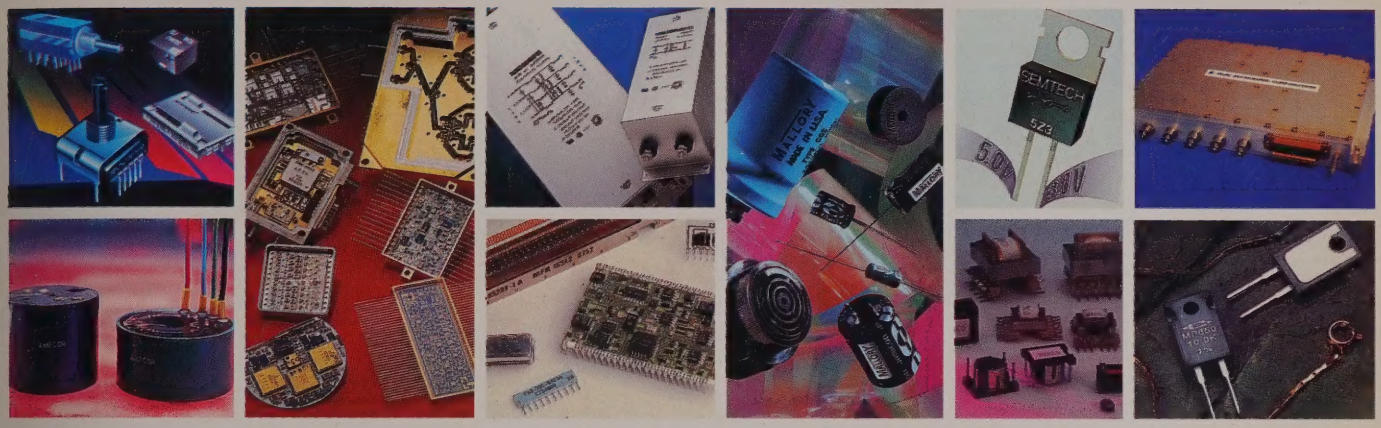
ISSN 0732-9016

eem 93 94

electronic engineers master catalog

VOLUME A



electronic components

36th EDITION

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1800 Coils, Chokes, & Inductors
1850 Cores, Magnets, & Ferrites
2300 Crystals, Oscillators, Crystal & Piezoelectric Filters
2350 Delay Lines
2700 Filters, Power
2750 Filters, RF & Signal
3130 Integrated Circuits, Hybrid Circuits, & Function Modules
3450 Microwave Components, Systems, & Equipment
4700 Resistors
4750 Potentiometers, Trimmers, Controls, & Rheostats
4800 Discrete Semiconductors
5600 Transformers

volume B Electromechanical, electro-optical, and military components

volume C Interconnections, packaging, and hardware

volume D Power sources, instrumentation, computer products, and equipment

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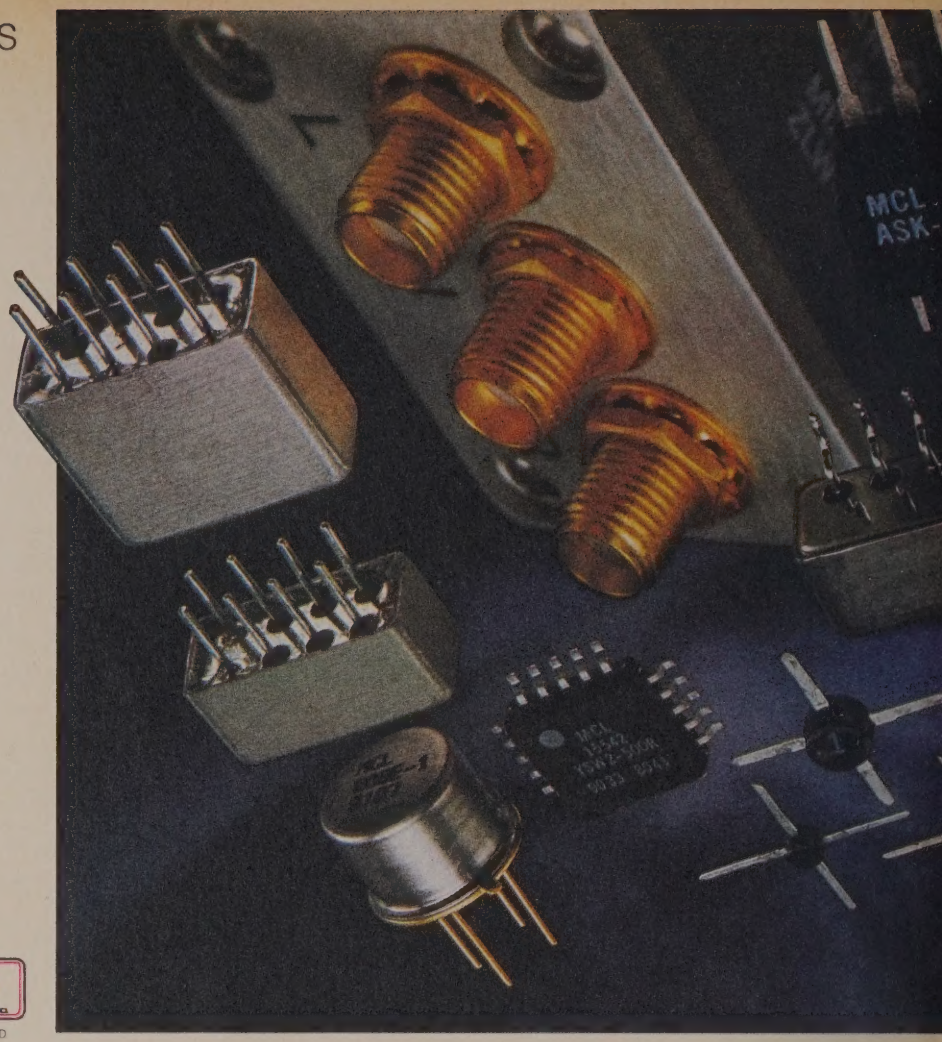

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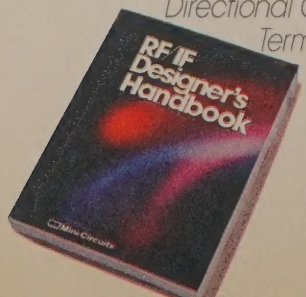

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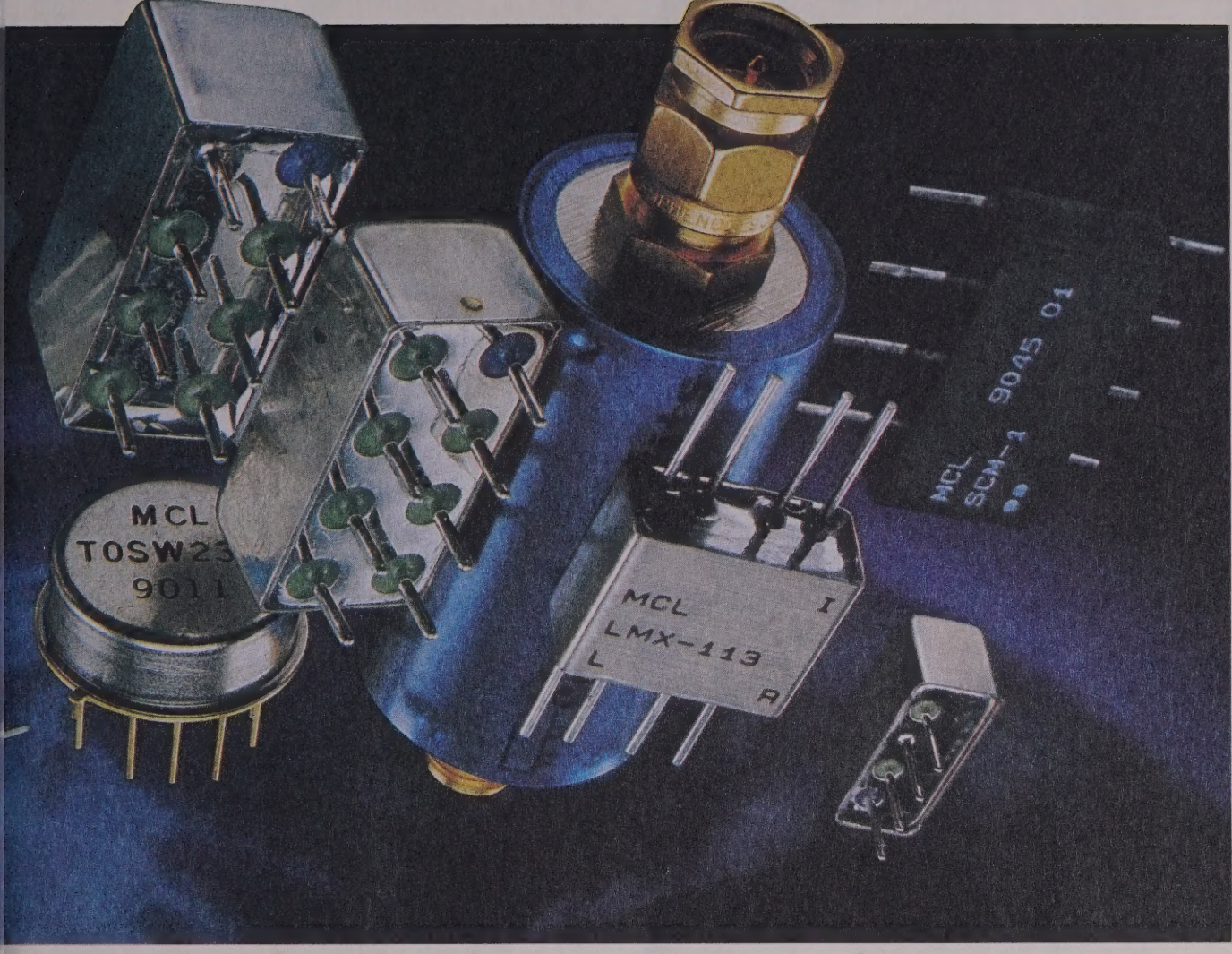

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how to use eem

The 36th edition of EEM is arranged in four volumes each composed of related Product Sections. For user convenience, each volume contains its own Product Index and Directory (green pages) and its own Manufacturers and Sales Offices Directory (yellow pages). Every Product Heading and every manufacturer of electronic products is listed in each volume. Where, however, the Product Section is assigned to a volume other that that in use, a cross reference is made to the appropriate volume for further information.

To locate a specific product. Start by choosing the volume whose title describes the class of electronic product you are seeking. If you are not sure which volume is appropriate, pick up the first one at hand and look up the product heading in the green pages. There you will find either a list of that product's manufacturers or you will be referred to the proper volume. All products are identified by their generic terms. Please read the instructions on the first page of each section. Manufacturers with catalog data pages in this edition of EEM appear in boldface type and page numbers are shown. Manufacturers appearing in lightface type have submitted verifying evidence that they supply the products shown. When you have located a product of interest, turn to the page(s) shown for further information. You will find these pages in each volume in the appropriate sections.

product selection guides

There are 37 Product Selection Guides included in this edition of EEM. They are located on the first pages of the Product Section to which they apply. Use these guides for basic selection parameters and then go to the EEM pages shown in the guide for more detailed information.

product selection index

Product Section Guide		Vol. A	Vol. B	Vol. C	Vol. D
1100	Amplifier Assemblies, Instrumentation				D•1002
1200	Antennas & Accessories				D•1022
1300	Audio Equipment & Accessories				D•1026
1400*	Cabinets, Enclosures, Racks, & Chassis			C•1002	
1500*	Capacitors	A•1002			
1600	Chemical Compounds (Adhesives, Cleaners, Coatings)			C•1134	
1700	Circuit Boards (Printed), Materials, & Accessories			C•1135	
1800*	Coils, Chokes, & Inductors	A•1178			
1850	Cores, Magnets, & Ferrites	A•1316			
1900	Communications & Telemetry Equipment				D•1073
2000	Computer Peripheral Equipment				D•1078
2025	Computers (Mini/Micro/Boards)				D•1116
2050	Computer Software				D•1147
2100*	Connectors, Terminals, & Sockets			C•1138	
2200	Control Systems & Components				D•1149
2300*	Crystals, Oscillators, Crystal & Piezoelectric Filters	A•1324			
2325	Data Acquisition/Handling Systems & Accessories				D•1170
2350*	Delay Lines	A•1512			
2400*	Panel Hardware (Bezels, Dials, Knobs, etc.)			C•1522	
2440*	Military Components and Equipment		B•1002		
2450*	Displays, Readouts, & CRTs		B•1019		
2460*	Lamps, Lights, & Indicators		B•1130		
2475*	Fiber Optic Equipment & Accessories		B•1200		
2500	Hardware & Mechanical Components			C•1537	
2550	Environmental Test Equipment				D•1211
2600*	Fans, Blowers, Cooling Equipment, & Heat Exchangers			C•1556	
2700*	Filters, Power	A•1584			
2750*	Filters, Signal	A•1616			
2900*	Instruments, Test & Measuring				D•1214
2950*	Panel Meters (Analog & Digital)				D•1336
2975*	Instruments, Oscilloscopes				D•1402
3000	Instruments, Graphic Recording				D•1410
3100	Insulators & Insulating Materials			C•1654	
3130*	Integrated Circuits, Hybrid Circuits, & Function Modules	A•1688			
3200*	Interconnection Systems (Backpanels, Card Holders, & Packaging Systems)			C•1670	
3450*	Microwave Components, Systems, & Equipment	A•1719			
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4000*	Power Supplies, DC				D•1486
4025*	DC-DC Converters				D•2048
4050*	Power Supplies, AC				D•2221
4100	Production Equipment & Manufacturing Services				D•2310
4200	Prototype Boards, Kits, & Design Aids			C•1677	
4300*	Protective Components (Fuses, Circuit Breakers, etc.)		B•1340		
4500*	Relays		B•1400		
4525	Shields & Shielding			C•1682	
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4700*	Resistors	A•1858			
4750*	Potentiometers, Trimmers, Controls, & Rheostats	A•2052			
4800*	Discrete Semiconductors	A•2130			
4900	Servomechanisms & Robotic Equipment				D•2314
5100*	Switches		B•1656		
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5300*	Thermal Components		B•1856		
5400	Tools (Manual & Power)			C•1700	
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6000*	Wire & Cable			C•1701	

* A Product Selection Guide precedes these Product Sections.

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advertisers' index

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manufacturers' index

In the EEM yellow pages you will find pertinent details on all manufacturers listed in EEM including local sales offices and/or distributors. Please refer to the detailed instructions on the first page of the EEM yellow pages for additional information.

to order a product found in eem

When you have located the product that suits your needs, call the manufacturer or the local sales rep or distributor as shown in the EEM yellow pages. Give the EEM data page number and specs from that page. You and the supplier will be talking on the same wave length which should simplify your ordering and buying.

to file manufacturers' catalogs and data

The EEM File System is revised and updated to reflect changes in EEM itself. Each new EEM File System contains a complete Product Index. This index tells you where to file which catalog. It also contains a cross reference identifying what should be filed in each section. In order to use the EEM File System all you need is a supply of standard letter size, third-cut manila file folders. You then use the pressure sensitive labels which are supplied with the system to go into as much detail as you want or need.

Each label fits the third-cut file folder exactly. There are over 300 of these labels in each system: one for the index, one each for the EEM Product Sections, 24 for the alphabetical file of multiproduct catalogs, plus more than 200 additional labels for system expansion. The EEM File System also includes Cross Reference Cards so you can quickly and easily find multiproduct catalogs. The EEM File System is complete and can save you countless hours of time and thousands of dollars. Send your check for $25.00 to: EEM File System, 645 Stewart Ave., Garden City, NY 11530 and we'll absorb postage and handling. Send a purchase order and add $5.00 for postage and handling. NY, CA and MA residents, please add sales tax.

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93 94 Alphabetical Index of Manufacturers Catalog Pages

This index provides an alphabetical listing of manufacturers pages and where to find them

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† Rantec Microwave & Electronics, Esco Electronics, Calabasas, CA 91302 818-591-8189
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Analyzers, Microwave-3450

Advantest America, Inc., Buffalo Grove, IL 60089-4503 800-441-0852
† Anritsu Wiltron Sales Co., Morgan Hill, CA 95037-2809 408-776-8300
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Continental Resources, Inc, Test Instruments Div., Bedford, MA 01730 ... 617-275-0850; 800-937-4688
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Trilithic, Inc., Indianapolis, IN 46236 800-344-2412
Tucker Electronics, Dallas, TX 75355-1419 ..... 214-348-8800;800-527-4642

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§ **Mallory Controls, Emerson Electric Canada, Woodstock, Ont., CANADA N4S 7W8, 519-539-4891** ..... **A•2093**
Northwest Microcircuits, Inc., Philomath, OR 97370, 503-929-6424 ..... **A•1712**
† **Ohmite Manufacturing Co., Skokie, IL 60076, 708-675-2600** ..... **D•1056**
Shallco, Inc., Smithfield, NC 27577, 919-934-3135; 1-800-876-3135 ..... **D•1323**
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§ Bogen Communications, Inc., Sound Prods., Ramsey, NJ 07446 201-934-8500
§ Clarostat Sensors and Controls Group, BYR, PLC, Plano, TX 75075 ..... 214-422-1844; 1-800-872-0044
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§ Martin Sound Prods. Inc., Cleveland, OH 44143-2297 216-442-2286
§ Philmore Manufacturing, Rockford, IL 61125-1386 815-229-7773
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006 214-466-6000
§ Speco Div., Components Specialties, Inc., Lindenhurst, NY 11757-0624 ..... 516-957-8700;800-645-5516
Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Schaumburg, IL 60173 708-884-6664
§ Vernitron Corp., Precision Comps. Group, St. Petersburg, FL 33710 813-347-2181

Attenuators, Coaxial-3450

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† **Kay Elemetrics Corp., Pine Brook, NJ 07058-2025, 201-227-2000** ..... **A•1846**
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§ AVA Electronics Corporation, Drexel Hill, PA 19026 215-284-2500
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§ Compac, Holbrook, NY 11741 516-585-3400
§ Concord Electronics Corporation, New York, NY 10012 1-212-777-6571
§ Contact East, N. Andover, MA 01845 508-682-2000
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† Dielectric Communications, General Signal, Raymond, ME 04071 ..... 207-655-4555; 800-341-9678
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† Electro Impulse, Neptune, NJ 07754-0278 908-776-5800
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General Microwave Corporation, Amityville, NY 11701 516-226-8900
Hameg Instruments, Oceanside, CA 92056 ..... 619-630-4080;800-247-1241
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† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
Lectronic Research Labs., Inc., Camden, NJ 08104 800-358-8378
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§ Lucas Weinschel, Gaithersburg, MD 20884-6001 301-948-3434
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M/A-COM Microelectroincs Division, M/A-COM, Lowell, MA 01853-3295 508-442-5000
MarLee Switch Co., Upland, CA 91786 714-982-8988
Matrix Systems Corp., Calabasas, CA 91302 818-222-2301
† Maury Microwave Corp., Ontario, CA 91764 909-987-4715
† Metropole Products Inc., Stafford, VA 22554 703-659-2132
† Microlab/FXR, Livingston, NJ 07039 201-992-7700
† Micro Mode Prods., El Cajon, CA 92020 619-449-3844
§† Midwest Microwave, Saline, MI 48176-9569 ..... 313-429-4773;800-521-4410
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3 ..... 514-694-6666; 800-724-3911
† Pasternack Enterprises, Irvine, CA 92713 714-261-1920
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† RLC Electronics, Inc., Mt. Kisco, NY 10549 914-241-1334
† Servo Corporation of America, Hicksville, NY 11801-5259 516-938-9700
Signal Switch Company, Corona, CA 91720 909-736-5404
§ Solitron/Microwave, Solitron Devices, Inc., West Palm Beach, FL 33407-4697 407-848-4311
§† Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
Tektronix, Inc., Wilsonville, OR 97070 800-835-9433
§† Telephonics Corporation/PRD Instruments, Huntington, NY 11743 ..... 516-549-6415/6428
† Telonic/Berkeley, Berkeley Inds. Inc., Laguna Beach, CA 92652 714-494-9401
§ Test Probes, Inc., San Diego, CA 92121 619-552-2090
† Transco Products, Inc., Subsidiary of Datron Systems Inc., Camarillo, CA 93012 805-987-8007
Trilithic, Inc., Indianapolis, IN 46236 800-344-2412
Tucker Electronics, Dallas, TX 75355-1419 ..... 214-348-8800;800-527-4642
Universal Ad-Yu/D-F Inc., St. Francis, WI 53235 414-482-4100
† Vectronics Microwave Corp., Middlesex, NJ 08846 908-356-2377
† Wavetek Communications Div., (Formerly Wavetek Indiana, Inc.), Indianapolis, IN 46203-6109 317-788-9351
Western Multiplex Corp., Belmont, CA 94002 415-592-8832
§ Wiltron, Morgan Hill, CA 95037-2809 408-778-2000

Attenuators, Decade-3450

IET Labs, Inc., Westbury, NY 11590, 516-334-5959;800-899-8438 ..... **D•1266-1269**
BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
§ Contact East, N. Andover, MA 01845 508-682-2000
Lectronic Research Labs., Inc., Camden, NJ 08104 800-358-8378
MACOM, Inc., Lowell, MA 01851 617-272-3000
Shallco, Inc., Smithfield, NC 27577 ..... 919-934-3135; 1-800-876-3135
† Tech Laboratories Inc., Palisades Pk., NJ 07650 201-944-2221

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Attenuators, Fixed-3450

† **JFW Industries, Inc., Indianapolis, IN 46237, 317-887-1340** ..... **A•1722**
§† **Microwave Filter Inc., East Syracuse, NY 13057-0486, 315-437-3953;800-448-1666** ..... **A•1656**
Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500 ..... **A•1725**
† **Tech Laboratories Inc., Palisades Pk., NJ 07650, 201-944-2221** ..... **B•1815**
Advanced Technical Materials, Inc., Patchogue, NY 11772 ..... 516-363-9018; 516-289-0363
† Alan Industries Inc., Columbus, IN 47202 812-372-8869
Allen Avionics, Inc., Mineola, NY 11501 516-248-8080
Augat Alcoswitch, Augat Inc., Attleboro Falls, MA 02763 508-699-9800
† Barth Electronics, Inc., Boulder City, NV 89005 702-293-1576
§† Bird Electronic Corp., Cleveland, OH 44139-2794 216-248-1200
Compac, Holbrook, NY 11741 516-585-3400
† Elcom Systems, Inc., Boca Raton, FL 33487 407-994-1774
§† EMC Technology Inc, Cherry Hill, NJ 08034 609-429-7800
Frequency Selective Networks, Woodside, NY 11377 718-424-7500
General Resistance, A Prime Technology Company, N. Branford, CT 06471 203-481-5721
GTE Control Devices, Inc., Standish, ME 04084 207-642-4535
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
Hyletronics:Litton Industries, Lexington, MA 02173-3199 617-276-3298
§ Inmet Corporation, Ann Arbor, MI 48103 313-426-5553
† Integrated Microwave, San Diego, CA 92121-1009 619-259-2600
International Manufacturing Services, Portsmouth, RI 02871-2418 401-683-9700
† International Telecommunications Components, Inc., Deer Park, NY 11729 516-243-1444
§ ITT Pomona Electronics, Pomona, CA 91766 909-469-2900
† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
Lectronic Research Labs., Inc., Camden, NJ 08104 800-358-8378
† Loral Microwave Narda, Hauppauge, NY 11788 516-231-1700
§† Lucas Weinschel, Gaithersburg, MD 20884-6001 301-948-3434
MACOM, Inc., Lowell, MA 01851 617-272-3000
† Maury Microwave Corp., Ontario, CA 91764 909-987-4715
3M Private Network Products, 3M, Austin, TX 78726 ..... 512-984-3400;800-426-8626
† Microlab/FXR, Livingston, NJ 07039 201-992-7700
§ Microwave Development Laboratories, Natick, MA 01760 508-655-0060
Mini-Systems, Inc., Thick/Thin Film Division, North Attleboro, MA 02761 508-695-0203
Mini-Systems, Inc., Sunbelt Microelectronic Division, Deltona, FL 32725 407-574-0208
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† Pasternack Enterprises, Irvine, CA 92713 714-261-1920
† Piconics, Incorporated, Tyngsboro, MA 01879 508-649-7501
§† Probe Master, Inc., San Diego, CA 92111 ..... 619-560-9676; 800-772-1519
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§† RCD Components, Inc., Manchester, NH 03109 603-669-0054
† RLC Electronics, Inc., Mt. Kisco, NY 10549 914-241-1334
† Ross Engineering Corp., Campbell, CA 95008 408-377-4621
† Servo Corporation of America, Hicksville, NY 11801-5259 516-938-9700
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† Teledyne Microelectronics, Los Angeles, CA 90066 ..... 310-822-8229;310-305-0248
† Telegenix/Grim Corp., Cherry Hill, NJ 08034 609-424-5220
§† Telephonics Corporation/PRD Instruments, Huntington, NY 11743 ..... 516-549-6415/6428
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291
§ Test Probes, Inc., San Diego, CA 92121 619-552-2090
Trilithic, Inc., Indianapolis, IN 46236 800-344-2412
TTE, Incorporated, W. Los Angeles, CA 90064-1400 ..... 310-478-8224;800-776-7614
Tucker Electronics, Dallas, TX 75355-1419 ..... 214-348-8800;800-527-4642
Vernitron Corp., Precision Comps. Group, St. Petersburg, FL 33710 813-347-2181
Western Multiplex Corp., Belmont, CA 94002 415-592-8832
§ Wiltron, Morgan Hill, CA 95037-2809 408-778-2000

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Attenuators, Impedance Matching-3450

† JFW Industries, Inc., Indianapolis, IN 46237, 317-887-1340 ..... A•1722
† Kay Elemetrics Corp., Pine Brook, NJ 07058-2025, 201-227-2000 ..... A•1846
Shallco, Inc., Smithfield, NC 27577, 919-934-3135; 1-800-876-3135 ..... D•1323
† Tech Laboratories Inc., Palisades Pk., NJ 07650, 201-944-2221 ..... B•1815
† Alan Industries Inc., Columbus, IN 47202 812-372-8869
Allen Avionics, Inc., Mineola, NY 11501 516-248-8080
§ Atlas/Soundolier, Commercial Sound Div., Atapco Security & Communications Group, Fenton, MO 63026 314-349-3110
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
Bourns, Inc., Electronic Components Sls., Riverside, CA 92507-2114 ..... 909-781-5500; 801-750-7200
§ Clarostat Sensors and Controls Group, BYR, PLC, Plano, TX 75075 ..... 214-422-1844; 1-800-872-0044
Compac, Holbrook, NY 11741 516-585-3400
§ Contact East, N. Andover, MA 01845 508-682-2000
Control Concepts Corp., Liebert Corp., Binghamton, NY 13902-1380 607-724-2484
† Elcom Systems, Inc., Boca Raton, FL 33487 407-994-1774
§ Inmet Corporation, Ann Arbor, MI 48103 313-426-5553
† Integrated Microwave, San Diego, CA 92121-1009 619-259-2600
§ ITT Pomona Electronics, Pomona, CA 91766 909-469-2900
§ Leader Instruments Corp., Hauppauge, NY 11788-3694 ..... 516-231-6900; 1-800-645-5104
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§ Ohmite Manufacturing Co., Skokie, IL 60076 708-675-2600
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§† RCD Components, Inc., Manchester, NH 03109 603-669-0054
† Servo Corporation of America, Hicksville, NY 11801-5259 516-938-9700
§ Sescom, Inc., Henderson, NV 89015-4249 702-565-3400
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§ Shure Brothers Inc., Evanston, IL 60202-3696 708-866-2200
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Trilithic, Inc., Indianapolis, IN 46236 800-344-2412
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Attenuators, Logarithmic-3450

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BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
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Attenuators, Microwave-3450

§† AMITRON, American Micro-Tronix, Inc., North Andover, MA 01845, 508-686-1882 ..... A•1720,1865
† Electro-Films, Inc., Warwick, RI 02886, 401-738-9150 ..... A•1721
† JFW Industries, Inc., Indianapolis, IN 46237, 317-887-1340 ..... A•1722
† Kay Elemetrics Corp., Pine Brook, NJ 07058-2025, 201-227-2000 ..... A•1846
§† Microwave Filter Inc., East Syracuse, NY 13057-0486, 315-437-3953;800-448-1666 ..... A•1656
Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500 ..... A•1725
Advanced Technical Materials, Inc., Patchogue, NY 11772 ..... 516-363-9018; 516-289-0363
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† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950 201-539-5500
† Alan Industries Inc., Columbus, IN 47202 812-372-8869
§† Anaren Microwave, Inc., E. Syracuse, NY 13057 315-432-8930
§† Avantek, Inc, A Subsidiary of Hewlett-Packard, Santa Clara, CA 95054 408-727-0700
§† Bird Electronic Corp., Cleveland, OH 44139-2794 216-248-1200
Compac, Holbrook, NY 11741 516-585-3400
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§† EMC Technology Inc, Cherry Hill, NJ 08034 609-429-7800
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§† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
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§† Midwest Microwave, Saline, MI 48176-9569 ..... 313-429-4773;800-521-4410
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† Radio Research Instrument Co., Inc., Waterbury, CT 06704-3506 203-753-5840
† Raytheon Co., Electronic Components Division, Waltham, MA 02254 617-899-8400
† Sage Laboratories, Inc., Natick, MA 01760 508-653-0844
† Servo Corporation of America, Hicksville, NY 11801-5259 516-938-9700
Sivers IMA AB, Culver City, CA 90230 213-306-4248
§† Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
Tektronix, Inc., Wilsonville, OR 97070 800-835-9433
§† Telephonics Corporation/PRD Instruments, Huntington, NY 11743 ..... 516-549-6415/6428
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291
† Telonic/Berkeley, Berkeley Inds. Inc., Laguna Beach, CA 92652 714-494-9401
† Transco Products, Inc., Subsidiary of Datron Systems Inc., Camarillo, CA 93012 805-987-8007
Trilithic, Inc., Indianapolis, IN 46236 800-344-2412
Tucker Electronics, Dallas, TX 75355-1419 ..... 214-348-8800;800-527-4642
† Vectronics Microwave Corp., Middlesex, NJ 08846 908-356-2377
§ Wiltron, Morgan Hill, CA 95037-2809 408-778-2000

Attenuators, Programmable-3450

† JFW Industries, Inc., Indianapolis, IN 46237, 317-887-1340 ..... A•1722-1723
† Kay Elemetrics Corp., Pine Brook, NJ 07058-2025, 201-227-2000 ..... A•1846
† Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500 ..... A•1725
Programmed Test Sources, Littleton, MA 01460, 508-486-3008 ..... D•1316
† Alan Industries Inc., Columbus, IN 47202 812-372-8869
CAL-AV Labs, Inc., Campbell, CA 95008 408-369-1000
† Daico Industries, Inc., Rancho Dominguez, CA 90220 310-631-1143
† EMC Technology Inc, Cherry Hill, NJ 08034 609-429-7800
Flann Microwave Inc., Cambridge, MA 02139 1-800-937-3772
† General Microwave Corporation, Amityville, NY 11701 516-226-8900
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
Hyletronics:Litton Industries, Lexington, MA 02173-3199 617-276-3298
† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
† Loral Microwave Narda, Hauppauge, NY 11788 516-231-1700
† Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710 813-347-2181
§ Lucas Weinschel, Gaithersburg, MD 20884-6001 301-948-3434
Matrix Systems Corp., Calabasas, CA 91302 818-222-2301
Noble U.S.A., Inc., Rolling Meadows, IL 60008 708-364-6038
Phoenix Microwave, Telford, PA 18969 215-723-6011
† Racal-Dana Instrs. Inc., Irvine, CA 92718 714-859-8999
† RLC Electronics, Inc., Mt. Kisco, NY 10549 914-241-1334
† Servo Corporation of America, Hicksville, NY 11801-5259 516-938-9700
ST Olektron Corporation, Subsidiary of Signal Technology Corp., Beverly, MA 01915 508-922-0019
† Teledyne Microelectronics, Los Angeles, CA 90066 ..... 310-822-8229;310-305-0248
Telephonics Corporation/PRD Instruments, Huntington, NY 11743 ..... 516-549-6415/6428
† Telonic/Berkeley, Berkeley Inds. Inc., Laguna Beach, CA 92652 714-494-9401
Trilithic, Inc., Indianapolis, IN 46236 800-344-2412
Tucker Electronics, Dallas, TX 75355-1419 ..... 214-348-8800;800-527-4642
† Vectronics Microwave Corp., Middlesex, NJ 08846 908-356-2377
† Wavetek Communications Div., (Formerly Wavetek Indiana, Inc.), Indianapolis, IN 46203-6109 317-788-9351
§ Wiltron, Morgan Hill, CA 95037-2809 408-778-2000

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Attenuators, Switchable-3450

† Kay Elemetrics Corp., Pine Brook, NJ 07058-2025, 201-227-2000 ..... A•1846
Shallco, Inc., Smithfield, NC 27577, 919-934-3135; 1-800-876-3135 ..... D•1323
AEL Defense Corp., Lansdale, PA 19446 215-822-2929
† Alan Industries Inc., Columbus, IN 47202 812-372-8869
† EMC Technology Inc, Cherry Hill, NJ 08034 609-429-7800
† General Microwave Corporation, Amityville, NY 11701 516-226-8900
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
§ Lucas Weinschel, Gaithersburg, MD 20884-6001 301-948-3434
MarLee Switch Co., Upland, CA 91786 714-982-8988
Matrix Systems Corp., Calabasas, CA 91302 818-222-2301
§† Midwest Microwave, Saline, MI 48176-9569 ..... 313-429-4773;800-521-4410
Northwest Microcircuits, Inc., Philomath, OR 97370 503-929-6424
Phoenix Microwave, Telford, PA 18969 215-723-6011
Signal Switch Company, Corona, CA 91720 909-736-5404
† Teledyne Microwave, Mountain View, CA 94043 415-968-2211
§ Test Probes, Inc., San Diego, CA 92121 619-552-2090
Trilithic, Inc., Indianapolis, IN 46236 800-344-2412
§ Vernitron Corp., Precision Comps. Group, St. Petersburg, FL 33710 813-347-2181
† Wavetek Communications Div., (Formerly Wavetek Indiana, Inc.), Indianapolis, IN 46203-6109 317-788-9351
Western Multiplex Corp., Belmont, CA 94002 415-592-8832

Attenuators, Turret-3450

† Tech Laboratories Inc., Palisades Pk., NJ 07650, 201-944-2221 ..... B•1815
† Alan Industries Inc., Columbus, IN 47202 812-372-8869
JFW Industries, Inc., Indianapolis, IN 46237 317-887-1340
Lectronic Research Labs., Inc., Camden, NJ 08104 800-358-8378
† Loral Microwave Narda, Hauppauge, NY 11788 516-231-1700
§ Lucas Weinschel, Gaithersburg, MD 20884-6001 301-948-3434
† Microlab/FXR, Livingston, NJ 07039 201-992-7700

† Telonic/Berkeley, Berkeley Inds. Inc., Laguna Beach, CA 92652 714-494-9401
Trilithic, Inc., Indianapolis, IN 46236 800-344-2412
† Wavetek Communications Div., (Formerly Wavetek Indiana, Inc.), Indianapolis, IN 46203-6109 317-788-9351

Attenuators, Variable-3450

† JFW Industries, Inc., Indianapolis, IN 46237, 317-887-1340 ..... A•1722
† Kay Elemetrics Corp., Pine Brook, NJ 07058-2025, 201-227-2000 ..... A•1846
† Microwave Filter Inc., East Syracuse, NY 13057-0486, 315-437-3953;800-448-1666 ..... A•1656
† Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500 ..... A•1725
† Tech Laboratories Inc., Palisades Pk., NJ 07650, 201-944-2221 ..... B•1815
§ Vernitron Corp., Precision Comps. Group, St. Petersburg, FL 33710, 813-347-2181 ..... A•2124
ADC Telecommunications, Inc., Minneapolis, MN 55435 612-938-8080
Advanced Technical Materials, Inc., Patchogue, NY 11772 ..... 516-363-9018; 516-289-0363
† Alan Industries Inc., Columbus, IN 47202 812-372-8869
Allen Avionics, Inc., Mineola, NY 11501 516-248-8080
§† Anaren Microwave, Inc., E. Syracuse, NY 13057 315-432-8930
§† Avantek, Inc, A Subsidiary of Hewlett-Packard, Santa Clara, CA 95054 408-727-0700
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
Bourns, Inc., Electronic Components Sls., Riverside, CA 92507-2114 ..... 909-781-5500; 801-750-7200
§ Clarostat Sensors and Controls Group, BYR, PLC, Plano, TX 75075 ..... 214-422-1844; 1-800-872-0044
§ Contact East, N. Andover, MA 01845 508-682-2000
Elcom Systems, Inc., Boca Raton, FL 33487 407-994-1774
§ EXFO, E.O. Engineering, Inc., Vanier, QC., CANADA G1M 3G7 ..... 418-683-0211; 1-800-663-EXFO
† Gamma-f Corp. Vertex Communications, Torrance, CA 90505 310-539-6704
† General Microwave Corporation, Amityville, NY 11701 516-226-8900
† Harris Microwave Semiconductor, Harris Semiconductor, Milpitas, CA 95035 408-433-2222
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
Hyletronics:Litton Industries, Lexington, MA 02173-3199 617-276-3298
† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
§ Leader Instruments Corp., Hauppauge, NY 11788-3694 ..... 516-231-6900; 1-800-645-5104
Lectronic Research Labs., Inc., Camden, NJ 08104 800-358-8378
† Loral Microwave Narda, Hauppauge, NY 11788 516-231-1700
† Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710 813-347-2181
§ Lucas Weinschel, Gaithersburg, MD 20884-6001 301-948-3434
MACOM, Inc., Lowell, MA 01851 617-272-3000
Matrix Systems Corp., Calabasas, CA 91302 818-222-2301
3M Private Network Products, 3M, Austin, TX 78726 ..... 512-984-3400;800-426-8626
† Merrimac Industries, West Caldwell, NJ 07006 201-575-1300
† Microlab/FXR, Livingston, NJ 07039 201-992-7700
MicroSignals Inc., LI.C., NY 11101 ..... 718-937-7955;718-937-0391;800-648-2252
§ Microwave Development Laboratories, Natick, MA 01760 508-655-0060
§† Midwest Microwave, Saline, Mi 48176-9569 ..... 313-429-4773;800-521-4410
Noble U.S.A., Inc., Rolling Meadows, IL 60008 708-364-6038
§ Ohmite Manufacturing Co., Skokie, IL 60076 708-675-2600
Phoenix Microwave, Telford, PA 18969 215-723-6011
† Premier Microwave, Port Chester, NY 10573 914-939-8900
Pro Com Technology Inc., Plainview, NY 11803 ..... 516-293-4443;800-762-3785
† RLC Electronics, Inc., Mt. Kisco, NY 10549 914-241-1334
Shallco, Inc., Smithfield, NC 27577 ..... 919-934-3135; 1-800-876-3135
§ Shure Brothers Inc., Evanston, IL 60202-3696 708-866-2200
§ Sinclair Radio Laboratories Ltd., Aurora, ONT., CANADA L4G 3G9 416-727-0165
Sivers IMA AB, Culver City, CA 90230 ..... 213-306 4248
§† Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
† Telegenix/Grim Corp., Cherry Hill, NJ 08034 609-424-5220
§† Telephonics Corporation/PRD Instruments, Huntington, NY 11743 ..... 516-549-6415/6428
† Telonic/Berkeley, Berkeley Inds. Inc., Laguna Beach, CA 92652 714-494-9401
† TRAK Microwave Ltd., TRAK Microwave Corp., Dundee, SCOTLAND DD2 1TY 44-382-561509
Trilithic, Inc., Indianapolis, IN 46236 800-344-2412
† TRM, Inc., Manchester, NH 03110 603-627-6000
Tucker Electronics, Dallas, TX 75355-1419 ..... 214-348-8800;800-527-4642
Western Multiplex Corp., Belmont, CA 94002 415-592-8832

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AMITRON, American Micro-Tronix, Inc., North Andover, MA 01845, 508-686-1882 ..... A•1865
† JFW Industries, Inc., Indianapolis, IN 46237, 317-887-1340 ..... A•1722
† Kay Elemetrics Corp., Pine Brook, NJ 07058-2025, 201-227-2000 ..... A•1846
Alan Industries Inc., Columbus, IN 47202 812-372-8869
§† Amplifonix, Inc., Philadelphia, PA 19154 215-464-4000
§† Avantek, Inc, A Subsidiary of Hewlett-Packard, Santa Clara, CA 95054 408-727-0700
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328 215-968-4271
§ Clarostat Sensors and Controls Group, BYR, PLC, Plano, TX 75075 ..... 214-422-1844; 1-800-872-0044
Control Concepts Corp., Liebert Corp., Binghamton, NY 13902-1380 607-724-2484
† Daico Industries, Inc., Rancho Dominguez, CA 90220 310-631-1143
† General Microwave Corporation, Amityville, NY 11701 516-226-8900
Hyletronics:Litton Industries, Lexington, MA 02173-3199 617-276-3298
† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
§ Lucas Weinschel, Gaithersburg, MD 20884-6001 301-948-3434
MACOM, Inc., Lowell, MA 01851 617-272-3000
§† M/A-COM Microelectroincs Division, M/A-COM, Lowell, MA 01853-3295 508-442-5000
† Merrimac Industries, West Caldwell, NJ 07006 201-575-1300
† Micronetics, Hudson, NH 03051 603-883-2900
† MITEQ Inc., Hauppauge, NY 11788 516-436-7400
Phoenix Microwave, Telford, PA 18969 215-723-6011
§ Sescom, Inc., Henderson, NV 89015-4249 702-565-3400
† Vectronics Microwave Corp., Middlesex, NJ 08846 908-356-2377

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Amecon, Inc., Anaheim, CA 92805, 714-634-2220;800-392-2292 ..... A•1182
Lumintech Inc., Irvington, NJ 07111, 201-374-1091 ..... A•2376
AFP ISOREG, AFP Transformers, Inc., Littleton, MA 01460 508-486-9483
§ Electrocube, Monrovia, CA 91016 818-301-0122
TMP Inc., Santa Ana, CA 92705 714-558-8028

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Advanced Technical Materials, Inc., Patchogue, NY 11772 ..... 516-363-9018; 516-289-0363
† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950 201-539-5500
† Eastern Microwave, Winchester, MA 01890 617-721-9800
Flann Microwave Inc., Cambridge, MA 02139 1-800-937-3772
† Gamma-f Corp., Vertex Communications, Torrance, CA 90505 310-539-6704
† International Telecommunications Components, Inc., Deer Park, NY 11729 516-243-1444
† Loral Microwave Narda, Hauppauge, NY 11788 516-231-1700
MACOM, Inc., Lowell, MA 01851 617-272-3000
† Maury Microwave Corp., Ontario, CA 91764 909-987-4715
Microdry, Inc., Crestwood, KENTUCKY 40014 502-241-8933
† Microlab/FXR, Livingston, NJ 07039 201-992-7700
§ Microwave Development Laboratories, Natick, MA 01760 508-655-0060
† Sivers IMA AB, Culver City, CA 90230 213-306-4248
Tucker Electronics, Dallas, TX 75355-1419 ..... 214-348-8800;800-527-4642

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Collmer Semiconductor, Inc., Dallas, TX 75244, 800-527-0251;214-233-1589 ..... D•1630
§ **Electronic Devices, Inc., Yonkers, NY 10710, 914-965-4400** ..... A•2143
§ **ISKRA Electronics, Inc., Plainview, NY 11803, 516-349-0222** ..... A•1085,2146
§ **Philips ECG, North American Philips Co., Williamsport, PA 17701, 717-323-4691** ..... A•2173
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§ **QMI/NIEC, Twin Oaks, CA 93518, 805-867-2555** ..... A•2176-2177
§† **Semtech Corporation, Newbury Park, CA 91320, 805-498-2111** ..... A•2180
American Microsemiconductor, Inc., Madison, NJ 07940 201-377-9566
§ C-S Electronic Sales, Inc., Frankfort, IN 46041 317-659-1874
Darrah Electric Company, Cleveland, OH 44102 216-631-0912
Diodes Inc., Chatsworth, CA 91311 ..... 818-882-4920;800-821-1178
Diotec Electronics Corp., Gardena, CA 90248 310-767-1052
§ General Instrument, Power Semiconductor Div., Hicksville, NY 11802 516-933-3333
Gentron Corporation, Scottsdale, AZ 85260 602-443-1288
† HV Component Associates Inc., Farmingdale, NJ 07727 908-938-4499
§ International Components Corp., Melville, NY 11747 516-293-1500
International Microelectronics, Arlington, TX 76003 817-473-1730
§ International Rectifier Corp., El Segundo, CA 90245 310-322-3331
§ Jaro Components, Inc., Boca Raton, FL 33487-8295 407-241-8600
§† Microsemi Corp., Santa Ana, CA 92799-6890 714-979-8220
Mouser Electronics, Santee, CA 92071 800-346-6873
Mouser Electronics, Mansfield, TX 76063 800-346-6873
Mouser Electronics, Gilroy, CA 95020 800-346-6873
§ NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
§ Promax-Johnton Electronic Corp., Irvine, CA 92714 714-975-1245
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
Reliable Electronic Mfg., Wyvern Technologies, Santa Ana, CA 92705 714-966-0710
Renard Manufacturing Company, Inc., Miami, FL 33122-1015 305-592-1500
§ RF Electronics, Inc., Irvine, CA 92714-5517 714-263-0661
Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
§ Solid State, Inc., Bloomfield, NJ 07003-2596 201-429-8700
Stetron International, Inc., Buffalo, NY 14203 716-854-3443

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§ Collmer Semiconductor, Inc., Dallas, TX 75244, 800-527-0251;214-233-1589 ..... A•2135
§ Electronic Devices, Inc., Yonkers, NY 10710, 914-965-4400 ..... A•2143
§ Powerex, Inc., Youngwood, PA 15697-1800, 412-925-7272 ..... A•2175
Semtech Corporation, Newbury Park, CA 91320, 805-498-2111 ..... A•2180
A E G Corporation, Basking Ridge, NJ 07920 908-204-8900
Diotec Electronics Corp., Gardena, CA 90248 310-767-1052
§ Fagor Electronic Components, Inc., Fagor Electronica S. Coop., Elk Grove Village, IL 60007 708-981-0161
† HV Component Associates Inc., Farmingdale, NJ 07727 908-938-4499
§ International Rectifier Corp., El Segundo, CA 90245 310-322-3331
§ Promax-Johnton Electronic Corp., Irvine, CA 92714 714-975-1245
Sanford-Miller Corp., Oceanside, NY 11572 ..... 516-763-0926;800-645-5900

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§ ABL Electronics Supply, Inc., Peekskill, NY 10566, 914-736-1010; 1-800-431-2103 ..... C•1287
C & C Jetronic, Inc., Allentown, NJ 08501, 609-259-8855 ..... C•1274
§ Concord Electronics Corporation, New York, NY 10012, 1-212-777-6571 ..... C•1290
GSI Corp., Timonium, MD 21093, 410-252-1768 ..... C•1750
† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950 201-539-5500
† Alpha Products, Inc., Westlake Village, CA 91362 818-889-9304
Amphenol Corporation, Corporate Headquarters, Wallingford, CT 06492 203-265-8910
Andrew Corp., Orland Pk., IL 60462 800-255-1479
Applied Engineering Products, New Haven, CT 06513 203-756-1669
CableStar, Incorporated, Glasgow, KY 42141 800-338-8223
Cardinal Control Co., Kensington, CT 06037 203-828-6379
† C.E. Precision Assemblies, Inc., Chandler, AZ 85226 602-940-0740
† Coax Connection, Peekskill, NY 10566 914-736-1010
†# Component Mfg. Svc., Inc., W. Bridgewater, MA 02379 508-580-0111
† CSD Industries, Inc., dba C Enterprises , San Marcos, CA 92069 ..... 619-744-8182; 800-334-3815
† De Anza Mfg. Svcs. Inc., Sunnyvale, CA 94089 408-734-2020
Electronic Connection Corp., Bloomfield, CT 06002 203-243-3356
† Fema Elctrns. Corp., E. Brunswick, NJ 08816 908-238-1223
Foxconn International, Hon Hai, Sunnyvale, CA 94086 408-749-1228
§ ITT Pomona Electronics, Pomona, CA 91766 909-469-2900
† Kaman Instrumentation, Colo Springs, CO 80907 719-599-1132
Kings Electronics Co., Inc., Tuckahoe, NY 10707 914-793-5000
MACOM, Inc., Lowell, MA 01851 617-272-3000

§ Midwest Microwave, Saline, MI 48176-9569 ..... 313-429-4773;800-521-4410
† Pasternack Enterprises, Irvine, CA 92713 714-261-1920
§† Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018 ..... 408-730-0300;800-PENSTOCK
† Precision Tube, N. Wales, PA 19454 215-699-5801
† Precision Tube Co., Coaxitube Div., Salisbury, MD 21801 410-546-3911
§† Quality Microwave Interconnects, Inc., Wilmington, MA 01887 508-988-9090
Solitron/Microwave, Solitron Devices, Inc., West Palm Beach, FL 33407-4697 407-848-4311
† ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086 408-730-6300
† Storm Products Co., Hinsdale, IL 60521 708-323-9121
Transtechnology Electronics, Transtechnology Corporation, Peoria, IL 61615-1584 309-693-3300
§† U.S. Power Converting Company/Relco, Leonard V. Snow & Assocs., Torrance, CA 90503 310-316-9984
§† Western Electronic Products Co., San Clemente, CA 92673 714-492-4677
§ Wiltron, Morgan Hill, CA 95037-2809 408-778-2000

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§ **Electrocube, Monrovia, CA 91016, 818-301-0122** ..... **A•1067**
§ **KCK America Inc., Mitsubishi Materials Corporation, Rolling Meadows, IL 60008, 708-577-0200** ..... **A•1647**
§† American Capacitor Corporation, Irwindale, CA 91706 818-814-4444
American Radionic Co. Inc., Palm Coast, FL 32137 904-445-6000
Component Research Co. Inc., Santa Monica, CA 90404 310-829-3615
§† Electron Products, Irwindale, CA 91706 818-960-2299
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
† Genisco Electronics, A Division of GTC, Anaheim, CA 92805 714-563-4300
§ Jaro Components, Inc., Boca Raton, FL 33487-8295 407-241-8600
S & El Manufacturing, Northridge, CA 91324 818-349-4111
Sprague, Solid Tantalum Capacitors, Sanford, ME 04073-0231 207-324-4140
† Standard Condenser Corp., Skokie, IL 60076 708-675-3133
§ Stetco, Inc., Franklin Pk., IL 60131 708-671-4208

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§ **Allen Co., Inc., Robert G., N. Hollywood, CA 91605, 818-765-8300;800-827-7422** ..... **A•1010-1011,1013**
§ **Armbar Industries, Inc., Old Bridge, NJ 08857, 908-679-3377** ..... **A•1015**
ASC Capacitors, Ogallala, NE 69153, 308-284-3611 ..... **A•1016,1018**
§† **AVX Corporation, A Kyocera Group Company, Myrtle Beach, SC 29577, 803-448-9411** ..... **A•1024-1028**
Cornell-Dubilier Elctrns. (Intl. Sls., Distbn. Warehouse), New Bedford, MA. 02744, MA 02741, 508-996-8564 ..... **A•1063**
Electrocube, Monrovia, CA 91016, 818-301-0122 ..... **A•1067**
§† **Electro-Films, Inc., Warwick, RI 02886, 401-738-9150** ..... **A•1721,1934**
Inter-Technical Group Inc., WIMA Div., Elmsford, NY 10523, 914-347-2474 ..... **A•1084**
§ **ISKRA Electronics, Inc., Plainview, NY 11803, 516-349-0222** ..... **A•1085**
§ **ITW Paktron, Div. of Illinois Tool Works, Lynchburg, VA 24502, 804-239-6941** ..... **A•1087**
† **Johanson Dielectrics, Inc., Sylmar, CA 91342, 818-364-9800** ..... **A•1089**
Johanson Manufacturing Corporation, Boonton, NJ 07005, 201-334-2676 ..... **A•1088**
§ **KCK America Inc., Mitsubishi Materials Corporation, Rolling Meadows, IL 60008, 708-577-0200** ..... **A•1091**
§† **Kemet Electronics Corporation, Greenville, SC 29606, 803-963-6621** ..... **A•1092-1093**
§ **KOA Speer Electronics, Bradford, PA 16701, 814-362-5536** ... **A•1095,1964,1971**
Maida Development Co., Hampton, VA 23663, 804-723-0785 ..... **A•1980**
§ **Matsuo Electronics, Huntington Beach, CA 92648, 714-969-2491** ..... **A•1102,1104-1105**
† **Metuchen Capacitors, Inc., Old Bridge, NJ 08857, 908-679-3366** ..... **A•1107-1108,1111-1114**
§ **Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300** ..... **A•1117-1118,1120**
§ **NEC Electronics, Inc., Mountain View, CA 94039-7241, 1-800-366-9782** ..... **A•1122-1129**
§ **North American Capacitor Co., Indianapolis, IN 46224, 317-273-0090** ..... **A•1134-1135**
§ **Paccom Electronics, Redmond, WA 98052-5350, 206-883-9200;800-426-6254** ..... **A•1142**
§ **Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200** ..... **A•1144-1145,1147-1148, B•1015**
Seacor, Inc., Westwood, NJ 07675, 201-666-5600 ..... **A•1160-1162**
§ **Semtech Corporation, Newbury Park, CA 91320, 805-498-2111** ..... **A•2180**
Sprague, Concord, NH 03301, 603-224-1961 ..... **A•1166**
Sprague, Solid Tantalum Capacitors, Sanford, ME 04073-0231, 207-324-4140 ..... **A•1166**
Sprague, Wet & Foil Tantalum Capacitors, North Adams, MA 01247-3987, 413-664-4431 ..... **A•1166**
§ **United Chemi-Con Inc., Rosemont, IL 60018, 708-696-2000** ..... **A•1171-1173**
§ Allegro MicroSystems, Inc., formerly Sprague Semiconductor Grp., Worcester, MA 01605 508-795-1300
† Alpha Industries, Inc., Woburn, MA 01801 617-935-5150
† American Technical Ceramics Corporation, Huntington Sta., NY 11746-2102 516-547-5700
§† Arco Electronics, Chatsworth, CA 91311 818-882-8707
† AVX Filters Corp., Sun Valley, CA 91352 818-767-6770
§ Baknor Industries Inc., Mississauga, ONT., CANADA L5L 1X1 416-828-2400
§† California Micro Devices, Inc., Milpitas, CA 95035 408-263-3214
† Compex Corp., Medford, NJ 08055 609-596-9388
Cornell-Dubilier Elctrns. (Corporate Headquarters), Wayne, NJ 07470 201-694-8600
§ C-S Electronic Sales, Inc., Frankfort, IN 46041 317-659-1874
§† Dielectric Labs., Cazenovia, NY 13035 315-655-8710
† Dionics, Westbury, NY 11590 516-997-7474
Elna America, Inc., Cypress, CA 90630 714-761-8600
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
§# F. W. Capacitors Inc., Florence, SC 29504-0636 ..... 803-662-4728;803-662-4844
§ GML Chip Components Limited, Hyderabad A.P., INDIA 500 044 ..... (91) 842-660106,661593
§† Hilton Industries, Inc., Subsidiary of Core Industries, Sarasota, FL 34232 813-371-2600
§ International Components Corp., Melville, NY 11747 516-293-1500
International Microelectronics, Arlington, TX 76003 817-473-1730
ISL Products Int'l, Ltd., Syosset, NY 11791-6093 ..... 516-937-3475;800-626-6116
§ ITT Components, ITT Corporation, Irvine, CA 92718 714-727-3001
§ Jaro Components, Inc., Boca Raton, FL 33487-8295 407-241-8600
† KD Components, Inc., Carson City, NV 89706 702-883-8003
§ Laube Technology, Woodland Hills, CA 91367 818-703-1188

† Loral Microwave-FSI, Semiconductor Div., Chelmsford, MA 01824 ..... 508-256-4113/8101
§† Marcon America Corp., Vernon Hills, IL 60061 708-913-9980
† Micro-Ceramx Technology, A MicroSemi Company, Escondido, CA 92029 619-480-1906
Mini-Systems, Inc., Thick/Thin Film Division, North Attleboro, MA 02761 508-695-0203
Mini-Systems, Inc., Sunbelt Microelectronic Division, Deltona, FL 32725 407-574-0208
§ Mouser Electronics, Santee, CA 92071 800-346-6873
§ Mouser Electronics, Mansfield, TX 76063 800-346-6873
§ Mouser Electronics, Gilroy, CA 95020 800-346-6873
§ MP/Capar, Multi Products International, West Paterson, NJ 07424 201-890-1344
Multi Products International, West Paterson, NJ 07424 201-890-1344
§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
§ Nemco Electronics, San Mateo, CA 94404 800-227-4058
NIC Components Corp., N. Amityville, NY 11701 516-226-7500
§ Panasonic Indl. Co. Standard Comps. Sector, Matsushita Elec. Corp. of America, Secaucus, NJ 07094 201-392-4818
§ Philips Components Discrete Products Div., A North American Philips Co., Jupiter, FL 33458 407-744-4200
† Presidio Components, Inc., San Diego, CA 92121 619-578-9390
§ Projections Unlimited, Tustin, CA 92680 714-544-2700
§ RF Electronics, Inc., Irvine, CA 92714-5517 714-263-0661
§ Roederstein Electronics, Inc., Vishay Electronic Components, Statesville, NC 28677 704-872-8101
Rogers Corp., Rogers, CT 06263 203-774-9605
Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013 615-641-2020
Samhwa U.S.A. Inc., Chatsworth, CA 91311 818-727-0512
† SFE Technologies, San Fernando, CA 91340 818-365-9411
Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
§ Soshin Electric Co., Ltd., Ota-Ku, Tokyo, JAPAN ..... (03) 3775-9119
§ Stetco, Inc., Franklin Pk., IL 60131 708-671-4208
§† Susco Elctrns., Farmingdale, NY 11735 516-249-4848
Taiyo Yuden (USA) Inc., Arlington Heights, IL 60005-4493 708-364-6104
§† Tansitor Electronics, Bennington, VT 05201 802-442-5473
§ TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056 708-803-6100
§ Thomas & Betts Corporation, Electronics Division, Greenville, SC 29616-2401 803-676-2900
Tokin America, Inc., San Jose, CA 95134 408-432-8020
Toshin Kogyo Co., R.G. Allen Co., N. Hollywood, CA 91605 818-765-8300
Unitrode Corp., Watertown, MA 02172 617-926-0404
USAPEX Corp., Santa Clara, CA 95051 408-982-9063
§ West Electronic Sales Team, Huntington Beach, CA 92647 ..... 714-375-6500; 310-495-5569
§ Xicon Capacitors, Arlington, TX 76003 800-628-0544

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Aerovox Inc., North Dartmouth, MA 02747-1217, 508-995-8000 ..... A•1008
§† Component Research Co. Inc., Santa Monica, CA 90404, 310-829-3615 .. A•1030
† Condenser Products Corp., Brooksville, FL 34609, 904-796-3561 ... A•1059-1060
§ Cornell-Dubilier Elctrns. (Intl. Sls., Distbn. Warehouse), New Bedford, MA. 02744, MA 02741, 508-996-8564 ..... A•1062,1064-1065
CSI Capacitors, CSI Technologies, San Marcos, CA 92069-3009, 619-747-4000 ..... A•1066
Del Electronics Corp., Valhalla, NY 10595, 914-686-3600 ..... A•1157-1158
Electronic Concepts, Inc., Eatontown, NJ 07724, 908-542-7880 ..... A•1069
Illinois Capacitor, Inc., Lincolnwood, IL 60645, 708-675-1760 ..... A•1082
§ NEC Electronics, Inc., Mountain View, CA 94039-7241, 1-800-366-9782 ..... A•1122-1123
NWL Capacitors, NWL Transformers, Snow Hill, NC 28580, 919-747-5943 ..... A•1136-1138
Paccom Electronics, Redmond, WA 98052-5350, 206-883-9200;800-426-6254 ..... A•1142
PPD, Inc., Raleigh, NC 27613, 919-781-3955 ..... A•1151-1152,1155
Reliable Capacitors/Hi-Rel Capacitors, Sante Fe Springs, CA 90690, 310-946-8577 ..... A•1156
Seacor, Inc., Westwood, NJ 07675, 201-666-5600 ..... A•1160,1162
§† American Capacitor Corporation, Irwindale, CA 91706 818-814-4444
American Radionic Co. Inc., Palm Coast, FL 32137 904-445-6000
† American Technical Ceramics Corporation, Huntington Sta., NY 11746-2102 516-547-5700
Aselco, Inc., Gaithersburg, MD 20877 301-863-1937
† The Carborundum Company, Electric Products, Niagara Falls, NY 14302 716-278-2521
Chicago Condenser Corp., Chicago, IL 60622 312-227-7070
§ Cornell-Dubilier Elctrns. (Corporate Headquarters), Wayne, NJ 07470 ... 201-694-8600
§† Electron Products, Irwindale, CA 91706 818-960-2299
§ Elpac Components, Elpac Electronics, Inc., Irvine, CA 92714 714-476-6070
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Haefely, Inc., Woodbridge, VA 22192 703-494-1900
High Energy, Inductotherm Industries, Parkesburg, PA 19365 215-593-2800
Hipotronics Inc., Brewster, NY 10509 914-279-8091
§# Jaro Components, Inc., Boca Raton, FL 33487-8295 407-241-8600
† KD Components, Inc., Carson City, NV 89706 702-883-8003
§ Marcon America Corp., Vernon Hills, IL 60061 708-913-9980
† Maxwell Laboratories, Inc., San Diego, CA 92123-1506 619-279-5100
† Motor Capacitors, Inc., Chicago, IL 60631 312-631-0713
§ Plastic Capacitors, Inc., Chicago, IL 60639 312-489-2229
§ Projections Unlimited, Tustin, CA 92680 714-544-2700
Samhwa U.S.A. Inc., Chatsworth, CA 91311 818-727-0512
S & EI Manufacturing, Northridge, CA 91324 818-349-4111
Sprague, Solid Tantalum Capacitors, Sanford, ME 04073-0231 207-324-4140
Sprague, Wet & Foil Tantalum Capacitors, North Adams, MA 01247-3987 413-664-4431
† Stanley Electronics Div., Mt. Vernon, NY 10550 914-699-2000
§† Susco Elctrns., Farmingdale, NY 11735 516-249-4848
† Wesco Electrical Co., Greenfield, MA 01301 413-774-4358

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§ Allen Co., Inc., Robert G., N. Hollywood, CA 91605, 818-765-8300;800-827-7422 ..... A•1010
§ ASC Capacitors, Ogallala, NE 69153, 308-284-3611 ..... A•1016-1018,1021,1023
§† Component Research Co. Inc., Santa Monica, CA 90404, 310-829-3615 .. A•1030
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CSI Capacitors, CSI Technologies, San Marcos, CA 92069-3009, 619-747-4000 ..... A•1066
Del Electronics Corp., Valhalla, NY 10595, 914-686-3600 ..... A•1157
§ Electrocube, Monrovia, CA 91016, 818-301-0122 ..... A•1067
Electronic Concepts, Inc., Eatontown, NJ 07724, 908-542-7880 ..... A•1071
§ Electronic Film Capacitors, Inc., Waterbury, CT 06705, 203-755-5629 .... A•1075
§ Elpac Components, Elpac Electronics, Inc., Irvine, CA 92714, 714-476-6070 ..... A•1076
§ GlobTek, Inc., Northvale, NJ 07647, 201-784-1000 ..... D•1732
† Motor Capacitors, Inc., Chicago, IL 60631, 312-631-0713 ..... A•1116
§ North American Capacitor Co., Indianapolis, IN 46224, 317-273-0090 .... A•1135
§ NTE Electronics, Inc., Bloomfield, NJ 07003, 201-748-5089 ..... A•2149
NWL Capacitors, NWL Transformers, Snow Hill, NC 28580, 919-747-5943 ..... A•1136-1138
§ Okaya Electric America, Inc., Okaya Electric Industries, Tokyo, Japan, Valparaiso, IN 46383, 219-477-4488 ..... A•1139-1140
§ Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... A•1144-1145,1148
PPD, Inc., Raleigh, NC 27613, 919-781-3955 ..... A•1150-1152,1155
Reliable Capacitors/Hi-Rel Capacitors, Sante Fe Springs, CA 90690, 310-946-8577 ..... A•1156
§ Seacor, Inc., Westwood, NJ 07675, 201-666-5600 ..... A•1162
Wesco Electrical Co., Greenfield, MA 01301, 413-774-4358 ..... A•1174
§ Aerovox Inc., North Dartmouth, MA 02747-1217 508-995-8000
§† American Capacitor Corporation, Irwindale, CA 91706 818-814-4444
American Radionic Co. Inc., Palm Coast, FL 32137 904-445-6000
Aselco, Inc., Gaithersburg, MD 20877 301-863-1937
§ Baknor Industries Inc., Mississauga, ONT., CANADA L5L 1X1 416-828-2400
Cera-Mite Corp., Grafton, WI 53024 414-377-3500
Commonwealth Sprague Capacitor, Inc., N. Adams, MA 01247 413-664-4556
§ Cornell-Dubilier Elctrns. (Corporate Headquarters), Wayne, NJ 07470 ... 201-694-8600
§† Electron Products, Irwindale, CA 91706 818-960-2299
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
High Energy, Inductotherm Industries, Parkesburg, PA 19365 215-593-2800
§ ICO-RALLY Corporation, Palo Alto, CA 94303 415-856-9900
§ Illinois Capacitor, Inc., Lincolnwood, IL 60645 708-675-1760
§ Inter-Technical Group Inc., WIMA Div., Elmsford, NY 10523 914-347-2474
§ ISKRA Electronics, Inc., Plainview, NY 11803 516-349-0222
§# Jaro Components, Inc., Boca Raton, FL 33487-8295 407-241-8600
§ Marcon America Corp., Vernon Hills, IL 60061 708-913-9980
Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
§ Nichicon (America) Corp., Schaumburg, IL 60173 708-843-7500
§# Nissei Denki America, Inc., Beaverton, OR 97005 503-646-1434
§ Peter Parts & Assocs., Webster, NY 14580 716-265-2540
§ Philips Components Discrete Products Div., A North American Philips Co., Columbia, SC 29212-3198 803-772-2500
§ Philips ECG, North American Philips Co., Williamsport, PA 17701 717-323-4691
Plastic Capacitors, Inc., Chicago, IL 60639 312-489-2229
§ Projections Unlimited, Tustin, CA 92680 714-544-2700
§ Roederstein Electronics, Inc., Vishay Electronic Components, Statesville, NC 28677 704-872-8101
Samhwa U.S.A. Inc., Chatsworth, CA 91311 818-727-0512
S & EI Manufacturing, Northridge, CA 91324 818-349-4111
Sprague, Solid Tantalum Capacitors, Sanford, ME 04073-0231 207-324-4140
Sprague, Wet & Foil Tantalum Capacitors, North Adams, MA 01247-3987 413-664-4431
Standard Condenser Corp., Skokie, IL 60076 708-675-3133
§† Susco Elctrns., Farmingdale, NY 11735 516-249-4848
† Teapo Electronic Corp. of America, Norcross, GA 30071 404-449-6220
§ Thomson Passive Components Corp., Woodland Hills, CA 91367 818-887-1010

Capacitors, Fixed, Air-1500

Del Electronics Corp., Valhalla, NY 10595, 914-686-3600 ..... A•1157
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ..... A•2118
High Energy, Inductotherm Industries, Parkesburg, PA 19365 215-593-2800
§ International Components Corp., Melville, NY 11747 516-293-1500
† Motor Capacitors, Inc., Chicago, IL 60631 312-631-0713
§ Projections Unlimited, Tustin, CA 92680 714-544-2700

Capacitors, Fixed, Aluminum Electrolytic-1500

Aerovox Inc., North Dartmouth, MA 02747-1217, 508-995-8000 .... A•1008-1009
§ Allen Co., Inc., Robert G., N. Hollywood, CA 91605, 818-765-8300;800-827-7422 ..... A•1010-1011
§† Cornell-Dubilier Elctrns. (Intl. Sls., Distbn. Warehouse), New Bedford, MA. 02744, MA 02741, 508-996-8564 ..... A•1062
§ Illinois Capacitor, Inc., Lincolnwood, IL 60645, 708-675-1760 ..... A•1082-1083
§ KCK America Inc., Mitsubishi Materials Corporation, Rolling Meadows, IL 60008, 708-577-0200 ..... A•1091
Mallory Controls, Emerson Electric Canada, Woodstock, Ont., CANADA N4S 7W8, 519-539-4891 ..... A•1099

NEC Electronics, Inc., Mountain View, CA 94039-7241, 1-800-366-9782 ..... A•1122-1124
§ North American Capacitor Co., Indianapolis, IN 46224, 317-273-0090 .... A•1135
§ Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 .... A•1144-1145,1147-1148
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ..... A•2118
Sprague, Concord, NH 03301, 603-224-1961 ..... A•1166-1167
Sprague, Solid Tantalum Capacitors, Sanford, ME 04073-0231, 207-324-4140 ..... A•1166-1167
Sprague, Wet & Foil Tantalum Capacitors, North Adams, MA 01247-3987, 413-664-4431 ..... A•1166-1167
§ United Chemi-Con Inc., Rosemont, IL 60018, 708-696-2000 ..... A•1171-1173
§ Air Electro Inc., Van Nuys, CA 91406 ..... 213-873-6400;818-988-4400
§ Alpha Dist. Corp., Richfield, OH 44286 ..... 216-659-7100; 1-800-628-0841
§† Arco Electronics, Chatsworth, CA 91311 818-882-8707
§ Baknor Industries Inc., Mississauga, ONT., CANADA L5L 1X1 416-828-2400
§† Capacitor Technology Products, Inc., Ft. Wayne, IN 46825 219-484-9054
§ Cornell-Dubilier Elctrns. (Corporate Headquarters), Wayne, NJ 07470 ... 201-694-8600
§ C-S Electronic Sales, Inc., Frankfort, IN 46041 317-659-1874
§ Elna America, Inc., Cypress, CA 90630 714-761-8600
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Evox-Rifa Inc., Lincolnshire, IL 60069 708-948-9511
GlobTek, Inc., Northvale, NJ 07647 201-784-1000
§ Hanovia, Canrad, Newark, NJ 07105 201-589-4300
§ ICO-RALLY Corporation, Palo Alto, CA 94303 415-856-9900
§ International Components Corp., Melville, NY 11747 516-293-1500
International Microelectronics, Arlington, TX 76003 817-473-1730
ISL Products Int'l, Ltd., Syosset, NY 11791-6093 ..... 516-937-3475;800-626-6116
§# Jaro Components, Inc., Boca Raton, FL 33487-8295 407-241-8600
§ Laube Technology, Woodland Hills, CA 91367 818-703-1188
§ Marcon America Corp., Vernon Hills, IL 60061 708-913-9980
† Motor Capacitors, Inc., Chicago, IL 60631 312-631-0713
§ Mouser Electronics, Santee, CA 92071 800-346-6873
§ Mouser Electronics, Mansfield, TX 76063 800-346-6873
§ Mouser Electronics, Gilroy, CA 95020 800-346-6873
§ MP/Capar, Multi Products International, West Paterson, NJ 07424 201-890-1344
§ Multi Products International, West Paterson, NJ 07424 201-890-1344
§ National Electronics Corp., Garden Grove, CA 92641 .... 714-892-7749;800-854-2451
§ NIC Components Corp., N. Amityville, NY 11701 516-226-7500
§ Nichicon (America) Corp., Schaumburg, IL 60173 708-843-7500
§ NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
Pacific Microtronics Corp., New York, NY 10021 212-517-5622
§ Panasonic Indl. Co. Standard Comps. Sector, Matsushita Elec. Corp. of America, Secaucus, NJ 07094 201-392-4818
§ Peter Parts & Assocs., Webster, NY 14580 716-265-2540
§ Philips Components Discrete Products Div., A North American Philips Co., Columbia, SC 29212-3198 803-772-2500
§ Philips ECG, North American Philips Co., Williamsport, PA 17701 717-323-4691
Plasticorp, Harbor City, CA 90710 310-539-9530
§ Projections Unlimited, Tustin, CA 92680 714-544-2700
§ RF Electronics, Inc., Irvine, CA 92714-5517 714-263-0661
Samhwa U.S.A. Inc., Chatsworth, CA 91311 818-727-0512
§ Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
Stetron International, Inc., Buffalo, NY 14203 716-854-3443
Susco Elctrns., Farmingdale, NY 11735 516-249-4848
§ Tansitor Electronics, Bennington, VT 05201 802-442-5473
† Teapo Electronic Corp. of America, Norcross, GA 30071 404-449-6220
Toshin Kogyo Co., R.G. Allen Co., N. Hollywood, CA 91605 818-765-8300
§ West Electronic Sales Team, Huntington Beach, CA 92647 ..... 714-375-6500; 310-495-5569
§ Xicon Capacitors, Arlington, TX 76003 800-628-0544

Capacitors, Fixed, Ceramic, Disc & Tubular-1500

§ Allen Co., Inc., Robert G., N. Hollywood, CA 91605, 818-765-8300;800-827-7422 ..... A•1010-1011
§ Armbar Industries, Inc., Old Bridge, NJ 08857, 908-679-3377 ..... A•1015
AVX Corporation, A Kyocera Group Company, Myrtle Beach, SC 29577, 803-448-9411 ..... A•1024
Del Electronics Corp., Valhalla, NY 10595, 914-686-3600 ..... A•1157
§ Illinois Capacitor, Inc., Lincolnwood, IL 60645, 708-675-1760 ..... A•1082
Johanson Dielectrics, Inc., Sylmar, CA 91342, 818-364-9800 ..... A•1089
Johanson Manufacturing Corporation, Boonton, NJ 07005, 201-334-2676 ..... A•1088
K & M Electronics Inc., W. Springfield, MA 01089, 413-781-1350 ..... A•1957
§ KCK America Inc., Mitsubishi Materials Corporation, Rolling Meadows, IL 60008, 708-577-0200 ..... A•1091
§† Kemet Electronics Corporation, Greenville, SC 29606, 803-963-6621 .... A•1093
§† Maida Development Co., Hampton, VA 23663, 804-723-0785 .. A•1096-1098,1980
Mallory Controls, Emerson Electric Canada, Woodstock, Ont., CANADA N4S 7W8, 519-539-4891 ..... A•1099
† Metuchen Capacitors, Inc., Old Bridge, NJ 08857, 908-679-3366 ..... A•1106-1111,1113-1114
§ Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ..... A•1117-1118,1120-1121
§ NEC Electronics, Inc., Mountain View, CA 94039-7241, 1-800-366-9782 ..... A•1128-1129
§ North American Capacitor Co., Indianapolis, IN 46224, 317-273-0090 .... A•1135
§ NTE Electronics, Inc., Bloomfield, NJ 07003, 201-748-5089 ..... A•2149
Okaya Electric America, Inc., Okaya Electric Industries, Tokyo, Japan, Valparaiso, IN 46383, 219-477-4488 ..... A•1140
§ Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... A•1144,1147-1148
§ Semtech Corporation, Newbury Park, CA 91320, 805-498-2111 ..... A•2180
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ..... A•2118
Spectrum Control, Inc., Erie, PA 16506, 814-835-4000 ..... A•1678-1679
§† Tusonix, Inc., Tucson, AZ 85740-7144, 602-744-0400 ..... A•1168-1169
§ Air Electro Inc., Van Nuys, CA 91406 ..... 213-873-6400;818-988-4400
§† Arco Electronics, Chatsworth, CA 91311 818-882-8707
§ Baknor Industries Inc., Mississauga, ONT., CANADA L5L 1X1 416-828-2400
§† Cera-Mite Corp., Grafton, WI 53024 414-377-3500
§ C-S Electronic Sales, Inc., Frankfort, IN 46041 317-659-1874
Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242 402-371-0080
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
High Energy, Inductotherm Industries, Parkesburg, PA 19365 215-593-2800
§ ICO-RALLY Corporation, Palo Alto, CA 94303 415-856-9900
§ International Components Corp., Melville, NY 11747 516-293-1500
International Microelectronics, Arlington, TX 76003 817-473-1730
§ ISKRA Electronics, Inc., Plainview, NY 11803 516-349-0222
ISL Products Int'l, Ltd., Syosset, NY 11791-6093 ..... 516-937-3475;800-626-6116
§ Jaro Components, Inc., Boca Raton, FL 33487-8295 407-241-8600
† KD Components, Inc., Carson City, NV 89706 702-883-8003
§ Laube Technology, Woodland Hills, CA 91367 818-703-1188
§ Mouser Electronics, Santee, CA 92071 800-346-6873
§ Mouser Electronics, Mansfield, TX 76063 800-346-6873
§ Mouser Electronics, Gilroy, CA 95020 800-346-6873
§ MP/Capar, Multi Products International, West Paterson, NJ 07424 201-890-1344
§ Multi Products International, West Paterson, NJ 07424 201-890-1344
§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
§ National Electronics Corp., Garden Grove, CA 92641 .... 714-892-7749;800-854-2451
§ NIC Components Corp., N. Amityville, NY 11701 516-226-7500
† Oxley Inc., Branford, CT 06405 203-488-1033
§ Panasonic Indl. Co. Standard Comps. Sector, Matsushita Elec. Corp. of America, Secaucus, NJ 07094 201-392-4818
§ Peter Parts & Assocs., Webster, NY 14580 716-265-2540
§ Philips Components Discrete Products Div., A North American Philips Co., Jupiter, FL 33458 407-744-4200
§ Philips ECG, North American Philips Co., Williamsport, PA 17701 717-323-4691
Quality Components, Inc., St. Marys, PA 15857 814-834-2817
Raltron Electronics, Miami, FL 33172 305-593-6033
§ RF Electronics, Inc., Irvine, CA 92714-5517 714-263-0661
Samhwa U.S.A. Inc., Chatsworth, CA 91311 818-727-0512
SFE Technologies, San Fernando, CA 91340 818-365-9411
§ Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
§ Stetco, Inc., Franklin Pk., IL 60131 708-671-4208
Stetron International, Inc., Buffalo, NY 14203 716-854-3443
Taiyo Yuden (USA) Inc., Arlington Heights, IL 60005-4493 708-364-6104
§ TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056 708-803-6100
§ Thomson Passive Components Corp., Woodland Hills, CA 91367 818-887-1010
§ Xicon Capacitors, Arlington, TX 76003 800-628-0544

Capacitors, Fixed, Ceramic, Monolithic-1500

§ Allen Co., Inc., Robert G., N. Hollywood, CA 91605, 818-765-8300;800-827-7422 ..... A•1010-1011,1013
§ Armbar Industries, Inc., Old Bridge, NJ 08857, 908-679-3377 ..... A•1015
§† AVX Corporation, A Kyocera Group Company, Myrtle Beach, SC 29577, 803-448-9411 ..... A•1024
† Johanson Dielectrics, Inc., Sylmar, CA 91342, 818-364-9800 ..... A•1089
Johanson Manufacturing Corporation, Boonton, NJ 07005, 201-334-2676 ..... A•1088
K & M Electronics Inc., W. Springfield, MA 01089, 413-781-1350 ..... A•1957
§ KCK America Inc., Mitsubishi Materials Corporation, Rolling Meadows, IL 60008, 708-577-0200 ..... A•1091
§† Kemet Electronics Corporation, Greenville, SC 29606, 803-963-6621 .... A•1093
Maida Development Co., Hampton, VA 23663, 804-723-0785 ..... A•1980
† Metuchen Capacitors, Inc., Old Bridge, NJ 08857, 908-679-3366 ... A•1107-1114
§† Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ..... A•1117-1118,1120-1121
§† North American Capacitor Co., Indianapolis, IN 46224, 317-273-0090 .... A•1135
§ Paccom Electronics, Redmond, WA 98052-5350, 206-883-9200;800-426-6254 ..... A•1142-1143
§† Semtech Corporation, Newbury Park, CA 91320, 805-498-2111 ..... A•2180
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ..... A•2118
† Spectrum Control, Inc., Erie, PA 16506, 814-835-4000 ..... A•1678
Sprague, Concord, NH 03301, 603-224-1961 ..... A•1166-1167
Sprague, Solid Tantalum Capacitors, Sanford, ME 04073-0231, 207-324-4140 ..... A•1166-1167
Sprague, Wet & Foil Tantalum Capacitors, North Adams, MA 01247-3987, 413-664-4431 ..... A•1166-1167
§† Tusonix, Inc., Tucson, AZ 85740-7144, 602-744-0400 ..... A•1168
§ Air Electro Inc., Van Nuys, CA 91406 ..... 213-873-6400;818-988-4400
† American Technical Ceramics Corporation, Huntington Sta., NY 11746-2102 516-547-5700
§† Arco Electronics, Chatsworth, CA 91311 818-882-8707
† AVX Filters Corp., Sun Valley, CA 91352 818-767-6770
§ Baknor Industries Inc., Mississauga, ONT., CANADA L5L 1X1 416-828-2400
§ C-S Electronic Sales, Inc., Frankfort, IN 46041 317-659-1874
Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242 402-371-0080
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§ International Components Corp., Melville, NY 11747 516-293-1500
International Microelectronics, Arlington, TX 76003 817-473-1730
§ ISKRA Electronics, Inc., Plainview, NY 11803 516-349-0222
ISL Products Int'l, Ltd., Syosset, NY 11791-6093 ..... 516-937-3475;800-626-6116
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† KD Components, Inc., Carson City, NV 89706 702-883-8003
§ Laube Technology, Woodland Hills, CA 91367 818-703-1188
Marcon America Corp., Vernon Hills, IL 60061 708-913-9980

† Micro-Ceramx Technology, A MicroSemi Company, Escondido, CA 92029 619-480-1906
§ Mouser Electronics, Santee, CA 92071 800-346-6873
§ Mouser Electronics, Mansfield, TX 76063 800-346-6873
§ Mouser Electronics, Gilroy, CA 95020 800-346-6873
§ MP/Capar, Multi Products International, West Paterson, NJ 07424 201-890-1344
§ Multi Products International, West Paterson, NJ 07424 201-890-1344
§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
§ National Electronics Corp., Garden Grove, CA 92641 .... 714-892-7749;800-854-2451
NEC Electronics, Inc., Mountain View, CA 94039-7241 1-800-366-9782
§ NIC Components Corp., N. Amityville, NY 11701 516-226-7500
Pacific Microtronics Corp., New York, NY 10021 212-517-5622
§ Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404 407-881-3200
§ Philips Components Discrete Products Div., A North American Philips Co., Jupiter, FL 33458 407-744-4200
† Presidio Components, Inc., San Diego, CA 92121 619-578-9390
§ Projections Unlimited, Tustin, CA 92680 714-544-2700
§ RF Electronics, Inc., Irvine, CA 92714-5517 714-263-0661
§† Rogers Corporation, Circuit Components Div., Tempe, AZ 85282 602-967-0624
Samhwa U.S.A. Inc., Chatsworth, CA 91311 818-727-0512
§† SFE Technologies, San Fernando, CA 91340 818-365-9411
§ Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
§ Stetco, Inc., Franklin Pk., IL 60131 708-671-4208
§† Susco Elctrns., Farmingdale, NY 11735 516-249-4848
§ TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056 708-803-6100
§ Thomson Passive Components Corp., Woodland Hills, CA 91367 818-887-1010
Tokin America, Inc., San Jose, CA 95134 408-432-8020
§ Xicon Capacitors, Arlington, TX 76003 800-628-0544

Capacitors, Fixed, Feedthru-1500

Allen Co., Inc., Robert G., N. Hollywood, CA 91605, 818-765-8300;800-827-7422 ..... A•1012
§† AVX Corporation, A Kyocera Group Company, Myrtle Beach, SC 29577, 803-448-9411 ..... A•1024-1025
Chicago Condenser Corp., Chicago, IL 60622, 312-227-7070 ..... A•1029
§† Component Research Co. Inc., Santa Monica, CA 90404, 310-829-3615 .. A•1030
§ Cornell-Dubilier Elctrns. (Intl. Sls., Distbn. Warehouse), New Bedford, MA. 02744, MA 02741, 508-996-8564 ..... A•1062
Electronic Concepts, Inc., Eatontown, NJ 07724, 908-542-7880 ..... A•1069
§ Elpac Components, Elpac Electronics, Inc., Irvine, CA 92714, 714-476-6070 ..... A•1076
Johanson Dielectrics, Inc., Sylmar, CA 91342, 818-364-9800 ..... A•1089
§ KCK America Inc., Mitsubishi Materials Corporation, Rolling Meadows, IL 60008, 708-577-0200 ..... A•1647
§† Maida Development Co., Hampton, VA 23663, 804-723-0785 ..... A•1096,1980
Mallory Controls, Emerson Electric Canada, Woodstock, Ont., CANADA N4S 7W8, 519-539-4891 ..... A•1099
† Metuchen Capacitors, Inc., Old Bridge, NJ 08857, 908-679-3366 ..... A•1109,1651, C•1416
§† Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 .. A•1661-1662
NWL Capacitors, NWL Transformers, Snow Hill, NC 28580, 919-747-5943 ..... A•1136
Reliable Capacitors/Hi-Rel Capacitors, Sante Fe Springs, CA 90690, 310-946-8577 ..... A•1156
Seacor, Inc., Westwood, NJ 07675, 201-666-5600 ..... A•1162
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ..... A•2118
§† Spectrum Control, Inc., Erie, PA 16506, 814-835-4000 ..... A•1678
§† Tusonix, Inc., Tucson, AZ 85740-7144, 602-744-0400 ..... A•1168-1169
Wesco Electrical Co., Greenfield, MA 01301, 413-774-4358 ..... A•1174
§† American Capacitor Corporation, Irwindale, CA 91706 818-814-4444
American Radionic Co. Inc., Palm Coast, FL 32137 904-445-6000
† American Technical Ceramics Corporation, Huntington Sta., NY 11746-2102 516-547-5700
§ Armbar Industries, Inc., Old Bridge, NJ 08857 908-679-3377
† AVX Filters Corp., Sun Valley, CA 91352 818-767-6770
§† Capcon, Inc., New York, NY 10001 212-243-6275
† Ceramic Devices Inc., San Diego, CA 92111 619-560-7575
Compac, Holbrook, NY 11741 516-585-3400
§ Cornell-Dubilier Elctrns. (Corporate Headquarters), Wayne, NJ 07470 ... 201-694-8600
Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242 402-371-0080
§† Electron Products, Irwindale, CA 91706 818-960-2299
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
† Filtron, RFI Corporation, Bayshore, NY 11706 516-231-6400
§ High Energy, Inductotherm Industries, Parkesburg, PA 19365 215-593-2800
§ ICO-RALLY Corporation, Palo Alto, CA 94303 415-856-9900
§ International Components Corp., Melville, NY 11747 516-293-1500
ISL Products Int'l, Ltd., Syosset, NY 11791-6093 ..... 516-937-3475;800-626-6116
§ Jaro Components, Inc., Boca Raton, FL 33487-8295 407-241-8600
† Joslyn Jennings Corporation, San Jose, CA 95122-2696 408-292-4025
† Motor Capacitors, Inc., Chicago, IL 60631 312-631-0713
§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
† Oxley Inc., Branford, CT 06405 203-488-1033
§ Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018 ..... 408-730-0300;800-PENSTOCK
Presidio Components, Inc., San Diego, CA 92121 619-578-9390
† RFI Corporation, Bay Shore, NY 11706 516-231-6400
† Ritron Corp., Skokie, IL 60076 708-679-7180
† S & EI Manufacturing, Northridge, CA 91324 818-349-4111
† SFE Technologies, San Fernando, CA 91340 818-365-9411
† Southern Electronic, F-Dyne, Burbank, CA 91502 818-845-2458
Sprague, Solid Tantalum Capacitors, Sanford, ME 04073-0231 207-324-4140
§† Standard Condenser Corp., Skokie, IL 60076 708-675-3133
§ Stetco, Inc., Franklin Pk., IL 60131 708-671-4208
§ TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056 708-803-6100

Capacitors, Fixed, Film, Metallized & Nonmetallized-1500

§ Aerovox Inc., North Dartmouth, MA 02747-1217, 508-995-8000 .... A•1008-1009
§ Allen Co., Inc., Robert G., N. Hollywood, CA 91605, 818-765-8300;800-827-7422 ..... A•1010-1012
§ ASC Capacitors, Ogallala, NE 69153, 308-284-3611 ..... A•1016-1023
† Chicago Condenser Corp., Chicago, IL 60622, 312-227-7070 ..... A•1029
§† Component Research Co. Inc., Santa Monica, CA 90404, 310-829-3615 .. A•1030
† Condenser Products Corp., Brooksville, FL 34609, 904-796-3561 ... A•1058-1060
§ Cornell-Dubilier Elctrns. (Intl. Sls., Distbn. Warehouse), New Bedford, MA. 02744, MA 02741, 508-996-8564 ..... A•1064-1065
CSI Capacitors, CSI Technologies, San Marcos, CA 92069-3009, 619-747-4000 ..... A•1066
Del Electronics Corp., Valhalla, NY 10595, 914-686-3600 ..... A•1157-1158
Eichhoff Electronics, Warwick, RI 02886, 401-738-1440;800-678-1040 ... A•1591
§ Electrocube, Monrovia, CA 91016, 818-301-0122 ..... A•1067
Electronic Concepts, Inc., Eatontown, NJ 07724, 908-542-7880 .... A•1068-1073
§ Electronic Film Capacitors, Inc., Waterbury, CT 06705, 203-755-5629 .... A•1075
§ Elpac Components, Elpac Electronics, Inc., Irvine, CA 92714, 714-476-6070 ..... A•1076-1081
§ Illinois Capacitor, Inc., Lincolnwood, IL 60645, 708-675-1760 ..... A•1083
§ Inter-Technical Group Inc., WIMA Div., Elmsford, NY 10523, 914-347-2474 ..... A•1084
§ ISKRA Electronics, Inc., Plainview, NY 11803, 516-349-0222 ..... A•1085
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Sprague, Concord, NH 03301, 603-224-1961 ..... A•1166-1167
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† Wesco Electrical Co., Greenfield, MA 01301, 413-774-4358 ..... A•1174-1175
§† American Capacitor Corporation, Irwindale, CA 91706 818-814-4444
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§ Bishop Electronics Corp., Pico Rivera, CA 90660 ..... 310-695-0446;310-692-9391
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Interelectronics Corp., Congers, NY 10920 ..... 914-EL8-8000
§ International Components Corp., Melville, NY 11747 516-293-1500
International Microelectronics, Arlington, TX 76003 817-473-1730
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§ Marcon America Corp., Vernon Hills, IL 60061 708-913-9980
§ Martin Sound Prods. Inc., Cleveland, OH 44143-2297 216-442-2286
† Maxwell Laboratories, Inc., San Diego, CA 92123-1506 619-279-5100
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MultiComp., Inc., Beaverton, OR 97006 503-626-4200
§ Multi Products International, West Paterson, NJ 07424 201-890-1344
§ National Electronics Corp., Garden Grove, CA 92641 .... 714-892-7749;800-854-2451
§ Nedco Electronics, Inc., Morton Grove, IL 60053 708-967-0500
§ NIC Components Corp., N. Amityville, NY 11701 516-226-7500
§ Nichicorr (America) Corp., Schaumburg, IL 60173 708-843-7500
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§ NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089

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§ Philips Components Discrete Products Div., A North American Philips Co., Columbia, SC 29212-3198 803-772-2500
§† Plastic Capacitors, Inc., Chicago, IL 60639 312-489-2229
§ Projections Unlimited, Tustin, CA 92680 714-544-2700
§ RF Electronics, Inc., Irvine, CA 92714-5517 714-263-0661
† RFI Corporation, Bay Shore, NY 11706 516-231-6400
§ Roederstein Electronics, Inc., Vishay Electronic Components, Statesville, NC 28677 704-872-8101
Rogers Corp., Rogers, CT 06263 203-774-9605
Samhwa U.S.A. Inc., Chatsworth, CA 91311 818-727-0512
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§ SB Electronics, Inc., Barre, VT 05641 802-476-4146
§ Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
Soshin Electric Co., Ltd., Ota-Ku, Tokyo, JAPAN ..... (03) 3775-9119
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§† Standard Condenser Corp., Skokie, IL 60076 708-675-3133
† Stanley Electronics Div., Mt. Vernon, NY 10550 914-699-2000
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Stetron International, Inc., Buffalo, NY 14203 716-854-3443
§† Susco Elctrns., Farmingdale, NY 11735 516-249-4848
† Teapo Electronic Corp. of America, Norcross, GA 30071 404-449-6220
§ Thomson Passive Components Corp., Woodland Hills, CA 91367 818-887-1010
Toshin Kogyo Co., R.G. Allen Co., N. Hollywood, CA 91605 818-765-8300
§ West Electronic Sales Team, Huntington Beach, CA 92647 ..... 714-375-6500; 310-495-5569
§ World Products Inc., Sonoma, CA 95476 707-996-5201
World Products Inc., Systems Devices Grp., Sonoma 95476 707-996-5201
§ Xicon Capacitors, Arlington, TX 76003 800-628-0544

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§ Allen Co., Inc., Robert G., N. Hollywood, CA 91605, 818-765-8300;800-827-7422 ..... A•1010
§† AVX Corporation, A Kyocera Group Company, Myrtle Beach, SC 29577, 803-448-9411 ..... A•1024
† Joslyn Jennings Corporation, San Jose, CA 95122-2696, 408-292-4025 .. A•1090
§ Air Electro Inc., Van Nuys, CA 91406 ..... 213-873-6400;818-988-4400
† American Technical Ceramics Corporation, Huntington Sta., NY 11746-2102 516-547-5700
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Nemeth Engineering Associates, Inc., Crestwood, KY 40014 502-241-1502
§ Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404 407-881-3200
§ Philips Components Discrete Products Div., A North American Philips Co., Jupiter, FL 33458 407-744-4200
Power Electronic Components, Inc., PEC, Inc, Crestwood, KY 40014 502-241-5970,800-245-0193
§ Projections Unlimited, Tustin, CA 92680 714-544-2700

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§† Component Research Co. Inc., Santa Monica, CA 90404, 310-829-3615 .. A•1030
Reliable Capacitors/Hi-Rel Capacitors, Sante Fe Springs, CA 90690, 310-946-8577 ..... A•1156
§† Tusonix, Inc., Tucson, AZ 85740-7144, 602-744-0400 ..... A•1168
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† American Technical Ceramics Corporation, Huntington Sta., NY 11746-2102 516-547-5700
Aselco, Inc., Gaithersburg, MD 20877 301-863-1937
BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
MultiComp., Inc., Beaverton, OR 97006 503-626-4200
§ Nichicon (America) Corp., Schaumburg, IL 60173 708-843-7500
Rutherford Research, Rutherford, NJ 07070 201-933-2091
S & EI Manufacturing, Northridge, CA 91324 818-349-4111
† Southern Electronic, F-Dyne, Burbank, CA 91502 818-845-2458
§† Standard Condenser Corp., Skokie, IL 60076 708-675-3133
Tucker Electronics, Dallas, TX 75355-1419 ..... 214-348-8800;800-527-4642

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§ Allen Co., Inc., Robert G., N. Hollywood, CA 91605, 818-765-8300;800-827-7422 ..... A•1010
§† Cornell-Dubilier Elctrns. (Intl. Sls., Distbn. Warehouse), New Bedford, MA. 02744, MA 02741, 508-996-8564 ..... A•1063
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§ Air Electro Inc., Van Nuys, CA 91406 ..... 213-873-6400;818-988-4400
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† Axel Electronics, Inc., Subsidiary of FPBSM Industries Inc., Rancho Dominquez, CA 90220 718-291-3900
§ Baknor Industries Inc., Mississauga, ONT., CANADA L5L 1X1 416-828-2400
† Cera-Mite Corp., Grafton, WI 53024 414-377-3500
§† Cornell-Dubilier Elctrns. (Corporate Headquarters), Wayne, NJ 07470 ... 201-694-8600
§ C-S Electronic Sales, Inc., Frankfort, IN 46041 317-659-1874
§† Custom Electronics, Oneonta, NY 13820 607-432-3880
§† Electron Products, Irwindale, CA 91706 818-960-2299
§ F. W. Capacitors Inc., Florence, SC 29504-0636 ..... 803-662-4728;803-662-4844
High Energy, Inductotherm Industries, Parkesburg, PA 19365 215-593-2800
§ ICO-RALLY Corporation, Palo Alto, CA 94303 415-856-9900
International Microelectronics, Arlington, TX 76003 817-473-1730
§ Jaro Components, Inc., Boca Raton, FL 33487-8295 407-241-8600
† Motor Capacitors, Inc., Chicago, IL 60631 312-631-0713
§ Mouser Electronics, Santee, CA 92071 800-346-6873
§ Mouser Electronics, Mansfield, TX 76063 800-346-6873
§ Mouser Electronics, Gilroy, CA 95020 800-346-6873
§ National Electronics Corp., Garden Grove, CA 92641 ..... 714-892-7749;800-854-2451
Pacific Microtronics Corp., New York, NY 10021 212-517-5622
§ Projections Unlimited, Tustin, CA 92680 714-544-2700
§† Soshin Electric Co., Ltd., Ota-Ku, Tokyo, JAPAN ..... (03) 3775-9119
† Standard Magnetic Corp., Garden Grove, CA 92641 714-379-5671
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§† Susco Elctrns., Farmingdale, NY 11735 516-249-4848
† Tobe Deutschmann Labs., Inc., Canton, MA 02021 617-828-3366

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† Condenser Products Corp., Brooksville, FL 34609, 904-796-3561 ... A•1058-1060
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§ American Radionic Co. Inc., Palm Coast, FL 32137 904-445-6000
Aselco, Inc., Gaithersburg, MD 20877 301-863-1937
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Commonwealth Sprague Capacitor, Inc., N. Adams, MA 01247 413-664-4556
§ Cornell-Dubilier Elctrns. (Corporate Headquarters), Wayne, NJ 07470 ... 201-694-8600
§† Electron Products, Irwindale, CA 91706 818-960-2299
§ Elpac Components, Elpac Electronics, Inc., Irvine, CA 92714 714-476-6070
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† Maxwell Laboratories, Inc., San Diego, CA 92123-1506 619-279-5100
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§ North American Capacitor Co., Indianapolis, IN 46224 317-273-0090
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§† Plastic Capacitors, Inc., Chicago, IL 60639 312-489-2229
§ Projections Unlimited, Tustin, CA 92680 714-544-2700
† RFI Corporation, Bay Shore, NY 11706 516-231-6400
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Standard Condenser Corp., Skokie, IL 60076 708-675-3133
† Standard Magnetic Corp., Garden Grove, CA 92641 714-379-5671
† Stanley Electronics Div., Mt. Vernon, NY 10550 914-699-2000
† Tobe Deutschmann Labs., Inc., Canton, MA 02021 617-828-3366

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† Johanson Dielectrics, Inc., Sylmar, CA 91342, 818-364-9800 ..... A•1089
† American Technical Ceramics Corporation, Huntington Sta., NY 11746-2102 516-547-5700
§† Dielectric Labs., Cazenovia, NY 13035 315-655-8710
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§† AVX Corporation, A Kyocera Group Company, Myrtle Beach, SC 29577, 803-448-9411 ..... A•1024,1026-1028
§ KCK America Inc., Mitsubishi Materials Corporation, Rolling Meadows, IL 60008, 708-577-0200 ..... A•1091
§† Kemet Electronics Corporation, Greenville, SC 29606, 803-963-6621 .... A•1092
§ KOA Speer Electronics, Bradford, PA 16701, 814-362-5536 ... A•1095,1964,1971
§ Matsuo Electronics, Huntington Beach, CA 92648, 714-969-2491 ... A•1100-1104
§ NEC Electronics, Inc., Mountain View, CA 94039-7241, 1-800-366-9782 ..... A•1125-1127
§† North American Capacitor Co., Indianapolis, IN 46224, 317-273-0090 ..... A•1132-1134
§ NTE Electronics, Inc., Bloomfield, NJ 07003, 201-748-5089 ..... A•2149
§ Paccom Electronics, Redmond, WA 98052-5350, 206-883-9200;800-426-6254 ..... A•1142-1143
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Sprague, Concord, NH 03301, 603-224-1961 ..... A•1166-1167
Sprague, Solid Tantalum Capacitors, Sanford, ME 04073-0231, 207-324-4140 ..... A•1166-1167
Sprague, Wet & Foil Tantalum Capacitors, North Adams, MA 01247-3987, 413-664-4431 ..... A•1166-1167
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§ Mouser Electronics, Mansfield, TX 76063 800-346-6873
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Lectronic Research Labs., Inc., Camden, NJ 08104 800-358-8378
Nemeth Engineering Associates, Inc., Crestwood, KY 40014 502-241-1502
Power Electronic Components, Inc., PEC, Inc, Crestwood, KY 40014 502-241-5970,800-245-0193

Capacitors, Variable, Air-1500

§† Johanson Manufacturing Corporation, Boonton, NJ 07005, 201-334-2676 ..... A•1088
§ Sprague-Goodman Elctrns., Inc., Garden City Pk., NY 11040, 516-746-1385 ..... A•1164-1165
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
International Microelectronics, Arlington, TX 76003 817-473-1730
§ Jaro Components, Inc., Boca Raton, FL 33487-8295 407-241-8600
§ Johnson, E. F., Co., Waseca, MN 56093 1-800-247-8256
James Millen Elctrns., Caywood Elec. Inc., No. Andover, MA 01845 508-975-2711
Mouser Electronics, Santee, CA 92071 800-346-6873
Mouser Electronics, Mansfield, TX 76063 800-346-6873
Mouser Electronics, Gilroy, CA 95020 800-346-6873
§ Murata Erie North America, Inc., Smyrna, GA 30080 404-436-1300
§ Trim-Tronics, Inc., Cazenovia, NY 13035 315-655-9528
† Voltronics Corporation, Denville, NJ 07834 201-586-8585

Capacitors, Variable, Ceramic-1500

§† Allen Co., Inc., Robert G., N. Hollywood, CA 91605, 818-765-8300;800-827-7422 ..... A•1010-1011
§ AVX Corporation, A Kyocera Group Company, Myrtle Beach, SC 29577, 803-448-9411 ..... A•1024
§† Johanson Manufacturing Corporation, Boonton, NJ 07005, 201-334-2676 ..... A•1088
† Joslyn Jennings Corporation, San Jose, CA 95122-2696, 408-292-4025 .. A•1090
§ Maida Development Co., Hampton, VA 23663, 804-723-0785 ..... A•1097,1980
§ Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 .. A•1119,1121
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ..... A•2118
§ Sprague-Goodman Elctrns., Inc., Garden City Pk., NY 11040, 516-746-1385 ..... A•1164-1165
§† Tusonix, Inc., Tucson, AZ 85740-7144, 602-744-0400 ..... A•1168
† American Technical Ceramics Corporation, Huntington Sta., NY 11746-2102 516-547-5700
† Compex Corp., Medford, NJ 08055 609-596-9388
Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242 402-371-0080
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
ISL Products Int'l, Ltd., Syosset, NY 11791-6093 ..... 516-937-3475;800-626-6116
§ Jaro Components, Inc., Boca Raton, FL 33487-8295 407-241-8600
§ Johnson, E. F., Co., Waseca, MN 56093 1-800-247-8256
§ Mouser Electronics, Santee, CA 92071 800-346-6873
§ Mouser Electronics, Mansfield, TX 76063 800-346-6873
§ Mouser Electronics, Gilroy, CA 95020 800-346-6873
NEC Electronics, Inc., Mountain View, CA 94039-7241 1-800-366-9782
Nemeth Engineering Associates, Inc., Crestwood, KY 40014 502-241-1502
† Oxley Inc., Branford, CT 06405 203-488-1033
§ Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404 407-881-3200
§ Philips Components Discrete Products Div., A North American Philips Co., Jupiter, FL 33458 407-744-4200
§ Projections Unlimited, Tustin, CA 92680 714-544-2700
§ SARONIX, Palo Alto, CA 94303 415-856-6900
§† Stetco, Inc., Franklin Pk., IL 60131 708-671-4208
§ Xicon Capacitors, Arlington, TX 76003 800-628-0544

Capacitors, Variable, Film-1500

§† Allen Co., Inc., Robert G., N. Hollywood, CA 91605, 818-765-8300;800-827-7422 ..... A•1010-1011
§ Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... A•1144,1146,1148
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ..... A•2118
§ Sprague-Goodman Elctrns., Inc., Garden City Pk., NY 11040, 516-746-1385 ..... A•1164-1165
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
§ Johnson, E. F., Co., Waseca, MN 56093 1-800-247-8256
§ Philips Components Discrete Products Div., A North American Philips Co., Columbia, SC 29212-3198 803-772-2500

Capacitors, Variable, Gas Filled-1500

† Joslyn Jennings Corporation, San Jose, CA 95122-2696, 408-292-4025 .. A•1090
Continental Electronics Corporation, Dallas, TX 75227 214-381-7161

Capacitors, Variable, Glass-1500

§† **Johanson Manufacturing Corporation, Boonton, NJ 07005, 201-334-2676** ..... **A•1088**
† **Joslyn Jennings Corporation, San Jose, CA 95122-2696, 408-292-4025** .. **A•1090**
§† **Sprague-Goodman Elctrns., Inc., Garden City Pk., NY 11040, 516-746-1385** ..... **A•1164-1165**
Metuchen Capacitors, Inc., Old Bridge, NJ 08857 908-679-3366
Nemeth Engineering Associates, Inc., Crestwood, KY 40014 502-241-1502
Power Electronic Components, Inc., PEC, Inc, Crestwood, KY 40014 502-241-5970,800-245-0193
† Voltronics Corporation, Denville, NJ 07834 201-586-8585

Capacitors, Variable, HV (Lab Type)-Also See Decade Boxes, Capacitance-1500

Chicago Condenser Corp., Chicago, IL 60622, 312-227-7070 ..... **A•1029**
Del Electronics Corp., Valhalla, NY 10595, 914-686-3600 ..... **A•1157**
IET Labs, Inc., Westbury, NY 11590, 516-334-5959;800-899-8438 ..... **D•1266**
§† **Johanson Manufacturing Corporation, Boonton, NJ 07005, 201-334-2676** ..... **A•1088**
Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ..... **A•1121**
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... **A•1148**
BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
† Joslyn Jennings Corporation, San Jose, CA 95122-2696 408-292-4025
§† Ohmite Manufacturing Co., Skokie, IL 60076 708-675-2600
Polyflon Company, Crane Co., New Rochelle, NY 10801 914-636-7222
† Southern Electronic, F-Dyne, Burbank, CA 91502 818-845-2458
† Voltronics Corporation, Denville, NJ 07834 201-586-8585

Capacitors, Variable, Mica-1500

§† **Allen Co., Inc., Robert G., N. Hollywood, CA 91605, 818-765-8300;800-827-7422** ..... **A•1010**
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ..... **A•2118**
§ **Sprague-Goodman Elctrns., Inc., Garden City Pk., NY 11040, 516-746-1385** ..... **A•1164-1165**
§ Arco Electronics, Chatsworth, CA 91311 818-882-8707
Del Electronics Corp., Valhalla, NY 10595 914-686-3600
§ F. W. Capacitors Inc., Florence, SC 29504-0636 ..... 803-662-4728;803-662-4844
Pacific Microtronics Corp., New York, NY 10021 212-517-5622

Capacitors, Variable, Padders & Trimmers-1500

§† **Allen Co., Inc., Robert G., N. Hollywood, CA 91605, 818-765-8300;800-827-7422** ..... **A•1010**
§† **Johanson Manufacturing Corporation, Boonton, NJ 07005, 201-334-2676** ..... **A•1088**
§ **Maida Development Co., Hampton, VA 23663, 804-723-0785** ..... **A•1096,1980**
§ **Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300** ..... **A•1119**
§† **Sprague-Goodman Elctrns., Inc., Garden City Pk., NY 11040, 516-746-1385** ..... **A•1164-1165**
§† **Tusonix, Inc., Tucson, AZ 85740-7144, 602-744-0400** ..... **A•1168-1169**
† American Technical Ceramics Corporation, Huntington Sta., NY 11746-2102 516-547-5700
§ Arco Electronics, Chatsworth, CA 91311 818-882-8707
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
§ F. W. Capacitors Inc., Florence, SC 29504-0636 ..... 803-662-4728;803-662-4844
§ Jaro Components, Inc., Boca Raton, FL 33487-8295 407-241-8600
§ Johnson, E. F., Co., Waseca, MN 56093 1-800-247-8256
Metuchen Capacitors, Inc., Old Bridge, NJ 08857 908-679-3366
James Millen Elctrns., Caywood Elec. Inc., No. Andover, MA 01845 508-975-2711
Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
† Oxley Inc., Branford, CT 06405 203-488-1033
Pacific Microtronics Corp., New York, NY 10021 212-517-5622
§ Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018 ..... 408-730-0300;800-PENSTOCK
§ Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404 407-881-3200
§ Philips Components Discrete Products Div., A North American Philips Co., Columbia, SC 29212-3198 803-772-2500
Polyflon Company, Crane Co., New Rochelle, NY 10801 914-636-7222
§ Stetco, Inc., Franklin Pk., IL 60131 708-671-4208
† Voltronics Corporation, Denville, NJ 07834 201-586-8585

Capacitors, Variable, Vacuum-1500

† **Joslyn Jennings Corporation, San Jose, CA 95122-2696, 408-292-4025** .. **A•1090**
Seiko Instruments U.S.A., Inc. Electronic Components, Torrance, CA 90505, 310-517-7770 ..... **D•1473**
† EEV Inc., Elmsford, NY 10523 914-592-6050
§ Inmark Corp., Norwalk, CT 06850 203-866-8474
Lectronic Research Labs., Inc., Camden, NJ 08104 800-358-8378
Nemeth Engineering Associates, Inc., Crestwood, KY 40014 502-241-1502
Power Electronic Components, Inc., PEC, Inc, Crestwood, KY 40014 502-241-5970,800-245-0193

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Capacitors (MIL), Variable-2440 — ***See Vol. B***

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Caps, Forms & Tapes, Heat Shrinkable-Also See Tubing, Heat Shrinkable-2500 — ***See Vol. C***

Caps, Lenses, Indicator Light-2460 — ***See Vol. B***

Caps, Wire Splicing — See Splicers, Wire (Vol. C)

Caps (MIL)-2440 — ***See Vol. B***

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Card Equipment, Mark Sense-2000 — ***See Vol. D***

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Card Equip., Reader/Punch-2000 — ***See Vol. D***

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Cards, Data Communication/Interfaces-2000 — ***See Vol. D***

Cards, Extender — See Extender Boards (Vol. D)

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Cards, Logic-2000 — ***See Vol. D***

Cards, Memory — See Memory Devices (Vol. D), Memory Systems (Vol. D)

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Carrier Tape, Component-4100 — ***See Vol. D***

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Cases, Equipment, Instrument, Meter (Stationary) — See Enclosures, Equipment & Panel Mounting (Vol. C)

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Cathode-Ray Readout Tubes — See Tubes, Readout (Vol. A)

CATV Systems & Equipment-1900 — ***See Vol. D***

Cavities, Microwave-3450

† Integrated Microwave, San Diego, CA 92121-1009 619-259-2600
† Loral Microwave-Wavecom, Northridge, CA 91324 818-882-3010
† Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710 813-347-2181
Lucas Epsco, Inc., Hopkinton, MA 01748-2204 508-435-2400
† M/A COM Ltd., Bedfordshire, ENGLAND LU5 4SX, England ..... 44(582)471200
† MCL, Inc., Bolingbrook, IL 60440-4999 708-759-9500
† Microphase, Norwalk, CT 06856 203-866-8000
Penny Technologies, Inc., Greenpoint, NY 11222 718-782-4149
† Premier Microwave, Port Chester, NY 10573 914-939-8900
† UTE Microwave, Asbury Park, NJ 07712 908-922-1009
Zero Enclosures, Zero Corp., North Salt Lake, UTAH 84054-0310 801-298-5900

Cells, Electrolytic (Timing) — See Timers, Electrolytic Cell (Vol. D)

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Chambers, Fluid Conditioner-2550 — ***See Vol. D***

Chambers, Humidity-2550 — ***See Vol. D***

Chambers, Magnetic, Degaussing Coil-4525 — ***See Vol. C***

Chambers, Pressure-2550 — ***See Vol. D***

Chambers, Radiation-2550 — ***See Vol. D***

Chambers, RFI/EMI-2550 — ***See Vol. D***

Chambers, Shock-2550 — ***See Vol. D***

Chambers, Space Simulation-2440 — *See Vol. B*

Chambers, Temperature-2550 — *See Vol. D*

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† Abbott Technologies, Inc., Sun Valley, CA 91352, 818-504-0644;1-800-367-8200 ... A•2234
Abracon Corporation, San Clemente, CA 92673, 714-498-4505 ... A•1180
Advanced Components Inds., Inc., Div of Kaschke, Torrance, CA 90501, 310-328-0060 ... A•1318
Amecon, Inc., Anaheim, CA 92805, 714-634-2220;800-392-2292 ... A•1182,1185
American Precision Ind.,Delevan/SMD Divisions, E. Aurora, NY 14052, 716-652-3600 ... A•1188
Bel Fuse, Jersey City, NJ 07302, 201-432-0463 ... A•1518-1521,1523,2279-2282,2284-2286
§ Bell Inds., J. W. Miller Div., Gardena, CA 90247-1059, 310-515-1720 ... A•1190-1192,1195
BH Electronics, Inc., Burnsville, MN 55337, 612-894-9590 ... A•1197
Caddell-Burns Mfg., Mineola, NY 11501-3508, 516-746-2310 ... A•1198-1212
Caddell Coil Corp., Middletown Springs, VT 05757, 802-235-2019 ... A•1213
† Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ... A•1224
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180, 605-665-9301 ... A•1226,1229,1232-1233
Eichhoff Electronics, Warwick, RI 02886, 401-738-1440;800-678-1040 ... A•1588
§† Electromech, Inc., Irvington, NJ 07111, 201-318-7999 ... A•2324
§ Fee Fil-Mag, San Diego, CA 92123, 619-569-6577 ... A•1635,1637
§† Gowanda Electronics Corp., Gowanda, NY 14070, 716-532-2234 ... A•1240-1241
Hisonic, Inc., Olathe, KS 66051, 913-782-0012 ... A•2360
Hitran Corporation, Flemington, NJ 08822-1238, 908-782-5525 ... A•2361
Kappa Technologies, Inc., Rahway, NJ 07065, 908-396-9400;1-800-223-0603 ... A•1645
† Lenco Elctrns., Inc., McHenry, IL 60050, 815-344-2900 ... A•2375
Magnelab, Boulder, CO 80301-4696, 303-442-6700 ... A•2380
Magnetek Triad, Huntington, IN 46750 219-356-7100 ... A•1248-1249
† Magnetic Component Engineering, Inc., Inglewood, CA 90301, 310-677-6600 ... A•1253
§† Microtran Co. Inc., Valley Stream, NY 11582-0236, 516-561-6050 ... A•2411
Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ... A•1256
† NWL Transformers, Bordentown, NJ 08505, 609-298-7300 ... A•2437, D•1851
PCA Electronics, Sepulveda, CA 91343, 818-892-0761 ... A•1670-1671
† Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ... A•1263
Precision Electronics Inc., Copiague, NY 11726, 516-842-4900 ... A•2526
Prem Magnetics, Inc., McHenry, IL 60050, 815-385-2700 ... A•1277-1279,2525
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ... A•1282,2019
Renco Electronics, Inc., Deer Pk., NY 11729, 516-586-5566;1-800-645-5828 ... A•1286-1287,1289
RFI Corporation, Bay Shore, NY 11706, 516-231-6400 ... A•2532
† Signal Transformer Co., Inc., Insilco Corporation, Inwood, NY 11696, 516-239-5777 ... A•2536
§ Stancor, White-Rodgers, Logansport, IN 46947, 219-722-2244 ... A•2564
† Standex Electronics, Standex International, Cincinnati, OH 45209, 513-871-3777 ... A•1290-1291
Talema Electronic, Inc., Saint James, MO 65559, 314-265-5500 ... A•2566,2569
§ Tamura Corporation of America, Temecula, CA 92589-2230, 909-699-1270 ... A•2571
TMP Inc., Santa Ana, CA 92705, 714-558-8028 ... A•1300
§† Todd Systems, Inc., Yonkers, NY 10701, 914-963-3400 ... A•2582,2584
† Toroid Corp. of Maryland, Salisbury, MD 21801, 410-860-0300 ... A•2586
† Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314 ... A•1303-1305,1307,2594
§ Valor Electronics, San Diego, CA 92131-1642, 619-537-2500 ... A•2602-2603
Wilco Corp., Indianapolis, IN 46268, 317-293-9300 ... A•1309-1310,1312-1313
† ZMAN Magnetics, Kent, WA 98032, 206-251-8064 ... A•1315
Albar, Inc., Lynnwood, WA 98036 ... 206-771-4006;800-822-5227
American Magnetics, Carterville, IL 62918 ... 618-985-4838
APX Technologies Inc., Hicksville, NY 11801 ... 516-433-1313
ATC-Frost Magnetics Inc., Oakville,Ont., CANADA L6H 2R4 ... 416-844-6681
Atlas Engineering Corp., Dorchester, MA 02121 ... 617-445-7100
† Automatic Coil Corp., Miami, FL 33147 ... 305-696-6660
§† Aydin Corporation (West), San Jose, CA 95119-1371 ... 408-629-1100
Berkshire Transformer Corp., Kent, CT 06757 ... 203-927-3541
† Bicron Electronics, Canaan, CT 06018 ... 203-824-5125
§† Capcon, Inc., New York, NY 10001 ... 212-243-6275
Component Specialties Corp., Temple City, CA 91780 ... 213-283-0015
† Corona Magnetics, Inc., Corona, CA 91719 ... 909-735-7558
† Cramer Coil & Transformer Co., Inc., Saukville, WI 53080 ... 414-268-2150;414-375-5700
Custom Bobbin Windings, A & K Corporation, Zanesville, OH 43702-2369 ... 614-452-6973
Custom Coils Inc., Alcester, SD 57001-0348 ... 605-934-2460
† Del Electronics Corp., Valhalla, NY 10595 ... 914-686-3600
§ Delevan Div., American Precision Inds. Inc., E. Aurora, NY 14052-0449 ... 716-652-3600
† Delta Products Corporation, Fremont, CA 94538 ... 510-770-0660
Deltona Transformer Corp., DeLand, FL 32724 ... 904-736-7900
Dynapower Corporation, S. Burlington, VT 05407 ... 802-860-7200
Ecliptek Corporation, Costa Mesa, CA 92626 ... 714-433-1200
Electro Assemblies Corp., Northbrook, IL 60062-2319 ... 708-498-6520
Electronic Transformer Corp., Paterson, NJ 07544-0487 ... 201-942-2222
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ... 201-288-4477; 800-447-5639
† Fernwood Transformer Co., Transistor Devices Inc., Belvidere, NJ 07823 ... 908-475-3207
Freed Transformer Co., Inc., Electronic Transformer Corp., Paterson, NJ 07544-0487 ... 201-942-2222
Gavagan Electronics, Danbury, CT 06810 ... 203-748-5248
GC International Inc., Plano, TX 75074 ... 214-423-8411
† Genisco Electronics, A Division of GTC, Anaheim, CA 92805 ... 714-563-4300
Grand Transformer, Inc., Grand Haven, MI 49417 ... 616-842-5430
§ Hammond Manufacturing Co., Buffalo, NY 14225 ... 716-894-5710
§ Hurricane Electronics Lab, Hurricane, UT 84737 ... 801-635-2003
§ Jeffers Electronics, Nogales, AZ 85621 ... 602-281-4925
† Keytronics, Inc., Endicott, NY 13760 ... 607-754-5405
† KIP Transformers Inc., Wolcott, CT 06716 ... 203-758-7085
† Magnecomp, Inc., Pickens, SC 29671 ... 803-878-4700
§ Magnetek Triad, Huntington, IN 46750 ... 219-356-7100
† Magnetico Inc., Holtsville, NY 11742 ... 516-654-1166
§ Martin Sound Prods. Inc., Cleveland, OH 44143-2297 ... 216-442-2286
Mech-Tronics, Mount Holly, NJ 08060 ... 609-267-0680
Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
Pacific Transformer Corp., Anaheim, CA 92807 ... 714-779-0450;1-800-325-0501
§ Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404 ... 407-881-3200
Philips Components Discrete Products Div., A North American Philips Co., Saugerties, NY 12477 ... 914-246-2811
† Polyphase Instrument, Ft. Washington, PA 19034 ... 215-643-6950
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861 ... 908-826-4700
† PTC Transformers, Bordentown, NJ 08505 ... 609-298-8200
Pulse Engineering, Inc., San Diego, CA 92128 ... 619-674-8100
Radio Television Products Corp., Douglas, AZ 85607 ... 602-364-4438
RDI Elctrns., Inc., Mamaroneck, NY 10543 ... 914-777-7000
Sanford-Miller Corp., Oceanside, NY 11572 ... 516-763-0926;800-645-5900
§ Schaffner EMC, Inc. Components Division, Springfield, NJ 07081 ... 201-379-7778; 800-367-5566
Schott Corp., Wayzata, MN 55391 ... 612-475-1173
† Sigmapower, Inc, FPBSM Industries, Inc., Rancho Dominguez, CA 90220-6404 ... 310-884-5200
§† Skyway Magnetics, Warner Springs, CA 92086-9714 ... 619-782-3342
South American Development Corp., Poughkeepsie, NY 12590 ... 914-452-1305
Staco Transpower, Components Corp. of America, Mt. Carmel, IL 62863 ... 618-262-5555
Standard Magnetic Corp., Garden Grove, CA 92641 ... 714-379-5671
§ Steward, Inc., Chattanooga, TN 37401 ... 615-867-4100
Texas Transformer Corp., Plano, TX 75086 ... 214-424-1581
§ Tokin America, Inc., San Jose, CA 95134 ... 408-432-8020
§ Toko America, Inc., Mt. Prospect, IL 60056 ... 708-297-0070
† Torwico Elctrns. Inc., Lakewood, NJ 08701 ... 908-364-1800
† Trans American Transformer, E. Setauket, NY 11733 ... 516-928-0762
†# United States Electronics, Springfield, NJ 07081 ... 201-912-0111
§ Vitec Electronics Corp., Visalia, CA 93291 ... 209-651-1535
The Winatic Corp., Electro-Technik Industries, Inc., Vestal, NY 13850 ... 607-729-6318
† Wirebenders, Inc., Phoenix, AZ 85021-2824 ... 602-861-1856
WPI Group, Inc., Warner, NH 03278 ... 603-456-3111
§† Zambre Co., Inc., Mountain View, CA 94043 ... 415-968-9176

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† Abbott Technologies, Inc., Sun Valley, CA 91352, 818-504-0644;1-800-367-8200 ... A•2234
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§ EWC, Inc., Englishtown, NJ 07726, 908-446-3110 ... A•1235,2340
§ Gowanda Electronics Corp., Gowanda, NY 14070, 716-532-2234 ... A•1240-1241
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§† Microtran Co. Inc., Valley Stream, NY 11582-0236, 516-561-6050 ... A•2404,2411
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† NWL Transformers, Bordentown, NJ 08505, 609-298-7300 ... A•2437, D•1851
† Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ... A•1263
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† Signal Transformer Co., Inc., Insilco Corporation, Inwood, NY 11696, 516-239-5777 ... A•2536
† Standex Electronics, Standex International, Cincinnati, OH 45209, 513-871-3777 ... A•1291
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† Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314 ... A•1307,2594
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American Magnetics, Carterville, IL 62918 ... 618-985-4838
† American Monarch, Minneapolis, MN 55421 ... 612-788-9161
ATC-Frost Magnetics Inc., Oakville,Ont., CANADA L6H 2R4 ... 416-844-6681
† Automatic Coil Corp., Miami, FL 33147 ... 305-696-6660
§† Aydin Corporation (West), San Jose, CA 95119-1371 ... 408-629-1100
Bel Fuse, Jersey City, NJ 07302 ... 201-432-0463
Bell Inds., J. W. Miller Div., Gardena, CA 90247-1059 ... 310-515-1720
Berkshire Transformer Corp., Kent, CT 06757 ... 203-927-3541
† Coast Coil Co., Coast Magnetics, Los Angeles, CA 90016 ... 213-936-6188
† Communication Coil Inc., Chicago, IL 60634 ... 312-637-1333
Component Specialties Corp., Temple City, CA 91780 ... 213-283-0015
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 ... 605-665-9301
† Del Electronics Corp., Valhalla, NY 10595 ... 914-686-3600
† Dietz Design, Inc., Belton, MO 64012 ... 816-331-4911
Electro Assemblies Corp., Northbrook, IL 60062-2319 ... 708-498-6520
† Electronic Transformer Corp., Paterson, NJ 07544-0487 ... 201-942-2222
† Fernwood Transformer Co., Transistor Devices Inc., Belvidere, NJ 07823 ... 908-475-3207
† Freed Transformer Co., Inc., Electronic Transformer Corp., Paterson, NJ 07544-0487 ... 201-942-2222
Gavagan Electronics, Danbury, CT 06810 ... 203-748-5248
GC International Inc., Plano, TX 75074 ... 214-423-8411
Grand Transformer, Inc., Grand Haven, MI 49417 ... 616-842-5430
§ Hammond Manufacturing Co., Buffalo, NY 14225 ... 716-894-5710
§ Hurricane Electronics Lab, Hurricane, UT 84737 ... 801-635-2003
† Keytronics, Inc., Endicott, NY 13760 ... 607-754-5405
Mag-Con, St. Paul, MN 55113 ... 612-633-8820
† Magnecomp, Inc., Pickens, SC 29671 ... 803-878-4700
† Magnetic Circuit Elements, Salinas, CA 93905 ... 408-757-8752
† Magnetico Inc., Holtsville, NY 11742 ... 516-654-1166
James Millen Elctrns., Caywood Elec. Inc., No. Andover, MA 01845 ... 508-975-2711
† Northlake Engineering, Inc., Bristol, WI 53104-0370 ... 414-857-9600
Pacific Transformer Corp., Anaheim, CA 92807 ... 714-779-0450;1-800-325-0501
† Polyphase Instrument, Ft. Washington, PA 19034 ... 215-643-6950
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861 ... 908-826-4700
† PTC Transformers, Bordentown, NJ 08505 ... 609-298-8200
Radio Television Products Corp., Douglas, AZ 85607 ... 602-364-4438
† Sigma Electronics Inc., Houston, TX 77099 ... 713-933-4700;800-874-7121
† Sigmapower, Inc, FPBSM Industries, Inc., Rancho Dominguez, CA 90220-6404 ... 310-884-5200
§† Skyway Magnetics, Warner Springs, CA 92086-9714 ... 619-782-3342
South American Development Corp., Poughkeepsie, NY 12590 ... 914-452-1305
Standard Magnetic Corp., Garden Grove, CA 92641 ... 714-379-5671
Tamura Corporation of America, Temecula, CA 92589-2230 ... 909-699-1270
§† Thordarson Meissner, Components Corp. of Amer., Mt. Carmel, IL 62863 ... 618-262-5121
† Toroid Corp. of Maryland, Salisbury, MD 21801 ... 410-860-0300
† Torwico Elctrns. Inc., Lakewood, NJ 08701 ... 908-364-1800
† Trans American Transformer, E. Setauket, NY 11733 ... 516-928-0762
† Wirebenders, Inc., Phoenix, AZ 85021-2824 ... 602-861-1856

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MultiComp., Inc., Beaverton, OR 97006, 503-626-4200 ... A•1255
† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950 ... 201-539-5500
Lectronic Research Labs., Inc., Camden, NJ 08104 ... 800-358-8378
† Maury Microwave Corp., Ontario, CA 91764 ... 909-987-4715
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861 ... 908-826-4700
† Premier Microwave, Port Chester, NY 10573 ... 914-939-8900

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Elecsys,Inc., Div. of C & C Jetronic, Princeton, NJ 08540, 609-259-8866 ... A•1693
† FDK America, Inc., Fuji Electrochemical Co., Ltd., San Jose, CA 95134, 408-432-8331 ... A•1698
† Frequency Electronics, Inc., Mitchel Field, NY 11553, 516-794-4500 ... A•1403
§ Gordos, Crouzet Corp., Carrollton, TX 75006-2506, 214-250-1647;1-800-677-5311 ... A•1695
† HEI, Inc., Hybrid Electronics Div., Victoria, MN 55386, 612-443-2500 ... A•1700-1701
§† Hybrids International Ltd., Thick Film Division, Olathe, KS 66062, 913-764-6400 ... A•1406,1699
† ILC Data Device Corp., Bohemia, NY 11716-2482, 516-567-5600 ... D•1190
† International Sensor Systems, Inc., Aurora, NE 68818, 402-694-6111 ... A•1704-1705
† Interpoint Corporation, Redmond, WA 98052, 206-882-3100 ... A•1706-1707, D•2112
† Micro-Precision Technologies, Inc., Salem, NH 03079, 603-893-7600 ... A•1703
† Mini-Systems, Inc., Thick/Thin Film Division, North Attleboro, MA 02761, 508-695-0203 ... A•1993
† Modular Devices, Shirley, NY 11967, 516-345-3100 ... D•2136
§ Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ... A•1708-1709
Noritake Co., Inc., Arlington Heights, IL 60005, 708-439-9020 ... A•1711
† Northwest Microcircuits, Inc., Philomath, OR 97370, 503-929-6424 ... A•1712
† Raytheon Company, Quincy Operation, Quincy, MA 02269, 617-479-5300 ... A•1713-1715
State of the Art, Inc., State College, PA 16803-1797, 814-355-8004 ... A•2020
ACC Electronics Company, Echlin Inc., Independence, KS 67301 ... 316-331-1000
† Addacon Greensboro, Greensboro, NC 27407 ... 919-852-6200
† Advanced Analog, Intech, Santa Clara, CA 95050 ... 408-988-4930
AEL Defense Corp., Lansdale, PA 19446 ... 215-822-2929
† Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803 ... 516-694-6700
† AlliedSignal Inc., Communications Systems, Towson, MD 21286-5999 ... 410-583-4000
† Analog Devices, Inc., Norwood, MA 02062-9106 ... 617-329-4700
Applied Design Company, Minneapolis, MN 55413 ... 612-378-0094
§ Aptek Technologies, Inc., DBA Aptek Microsystems, Deerfield Beach, FL 33442 ... 305-421-8450
Argo Transdata Corp., Clinton, CT 06413-0554 ... 203-669-2233
† A.S.I. Microsystems, Inc., (Formerly Andrich Systems, Inc.), Bohemia, NY 11716 ... 516-589-5656
AT&T Microelectronics, Allentown, PA 18103 ... 1-800-372-2447;In Can.:1-800-553-2448
Aydin Corp., Horsham, PA 19044 ... 215-657-7510
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328 ... 215-968-4271
Aztec Industries, Inc., Mesa, AZ 85210 ... 602-833-3131;800-729-3132
† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635 ... 714-447-2300
Beck Systems Inc., Beck Technology, Saskatoon, SK, CAN S7L 5X5 ... 306-975-1080
Bosch, Robert, Corp., Broadview, IL 60153 ... 708-865-5301
† C-Mac Industries Inc., Sherbrooke, Quebec, CANADA J1L 1V8 ... 819-821-4524
Coors Electronic Package Co., Chattanooga, TN 37405 ... 615-755-5452
† CTS Corporation, Elkhart, IN 46514 ... 219-293-7511
† CTS Corp, Microelectronics, W. Lafayette, IN 47906 ... 317-463-2565
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 ... 402-563-6506
§ Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242 ... 402-371-0080
† Datel, Inc., Mansfield, MA 02048-1194 ... 508-339-3000
† Densepac Microsystems, Inc., Garden Grove, CA 92641-1428 ... 714-898-0007; 800-64-CHIPS
Displays, Inc., Lewistown, PA 17044 ... 717-242-2541
Dover Electronics Manufacturing, Binghamton, NY 13902-5212 ... 607-772-7563
† Electronic Systems Division, Boeing Defense & Space Grp., Seattle, WA 98124-2499 ... 206-657-7474
† ELPAQ, Elmo Semiconductor, Burbank, CA 91504-1052 ... 818-768-7500
Eltec Instruments Inc., Daytona Bch., FL 32120 ... 904-253-5328
† EMC Technology Inc, Cherry Hill, NJ 08034 ... 609-429-7800
EVI, Inc., Columbia, MD 21046 ... 410-290-1919
§ Fox Electronics, Ft. Myers, FL 33905 ... 813-693-0099
§ Fujitsu Microelectronics Inc., Semiconductor Division & Electronic Components Div., San Jose, CA 95134-1804 ... 408-922-9000
GC International Inc., Plano, TX 75074 ... 214-423-8411
General Automation, A Div. of 769442 Ont. Ltd., Kemptville, Ont., CANADA KOG 1JO ... 613-724-1993
§† General Mircocircuits, Billerica, MA 01821 ... 508-663-9101
Gentron Corporation, Scottsdale, AZ 85260 ... 602-443-1288
Hokuriku USA Ltd., Madison, AL 35758 ... 205-772-9620
† Hughes Microelectronic Circuits Division, Newport Beach, CA 92658-8903 ... 714-759-2952
† Hybrid Designs, Inc., Costa Mesa, CA 92626 ... 714-557-9933
† Hybrid Electronics Corp., Bedford, MA 01730 ... 617-275-5350
Hybridyne, Inc., Tucson, AZ 85745 ... 602-629-0001
† Hycomp, Inc., Marlborough, MA 01752 ... 508-485-6300
† Hytek Microsystems, Inc., Carson City, NV 89706 ... 702-883-0820
Hyundai Electronics Industries Co. Ltd., Kyoungki-do, KOREA ... (0336)30-4114,(02)741-0661
§ International Rectifier Corp., El Segundo, CA 90245 ... 310-322-3331
§ International Resistive Company, Boone, NC 28607 ... 704-264-8861
ISKRA Electronics, Inc., Plainview, NY 11803 ... 516-349-0222
ISL Products Int'l, Ltd., Syosset, NY 11791-6093 ... 516-937-3475;800-626-6116
IXYS Corp., San Jose, CA 95131-1109 ... 408-435-1900
† KDI/Triangle Electronics, Whippany, NJ 07981 ... 201-887-5700
† M.S. Kennedy Corp., Cicero, NY 13039 ... 315-699-9201
LTI, Inc., Autotech Technologies, LP, Carol Stream, IL 60188 ... 708-668-8886
MACOM, Inc., Lowell, MA 01851 ... 617-272-3000

§† M/A-COM Microelectroincs Division, M/A-COM, Lowell, MA 01853-3295 508-442-5000
McCoy/Ovenaire/Spectrum, A Sub. of Oak Industries, Mt. Holly Springs, PA 17065 717-486-3411
Micro Electronic Technologies, Hopkinton, MA 01748 508-435-9057
† Micro Hybrids, Inc., Medford, NY 11763 516-732-3448
Micronel U.S., Vista, CA 92083 619-727-7400
† Micro Networks, Unitrode Corporation, Worcester, MA 01606 508-852-5400
† Micropac Inds., Inc., Garland, TX 75040 214-272-3571
Microplex, Inc., Anaheim, CA 92806 714-634-1535
† Micro Systems Engineering, Inc., Lake Oswego, OR 97035 503-635-4016
Mini-Systems, Inc., Sunbelt Microelectronic Division, Deltona, FL 32725 407-574-0208
§ Mitel Semiconductor Div. of Mitel Corp., Kanata, Ont., CANADA K2K 1X3 613-592-2122
MTI International Inc., Menomonee Falls, WI 53051 414-783-6080
† M-Tron Industries, Yankton, SD 57078 605-665-9321
§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
† Natel Engineering Co., Inc., Simi Valley, CA 93063-3449 805-581-3950
NF Electronic Instruments, State College, PA 16801 814-237-5580
§ Optek Technology Inc., Carrollton, TX 75006 214-323-2200
§ Opto Technology, Inc., Wheeling, IL 60090 708-537-4277
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Phoenix Microwave, Telford, PA 18969 215-723-6011
† Piezo Technology Inc., Orlando, FL 32804 407-298-2000
Power Solutions Inc., Pompano Bch., FL 33064 305-943-4110
† Q-Tech Corp., Culver City, CA 90232-3510 310-836-7900
† Qualtronics Corp., Inc., Palm, PA 18070-0468 215-679-0900
Radix Microelectronics Inc., Colorado Springs, CO 80909 719-597-1975
§ Raltron Electronics, Miami, FL 33172 305-593-6033
† Raytheon Co., Electronic Components Division, Waltham, MA 02254 617-899-8400
§† RCD Components, Inc., Manchester, NH 03109 603-669-0054
Reliable Electronic Mfg., Wyvern Technologies, Santa Ana, CA 92705 ... 714-966-0710
† Resistance Technology Inc., St. Paul, MN 55112 612-636-9770
§ Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013 615-641-2020
Sanken Electric USA Corp., Hoffman Estates, IL 60195 708-519-1717
§ Sanyo Semiconductor Corp., Allendale, NJ 07401 201-825-8080
Schaffner EMC, Inc., Intepro, Springfield, NJ 07081 201-379-7778
Sensitron Semiconductor, RSM Electron Power Div., Deer Park, NY 11729 516-586-7600
SFE Technologies, San Fernando, CA 91340 818-365-9411
Signatron, A Subsidiary of Meteor Communications Corp., Lexington, MA 02173 617-861-1500
† Sipex Corp., Billerica, MA 01821 508-667-8700
† Solid State Devices, La Mirada, CA 90638 714-670-7734
§ Soshin Electric Co., Ltd., Ota-Ku, Tokyo, JAPAN ..... (03) 3775-9119
Sprague, Hudson, NH 03051 ..... 603-881-7200; 603-883-9774 (Mktg)
ST Olektron Corporation, Subsidiary of Signal Technology Corp., Beverly, MA 01915 508-922-0019
† Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901 609-589-7500
Tadiran Electronic Industries, Inc., Port Washington, NY 11050 516-621-4980
Taiyo Yuden (USA) Inc., Arlington Heights, IL 60005-4493 708-364-6104
Tektronix, Inc., Wilsonville, OR 97070 800-835-9433
† Teledyne Microelectronics, Los Angeles, CA 90066 ..... 310-822-8229;310-305-0248
† Teledyne Microwave, Mountain View, CA 94043 415-968-2211
† TH Electronics, Tong Hsing Electronic Ind., Ltd., Tucson, AZ 85745-1443 602-791-7825
Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Schaumburg, IL 60173 708-884-6664
† Trend Circuits, Fremont, CA 94538-6148 510-651-1150
† United Supertek, Inc., San Jose, CA 95131-1101 408-922-0730
† Voltage Multipliers, Inc., Visalia, CA 93291 209-651-1402
† White Technology, Inc., Bowmar Instrument Corp., Phoenix, AZ 85040 .. 602-437-1520

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† **AMITRON, American Micro-Tronix, Inc., North Andover, MA 01845, 508-686-1882** ..... **A•1688,1720,1865**
§† **Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635, 714-447-2300** ..... **A•1868**
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§ **Crydom Company, Long Beach, CA 90805, 310-865-3536** ..... **A•2138,2142**
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§† **FDK America, Inc., Fuji Electrochemical Co., Ltd., San Jose, CA 95134, 408-432-8331** ..... **A•1698**
† **Frequency Electronics, Inc., Mitchel Field, NY 11553, 516-794-4500** ..... **A•1403**
§ **Gordos, Crouzet Corp., Carrollton, TX 75006-2506, 214-250-1647;1-800-677-5311** ..... **A•1695, B•1461**
† **HEI, Inc., Hybrid Electronics Div., Victoria, MN 55386, 612-443-2500** ..... **A•1700-1701**
§† **Hybrids International Ltd., Thick Film Division, Olathe, KS 66062, 913-764-6400** ..... **A•1406,1699**
IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643 ..... **D•1117**
† **ILC Data Device Corp., Bohemia, NY 11716-2482, 516-567-5600** ..... **D•1190**
† **International Sensor Systems, Inc., Aurora, NE 68818, 402-694-6111** ..... **A•1704-1705**
† **Interpoint Corporation, Redmond, WA 98052, 206-882-3100** ..... **A•1706-1707, D•2112**
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† **Mini-Systems, Inc., Thick/Thin Film Division, North Attleboro, MA 02761, 508-695-0203** ..... **A•1993**
† **Modular Devices, Shirley, NY 11967, 516-345-3100** ..... **D•1837**
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† **Northwest Microcircuits, Inc., Philomath, OR 97370, 503-929-6424** ..... **A•1712**
† **Raytheon Company, Quincy Operation, Quincy, MA 02269, 617-479-5300** ..... **A•1713-1715**
§† **Solitron Devices, Inc., Semiconductor Group, West Palm Beach, FL 33407-4697, 407-848-4311** ..... **A•2219**
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Techno Division, Dale Electronics, Van Nuys, CA 91405-1139, 818-781-1642 ..... **A•1925**
ACC Electronics Company, Echlin Inc., Independence, KS 67301 316-331-1000
† Addacon Greensboro, Greensboro, NC 27407 919-852-6200
† Advanced Analog, Intech, Santa Clara, CA 95050 408-988-4930
A E G Corporation, Basking Ridge, NJ 07920 908-204-8900
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Bosch, Robert, Corp., Broadview, IL 60153 708-865-5301
Burr-Brown Corp., Tucson, AZ 85734 602-746-1111
California Eastern Labs. Inc., Santa Clara, CA 95056-0964 408-988-3500
† C-Mac Industries Inc., Sherbrooke, Quebec, CANADA J1L 1V8 819-821-4524
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† CTS Corp, Microelectronics, W. Lafayette, IN 47906 317-463-2565
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 402-563-6506
Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242 402-371-0080
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§† Elantec, Inc., Milpitas, CA 95035 ..... 408-945-1323;800-333-6314
† Electronic Systems Division, Boeing Defense & Space Grp., Seattle, WA 98124-2499 206-657-7474
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† EMC Technology Inc, Cherry Hill, NJ 08034 609-429-7800
EVI, Inc., Columbia, MD 21046 410-290-1919
Ferro Corporation, Electronic Materials Div., Santa Barbara, CA 93117-3092 805-968-5000
§ Fox Electronics, Ft. Myers, FL 33905 813-693-0099
§ Fujitsu Microelectronics Inc., Semiconductor Division & Electronic Components Div., San Jose, CA 95134-1804 408-922-9000
GC International Inc., Plano, TX 75074 214-423-8411
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† Hybridyne, Inc., Tucson, AZ 85745 602-629-0001
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ISKRA Electronics, Inc., Plainview, NY 11803 516-349-0222
ISL Products Int'l, Ltd., Syosset, NY 11791-6093 ..... 516-937-3475;800-626-6116
† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
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Kyocera Industrial Ceramics Corp., San Diego, CA 92123 619-576-2688
Leach Corporation, Buena Pk., CA 90622-5032 714-739-0770
LTI, Inc., Autotech Technologies, LP, Carol Stream, IL 60188 708-668-8886
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† Micro Networks, Unitrode Corporation, Worcester, MA 01606 508-852-5400
† Micropac Inds., Inc., Garland, TX 75040 214-272-3571
Microplex, Inc., Anaheim, CA 92806 714-634-1535
† Micro Systems Engineering, Inc., Lake Oswego, OR 97035 503-635-4016
Mini-Systems, Inc., Sunbelt Microelectronic Division, Deltona, FL 32725 407-574-0208
§ Mitel Semiconductor Div. of Mitel Corp., Kanata, Ont., CANADA K2K 1X3 613-592-2122
MTI International Inc., Menomonee Falls, WI 53051 414-783-6080
† M-Tron Industries, Yankton, SD 57078 605-665-9321
§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
† Natel Engineering Co., Inc., Simi Valley, CA 93063-3449 805-581-3950
NF Electronic Instruments, State College, PA 16801 814-237-5580
Ohmtek Inc., Vishay, Niagara Falls, NY 14304 716-283-4025

Opto Technology, Inc., Wheeling, IL 60090 708-537-4277
Phoenix Microwave, Telford, PA 18969 215-723-6011
†Piezo Technology Inc., Orlando, FL 32804 407-298-2000
†Q-Tech Corp., Culver City, CA 90232-3510 310-836-7900
Radix Microelectronics Inc., Colorado Springs, CO 80909 719-597-1975
§Raltron Electronics, Miami, FL 33172 305-593-6033
†Raytheon Co., Electronic Components Division, Waltham, MA 02254 617-899-8400
§†RCD Components, Inc., Manchester, NH 03109 603-669-0054
†Resistance Technology Inc., St. Paul, MN 55112 612-636-9770
§Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013 615-641-2020
§Sanyo Semiconductor Corp., Allendale, NJ 07401 201-825-8080
Schaffner EMC, Inc., Intepro, Springfield, NJ 07081 201-379-7778
Semtech Corpus Christi, Semtech Corporation, Corpus Christi, TX 78410 512-289-0403
§†Silicon General, Garden Grove, CA 92641 714-898-8121
Smart Relay Technology, Inc., Commack, NY 11725 516-543-7161
§Soshin Electric Co., Ltd., Ota-Ku, Tokyo, JAPAN ..... (03) 3775-9119
Spectrum Control, Inc., Erie, PA 16506 814-835-4000
Sprague, Hudson, NH 03051 ..... 603-881-7200; 603-883-9774 (Mktg)
†Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901 609-589-7500
Tadiran Electronic Industries, Inc., Port Washington, NY 11050 516-621-4980
Taiyo Yuden (USA) Inc., Arlington Heights, IL 60005-4493 708-364-6104
§TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056 708-803-6100
Tektronix, Inc., Wilsonville, OR 97070 800-835-9433
†Teledyne Microelectronics, Los Angeles, CA 90066 ..... 310-822-8229;310-305-0248
†TH Electronics, Tong Hsing Electronic Ind., Ltd., Tucson, AZ 85745-1443 602-791-7825
Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Schaumburg, IL 60173 708-884-6664
§Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
†United Supertek, Inc., San Jose, CA 95131-1101 408-922-0730
†White Technology, Inc., Bowmar Instrument Corp., Phoenix, AZ 85040 602-437-1520

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§†Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635, 714-447-2300 ..... A•1868
Bel Fuse, Jersey City, NJ 07302, 201-432-0463 ..... A•1522
Elecsys,Inc., Div. of C & C Jetronic, Princeton, NJ 08540, 609-259-8866 ..... A•1693
†Frequency Electronics, Inc., Mitchel Field, NY 11553, 516-794-4500 ..... A•1403
§†Hybrids International Ltd., Thick Film Division, Olathe, KS 66062, 913-764-6400 ..... A•1699
IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643 ..... D•1117
†ILC Data Device Corp., Bohemia, NY 11716-2482, 516-567-5600 ..... D•1190
International Sensor Systems, Inc., Aurora, NE 68818, 402-694-6111 ..... A•1704
†Micro-Precision Technologies, Inc., Salem, NH 03079, 603-893-7600 ..... A•1703
†Mini-Systems, Inc., Thick/Thin Film Division, North Attleboro, MA 02761, 508-695-0203 ..... A•1993
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†Raytheon Company, Quincy Operation, Quincy, MA 02269, 617-479-5300 ..... A•1713-1715
§†Solitron Devices, Inc., Semiconductor Group, West Palm Beach, FL 33407-4697, 407-848-4311 ..... A•2219
State of the Art, Inc., State College, PA 16803-1797, 814-355-8004 ..... A•2020-2021,2023-2025,2027
†Advanced Analog, Intech, Santa Clara, CA 95050 408-988-4930
AEL Defense Corp., Lansdale, PA 19446 215-822-2929
Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803 516-694-6700
†Analog Devices, Inc., Norwood, MA 02062-9106 617-329-4700
†A.S.I. Microsystems, Inc., (Formerly Andrich Systems, Inc.), Bohemia, NY 11716 516-589-5656
AT&T Microelectronics, Allentown, PA 18103 ..... 1-800-372-2447;In Can.:1-800-553-2448
§†Avantek, Inc, A Subsidiary of Hewlett-Packard, Santa Clara, CA 95054 408-727-0700
Aydin Corp., Horsham, PA 19044 215-657-7510
Bosch, Robert, Corp., Broadview, IL 60153 708-865-5301
Burr-Brown Corp., Tucson, AZ 85734 602-746-1111
§†California Micro Devices, Inc., Milpitas, CA 95035 408-263-3214
Coors Electronic Package Co., Chattanooga, TN 37405 615-755-5452
†CTS Corporation, Elkhart, IN 46514 219-293-7511
†CTS Corp, Microelectronics, W. Lafayette, IN 47906 317-463-2565
§†Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242 402-371-0080
†Datel, Inc., Mansfield, MA 02048-1194 508-339-3000
Dover Electronics Manufacturing, Binghamton, NY 13902-5212 607-772-7563
§Fujitsu Microelectronics Inc., Semiconductor Division & Electronic Components Div., San Jose, CA 95134-1804 408-922-9000
§†General Mircocircuits, Billerica, MA 01821 508-663-9101
Hokuriku USA Ltd., Madison, AL 35758 205-772-9620
†Hughes Microelectronic Circuits Division, Newport Beach, CA 92658-8903 714-759-2952
†Hybrid Designs, Inc., Costa Mesa, CA 92626 714-557-9933
†Hybrid Electronics Corp., Bedford, MA 01730 617-275-5350
†Hycomp, Inc., Marlborough, MA 01752 508-485-6300
Hyundai Electronics Industries Co. Ltd., Kyoungki-do, KOREA ..... (0336)30-4114,(02)741-0661
§International Resistive Company, Boone, NC 28607 704-264-8861
†KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
†M.S. Kennedy Corp., Cicero, NY 13039 315-699-9201
Kyocera Industrial Ceramics Corp., San Diego, CA 92123 619-576-2688
MACOM, Inc., Lowell, MA 01851 617-272-3000
§†M/A-COM Microelectroincs Division, M/A-COM, Lowell, MA 01853-3295 508-442-5000
†Micro Hybrids, Inc., Medford, NY 11763 516-732-3448
†Micro Networks, Unitrode Corporation, Worcester, MA 01606 508-852-5400
†Micro Systems Engineering, Inc., Lake Oswego, OR 97035 503-635-4016
Mini-Systems, Inc., Sunbelt Microelectronic Division, Deltona, FL 32725 407-574-0208
†Modular Devices, Shirley, NY 11967 516-345-3100
†Natel Engineering Co., Inc., Simi Valley, CA 93063-3449 805-581-3950
NF Electronic Instruments, State College, PA 16801 814-237-5580
§Raltron Electronics, Miami, FL 33172 305-593-6033
§†RCD Components, Inc., Manchester, NH 03109 603-669-0054
§Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013 615-641-2020
§Sanyo Semiconductor Corp., Allendale, NJ 07401 201-825-8080
†Sipex Corp., Billerica, MA 01821 508-667-8700
Smart Relay Technology, Inc., Commack, NY 11725 516-543-7161
Staffall Inc., Cranston, RI 02910 401-461-5554
Taiyo Yuden (USA) Inc., Arlington Heights, IL 60005-4493 708-364-6104
Tektronix, Inc., Wilsonville, OR 97070 800-835-9433
†Teledyne Microelectronics, Los Angeles, CA 90066 ..... 310-822-8229;310-305-0248
†Teledyne Microwave, Mountain View, CA 94043 415-968-2211
†TFD Inc. (DBA Thin Film Devices Inc.), Anaheim, CA 92807 714-630-7127

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§†TRAK Microwave Corp., Tampa, FL 33634, 813-884-1411 ..... A•1855-1857
†Airtron, Litton Industries, Inc., Morris Plains, NJ 07950 201-539-5500
†Alpha Industries, Inc., Woburn, MA 01801 617-935-5150
†Connecticut Microwave Corp., Cheshire, CT 06410 203-250-9678
§†FDK America, Inc., Fuji Electrochemical Co., Ltd., San Jose, CA 95134 408-432-8331
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
Lectronic Research Labs., Inc., Camden, NJ 08104 800-358-8378
†Loral Microwave Narda, Hauppauge, NY 11788 516-231-1700
†Loral Microwave-Narda West, Rancho Cordova, CA 95670-6001 916-638-5500
†M/A COM Ltd., Bedfordshire, ENGLAND LU5 4SX, England ..... 44(582)471200
M/A-COM Microelectroincs Division, M/A-COM, Lowell, MA 01853-3295 508-442-5000
†Maury Microwave Corp., Ontario, CA 91764 909-987-4715
†Merrimac Industries, West Caldwell, NJ 07006 201-575-1300
Microwave Development Laboratories, Natick, MA 01760 508-655-0060
†Premier Microwave, Port Chester, NY 10573 914-939-8900
†Raytheon Co., Electronic Components Division, Waltham, MA 02254 617-899-8400
#Relm Communications, Inc., Adage, Inc., Indianapolis, IN 46226 317-545-4281
§†Sinclair Radio Laboratories Ltd., Aurora, ONT., CANADA L4G 3G9 416-727-0165
†ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086 408-730-6300
†Teledyne Microwave, Mountain View, CA 94043 415-968-2211
†TRAK Microwave Ltd., TRAK Microwave Corp., Dundee, SCOTLAND DD2 1TY 44-382-561509
†UTE Microwave, Asbury Park, NJ 07712 908-922-1009

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Ohmite Manufacturing Co., Skokie, IL 60076 708-675-2600
§† Seaboard Electronics, New Rochelle, NY 10805 914-235-8073
§† Vega Precision Labs., Vienna, VA 22180 703-938-6300

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Custom Coils Inc., Alcester, SD 57001-0348, 605-934-2460 ..... A•2311
Dormeyer Industries, A.F. Dormeyer Mfg. Co. Inc., Chicago, IL 60631-1521, 312-775-3600 ..... B•1635
EWC, Inc., Englishtown, NJ 07726, 908-446-3110 ..... A•1235
§† Gowanda Electronics Corp., Gowanda, NY 14070, 716-532-2234 ..... A•1239
Lodestone Pacific, Anaheim, CA 92807, 714-630-1343 ..... A•1244-1245,1247
Magnelab, Boulder, CO 80301-4696, 303-442-6700 ..... A•2378,2382
Magnos, Hudson, MA 01749, 508-562-1173 ..... D•1296
Prem Magnetics, Inc., McHenry, IL 60050, 815-385-2700 ..... A•1277-1281,2525
Renco Electronics, Inc., Deer Pk., NY 11729, 516-586-5566;1-800-645-5828 ..... A•1289
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ..... A•2118
Standex Electronics, Standex International, Cincinnati, OH 45209, 513-871-3777 ..... A•1292,1295
† Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314 ..... A•1307
Wilco Corp., Indianapolis, IN 46268, 317-293-9300 ..... A•1309-1313
† ZMAN Magnetics, Kent, WA 98032, 206-251-8064 ..... A•1315
§† American Precision Ind.,Delevan/SMD Divisions, E. Aurora, NY 14052 .. 716-652-3600
† Apollo Magnetics Corp., Los Angeles, CA 90057 213-381-2500
APX Technologies Inc., Hicksville, NY 11801 516-433-1313
Automatic Coil Corp., Miami, FL 33147 305-696-6660
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
Bell Inds., J. W. Miller Div., Gardena, CA 90247-1059 310-515-1720
† BG Electronics, EPC Corp., Mt. Vernon, NY 10550-4430 914-664-5591
Caddell-Burns Mfg., Mineola, NY 11501-3508 516-746-2310
Caddell Coil Corp., Middletown Springs, VT 05757 802-235-2019
Cardinal Control Co., Kensington, CT 06037 203-828-6379
Chloride Electro Networks, Chloride Power Electronics, Inc., Caledonia, NY 14423 716-538-4421
†# Cletronics Inc., Medina, OH 44256-9623 216-722-3030
§ Communication Devices, Inc., Scarborough, Ont., CAN M1B3R6 416-292-4463
Cortec, Inc., Huntington Bch., CA 92649 714-897-2529
Cosmo Corporation, Cleveland, OH 44109 216-861-5594
† Cramer Coil & Transformer Co., Inc., Saukville, WI 53080 .. 414-268-2150;414-375-5700
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 605-665-9301
D & L Electronics, Langhorne, PA 19047 800-942-3631
† Delta Products Corporation, Fremont, CA 94538 510-770-0660
Deltona Transformer Corp., DeLand, FL 32724 904-736-7900
Douglas Randall, Pawcatuck, CT 06379 203-599-2075
Dynacast Inc., Yorktown Heights, NY 10598 914-962-6300
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012 605-296-3462
Electro Assemblies Corp., Northbrook, IL 60062-2319 708-498-6520
§† Electromech, Inc., Irvington, NJ 07111 201-318-7999
Electronetics, Inc., Everett, WA 98204 206-355-1855
Endicott Coil Co., Inc., Binghamton, NY 13905 607-797-1263
§ Frontier Electronics, Simi Valley, CA 93065 805-522-9998
GC International Inc., Plano, TX 75074 214-423-8411
General Vibrations Mfg. Co., Manchester, CT 06040 203-646-0090
Grand Transformer, Inc., Grand Haven, MI 49417 616-842-5430
§† Jaico Products, Jaidinger Mfg. Co., Inc., Chicago, IL 60622 312-421-1090
§ Katronic Elektronic Ges.m.b.H., AUSTRIA 04762-5340
† Magnetic Component Engineering, Inc., Inglewood, CA 90301 310-677-6600
† Magnetico Inc., Holtsville, NY 11742 516-654-1166
MCI Transformer Corporation, Babylon, NY 11704 516-587-0510
Miles Platts Inc., Elk Grove Village, IL 60007 1-708-364-0363
§† MMG-North America, Paterson, NJ 07509 201-345-8900
Multi Products International, West Paterson, NJ 07424 201-890-1344
† Newport Manufacturing Co., Santa Ana, CA 92704 800-726-0715
† Ogallala Elctrns., Div. Arnold Engrg. Co., Ogallala, NE 69153 308-284-4093
† Ohmite Manufacturing Co., Skokie, IL 60076 708-675-2600
Pacific Transformer Corp., Anaheim, CA 92807 ..... 714-779-0450;1-800-325-0501
† PCA Electronics, Sepulveda, CA 91343 818-892-0761
† Permaluster, Inc., Burbank, CA 91504 ..... 213-849-4543;213-849-6454
Piconics, Incorporated, Tyngsboro, MA 01879 508-649-7501
Plastron Corp., Bensenville, IL 60106 708-595-2212
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861 908-826-4700
Precision Paper Tube Co., Wheeling, IL 60090 708-537-4250
§† PTS Corporation, Bloomington, IN 47401 812-824-9331
Quality Components, Inc., St. Marys, PA 15857 814-834-2817
§† RCD Components, Inc., Manchester, NH 03109 603-669-0054
Shogyo International Corp., Great Neck, NY 11021-4799 516-466-0911
SinoTECH Made in China, Inc., Technology Communications Group, Inc., West Linn, OR 97068 503-638-1000
Staffall Inc., Cranston, RI 02910 401-461-5554
Standard Magnetic Corp., Garden Grove, CA 92641 714-379-5671
† Stevens Products, Inc., E. Orange, NJ 07019 201-672-2140
† Telectro Systems Corp., Corona, NY 11368 718-651-8900
Toko America, Inc., Mt. Prospect,, IL 60056 708-297-0070
† Torelco, Inc., Irvington, NJ 07111 ..... 201-374-8641;800-867-3526
Trionics, Inc., St. Charles, IL 60174 708-365-6570
†# United States Electronics, Springfield, NJ 07081 201-912-0111
United Technical Products, Fallsington, PA 19054 800-553-5300
Wabash Magnetics, Control Prods. Grp., Wabash, IN 46992 219-563-2191
Wontronics, Los Angeles, CA 90039 213-660-6230
§† Zambre Co., Inc., Mountain View, CA 94043 415-968-9176

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† Magnetic Component Engineering, Inc., Inglewood, CA 90301, 310-677-6600 ..... A•1252-1253
North Hills Signal Processing, Syosset, NY 11791, 516-682-7740 ..... A•2438
† Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•1263
Prem Magnetics, Inc., McHenry, IL 60050, 815-385-2700 ..... A•2525
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•1282
Renco Electronics, Inc., Deer Pk., NY 11729, 516-586-5566;1-800-645-5828 ..... A•1284,1288-1289
Signal Transformer Co., Inc., Insilco Corporation, Inwood, NY 11696, 516-239-5777 ..... A•2536
Sprague-Goodman Elctrns., Inc., Garden City Pk., NY 11040, 516-746-1385 ..... A•1164
† Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314 ..... A•1307,2594
Wilco Corp., Indianapolis, IN 46268, 317-293-9300 ..... A•1309
Abbott Technologies, Inc., Sun Valley, CA 91352 ..... 818-504-0644;1-800-367-8200
American Magnetics, Carterville, IL 62918 618-985-4838
† American Trans-Coil Corporation, Richmond Hill, NY 11419-1410 718-441-5207
Apollo Magnetics Corp., Los Angeles, CA 90057 213-381-2500
APX Technologies Inc., Hicksville, NY 11801 516-433-1313
† Automatic Coil Corp., Miami, FL 33147 305-696-6660
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
Coast Coil Co., Coast Magnetics, Los Angeles, CA 90016 213-936-6188
† Coil-Q Corp., Bronxville, NY 10708 914-337-4775
† Corona Magnetics, Inc., Corona, CA 91719 909-735-7558
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 605-665-9301
De Coursey Engineering Laboratory, Culver City, CA 90230 1-310-397-9668
† Delta Products Corporation, Fremont, CA 94538 510-770-0660
† De Young Mfg., Inc., Kirkland, WA 98034 206-823-4798
† Dietz Design, Inc., Belton, MO 64012 816-331-4911
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012 605-296-3462
Ecliptek Corporation, Costa Mesa, CA 92626 714-433-1200
Electro Assemblies Corp., Northbrook, IL 60062-2319 708-498-6520
Electrocom Industries, S. Bend, IN 46615 219-232-2743
† Electronic Transformer Corp., Paterson, NJ 07544-0487 201-942-2222
† ESC Electronics Corp., Palisades Pk., NJ 07650 201-947-0400
† Freed Transformer Co., Inc., Electronic Transformer Corp., Paterson, NJ 07544-0487 201-942-2222
Gavagan Electronics, Danbury, CT 06810 203-748-5248
GC International Inc., Plano, TX 75074 214-423-8411
† Hisonic, Inc., Olathe, KS 66051 913-782-0012
Integrity Technology Corporation, Santa Clara, CA 95050 408-262-8640
§† JB Electronic Transformers Inc., Chicago, IL 60647 312-342-0080

† Keytronics, Inc., Endicott, NY 13760 607-754-5405
KGS Electronics, Inc., Arcadia, CA 91006 818-574-1175
Mag-Con, St. Paul, MN 55113 612-633-8820
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† Magnetico Inc., Holtsville, NY 11742 516-654-1166
§† Microtran Co. Inc., Valley Stream, NY 11582-0236 516-561-6050
† Neshaminy Transformer Corp., Furlong, PA 18925 215-794-7411
† Newport Manufacturing Co., Santa Ana, CA 92704 800-726-0715
† Northlake Engineering, Inc., Bristol, WI 53104-0370 414-857-9600
Oeco Corp., Milwaukie, OR 97222 503-659-7932
† PCA Electronics, Sepulveda, CA 91343 818-892-0761
† Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861 908-826-4700
† PTC Transformers, Bordentown, NJ 08505 609-298-8200
Radio Television Products Corp., Douglas, AZ 85607 602-364-4438
SAE Power, Inc., Santa Clara, CA 95050 408-988-0700
§† Skyway Magnetics, Warner Springs, CA 92086-9714 619-782-3342
† Standex Electronics, Standex International, Cincinnati, OH 45209 513-871-3777
§ Tamura Corporation of America, Temecula, CA 92589-2230 909-699-1270
Texas Transformer Corp., Plano, TX 75086 214-424-1581
§† Thordarson Meissner, Components Corp. of Amer., Mt. Carmel, IL 62863 618-262-5121
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
† Torwico Elctrns. Inc., Lakewood, NJ 08701 908-364-1800
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
Xylog Corp., Hackensack, NJ 07601 201-489-4040
† ZMAN Magnetics, Kent, WA 98032 206-251-8064

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Caddell-Burns Mfg., Mineola, NY 11501-3508, 516-746-2310 ..... A•1198
† Caddell Coil Corp., Middletown Springs, VT 05757, 802-235-2019 ..... A•1213
Prem Magnetics, Inc., McHenry, IL 60050, 815-385-2700 ..... A•2525
APX Technologies Inc., Hicksville, NY 11801 516-433-1313
† Automatic Coil Corp., Miami, FL 33147 305-696-6660
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
† Communication Coil Inc., Chicago, IL 60634 312-637-1333
† Cramer Coil & Transformer Co., Inc., Saukville, WI 53080 .. 414-268-2150;414-375-5700
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 605-665-9301
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012 605-296-3462
Electro Assemblies Corp., Northbrook, IL 60062-2319 708-498-6520
Integrity Technology Corporation, Santa Clara, CA 95050 408-262-8640
† Magnetic Component Engineering, Inc., Inglewood, CA 90301 310-677-6600
† Newport Manufacturing Co., Santa Ana, CA 92704 800-726-0715
Renco Electronics, Inc., Deer Pk., NY 11729 ..... 516-586-5566;1-800-645-5828
South American Development Corp., Poughkeepsie, NY 12590 914-452-1305
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
Unadilla Antenna Mfg. Co., Andover, MA 01810 508-475-7831
†# United States Electronics, Springfield, NJ 07081 201-912-0111
† Wirebenders, Inc., Phoenix, AZ 85021-2824 602-861-1856
† ZMAN Magnetics, Kent, WA 98032 206-251-8064

Coils, Chip-1800

Abracon Corporation, San Clemente, CA 92673, 714-498-4505 ..... A•1180
§† American Precision Ind.,Delevan/SMD Divisions, E. Aurora, NY 14052, 716-652-3600 ..... A•1188
Bel Fuse, Jersey City, NJ 07302, 201-432-0463 .... A•1518-1519,2279-2280,2283
Bell Inds., J. W. Miller Div., Gardena, CA 90247-1059, 310-515-1720 ..... A•1190,1192
BH Electronics, Inc., Burnsville, MN 55337, 612-894-9590 ..... A•1196
Coilcraft, Cary, IL 60013, 708-639-2361 ..... A•1215-1217,1219-1221
Coil-Q Corp., Bronxville, NY 10708, 914-337-4775 ..... A•1223
† Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ..... A•1224
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180, 605-665-9301 ..... A•1225,1233
Ecliptek Corporation, Costa Mesa, CA 92626, 714-433-1200 ..... A•1258
§ Gowanda Electronics Corp., Gowanda, NY 14070, 716-532-2234 ... A•1239-1241
§ KOA Speer Electronics, Bradford, PA 16701, 814-362-5536 ..... A•1242-1243,1964,1970
MultiComp., Inc., Beaverton, OR 97006, 503-626-4200 ..... A•1255
§ Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 .. A•1256-1257
† Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•1263
† Piconics, Incorporated, Tyngsboro, MA 01879, 508-649-7501 ..... A•1274-1275
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•1282
Renco Electronics, Inc., Deer Pk., NY 11729, 516-586-5566;1-800-645-5828 ..... A•1284,1288-1289
§ Sprague-Goodman Elctrns., Inc., Garden City Pk., NY 11040, 516-746-1385 ..... A•1164-1165
Standex Electronics, Standex International, Cincinnati, OH 45209; 513-871-3777 ..... A•1290
Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314 ..... A•1307
Vernitron Corp., Precision Comps. Group, St. Petersburg, FL 33710, 813-347-2181 ..... A•1308
ZMAN Magnetics, Kent, WA 98032, 206-251-8064 ..... A•1315
§† Delevan Div., American Precision Inds. Inc., E. Aurora, NY 14052-0449 .. 716-652-3600
† Electro-Films, Inc., Warwick, RI 02886 401-738-9150
§ GC International Inc., Plano, TX 75074 214-423-8411
§† Hybrids International Ltd., Thick Film Division, Olathe, KS 66062 913-764-6400
Jeffers Electronics, Nogales, AZ 85621 602-281-4925
§ Laube Technology, Woodland Hills, CA 91367 818-703-1188
Magnelab, Boulder, CO 80301-4696 303-442-6700
Microtran Co. Inc., Valley Stream, NY 11582-0236 516-561-6050
§† MMG-North America, Paterson, NJ 07509 201-345-8900
Mouser Electronics, Santee, CA 92071 800-346-6873
Mouser Electronics, Mansfield, TX 76063 800-346-6873
Mouser Electronics, Gilroy, CA 95020 800-346-6873
† Newport Manufacturing Co., Santa Ana, CA 92704 800-726-0715
OPT Industries, Inc., Phillipsburg, NJ 08865 908-454-2600
§ Projections Unlimited, Tustin, CA 92680 714-544-2700
§ RF Electronics, Inc., Irvine, CA 92714-5517 714-263-0661
† Stetco, Inc., Franklin Pk, IL 60131 708-671-4208
TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056 708-803-6100
TMP Inc., Santa Ana, CA 92705 714-558-8028
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
USAPEX Corp., Santa Clara, CA 95051 408-982-9063
§† Vanguard Electronics Co., Gardena, CA 90248 310-323-4100

Coils, Field-1800

Magnos, Hudson, MA 01749, 508-562-1173 ..... D•1296
§ Walker Scientific, Worcester, MA 01606, 508-852-3674;508-853-3232;800-962-4638 ..... D•1334
Albar, Inc., Lynnwood, WA 98036 ..... 206-771-4006;800-822-5227
† A.P.W. Co., Inc., Rockaway, NJ 07866 201-627-0643
Automatic Coil Corp., Miami, FL 33147 305-696-6660
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
† Corona Magnetics, Inc., Corona, CA 91719 909-735-7558
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012 605-296-3462
† Electronic Transformer Corp., Paterson, NJ 07544-0487 201-942-2222
Elma Engineering, Palo Alto, CA 94303 415-494-7303
† Freed Transformer Co., Inc., Electronic Transformer Corp., Paterson, NJ 07544-0487 201-942-2222
§ GC International Inc., Plano, TX 75074 214-423-8411
LDJ Electronics, Troy, MI 48099-0219 313-528-2202
† Newport Manufacturing Co., Santa Ana, CA 92704 800-726-0715
† Permaluster, Inc., Burbank, CA 91504 ..... 213-849-4543;213-849-6454
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
†# United States Electronics, Springfield, NJ 07081 201-912-0111

Coils, Focusing-1800

† Penn-Tran Corp.,Sub. of Spectrum Elctrns. Inc., Wingate, PA 16880, 814-355-1521 ..... A•1260-1261
Prem Magnetics, Inc., McHenry, IL 60050, 815-385-2700 ..... A•2525
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
† CELCO, Mahwah, NJ 07430 201-327-1123
†# Cletronics Inc., Medina, OH 44256-9623 216-722-3030
Custom Coils Inc., Alcester, SD 57001-0348 605-934-2460
† Electronic Transformer Corp., Paterson, NJ 07544-0487 201-942-2222
Elma Engineering, Palo Alto, CA 94303 415-494-7303
† Freed Transformer Co., Inc., Electronic Transformer Corp., Paterson, NJ 07544-0487 201-942-2222
† Newport Manufacturing Co., Santa Ana, CA 92704 800-726-0715
† Ogallala Elctrns., Div. Arnold Engrg. Co., Ogallala, NE 69153 308-284-4093
Renco Electronics, Inc., Deer Pk., NY 11729 ..... 516-586-5566;1-800-645-5828
† Stangenes Industries, Inc., Palo Alto, CA 94303 415-493-0814
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
Walker Scientific, Worcester, MA 01606 ... 508-852-3674;508-853-3232;800-962-4638

Coils, Foil Wound-1800

† Abbott Technologies, Inc., Sun Valley, CA 91352, 818-504-0644;1-800-367-8200 ..... A•2234
§ Electrocube, Monrovia, CA 91016, 818-301-0122 ..... A•1067
EWC, Inc., Englishtown, NJ 07726, 908-446-3110 ..... A•1235
KOA Speer Electronics, Bradford, PA 16701, 814-362-5536 ..... A•1242-1243
MultiComp., Inc., Beaverton, OR 97006, 503-626-4200 ..... A•1255
Signal Transformer Co., Inc., Insilco Corporation, Inwood, NY 11696, 516-239-5777 ..... A•2536
† Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314 ..... A•1307,2594
Albar, Inc., Lynnwood, WA 98036 ..... 206-771-4006;800-822-5227
§ Allen Co., Inc., Robert G., N. Hollywood, CA 91605 ..... 818-765-8300;800-827-7422
American Magnetics, Carterville, IL 62918 618-985-4838
Andover, Inc., Lafayette, IN 47904 317-447-1157
ATC-Frost Magnetics Inc., Oakville,Ont., CANADA L6H 2R4 416-844-6681
Atlas Engineering Corp., Dorchester, MA 02121 617-445-7100
Automatic Coil Corp., Miami, FL 33147 305-696-6660
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
Chloride Electro Networks, Chloride Power Electronics, Inc., Caledonia, NY 14423 716-538-4421
† Communication Coil Inc., Chicago, IL 60634 312-637-1333
† Corona Magnetics, Inc., Corona, CA 91719 909-735-7558
CSI Capacitors, CSI Technologies, San Marcos, CA 92069-3069 619-747-4000
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 605-665-9301
† Delta Products Corporation, Fremont, CA 94538 510-770-0660
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012 605-296-3462
EG&G Electro-Optics, EG&G Optoelectronics, EG&G Inc., Salem, MA 01970 ..... 508-745-3200;1-800-950-3441
Electro Assemblies Corp., Northbrook, IL 60062-2319 708-498-6520
Electromech, Inc., Irvington, NJ 07111 201-318-7999
Elma Engineering, Palo Alto, CA 94303 415-494-7303
† ESC Electronics Corp., Palisades Pk., NJ 07650 201-947-0400
† Fernwood Transformer Co., Transistor Devices Inc., Belvidere, NJ 07823 908-475-3207
JB Electronic Transformers Inc., Chicago, IL 60647 312-342-0080
† Keytronics, Inc., Endicott, NY 13760 607-754-5405
† Lenco Elctrns., Inc., McHenry, IL 60050 815-344-2900
LEPCO/Leonard Elec. Prods., Brownsville, TX 78521 210-546-1625

Mag-Con, St. Paul, MN 55113 ... 612-633-8820
Magna-Power Electronics, Inc., Whippany, NJ 07981 ... 201-428-1197
† Magnecomp, Inc., Pickens, SC 29671 ... 803-878-4700
† Magnetico Inc., Holtsville, NY 11742 ... 516-654-1166
Microtran Co. Inc., Valley Stream, NY 11582-0236 ... 516-561-6050
† Neshaminy Transformer Corp., Furlong, PA 18925 ... 215-794-7411
† Newport Manufacturing Co., Santa Ana, CA 92704 ... 800-726-0715
† NWL Transformers, Bordentown, NJ 08505 ... 609-298-7300
Oeco Corp., Milwaukie, OR 97222 ... 503-659-7932
† Ogallala Elctrns., Div. Arnold Engrg. Co., Ogallala, NE 69153 ... 308-284-4093
OPT Industries, Inc., Phillipsburg, NJ 08865 ... 908-454-2600
Pacific Transformer Corp., Anaheim, CA 92807 ... 714-779-0450;1-800-325-0501
† Permaluster, Inc., Burbank, CA 91504 ... 213-849-4543;213-849-6454
RCD Components, Inc., Manchester, NH 03109 ... 603-669-0054
Schott Corp., Wayzata, MN 55391 ... 612-475-1173
† Skyway Magnetics, Warner Springs, CA 92086-9714 ... 619-782-3342
Standard Magnetic Corp., Garden Grove, CA 92641 ... 714-379-5671
Texas Transformer Corp., Plano, TX 75086 ... 214-424-1581
† Torwico Elctrns. Inc., Lakewood, NJ 08701 ... 908-364-1800
† Trans American Transformer, E. Setauket, NY 11733 ... 516-928-0762
†# United States Electronics, Springfield, NJ 07081 ... 201-912-0111
§ Walker Scientific, Worcester, MA 01606 ... 508-852-3674;508-853-3232;800-962-4638
† Wirebenders, Inc., Phoenix, AZ 85021-2824 ... 602-861-1856
WPI Group, Inc., Warner, NH 03278 ... 603-456-3111
† ZMAN Magnetics, Kent, WA 98032 ... 206-251-8064

Coils, High Q, High Frequency-1800

Coil-Q Corp., Bronxville, NY 10708, 914-337-4775 ... A•1223
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Renco Electronics, Inc., Deer Pk., NY 11729, 516-586-5566;1-800-645-5828 ... A•1283,1288-1289
Sprague-Goodman Elctrns., Inc., Garden City Pk., NY 11040, 516-746-1385 ... A•1164
Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314 ... A•2594
AVX Corporation, A Kyocera Group Company, Myrtle Beach, SC 29577 ... 803-448-9411
†# Cletronics Inc., Medina, OH 44256-9623 ... 216-722-3030
† Corona Magnetics, Inc., Corona, CA 91719 ... 909-735-7558
Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
† ZMAN Magnetics, Kent, WA 98032 ... 206-251-8064

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APX Technologies Inc., Hicksville, NY 11801, 516-433-1313 ... A•2267
Caddell-Burns Mfg., Mineola, NY 11501-3508, 516-746-2310 ... A•1198,1200-1203,1206-1208,1210-1211
† Caddell Coil Corp., Middletown Springs, VT 05757, 802-235-2019 ... A•1213
† Coil-Q Corp., Bronxville, NY 10708, 914-337-4775 ... A•1222-1223
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180, 605-665-9301 ... A•1225,1228-1229,1232-1233
§ Dormeyer Industries, A.F. Dormeyer Mfg. Co. Inc., Chicago, IL 60631-1521, 312-775-3600 ... B•1635
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† Hisonic, Inc., Olathe, KS 66051, 913-782-0012 ... A•2360
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† Magnetic Component Engineering, Inc., Inglewood, CA 90301, 310-677-6600 ... A•1251-1252,1321
§† Microtran Co. Inc., Valley Stream, NY 11582-0236, 516-561-6050 ... A•1254
North Hills Signal Processing, Syosset, NY 11791, 516-682-7740 ... A•2438
† PCA Electronics, Sepulveda, CA 91343, 818-892-0761 ... A•1670
† Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ... A•1263
† Piconics, Incorporated, Tyngsboro, MA 01879, 508-649-7501 ... A•1274
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§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ... A•1282
Renco Electronics, Inc., Deer Pk., NY 11729, 516-586-5566;1-800-645-5828 ... A•1283-1285,1288
† Signal Transformer Co., Inc., Insilco Corporation, Inwood, NY 11696, 516-239-5777 ... A•2536
Sprague-Goodman Elctrns., Inc., Garden City Pk., NY 11040, 516-746-1385 ... A•1164
† Standex Electronics, Standex International, Cincinnati, OH 45209, 513-871-3777 ... A•1290,1292-1295
Talema Electronic, Inc., Saint James, MO 65559, 314-265-5500 ... A•2569
Tamura Corporation of America, Temecula, CA 92589-2230, 909-699-1270 ... A•1298
† Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314 ... A•1307
Vernitron Corp., Precision Comps. Group, St. Petersburg, FL 33710, 813-347-2181 ... A•1308
Wilco Corp., Indianapolis, IN 46268, 317-293-9300 ... A•1309-1311
† ZMAN Magnetics, Kent, WA 98032, 206-251-8064 ... A•1315
Abbott Technologies, Inc., Sun Valley, CA 91352 ... 818-504-0644;1-800-367-8200
American Magnetics, Carterville, IL 62918 ... 618-985-4838
§† American Precision Ind.,Delevan/SMD Divisions, E. Aurora, NY 14052 ... 716-652-3600
§† Associated Spring, Barnes Grp., Bristol, CT 06010 ... 203-583-1331
† Automatic Coil Corp., Miami, FL 33147 ... 305-696-6660
§† Aydin Corporation (West), San Jose, CA 95119-1371 ... 408-629-1100
§ Bell Inds., J. W. Miller Div., Gardena, CA 90247-1059 ... 310-515-1720
† BG Electronics, EPC Corp., Mt. Vernon, NY 10550-4430 ... 914-664-5591
† CELCO, Mahwah, NJ 07430 ... 201-327-1123
Chloride Electro Networks, Chloride Power Electronics, Inc., Caledonia, NY 14423 ... 716-538-4421
†# Cletronics Inc., Medina, OH 44256-9623 ... 216-722-3030
† Coast Coil Co., Coast Magnetics, Los Angeles, CA 90016 ... 213-936-6188
† Communication Coil Inc., Chicago, IL 60634 ... 312-637-1333
† Corona Magnetics, Inc., Corona, CA 91719 ... 909-735-7558
† Cramer Coil & Transformer Co., Inc., Saukville, WI 53080 ... 414-268-2150;414-375-5700
† De Young Mfg., Inc., Kirkland, WA 98034 ... 206-823-4798
† Dietz Design, Inc., Belton, MO 64012 ... 816-331-4911
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012 ... 605-296-3462
Electro Assemblies Corp., Northbrook, IL 60062-2319 ... 708-498-6520
Electrocom Industries, S. Bend, IN 46615 ... 219-232-2743
Electromech, Inc., Irvington, NJ 07111 ... 201-318-7999
† Electronic Transformer Corp., Paterson, NJ 07544-0487 ... 201-942-2222
Elma Engineering, Palo Alto, CA 94303 ... 415-494-7303
† ESC Electronics Corp., Palisades Pk, NJ 07650 ... 201-947-0400
† Fernwood Transformer Co., Transistor Devices Inc., Belvidere, NJ 07823 ... 908-475-3207
† Freed Transformer Co., Inc., Electronic Transformer Corp., Paterson, NJ 07544-0487 ... 201-942-2222
§ Frontier Electronics, Simi Valley, CA 93065 ... 805-522-9998
Gavagan Electronics, Danbury, CT 06810 ... 203-748-5248
§ GC International Inc., Plano, TX 75074 ... 214-423-8411
JB Electronic Transformers Inc., Chicago, IL 60647 ... 312-342-0080
† Keytronics, Inc., Endicott, NY 13760 ... 607-754-5405
KGS Electronics, Inc., Arcadia, CA 91006 ... 818-574-1175
† Lenox-Fugle Electronics, S. Plainfield, NJ 07080 ... 908-756-1164
† Magnecomp, Inc., Pickens, SC 29671 ... 803-878-4700
† Magnetico Inc., Holtsville, NY 11742 ... 516-654-1166
† Newport Manufacturing Co., Santa Ana, CA 92704 ... 800-726-0715
† Northlake Engineering, Inc., Bristol, WI 53104-0370 ... 414-857-9600
† NWL Transformers, Bordentown, NJ 08505 ... 609-298-7300
Nytron Inductors, Inc.(VSD, Inc.), Offered by: Dale Electronics, Inc., Yankton, SD 57078-0180 ... 605-665-9301
† OPT Industries, Inc., Phillipsburg, NJ 08865 ... 908-454-2600
Oxley Inc., Branford, CT 06405 ... 203-488-1033
Pacific Transformer Corp., Anaheim, CA 92807 ... 714-779-0450;1-800-325-0501
† Permaluster, Inc., Burbank, CA 91504 ... 213-849-4543;213-849-6454
† Polyphase Instrument, Ft. Washington, PA 19034 ... 215-643-6950
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861 ... 908-826-4700
Pulse Engineering, Inc., San Diego, CA 92128 ... 619-674-8100
Radio Television Products Corp., Douglas, AZ 85607 ... 602-364-4438
Schott Corp., Wayzata, MN 55391 ... 612-475-1173
† Sigma Electronics Inc., Houston, TX 77099 ... 713-933-4700;800-874-7121
† Sigmapower, Inc, FPBSM Industries, Inc., Rancho Dominguez, CA 90220-6404 ... 310-884-5200
† Skyway Magnetics, Warner Springs, CA 92086-9714 ... 619-782-3342
South American Development Corp., Poughkeepsie, NY 12590 ... 914-452-1305
Standard Magnetic Corp., Garden Grove, CA 92641 ... 714-379-5671
Texas Transformer Corp., Plano, TX 75086 ... 214-424-1581
§ Toko America, Inc., Mt. Prospect, IL 60056 ... 708-297-0070
† Torelco, Inc., Irvington, NJ 07111 ... 201-374-8641;800-867-3526
† Torwico Elctrns. Inc., Lakewood, NJ 08701 ... 908-364-1800
† Trans American Transformer, E. Setauket, NY 11733 ... 516-928-0762
†# United States Electronics, Springfield, NJ 07081 ... 201-912-0111
§† Vanguard Electronics Co., Gardena, CA 90248 ... 310-323-4100
§ Vitec Electronics Corp., Visalia, CA 93291 ... 209-651-1535
Wirebenders, Inc., Phoenix, AZ 85021-2824 ... 602-861-1856
§† Zambre Co., Inc., Mountain View, CA 94043 ... 415-968-9176

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Coils, Hybrid & Repeater-1800

EWC, Inc., Englishtown, NJ 07726, 908-446-3110 ... A•1235
§† Microtran Co. Inc., Valley Stream, NY 11582-0236, 516-561-6050 ... A•1254
MultiComp., Inc., Beaverton, OR 97006, 503-626-4200 ... A•1255
Prem Magnetics, Inc., McHenry, IL 60050, 815-385-2700 ... A•2525
American Magnetics, Carterville, IL 62918 ... 618-985-4838
Automatic Coil Corp., Miami, FL 33147 ... 305-696-6660
Cardinal Control Co., Kensington, CT 06037 ... 203-828-6379
Coil-Q Corp., Bronxville, NY 10708 ... 914-337-4775
§† Delevan Div., American Precision Inds. Inc., E. Aurora, NY 14052-0449 ... 716-652-3600
† Dietz Design, Inc., Belton, MO 64012 ... 816-331-4911
† Electronic Transformer Corp., Paterson, NJ 07544-0487 ... 201-942-2222
† Freed Transformer Co., Inc., Electronic Transformer Corp., Paterson, NJ 07544-0487 ... 201-942-2222
† Magnetico Inc., Holtsville, NY 11742 ... 516-654-1166
† Newport Manufacturing Co., Santa Ana, CA 92704 ... 800-726-0715
† Pico Electronics, Inc., Mt. Vernon, NY 10552 ... 914-699-5514;800-431-1064
Radio Television Products Corp., Douglas, AZ 85607 ... 602-364-4438
Renco Electronics, Inc., Deer Pk, NY 11729 ... 516-586-5566;1-800-645-5828
† Sigma Electronics Inc., Houston, TX 77099 ... 713-933-4700;800-874-7121
South American Development Corp., Poughkeepsie, NY 12590 ... 914-452-1305
§ Tamura Corporation of America, Temecula, CA 92589-2230 ... 909-699-1270
† Trans American Transformer, E. Setauket, NY 11733 ... 516-928-0762
§† Vanguard Electronics Co., Gardena, CA 90248 ... 310-323-4100

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APX Technologies Inc., Hicksville, NY 11801, 516-433-1313 ... A•2267
Caddell-Burns Mfg., Mineola, NY 11501-3508, 516-746-2310 ... A•1198,1206-1212
† Caddell Coil Corp., Middletown Springs, VT 05757, 802-235-2019 ... A•1213
Coilcraft, Cary, IL 60013, 708-639-2361 ... A•1215-1218,1220-1221
EWC, Inc., Englishtown, NJ 07726, 908-446-3110 ... A•1235

† **Magnetic Component Engineering, Inc., Inglewood, CA 90301, 310-677-6600** ..... **A•1253,1321**
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ..... **A•2118**
Sprague-Goodman Elctrns., Inc., Garden City Pk., NY 11040, 516-746-1385 ..... **A•1164**
† **Standex Electronics, Standex International, Cincinnati, OH 45209, 513-871-3777** ..... **A•1292**
† **Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314** ..... **A•1307**
Wilco Corp., Indianapolis, IN 46268, 317-293-9300 ..... **A•1309**
† American Trans-Coil Corporation, Richmond Hill, NY 11419-1410 718-441-5207
† Automatic Coil Corp., Miami, FL 33147 305-696-6660
§ Bell Inds., J. W. Miller Div., Gardena, CA 90247-1059 310-515-1720
CET Technology, Hudson, NH 03051 603-883-5912
† Coil-Q Corp., Bronxville, NY 10708 914-337-4775
† Communication Coil Inc., Chicago, IL 60634 312-637-1333
† Cramer Coil & Transformer Co., Inc., Saukville, WI 53080 .. 414-268-2150;414-375-5700
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 605-665-9301
† Delta Products Corporation, Fremont, CA 94538 510-770-0660
† De Young Mfg., Inc., Kirkland, WA 98034 206-823-4798
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012 605-296-3462
Electro Assemblies Corp., Northbrook, IL 60062-2319 708-498-6520
Fernwood Transformer Co., Transistor Devices Inc., Belvidere, NJ 07823 908-475-3207
§ Frontier Electronics, Simi Valley, CA 93065 805-522-9998
§ GC International Inc., Plano, TX 75074 214-423-8411
Hisonic, Inc., Olathe, KS 66051 913-782-0012
Integrity Technology Corporation, Santa Clara, CA 95050 408-262-8640
† Newport Manufacturing Co., Santa Ana, CA 92704 800-726-0715
§† Ohmite Manufacturing Co., Skokie, IL 60076 708-675-2600
† Piconics, Incorporated, Tyngsboro, MA 01879 508-649-7501
† Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861 908-826-4700
§† PTS Corporation, Bloomington, IN 47401 812-824-9331
Radio Television Products Corp., Douglas, AZ 85607 602-364-4438
Renco Electronics, Inc., Deer Pk., NY 11729 ..... 516-586-5566;1-800-645-5828
Shogyo International Corp., Great Neck, NY 11021-4799 516-466-0911
South American Development Corp., Poughkeepsie, NY 12590 914-452-1305
Tamura Corporation of America, Temecula, CA 92589-2230 909-699-1270
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
† Torwico Elctrns. Inc., Lakewood, NJ 08701 908-364-1800
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
†# United States Electronics, Springfield, NJ 07081 201-912-0111
§† Vanguard Electronics Co., Gardena, CA 90248 310-323-4100
† Wirebenders, Inc., Phoenix, AZ 85021-2824 602-861-1856

Coils, Molded-1800

Abracon Corporation, San Clemente, CA 92673, 714-498-4505 ..... **A•1180**
Amecon, Inc., Anaheim, CA 92805, 714-634-2220;800-392-2292 ..... **A•1182-1185**
§† **American Precision Ind.,Delevan/SMD Divisions, E. Aurora, NY 14052, 716-652-3600** ..... **A•1187**
APX Technologies Inc., Hicksville, NY 11801, 516-433-1313 ..... **A•2267**
§† **Bell Inds., J. W. Miller Div., Gardena, CA 90247-1059, 310-515-1720** ..... **A•1190-1192**
Caddell-Burns Mfg., Mineola, NY 11501-3508, 516-746-2310 ..... **A•1198,1201**
Coilcraft, Cary, IL 60013, 708-639-2361 ..... **A•1215-1217,1219-1221**
† **Communication Coil Inc., Chicago, IL 60634, 312-637-1333** ..... **A•1224**
CSI Capacitors, CSI Technologies, San Marcos, CA 92069-3009, 619-747-4000 ..... **A•1066**
Custom Coils Inc., Alcester, SD 57001-0348, 605-934-2460 ..... **A•2311**
§ **Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180, 605-665-9301** ..... **A•1225-1228,1230**
§† **Dormeyer Industries, A.F. Dormeyer Mfg. Co. Inc., Chicago, IL 60631-1521, 312-775-3600** ..... **B•1635**
Ecliptek Corporation, Costa Mesa, CA 92626, 714-433-1200 ..... **A•1258**
EWC, Inc., Englishtown, NJ 07726, 908-446-3110 ..... **A•1235**
§ **Frontier Electronics, Simi Valley, CA 93065, 805-522-9998** ..... **A•1236-1237**
§† **Gowanda Electronics Corp., Gowanda, NY 14070, 716-532-2234** ..... **A•1239,1241**
† Hisonic, Inc., Olathe, KS 66051, 913-782-0012 ..... A•2360
KOA Speer Electronics, Bradford, PA 16701, 814-362-5536 ..... **A•1242-1243**
Magnetek Triad, Huntington, IN 46750 219-356-7100 ..... **A•1248-1249**
Magnetic Component Engineering, Inc., Inglewood, CA 90301, 310-677-6600 ..... **A•1321**
§† **Microtran Co. Inc., Valley Stream, NY 11582-0236, 516-561-6050** ..... **A•1254,2411**
§† **Nytron Inductors, Inc.(VSD, Inc.), Offered by: Dale Electronics, Inc., Yankton, SD 57078-0180, 605-665-9301** ..... **A•1231**
Ohmite Manufacturing Co., Skokie, IL 60076, 708-675-2600 ..... **A•1259**
† **Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064** **A•1263**
† **Piconics, Incorporated, Tyngsboro, MA 01879, 508-649-7501** ..... **A•1274**
Powertronix Corp., Foster City, CA 94404, 415-345-6800 ..... **A•2511**
§† **RCD Components, Inc., Manchester, NH 03109, 603-669-0054** ..... **A•1282,2019**
Renco Electronics, Inc., Deer Pk., NY 11729, 516-586-5566;1-800-645-5828 ..... **A•1284-1285,1289**
Sprague-Goodman Elctrns., Inc., Garden City Pk., NY 11040, 516-746-1385 ..... **A•1164**
Standex Electronics, Standex International, Cincinnati, OH 45209, 513-871-3777 ..... **A•1290,1292-1295**
§ **Tamura Corporation of America, Temecula, CA 92589-2230, 909-699-1270** ..... **A•2572**
† **Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314** ..... **A•1307,2594**
Wilco Corp., Indianapolis, IN 46268, 317-293-9300 ..... **A•1310-1311**
† American Trans-Coil Corporation, Richmond Hill, NY 11419-1410 718-441-5207
Andover, Inc., Lafayette, IN 47904 317-447-1157
† Automatic Coil Corp., Miami, FL 33147 305-696-6660
† Bicron Electronics, Canaan, CT 06018 203-824-5125
Capewell Components, Cromwell, CT 06416 203-635-4045
CET Technology, Hudson, NH 03051 603-883-5912
Chloride Electro Networks, Chloride Power Electronics, Inc., Caledonia, NY 14423 716-538-4421
†# Cletronics Inc., Medina, OH 44256-9623 216-722-3030
† Component Specialties Corp., Temple City, CA 91780 213-283-0015
† Corona Magnetics, Inc., Corona, CA 91719 909-735-7558
Cosmo Corporation, Cleveland, OH 44109 216-861-5594
§ Coto Wabash, A Kearney National Company, Providence, RI 02907 401-943-2686
D & L Electronics, Langhorne, PA 19047 800-942-3631
§† Delevan Div., American Precision Inds. Inc., E. Aurora, NY 14052-0449 .. 716-652-3600
§ Deltrol Controls, Milwaukee, WI 53215 414-671-6800
Douglas Randall, Pawcatuck, CT 06379 203-599-2075
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012 605-296-3462
Electronic Coil Corp., Bloomfield, CT 06002 203-243-5233
Elma Engineering, Palo Alto, CA 94303 415-494-7303
Endicott Coil Co., Inc., Binghamton, NY 13905 607-797-1263
† ESC Electronics Corp., Palisades Pk., NJ 07650 201-947-0400
§ Fee Fil-Mag, San Diego, CA 92123 619-569-6577
Furnas Elec., Batavia, IL 60510 708-879-6000
§ GC International Inc., Plano, TX 75074 214-423-8411
§† JB Electronic Transformers Inc., Chicago, IL 60647 312-342-0080
§† Jeffers Electronics, Nogales, AZ 85621 602-281-4925
† Kappa Technologies, Inc., Rahway, NJ 07065 ..... 908-396-9400;1-800-223-0603
Kentron, Inc., Cedarburg, WI 53012-0142 414-377-3733
KGS Electronics, Inc., Arcadia, CA 91006 818-574-1175
† Lenox-Fugle Electronics, S. Plainfield, NJ 07080 908-756-1164
Mag-Con, St. Paul, MN 55113 612-633-8820
† Magnecomp, Inc., Pickens, SC 29671 803-878-4700
Magnelab, Boulder, CO 80301-4696 303-442-6700
† Magnetico Inc., Holtsville, NY 11742 516-654-1166
Magnet Schultz of America, Westmont, IL 60559 708-789-0600
§ Namco Controls Corporation, Mentor, OH 44060 216-946-9900
† Newport Manufacturing Co., Santa Ana, CA 92704 800-726-0715
† Ny-Glass Plastics Inc., Calnetics Corp., Corona, CA 91720 909-737-9110
Oeco Corp., Milwaukie, OR 97222 503-659-7932
† OPT Industries, Inc., Phillipsburg, NJ 08865 908-454-2600
† PCA Electronics, Sepulveda, CA 91343 818-892-0761
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861 908-826-4700
§ RF Electronics, Inc., Irvine, CA 92714-5517 714-263-0661
† Schott Corp., Wayzata, MN 55391 612-475-1173
† Sigma Electronics Inc., Houston, TX 77099 ..... 713-933-4700;800-874-7121
Skyway Magnetics, Warner Springs, CA 92086-9714 619-782-3342
South American Development Corp., Poughkeepsie, NY 12590 914-452-1305
Standard Magnetic Corp., Garden Grove, CA 92641 714-379-5671
§ Stetco, Inc., Franklin Pk., IL 60131 708-671-4208
§ TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056 708-803-6100
3L Global Electronics, 3L Coils, St. Petersburg, FL 33710 813-343-2679
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
† Torotron Corp., Mt. Vernon, NY 10550 914-664-2050
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
† Trinetics Inc., Mishawaka, IN 46545-4899 219-259-8535
†# United States Electronics, Springfield, NJ 07081 201-912-0111
United Technical Products, Fallsington, PA 19054 800-553-5300
† Vanguard Electronics Co., Gardena, CA 90248 310-323-4100
§ Vitec Electronics Corp., Visalia, CA 93291 209-651-1535
Wabash Magnetics, Control Prods. Grp., Wabash, IN 46992 219-563-2191

Coils, pi Winding-1800

Amecon, Inc., Anaheim, CA 92805, 714-634-2220;800-392-2292 ..... **A•1184**
§ **Bell Inds., J. W. Miller Div., Gardena, CA 90247-1059, 310-515-1720** ..... **A•1192**
Caddell-Burns Mfg., Mineola, NY 11501-3508, 516-746-2310 ..... **A•1198**
EI & S, Prime Technology Inc., North Branford, CT 06471, 203-481-5721 ..... **B•1482**
† **Magnetic Component Engineering, Inc., Inglewood, CA 90301, 310-677-6600** ..... **A•1251**
North Hills Signal Processing, Syosset, NY 11791, 516-682-7740 ..... **A•2438**
† **Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064** ..... **A•1263**
§† **RCD Components, Inc., Manchester, NH 03109, 603-669-0054** ..... **A•1282**
Renco Electronics, Inc., Deer Pk., NY 11729, 516-586-5566;1-800-645-5828 ..... **A•1288-1289**
Wilco Corp., Indianapolis, IN 46268, 317-293-9300 ..... **A•1309,1312**
§† American Precision Ind.,Delevan/SMD Divisions, E. Aurora, NY 14052 .. 716-652-3600
† American Trans-Coil Corporation, Richmond Hill, NY 11419-1410 718-441-5207
§† Associated Spring, Barnes Grp., Bristol, CT 06010 203-583-1331
† Automatic Coil Corp., Miami, FL 33147 305-696-6660
Caddell Coil Corp., Middletown Springs, VT 05757 802-235-2019
†# Cletronics Inc., Medina, OH 44256-9623 216-722-3030
† Communication Coil Inc., Chicago, IL 60634 312-637-1333
† Corona Magnetics, Inc., Corona, CA 91719 909-735-7558
Dormeyer Industries, A.F. Dormeyer Mfg. Co. Inc., Chicago, IL 60631-1521 312-775-3600
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012 605-296-3462
EG&G Electro-Optics, EG&G Optoelectronics, EG&G Inc., Salem, MA 01970 ..... 508-745-3200;1-800-950-3441
Electro Assemblies Corp., Northbrook, IL 60062-2319 708-498-6520
Electronic Coil Corp., Bloomfield, CT 06002 203-243-5233
† Magnecomp, Inc., Pickens, SC 29671 803-878-4700
† Newport Manufacturing Co., Santa Ana, CA 92704 800-726-0715
Radio Television Products Corp., Douglas, AZ 85607 602-364-4438
Schott Corp., Wayzata, MN 55391 612-475-1173
† Skyway Magnetics, Warner Springs, CA 92086-9714 619-782-3342
† Trinetics Inc., Mishawaka, IN 46545-4899 219-259-8535

†# United States Electronics, Springfield, NJ 07081 201-912-0111
† ZMAN Magnetics, Kent, WA 98032 206-251-8064

Coils, Relay-1800

APX Technologies Inc., Hicksville, NY 11801, 516-433-1313 ..... A•2266
Gowanda Electronics Corp., Gowanda, NY 14070, 716-532-2234 ..... A•1241
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ..... A•2118
Standex Electronics, Standex International, Cincinnati, OH 45209, 513-871-3777 ..... A•1290,1292
Aleph International Corp., San Fernando, CA 91340 ..... 818-365-9856;800-423-5622
American Magnetics, Carterville, IL 62918 618-985-4838
Andover, Inc., Lafayette, IN 47904 317-447-1157
† A.P.W. Co., Inc., Rockaway, NJ 07866 201-627-0643
† Automatic Coil Corp., Miami, FL 33147 305-696-6660
Capewell Components, Cromwell, CT 06416 203-635-4045
Cardinal Control Co., Kensington, CT 06037 203-828-6379
† Computer Components, Inc., East Granby, CT 06026 203-653-9909
† Corona Magnetics, Inc., Corona, CA 91719 909-735-7558
§ Coto Wabash, A Kearney National Company, Providence, RI 02907 401-943-2686
Custom Bobbin Windings, A & K Corporation, Zanesville, OH 43702-2369 614-452-6973
§ Deltrol Controls, Milwaukee, WI 53215 414-671-6800
† De Young Mfg., Inc., Kirkland, WA 98034 206-823-4798
Douglas Randall, Pawcatuck, CT 06379 203-599-2075
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012 605-296-3462
Electronic Coil Corp., Bloomfield, CT 06002 203-243-5233
Endicott Coil Co., Inc., Binghamton, NY 13905 607-797-1263
Gavagan Electronics, Danbury, CT 06810 203-748-5248
GC International Inc., Plano, TX 75074 214-423-8411
Grand Transformer, Inc., Grand Haven, MI 49417 616-842-5430
§ GTE Supply, GTE, Irving, TX 75038 800-433-4837
† INRESCO, Inc., Manasquan, NJ 08736 908-223-6330
§† Jaico Products, Jaidinger Mfg. Co., Inc., Chicago, IL 60622 312-421-1090
JB Electronic Transformers Inc., Chicago, IL 60647 312-342-0080
Kappa Technologies, Inc., Rahway, NJ 07065 ..... 908-396-9400;1-800-223-0603
Liberty Controls, Shorewood, IL 60435 815-725-2241
Line Electric Products, Glastonbury, CT 06033 ..... 203-659-3573;1-800-331-1137
Magnecraft Electric Co., Northbrook, IL 60062-5376 708-564-8800
MCI Transformer Corporation, Babylon, NY 11704 516-587-0510
† Newport Manufacturing Co., Santa Ana, CA 92704 800-726-0715
Pacific Transformer Corp., Anaheim, CA 92807 ..... 714-779-0450;1-800-325-0501
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861 908-826-4700
Relay Service Co., Chicago, IL 60651 312-252-2700
Renco Electronics, Inc., Deer Pk., NY 11729 ..... 516-586-5566;1-800-645-5828
Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901 609-589-7500
Texas Transformer Corp., Plano, TX 75086 214-424-1581
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
† Trinetics Inc., Mishawaka, IN 46545-4899 219-259-8535
†# United States Electronics, Springfield, NJ 07081 201-912-0111
Wabash Magnetics, Control Prods. Grp., Wabash, IN 46992 219-563-2191
The Winatic Corp., Electro-Technik Industries, Inc., Vestal, NY 13850 607-729-6318
† ZMAN Magnetics, Kent, WA 98032 206-251-8064

Coils, RF-1800

Advanced Components Inds., Inc., Div of Kaschke, Torrance, CA 90501, 310-328-0060 ..... A•1318
§† American Precision Ind.,Delevan/SMD Divisions, E. Aurora, NY 14052, 716-652-3600 ..... A•1186-1187
APX Technologies Inc., Hicksville, NY 11801, 516-433-1313 ..... A•2267
§ Bell Inds., J. W. Miller Div., Gardena, CA 90247-1059, 310-515-1720 ..... A•1190-1193,1195
BH Electronics, Inc., Burnsville, MN 55337, 612-894-9590 ..... A•1197
Caddell-Burns Mfg., Mineola, NY 11501-3508, 516-746-2310 ..... A•1198,1201-1203,1206-1212
† Caddell Coil Corp., Middletown Springs, VT 05757, 802-235-2019 ..... A•1213
Coilcraft, Cary, IL 60013, 708-639-2361 ..... A•1215-1218,1220-1221
† Coil-Q Corp., Bronxville, NY 10708, 914-337-4775 ..... A•1222
† Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ..... A•1224
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180, 605-665-9301 ..... A•1225-1226
EI & S, Prime Technology Inc., North Branford, CT 06471, 203-481-5721 ..... A•1227
† EWC, Inc., Englishtown, NJ 07726, 908-446-3110 ..... A•1235
Fee Fil-Mag, San Diego, CA 92123, 619-569-6577 ..... A•2350
Fetco, Sanford, FL 32773, 407-321-3800 ..... A•2353
§ Frontier Electronics, Simi Valley, CA 93065, 805-522-9998 ..... A•1236-1237
§† Gowanda Electronics Corp., Gowanda, NY 14070, 716-532-2234 ..... A•1239,1241
† Hisonic, Inc., Olathe, KS 66051, 913-782-0012 ..... A•2360
Kappa Technologies, Inc., Rahway, NJ 07065, 908-396-9400;1-800-223-0603 ..... A•1645,2371
† Magnetic Component Engineering, Inc., Inglewood, CA 90301, 310-677-6600 ..... A•1251-1253,1321
Microtran Co. Inc., Valley Stream, NY 11582-0236, 516-561-6050 ..... A•1254
Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ..... A•1257
North Hills Signal Processing, Syosset, NY 11791, 516-682-7740 ..... A•2438
§† Ohmite Manufacturing Co., Skokie, IL 60076, 708-675-2600 ..... A•1259
Penn-Tran Corp.,Sub. of Spectrum Elctrns. Inc., Wingate, PA 16880, 814-355-1521 ..... A•1260-1261
† Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•1263
† Piconics, Incorporated, Tyngsboro, MA 01879, 508-649-7501 ..... A•1274-1275
† Polara Engineering Inc., Fullerton, CA 92633, 714-521-0900 ..... A•1576
Prem Magnetics, Inc., McHenry, IL 60050, 815-385-2700 ..... A•2525
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•1282
Renco Electronics, Inc., Deer Pk., NY 11729, 516-586-5566;1-800-645-5828 ..... A•1284,1288-1289
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ..... A•2118
§ Sprague-Goodman Elctrns., Inc., Garden City Pk., NY 11040, 516-746-1385 ..... A•1164-1165
† Standex Electronics, Standex International, Cincinnati, OH 45209, 513-871-3777 ..... A•1290,1292,1295
Tamura Corporation of America, Temecula, CA 92589-2230, 909-699-1270 ..... A•1298-1299
TMP Inc., Santa Ana, CA 92705, 714-558-8028 ..... A•1300
† Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314 ..... A•1307,2594
Vernitron Corp., Precision Comps. Group, St. Petersburg, FL 33710, 813-347-2181 ..... A•1308
Wilco Corp., Indianapolis, IN 46268, 317-293-9300 ..... A•1309-1310,1312
† ZMAN Magnetics, Kent, WA 98032, 206-251-8064 ..... A•1315
Abracon Corporation, San Clemente, CA 92673 714-498-4505
† American Trans-Coil Corporation, Richmond Hill, NY 11419-1410 718-441-5207
ATC-Frost Magnetics Inc., Oakville,Ont., CANADA L6H 2R4 416-844-6681
§ Atlantic Magnetics, Inc., Pompano Beach, FL 33069 305-979-7920
† Automatic Coil Corp., Miami, FL 33147 305-696-6660
† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635 714-447-2300
Bey Electric, Inc., Lincoln Park, NJ 07035 201-694-5000
† BG Electronics, EPC Corp., Mt. Vernon, NY 10550-4430 914-664-5591
§ Ceramic Magnetics, Inc., Fairfield, NJ 07004 201-227-4222
CET Technology, Hudson, NH 03051 603-883-5912
§ Communication Devices, Inc., Scarborough, Ont., CAN M1B3R6 416-292-4463
† Corona Magnetics, Inc., Corona, CA 91719 909-735-7558
† Cramer Coil & Transformer Co., Inc., Saukville, WI 53080 ..... 414-268-2150;414-375-5700
§† Delevan Div., American Precision Inds. Inc., E. Aurora, NY 14052-0449 716-652-3600
† De Young Mfg., Inc., Kirkland, WA 98034 206-823-4798
Ecliptek Corporation, Costa Mesa, CA 92626 714-433-1200
† Electro Assemblies Corp., Northbrook, IL 60062-2319 708-498-6520
†# Elite Electronic Engineering Co., Downers Grove, IL 60515 708-495-9770
Elma Engineering, Palo Alto, CA 94303 415-494-7303
† ESC Electronics Corp., Palisades Pk, NJ 07650 201-947-0400
† Fernwood Transformer Co., Transistor Devices Inc., Belvidere, NJ 07823 908-475-3207
§ GC International Inc., Plano, TX 75074 214-423-8411
§ Hammond Manufacturing Co., Buffalo, NY 14225 716-894-5710
Integrity Technology Corporation, Santa Clara, CA 95050 408-262-8640
International Microelectronics, Arlington, TX 76003 817-473-1730
§† Jeffers Electronics, Nogales, AZ 85621 602-281-4925
Lenco Elctrns., Inc., McHenry, IL 60050 815-344-2900
† Lenox-Fugle Electronics, S. Plainfield, NJ 07080 908-756-1164
† Magnecomp, Inc., Pickens, SC 29671 803-878-4700
† Magnetico Inc., Holtsville, NY 11742 516-654-1166
Mech-Tronics, Mount Holly, NJ 08060 609-267-0680
Mouser Electronics, Santee, CA 92071 800-346-6873
Mouser Electronics, Mansfield, TX 76063 800-346-6873
Mouser Electronics, Gilroy, CA 95020 800-346-6873
Nemeth Engineering Associates, Inc., Crestwood, KY 40014 502-241-1502
† Newport Manufacturing Co., Santa Ana, CA 92704 800-726-0715
§† Nytron Inductors, Inc.(VSD, Inc.), Offered by: Dale Electronics, Inc., Yankton, SD 57078-0180 605-665-9301
OPT Industries, Inc., Phillipsburg, NJ 08865 908-454-2600
Oxley Inc., Branford, CT 06405 203-488-1033
† PCA Electronics, Sepulveda, CA 91343 818-892-0761
Radio Television Products Corp., Douglas, AZ 85607 602-364-4438
† Raytheon Co., Electronic Components Division, Waltham, MA 02254 617-899-8400
† RFI Corporation, Bay Shore, NY 11706 516-231-6400
Rutherford Research, Rutherford, NJ 07070 201-933-2091
Schott Corp., Wayzata, MN 55391 612-475-1173
† Shogyo International Corp., Great Neck, NY 11021-4799 516-466-0911
South American Development Corp., Poughkeepsie, NY 12590 914-452-1305
Standard Magnetic Corp., Garden Grove, CA 92641 714-379-5671
§ Stetco, Inc., Franklin Pk., IL 60131 708-671-4208
Taiyo Yuden (USA) Inc., Arlington Heights, IL 60005-4493 708-364-6104
TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056 708-803-6100
Texas Transformer Corp., Plano, TX 75086 214-424-1581
3L Global Electronics, 3L Coils, St. Petersburg, FL 33710 813-343-2679
Tokin America, Inc., San Jose, CA 95134 408-432-8020
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
Torad Coil Co., Inc., Wayne, NJ 07470 201-835-6195
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
†# United States Electronics, Springfield, NJ 07081 201-912-0111
§† Vanguard Electronics Co., Gardena, CA 90248 310-323-4100
§ Vitec Electronics Corp., Visalia, CA 93291 209-651-1535
The Winatic Corp., Electro-Technik Industries, Inc., Vestal, NY 13850 607-729-6318
† Wirebenders, Inc., Phoenix, AZ 85021-2824 602-861-1856
§† Zambre Co., Inc., Mountain View, CA 94043 415-968-9176

Coils, Saturable Reactor-1800

Caddell-Burns Mfg., Mineola, NY 11501-3508, 516-746-2310 ..... A•1198-1200,1204-1205,1209
† Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ..... A•1224
† EWC, Inc., Englishtown, NJ 07726, 908-446-3110 ..... A•1235
Magnelab, Boulder, CO 80301-4696, 303-442-6700 ..... A•2378
§† Microtran Co. Inc., Valley Stream, NY 11582-0236, 516-561-6050 ..... A•1254
† Penn-Tran Corp.,Sub. of Spectrum Elctrns. Inc., Wingate, PA 16880, 814-355-1521 ..... A•1260-1261
Precision Electronics Inc., Copiague, NY 11726, 516-842-4900 ..... A•2526
Prem Magnetics, Inc., McHenry, IL 60050, 815-385-2700 ..... A•2525
† Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314 ..... A•1307,2594
Abbott Technologies, Inc., Sun Valley, CA 91352 ..... 818-504-0644;1-800-367-8200

Albar, Inc., Lynnwood, WA 98036 ..... 206-771-4006;800-822-5227
† American Aerospace Controls, Farmingdale, NY 11735 516-694-5100
American Magnetics, Carterville, IL 62918 618-985-4838
† American Trans-Coil Corporation, Richmond Hill, NY 11419-1410 718-441-5207
† Atlas Engineering Corp., Dorchester, MA 02121 617-445-7100
Automatic Coil Corp., Miami, FL 33147 305-696-6660
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
Bey Electric, Inc., Lincoln Park, NJ 07035 201-694-5000
† Bicron Electronics, Canaan, CT 06018 203-824-5125
†# Cletronics Inc., Medina, OH 44256-9623 216-722-3030
† Corona Magnetics, Inc., Corona, CA 91719 909-735-7558
Cross Electronics, Warrendale, PA 15086 412-776-1591
Custom Coils Inc., Alcester, SD 57001-0348 605-934-2460
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 605-665-9301
† Del Electronics Corp., Valhalla, NY 10595 914-686-3600
† Dietz Design, Inc., Belton, MO 64012 816-331-4911
† Electrocom Industries, S. Bend, IN 46615 219-232-2743
Electromech, Inc., Irvington, NJ 07111 201-318-7999
† Electronic Transformer Corp., Paterson, NJ 07544-0487 201-942-2222
Elma Engineering, Palo Alto, CA 94303 415-494-7303
† Fernwood Transformer Co., Transistor Devices Inc., Belvidere, NJ 07823 908-475-3207
† Freed Transformer Co., Inc., Electronic Transformer Corp., Paterson, NJ 07544-0487 201-942-2222
Gavagan Electronics, Danbury, CT 06810 203-748-5248
Hipotronics Inc., Brewster, NY 10509 914-279-8091
† Hisonic, Inc., Olathe, KS 66051 913-782-0012
Hitran Corporation, Flemington, NJ 08822-1238 908-782-5525
† Industrial Control Co., Rockledge, FL 32955 407-259-7105
JB Electronic Transformers Inc., Chicago, IL 60647 312-342-0080
Keytronics, Inc., Endicott, NY 13760 607-754-5405
KGS Electronics, Inc., Arcadia, CA 91006 818-574-1175
† L/C Magnetics, Anaheim, CA 92806 714-666-0787
LEPCO/Leonard Elec. Prods., Brownsville, TX 78521 210-546-1625
Mag-Con, St. Paul, MN 55113 612-633-8820
† Magnecomp, Inc., Pickens, SC 29671 803-878-4700
† Magnetico Inc., Holtsville, NY 11742 516-654-1166
† Newport Manufacturing Co., Santa Ana, CA 92704 800-726-0715
† Northlake Engineering, Inc., Bristol, WI 53104-0370 414-857-9600
† NWL Transformers, Bordentown, NJ 08505 609-298-7300
Nytron Inductors, Inc.(VSD, Inc.), Offered by: Dale Electronics, Inc., Yankton, SD 57078-0180 605-665-9301
Oeco Corp., Milwaukie, OR 97222 503-659-7932
OPT Industries, Inc., Phillipsburg, NJ 08865 908-454-2600
† Oram High Voltage, Dayton, TX 77535 409-258-5553
Pacific Transformer Corp., Anaheim, CA 92807 ..... 714-779-0450;1-800-325-0501
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861 908-826-4700
Renco Electronics, Inc., Deer Pk., NY 11729 ..... 516-586-5566;1-800-645-5828
Ritron Corp., Skokie, IL 60076 708-679-7180
Schott Corp., Wayzata, MN 55391 612-475-1173
† Sigma Electronics Inc., Houston, TX 77099 ..... 713-933-4700;800-874-7121
Skyway Magnetics, Warner Springs, CA 92086-9714 619-782-3342
Standard Magnetic Corp., Garden Grove, CA 92641 714-379-5671
Standex Electronics, Standex International, Cincinnati, OH 45209 513-871-3777
Talema Electronic, Inc., Saint James, MO 65559 314-265-5500
Torad Coil Co., Inc., Wayne, NJ 07470 201-835-6195
† Torelco, Inc., Irvington, NJ 07111 ..... 201-374-8641;800-867-3526
† Torotron Corp., Mt. Vernon, NY 10550 914-664-2050
† Torwico Elctrns. Inc., Lakewood, NJ 08701 908-364-1800
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
Wilco Corp., Indianapolis, IN 46268 317-293-9300
WPI Group, Inc., Warner, NH 03278 603-456-3111
§ Zambre Co., Inc., Mountain View, CA 94043 415-968-9176
† ZMAN Magnetics, Kent, WA 98032 206-251-8064

Coils, Shielded-1800

Abracon Corporation, San Clemente, CA 92673, 714-498-4505 ..... A•1180
§† American Precision Ind.,Delevan/SMD Divisions, E. Aurora, NY 14052, 716-652-3600 ..... A•1187,1189
§† Bell Inds., J. W. Miller Div., Gardena, CA 90247-1059, 310-515-1720 ..... A•1190,1192
Caddell-Burns Mfg., Mineola, NY 11501-3508, 516-746-2310 .. A•1198,1211-1212
Caddell Coil Corp., Middletown Springs, VT 05757, 802-235-2019 ..... A•1213
Coilcraft, Cary, IL 60013, 708-639-2361 ..... A•1215-1216,1218-1219
Coil-Q Corp., Bronxville, NY 10708, 914-337-4775 ..... A•1222-1223
† Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ..... A•1224
§† Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180, 605-665-9301 ..... A•1225-1226,1230,1233
Ecliptek Corporation, Costa Mesa, CA 92626, 714-433-1200 ..... A•1258
EWC, Inc., Englishtown, NJ 07726, 908-446-3110 ..... A•1235
§ Frontier Electronics, Simi Valley, CA 93065, 805-522-9998 ..... A•1236
§† Gowanda Electronics Corp., Gowanda, NY 14070, 716-532-2234 ... A•1239,1241
† Hisonic, Inc., Olathe, KS 66051, 913-782-0012 ..... A•2360
Kappa Technologies, Inc., Rahway, NJ 07065, 908-396-9400;1-800-223-0603 ..... A•1645
† Magnetic Component Engineering, Inc., Inglewood, CA 90301, 310-677-6600 ..... A•1251,1253,1321
Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ..... A•1257
§† Nytron Inductors, Inc.(VSD, Inc.), Offered by: Dale Electronics, Inc., Yankton, SD 57078-0180, 605-665-9301 ..... A•1231
Ohmite Manufacturing Co., Skokie, IL 60076, 708-675-2600 ..... A•1259
† Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•1263
Piconics, Incorporated, Tyngsboro, MA 01879, 508-649-7501 ..... A•1274
Prem Magnetics, Inc., McHenry, IL 60050, 815-385-2700 ..... A•1277-1281,2525
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•1282,2019
Renco Electronics, Inc., Deer Pk., NY 11729, 516-586-5566;1-800-645-5828 ..... A•1288
§ Sprague-Goodman Elctrns., Inc., Garden City Pk., NY 11040, 516-746-1385 ..... A•1164-1165
† Standex Electronics, Standex International, Cincinnati, OH 45209, 513-871-3777 ..... A•1290,1292-1295
† Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314 ..... A•1307
Vernitron Corp., Precision Comps. Group, St. Petersburg, FL 33710, 813-347-2181 ..... A•1308
Wilco Corp., Indianapolis, IN 46268, 317-293-9300 ..... A•1309
† ZMAN Magnetics, Kent, WA 98032, 206-251-8064 ..... A•1315
Albar, Inc., Lynnwood, WA 98036 ..... 206-771-4006;800-822-5227
American Magnetics, Carterville, IL 62918 618-985-4838
† American Trans-Coil Corporation, Richmond Hill, NY 11419-1410 718-441-5207
† Automatic Coil Corp., Miami, FL 33147 305-696-6660
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
† Bicron Electronics, Canaan, CT 06018 203-824-5125
† CELCO, Mahwah, NJ 07430 201-327-1123
CET Technology, Hudson, NH 03051 603-883-5912
†# Cletronics Inc., Medina, OH 44256-9623 216-722-3030
† Corona Magnetics, Inc., Corona, CA 91719 909-735-7558
† Cramer Coil & Transformer Co., Inc., Saukville, WI 53080 .. 414-268-2150;414-375-5700
Custom Coils Inc., Alcester, SD 57001-0348 605-934-2460
§† Delevan Div., American Precision Inds. Inc., E. Aurora, NY 14052-0449 .. 716-652-3600
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012 605-296-3462
† Electronic Transformer Corp., Paterson, NJ 07544-0487 201-942-2222
Elma Engineering, Palo Alto, CA 94303 415-494-7303
† Fernwood Transformer Co., Transistor Devices Inc., Belvidere, NJ 07823 908-475-3207
† Freed Transformer Co., Inc., Electronic Transformer Corp., Paterson, NJ 07544-0487 201-942-2222
§ GC International Inc., Plano, TX 75074 214-423-8411
Hitran Corporation, Flemington, NJ 08822-1238 908-782-5525
§† JB Electronic Transformers Inc., Chicago, IL 60647 312-342-0080
§† Jeffers Electronics, Nogales, AZ 85621 602-281-4925
Keytronics, Inc., Endicott, NY 13760 607-754-5405
† Lenox-Fugle Electronics, S. Plainfield, NJ 07080 908-756-1164
† Magnecomp, Inc., Pickens, SC 29671 803-878-4700
Magnelab, Boulder, CO 80301-4696 303-442-6700
† Magnetico Inc., Holtsville, NY 11742 516-654-1166
Mech-Tronics, Mount Holly, NJ 08060 609-267-0680
† Newport Manufacturing Co., Santa Ana, CA 92704 800-726-0715
† North Hills Signal Processing, Syosset, NY 11791 516-682-7740
† NWL Transformers, Bordentown, NJ 08505 609-298-7300
† OPT Industries, Inc., Phillipsburg, NJ 08865 908-454-2600
Pacific Transformer Corp., Anaheim, CA 92807 ..... 714-779-0450;1-800-325-0501
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861 908-826-4700
Radio Television Products Corp., Douglas, AZ 85607 602-364-4438
Schott Corp., Wayzata, MN 55391 612-475-1173
† Sigma Electronics Inc., Houston, TX 77099 ..... 713-933-4700;800-874-7121
† Skyway Magnetics, Warner Springs, CA 92086-9714 619-782-3342
South American Development Corp., Poughkeepsie, NY 12590 914-452-1305
Talema Electronic, Inc., Saint James, MO 65559 314-265-5500
§ Tamura Corporation of America, Temecula, CA 92589-2230 909-699-1270
TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056 708-803-6100
Texas Transformer Corp., Plano, TX 75086 214-424-1581
3L Global Electronics, 3L Coils, St. Petersburg, FL 33710 813-343-2679
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
Torad Coil Co., Inc., Wayne, NJ 07470 201-835-6195
† Torelco, Inc., Irvington, NJ 07111 ..... 201-374-8641;800-867-3526
† Torwico Elctrns. Inc., Lakewood, NJ 08701 908-364-1800
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
§† Vanguard Electronics Co., Gardena, CA 90248 310-323-4100
§ Vitec Electronics Corp., Visalia, CA 93291 209-651-1535
† Wirebenders, Inc., Phoenix, AZ 85021-2824 602-861-1856

Coils, Solenoid-1800

APX Technologies Inc., Hicksville, NY 11801, 516-433-1313 ..... A•2267
Cramer Coil & Transformer Co., Inc., Saukville, WI 53080, 414-268-2150,414-375-5700 ..... A•2308
§† Dormeyer Industries, A.F. Dormeyer Mfg. Co. Inc., Chicago, IL 60631-1521, 312-775-3600 ..... B•1632-1635
Gowanda Electronics Corp., Gowanda, NY 14070, 716-532-2234 ..... A•1239
Liberty Controls, Shorewood, IL 60435, 815-725-2241 ..... B•1644-1645
Magnelab, Boulder, CO 80301-4696, 303-442-6700 ..... A•2378,2382
Magnos, Hudson, MA 01749, 508-562-1173 ..... D•1296
Mitchell Electronics Corp., Mt. Vernon, NY 10552, 914-699-3800 ..... A•2433
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ..... A•2118
Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314 ..... A•2594
§ Walker Scientific, Worcester, MA 01606, 508-852-3674;508-853-3232;800-962-4638 ..... D•1334
Wilco Corp., Indianapolis, IN 46268, 317-293-9300 ..... A•1309,1312
Ajax Magnethermic Corp., Warren, OH 44483 216-372-8511
Albar, Inc., Lynnwood, WA 98036 ..... 206-771-4006;800-822-5227
§ Allen Co., Inc., Robert G., N. Hollywood, CA 91605 ..... 818-765-8300;800-827-7422
American Magnetics, Carterville, IL 62918 618-985-4838
American Magnetics, Oak Ridge, TN 37831-2509 615-482-1056
§† American Precision Ind.,Delevan/SMD Divisions, E. Aurora, NY 14052 .. 716-652-3600
Andover, Inc., Lafayette, IN 47904 317-447-1157
† A.P.W. Co., Inc., Rockaway, NJ 07866 201-627-0643
ATC-Frost Magnetics Inc., Oakville,Ont., CANADA L6H 2R4 416-844-6681
§ Atlantic Magnetics, Inc., Pompano Beach, FL 33069 305-979-7920
† Automatic Coil Corp., Miami, FL 33147 305-696-6660
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100

† Bicron Electronics, Canaan, CT 06018 ... 203-824-5125
§ Canfield Connector, Canfield Industries, Youngstown, OH 44514 ... 216-758-8299
Capewell Components, Cromwell, CT 06416 ... 203-635-4045
Cardinal Control Co., Kensington, CT 06037 ... 203-828-6379
† Communication Coil Inc., Chicago, IL 60634 ... 312-637-1333
† Component Specialties Corp., Temple City, CA 91780 ... 213-283-0015
† Corona Magnetics, Inc., Corona, CA 91719 ... 909-735-7558
Cryomagnetics, Inc., Oak Ridge, TN 37830 ... 615-482-9551
Custom Bobbin Windings, A & K Corporation, Zanesville, OH 43702-2369 ... 614-452-6973
Custom Coils Inc., Alcester, SD 57001-0348 ... 605-934-2460
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 ... 605-665-9301
Delevan Div., American Precision Inds. Inc., E. Aurora, NY 14052-0449 ... 716-652-3600
§ Deltrol Controls, Milwaukee, WI 53215 ... 414-671-6800
Detroit Coil Co., Ferndale, MI 48220 ... 313-398-5600
† De Young Mfg., Inc., Kirkland, WA 98034 ... 206-823-4798
Douglas Randall, Pawcatuck, CT 06379 ... 203-599-2075
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012 ... 605-296-3462
Ecliptek Corporation, Costa Mesa, CA 92626 ... 714-433-1200
EG&G Electro-Optics, EG&G Optoelectronics, EG&G Inc., Salem, MA 01970 ... 508-745-3200;1-800-950-3441
Electro Assemblies Corp., Northbrook, IL 60062-2319 ... 708-498-6520
Electrocom Industries, S. Bend, IN 46615 ... 219-232-2743
Electromech, Inc., Irvington, NJ 07111 ... 201-318-7999
Electronic Coil Corp., Bloomfield, CT 06002 ... 203-243-5233
† Electronic Transformer Corp., Paterson, NJ 07544-0487 ... 201-942-2222
Elma Engineering, Palo Alto, CA 94303 ... 415-494-7303
Endicott Coil Co., Inc., Binghamton, NY 13905 ... 607-797-1263
† ESC Electronics Corp., Palisades Pk, NJ 07650 ... 201-947-0400
† Freed Transformer Co., Inc., Electronic Transformer Corp., Paterson, NJ 07544-0487 ... 201-942-2222
Gavagan Electronics, Danbury, CT 06810 ... 203-748-5248
GC International Inc., Plano, TX 75074 ... 214-423-8411
Grand Transformer, Inc., Grand Haven, MI 49417 ... 616-842-5430
§† Jaico Products, Jaidinger Mfg. Co., Inc., Chicago, IL 60622 ... 312-421-1090
JB Electronic Transformers Inc., Chicago, IL 60647 ... 312-342-0080
† Kappa Technologies, Inc., Rahway, NJ 07065 ... 908-396-9400;1-800-223-0603
LDJ Electronics, Troy, MI 48099-0219 ... 313-528-2202
Line Electric Products, Glastonbury, CT 06033 ... 203-659-3573;1-800-331-1137
† Lisk, G. W., Co., Clifton Springs, NY 14432 ... 315-462-2611
† Magnetico Inc., Holtsville, NY 11742 ... 516-654-1166
Magnet Schultz of America, Westmont, IL 60559 ... 708-789-0600
§ Namco Controls Corporation, Mentor, OH 44060 ... 216-946-9900
† Newport Manufacturing Co., Santa Ana, CA 92704 ... 800-726-0715
Northern Magnetics Inc., Van Nuys, CA 91406 ... 818-997-8675
† Northlake Engineering, Inc., Bristol, WI 53104-0370 ... 414-857-9600
OPT Industries, Inc., Phillipsburg, NJ 08865 ... 908-454-2600
† PCA Electronics, Sepulveda, CA 91343 ... 818-892-0761
† Permaluster, Inc., Burbank, CA 91504 ... 213-849-4543;213-849-6454
† Piconics, Incorporated, Tyngsboro, MA 01879 ... 508-649-7501
Renco Electronics, Inc., Deer Pk., NY 11729 ... 516-586-5566;1-800-645-5828
Ross Engineering Corp., Campbell, CA 95008 ... 408-377-4621
Schott Corp., Wayzata, MN 55391 ... 612-475-1173
† SR Engineering, BW/IP International, Inc., Garden Grove, CA 92643 ... 714-554-4200
† Stangenes Industries, Inc., Palo Alto, CA 94303 ... 415-493-0814
† Trans American Transformer, E. Setauket, NY 11733 ... 516-928-0762
† Trinetics Inc., Mishawaka, IN 46545-4899 ... 219-259-8535
†# United States Electronics, Springfield, NJ 07081 ... 201-912-0111
§ Vitec Electronics Corp., Visalia, CA 93291 ... 209-651-1535
Wabash Magnetics, Control Prods. Grp., Wabash, IN 46992 ... 219-563-2191
The Winatic Corp., Electro-Technik Industries, Inc., Vestal, NY 13850 ... 607-729-6318
† ZMAN Magnetics, Kent, WA 98032 ... 206-251-8064

Coils, Switching, Power-1800

Albar, Inc., Lynnwood, WA 98036, 206-771-4006;800-822-5227 ... A•1181
Amecon, Inc., Anaheim, CA 92805, 714-634-2220;800-392-2292 ... A•1185
BH Electronics, Inc., Burnsville, MN 55337, 612-894-9590 ... A•1196
Caddell-Burns Mfg., Mineola, NY 11501-3508, 516-746-2310 ... A•1198-1210
Caddell Coil Corp., Middletown Springs, VT 05757, 802-235-2019 ... A•1213
Cramer Coil & Transformer Co., Inc., Saukville, WI 53080, 414-268-2150;414-375-5700 ... A•2306
Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180, 605-665-9301 ... A•1232
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012, 605-296-3462 ... A•2318
Electromech, Inc., Irvington, NJ 07111, 201-318-7999 ... A•2324
§ Fee Fil-Mag, San Diego, CA 92123, 619-569-6577 ... A•2350-2351, D•2109
§ Gowanda Electronics Corp., Gowanda, NY 14070, 716-532-2234 ... A•1239
† Magnecomp, Inc., Pickens, SC 29671, 803-878-4700 ... A•2377
§† Microtran Co. Inc., Valley Stream, NY 11582-0236, 516-561-6050 ... A•2411
MultiComp., Inc., Beaverton, OR 97006, 503-626-4200 ... A•1255
† Standex Electronics, Standex International, Cincinnati, OH 45209, 513-871-3777 ... A•1290,1292
TMP Inc., Santa Ana, CA 92705, 714-558-8028 ... A•1300
† Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314 ... A•1301,1305,1307,2594
Vernitron Corp., Precision Comps. Group, St. Petersburg, FL 33710, 813-347-2181 ... A•1308
† ZMAN Magnetics, Kent, WA 98032, 206-251-8064 ... A•1315
Aleph International Corp., San Fernando, CA 91340 ... 818-365-9856;800-423-5622
American Magnetics, Carterville, IL 62918 ... 618-985-4838
† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635 ... 714-447-2300
Bell Inds., J. W. Miller Div., Gardena, CA 90247-1059 ... 310-515-1720
† Cal-Power Corp., Standard Magnetic Corp., Garden Grove, CA 92641 ... 714-379-5672
†# Cletronics Inc., Medina, OH 44256-9623 ... 216-722-3030
† Communication Coil Inc., Chicago, IL 60634 ... 312-637-1333
† Corona Magnetics, Inc., Corona, CA 91719 ... 909-735-7558
Custom Coils Inc., Alcester, SD 57001-0348 ... 605-934-2460
Datatronics, Inc., Romoland, CA 92585 ... 909-928-7700
Electronic Coil Corp., Bloomfield, CT 06002 ... 203-243-5233
† ESC Electronics Corp., Palisades Pk, NJ 07650 ... 201-947-0400
† Fernwood Transformer Co., Transistor Devices Inc., Belvidere, NJ 07823 ... 908-475-3207
Gavagan Electronics, Danbury, CT 06810 ... 203-748-5248
§ GC International Inc., Plano, TX 75074 ... 214-423-8411
Grand Transformer, Inc., Grand Haven, MI 49417 ... 616-842-5430
§ Hurricane Electronics Lab, Hurricane, UT 84737 ... 801-635-2003
Integrity Technology Corporation, Santa Clara, CA 95050 ... 408-262-8640
† Magnetico Inc., Holtsville, NY 11742 ... 516-654-1166
Mech-Tronics, Mount Holly, NJ 08060 ... 609-267-0680
† Newport Manufacturing Co., Santa Ana, CA 92704 ... 800-726-0715
† OPT Industries, Inc., Phillipsburg, NJ 08865 ... 908-454-2600
Pacific Transformer Corp., Anaheim, CA 92807 ... 714-779-0450;1-800-325-0501
† Premier Magnetics Inc., Aliso Viejo, CA 92656 ... 714-362-4211
Pulse Engineering, Inc., San Diego, CA 92128 ... 619-674-8100
Radio Television Products Corp., Douglas, AZ 85607 ... 602-364-4438
Ritter Coil, Inc., Easton, PA 18043-3130 ... 215-258-6780
Schott Corp., Wayzata, MN 55391 ... 612-475-1173
Skyway Magnetics, Warner Springs, CA 92086-9714 ... 619-782-3342
Standard Magnetic Corp., Garden Grove, CA 92641 ... 714-379-5671
Texas Transformer Corp., Plano, TX 75086 ... 214-424-1581
† Torelco, Inc., Irvington, NJ 07111 ... 201-374-8641;800-867-3526
† Trans American Transformer, E. Setauket, NY 11733 ... 516-928-0762
U.S. Transformer and Inductor, Cheyenne, WY 82007 ... 800-584-9339
§† Vitec Electronics Corp., Visalia, CA 93291 ... 209-651-1535
Wilco Corp., Indianapolis, IN 46268 ... 317-293-9300
† Wirebenders, Inc., Phoenix, AZ 85021-2824 ... 602-861-1856

Coils, Telephone-1800

APX Technologies Inc., Hicksville, NY 11801, 516-433-1313 ... A•2267
BH Electronics, Inc., Burnsville, MN 55337, 612-894-9590 ... A•1197
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012, 605-296-3462 ... A•2319
Kappa Technologies, Inc., Rahway, NJ 07065, 908-396-9400;1-800-223-0603 ... A•2371
Magnetek Triad, Huntington, IN 46750, 219-356-7100 ... A•2387
§† Microtran Co. Inc., Valley Stream, NY 11582-0236, 516-561-6050 ... A•1254,2415
Para-Line Transformer Co., Inc., Alhambra, CA 91803, 818-281-0222 ... A•2444
† Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ... A•1263
Prem Magnetics, Inc., McHenry, IL 60050, 815-385-2700 .. A•2516,2519,2522,2525
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ... A•1282
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ... A•2118
TMP Inc., Santa Ana, CA 92705, 714-558-8028 ... A•1300
† Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314 ... A•1307
American Magnetics, Carterville, IL 62918 ... 618-985-4838
† A.P.W. Co., Inc., Rockaway, NJ 07866 ... 201-627-0643
Cardinal Control Co., Kensington, CT 06037 ... 203-828-6379
Coil-Q Corp., Bronxville, NY 10708 ... 914-337-4775
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 ... 605-665-9301
† De Young Mfg., Inc., Kirkland, WA 98034 ... 206-823-4798
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Electronic Coil Corp., Bloomfield, CT 06002 ... 203-243-5233
† Electronic Transformer Corp., Paterson, NJ 07544-0487 ... 201-942-2222
† ESC Electronics Corp., Palisades Pk, NJ 07650 ... 201-947-0400
† Freed Transformer Co., Inc., Electronic Transformer Corp., Paterson, NJ 07544-0487 ... 201-942-2222
§ GC International Inc., Plano, TX 75074 ... 214-423-8411
§ GTE Supply, GTE, Irving, TX 75038 ... 800-433-4837
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§† JB Electronic Transformers Inc., Chicago, IL 60647 ... 312-342-0080
LEPCO/Leonard Elec. Prods., Brownsville, TX 78521 ... 210-546-1625
† Magnetico Inc., Holtsville, NY 11742 ... 516-654-1166
† Newport Manufacturing Co., Santa Ana, CA 92704 ... 800-726-0715
† OPT Industries, Inc., Phillipsburg, NJ 08865 ... 908-454-2600
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861 ... 908-826-4700
† Precision Components, Inc., Wilmington, IL 60481 ... 708-543-6448
Renco Electronics, Inc., Deer Pk., NY 11729 ... 516-586-5566;1-800-645-5828
† Sigma Electronics Inc., Houston, TX 77099 ... 713-933-4700;800-874-7121
South American Development Corp., Poughkeepsie, NY 12590 ... 914-452-1305
§ Tamura Corporation of America, Temecula, CA 92589-2230 ... 909-699-1270
Texas Transformer Corp., Plano, TX 75086 ... 214-424-1581
§ Toko America, Inc., Mt. Prospect, IL 60056 ... 708-297-0070
† Torwico Elctrns. Inc., Lakewood, NJ 08701 ... 908-364-1800
† Trans American Transformer, E. Setauket, NY 11733 ... 516-928-0762
§ Vitec Electronics Corp., Visalia, CA 93291 ... 209-651-1535

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TMP Inc., Santa Ana, CA 92705, 714-558-8028 ..... A•1300
† Torelco, Inc., Irvington, NJ 07111, 201-374-8641;800-867-3526 ..... A•2581
† Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314 ..... A•1301,1306-1307,2594
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† ZMAN Magnetics, Kent, WA 98032, 206-251-8064 ..... A•1315
§ Allen Co., Inc., Robert G., N. Hollywood, CA 91605 ..... 818-765-8300;800-827-7422
American Magnetics, Carterville, IL 62918 618-985-4838
† American Trans-Coil Corporation, Richmond Hill, NY 11419-1410 718-441-5207
Andover, Inc., Lafayette, IN 47904 317-447-1157
ATC-Frost Magnetics Inc., Oakville,Ont., CANADA L6H 2R4 416-844-6681
§ Atlantic Magnetics, Inc., Pompano Beach, FL 33069 305-979-7920
† Atlas Engineering Corp., Dorchester, MA 02121 617-445-7100
† Automatic Coil Corp., Miami, FL 33147 305-696-6660
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635 714-447-2300
Bey Electric, Inc., Lincoln Park, NJ 07035 201-694-5000
† BG Electronics, EPC Corp., Mt. Vernon, NY 10550-4430 914-664-5591
§† Capcon, Inc., New York, NY 10001 212-243-6275
Cardinal Control Co., Kensington, CT 06037 203-828-6379
Caritronics Inc., West Caldwell, NJ 07007 201-575-8916
Chloride Electro Networks, Chloride Power Electronics, Inc., Caledonia, NY 14423 716-538-4421
†# Cletronics Inc., Medina, OH 44256-9623 216-722-3030
Coil-Q Corp., Bronxville, NY 10708 914-337-4775
† Communication Coil Inc., Chicago, IL 60634 312-637-1333
† Corona Magnetics, Inc., Corona, CA 91719 909-735-7558
Cross Electronics, Warrendale, PA 15086 412-776-1591
D & L Electronics, Langhorne, PA 19047 800-942-3631
Datatronics, Inc., Romoland, CA 92585 909-928-7700
§ De Coursey Engineering Laboratory, Culver City, CA 90230 1-310-397-9668
§† Delevan Div., American Precision Inds. Inc., E. Aurora, NY 14052-0449 .. 716-652-3600
† Delta Products Corporation, Fremont, CA 94538 510-770-0660
† De Young Mfg., Inc., Kirkland, WA 98034 206-823-4798
† Dietz Design, Inc., Belton, MO 64012 816-331-4911
Ecliptek Corporation, Costa Mesa, CA 92626 714-433-1200
EG&G Electro-Optics, EG&G Optoelectronics, EG&G Inc., Salem, MA 01970 ..... 508-745-3200;1-800-950-3441
Eichhoff Electronics, Warwick, RI 02886 ..... 401-738-1440;800-678-1040
Electro Assemblies Corp., Northbrook, IL 60062-2319 708-498-6520
† Electrocom Industries, S. Bend, IN 46615 219-232-2743
§† Electromech, Inc., Irvington, NJ 07111 201-318-7999
Electronic Coil Corp., Bloomfield, CT 06002 203-243-5233
† Electronic Transformer Corp., Paterson, NJ 07544-0487 201-942-2222
E.M.S., Div. of Sandberg Industries, Tustin, CA 92680 714-669-9473
Endicott Coil Co., Inc., Binghamton, NY 13905 607-797-1263
† Engineered Components Co., San Luis Obispo, CA 93403-8121 805-544-3800
† ESC Electronics Corp., Palisades Pk, NJ 07650 201-947-0400
§ Fee Fil-Mag, San Diego, CA 92123 619-569-6577
† Fernwood Transformer Co., Transistor Devices Inc., Belvidere, NJ 07823 908-475-3207
† Freed Transformer Co., Inc., Electronic Transformer Corp., Paterson, NJ 07544-0487 201-942-2222
Fumas Elec., Batavia, IL 60510 708-879-6000
Gavagan Electronics, Danbury, CT 06810 203-748-5248
§ GC International Inc., Plano, TX 75074 214-423-8411
Grand Transformer, Inc., Grand Haven, MI 49417 616-842-5430
§ Hurricane Electronics Lab, Hurricane, UT 84737 801-635-2003
Integrity Technology Corporation, Santa Clara, CA 95050 408-262-8640
ISL Products Int'l, Ltd., Syosset, NY 11791-6093 ..... 516-937-3475;800-626-6116
† JB Electronic Transformers Inc., Chicago, IL 60647 312-342-0080
JEMA, Wilmette, IL 60091 708-251-3600
§† Jovil Manufacturing Co., Inc., Danbury, CT 06810 203-792-6700
† Kappa Technologies, Inc., Rahway, NJ 07065 ..... 908-396-9400;1-800-223-0603
KGS Electronics, Inc., Arcadia, CA 91006 818-574-1175
† L/C Magnetics, Anaheim, CA 92806 714-666-0787
LEPCO/Leonard Elec. Prods., Brownsville, TX 78521 210-546-1625
† Magnecomp, Inc., Pickens, SC 29671 803-878-4700
† Magnetic Circuit Elements, Salinas, CA 93905 408-757-8752
† Magnetico Inc., Holtsville, NY 11742 516-654-1166
Mech-Tronics, Mount Holly, NJ 08060 609-267-0680
† Neshaminy Transformer Corp., Furlong, PA 18925 215-794-7411
† Newport Manufacturing Co., Santa Ana, CA 92704 800-726-0715
† North Hills Signal Processing, Syosset, NY 11791 516-682-7740
Oeco Corp., Milwaukie, OR 97222 503-659-7932
† Ohmite Manufacturing Co., Skokie, IL 60076 708-675-2600
§† OPT Industries, Inc., Phillipsburg, NJ 08865 908-454-2600
Pacific Transformer Corp., Anaheim, CA 92807 ..... 714-779-0450;1-800-325-0501
† Piconics, Incorporated, Tyngsboro, MA 01879 508-649-7501
† Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861 908-826-4700
† Precision Components, Inc., Wilmington, IL 60481 708-543-6448
† Premier Magnetics Inc., Aliso Viejo, CA 92656 714-362-4211
Pulse Engineering, Inc., San Diego, CA 92128 619-674-8100
Radio Television Products Corp., Douglas, AZ 85607 602-364-4438
RF Electronics, Inc., Irvine, CA 92714-5517 714-263-0661
† RFI Corporation, Bay Shore, NY 11706 516-231-6400
Ritter Coil, Inc., Easton, PA 18043-3130 215-258-6780
Rtron Corp., Skokie, IL 60076 708-679-7180
SAE Power, Inc., Santa Clara, CA 95050 408-988-0700
† Schott Corp., Wayzata, MN 55391 612-475-1173
† Scientific Technologies Inc., Control Components Div., Hayward, CA 94544-7831 ..... 510-471-9717;800-221-7060
Shogyo International Corp., Great Neck, NY 11021-4799 516-466-0911
† Siemens-B C L Magnetics, Siemens Automotive Ltd., Burlington, Ont., CANADA L7L 5H6 416-335-2530
† Sigma Electronics Inc., Houston, TX 77099 ..... 713-933-4700;800-874-7121
† Sigmapower, Inc, FPBSM Industries, Inc., Rancho Dominguez, CA 90220-6404 310-884-5200
§† Skyway Magnetics, Warner Springs, CA 92086-9714 619-782-3342
South American Development Corp., Poughkeepsie, NY 12590 914-452-1305
Standard Condenser Corp., Skokie, IL 60076 708-675-3133
Standard Magnetic Corp., Garden Grove, CA 92641 714-379-5671
Texas Transformer Corp., Plano, TX 75086 214-424-1581
3L Global Electronics, 3L Coils, St. Petersburg, FL 33710 813-343-2679
§ Tokin America, Inc., San Jose, CA 95134 408-432-8020
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
Toltec Industries, Inc., San Diego, CA 92154 619-423-0700
Torad Coil Co., Inc., Wayne, NJ 07470 201-835-6195
Torema U.S.A., Inc., Houston, TX 77042 713-977-2500
† Toroid Corp. of Maryland, Salisbury, MD 21801 410-860-0300
† Torotron Corp., Mt. Vernon, NY 10550 914-664-2050
Tortran Inc., Bridgeport, CT 06608 203-367-5188
† Torwico Elctrns. Inc., Lakewood, NJ 08701 908-364-1800
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
†# United States Electronics, Springfield, NJ 07081 201-912-0111
United Technical Products, Fallsington, PA 19054 800-553-5300
U.S. Transformer and Inductor, Cheyenne, WY 82007 800-584-9339
§ Valor Electronics, San Diego, CA 92131-1642 619-537-2500
§† Vanguard Electronics Co., Gardena, CA 90248 310-323-4100
§† Vitec Electronics Corp., Visalia, CA 93291 209-651-1535
† Wirebenders, Inc., Phoenix, AZ 85021-2824 602-861-1856
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† American Aerospace Controls, Farmingdale, NY 11735 516-694-5100
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† Electronic Transformer Corp., Paterson, NJ 07544-0487 201-942-2222
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† Freed Transformer Co., Inc., Electronic Transformer Corp., Paterson, NJ 07544-0487 201-942-2222
Frontier Electronics, Simi Valley, CA 93065 805-522-9998

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Sensor Corp., Scottdale, PA 15683 412-887-4080
† Sigma Electronics Inc., Houston, TX 77099 ..... 713-933-4700;800-874-7121
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Techno Scientific Inc., Woodbridge, Ont., CANADA L4L 5Y9 905-851-9958
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† Vanguard Electronics Co., Gardena, CA 90248 310-323-4100
† Wirebenders, Inc., Phoenix, AZ 85021-2824 602-861-1856
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† **PCA Electronics, Sepulveda, CA 91343, 818-892-0761** ..... **D•1856**
† **Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064** ..... **A•1263**
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Standex Electronics, Standex International, Cincinnati, OH 45209, 513-871-3777 ..... **A•1290-1292**
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† **Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314** ..... **A•1307**
§ **Valor Electronics, San Diego, CA 92131-1642, 619-537-2500** ..... **A•2603**
Abacus Controls Inc., Somerville, NJ 08876 908-526-6010
§ Acme Transformer, Acme Electric Corporation, Lumberton, NC 28358 ... 919-738-1121
Albar, Inc., Lynnwood, WA 98036 ..... 206-771-4006;800-822-5227
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American Magnetics, Carterville, IL 62918 618-985-4838
† American Monarch, Minneapolis, MN 55421 612-788-9161
† American Trans-Coil Corporation, Richmond Hill, NY 11419-1410 718-441-5207
Andover, Inc., Lafayette, IN 47904 317-447-1157
† A.P.W. Co., Inc., Rockaway, NJ 07866 201-627-0643
ATC-Frost Magnetics Inc., Oakville,Ont., CANADA L6H 2R4 416-844-6681
§ Atlantic Magnetics, Inc., Pompano Beach, FL 33069 305-979-7920
† Atlas Engineering Corp., Dorchester, MA 02121 617-445-7100
† Automatic Coil Corp., Miami, FL 33147 305-696-6660
† Avionic Instruments, REA International Inc., Avenel, NJ 07001 908-388-3500
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† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635 714-447-2300
§ Bell Inds., J. W. Miller Div., Gardena, CA 90247-1059 310-515-1720
Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
Bey Electric, Inc., Lincoln Park, NJ 07035 201-694-5000
Capewell Components, Cromwell, CT 06416 203-635-4045
Cardinal Control Co., Kensington, CT 06037 203-828-6379
Chloride Electro Networks, Chloride Power Electronics, Inc., Caledonia, NY 14423 716-538-4421
†# Cletronics Inc., Medina, OH 44256-9623 216-722-3030
† Coast Magnetics, Adams-Maxwell Division, Inglewood, CA 90302-1284 310-673-3245
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† Component Specialties Corp., Temple City, CA 91780 213-283-0015
§ Computer Power Inc., High Bridge, NJ 08829 ..... 908-638-8000;800-526-5088
† Corona Magnetics, Inc., Corona, CA 91719 909-735-7558
Custom Bobbin Windings, A & K Corporation, Zanesville, OH 43702-2369 614-452-6973
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 605-665-9301
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† Del Electronics Corp., Valhalla, NY 10595 914-686-3600
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Deltona Transformer Corp., DeLand, FL 32724 904-736-7900
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† Dietz Design, Inc., Belton, MO 64012 816-331-4911
EG&G Electro-Optics, EG&G Optoelectronics, EG&G Inc., Salem, MA 01970 ..... 508-745-3200;1-800-950-3441
Eichhoff Electronics, Warwick, RI 02886 ..... 401-738-1440;800-678-1040
Electro Assemblies Corp., Northbrook, IL 60062-2319 708-498-6520
Electrocom Industries, S. Bend, IN 46615 219-232-2743
Electronetics, Inc., Everett, WA 98204 206-355-1855
Electronic Coil Corp., Bloomfield, CT 06002 203-243-5233
† Electronic Transformer Corp., Paterson, NJ 07544-0487 201-942-2222
Elma Engineering, Palo Alto, CA 94303 415-494-7303
Endicott Coil Co., Inc., Binghamton, NY 13905 607-797-1263
Engineering Design & Sls., Danville, VA 24541 804-792-6405
† ESC Electronics Corp., Palisades Pk, NJ 07650 201-947-0400
† Fernwood Transformer Co., Transistor Devices Inc., Belvidere, NJ 07823 908-475-3207
† Freed Transformer Co., Inc., Electronic Transformer Corp., Paterson, NJ 07544-0487 201-942-2222
Gavagan Electronics, Danbury, CT 06810 203-748-5248
§ GC International Inc., Plano, TX 75074 214-423-8411
Gettysburg Transformer Corporation, Gettysburg, PA 17325 717-334-2191
§ Hanovia, Canrad, Newark, NJ 07105 201-589-4300
Hitran Corporation, Flemington, NJ 08822-1238 908-782-5525
§ Hurricane Electronics Lab, Hurricane, UT 84737 801-635-2003
Integrity Technology Corporation, Santa Clara, CA 95050 408-262-8640
§† JB Electronic Transformers Inc., Chicago, IL 60647 312-342-0080
§ Katronic Elektronic Ges.m.b.H., AUSTRIA 04762-5340
Keytronics, Inc., Endicott, NY 13760 607-754-5405
KGS Electronics, Inc., Arcadia, CA 91006 818-574-1175
† L/C Magnetics, Anaheim, CA 92806 714-666-0787
LEPCO/Leonard Elec. Prods., Brownsville, TX 78521 210-546-1625
Mag-Con, St. Paul, MN 55113 612-633-8820
Magna-Power Electronics, Inc., Whippany, NJ 07981 201-428-1197
† Magnecomp, Inc., Pickens, SC 29671 803-878-4700
† Magnetico Inc., Holtsville, NY 11742 516-654-1166
MCI Transformer Corporation, Babylon, NY 11704 516-587-0510
Mech-Tronics, Mount Holly, NJ 08060 609-267-0680
§† MMG-North America, Paterson, NJ 07509 201-345-8900
Multi Products International, West Paterson, NJ 07424 201-890-1344
† Neshaminy Transformer Corp., Furlong, PA 18925 215-794-7411
† Newport Manufacturing Co., Santa Ana, CA 92704 800-726-0715
† Northlake Engineering, Inc., Bristol, WI 53104-0370 414-857-9600
† NWL Transformers, Bordentown, NJ 08505 609-298-7300
Oeco Corp., Milwaukie, OR 97222 503-659-7932
§ OPT Industries, Inc., Phillipsburg, NJ 08865 908-454-2600
† Oram High Voltage, Dayton, TX 77535 409-258-5553
Pacific Transformer Corp., Anaheim, CA 92807 ..... 714-779-0450;1-800-325-0501
† Permaluster, Inc., Burbank, CA 91504 ..... 213-849-4543;213-849-6454
Phenix Technologies, Accident, MD 21520 301-746-8118
† Piconics, Incorporated, Tyngsboro, MA 01879 508-649-7501
Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861 908-826-4700
† Precision Components, Inc., Wilmington, IL 60481 708-543-6448
† PTC Transformers, Bordentown, NJ 08505 609-298-8200
Pulse Engineering, Inc., San Diego, CA 92128 619-674-8100
Radio Television Products Corp., Douglas, AZ 85607 602-364-4438
RAE Company Inc., Indianapolis, IN 46239 317-351-1774
RF Electronics, Inc., Irvine, CA 92714-5517 714-263-0661
Rodale Technical Sales Inc., Islip, NY 11751 516-277-5454
SAE Power, Inc., Santa Clara, CA 95050 408-988-0700
Schott Corp., Wayzata, MN 55391 612-475-1173
† Scientific Technologies Inc., Control Components Div., Hayward, CA 94544-7831 ..... 510-471-9717;800-221-7060
† Shogyo International Corp., Great Neck, NY 11021-4799 516-466-0911
† Sigma Electronics Inc., Houston, TX 77099 ..... 713-933-4700;800-874-7121
† Sigmapower, Inc, FPBSM Industries, Inc., Rancho Dominguez, CA 90220-6404 310-884-5200
§† Skyway Magnetics, Warner Springs, CA 92086-9714 619-782-3342
South American Development Corp., Poughkeepsie, NY 12590 914-452-1305
Standard Magnetic Corp., Garden Grove, CA 92641 714-379-5671
Texas Transformer Corp., Plano, TX 75086 214-424-1581
§† Thordarson Meissner, Components Corp. of Amer., Mt. Carmel, IL 62863 618-262-5121
§ Tokin America, Inc., San Jose, CA 95134 408-432-8020
§ Toko America, Inc., Mt. Prospect,, IL 60056 708-297-0070
Toltec Industries, Inc., San Diego, CA 92154 619-423-0700
Torad Coil Co., Inc., Wayne, NJ 07470 201-835-6195
† Torelco, Inc., Irvington, NJ 07111 ..... 201-374-8641;800-867-3526
† Torotron Corp., Mt. Vernon, NY 10550 914-664-2050
† Torwico Elctrns. Inc., Lakewood, NJ 08701 908-364-1800

† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
TTE, Incorporated, W. Los Angeles, CA 90064-1400 ..... 310-478-8224;800-776-7614
†# United States Electronics, Springfield, NJ 07081 201-912-0111
United Technical Products, Fallsington, PA 19054 800-553-5300
U.S. Transformer and Inductor, Cheyenne, WY 82007 800-584-9339
† Vanguard Electronics Co., Gardena, CA 90248 310-323-4100
§ Vitec Electronics Corp., Visalia, CA 93291 209-651-1535
Wilco Corp., Indianapolis, IN 46268 317-293-9300
The Winatic Corp., Electro-Technik Industries, Inc., Vestal, NY 13850 607-729-6318
Wontronics, Los Angeles, CA 90039 213-660-6230
WPI Group, Inc., Warner, NH 03278 603-456-3111
Xylog Corp., Hackensack, NJ 07601 201-489-4040
† ZMAN Magnetics, Kent, WA 98032 206-251-8064

Coils, TV (All Types)-1800

§ Bell Inds., J. W. Miller Div., Gardena, CA 90247-1059, 310-515-1720 ..... A•1195
Caddell-Burns Mfg., Mineola, NY 11501-3508, 516-746-2310 ..... A•1198
Penn-Tran Corp.,Sub. of Spectrum Elctrns. Inc., Wingate, PA 16880, 814-355-1521 ..... A•1260-1261, D•1857
Prem Magnetics, Inc., McHenry, IL 60050, 815-385-2700 ..... A•2525
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•1282
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ..... A•2118
TMP Inc., Santa Ana, CA 92705, 714-558-8028 ..... A•1300
Abracon Corporation, San Clemente, CA 92673 714-498-4505
Automatic Coil Corp., Miami, FL 33147 305-696-6660
† CELCO, Mahwah, NJ 07430 201-327-1123
† Corona Magnetics, Inc., Corona, CA 91719 909-735-7558
† Cramer Coil & Transformer Co., Inc., Saukville, WI 53080 .. 414-268-2150;414-375-5700
Custom Coils Inc., Alcester, SD 57001-0348 605-934-2460
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 605-665-9301
† Delta Products Corporation, Fremont, CA 94538 510-770-0660
§ Frontier Electronics, Simi Valley, CA 93065 805-522-9998
§ GC International Inc., Plano, TX 75074 214-423-8411
† Magnetic Component Engineering, Inc., Inglewood, CA 90301 310-677-6600
† Newport Manufacturing Co., Santa Ana, CA 92704 800-726-0715
Radio Television Products Corp., Douglas, AZ 85607 602-364-4438
Renco Electronics, Inc., Deer Pk., NY 11729 ..... 516-586-5566;1-800-645-5828
South American Development Corp., Poughkeepsie, NY 12590 914-452-1305
Standex Electronics, Standex International, Cincinnati, OH 45209 513-871-3777
3L Global Electronics, 3L Coils, St. Petersburg, FL 33710 813-343-2679
§ Toko America, Inc., Mt. Prospect,, IL 60056 708-297-0070
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762

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Abracon Corporation, San Clemente, CA 92673, 714-498-4505 ..... A•1180
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† Caddell Coil Corp., Middletown Springs, VT 05757, 802-235-2019 ..... A•1213
Coilcraft, Cary, IL 60013, 708-639-2361 ..... A•1215-1218,1220-1221
† Coil-Q Corp., Bronxville, NY 10708, 914-337-4775 ..... A•1222
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Ecliptek Corporation, Costa Mesa, CA 92626, 714-433-1200 ..... A•1258
§† Gowanda Electronics Corp., Gowanda, NY 14070, 716-532-2234 ... A•1239,1241
† Hisonic, Inc., Olathe, KS 66051, 913-782-0012 ..... A•2360
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Prem Magnetics, Inc., McHenry, IL 60050, 815-385-2700 ..... A•1277-1281,2525
§ RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•1282
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Vernitron Corp., Precision Comps. Group, St. Petersburg, FL 33710, 813-347-2181 ..... A•1308
† ZMAN Magnetics, Kent, WA 98032, 206-251-8064 ..... A•1315
§† American Precision Ind.,Delevan/SMD Divisions, E. Aurora, NY 14052 .. 716-652-3600
† American Trans-Coil Corporation, Richmond Hill, NY 11419-1410 718-441-5207
† Automatic Coil Corp., Miami, FL 33147 305-696-6660
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
† Communication Coil Inc., Chicago, IL 60634 312-637-1333
† Component Specialties Corp., Temple City, CA 91780 213-283-0015
† Corona Magnetics, Inc., Corona, CA 91719 909-735-7558
† Cramer Coil & Transformer Co., Inc., Saukville, WI 53080 .. 414-268-2150;414-375-5700
Custom Coils Inc., Alcester, SD 57001-0348 605-934-2460
§† Delevan Div., American Precision Inds. Inc., E. Aurora, NY 14052-0449 .. 716-652-3600
† Delta Products Corporation, Fremont, CA 94538 510-770-0660
Electro Assemblies Corp., Northbrook, IL 60062-2319 708-498-6520
Electrocom Industries, S. Bend, IN 46615 219-232-2743
§ Frontier Electronics, Simi Valley, CA 93065 805-522-9998
§ GC International Inc., Plano, TX 75074 214-423-8411
Integrity Technology Corporation, Santa Clara, CA 95050 408-262-8640
Lenco Elctrns., Inc., McHenry, IL 60050 815-344-2900
† Newport Manufacturing Co., Santa Ana, CA 92704 800-726-0715
North Hills Signal Processing, Syosset, NY 11791 516-682-7740
§† Nytron Inductors, Inc.(VSD, Inc.), Offered by: Dale Electronics, Inc., Yankton, SD 57078-0180 605-665-9301
† Permaluster, Inc., Burbank, CA 91504 ..... 213-849-4543;213-849-6454
† Piconics, Incorporated, Tyngsboro, MA 01879 508-649-7501
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861 908-826-4700
Radio Television Products Corp., Douglas, AZ 85607 602-364-4438
Renco Electronics, Inc., Deer Pk., NY 11729 ..... 516-586-5566;1-800-645-5828
Ritter Coil, Inc., Easton, PA 18043-3130 215-258-6780
South American Development Corp., Poughkeepsie, NY 12590 914-452-1305
3L Global Electronics, 3L Coils, St. Petersburg, FL 33710 813-343-2679
§ Toko America, Inc., Mt. Prospect,, IL 60056 708-297-0070
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
† Vanguard Electronics Co., Gardena, CA 90248 310-323-4100
Wilco Corp., Indianapolis, IN 46268 317-293-9300
† Wirebenders, Inc., Phoenix, AZ 85021-2824 602-861-1856

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§ Advanced Video Products, E-Systems, Westford, MA 01886 508-692-2020
AEL Defense Corp., Lansdale, PA 19446 215-822-2929
† Alpha Industries, Inc., Woburn, MA 01801 617-935-5150
† Aydin Corp., Horsham, PA 19044 215-657-7510
† Cardion, Inc., A Siemens Company, Woodbury, NY 11797-2925 516-921-7300
§ Comdata Corp., Morton Grove, IL 60053 708-470-9600
† Continental Microwave Technology Inc., Glen Cove, NY 11542 516-759-5600
Datum Timing, Datum Inc., Anaheim, CA 92806-5790 714-533-6333
† Digital Radio Corp., Redondo Beach, CA 90277 213-316-4114
Dowty Avionics, Arcadia, CA 91006 818-445-5955
Epsilon-Lambda Elctrns. Corp., Geneva, IL 60134 708-232-9611
† FEI Microwave, Inc., Frequency Electronics, Inc., Sunnyvale, CA 94086 .. 408-732-0880
Φ Genstar Rentals, Inc., Calabasas, CA 91302 800-422-3300
HDS Inc., Reston, VA 22091 703-620-6200
† LNR Communications, Inc., Hauppauge, NY 11788 516-273-7111
Loral TerraCom, Sub. of Loral Corp., San Diego, CA 92123-1595 619-278-4100
† Lucas Zeta, Lucas Aerospace, Inc., San Jose, CA 95134 408-434-3600
† M/A COM Ltd., Bedfordshire, ENGLAND LU5 4SX, England ..... 44(582)471200
† MCL, Inc., Bolingbrook, IL 60440-4999 708-759-9500
† Microwave Technology Div., JHP Industrial, Syracuse, NY 13202-3442 315-422-0050
† MITEQ Inc., Hauppauge, NY 11788 516-436-7400
Modular Mining Systems, Inc., Tuscon, AZ 85706 602-746-9127
† RHG Electronics Laboratory, Inc., Deer Park, NY 11729 516-242-1100
†# Solid State Electronics Corp., Northridge, CA 91324 818-993-8257
Varian Microwave Equipment Products, Varian Assocs., Inc., Santa Clara, CA 95054 408-496-6273
Western Multiplex Corp., Belmont, CA 94002 415-592-8832

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Wide Band Engineering Co., Inc., Phoenix, AZ 85036 602-254-1570

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Converters, Synchro to Sine/Cosine-2325 — *See Vol. D*

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Cores, Ceramic-1850

A-L-L Magnetics Inc./The Magnet Source, Placentia, CA 92670, 800-262-4638;800-525-3536 ..... **A•1319**
† Magnetics, Spang & Co., Butler, PA 16003-0391, 412-282-8282 ..... **A•1322**
§ Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ..... **A•1256**
§ Ceramic Magnetics, Inc., Fairfield, NJ 07004 201-227-4222
Kyocera Industrial Ceramics Corp., San Diego, CA 92123 619-576-2688
Quartzite Processing, Inc., Malden, MA 02148 617-322-3611

Cores, Magnetic, Ferrite, L, E, etc.-1850

A-L-L Magnetics Inc./The Magnet Source, Placentia, CA 92670, 800-262-4638;800-525-3536 ..... **A•1319**
Coilcraft, Cary, IL 60013, 708-639-2361 ..... **A•1219**
Frontier Electronics, Simi Valley, CA 93065, 805-522-9998 ..... **A•1236**
Lodestone Pacific, Anaheim, CA 92807, 714-630-1343 ..... **A•1244,1247**
§† Magnetics, Spang & Co., Butler, PA 16003-0391, 412-282-8282 ..... **A•1322**
Advanced Components Inds., Inc., Div of Kaschke, Torrance, CA 90501 310-328-0060
Ampex Corp., Redwood City, CA 94063-3199 415-367-2011
Apollo Magnetics Corp., Los Angeles, CA 90057 213-381-2500
§ Ceramic Magnetics, Inc., Fairfield, NJ 07004 201-227-4222
§ Chomerics, Inc.:W.R. Grace & Co., Woburn, MA 01888 617-935-4850
Cosmo Corporation, Cleveland, OH 44109 216-861-5594
Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 605-665-9301
D & L Electronics, Langhorne, PA 19047 800-942-3631
§ Elna Ferrite Laboratories, Inc., Woodstock, NY 12498 800-553-2870
Elna Ferrite Laboratories, Inc., Woodstock, NY 12498 800-553-2870
§ Fair-Rite Prods., Wallkill, NY 12589 914-895-2055
§† FDK America, Inc., Fuji Electrochemical Co., Ltd., San Jose, CA 95134 408-432-8331
§ GC International Inc., Plano, TX 75074 214-423-8411
§ ISKRA Electronics, Inc., Plainview, NY 11803 516-349-0222
Kyocera Industrial Ceramics Corp., San Diego, CA 92123 619-576-2688
Micro Switch, A Honeywell Div., Freeport, IL 61032 1-800-537-6945
§† MMG-North America, Paterson, NJ 07509 201-345-8900
§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 075-951-9111
§ Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404 407-881-3200
Philips Components Discrete Products Div., A North American Philips Co., Saugerties, NY 12477 914-246-2811
Sealing Devices, Inc., Lancaster, NY 14086 716-684-7600
§ Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
§ Steward, Inc., Chattanooga, TN 37401 615-867-4100

§ TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056 708-803-6100
Thomson Passive Components Corp., Woodland Hills, CA 91367 818-887-1010
§ Tokin America, Inc., San Jose, CA 95134 408-432-8020
United Technical Products, Fallsington, PA 19054 800-553-5300

Cores, Magnetic, Ferrite, Pot/Cup-1850

A-L-L Magnetics Inc./The Magnet Source, Placentia, CA 92670, 800-262-4638;800-525-3536 ..... A•1319
Lodestone Pacific, Anaheim, CA 92807, 714-630-1343 ..... A•1244
Magnelab, Boulder, CO 80301-4696, 303-442-6700 ..... A•2380-2381
§† **Magnetics, Spang & Co., Butler, PA 16003-0391, 412-282-8282 ..... A•1322**
Renco Electronics, Inc., Deer Pk., NY 11729, 516-586-5566;1-800-645-5828 ..... A•1285,1289,2527-2528
Advanced Components Inds., Inc., Div of Kaschke, Torrance, CA 90501 310-328-0060
§ Ceramic Magnetics, Inc., Fairfield, NJ 07004 201-227-4222
D & L Electronics, Langhorne, PA 19047 800-942-3631
§ Elna Ferrite Laboratories, Inc., Woodstock, NY 12498 800-553-2870
Elna Ferrite Laboratories, Inc., Woodstock, NY 12498 800-553-2870
§ Fair-Rite Prods., Wallkill, NY 12589 914-895-2055
§† FDK America, Inc., Fuji Electrochemical Co., Ltd., San Jose, CA 95134 408-432-8331
GC International Inc., Plano, TX 75074 214-423-8411
§ ISKRA Electronics, Inc., Plainview, NY 11803 516-349-0222
Kyocera Industrial Ceramics Corp., San Diego, CA 92123 619-576-2688
† Lenco Elctrns., Inc., McHenry, IL 60050 815-344-2900
§† MMG-North America, Paterson, NJ 07509 201-345-8900
§ Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404 407-881-3200
Philips Components Discrete Products Div., A North American Philips Co., Saugerties, NY 12477 914-246-2811
§ Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056 708-803-6100
Thomson Passive Components Corp., Woodland Hills, CA 91367 818-887-1010
§ Tokin America, Inc., San Jose, CA 95134 408-432-8020
United Technical Products, Fallsington, PA 19054 800-553-5300

Cores, Magnetic, Ferrite, Slug-1850

A-L-L Magnetics Inc./The Magnet Source, Placentia, CA 92670, 800-262-4638;800-525-3536 ..... A•1319
Lodestone Pacific, Anaheim, CA 92807, 714-630-1343 ..... A•1244
Magnelab, Boulder, CO 80301-4696, 303-442-6700 ..... A•2381
§† **Magnetics, Spang & Co., Butler, PA 16003-0391, 412-282-8282 ..... A•1322**
Advanced Components Inds., Inc., Div of Kaschke, Torrance, CA 90501 310-328-0060
§ Ceramic Magnetics, Inc., Fairfield, NJ 07004 201-227-4222
§ Fair-Rite Prods., Wallkill, NY 12589 914-895-2055
Ferronics, Fairport, NY 14450 716-388-1020
GC International Inc., Plano, TX 75074 214-423-8411
Kyocera Industrial Ceramics Corp., San Diego, CA 92123 619-576-2688
§† MMG-North America, Paterson, NJ 07509 201-345-8900
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Philips Components Discrete Products Div., A North American Philips Co., Saugerties, NY 12477 914-246-2811
§ Steward, Inc., Chattanooga, TN 37401 615-867-4100
TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056 708-803-6100
Thomson Passive Components Corp., Woodland Hills, CA 91367 818-887-1010
Tokin America, Inc., San Jose, CA 95134 408-432-8020

Cores, Magnetic, Ferrite, Toroid-1850

A-L-L Magnetics Inc./The Magnet Source, Placentia, CA 92670, 800-262-4638;800-525-3536 ..... A•1319
Lodestone Pacific, Anaheim, CA 92807, 714-630-1343 ..... A•1244-1246
Magnelab, Boulder, CO 80301-4696, 303-442-6700 ..... A•2380-2381
§† **Magnetics, Spang & Co., Butler, PA 16003-0391, 412-282-8282 ..... A•1322**
Advanced Components Inds., Inc., Div of Kaschke, Torrance, CA 90501 310-328-0060
§ Ceramic Magnetics, Inc., Fairfield, NJ 07004 201-227-4222
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 605-665-9301
D & L Electronics, Langhorne, PA 19047 800-942-3631
Elna Ferrite Laboratories, Inc., Woodstock, NY 12498 800-553-2870
§ Fair-Rite Prods., Wallkill, NY 12589 914-895-2055
§† FDK America, Inc., Fuji Electrochemical Co., Ltd., San Jose, CA 95134 408-432-8331
Ferronics, Fairport, NY 14450 716-388-1020
§ GC International Inc., Plano, TX 75074 214-423-8411
§ ISKRA Electronics, Inc., Plainview, NY 11803 516-349-0222
Kyocera Industrial Ceramics Corp., San Diego, CA 92123 619-576-2688
§† MMG-North America, Paterson, NJ 07509 201-345-8900
§ Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404 407-881-3200
Philips Components Discrete Products Div., A North American Philips Co., Saugerties, NY 12477 914-246-2811
Seacor, Inc., Westwood, NJ 07675 201-666-5600
§ Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
§ Steward, Inc., Chattanooga, TN 37401 615-867-4100
TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056 708-803-6100
Thomson Passive Components Corp., Woodland Hills, CA 91367 818-887-1010
§ Tokin America, Inc., San Jose, CA 95134 408-432-8020
United Technical Products, Fallsington, PA 19054 800-553-5300

Cores, Magnetic, Ferrite, Yoke Section-1850

A-L-L Magnetics Inc./The Magnet Source, Placentia, CA 92670, 800-262-4638;800-525-3536 ..... A•1319
Magnelab, Boulder, CO 80301-4696, 303-442-6700 ..... A•2381
§ Ceramic Magnetics, Inc., Fairfield, NJ 07004 201-227-4222
§† FDK America, Inc., Fuji Electrochemical Co., Ltd., San Jose, CA 95134 408-432-8331
GC International Inc., Plano, TX 75074 214-423-8411
Kyocera Industrial Ceramics Corp., San Diego, CA 92123 619-576-2688
Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056 708-803-6100
Thomson Passive Components Corp., Woodland Hills, CA 91367 818-887-1010
Tokin America, Inc., San Jose, CA 95134 408-432-8020

Cores, Magnetic, Metal Alloy (Other Than Silicon & Nickel-Iron)-1850

A-L-L Magnetics Inc./The Magnet Source, Placentia, CA 92670, 800-262-4638;800-525-3536 ..... A•1319
† **Magnetics, Spang & Co., Butler, PA 16003-0391, 412-282-8282 ..... A•1322**
† Arnold Engineering Company, Sub. SPS Technologies, Marengo, IL 60152 815-568-2000
GC International Inc., Plano, TX 75074 214-423-8411
International Power Devices Inc., Boston, MA 02134 617-782-3331
† Pyroferric International, Inc., Toledo, IL 62468-0159 217-849-3300
TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056 708-803-6100
Wontronics, Los Angeles, CA 90039 213-660-6230

Cores, Magnetic, Nickel-Iron, L, EE, F, & Ring Laminations-1850

A-L-L Magnetics Inc./The Magnet Source, Placentia, CA 92670, 800-262-4638;800-525-3536 ..... A•1319
† **Magnetics, Spang & Co., Butler, PA 16003-0391, 412-282-8282 ..... A•1322**
§ CCW Industries Inc., Bethel, CT 06801 203-744-6715
Framar Metal Products Co., Inc., Kenilworth, NJ 07033 908-241-0710
GC International Inc., Plano, TX 75074 214-423-8411
† Products Engrg. Corp., Azusa, CA 91702-5131 818-969-5879
† Siemens-B C L Magnetics, Siemens Automotive Ltd., Burlington, Ont., CANADA L7L 5H6 416-335-2530
TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056 708-803-6100
Wontronics, Los Angeles, CA 90039 213-660-6230

Cores, Magnetic, Nickel-Iron, Toroid-1850

A-L-L Magnetics Inc./The Magnet Source, Placentia, CA 92670, 800-262-4638;800-525-3536 ..... A•1319
† **Magnetics, Spang & Co., Butler, PA 16003-0391, 412-282-8282 ..... A•1322**
Alpha-Core Inc., Bridgeport, CT 06608 203-335-6805
† Arnold Engineering Company, Sub. SPS Technologies, Marengo, IL 60152 815-568-2000
GC International Inc., Plano, TX 75074 214-423-8411
† Infinetics Inc., Friskem Div., Wilmington, DE 19802 302-658-2471
§† MMG-North America, Paterson, NJ 07509 201-345-8900
TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056 708-803-6100

Cores, Magnetic, Powdered Iron, Pot/Cup-1850

A-L-L Magnetics Inc./The Magnet Source, Placentia, CA 92670, 800-262-4638;800-525-3536 ..... A•1319
Lodestone Pacific, Anaheim, CA 92807, 714-630-1343 ..... A•1244-1245
Renco Electronics, Inc., Deer Pk., NY 11729, 516-586-5566;1-800-645-5828 ..... A•1285,1289,2527
† Arnold Engineering Company, Sub. SPS Technologies, Marengo, IL 60152 815-568-2000
Cortec, Inc., Huntington Bch., CA 92649 714-897-2529
GC International Inc., Plano, TX 75074 214-423-8411
Micrometals, Anaheim, CA 92807 ..... 714-630-7420;800-356-5977
Micro Switch, A Honeywell Div., Freeport, IL 61032 1-800-537-6945
† Pyroferric International, Inc., Toledo, IL 62468-0159 217-849-3300
Quality Components, Inc., St. Marys, PA 15857 814-834-2817
TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056 708-803-6100

Cores, Magnetic, Powdered Iron, Slug-1850

A-L-L Magnetics Inc./The Magnet Source, Placentia, CA 92670, 800-262-4638;800-525-3536 ..... A•1319
Lodestone Pacific, Anaheim, CA 92807, 714-630-1343 ..... A•1244-1245
Renco Electronics, Inc., Deer Pk., NY 11729, 516-586-5566;1-800-645-5828 ..... A•1285,2527
Advanced Components Inds., Inc., Div of Kaschke, Torrance, CA 90501 310-328-0060
† Arnold Engineering Company, Sub. SPS Technologies, Marengo, IL 60152 815-568-2000
Cortec, Inc., Huntington Bch., CA 92649 714-897-2529
GC International Inc., Plano, TX 75074 214-423-8411
Micrometals, Anaheim, CA 92807 ..... 714-630-7420;800-356-5977
† Pyroferric International, Inc., Toledo, IL 62468-0159 217-849-3300
Quality Components, Inc., St. Marys, PA 15857 814-834-2817
TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056 708-803-6100

Cores, Magnetic, Powdered Iron, Toroid-1850

A-L-L Magnetics Inc./The Magnet Source, Placentia, CA 92670, 800-262-4638;800-525-3536 ..... A•1319
Advanced Components Inds., Inc., Div of Kaschke, Torrance, CA 90501 310-328-0060

† Arnold Engineering Company, Sub. SPS Technologies, Marengo, IL 60152 815-568-2000
Cortec, Inc., Huntington Bch., CA 92649 714-897-2529
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 605-665-9301
GC International Inc., Plano, TX 75074 214-423-8411
Micrometals, Anaheim, CA 92807 ..... 714-630-7420;800-356-5977
† Pyroferric International, Inc., Toledo, IL 62468-0159 217-849-3300
Quality Components, Inc., St. Marys, PA 15857 814-834-2817
TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056 708-803-6100

Cores, Magnetic, Powdered Permalloy, Toroid-1850

A-L-L Magnetics Inc./The Magnet Source, Placentia, CA 92670, 800-262-4638;800-525-3536 ..... A•1319
† Magnetics, Spang & Co., Butler, PA 16003-0391, 412-282-8282 ..... A•1322
† Arnold Engineering Company, Sub. SPS Technologies, Marengo, IL 60152 815-568-2000
GC International Inc., Plano, TX 75074 214-423-8411
TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056 708-803-6100

Cores, Magnetic, Silicon C-1850

A-L-L Magnetics Inc./The Magnet Source, Placentia, CA 92670, 800-262-4638;800-525-3536 ..... A•1319
Alpha-Core Inc., Bridgeport, CT 06608 203-335-6805
† Arnold Engineering Company, Sub. SPS Technologies, Marengo, IL 60152 815-568-2000
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
Dynapower Corporation, S. Burlington, VT 05407 802-860-7200
Framar Metal Products Co., Inc., Kenilworth, NJ 07033 908-241-0710
† Products Engrg. Corp., Azusa, CA 91702-5131 818-969-5879
† Sko-Die, Inc., Morton Grove, IL 60053 708-965-1130

Cores, Magnetic, Silicon EI, EE, & F Laminations-1850

A-L-L Magnetics Inc./The Magnet Source, Placentia, CA 92670, 800-262-4638;800-525-3536 ..... A•1319
Apollo Magnetics Corp., Los Angeles, CA 90057 213-381-2500
Dynapower Corporation, S. Burlington, VT 05407 802-860-7200
Framar Metal Products Co., Inc., Kenilworth, NJ 07033 908-241-0710
†# Lamination Specialties Corp., Chicago, IL 60612 312-243-2181
† National Lamination Co., National Material Ltd., Des Plaines, IL 60018 708-298-7676
† Products Engrg. Corp., Azusa, CA 91702-5131 818-969-5879
† Siemens-B C L Magnetics, Siemens Automotive Ltd., Burlington, Ont., CANADA L7L 5H6 416-335-2530
† Sko-Die, Inc., Morton Grove, IL 60053 708-965-1130

Cores, Magnetic, Silicon, Toroid-1850

A-L-L Magnetics Inc./The Magnet Source, Placentia, CA 92670, 800-262-4638;800-525-3536 ..... A•1319
† Magnetics, Spang & Co., Butler, PA 16003-0391, 412-282-8282 ..... A•1322
Alpha-Core Inc., Bridgeport, CT 06608 203-335-6805
† Arnold Engineering Company, Sub. SPS Technologies, Marengo, IL 60152 815-568-2000
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 605-665-9301
Micro Switch, A Honeywell Div., Freeport, IL 61032 1-800-537-6945
† Siemens-B C L Magnetics, Siemens Automotive Ltd., Burlington, Ont., CANADA L7L 5H6 416-335-2530

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† A-L-L Magnetics Inc./The Magnet Source, Placentia, CA 92670, 800-262-4638;800-525-3536 ..... A•1319
Coilcraft, Cary, IL 60013, 708-639-2361 ..... A•1219
Lodestone Pacific, Anaheim, CA 92807, 714-630-1343 ..... A•1244
† Arnold Engineering Company, Sub. SPS Technologies, Marengo, IL 60152 815-568-2000
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
D & L Electronics, Langhorne, PA 19047 800-942-3631
Electrical Insulation Suppliers, Inc., Hillside, IL 60162 708-547-5400
§ Elna Ferrite Laboratories, Inc., Woodstock, NY 12498 800-553-2870
Elna Ferrite Laboratories, Inc., Woodstock, NY 12498 800-553-2870
Fair-Rite Prods., Wallkill, NY 12589 914-895-2055
Ferronics, Fairport, NY 14450 716-388-1020
§ GC International Inc., Plano, TX 75074 214-423-8411
§ ISKRA Electronics, Inc., Plainview, NY 11803 516-349-0222
Magnet Sales & Mfg., Inc., Culver City, CA 90230-6162 ..... 310-391-7213;800-421-6692 (N. CA and out of state)
† Miami Magnet Co., Inc., The Magnet Source, Miami, FL 33015 800-222-7846
† Quartzite Processing, Inc., Malden, MA 02148 617-322-3611
ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086 408-730-6300
§ TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056 708-803-6100
Tokin America, Inc., San Jose, CA 95134 408-432-8020
United Technical Products, Fallsington, PA 19054 800-553-5300

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Amplifier Research, Souderton, PA 18964-9990, 215-723-8181 ..... D•1003
§† Microwave Filter Inc., East Syracuse, NY 13057-0486, 315-437-3953;800-448-1666 ..... A•1655-1656,1658-1659
† Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500 ..... A•1725
North Hills Signal Processing, Syosset, NY 11791, 516-682-7740 ..... A•2438,2440-2441
Advanced Technical Materials, Inc., Patchogue, NY 11772 ..... 516-363-9018; 516-289-0363
† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950 201-539-5500
§† Anaren Microwave, Inc., E. Syracuse, NY 13057 315-432-8930
† Bird Electronic Corp., Cleveland, OH 44139-2794 216-248-1200
BT & D Technologies, Kennett Square, PA 19348 ..... 215-444-6888;800-545-4306
C-COR Elctrns., Inc., State College, PA 16801 ..... 814-238-2461;800-233-2267
Coaxial Dynamics, Cleveland, OH 44135 ..... 1-800-COAXIAL
Coil-Q Corp., Bronxville, NY 10708 914-337-4775
† Connecticut Microwave Corp., Cheshire, CT 06410 203-250-9678
Continental Resources, Inc, Test Instruments Div., Bedford, MA 01730 ..... 617-275-0850; 800-937-4688
† Dielectric Communications, General Signal, Raymond, ME 04071 ..... 207-655-4555; 800-341-9678
Elcom Systems, Inc., Boca Raton, FL 33487 407-994-1774
Flann Microwave Inc., Cambridge, MA 02139 1-800-937-3772
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
Hyletronics:Litton Industries, Lexington, MA 02173-3199 617-276-3298
† International Telecommunications Components, Inc., Deer Park, NY 11729 516-243-1444
† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
† Loral Microwave Narda, Hauppauge, NY 11788 516-231-1700
† Loral Microwave-Wavecom, Northridge, CA 91324 818-882-3010
† Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710 813-347-2181
MACOM, Inc., Lowell, MA 01851 617-272-3000
§† M/A-COM Microelectroincs Division, M/A-COM, Lowell, MA 01853-3295 508-442-5000
† Maury Microwave Corp., Ontario, CA 91764 909-987-4715
† Merrimac Industries, West Caldwell, NJ 07006 201-575-1300
† Microlab/FXR, Livingston, NJ 07039 201-992-7700
† Microphase, Norwalk, CT 06856 203-866-8000
MicroSignals Inc., L.I.C., NY 11101 ..... 718-937-7955;718-937-0391;800-648-2252
Microwave Communications Corp., Valencia, CA 91355 805-257-1948
§ Microwave Development Laboratories, Natick, MA 01760 508-655-0060
§† Midwest Microwave, Saline, MI 48176-9569 ..... 313-429-4773;800-521-4410
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3 ..... 514-694-6666; 800-724-3911
Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 075-951-9111
† Pasternack Enterprises, Irvine, CA 92713 714-261-1920
Penny Technologies, Inc., Greenpoint, NY 11222 718-782-4149
§ Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018 ..... 408-730-0300;800-PENSTOCK
† Premier Microwave, Port Chester, NY 10573 914-939-8900
§† Pro Com Technology Inc., Plainview, NY 11803 ..... 516-293-4443;800-762-3785
† RLC Electronics, Inc., Mt. Kisco, NY 10549 914-241-1334
† Sage Laboratories, Inc., Natick, MA 01760 508-653-0844
† Servo Corporation of America, Hicksville, NY 11801-5259 516-938-9700
Sivers IMA AB, Culver City, CA 90230 213-306-4248
ST Olektron Corporation, Subsidiary of Signal Technology Corp., Beverly, MA 01915 508-922-0019
§† Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
§† Telephonics Corporation/PRD Instruments, Huntington, NY 11743 ..... 516-549-6415/6428

Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291
† TRAK Microwave Ltd., TRAK Microwave Corp., Dundee, SCOTLAND DD2 1TY 44-382-561509
† Transco Products, Inc., Subsidiary of Datron Systems Inc., Camarillo, CA 93012 805-987-8007
† TRM, Inc., Manchester, NH 03110 603-627-6000
Tucker Electronics, Dallas, TX 75355-1419 ..... 214-348-8800;800-527-4642
† Vectronics Microwave Corp., Middlesex, NJ 08846 908-356-2377
† Werlatone, Inc., Brewster, NY 10509 914-279-6187
Wide Band Engineering Co., Inc., Phoenix, AZ 85036 602-254-1570
§ Wiltron, Morgan Hill, CA 95037-2809 408-778-2000

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† Eagle Wichita, Wichita, KS 67277, 316-942-5100 ..... A•1632
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§† Microwave Filter Inc., East Syracuse, NY 13057-0486, 315-437-3953;800-448-1666 ..... A•1655-1656,1658-1659
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Advanced Technical Materials, Inc., Patchogue, NY 11772 ..... 516-363-9018; 516-289-0363
† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950 201-539-5500
§† Anaren Microwave, Inc., E. Syracuse, NY 13057 315-432-8930
Avtech Electrosystems Ltd., Ottawa, Ontario, CANADA K2C 3H4 613-226-5772
Communications & Energy Corp., E. Syracuse, NY 13057 315-452-0709
† Connecticut Microwave Corp., Cheshire, CT 06410 203-250-9678
† Dielectric Communications, General Signal, Raymond, ME 04071 ..... 207-655-4555; 800-341-9678
† Eastern Microwave, Winchester, MA 01890 617-721-9800
† Elcom Systems, Inc., Boca Raton, FL 33487 407-994-1774
Flann Microwave Inc., Cambridge, MA 02139 1-800-937-3772
Gabriel Elctrns. Inc., Scarborough, ME 04070 207-883-5161
† Gamma-f Corp., Vertex Communications, Torrance, CA 90505 310-539-6704
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
§ Hirose Electric U.S.A., Inc. (HRS), Div. of Hirose Electric Co. Ltd. (Japan), Simi Valley, CA 93065 805-522-7958
Hyletronics:Litton Industries, Lexington, MA 02173-3199 617-276-3298
† Integrated Microwave, San Diego, CA 92121-1009 619-259-2600
† International Telecommunications Components, Inc., Deer Park, NY 11729 516-243-1444
† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
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† Loral Microwave-Wavecom, Northridge, CA 91324 818-882-3010
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† Merrimac Industries, West Caldwell, NJ 07006 201-575-1300
† Microlab/FXR, Livingston, NJ 07039 201-992-7700
† Microphase, Norwalk, CT 06856 203-866-8000
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§ Microwave Development Laboratories, Natick, MA 01760 508-655-0060
† Microwave Technology Div., JHP Industrial, Syracuse, NY 13202-3442 315-422-0050
§ Midwest Microwave, Saline, MI 48176-9569 ..... 313-429-4773;800-521-4410
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3 ..... 514-694-6666; 800-724-3911
MITEQ Inc., Hauppauge, NY 11788 516-436-7400
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§† Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018 ..... 408-730-0300;800-PENSTOCK
Polyflon Company, Crane Co., New Rochelle, NY 10801 914-636-7222
† Premier Microwave, Port Chester, NY 10573 914-939-8900
† Pro Com Technology Inc., Plainview, NY 11803 ..... 516-293-4443;800-762-3785
† RHG Electronics Laboratory, Inc., Deer Park, NY 11729 516-242-1100
† RLC Electronics, Inc., Mt. Kisco, NY 10549 914-241-1334
† Sage Laboratories, Inc., Natick, MA 01760 508-653-0844
† Servo Corporation of America, Hicksville, NY 11801-5259 516-938-9700
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§† Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
§† Telephonics Corporation/PRD Instruments, Huntington, NY 11743 ..... 516-549-6415/6428
† TRAK Microwave Ltd., TRAK Microwave Corp., Dundee, SCOTLAND DD2 1TY 44-382-561509
† Transco Products, Inc., Subsidiary of Datron Systems Inc., Camarillo, CA 93012 805-987-8007
† TRM, Inc., Manchester, NH 03110 603-627-6000
Tucker Electronics, Dallas, TX 75355-1419 ..... 214-348-8800;800-527-4642
† Vectronics Microwave Corp., Middlesex, NJ 08846 908-356-2377

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† Litton Poly-Scientific, Div. of Litton Industries, Blacksburg, VA 24060-3100, 800-336-2112;703-953-4751 ..... B•1278,1283-1287
Micro Mo Electronics, Inc., St. Petersburg, FL 33701, 813-822-2529 ..... B•1294, D•2316
North Hills Signal Processing, Syosset, NY 11791, 516-682-7740 ... A•2440-2441
† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950 201-539-5500
† Eastern Microwave, Winchester, MA 01890 617-721-9800
Mercotac Inc., Carlsbad, CA 92009 619-431-7723
† Microphase, Norwalk, CT 06856 203-866-8000
§ Microwave Development Laboratories, Natick, MA 01760 508-655-0060
Polyflon Company, Crane Co., New Rochelle, NY 10801 914-636-7222
† Premier Microwave, Port Chester, NY 10573 914-939-8900
† Sage Laboratories, Inc., Natick, MA 01760 508-653-0844
Sivers IMA AB, Culver City, CA 90230 213-306-4248
Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
S.S White Technologies Inc., Piscataway, NJ 08854-3761 908-752-8300

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Abracon Corporation, San Clemente, CA 92673, 714-498-4505 ..... A•1330-1331
§ Bomar Crystal Company, Middlesex, NJ 08846, 908-356-7787;800-526-3935 ..... A•1346
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§ Fox Electronics, Ft. Myers, FL 33905, 813-693-0099 ..... A•1401
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§† Monitor Products Co., Inc., Oceanside, CA 92054, 619-433-4510 ..... A•1424,1427-1428
§† M-Tron Industries, Yankton, SD 57078, 605-665-9321 ..... A•1431
Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ..... A•1434
Musashino Corporation, Mission Viejo, CA 92691, 714-458-1155 ..... A•1438
§ NDK America, Inc., Fremont, CA 94539, 415-623-6500 ..... A•1441
Oscillatek, A Dover Technologies Company, Olathe, KS 66062, 913-829-1777 ..... A•1448
Pletronics, Inc., Lynnwood, WA 98036, 206-776-1880 ..... A•1449-1452
† Q-Tech Corp., Culver City, CA 90232-3510, 310-836-7900 ..... A•1457,1459
§# R X D Inc., Relm Communications, Norfolk, NE 68701, 402-379-0112;800-228-8108 ..... A•1472-1473
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§ Standard Crystal Corporation, El Monte, CA 91731, 818-443-2121 ..... A•1481
Statek Corp., Orange, CA 92668, 714-639-7810 ..... A•1482-1483
TOYOCOM USA INC., Arlington Heights, IL 60005, 708-593-8780/1-800-TOYOCOM ..... A•1484,1490
Anderson Electronics, Hollidaysburg, PA 16648 814-695-4428
§ Baknor Industries Inc., Mississauga, ONT., CANADA L5L 1X1 416-828-2400
Blackhawk Networks Corp., Janesville, WI 53545 608-752-8701
Cal Crystal Lab., Inc., Anaheim, CA 92801 ..... 714-991-1580;800-333-9825
Croven Crystals, Whitby, ON, CANADA L1N 5S5 416-668-3324
CTS Corporation, Elkhart, IN 46514 219-293-7511
§ CTS Corp., Frequency Controls, Sandwich, IL 60548 815-786-8411
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
§† Hybrids International, Frequency Products Div., Olathe, KS 66062 913-764-4544
§† Hybrids International Ltd., Thick Film Division, Olathe, KS 66062 913-764-6400
International Crystal Mfg., Oklahoma City, OK 73126-0330 ..... 405-236-3741; 1-800-725-1426
Jan Crystals, Bob Whan and Son Electronics, Ft. Myers, FL 33907 ..... 813-936-2397; 1-800-526-9825
§ KCK America Inc., Mitsubishi Materials Corporation, Rolling Meadows, IL 60008 708-577-0200
§† KDS America, Daishinku Corp., Overland Pk., KS 66211 913-491-6825
McCoy/Ovenaire/Spectrum, A Sub. of Oak Industries, Mt. Holly Springs, PA 17065 717-486-3411
Mouser Electronics, Santee, CA 92071 800-346-6873
Mouser Electronics, Mansfield, TX 76063 800-346-6873
Mouser Electronics, Gilroy, CA 95020 800-346-6873
NTK Technical Ceramics, NGK Spark Plugs (USA), Mt. Prospect, IL 60056 708-824-1133
† Piezo Crystal Co., Carlisle, PA 17013 717-249-2151
§† Pioneer Components, Brooklyn, NY 11234 718-444-3880
† Savoy Electronics, Inc., Ft. Lauderdale, FL 33310 ..... 305-563-1333;800-359-5400
† Sentry Manufacturing Company, Chickasha, OK 73023 405-224-6780
§† United States Crystal Corp., Fort Worth, TX 76110 ..... 817-921-3014;800-433-7140
§ Valpey-Fisher:Matec Corp, Hopkinton, MA 01748 508-435-6831
§ West Electronic Sales Team, Huntington Beach, CA 92647 ..... 714-375-6500; 310-495-5569

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§ Bomar Crystal Company, Middlesex, NJ 08846, 908-356-7787;800-526-3935 ..... A•1346
† Colorado Crystal Corp., Loveland, CO 80537, 303-667-9248 ..... A•1348
§ Fox Electronics, Ft. Myers, FL 33905, 813-693-0099 ..... A•1397-1398,1401

Hy-Q International (USA) Inc., Erlanger, KY 41018, 606-283-5000 ..... A•1408
Micro Crystal/Division SMH, Arlington Heights, IL 60005, 708-806-1485 ..... A•1420,1423
† **Monitor Products Co., Inc., Oceanside, CA 92054, 619-433-4510 ... A•1424,1427**
§† **M-Tron Industries, Yankton, SD 57078, 605-665-9321 ..... A•1431**
† **Q-Tech Corp., Culver City, CA 90232-3510, 310-836-7900 ..... A•1456-1457**
† **Reeves-Hoffman Div., Dynamics Corporation of America, Carlisle, PA 17013-2248, 717-243-5929 ..... A•1464**
SARONIX, Palo Alto, CA 94303, 415-856-6900 ..... A•1475,1477
TOYOCOM USA INC., Arlington Heights, IL 60005, 708-593-8780/1-800-TOYOCOM ..... A•1490
† Anderson Electronics, Hollidaysburg, PA 16648 814-695-4428
§ AT&T Microelectronics, Allentown, PA 18103 ..... 1-800-372-2447;In Can.:1-800-553-2448
§† Atomergic Chemetals Corp., Farmingdale, NY 11735-1718 516-694-9000
§ Baknor Industries Inc., Mississauga, ONT., CANADA L5L 1X1 416-828-2400
Blackhawk Networks Corp., Janesville, WI 53545 608-752-8701
Cal Crystal Lab., Inc., Anaheim, CA 92801 ..... 714-991-1580;800-333-9825
† Channel Industries, Santa Barbara, CA 93111 805-967-0171
† Croven Crystals, Whitby, ON, CANADA L1N 5S5 416-668-3324
CTS Corporation, Elkhart, IN 46514 219-293-7511
CTS Corp., Frequency Controls, Sandwich, IL 60548 815-786-8411
Ecliptek Corporation, Costa Mesa, CA 92626 714-433-1200
EDO Corporation, Acoustics Division, Salt Lake City, UT 84115 801-486-2115
† EG & G Frequency Products Inc., EG & G Inc., Cincinnati, OH 45232 513-542-5555
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
§† Hybrids International, Frequency Products Div., Olathe, KS 66062 913-764-4544
International Crystal Mfg., Oklahoma City, OK 73126-0330 ..... 405-236-3741; 1-800-725-1426
§† KDS America, Daishinku Corp., Overland Pk., KS 66211 913-491-6825
† McCoy/Ovenaire/Spectrum, A Sub. of Oak Industries, Mt. Holly Springs, PA 17065 717-486-3411
† Morgan-Matroc, Electro Ceramics Division, Bedford, OH 44146-5478 ... 216-232-8600
NTK Technical Ceramics, NGK Spark Plugs (USA), Mt. Prospect, IL 60056 708-824-1133
† Piezo Crystal Co., Carlisle, PA 17013 717-249-2151
† Piezo Technology Inc., Orlando, FL 32804 407-298-2000
§† Pioneer Components, Brooklyn, NY 11234 718-444-3880
§† Reade Advanced Materials, A Reade Intl. business unit, Riverside, RI 02915-0039 401-433-7000
§# R X D Inc., Reim Communications, Norfolk, NE 68701 ... 402-379-0112;800-228-8108
† Savoy Electronics, Inc., Ft. Lauderdale, FL 33310 ..... 305-563-1333;800-359-5400
† Sentry Manufacturing Company, Chickasha, OK 73023 405-224-6780
† Time and Frequency Ltd., Miami, FL 33172 305-593-8000
§ Tokin America, Inc., San Jose, CA 95134 408-432-8020
§† United States Crystal Corp., Fort Worth, TX 76110 ..... 817-921-3014;800-433-7140
§ Valpey-Fisher:Matec Corp, Hopkinton, MA 01748 508-435-6831

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† **Anderson Electronics, Hollidaysburg, PA 16648, 814-695-4428 ..... A•1333**
† **Bliley Electric Co., Erie, PA 16506, 814-838-3571 ..... A•1344-1345**
Bomar Crystal Company, Middlesex, NJ 08846, 908-356-7787;800-526-3935 ..... A•1346
† **Colorado Crystal Corp., Loveland, CO 80537, 303-667-9248 ..... A•1348**
CTS Corp., Frequency Controls, Sandwich, IL 60548, 815-786-8411 ..... A•1374
§ **Epson America Inc., Component Sales Dept., Torrance, CA 90503, 310-782-5318 ..... A•1392-1393,1395**
† **McCoy/Ovenaire/Spectrum, A Sub. of Oak Industries, Mt. Holly Springs, PA 17065, 717-486-3411 ..... A•1412-1413**
Micro Crystal/Division SMH, Arlington Heights, IL 60005, 708-806-1485 ..... A•1420
Monitor Products Co., Inc., Oceanside, CA 92054, 619-433-4510 ..... A•1427
§† **M-Tron Industries, Yankton, SD 57078, 605-665-9321 ..... A•1431**
Musashino Corporation, Mission Viejo, CA 92691, 714-458-1155 ... A•1437-1438
NDK America, Inc., Fremont, CA 94539, 415-623-6500 ..... A•1440
Pletronics, Inc., Lynnwood, WA 98036, 206-776-1880 ..... A•1450-1451
Q-Tech Corp., Culver City, CA 90232-3510, 310-836-7900 ..... A•1456
§ **Raltron Electronics, Miami, FL 33172, 305-593-6033 ..... A•1460**
† **Reeves-Hoffman Div., Dynamics Corporation of America, Carlisle, PA 17013-2248, 717-243-5929 ..... A•1464**
§ **SARONIX, Palo Alto, CA 94303, 415-856-6900 ..... A•1474-1475,1477**
§ **Standard Crystal Corporation, El Monte, CA 91731, 818-443-2121 ..... A•1481**
§† **Statek Corp., Orange, CA 92668, 714-639-7810 ..... A•1482-1483**
TOYOCOM USA INC., Arlington Heights, IL 60005, 708-593-8780/1-800-TOYOCOM ..... A•1484,1490
TTE Frequency Devices, Ltd., Bohemia, NY 11716, 516-589-7789 ..... A•1496,1499-1501
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§† Atomergic Chemetals Corp., Farmingdale, NY 11735-1718 516-694-9000
§ Baknor Industries Inc., Mississauga, ONT., CANADA L5L 1X1 416-828-2400
Blackhawk Networks Corp., Janesville, WI 53545 608-752-8701
Cal Crystal Lab., Inc., Anaheim, CA 92801 ..... 714-991-1580;800-333-9825
C-Mac Industries Inc., Sherbrooke, Quebec, CANADA J1L 1V8 819-821-4524
† Croven Crystals, Whitby, ON, CANADA L1N 5S5 416-668-3324
† CTS of Canada, Ltd., Streetsville, ONTARIO, CAN. L5M 1Y9 416-826-1141
† EG & G Frequency Products Inc., EG & G Inc., Cincinnati, OH 45232 513-542-5555
† Electronic Research Co., Overland Park, KS 66204 913-631-6700
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
† Hoffman, P.R., Co., Materials Proc, Carlisle, PA 17013 717-243-2011
† Hughes Microelectronic Circuits Division, Newport Beach, CA 92658-8903 714-759-2952
§† Hybrids International, Frequency Products Div., Olathe, KS 66062 913-764-4544
§† Hybrids International Ltd., Thick Film Division, Olathe, KS 66062 913-764-6400
International Crystal Mfg., Oklahoma City, OK 73126-0330 ..... 405-236-3741; 1-800-725-1426
§ Jaro Components, Inc., Boca Raton, FL 33487-8295 407-241-8600
§ KCK America Inc., Mitsubishi Materials Corporation, Rolling Meadows, IL 60008 708-577-0200
§† KDS America, Daishinku Corp., Overland Pk., KS 66211 913-491-6825
† K-W Manufacturing Co., Inc., Prague, OK 74864 405-567-2285
§ Leybold Inficon Inc., E. Syracuse, NY 13057-9714 315-434-1100
§ NEL Frequency Controls, Inc., Burlington, WI 53105 414-763-3591
§ NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
§ Oscilloquartz, B & J Marketing, Northridge, CA 91325 818-993-0048
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404 407-881-3200
Philips Components Discrete Products Div., A North American Philips Co., Saugerties, NY 12477 914-246-2811
† Piezo Crystal Co., Carlisle, PA 17013 717-249-2151
† Piezo Technology Inc., Orlando, FL 32804 407-298-2000
§# R X D Inc., Reim Communications, Norfolk, NE 68701 ... 402-379-0112;800-228-8108
† Savoy Electronics, Inc., Ft. Lauderdale, FL 33310 ..... 305-563-1333;800-359-5400
§ Seiko Instruments U.S.A., Inc. Electronic Components, Torrance, CA 90505 310-517-7770
† Sentry Manufacturing Company, Chickasha, OK 73023 405-224-6780
§ Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
Stetron International, Inc., Buffalo, NY 14203 716-854-3443
† Time and Frequency Ltd., Miami, FL 33172 305-593-8000
§† United States Crystal Corp., Fort Worth, TX 76110 ..... 817-921-3014;800-433-7140
§† Valpey-Fisher:Matec Corp, Hopkinton, MA 01748 508-435-6831

Crystals, Quartz, High Frequency (1 MHz-200MHz)-2300

Abracon Corporation, San Clemente, CA 92673, 714-498-4505 ..... A•1330-1331
† **Bliley Electric Co., Erie, PA 16506, 814-838-3571 ..... A•1340-1345**
Bomar Crystal Company, Middlesex, NJ 08846, 908-356-7787;800-526-3935 ..... A•1346
§ **Champion Technologies, Inc., Franklin Park, IL 60131, 708-451-1000 .... A•1347**
† **Colorado Crystal Corp., Loveland, CO 80537, 303-667-9248 ..... A•1348**
Connor-Winfield Corp., Aurora, IL 60505-1335, 708-851-4722 ..... A•1350
CTS Corp., Frequency Controls, Sandwich, IL 60548, 815-786-8411 ..... A•1366-1372
Ecliptek Corporation, Costa Mesa, CA 92626, 714-433-1200 ..... A•1386
§ **Fox Electronics, Ft. Myers, FL 33905, 813-693-0099 ..... A•1397-1398,1401**
Hy-Q International (USA) Inc., Erlanger, KY 41018, 606-283-5000 ..... A•1408
International Crystal Mfg., Oklahoma City, OK 73126-0330, 405-236-3741;1-800-725-1426 ..... A•1409
MF Elctrns. Corp., New Rochelle, NY 10801, 914-576-6570 ..... A•1419
Micro Crystal/Division SMH, Arlington Heights, IL 60005, 708-806-1485 ..... A•1420-1423
§† **Monitor Products Co., Inc., Oceanside, CA 92054, 619-433-4510 ... A•1426-1427**
M-Tron Industries, Yankton, SD 57078, 605-665-9321 ..... A•1431
Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 .. A•1432-1434
Musashino Corporation, Mission Viejo, CA 92691, 714-458-1155 ..... A•1438
§ **Pletronics, Inc., Lynnwood, WA 98036, 206-776-1880 ..... A•1449-1450**
Raltron Electronics, Miami, FL 33172, 305-593-6033 ..... A•1460
Reeves-Hoffman Div., Dynamics Corporation of America, Carlisle, PA 17013-2248, 717-243-5929 ..... A•1464,1467
§# **R X D Inc., Reim Communications, Norfolk, NE 68701, 402-379-0112;800-228-8108 ..... A•1473**
§ **SARONIX, Palo Alto, CA 94303, 415-856-6900 ..... A•1475-1477**
§† **Statek Corp., Orange, CA 92668, 714-639-7810 ..... A•1482**
TOYOCOM USA INC., Arlington Heights, IL 60005, 708-593-8780/1-800-TOYOCOM ..... A•1484,1490
TTE Frequency Devices, Ltd., Bohemia, NY 11716, 516-589-7789 ..... A•1496
Vectron Laboratories, Inc., Norwalk, CT 06856-5160, 203-853-4433 ..... A•1506
Blackhawk Networks Corp., Janesville, WI 53545 608-752-8701
C-Mac Industries Inc., Sherbrooke, Quebec, CANADA J1L 1V8 819-821-4524
Croven Crystals, Whitby, ON, CANADA L1N 5S5 416-668-3324
CTS Corporation, Elkhart, IN 46514 219-293-7511
† EG & G Frequency Products Inc., EG & G Inc., Cincinnati, OH 45232 513-542-5555
† Hoffman, P.R., Co., Materials Proc, Carlisle, PA 17013 717-243-2011
Integrity Technology Corporation, Santa Clara, CA 95050 408-262-8640
Jan Crystals, Bob Whan and Son Electronics, Ft. Myers, FL 33907 ..... 813-936-2397; 1-800-526-9825
K-W Manufacturing Co., Inc., Prague, OK 74864 405-567-2285
§ Nedco Electronics, Inc., Morton Grove, IL 60053 708-967-0500
§† NEL Frequency Controls, Inc., Burlington, WI 53105 414-763-3591
† Sentry Manufacturing Company, Chickasha, OK 73023 405-224-6780
† ST Microsonics Corp., Subsidiary of Signal Technology Corporation, Weymouth, MA 02188 617-337-4200
2M Sales Company, Burnsville, MN 55337 612-890-7774
USAPEX Corp., Santa Clara, CA 95051 408-982-9063
Valpey-Fisher:Matec Corp, Hopkinton, MA 01748 508-435-6831

Crystals, Quartz, Low Frequency (1 KHz-999KHz)-2300

Abracon Corporation, San Clemente, CA 92673, 714-498-4505 ..... A•1330-1331
AVX Corporation, A Kyocera Group Company, Myrtle Beach, SC 29577, 803-448-9411 ..... A•1336
† **Bliley Electric Co., Erie, PA 16506, 814-838-3571 ..... A•1344**
§ **Champion Technologies, Inc., Franklin Park, IL 60131, 708-451-1000 .... A•1347**
Connor-Winfield Corp., Aurora, IL 60505-1335, 708-851-4722 ..... A•1350
CTS Corp., Frequency Controls, Sandwich, IL 60548, 815-786-8411 ..... A•1376-1377
§ **Fox Electronics, Ft. Myers, FL 33905, 813-693-0099 ..... A•1397-1398,1401**
International Crystal Mfg., Oklahoma City, OK 73126-0330, 405-236-3741;1-800-725-1426 ..... A•1409
MF Elctrns. Corp., New Rochelle, NY 10801, 914-576-6570 ..... A•1419
Micro Crystal/Division SMH, Arlington Heights, IL 60005, 708-806-1485 ..... A•1420-1423

§† Monitor Products Co., Inc., Oceanside, CA 92054, 619-433-4510 ..... A•1426
M-Tron Industries, Yankton, SD 57078, 605-665-9321 ..... A•1431
Musashino Corporation, Mission Viejo, CA 92691, 714-458-1155 ..... A•1437
Reeves-Hoffman Div., Dynamics Corporation of America, Carlisle, PA 17013-2248, 717-243-5929 ..... A•1464
R X D Inc., Relm Communications, Norfolk, NE 68701, 402-379-0112;800-228-8108 ..... A•1473
§ SARONIX, Palo Alto, CA 94303, 415-856-6900 ..... A•1475-1477
§† Statek Corp., Orange, CA 92668, 714-639-7810 ..... A•1482
TOYOCOM USA INC., Arlington Heights, IL 60005, 708-593-8780/1-800-TOYOCOM ..... A•1484,1490
Vectron Laboratories, Inc., Norwalk, CT 06856-5160, 203-853-4433 ..... A•1506
Blackhawk Networks Corp., Janesville, WI 53545 608-752-8701
Ecliptek Corporation, Costa Mesa, CA 92626 714-433-1200
† Hoffman, P.R., Co., Materials Proc, Carlisle, PA 17013 717-243-2011
Integrity Technology Corporation, Santa Clara, CA 95050 408-262-8640
Jan Crystals, Bob Whan and Son Electronics, Ft. Myers, FL 33907 ..... 813-936-2397; 1-800-526-9825
§† NEL Frequency Controls, Inc., Burlington, WI 53105 414-763-3591
Raltron Electronics, Miami, FL 33172 305-593-6033
2M Sales Company, Burnsville, MN 55337 612-890-7774
Valpey-Fisher:Matec Corp, Hopkinton, MA 01748 508-435-6831

Crystals, Quartz, Strip-2300

§ Fox Electronics, Ft. Myers, FL 33905, 813-693-0099 ..... A•1397-1398,1401
Micro Crystal/Division SMH, Arlington Heights, IL 60005, 708-806-1485 ..... A•1422
§ Monitor Products Co., Inc., Oceanside, CA 92054, 619-433-4510 ..... A•1428
§ SARONIX, Palo Alto, CA 94303, 415-856-6900 ..... A•1474-1476
TOYOCOM USA INC., Arlington Heights, IL 60005, 708-593-8780/1-800-TOYOCOM ..... A•1484
TTE Frequency Devices, Ltd., Bohemia, NY 11716, 516-589-7789 ..... A•1496,1499-1501
Abracon Corporation, San Clemente, CA 92673 714-498-4505
Blackhawk Networks Corp., Janesville, WI 53545 608-752-8701
C-Mac Industries Inc., Sherbrooke, Quebec, CANADA J1L 1V8 819-821-4524
CTS Corp., Frequency Controls, Sandwich, IL 60548 815-786-8411
Ecliptek Corporation, Costa Mesa, CA 92626 714-433-1200
† Hoffman, P.R., Co., Materials Proc, Carlisle, PA 17013 717-243-2011
Hy-Q International (USA) Inc., Erlanger, KY 41018 606-283-5000
§ Pletronics, Inc., Lynnwood, WA 98036 206-776-1880

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Cups, Encapsulation-1600 — *See Vol. C*

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Cutters, Wire, Automatic — See Machines, Wire Measuring & Cutting (Vol. D)

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Data Collection Equipment, Modular-2000 — *See Vol. D*

Data Collection Equipment, Portable-2000 — *See Vol. D*

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Data Loggers-2325 — *See Vol. D*

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Decade Boxes, Resistance-2900 — *See Vol. D*

Decade Boxes, Resistance, Programmable-2900 — *See Vol. D*

Decade Boxes, Transformer-2900 — *See Vol. D*

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Delay Lines, Active-2350

§ Bel Fuse, Jersey City, NJ 07302, 201-432-0463 ..... A•1515,2276
§ Dallas Semiconductor, Dallas, TX 75244, 214-450-0400 ..... A•1525-1527
§† Data Delay Devices, Clifton, NJ 07013-1915, 201-773-2299 ..... A•1528-1534,1536,1538-1541
ELMEC Technology Of America, Inc., San Mateo, CA 94402, 415-341-1611 ..... A•1546-1551
† ESC Electronics Corp., Palisades Pk., NJ 07650, 201-947-0400 .... A•1552-1565
§† JBM Electronics, Inc., Bedford, NH 03110-6802, 603-623-0222 ..... A•1567,2363
§† Kappa Technologies, Inc., Rahway, NJ 07065, 908-396-9400;1-800-223-0603 ..... A•1568-1569
† KR Electronics, Inc., Avenel, NJ 07001, 908-636-1900 ..... A•1648
§ PCA Electronics, Sepulveda, CA 91343, 818-892-0761 ..... A•1572-1575
† Polara Engineering Inc., Fullerton, CA 92633, 714-521-0900 ..... A•1576
† Premier Magnetics Inc., Aliso Viejo, CA 92656, 714-362-4211 ..... A•2508
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•1577,2019
§† Rhombus Industries, Huntington Bch., CA 92649-1595, 714-898-0960 ... A•1579
† Technitrol, Philadelphia, PA 19134, 215-426-9105 ..... A•1580-1582
† Automatic Coil Corp., Miami, FL 33147 305-696-6660
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
Datatronics, Inc., Romoland, CA 92585 909-928-7700
§† Delta Products Corporation, Fremont, CA 94538 510-770-0660
EG&G Optoelectronics- Reticon, Sunnyvale, CA 94086-4197 408-738-4266
§ Fee Fil-Mag, San Diego, CA 92123 619-569-6577
GC International Inc., Plano, TX 75074 214-423-8411
† Hytek Microsystems, Inc., Carson City, NV 89706 702-883-0820
§ TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056 708-803-6100
Television Equipment Assocs., So. Salem, NY 10590-0393 914-763-8893
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
§ Valor Electronics, San Diego, CA 92131-1642 619-537-2500

Delay Lines, CMOS-2350

† ESC Electronics Corp., Palisades Pk., NJ 07650, 201-947-0400 ..... A•1552
† Premier Magnetics Inc., Aliso Viejo, CA 92656, 714-362-4211 ..... A•2508
RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•1577,2019
Rhombus Industries, Huntington Bch., CA 92649-1595, 714-898-0960 ... A•1579

ELMEC Technology Of America, Inc., San Mateo, CA 94402 415-341-1611
Fee Fil-Mag, San Diego, CA 92123 619-569-6577
§ JBM Electronics, Inc., Bedford, NH 03110-6802 603-623-0222

Delay Lines, Cable-2350

† **Allen Avionics, Inc., Mineola, NY 11501, 516-248-8080 ..... A•1514**
ESC Electronics Corp., Palisades Pk., NJ 07650, 201-947-0400 ..... A•1552
Amphenol RF Operations, Amphenol Corporation, Danbury, CT 06810 ... 203-743-9272; 800-627-7100
† Automatic Coil Corp., Miami, FL 33147 305-696-6660
§ AVA Electronics Corporation, Drexel Hill, PA 19026 215-284-2500
† Barth Electronics, Inc., Boulder City, NV 89005 702-293-1576
Bel Fuse, Jersey City, NJ 07302 201-432-0463
† C.E. Precision Assemblies, Inc., Chandler, AZ 85226 602-940-0740
† Control Electronics, Neurotech Corp., Farmingdale, NY 11735 516-694-0125
W.W. Fischer Electronic Connectors, Atlanta, GA 30338 1-800-551-0121
GC International Inc., Plano, TX 75074 214-423-8411
W.L. Gore & Assocs., Newark, DE 19714 302-738-4880
† Integrated Microwave, San Diego, CA 92121-1009 619-259-2600
MACOM, Inc., Lowell, MA 01851 617-272-3000
§† Micro-Coax, Collegeville, PA 19426 215-489-3700
† Micro Mode Prods., El Cajon, CA 92020 619-449-3844
Penny Technologies, Inc., Greenpoint, NY 11222 718-782-4149
§† Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018 ..... 408-730-0300;800-PENSTOCK
† Precision Tube, N. Wales, PA 19454 215-699-5801
† Precision Tube Co., Coaxitube Div., Salisbury, MD 21801 410-546-3911
† ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086 408-730-6300
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291
Universal Ad-Yu/D-F Inc., St. Francis, WI 53235 414-482-4100

Delay Lines, Digital-2350

Allen Avionics, Inc., Mineola, NY 11501, 516-248-8080 ..... A•1514,1619
§ Bel Fuse, Jersey City, NJ 07302, 201-432-0463 ..... A•1515-1520,2276-2281
§ Dallas Semiconductor, Dallas, TX 75244, 214-450-0400 ..... A•1525-1527
§† Data Delay Devices, Clifton, NJ 07013-1915, 201-773-2299 ..... A•1528-1529,1534,1542-1544
ELMEC Technology Of America, Inc., San Mateo, CA 94402, 415-341-1611 ..... A•1546-1551
† ESC Electronics Corp., Palisades Pk., NJ 07650, 201-947-0400 .... A•1552-1565
§† JBM Electronics, Inc., Bedford, NH 03110-6802, 603-623-0222 ..... A•1567
§† Kappa Technologies, Inc., Rahway, NJ 07065, 908-396-9400;1-800-223-0603 ..... A•1568-1569
Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ..... A•1571
† Premier Magnetics Inc., Aliso Viejo, CA 92656, 714-362-4211 ..... A•2508
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•1577,2019
§† Rhombus Industries, Huntington Bch., CA 92649-1595, 714-898-0960 ... A•1579
† Technitrol, Philadelphia, PA 19134, 215-426-9105 ..... A•1580-1581
† Automatic Coil Corp., Miami, FL 33147 305-696-6660
CET Technology, Hudson, NH 03051 603-883-5912
Datatronics, Inc., Romoland, CA 92585 909-928-7700
† Engineered Components Co., San Luis Obispo, CA 93403-8121 805-544-3800
† Eventide, Inc., Little Ferry, NJ 07643 201-641-1200
§† FDK America, Inc., Fuji Electrochemical Co., Ltd., San Jose, CA 95134 .. 408-432-8331
Fee Fil-Mag, San Diego, CA 92123 619-569-6577
† Hytek Microsystems, Inc., Carson City, NV 89706 702-883-0820
§† PCA Electronics, Sepulveda, CA 91343 818-892-0761
Phoenix Microwave, Telford, PA 18969 215-723-6011
† Polara Engineering Inc., Fullerton, CA 92633 714-521-0900
TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056 708-803-6100
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
§ Valor Electronics, San Diego, CA 92131-1642 619-537-2500

Delay Lines, Distributed Constant (Fixed)-2350

† **Allen Avionics, Inc., Mineola, NY 11501, 516-248-8080 ..... A•1514**
§† Data Delay Devices, Clifton, NJ 07013-1915, 201-773-2299 ..... A•1543
ELMEC Technology Of America, Inc., San Mateo, CA 94402, 415-341-1611 ..... A•1546-1551
† Kappa Technologies, Inc., Rahway, NJ 07065, 908-396-9400;1-800-223-0603 ..... A•1568-1569
§† PCA Electronics, Sepulveda, CA 91343, 818-892-0761 ..... A•1572
† Premier Magnetics Inc., Aliso Viejo, CA 92656, 714-362-4211 ..... A•2508
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•1577
Rhombus Industries, Huntington Bch., CA 92649-1595, 714-898-0960 ... A•1579
† Automatic Coil Corp., Miami, FL 33147 305-696-6660
Bel Fuse, Jersey City, NJ 07302 201-432-0463
† Control Electronics, Neurotech Corp., Farmingdale, NY 11735 516-694-0125
† Daico Industries, Inc., Rancho Dominguez, CA 90220 310-631-1143
Engineered Components Co., San Luis Obispo, CA 93403-8121 805-544-3800
† Frequency Selective Networks, Woodside, NY 11377 718-424-7500
† Integrated Microwave, San Diego, CA 92121-1009 619-259-2600
Penny Technologies, Inc., Greenpoint, NY 11222 718-782-4149
† Polara Engineering Inc., Fullerton, CA 92633 714-521-0900
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291
§ Television Equipment Assocs., So. Salem, NY 10590-0393 914-763-8893
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
Universal Ad-Yu/D-F Inc., St. Francis, WI 53235 414-482-4100
§ Valor Electronics, San Diego, CA 92131-1642 619-537-2500

Delay Lines, ECL-2350

Bel Fuse, Jersey City, NJ 07302, 201-432-0463 ..... A•1521-1522,2282
ELMEC Technology Of America, Inc., San Mateo, CA 94402, 415-341-1611 ..... A•1546-1549,1551
† ESC Electronics Corp., Palisades Pk., NJ 07650, 201-947-0400 ..... A•1552
RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•1577,2019
Rhombus Industries, Huntington Bch., CA 92649-1595, 714-898-0960 ... A•1579
CET Technology, Hudson, NH 03051 603-883-5912
† Control Electronics, Neurotech Corp., Farmingdale, NY 11735 516-694-0125
† Engineered Components Co., San Luis Obispo, CA 93403-8121 805-544-3800
Fee Fil-Mag, San Diego, CA 92123 619-569-6577
§† JBM Electronics, Inc., Bedford, NH 03110-6802 603-623-0222

Delay Lines, Lumped Constant (Fixed)-2350

† Allen Avionics, Inc., Mineola, NY 11501, 516-248-8080 ..... A•1514
Bel Fuse, Jersey City, NJ 07302, 201-432-0463 ..... A•1521-1522,2282
ELMEC Technology Of America, Inc., San Mateo, CA 94402, 415-341-1611 ..... A•1546-1551
† ESC Electronics Corp., Palisades Pk., NJ 07650, 201-947-0400 .... A•1552-1565
§† Kappa Technologies, Inc., Rahway, NJ 07065, 908-396-9400;1-800-223-0603 ..... A•1568-1569
† KR Electronics, Inc., Avenel, NJ 07001, 908-636-1900 ..... A•1648
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•1577
§† Rhombus Industries, Huntington Bch., CA 92649-1595, 714-898-0960 ... A•1579
† Technitrol, Philadelphia, PA 19134, 215-426-9105 ..... A•1580
† Automatic Coil Corp., Miami, FL 33147 305-696-6660
† BG Electronics, EPC Corp., Mt. Vernon, NY 10550-4430 914-664-5591
† Control Electronics, Neurotech Corp., Farmingdale, NY 11735 516-694-0125
§† Data Delay Devices, Clifton, NJ 07013-1915 201-773-2299
Datatronics, Inc., Romoland, CA 92585 909-928-7700
† Engineered Components Co., San Luis Obispo, CA 93403-8121 805-544-3800
§† FDK America, Inc., Fuji Electrochemical Co., Ltd., San Jose, CA 95134 .. 408-432-8331
§ Fee Fil-Mag, San Diego, CA 92123 619-569-6577
† Frequency Selective Networks, Woodside, NY 11377 718-424-7500
† Hisonic, Inc., Olathe, KS 66051 913-782-0012
† Integrated Microwave, San Diego, CA 92121-1009 619-259-2600
§† JBM Electronics, Inc., Bedford, NH 03110-6802 603-623-0222
James Millen Elctrns., Caywood Elec. Inc., No. Andover, MA 01845 508-975-2711
§† PCA Electronics, Sepulveda, CA 91343 818-892-0761
Penny Technologies, Inc., Greenpoint, NY 11222 718-782-4149
† Polara Engineering Inc., Fullerton, CA 92633 714-521-0900
† Premier Magnetics Inc., Aliso Viejo, CA 92656 714-362-4211
§ TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056 708-803-6100
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291
§ Television Equipment Assocs., So. Salem, NY 10590-0393 914-763-8893
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
Universal Ad-Yu/D-F Inc., St. Francis, WI 53235 414-482-4100
§ Valor Electronics, San Diego, CA 92131-1642 619-537-2500

Delay Lines, Programmable-2350

Allen Avionics, Inc., Mineola, NY 11501, 516-248-8080 ..... A•1514
Bel Fuse, Jersey City, NJ 07302, 201-432-0463 ..... A•1515,2276
§ Dallas Semiconductor, Dallas, TX 75244, 214-450-0400 ..... A•1525-1527
§† Data Delay Devices, Clifton, NJ 07013-1915, 201-773-2299 ..... A•1528-1529,1534,1540
ELMEC Technology Of America, Inc., San Mateo, CA 94402, 415-341-1611 ..... A•1546-1551
† ESC Electronics Corp., Palisades Pk., NJ 07650, 201-947-0400 ..... A•1552-1563,1565
§† JBM Electronics, Inc., Bedford, NH 03110-6802, 603-623-0222 ..... A•1567
§† Kappa Technologies, Inc., Rahway, NJ 07065, 908-396-9400;1-800-223-0603 ..... A•1568
§ PCA Electronics, Sepulveda, CA 91343, 818-892-0761 ..... A•1572-1573
† Polara Engineering Inc., Fullerton, CA 92633, 714-521-0900 ..... A•1576
Premier Magnetics Inc., Aliso Viejo, CA 92656, 714-362-4211 ..... A•2508
§ RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•1577
† Rhombus Industries, Huntington Bch., CA 92649-1595, 714-898-0960 ... A•1579
† Technitrol, Philadelphia, PA 19134, 215-426-9105 ..... A•1580-1583
† Automatic Coil Corp., Miami, FL 33147 305-696-6660
CET Technology, Hudson, NH 03051 603-883-5912
Control Electronics, Neurotech Corp., Farmingdale, NY 11735 516-694-0125
Datatronics, Inc., Romoland, CA 92585 909-928-7700
† Engineered Components Co., San Luis Obispo, CA 93403-8121 805-544-3800
† Eventide, Inc., Little Ferry, NJ 07643 201-641-1200
§ Fee Fil-Mag, San Diego, CA 92123 619-569-6577
Phoenix Microwave, Telford, PA 18969 215-723-6011
† Teledyne Microwave, Mountain View, CA 94043 415-968-2211
Television Equipment Assocs., So. Salem, NY 10590-0393 914-763-8893
§ Valor Electronics, San Diego, CA 92131-1642 619-537-2500

Delay Lines, SAW – See Surface Acoustic Wave Devices (Vol. A)

Delay Lines, TTL-2350

Bel Fuse, Jersey City, NJ 07302, 201-432-0463 .... A•1517-1523,2278-2282,2284
ELMEC Technology Of America, Inc., San Mateo, CA 94402, 415-341-1611 ..... A•1546-1548
† ESC Electronics Corp., Palisades Pk., NJ 07650, 201-947-0400 ..... A•1552
§† JBM Electronics, Inc., Bedford, NH 03110-6802, 603-623-0222 ..... A•1567,2363
Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ..... A•1571
PCA Electronics, Sepulveda, CA 91343, 818-892-0761 ..... A•1574-1575
RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•1577,2019
Rhombus Industries, Huntington Bch., CA 92649-1595, 714-898-0960 ... A•1579
Technitrol, Philadelphia, PA 19134, 215-426-9105 ..... A•1582-1583
† Control Electronics, Neurotech Corp., Farmingdale, NY 11735 516-694-0125
† Engineered Components Co., San Luis Obispo, CA 93403-8121 805-544-3800
Fee Fil-Mag, San Diego, CA 92123 619-569-6577
† Premier Magnetics Inc., Aliso Viejo, CA 92656 714-362-4211

Delay Lines, Ultrasonic-2350

Allen Avionics, Inc., Mineola, NY 11501, 516-248-8080 ..... A•1514,1619

† **Kappa Technologies, Inc., Rahway, NJ 07065, 908-396-9400;1-800-223-0603** ..... **A•1568**
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
† Control Electronics, Neurotech Corp., Farmingdale, NY 11735 516-694-0125
Datatronics, Inc., Romoland, CA 92585 909-928-7700
Murata Erie North America, Inc., Smyrna, GA 30080 404-436-1300
† Phonon Corporation, Simsbury, CT 06070 203-651-0211
† Radio Research Instrument Co., Inc., Waterbury, CT 06704-3506 203-753-5840
† ST Microsonics Corp., Subsidiary of Signal Technology Corporation, Weymouth, MA 02188 617-337-4200
† Teledyne Microwave, Mountain View, CA 94043 415-968-2211
Television Equipment Assocs., So. Salem, NY 10590-0393 914-763-8893

Delay Lines, Video — See Delay Lines, Ultrasonic (Vol. A)

Delay Lines (MIL)-2440 — *See Vol. B*

Demagnetizers-1850

§ **Walker Scientific, Worcester, MA 01606, 508-852-3674;508-853-3232;800-962-4638** ..... **D•1334**
§ Axial Magnetics, Tencal Inc., Simi Valley, CA 93065 805-527-0900
§† Benjamin International, Inc., Lake Worth, FL 33461 407-533-0064
† E M S Development Corp., Farmingdale, NY 11735 516-293-7900
§ GC-Thorsen, Rockford, IL 61105-1209 815-968-9661
§ L & R Mfg. Co., Kearny, NJ 07032 201-991-5330
Mag-Con, St. Paul, MN 55113 612-633-8820
Magnetic Instrumentation, Inc., Indianapolis, IN 46226 317-545-2102
§ Microtran Co. Inc., Valley Stream, NY 11582-0236 516-561-6050
§ Recoton Corp., Long Island City, NY 11101 718-392-6442
† Schonstedt Instrument Co., Reston, VA 22090 703-471-1050
§† Wide Range Elctrns. Corp., Chesterfield, MISSOURI 63005 314-532-5887

Demodulators-1900 — *See Vol. D*

Demodulators, Magnetic-2200 — *See Vol. D*

Densitometers-2900 — *See Vol. D*

Deposition Equipment, Vacuum & Accessories-Also See Evaporation Equipment, Electron Beam-4100 — *See Vol. D*

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Desks, Data Terminal — See Benches, Consoles, Tables (Vol. C)

Desoldering Tools & Equipment — See Soldering Accessories (Vol. C), Soldering Equip. (Vol. C), Soldering Guns (Vol. C), etc.

Detection & Ranging Systems (MIL)-2440 — *See Vol. B*

Detection Systems, Laser-3700 — *See Vol. B*

Detectors, Air Flow-2900 — *See Vol. D*

Detectors, Arc (for high power tubes)-2900 — *See Vol. D*

Detectors, RF-2900 — *See Vol. D*

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Detectors, Coaxial-2900 — *See Vol. D*

Detectors, Corona — See Testers, Corona (Vol. D)

Detectors, Crystal-2300

BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
§ FEI Microwave, Inc., Frequency Electronics, Inc., Sunnyvale, CA 94086 408-732-0880
Flann Microwave Inc., Cambridge, MA 02139 1-800-937-3772
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
† JFW Industries, Inc., Indianapolis, IN 46237 317-887-1340
† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
Lixi, Inc. Downers Grove, IL 60515 708-620-4646
† Loral Microwave Narda, Hauppauge, NY 11788 516-231-1700
† M/A COM Ltd., Bedfordshire, ENGLAND LU5 4SX, England ..... 44(582)471200
† Microlab/FXR, Livingston, NJ 07039 201-992-7700
† Microphase, Norwalk, CT 06856 203-866-8000
Microwave Development Laboratories, Natick, MA 01760 508-655-0060
§ Nuclear Measurements Group, Oxford Instruments, Inc., Oak Ridge, TN 37831-2560 615-483-8405
† RLC Electronics, Inc., Mt. Kisco, NY 10549 914-241-1334
† Sage Laboratories, Inc., Natick, MA 01760 508-653-0844
§† Telephonics Corporation/PRD Instruments, Huntington, NY 11743 ..... 516-549-6415/6428
Teleplex, Inc., Alford Division, Woburn, MA 01801 617-935-8610
Trilithic, Inc., Indianapolis, IN 46236 800-344-2412
§ Wiltron, Morgan Hill, CA 95037-2809 408-778-2000

Detectors, Fiber Optic-2475 — *See Vol. B*

Detectors, Flaw & Defect-2900 — *See Vol. D*

Detectors, GaAs-3450

Hamamatsu Corp., Hamamatsu Photonics, K.K., Bridgewater, NJ 08807, 908-231-0960 ..... **B•1317-1319**
Abom Electronics Inc., San Jose, CA 95131 408-436-5444
Houston Atlas, Envirotech Controls, Inc., Kingwood, TX 77339-3804 713-348-1000
§ Micro Switch, A Honeywell Div., Freeport, IL 61032 1-800-537-6945
Oriel Corp., Stratford, CT 06497-0872 203-377-8282
§ Siemens Components, Inc., Optoelectronics Division, Cupertino, CA 95014 408-257-7910
Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900

Detectors, Gas-2900 — *See Vol. D*

Detectors, Impedance — See Meters, Impedance (Vol. D)

Detectors, Infrared-3700 — *See Vol. B*

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Detectors, Light Intensity — See Meters, Light, Nonphotographic (Vol. D)

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Detectors, Metal, Handheld-4100 — *See Vol. D*

Detectors, Metal, Walk Through-4100 — *See Vol. D*

Detectors, Microwave-3450

Microwave Filter Inc., East Syracuse, NY 13057-0486, 315-437-3953;800-448-1666 ..... **A•1659**
† **Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500** ..... **A•1725**
† AIL Systems, Inc., Eaton Corp., Deer Park, NY 11729 516-595-3094
† Alan Industries Inc., Columbus, IN 47202 812-372-8869
† Alpha Industries, Inc., Woburn, MA 01801 617-935-5150
§† Avantek, Inc, A Subsidiary of Hewlett-Packard, Santa Clara, CA 95054 408-727-0700
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
† Bird Electronic Corp., Cleveland, OH 44139-2794 216-248-1200
† Eastern Microwave, Winchester, MA 01890 617-721-9800
Elcom Systems, Inc., Boca Raton, FL 33487 407-994-1774
† EMC Technology Inc, Cherry Hill, NJ 08034 609-429-7800
§ FEI Microwave, Inc., Frequency Electronics, Inc., Sunnyvale, CA 94086 408-732-0880
Flann Microwave Inc., Cambridge, MA 02139 1-800-937-3772
† General Microwave Corporation, Amityville, NY 11701 516-226-8900
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
§ Holaday Industries, Inc., Eden Prairie, MN 55344 612-934-4920
Hyletronics:Litton Industries, Lexington, MA 02173-3199 617-276-3298
† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
Lectronic Research Labs., Inc., Camden, NJ 08104 800-358-8378
MACOM, Inc., Lowell, MA 01851 617-272-3000
§† M/A-COM Omni Spectra, Inc., Waltham, MA 02254-9101 617-890-4750
† Maury Microwave Corp., Ontario, CA 91764 909-987-4715
† Microlab/FXR, Livingston, NJ 07039 201-992-7700
† Microphase, Norwalk, CT 06856 203-866-8000
Microwave Development Laboratories, Natick, MA 01760 508-655-0060
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3 ..... 514-694-6666; 800-724-3911
§ Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018 ..... 408-730-0300;800-PENSTOCK
Peter Parts & Assocs., Webster, NY 14580 716-265-2540
† Premier Microwave, Port Chester, NY 10573 914-939-8900
† RLC Electronics, Inc., Mt. Kisco, NY 10549 914-241-1334
† Sage Laboratories, Inc., Natick, MA 01760 508-653-0844
§ Simpson Electric Co., Elgin, IL 60120 708-697-2260
Sivers IMA AB, Culver City, CA 90230 213-306-4248
† Stock Drive Products, a DSG Company, New Hyde Pk., NY 11042-5416 ..... 516-328-0200;328-3300
§† Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
§† Telephonics Corporation/PRD Instruments, Huntington, NY 11743 ..... 516-549-6415, 6428
† Teloric/Berkeley, Berkeley Inds. Inc., Laguna Beach, CA 92652 714-494-9401
Trilithic, Inc., Indianapolis, IN 46236 800-344-2412
Tucker Electronics, Dallas, TX 75355-1419 ..... 214-348-8800;800-527-4642
† Vectronics Microwave Corp., Middlesex, NJ 08846 908-356-2377
§ Wiltron, Morgan Hill, CA 95037-2809 408-778-2000

Detectors, Null — See Indicators, Null (Vol. D)

Detectors, Phase Sensitive-2900 — *See Vol. D*

Detectors, Photovoltaic — See Cells, Photovoltaic (Vol. B)

Detectors, RF-2900 — *See Vol. D*

Detectors, Radiation-2900 — *See Vol. D*

Detectors, Resistance Temperature (RTDs) — See Thermometers, Resistance (Vol. D)

Detectors, Standing Wave-2900 — *See Vol. D*

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DIACs-4800

§ **NTE Electronics, Inc., Bloomfield, NJ 07003, 201-748-5089 ..... A•2149**
§ **Philips ECG, North American Philips Co., Williamsport, PA 17701, 717-323-4691 ..... A•2172**
§ **Teccor Electronics, Inc., Irving, TX 75038, 214-580-1515 ..... A•2220-2223**
American Microsemiconductor, Inc., Madison, NJ 07940 201-377-9566
Central Semiconductor Corp., Hauppauge, NY 11788 516-435-1110
§ Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
Raytheon/TAG Semiconductors Ltd., Burlington, MA. 01803 ..... 617-272-3704 (3705)
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006 214-466-6000

Dials, Instrument, Metal, Plastic, etc.-2400 — *See Vol. C*

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Digitizers, Video-2000 — *See Vol. D*

Digitizers, Pencil Follower (Incl. Coordinate & Graphic)-2000 — *See Vol. D*

Digitizers, Transient & Waveform-2900 — *See Vol. D*

Dimmers, Light — See Controls, Lamp Dimming, Flashing (Vol. D)

Diode Arrays (Incl. Photo)-3700 — *See Vol. B*

Diodes, Avalanche-4800

§† BKC Semiconductors Incorporated., Lawrence, MA 01841, 508-681-0392 ..... A•2131
§ **Electronic Devices, Inc., Yonkers, NY 10710, 914-965-4400 ..... A•2143**
§ **NTE Electronics, Inc., Bloomfield, NJ 07003, 201-748-5089 ..... A•2149**
§ **Philips ECG, North American Philips Co., Williamsport, PA 17701, 717-323-4691 ..... A•2173**
§† **Semtech Corporation, Newbury Park, CA 91320, 805-498-2111 ..... A•2180**
§ **World Products Inc., Sonoma, CA 95476, 707-996-5201 ... A•2224-2225, B•1399**
† Advanced Photonix, Inc., Camarillo, CA 93012 805-484-2884
§ A E G Corporation, Basking Ridge, NJ 07920 908-204-8900
American Microsemiconductor, Inc., Madison, NJ 07940 201-377-9566
§ Continental Device India Limited, New Delhi, INDIA 110028 ..... 536150-53 (4 lines)
Diotec Electronics Corp., Gardena, CA 90248 310-767-1052
† Edal Industries, East Haven, CT 06512 203-467-2591
§# EG&G Optoelectronics, EG&G Canada Ltd., Vaudreuil, Quebec, CANADA J7V 8P7 514-424-3300
Hamamatsu Corp., Hamamatsu Photonics, K.K., Bridgewater, NJ 08807 908-231-0960
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
§ Hitachi America, Ltd., Tarrytown, NY 10591 914-631-0600
† M/A COM Ltd., Bedfordshire, ENGLAND LU5 4SX, England ..... 44(582)471200
§Φ Micro Quality Semiconductor, Inc., Microsemi Corp., Garland, TX 75042 214-272-7811
§† Microsemi Corp., Santa Ana, CA 92799-6890 714-979-8220
§† Microsemi Corp. - Scottsdale, Microsemi Corporation, Scottsdale, AZ 85252-1390 602-941-6300
† Microwave Device Tech., Westford, MA 01886 508-692-7800
§ Mitsubishi Elctrns. America, Inc., Elctrn. Device Grp., Sunnyvale, CA 94086 408-730-5900
§† Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
§ Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404 407-881-3200
§ Philips Components Discrete Products Div., Discrete Semiconductor Group, Slatersville, RI 02876-2078 401-762-3800
Renard Manufacturing Company, Inc., Miami, FL 33122-1015 305-592-1500
§ RF Electronics, Inc., Irvine, CA 92714-5517 714-263-0661
Sanken Electric USA Corp., Hoffman Estates, IL 60195 708-519-1717
§ Semikron, Inc., Hudson, NH 03051-0066 ..... 603-883-8102;1-800-258-1308
§ Solid State, Inc., Bloomfield, NJ 07003-2596 201-429-8700
† Solid State Devices, La Mirada, CA 90638 714-670-7734
§† St-Semiconductors of Indiana, Inc., Bloomington, IN 47402-0609 812-332-1435
† Texas Optoelectronics, Inc., Garland, TX 75042 214-487-0085
† Voltage Multipliers, Inc., Visalia, CA 93291 209-651-1402
World Products Inc., Systems Devices Grp., Sonoma 95476 707-996-5201

Diodes, Backward-4800

BKC Semiconductors Incorporated., Lawrence, MA 01841, 508-681-0392 ..... A•2131
American Microsemiconductor, Inc., Madison, NJ 07940 201-377-9566
Diotec Electronics Corp., Gardena, CA 90248 310-767-1052
† Edal Industries, East Haven, CT 06512 203-467-2591
§† Germanium Power Devices, Andover, MA 01810-3065 508-475-5982
† Microphase, Norwalk, CT 06856 203-866-8000
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
† Solid State Devices, La Mirada, CA 90638 714-670-7734

Diodes, Breakdown — See Diodes, Avalanche (Vol. A)

Diodes, Chip, Unpackaged-4800

§ **Electronic Devices, Inc., Yonkers, NY 10710, 914-965-4400 ..... A•2143**
§ **Zetex, Inc., Zetex plc., Commack, NY 11725, 516-543-7100 ..... A•2227**
† Advanced Photonix, Inc., Camarillo, CA 93012 805-484-2884
§† Allegro MicroSystems, Inc., formerly Sprague Semiconductor Grp., Worcester, MA 01605 508-795-1300
Alpha Industries, Inc., Woburn, MA 01801 617-935-5150
American Microsemiconductor, Inc., Madison, NJ 07940 201-377-9566
Bosch, Robert, Corp., Broadview, IL 60153 708-865-5301
Centronic, Inc., The Morgan Crucible Company plc, Newbury Park, CA 91320-1702 805-499-5902
§† Compensated Devices Incorporated, Melrose, MA 02176 617-665-1071
† Dionics, Westbury, NY 11590 516-997-7474
Diotec Electronics Corp., Gardena, CA 90248 310-767-1052
Edal Industries, East Haven, CT 06512 203-467-2591
EG&G Optoelectronics, EG&G Canada Ltd., Vaudreuil, Quebec, CANADA J7V 8P7 514-424-3300
General Instrument, Power Semiconductor Div., Hicksville, NY 11802 516-933-3333
† M/A COM Ltd., Bedfordshire, ENGLAND LU5 4SX, England ..... 44(582)471200
Φ Micro Quality Semiconductor, Inc., Microsemi Corp., Garland, TX 75042 214-272-7811
† Microsemi Corp., Santa Ana, CA 92799-6890 714-979-8220
§ Microsemi Corp. Colorado, Microsemi Corp., Broomfield, CO 80020 303-469-2161
† Microsemi Corporation, Power Technology Components, Torrance, CA 90501 310-534-3737
§† Microsemi Corp. - Scottsdale, Microsemi Corporation, Scottsdale, AZ 85252-1390 602-941-6300
† Microwave Device Tech., Westford, MA 01886 508-692-7800
Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
MSI Electronics, Inc., Woodside, NY 11377 718-672-6500
New England Semiconductor, Lawrence, MA 01841 ..... 508-794-1666;800-446-1158
§† Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018 ..... 408-730-0300;800-PENSTOCK
§ Semikron, Inc., Hudson, NH 03051-0066 ..... 603-883-8102;1-800-258-1308
§ Shindengen America Inc., Westlake Vl, CA 91362 800-634-3654
† Silicon Sensors, Dodgeville, WI 53533 608-935-2707
† Solid State Devices, La Mirada, CA 90638 714-670-7734
Texas Optoelectronics, Inc., Garland, TX 75042 214-487-0085

Diodes, Electroluminescent (Radiating)-4800

Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ..... A•2118
§ A E G Corporation, Basking Ridge, NJ 07920 908-204-8900
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
§† Leecraft Mfg., Long Island City, NY 11101 718-392-8800

Diodes, Frequency Multiplier-4800

Centronic, Inc., The Morgan Crucible Company plc, Newbury Park, CA 91320-1702, 805-499-5902 ..... B•1313-1314
Semtech Corporation, Newbury Park, CA 91320, 805-498-2111 ..... A•2180
§ Alpha Industries, Inc., Woburn, MA 01801 617-935-5150
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
† M/A COM Ltd., Bedfordshire, ENGLAND LU5 4SX, England ..... 44(582)471200
† Microwave Device Tech., Westford, MA 01886 508-692-7800
Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900

Diodes, Germanium-4800

§† **BKC Semiconductors Incorporated., Lawrence, MA 01841, 508-681-0392 ..... A•2131**
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ..... A•2118, B•1181
American Microsemiconductor, Inc., Madison, NJ 07940 201-377-9566
Central Semiconductor Corp., Hauppauge, NY 11788 516-435-1110
Diodes Inc., Chatsworth, CA 91311 ..... 818-882-4920;800-821-1178
† EG & G Judson, Montgomeryville, PA 18936 215-368-6900
EG&G Optoelectronics, EG&G Canada Ltd., Vaudreuil, Quebec, CANADA J7V 8P7 514-424-3300
Hamamatsu Corp., Hamamatsu Photonics, K.K., Bridgewater, NJ 08807 908-231-0960
§ International Components Corp., Melville, NY 11747 516-293-1500
§ International Diode, Harrison, NJ 07029 201-482-6518
ISL Products Int'l, Ltd., Syosset, NY 11791-6093 ..... 516-937-3475;800-626-6116
§ Laube Technology, Woodland Hills, CA 91367 818-703-1188
† Microphase, Norwalk, CT 06856 203-866-8000
Mouser Electronics, Santee, CA 92071 800-346-6873
Mouser Electronics, Mansfield, TX 76063 800-346-6873
Mouser Electronics, Gilroy, CA 95020 800-346-6873
§ NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
§ Nuclear Measurements Group, Oxford Instruments, Inc., Oak Ridge, TN 37831-2560 615-483-8405
§ Philips ECG, North American Philips Co., Williamsport, PA 17701 717-323-4691
§ RF Electronics, Inc., Irvine, CA 92714-5517 714-263-0661
Scientific Instruments, West Palm Beach, FL 33407 407-881-8500
§ Semiconductor Technology, Inc., Stuart, FL 34997 407-283-4500
§ Solid State, Inc., Bloomfield, NJ 07003-2596 201-429-8700
† 2M Sales Company, Burnsville, MN 55337 612-890-7774

Diodes, Gunn-4800

§ Alpha Industries, Inc., Woburn, MA 01801 617-935-5150
MACOM, Inc., Lowell, MA 01851 617-272-3000
† M/A COM Ltd., Bedfordshire, ENGLAND LU5 4SX, England ..... 44(582)471200
† Microwave Device Tech., Westford, MA 01886 508-692-7800

Diodes, High Voltage (1,000 Volts & Over)-4800

§ Collmer Semiconductor, Inc., Dallas, TX 75244, 800-527-0251;214-233-1589 ..... A•2135, D•1630
Electronic Devices, Inc., Yonkers, NY 10710, 914-965-4400 ..... A•2143
§ Frontier Electronics, Simi Valley, CA 93065, 805-522-9998 ..... A•1236
§ Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... A•2153
§ Philips ECG, North American Philips Co., Williamsport, PA 17701, 717-323-4691 ..... A•2173
§ Powerex, Inc., Youngwood, PA 15697-1800, 412-925-7272 ..... A•2175
§ Semtech Corporation, Newbury Park, CA 91320, 805-498-2111 ..... A•2180
§† Solitron Devices, Inc., Semiconductor Group, West Palm Beach, FL 33407-4697, 407-848-4311 ..... A•2219
§ World Products Inc., Sonoma, CA 95476, 707-996-5201 ..... B•1399
§ Alpha Industries, Inc., Woburn, MA 01801 617-935-5150
American Microsemiconductor, Inc., Madison, NJ 07940 201-377-9566
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
§ C-S Electronic Sales, Inc., Frankfort, IN 46041 317-659-1874
Diodes Inc., Chatsworth, CA 91311 ..... 818-882-4920;800-821-1178
Diotec Electronics Corp., Gardena, CA 90248 310-767-1052
† Edal Industries, East Haven, CT 06512 203-467-2591
§ Hitachi America, Ltd., Tarrytown, NY 10591 914-631-0600
† HV Component Associates Inc., Farmingdale, NJ 07727 908-938-4499
International Components Corp., Melville, NY 11747 516-293-1500
§ International Diode, Harrison, NJ 07029 201-482-6518
§ International Rectifier Corp., El Segundo, CA 90245 310-322-3331
§Φ Micro Quality Semiconductor, Inc., Microsemi Corp., Garland, TX 75042 214-272-7811
§† Microsemi Corp., Santa Ana, CA 92799-6890 714-979-8220
§ Microsemi Corp. Colorado, Microsemi Corp., Broomfield, CO 80020 303-469-2161
† Microwave Device Tech., Westford, MA 01886 508-692-7800
Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
§ NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
§ Philips Components Discrete Products Div., Discrete Semiconductor Group, Slatersville, RI 02876-2078 401-762-3800
§ Promax-Johnton Electronic Corp., Irvine, CA 92714 714-975-1245
§ RF Electronics, Inc., Irvine, CA 92714-5517 714-263-0661
Sanken Electric USA Corp., Hoffman Estates, IL 60195 708-519-1717
§ Semiconductor Technology, Inc., Stuart, FL 34997 407-283-4500
§ Semikron, Inc., Hudson, NH 03051-0066 ..... 603-883-8102;1-800-258-1308
Sensitron Semiconductor, RSM Electron Power Div., Deer Park, NY 11729 516-586-7600
§ Shindengen America Inc., Westlake Vl, CA 91362 800-634-3654
§ Solid State, Inc., Bloomfield, NJ 07003-2596 201-429-8700
† Solid State Devices, La Mirada, CA 90638 714-670-7734
§† St-Semiconductors of Indiana, Inc., Bloomington, IN 47402-0609 812-332-1435
Victoreen, Inc., Solon, OH 44139-3395 ..... 216-248-9300;216-248-9043
† Voltage Multipliers, Inc., Visalia, CA 93291 209-651-1402
World Products Inc., Systems Devices Grp., Sonoma 95476 707-996-5201

Diodes, Hot Carrier-4800

BKC Semiconductors Incorporated., Lawrence, MA 01841, 508-681-0392 ..... A•2131
§ Alpha Industries, Inc., Woburn, MA 01801 617-935-5150
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
§ Microsemi Corp. Colorado, Microsemi Corp., Broomfield, CO 80020 303-469-2161
§† Microsemi Corp. - Scottsdale, Microsemi Corporation, Scottsdale, AZ 85252-1390 602-941-6300
† 2M Sales Company, Burnsville, MN 55337 612-890-7774

Diodes, Impatt-4800

Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
MACOM, Inc., Lowell, MA 01851 617-272-3000
† M/A COM Ltd., Bedfordshire, ENGLAND LU5 4SX, England ..... 44(582)471200
† Microwave Device Tech., Westford, MA 01886 508-692-7800

Diodes, Infrared-4800

Centronic, Inc., The Morgan Crucible Company plc, Newbury Park, CA 91320-1702, 805-499-5902 ..... B•1313
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647, 402-563-6506 ..... B•1026
§ Dialight Corporation, Manasquan, NJ 08736, 908-223-9400 ..... B•1141
† Gilway Technical Lamp, Woburn, MA 01801, 617-935-4442 ..... B•1152
Idea, Inc., Brea, CA 92621, 310-697-4332 ..... B•1164
Imatronic, Inc., Batavia, IL 60510, 708-406-1920 ..... B•1323
Micro Switch, A Honeywell Div., Freeport, IL 61032, 1-800-537-6945 ..... B•1324
§ NEC Electronics, Inc., Mountain View, CA 94039-7241, 1-800-366-9782 ..... B•1332
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ..... A•2118, B•1181
I I Stanley Co., Inc., Irvine, CA 92714, 1-800-LED-LCD1 ..... B•1188
§ Zetex, Inc., Zetex plc., Commack, NY 11725, 516-543-7100 ..... A•2227
† Advanced Photonix, Inc., Camarillo, CA 93012 805-484-2884
BT & D Technologies, Kennett Square, PA 19348 ..... 215-444-6888;800-545-4306
Clarostat Sensors and Controls Group, BYR, PLC, Plano, TX 75075 ..... 214-422-1844; 1-800-872-0044
§ Codenoll Technology Corp., Yonkers, NY 10701 914-965-6300
§† Data Display Products, El Segundo, CA 90245-4630 ..... 310-640-0442;800-421-6815
† EG & G Judson, Montgomeryville, PA 18936 215-368-6900
EG&G Optoelectronics, EG&G Canada Ltd., Vaudreuil, Quebec, CANADA J7V 8P7 514-424-3300
Eina America, Inc., Cypress, CA 90630 714-761-8600
Hamamatsu Corp., Hamamatsu Photonics, K.K., Bridgewater, NJ 08807 908-231-0960
Ledtech Electronics Corp., Valencia, CA 91355 805-257-6964
† Ledtronics, Inc., Torrance, CA 90505 310-534-1505
§ Lite-On Inc., Milpitas, CA 95035 408-946-4873
§ Lumex Opto/Components, Inc., Palatine, IL 60067-6955 708-359-2790
§ Marktech International Corp., Latham, NY 12110 518-786-6591
§ Micro Lamps, Inc., Batavia, IL 60510-1488 708-879-0900
§ Mitsubishi Elctrns. America, Inc., Elctrn. Device Grp., Sunnyvale, CA 94086 408-730-5900
Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
§ Okaya Electric America, Inc., Okaya Electric Industries, Tokyo, Japan, Valparaiso, IN 46383 219-477-4488
§ Optek Technology Inc., Carrollton, TX 75006 214-323-2200
† Opto Diode Corp., Newbury Park, CA 91320 805-499-0335
§ Opto Technology, Inc., Wheeling, IL 60090 708-537-4277
Oxley Inc., Branford, CT 06405 203-488-1033
Power Technology, Inc., Little Rock, AR 72219-1117 501-568-1995
§ Promax-Johnton Electronic Corp., Irvine, CA 92714 714-975-1245
RF Electronics, Inc., Irvine, CA 92714-5517 714-263-0661
§ Sanyo Semiconductor Corp., Allendale, NJ 07401 201-825-8080
§ Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98607 206-834-2500
Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
†# Spectrum Devices, Sugar Land, TX 77487-1586 713-242-6417
† Texas Optoelectronics, Inc., Garland, TX 75042 214-487-0085
§ Three-Five Sys., Inc., Phoenix, AZ 85044 602-496-0035
Warnco, Inc., Fountain Valley, CA 92708 714-545-5560

Diodes, Laser-4800

Analog Modules, Inc., Longwood, FL 32750-3426, 407-339-4355 ..... B•1210, D•1573
Centronic, Inc., The Morgan Crucible Company plc, Newbury Park, CA 91320-1702, 805-499-5902 ..... B•1313
Gilway Technical Lamp, Woburn, MA 01801, 617-935-4442 ..... B•1153
Imatronic, Inc., Batavia, IL 60510, 708-406-1920 ..... B•1323
§† Laser Diode, Inc., A Morgan Crucible Company, Edison, NJ 08820, 908-549-9001 ..... B•1213-1214
Micro Switch, A Honeywell Div., Freeport, IL 61032, 1-800-537-6945 ..... B•1324
§ NEC Electronics, Inc., Mountain View, CA 94039-7241, 1-800-366-9782 ..... B•1332
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ..... A•2118, B•1181
§ A E G Corporation, Basking Ridge, NJ 07920 908-204-8900
AT&T Microelectronics, Allentown, PA 18103 ..... 1-800-372-2447;In Can.:1-800-553-2448
BT & D Technologies, Kennett Square, PA 19348 ..... 215-444-6888;800-545-4306
† D. O. Industries, Rochester, NY 14623 716-359-4000
§# EG&G Optoelectronics, EG&G Canada Ltd., Vaudreuil, Quebec, CANADA J7V 8P7 514-424-3300
§ EXFO. E.O. Engineering, Inc., Vanier, QC., CANADA G1M 3G7 ..... 418-683-0211; 1-800-663-EXFO
§ Mitsubishi Elctrns. America, Inc., Elctrn. Device Grp., Sunnyvale, CA 94086 408-730-5900
Optima Precision, Inc., West Linn, OR 97068 ..... 800-544-4118;503-638-2525
Oriel Corp., Stratford, CT 06497-0872 203-377-8282
Ortel Corp., Alhambra, CA 91803 818-281-3636
Philips Technologies, North American Philips Corporation, Cheshire, CT 06410 203-271-6525
Philips Technologies, Philips Key Modules Group, San Jose, CA 95110 408-453-7373
Power Technology, Inc., Little Rock, AR 72219-1117 501-568-1995
Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013 615-641-2020
§ Sanyo Semiconductor Corp., Allendale, NJ 07401 201-825-8080
§ Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98607 206-834-2500
§ Sony Component Products Co, Semiconductor Division, Cypress, CA 90630 714-229-4197
Xenon Corp., Woburn, MA 01801 617-938-3594

Diodes, Light Emitting (LEDs)-3700 — *See Vol. B*

Diodes, Liquid Crystal (LCDs)-3700 — *See Vol. B*

Diodes, Microwave Detector-4800

§† Alpha Industries, Inc., Woburn, MA 01801 617-935-5150
Elcom Systems, Inc., Boca Raton, FL 33487 407-994-1774
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
MACOM, Inc., Lowell, MA 01851 617-272-3000
† M/A COM Ltd., Bedfordshire, ENGLAND LU5 4SX, England ..... 44(582)471200
† Microphase, Norwalk, CT 06856 203-866-8000
† Microwave Device Tech., Westford, MA 01886 508-692-7800
§† Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018 ..... 408-730-0300;800-PENSTOCK
Peter Parts & Assocs., Webster, NY 14580 716-265-2540
Sanken Electric USA Corp., Hoffman Estates, IL 60195 708-519-1717
§ Shindengen America Inc., Westlake Vl, CA 91362 800-634-3654

Diodes, Microwave Mixer-4800

§† Alpha Industries, Inc., Woburn, MA 01801 617-935-5150
† California Eastern Labs. Inc., Santa Clara, CA 95056-0964 408-988-3500
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
MACOM, Inc., Lowell, MA 01851 617-272-3000
† M/A COM Ltd., Bedfordshire, ENGLAND LU5 4SX, England ..... 44(582)471200
† Microphase, Norwalk, CT 06856 203-866-8000
† Microwave Device Tech., Westford, MA 01886 508-692-7800
§† Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018 ..... 408-730-0300;800-PENSTOCK
Peter Parts & Assocs., Webster, NY 14580 716-265-2540
§ Shindengen America Inc., Westlake Vl, CA 91362 800-634-3654

Diodes, Noise-4800

† Noise Com Inc., Paramus, NJ 07652, 201-261-8797 ..... A•1848, D•1298

† Accu-Noise Lab, Marek Technology Inc., Danbury, CT 06811 203-743-3633
§ Alpha Industries, Inc., Woburn, MA 01801 617-935-5150
† Koep Precision Standards, Inc., Tuckerton, NJ 08087 609-296-9686
§ Loral Microwave-FSI, Semiconductor Div., Chelmsford, MA 01824 ..... 508-256-4113/8101
MACOM, Inc., Lowell, MA 01851 617-272-3000
† MDF Products Inc., Danbury, CT 06811 203-743-3579
† Micronetics, Hudson, NH 03051 603-883-2900
§† Microsemi Corp., Santa Ana, CA 92799-6890 714-979-8220
§† Microsemi Corp. - Scottsdale, Microsemi Corporation, Scottsdale, AZ 85252-1390 602-941-6300
† Microwave Device Tech., Westford, MA 01886 508-692-7800

Diodes, Photoelectric-3700 — *See Vol. B*

Diodes, PIN-4800

Hamamatsu Corp., Hamamatsu Photonics, K.K., Bridgewater, NJ 08807, 908-231-0960 ..... B•1320
§† Laser Diode, Inc., A Morgan Crucible Company, Edison, NJ 08820, 908-549-9001 ..... B•1213-1214
Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500 ..... A•1725
NEC Electronics, Inc., Mountain View, CA 94039-7241, 1-800-366-9782 ..... B•1327-1328,1331-1334
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ..... A•2118
H Stanley Co., Inc., Irvine, CA 92714, 1-800-LED-LCD1 ..... B•1188
Zetex, Inc., Zetex plc., Commack, NY 11725, 516-543-7100 ..... A•2227
Aborn Electronics Inc., San Jose, CA 95131 408-436-5444
† Advanced Photonix, Inc., Camarillo, CA 93012 805-484-2884
§ A E G Corporation, Basking Ridge, NJ 07920 908-204-8900
§ Alpha Industries, Inc., Woburn, MA 01801 617-935-5150
AT&T Microelectronics, Allentown, PA 18103 ..... 1-800-372-2447;In Can.:1-800-553-2448
BT & D Technologies, Kennett Square, PA 19348 ..... 215-444-6888;800-545-4306
† Centronic, Inc., The Morgan Crucible Company plc, Newbury Park, CA 91320-1702 805-499-5902
Clarostat Sensors and Controls Group, BYR, PLC, Plano, TX 75075 ..... 214-422-1844; 1-800-872-0044
§# EG&G Optoelectronics, EG&G Canada Ltd., Vaudreuil, Quebec, CANADA J7V 8P7 514-424-3300
§ EG & G Vactec, St. Louis, MO 63132 314-423-4900
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
§ Loral Microwave-FSI, Semiconductor Div., Chelmsford, MA 01824 ..... 508-256-4113 8101
MACOM, Inc., Lowell, MA 01851 617-272-3000
† M/A COM Ltd., Bedfordshire, ENGLAND LU5 4SX, England ..... 44(582)471200
† Microsemi Corporation, Power Technology Components, Torrance, CA 90501 310-534-3737
† Microwave Device Tech., Westford, MA 01886 508-692-7800
§ Mitsubishi Elctrns. America, Inc., Elctrn. Device Grp., Sunnyvale, CA 94086 408-730-5900
§ Optek Technology Inc., Carrollton, TX 75006 214-323-2200
§† Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018 ..... 408-730-0300;800-PENSTOCK
§ Philips ECG, North American Philips Co., Williamsport, PA 17701 717-323-4691
§ Sanyo Semiconductor Corp., Allendale, NJ 07401 201-825-8080
§ Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98607 206-834-2500
† Texas Optoelectronics, Inc., Garland, TX 75042 214-487-0085
§† Unitrode Corp., Watertown, MA 02172 617-926-0404

Diodes, Power, Surface Mount-4800

§† BKC Semiconductors Incorporated., Lawrence, MA 01841, 508-681-0392 ..... A•2131
§ Collmer Semiconductor, Inc., Dallas, TX 75244, 800-527-0251;214-233-1589 ..... A•2135
Crydom Company, Long Beach, CA 90805, 310-865-3536 ..... A•2136-2137,2139-2141
§ QMI/NIEC, Twin Oaks, CA 93518, 805-867-2555 ..... A•2176-2177
§ Semtech Corporation, Newbury Park, CA 91320, 805-498-2111 ..... A•2180
American Microsemiconductor, Inc., Madison, NJ 07940 201-377-9566
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
§ Baknor Industries Inc., Mississauga, ONT., CANADA L5L 1X1 416-828-2400
Bosch, Robert, Corp., Broadview, IL 60153 708-865-5301
Central Semiconductor Corp., Hauppauge, NY 11788 516-435-1110
C-S Electronic Sales, Inc., Frankfort, IN 46041 317-659-1874
Diodes Inc., Chatsworth, CA 91311 ..... 818-882-4920;800-821-1178
Diotec Electronics Corp., Gardena, CA 90248 310-767-1052
§ International Rectifier Corp., El Segundo, CA 90245 310-322-3331
† Microsemi Corp., Santa Ana, CA 92799-6890 714-979-8220
§ Microsemi Corp. Colorado, Microsemi Corp., Broomfield, CO 80020 303-469-2161
† Microsemi Corporation, Power Technology Components, Torrance, CA 90501 310-534-3737
§† Microsemi Corp. - Scottsdale, Microsemi Corporation, Scottsdale, AZ 85252-1390 602-941-6300
§† Optek Technology Inc., Carrollton, TX 75006 214-323-2200
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
§ RF Electronics, Inc., Irvine, CA 92714-5517 714-263-0661
§ Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013 615-641-2020
§† Sensitron Semiconductor, RSM Electron Power Div., Deer Park, NY 11729 516-586-7600
† Voltage Multipliers, Inc., Visalia, CA 93291 209-651-1402

Diodes, Schottky-4800

§† BKC Semiconductors Incorporated., Lawrence, MA 01841, 508-681-0392 ..... A•2131
§ Collmer Semiconductor, Inc., Dallas, TX 75244, 800-527-0251;214-233-1589 ..... A•2135, D•1630
§ ITT Components, ITT Corporation, Irvine, CA 92718, 714-727-3001 ..... A•2147
§ Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... A•2152,2159
§ QMI/NIEC, Twin Oaks, CA 93518, 805-867-2555 ..... A•2176-2177
§ Semtech Corporation, Newbury Park, CA 91320, 805-498-2111 ..... A•2180
§ Zetex, Inc., Zetex plc., Commack, NY 11725, 516-543-7100 ..... A•2227
§ Allegro MicroSystems, Inc., formerly Sprague Semiconductor Grp., Worcester, MA 01605 508-795-1300
§ Alpha Industries, Inc., Woburn, MA 01801 617-935-5150
American Microsemiconductor, Inc., Madison, NJ 07940 201-377-9566
† California Eastern Labs. Inc., Santa Clara, CA 95056-0964 408-988-3500
§† California Micro Devices, Inc., Milpitas, CA 95035 408-263-3214
Central Semiconductor Corp., Hauppauge, NY 11788 516-435-1110
§† Compensated Devices Incorporated, Melrose, MA 02176 617-665-1071
§ C-S Electronic Sales, Inc., Frankfort, IN 46041 317-659-1874
Diodes Inc., Chatsworth, CA 91311 ..... 818-882-4920;800-821-1178
Diotec Electronics Corp., Gardena, CA 90248 310-767-1052
Elcom Systems, Inc., Boca Raton, FL 33487 407-994-1774
§† Germanium Power Devices, Andover, MA 01810-3065 508-475-5982
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
§ International Components Corp., Melville, NY 11747 516-293-1500
§† International Rectifier Corp., El Segundo, CA 90245 310-322-3331
§ Laube Technology, Woodland Hills, CA 91367 818-703-1188
MACOM, Inc., Lowell, MA 01851 617-272-3000
† Microphase, Norwalk, CT 06856 203-866-8000
§Φ Micro Quality Semiconductor, Inc., Microsemi Corp., Garland, TX 75042 214-272-7811
§† Microsemi Corp. Colorado, Microsemi Corp., Broomfield, CO 80020 303-469-2161
† Microsemi Corporation, Power Technology Components, Torrance, CA 90501 310-534-3737
§† Microsemi Corp. - Scottsdale, Microsemi Corporation, Scottsdale, AZ 85252-1390 602-941-6300
† Microwave Device Tech., Westford, MA 01886 508-692-7800
§† Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
§ NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
§† Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018 ..... 408-730-0300;800-PENSTOCK
§ Philips Components Discrete Products Div., Discrete Semiconductor Group, Slatersville, RI 02876-2078 401-762-3800
§ Philips ECG, North American Philips Co., Williamsport, PA 17701 717-323-4691
§ Promax-Johnton Electronic Corp., Irvine, CA 92714 714-975-1245
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
§ RF Electronics, Inc., Irvine, CA 92714-5517 714-263-0661
Sanken Electric USA Corp., Hoffman Estates, IL 60195 708-519-1717
§ Sanyo Semiconductor Corp., Allendale, NJ 07401 201-825-8080
§ Semikron, Inc., Hudson, NH 03051-0066 ..... 603-883-8102;1-800-258-1308
§† Sensitron Semiconductor, RSM Electron Power Div., Deer Park, NY 11729 516-586-7600
§ Shindengen America Inc., Westlake VL, CA 91362 800-634-3654
§ Unitrode Corp., Watertown, MA 02172 617-926-0404

Diodes, Selenium — See Rectifiers, Selenium (Vol. A)

Diodes, Silicon-4800

§† BKC Semiconductors Incorporated., Lawrence, MA 01841, 508-681-0392 ..... A•2131
Centronic, Inc., The Morgan Crucible Company plc, Newbury Park, CA 91320-1702, 805-499-5902 ..... B•1314
§ Collmer Semiconductor, Inc., Dallas, TX 75244, 800-527-0251;214-233-1589 ..... D•1630
Crydom Company, Long Beach, CA 90805, 310-865-3536 ..... A•2136-2137,2139-2140,2142
Douglas Randall, Pawcatuck, CT 06379, 203-599-2075 ..... A•2144
§ Electronic Devices, Inc., Yonkers, NY 10710, 914-965-4400 ..... A•2143
Hamamatsu Corp., Hamamatsu Photonics, K.K., Bridgewater, NJ 08807, 908-231-0960 ..... B•1317,1320-1321
§ ISKRA Electronics, Inc., Plainview, NY 11803, 516-349-0222 ..... A•1085,2146
§ ITT Components, ITT Corporation, Irvine, CA 92718, 714-727-3001 ..... A•2147
§ Powerex, Inc., Youngwood, PA 15697-1800, 412-925-7272 ..... A•2175
§ Semtech Corporation, Newbury Park, CA 91320, 805-498-2111 ..... A•2180
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ..... A•2118
§† Solitron Devices, Inc., Semiconductor Group, West Palm Beach, FL 33407-4697, 407-848-4311 ..... A•2219
§ Teccor Electronics, Inc., Irving, TX 75038, 214-580-1515 ..... A•2220,2223
§ World Products Inc., Sonoma, CA 95476, 707-996-5201 ..... A•2224-2225
§ Zetex, Inc., Zetex plc., Commack, NY 11725, 516-543-7100 ..... A•2227
† Advanced Photonix, Inc., Camarillo, CA 93012 805-484-2884
§ Allegro MicroSystems, Inc., formerly Sprague Semiconductor Grp., Worcester, MA 01605 508-795-1300
§ Alpha Industries, Inc., Woburn, MA 01801 617-935-5150
American Microsemiconductor, Inc., Madison, NJ 07940 201-377-9566
§ Baknor Industries Inc., Mississauga, ONT., CANADA L5L 1X1 416-828-2400
Bosch, Robert, Corp., Broadview, IL 60153 708-865-5301
Central Semiconductor Corp., Hauppauge, NY 11788 516-435-1110
Clarostat Sensors and Controls Group, BYR, PLC, Plano, TX 75075 ..... 214-422-1844; 1-800-872-0044
§ Continental Device India Limited, New Delhi, INDIA 110028 ..... 536150-53 (4 lines)
§ C-S Electronic Sales, Inc., Frankfort, IN 46041 317-659-1874
Darrah Electric Company, Cleveland, OH 44102 216-631-0912
Diodes Inc., Chatsworth, CA 91311 ..... 818-882-4920;800-821-1178
† Dionics, Westbury, NY 11590 516-997-7474
Diotec Electronics Corp., Gardena, CA 90248 310-767-1052
† Edal Industries, East Haven, CT 06512 203-467-2591

§# EG&G Optoelectronics, EG&G Canada Ltd., Vaudreuil, Quebec, CANADA J7V 8P7 514-424-3300
§ EG & G Vactec, St. Louis, MO 63132 314-423-4900
§ Fagor Electronic Components, Inc., Fagor Electronica S. Coop., Elk Grove Village, IL 60007 708-981-0161
§ Harris Semiconductor, Melbourne, FL 32902 ..... 1-800-4 HARRIS
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
§† Honeywell Microswitch Div., Richardson, TX 75081 214-470-4271
† HV Component Associates Inc., Farmingdale, NJ 07727 908-938-4499
§ International Components Corp., Melville, NY 11747 516-293-1500
§ International Diode, Harrison, NJ 07029 201-482-6518
§ International Rectifier Corp., El Segundo, CA 90245 310-322-3331
† Linear Integrated Systems, Milpitas, CA 95035 408-263-8401
§ Loral Microwave-FSI, Semiconductor Div., Chelmsford, MA 01824 ..... 508-256-4113/8101
MACOM, Inc., Lowell, MA 01851 617-272-3000
†M/A COM Ltd., Bedfordshire, ENGLAND LU5 4SX, England ..... 44(582)471200
§ MG Electronics, Hauppauge, NY 11788 516-582-3400
§Φ Micro Quality Semiconductor, Inc., Microsemi Corp., Garland, TX 75042 214-272-7811
§† Microsemi Corp., Santa Ana, CA 92799-6890 714-979-8220
† Microsemi Corporation, Power Technology Components, Torrance, CA 90501 310-534-3737
§† Microsemi Corp. - Scottsdale, Microsemi Corporation, Scottsdale, AZ 85252-1390 602-941-6300
§† Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
Mouser Electronics, Santee, CA 92071 800-346-6873
Mouser Electronics, Mansfield, TX 76063 800-346-6873
Mouser Electronics, Gilroy, CA 95020 800-346-6873
§ NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
§† Optek Technology Inc., Carrollton, TX 75006 214-323-2200
§ Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404 407-881-3200
§ Philips Components Discrete Products Div., Discrete Semiconductor Group, Slatersville, RI 02876-2078 401-762-3800
§ Philips ECG, North American Philips Co., Williamsport, PA 17701 717-323-4691
§ Promax-Johnton Electronic Corp., Irvine, CA 92714 714-975-1245
§ QMI/NIEC, Twin Oaks, CA 93518 805-867-2555
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
Renard Manufacturing Company, Inc., Miami, FL 33122-1015 305-592-1500
§ RF Electronics, Inc., Irvine, CA 92714-5517 714-263-0661
§ Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013 615-641-2020
Sanford-Miller Corp., Oceanside, NY 11572 ..... 516-763-0926;800-645-5900
§ Sanyo Semiconductor Corp., Allendale, NJ 07401 201-825-8080
Scientific Instruments, West Palm Beach, FL 33407 407-881-8500
§ Semiconductor Technology, Inc., Stuart, FL 34997 407-283-4500
§ Semikron, Inc., Hudson, NH 03051-0066 ..... 603-883-8102;1-800-258-1308
§† Sensitron Semiconductor, RSM Electron Power Div., Deer Park, NY 11729 516-586-7600
§ Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
† Silicon Sensors, Dodgeville, WI 53533 608-935-2707
§ Solid State, Inc., Bloomfield, NJ 07003-2596 201-429-8700
† Solid State Devices, La Mirada, CA 90638 714-670-7734
§ Solid State Electronics Corp., Northridge, CA 91324 818-993-8257
Stetron International, Inc., Buffalo, NY 14203 716-854-3443
§† St-Semiconductors of Indiana, Inc., Bloomington, IN 47402-0609 812-332-1435
Texas Optoelectronics, Inc., Garland, TX 75042 214-487-0085
§ Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Schaumburg, IL 60173 708-884-6664
† 2M Sales Company, Burnsville, MN 55337 612-890-7774
§† Unitrode Corp., Watertown, MA 02172 617-926-0404
† Voltage Multipliers, Inc., Visalia, CA 93291 209-651-1402
World Products Inc., Systems Devices Grp., Sonoma 95476 707-996-5201

Diodes, Switching-4800

§† BKC Semiconductors Incorporated., Lawrence, MA 01841, 508-681-0392 ..... A•2131
§ Electronic Devices, Inc., Yonkers, NY 10710, 914-965-4400 ..... A•2143
§ ITT Components, ITT Corporation, Irvine, CA 92718, 714-727-3001 ..... A•2147
§ Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... A•2152,2159
§ Semtech Corporation, Newbury Park, CA 91320, 805-498-2111 ..... A•2180
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ..... A•2118, B•1181
§ Zetex, Inc., Zetex plc., Commack, NY 11725, 516-543-7100 ..... A•2227
§ A E G Corporation, Basking Ridge, NJ 07920 908-204-8900
§ Allegro MicroSystems, Inc., formerly Sprague Semiconductor Grp., Worcester, MA 01605 508-795-1300
§ Alpha Industries, Inc., Woburn, MA 01801 617-935-5150
American Microsemiconductor, Inc., Madison, NJ 07940 201-377-9566
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
Bosch, Robert, Corp., Broadview, IL 60153 708-865-5301
Central Semiconductor Corp., Hauppauge, NY 11788 516-435-1110
§ Continental Device India Limited, New Delhi, INDIA 110028 ..... 536150-53 (4 lines)
Diodes Inc., Chatsworth, CA 91311 ..... 818-882-4920;800-821-1178
Diotec Electronics Corp., Gardena, CA 90248 310-767-1052
† Edal Industries, East Haven, CT 06512 203-467-2591
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
§ International Components Corp., Melville, NY 11747 516-293-1500
§ International Diode, Harrison, NJ 07029 201-482-6518
§ International Rectifier Corp., El Segundo, CA 90245 310-322-3331
§ Laube Technology, Woodland Hills, CA 91367 818-703-1188
† Linear Integrated Systems, Milpitas, CA 95035 408-263-8401
MACOM, Inc., Lowell, MA 01851 617-272-3000
† Microphase, Norwalk, CT 06856 203-866-8000
§† Microsemi Corp., Santa Ana, CA 92799-6890 714-979-8220
† Microsemi Corporation, Power Technology Components, Torrance, CA 90501 310-534-3737
§† Microsemi Corp. - Scottsdale, Microsemi Corporation, Scottsdale, AZ 85252-1390 602-941-6300
† Microwave Device Tech., Westford, MA 01886 508-692-7800
§† Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
NEC Electronics, Inc., Mountain View, CA 94039-7241 1-800-366-9782
New England Semiconductor, Lawrence, MA 01841 ..... 508-794-1666;800-446-1158
§ NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
§ Philips Components Discrete Products Div., Discrete Semiconductor Group, Slatersville, RI 02876-2078 401-762-3800
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
§ RF Electronics, Inc., Irvine, CA 92714-5517 714-263-0661
§ Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013 615-641-2020
§ Shindengen America Inc., Westlake Vl., CA 91362 800-634-3654
§ Solid State, Inc., Bloomfield, NJ 07003-2596 201-429-8700
† Solid State Devices, La Mirada, CA 90638 714-670-7734
§ Solid State Electronics Corp., Northridge, CA 91324 818-993-8257
† 2M Sales Company, Burnsville, MN 55337 612-890-7774
§† Unitrode Corp., Watertown, MA 02172 617-926-0404

Diodes, Switching, Surface Mount-4800

§† BKC Semiconductors Incorporated., Lawrence, MA 01841, 508-681-0392 ..... A•2131
§ ITT Components, ITT Corporation, Irvine, CA 92718, 714-727-3001 ..... A•2147
§ Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... A•2159,2162
§ Zetex, Inc., Zetex plc., Commack, NY 11725, 516-543-7100 ..... A•2227
§ Allegro MicroSystems, Inc., formerly Sprague Semiconductor Grp., Worcester, MA 01605 508-795-1300
§† Allen Co., Inc., Robert G., N. Hollywood, CA 91605 ..... 818-765-8300;800-827-7422
American Microsemiconductor, Inc., Madison, NJ 07940 201-377-9566
Bosch, Robert, Corp., Broadview, IL 60153 708-865-5301
Central Semiconductor Corp., Hauppauge, NY 11788 516-435-1110
Diodes Inc., Chatsworth, CA 91311 ..... 818-882-4920;800-821-1178
Diotec Electronics Corp., Gardena, CA 90248 310-767-1052
§ International Rectifier Corp., El Segundo, CA 90245 310-322-3331
† Linear Integrated Systems, Milpitas, CA 95035 408-263-8401
MACOM, Inc., Lowell, MA 01851 617-272-3000
Manix Mfg. Inc., Warminster, PA 18974 215-957-6565
† Microsemi Corp., Santa Ana, CA 92799-6890 714-979-8220
§ Microsemi Corp. Colorado, Microsemi Corp., Broomfield, CO 80020 303-469-2161
§† Microsemi Corp. - Scottsdale, Microsemi Corporation, Scottsdale, AZ 85252-1390 602-941-6300
† Microwave Device Tech., Westford, MA 01886 508-692-7800
§ Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
§ Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018 ..... 408-730-0300;800-PENSTOCK
§ Philips Components Discrete Products Div., Discrete Semiconductor Group, Slatersville, RI 02876-2078 401-762-3800
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
§ RF Electronics, Inc., Irvine, CA 92714-5517 714-263-0661
§ Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013 615-641-2020
§ Shindengen America Inc., Westlake Vl, CA 91362 800-634-3654

Diodes, Temperature Compensating-4800

Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... A•2152
§ Philips ECG, North American Philips Co., Williamsport, PA 17701, 717-323-4691 ..... A•2173
Quality Thermistor, Boise, ID 83709, 208-377-3373 ..... B•1892-1893
§† Allen Co., Inc., Robert G., N. Hollywood, CA 91605 ..... 818-765-8300;800-827-7422
Alpha Industries, Inc., Woburn, MA 01801 617-935-5150
American Microsemiconductor, Inc., Madison, NJ 07940 201-377-9566
Central Semiconductor Corp., Hauppauge, NY 11788 516-435-1110
§† Compensated Devices Incorporated, Melrose, MA 02176 617-665-1071
International Components Corp., Melville, NY 11747 516-293-1500
§ International Diode, Harrison, NJ 07029 201-482-6518
§ ITT Components, ITT Corporation, Irvine, CA 92718 714-727-3001
§† Microsemi Corp., Santa Ana, CA 92799-6890 714-979-8220
§† Microsemi Corp. - Scottsdale, Microsemi Corporation, Scottsdale, AZ 85252-1390 602-941-6300
Micro Switch, A Honeywell Div., Freeport, IL 61032 1-800-537-6945
§† Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
§ Solid State, Inc., Bloomfield, NJ 07003-2596 201-429-8700
† Solid State Devices, La Mirada, CA 90638 714-670-7734

Diodes, Trigger — See Diodes, Avalanche (Vol. A)

Diodes, Tuning, Surface Mount-4800

Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... A•2159
§ Zetex, Inc., Zetex plc., Commack, NY 11725, 516-543-7100 ..... A•2227
Diodes Inc., Chatsworth, CA 91311 ..... 818-882-4920;800-821-1178
MACOM, Inc., Lowell, MA 01851 617-272-3000
† Microwave Device Tech., Westford, MA 01886 508-692-7800
§ Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900

Diodes, Tunnel-4800

American Microsemiconductor, Inc., Madison, NJ 07940 201-377-9566
§† Germanium Power Devices, Andover, MA 01810-3065 508-475-5982
† Microphase, Norwalk, CT 06856 203-866-8000
§† Microsemi Corp., Santa Ana, CA 92799-6890 714-979-8220

§ Solid State, Inc., Bloomfield, NJ 07003-2596 201-429-8700
† Solid State Devices, La Mirada, CA 90638 714-670-7734

Diodes, Varactor-4800

§ Philips ECG, North American Philips Co., Williamsport, PA 17701, 717-323-4691 ..... A•2173
§ Zetex, Inc., Zetex plc., Commack, NY 11725, 516-543-7100 ..... A•2227
§ Alpha Industries, Inc., Woburn, MA 01801 617-935-5150
American Microsemiconductor, Inc., Madison, NJ 07940 201-377-9566
Diodes Inc., Chatsworth, CA 91311 ..... 818-882-4920;800-821-1178
EPD Electronics, Inc., Gardena, CA 90247 310-515-4996
§ Loral Microwave-FSI, Semiconductor Div., Chelmsford, MA 01824 ..... 508-256-4113, 8101
MACOM, Inc., Lowell, MA 01851 617-272-3000
† M/A COM Ltd., Bedfordshire, ENGLAND LU5 4SX, England ..... 44(582)471200
† Microwave Device Tech., Westford, MA 01886 508-692-7800
§† Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
MSI Electronics, Inc., Woodside, NY 11377 718-672-6500
§ NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
§ Sanyo Semiconductor Corp., Allendale, NJ 07401 201-825-8080
§ Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070

Diodes, Varactor, Surface Mount-4800

§ Zetex, Inc., Zetex plc., Commack, NY 11725, 516-543-7100 ..... A•2227
† Alpha Industries, Inc., Woburn, MA 01801 617-935-5150
American Microsemiconductor, Inc., Madison, NJ 07940 201-377-9566
Diodes Inc., Chatsworth, CA 91311 ..... 818-882-4920;800-821-1178
MACOM, Inc., Lowell, MA 01851 617-272-3000
Manix Mfg. Inc., Warminster, PA 18974 215-957-6565
† Microwave Device Tech., Westford, MA 01886 508-692-7800
MSI Electronics, Inc., Woodside, NY 11377 718-672-6500
§ Sanyo Semiconductor Corp., Allendale, NJ 07401 201-825-8080

Diodes, Video Detector — See Diodes, Microwave Detector (Vol. A)

Diodes, Zener & Stabistors (Forward Reference Diodes)-4800

§† BKC Semiconductors Incorporated., Lawrence, MA 01841, 508-681-0392 ..... A•2131
§ ITT Components, ITT Corporation, Irvine, CA 92718, 714-727-3001 ..... A•2147
§ Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... A•2151-2153,2157
§ Philips ECG, North American Philips Co., Williamsport, PA 17701, 717-323-4691 ..... A•2173
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ..... A•2118, B•1181
Zetex, Inc., Zetex plc., Commack, NY 11725, 516-543-7100 ..... A•2227
§ A E G Corporation, Basking Ridge, NJ 07920 908-204-8900
§ Allegro MicroSystems, Inc., formerly Sprague Semiconductor Grp., Worcester, MA 01605 508-795-1300
American Microsemiconductor, Inc., Madison, NJ 07940 201-377-9566
§ Baknor Industries Inc., Mississauga, ONT., CANADA L5L 1X1 416-828-2400
Central Semiconductor Corp., Hauppauge, NY 11788 516-435-1110
§† Compensated Devices Incorporated, Melrose, MA 02176 617-665-1071
§† Continental Device India Limited, New Delhi, INDIA 110028 ..... 536150-53 (4 lines)
Diodes Inc., Chatsworth, CA 91311 ..... 818-882-4920;800-821-1178
Diotec Electronics Corp., Gardena, CA 90248 310-767-1052
Edal Industries, East Haven, CT 06512 203-467-2591
§ Hitachi America, Ltd., Tarrytown, NY 10591 914-631-0600
§ International Components Corp., Melville, NY 11747 516-293-1500
§ International Diode, Harrison, NJ 07029 201-482-6518
Julie Research Labs., New York, NY 10001 212-633-6625
§ Laube Technology, Woodland Hills, CA 91367 818-703-1188
† Linear Integrated Systems, Milpitas, CA 95035 408-263-8401
§† Microsemi Corp., Santa Ana, CA 92799-6890 714-979-8220
§† Microsemi Corp. - Scottsdale, Microsemi Corporation, Scottsdale, AZ 85252-1390 602-941-6300
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Mouser Electronics, Mansfield, TX 76063 800-346-6873
Mouser Electronics, Gilroy, CA 95020 800-346-6873
NEC Electronics, Inc., Mountain View, CA 94039-7241 1-800-366-9782
§ NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
§ Philips Components Discrete Products Div., Discrete Semiconductor Group, Slatersville, RI 02876-2078 401-762-3800
Rectron, Industry, CA 91746 818-333-3802
§ RF Electronics, Inc., Irvine, CA 92714-5517 714-263-0661
§ Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013 615-641-2020
§ Schauer Manufacturing, Cincinnati, OH 45242 513-791-3030
§ Semiconductor Technology, Inc., Stuart, FL 34997 407-283-4500
§ Solid State, Inc., Bloomfield, NJ 07003-2596 201-429-8700
Stetron International, Inc., Buffalo, NY 14203 716-854-3443
§† St-Semiconductors of Indiana, Inc., Bloomington, IN 47402-0609 812-332-1435
§† Unitrode Corp., Watertown, MA 02172 617-926-0404

Diodes, Zener, Surface Mount-4800

§† BKC Semiconductors Incorporated., Lawrence, MA 01841, 508-681-0392 ..... A•2131
§ Frontier Electronics, Simi Valley, CA 93065, 805-522-9998 ..... A•1236
§ ITT Components, ITT Corporation, Irvine, CA 92718, 714-727-3001 ..... A•2147
§ Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... A•2151-2152,2157-2158,2162
§ QMI/NIEC, Twin Oaks, CA 93518, 805-867-2555 ..... A•2177
§ Zetex, Inc., Zetex plc., Commack, NY 11725, 516-543-7100 ..... A•2227
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American Microsemiconductor, Inc., Madison, NJ 07940 201-377-9566
§ Baknor Industries Inc., Mississauga, ONT., CANADA L5L 1X1 416-828-2400
Bosch, Robert, Corp., Broadview, IL 60153 708-865-5301
Central Semiconductor Corp., Hauppauge, NY 11788 516-435-1110
§† Compensated Devices Incorporated, Melrose, MA 02176 617-665-1071
Diodes Inc., Chatsworth, CA 91311 ..... 818-882-4920;800-821-1178
§ General Instrument, Power Semiconductor Div., Hicksville, NY 11802 516-933-3333
† Linear Integrated Systems, Milpitas, CA 95035 408-263-8401
Manix Mfg. Inc., Warminster, PA 18974 215-957-6565
† Microsemi Corp., Santa Ana, CA 92799-6890 714-979-8220
§† Microsemi Corp. - Scottsdale, Microsemi Corporation, Scottsdale, AZ 85252-1390 602-941-6300
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§ Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013 615-641-2020
§ Sanyo Semiconductor Corp., Allendale, NJ 07401 201-825-8080
† 2M Sales Company, Burnsville, MN 55337 612-890-7774

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Diplexers, Antenna-1200 — *See Vol. D*

Direction Finding Sets & Systems (MIL)-2440 — *See Vol. B*

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Discriminators-1900 — *See Vol. D*

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Disks, Diagnostic, Flexible Disk Drive-2000 — *See Vol. D*

Disks, Magnetic 3½"-2000 — *See Vol. D*

Disks, Magnetic, 5¼" Flexible-2000 — *See Vol. D*

Disks, Magnetic, 8" Flexible-2000 — *See Vol. D*

Disks, Magnetic, Front-loading Cartridge-2000 — *See Vol. D*

Disks, Magnetic, Pack-2000 — *See Vol. D*

Disks, Magnetic, Top-loading Cartridge-2000 — *See Vol. D*

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Displays, Dot Matrix-2450 — *See Vol. B*

Displays, Edge Lighted & Back Lighted-2450 — *See Vol. B*

Displays, Electroluminescent-2450 — *See Vol. B*

Displays, Electromagnetic-2450 — *See Vol. B*

Displays, Electromechanical-2450 — *See Vol. B*

Displays, Fiber Optic-2475 — *See Vol. B*

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Displays, Head Up (HUD)-2450 — *See Vol. B*

Displays, Indicator Lights-2450 — *See Vol. B*

Displays, Intelligent-2450 — *See Vol. B*

Displays, Laser-2450 — *See Vol. B*

Displays, Light-emitting Diode (LED)-2450 — *See Vol. B*

Displays, Lighted Segment-2450 — *See Vol. B*

Displays, Liquid Crystal (LCD)-2450 — *See Vol. B*

Displays, Message-2450 — *See Vol. B*

Displays, Multifunction-2450 — *See Vol. B*

Displays, Planar Gas Discharge-2450 — *See Vol. B*

Displays, Plasma-2450 — *See Vol. B*

Displays, Programmable-2450 — *See Vol. B*

Displays, Projection Type (CRT; Electromechanical; Film; Light Valve)-2450 — *See Vol. B*

Displays, Remote-2450 — *See Vol. B*

Displays, Status-2450 — *See Vol. B*

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Displays, Surface Mount-2450 — *See Vol. B*

Displays, Touch Sensitive (Infrared & Mechanical) — See Touch Monitors (Vol. D), Touch Panels (Vol. D), Touch Terminals (Vol. D)

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Distortion Analyzers, Indicators — See Analyzers, AF (Vol. D)

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Dividers, Frequency-3450

† **Frequency Electronics, Inc., Mitchel Field, NY 11553, 516-794-4500 ..... A•1402**
Gamma High Voltage Resch. Inc., Ormond Beach, FL 32174, 904-677-7070 ..... D•1709
Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500 ..... A•1725
North Hills Signal Processing, Syosset, NY 11791, 516-682-7740 ..... A•2438
Advanced Technical Materials, Inc., Patchogue, NY 11772 ..... 516-363-9018; 516-289-0363
BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
† California Eastern Labs. Inc., Santa Clara, CA 95056-0964 408-988-3500
§ Fox Electronics, Ft. Myers, FL 33905 813-693-0099
† Luff Research, Inc., Floral Park, NY 11001 516-358-2880
§† M/A-COM Microelectroincs Division, M/A-COM, Lowell, MA 01853-3295 508-442-5000
§ Martin Sound Prods. Inc., Cleveland, OH 44143-2297 216-442-2286
† Microphase, Norwalk, CT 06856 203-866-8000
† Sage Laboratories, Inc., Natick, MA 01760 508-653-0844
Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
Tempo Instrument, Inc., Commack, NY 11725 516-864-3700

Dividers, Power (LF, HF, VHF, UHF)-3450

Amplifier Research, Souderton, PA 18964-9990, 215-723-8181 ..... D•1003,1022-1023
§ **Caddock Electronics, Inc., Riverside, CA 92507, 909-788-1700 ..... A•1877**
† **Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500 ..... A•1725**
† **North Hills Signal Processing, Syosset, NY 11791, 516-682-7740 ..... A•2438,2440-2441**
† Alan Industries Inc., Columbus, IN 47202 812-372-8869
§† Anaren Microwave, Inc., E. Syracuse, NY 13057 315-432-8930
† Antenna Specialists, The Allen Group, Cleveland, OH 44139 216-349-8400
§† Avantek, Inc. A Subsidiary of Hewlett-Packard, Santa Clara, CA 95054 408-727-0700
Avtech Electrosystems Ltd., Ottawa, Ontario, CANADA K2C 3H4 613-226-5772
BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
† Coil-Q Corp., Bronxville, NY 10708 914-337-4775
Communications & Energy Corp., E. Syracuse, NY 13057 315-452-0709
† Communications Sys. Technology, Inc., Hermosa Beach, CA 90254 213-374-3849
† Dielectric Communications, General Signal, Raymond, ME 04071 ..... 207-655-4555; 800-341-9678
Elcom Systems, Inc., Boca Raton, FL 33487 407-994-1774
† Integrated Microwave, San Diego, CA 92121-1009 619-259-2600
† JFW Industries, Inc., Indianapolis, IN 46237 317-887-1340
† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
† Locus, Inc., State College, PA 16804 814-466-6275
† Locus, Kaman, State College, PA 16804 814-466-6275
† Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710 813-347-2181
§ Lucas Weinschel, Gaithersburg, MD 20884-6001 301-948-3434
M/A-COM Microelectroincs Division, M/A-COM, Lowell, MA 01853-3295 508-442-5000
Matrix Systems Corp., Calabasas, CA 91302 818-222-2301
† Merrimac Industries, West Caldwell, NJ 07006 201-575-1300
† Microphase, Norwalk, CT 06856 203-866-8000
MicroSignals Inc., L.I.C., NY 11101 ..... 718-937-7955;718-937-0391;800-648-2252
Microwave Communications Corp., Valencia, CA 91355 805-257-1948
§ Mirage/KLM, Morgan Hill, CA 95037 408-779-7363
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3 ..... 514-694-6666; 800-724-3911
† Pasternack Enterprises, Irvine, CA 92713 714-261-1920
Penny Technologies, Inc., Greenpoint, NY 11222 718-782-4149
§ Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018 ..... 408-730-0300;800-PENSTOCK
RLC Electronics, Inc., Mt. Kisco, NY 10549 914-241-1334
† Sage Laboratories, Inc., Natick, MA 01760 508-653-0844
§† ST Oiektron Corporation, Subsidiary of Signal Technology Corp. Beverly, MA 01915 508-922-0019
Synergy Microwave Corporation, Paterson, NJ 07504 201-881-8800
Teleplex, Inc., Alford Division, Woburn, MA 01801 617-935-8610
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291
† TRM, Inc., Manchester, NH 03110 603-627-6000
§† Vega Precision Labs., Vienna, VA 22180 703-938-6300
† Werlatone, Inc., Brewster, NY 10509 914-279-6187
Wide Band Engineering Co., Inc., Phoenix, AZ 85036 602-254-1570
§ Wiltron, Morgan Hill, CA 95037-2809 408-778-2000
§ Winegard Co., Burlington, IA 52601-2000 319-754-0600

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Amplifier Research, Souderton, PA 18964-9990, 215-723-8181 ..... D•1023
§ **Microwave Filter Inc., East Syracuse, NY 13057-0486, 315-437-3953;800-448-1666 ..... A•1659**
† **Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500 ..... A•1725**
North Hills Signal Processing, Syosset, NY 11791, 516-682-7740 ... A•2438,2440
Advanced Technical Materials, Inc., Patchogue, NY 11772 ..... 516-363-9018; 516-289-0363
† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950 201-539-5500
† Alan Industries Inc., Columbus, IN 47202 812-372-8869
§† Anaren Microwave, Inc., E. Syracuse, NY 13057 315-432-8930
§† Avantek, Inc, A Subsidiary of Hewlett-Packard, Santa Clara, CA 95054 408-727-0700
† Barth Electronics, Inc., Boulder City, NV 89005 702-293-1576
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
Communications & Energy Corp., E. Syracuse, NY 13057 315-452-0709
† Continental Microwave Technology Inc., Glen Cove, NY 11542 516-759-5600
† Eastern Microwave, Winchester, MA 01890 617-721-9800
Elcom Systems, Inc., Boca Raton, FL 33487 407-994-1774
† EMC Technology Inc, Cherry Hill, NJ 08034 609-429-7800
Flann Microwave Inc., Cambridge, MA 02139 1-800-937-3772
† Gamma-f Corp., Vertex Communications, Torrance, CA 90505 310-539-6704
† Integrated Microwave, San Diego, CA 92121-1009 619-259-2600
† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
† Locus, Inc., State College, PA 16804 814-466-6275
† Locus, Kaman, State College, PA 16804 814-466-6275
† Loral Microwave Narda, Hauppauge, NY 11788 516-231-1700
† Loral Microwave-Wavecom, Northridge, CA 91324 818-882-3010
† Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710 813-347-2181
§ Lucas Weinschel, Gaithersburg, MD 20884-6001 301-948-3434
MACOM, Inc., Lowell, MA 01851 617-272-3000
M/A-COM Microelectroincs Division, M/A-COM, Lowell, MA 01853-3295 508-442-5000
Matrix Systems Corp., Calabasas, CA 91302 818-222-2301
† Merrimac Industries, West Caldwell, NJ 07006 201-575-1300
† Microlab/FXR, Livingston, NJ 07039 201-992-7700
† Microphase, Norwalk, CT 06856 203-866-8000
Microwave Communications Corp., Valencia, CA 91355 805-257-1948
§ Microwave Development Laboratories, Natick, MA 01760 508-655-0060
† Microwave Technology Div., JHP Industrial, Syracuse, NY 13202-3442 315-422-0050
§ Midwest Microwave, Saline, MI 48176-9569 ..... 313-429-4773;800-521-4410
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3 ..... 514-694-6666; 800-724-3911
† Pasternack Enterprises, Irvine, CA 92713 714-261-1920
Penny Technologies, Inc., Greenpoint, NY 11222 718-782-4149
§† Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018 ..... 408-730-0300;800-PENSTOCK
Polyflon Company, Crane Co., New Rochelle, NY 10801 914-636-7222
† Premier Microwave, Port Chester, NY 10573 914-939-8900
† RLC Electronics, Inc., Mt. Kisco, NY 10549 914-241-1334
† Sage Laboratories, Inc., Natick, MA 01760 508-653-0844
§† Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291
† TRAK Microwave Ltd., TRAK Microwave Corp., Dundee, SCOTLAND DD2 1TY 44-382-561509
† Transco Products, Inc., Subsidiary of Datron Systems Inc., Camarillo, CA 93012 805-987-8007
† TRM, Inc., Manchester, NH 03110 603-627-6000
† Vectronics Microwave Corp., Middlesex, NJ 08846 908-356-2377
§† Vega Precision Labs., Vienna, VA 22180 703-938-6300
§ Wiltron, Morgan Hill, CA 95037-2809 408-778-2000

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Semtech Corporation, Newbury Park, CA 91320, 805-498-2111 ..... A•2180
† Ascent Power Technology, Concord, Ont., CANADA L4K3C3 905-660-9819
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
† Del Electronics Corp., Valhalla, NY 10595 914-686-3600
† Mep Controls, Bordentown, NJ 08505 609-298-7300
§ NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
† NWL Transformers, Bordentown, NJ 08505 609-298-7300
§ Philips ECG, North American Philips Co., Williamsport, PA 17701 717-323-4691
§ Semikron, Inc., Hudson, NH 03051-0066 ..... 603-883-8102;1-800-258-1308
§ Staco Energy Products Co., Dayton, OH 45403 513-253-1191
Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900

Down Converters-3450

† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950 201-539-5500
† Communications Sys. Technology, Inc., Hermosa Beach, CA 90254 213-374-3849
† Electrospace Systems, Inc., Richardson, TX 75083-1359 214-470-2106
† FEI Microwave, Inc., Frequency Electronics, Inc., Sunnyvale, CA 94086 408-732-0880
† Ferretec Inc., Fremont, CA 94538-6525 510-226-1216
HDS Inc., Reston, VA 22091 703-620-6200
Lucas Weinschel, Gaithersburg, MD 20884-6001 301-948-3434

Lucas Zeta, Lucas Aerospace, Inc., San Jose, CA 95134 408-434-3600
MACOM, Inc., Lowell, MA 01851 617-272-3000
† Magnum Microwave Corp., Fremont, CA 94538 510-657-9898
† Microwave Technology Div., JHP Industrial, Syracuse, NY 13202-3442 315-422-0050
† Racal-Dana Instrs. Inc., Irvine, CA 92718 714-859-8999
Servo Corporation of America, Hicksville, NY 11801-5259 516-938-9700
† Stanford Telecommunications, Inc., Santa Clara, CA 95056 408-748-1010
Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291
TRAK Microwave Corp., Tampa, FL 33634 813-884-1411

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Drivers, Nut-5400 — *See Vol. C*

Drivers, Solenoid-4550 — *See Vol. B*

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† Micro-Precision Technologies, Inc., Salem, NH 03079, 603-893-7600 ..... A•1703
Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803 516-694-6700
CP Technology, Inc., Cupertino, CA 95014 408-996-8069
† Daico Industries, Inc., Rancho Dominguez, CA 90220 310-631-1143
† Film Microelectronics Inc., Peabody, MA 01960 508-532-9913
Flann Microwave Inc., Cambridge, MA 02139 1-800-937-3772
† Micronetics, Hudson, NH 03051 603-883-2900
Silicon General, Garden Grove, CA 92641 714-898-8121
§ Teledyne Components, Mountain View, CA 94039-7267 415-968-9241

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Drives/Subsystems, Disk, 3¼" Winchester-2000 — *See Vol. D*

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Communications & Energy Corp., E. Syracuse, NY 13057, 315-452-0709 ..... A•1625
Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ..... A•1847
† TRAK Microwave Corp., Tampa, FL 33634, 813-884-1411 ..... A•1857
† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950 201-539-5500
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
† Integrated Microwave, San Diego, CA 92121-1009 619-259-2600
† K&L Microwave, Inc., Salisbury, MD 21801 410-749-2424
† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
† Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710 813-347-2181
MACOM, Inc., Lowell, MA 01851 617-272-3000
Metropole Products Inc., Stafford, VA 22554 703-659-2132
† Microphase, Norwalk, CT 06856 203-866-8000
Microwave Communications Corp., Valencia, CA 91355 805-257-1948
§ Microwave Development Laboratories, Natick, MA 01760 508-655-0060
† Microwave Technology Div., JHP Industrial, Syracuse, NY 13202-3442 315-422-0050
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3 ..... 514-694-6666; 800-724-3911
§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
† Premier Microwave, Port Chester, NY 10573 914-939-8900
† Servo Corporation of America, Hicksville, NY 11801-5259 516-938-9700
ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086 408-730-6300
† Transco Products, Inc., Subsidiary of Datron Systems Inc., Camarillo, CA 93012 805-987-8007
† UTE Microwave, Asbury Park, NJ 07712 908-922-1009

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GMW Associates, Redwood City, CA 94064, 415-368-4884 ..... D•1263
Magnet Schultz of America, Westmont, IL 60559, 708-789-0600 ..... B•1653
§ Walker Scientific, Worcester, MA 01606, 508-852-3674;508-853-3232;800-962-4638 ..... D•1334
† A.P.W. Co., Inc., Rockaway, NJ 07866 201-627-0643
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
Magnetic Instrumentation, Inc., Indianapolis, IN 46226 317-545-2102
† Magnet Sales & Mfg., Inc., Culver City, CA 90230-6162 .... 310-391-7213;800-421-6692 (N. CA and out of state)
# Metrolab Instruments SA, Geneva, SWITZERLAND CH-1228 ..... +41(22)7941121
Northern Magnetics Inc., Van Nuys, CA 91406 818-997-8675
TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056 708-803-6100
Tokin America, Inc., San Jose, CA 95134 408-432-8020

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Erasing Equipment, EPROM-3130

§† BYTEK Corp., Instrument Systems Div., Boca Raton, FL 33487-1323 407-994-3520

HMC/Hub Material Company, Canton, MA 02021 617-821-1870

International Instrumentation, Inc., Westlake Vlg., CA 91361 805-495-7673

§ International Microsystems, Milpitas, CA 95035 408-942-1001

Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500

§ Southern Computer Corp., Atlanta, GA 30342 404-252-3340

§† Spectronics Corp., Westbury, NY 11590 .... 516-333-4840/1-800-274-8888

§ Stag Microsystems Inc., Santa Clara, CA 95054 .... 408-988-1118;1-800-227-8836

Sunrise Electronics, Inc., Glendora, CA 91740 818-914-1926

§ UVP, Inc., San Gabriel, CA 91776 .... 818-285-3123;800-452-6788

§ Xeltek, Sunnyvale, CA 94086 408-524-1935

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Abracon Corporation, San Clemente, CA 92673, 714-498-4505 .... **A•1180**

Advanced Components Inds., Inc., Div of Kaschke, Torrance, CA 90501, 310-328-0060 .... **A•1318**

Bell Inds., J. W. Miller Div., Gardena, CA 90247-1059, 310-515-1720 .... **A•1190,1193,1195**

International Electro Magnetics, Inc., Palatine, IL 60067, 708-358-4622 ... **D•1039**

Lodestone Pacific, Anaheim, CA 92807, 714-630-1343 .... **A•1244-1245,1247**

§† **Magnetics, Spang & Co., Butler, PA 16003-0391, 412-282-8282** .... **A•1322**

Microwave Filter Inc., East Syracuse, NY 13057-0486, 315-437-3953;800-448-1666 .... **A•1656**

Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 .. **A•1256,1661**

Wilco Corp., Indianapolis, IN 46268, 317-293-9300 .... **A•1313**

§† Capcon, Inc., New York, NY 10001 212-243-6275

§ Ceramic Magnetics, Inc., Fairfield, NJ 07004 201-227-4222

§ Cosmo Corporation, Cleveland, OH 44109 216-861-5594

§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 605-665-9301

§† Elna Ferrite Laboratories, Inc., Woodstock, NY 12498 800-553-2870

† Elna Ferrite Laboratories, Inc., Woodstock, NY 12498 800-553-2870

§ Fair-Rite Prods., Wallkill, NY 12589 914-895-2055

§† FDK America, Inc., Fuji Electrochemical Co., Ltd., San Jose, CA 95134 .. 408-432-8331

† Ferrite International, Wadsworth, IL 60083 708-249-4900

Ferrofluidics Corp., Nashua, NH 03061 603-883-9800

Ferronics, Fairport, NY 14450 716-388-1020

§ GC International Inc., Plano, TX 75074 214-423-8411

Hoosier Magnetics, Inc., Toledo, OH 43617 419-841-7173

JEMA, Wilmette, IL 60091 708-251-3600

Kyocera Industrial Ceramics Corp., San Diego, CA 92123 619-576-2688
MACOM, Inc., Lowell, MA 01851 617-272-3000
Magnet Sales & Mfg., Inc., Culver City, CA 90230-6162 .... 310-391-7213;800-421-6692 (N. CA and out of state)
§† MMG-North America, Paterson, NJ 07509 201-345-8900
Multi Products International, West Paterson, NJ 07424 201-890-1344
§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
§ Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404 407-881-3200
Philips Components Discrete Products Div., A North American Philips Co., Saugerties, NY 12477 914-246-2811
Quartzite Processing, Inc., Malden, MA 02148 617-322-3611
† Raytheon Co., Electronic Components Division, Waltham, MA 02254 617-899-8400
†# Reade Advanced Materials, A Reade Intl. business unit, Riverside, RI 02915-0039 401-433-7000
Sealing Devices, Inc., Lancaster, NY 14086 716-684-7600
§ Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
§ Steward, Inc., Chattanooga, TN 37401 615-867-4100
§ TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056 708-803-6100
§ Tokin America, Inc., San Jose, CA 95134 408-432-8020

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Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635, 714-447-2300 ..... A•1868
† Acheson Colloids, Div. of Acheson Industries, Inc., Port Huron, MI 48061-1747 313-984-5581
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 402-563-6506
Datak Corp., An LKG Company, Rockford, IL 61104 .... 815-229-7773;1-800-645-2262
† Hybrid Designs, Inc., Costa Mesa, CA 92626 714-557-9933
† Hycomp, Inc., Marlborough, MA 01752 508-485-6300
International Resistive Company, Boone, NC 28607 704-264-8861
† Ohmtek Inc., Vishay, Niagara Falls, NY 14304 716-283-4025
§ Solitron/Microwave, Solitron Devices, Inc., West Palm Beach, FL 33407-4697 407-848-4311
† TFD Inc. (DBA Thin Film Devices Inc.), Anaheim, CA 92807 714-630-7127

Filters, AC Power Line-2700

§ Aerovox Inc., North Dartmouth, MA 02747-1217, 508-995-8000 ..... A•1585
Amber Inds., Inc., Carrollton, TX 75006, 214-490-9801 ..... B•1343
Controlled Power Co., Troy, MI 48083, 313-528-3700;1-800-521-4792 ..... D•2254-2255
Corcom, Inc., Libertyville, IL 60048, 708-680-7400 ..... A•1586-1587, C•1300
Eichhoff Electronics, Warwick, RI 02886, 401-738-1440;800-678-1040 ..... A•1588-1591
Electronic Precision Components, Mt. Vernon, NY 10550-4430, 914-664-2333 ..... A•1633
Filter Concepts Inc., Santa Ana, CA 92707, 714-545-7003 .... A•1592,1594-1595
† Genisco Electronics, A Division of GTC, Anaheim, CA 92805, 714-563-4300 ..... A•1641
GlobTek, Inc., Northvale, NJ 07647, 201-784-1000 ..... C•1340, D•1732
§† JMK, Inc., Amherst, NH 03031, 603-886-4100 ..... A•1596-1597
Marway Prods. Inc., Santa Ana, CA 92703, 714-973-1800 ..... D•2278
Metuchen Capacitors, Inc., Old Bridge, NJ 08857, 908-679-3366 ..... A•1652-1653, C•1419
§ Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 .. A•1660-1663
§ Okaya Electric America, Inc., Okaya Electric Industries, Tokyo, Japan, Valparaiso, IN 46383, 219-477-4488 ..... A•1139,1598
† Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•1263
§ Pulizzi Engineering, Inc., Santa Ana, CA 92704-6865, 714-540-4229 ..... D•2300
§ Qualtek Electronics Corp., Mentor, OH 44060, 216-951-3300 ..... A•1600
§ Schaffner EMC, Inc. Components Division, Springfield, NJ 07081, 201-379-7778;800-367-5566 ..... A•1602-1605, D•1322
§ Schurter, Inc., Petaluma, CA 94954, 800-848-2600 ext.62 ..... A•1606-1608
Tamura Corporation of America, Temecula, CA 92589-2230, 909-699-1270 ..... A•1610-1611
† Tri-Mag, Inc., Visalia, CA 93291, 209-651-2222 ..... A•1612-1614
Comstron A Div. of Aeroflex, Plainview, NY 11803 516-752-2351
§† Control Concepts Corp., Liebert Corp., Binghamton, NY 13902-1380 607-724-2484
§ Curtis Industries, Milwaukee, WI 53234-3925 414-649-4200
§ Delta Products Corporation, Fremont, CA 94538 510-770-0660
§# Drivecon Corporation, Libertyville, IL 60048 708-918-1406
Elpac Components, Elpac Electronics, Inc., Irvine, CA 92714 714-476-6070
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
† Filtron, RFI Corporation, Bayshore, NY 11706 516-231-6400
General Protection Co., Inc., Circuit Protection Group, Chicago, IL 60659 312-761-0403
LZR Electronics, Inc., Gaithersburg, MD 20879 301-921-4600
MagneTek Power Conversion Systems, Teledyne, Inc., Anaheim, CA 92805 714-956-9200
MCG Elctrns., Deer Park, NY 11729 516-586-5125
§ MTE Corp., Menomonee Falls, WI 53051 414-253-8200
† Powercube Corp., Sub. Unitrode Corp., Billerica, MA 01821 508-667-9500
§ Power Dynamics Inc., West Orange, NJ 07052 201-736-5722
Pulse Engineering, Inc., San Diego, CA 92128 619-674-8100
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
RME Filters, Inc., Amherst, NH 03031 603-595-4573
Sprague, Wet & Foil Tantalum Capacitors, North Adams, MA 01247-3987 413-664-4431
Superior Electric, Warner Electric, Bristol, CT 06010 203-582-9561
† Teal Electronics Corporation, San Diego, CA 92121 619-558-9000
§ Tycor International Inc., Calgary, Alberta, CANADA T2H 1L9 403-259-3200

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Corcom, Inc., Libertyville, IL 60048, 708-680-7400 ..... C•1300
† Electronic Precision Components, Mt. Vernon, NY 10550-4430, 914-664-2333 ..... A•1633
JMK, Inc., Amherst, NH 03031, 603-886-4100 ..... A•1597
† Kappa Technologies, Inc., Rahway, NJ 07065, 908-396-9400;1-800-223-0603 ..... A•1642-1643
† KR Electronics, Inc., Avenel, NJ 07001, 908-636-1900 ..... A•1648
Precision Filters, Inc., Ithaca, NY 14850, 607-277-3550 ..... A•1674-1675
† TTE, Incorporated, W. Los Angeles, CA 90064-1400, 310-478-8224;800-776-7614 ..... A•1680
† Alpha Components, Mechanicsburg, PA 17055 717-697-8595
† Anatech Electronics, Inc., Garfield, NJ 07026 201-772-4242
A. P. Circuit, Brooklyn, NY 11237 718-456-2717
† Axel Electronics, Inc., Subsidiary of FPBSM Industries Inc., Rancho Dominquez, CA 90220 718-291-3900
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
§ Balston, Haverhill, MA 01835-0723 508-374-7400
† BG Electronics, EPC Corp., Mt. Vernon, NY 10550-4430 914-664-5591
† Chesterfield Products, Inc., Microwave Filter Co., Inc., East Syracuse, NY 13057 ..... 800-666-9655;315-463-2309
† Comstron A Div. of Aeroflex, Plainview, NY 11803 516-752-2351
Dantel, Fresno, CA 93727 209-292-1111
Data Delay Devices, Clifton, NJ 07013-1915 201-773-2299
Datel, Inc., Mansfield, MA 02048-1194 508-339-3000
De Coursey Engineering Laboratory, Culver City, CA 90230 1-310-397-9668
Electrocom Industries, S. Bend, IN 46615 219-232-2743
§ Electronic Specialists, Natick, MA 01760 ..... 508-655-1532;800-225-4876
† ESC Electronics Corp., Palisades Pk., NJ 07650 201-947-0400
† Filter Products, Rockwell International, Costa Mesa, CA 92626 714-641-5311
Frequency Devices, Inc., Haverhill, MA 01830 508-374-0761
Frequency Selective Networks, Woodside, NY 11377 718-424-7500
Gennum Corp., Burlington, ON, CANADA L7R 3Y3 ..... 800-263-9353;416-632-2996
† Hisonic, Inc., Olathe, KS 66051 913-782-0012
† Integrated Microwave, San Diego, CA 92121-1009 619-259-2600
ITHACO, Inc., Meas. & Control Instrs. Div., Ithaca, NY 14851-6437 607-272-7640
Keytronics, Inc., Endicott, NY 13760 607-754-5405
Krohn-Hite Corp., Avon, MA 02322 508-580-1660
LCR Electronics-Hopkins Engineering, Norristown, PA 19401 215-278-0840
§† Linear Technology Corp., Milpitas, CA 95035-7487 408-432-1900
† Magnecomp, Inc., Pickens, SC 29671 803-878-4700
† Magnetico Inc., Holtsville, NY 11742 516-654-1166
McCoy/Ovenaire/Spectrum, A Sub. of Oak Industries, Mt. Holly Springs, PA 17065 717-486-3411
Modular Audio Products, Modular Devices, Inc., Shirley, NY 11967 516-345-3100
† NETCOM, Inc, Northbrook, IL 60065-3025 708-564-5100
† Networks International Corporation, Lenexa, KS 66215 913-469-6494
NF Electronic Instruments, State College, PA 16801 814-237-5580
† Pico Electronics, Inc., Mt. Vernon, NY 10552 ..... 914-699-5514;800-431-1064
Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
† RFI Corporation, Bay Shore, NY 11706 516-231-6400
† Rockwell International, Costa Mesa, CA 92626 714-641-5311
§ Shure Brothers Inc., Evanston, IL 60202-3696 708-866-2200
Solar Electronics Co., A. T. Parker, Inc., Hollywood, CA 90038 800-952-5302
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
Universal Ad-Yu/D-F Inc., St. Francis, WI 53235 414-482-4100
Valpey-Opt Company, Valpey-Fisher Corp./Opt Inds., Hopkinton, MA 01748 508-435-6831

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Micronel U.S., Vista, CA 92083, 619-727-7400 ..... C•1618-1625
Air Filtration Products, Inc., Tuscon, AZ 85705 602-624-2272
§† ALFCO, Div. of Air Maze, Carpinteria, CA 93013 805-684-7651
§ Daitron, Inc., Tigard, OR 97223 503-620-2879
W.L. Gore & Assocs., Newark, DE 19714 302-738-4880

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† Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ..... A•1623
Kappa Technologies, Inc., Rahway, NJ 07065, 908-396-9400;1-800-223-0603 ..... A•1642
† KR Electronics, Inc., Avenel, NJ 07001, 908-636-1900 ..... A•1648

§† **Microwave Filter Inc., East Syracuse, NY 13057-0486, 315-437-3953;800-448-1666** ..... **A•1655,1658-1659**
† **TTE, Incorporated, W. Los Angeles, CA 90064-1400, 310-478-8224;800-776-7614** ..... **A•1680**
† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950 201-539-5500
† Alpha Components, Mechanicsburg, PA 17055 717-697-8595
† American Trans-Coil Corporation, Richmond Hill, NY 11419-1410 718-441-5207
† Anatech Electronics, Inc., Garfield, NJ 07026 201-772-4242
† Bird Electronic Corp., Cleveland, OH 44139-2794 216-248-1200
† Chesterfield Products, Inc., Microwave Filter Co., Inc., East Syracuse, NY 13057 ..... 800-666-9655;315-463-2309
† Comstron A Div. of Aeroflex, Plainview, NY 11803 516-752-2351
Continental Electronics Corporation, Dallas, TX 75227 214-381-7161
Electronic Precision Components, Mt. Vernon, NY 10550-4430 914-664-2333
§ Electronic Specialists, Natick, MA 01760 ..... 508-655-1532;800-225-4876
† Frequency Selective Networks, Woodside, NY 11377 718-424-7500
† Gamma-f Corp., Vertex Communications, Torrance, CA 90505 310-539-6704
† Hisonic, Inc., Olathe, KS 66051 913-782-0012
Hughes Microelectronic Circuits Division, Newport Beach, CA 92658-8903 714-759-2952
† K&L Microwave, Inc., Salisbury, MD 21801 410-749-2424
† Loral Microwave-Narda West, Rancho Cordova, CA 95670-6001 916-638-5500
† Loral Microwave-Wavecom, Northridge, CA 91324 818-882-3010
† Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710 813-347-2181
McCoy/Ovenaire/Spectrum, A Sub. of Oak Industries, Mt. Holly Springs, PA 17065 717-486-3411
Micro-Coax, Collegeville, PA 19426 215-489-3700
† Microphase, Norwalk, CT 06856 203-866-8000
Microwave Development Laboratories, Natick, MA 01760 508-655-0060
§ Murata Erie North America, Inc., Smyrna, GA 30080 404-436-1300
§ Omicron electronic, Hohenems, AUSTRIA A-6845 ..... +/5576/4010-0
OPT Industries, Inc., Phillipsburg, NJ 08865 908-454-2600
Penny Technologies, Inc., Greenpoint, NY 11222 718-782-4149
† Piezo Technology Inc., Orlando, FL 32804 407-298-2000
Polyflon Company, Crane Co., New Rochelle, NY 10801 914-636-7222
† Premier Microwave, Port Chester, NY 10573 914-939-8900
† Reactel, Inc., Rockville, MD 20850 301-279-5535
# Relm Communications, Inc., Adage, Inc., Indianapolis, IN 46226 317-545-4281
† RFI Corporation, Bay Shore, NY 11706 516-231-6400
† Sage Laboratories, Inc., Natick, MA 01760 508-653-0844
† Servo Corporation of America, Hicksville, NY 11801-5259 516-938-9700
§† Sinclair Radio Laboratories Ltd., Aurora, ONT., CANADA L4G 3G9 416-727-0165
§ Soshin Electric Co., Ltd., Ota-Ku, Tokyo, JAPAN ..... (03) 3775-9119
Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
† Telonic/Berkeley, Berkeley Inds. Inc., Laguna Beach, CA 92652 714-494-9401
† Torotron Corp., Mt. Vernon, NY 10550 914-664-2050
† Transco Products, Inc., Subsidiary of Datron Systems Inc., Camarillo, CA 93012 805-987-8007
† Trilithic, Inc., Indianapolis, IN 46236 800-344-2412
Valpey-Opt Company, Valpey-Fisher Corp./Opt Inds., Hopkinton, MA 01748 508-435-6831

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† **Avens Signal Equipment, Elmhurst, NY 11373, 718-335-1886** ..... **A•1621**
† **Communication Coil Inc., Chicago, IL 60634, 312-637-1333** ..... **A•1623**
Datel, Inc., Mansfield, MA 02048-1194, 508-339-3000 ..... **D•1185**
Frequency Devices, Inc., Haverhill, MA 01830, 508-374-0761 ..... **A•1638-1639**
† **KR Electronics, Inc., Avenel, NJ 07001, 908-636-1900** ..... **A•1648-1649**
Precision Filters, Inc., Ithaca, NY 14850, 607-277-3550 ..... **A•1673-1675, D•1018,1201**
† **TTE, Incorporated, W. Los Angeles, CA 90064-1400, 310-478-8224;800-776-7614** ..... **A•1680,1683**
ADAC Corporation, Woburn, MA 01801 617-935-6668
§ Alligator Technologies, Fountain Valley, CA 92708 714-850-9984
† Alpha Components, Mechanicsburg, PA 17055 717-697-8595
† Anatech Electronics, Inc., Garfield, NJ 07026 201-772-4242
A. P. Circuit, Brooklyn, NY 11237 718-456-2717
† BG Electronics, EPC Corp., Mt. Vernon, NY 10550-4430 914-664-5591
Burr-Brown Corp., Tucson, AZ 85734 602-746-1111
† Chesterfield Products, Inc., Microwave Filter Co., Inc., East Syracuse, NY 13057 ..... 800-666-9655;315-463-2309
DSP Technology, Fremont, CA 94538-7338 510-657-7555
Φ Encore Electronics, Inc., Saratoga Springs, NY 12866 518-584-5354
† Filtronetics, Inc., Kansas City, MO 64120 816-231-7375
Hycomp, Inc., Marlborough, MA 01752 508-485-6300
Krohn-Hite Corp., Avon, MA 02322 508-580-1660
§† Linear Technology Corp., Milpitas, CA 95035-7487 408-432-1900
NF Electronic Instruments, State College, PA 16801 814-237-5580
§ Omicron electronic, Hohenems, AUSTRIA A-6845 ..... +/5576/4010-0
R. C. Electronics Inc., Goleta, CA 93117 805-685-7770
§† Rockland Scientific Corporation, Princeton, NJ 08543 609-844-0800
† Rockwell International, Costa Mesa, CA 92626 714-641-5311
Television Equipment Assocs., So. Salem, NY 10590-0393 914-763-8893
Tustin Electronics Co., Anaheim, CA 92807 714-777-5800
Valpey-Opt Company, Valpey-Fisher Corp./Opt Inds., Hopkinton, MA 01748 508-435-6831

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Allen Avionics, Inc., Mineola, NY 11501, 516-248-8080 ..... **A•1514,1619**
† **Avens Signal Equipment, Elmhurst, NY 11373, 718-335-1886** ..... **A•1620-1622**
† **Communication Coil Inc., Chicago, IL 60634, 312-637-1333** ..... **A•1623**
Communications & Energy Corp., E. Syracuse, NY 13057, 315-452-0709 ..... **A•1625**
† **Eagle Wichita, Wichita, KS 67277, 316-942-5100** ..... **A•1626,1630**
Electronic Precision Components, Mt. Vernon, NY 10550-4430, 914-664-2333 ..... **A•1633**
Frequency Devices, Inc., Haverhill, MA 01830, 508-374-0761 ..... **A•1638-1639**
† **Genisco Electronics, A Division of GTC, Anaheim, CA 92805, 714-563-4300** ..... **A•1641**
† **Kappa Technologies, Inc., Rahway, NJ 07065, 908-396-9400;1-800-223-0603** ..... **A•1642-1643**
† **KR Electronics, Inc., Avenel, NJ 07001, 908-636-1900** ..... **A•1648-1649**
Krohn-Hite Corp., Avon, MA 02322, 508-580-1660 ..... **A•1650**
† **McCoy/Ovenaire/Spectrum, A Sub. of Oak Industries, Mt. Holly Springs, PA 17065, 717-486-3411** ..... **A•1417**
Metuchen Capacitors, Inc., Old Bridge, NJ 08857, 908-679-3366 ..... **A•1653**
§† **Microwave Filter Inc., East Syracuse, NY 13057-0486, 315-437-3953;800-448-1666** ..... **A•1655-1658**
Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500 ..... **A•1725**
Morgan-Matroc, Electro Ceramics Division, Bedford, OH 44146-5478, 216-232-8600 ..... **B•1974**
† **Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300** ..... **A•1436**
Musashino Corporation, Mission Viejo, CA 92691, 714-458-1155 ..... **A•1439**
PCA Electronics, Sepulveda, CA 91343, 818-892-0761 ..... **A•1668-1669**
Precision Filters, Inc., Ithaca, NY 14850, 607-277-3550 ..... **A•1673-1675**
TOYOCOM USA INC., Arlington Heights, IL 60005, 708-593-8780/1-800-TOYOCOM ..... **A•1494**
† **TTE, Incorporated, W. Los Angeles, CA 90064-1400, 310-478-8224;800-776-7614** ..... **A•1680,1683**
Wilco Corp., Indianapolis, IN 46268, 317-293-9300 ..... **A•1313**
Advanced Filter Devices, Inc., Carlsbad, CA 92009 619-438-2074
† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950 201-539-5500
† Alpha Components, Mechanicsburg, PA 17055 717-697-8595
† American Trans-Coil Corporation, Richmond Hill, NY 11419-1410 718-441-5207
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† Bird Electronic Corp., Cleveland, OH 44139-2794 216-248-1200
Burr-Brown Corp., Tucson, AZ 85734 602-746-1111
† Chesterfield Products, Inc., Microwave Filter Co., Inc., East Syracuse, NY 13057 ..... 800-666-9655;315-463-2309
† Cir-Q-Tel, Trilithic, Indianapolis, IN 46236 800-344-2412
† Coast Coil Co., Coast Magnetics, Los Angeles, CA 90016 213-936-6188
Coilcraft, Cary, IL 60013 708-639-2361
† Communications Sys. Technology, Inc., Hermosa Beach, CA 90254 213-374-3849
† Comstron A Div. of Aeroflex, Plainview, NY 11803 516-752-2351
Corcom, Inc., Libertyville, IL 60048 708-680-7400
† Daden Associates, San Clemente, CA 92673 714-366-1522
Dantel, Fresno, CA 93727 209-292-1111
Datel, Inc., Mansfield, MA 02048-1194 508-339-3000
§ De Coursey Engineering Laboratory, Culver City, CA 90230 1-310-397-9668
† Dontech, Inc., Doylestown, PA 18901 215-348-5010
§ Dynamics, Div. of Waugh Controls Corp., Chatsworth, CA 91311 818-998-8281
† EG & G Frequency Products Inc., EG & G Inc., Cincinnati, OH 45232 513-542-5555
Electrocom Industries, S. Bend, IN 46615 219-232-2743
§ Electro-Metrics, Incorporated, A Penril Corp., Amsterdam, NY 12010 518-843-2600
† Electronic Transformer Corp., Paterson, NJ 07544-0487 201-942-2222
Elpac Components, Elpac Electronics, Inc., Irvine, CA 92714 714-476-6070
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
† ESC Electronics Corp., Palisades Pk., NJ 07650 201-947-0400
† EWC, Inc., Englishtown, NJ 07726 908-446-3110
† Ferretec Inc., Fremont, CA 94538-6525 510-226-1216
† Filtron, RFI Corporation, Bayshore, NY 11706 516-231-6400
† Filtronetics, Inc., Kansas City, MO 64120 816-231-7375
† Freed Transformer Co., Inc., Electronic Transformer Corp., Paterson, NJ 07544-0487 201-942-2222
† Frequency Electronics, Inc., Mitchel Field, NY 11553 516-794-4500
† Frequency Selective Networks, Woodside, NY 11377 718-424-7500
† Hisonic, Inc., Olathe, KS 66051 913-782-0012
† Hughes Microelectronic Circuits Division, Newport Beach, CA 92658-8903 714-759-2952
† Integrated Microwave, San Diego, CA 92121-1009 619-259-2600
† International Sensor Systems, Inc., Aurora, NE 68818 402-694-6111
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† K&L Microwave, Inc., Salisbury, MD 21801 410-749-2424
† Liberty Mirror Co., Pilkington Aerospace Inc., Brackenridge, PA 15014 412-224-1800
§† Linear Technology Corp., Milpitas, CA 95035-7487 408-432-1900
† Loral Microwave-Narda West, Rancho Cordova, CA 95670-6001 916-638-5500
† Loral Microwave-Wavecom, Northridge, CA 91324 818-882-3010
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† Magnetico Inc., Holtsville, NY 11742 516-654-1166
Marconi Instruments, Allendale, NJ 07401 201-934-9050
† Metropole Products Inc., Stafford, VA 22554 703-659-2132
† Microphase, Norwalk, CT 06856 203-866-8000
Microwave Communications Corp., Valencia, CA 91355 805-257-1948
§ Microwave Development Laboratories, Natick, MA 01760 508-655-0060
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3 ..... 514-694-6666; 800-724-3911
§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 075-951-9111
† NETCOM, Inc, Northbrook, IL 60065-3025 708-564-5100
† Networks International Corporation, Lenexa, KS 66215 913-469-6494
NF Electronic Instruments, State College, PA 16801 814-237-5580
† North Hills Signal Processing, Syosset, NY 11791 516-682-7740
§ Omicron electronic, Hohenems, AUSTRIA A-6845 ..... +/5576/4010-0
OPT Industries, Inc., Phillipsburg, NJ 08865 908-454-2600
Penny Technologies, Inc., Greenpoint, NY 11222 718-782-4149
† Piezo Technology Inc., Orlando, FL 32804 407-298-2000

† Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
† Premier Microwave, Port Chester, NY 10573 914-939-8900
† Reactel, Inc., Rockville, MD 20850 301-279-5535
† RFI Corporation, Bay Shore, NY 11706 516-231-6400
† RF Monolithics, Inc., Dallas, TX 75244 214-233-2903
§† Rockland Scientific Corporation, Princeton, NJ 08543 609-844-0800
† Servo Corporation of America, Hicksville, NY 11801-5259 516-938-9700
§† Sinclair Radio Laboratories Ltd., Aurora, ONT., CANADA L4G 3G9 416-727-0165
§ Soshin Electric Co., Ltd., Ota-Ku, Tokyo, JAPAN ..... (03) 3775-9119
§ Spectra Sonics, Ogden, UT 84405 801-392-7531
§† Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
† Teledyne Microwave, Mountain View, CA 94043 415-968-2211
Television Equipment Assocs., So. Salem, NY 10590-0393 914-763-8893
† Telonic/Berkeley, Berkeley Inds. Inc., Laguna Beach, CA 92652 714-494-9401
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
† Torotron Corp., Mt. Vernon, NY 10550 914-664-2050
† Trilithic, Inc., Indianapolis, IN 46236 800-344-2412
Valpey-Opt Company, Valpey-Fisher Corp./Opt Inds., Hopkinton, MA 01748 508-435-6631
† Vanguard Electronics Co., Gardena, CA 90248 310-323-4100
Western Multiplex Corp., Belmont, CA 94002 415-592-8832

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Allen Avionics, Inc., Mineola, NY 11501, 516-248-8080 ..... A•1514,1619
† Avens Signal Equipment, Elmhurst, NY 11373, 718-335-1886 ..... A•1620-1622
† Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ..... A•1623
Communications & Energy Corp., E. Syracuse, NY 13057, 315-452-0709 ..... A•1625
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† Eagle Wichita, Wichita, KS 67277, 316-942-5100 ..... A•1626,1630
† Electronic Precision Components, Mt. Vernon, NY 10550-4430, 914-664-2333 ..... A•1633
Fee Fil-Mag, San Diego, CA 92123, 619-569-6577 ..... A•2349
Frequency Devices, Inc., Haverhill, MA 01830, 508-374-0761 ..... A•1638-1639
† Genisco Electronics, A Division of GTC, Anaheim, CA 92805, 714-563-4300 ..... A•1641
Hy-Q International (USA) Inc., Erlanger, KY 41018, 606-283-5000 ..... A•1408
† Kappa Technologies, Inc., Rahway, NJ 07065, 908-396-9400;1-800-223-0603 ..... A•1642-1643
† KR Electronics, Inc., Avenel, NJ 07001, 908-636-1900 ..... A•1648-1649
Krohn-Hite Corp., Avon, MA 02322, 508-580-1660 ..... A•1650
† McCoy/Ovenaire/Spectrum, A Sub. of Oak Industries, Mt. Holly Springs, PA 17065 717-486-3411 ..... A•1417
Metuchen Capacitors, Inc., Old Bridge, NJ 08857, 908-679-3366 ..... A•1653
§† Microwave Filter Inc., East Syracuse, NY 13057-0486, 315-437-3953;800-448-1666 ..... A•1655-1659
Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500 ..... A•1725
† Morgan-Matroc, Electro Ceramics Division, Bedford, OH 44146-5478, 216-232-8600 ..... B•1974
† Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ..... A•1436,1708-1709
Musashino Corporation, Mission Viejo, CA 92691, 714-458-1155 ..... A•1439
§ PCA Electronics, Sepulveda, CA 91343, 818-892-0761 ..... A•1668
† Polara Engineering Inc., Fullerton, CA 92633, 714-521-0900 ..... A•1576
Precision Filters, Inc., Ithaca, NY 14850, 607-277-3550 ..... A•1673-1674
† TTE, Incorporated, W. Los Angeles, CA 90064-1400, 310-478-8224;800-776-7614 ..... A•1680,1682-1683
† Advanced Filter Devices, Inc., Carlsbad, CA 92009 619-438-2074
† Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803 516-694-6700
† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950 201-539-5500
† Alpha Components, Mechanicsburg, PA 17055 717-697-8595
† American Trans-Coil Corporation, Richmond Hill, NY 11419-1410 718-441-5207
† Anatech Electronics, Inc., Garfield, NJ 07026 201-772-4242
† Antenna Specialists, The Allen Group, Cleveland, OH 44139 216-349-8400
A. P. Circuit, Brooklyn, NY 11237 718-456-2717
§ Aptek Technologies, Inc., DBA Aptek Microsystems, Deerfield Beach, FL 33442 305-421-8450
§ ATV Research, Inc., Dakota City, NE 68731 402-987-3771
AVX Corporation, A Kyocera Group Company, Myrtle Beach, SC 29577 803-448-9411
† Axel Electronics, Inc., Subsidiary of FPBSM Industries Inc., Rancho Dominquez, CA 90220 713-291-3900
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635 714-447-2300
† BG Electronics, EPC Corp., Mt. Vernon, NY 10550-4430 914-664-5591
† Bird Electronic Corp., Cleveland, OH 44139-2794 216-248-1200
† Blackhawk Networks Corp., Janesville, WI 53545 608-752-8701
Bruel & Kjaer Instrs. Inc., Decatur, GA 30035 404-981-6225
Burr-Brown Corp., Tucson, AZ 85734 602-746-1111
† Chesterfield Products, Inc., Microwave Filter Co., Inc., East Syracuse, NY 13057 800-666-9655,315-463-2309
† Cir-Q-Tel, Trilithic, Indianapolis, IN 46236 800-344-2412
† Coast Coil Co., Coast Magnetics, Los Angeles, CA 90016 213-936-6188
Coaxial Dynamics, Cleveland, OH 44135 ..... 1-800-COAXIAL
Coilcraft, Cary, IL 60013 708-639-2361
† Coil-Q Corp., Bronxville, NY 10708 914-337-4775
† Communications Sys. Technology, Inc., Hermosa Beach, CA 90254 213-374-3849
† Comstron A Div. of Aeroflex, Plainview, NY 11803 516-752-2351
Connecticut Microwave Corp., Cheshire, CT 06410 203-250-9678
Continental Electronics Corporation, Dallas, TX 75227 214-381-7161
Curtis Industries, Milwaukee, WI 53234-3925 414-649-4200
† Daden Associates, San Clemente, CA 92673 714-366-1522
Dantel, Fresno, CA 93727 209-292-1111
§ De Coursey Engineering Laboratory, Culver City, CA 90230 1-310-397-9668
Dowty Avionics, Arcadia, CA 91006 818-445-5955
§ Dynamics, Div. of Waugh Controls Corp., Chatsworth, CA 91311 818-998-8281
† EG & G Frequency Products Inc., EG & G Inc., Cincinnati, OH 45232 513-542-5555
EG&G Optoelectronics- Reticon, Sunnyvale, CA 94086-4197 408-738-4266
Electrocom Industries, S. Bend, IN 46615 219-232-2743
† Electronic Transformer Corp., Paterson, NJ 07544-0487 201-942-2222
Elpac Components, Elpac Electronics, Inc., Irvine, CA 92714 714-476-6070
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
§ Ercona, Patchogue, NY 11772 516-758-0700
† ESC Electronics Corp., Palisades Pk., NJ 07650 201-947-0400
EWC, Inc., Englishtown, NJ 07726 908-446-3110
§ Exar Corp., San Jose, CA 95161-9007 408-434-6400
† Ferretec Inc., Fremont, CA 94538-6525 510-226-1216
† Filter Products, Rockwell International, Costa Mesa, CA 92626 714-641-5311
† Filtron, RFI Corporation, Bayshore, NY 11706 516-231-6400
† Filtronetics, Inc., Kansas City, MO 64120 816-231-7375
§ Fox Electronics, Ft. Myers, FL 33905 813-693-0099
† Freed Transformer Co., Inc., Electronic Transformer Corp., Paterson, NJ 07544-0487 201-942-2222
† Frequency Electronics, Inc., Mitchel Field, NY 11553 516-794-4500
† Frequency Selective Networks, Woodside, NY 11377 718-424-7500
† Gamma-f Corp., Vertex Communications, Torrance, CA 90505 310-539-6704
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
† Hisonic, Inc., Olathe, KS 66051 913-782-0012
† Hughes Microelectronic Circuits Division, Newport Beach, CA 92658-8903 714-759-2952
Hycomp, Inc., Marlborough, MA 01752 508-485-6300
Hyletronics:Litton Industries, Lexington, MA 02173-3199 617-276-3298
† Integrated Microwave, San Diego, CA 92121-1009 619-259-2600
International Crystal Mfg., Oklahoma City, OK 73126-0330 ..... 405-236-3741; 1-800-725-1426
† International Sensor Systems, Inc., Aurora, NE 68818 402-694-6111
ITHACO, Inc., Meas. & Control Instrs. Div., Ithaca, NY 14851-6437 607-272-7640
† K&L Microwave, Inc., Salisbury, MD 21801 410-749-2424
KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
§† KDS America, Daishinku Corp., Overland Pk, KS 66211 913-491-6825
Keytronics, Inc., Endicott, NY 13760 607-754-5405
† Lark Engineering Co., Baier & Baier Inc., San Juan Capistrano, CA 92675 714-240-1233
Lectronic Research Labs., Inc., Camden, NJ 08104 800-358-8378
† Liberty Mirror Co., Pilkington Aerospace Inc., Brackenridge, PA 15014 412-224-1800
§† Linear Technology Corp., Milpitas, CA 95035-7487 408-432-1900
† Loral Microwave-Narda West, Rancho Cordova, CA 95670-6001 916-638-5500
† Loral Microwave-Wavecom, Northridge, CA 91324 818-882-3010
† Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710 813-347-2181
MACOM, Inc., Lowell, MA 01851 617-272-3000
† Magnecomp, Inc., Pickens, SC 29671 803-878-4700
† Magnetico Inc., Holtsville, NY 11742 516-654-1166
† Metropole Products Inc., Stafford, VA 22554 703-659-2132
§† Micro-Coax, Collegeville, PA 19426 215-489-3700
† Microlab/FXR, Livingston, NJ 07039 201-992-7700
† Microphase, Norwalk, CT 06856 203-866-8000
MicroSignals Inc., L.I.C., NY 11101 ..... 718-937-7955;718-937-0391;800-648-2252
† Microsonics, Inc., Weymouth, MA 02188 617-337-4200
Microwave Communications Corp., Valencia, CA 91355 805-257-1948
§ Microwave Development Laboratories, Natick, MA 01760 508-655-0060
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3 ..... 514-694-6666; 800-724-3911
§ Motorola Ceramic Products, Components Division, Albuquerque, NM 87113 505-822-8801
§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 075-951-9111
NEC Electronics, Inc., Mountain View, CA 94039-7241 1-800-366-9782
† NETCOM, Inc, Northbrook, IL 60065-3025 708-564-5100
† Networks International Corporation, Lenexa, KS 66215 913-469-6494
NF Electronic Instruments, State College, PA 16801 814-237-5580
† North Hills Signal Processing, Syosset, NY 11791 516-682-7740
§ Omicron electronic, Hohenems, AUSTRIA A-6845 ..... + /5576/4010-0
OPT Industries, Inc., Phillipsburg, NJ 08865 908-454-2600
Oriel Corp., Stratford, CT 06497-0872 203-377-8282
Penny Technologies, Inc., Greenpoint, NY 11222 718-782-4149
† Piezo Technology Inc., Orlando, FL 32804 407-298-2000
Pole/Zero Corporation, West Chester, OH 45069 513-870-9060
† Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
† Premier Microwave, Port Chester, NY 10573 914-939-8900
† Reactel, Inc., Rockville, MD 20850 301-279-5535
# Relm Communications, Inc., Adage, Inc., Indianapolis, IN 46226 317-545-4281
† RFI Corporation, Bay Shore, NY 11706 516-231-6400
† RLC Electronics, Inc., Mt. Kisco, NY 10549 914-241-1334
RME Filters, Inc., Amherst, NH 03031 603-595-4573
§† Rockland Scientific Corporation, Princeton, NJ 08543 609-844-0800
† Rockwell International, Costa Mesa, CA 92626 714-641-5311
† Sage Laboratories, Inc., Natick, MA 01760 508-653-0844
† Sawtek Inc., Orlando, FL 32860-9501 407-886-8860
§ Seiko Instruments U.S.A., Inc. Electronic Components, Torrance, CA 90505 310-517-7770
Servo Corporation of America, Hicksville, NY 11801-5259 516-938-9700
SFE Technologies, San Fernando, CA 91340 818-365-9411
§ Shure Brothers Inc., Evanston, IL 60202-3696 708-866-2200
Signatron, A Subsidiary of Meteor Communications Corp., Lexington, MA 02173 617-861-1500
§† Sinclair, Radio Laboratories Ltd., Aurora, ONT., CANADA L4G 3G9 416-727-0165
Solar Electronics Co., A. T. Parker, Inc., Hollywood, CA 90038 800-952-5302
§ Soshin Electric Co., Ltd., Ota-Ku, Tokyo, JAPAN ..... (03) 3775-9119
§ Spectra Sonics, Ogden, UT 84405 801-392-7531
Stanford Resch. Sys., Inc., Sunnyvale, CA 94089 408-744-9040

† ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086 408-730-6300
§† Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
† Teledyne Microelectronics, Los Angeles, CA 90066 ..... 310-822-8229;310-305-0248
† Teledyne Microwave, Mountain View, CA 94043 415-968-2211
§ Television Equipment Assocs., So. Salem, NY 10590-0393 914-763-8893
† Telonic/Berkeley, Berkeley Inds. Inc., Laguna Beach, CA 92652 714-494-9401
Til-Tek Limited, Kemptville, Ontario, CANADA K0G 1J0 613-258-5928
§ Toko America, Inc., Mt. Prospect,, IL 60056 708-297-0070
† Torotron Corp., Mt. Vernon, NY 10550 914-664-2050
† Trilithic, Inc., Indianapolis, IN 46236 800-344-2412
Tucker Electronics, Dallas, TX 75355-1419 ..... 214-348-8800;800-527-4642
Universal Ad-Yu/D-F Inc., St. Francis, WI 53235 414-482-4100
† UTE Microwave, Asbury Park, NJ 07712 908-922-1009
Valpey-Opt Company, Valpey-Fisher Corp./Opt Inds., Hopkinton, MA 01748 508-435-6831
† Vanguard Electronics Co., Gardena, CA 90248 310-323-4100
† Watkins-Johnson Co., Palo Alto, CA 94304 415-493-4141
Wavetek Corp., San Diego, CA 92123 619-279-2200
Wavetek Instruments Division, Wavetek Corp., San Diego, CA 92123 619-279-2200
Western Multiplex Corp., Belmont, CA 94002 415-592-8832
Wide Band Engineering Co., Inc., Phoenix, AZ 85036 602-254-1570

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Communications & Energy Corp., E. Syracuse, NY 13057, 315-452-0709 ..... A•1625
† Frequency Electronics, Inc., Mitchel Field, NY 11553, 516-794-4500 ..... A•1403
Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 .. A•1708-1709
NDK America, Inc., Fremont, CA 94539, 415-623-6500 ..... A•1440
Anatech Electronics, Inc., Garfield, NJ 07026 201-772-4242
A. P. Circuit, Brooklyn, NY 11237 718-456-2717
§ AT&T Microelectronics, Allentown, PA 18103 ..... 1-800-372-2447;In Can.:1-800-553-2448
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
† Genisco Electronics, A Division of GTC, Anaheim, CA 92805 714-563-4300
§ Hitachi America, Ltd., Tarrytown, NY 10591 914-631-0600
§† Linear Technology Corp., Milpitas, CA 95035-7487 408-432-1900
† McCoy/Ovenaire/Spectrum, A Sub. of Oak Industries, Mt. Holly Springs, PA 17065 717-486-3411
§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
† Phonon Corporation, Simsbury, CT 06070 203-651-0211
† RF Monolithics, Inc., Dallas, TX 75244 214-233-2903
† RLC Electronics, Inc., Mt. Kisco, NY 10549 914-241-1334
† Sawtek Inc., Orlando, FL 32860-9501 407-886-8860
Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
§ Toko America, Inc., Mt. Prospect,, IL 60056 708-297-0070

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Electronic Precision Components, Mt. Vernon, NY 10550-4430, 914-664-2333 ..... A•1633
§ KCK America Inc., Mitsubishi Materials Corporation, Rolling Meadows, IL 60008, 708-577-0200 ..... A•1091,1647
† Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ..... A•1436
§ NTK Technical Ceramics, NGK Spark Plugs (USA), Mt. Prospect, IL 60056, 708-824-1133 ..... A•1664,1666-1667
§† Spectrum Control, Inc., Erie, PA 16506, 814-835-4000 ..... A•1677
§† Tusonix, Inc., Tucson, AZ 85740-7144, 602-744-0400 ..... A•1169,1684
Antenna Specialists, The Allen Group, Cleveland, OH 44139 216-349-8400
§† AVX Corporation, A Kyocera Group Company, Myrtle Beach, SC 29577 803-448-9411
† AVX Filters Corp., Sun Valley, CA 91352 818-767-6770
† Ceramic Devices Inc., San Diego, CA 92111 619-560-7575
Curtis Industries, Milwaukee, WI 53234-3925 414-649-4200
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
§† Hybrids International, Frequency Products Div., Olathe, KS 66062 913-764-4544
† Integrated Microwave, San Diego, CA 92121-1009 619-259-2600
Integrity Technology Corporation, Santa Clara, CA 95050 408-262-8640
§ Motorola Ceramic Products, Components Division, Albuquerque, NM 87113 505-822-8801
§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
† NETCOM, Inc, Northbrook, IL 60065-3025 708-564-5100
† RFI Corporation, Bay Shore, NY 11706 516-231-6400
§† SFE Technologies, San Fernando, CA 91340 818-365-9411
Sprague, Wet & Foil Tantalum Capacitors, North Adams, MA 01247-3987 413-664-4431
§ TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056 708-803-6100
§ Toko America, Inc., Mt. Prospect,, IL 60056 708-297-0070

Filters, Ceramic, Surface Mount-2750

† Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ..... A•1623
§ NTK Technical Ceramics, NGK Spark Plugs (USA), Mt. Prospect, IL 60056, 708-824-1133 ..... A•1664,1666
§† Tusonix, Inc., Tucson, AZ 85740-7144, 602-744-0400 ..... A•1684
A. P. Circuit, Brooklyn, NY 11237 718-456-2717
AVX Corporation, A Kyocera Group Company, Myrtle Beach, SC 29577 803-448-9411
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
† Integrated Microwave, San Diego, CA 92121-1009 619-259-2600
§ Motorola Ceramic Products, Components Division, Albuquerque, NM 87113 505-822-8801
§ Murata Erie North America, Inc., Smyrna, GA 30080 404-436-1300
§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
Oxley Inc., Branford, CT 06405 203-488-1033
§ Toko America, Inc., Mt. Prospect,, IL 60056 708-297-0070
† Trilithic, Inc., Indianapolis, IN 46236 800-344-2412

Filters, Coaxial-2750

† Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ..... A•1623
§† Microwave Filter Inc., East Syracuse, NY 13057-0486, 315-437-3953;800-448-1666 ..... A•1655-1659
Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500 ..... A•1725
§† Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 .. A•1660-1661
§† Spectrum Control, Inc., Erie, PA 16506, 814-835-4000 ..... A•1677
† TTE, Incorporated, W. Los Angeles, CA 90064-1400, 310-478-8224;800-776-7614 ..... A•1680
§† Tusonix, Inc., Tucson, AZ 85740-7144, 602-744-0400 ..... A•1684
† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950 201-539-5500
Allen Avionics, Inc., Mineola, NY 11501 516-248-8080
Antenna Specialists, The Allen Group, Cleveland, OH 44139 216-349-8400
§ AVA Electronics Corporation, Drexel Hill, PA 19026 215-284-2500
Axel Electronics, Inc., Subsidiary of FPBSM Industries Inc., Rancho Dominquez, CA 90220 718-291-3900
BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
† Bird Electronic Corp., Cleveland, OH 44139-2794 216-248-1200
† Cir-Q-Tel, Trilithic, Indianapolis, IN 46236 800-344-2412
Connecticut Microwave Corp., Cheshire,, CT 06410 203-250-9678
† Daden Associates, San Clemente, CA 92673 714-366-1522
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
† Integrated Microwave, San Diego, CA 92121-1009 619-259-2600
† K&L Microwave, Inc., Salisbury, MD 21801 410-749-2424
† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
† Lark Engineering Co., Baier & Baier Inc., San Juan Capistrano, CA 92675 714-240-1233
Lectronic Research Labs., Inc., Camden, NJ 08104 800-358-8378
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† Loral Microwave-Wavecom, Northridge, CA 91324 818-882-3010
† Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710 813-347-2181
MACOM, Inc., Lowell, MA 01851 617-272-3000
† Metropole Products Inc., Stafford, VA 22554 703-659-2132
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† Microlab/FXR, Livingston, NJ 07039 201-992-7700
† Microphase, Norwalk, CT 06856 203-866-8000
Microwave Communications Corp., Valencia, CA 91355 805-257-1948
§ Microwave Development Laboratories, Natick, MA 01760 508-655-0060
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3 ..... 514-694-6666; 800-724-3911
Motorola Ceramic Products, Components Division, Albuquerque, NM 87113 505-822-8801
Penny Technologies, Inc., Greenpoint, NY 11222 718-782-4149
† Reactel Inc., Rockville, MD 20850 301-279-5535
RFI Corporation, Bay Shore, NY 11706 516-231-6400
† Sage Laboratories, Inc., Natick, MA 01760 508-653-0844
SFE Technologies, San Fernando, CA 91340 818-365-9411
§† Sinclair Radio Laboratories Ltd., Aurora, ONT., CANADA L4G 3G9 416-727-0165
H H Smith, NT-T Inc., Meadville, PA 16335 814-724-6440
ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086 408-730-6300
§† Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
† Teledyne Microwave, Mountain View, CA 94043 415-968-2211
† Telonic/Berkeley, Berkeley Inds. Inc., Laguna Beach, CA 92652 714-494-9401
† Transco Products, Inc., Subsidiary of Datron Systems Inc., Camarillo, CA 93012 805-987-8007
† Trilithic, Inc., Indianapolis, IN 46236 800-344-2412
† UTE Microwave, Asbury Park, NJ 07712 908-922-1009
† Vanguard Electronics Co., Gardena, CA 90248 310-323-4100
Veeco Instruments Inc., Plainview, NY 11803 516-349-8300
Western Multiplex Corp., Belmont, CA 94002 415-592-8832

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Filters, Comb-2750

KR Electronics, Inc., Avenel, NJ 07001, 908-636-1900 ..... A•1648
† TTE, Incorporated, W. Los Angeles, CA 90064-1400, 310-478-8224;800-776-7614 ..... A•1680
Advanced Filter Devices, Inc., Carlsbad, CA 92009 619-438-2074
† Alpha Components, Mechanicsburg, PA 17055 717-697-8595
† Anatech Electronics, Inc., Garfield, NJ 07026 201-772-4242
† Axel Electronics, Inc., Subsidiary of FPBSM Industries Inc., Rancho Dominquez, CA 90220 718-291-3900
† BG Electronics, EPC Corp., Mt. Vernon, NY 10550-4430 914-664-5591
† Blackhawk Networks Corp., Janesville, WI 53545 608-752-8701
† Communications Sys. Technology, Inc., Hermosa Beach, CA 90254 213-374-3849
De Coursey Engineering Laboratory, Culver City, CA 90230 1-310-397-9668
† EG & G Frequency Products Inc., EG & G Inc., Cincinnati, OH 45232 513-542-5555
EG&G Optoelectronics- Reticon, Sunnyvale, CA 94086-4197 408-738-4266
Electrocom Industries, S. Bend, IN 46615 219-232-2743
† Electronic Precision Components, Mt. Vernon, NY 10550-4430 914-664-2333
Elpac Components, Elpac Electronics, Inc., Irvine, CA 92714 714-476-6070
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
† Filter Products, Rockwell International, Costa Mesa, CA 92626 714-641-5311
† Filtronetics, Inc., Kansas City, MO 64120 816-231-7375

† Frequency Electronics, Inc., Mitchel Field, NY 11553 516-794-4500
† Frequency Selective Networks, Woodside, NY 11377 718-424-7500
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† Hisonic, Inc., Olathe, KS 66051 913-782-0012
† Hughes Microelectronic Circuits Division, Newport Beach, CA 92658-8903 714-759-2952
Hyletronics:Litton Industries, Lexington, MA 02173-3199 617-276-3298
† Integrated Microwave, San Diego, CA 92121-1009 619-259-2600
† K&L Microwave, Inc., Salisbury, MD 21801 410-749-2424
KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
† Lark Engineering Co., Baier & Baier Inc., San Juan Capistrano, CA 92675 714-240-1233
† Loral Microwave-Narda West, Rancho Cordova, CA 95670-6001 916-638-5500
† Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710 813-347-2181
McCoy/Ovenaire/Spectrum, A Sub. of Oak Industries, Mt. Holly Springs, PA 17065 717-486-3411
† Microlab/FXR, Livingston, NJ 07039 201-992-7700
† Microphase, Norwalk, CT 06856 203-866-8000
Microwave Development Laboratories, Natick, MA 01760 508-655-0060
§ Microwave Filter Inc., East Syracuse, NY 13057-0486 ..... 315-437-3953;800-448-1666
OPT Industries, Inc., Phillipsburg, NJ 08865 908-454-2600
Penny Technologies, Inc., Greenpoint, NY 11222 718-782-4149
Precision Filters, Inc., Ithaca, NY 14850 607-277-3550
† Reactel, Inc., Rockville, MD 20850 301-279-5535
RFI Corporation, Bay Shore, NY 11706 516-231-6400
† Rockwell International, Costa Mesa, CA 92626 714-641-5311
† Servo Corporation of America, Hicksville, NY 11801-5259 516-938-9700
§ Sinclair Radio Laboratories Ltd., Aurora, ONT., CANADA L4G 3G9 416-727-0165
† Teledyne Microwave, Mountain View, CA 94043 415-968-2211
† Telonic/Berkeley, Berkeley Inds. Inc., Laguna Beach, CA 92652 714-494-9401
† Torotron Corp., Mt. Vernon, NY 10550 914-664-2050
† Trilithic, Inc., Indianapolis, IN 46236 800-344-2412
Valpey-Opt Company, Valpey-Fisher Corp./Opt Inds., Hopkinton, MA 01748 508-435-6831

Filters, Continuously Variable-2750

† Avens Signal Equipment, Elmhurst, NY 11373, 718-335-1886 ..... A•1622
Datel, Inc., Mansfield, MA 02048-1194, 508-339-3000 ..... D•1185
† Eagle Wichita, Wichita, KS 67277, 316-942-5100 ..... A•1626
Frequency Devices, Inc., Haverhill, MA 01830, 508-374-0761 ..... A•1638
§† Microwave Filter Inc., East Syracuse, NY 13057-0486, 315-437-3953;800-448-1666 ..... A•1655-1657
Precision Filters, Inc., Ithaca, NY 14850, 607-277-3550 ..... A•1673-1675
§ Pulizzi Engineering, Inc., Santa Ana, CA 92704-6865, 714-540-4229 ..... D•2300
† TTE, Incorporated, W. Los Angeles, CA 90064-1400, 310-478-8224;800-776-7614 ..... A•1680
A. P. Circuit, Brooklyn, NY 11237 718-456-2717
† Axel Electronics, Inc., Subsidiary of FPBSM Industries Inc., Rancho Dominquez, CA 93220 718-291-3900
† BG Electronics, EPC Corp., Mt. Vernon, NY 10550-4430 914-664-5591
† Cir-Q-Tel, Trilithic, Indianapolis, IN 46236 800-344-2412
Comstron A Div. of Aeroflex, Plainview, NY 11803 516-752-2351
Control Concepts Corp., Liebert Corp., Binghamton, NY 13902-1380 607-724-2484
† Daden Associates, San Clemente, CA 92673 714-366-1522
§ Dynamics, Div. of Waugh Controls Corp., Chatsworth, CA 91311 818-998-8281
EG&G Optoelectronics- Reticon, Sunnyvale, CA 94086-4197 408-738-4266
Φ Encore Electronics, Inc., Saratoga Springs, NY 12866 518-584-5354
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
§ Exar Corp., San Jose, CA 95161-9007 408-434-6400
† Ferretec Inc., Fremont, CA 94538-6525 510-226-1216
Frequency Selective Networks, Woodside, NY 11377 718-424-7500
† Integrated Microwave, San Diego, CA 92121-1009 619-259-2600
† K&L Microwave, Inc., Salisbury, MD 21801 410-749-2424
Krohn-Hite Corp., Avon, MA 02322 508-580-1660
§† Linear Technology Corp., Milpitas, CA 95035-7487 408-432-1900
† Loral Microwave-Wavecom, Northridge, CA 91324 818-882-3010
† Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710 813-347-2181
† Microlab/FXR, Livingston, NJ 07039 201-992-7700
NF Electronic Instruments, State College, PA 16801 814-237-5580
§ Omicron electronic, Hohenems, AUSTRIA A-6845 ..... +/5576/4010-0
Pole/Zero Corporation, West Chester, OH 45069 513-870-9060
† Premier Microwave, Port Chester, NY 10573 914-939-8900
R. C. Electronics Inc., Goleta, CA 93117 805-685-7770
RFI Corporation, Bay Shore, NY 11706 516-231-6400
§† Rockland Scientific Corporation, Princeton, NJ 08543 609-844-0800
Stanford Resch. Sys., Inc., Sunnyvale, CA 94089 408-744-9040
Systems Research Laboratories, Arvin/Calspan, Dayton, OH 45440 513-426-6000
† Teledyne Microelectronics, Los Angeles, CA 90066 ..... 310-822-8229;310-305-0248
Television Equipment Assocs., So. Salem, NY 10590-0393 914-763-8893
† Telonic/Berkeley, Berkeley Inds. Inc., Laguna Beach, CA 92652 714-494-9401
† Trilithic, Inc., Indianapolis, IN 46236 800-344-2412
Universal Ad-Yu/D-F Inc., St. Francis, WI 53235 414-482-4100

Filters, Crystal-2300

† Frequency Electronics, Inc., Mitchel Field, NY 11553, 516-794-4500 ..... A•1403
§† Hybrids International Ltd., Thick Film Division, Olathe, KS 66062, 913-764-6400 ..... A•1406
Hy-Q International (USA) Inc., Erlanger, KY 41018, 606-283-5000 ..... A•1408
† McCoy/Ovenaire/Spectrum, A Sub. of Oak Industries, Mt. Holly Springs, PA 17065, 717-486-3411 ..... A•1417
Musashino Corporation, Mission Viejo, CA 92691, 714-458-1155 ..... A•1439
§ NDK America, Inc., Fremont, CA 94539, 415-623-6500 ..... A•1440
TOYOCOM USA INC., Arlington Heights, IL 60005, 708-593-8780/1-800-TOYOCOM ..... A•1484,1494
† Advanced Filter Devices, Inc., Carlsbad, CA 92009 619-438-2074
† Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803 516-694-6700
† Alpha Components, Mechanicsburg, PA 17055 717-697-8595
† American Trans-Coil Corporation, Richmond Hill, NY 11419-1410 718-441-5207
† Blackhawk Networks Corp., Janesville, WI 53545 608-752-8701
Cal Crystal Lab., Inc., Anaheim, CA 92801 ..... 714-991-1580;800-333-9825
Chesterfield Products, Inc., Microwave Filter Co., Inc., East Syracuse, NY 13057 ..... 800-666-9655;315-463-2309
† Comstron A Div. of Aeroflex, Plainview, NY 11803 516-752-2351
Delta Products Corporation, Fremont, CA 94538 510-770-0660
† EG & G Frequency Products Inc., EG & G Inc., Cincinnati, OH 45232 513-542-5555
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
† Filtronetics, Inc., Kansas City, MO 64120 816-231-7375
§ Fox Electronics, Ft. Myers, FL 33905 813-693-0099
† Frequency Selective Networks, Woodside, NY 11377 718-424-7500
† Hughes Microelectronic Circuits Division, Newport Beach, CA 92658-8903 714-759-2952
§† Hybrids International, Frequency Products Div., Olathe, KS 66062 913-764-4544
† Integrated Microwave, San Diego, CA 92121-1009 619-259-2600
Integrity Technology Corporation, Santa Clara, CA 95050 408-262-8640
International Crystal Mfg., Oklahoma City, OK 73126-0330 ..... 405-236-3741; 1-800-725-1426
§† KDS America, Daishinku Corp., Overland Pk., KS 66211 913-491-6825
MicroSignals Inc., L.I.C., NY 11101 ..... 718-937-7955;718-937-0391;800-648-2252
† Microsonics, Inc., Weymouth, MA 02188 617-337-4200
§† Microwave Filter Inc., East Syracuse, NY 13057-0486 ..... 315-437-3953;800-448-1666
§† Monitor Products Co., Inc., Oceanside, CA 92054 619-433-4510
§† Murata Erie North America, Inc., Smyrna, GA 30080 404-436-1300
§ NEL Frequency Controls, Inc., Burlington, WI 53105 414-763-3591
† NETCOM, Inc, Northbrook, IL 60065-3025 708-564-5100
† Networks International Corporation, Lenexa, KS 66215 913-469-6494
OPT Industries, Inc., Phillipsburg, NJ 08865 908-454-2600
† Piezo Technology Inc., Orlando, FL 32804 407-298-2000
§ Raltron Electronics, Miami, FL 33172 305-593-6033
RFI Corporation, Bay Shore, NY 11706 516-231-6400
† Savoy Electronics, Inc., Ft. Lauderdale, FL 33310 ..... 305-563-1333;800-359-5400
† ST Microsonics Corp., Subsidiary of Signal Technology Corporation, Weymouth, MA 02188 617-337-4200
ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086 408-730-6300
† Teledyne Microelectronics, Los Angeles, CA 90066 ..... 310-822-8229;310-305-0248
† Time and Frequency Ltd., Miami, FL 33172 305-593-8000
Valpey-Opt Company, Valpey-Fisher Corp./Opt Inds., Hopkinton, MA 01748 508-435-6831

Filters, Delay-2750

† Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ..... A•1623
Electronic Precision Components, Mt. Vernon, NY 10550-4430, 914-664-2333 ..... A•1633
JMK, Inc., Amherst, NH 03031, 603-886-4100 ..... A•1597
† KR Electronics, Inc., Avenel, NJ 07001, 908-636-1900 ..... A•1648-1649
NTK Technical Ceramics, NGK Spark Plugs (USA), Mt. Prospect, IL 60056, 708-824-1133 ..... A•1667
Precision Filters, Inc., Ithaca, NY 14850, 607-277-3550 ..... A•1674-1675, D•1018
† TTE, Incorporated, W. Los Angeles, CA 90064-1400, 310-478-8224;800-776-7614 ..... A•1680
† Alpha Components, Mechanicsburg, PA 17055 717-697-8595
Anatech Electronics, Inc., Garfield, NJ 07026 201-772-4242
Arco Electronics, Chatsworth, CA 91311 818-882-8707
† BG Electronics, EPC Corp., Mt. Vernon, NY 10550-4430 914-664-5591
EG&G Optoelectronics- Reticon, Sunnyvale, CA 94086-4197 408-738-4266
† ESC Electronics Corp., Palisades Pk., NJ 07650 201-947-0400
† Filter Products, Rockwell International, Costa Mesa, CA 92626 714-641-5311
Frequency Devices, Inc., Haverhill, MA 01830 508-374-0761
† Integrated Microwave, San Diego, CA 92121-1009 619-259-2600
JBM Electronics, Inc., Bedford, NH 03110-6802 603-623-0222
McCoy/Ovenaire/Spectrum, A Sub. of Oak Industries, Mt. Holly Springs, PA 17065 717-486-3411
Metuchen Capacitors, Inc., Old Bridge, NJ 08857 908-679-3366
Penny Technologies, Inc., Greenpoint, NY 11222 718-782-4149
† RF Monolithics, Inc., Dallas, TX 75244 214-233-2903
† Rockwell International, Costa Mesa, CA 92626 714-641-5311
Soshin Electric Co., Ltd., Ota-Ku, Tokyo, JAPAN ..... (03) 3775-9119
ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086 408-730-6300
Valpey-Opt Company, Valpey-Fisher Corp./Opt Inds., Hopkinton, MA 01748 508-435-6831
Western Multiplex Corp., Belmont, CA 94002 415-592-8832

Filters, Digital-2750

§ Fee Fil-Mag, San Diego, CA 92123, 619-569-6577 ..... A•1637
Frequency Devices, Inc., Haverhill, MA 01830, 508-374-0761 ..... A•1639
JMK, Inc., Amherst, NH 03031, 603-886-4100 ..... A•1597
Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ..... A•1436
Precision Filters, Inc., Ithaca, NY 14850, 607-277-3550 ..... A•1674-1675
† Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803 516-694-6700
A. P. Circuit, Brooklyn, NY 11237 718-456-2717
Arco Electronics, Chatsworth, CA 91311 818-882-8707
Avens Signal Equipment, Elmhurst, NY 11373 718-335-1886
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328 215-968-4271
Bruel & Kjaer Instrs. Inc., Decatur, GA 30035 404-981-6225
Curtis Industries, Milwaukee, WI 53234-3925 414-649-4200
† Digital Radio Corp., Redondo Beach, CA 90277 213-316-4114
Engineered Components Co., San Luis Obispo, CA 93403-8121 805-544-3800
† Genisco Electronics, A Division of GTC, Anaheim, CA 92805 714-563-4300
† K&L Microwave, Inc., Salisbury, MD 21801 410-749-2424

Mathematical Systems Design, Inc., Los Angeles, CA 90064 310-479-7180
McCoy/Ovenaire/Spectrum, A Sub. of Oak Industries, Mt. Holly Springs, PA 17065 717-486-3411
§† Raytheon-La Jolla, La Jolla, CA 92038 619-457-1000
R. C. Electronics Inc., Goleta, CA 93117 805-685-7770
RFI Corporation, Bay Shore, NY 11706 516-231-6400
Signatron, A Subsidiary of Meteor Communications Corp., Lexington, MA 02173 617-861-1500
§ Spectrum Signal Proc., Blaine, WA 98231-0025 ... 1-800-663-8986 (US);604-421-5422
Television Equipment Assocs., So. Salem, NY 10590-0393 914-763-8893
† Telonic/Berkeley, Berkeley Inds. Inc., Laguna Beach, CA 92652 714-494-9401
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
§ Valor Electronics, San Diego, CA 92131-1642 619-537-2500

Filters, Digital, High Speed FFT/FIR-2750

Allen Avionics, Inc., Mineola, NY 11501, 516-248-8080 ..... A•1619
Fee Fil-Mag, San Diego, CA 92123, 619-569-6577 ..... A•1637
Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ..... A•1436
A. P. Circuit, Brooklyn, NY 11237 718-456-2717
† Communications Sys. Technology, Inc., Hermosa Beach, CA 90254 213-374-3849
§ Interactive Circuits Systems Ltd., Gloucester, Ont., CANADA K1J 9G2 ..... 613-749-9241; 1-800-267-9794
LeCroy Corp., Chestnut Ridge, NY 10977 914-425-2000
Mathematical Systems Design, Inc., Los Angeles, CA 90064 310-479-7180
§† Raytheon-La Jolla, La Jolla, CA 92038 619-457-1000
†# Synetcom Digital Incorporated, Redondo Bch., CA 90278 310-379-2000

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Filters, EMI/RFI-2700

§ Aerovox Inc., North Dartmouth, MA 02747-1217, 508-995-8000 ..... A•1585
Amecon, Inc., Anaheim, CA 92805, 714-634-2220;800-392-2292 ..... A•1182
§† AMP, Harrisburg, PA 17105, 717-564-0100;800-522-6752 ..... C•1163
Bell Inds., J. W. Miller Div., Gardena, CA 90247-1059, 310-515-1720 ..... A•1192
BH Electronics, Inc., Burnsville, MN 55337, 612-894-9590 ..... A•1197
§ Bourns, Inc., Electronic Components Sls., Riverside, CA 92507-2114, 909-781-5500;801-750-7200 ..... A•1874
Coilcraft, Cary, IL 60013, 708-639-2361 ..... A•1215
† Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ..... A•1623
§ Corcom, Inc., Libertyville, IL 60048, 708-680-7400 ..... A•1586-1587, C•1301
Del Electronics Corp., Valhalla, NY 10595, 914-686-3600 ..... A•1601,1676
Eichhoff Electronics, Warwick, RI 02886, 401-738-1440;800-678-1040 ..... A•1588-1591
§ Electrocube, Monrovia, CA 91016, 818-301-0122 ..... A•1067
§ Fee Fil-Mag, San Diego, CA 92123, 619-569-6577 ..... A•2349
Fetco, Sanford, FL 32773, 407-321-3800 ..... A•2353
Filter Concepts Inc., Santa Ana, CA 92707, 714-545-7003 ..... A•1592-1595
† Genisco Electronics, A Division of GTC, Anaheim, CA 92805, 714-563-4300 ..... A•1641
 # The Hirol Company, Ft. Lauderdale, FL 33309, 305-974-4900 ..... C•1685
† Interpoint Corporation, Redmond, WA 98052, 206-882-3100 .. D•2112,2117-2120
§† JMK, Inc., Amherst, NH 03031, 603-886-4100 ..... A•1596-1597
§ KCK America Inc., Mitsubishi Materials Corporation, Rolling Meadows, IL 60008, 708-577-0200 ..... A•1091,1647
Magnelab, Boulder, CO 80301-4696, 303-442-6700 ..... A•2378
Marway Prods. Inc., Santa Ana, CA 92703, 714-973-1800 ..... D•2278-2279,2281
† Metuchen Capacitors, Inc., Old Bridge, NJ 08857, 908-679-3366 ..... A•1651-1653, C•1416-1419
§† Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 .. A•1660-1663
§ Okaya Electric America, Inc., Okaya Electric Industries, Tokyo, Japan, Valparaiso, IN 46383, 219-477-4488 ..... A•1139,1598
† Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•1263
† Polara Engineering Inc., Fullerton, CA 92633, 714-521-0900 ..... A•1576
† Powercube Corp., Sub. Unitrode Corp., Billerica, MA 01821, 508-667-9500 ..... D•2196-2197
§ Pulizzi Engineering, Inc., Santa Ana, CA 92704-6865, 714-540-4229 ..... D•2300
§ Qualtek Electronics Corp., Mentor, OH 44060, 216-951-3300 ..... A•1600, C•1638-1639
Renco Electronics, Inc., Deer Pk., NY 11729, 516-586-5566;1-800-645-5828 ..... A•1287,1289
§ Schaffner EMC, Inc. Components Division, Springfield, NJ 07081, 201-379-7778;800-367-5566 ..... A•1602, D•1322
§ Schurter, Inc., Petaluma, CA 94954, 800-848-2600 ext.62 ..... A•1606-1608
Signal Transformer Co., Inc., Insilco Corporation, Inwood, NY 11696, 516-239-5777 ..... A•2536
§† Spectrum Control, Inc., Erie, PA 16506, 814-835-4000 ..... A•1677-1679
Standex Electronics, Standex International, Cincinnati, OH 45209, 513-871-3777 ..... A•1291
§ Tamura Corporation of America, Temecula, CA 92589-2230, 909-699-1270 ..... A•1299,1610-1611
Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314 ..... A•1303-1304
† Tri-Mag, Inc., Visalia, CA 93291, 209-651-2222 ..... A•1612, D•2004
§† Tusonix, Inc., Tucson, AZ 85740-7144, 602-744-0400 ..... A•1169,1684-1685
§ Valor Electronics, San Diego, CA 92131-1642, 619-537-2500 ..... A•1686
Wilco Corp., Indianapolis, IN 46268, 317-293-9300 ..... A•1309-1310
Air Filtration Products, Inc., Tuscon, AZ 85705 602-624-2272
§ ALFCO, Div. of Air Maze, Carpinteria, CA 93013 805-684-7651
† American Trans-Coil Corporation, Richmond Hill, NY 11419-1410 718-441-5207
§† Amphenol Canada Corp., Scarborough, Ontario, CANADA M1B 2X6 416-291-4401
§ Armbar Industries, Inc., Old Bridge, NJ 08857 908-679-3377
§ AVA Electronics Corporation, Drexel Hill, PA 19026 215-284-2500
AVX Corporation, A Kyocera Group Company, Myrtle Beach, SC 29577 803-448-9411
† AVX Filters Corp., Sun Valley, CA 91352 818-767-6770
† Axel Electronics, Inc., Subsidiary of FPBSM Industries Inc., Rancho Dominquez, CA 90220 718-291-3900
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
§† California Micro Devices, Inc., Milpitas, CA 95035 408-263-3214
§† Capcon, Inc., New York, NY 10001 212-243-6275
† Ceramic Devices Inc., San Diego, CA 92111 619-560-7575
† Chomerics, Inc.:W.R. Grace & Co., Woburn, MA 01888 617-935-4850
§† Compac, Holbrook, NY 11741 516-585-3400
Comstron A Div. of Aeroflex, Plainview, NY 11803 516-752-2351
Control Concepts Corp., Liebert Corp., Binghamton, NY 13902-1380 607-724-2484
§† Current Technology, Inc., Richardson, TX 75081-4802 214-238-5300
§ Curtis Industries, Milwaukee, WI 53234-3925 414-649-4200
† DARE Electronics, Inc., Troy, OH 45373 513-335-0031
§† Delta Products Corporation, Fremont, CA 94538 510-770-0660
† Dontech, Inc., Doylestown, PA 18901 215-348-5010
† Dynamic Air Engrg., Inc., Santa Ana, CA 92705-5697 714-540-1000
§ Electronic Specialists, Natick, MA 01760 ..... 508-655-1532;800-225-4876
†# Elite Electronic Engineering Co., Downers Grove, IL 60515 708-495-9770
ELMA Electronic Inc., Fremont, CA 94538 510-656-3400
§† Elpac Components, Elpac Electronics, Inc., Irvine, CA 92714 714-476-6070
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Engineered Components Co., San Luis Obispo, CA 93403-8121 805-544-3800
§† EWC, Inc., Englishtown, NJ 07726 908-446-3110
§† FDK America, Inc., Fuji Electrochemical Co., Ltd., San Jose, CA 95134 .. 408-432-8331
† Filtron, RFI Corporation, Bayshore, NY 11706 516-231-6400
† Filtronetics, Inc., Kansas City, MO 64120 816-231-7375
Fuses Unlimited, D.E.I., Van Nuys, CA 91406 818-786-8111
GC International Inc., Plano, TX 75074 214-423-8411
General Protection Co., Inc., Circuit Protection Group, Chicago, IL 60659 312-761-0403
§ GlobTek, Inc., Northvale, NJ 07647 201-784-1000
† Homalite, Whitco, Inc., Wilmington, DE 19804 302-652-3686
§ ICO-RALLY Corporation, Palo Alto, CA 94303 415-856-9900
† ILC Data Device Corp., Bohemia, NY 11716-2482 516-567-5600
§ ISKRA Electronics, Inc., Plainview, NY 11803 516-349-0222
§† ITT Cannon, Santa Ana, CA 92705-5684 714-557-4700
§ Kalglo Elctrns. Co., Inc., Bethlehem, PA 18017-9359 215-837-0700
Lambda Electronics Inc., Melville, NY 11747-3700 516-694-4200
§† LCR Electronics-Hopkins Engineering, Norristown, PA 19401 215-278-0840
† LectroMagnetics Division, Los Angeles, CA 90016 .. 213-870-9383;USA 800-969-9383
† Liberty Mirror Co., Pilkington Aerospace Inc., Brackenridge, PA 15014 ... 412-224-1800
† Lindgren RF Enclosures, Inc., Glendale Hgts., IL 60139 708-307-7200
§ Lodan Electronics, Inc., Arlington Hgts., IL 60004-7805 ... 708-398-5311;800-323-5207
LZR Electronics, Inc., Gaithersburg, MD 20879 301-921-4600
† Magnetico Inc., Holtsville, NY 11742 516-654-1166
MCG Elctrns., Deer Park, NY 11729 516-586-5125
† Motor Technology, Inc., Dayton, OH 45429 513-294-1041
MultiComp., Inc., Beaverton, OR 97006 503-626-4200
§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
Nedco Electronics, Inc., Morton Grove, IL 60053 708-967-0500
§# Nissei Denki America, Inc., Beaverton, OR 97005 503-646-1434
§ Oneac Corporation, Libertyville, IL 60048 ..... 708-816-6000;800-327-8801
OPT Industries, Inc., Phillipsburg, NJ 08865 908-454-2600
† Oxley Inc., Branford, CT 06405 203-488-1033
§ Panasonic Indl. Co. Standard Comps. Sector, Matsushita Elec. Corp. of America, Secaucus, NJ 07094 201-392-4818
Panel Components Corp., Oskaloosa, IA 52577 515-673-0097
§ Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018 ..... 408-730-0300;800-PENSTOCK
Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
§ PolyPhaser Corporation, Minden, NV 89423-9000 ..... 702-782-2511;800-325-7170
§ Power Dynamics Inc., West Orange, NJ 07052 201-736-5722
§† Preferred Electronics, Inc., Westfield, MA 01086 ..... 413-568-2301;1-800-553-6374
Pulse Engineering, Inc., San Diego, CA 92128 619-674-8100
Ray Proof, Shielding Systems Corp., Norwalk, CT 06854 800-243-5704
Reliable Electronic Mfg., Wyvern Technologies, Santa Ana, CA 92705 ... 714-966-0710
† RFI Corporation, Bay Shore, NY 11706 516-231-6400
RME Filters, Inc., Amherst, NH 03031 603-595-4573
† Rtron Corp., Skokie, IL 60076 708-679-7180
§ SAE Power, Inc., Santa Clara, CA 95050 408-988-0700
§ Schaffner EMC, Inc. Instr. Div., Springfield, NJ 07081 201-379-7778
Schaffner EMC, Inc., Intepro, Springfield, NJ 07081 201-379-7778
† Sealing Devices, Inc., Lancaster, NY 14086 716-684-7600
† SFE Technologies, San Fernando, CA 91340 818-365-9411
§ Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
§ SL Waber, Inc., Mt. Laurel, NJ 08054 ..... 609-866-8888;800-257-8384
H H Smith, NT-T Inc., Meadville, PA 16335 814-724-6440
Solar Electronics Co., A. T. Parker, Inc., Hollywood, CA 90038 800-952-5302
§ Soshin Electric Co., Ltd., Ota-Ku, Tokyo, JAPAN ..... (03) 3775-9119
South American Development Corp., Poughkeepsie, NY 12590 914-452-1305
† Southwall Technologies Inc., Palo Alto, CA 94303 415-962-9111
† Spira Manufacturing Corp., North Hollywood, CA 91605 818-764-8222
Sprague, Wet & Foil Tantalum Capacitors, North Adams, MA 01247-3987 413-664-4431
† Standard Condenser Corp., Skokie, IL 60076 708-675-3133
§ Steward, Inc., Chattanooga, TN 37401 615-867-4100
Superior Electric, Warner Electric, Bristol, CT 06010 203-582-9561
Switching Power Inc., Ronkonkoma, NY 11779 516-981-7231
§ TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056 708-803-6100
† Teal Electronics Corporation, San Diego, CA 92121 619-558-9000
† Tecknit, Cranford, NJ 07016 908-272-5500
§ Tokin America, Inc., San Jose, CA 95134 408-432-8020
§ Tripp Lite, Chicago, IL 60610-4188 312-329-1777

§† Tycor International Inc., Calgary, Alberta, CANADA T2H 1L9 403-259-3200
† Watkins-Johnson Co., Palo Alto, CA 94304 415-493-4141
§ World Products Inc., Sonoma, CA 95476 707-996-5201
World Products Inc., Systems Devices Grp., Sonoma 95476 707-996-5201

Filters, Equalizer-2750

Allen Avionics, Inc., Mineola, NY 11501, 516-248-8080 ..... A•1514
† Avens Signal Equipment, Elmhurst, NY 11373, 718-335-1886 ..... A•1620
Electronic Precision Components, Mt. Vernon, NY 10550-4430, 914-664-2333 ..... A•1633
† Kappa Technologies, Inc., Rahway, NJ 07065, 908-396-9400;1-800-223-0603 ..... A•1642-1643
† KR Electronics, Inc., Avenel, NJ 07001, 908-636-1900 ..... A•1648-1649
† McCoy/Ovenaire/Spectrum, A Sub. of Oak Industries, Mt. Holly Springs, PA 17065, 717-486-3411 ..... A•1417
TTE, Incorporated, W. Los Angeles, CA 90064-1400, 310-478-8224;800-776-7614 ..... A•1680
† Alpha Components, Mechanicsburg, PA 17055 717-697-8595
† Anatech Electronics, Inc., Garfield, NJ 07026 201-772-4242
A. P. Circuit, Brooklyn, NY 11237 ..... 718-456 2717
† Axel Electronics, Inc., Subsidiary of FPBSM Industries Inc., Rancho Dominquez, CA 90220 718-291-3900
† BG Electronics, EPC Corp., Mt. Vernon, NY 10550-4430 914-664-5591
† Chesterfield Products, Inc., Microwave Filter Co., Inc., East Syracuse, NY 13057 ..... 800-666-9655;315-463-2309
† Cir-Q-Tel, Trilithic, Indianapolis, IN 46236 800-344-2412
† Comstron A Div. of Aeroflex, Plainview, NY 11803 516-752-2351
† Eagle Wichita, Wichita, KS 67277 316-942-5100
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
† ESC Electronics Corp., Palisades Pk., NJ 07650 201-947-0400
§ Exar Corp., San Jose, CA 95161-9007 408-434-6400
† Filter Products, Rockwell International, Costa Mesa, CA 92626 714-641-5311
† Filtronetics, Inc., Kansas City, MO 64120 816-231-7375
Frequency Devices, Inc., Haverhill, MA 01830 508-374-0761
† Frequency Electronics, Inc., Mitchel Field, NY 11553 516-794-4500
† Frequency Selective Networks, Woodside, NY 11377 718-424-7500
† Hisonic, Inc., Olathe, KS 66051 913-782-0012
† Integrated Microwave, San Diego, CA 92121-1009 619-259-2600
§† Linear Technology Corp., Milpitas, CA 95035-7487 408-432-1900
† Loral Microwave-Wavecom, Northridge, CA 91324 818-882-3010
† Magnetico Inc., Holtsville, NY 11742 516-654-1166
Microwave Development Laboratories, Natick, MA 01760 508-655-0060
† NETCOM, Inc, Northbrook, IL 60065-3025 708-564-5100
† Networks International Corporation, Lenexa, KS 66215 913-469-6494
Pacific Transformer Corp., Anaheim, CA 92807 ..... 714-779-0450;1-800-325-0501
† Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
Precision Filters, Inc., Ithaca, NY 14850 607-277-3550
RFI Corporation, Bay Shore, NY 11706 516-231-6400
† Rockwell International, Costa Mesa, CA 92626 714-641-5311
Soshin Electric Co., Ltd., Ota-Ku, Tokyo, JAPAN ..... (03) 3775-9119
§ Spectra Sonics, Ogden, UT 84405 801-392-7531
Television Equipment Assocs., So. Salem, NY 10590-0393 914-763-8893
Valpey-Opt Company, Valpey-Fisher Corp./Opt Inds., Hopkinton, MA 01748 508-435-6831
Western Multiplex Corp., Belmont, CA 94002 415-592-8832

Filters, Harmonic-2750

† Avens Signal Equipment, Elmhurst, NY 11373, 718-335-1886 ..... A•1620
† Eagle Wichita, Wichita, KS 67277, 316-942-5100 ..... A•1626
Electronic Precision Components, Mt. Vernon, NY 10550-4430, 914-664-2333 ..... A•1633
† Genisco Electronics, A Division of GTC, Anaheim, CA 92805, 714-563-4300 ..... A•1641
§† JMK, Inc., Amherst, NH 03031, 603-886-4100 ..... A•1596-1597
† KR Electronics, Inc., Avenel, NJ 07001, 908-636-1900 ..... A•1648
§† Microwave Filter Inc., East Syracuse, NY 13057-0486, 315-437-3953;800-448-1666 ..... A•1655-1657
† TTE, Incorporated, W. Los Angeles, CA 90064-1400, 310-478-8224;800-776-7614 ..... A•1680
Aerovox Inc., North Dartmouth, MA 02747-1217 508-995-8000
† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950 201-539-5500
† Alpha Components, Mechanicsburg, PA 17055 717-697-8595
† American Trans-Coil Corporation, Richmond Hill, NY 11419-1410 718-441-5207
† Anatech Electronics, Inc., Garfield, NJ 07026 201-772-4242
A. P. Circuit, Brooklyn, NY 11237 718-456-2717
† Axel Electronics, Inc., Subsidiary of FPBSM Industries Inc., Rancho Dominquez, CA 90220 718-291-3900
† BG Electronics, EPC Corp., Mt. Vernon, NY 10550-4430 914-664-5591
† Chesterfield Products, Inc., Microwave Filter Co., Inc., East Syracuse, NY 13057 ..... 800-666-9655;315-463-2309
† Coast Coil Co., Coast Magnetics, Los Angeles, CA 90016 213-936-6188
Communications & Energy Corp., E. Syracuse, NY 13057 315-452-0709
† Comstron A Div. of Aeroflex, Plainview, NY 11803 516-752-2351
Continental Electronics Corporation, Dallas, TX 75227 214-381-7161
Control Concepts Corp., Liebert Corp., Binghamton, NY 13902-1380 607-724-2484
Curtis Industries, Milwaukee, WI 53234-3925 414-649-4200
Datel, Inc., Mansfield, MA 02048-1194 508-339-3000
† Electronic Transformer Corp., Paterson, NJ 07544-0487 201-942-2222
Elpac Components, Elpac Electronics, Inc., Irvine, CA 92714 714-476-6070
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
† ESC Electronics Corp., Palisades Pk., NJ 07650 201-947-0400
† Ferretec Inc., Fremont, CA 94538-6525 510-226-1216
† Filtron, RFI Corporation, Bayshore, NY 11706 516-231-6400
† Filtronetics, Inc., Kansas City, MO 64120 816-231-7375
† Freed Transformer Co., Inc., Electronic Transformer Corp., Paterson, NJ 07544-0487 201-942-2222
† Frequency Selective Networks, Woodside, NY 11377 718-424-7500
† Gamma-f Corp., Vertex Communications, Torrance, CA 90505 310-539-6704
Georator Corp., Manassas, VA 22110-5512 800-523-9938
† Hisonic, Inc., Olathe, KS 66051 913-782-0012
† Integrated Microwave, San Diego, CA 92121-1009 619-259-2600
† International Telecommunications Components, Inc., Deer Park, NY 11729 516-243-1444
§† Linear Technology Corp., Milpitas, CA 95035-7487 408-432-1900
† Loral Microwave-Narda West, Rancho Cordova, CA 95670-6001 916-638-5500
† Loral Microwave-Wavecom, Northridge, CA 91324 818-882-3010
† Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710 813-347-2181
MACROAMP Inc., Ukiah, CA 95482 800-458-8892
MagneTek Power Conversion Systems, Teledyne, Inc., Anaheim, CA 92805 714-956-9200
† Magnetico Inc., Holtsville, NY 11742 516-654-1166
Micro-Coax, Collegeville, PA 19426 215-489-3700
† Microlab/FXR, Livingston, NJ 07039 201-992-7700
† Microphase, Norwalk, CT 06856 203-866-8000
Microwave Communications Corp., Valencia, CA 91355 805-257-1948
§ Microwave Development Laboratories, Natick, MA 01760 508-655-0060
§ Murata Erie North America, Inc., Smyrna, GA 30080 404-436-1300
† Networks International Corporation, Lenexa, KS 66215 913-469-6494
† Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
Precision Filters, Inc., Ithaca, NY 14850 607-277-3550
† Premier Microwave, Port Chester, NY 10573 914-939-8900
† Reactel, Inc., Rockville, MD 20850 301-279-5535
# Relm Communications, Inc., Adage, Inc., Indianapolis, IN 46226 317-545-4281
† RFI Corporation, Bay Shore, NY 11706 516-231-6400
† RLC Electronics, Inc., Mt. Kisco, NY 10549 914-241-1334
§† Sinclair Radio Laboratories Ltd., Aurora, ONT., CANADA L4G 3G9 416-727-0165
† Telonic/Berkeley, Berkeley Inds. Inc., Laguna Beach, CA 92652 714-494-9401
† Torotron Corp., Mt. Vernon, NY 10550 914-664-2050
† Trilithic, Inc., Indianapolis, IN 46236 800-344-2412
§† Tycor International Inc., Calgary, Alberta, CANADA T2H 1L9 403-259-3200
Valpey-Opt Company, Valpey-Fisher Corp./Opt Inds., Hopkinton, MA 01748 508-435-6831
† Watkins-Johnson Co., Palo Alto, CA 94304 415-493-4141
Western Multiplex Corp., Belmont, CA 94002 415-592-8832

Filters, High Pass-2750

Allen Avionics, Inc., Mineola, NY 11501, 516-248-8080 ..... A•1514,1619
† Avens Signal Equipment, Elmhurst, NY 11373, 718-335-1886 ..... A•1620-1622
† Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ..... A•1623
Communications & Energy Corp., E. Syracuse, NY 13057, 315-452-0709 ..... A•1625
† Eagle Wichita, Wichita, KS 67277, 316-942-5100 ..... A•1626,1631-1632
† Electronic Precision Components, Mt. Vernon, NY 10550-4430, 914-664-2333 ..... A•1633
Frequency Devices, Inc., Haverhill, MA 01830, 508-374-0761 ..... A•1638-1639
† Genisco Electronics, A Division of GTC, Anaheim, CA 92805, 714-563-4300 ..... A•1641
† Kappa Technologies, Inc., Rahway, NJ 07065, 908-396-9400;1-800-223-0603 ..... A•1642-1643
† KR Electronics, Inc., Avenel, NJ 07001, 908-636-1900 ..... A•1648
Krohn-Hite Corp., Avon, MA 02322, 508-580-1660 ..... A•1650
§† Microwave Filter Inc., East Syracuse, NY 13057-0486, 315-437-3953;800-448-1666 ..... A•1655,1657-1658
Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500 ..... A•1725
§ PCA Electronics, Sepulveda, CA 91343, 818-892-0761 ..... A•1668
Precision Filters, Inc., Ithaca, NY 14850, 607-277-3550 ..... A•1674-1675
† TTE, Incorporated, W. Los Angeles, CA 90064-1400, 310-478-8224;800-776-7614 ..... A•1680,1683
Wilco Corp., Indianapolis, IN 46268, 317-293-9300 ..... A•1313
Advanced Filter Devices, Inc., Carlsbad, CA 92009 619-438-2074
† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950 201-539-5500
† Alpha Components, Mechanicsburg, PA 17055 717-697-8595
† American Trans-Coil Corporation, Richmond Hill, NY 11419-1410 718-441-5207
† Anatech Electronics, Inc., Garfield, NJ 07026 201-772-4242
A. P. Circuit, Brooklyn, NY 11237 718-456-2717
† AVX Filters Corp., Sun Valley, CA 91352 818-767-6770
† Axel Electronics, Inc., Subsidiary of FPBSM Industries Inc., Rancho Dominquez, CA 90220 718-291-3900
† BG Electronics, EPC Corp., Mt. Vernon, NY 10550-4430 914-664-5591
† Bird Electronic Corp., Cleveland, OH 44139-2794 216-248-1200
Bruel & Kjaer Instrs. Inc., Decatur, GA 30035 404-981-6225
Burr-Brown Corp., Tucson, AZ 85734 602-746-1111
† Chesterfield Products, Inc., Microwave Filter Co., Inc., East Syracuse, NY 13057 ..... 800-666-9655;315-463-2309
† Cir-Q-Tel, Trilithic, Indianapolis, IN 46236 800-344-2412
† Coast Coil Co., Coast Magnetics, Los Angeles, CA 90016 213-936-6188
Coaxial Dynamics, Cleveland, OH 44135 ..... 1-800-COAXIAL
Coilcraft, Cary, IL 60013 708-639-2361
Coil-Q Corp., Bronxville, NY 10708 914-337-4775
† Comstron A Div. of Aeroflex, Plainview, NY 11803 516-752-2351
Continental Resources, Inc, Test Instruments Div., Bedford, MA 01730 ..... 617-275-0850; 800-937-4688
Curtis Industries, Milwaukee, WI 53234-3925 414-649-4200
† Daden Associates, San Clemente, CA 92673 714-366-1522
Dantel, Fresno, CA 93727 209-292-1111
† Data Delay Devices, Clifton, NJ 07013-1915 201-773-2299
Datel, Inc., Mansfield, MA 02048-1194 508-339-3000
De Coursey Engineering Laboratory, Culver City, CA 90230 1-310-397-9668
§ Dynamics, Div. of Waugh Controls Corp., Chatsworth, CA 91311 818-998-8281
† EG & G Frequency Products Inc., EG & G Inc., Cincinnati, OH 45232 513-542-5555

EG&G Optoelectronics- Reticon, Sunnyvale, CA 94086-4197 408-738-4266
Electrocom Industries, S. Bend, IN 46615 219-232-2743
§ Electronic Specialists, Natick, MA 01760 ..... 508-655-1532;800-225-4876
† Electronic Transformer Corp., Paterson, NJ 07544-0487 201-942-2222
Elpac Components, Elpac Electronics, Inc., Irvine, CA 92714 714-476-6070
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Engineered Components Co., San Luis Obispo, CA 93403-8121 805-544-3800
† ESC Electronics Corp., Palisades Pk, NJ 07650 201-947-0400
§† EWC, Inc., Englishtown, NJ 07726 908-446-3110
§ Exar Corp., San Jose, CA 95161-9007 408-434-6400
Fee Fil-Mag, San Diego, CA 92123 619-569-6577
† Filtron, RFI Corporation, Bayshore, NY 11706 516-231-6400
† Filtronetics, Inc., Kansas City, MO 64120 816-231-7375
† Freed Transformer Co., Inc., Electronic Transformer Corp., Paterson, NJ 07544-0487 201-942-2222
† Frequency Selective Networks, Woodside, NY 11377 718-424-7500
† Gamma-f Corp., Vertex Communications, Torrance, CA 90505 310-539-6704
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
† Hisonic, Inc., Olathe, KS 66051 913-782-0012
† Hughes Microelectronic Circuits Division, Newport Beach, CA 92658-8903 714-759-2952
Hycomp, Inc., Marlborough, MA 01752 508-485-6300
Hyletronics:Litton Industries, Lexington, MA 02173-3199 617-276-3298
§ ICO-RALLY Corporation, Palo Alto, CA 94303 415-856-9900
† Integrated Microwave, San Diego, CA 92121-1009 619-259-2600
† International Sensor Systems, Inc., Aurora, NE 68818 402-694-6111
ITHACO, Inc., Meas. & Control Instrs. Div., Ithaca, NY 14851-6437 607-272-7640
† K&L Microwave, Inc., Salisbury, MD 21801 410-749-2424
KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
† Lark Engineering Co., Baier & Baier Inc., San Juan Capistrano, CA 92675 714-240-1233
† LCR Electronics-Hopkins Engineering, Norristown, PA 19401 215-278-0840
† LectroMagnetics Division, Los Angeles, CA 90016 .. 213-870-9383;USA 800-969-9383
§† Linear Technology Corp., Milpitas, CA 95035-7487 408-432-1900
† Loral Microwave-Narda West, Rancho Cordova, CA 95670-6001 916-638-5500
† Loral Microwave-Wavecom, Northridge, CA 91324 818-882-3010
† Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710 813-347-2181
† Magnecomp, Inc., Pickens, SC 29671 803-878-4700
† Magnetico Inc., Holtsville, NY 11742 516-654-1166
McCoy/Ovenaire/Spectrum, A Sub. of Oak Industries, Mt. Holly Springs, PA 17065 717-486-3411
† Metropole Products Inc., Stafford, VA 22554 703-659-2132
§† Micro-Coax, Collegeville, PA 19426 215-489-3700
† Microlab/FXR, Livingston, NJ 07039 201-992-7700
† Microphase, Norwalk, CT 06856 203-866-8000
MicroSignals Inc., LIC., NY 11101 ..... 718-937-7955;718-937-0391;800-648-2252
Microwave Communications Corp., Valencia, CA 91355 805-257-1948
§ Microwave Development Laboratories, Natick, MA 01760 508-655-0060
§† Murata Erie North America, Inc., Smyrna, GA 30080 404-436-1300
† NETCOM, Inc. Northbrook, IL 60065-3025 708-564-5100
† Networks International Corporation, Lenexa, KS 66215 913-469-6494
NF Electronic Instruments, State College, PA 16801 814-237-5580
† North Hills Signal Processing, Syosset, NY 11791 516-682-7740
§ Omicron electronic, Hohenems, AUSTRIA A-6845 ..... + /5576/4010-0
OPT Industries, Inc., Phillipsburg, NJ 08865 908-454-2600
† Polara Engineering Inc., Fullerton, CA 92633 714-521-0900
† Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
† Premier Microwave, Port Chester, NY 10573 914-939-8900
† Reactel, Inc., Rockville, MD 20850 301-279-5535
# Relm Communications, Inc., Adage, Inc., Indianapolis, IN 46226 317-545-4281
† RFI Corporation, Bay Shore, NY 11706 516-231-6400
† RLC Electronics, Inc., Mt. Kisco, NY 10549 914-241-1334
RME Filters, Inc., Amherst, NH 03031 603-595-4573
§† Rockland Scientific Corporation, Princeton, NJ 08543 609-844-0800
† Sage Laboratories, Inc., Natick, MA 01760 508-653-0844
† Servo Corporation of America, Hicksville, NY 11801-5259 516-938-9700
§ Shure Brothers Inc., Evanston, IL 60202-3696 708-866-2200
§† Sinclair Radio Laboratories Ltd., Aurora, ONT., CANADA L4G 3G9 416-727-0165
Solar Electronics Co., A. T. Parker, Inc., Hollywood, CA 90038 800-952-5302
§ Soshin Electric Co., Ltd., Ota-Ku, Tokyo, JAPAN ..... (03) 3775-9119
§ Spectra Sonics, Ogden, UT 84405 801-392-7531
Sprague, Wet & Foil Tantalum Capacitors, North Adams, MA 01247-3987 413-664-4431
† ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086 408-730-6300
† Teledyne Microelectronics, Los Angeles, CA 90066 ..... 310-822-8229;310-305-0248
† Teledyne Microwave, Mountain View, CA 94043 415-968-2211
Television Equipment Assocs., So. Salem, NY 10590-0393 914-763-8893
† Telonic, Berkeley, Berkeley Inds. Inc., Laguna Beach, CA 92652 714-494-9401
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
† Torotron Corp., Mt. Vernon, NY 10550 914-664-2050
TOYOCOM USA INC., Arlington Heights, IL 60005 ... 708-593-8780/1-800-TOYOCOM
† Trilithic, Inc., Indianapolis, IN 46236 800-344-2412
Tucker Electronics, Dallas, TX 75355-1419 ..... 214-348-8800;800-527-4642
Unadilla Antenna Mfg. Co., Andover, MA 01810 508-475-7831
Valpey-Opt Company, Valpey-Fisher Corp./Opt Inds., Hopkinton, MA 01748 508-435-6831
† Vanguard Electronics Co., Gardena, CA 90248 310-323-4100
† Watkins-Johnson Co., Palo Alto, CA 94304 415-493-4141
Wavetek Corp., San Diego, CA 92123 619-279-2200
Wavetek Instruments Division, Wavetek Corp., San Diego, CA 92123 619-279-2200
Western Multiplex Corp., Belmont, CA 94002 415-592-8832
Wide Band Engineering Co., Inc., Phoenix, AZ 85036 602-254-1570

Filters, Hybrid-2750

ASC Capacitors, Ogallala, NE 69153, 308-284-3611 ..... A•1017
† Avens Signal Equipment, Elmhurst, NY 11373, 718-335-1886 ..... A•1620
Datel, Inc., Mansfield, MA 02048-1194, 508-339-3000 ..... D•1185
Del Electronics Corp., Valhalla, NY 10595, 914-686-3600 ..... A•1601,1676
Eagle Wichita, Wichita, KS 67277, 316-942-5100 ..... A•1626
§† Hybrids International Ltd., Thick Film Division, Olathe, KS 66062, 913-764-6400 ..... A•1406
† Modular Devices, Shirley, NY 11967, 516-345-3100 ..... D•1838
PCA Electronics, Sepulveda, CA 91343, 818-892-0761 ..... A•1668
Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803 516-694-6700
A. P. Circuit, Brooklyn, NY 11237 718-456-2717
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328 215-968-4271
Comstron A Div. of Aeroflex, Plainview, NY 11803 516-752-2351
Elpac Components, Elpac Electronics, Inc., Irvine, CA 92714 714-476-6070
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Fee Fil-Mag, San Diego, CA 92123 619-569-6577
§ Fox Electronics, Ft. Myers, FL 33905 813-693-0099
Frequency Devices, Inc., Haverhill, MA 01830 508-374-0761
Frequency Selective Networks, Woodside, NY 11377 718-424-7500
† Hisonic, Inc., Olathe, KS 66051 913-782-0012
† Hughes Microelectronic Circuits Division, Newport Beach, CA 92658-8903 714-759-2952
† ILC Data Device Corp., Bohemia, NY 11716-2482 516-567-5600
† Integrated Microwave, San Diego, CA 92121-1009 619-259-2600
† K&L Microwave, Inc., Salisbury, MD 21801 410-749-2424
§† KDS America, Daishinku Corp., Overland Pk., KS 66211 913-491-6825
† Micro Hybrids, Inc., Medford, NY 11763 516-732-3448
§ Microwave Filter Inc., East Syracuse, NY 13057-0486 .... 315-437-3953;800-448-1666
MTI International Inc., Menomonee Falls, WI 53051 414-783-6080
Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
† Natel Engineering Co., Inc., Simi Valley, CA 93063-3449 805-581-3950
NF Electronic Instruments, State College, PA 16801 814-237-5580
† Piezo Technology Inc., Orlando, FL 32804 407-298-2000
Reliable Electronic Mfg., Wyvern Technologies Santa Ana, CA 92705 ... 714-966-0710
Relm Communications, Inc., Adage, Inc., Indianapolis, IN 46226 317-545-4281
Teal Electronics Corporation, San Diego, CA 92121 619-558-9000
Television Equipment Assocs., So. Salem, NY 10590-0393 914-763-8893
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
§† Tycor International Inc., Calgary, Alberta, CANADA T2H 1L9 403-259-3200
Western Multiplex Corp., Belmont, CA 94002 415-592-8832

Filters, IF-2750

Coil-Q Corp., Bronxville, NY 10708, 914-337-4775 ..... A•1222
† Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ..... A•1623
† Eagle Wichita, Wichita, KS 67277, 316-942-5100 ..... A•1626
Electronic Precision Components, Mt. Vernon, NY 10550-4430, 914-664-2333 ..... A•1633
Hy-Q International (USA) Inc., Erlanger, KY 41018, 606-283-5000 ..... A•1408
JMK, Inc., Amherst, NH 03031, 603-886-4100 ..... A•1596-1597
† KR Electronics, Inc., Avenel, NJ 07001, 908-636-1900 ..... A•1648
† McCoy/Ovenaire/Spectrum, A Sub. of Oak Industries, Mt. Holly Springs, PA 17065, 717-486-3411 ..... A•1417
Morgan-Matroc, Electro Ceramics Division, Bedford, OH 44146-5478, 216-232-8600 ..... B•1974
§ NTK Technical Ceramics, NGK Spark Plugs (USA), Mt. Prospect, IL 60056, 708-824-1133 ..... A•1666
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ..... A•2118
† TTE, Incorporated, W. Los Angeles, CA 90064-1400, 310-478-8224;800-776-7614 ..... A•1680,1683
† Advanced Filter Devices, Inc., Carlsbad, CA 92009 619-438-2074
† Alpha Components, Mechanicsburg, PA 17055 717-697-8595
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† Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710 813-347-2181
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Microwave Development Laboratories, Natick, MA 01760 508-655-0060

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† Sawtek Inc., Orlando, FL 32860-9501 407-886-8860
Servo Corporation of America, Hicksville, NY 11801-5259 516-938-9700
§ Soshin Electric Co., Ltd., Ota-Ku, Tokyo, JAPAN .... (03) 3775-9119
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† KR Electronics, Inc., Avenel, NJ 07001, 908-636-1900 .... A•1648
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† TTE, Incorporated, W. Los Angeles, CA 90064-1400, 310-478-8224;800-776-7614 .... A•1680
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Valpey-Opt Company, Valpey-Fisher Corp./Opt Inds., Hopkinton, MA 01748 508-435-6831

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§ Fee Fil-Mag, San Diego, CA 92123, 619-569-6577 .... A•1635,1637,2349
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§ Valor Electronics, San Diego, CA 92131-1642, 619-537-2500 .... A•1686
JBM Electronics, Inc., Bedford, NH 03110-6802 603-623-0222
§ Microwave Filter Inc., East Syracuse, NY 13057-0486 .... 315-437-3953;800-448-1666
§ Onan Power/Electronics, Minneapolis, MN 55344-3577 612-943-4600
Pulse Engineering, Inc., San Diego, CA 92128 619-674-8100
§ Superior Electric, Warner Electric, Bristol, CT 06010 203-582-9561

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Allen Avionics, Inc., Mineola, NY 11501, 516-248-8080 .... A•1514,1619
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† Communication Coil Inc., Chicago, IL 60634, 312-637-1333 .... A•1623
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§† Hybrids International Ltd., Thick Film Division, Olathe, KS 66062, 913-764-6400 .... A•1406
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§† Spectrum Control, Inc., Erie, PA 16506, 814-835-4000 .... A•1677
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Hy-Q International (USA) Inc., Erlanger, KY 41018 606-283-5000
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OPT Industries, Inc., Phillipsburg, NJ 08865 908-454-2600
† Oxley Inc., Branford, CT 06405 203-488-1033
§ Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018 .... 408-730-0300;800-PENSTOCK
† Performance Controls, Inc., Horsham, PA 19044 215-675-6500
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Rtron Corp., Skokie, IL 60076 708-679-7180
§ Schaffner EMC, Inc. Components Division, Springfield, NJ 07081 .... 201-379-7778; 800-367-5566
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† Sigmapower, Inc, FPBSM Industries, Inc., Rancho Dominguez, CA 90220-6404 310-884-5200
§ Soshin Electric Co., Ltd., Ota-Ku, Tokyo, JAPAN .... (03) 3775-9119
Sprague, Wet & Foil Tantalum Capacitors, North Adams, MA 01247-3987 413-664-4431
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Datel, Inc., Mansfield, MA 02048-1194, 508-339-3000 .... D•1185
Eagle Wichita, Wichita, KS 67277, 316-942-5100 .... A•1626-1628,1630,1632
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Frequency Devices, Inc., Haverhill, MA 01830, 508-374-0761 .... A•1638-1639
† Frequency Electronics, Inc., Mitchel Field, NY 11553, 516-794-4500 .... A•1403
† Kappa Technologies, Inc., Rahway, NJ 07065, 908-396-9400;1-800-223-0603 .... A•1642
† KR Electronics, Inc., Avenel, NJ 07001, 908-636-1900 .... A•1648
† McCoy/Ovenaire/Spectrum, A Sub. of Oak Industries, Mt. Holly Springs, PA 17065, 717-486-3411 .... A•1417

Precision Filters, Inc., Ithaca, NY 14850, 607-277-3550 ..... A•1674-1675
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† Eagle Wichita, Wichita, KS 67277, 316-942-5100 ..... A•1626-1630,1632
† Electronic Precision Components, Mt. Vernon, NY 10550-4430, 914-664-2333 ..... A•1633
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† KR Electronics, Inc., Avenel, NJ 07001, 908-636-1900 ..... A•1648-1649
Krohn-Hite Corp., Avon, MA 02322, 508-580-1660 ..... A•1650
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§† Microwave Filter Inc., East Syracuse, NY 13057-0486, 315-437-3953;800-448-1666 ..... A•1655,1657-1658
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Precision Filters, Inc., Ithaca, NY 14850, 607-277-3550 ..... A•1673-1675
§† Spectrum Control, Inc., Erie, PA 16506, 814-835-4000 ..... A•1677
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† Filtron, RFI Corporation, Bayshore, NY 11706 516-231-6400
† Filtronetics, Inc., Kansas City, MO 64120 816-231-7375
† Freed Transformer Co., Inc., Electronic Transformer Corp., Paterson, NJ 07544-0487 201-942-2222
† Frequency Selective Networks, Woodside, NY 11377 718-424-7500
† Gamma-f Corp., Vertex Communications, Torrance, CA 90505 310-539-6704
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
† Hisonic, Inc., Olathe, KS 66051 913-782-0012
† Hughes Microelectronic Circuits Division, Newport Beach, CA 92658-8903 714-759-2952
Hycomp, Inc., Marlborough, MA 01752 508-485-6300
Hyletronics:Litton Industries, Lexington, MA 02173-3199 617-276-3298
† Integrated Microwave, San Diego, CA 92121-1009 619-259-2600
† International Sensor Systems, Inc., Aurora, NE 68818 402-694-6111
ITHACO, Inc., Meas. & Control Instrs. Div., Ithaca, NY 14851-6437 607-272-7640
JBM Electronics, Inc., Bedford, NH 03110-6802 603-623-0222
† K&L Microwave, Inc., Salisbury, MD 21801 410-749-2424
† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
§† KDS America, Daishinku Corp., Overland Pk., KS 66211 913-491-6825
† Lark Engineering Co., Baier & Baier Inc., San Juan Capistrano, CA 92675 714-240-1233
† LCR Electronics-Hopkins Engineering, Norristown, PA 19401 215-278-0840
† LectroMagnetics Division, Los Angeles, CA 90016 ..... 213-870-9383;USA 800-969-9383
Lindgren RF Enclosures, Inc., Glendale Hgts., IL 60139 708-307-7200
§† Linear Technology Corp., Milpitas, CA 95035-7487 408-432-1900
† Loral Microwave-Narda West, Rancho Cordova, CA 95670-6001 916-638-5500
† Loral Microwave-Wavecom, Northridge, CA 91324 818-882-3010
† Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710 813-347-2181
MACOM, Inc., Lowell, MA 01851 617-272-3000
† Magnecomp, Inc., Pickens, SC 29671 803-878-4700
† Magnetico Inc., Holtsville, NY 11742 516-654-1166
McCoy/Ovenaire/Spectrum, A Sub. of Oak Industries, Mt. Holly Springs, PA 17065 717-486-3411
† Metropole Products Inc., Stafford, VA 22554 703-659-2132
§† Micro-Coax, Collegeville, PA 19426 215-489-3700
† Microlab/FXR, Livingston, NJ 07039 201-992-7700
† Microphase, Norwalk, CT 06856 203-866-8000
MicroSignals Inc., L.I.C., NY 11101 ..... 718-937-7955;718-937-0391;800-648-2252
Microwave Communications Corp., Valencia, CA 91355 805-257-1948
§ Microwave Development Laboratories, Natick, MA 01760 508-655-0060
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3 ..... 514-694-6666; 800-724-3911
Morgan-Matroc, Electro Ceramics Division, Bedford, OH 44146-5478 216-232-8600
§† Murata Erie North America, Inc., Smyrna, GA 30080 404-436-1300
§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 075-951-9111
† NETCOM, Inc, Northbrook, IL 60065-3025 708-564-5100
† Networks International Corporation, Lenexa, KS 66215 913-469-6494

NF Electronic Instruments, State College, PA 16801 814-237-5580
† North Hills Signal Processing, Syosset, NY 11791 516-682-7740
§ Omicron electronic, Hohenems, AUSTRIA A-6845 ..... + /5576/4010-0
OPT Industries, Inc., Phillipsburg, NJ 08865 908-454-2600
Pacific Instruments Inc., Concord, CA 94520 510-827-9010
Penny Technologies, Inc., Greenpoint, NY 11222 718-782-4149
† Performance Controls, Inc., Horsham, PA 19044 215-675-6500
† Piezo Technology Inc., Orlando, FL 32804 407-298-2000
† Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
† Premier Microwave, Port Chester, NY 10573 914-939-8900
Pulse Engineering, Inc., San Diego, CA 92128 619-674-8100
R. C. Electronics Inc., Goleta, CA 93117 805-685-7770
† Reactel, Inc., Rockville, MD 20850 301-279-5535
# Relm Communications, Inc., Adage, Inc., Indianapolis, IN 46226 317-545-4281
† RFI Corporation, Bay Shore, NY 11706 516-231-6400
† RLC Electronics, Inc., Mt. Kisco, NY 10549 914-241-1334
RME Filters, Inc., Amherst, NH 03031 603-595-4573
§† Rockland Scientific Corporation, Princeton, NJ 08543 609-844-0800
Ritron Corp., Skokie, IL 60076 708-679-7180
† Sage Laboratories, Inc., Natick, MA 01760 508-653-0844
§ Schaffner EMC, Inc. Components Division, Springfield, NJ 07081 ..... 201-379-7778; 800-367-5566
§ Schurter, Inc., Petaluma, CA 94954 ..... 800-848-2600 ext.62
† Servo Corporation of America, Hicksville, NY 11801-5259 516-938-9700
† SFE Technologies, San Fernando, CA 91340 818-365-9411
§ Shure Brothers Inc., Evanston, IL 60202-3696 708-866-2200
† Signal Processing Technologies, Colorado Springs, CO 80907 719-528-2300
Solar Electronics Co., A. T. Parker, Inc., Hollywood, CA 90038 800-952-5302
§ Soshin Electric Co., Ltd., Ota-Ku, Tokyo, JAPAN ..... (03) 3775-9119
§ Spectra Sonics, Ogden, UT 84405 801-392-7531
Sprague, Wet & Foil Tantalum Capacitors, North Adams, MA 01247-3987 413-664-4431
Stanford Resch. Sys., Inc., Sunnyvale, CA 94089 408-744-9040
† ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086 408-730-6300
† Teledyne Microelectronics, Los Angeles, CA 90066 ..... 310-822-8229;310-305-0248
† Teledyne Microwave, Mountain View, CA 94043 415-968-2211
Television Equipment Assocs., So. Salem, NY 10590-0393 914-763-8893
† Telonic/Berkeley, Berkeley Inds. Inc., Laguna Beach, CA 92652 714-494-9401
Tokin America, Inc., San Jose, CA 95134 408-432-8020
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
TOYOCOM USA INC., Arlington Heights, IL 60005 ... 708-593-8780/1-800-TOYOCOM
† Trilithic, Inc., Indianapolis, IN 46236 800-344-2412
Tucker Electronics, Dallas, TX 75355-1419 ..... 214-348-8800;800-527-4642
§† Tycor International Inc., Calgary, Alberta, CANADA T2H 1L9 403-259-3200
Unadilla Antenna Mfg. Co., Andover, MA 01810 508-475-7831
Valpey-Opt Company, Valpey-Fisher Corp./Opt Inds., Hopkinton, MA 01748 508-435-6831
† Vanguard Electronics Co., Gardena, CA 90248 310-323-4100
† Watkins-Johnson Co., Palo Alto, CA 94304 415-493-4141
Wavetek Corp., San Diego, CA 92123 619-279-2200
Wavetek Instruments Division, Wavetek Corp., San Diego, CA 92123 619-279-2200
Western Multiplex Corp., Belmont, CA 94002 415-592-8832
Wide Band Engineering Co., Inc., Phoenix, AZ 85036 602-254-1570

Filters, Mechanical-2750

§ CUNO, Inc., Process Filtration Products, Meriden, CT 06450 203-237-5541
† Filter Products, Rockwell International, Costa Mesa, CA 92626 714-641-5311
# The Hirol Company, Ft. Lauderdale, FL 33309 305-974-4900
† Microphase, Norwalk, CT 06856 203-866-8000
Penny Technologies, Inc., Greenpoint, NY 11222 718-782-4149
RFI Corporation, Bay Shore, NY 11706 516-231-6400
† Rockwell International, Costa Mesa, CA 92626 714-641-5311
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070

Filters, Microwave-3450

† Eagle Wichita, Wichita, KS 67277, 316-942-5100 ..... A•1626,1629
§† Microwave Filter Inc., East Syracuse, NY 13057-0486, 315-437-3953;800-448-1666 ..... A•1655-1659
Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500 ..... A•1725
§† Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ..... A•1436,1847, C•1425
† Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803 516-694-6700
† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950 201-539-5500
Allen Avionics, Inc., Mineola, NY 11501 516-248-8080
Alpha Industries, Inc., Woburn, MA 01801 617-935-5150
† Anatech Electronics, Inc., Garfield, NJ 07026 201-772-4242
§† Avantek, Inc, A Subsidiary of Hewlett-Packard, Santa Clara, CA 95054 .. 408-727-0700
Axel Electronics, Inc., Subsidiary of FPBSM Industries Inc., Rancho Dominquez, CA 90220 718-291-3900
§† Capcon, Inc., New York, NY 10001 212-243-6275
† Ceramic Devices Inc., San Diego, CA 92111 619-560-7575
† Cir-Q-Tel, Trilithic, Indianapolis, IN 46236 800-344-2412
Communications & Energy Corp., E. Syracuse, NY 13057 315-452-0709
† Communications Sys. Technology, Inc., Hermosa Beach, CA 90254 213-374-3849
Comstron A Div. of Aeroflex, Plainview, NY 11803 516-752-2351
† Daden Associates, San Clemente, CA 92673 714-366-1522
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
§† FDK America, Inc., Fuji Electrochemical Co., Ltd., San Jose, CA 95134 .. 408-432-8331
† Ferretec Inc., Fremont, CA 94538-6525 510-226-1216
Flann Microwave Inc., Cambridge, MA 02139 1-800-937-3772
Frequency Selective Networks, Woodside, NY 11377 718-424-7500
† Gamma-f Corp., Vertex Communications, Torrance, CA 90505 310-539-6704
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
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† International Telecommunications Components, Inc., Deer Park, NY 11729 516-243-1444
† K&L Microwave, Inc., Salisbury, MD 21801 410-749-2424
† Lark Engineering Co., Baier & Baier Inc., San Juan Capistrano, CA 92675 714-240-1233
Lectronic Research Labs., Inc., Camden, NJ 08104 800-358-8378
† Loral Microwave-Narda West, Rancho Cordova, CA 95670-6001 916-638-5500
† Loral Microwave-Wavecom, Northridge, CA 91324 818-882-3010
† Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710 813-347-2181
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McCoy/Ovenaire/Spectrum, A Sub. of Oak Industries, Mt. Holly Springs, PA 17065 717-486-3411
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† Microlab/FXR, Livingston, NJ 07039 201-992-7700
† Microphase, Norwalk, CT 06856 203-866-8000
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§ Microwave Development Laboratories, Natick, MA 01760 508-655-0060
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3 ..... 514-694-6666; 800-724-3911
§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
§ Omicron electronic, Hohenems, AUSTRIA A-6845 ..... + /5576/4010-0
Oxley Inc., Branford, CT 06405 203-488-1033
Penny Technologies, Inc., Greenpoint, NY 11222 718-782-4149
§† Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018 ..... 408-730-0300;800-PENSTOCK
† Piezo Technology Inc., Orlando, FL 32804 407-298-2000
Polyflon Company, Crane Co., New Rochelle, NY 10801 914-636-7222
† Premier Microwave, Port Chester, NY 10573 914-939-8900
† Reactel, Inc., Rockville, MD 20850 301-279-5535
† RLC Electronics, Inc., Mt. Kisco, NY 10549 914-241-1334
RME Filters, Inc., Amherst, NH 03031 603-595-4573
† Sage Laboratories, Inc., Natick, MA 01760 508-653-0844
† Servo Corporation of America, Hicksville, NY 11801-5259 516-938-9700
† ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086 408-730-6300
§† Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
† Tecknit, Cranford, NJ 07016 908-272-5500
† Teledyne Microelectronics, Los Angeles, CA 90066 ..... 310-822-8229;310-305-0248
† Teledyne Microwave, Mountain View, CA 94043 415-968-2211
Television Equipment Assocs., So. Salem, NY 10590-0393 914-763-8893
† Telonic/Berkeley, Berkeley Inds. Inc., Laguna Beach, CA 92652 714-494-9401
† Transco Products, Inc., Subsidiary of Datron Systems Inc., Camarillo, CA 93012 805-987-8007
† Trilithic, Inc., Indianapolis, IN 46236 800-344-2412
TTE, Incorporated, W. Los Angeles, CA 90064-1400 ..... 310-478-8224;800-776-7614
† UTE Microwave, Asbury Park, NJ 07712 908-922-1009
† Watkins-Johnson Co., Palo Alto, CA 94304 415-493-4141

Filters, Monolithic-2300

Hy-Q International (USA) Inc., Erlanger, KY 41018, 606-283-5000 ..... A•1408
Burr-Brown Corp., Tucson, AZ 85734 602-746-1111
Datel, Inc., Mansfield, MA 02048-1194 508-339-3000
§ Fox Electronics, Ft. Myers, FL 33905 813-693-0099
Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
NEL Frequency Controls, Inc., Burlington, WI 53105 414-763-3591
OPT Industries, Inc., Phillipsburg, NJ 08865 908-454-2600
† Teledyne Microwave, Mountain View, CA 94043 415-968-2211

Filters, Notch — See Filters, Band Elimination (Vol. A)

Filters, Optical-3700 — *See Vol. B*

Filters, Programmable — See Filters, Variable (Vol. A)

Filters, RF-2750

§ Aerovox Inc., North Dartmouth, MA 02747-1217, 508-995-8000 ..... A•1585
Allen Avionics, Inc., Mineola, NY 11501, 516-248-8080 ..... A•1514,1619
Coil-Q Corp., Bronxville, NY 10708, 914-337-4775 ..... A•1222
† Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ..... A•1623
Communications & Energy Corp., E. Syracuse, NY 13057, 315-452-0709 ..... A•1625
§ Corcom, Inc., Libertyville, IL 60048, 708-680-7400 ..... A•1586-1587, C•1301
Del Electronics Corp., Valhalla, NY 10595, 914-686-3600 ..... A•1601,1676
† Eagle Wichita, Wichita, KS 67277, 316-942-5100 ..... A•1626,1628
† Frequency Electronics, Inc., Mitchel Field, NY 11553, 516-794-4500 ..... A•1403
† Genisco Electronics, A Division of GTC, Anaheim, CA 92805, 714-563-4300 ..... A•1641
Hy-Q International (USA) Inc., Erlanger, KY 41018, 606-283-5000 ..... A•1408
JMK, Inc., Amherst, NH 03031, 603-886-4100 ..... A•1596-1597
† Kappa Technologies, Inc., Rahway, NJ 07065, 908-396-9400;1-800-223-0603 ..... A•1642
† KR Electronics, Inc., Avenel, NJ 07001, 908-636-1900 ..... A•1648
† McCoy/Ovenaire/Spectrum, A Sub. of Oak Industries, Mt. Holly Springs, PA 17065, 717-486-3411 ..... A•1417
Metuchen Capacitors, Inc., Old Bridge, NJ 08857, 908-679-3366 ..... A•1651
§ Microwave Filter Inc., East Syracuse, NY 13057-0486, 315-437-3953;800-448-1666 ..... A•1655,1657-1658
Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500 ..... A•1725
Morgan-Matroc, Electro Ceramics Division, Bedford, OH 44146-5478, 216-232-8600 ..... B•1974
§† Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ..... A•1436,1708-1709
§ NTK Technical Ceramics, NGK Spark Plugs (USA), Mt. Prospect, IL 60056, 708-824-1133 ..... A•1667

† **Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064** ..... **A•1263**
Precision Filters, Inc., Ithaca, NY 14850, 607-277-3550 ..... **D•1018**
§ **Pulizzi Engineering, Inc., Santa Ana, CA 92704-6865, 714-540-4229** ..... **D•2300**
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ..... **A•2118**
§† **Spectrum Control, Inc., Erie, PA 16506, 814-835-4000** .... **A•1677-1678, C•1468**
† **TTE, Incorporated, W. Los Angeles, CA 90064-1400, 310-478-8224;800-776-7614** ..... **A•1680,1682-1683**
Wilco Corp., Indianapolis, IN 46268, 317-293-9300 ..... **A•1309,1312**
Advanced Filter Devices, Inc., Carlsbad, CA 92009 619-438-2074
† Alpha Components, Mechanicsburg, PA 17055 717-697-8595
§ American Precision Ind.,Delevan/SMD Divisions, E. Aurora, NY 14052 .. 716-652-3600
† American Trans-Coil Corporation, Richmond Hill, NY 11419-1410 718-441-5207
† Anatech Electronics, Inc., Garfield, NJ 07026 201-772-4242
† Antenna Specialists, The Allen Group, Cleveland, OH 44139 216-349-8400
A. P. Circuit, Brooklyn, NY 11237 718-456-2717
§ AVA Electronics Corporation, Drexel Hill, PA 19026 215-284-2500
† Axel Electronics, Inc., Subsidiary of FPBSM Industries Inc., Rancho Dominquez, CA 90220 718-291-3900
† BG Electronics, EPC Corp., Mt. Vernon, NY 10550-4430 914-664-5591
† Bird Electronic Corp., Cleveland, OH 44139-2794 216-248-1200
† Ceramic Devices Inc., San Diego, CA 92111 619-560-7575
† Chesterfield Products, Inc., Microwave Filter Co., Inc., East Syracuse, NY 13057 ..... 800-666-9655;315-463-2309
† Chomerics, Inc.:W.R. Grace & Co., Woburn, MA 01888 617-935-4850
† Cir-Q-Tel, Trilithic, Indianapolis, IN 46236 800-344-2412
Coilcraft, Cary, IL 60013 708-639-2361
Compac, Holbrook, NY 11741 516-585-3400
† Comstron A Div. of Aeroflex, Plainview, NY 11803 516-752-2351
Continental Electronics Corporation, Dallas, TX 75227 214-381-7161
Control Concepts Corp., Liebert Corp., Binghamton, NY 13902-1380 607-724-2484
Curtis Industries, Milwaukee, WI 53234-3925 414-649-4200
† Daden Associates, San Clemente, CA 92673 714-366-1522
Dowty Avionics, Arcadia, CA 91006 818-445-5955
† Dynamic Air Engrg., Inc., Santa Ana, CA 92705-5697 714-540-1000
† EG & G Frequency Products Inc., EG & G Inc., Cincinnati, OH 45232 513-542-5555
§ Electro-Metrics, Incorporated, A Penril Corp., Amsterdam, NY 12010 518-843-2600
† Electronic Precision Components, Mt. Vernon, NY 10550-4430 914-664-2333
Elpac Components, Elpac Electronics, Inc., Irvine, CA 92714 714-476-6070
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
§ Ercona, Patchogue, NY 11772 516-758-0700
† ESC Electronics Corp., Palisades Pk., NJ 07650 201-947-0400
§† FDK America, Inc., Fuji Electrochemical Co., Ltd., San Jose, CA 95134 .. 408-432-8331
Fee Fil-Mag, San Diego, CA 92123 619-569-6577
† Ferretec Inc., Fremont, CA 94538-6525 510-226-1216
† Filtron, RFI Corporation, Bayshore, NY 11706 516-231-6400
† Filtronetics, Inc., Kansas City, MO 64120 816-231-7375
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† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
Krohn-Hite Corp., Avon, MA 02322 508-580-1660
† Lark Engineering Co., Baier & Baier Inc., San Juan Capistrano, CA 92675 714-240-1233
† LCR Electronics-Hopkins Engineering, Norristown, PA 19401 215-278-0840
† LectroMagnetics Division, Los Angeles, CA 90016 .. 213-870-9383;USA 800-969-9383
† Liberty Mirror Co., Pilkington Aerospace Inc., Brackenridge, PA 15014 ... 412-224-1800
Lindgren RF Enclosures, Inc., Glendale Hgts., IL 60139 708-307-7200
† Loral Microwave-Narda West, Rancho Cordova, CA 95670-6001 916-638-5500
† Loral Microwave-Wavecom, Northridge, CA 91324 818-882-3010
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Peca, Inc., Bensalem, PA 19020 215-245-1550
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§ Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018 ..... 408-730-0300;800-PENSTOCK
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† Rockwell International, Costa Mesa, CA 92626 714-641-5311
† Rtron Corp., Skokie, IL 60076 708-679-7180
† Sawtek Inc., Orlando, FL 32860-9501 407-886-8860
† Servo Corporation of America, Hicksville, NY 11801-5259 516-938-9700
† SFE Technologies, San Fernando, CA 91340 818-365-9411
§ Soshin Electric Co., Ltd., Ota-Ku, Tokyo, JAPAN ..... (03) 3775-9119
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Vernitron Corp., Precision Comps. Group, St. Petersburg, FL 33710 813-347-2181
Wide Band Engineering Co., Inc., Phoenix, AZ 85036 602-254-1570
§ World Products Inc., Sonoma, CA 95476 707-996-5201
World Products Inc., Systems Devices Grp., Sonoma 95476 707-996-5201

Filters, Single Sideband-2750

† **Communication Coil Inc., Chicago, IL 60634, 312-637-1333** ..... **A•1623**
Electronic Precision Components, Mt. Vernon, NY 10550-4430, 914-664-2333 ..... **A•1633**
† **Frequency Electronics, Inc., Mitchel Field, NY 11553, 516-794-4500** ..... **A•1403**
Hy-Q International (USA) Inc., Erlanger, KY 41018, 606-283-5000 ..... **A•1408**
† **KR Electronics, Inc., Avenel, NJ 07001, 908-636-1900** ..... **A•1648**
† **McCoy/Ovenaire/Spectrum, A Sub. of Oak Industries, Mt. Holly Springs, PA 17065. 717-486-3411** ..... **A•1417**
Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500 ..... **A•1725**
† **TTE, Incorporated, W. Los Angeles, CA 90064-1400, 310-478-8224;800-776-7614** ..... **A•1680**
Advanced Filter Devices, Inc., Carlsbad, CA 92009 619-438-2074
† Alpha Components, Mechanicsburg, PA 17055 717-697-8595
† American Trans-Coil Corporation, Richmond Hill, NY 11419-1410 718-441-5207
† Axel Electronics, Inc., Subsidiary of FPBSM Industries Inc., Rancho Dominquez, CA 90220 718-291-3900
† BG Electronics, EPC Corp., Mt. Vernon, NY 10550-4430 914-664-5591
† Blackhawk Networks Corp., Janesville, WI 53545 608-752-8701
† Comstron A Div. of Aeroflex, Plainview, NY 11803 516-752-2351
† EG & G Frequency Products Inc., EG & G Inc., Cincinnati, OH 45232 513-542-5555
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
† ESC Electronics Corp., Palisades Pk., NJ 07650 201-947-0400
† Ferretec Inc., Fremont, CA 94538-6525 510-226-1216
† Filter Products, Rockwell International, Costa Mesa, CA 92626 714-641-5311
† Filtronetics, Inc., Kansas City, MO 64120 816-231-7375
† Frequency Selective Networks, Woodside, NY 11377 718-424-7500
† Hisonic, Inc., Olathe, KS 66051 913-782-0012
† Hughes Microelectronic Circuits Division, Newport Beach, CA 92658-8903 714-759-2952
† Integrated Microwave, San Diego, CA 92121-1009 619-259-2600
Microwave Development Laboratories, Natick, MA 01760 508-655-0060
§ Microwave Filter Inc., East Syracuse, NY 13057-0486 .... 315-437-3953;800-448-1666
† NETCOM, Inc, Northbrook, IL 60065-3025 708-564-5100
† Networks International Corporation, Lenexa, KS 66215 913-469-6494
§ Omicron electronic, Hohenems, AUSTRIA A-6845 ..... +/5576/4010-0
† RFI Corporation, Bay Shore, NY 11706 516-231-6400
† Rockwell International, Costa Mesa, CA 92626 714-641-5311
† Savoy Electronics, Inc., Ft. Lauderdale, FL 33310 ..... 305-563-1333;800-359-5400
Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
† Torotron Corp., Mt. Vernon, NY 10550 914-664-2050
Valpey-Opt Company, Valpey-Fisher Corp./Opt Inds., Hopkinton, MA 01748 508-435-6831

Filters, Surface Acoustic Wave (SAW)-2300

§ **AT&T Microelectronics, Allentown, PA 18103, 1-800-372-2447;In Can.:1-800-553-2448** ..... **A•1335**
† **Frequency Electronics, Inc., Mitchel Field, NY 11553, 516-794-4500** ..... **A•1403**
TOYOCOM USA INC., Arlington Heights, IL 60005, 708-593-8780/1-800-TOYOCOM ..... **A•1495**
AVX Corporation, A Kyocera Group Company, Myrtle Beach, SC 29577 803-448-9411
C-Mac Industries Inc., Sherbrooke, Quebec, CANADA J1L 1V8 819-821-4524
Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
§ Panasonic Indl. Co. Standard Comps. Sector, Matsushita Elec. Corp. of America, Secaucus, NJ 07094 201-392-4818
Soshin Electric Co., Ltd., Ota-Ku, Tokyo, JAPAN ..... (03) 3775-9119
† Teledyne Microelectronics, Los Angeles, CA 90066 ..... 310-822-8229;310-305-0248

Filters, Synchronous Tracking-2750

† **Communication Coil Inc., Chicago, IL 60634, 312-637-1333** ..... **A•1623**

Electronic Precision Components, Mt. Vernon, NY 10550-4430, 914-664-2333 ... **A•1633**
† **KR Electronics, Inc., Avenel, NJ 07001, 908-636-1900** ... **A•1648**
Precision Filters, Inc., Ithaca, NY 14850, 607-277-3550 ... **A•1674-1675**
† **TTE, Incorporated, W. Los Angeles, CA 90064-1400, 310-478-8224;800-776-7614** ... **A•1680**
Alpha Components, Mechanicsburg, PA 17055 ... 717-697-8595
† American Trans-Coil Corporation, Richmond Hill, NY 11419-1410 ... 718-441-5207
† Axel Electronics, Inc., Subsidiary of FPBSM Industries Inc., Rancho Dominquez, CA 90220 ... 718-291-3900
† CEC Instruments, Imo Industries Inc., San Dimas, CA 91773 ... 909-394-4410
Control Concepts Corp., Liebert Corp., Binghamton, NY 13902-1380 ... 607-724-2484
† EG & G Frequency Products Inc., EG & G Inc., Cincinnati, OH 45232 ... 513-542-5555
† ESC Electronics Corp., Palisades Pk., NJ 07650 ... 201-947-0400
† Ferretec Inc., Fremont, CA 94538-6525 ... 510-226-1216
† Filtronetics, Inc., Kansas City, MO 64120 ... 816-231-7375
Krohn-Hite Corp., Avon, MA 02322 ... 508-580-1660
† Networks International Corporation, Lenexa, KS 66215 ... 913-469-6494
RFI Corporation, Bay Shore, NY 11706 ... 516-231-6400
†# Synetcom Digital Incorporated, Redondo Bch., CA 90278 ... 310-379-2000
† Telonic/Berkeley, Berkeley Inds. Inc., Laguna Beach, CA 92652 ... 714-494-9401
Unholtz-Dickie Corp., Wallingford, CT 06492 ... 203-265-3929
† UTE Microwave, Asbury Park, NJ 07712 ... 908-922-1009

Filters, Telemetering-1900 — *See Vol. D*

Filters, Tone, Telegraph-2750

Electronic Precision Components, Mt. Vernon, NY 10550-4430, 914-664-2333 ... **A•1633**
† **TTE, Incorporated, W. Los Angeles, CA 90064-1400, 310-478-8224;800-776-7614** ... **A•1680**
Alpha Components, Mechanicsburg, PA 17055 ... 717-697-8595
A. P. Circuit, Brooklyn, NY 11237 ... 718-456-2717
Avens Signal Equipment, Elmhurst, NY 11373 ... 718-335-1886
† Axel Electronics, Inc., Subsidiary of FPBSM Industries Inc., Rancho Dominquez, CA 90220 ... 718-291-3900
† BG Electronics, EPC Corp., Mt. Vernon, NY 10550-4430 ... 914-664-5591
† Chesterfield Products, Inc., Microwave Filter Co., Inc., East Syracuse, NY 13057 ... 800-666-9655;315-463-2309
† Coast Coil Co., Coast Magnetics, Los Angeles, CA 90016 ... 213-936-6188
† Comstron A Div. of Aeroflex, Plainview, NY 11803 ... 516-752-2351
Dantel, Fresno, CA 93727 ... 209-292-1111
§ De Coursey Engineering Laboratory, Culver City, CA 90230 ... 1-310-397-9668
† EG & G Frequency Products Inc., EG & G Inc., Cincinnati, OH 45232 ... 513-542-5555
Electrocom Industries, S. Bend, IN 46615 ... 219-232-2743
Elpac Components, Elpac Electronics, Inc., Irvine, CA 92714 ... 714-476-6070
Engineered Components Co., San Luis Obispo, CA 93403-8121 ... 805-544-3800
† ESC Electronics Corp., Palisades Pk., NJ 07650 ... 201-947-0400
† Filter Products, Rockwell International, Costa Mesa, CA 92626 ... 714-641-5311
† Filtron, RFI Corporation, Bayshore, NY 11706 ... 516-231-6400
Frequency Devices, Inc., Haverhill, MA 01830 ... 508-374-0761
† Frequency Selective Networks, Woodside, NY 11377 ... 718-424-7500
† Hisonic, Inc., Olathe, KS 66051 ... 913-782-0012
† K&L Microwave, Inc., Salisbury, MD 21801 ... 410-749-2424
† KR Electronics, Inc., Avenel, NJ 07001 ... 908-636-1900
† Magnetico Inc., Holtsville, NY 11742 ... 516-654-1166
McCoy/Ovenaire/Spectrum, A Sub. of Oak Industries, Mt. Holly Springs, PA 17065 ... 717-486-3411
Morgan-Matroc, Electro Ceramics Division, Bedford, OH 44146-5478 ... 216-232-8600
§ Omicron electronic, Hohenems, AUSTRIA A-6845 ... + /5576/4010-0
OPT Industries, Inc., Phillipsburg, NJ 08865 ... 908-454-2600
† Polyphase Instrument, Ft. Washington, PA 19034 ... 215-643-6950
† RFI Corporation, Bay Shore, NY 11706 ... 516-231-6400
† Torotron Corp., Mt. Vernon, NY 10550 ... 914-664-2050
Valpey-Opt Company, Valpey-Fisher Corp./Opt Inds., Hopkinton, MA 01748 ... 508-435-6831

Filters, Tunable — See Filters, Continuously Variable (Vol. A)

Filters, Tuning Fork-2300

§† KDS America, Daishinku Corp., Overland Pk., KS 66211 ... 913-491-6825
§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111

Filters, UHF & VHF-2750

Allen Avionics, Inc., Mineola, NY 11501, 516-248-8080 ... **A•1514,1619**
† **Communication Coil Inc., Chicago, IL 60634, 312-637-1333** ... **A•1623**
Communications & Energy Corp., E. Syracuse, NY 13057, 315-452-0709 ... **A•1625**
† **Eagle Wichita, Wichita, KS 67277, 316-942-5100** ... **A•1626,1629**
Electronic Precision Components, Mt. Vernon, NY 10550-4430, 914-664-2333 ... **A•1633**
JMK, Inc., Amherst, NH 03031, 603-886-4100 ... **A•1596-1597**
Kappa Technologies, Inc., Rahway, NJ 07065, 908-396-9400;1-800-223-0603 ... **A•1642**
† **KR Electronics, Inc., Avenel, NJ 07001, 908-636-1900** ... **A•1648**
McCoy/Ovenaire/Spectrum, A Sub. of Oak Industries, Mt. Holly Springs, PA 17065, 717-486-3411 ... **A•1417**
§† **Microwave Filter Inc., East Syracuse, NY 13057-0486, 315-437-3953;800-448-1666** ... **A•1655-1659**
Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500 ... **A•1725**
§† **Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300** ... **A•1436,1708-1709**
§ **NTK Technical Ceramics, NGK Spark Plugs (USA), Mt. Prospect, IL 60056, 708-824-1133** ... **A•1667**
Tri-Mag, Inc., Visalia, CA 93291, 209-651-2222 ... **A•1612**
† **TTE, Incorporated, W. Los Angeles, CA 90064-1400, 310-478-8224;800-776-7614** ... **A•1680-1683**
Advanced Filter Devices, Inc., Carlsbad, CA 92009 ... 619-438-2074
† Alpha Components, Mechanicsburg, PA 17055 ... 717-697-8595
† Anatech Electronics, Inc., Garfield, NJ 07026 ... 201-772-4242
A. P. Circuit, Brooklyn, NY 11237 ... 718-456-2717
Axel Electronics, Inc., Subsidiary of FPBSM Industries Inc., Rancho Dominquez, CA 90220 ... 718-291-3900
† Bird Electronic Corp., Cleveland, OH 44139-2794 ... 216-248-1200
† Chesterfield Products, Inc., Microwave Filter Co., Inc., East Syracuse, NY 13057 ... 800-666-9655;315-463-2309
† Communications Sys. Technology, Inc., Hermosa Beach, CA 90254 ... 213-374-3849
† Comstron A Div. of Aeroflex, Plainview, NY 11803 ... 516-752-2351
† Daden Associates, San Clemente, CA 92673 ... 714-366-1522
† Dielectric Communications, General Signal, Raymond, ME 04071 ... 207-655-4555; 800-341-9678
† EG & G Frequency Products Inc., EG & G Inc., Cincinnati, OH 45232 ... 513-542-5555
Elpac Components, Elpac Electronics, Inc., Irvine, CA 92714 ... 714-476-6070
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ... 201-288-4477; 800-447-5639
† ESC Electronics Corp., Palisades Pk., NJ 07650 ... 201-947-0400
† Filtronetics, Inc., Kansas City, MO 64120 ... 816-231-7375
† Frequency Electronics, Inc., Mitchel Field, NY 11553 ... 516-794-4500
† Frequency Selective Networks, Woodside, NY 11377 ... 718-424-7500
Hisonic, Inc., Olathe, KS 66051 ... 913-782-0012
† Hughes Microelectronic Circuits Division, Newport Beach, CA 92658-8903 ... 714-759-2952
Hyletronics:Litton Industries, Lexington, MA 02173-3199 ... 617-276-3298
† Integrated Microwave, San Diego, CA 92121-1009 ... 619-259-2600
† K&L Microwave, Inc., Salisbury, MD 21801 ... 410-749-2424
§† KDS America, Daishinku Corp., Overland Pk., KS 66211 ... 913-491-6825
† Lark Engineering Co., Baier & Baier Inc., San Juan Capistrano, CA 92675 ... 714-240-1233
† Loral Microwave-Wavecom, Northridge, CA 91324 ... 818-882-3010
† Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710 ... 813-347-2181
† Magnetic Component Engineering, Inc., Inglewood, CA 90301 ... 310-677-6600
Metropole Products Inc., Stafford, VA 22554 ... 703-659-2132
Micro-Coax, Collegeville, PA 19426 ... 215-489-3700
† Microphase, Norwalk, CT 06856 ... 203-866-8000
Microwave Communications Corp., Valencia, CA 91355 ... 805-257-1948
Microwave Development Laboratories, Natick, MA 01760 ... 508-655-0060
North Hills Signal Processing, Syosset, NY 11791 ... 516-682-7740
§ Omicron electronic, Hohenems, AUSTRIA A-6845 ... + /5576/4010-0
Oxley Inc., Branford, CT 06405 ... 203-488-1033
Penny Technologies, Inc., Greenpoint, NY 11222 ... 718-782-4149
† Piezo Technology Inc., Orlando, FL 32804 ... 407-298-2000
Precision Filters, Inc., Ithaca, NY 14850 ... 607-277-3550
† Reactel, Inc., Rockville, MD 20850 ... 301-279-5535
† RFI Corporation, Bay Shore, NY 11706 ... 516-231-6400
† RF Monolithics, Inc., Dallas, TX 75244 ... 214-233-2903
† RLC Electronics, Inc., Mt. Kisco, NY 10549 ... 914-241-1334
Servo Corporation of America, Hicksville, NY 11801-5259 ... 516-938-9700
§† Sinclair Radio Laboratories Ltd., Aurora, ONT., CANADA L4G 3G9 ... 416-727-0165
§ Soshin Electric Co., Ltd., Ota-Ku, Tokyo, JAPAN ... (03) 3775-9119
TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056 ... 708-803-6100
† Teledyne Microwave, Mountain View, CA 94043 ... 415-968-2211
† Telonic/Berkeley, Berkeley Inds. Inc., Laguna Beach, CA 92652 ... 714-494-9401
§ Toko America, Inc., Mt. Prospect., IL 60056 ... 708-297-0070
TOYOCOM USA INC., Arlington Heights, IL 60005 ... 708-593-8780/1-800-TOYOCOM
† Transco Products, Inc., Subsidiary of Datron Systems Inc., Camarillo, CA 93012 ... 805-987-8007
† Trilithic, Inc., Indianapolis, IN 46236 ... 800-344-2412
† Vanguard Electronics Co., Gardena, CA 90248 ... 310-323-4100
Vernitron Corp., Precision Comps. Group, St. Petersburg, FL 33710 ... 813-347-2181
Wavetek Corp., San Diego, CA 92123 ... 619-279-2200
Wavetek Instruments Division, Wavetek Corp., San Diego, CA 92123 ... 619-279-2200
Wide Band Engineering Co., Inc., Phoenix, AZ 85036 ... 602-254-1570

Filters, Variable-2750

† **Avens Signal Equipment, Elmhurst, NY 11373, 718-335-1886** ... **A•1620-1621**
Datel, Inc., Mansfield, MA 02048-1194, 508-339-3000 ... **D•1185**
Del Electronics Corp., Valhalla, NY 10595, 914-686-3600 ... **A•1601,1676**
† **Eagle Wichita, Wichita, KS 67277, 316-942-5100** ... **A•1626,1632**
Filter Concepts Inc., Santa Ana, CA 92707, 714-545-7003 ... **A•1595**
Frequency Devices, Inc., Haverhill, MA 01830, 508-374-0761 ... **A•1638-1639**
JMK, Inc., Amherst, NH 03031, 603-886-4100 ... **A•1596-1597**
Krohn-Hite Corp., Avon, MA 02322, 508-580-1660 ... **A•1650**
Metuchen Capacitors, Inc., Old Bridge, NJ 08857, 908-679-3366 ... **A•1651**
§† **Microwave Filter Inc., East Syracuse, NY 13057-0486, 315-437-3953;800-448-1666** ... **A•1655-1656,1658-1659**
NTK Technical Ceramics, NGK Spark Plugs (USA), Mt. Prospect, IL 60056, 708-824-1133 ... **A•1666**
Precision Filters, Inc., Ithaca, NY 14850, 607-277-3550 ... **A•1673-1675**
TTE, Incorporated, W. Los Angeles, CA 90064-1400, 310-478-8224;800-776-7614 ... **A•1680,1683**
§ Alligator Technologies, Fountain Valley, CA 92708 ... 714-850-9984
† American Trans-Coil Corporation, Richmond Hill, NY 11419-1410 ... 718-441-5207
A. P. Circuit, Brooklyn, NY 11237 ... 718-456-2717
Arco Electronics, Chatsworth, CA 91311 ... 818-882-8707
† Axel Electronics, Inc., Subsidiary of FPBSM Industries Inc., Rancho Dominquez, CA 90220 ... 718-291-3900
Bently Nevada Corp., Minden, NV 89423 ... 800-227-5514;702-782-3611
Burr-Brown Corp., Tucson, AZ 85734 ... 602-746-1111
Coaxial Dynamics, Cleveland, OH 44135 ... 1-800-COAXIAL
Coil-Q Corp., Bronxville, NY 10708 ... 914-337-4775
Communications & Energy Corp., E. Syracuse, NY 13057 ... 315-452-0709
Comstron A Div. of Aeroflex, Plainview, NY 11803 ... 516-752-2351

† Daden Associates, San Clemente, CA 92673 714-366-1522
§ Dynamics, Div. of Waugh Controls Corp., Chatsworth, CA 91311 818-998-8281
EG&G Optoelectronics- Reticon, Sunnyvale, CA 94086-4197 408-738-4266
† Ferretec Inc., Fremont, CA 94538-6525 510-226-1216
† Filtronetics, Inc., Kansas City, MO 64120 816-231-7375
Hughes Microelectronic Circuits Division, Newport Beach, CA 92658-8903 714-759-2952
† Integrated Microwave, San Diego, CA 92121-1009 619-259-2600
ITHACO, Inc., Meas. & Control Instrs. Div., Ithaca, NY 14851-6437 607-272-7640
† K&L Microwave, Inc., Salisbury, MD 21801 410-749-2424
LCR Electronics-Hopkins Engineering, Norristown, PA 19401 215-278-0840
Lectronic Research Labs., Inc., Camden, NJ 08104 800-358-8378
† Loral Microwave-Wavecom, Northridge, CA 91324 818-882-3010
† Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710 813-347-2181
McCoy/Ovenaire/Spectrum, A Sub. of Oak Industries, Mt. Holly Springs, PA 17065 717-486-3411
§ Microwave Development Laboratories, Natick, MA 01760 508-655-0060
NF Electronic Instruments, State College, PA 16801 814-237-5580
§ Omicron electronic, Hohenems, AUSTRIA A-6845 ..... + /5576/4010-0
Pacific Instruments Inc., Concord, CA 94520 510-827-9010
† Piezo Technology Inc., Orlando, FL 32804 407-298-2000
† Premier Microwave, Port Chester, NY 10573 914-939-8900
R. C. Electronics Inc., Goleta, CA 93117 805-685-7770
RFI Corporation, Bay Shore, NY 11706 516-231-6400
Sivers IMA AB, Culver City, CA 90230 213-306-4248
Stanford Resch. Sys., Inc., Sunnyvale, CA 94089 408-744-9040
† Telonic/Berkeley, Berkeley Inds. Inc., Laguna Beach, CA 92652 714-494-9401
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
† Transco Products, Inc., Subsidiary of Datron Systems Inc., Camarillo, CA 93012 805-987-8007
† Trilithic, Inc., Indianapolis, IN 46236 800-344-2412
Tucker Electronics, Dallas, TX 75355-1419 ..... 214-348-8800;800-527-4642
† Vanguard Electronics Co., Gardena, CA 90248 310-323-4100

Filters, Vestigial Sideband-2750

† Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ..... A•1623
† TTE, Incorporated, W. Los Angeles, CA 90064-1400, 310-478-8224;800-776-7614 ..... A•1680
Alpha Components, Mechanicsburg, PA 17055 717-697-8595
§ ATV Research, Inc., Dakota City, NE 68731 402-987-3771
† Axel Electronics, Inc., Subsidiary of FPBSM Industries Inc., Rancho Dominquez, CA 90220 718-291-3900
† BG Electronics, EPC Corp., Mt. Vernon, NY 10550-4430 914-664-5591
† Comstron A Div. of Aeroflex, Plainview, NY 11803 516-752-2351
† Frequency Selective Networks, Woodside, NY 11377 718-424-7500
† Hisonic, Inc., Olathe, KS 66051 913-782-0012
Hy-Q International (USA) Inc., Erlanger, KY 41018 606-283-5000
International Crystal Mfg., Oklahoma City, OK 73126-0330 ..... 405-236-3741; 1-800-725-1426
† KR Electronics, Inc., Avenel, NJ 07001 908-636-1900
Microwave Development Laboratories, Natick, MA 01760 508-655-0060
§ Omicron electronic, Hohenems, AUSTRIA A-6845 ..... + /5576/4010-0
† Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
RFI Corporation, Bay Shore, NY 11706 516-231-6400
† Sawtek Inc., Orlando, FL 32860-9501 407-886-8860
Valpey-Opt Company, Valpey-Fisher Corp./Opt Inds., Hopkinton, MA 01748 508-435-6831

Filters, Video-2750

Allen Avionics, Inc., Mineola, NY 11501, 516-248-8080 ..... A•1514,1619
† Eagle Wichita, Wichita, KS 67277, 316-942-5100 ..... A•1626
Electronic Precision Components, Mt. Vernon, NY 10550-4430, 914-664-2333 ..... A•1633
JMK, Inc., Amherst, NH 03031, 603-886-4100 ..... A•1596-1597
† KR Electronics, Inc., Avenel, NJ 07001, 908-636-1900 ..... A•1648-1649
§ Microwave Filter Inc., East Syracuse, NY 13057-0486, 315-437-3953;800-448-1666 ..... A•1658
§ Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 .. A•1436,1708
† TTE, Incorporated, W. Los Angeles, CA 90064-1400, 310-478-8224;800-776-7614 ..... A•1680
† Alpha Components, Mechanicsburg, PA 17055 717-697-8595
† Anatech Electronics, Inc., Garfield, NJ 07026 201-772-4242
Arco Electronics, Chatsworth, CA 91311 818-882-8707
Chesterfield Products, Inc., Microwave Filter Co., Inc., East Syracuse, NY 13057 ..... 800-666-9655;315-463-2309
Coilcraft, Cary, IL 60013 708-639-2361
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
† ESC Electronics Corp., Palisades Pk., NJ 07650 201-947-0400
† Filtron, RFI Corporation, Bayshore, NY 11706 516-231-6400
† Filtronetics, Inc., Kansas City, MO 64120 816-231-7375
Penny Technologies, Inc., Greenpoint, NY 11222 718-782-4149
§† Raytheon-La Jolla, La Jolla, CA 92038 619-457-1000
Soshin Electric Co., Ltd., Ota-Ku, Tokyo, JAPAN ..... (03) 3775-9119
Television Equipment Assocs., So. Salem, NY 10590-0393 914-763-8893
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
Western Multiplex Corp., Belmont, CA 94002 415-592-8832

Filters, Waveguide-3450

§† Microwave Filter Inc., East Syracuse, NY 13057-0486, 315-437-3953;800-448-1666 ..... A•1655-1659
† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950 201-539-5500
Allen Avionics, Inc., Mineola, NY 11501 516-248-8080
Alpha Industries, Inc., Woburn, MA 01801 617-935-5150
BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
Communications & Energy Corp., E. Syracuse, NY 13057 315-452-0709
† Eastern Microwave, Winchester, MA 01890 617-721-9800
Flann Microwave Inc., Cambridge, MA 02139 1-800-937-3772
† Gamma-f Corp., Vertex Communications, Torrance, CA 90505 310-539-6704
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
† Integrated Microwave, San Diego, CA 92121-1009 619-259-2600
† International Telecommunications Components, Inc., Deer Park, NY 11729 516-243-1444
† K&L Microwave, Inc., Salisbury, MD 21801 410-749-2424
Lectronic Research Labs., Inc., Camden, NJ 08104 800-358-8378
Lindgren RF Enclosures, Inc., Glendale Hgts., IL 60139 708-307-7200
† Loral Microwave-Wavecom, Northridge, CA 91324 818-882-3010
† Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710 813-347-2181
MACOM, Inc., Lowell, MA 01851 617-272-3000
† Metropole Products Inc., Stafford, VA 22554 703-659-2132
† Microlab/FXR, Livingston, NJ 07039 201-992-7700
† Microphase, Norwalk, CT 06856 203-866-8000
Microwave Communications Corp., Valencia, CA 91355 805-257-1948
§ Microwave Development Laboratories, Natick, MA 01760 508-655-0060
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3 ..... 514-694-6666; 800-724-3911
Penny Technologies, Inc., Greenpoint, NY 11222 718-782-4149
† Premier Microwave, Port Chester, NY 10573 914-939-8900
Pro Com Technology Inc., Plainview, NY 11803 ..... 516-293-4443;800-762-3785
† Radio Research Instrument Co., Inc., Waterbury, CT 06704-3506 203-753-5840
† Reactel, Inc., Rockville, MD 20850 301-279-5535
RFI Corporation, Bay Shore, NY 11706 516-231-6400
† Sage Laboratories, Inc., Natick, MA 01760 508-653-0844
§† Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
† Tecknit, Cranford, NJ 07016 908-272-5500
† Trilithic, Inc., Indianapolis, IN 46236 800-344-2412
† UTE Microwave, Asbury Park, NJ 07712 908-922-1009
Vernitron Corp., Precision Comps. Group, St. Petersburg, FL 33710 813-347-2181

Filters, YIG-2750

BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
† Communications Sys. Technology, Inc., Hermosa Beach, CA 90254 213-374-3849
† Ferretec Inc., Fremont, CA 94538-6525 510-226-1216
MACOM, Inc., Lowell, MA 01851 617-272-3000
Sivers IMA AB, Culver City, CA 90230 213-306-4248
† ST Microwave Corp., Sub. of Signal Technig. Corp., Sunnyvale, CA 94086 408-730-6300
† Watkins-Johnson Co., Palo Alto, CA 94304 415-493-4141

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Foil, Magnetic-1850

† Ad-Vance Magnetics, Inc., Rochester, IN 46975, 219-223-3158 ..... C•1682
† Amuneal Manufactoring Corp., Philadelphia, PA 19124, 215-535-3000 ... C•1683
† Magnetic Shield Corporation, Perfection Mica Co., Bensenville, IL 60106, 708-766-7800 ..... C•1696-1697
† Arnold Engineering Company, Sub. SPS Technologies, Marengo, IL 60152 815-568-2000
† Eagle Magnetic Company, Inc., Indianapolis, IN 46224 317-297-1030
§ Egis Corporation, Barrington Hills, IL 60010 708-639-1555
Framar Metal Products Co., Inc., Kenilworth, NJ 07033 908-241-0710
† Magnetics, Spang & Co., Butler, PA 16003-0391 412-282-8282
† Permaluster, Inc., Burbank, CA 91504 ..... 213-849-4543;213-849-6454
†# Reade Advanced Materials, A Reade Intl. business unit, Riverside, RI 02915-0039 401-433-7000
† SAS Industries Inc., Manorville, NY 11949 ..... 516-727-1441;1-800-544-5238
Shin-Etsu Polymer America, Inc., Union City, CA 94587 510-475-9000
† Zippertubing Co., Los Angeles, CA 90061 310-527-0488

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† Bell, F. W., Inc., Orlando, FL 32807, 407-678-6900 ..... B•1918, D•1153
GMW Associates, Redwood City, CA 94064, 415-368-4884 ..... B•1951
Weschler Instruments, Hughes Corp., Cleveland, OH 44136, 216-238-2550 ..... D•1391

† Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803 516-694-6700
† American Aerospace Controls, Farmingdale, NY 11735 516-694-5100
BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
Cryomagnetics, Inc., Oak Ridge, TN 37830 615-482-9551
Lake Shore Cryotronics, Inc., Westerville, OH 43081 614-891-2243
LDJ Electronics, Troy, MI 48099-0219 313-528-2202
Magnetic Instrumentation, Inc., Indianapolis, IN 46226 317-545-2102
Ohio Semitronics, Inc., Columbus, OH 43212 614-486-9561
§† Optek Technology Inc., Carrollton, TX 75006 214-323-2200
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
§ Walker Scientific, Worcester, MA 01606 ... 508-852-3674;508-853-3232;800-962-4638

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Amplifier Research, Souderton, PA 18964-9990, 215-723-8181 ..... D•1023
†§ Noise Com Inc., Paramus, NJ 07652, 201-261-8797 ..... D•1311
† TRAK Microwave Corp., Tampa, FL 33634, 813-884-1411 ..... A•1854
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
† Boonton Electronics Corp., Randolph, NJ 07869 201-584-1077
Cober Electronics, Stamford, CT 06902 203-327-0003
Comstron A Div. of Aeroflex, Plainview, NY 11803 516-752-2351
§† EIP Microwave, Inc., Milpitas, CA 95035 408-945-1477
† EEI Microwave, Inc. Frequency Electronics, Inc., Sunnyvale, CA 94086 408-732-0880
Flann Microwave Inc., Cambridge, MA 02139 1-800-937-3772
† Giga-tronics, Inc., Sunnyvale, CA 94089 408-734-5780
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
§ Leader Instruments Corp., Hauppauge, NY 11788-3694 ..... 516-231-6900; 1-800-645-5104
Lectronic Research Labs., Inc., Camden, NJ 08104 800-358-8378
Loral Microwave Narda, Hauppauge, NY 11788 516-231-1700
† Loral Microwave-Narda West, Rancho Cordova, CA 95670-6001 916-638-5500
Lucas Epsco, Inc., Hopkinton, MA 01748-2204 508-435-2400
Lucas Weinschel, Gaithersburg, MD 20884-6001 301-948-3434
Lucas Zeta, Lucas Aerospace, Inc., San Jose, CA 95134 408-434-3600
† M/A COM Ltd., Bedfordshire, ENGLAND LU5 4SX, England ..... 44(582)471200
Magnum Microwave Corp., Fremont, CA 94538 510-657-9898
§ Marconi Instruments, Allendale, NJ 07401 201-934-9050
† MCL, Inc., Bolingbrook, IL 60440-4999 708-759-9500
Microdry, Inc., Crestwood, KENTUCKY 40014 502-241-8933
† Micronetics, Hudson, NH 03051 603-883-2900
§ Micro-Now Instr. Co., Inc., Skokie, IL 60076 708-677-4700
§ Microwave Development Laboratories, Natick, MA 01760 508-655-0060
† Microwave Technology Div., JHP Industrial, Syracuse, NY 13202-3442 315-422-0050
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3 ..... 514-694-6666; 800-724-3911
Nemeth Engineering Associates, Inc., Crestwood, KY 40014 502-241-1502
† Pro-Comm, Inc., Brick, NJ 08724 908-206-0660
† Racal-Dana Instrs. Inc., Irvine, CA 92716 714-859-8999
† Radio Research Instrument Co., Inc., Waterbury, CT 06704-3506 203-753-5840
RAC Electronics, Inc., Canoga Park, CA 91304 ..... 818-998-6500;800-732-3457
† Republic Electronics Co., Esterline Technologies, Hauppauge, NY 11788 516-273-9800
Servo Corporation of America, Hicksville, NY 11801-5259 516-938-9700
ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086 408-730-6300
Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
† Techtrol Cyclonetics, Inc., New Cumberland, PA 17070 717-774-2746
Tektronix, Inc., Wilsonville, OR 97070 800-835-9433
Tucker Electronics, Dallas, TX 75355-1419 ..... 214-348-8800;800-527-4642
† Watkins-Johnson Co., Palo Alto, CA 94304 415-493-4141
Wavetek Corp., San Diego, CA 92123 619-279-2200
Wavetek Instruments Division, Wavetek Corp., San Diego, CA 92123 619-279-2200
§ Wiltron, Morgan Hill, CA 95037-2809 408-778-2000

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§ Bivar, Inc., Irvine, CA 92718, 714-951-8808 ..... C•1537
Bliley Electric Co., Erie, PA 16506, 814-838-3571 ..... A•1344
Colorado Crystal Corp., Loveland, CO 80537, 303-667-9248 ..... A•1348
CTS Corp., Frequency Controls, Sandwich, IL 60548, 815-786-8411 ..... A•1373,1375
McCoy/Ovenaire/Spectrum, A Sub. of Oak Industries, Mt. Holly Springs, PA 17065, 717-486-3411 ..... A•1412-1413
† Reeves-Hoffman Div., Dynamics Corporation of America, Carlisle, PA 17013-2248, 717-243-5929 ..... A•1464
§ Standard Crystal Corporation, El Monte, CA 91731, 818-443-2121 ..... A•1481
§† Atlee Inc., North Andover, MA 01845 508-681-1003
† Connector Corp., Chicago, IL 60646 312-539-3108
Coors Electronic Package Co., Chattanooga, TN 37405 615-755-5452
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
International Crystal Mfg., Oklahoma City, OK 73126-0330 ..... 405-236-3741; 1-800-725-1426
† Microphase, Norwalk, CT 06856 203-866-8000
§ Microwave Development Laboratories, Natick, MA 01760 508-655-0060
James Millen Elctrns., Caywood Elec. Inc., No. Andover, MA 01845 508-975-2711
† Milton Ross Co., Warrington, PA 18976 215-491-0600
† M-Tron Industries, Yankton, SD 57078 605-665-9321
Raltron Electronics, Miami, FL 33172 305-593-6033
† Sage Laboratories, Inc., Natick, MA 01760 508-653-0844
Schott Electronics, Seymour, CT 06483 203-881-0102
Telephonics Corporation/PRD Instruments, Huntington, NY 11743 ..... 516-549-6415, 6428

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§ Bivar, Inc., Irvine, CA 92718, 714-951-8808 ..... C•1537

Ohmtek Inc., Vishay, Niagara Falls, NY 14304, 716-283-4025 ..... **A•2003**
Acme Model Engineering Co., Ridgefield, NJ 07657 201-943-7650
Burndy Corporation, An FCI Company, Norwalk, CT 06856 203-838-4444
†Detoronics Corporation, S. El Monte, CA 91733 818-579-7130
#Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
§†Garry Electronics, WPI, Salem, NJ 08079 609-935-7603
†Gordon, L., Packaging, Baltimore, MD 21230 410-539-6537
ISL Produots Int'l, Ltd., Syosset, NY 11791-6093 ..... 516-937-3475;800-626-6116
Jonard Industries Corp., Tuckahoe, NY 10707 914-793-0700
§3M-Electronic Products Division, Austin, TX 78726 ... 1-800-225-5373 Sls. & Prod. Info.
Milton Ross Co., Warrington, PA 18976 215-491-0600
Robinson Nugent, Inc., New Albany, IN 47150 812-948-0564
§Wells Electronics, Inc., South Bend, IN 46613 219-287-5941

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Allen Avionics, Inc., Mineola, NY 11501, 516-248-8080 ..... **A•1514,1619**
†North Hills Signal Processing, Syosset, NY 11791, 516-682-7740 ..... **A•2438**
Delta Products Corporation, Fremont, CA 94538 510-770-0660

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Morgan-Matroc, Electro Ceramics Division, Bedford, OH 44146-5478, 216-232-8600 ..... **B•1974**
§NTK Technical Ceramics, NGK Spark Plugs (USA), Mt. Prospect, IL 60056, 708-824-1133 ..... **A•1665**
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012 605-296-3462
Kentron, Inc., Cedarburg, WI 53012-0142 414-377-3733
§Panasonic Indl. Co. Standard Comps. Sector, Matsushita Elec. Corp. of America, Secaucus, NJ 07094 201-392-4818
†Valhalla Scientific, San Diego, CA 92121 619-457-5576

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Continental Resources, Inc, Test Instruments Div., Bedford, MA 01730 ... 617-275-0850; 800-937-4688
Eltec Instruments Inc., Daytona Bch., FL 32120 904-253-5328
Micro-Coax, Collegeville, PA 19426 215-489-3700
†Premier Microwave, Port Chester, NY 10573 914-939-8900

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Integrated Circuits, Custom/Semicustom-3130

FDK America, Inc., Fuji Electrochemical Co., Ltd., San Jose, CA 95134, 408-432-8331 ..... A•1698
§† Hybrids International Ltd., Thick Film Division, Olathe, KS 66062, 913-764-6400 ..... A•1699
IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643 ..... D•1117
§ National Instruments, Austin, TX 78730-5039, 512-794-0100 .. D•1147,1198,1302
§ NEC Electronics, Inc., Mountain View, CA 94039-7241, 1-800-366-9782 .. B•1328
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Custom Linear Inc., Sunnyvale, CA 94086-3832 408-749-9933
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§† National Semiconductor, Santa Clara, CA 95052-8090 800-272-9959
§ Newbridge Microsystems, Newbridge Networks Corporation, Kanata, Ontario, CANADA K2K-2M5 ..... 613-592-0714;800-267-7231
Optotek Limited, Kanata, Ont., CANADA K2K 2A9 613-591-0336
Optrex/Satori, Torrance, CA 90503 310-214-1791
Rockwell Int'l:Semiconductor Products Division, Newport Beach, CA 92660 714-833-4600
§ Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013 615-641-2020
§ Sanyo Semiconductor Corp., Allendale, NJ 07401 201-825-8080
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Tektronix, Inc., Wilsonville, OR 97070 800-835-9433
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U. S. Digital Corp., Vancouver, WA 98682, 206-260-7451 ..... B•2021,2023
Vectron Laboratories, Inc., Norwalk, CT 06856-5160, 203-853-4433 ..... A•1508
† Advanced Analog, Intech, Santa Clara, CA 95050 408-988-4930
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§ Verdure Industries Inc., Omaha, NE 68124 402-691-8300

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Integrated Circuit Systems Inc., Valley Forge, PA 19482-0968 215-666-1900
§† Integrated Device Technology, Inc., Santa Clara, CA 95054-3090 408-727-6116
IXYS Corp., San Jose, CA 95131-1109 408-435-1900
† Linear Integrated Systems, Milpitas, CA 95035 408-263-8401
§† Linear Technology Corp., Milpitas, CA 95035-7487 408-432-1900
† MCE Semiconductor, Inc., West Palm Beach, FL 33407 407-845-2837
§† McGuirk Electronics Co. Inc., Middleton, MA 01949 617-933-3500
§ Mitel Semiconductor Div. of Mitel Corp., Kanata, Ont., CANADA K2K 1X3 613-592-2122
§ Mitsubishi Elctrns. America, Inc., Elctrn. Device Grp., Sunnyvale, CA 94086 408-730-5900
† Modular Devices, Shirley, NY 11967 516-345-3100
§† Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
§† National Semiconductor, Santa Clara, CA 95052-8090 800-272-9959
NEC Electronics, Inc., Mountain View, CA 94039-7241 1-800-366-9782
§ Newbridge Microsystems, Newbridge Networks Corporation, Kanata, Ontario, CANADA K2K-2M5 ..... 613-592-0714;800-267-7231
§ NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
Pacific Microtronics Corp., New York, NY 10021 212-517-5622
§† Philips Semiconductors, Philips Electroincs, Sunnyvale, CA 94088-3409 408-991-2000
§† Raytheon Semiconductor, Mountain View, CA 94043 408-522-7068
§ Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013 615-641-2020
§ Sanyo Semiconductor Corp., Allendale, NJ 07401 201-825-8080
† Semtech Corpus Christi, Semtech Corporation, Corpus Christi, TX 78410 512-289-0403
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006 214-466-6000
Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
Sierra Semiconductor Corp., San Jose, CA 95132 408-263-9300
§† Silicon General, Garden Grove, CA 92641 714-898-8121
§† Sipex Corp., Billerica, MA 01821 508-667-8700
§† Standard Microsystems, Hauppauge, NY 11788 516-273-3100
§† Teledyne Components, Mountain View, CA 94039-7267 415-968-9241
† Teledyne Microelectronics, Los Angeles, CA 90066 ..... 310-822-8229;310-305-0248
† Third Domain, Inc., Tucson, AZ 85731-7568 602-290-1820
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
§† Unitrode Corp., Watertown, MA 02172 617-926-0404
§† Xicor, Inc., Milpitas, CA 95035 408-432-8888

Integrated Circuits, Logic, Programmable-3130

Elan Systems, Inc., Morgan Hill, CA 95037, 800-541-3526 ..... A•1696, D•1087
IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643 ..... D•1117
MSD3, Morgan Hill, CA 95037, 800-541-3526;408-778-7267 ..... A•1697
§† Actel Corporation, Sunnyvale, CA 94086 408-739-1010
Advanced Hardware Architectures, Inc., Moscow, ID 83843 208-883-8000
§† American Microsystems, Inc., Nikko Kyodo, Ltd., Pocatello, ID 83201 208-233-4690
§† Atmel Corporation, San Jose, CA 95131 408-441-0311
§ Austria Mikro Systeme International, Unterpremstaetten, AUSTRIA A-8141 ..... (03136) 500
Beck Systems Inc., Beck Technology, Saskatoon, SK, CAN S7L 5X5 306-975-1080
† Densepac Microsystems, Inc., Garden Grove, CA 92641-1428 ..... 714-898-0007; 800-64-CHIPS
§† Harris Semiconductor, Melbourne, FL 32902 ..... 1-800-4 HARRIS
# Indiana Microelectronics Center, Indiana Bus. Modernization & Technology Corp., Fort Wayne, IN 46825 219-482-8200
MACOM, Inc., Lowell, MA 01851 617-272-3000
MSD3, Morgan Hill, CA 95037 ..... 800-541-3526;408-778-7267
§† Philips Semiconductors, Philips Electroincs, Sunnyvale, CA 94088-3409 408-991-2000
§ Prologic Systems, Broomfield, CO 80020 303-460-0103
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006 214-466-6000
§ Sony Component Products Co, Semiconductor Division, Cypress, CA 90630 714-229-4197
† Teledyne Microelectronics, Los Angeles, CA 90066 ..... 310-822-8229;310-305-0248
§ Vail Silicon Tools, Deerfield Beach, FL 33442 305-570-5580
§† WSI, Fremont, CA 94538 ..... 510-656-5400;800-451-5970 (USA)

Integrated Circuits, Memory-3130

Elan Systems, Inc., Morgan Hill, CA 95037, 800-541-3526 ..... A•1696, D•1087
IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643 ..... D•1117
MSD3, Morgan Hill, CA 95037, 800-541-3526;408-778-7267 ..... A•1697
§ Philips ECG, North American Philips Co., Williamsport, PA 17701, 717-323-4691 ..... A•2172
American Microsemiconductor, Inc., Madison, NJ 07940 201-377-9566
§† American Microsystems, Inc., Nikko Kyodo, Ltd., Pocatello, ID 83201 208-233-4690
† A.S.I. Microsystems, Inc., (Formerly Andrich Systems, Inc.), Bohemia, NY 11716 516-589-5656
§ AT&T Microelectronics, Allentown, PA 18103 ..... 1-800-372-2447;In Can.:1-800-553-2448
§† Atmel Corporation, San Jose, CA 95131 408-441-0311
Austria Mikro Systeme International, Unterpremstaetten, AUSTRIA A-8141 ..... (03136) 500
Avasem Corporation, San Jose, CA 95126 408-297-1201
§ Benchmarq Microelectronics, Inc., Carrollton, TX 75006 214-407-0011
§ Dallas Semiconductor, Dallas, TX 75244 214-450-0400
† Densepac Microsystems, Inc., Garden Grove, CA 92641-1428 ..... 714-898-0007; 800-64-CHIPS
† ELPAQ, Elmo Semiconductor, Burbank, CA 91504-1052 818-768-7500
Epson America Inc., Component Sales Dept., Torrance, CA 90503 310-782-5318
§ Fujitsu Microelectronics Inc., Semiconductor Division & Electronic Components Div., San Jose, CA 95134-1804 408-922-9000
§† Harris Semiconductor, Melbourne, FL 32902 ..... 1-800-4 HARRIS
Hualon Microeletronics Corporation, Hualon Group, Hsin-Chu, TAIWAN 415-288-0390
§† Integrated Device Technology, Inc., Santa Clara, CA 95054-3090 408-727-6116
International Microelectronics, Arlington, TX 76003 817-473-1730
§† LSI Logic Corp., Milpitas, CA 95035 408-433-8000
† Micrel Semiconductor, San Jose, CA 95131 408-944-0800
§† Microchip Technology Inc., Chandler, AZ 85224 602-963-7373
§ Mitsubishi Elctrns. America, Inc., Elctrn. Device Grp., Sunnyvale, CA 94086 408-730-5900
† Modular Devices, Shirley, NY 11967 516-345-3100
§† Mosaic Semiconductor Inc., Implex Inc., San Diego, CA 92121 619-271-4565
§ Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
§ Mouser Electronics, Santee, CA 92071 800-346-6873
§ Mouser Electronics, Mansfield, TX 76063 800-346-6873
§ Mouser Electronics, Gilroy, CA 95020 800-346-6873
MSD3, Morgan Hill, CA 95037 ..... 800-541-3526;408-778-7267
§† National Semiconductor, Santa Clara, CA 95052-8090 800-272-9959
§ NEC Electronics, Inc., Mountain View, CA 94039-7241 1-800-366-9782
§ NMB Technologies Inc., Chatsworth, CA 91311 818-341-3355
§ NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
Optrex/Satori, Torrance, CA 90503 310-214-1791
§† Philips Semiconductors, Philips Electroincs, Sunnyvale, CA 94088-3409 408-991-2000
§ Prologic Systems, Broomfield, CO 80020 303-460-0103
§ Ramtron International Corporation, Colo. Springs, CO 80921 ..... 719-481-7000; 800-545-3726
§† Raytheon Semiconductor, Mountain View, CA 94043 408-522-7068
§ Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013 615-641-2020
§ Sanyo Semiconductor Corp., Allendale, NJ 07401 201-825-8080
§† SEEQ Technology, San Jose, CA 95131 ..... 408-432-7400;1-800-333-7706
Seiko Instruments U.S.A., Inc. Electronic Components, Torrance, CA 90505 310-517-7770
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006 214-466-6000
§ Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98607 206-834-2500
Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
§† Simtek Corp., Colorado Springs, CO 80920 719-531-9444
§ Sony Component Products Co, Semiconductor Division, Cypress, CA 90630 714-229-4197
† Teledyne Microelectronics, Los Angeles, CA 90066 ..... 310-822-8229;310-305-0248
† Third Domain, Inc., Tucson, AZ 85731-7568 602-290-1820
† United Technologies Microelectronics Center, United Technologies Corp., Colorado Springs, CO 80907 ..... 719-594-8000;1-800-MIL-UTMC
§† WSI, Fremont, CA 94538 ..... 510-656-5400;800-451-5970 (USA)
§† Xicor, Inc., Milpitas, CA 95035 408-432-8888

Integrated Circuits, Microprocessor-3130

Elan Systems, Inc., Morgan Hill, CA 95037, 800-541-3526 ..... A•1696, D•1087
IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643 ..... D•1117
MSD3, Morgan Hill, CA 95037, 800-541-3526;408-778-7267 ..... A•1697
§ Philips ECG, North American Philips Co., Williamsport, PA 17701, 717-323-4691 ..... A•2173
American Microsemiconductor, Inc., Madison, NJ 07940 201-377-9566
American Neuralogix, Inc., Sanford, FL 32771 407-322-5608
§† Analog Devices, Inc., Norwood, MA 02062-9106 617-329-4700
array Microsystems, Colorado Springs, CO 80906 719-540-7999
Atmel Corporation, San Jose, CA 95131 408-441-0311
California Micro Devices, Inc., Milpitas, CA 95035 408-263-3214
§ Dallas Semiconductor, Dallas, TX 75244 214-450-0400
Data Translation, Inc., Marlboro, MA 01752 508-481-3700
Epson America Inc., Component Sales Dept., Torrance, CA 90503 310-782-5318
§ Fujitsu Microelectronics Inc., Semiconductor Division & Electronic Components Div., San Jose, CA 95134-1804 408-922-9000
§† Harris Semiconductor, Melbourne, FL 32902 ..... 1-800-4 HARRIS
§† Integrated Device Technology, Inc., Santa Clara, CA 95054-3090 408-727-6116
Intergraph Corp., Advanced Processor Division, Palo Alto, CA 94303 415-494-8800
International Microelectronics, Arlington, TX 76003 817-473-1730
§† LSI Logic Corp., Milpitas, CA 95035 408-433-8000
§† Microchip Technology Inc., Chandler, AZ 85224 602-963-7373
§ Mitsubishi Elctrns. America, Inc., Elctrn. Device Grp., Sunnyvale, CA 94086 408-730-5900
§† Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
§ Mouser Electronics, Santee, CA 92071 800-346-6873
§ Mouser Electronics, Mansfield, TX 76063 800-346-6873
§ Mouser Electronics, Gilroy, CA 95020 800-346-6873
MSD3, Morgan Hill, CA 95037 ..... 800-541-3526;408-778-7267
§† National Semiconductor, Santa Clara, CA 95052-8090 800-272-9959
§ NEC Electronics, Inc., Mountain View, CA 94039-7241 1-800-366-9782
§† Newbridge Microsystems, Newbridge Networks Corporation, Kanata, Ontario, CANADA K2K-2M5 ..... 613-592-0714;800-267-7231
§ NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
§† Philips Semiconductors, Philips Electroincs, Sunnyvale, CA 94088-3409 408-991-2000
Rockwell Int'l:Semiconductor Products Division, Newport Beach, CA 92660 714-833-4600
Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013 615-641-2020
§ Sanyo Semiconductor Corp., Allendale, NJ 07401 201-825-8080
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006 214-466-6000
§ Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98607 206-834-2500

Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
§† Standard Microsystems, Hauppauge, NY 11788 516-273-3100
§ Star Semiconductor Corp., Warren, NJ 07059 908-647-9400
§ Star Semiconductor Corp., Warren, NJ 07059 908-647-9400
† Teledyne Microelectronics, Los Angeles, CA 90066 ..... 310-822-8229;310-305-0248
† United Technologies Microelectronics Center, United Technologies Corp., Colorado Springs, CO 80907 ..... 719-594-8000;1-800-MIL-UTMC
§ Vail Silicon Tools, Deerfield Beach, FL 33442 305-570-5580
§ VLSI Technology, Inc., San Jose, CA 95131 408-434-3000
§ Western Digital Corp., Irvine, CA 92718 714-932-6000
§† WSI, Fremont, CA 94538 ..... 510-656-5400;800-451-5970 (USA)

Integrated Circuits, Standard Cells-3130

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643 ..... D•1117
Advanced Hardware Architectures, Inc., Moscow, ID 83843 208-883-8000
† American Microsystems, Inc., Nikko Kyodo, Ltd., Pocatello, ID 83201 208-233-4690
AT&T Microelectronics, Allentown, PA 18103 ..... 1-800-372-2447;In Can.:1-800-553-2448
§ Austria Mikro Systeme International, Unterpremstaetten, AUSTRIA A-8141 ..... (03136) 500
Avasem Corporation, San Jose, CA 95126 408-297-1201
§† Exar Corp., San Jose, CA 95161-9007 408-434-6400
§† Harris Semiconductor, Melbourne, FL 32902 ..... 1-800-4 HARRIS
† Holt Inc., Irvine, CA 92718 714-859-8800
# Indiana Microelectronics Center, Indiana Bus. Modernization & Technology Corp., Fort Wayne, IN 46825 219-482-8200
Integrated Circuit Systems Inc., Valley Forge, PA 19482-0968 215-666-1900
§ Mitel Semiconductor Div. of Mitel Corp., Kanata, Ont., CANADA K2K 1X3 613-592-2122
Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
§† National Semiconductor, Santa Clara, CA 95052-8090 800-272-9959
§ Newbridge Microsystems, Newbridge Networks Corporation, Kanata, Ontario, CANADA K2K-2M5 ..... 613-592-0714;800-267-7231
Optrex/Satori, Torrance, CA 90503 310-214-1791
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006 214-466-6000
Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98607 206-834-2500
§ Sierra Semiconductor Corp., San Jose, CA 95132 408-263-9300
† Sipex Corp., Billerica, MA 01821 508-667-8700
§ Sony Component Products Co, Semiconductor Division, Cypress, CA 90630 714-229-4197
§† VLSI Technology, Inc., San Jose, CA 95131 408-434-3000

Integrated Circuits, Telecommunications-3130

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643 ..... D•1117
Allegro MicroSystems, Inc., formerly Sprague Semiconductor Grp., Worcester, MA 01605 508-795-1300
§† American Microsystems, Inc., Nikko Kyodo, Ltd., Pocatello, ID 83201 208-233-4690
Austria Mikro Systeme International, Unterpremstaetten, AUSTRIA A-8141 ..... (03136) 500
§† California Micro Devices, Inc., Milpitas, CA 95035 408-263-3214
Cirrus Logic, Inc., Fremont, CA 94538 510-623-8300
§† Exar Corp., San Jose, CA 95161-9007 408-434-6400
Harris Microwave Semiconductor, Harris Semiconductor, Milpitas, CA 95035 408-433-2222
Integrated Circuit Systems Inc., Valley Forge, PA 19482-0968 215-666-1900
Level One Communications, Inc., Folsom, CA 95630 916-985-3670
M/A-COM Microelectroincs Division, M/A-COM, Lowell, MA 01853-3295 508-442-5000
§ Mitel Semiconductor Div. of Mitel Corp., Kanata, Ont., CANADA K2K 1X3 613-592-2122
Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 075-951-9111
§† National Semiconductor, Santa Clara, CA 95052-8090 800-272-9959
§† Philips Semiconductors, Philips Electroincs, Sunnyvale, CA 94088-3409 408-991-2000
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006 214-466-6000
§ Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98607 206-834-2500
§ Sony Component Products Co, Semiconductor Division, Cypress, CA 90630 714-229-4197
† Teledyne Microelectronics, Los Angeles, CA 90066 ..... 310-822-8229;310-305-0248

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Isolators, Antenna-1200 — *See Vol. D*

Isolators, Ferrite-3450

§† TRAK Microwave Corp., Tampa, FL 33634, 813-884-1411 ..... A•1856-1857
† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950 201-539-5500
Alpha Industries, Inc., Woburn, MA 01801 617-935-5150
Antenna Specialists, The Allen Group, Cleveland, OH 44139 216-349-8400
§† FDK America, Inc., Fuji Electrochemical Co., Ltd., San Jose, CA 95134 408-432-8331
Lectronic Research Labs., Inc., Camden, NJ 08104 800-358-8378
† Loral Microwave-Narda West, Rancho Cordova, CA 95670-6001 916-638-5500
MACOM, Inc., Lowell, MA 01851 617-272-3000
M/A-COM Microelectroincs Division, M/A-COM, Lowell, MA 01853-3295 508-442-5000
† Maury Microwave Corp., Ontario, CA 91764 909-987-4715
† Premier Microwave, Port Chester, NY 10573 914-939-8900
† Quartzite Processing, Inc., Malden, MA 02148 617-322-3611
† Raytheon Co., Electronic Components Division, Waltham, MA 02254 617-899-8400
# Relm Communications, Inc., Adage, Inc., Indianapolis, IN 46226 317-545-4281
§† Sinclair Radio Laboratories Ltd., Aurora, ONT., CANADA L4G 3G9 416-727-0165
† ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086 408-730-6300
† Teledyne Microwave, Mountain View, CA 94043 415-968-2211
† TRAK Microwave Ltd., TRAK Microwave Corp., Dundee, SCOTLAND DD2 1TY 44-382-561509
† UTE Microwave, Asbury Park, NJ 07712 908-922-1009

Isolators, High Voltage-4050 — *See Vol. D*

Isolators, Line-4050 — *See Vol. D*

Isolators, Microwave (all types)-3450

Datel, Inc., Mansfield, MA 02048-1194, 508-339-3000 ..... D•1185
Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ..... A•1847
§† TRAK Microwave Corp., Tampa, FL 33634, 813-884-1411 ..... A•1856-1857
† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950 201-539-5500
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
§† FDK America, Inc., Fuji Electrochemical Co., Ltd., San Jose, CA 95134 408-432-8331
Lectronic Research Labs., Inc., Camden, NJ 08104 800-358-8378
† Loral Microwave Narda, Hauppauge, NY 11788 516-231-1700
† Loral Microwave-Narda West, Rancho Cordova, CA 95670-6001 916-638-5500
MACOM, Inc., Lowell, MA 01851 617-272-3000
† M/A COM Ltd., Bedfordshire, ENGLAND LU5 4SX, England ..... 44(582)471200
M/A-COM Microelectroincs Division, M/A-COM, Lowell, MA 01853-3295 508-442-5000
† Maury Microwave Corp., Ontario, CA 91764 909-987-4715
† Merrimac Industries, West Caldwell, NJ 07006 201-575-1300
† Microlab/FXR, Livingston, NJ 07039 201-992-7700
† Premier Microwave, Port Chester, NY 10573 914-939-8900
† ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086 408-730-6300
§† Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
§ TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056 708-803-6100
† Teledyne Microwave, Mountain View, CA 94043 415-968-2211
§† Telephonics Corporation/PRD Instruments, Huntington, NY 11743 ..... 516-549-6415/6428
† TRAK Microwave Ltd., TRAK Microwave Corp., Dundee, SCOTLAND DD2 1TY 44-382-561509
† UTE Microwave, Asbury Park, NJ 07712 908-922-1009

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Joints, Rotary, Fiber Optic-2475 — *See Vol. B*

Joints, Rotary, Microwave-3450

† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950 201-539-5500

† Eastern Microwave, Winchester, MA 01890 617-721-9800
† Gamma-f Corp., Vertex Communications, Torrance, CA 90505 310-539-6704
† Graphite Metallizing Corp., Yonkers, NY 10702 914-968-8400
MACOM, Inc., Lowell, MA 01851 617-272-3000
† Maury Microwave Corp., Ontario, CA 91764 909-987-4715
§ Microwave Development Laboratories, Natick, MA 01760 508-655-0060
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3 ..... 514-694-6666; 800-724-3911
† Premier Microwave, Port Chester, NY 10573 914-939-8900
† Sage Laboratories, Inc., Natick, MA 01760 508-653-0844
† Sivers IMA AB, Culver City, CA 90230 213-306-4248
§† Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900

Joysticks — See Controls, Computer Input (Vol. D)

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Joysticks, Potentiometer-2200 — *See Vol. D*

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Jumpers, Circuit Board-2100 — *See Vol. C*

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Junctions, Hybrid, Microwave-3450

† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950 201-539-5500
§† Anaren Microwave, Inc., E. Syracuse, NY 13057 315-432-8930
† Eastern Microwave, Winchester, MA 01890 617-721-9800
Flann Microwave Inc., Cambridge, MA 02139 1-800-937-3772
† Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710 813-347-2181
§† M/A-COM Microelectroincs Division, M/A-COM, Lowell, MA 01853-3295 508-442-5000
† Maury Microwave Corp., Ontario, CA 91764 909-987-4715
† Merrimac Industries, West Caldwell, NJ 07006 201-575-1300
† Microphase, Norwalk, CT 06856 203-866-8000
§ Microwave Development Laboratories, Natick, MA 01760 508-655-0060
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3 ..... 514-694-6666; 800-724-3911
† Premier Microwave, Port Chester, NY 10573 914-939-8900
Sivers IMA AB, Culver City, CA 90230 213-306-4248
Teleplex, Inc., Alford Division, Woburn, MA 01801 617-935-8610
† Transco Products, Inc., Subsidiary of Datron Systems Inc., Camarillo, CA 93012 805-987-8007
† TRM, Inc., Manchester, NH 03110 603-627-6000

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Keyboards, Capacitive-5150 — *See Vol. B*

Keyboards, Conductive Rubber-5150 — *See Vol. B*

Keyboards, Full Travel-5150 — *See Vol. B*

Keyboards, Hard Contact-5150 — *See Vol. B*

Keyboards, Lighted-5150 — *See Vol. B*

Keyboards, Low Profile-5150 — *See Vol. B*

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Kits, Potentiometer, Rheostat-4750

Memcor-Truohm, Inc., Huntington, IN 46750, 219-356-4300 ..... A•2105
ABL Electronics Supply, Inc., Peekskill, NY 10566 ..... 914-736-1010; 1-800-431-2103
Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201 414-382-2000
§ Bourns, Inc., Electronic Components Sls., Riverside, CA 92507-2114 ..... 909-781-5500; 801-750-7200
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
International Microelectronics, Arlington, TX 76003 817-473-1730
Mouser Electronics, Santee, CA 92071 800-346-6873
Mouser Electronics, Mansfield, TX 76063 800-346-6873
Mouser Electronics, Gilroy, CA 95020 800-346-6873

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Knobs, Limit Stop-2400 — *See Vol. C*

Knobs, Locking, Control Shaft-2400 — *See Vol. C*

Knobs, Push to Turn-2400 — *See Vol. C*

Knobs, Slip Clutch-2400 — *See Vol. C*

Knobs, Torque, Incremental, Ratio Drive-2400 — *See Vol. C*

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Laminates, Metal Clad (Including Copper)-2500 — *See Vol. C*

Laminates, Plastic Impregnated (Unclad)-2500 — *See Vol. C*

Laminates, Plastic (With Integral Heating Elements)-5300 — *See Vol. B*

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Lamps, Fluorescent-2460 — *See Vol. B*

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Lamps, Hollow Cathode-2460 — *See Vol. B*

Lamps, Incandescent-2460 — *See Vol. B*

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Lamps, Infrared-2460 — *See Vol. B*

Lamps, Krypton-2460 — *See Vol. B*

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Lamps, Press-to-Test-2460 — *See Vol. B*

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Lamps, Xenon-2460 — ***See Vol. B***

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Laser Components & Laser Accessories-3700 — ***See Vol. B***

Laser Diodes — See Diodes, Laser (Vol. A)

Latches, Panels & Cabinets-2400 — ***See Vol. C***

LCDs — See Diodes, Liquid Crystal (Vol. B)

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Lead Preparation Equipment, Surface Mount-4100 — ***See Vol. D***

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Lenses, Optical & Camera-3700 — ***See Vol. B***

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Light Pens-2000 — ***See Vol. D***

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Light Sources, Photoelectric-3700 — ***See Vol. B***

Light Sources, Stroboscopic-3700 — ***See Vol. B***

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Limiters, Microwave-3450

† Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500 ..... A•1725
† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950 201-539-5500
§† Avantek, Inc, A Subsidiary of Hewlett-Packard, Santa Clara, CA 95054 .. 408-727-0700
§ FEI Microwave, Inc., Frequency Electronics, Inc., Sunnyvale, CA 94086 .. 408-732-0880
† General Microwave Corporation, Amityville, NY 11701 516-226-8900
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
MACOM, Inc., Lowell, MA 01851 617-272-3000
† M/A COM Ltd., Bedfordshire, ENGLAND LU5 4SX, England ..... 44(582)471200
† Merrimac Industries, West Caldwell, NJ 07006 201-575-1300
† Microphase, Norwalk, CT 06856 203-866-8000
§† Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018 ..... 408-730-0300;800-PENSTOCK
ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086 408-730-6300
† Watkins-Johnson Co., Palo Alto, CA 94304 415-493-4141
§ Wiltron, Morgan Hill, CA 95037-2809 408-778-2000

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Machines, Component Handling, Feeding, Insertion & Sorting-4100 — ***See Vol. D***

Machines, Drilling, Laser-4100 — ***See Vol. D***

Machines, Hermetic Sealing-4100 — ***See Vol. D***

Machines, Induction Heating (Electronic)-4100 — ***See Vol. D***

Machines, Lead Cutting & Forming-4100 — ***See Vol. D***

Machines, Magnet Wire Twisting-4100 — ***See Vol. D***

Machines, Marking & Numbering-4100 — ***See Vol. D***

Machines, Marking, Laser-4100 — ***See Vol. D***

Machines, Mask Alignment & Exposure-4100 — ***See Vol. D***

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Machines, Plating-4100 — ***See Vol. D***

Machines, Printed Circuit Drilling, Etching & Punching-4100 — ***See Vol. D***

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Machines, Wire Marking, Manual & Automatic-4100 — ***See Vol. D***

Machines, Wire Measuring & Cutting-4100 — ***See Vol. D***

Machines, Wire Stripping, Laser-4100 — ***See Vol. D***

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Magnetizers-2900 — ***See Vol. D***

Magnetodiodes — See Magnetoresistors, Hall (Vol. A)

Magnetometers-2900 — ***See Vol. D***

Magnetoresistors, Hall-4800

† American Aerospace Controls, Farmingdale, NY 11735 516-694-5100
Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98607 206-834-2500
§ Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400

Magnetrons — See Tubes, Microwave (Vol. A)

Magnets, Focusing — See Magnets, Permanent (Vol. C)

Magnets (Lab. Type)-1850

† A-L-L Magnetics Inc./The Magnet Source, Placentia, CA 92670, 800-262-4638;800-525-3536 ..... A•1319
GMW Associates, Redwood City, CA 94064, 415-368-4884 ..... D•1260,1263
† Jobmaster Corp., Randallstown, MD 21133-0207, 410-655-1400;1-800-642-1400 ..... A•1320
Magnetic Component Engineering, Inc., Inglewood, CA 90301, 310-677-6600 ..... A•1321
Magnos, Hudson, MA 01749, 508-562-1173 ..... D•1296
§ Walker Scientific, Worcester, MA 01606, 508-852-3674;508-853-3232;800-962-4638 ..... D•1334
† Arnold Engineering Company, Sub. SPS Technologies, Marengo, IL 60152 815-568-2000
The Electrodyne Company, Inc., Batavia, OH 45013 513-732-2822
Elma Engineering, Palo Alto, CA 94303 415-494-7303
JEMA, Wilmette, IL 60091 708-251-3600
Lake Shore Cryotronics, Inc., Westerville, OH 43081 614-891-2243
LDJ Electronics, Troy, MI 48099-0219 313-528-2202
Magnetic Instrumentation, Inc., Indianapolis, IN 46226 317-545-2102
† Magnet Sales & Mfg., Inc., Culver City, CA 90230-6162 .... 310-391-7213;800-421-6692 (N. CA and out of state)
† Master Magnetics Inc., The Magnet Source, Castle Rock, CO 80104 800-525-3536
§† Miami Magnet Co., Inc., The Magnet Source, Miami, FL 33015 800-222-7846
Micro Switch, A Honeywell Div., Freeport, IL 61032 1-800-537-6945
RJF Interantional Corp., Fairlawn, OH 44333 216-668-7689
§ TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056 708-803-6100
§ Techni-Tool, Plymouth Meeting, PA 19462 215-825-4990

Magnets, Permanent-1850

† A-L-L Magnetics Inc./The Magnet Source, Placentia, CA 92670, 800-262-4638;800-525-3536 ..... A•1319
§ Hamlin Inc., Lake Mills, WI 53551, 414-648-3000 ..... B•1734
§† Jobmaster Corp., Randallstown, MD 21133-0207, 410-655-1400;1-800-642-1400 ..... A•1320
Magnetic Component Engineering, Inc., Inglewood, CA 90301, 310-677-6600 ..... A•1321
Aleph International Corp., San Fernando, CA 91340 ..... 818-365-9856;800-423-5622
Approved Purification Corp., Stamford, CT 06907 203-357-0141
† Arnold Engineering Company, Sub. SPS Technologies, Marengo, IL 60152 815-568-2000
§ Bunting Magnetics Co., Newton, KS 67114 ..... 316-284-2020;800-835-2526
§ Ceramic Magnetics, Inc., Fairfield, NJ 07004 201-227-4222
# Douglas International, Inc., Geneva, IL 60134-0761 708-232-7419
The Electrodyne Company, Inc., Batavia, OH 45013 513-732-2822
§ George Risk Industries, Inc., Kimball, NE 69145 308-235-4645
§ Go Switch, Louisville, KY 40233 502-969-2386
ISKRA Electronics, Inc., Plainview, NY 11803 516-349-0222
JEMA, Wilmette, IL 60091 708-251-3600
§† Magnetic Technologies Corp., Rochester, NY 14625 716-385-9010
† Magnet Sales & Mfg., Inc., Culver City, CA 90230-6162 .... 310-391-7213;800-421-6692 (N. CA and out of state)
† Master Magnetics Inc., The Magnet Source, Castle Rock, CO 80104 800-525-3536
§† Miami Magnet Co., Inc., The Magnet Source, Miami, FL 33015 800-222-7846
Micro Switch, A Honeywell Div., Freeport, IL 61032 1-800-537-6945
Namiki, Precision of America, Inc., Rochelle Park, NJ 07662 201-368-0123
Northern Magnetics Inc., Van Nuys, CA 91406 818-997-8675
† Ogallala Elctrns., Div. Arnold Engrg. Co., Ogallala, NE 69153 308-284-4093
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404 407-881-3200
Philips Components Discrete Products Div., A North American Philips Co., Saugerties, NY 12477 914-246-2811
R-Columbia Prods. Co., Inc., Highland Park, IL 60035 708-432-7915
RJF Interantional Corp., Fairlawn, OH 44333 216-668-7689
Shin-Etsu Polymer America, Inc., Union City, CA 94587 510-475-9000
SinoTECH Made in China, Inc., Technology Communications Group, Inc., West Linn, OR 97068 503-638-1000
Stackpole, Magnet Div., Kane, PA 16735 814-837-0272
§ Tokin America, Inc., San Jose, CA 95134 408-432-8020

Magnets, Superconducting-1850

† A-L-L Magnetics Inc./The Magnet Source, Placentia, CA 92670, 800-262-4638;800-525-3536 ..... A•1319
Walker Scientific, Worcester, MA 01606, 508-852-3674;508-853-3232;800-962-4638 ..... D•1334
American Magnetics, Oak Ridge, TN 37831-2509 615-482-1056
Cryomagnetics, Inc., Oak Ridge, TN 37830 615-482-9551
† Master Magnetics Inc., The Magnet Source, Castle Rock, CO 80104 800-525-3536
§† Miami Magnet Co., Inc., The Magnet Source, Miami, FL 33015 800-222-7846
TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056 708-803-6100

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Material, Permanent Magnet, Alnico-1850

† A-L-L Magnetics Inc./The Magnet Source, Placentia, CA 92670, 800-262-4638;800-525-3536 ..... A•1319
Magnetic Component Engineering, Inc., Inglewood, CA 90301, 310-677-6600 ..... A•1321
Aleph International Corp., San Fernando, CA 91340 ..... 818-365-9856;800-423-5622
† Magnet Sales & Mfg., Inc., Culver City, CA 90230-6162 .... 310-391-7213;800-421-6692 (N. CA and out of state)
† Master Magnetics Inc., The Magnet Source, Castle Rock, CO 80104 800-525-3536
§† Miami Magnet Co., Inc., The Magnet Source, Miami, FL 33015 800-222-7846
†# Reade Advanced Materials, A Reade Intl. business unit, Riverside, RI 02915-0039 401-433-7000

Material, Permanent Magnet, Ceramic-1850

† A-L-L Magnetics Inc./The Magnet Source, Placentia, CA 92670, 800-262-4638;800-525-3536 ..... A•1319
Magnetic Component Engineering, Inc., Inglewood, CA 90301, 310-677-6600 ..... A•1321
Aleph International Corp., San Fernando, CA 91340 ..... 818-365-9856;800-423-5622
EDO Corporation, Acoustics Division, Salt Lake City, UT 84115 801-486-2115
Hoosier Magnetics, Inc., Toledo, OH 43617 419-841-7173
Kyocera Industrial Ceramics Corp., San Diego, CA 92123 619-576-2688
† Magnet Sales & Mfg., Inc., Culver City, CA 90230-6162 .... 310-391-7213;800-421-6692 (N. CA and out of state)
† Master Magnetics Inc., The Magnet Source, Castle Rock, CO 80104 800-525-3536
§† Miami Magnet Co., Inc., The Magnet Source, Miami, FL 33015 800-222-7846
†# Reade Advanced Materials, A Reade Intl. business unit, Riverside, RI 02915-0039 401-433-7000

Material, Permanent Magnet, Rare Earth-1850

† A-L-L Magnetics Inc./The Magnet Source, Placentia, CA 92670, 800-262-4638;800-525-3536 ..... A•1319
Magnetic Component Engineering, Inc., Inglewood, CA 90301, 310-677-6600 ..... A•1321
Aleph International Corp., San Fernando, CA 91340 ..... 818-365-9856;800-423-5622
EDO Corporation, Acoustics Division, Salt Lake City, UT 84115 801-486-2115
† Magnet Sales & Mfg., Inc., Culver City, CA 90230-6162 .... 310-391-7213;800-421-6692 (N. CA and out of state)
† Master Magnetics Inc., The Magnet Source, Castle Rock, CO 80104 800-525-3536
§† Miami Magnet Co., Inc., The Magnet Source, Miami, FL 33015 800-222-7846
†# Reade Advanced Materials, A Reade Intl. business unit, Riverside, RI 02915-0039 401-433-7000

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Meters, Ampere, DC-2900 — *See Vol. D*
Meters, Ampere, RF-2900 — *See Vol. D*
Meters, Ampere, True RMS-2900 — *See Vol. D*
Meters, Ampere Hour-2900 — *See Vol. D*
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Meters, Capacitance, Inductance-2900 — *See Vol. D*
Meters, Clamp-on-2900 — *See Vol. D*
Meters, Coercivity-2900 — *See Vol. D*
Meters, Conductance-2900 — *See Vol. D*
Meters, Counting Rate, Nuclear-2900 — *See Vol. D*
Meters, Decibel Indicating-2900 — *See Vol. D*
Meters, Deviation-2900 — *See Vol. D*
Meters, Digital ESR-2900 — *See Vol. D*
Meters, Digital RPM-2900 — *See Vol. D*
Meters, Digital, 2-wire, 4-20 mA Current Loop-2950 — *See Vol. D*
Meters, Dissolved Oxygen-2900 — *See Vol. D*
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Meters, Frequency Deviation-2900 — *See Vol. D*
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Meters, Gauss-2900 — *See Vol. D*
Meters, Hand Held-2900 — *See Vol. D*
Meters, Humidity-2900 — *See Vol. D*
Meters, Illuminated Scale-2950 — *See Vol. D*
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Meters, Moving Iron-2950 — *See Vol. D*
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Meters, Multifunction (Digital)-2900 — *See Vol. D*
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Meters, PH-2900 — *See Vol. D*
Meters, Phase-2900 — *See Vol. D*
Meters, Plating Thickness-2900 — *See Vol. D*
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Meters, VAR-2900 — *See Vol. D*
Meters, Vibration-2900 — *See Vol. D*
Meters, Volt, AC-2900 — *See Vol. D*
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† **Frequency Electronics, Inc., Mitchel Field, NY 11553, 516-794-4500** ..... **A•1403**
NTK Technical Ceramics, NGK Spark Plugs (USA), Mt. Prospect, IL 60056, 708-824-1133 ..... **A•1664,1849**
† **Raytheon Company, Quincy Operation, Quincy, MA 02269, 617-479-5300** ..... **A•1850-1851**
Vernitron Corp., Precision Comps. Group, St. Petersburg, FL 33710, 813-347-2181 ..... **A•1308**
AEL Defense Corp., Lansdale, PA 19446 215-822-2929
† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950 201-539-5500
§† Avantek, Inc, A Subsidiary of Hewlett-Packard, Santa Clara, CA 95054 408-727-0700
† Daico Industries, Inc., Rancho Dominguez, CA 90220 310-631-1143
Elecsys,Inc., Div. of C & C Jetronic, Princeton, NJ 08540 609-259-8866
§ Electro Rent Corp., Van Nuys, CA 91411 800-688-1111
† EMC Technology Inc, Cherry Hill, NJ 08034 609-429-7800
† Harris Microwave Semiconductor, Harris Semiconductor, Milpitas, CA 95035 408-433-2222
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
Hyletronics:Litton Industries, Lexington, MA 02173-3199 617-276-3298
† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
† Locus, Inc., State College, PA 16804 814-466-6275
† Locus, Kaman, State College, PA 16804 814-466-6275
† Loral Microwave Narda, Hauppauge, NY 11788 516-231-1700
† M/A COM Ltd., Bedfordshire, ENGLAND LU5 4SX, England ..... 44(582)471200
§† M/A-COM Microelectroincs Division, M/A-COM, Lowell, MA 01853-3295 508-442-5000
† Magnum Microwave Corp., Fremont, CA 94538 510-657-9898
§ Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
Oxley Inc., Branford, CT 06405 203-488-1033
§ Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018 ..... 408-730-0300;800-PENSTOCK
† Raytheon Co., Electronic Components Division, Waltham, MA 02254 617-899-8400
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006 214-466-6000
Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
† ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086 408-730-6300
Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
Tektronix, Inc., Wilsonville, OR 97070 800-835-9433
† Teledyne Microelectronics, Los Angeles, CA 90066 ..... 310-822-8229;310-305-0248
† Teledyne Microwave, Mountain View, CA 94043 415-968-2211
† TRAK Microwave Corp., Tampa, FL 33634 813-884-1411
† Vectronics Microwave Corp., Middlesex, NJ 08846 908-356-2377

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Vernitron Corp., Precision Comps. Group, St. Petersburg, FL 33710, 813-347-2181 ..... **A•1308**
† Aydin Corp., Horsham, PA 19044 215-657-7510
Elecsys,Inc., Div. of C & C Jetronic, Princeton, NJ 08540 609-259-8866
Loral TerraCom, Sub. of Loral Corp., San Diego, CA 92123-1595 619-278-4100
§ Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018 ..... 408-730-0300;800-PENSTOCK
Western Multiplex Corp., Belmont, CA 94002 415-592-8832

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† **Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500** ..... **A•1725**
Vernitron Corp., Precision Comps. Group, St. Petersburg, FL 33710, 813-347-2181 ..... **A•1308**
† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950 201-539-5500
§† Anaren Microwave, Inc., E. Syracuse, NY 13057 315-432-8930
§† Avantek, Inc, A Subsidiary of Hewlett-Packard, Santa Clara, CA 95054 408-727-0700
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
† Communications Sys. Technology, Inc., Hermosa Beach, CA 90254 213-374-3849
Continental Resources, Inc, Test Instruments Div., Bedford, MA 01730 ..... 617-275-0850; 800-937-4688
† Eastern Microwave, Winchester, MA 01890 617-721-9800
† Elcom Systems, Inc., Boca Raton, FL 33487 407-994-1774
Elecsys,Inc., Div. of C & C Jetronic, Princeton, NJ 08540 609-259-8866
† FEI Microwave, Inc., Frequency Electronics, Inc., Sunnyvale, CA 94086 408-732-0880
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
Lectronic Research Labs., Inc., Camden, NJ 08104 800-358-8378
† LNR Communications, Inc., Hauppauge, NY 11788 516-273-7111
† Locus, Inc., State College, PA 16804 814-466-6275
† Loral Microwave Narda, Hauppauge, NY 11788 516-231-1700
† Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710 813-347-2181
MACOM, Inc., Lowell, MA 01851 617-272-3000
† M/A COM Ltd., Bedfordshire, ENGLAND LU5 4SX, England ..... 44(582)471200
§† M/A-COM Microelectroincs Division, M/A-COM, Lowell, MA 01853-3295 508-442-5000
† Magnum Microwave Corp., Fremont, CA 94538 510-657-9898
† Merrimac Industries, West Caldwell, NJ 07006 201-575-1300
† Microlab/FXR, Livingston, NJ 07039 201-992-7700
§ Micro-Now Instr. Co., Inc., Skokie, IL 60076 708-677-4700
† Microphase, Norwalk, CT 06856 203-866-8000
§ Microwave Development Laboratories, Natick, MA 01760 508-655-0060
† Microwave Technology Div., JHP Industrial, Syracuse, NY 13202-3442 315-422-0050
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3 ..... 514-694-6666; 800-724-3911
† MITEQ Inc., Hauppauge, NY 11788 516-436-7400
Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 075-951-9111
§† Pearl Technology, Santa Clara, CA 95054 408-996-9823
§ Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018 ..... 408-730-0300;800-PENSTOCK
† Premier Microwave, Port Chester, NY 10573 914-939-8900
† RHG Electronics Laboratory, Inc., Deer Park, NY 11729 516-242-1100
† Sage Laboratories, Inc., Natick, MA 01760 508-653-0844
† ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086 408-730-6300
Synergy Microwave Corporation, Paterson, NJ 07504 201-881-8800
§† Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
Tektronix, Inc., Wilsonville, OR 97070 800-835-9433
† Teledyne Microelectronics, Los Angeles, CA 90066 ..... 310-822-8229;310-305-0248
§† Telephonics Corporation/PRD Instruments, Huntington, NY 11743 ..... 516-549-6415/6428
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291
† TRM, Inc., Manchester, NH 03110 603-627-6000
† Vectronics Microwave Corp., Middlesex, NJ 08846 908-356-2377
† Watkins-Johnson Co., Palo Alto, CA 94304 415-493-4141

Mixers, RF-3450

† **Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500** ..... **A•1725**
Vernitron Corp., Precision Comps. Group, St. Petersburg, FL 33710, 813-347-2181 ..... **A•1308**
§† Anaren Microwave, Inc., E. Syracuse, NY 13057 315-432-8930
§† Avantek, Inc, A Subsidiary of Hewlett-Packard, Santa Clara, CA 95054 408-727-0700
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
† Communications Sys. Technology, Inc., Hermosa Beach, CA 90254 213-374-3849
† Elcom Systems, Inc., Boca Raton, FL 33487 407-994-1774
Elecsys,Inc., Div. of C & C Jetronic, Princeton, NJ 08540 609-259-8866
† FEI Microwave, Inc., Frequency Electronics, Inc., Sunnyvale, CA 94086 408-732-0880
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
† Locus, Inc., State College, PA 16804 814-466-6275
† Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710 813-347-2181
MACOM, Inc., Lowell, MA 01851 617-272-3000

§† M/A-COM Microelectroincs Division, M/A-COM, Lowell, MA 01853-3295 508-442-5000
† Magnum Microwave Corp., Fremont, CA 94538 510-657-9898
† Merrimac Industries, West Caldwell, NJ 07006 201-575-1300
† Microphase, Norwalk, CT 06856 203-866-8000
MicroSignals Inc., LI.C., NY 11101 ..... 718-937-7955;718-937-0391;800-648-2252
§ Microwave Development Laboratories, Natick, MA 01760 508-655-0060
Microwave Technology Div., JHP Industrial, Syracuse, NY 13202-3442 315-422-0050
† MITEQ Inc., Hauppauge, NY 11788 516-436-7400
§† Pearl Technology, Santa Clara, CA 95054 408-996-9823
† RHG Electronics Laboratory, Inc., Deer Park, NY 11729 516-242-1100
† ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086 408-730-6300
† ST Olektron Corporation, Subsidiary of Signal Technology Corp., Beverly, MA 01915 508-922-0019
Synergy Microwave Corporation, Paterson, NJ 07504 201-881-8800
Tektronix, Inc., Wilsonville, OR 97070 800-835-9433
† Teledyne Microelectronics, Los Angeles, CA 90066 ..... 310-822-8229;310-305-0248
Telephonics Corporation/PRD Instruments, Huntington, NY 11743 ..... 516-549-6415, 6428
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291
† TRM, Inc., Manchester, NH 03110 603-627-6000
† Watkins-Johnson Co., Palo Alto, CA 94304 415-493-4141
† Wenzel Associates, Inc., Austin, TX 78752 512-450-1400

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EPD Electronics, Inc., Gardena, CA 90247, 310-515-4996 ..... D•1073
Universal Voltronics Div., Thermo Voltek Corp., Mt. Kisco, NY 10549, 914-241-1300 ..... D•2038
AEL Defense Corp., Lansdale, PA 19446 215-822-2929
§† Anaren Microwave, Inc., E. Syracuse, NY 13057 315-432-8930
Cober Electronics, Stamford, CT 06902 203-327-0003
† Communications Sys. Technology, Inc., Hermosa Beach, CA 90254 213-374-3849
Control Technology Co., Inc., Long Island City, NY 11101 718-361-2133
Elecsys,Inc., Div. of C & C Jetronic, Princeton, NJ 08540 609-259-8866
† ETM Electromatic Inc, Newark, CA 94560 510-797-1100
† FEI Microwave, Inc., Frequency Electronics, Inc., Sunnyvale, CA 94086 408-732-0880
† General Microwave Corporation, Amityville, NY 11701 516-226-8900
HDS Inc., Reston, VA 22091 703-620-6200
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
Hughes Microelectronic Circuits Division, Newport Beach, CA 92658-8903 714-759-2952
† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
† Loral Microwave Narda, Hauppauge, NY 11788 516-231-1700
Lucas Epsco, Inc., Hopkinton, MA 01748-2204 508-435-2400
MACOM, Inc., Lowell, MA 01851 617-272-3000
§† M/A-COM Microelectroincs Division, M/A-COM, Lowell, MA 01853-3295 508-442-5000
† Magnum Microwave Corp., Fremont, CA 94538 510-657-9898
† Micronetics, Hudson, NH 03051 603-883-2900
† Microphase, Norwalk, CT 06856 203-866-8000
† Microwave Technology Div., JHP Industrial, Syracuse, NY 13202-3442 315-422-0050
† MITEQ Inc., Hauppauge, NY 11788 516-436-7400
† Premier Microwave, Port Chester, NY 10573 914-939-8900
† Radio Research Instrument Co., Inc., Waterbury, CT 06704-3506 203-753-5840
† Rantec Microwave & Electronics, Esco Electronics, Calabasas, CA 91302 818-591-8189
† Raytheon Co., Electronic Components Division, Waltham, MA 02254 617-899-8400
† RHG Electronics Laboratory, Inc., Deer Park, NY 11729 516-242-1100
Sivers IMA AB, Culver City, CA 90230 213-306-4248
ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086 408-730-6300
Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
† Teledyne Microelectronics, Los Angeles, CA 90066 ..... 310-822-8229;310-305-0248
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291
† Vectronics Microwave Corp., Middlesex, NJ 08846 908-356-2377
† Watkins-Johnson Co., Palo Alto, CA 94304 415-493-4141

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Axel Electronics, Inc., Subsidiary of FPBSM Industries Inc., Rancho Dominquez, CA 90220 718-291-3900
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
† Brandt Electronics, Inc., Mountain View, CA 94043 415-967-4944
Cober Electronics, Stamford, CT 06902 203-327-0003
† Communications Sys. Technology, Inc., Hermosa Beach, CA 90254 213-374-3849
Continental Electronics Corporation, Dallas, TX 75227 214-381-7161
† Del Electronics Corp., Valhalla, NY 10595 914-686-3600
† ETM Electromatic Inc, Newark, CA 94560 510-797-1100
† General Microwave Corporation, Amityville, NY 11701 516-226-8900
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
† Instrument Research Co., Santa Barbara, CA 93103 805-962-8336
Instrument Research Co., Columbia, MD 21045 410-740-3411
Lucas Epsco, Inc., Hopkinton, MA 01748-2204 508-435-2400
† Maxwell Laboratories, Inc., San Diego, CA 92123-1506 619-279-5100
† Microwave Technology Div., JHP Industrial, Syracuse, NY 13202-3442 315-422-0050
† Power Sys. Grp., Rantec Div., Emerson Elec. Co., Chatsworth, CA 91311 818-885-8223
† Radio Research Instrument Co., Inc., Waterbury, CT 06704-3506 203-753-5840
† Raytheon Co., Electronic Components Division, Waltham, MA 02254 617-899-8400
RE America, Westlake, OH 44145 216-871-7617
§† Silicon General, Garden Grove, CA 92641 714-898-8121
Standard Magnetic Corp., Garden Grove, CA 92641 714-379-5671
Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291
Unitrode Corp., Watertown, MA 02172 617-926-0404
Universal Voltronics Div., Thermo Voltek Corp., Mt. Kisco, NY 10549 914-241-1300
† Vectronics Microwave Corp., Middlesex, NJ 08846 908-356-2377
§ Verdure Industries Inc., Omaha, NE 68124 402-691-8300
Wavetek Corp., San Diego, CA 92123 619-279-2200
Wavetek Instruments Division, Wavetek Corp., San Diego, CA 92123 619-279-2200

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† Analog Modules, Inc., Longwood, FL 32750-3426, 407-339-4355 ..... B•1210, D•1005
Avens Signal Equipment, Elmhurst, NY 11373, 718-335-1886 ..... A•1622
EPD Electronics, Inc., Gardena, CA 90247, 310-515-4996 ..... D•1073
Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500 ..... A•1725
Northwest Microcircuits, Inc., Philomath, OR 97370, 503-929-6424 ..... A•1712
§ Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... A•2163
Plitron Manufacturing, Inc., Downsview, Ont., CAN M3J 2N5, 416-667-9914 ..... A•2506
† Advanced Analog, Intech, Santa Clara, CA 95050 408-988-4930
† American Microwave Technology, Inc., Brea, CA 92621 714-993-0802
§† Analog Devices, Inc., Norwood, MA 02062-9106 617-329-4700
Analogic Corp., Data Conversion Prods. Grp., Wakefield, MA 01880 508-977-3000
§† Avantek, Inc, A Subsidiary of Hewlett-Packard, Santa Clara, CA 95054 408-727-0700
Burr-Brown Corp., Tucson, AZ 85734 602-746-1111
† CELCO, Mahwah, NJ 07430 201-327-1123
Compact Power Company, Yorba Linda, CA 92686 714-996-5826
Data Translation, Inc., Marlboro, MA 01752 508-481-3700
† Datel, Inc., Mansfield, MA 02048-1194 508-339-3000
DEVAR, Inc., Bridgeport, CT 06605 203-368-6751
† FEI Microwave, Inc., Frequency Electronics, Inc., Sunnyvale, CA 94086 408-732-0880
† Inland Motor, Kollmorgen Corp., Radford, VA 24141 703-639-9045
Instruments for Industry, Inc., Ronkonkoma, NY 11779 516-467-8400
† International Sensor Systems, Inc., Aurora, NE 68818 402-694-6111
Lucas Zeta, Lucas Aerospace, Inc., San Jose, CA 95134 408-434-3600
Modular Audio Products, Modular Devices, Inc., Shirley, NY 11967 516-345-3100
† Modular Devices, Shirley, NY 11967 516-345-3100
§ Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
NF Electronic Instruments, State College, PA 16801 814-237-5580
§ NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
§ Nuclear Measurements Group, Oxford Instruments, Inc., Oak Ridge, TN 37831-2560 615-483-8405
§ Philips Components Discrete Products Div., Discrete Semiconductor Group, Slatersville, RI 02876-2078 401-762-3800
Precision Filters, Inc., Ithaca, NY 14850 607-277-3550
† Teledyne Microelectronics, Los Angeles, CA 90066 ..... 310-822-8229;310-305-0248
Texmate, Inc., Vista, CA 92083-8397 619-598-9899
† TRAK Microwave Corp., Tampa, FL 33634 813-884-1411
† Transmagnetics, Farmingdale, NY 11735 516-293-3100
Tustin Electronics Co., Anaheim, CA 92807 714-777-5800

Validyne Engineering Corporation, Northridge, CA 91324 818-886-2057
ΦWestern Graphtec, Inc., Irvine, CA 92718-2067 ..... 714-770-6010;800-854-8385

Modules, Analog Multiplier-3130

†**Transmagnetics, Farmingdale, NY 11735, 516-293-3100 ..... D•1208**
Advanced Analog, Intech, Santa Clara, CA 95050 408-988-4930
§† Analog Devices, Inc., Norwood, MA 02062-9106 617-329-4700
Analogic Corp., Data Conversion Prods. Grp., Wakefield, MA 01880 508-977-3000
§DEVAR, Inc., Bridgeport, CT 06605 203-368-6751
†Natel Engineering Co., Inc., Simi Valley, CA 93063-3449 805-581-3950

Modules, Analog-to-Digital(A/D) Conversion-3130

†**Computer Conversions Corp., E. Northport, NY 11731, 516-261-3300 .... D•1172**
†**Datel, Inc., Mansfield, MA 02048-1194, 508-339-3000 ..... D•1185**
§**Gordos, Crouzet Corp., Carrollton, TX 75006-2506, 214-250-1647;1-800-677-5311 ..... D•1183**
Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344 ..... D•1205
Precision Filters, Inc., Ithaca, NY 14850, 607-277-3550 .... A•1673, D•1200,1202
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899 ..... D•1205
†**Transmagnetics, Farmingdale, NY 11735, 516-293-3100 ..... D•1208,1210**
Weschler Instruments, Hughes Corp., Cleveland, OH 44136, 216-238-2550 ..... D•1389,1392
§Action Instruments, San Diego, CA 92123 619-279-5726
ADAC Corporation, Woburn, MA 01801 617-935-6668
†Addacon Greensboro, Greensboro, NC 27407 919-852-6200
†Advanced Analog, Intech, Santa Clara, CA 95050 408-988-4930
†Advanced Electronic Packaging, Huntington Beach, CA 92646 714-969-1150
§† Analog Devices, Inc., Norwood, MA 02062-9106 617-329-4700
Analogic Corp., Peabody, MA 01960 508-977-3000
Analogic Corp., Data Conversion Prods. Grp., Wakefield, MA 01880 508-977-3000
†Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635 714-447-2300
Burr-Brown Corp., Tucson, AZ 85734 602-746-1111
†Computer Products, Inc, Process Automation, Pompano Beach, FL 33069 305-974-5500
Data Translation, Inc., Marlboro, MA 01752 508-481-3700
DGH Corporation, Manchester, NH 03108 603-622-0452
§Eagle Signal Controls, Mark IV Industries, Inc., Austin, TX 78753 512-837-8300
Electronic Innovations Corp. (E.I.C.), Lakewood, CO 80227 303-987-2441
§Encoder Products, Sandpoint, ID 83864 208-263-8541
§Giddings & Lewis-Nexes Automation, Giddings & Lewis, Inc., Fond du Lac, WI 54936-1658 414-921-7100
†Greenspring Computers, Inc., Menlo Park, CA 94025 415-327-1200
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
Highland Technology, Inc., San Francisco, CA 94122 415-753-5814
†Hopper Electronics, Phoenix, AZ 85021-1932 602-870-3093
†ILC Data Device Corp., Bohemia, NY 11716-2482 516-567-5600
§Industrial Computer Designs, Inc., Westlake Village, CA 91362 818-889-3179
§† Integrated Device Technology, Inc., Santa Clara, CA 95054-3090 408-727-6116
†Interface Engineering Inc., Holbrook, MA 02343 617-986-2600
§Interloop, San Jose, CA 95131 408-922-0520
†International Sensor Systems, Inc., Aurora, NE 68818 402-694-6111
§Keithley MetraByte, Taunton, MA 02780 508-880-3000
KineticSystems Corp., Lockport, IL 60441 815-838-0005
LeCroy Corp., Chestnut Ridge, NY 10977 914-425-2000
§Lutze, Inc., Charlotte, NC 28217-9805 ..... 704-357-8835;800-447-2371
Maxus Electronic Corp., Boulder, CO 80301 303-447-1226
§† Meret Optical Communications, Inc., An Amoco Co., Santa Monica, CA 90404-4998 310-828-7496
†Micro Networks, Unitrode Corporation, Worcester, MA 01606 508-852-5400
†Natel Engineering Co., Inc., Simi Valley, CA 93063-3449 805-581-3950
§National Instruments, Austin, TX 78730-5039 512-794-0100
§Nuclear Measurements Group, Oxford Instruments, Inc., Oak Ridge, TN 37831-2560 615-483-8405
§Opto 22, Temecula, CA 92590 714-695-9299
§Phoenix Contact Inc., Harrisburg, PA 17111 717-944-1300
Preferred Electronics, Inc., Westfield, MA 01086 ..... 413-568-2301;1-800-553-6374
†#Solid State Electronics Corp., Northridge, CA 91324 818-993-8257
†Teledyne Microelectronics, Los Angeles, CA 90066 ..... 310-822-8229;310-305-0248
§TURCK Inc., Minneapolis, MN 55441-2656 ..... 612-553-9224;1-800-328-0580
Tustin Electronics Co., Anaheim, CA 92807 714-777-5800
§VGI, Inc., Vikay Industrial Pte. Ltd., Roseville, CA 95661 916-783-7878
§Weidmuller Inc., Richmond, VA 23236 804-794-2877
ΦWestern Graphtec, Inc., Irvine, CA 92718-2067 ..... 714-770-6010;800-854-8385

Modules, Arithmetic (Binary)-3130

Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344 ..... D•1376
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899 ..... D•1376

Modules, CAMAC-2900 — *See Vol. D*

Modules, Control & Switching-2200 — *See Vol. D*

Modules, Data Acquisition-2325 — *See Vol. D*

Modules, Data Retention-2325 — *See Vol. D*

Modules, DIN Interface-2100 — *See Vol. C*

Modules, Delay Line-2350

§†**Data Delay Devices, Clifton, NJ 07013-1915, 201-773-2299 ... A•1536-1537,1542**
†**Technitrol, Philadelphia, PA 19134, 215-426-9105 ..... A•1580-1581**
†Advanced Electronic Packaging, Huntington Beach, CA 92646 714-969-1150
†Automatic Coil Corp., Miami, FL 33147 305-696-6660
Datatronics, Inc., Romoland, CA 92585 909-928-7700
Fee Fil-Mag, San Diego, CA 92123 619-569-6577
†Integrated Microwave, San Diego, CA 92121-1009 619-259-2600
§† Rhombus Industries, Huntington Bch., CA 92649-1595 714-898-0960
†Teledyne Microwave, Mountain View, CA 94043 415-968-2211
§Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
§Valor Electronics, San Diego, CA 92131-1642 619-537-2500

Modules, Digital-to-Analog(D/A) Conversion-3130

†**Computer Conversions Corp., E. Northport, NY 11731, 516-261-3300 ..... D•1172-1173**
†**Datel, Inc., Mansfield, MA 02048-1194, 508-339-3000 ..... D•1185**
§**Gordos, Crouzet Corp., Carrollton, TX 75006-2506, 214-250-1647;1-800-677-5311 ..... D•1182**
Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344 ..... D•1205,1374
Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ..... A•1708
§**National Instruments, Austin, TX 78730-5039, 512-794-0100 ..... D•1147**
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899 ..... D•1205,1374
†**Transmagnetics, Farmingdale, NY 11735, 516-293-3100 ..... D•1208,1210**
Weschler Instruments, Hughes Corp., Cleveland, OH 44136, 216-238-2550 ..... D•1392
§Action Instruments, San Diego, CA 92123 619-279-5726
§ADAC Corporation, Woburn, MA 01801 617-935-6668
†Addacon Greensboro, Greensboro, NC 27407 919-852-6200
†Advanced Analog, Intech, Santa Clara, CA 95050 408-988-4930
§† Analog Devices, Inc., Norwood, MA 02062-9106 617-329-4700
Analogic Corp., Peabody, MA 01960 508-977-3000
Analogic Corp., Data Conversion Prods. Grp., Wakefield, MA 01880 508-977-3000
†Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635 714-447-2300
Burr-Brown Corp., Tucson, AZ 85734 602-746-1111
†Computer Products, Inc, Process Automation, Pompano Beach, FL 33069 305-974-5500
§Covid, Inc., Tempe, AZ 85281 602-966-2221
C-Tek Inc., Wakefield, MA 01880 617-246-1720
Data Translation, Inc., Marlboro, MA 01752 508-481-3700
DSP Technology, Fremont, CA 94538-7338 510-657-7555
§duTec, Inc., Jackson, MI 49204-0964 800-248-1632
§Eagle Signal Controls, Mark IV Industries, Inc., Austin, TX 78753 512-837-8300
Electronic Innovations Corp. (E.I.C.), Lakewood, CO 80227 303-987-2441
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
†Hopper Electronics, Phoenix, AZ 85021-1932 602-870-3093
†ILC Data Device Corp., Bohemia, NY 11716-2482 516-567-5600
§Industrial Computer Designs, Inc., Westlake Village, CA 91362 818-889-3179
§† Integrated Device Technology, Inc., Santa Clara, CA 95054-3090 408-727-6116
†Interface Engineering Inc., Holbrook, MA 02343 617-986-2600
§International Technologies, Inc., Warwick, RI 02888 401-781-5595
§Keithley MetraByte, Taunton, MA 02780 508-880-3000
KineticSystems Corp., Lockport, IL 60441 815-838-0005
§Lutze, Inc., Charlotte, NC 28217-9805 ..... 704-357-8835;800-447-2371
Maxus Electronic Corp., Boulder, CO 80301 303-447-1226
§† Meret Optical Communications, Inc., An Amoco Co., Santa Monica, CA 90404-4998 310-828-7496
†Micro Networks, Unitrode Corporation, Worcester, MA 01606 508-852-5400
†Natel Engineering Co., Inc., Simi Valley, CA 93063-3449 805-581-3950
§Opto 22, Temecula, CA 92590 714-695-9299
§Phoenix Contact Inc., Harrisburg, PA 17111 717-944-1300
Preferred Electronics, Inc., Westfield, MA 01086 ..... 413-568-2301;1-800-553-6374
R. C. Electronics Inc., Goleta, CA 93117 805-685-7770
Tustin Electronics Co., Anaheim, CA 92807 714-777-5800
§Weidmuller Inc., Richmond, VA 23236 804-794-2877

Modules, Display — See Display Modules (Vol. B)

Modules, Encoding/Decoding-3130

†**Computer Conversions Corp., E. Northport, NY 11731, 516-261-3300 .... D•1173**
†**Control Sciences, Inc., Chatsworth, CA 91311, 818-709-5510 ..... D•1176-1179, 1181**
Datel, Inc., Mansfield, MA 02048-1194, 508-339-3000 ..... D•1185
F-P Electronics, A Mark IV Industries Company, Mississauga, Ont., CANADA L4W 2P1, 416-624-3020 ..... B•1066-1069
Gossen/Texmate, Vista, CA 92083-8397, 619-598-9899;1-800-394-8344 ..... D•1374
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... B•1337-1338
Texmate, Inc., Vista, CA 92083-8397, 619-598-9899 ..... D•1374
Transmagnetics, Farmingdale, NY 11735, 516-293-3100 ..... D•1210
Vetra Systems Corp., Plainview, NY 11803, 516-454-6469 ..... B•1852
§Analog Devices, Inc., Norwood, MA 02062-9106 617-329-4700
§Aptek Technologies, Inc., DBA Aptek Microsystems, Deerfield Beach, FL 33442 305-421-8450
†Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328 215-968-4271
Clarostat Sensors and Controls Group, BYR, PLC, Plano, TX 75075 ..... 214-422-1844; 1-800-872-0044
Data Translation, Inc., Marlboro, MA 01752 508-481-3700
Disc Instruments, Honeywell, Costa Mesa, CA 92626 714-433-0343
#Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
†Engineered Components Co., San Luis Obispo, CA 93403-8121 805-544-3800
§Giddings & Lewis-Nexes Automation, Giddings & Lewis, Inc., Fond du Lac, WI 54936-1658 414-921-7100
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844

Hualon Microeletronics Corporation, Hualon Group, Hsin-Chu, TAIWAN 415-288-0390
† ILC Data Device Corp., Bohemia, NY 11716-2482 516-567-5600
† Interface Engineering Inc., Holbrook, MA 02343 617-986-2600
§ Interswitch, Wm. J. Purdy Co., Burlingame, CA 94010 415-347-8217
† Telegenix/Grim Corp., Cherry Hill, NJ 08034 609-424-5220
† Vernitech:Vernitron Corp., Deer Pk., NY 11729 516-586-5100
§ Xico, Inc., Chatsworth, CA 91311 818-709-4403

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Avens Signal Equipment, Elmhurst, NY 11373, 718-335-1886 ..... A•1621-1622
§ Corcom, Inc., Libertyville, IL 60048, 708-680-7400 ..... C•1301
Datel, Inc., Mansfield, MA 02048-1194, 508-339-3000 ..... D•1185
§ Fee Fil-Mag, San Diego, CA 92123, 619-569-6577 ..... A•1635-1636,2349,2351
§ GlobTek, Inc., Northvale, NJ 07647, 201-784-1000 ..... D•1732
Kappa Technologies, Inc., Rahway, NJ 07065, 908-396-9400;1-800-223-0603 ..... A•1643-1644
LMI Connectors Inc., Boca Raton, FL 33487-2710, 407-994-5896;800-247-0564 ..... C•1399
Marway Prods. Inc., Santa Ana, CA 92703, 714-973-1800 ..... D•2278
Powercube Corp., Sub. Unitrode Corp., Billerica, MA 01821, 508-667-9500 ..... D•2196-2197
Precision Filters, Inc., Ithaca, NY 14850, 607-277-3550 ..... A•1673-1675
§ Schaffner EMC, Inc. Components Division, Springfield, NJ 07081, 201-379-7778;800-367-5566 ..... A•1602-1605, D•1322
§ Valor Electronics, San Diego, CA 92131-1642, 619-537-2500 ..... A•1686-1687
ADAC Corporation, Woburn, MA 01801 617-935-6668
A. P. Circuit, Brooklyn, NY 11237 718-456-2717
§ Aptek Technologies, Inc., DBA Aptek Microsystems, Deerfield Beach, FL 33442 305-421-8450
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328 215-968-4271
Delta Products Corporation, Fremont, CA 94538 510-770-0660
ELMA Electronic Inc., Fremont, CA 94538 510-656-3400
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
† Engineered Components Co., San Luis Obispo, CA 93403-8121 805-544-3800
† ESC Electronics Corp., Palisades Pk., NJ 07650 201-947-0400
§ Fox Electronics, Ft. Myers, FL 33905 813-693-0099
† Genisco Electronics, A Division of GTC, Anaheim, CA 92805 714-563-4300
† Integrated Microwave, San Diego, CA 92121-1009 619-259-2600
† International Sensor Systems, Inc., Aurora, NE 68818 402-694-6111
LCR Electronics-Hopkins Engineering, Norristown, PA 19401 215-278-0840
† Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710 813-347-2181
Lunaire Environmental, Inc., Lunaire Limited, Williamsport, PA 17701 717-326-1770
McCoy/Ovenaire/Spectrum, A Sub. of Oak Industries, Mt. Holly Springs, PA 17065 717-486-3411
NF Electronic Instruments, State College, PA 16801 814-237-5580
§ Power Dynamics Inc., West Orange, NJ 07052 201-736-5722
Pulse Engineering, Inc., San Diego, CA 92128 619-674-8100
Reliable Electronic Mfg., Wyvern Technologies, Santa Ana, CA 92705 714-966-0710
† Sawtek Inc., Orlando, FL 32860-9501 407-886-8860
§ Schurter, Inc., Petaluma, CA 94954 ..... 800-848-2600 ext.62
† Teledyne Microwave, Mountain View, CA 94043 415-968-2211
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
† Trilithic, Inc., Indianapolis, IN 46236 800-344-2412

Modules, I/O Relay-3130

§ Altech Corp., Flemington, NJ 08822-6000, 908-806-9400 ..... C•1158
Aromat Corp., Matsushita Electrical Works Ltd., New Providence, NJ 07974, 908-464-3550 ..... B•1434
§ Crydom Company, Long Beach, CA 90805, 310-865-3536 ..... B•1464-1472
CYTEC Corp., Penfield, NY 14526, 716-381-4740;800-346-3117 ..... D•1250
Douglas Randall, Pawcatuck, CT 06379, 203-599-2075 ..... A•2144
§ Gordos, Crouzet Corp., Carrollton, TX 75006-2506, 214-250-1647;1-800-677-5311 ..... B•1460-1461
§ Grayhill Inc., La Grange, IL 60525, 708-354-1040 ..... B•1507
Master Electronic Controls, Los Angeles, CA 90025, 310-452-1336 ..... B•1558
§ NTE Electronics, Inc., Bloomfield, NJ 07003, 201-748-5089 ..... B•1576
§ Potter & Brumfield, A Siemens Co., Princeton, IN 47671-0001, 812-386-1000 ..... B•1586-1587,1590
§ WECO Electrical Connectors, Inc., Mooers, NY 12958, 518-298-4810 ..... C•1519-1521
§ WECO Electrical Connectors, Inc., Kirkland, Quebec, CANADA H9H 3L4, 514-694-9136 ..... C•1520-1521
§ ABB Kent-Taylor Inc, Asea Brown Boveri, Rochester, NY 14602-0550 716-292-6050
§ Action Instruments, San Diego, CA 92123 619-279-5726
§ ADAC Corporation, Woburn, MA 01801 617-935-6668
Aleph International Corp., San Fernando, CA 91340 ..... 818-365-9856;800-423-5622
§ Brentek International, Inc., York, PA 17406 717-755-8000
DDI Inc., Beverly, MA 01915-1703 508-927-7976
Dixson, Inc., Grand Junction, CO 81503 303-244-1241
§ duTec, Inc., Jackson, MI 49204-0964 800-248-1632
§ Eagle Signal Controls, Mark IV Industries, Inc., Austin, TX 78753 512-837-8300
EI & S, Prime Technology Inc., North Branford, CT 06471 203-481-5721
§# Encoder Products, Sandpoint, ID 83864 208-263-8541
§ Entrelec Inc., Irving, TX 75038 214-550-9025
§ Global Components & Controls, Wanamassa, NJ 07712-4010 908-389-1470
§† Gunther, W., GmbH, D 8500 Nurnberg 82, GERMANY ..... (0)911/65521 or 65520
Highland Technology, Inc., San Francisco, CA 94122 415-753-5814
§ International Technologies, Inc., Warwick, RI 02888 401-781-5595
† Joslyn Jennings Corporation, San Jose, CA 95122-2696 408-292-4025
KineticSystems Corp., Lockport, IL 60441 815-838-0005
KMC Systems, Inc., Midland Pk., NJ 07432 201-447-0007
§ Lutze, Inc., Charlotte, NC 28217-9805 ..... 704-357-8835;800-447-2371
§ Magnecraft Electric Co., Northbrook, IL 60062-5376 708-564-8800
Maxus Electronic Corp., Boulder, CO 80301 303-447-1226
MicroDimensions, Inc., Mentor, OH 44060 216-974-8070
§ National Instruments, Austin, TX 78730-5039 512-794-0100
§ Opto 22, Temecula, CA 92590 714-695-9299
§ Phoenix Contact Inc., Harrisburg, PA 17111 717-944-1300
Quatech Inc., Akron, OH 44311 216-434-3154
Racal-Dana Instrs. Inc., Irvine, CA 92718 714-859-8999
§ Sierra Monitor Corp., Milpitas, CA 95035 408-262-6611
Smart Relay Technology, Inc., Commack, NY 11725 516-543-7161
SSAC Incorporated, Baldwinsville, NY 13027 315-638-1300
§ T-Bar Data Switch Corp., Orange, CT 06477 ..... 203-795-0739;800-726-8227
§† Teledyne Solid State, Hawthorne, CA 90250 213-777-0077
§ Weidmuller Inc., Richmond, VA 23236 804-794-2877

Modules, Logic-Also See Cards; Circuits; Networks-3130

§† Data Delay Devices, Clifton, NJ 07013-1915, 201-773-2299 ..... A•1536-1540
Elgenco, Inc., Hurricane, UT 84737, 801-635-4954 ..... D•1255
FDK America, Inc., Fuji Electrochemical Co., Ltd., San Jose, CA 95134, 408-432-8331 ..... A•1698
§ Gordos, Crouzet Corp., Carrollton, TX 75006-2506, 214-250-1647;1-800-677-5311 ..... D•1183
Matrix Systems Corp., Calabasas, CA 91302, 818-222-2301 ..... B•1564-1565
Philips ECG, North American Philips Co., Williamsport, PA 17701, 717-323-4691 ..... A•2172
Advanced Electronic Packaging, Huntington Beach, CA 92646 714-969-1150
† Assembly Specialists, Chelmsford, MA 01824 508-250-5900
† Astrosystems, Inc., Lake Success, NY 11042 516-328-1600
Datel, Inc., Mansfield, MA 02048-1194 508-339-3000
† Densepac Microsystems, Inc., Garden Grove, CA 92641-1428 ..... 714-898-0007; 800-64-CHIPS
Dynage/Controls, Inc., Canistota, SD 57012 605-296-3487
† Engineered Components Co., San Luis Obispo, CA 93403-8121 805-544-3800
† ILC Data Device Corp., Bohemia, NY 11716-2482 516-567-5600
† International Sensor Systems, Inc., Aurora, NE 68818 402-694-6111
† Logic Technology, Inc., Mtn. View, CA 94043 415-967-1007
§ Namco Controls Corporation, Mentor, OH 44060 216-946-9900
Preferred Electronics, Inc., Westfield, MA 01086 ..... 413-568-2301;1-800-553-6374
Racal-Dana Instrs. Inc., Irvine, CA 92718 714-859-8999
Rhombus Industries, Huntington Bch., CA 92649-1595 714-898-0960
Rockwell Int'l:Semiconductor Products Division, Newport Beach, CA 92660 714-833-4600
§ Struthers-Dunn, Inc. and Hi-G Co., Inc., Pitman, NJ 08071-0901 609-589-7500
Sunrise Electronics, Inc., Glendora, CA 91740 818-914-1926
§† Superior Electric, Warner Electric, Bristol, CT 06010 203-582-9561
Vetra Systems Corp., Plainview, NY 11803 516-454-6469
§ Weidmuller Inc., Richmond, VA 23236 804-794-2877

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Advanced Electronic Packaging, Huntington Beach, CA 92646 714-969-1150
AEL Defense Corp., Lansdale, PA 19446 215-822-2929
† Teledyne Microwave, Mountain View, CA 94043 415-968-2211
† TH Electronics, Tong Hsing Electronic Ind., Ltd., Tucson, AZ 85745-1443 602-791-7825

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§ Gordos, Crouzet Corp., Carrollton, TX 75006-2506, 214-250-1647;1-800-677-5311 ..... D•1183
IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643 ..... D•1117
Advanced Electronic Packaging, Huntington Beach, CA 92646 714-969-1150
† Densepac Microsystems, Inc., Garden Grove, CA 92641-1428 ..... 714-898-0007; 800-64-CHIPS
Packard Electric, General Motors, Warren, OH 44486 ..... 216-373-2121,1-800-PACKARD
§ PTS Corporation, Bloomington, IN 47401 812-824-9331
Rhombus Industries, Huntington Bch., CA 92649-1595 714-898-0960
White Technology, Inc., Bowmar Instrument Corp., Phoenix, AZ 85040 602-437-1520

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Modules, Oscillator-2300

§ AT&T Microelectronics, Allentown, PA 18103, 1-800-372-2447;In Can.:1-800-553-2448 ..... A•1335
§ Dale Electronics, Inc., Tempe Div., Tempe, AZ 85282-1883, 602-967-7874 ..... A•1379-1381
FTS/AUSTRON, Austin, TX 78761-4766, 512-251-2341 ..... A•1405
† International Sensor Systems, Inc., Aurora, NE 68818, 402-694-6111 ..... A•1705
† Oscillatek, A Dover Technologies Company, Olathe, KS 66062, 913-829-1777 ..... A•1443,1445-1447
† Vectron Laboratories, Inc., Norwalk, CT 06856-5160, 203-853-4433 ..... A•1502-1509
§† Avantek, Inc, A Subsidiary of Hewlett-Packard, Santa Clara, CA 95054 408-727-0700
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328 215-968-4271
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
§ Champion Technologies, Inc., Franklin Park, IL 60131 708-451-1000
† Computer Conversions Corp., E. Northport, NY 11731 516-261-3300
Connor-Winfield Corp., Aurora, IL 60505-1335 708-851-4722
† Control Sciences, Inc., Chatsworth, CA 91311 818-709-5510
† ELPAQ, Elmo Semiconductor, Burbank, CA 91504-1052 818-768-7500
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Engineered Components Co., San Luis Obispo, CA 93403-8121 805-544-3800
§ Fox Electronics, Ft. Myers, FL 33905 813-693-0099
† Gorman-Redlich Mfg. Co., Athens, OH 45701 614-593-3150
Magnum Microwave Corp., Fremont, CA 94538 510-657-9898
McCoy/Ovenaire/Spectrum, A Sub. of Oak Industries, Mt. Holly Springs, PA 17065 717-486-3411
† Micronetics, Hudson, NH 03051 603-883-2900
Modular Audio Products, Modular Devices, Inc., Shirley, NY 11967 516-345-3100

† Modular Devices, Shirley, NY 11967 516-345-3100
Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
NF Electronic Instruments, State College, PA 16801 814-237-5580
† Solid State Electronics Corp., Northridge, CA 91324 818-993-8257
ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086 408-730-6300
† Techtrol Cyclonetics, Inc., New Cumberland, PA 17070 717-774-2746
† Teledyne Microwave, Mountain View, CA 94043 415-968-2211
† TRAK Microwave Corp., Tampa, FL 33634 813-884-1411
† Z Communications, Inc., San Diego, CA 92126 619-621-2700

Modules, Power Entry, Filtered-2700

§ Aerovox Inc., North Dartmouth, MA 02747-1217, 508-995-8000 ..... A•1585
§ Corcom, Inc., Libertyville, IL 60048, 708-680-7400 ..... A•1587, C•1300,1302
Eichhoff Electronics, Warwick, RI 02886, 401-738-1440;800-678-1040 ..... A•1588-1591
Filter Concepts Inc., Santa Ana, CA 92707, 714-545-7003 ..... A•1592
§ GlobTek, Inc., Northvale, NJ 07647, 201-784-1000 ..... C•1340, D•1732
Marway Prods. Inc., Santa Ana, CA 92703, 714-973-1800 ..... D•2278,2281
Panel Components Corp., Oskaloosa, IA 52577, 515-673-0097 ..... C•1426-1430
Powercube Corp., Sub. Unitrode Corp., Billerica, MA 01821, 508-667-9500 ..... D•2196-2197
§ Pulizzi Engineering, Inc., Santa Ana, CA 92704-6865, 714-540-4229 ..... D•2300
§ Schaffner EMC, Inc. Components Division, Springfield, NJ 07081, 201-379-7778;800-367-5566 ..... A•1602-1605, D•1322
§ Schurter, Inc., Petaluma, CA 94954, 800-848-2600 ext.62 ..... A•1606-1608, C•1452-1454
† Tri-Mag, Inc., Visalia, CA 93291, 209-651-2222 ..... A•1613
Curtis Industries, Milwaukee, WI 53234-3925 414-649-4200
§† Delta Products Corporation, Fremont, CA 94538 510-770-0660
† ELPAQ, Elmo Semiconductor, Burbank, CA 91504-1052 818-768-7500
§† JMK, Inc., Amherst, NH 03031 603-886-4100
§ Power Dynamics Inc., West Orange, NJ 07052 201-736-5722
§ Sola, Elk Grove Village, IL 60007-5666 708-439-2800
Transducers & Systems, A Prime Technology Company, N. Branford, CT 06471 203-481-5721

Modules, RMS-to-DC Conversion-3130

Abbott Electronics, Los Angeles, CA 90034, 310-202-8820 ..... D•1491
Abbott Technologies, Inc., Sun Valley, CA 91352 ..... 818-504-0644;1-800-367-8200
Advanced Analog, Intech, Santa Clara, CA 95050 408-988-4930
BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
§ Semikron, Inc., Hudson, NH 03051-0066 ..... 603-883-8102;1-800-258-1308
§ Sola, Elk Grove Village, IL 60007-5666 708-439-2800
WECO Electrical Connectors, Inc., Mooers, NY 12958 518-298-4810
§ WECO Electrical Connectors, Inc., Kirkland, Quebec, CANADA H9H 3L4 514-694-9136

Modules, Sample & Hold-3130

Advanced Analog, Intech, Santa Clara, CA 95050 408-988-4930
§† Analog Devices, Inc., Norwood, MA 02062-9106 617-329-4700
Analogic Corp., Data Conversion Prods. Grp., Wakefield, MA 01880 508-977-3000
Data Translation, Inc., Marlboro, MA 01752 508-481-3700
Datel, Inc., Mansfield, MA 02048-1194 508-339-3000
† Hopper Electronics, Phoenix, AZ 85021-1932 602-870-3093
† ILC Data Device Corp., Bohemia, NY 11716-2482 516-567-5600
† International Sensor Systems, Inc., Aurora, NE 68818 402-694-6111
KineticSystems Corp., Lockport, IL 60441 815-838-0005
Precision Filters, Inc., Ithaca, NY 14850 607-277-3550
R. C. Electronics Inc., Goleta, CA 93117 805-685-7770
Texmate, Inc., Vista, CA 92083-8397 619-598-9899
§ WECO Electrical Connectors, Inc., Kirkland, Quebec, CANADA H9H 3L4 514-694-9136

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Mounts, Crystal-2300

§ Bivar, Inc., Irvine, CA 92718, 714-951-8808 ..... C•1537
McCoy/Ovenaire/Spectrum, A Sub. of Oak Industries, Mt. Holly Springs, PA 17065, 717-486-3411 ..... A•1412-1413
Accessories For Electronics, Inc., Baldwin, NY 11510-3593 516-546-1751
§† Atlee Inc., North Andover, MA 01845 508-681-1003
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
Lectronic Research Labs., Inc., Camden, NJ 08104 800-358-8378

† Microlab/FXR, Livingston, NJ 07039 201-992-7700
† Micronetics, Hudson, NH 03051 603-883-2900
† Microphase, Norwalk, CT 06856 203-866-8000
† Milton Ross Co., Warrington, PA 18976 215-491-0600
† Premier Microwave, Port Chester, NY 10573 914-939-8900
§† Telephonics Corporation/PRD Instruments, Huntington, NY 11743 ..... 516-549-6415/6428
TOYOCOM USA INC., Arlington Heights, IL 60005 ... 708-593-8780/1-800-TOYOCOM

Mounts, Integrated Circuit — See Sockets, Integrated Circuit (Vol. C), Boards, Plug-In (Vol. C)

Mounts, Microwave-3450

Andrew Corp., Orland Pk, IL 60462 800-255-1479
Gabriel Electns. Inc., Scarborough, ME 04070 207-883-5161
† Loral Microwave Narda, Hauppauge, NY 11788 516-231-1700
† Maury Microwave Corp., Ontario, CA 91764 909-987-4715
† Microlab/FXR, Livingston, NJ 07039 201-992-7700
† Micro Mounting Devices, Campbell, CA 95008 408-866-4626
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3 ..... 514-694-6666; 800-724-3911
† Premier Microwave, Port Chester, NY 10573 914-939-8900
§† Telephonics Corporation/PRD Instruments, Huntington, NY 11743 ..... 516-549-6415/6428

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Multipliers, Frequency-3450

† Frequency Electronics, Inc., Mitchel Field, NY 11553, 516-794-4500 ..... A•1402-1403
† Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500 ..... A•1725
† TRAK Microwave Corp., Tampa, FL 33634, 813-884-1411 ..... A•1852-1853
† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950 201-539-5500
† Ajax Magnethermic Corp., Warren, OH 44483 216-372-8511
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
† Comstron A Div. of Aeroflex, Plainview, NY 11803 516-752-2351
† Continental Microwave Technology Inc., Glen Cove, NY 11542 516-759-5600
§† Data Delay Devices, Clifton, NJ 07013-1915 201-773-2299
Dowty Avionics, Arcadia, CA 91006 818-445-5955
† Engineered Components Co. San Luis Obispo, CA 93403-8121 805-544-3800
† FEI Microwave, Inc., Frequency Electronics, Inc., Sunnyvale, CA 94086 408-732-0880
† Greenray Inds., Inc., Mechanicsburg, PA 17055 717-766-0223
† Hughes Microelectronic Circuits Division, Newport Beach, CA 92658-8903 714-759-2952
† Integrated Microwave, San Diego, CA 92121-1009 619-259-2600
† Lorch Electronics:Div. of Vemitron Corp., St. Petersburg, FL 33710 813-347-2181
† Lucas Zeta, Lucas Aerospace, Inc., San Jose, CA 95134 408-434-3600
† M/A COM Ltc. Bedfordshire, ENGLAND LU5 4SX, England ..... 44(582)471200
§† M/A-COM Microelectroincs Division, M/A-COM, Lowell, MA 01853-3295 508-442-5000
† Magnum Microwave Corp., Fremont, CA 94538 510-657-9898
MICRO DATA SYSTEMS, Thomasville, GA 31799 912-226-1709
† Microlab/FXR, Livingston, NJ 07039 201-992-7700
§ Micro-Now Instr. Co., Inc., Skokie, IL 60076 708-677-4700
† Microwave Technology Div., JHP Industrial, Syracuse, NY 13202-3442 315-422-0050
† MITEQ Inc., Hauppauge, NY 11788 516-436-7400
§ Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
§ Oscilloquartz, B & J Marketing, Northridge, CA 91325 818-993-0048
§ Reliance Comm/Tec, Reliance Electric, Cleveland, OH 44117 800-245-4501
† Servo Corporation of America, Hicksville, NY 11801-5259 516-938-9700
ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086 408-730-6300
† Techtrol Cyclonetics, Inc., New Cumberland, PA 17070 717-774-2746
† Teledyne Microelectronics, Los Angeles, CA 90066 ..... 310-822-8229;310-305-0248
† TRM, Inc., Manchester, NH 03110 603-627-6000
Tucker Electronics, Dallas, TX 75355-1419 ..... 214-348-8800;800-527-4642
† Watkins-Johnson Co., Palo Alto, CA 94304 415-493-4141
† Wenzel Associates, Inc., Austin, TX 78752 512-450-1400

Multipliers, Hall-4800

Bell, F. W., Inc., Orlando, FL 32807, 407-678-6900 ..... B•1918, D•1153
Ohio Semitronics, Inc., Columbus, OH 43212 614-486-9561
Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98607 206-834-2500

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Networks, Directional Antenna Phasing-1200 — *See Vol. D*

Networks, Hybrid-4700

Advanced Thermistor Div., U.S. Sensor Corp., Orange, CA 92667, 714-639-1000 ..... B•1860
Allen Co., Inc., Robert G., N. Hollywood, CA 91605, 818-765-8300;800-827-7422 ..... A•1863
§ Bourns, Inc., Electronic Components Sls., Riverside, CA 92507-2114, 909-781-5500;801-750-7200 ..... A•1874
Hybrids International Ltd., Thick Film Division, Olathe, KS 66062, 913-764-6400 ..... A•1699
† International Sensor Systems, Inc., Aurora, NE 68818, 402-694-6111 ..... A•1705
† Interpoint Corporation, Redmond, WA 98052, 206-882-3100 ..... A•1706-1707
† Northwest Microcircuits, Inc., Philomath, OR 97370, 503-929-6424 ..... A•1712
† Piconics, Incorporated, Tyngsboro, MA 01879, 508-649-7501 ..... A•2013
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•2019
Techno Division, Dale Electronics, Van Nuys, CA 91405-1139, 818-781-1642 ..... A•1916
ACC Electronics Company, Echlin Inc., Independence, KS 67301 316-331-1000
A E G Corporation, Basking Ridge, NJ 07920 908-204-8900
† Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803 516-694-6700
Anderson Electronics, Hollidaysburg, PA 16648 814-695-4428
A. P. Circuit, Brooklyn, NY 11237 718-456-2717
† A.S.I. Microsystems, Inc., (Formerly Andrich Systems, Inc.), Bohemia, NY 11716 516-589-5656
AVX Corporation, A Kyocera Group Company, Myrtle Beach, SC 29577 803-448-9411
§† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635 714-447-2300
Control Components & Systems, Inc., Pittsburgh, PA 15235 412-371-1111
CTS Corporation, Elkhart, IN 46514 219-293-7511
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 402-563-6506
§ Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242 402-371-0080
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
† Film Microelectronics Inc., Peabody, MA 01960 508-532-9913
§ Fox Electronics, Ft. Myers, FL 33905 813-693-0099
§ Gordos, Crouzet Corp., Carrollton, TX 75006-2506 ..... 214-250-1647;1-800-677-5311
Hokuriku USA Ltd., Madison, AL 35758 205-772-9620
† Hybrid Designs, Inc., Costa Mesa, CA 92626 714-557-9933
† Hycomp, Inc., Marlborough, MA 01752 508-485-6300
§ International Resistive Company, Boone, NC 28607 704-264-8861
KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
† Loral Microwave Narda, Hauppauge, NY 11788 516-231-1700
LTI, Inc., Autotech Technologies, LP, Carol Stream, IL 60188 708-668-8886
† Magnetic Component Engineering, Inc., Inglewood, CA 90301 310-677-6600
† Magnetico Inc., Holtsville, NY 11742 516-654-1166
Marc Enterprises, Laguna Niguel, CA 92677 714-249-0302
MICRO DATA SYSTEMS, Thomasville, GA 31799 912-226-1709
† Micro Hybrids, Inc., Medford, NY 11763 516-732-3448
Microplex, Inc., Anaheim, CA 92806 714-634-1535
Mini-Systems, Inc., Sunbelt Microelectronic Division, Deltona, FL 32725 407-574-0208
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3 ..... 514-694-6666; 800-724-3911
MTI International Inc., Menomonee Falls, WI 53051 414-783-6080
† Natel Engineering Co., Inc., Simi Valley, CA 93063-3449 805-581-3950
† NCR Comten, Inc., NCR Corp., St. Paul, MN 55113 612-638-7777
Pulse Engineering, Inc., San Diego, CA 92128 619-674-8100
§ Racal-Datacom, Sunrise, FL 33323-2899 ..... 305-846-1601;1-800-RACAL-55
§ Raltron Electronics, Miami, FL 33172 305-593-6033
Reliable Electronic Mfg., Wyvern Technologies, Santa Ana, CA 92705 714-966-0710
Schaffner EMC, Inc., Intepro, Springfield, NJ 07081 201-379-7778
§† Sipex Corp., Billerica, MA 01821 508-667-8700
Spectrum Control, Inc., Erie, PA 16506 814-835-4000
Tepro of Florida, Clearwater, FL 34623 813-796-1044
U.S. Sensor Corp., Orange, CA 92667 714-639-1000
U.S. Sensor Corp., Orange, CA 92667 714-639-1000
Vishay Resistors, Malvern, PA 19355 215-644-1300

Networks, Hybrid Substrates-3130

§ Bourns, Inc., Electronic Components Sls., Riverside, CA 92507-2114, 909-781-5500;801-750-7200 ..... A•1874
† Electro-Films, Inc., Warwick, RI 02886, 401-738-9150 ..... A•1721,1932
† Mini-Systems, Inc., Thick/Thin Film Division, North Attleboro, MA 02761, 508-695-0203 ..... A•1993
† Piconics, Incorporated, Tyngsboro, MA 01879, 508-649-7501 ..... A•2013
† State of the Art, Inc., State College, PA 16803-1797, 814-355-8004 ..... A•2020
ACC Electronics Company, Echlin Inc, Independence, KS 67301 316-331-1000
AVX Corporation, A Kyocera Group Company, Myrtle Beach, SC 29577 803-448-9411
§† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635 714-447-2300
§† California Micro Devices, Inc., Milpitas, CA 95035 408-263-3214
Control Components & Systems, Inc., Pittsburgh, PA 15235 412-371-1111
† Film Microelectronics Inc., Peabody, MA 01960 508-532-9913
§ Fox Electronics, Ft. Myers, FL 33905 813-693-0099
Hokuriku USA Ltd., Madison, AL 35758 205-772-9620
† Hycomp, Inc., Marlborough, MA 01752 508-485-6300
International Resistive Company, Boone, NC 28607 704-264-8861
ISL Products Int'l, Ltd., Syosset, NY 11791-6093 ..... 516-937-3475;800-626-6116
LTI, Inc., Autotech Technologies, LP, Carol Stream, IL 60188 708-668-8886
MICRO DATA SYSTEMS, Thomasville, GA 31799 912-226-1709
† Micro Hybrids, Inc., Medford, NY 11763 516-732-3448
† Microplex, Inc., Anaheim, CA 92806 714-634-1535
Mini-Systems, Inc., Sunbelt Microelectronic Division, Deltona, FL 32725 407-574-0208
MTI International Inc., Menomonee Falls, WI 53051 414-783-6080
† Natel Engineering Co., Inc., Simi Valley, CA 93063-3449 805-581-3950
Northwest Microcircuits, Inc., Philomath, OR 97370 503-929-6424
§ Raltron Electronics, Miami, FL 33172 305-593-6033
† Sipex Corp., Billerica, MA 01821 508-667-8700
† United Supertek, Inc., San Jose, CA 95131-1101 408-922-0730

Networks, Ladder-4700

§ Caddock Electronics, Inc., Riverside, CA 92507, 909-788-1700 ..... A•1877
† Electro-Films, Inc., Warwick, RI 02886, 401-738-9150 ..... A•1933
§ KOA Speer Electronics, Bradford, PA 16701, 814-362-5536 ..... A•1959,1971
Mills Resistor Co., Los Alamitos, CA 90720, 310-598-2454 ..... A•1987
§ Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ..... A•1995
Ohmtek Inc., Vishay, Niagara Falls, NY 14304, 716-283-4025 ..... A•2001,2003
† Piconics, Incorporated, Tyngsboro, MA 01879, 508-649-7501 ..... A•2013
Solitron Devices, Inc., Semiconductor Group, West Palm Beach, FL 33407-4697, 407-848-4311 ..... A•2219
Techno Division, Dale Electronics, Van Nuys, CA 91405-1139, 818-781-1642 ..... A•1916
† A.S.I. Microsystems, Inc., (Formerly Andrich Systems, Inc.), Bohemia, NY 11716 516-589-5656
AVX Corporation, A Kyocera Group Company, Myrtle Beach, SC 29577 803-448-9411
§† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635 714-447-2300
† BG Electronics, EPC Corp., Mt. Vernon, NY 10550-4430 914-664-5591
§ Bourns, Inc., Electronic Components Sls., Riverside, CA 92507-2114 ..... 909-781-5500; 801-750-7200
Burr-Brown Corp., Tucson, AZ 85734 602-746-1111
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 402-563-6506
Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242 402-371-0080
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
† ESC Electronics Corp., Palisades Pk., NJ 07650 201-947-0400
† Film Microelectronics Inc., Peabody, MA 01960 508-532-9913
† Frequency Selective Networks, Woodside, NY 11377 718-424-7500
General Resistance, A Prime Technology Company, N. Branford, CT 06471 203-481-5721
† Hisonic, Inc., Olathe, KS 66051 913-782-0012
Hokuriku USA Ltd., Madison, AL 35758 205-772-9620
† Hybrid Designs, Inc., Costa Mesa, CA 92626 714-557-9933
† Integrated Microwave, San Diego, CA 92121-1009 619-259-2600
† International Resistive Company, Boone, NC 28607 704-264-8861
Kelvin Industries, Inc., Sherman Oaks, CA 91403-3501 818-990-1192
† KRL/Bantry Components, Inc., Manchester, NH 03103 603-668-3210
Marc Enterprises, Laguna Niguel, CA 92677 714-249-0302
Meissner Industries, Dover, NJ 07801 201-366-1700
MICRO DATA SYSTEMS, Thomasville, GA 31799 912-226-1709
† Microplex, Inc., Anaheim, CA 92806 714-634-1535
Mini-Systems, Inc., Sunbelt Microelectronic Division, Deltona, FL 32725 407-574-0208
Precision Resistive Products, Inc., Mediapolis, IA 52637 319-394-9131
§ Raltron Electronics, Miami, FL 33172 305-593-6033
§† RCD Components, Inc., Manchester, NH 03109 603-669-0054
Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013 615-641-2020
† Sipex Corp., Billerica, MA 01821 508-667-8700
Sprague, Hudson, NH 03051 ..... 603-881-7200; 603-883-9774 (Mktg)
† Tech Laboratories Inc., Palisades Pk., NJ 07650 201-944-2221
Tepro of Florida, Clearwater, FL 34623 813-796-1044
† TTE, Incorporated, W. Los Angeles, CA 90064-1400 ..... 310-478-8224;800-776-7614
† Vishay Resistors, Malvern, PA 19355 215-644-1300

Networks, LC-2700

Allen Avionics, Inc., Mineola, NY 11501, 516-248-8080 ..... A•1619
Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ..... A•1623
† KR Electronics, Inc., Avenel, NJ 07001, 908-636-1900 ..... A•1648
Mills Resistor Co., Los Alamitos, CA 90720, 310-598-2454 ..... A•1987
† Piconics, Incorporated, Tyngsboro, MA 01879, 508-649-7501 ..... A•2013
Techno Division, Dale Electronics, Van Nuys, CA 91405-1139, 818-781-1642 ..... A•1916
† Alpha Components, Mechanicsburg, PA 17055 717-697-8595
† BG Electronics, EPC Corp., Mt. Vernon, NY 10550-4430 914-664-5591
† Chesterfield Products, Inc., Microwave Filter Co., Inc., East Syracuse, NY 13057 ..... 800-666-9655;315-463-2309
Control Components & Systems, Inc., Pittsburgh, PA 15235 412-371-1111
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 402-563-6506
Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242 402-371-0080
Design Automation, Inc., Lexington, MA 02173-3992 617-862-8998
Electrocom Industries, S. Bend, IN 46615 219-232-2743
† Electronic Precision Components, Mt. Vernon, NY 10550-4430 914-664-2333
† Electronic Transformer Corp., Paterson, NJ 07544-0487 201-942-2222
Engineered Components Co., San Luis Obispo, CA 93403-8121 805-544-3800
† ESC Electronics Corp., Palisades Pk., NJ 07650 201-947-0400
EWC, Inc., Englishtown, NJ 07726 908-446-3110
Fee Fil-Mag, San Diego, CA 92123 619-569-6577
† Freed Transformer Co., Inc., Electronic Transformer Corp., Paterson, NJ 07544-0487 201-942-2222
† Frequency Selective Networks, Woodside, NY 11377 718-424-7500
† Genisco Electronics, A Division of GTC, Anaheim, CA 92805 714-563-4300
† Hisonic, Inc., Olathe, KS 66051 913-782-0012
Hokuriku USA Ltd., Madison, AL 35758 205-772-9620
† Integrated Microwave, San Diego, CA 92121-1009 619-259-2600
† Magnetico Inc., Holtsville, NY 11742 516-654-1166
Ohmtek Inc., Vishay, Niagara Falls, NY 14304 716-283-4025
† Plastic Capacitors, Inc., Chicago, IL 60639 312-489-2229
Pulse Engineering, Inc., San Diego, CA 92128 619-674-8100
§† RCD Components, Inc., Manchester, NH 03109 603-669-0054
Rtron Corp., Skokie, IL 60076 708-679-7180
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
† TTE, Incorporated, W. Los Angeles, CA 90064-1400 ..... 310-478-8224;800-776-7614

Networks, Line Impedance Stabilization-1900 — *See Vol. D*

Networks, Matching-1900 — *See Vol. D*

Networks, Phase-2700

† KR Electronics, Inc., Avenel, NJ 07001, 908-636-1900 ..... A•1648
† Alpha Components, Mechanicsburg, PA 17055 717-697-8595
† BG Electronics, EPC Corp., Mt. Vernon, NY 10550-4430 914-664-5591
§† California Micro Devices, Inc., Milpitas, CA 95035 408-263-3214
Control Components & Systems, Inc., Pittsburgh, PA 15235 412-371-1111
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 402-563-6506
§† Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242 402-371-0080
Electronic Precision Components, Mt. Vernon, NY 10550-4430 914-664-2333
Engineered Components Co., San Luis Obispo, CA 93403-8121 805-544-3800
† ESC Electronics Corp., Palisades Pk., NJ 07650 201-947-0400
† Frequency Selective Networks, Woodside, NY 11377 718-424-7500
† Hisonic, Inc., Olathe, KS 66051 913-782-0012
† Merrimac Industries, West Caldwell, NJ 07006 201-575-1300
† TTE, Incorporated, W. Los Angeles, CA 90064-1400 ..... 310-478-8224;800-776-7614
† Velonex, Santa Clara, CA 95050 408-727-7370
Vishay Resistors, Malvern, PA 19355 215-644-1300

Networks, Pulse Forming-2700

† Del Electronics Corp., Valhalla, NY 10595, 914-686-3600 ..... A•1158
† KR Electronics, Inc., Avenel, NJ 07001, 908-636-1900 ..... A•1648
† Automatic Coil Corp., Miami, FL 33147 305-696-6660
† Axel Electronics, Inc., Subsidiary of FPBSM Industries Inc., Rancho Dominquez, CA 90220 718-291-3900
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 402-563-6506
Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242 402-371-0080
Electronic Precision Components, Mt. Vernon, NY 10550-4430 914-664-2333
Engineered Components Co., San Luis Obispo, CA 93403-8121 805-544-3800
† Frequency Selective Networks, Woodside, NY 11377 718-424-7500
Hipotronics Inc., Brewster, NY 10509 914-279-8091
† International Sensor Systems, Inc., Aurora, NE 68818 402-694-6111
† Maxwell Laboratories, Inc., San Diego, CA 92123-1506 619-279-5100
† Plastic Capacitors, Inc., Chicago, IL 60639 312-489-2229
† Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
† Radio Research Instrument Co., Inc., Waterbury, CT 06704-3506 203-753-5840
† Standard Magnetic Corp., Garden Grove, CA 92641 714-379-5671
† Stanley Electronics Div., Mt. Vernon, NY 10550 914-699-2000
† Tobe Deutschmann Labs., Inc., Canton, MA 02021 617-828-3366
† TTE, Incorporated, W. Los Angeles, CA 90064-1400 ..... 310-478-8224;800-776-7614
Vishay Resistors, Malvern, PA 19355 215-644-1300

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Networks, RC-4700

§ ASC Capacitors, Ogallala, NE 69153, 308-284-3611 ..... A•1016-1018
§ Bourns, Inc., Electronic Components Sls., Riverside, CA 92507-2114, 909-781-5500;801-750-7200 ..... A•1869-1871,1874
§ Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242, 402-371-0080 ..... A•1915
§ Electrocube, Monrovia, CA 91016, 818-301-0122 ..... A•1067
† Electro-Films, Inc., Warwick, RI 02886, 401-738-9150 ..... A•1933
K & M Electronics Inc., W. Springfield, MA 01089, 413-781-1350 ..... A•1957
† KR Electronics, Inc., Avenel, NJ 07001, 908-636-1900 ..... A•1648
Mills Resistor Co., Los Alamitos, CA 90720, 310-598-2454 ..... A•1987
§ Okaya Electric America, Inc., Okaya Electric Industries, Tokyo, Japan, Valparaiso, IN 46383, 219-477-4488 ..... A•1140
† Piconics, Incorporated, Tyngsboro, MA 01879, 508-649-7501 ..... A•2013
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•2019
† State of the Art, Inc., State College, PA 16803-1797, 814-355-8004 ..... A•2020

Techno Division, Dale Electronics, Van Nuys, CA 91405-1139, 818-781-1642 ..... **A•1916**
Tepro of Florida, Clearwater, FL 34623, 813-796-1044 ..... **A•2034**
ACC Electronics Company, Echlin Inc., Independence, KS 67301 316-331-1000
† A.S.I. Microsystems, Inc., (Formerly Andrich Systems, Inc.); Bohemia, NY 11716 516-589-5656
AVX Corporation, A Kyocera Group Company, Myrtle Beach, SC 29577 803-448-9411
§† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635 714-447-2300
† BG Electronics, EPC Corp., Mt. Vernon, NY 10550-4430 914-664-5591
§† CTS Corporation, Elkhart, IN 46514 219-293-7511
CTS Corp., Resistor Networks, Berne, IN 46711 219-589-3111
§ Custom Electronics, Oneonta, NY 13820 607-432-3880
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 402-563-6506
† Del Electronics Corp., Valhalla, NY 10595 914-686-3600
§ Electronic Film Capacitors, Inc., Waterbury, CT 06705 203-755-5629
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Engineered Components Co., San Luis Obispo, CA 93403-8121 805-544-3800
Fee Fil-Mag, San Diego, CA 92123 619-569-6577
† Frequency Selective Networks, Woodside, NY 11377 718-424-7500
Hokuriku USA Ltd., Madison, AL 35758 205-772-9620
† Hybrid Designs, Inc., Costa Mesa, CA 92626 714-557-9933
§ International Resistive Company, Boone, NC 28607 704-264-8861
† International Sensor Systems, Inc., Aurora, NE 68818 402-694-6111
Kelvin Industries, Inc., Sherman Oaks, CA 91403-3501 818-990-1192
KOA Speer Electronics, Bradford, PA 16701 814-362-5536
† KRL/Bantry Components, Inc., Manchester, NH 03103 603-668-3210
LTI, Inc., Autotech Technologies, LP, Carol Stream, IL 60188 708-668-8886
† Marc Enterprises, Laguna Niguel, CA 92677 714-249-0302
Meissner Industries, Dover, NJ 07801 201-366-1700
† Micro Hybrids, Inc., Medford, NY 11763 516-732-3448
† Microplex, Inc., Anaheim, CA 92806 714-634-1535
Mini-Systems, Inc., Sunbelt Microelectronic Division, Deltona, FL 32725 407-574-0208
† Northwest Microcircuits, Inc., Philomath, OR 97370 503-929-6424
Ohmtek Inc., Vishay, Niagara Falls, NY 14304 716-283-4025
§ Raltron Electronics, Miami, FL 33172 305-593-6033
Reliable Electronic Mfg., Wyvern Technologies, Santa Ana, CA 92705 714-966-0710
Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013 615-641-2020
Rtron Corp., Skokie, IL 60076 708-679-7180
† Southern Electronic, F-Dyne, Burbank, CA 91502 818-845-2458
Sprague, Hudson, NH 03051 ..... 603-881-7200; 603-883-9774 (Mktg)
§† Standard Condenser Corp., Skokie, IL 60076 708-675-3133
† TTE, Incorporated, W. Los Angeles, CA 90064-1400 ..... 310-478-8224;800-776-7614
† United Supertek, Inc., San Jose, CA 95131-1101 408-922-0730
Vishay Resistors, Malvern, PA 19355 215-644-1300

Networks, Resistance-4700

Advanced Thermistor Div., U.S. Sensor Corp., Orange, CA 92667, 714-639-1000 ..... **B•1860**
Allen Co., Inc., Robert G., N. Hollywood, CA 91605, 818-765-8300;800-827-7422 ..... **A•1862-1863**
AVX Corporation, A Kyocera Group Company, Myrtle Beach, SC 29577, 803-448-9411 ..... **A•1867**
§† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635, 714-447-2300 ..... **A•1868**
§ Bourns, Inc., Electronic Components Sls., Riverside, CA 92507-2114, 909-781-5500;801-750-7200 ..... **A•1869-1871,1873**
§ Caddock Electronics, Inc., Riverside, CA 92507, 909-788-1700 ..... **A•1877**
§ CTS Corp., Resistor Networks, Berne, IN 46711, 219-589-3111 ..... **A•1908**
§† Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242, 402-371-0080 ..... **A•1910,1912-1915**
† Electro-Films, Inc., Warwick, RI 02886, 401-738-9150 ..... **A•1932-1933**
International Manufacturing Services, Portsmouth, RI 02871-2418, 401-683-9700 ..... **A•1944**
† International Sensor Systems, Inc., Aurora, NE 68818, 402-694-6111 ..... **A•1704-1705**
Isotek Corporation, Swansea, MA 02777, 508-673-2900 ..... **A•1953-1954**
† Julie Research Labs., New York, NY 10001, 212-633-6625 .. **A•1956, D•1279-1280**
Ketema/Rodan Division, Anaheim, CA 92806, 714-630-0081 ..... **B•1876**
§ KOA Speer Electronics, Bradford, PA 16701, 814-362-5536 ... **A•1959,1967,1971**
† Micro-Precision Technologies, Inc., Salem, NH 03079, 603-893-7600 .... **A•1703**
Mills Resistor Co., Los Alamitos, CA 90720, 310-598-2454 ..... **A•1987**
† Mini-Systems, Inc., Thick/Thin Film Division, North Attleboro, MA 02761, 508-695-0203 ..... **A•1993**
§ Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ..... **A•1995**
† Ohmtek Inc., Vishay, Niagara Falls, NY 14304, 716-283-4025 ..... **A•2001, 2005-2004**
§ Paccom Electronics, Redmond, WA 98052-5350, 206-883-9200;800-426-6254 ..... **A•2005**
† Piconics, Incorporated, Tyngsboro, MA 01879, 508-649-7501 ..... **A•2013**
Precision Resistive Products, Inc., Mediapolis, IA 52637, 319-394-9131 .. **A•2014**
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... **A•2019**
Solitron Devices, Inc., Semiconductor Group, West Palm Beach, FL 33407-4697, 407-848-4311 ..... **A•2219**
§† State of the Art, Inc., State College, PA 16803-1797, 814-355-8004 ..... **A•2020,2025-2027**
Techno Division, Dale Electronics, Van Nuys, CA 91405-1139, 818-781-1642 ..... **A•1916**
Tepro of Florida, Clearwater, FL 34623, 813-796-1044 ..... **A•2034**
§† Vishay Resistors, Malvern, PA 19355, 215-644-1300 ..... **A•2046-2048**
ACC Electronics Company, Echlin Inc., Independence, KS 67301 316-331-1000
§ Augat Alcoswitch, Augat Inc., Attleboro Falls, MA 02763 508-699-9800
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
§† California Micro Devices, Inc., Milpitas, CA 95035 408-263-3214
Clarostat Sensors and Controls Group, BYR, PLC, Plano, TX 75075 ..... 214-422-1844; 1-800-872-0044
§† CTS Corporation, Elkhart, IN 46514 219-293-7511
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 402-563-6506
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Fee Fil-Mag, San Diego, CA 92123 619-569-6577
† General Resistance, A Prime Technology Company, N. Branford, CT 06471 203-481-5721
Hokuriku USA Ltd., Madison, AL 35758 205-772-9620
† Hybrid Designs, Inc., Costa Mesa, CA 92626 714-557-9933
† Hycomp, Inc., Marlborough, MA 01752 508-485-6300
§ International Components Corp., Melville, NY 11747 516-293-1500
International Microelectronics, Arlington, TX 76003 817-473-1730
§† International Resistive Company, Boone, NC 28607 704-264-8861
§ IRC-Shallcross, Smithfield, NC 27577 919-934-5181
§ Jaro Components, Inc., Boca Raton, FL 33487-8295 407-241-8600
Kelvin Industries, Inc., Sherman Oaks, CA 91403-3501 818-990-1192
Keystone Carbon, Thermistor Div., St. Marys, PA 15857 814-781-1591
† KRL/Bantry Components, Inc., Manchester, NH 03103 603-668-3210
LTI, Inc., Autotech Technologies, LP, Carol Stream, IL 60188 708-668-8886
Marc Enterprises, Laguna Niguel, CA 92677 714-249-0302
Meissner Industries, Dover, NJ 07801 201-366-1700
§ Micro-Ohm Corp., Duarte, CA 91010 818-3575377
† Microplex, Inc., Anaheim, CA 92806 714-634-1535
Mini-Systems, Inc., Sunbelt Microelectronic Division, Deltona, FL 32725 407-574-0208
Mouser Electronics, Santee, CA 92071 800-346-6873
Mouser Electronics, Mansfield, TX 76063 800-346-6873
Mouser Electronics, Gilroy, CA 95020 800-346-6873
MTI International Inc., Menomonee Falls, WI 53051 414-783-6080
§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
Nedco Electronics, Inc., Morton Grove, IL 60053 708-967-0500
NIC Components Corp., N. Amityville, NY 11701 516-226-7500
† Northwest Microcircuits, Inc., Philomath, OR 97370 503-929-6424
Peca, Inc., Bensalem, PA 19020 215-245-1550
Peter Parts & Assocs., Webster, NY 14580 716-265-2540
§ Raltron Electronics, Miami, FL 33172 305-593-6033
Reliable Electronic Mfg., Wyvern Technologies, Santa Ana, CA 92705 ... 714-966-0710
§ RF Electronics, Inc., Irvine, CA 92714-5517 714-263-0661
§ Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013 615-641-2020
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
Sprague, Hudson, NH 03051 ..... 603-881-7200; 603-883-9774 (Mktg)
† Tech Laboratories Inc., Palisades Pk., NJ 07650 201-944-2221
† United Supertek, Inc., San Jose, CA 95131-1101 408-922-0730
U.S. Sensor Corp., Orange, CA 92667 714-639-1000
U.S. Sensor Corp., Orange, CA 92667 714-639-1000
Victoreen, Inc., Solon, OH 44139-3395 ..... 216-248-9300;216-248-9043
Wilbrecht Electronics, St. Paul, MN 55107 612-222-2791

Networks, Resistance, Trimmer-4700

Allen Co., Inc., Robert G., N. Hollywood, CA 91605, 818-765-8300;800-827-7422 ..... **A•1862-1863**
Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635, 714-447-2300 ..... **A•1868**
Electro-Films, Inc., Warwick, RI 02886, 401-738-9150 ..... **A•1932-1933**
Paccom Electronics, Redmond, WA 98052-5350, 206-883-9200;800-426-6254 ..... **A•2005**
Precision Resistive Products, Inc., Mediapolis, IA 52637, 319-394-9131 .. **A•2014**
Clarostat Sensors and Controls Group, BYR, PLC, Plano, TX 75075 ..... 214-422-1844; 1-800-872-0044
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 402-563-6506
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Hokuriku USA Ltd., Madison, AL 35758 205-772-9620
§ Nepenthe, Inc., Palo Alto, CA 94303 415-496-6666
Raltron Electronics, Miami, FL 33172 305-593-6033
Tepro of Florida, Clearwater, FL 34623 813-796-1044

Networks, Resistance, Voltage Divider-4700

§† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635, 714-447-2300 ..... **A•1868**
§ Caddock Electronics, Inc., Riverside, CA 92507, 909-788-1700 ..... **A•1877**
§† Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242, 402-371-0080 ..... **A•1915**
IET Labs, Inc., Westbury, NY 11590, 516-334-5959;800-899-8438 ... **D•1266-1270**
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... **A•2019**
State of the Art, Inc., State College, PA 16803-1797, 814-355-8004 ..... **A•2020**
§ Techno Division, Dale Electronics, Van Nuys, CA 91405-1139, 818-781-1642 ..... **A•1916**
Bertan High Voltage, Hicksville, NY 11801 516-433-3110
§ Bourns, Inc., Electronic Components Sls., Riverside, CA 92507-2114 ..... 909-781-5500; 801-750-7200
§† California Micro Devices, Inc., Milpitas, CA 95035 408-263-3214
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 402-563-6506
† Electro-Films, Inc., Warwick, RI 02886 401-738-9150
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Glassman High Voltage Inc., Whitehouse Sta., NJ 08889 908-534-9007
Hipotronics Inc., Brewster, NY 10509 914-279-8091
Hokuriku USA Ltd., Madison, AL 35758 205-772-9620
Kelvin Industries, Inc., Sherman Oaks, CA 91403-3501 818-990-1192
Marc Enterprises, Laguna Niguel, CA 92677 714-249-0302
MTI International Inc., Menomonee Falls, WI 53051 414-783-6080
Northwest Microcircuits, Inc., Philomath, OR 97370 503-929-6424

§ Raltron Electronics, Miami, FL 33172 305-593-6033
Reliable Electronic Mfg., Wyvern Technologies, Santa Ana, CA 92705 ... 714-966-0710
Tepro of Florida, Clearwater, FL 34623 813-796-1044
Victoreen, Inc., Solon, OH 44139-3395 ..... 216-248-9300;216-248-9043
Wilbrecht Electronics, St. Paul, MN 55107 612-222-2791

Networks, Video-2700

Allen Avionics, Inc., Mineola, NY 11501, 516-248-8080 ..... A•1619
† KR Electronics, Inc., Avenel, NJ 07001, 908-636-1900 ..... A•1648
Alpha Components, Mechanicsburg, PA 17055 717-697-8595
§ Artel Communications Corp., Hudson, MA 01749 508-562-2100

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Noise Sources-2900 — *See Vol. D*

Nuclear EMP (NEMP) Protectors-4300 — *See Vol. B*

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Optical Radiation Measuring-2900 — *See Vol. D*

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Optocouplers-3700 — *See Vol. B*

Oscillators, Audio (Module)-1300 — *See Vol. D*

Oscillators, Audio (Test) — See Generators, Audio (Vol. D)

Oscillators, Crystal, Clock-2300

† Anderson Electronics, Hollidaysburg, PA 16648, 814-695-4428 ..... A•1333
§ AT&T Microelectronics, Allentown, PA 18103, 1-800-372-2447;In Can.:1-800-553-2448 ..... A•1334
AVX Corporation, A Kyocera Group Company, Myrtle Beach, SC 29577, 803-448-9411 ..... A•1336
† Bliley Electric Co., Erie, PA 16506, 814-838-3571 ..... A•1345
§ Bomar Crystal Company, Middlesex, NJ 08846, 908-356-7787;800-526-3935 ..... A•1346
§ Champion Technologies, Inc., Franklin Park, IL 60131, 708-451-1000 .... A•1347
§ Comclok, Inc., Anaheim, CA 92801, 714-991-1580;800-333-9825 ..... A•1349
† Connor-Winfield Corp., Aurora, IL 60505-1335, 708-851-4722 ..... A•1350,1353
§† CTS Corp., Frequency Controls, Sandwich, IL 60548, 815-786-8411 ..... A•1366-1372,1376-1377
§ Dale Electronics, Inc., Tempe Div., Tempe, AZ 85282-1883, 602-967-7874 ..... A•1379-1381
Ecliptek Corporation, Costa Mesa, CA 92626, 714-433-1200 .. A•1383,1385,1387
§ Epson America Inc., Component Sales Dept., Torrance, CA 90503, 310-782-5318 ..... A•1390-1391,1394-1395, B•1061
§ Fox Electronics, Ft. Myers, FL 33905, 813-693-0099 ..... A•1399-1401
† Frequency Electronics, Inc., Mitchel Field, NY 11553, 516-794-4500 ..... A•1402
FTS/AUSTRON, Austin, TX 78761-4766, 512-251-2341 ..... A•1405
§† Hybrids International Ltd., Thick Film Division, Olathe, KS 66062, 913-764-6400 ..... A•1406-1407
Hy-Q International (USA) Inc., Erlanger, KY 41018, 606-283-5000 ..... A•1408
† McCoy/Ovenaire/Spectrum, A Sub. of Oak Industries, Mt. Holly Springs, PA 17065, 717-486-3411 ..... A•1414-1415
§† MF Elctrns. Corp., New Rochelle, NY 10801, 914-576-6570 ..... A•1419
Micro Crystal/Division SMH, Arlington Heights, IL 60005, 708-806-1485 ..... A•1423
§† Monitor Products Co., Inc., Oceanside, CA 92054, 619-433-4510 ..... A•1424-1426,1428-1429
§ Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ..... A•1434
§ NDK America, Inc., Fremont, CA 94539, 415-623-6500 ..... A•1440
† Oscillatek, A Dover Technologies Company, Olathe, KS 66062, 913-829-1777 ..... A•1442-1443
§ Pletronics, Inc., Lynnwood, WA 98036, 206-776-1880 ..... A•1450-1455
† Q-Tech Corp., Culver City, CA 90232-3510, 310-836-7900 .... A•1456-1457,1459
§ Raltron Electronics, Miami, FL 33172, 305-593-6033 ..... A•1460
† Reeves-Hoffman Div., Dynamics Corporation of America, Carlisle, PA 17013-2248, 717-243-5929 ..... A•1465
§# R X D Inc., Relm Communications, Norfolk, NE 68701, 402-379-0112;800-228-8108 ..... A•1470-1472
§ SARONIX, Palo Alto, CA 94303, 415-856-6900 ..... A•1476-1479
§ Seiko Instruments U.S.A., Inc. Electronic Components, Torrance, CA 90505, 310-517-7770 ..... A•1480
§ Standard Crystal Corporation, El Monte, CA 91731, 818-443-2121 ..... A•1481

§† Statek Corp., Orange, CA 92668, 714-639-7810 ..... A•1483
TOYOCOM USA INC., Arlington Heights, IL 60005, 708-593-8780 / 1-800-TOYOCOM ..... A•1485-1488
TTE Frequency Devices, Ltd., Bohemia, NY 11716, 516-589-7789 ... A•1496-1498
† Vectron Laboratories, Inc., Norwalk, CT 06856-5160, 203-853-4433 ..... A•1502-1503,1508
† Xsis Electronics, Inc., Shawnee, KS 66216, 913-631-0448 ..... A•1511
Bel Fuse, Jersey City, NJ 07302 201-432-0463
§ Benchmarq Microelectronics, Inc., Carrollton, TX 75006 214-407-0011
Blackhawk Networks Corp., Janesville, WI 53545 608-752-8701
Cal Crystal Lab., Inc., Anaheim, CA 92801 ..... 714-991-1580;800-333-9825
§† CTS Corporation, Elkhart, IN 46514 219-293-7511
§† Data Delay Devices, Clifton, NJ 07013-1915 201-773-2299
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Engineered Components Co., San Luis Obispo, CA 93403-8121 805-544-3800
Frequency & Time Systems, Inc., Datum, Inc., Beverly, MA 01915 508-927-8220
† Greenray Inds., Inc., Mechanicsburg, PA 17055 717-766-0223
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
† Hughes Microelectronic Circuits Division, Newport Beach, CA 92658-8903 714-759-2952
§† Hybrids International, Frequency Products Div., Olathe, KS 66062 913-764-4544
Integrity Technology Corporation, Santa Clara, CA 95050 408-262-8640
International Microelectronics, Arlington, TX 76003 817-473-1730
Jan Crystals, Bob Whan and Son Electronics, Ft. Myers, FL 33907 ..... 813-936-2397; 1-800-526-9825
§† KDS America, Daishinku Corp., Overland Pk., KS 66211 913-491-6825
Micronetics, Hudson, NH 03051 603-883-2900
Mouser Electronics, Santee, CA 92071 800-346-6873
Mouser Electronics, Mansfield, TX 76063 800-346-6873
Mouser Electronics, Gilroy, CA 95020 800-346-6873
§† M-Tron Industries, Yankton, SD 57078 605-665-9321
§† NEL Frequency Controls, Inc., Burlington, WI 53105 414-763-3591
§ North American Capacitor Co., Indianapolis, IN 46224 317-273-0090
† Piezo Technology Inc., Orlando, FL 32804 407-298-2000
† Savoy Electronics, Inc., Ft. Lauderdale, FL 33310 ..... 305-563-1333;800-359-5400
Spectrum Technology, Inc., DATUM, Incorporated, Santa Barbara, CA 93111 805-964-7791
Stetron International, Inc., Buffalo, NY 14203 716-854-3443
† ST Microsonics Corp., Subsidiary of Signal Technology Corporation, Weymouth, MA 02188 617-337-4200
ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086 408-730-6300
† Time and Frequency Ltd., Miami, FL 33172 305-593-8000
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
United States Crystal Corp., Fort Worth, TX 76110 ..... 817-921-3014;800-433-7140
USAPEX Corp., Santa Clara, CA 95051 408-982-9063
§ Valpey-Fisher:Matec Corp, Hopkinton, MA 01748 508-435-6831
§ West Electronic Sales Team, Huntington Beach, CA 92647 ..... 714-375-6500; 310-495-5569

Oscillators, Crystal Controlled (Module)-2300

Abracon Corporation, San Clemente, CA 92673, 714-498-4505 ..... A•1330-1331
† Anderson Electronics, Hollidaysburg, PA 16648, 814-695-4428 ..... A•1333
§ AT&T Microelectronics, Allentown, PA 18103, 1-800-372-2447;In Can.:1-800-553-2448 ..... A•1334-1335
† Bliley Electric Co., Erie, PA 16506, 814-838-3571 ..... A•1341-1342
§ Champion Technologies, Inc., Franklin Park, IL 60131, 708-451-1000 .... A•1347
§ Comclok, Inc., Anaheim, CA 92801, 714-991-1580;800-333-9825 ..... A•1349
† Connor-Winfield Corp., Aurora, IL 60505-1335, 708-851-4722 ..... A•1353
† CTS Corp., Frequency Controls, Sandwich, IL 60548, 815-786-8411 ..... A•1358-1368,1376-1377
§ Dale Electronics, Inc., Tempe Div., Tempe, AZ 85282-1883, 602-967-7874 ..... A•1379,1381
Ecliptek Corporation, Costa Mesa, CA 92626, 714-433-1200 .. A•1383,1385,1387
Epson America Inc., Component Sales Dept., Torrance, CA 90503, 310-782-5318 ..... A•1389-1391,1393-1395, B•1061
§ Fox Electronics, Ft. Myers, FL 33905, 813-693-0099 ..... A•1397,1399-1401
† Frequency Electronics, Inc., Mitchel Field, NY 11553, 516-794-4500 ..... A•1402-1403
FTS/AUSTRON, Austin, TX 78761-4766, 512-251-2341 ..... A•1405
Hy-Q International (USA) Inc., Erlanger, KY 41018, 606-283-5000 ..... A•1408
International Crystal Mfg., Oklahoma City, OK 73126-0330, 405-236-3741;1-800-725-1426 ..... A•1409
† Isotemp Research, Inc., Charlottesville, VA 22903, 804-295-3101 ... A•1410-1411
† McCoy/Ovenaire/Spectrum, A Sub. of Oak Industries, Mt. Holly Springs, PA 17065, 717-486-3411 ..... A•1413,1415-1416
§† MF Elctrns. Corp., New Rochelle, NY 10801, 914-576-6570 ..... A•1419
§† Monitor Products Co., Inc., Oceanside, CA 92054, 619-433-4510 ... A•1424-1425
§ M-Tron Industries, Yankton, SD 57078, 605-665-9321 ..... A•1431
§† Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 .. A•1432-1434
Musashino Corporation, Mission Viejo, CA 92691, 714-458-1155 ... A•1437,1439
NDK America, Inc., Fremont, CA 94539, 415-623-6500 ..... A•1440-1441
† Oscillatek, A Dover Technologies Company, Olathe, KS 66062, 913-829-1777 ..... A•1442-1443,1448
§ Pletronics, Inc., Lynnwood, WA 98036, 206-776-1880 ... A•1449,1452-1453,1455
† Q-Tech Corp., Culver City, CA 90232-3510, 310-836-7900 ..... A•1456-1459
§ Raltron Electronics, Miami, FL 33172, 305-593-6033 ..... A•1461-1462
† Reeves-Hoffman Div., Dynamics Corporation of America, Carlisle, PA 17013-2248, 717-243-5929 ..... A•1465-1469
§ SARONIX, Palo Alto, CA 94303, 415-856-6900 ..... A•1474,1476-1479
§ Seiko Instruments U.S.A., Inc. Electronic Components, Torrance, CA 90505, 310-517-7770 ..... A•1480
§† Statek Corp., Orange, CA 92668, 714-639-7810 ..... A•1483

TOYOCOM USA INC., Arlington Heights, IL 60005, 708-593-8780/1-800-TOYOCOM ... A•1484-1488,1491-1493
† **TRAK Microwave Corp., Tampa, FL 33634, 813-884-1411 ... A•1852**
TTE Frequency Devices, Ltd., Bohemia, NY 11716, 516-589-7789 ... A•1497-1498
† **Vectron Laboratories, Inc., Norwalk, CT 06856-5160, 203-853-4433 ... A•1502-1503,1505,1507-1508**
† **Wenzel Associates, Inc., Austin, TX 78752, 512-450-1400 ... A•1510**
† **Xsis Electronics, Inc., Shawnee, KS 66216, 913-631-0448 ... A•1511**
† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950 ... 201-539-5500
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 ... 800-523-3808
† Berkeley Nucleonics Corp., Richmond, CA 94804 ... 510-234-1100
Blackhawk Networks Corp., Janesville, WI 53545 ... 608-752-8701
Cal Crystal Lab., Inc., Anaheim, CA 92801 ... 714-991-1580;800-333-9825
† Comstron A Div. of Aeroflex, Plainview, NY 11803 ... 516-752-2351
† CTS Corporation, Elkhart, IN 46514 ... 219-293-7511
† CTS of Canada, Ltd., Streetsville, ONTARIO, CAN. L5M 1Y9 ... 416-826-1141
Datum Timing, Datum Inc., Anaheim, CA 92806-5790 ... 714-533-6333
† EG & G Frequency Products Inc., EG & G Inc., Cincinnati, OH 45232 ... 513-542-5555
† Electronic Research Co., Overland Park, KS 66204 ... 913-631-6700
Elgar Electronics Corporation, San Diego, CA 92121 ... 619-450-0085;800-733-5427
† Frequency & Time Systems, Inc., Datum, Inc., Beverly, MA 01915 ... 508-927-8220
§† FSI/Fork Standards, Inc., Lombard, IL 60148-2097 ... 708-932-9380;800-468-6009
§† Gorman-Redlich Mfg. Co., Athens, OH 45701 ... 614-593-3150
† Greenray Inds., Inc., Mechanicsburg, PA 17055 ... 717-766-0223
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 ... 800-452-4844
† Hughes Microelectronic Circuits Division, Newport Beach, CA 92658-8903 ... 714-759-2952
§† Hybrids International, Frequency Products Div., Olathe, KS 66062 ... 913-764-4544
† Hytek Microsystems, Inc., Carson City, NV 89706 ... 702-883-0820
§ KCK America Inc., Mitsubishi Materials Corporation, Rolling Meadows, IL 60008 ... 708-577-0200
§† KDS America, Daishinku Corp., Overland Pk., KS 66211 ... 913-491-6825
† Lucas Zeta, Lucas Aerospace, Inc., San Jose, CA 95134 ... 408-434-3600
MACOM, Inc., Lowell, MA 01851 ... 617-272-3000
Micro Crystal/Division SMH, Arlington Heights, IL 60005 ... 708-806-1485
Micronetics, Hudson, NH 03051 ... 603-883-2900
† Microsonics, Inc., Weymouth, MA 02188 ... 617-337-4200
† MITEQ Inc., Hauppauge, NY 11788 ... 516-436-7400
§ NEL Frequency Controls, Inc., Burlington, WI 53105 ... 414-763-3591
† Ovenaire-Audio-Carpenter, Oak Crystal Inc., Charlottesville, VA 22901 ... 804-977-8050
† Piezo Crystal Co., Carlisle, PA 17013 ... 717-249-2151
† Piezo Technology Inc., Orlando, FL 32804 ... 407-298-2000
§# R X D Inc., Reim Communications, Norfolk, NE 68701 ... 402-379-0112;800-228-8108
† Savoy Electronics, Inc., Ft. Lauderdale, FL 33310 ... 305-563-1333;800-359-5400
Sensor Corp., Scottdale, PA 15683 ... 412-887-4080
† Solid State Electronics Corp., Northridge, CA 91324 ... 818-993-8257
§ Spectrum Control, Inc., Erie, PA 16506 ... 814-835-4000
† Spectrum Technology, Inc., DATUM, Incorporated, Santa Barbara, CA 93111 ... 805-964-7791
Standard Crystal Corporation, El Monte, CA 91731 ... 818-443-2121
Stetron International, Inc., Buffalo, NY 14203 ... 716-854-3443
ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086 ... 408-730-6300
† Techtrol Cyclonetics, Inc., New Cumberland, PA 17070 ... 717-774-2746
† Teledyne Microwave, Mountain View, CA 94043 ... 415-968-2211
† Time and Frequency Ltd., Miami, FL 33172 ... 305-593-8000
§ Valpey-Fisher:Matec Corp, Hopkinton, MA 01748 ... 508-435-6831

Oscillators, Crystal, Digitally Compensated Crystal (DCXO)-2300

Anderson Electronics, Hollidaysburg, PA 16648, 814-695-4428 ... A•1333
AT&T Microelectronics, Allentown, PA 18103, 1-800-372-2447;In Can.:1-800-553-2448 ... A•1335
Connor-Winfield Corp., Aurora, IL 60505-1335, 708-851-4722 ... A•1350,1352
Ecliptek Corporation, Costa Mesa, CA 92626, 714-433-1200 ... A•1383,1385,1387
Fox Electronics, Ft. Myers, FL 33905, 813-693-0099 ... A•1397
† **Frequency Electronics, Inc., Mitchel Field, NY 11553, 516-794-4500 ... A•1403**
Hy-Q International (USA) Inc., Erlanger, KY 41018, 606-283-5000 ... A•1408
McCoy/Ovenaire/Spectrum, A Sub. of Oak Industries, Mt. Holly Springs, PA 17065, 717-486-3411 ... A•1415-1416
MF Elctrns. Corp., New Rochelle, NY 10801, 914-576-6570 ... A•1419
Musashino Corporation, Mission Viejo, CA 92691, 714-458-1155 ... A•1437,1439
Oscillatek, A Dover Technologies Company, Olathe, KS 66062, 913-829-1777 ... A•1442
TOYOCOM USA INC., Arlington Heights, IL 60005, 708-593-8780/1-800-TOYOCOM ... A•1484,1491,1493
† **Vectron Laboratories, Inc., Norwalk, CT 06856-5160, 203-853-4433 ... A•1503**
† **Wenzel Associates, Inc., Austin, TX 78752, 512-450-1400 ... A•1510**
Aeroflex Laboratories Inc., ARX, Inc., Plainview, NY 11803 ... 516-694-6700
† Bliley Electric Co., Erie, PA 16506 ... 814-838-3571
CTS Corporation, Elkhart, IN 46514 ... 219-293-7511
CTS Corp., Frequency Controls, Sandwich, IL 60548 ... 815-786-8411
† EG & G Frequency Products Inc., EG & G Inc., Cincinnati, OH 45232 ... 513-542-5555
† ELPAQ, Elmo Semiconductor, Burbank, CA 91504-1052 ... 818-768-7500
† Greenray Inds., Inc., Mechanicsburg, PA 17055 ... 717-766-0223
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 ... 800-452-4844
Micronetics, Hudson, NH 03051 ... 603-883-2900
§ Monitor Products Co., Inc., Oceanside, CA 92054 ... 619-433-4510
§ NEL Frequency Controls, Inc., Burlington, WI 53105 ... 414-763-3591
§ Oscilloquartz, B & J Marketing, Northridge, CA 91325 ... 818-993-0048
† Q-Tech Corp., Culver City, CA 90232-3510 ... 310-836-7900
§ Raltron Electronics, Miami, FL 33172 ... 305-593-6033
ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086 ... 408-730-6300
† Teledyne Microelectronics, Los Angeles, CA 90066 ... 310-822-8229;310-305-0248
§ Valpey-Fisher:Matec Corp, Hopkinton, MA 01748 ... 508-435-6831

Oscillators, Hybrid-2300

§ **Champion Technologies, Inc., Franklin Park, IL 60131, 708-451-1000 ... A•1347**
Connor-Winfield Corp., Aurora, IL 60505-1335, 708-851-4722 ... A•1352-1354
CTS Corp., Frequency Controls, Sandwich, IL 60548, 815-786-8411 ... A•1366-1368
Dale Electronics, Inc., Tempe Div., Tempe, AZ 85282-1883, 602-967-7874 ... A•1379-1381
Ecliptek Corporation, Costa Mesa, CA 92626, 714-433-1200 ... A•1384
§ **Fox Electronics, Ft. Myers, FL 33905, 813-693-0099 ... A•1401**
† **Frequency Electronics, Inc., Mitchel Field, NY 11553, 516-794-4500 ... A•1402**
† Hybrids International Ltd., Thick Film Division, Olathe, KS 66062, 913-764-6400 ... A•1406
§† **Monitor Products Co., Inc., Oceanside, CA 92054, 619-433-4510 ... A•1424**
† **Oscillatek, A Dover Technologies Company, Olathe, KS 66062, 913-829-1777 ... A•1442,1444-1445**
Q-Tech Corp., Culver City, CA 90232-3510, 310-836-7900 ... A•1456-1457
Reeves-Hoffman Div., Dynamics Corporation of America, Carlisle, PA 17013-2248, 717-243-5929 ... A•1465-1466
§ **SARONIX, Palo Alto, CA 94303, 415-856-6900 ... A•1476-1479**
† **Statek Corp., Orange, CA 92668, 714-639-7810 ... A•1483**
TTE Frequency Devices, Ltd., Bohemia, NY 11716, 516-589-7789 ... A•1496
† **Vectron Laboratories, Inc., Norwalk, CT 06856-5160, 203-853-4433 ... A•1503,1505,1509**
§ AT&T Microelectronics, Allentown, PA 18103 ... 1-800-372-2447;In Can.:1-800-553-2448
† Greenray Inds., Inc., Mechanicsburg, PA 17055 ... 717-766-0223
† Hybrids International, Frequency Products Div., Olathe, KS 66062 ... 913-764-4544
† Hytek Microsystems, Inc., Carson City, NV 89706 ... 702-883-0820
Micronetics, Hudson, NH 03051 ... 603-883-2900
Murata Erie North America, Inc., Smyrna, GA 30080 ... 404-436-1300
Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086 ... 408-730-6300
§ Valpey-Fisher:Matec Corp, Hopkinton, MA 01748 ... 508-435-6831

Oscillators, Low Frequency (Module)-2300

§ **AT&T Microelectronics, Allentown, PA 18103, 1-800-372-2447;In Can.:1-800-553-2448 ... A•1334-1335**
† **Bliley Electric Co., Erie, PA 16506, 814-838-3571 ... A•1344**
† **Connor-Winfield Corp., Aurora, IL 60505-1335, 708-851-4722 ... A•1354-1355**
Ecliptek Corporation, Costa Mesa, CA 92626, 714-433-1200 ... A•1383
§ **Fox Electronics, Ft. Myers, FL 33905, 813-693-0099 ... A•1397,1399,1401**
† **Frequency Electronics, Inc., Mitchel Field, NY 11553, 516-794-4500 ... A•1402-1403**
† **Hybrids International Ltd., Thick Film Division, Olathe, KS 66062, 913-764-6400 ... A•1406**
† **McCoy/Ovenaire/Spectrum, A Sub. of Oak Industries, Mt. Holly Springs, PA 17065, 717-486-3411 ... A•1412**
§† **MF Elctrns. Corp., New Rochelle, NY 10801, 914-576-6570 ... A•1419**
§† **Monitor Products Co., Inc., Oceanside, CA 92054, 619-433-4510 ... A•1426,1429**
§† **M-Tron Industries, Yankton, SD 57078, 605-665-9321 ... A•1431**
§ **Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ... A•1433-1434**
† **Q-Tech Corp., Culver City, CA 90232-3510, 310-836-7900 ... A•1456,1458**
§# **R X D Inc., Reim Communications, Norfolk, NE 68701, 402-379-0112;800-228-8108 ... A•1470-1472**
§ **SARONIX, Palo Alto, CA 94303, 415-856-6900 ... A•1478-1479**
Standard Crystal Corporation, El Monte, CA 91731, 818-443-2121 ... A•1481
§† **Statek Corp., Orange, CA 92668, 714-639-7810 ... A•1483**
TTE Frequency Devices, Ltd., Bohemia, NY 11716, 516-589-7789 ... A•1497-1498
† **Vectron Laboratories, Inc., Norwalk, CT 06856-5160, 203-853-4433 ... A•1503**
AEL Defense Corp., Lansdale, PA 19446 ... 215-822-2929
Anderson Electronics, Hollidaysburg, PA 16648 ... 814-695-4428
BEC Inc./Certified Calibration Labs, Horsham, PA 19044 ... 800-523-3808
Blackhawk Networks Corp., Janesville, WI 53545 ... 608-752-8701
§ Champion Technologies, Inc., Franklin Park, IL 60131 ... 708-451-1000
Comstron A Div. of Aeroflex, Plainview, NY 11803 ... 516-752-2351
CTS Corporation, Elkhart, IN 46514 ... 219-293-7511
CTS Corp., Frequency Controls, Sandwich, IL 60548 ... 815-786-8411
† EG & G Frequency Products Inc., EG & G Inc., Cincinnati, OH 45232 ... 513-542-5555
† Electronic Research Co., Overland Park, KS 66204 ... 913-631-6700
Elgar Electronics Corporation, San Diego, CA 92121 ... 619-450-0085;800-733-5427
Frequency Devices, Inc., Haverhill, MA 01830 ... 508-374-0761
§† FSI/Fork Standards, Inc., Lombard, IL 60148-2097 ... 708-932-9380;800-468-6009
† Greenray Inds., Inc., Mechanicsburg, PA 17055 ... 717-766-0223
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 ... 800-452-4844
† Hughes Microelectronic Circuits Division, Newport Beach, CA 92658-8903 ... 714-759-2952
§ Industrial Test Equipment Co., Inc., Port Washington, NY 11050 ... 516-883-1700
Integrated Technologies Solutions Inc., Farmingdale, NY 11735 ... 516-420-9401
International Crystal Mfg., Oklahoma City, OK 73126-0330 ... 405-236-3741; 1-800-725-1426
† Isotemp Research, Inc., Charlottesville, VA 22903 ... 804-295-3101
§† KDS America, Daishinku Corp., Overland Pk., KS 66211 ... 913-491-6825
§† M/A-COM Microelectroincs Division, M/A-COM, Lowell, MA 01853-3295 ... 508-442-5000
Micronetics, Hudson, NH 03051 ... 603-883-2900
† Microsonics, Inc., Weymouth, MA 02188 ... 617-337-4200
§ NEL Frequency Controls, Inc., Burlington, WI 53105 ... 414-763-3591
† NH Research, Incorporated Instrumentation Products Division, Irvine, CA 92714 ... 714-474-3900
† Oscillatek, A Dover Technologies Company, Olathe, KS 66062 ... 913-829-1777
Ovenaire-Audio-Carpenter, Oak Crystal Inc., Charlottesville, VA 22901 ... 804-977-8050

† Pacific Power Source Corp., Huntington Bch., CA 92649 .. 714-898-2691;800-854-2433
† Piezo Crystal Co., Carlisle, PA 17013 717-249-2151
† Piezo Technology Inc., Orlando, FL 32804 407-298-2000
† Solid State Electronics Corp., Northridge, CA 91324 818-993-8257
Spectrum Technology, Inc., DATUM, Incorporated, Santa Barbara, CA 93111 805-964-7791
ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086 408-730-6300
§ Syntest Corp., Marlboro, MA 01752-9973 508-481-7827
† Teledyne Microelectronics, Los Angeles, CA 90066 ..... 310-822-8229;310-305-0248
Transmagnetics, Farmingdale, NY 11735 516-293-3100
Trilithic, Inc., Indianapolis, IN 46236 800-344-2412
§ Valpey-Fisher:Matec Corp. Hopkinton, MA 01748 508-435-6831

Oscillators, Microwave-3450

† Continental Microwave Technology Inc., Glen Cove, NY 11542, 516-759-5600 ..... A•1357
† Frequency Electronics, Inc., Mitchel Field, NY 11553, 516-794-4500 ..... A•1403
§ Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ..... A•1847
§ NTK Technical Ceramics, NGK Spark Plugs (USA), Mt. Prospect, IL 60056, 708-824-1133 ..... A•1849
R X D Inc., Reim Communications, Norfolk, NE 68701, 402-379-0112;800-228-8108 ..... A•1470
† TRAK Microwave Corp., Tampa, FL 33634, 813-884-1411 ..... A•1854
† Vectron Laboratories, Inc., Norwalk, CT 06856-5160, 203-853-4433 ..... A•1502,1505-1506
AEL Defense Corp., Lansdale, PA 19446 215-822-2929
† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950 201-539-5500
† Alpha Industries, Inc., Woburn, MA 01801 617-935-5150
§ AT&T Microelectronics, Allentown, PA 18103 ..... 1-800-372-2447;In Can.:1-800-553-2448
§† Avantek, Inc, A Subsidiary of Hewlett-Packard, Santa Clara, CA 95054 .. 408-727-0700
† Aydin Corp., Horsham, PA 19044 215-657-7510
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
Comstron A Div. of Aeroflex, Plainview, NY 11803 516-752-2351
EG & G Frequency Products Inc., EG & G Inc., Cincinnati, OH 45232 513-542-5555
† Electronic Research Co., Overland Park, KS 66204 913-631-6700
EVI, Inc., Columbia, MD 21046 410-290-1919
† FEI Microwave, Inc., Frequency Electronics, Inc., Sunnyvale, CA 94086 .. 408-732-0880
† Ferretec Inc., Fremont, CA 94538-6525 510-226-1216
† General Microwave Corporation, Amityville, NY 11701 516-226-8900
† Greenray Inds., Inc., Mechanicsburg, PA 17055 717-766-0223
HDS Inc., Reston, VA 22091 703-620-6200
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
† Hughes Microelectronic Circuits Division, Newport Beach, CA 92658-8903 714-759-2952
† Hybrids International, Frequency Products Div., Olathe, KS 66062 913-764-4544
† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
Lectronic Research Labs., Inc., Camden, NJ 08104 800-358-8378
† Loral Microwave Narda, Hauppauge, NY 11788 516-231-1700
† Loral Microwave-Narda West, Rancho Cordova, CA 95670-6001 916-638-5500
Lucas Epsco, Inc., Hopkinton, MA 01748-2204 508-435-2400
† Lucas Zeta, Lucas Aerospace, Inc., San Jose, CA 95134 408-434-3600
MACOM, Inc., Lowell, MA 01851 617-272-3000
† M/A COM Ltd., Bedfordshire, ENGLAND LU5 4SX, England ..... 44(582)471200
§† M/A-COM Microelectroinics Division, M/A-COM, Lowell, MA 01853-3295 508-442-5000
† Magnum Microwave Corp., Fremont, CA 94538 510-657-9898
† MCL, Inc., Bolingbrook, IL 60440-4999 708-759-9500
MF Elctrns. Corp., New Rochelle, NY 10801 914-576-6570
Micronetics, Hudson, NH 03051 603-883-2900
† Micropac Inds., Inc., Garland, TX 75040 214-272-3571
† Microwave Device Tech., Westford, MA 01886 508-692-7800
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3 ..... 514-694-6666; 800-724-3911
† MITEQ Inc., Hauppauge, NY 11788 516-436-7400
§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
§ NEL Frequency Controls, Inc., Burlington, WI 53105 414-763-3591
Ovenaire-Audio-Carpenter, Oak Crystal Inc., Charlottesville, VA 22901 .. 804-977-8050
§ Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018 ..... 408-730-0300;800-PENSTOCK
† Piezo Technology Inc., Orlando, FL 32804 407-298-2000
† Pro-Comm, Inc., Brick, NJ 08724 908-206-0660
† Q-Tech Corp., Culver City, CA 90232-3510 310-836-7900
† Racal-Dana Instrs. Inc., Irvine, CA 92718 714-859-8999
Sivers IMA AB, Culver City, CA 90230 213-306-4248
† ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086 408-730-6300
§ Syntest Corp., Marlboro, MA 01752-9973 508-481-7827
† Techtrol Cyclonetics, Inc., New Cumberland, PA 17070 717-774-2746
Tektronix, Inc., Wilsonville, OR 97070 800-835-9433
† Teledyne Microwave, Mountain View, CA 94043 415-968-2211
Trilithic, Inc., Indianapolis, IN 46236 800-344-2412
Tucker Electronics, Dallas, TX 75355-1419 ..... 214-348-8800;800-527-4642
† Watkins-Johnson Co., Palo Alto, CA 94304 415-493-4141
† Z Communications, Inc., San Diego, CA 92126 619-621-2700

Oscillators, Ovenized-2300

† Bliley Electric Co., Erie, PA 16506, 814-838-3571 ..... A•1340-1343
† Connor-Winfield Corp., Aurora, IL 60505-1335, 708-851-4722 ..... A•1355
† CTS Corp., Frequency Controls, Sandwich, IL 60548, 815-786-8411 ..... A•1358-1361,1374
† Frequency Electronics, Inc., Mitchel Field, NY 11553, 516-794-4500 ..... A•1402
FTS/AUSTRON, Austin, TX 78761-4766, 512-251-2341 ..... A•1405
Isotemp Research, Inc., Charlottesville, VA 22903, 804-295-3101 ... A•1410-1411
† McCoy/Ovenaire/Spectrum, A Sub. of Oak Industries, Mt. Holly Springs, PA 17065, 717-486-3411 ..... A•1413,1416
§† Monitor Products Co., Inc., Oceanside, CA 92054, 619-433-4510 ..... A•1424
§ Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 .. A•1433-1434
Oscillatek, A Dover Technologies Company, Olathe, KS 66062, 913-829-1777 ..... A•1442,1448
§ Raltron Electronics, Miami, FL 33172, 305-593-6033 ..... A•1462
† Reeves-Hoffman Div., Dynamics Corporation of America, Carlisle, PA 17013-2248, 717-243-5929 ..... A•1467-1468
TOYOCOM USA INC., Arlington Heights, IL 60005, 708-593-8780/1-800-TOYOCOM ..... A•1484,1492-1493
† TRAK Microwave Corp., Tampa, FL 33634, 813-884-1411 ..... A•1852
† Vectron Laboratories, Inc., Norwalk, CT 06856-5160, 203-853-4433 .. A•1504-1507
† Wenzel Associates, Inc., Austin, TX 78752, 512-450-1400 ..... A•1510
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Comstron A Div. of Aeroflex, Plainview, NY 11803 516-752-2351
CTS Corporation, Elkhart, IN 46514 219-293-7511
Datum Timing, Datum Inc., Anaheim, CA 92806-5790 714-533-6333
† EG & G Frequency Products Inc., EG & G Inc., Cincinnati, OH 45232 513-542-5555
† Electronic Research Co., Overland Park, KS 66204 913-631-6700
† ELPAQ, Elmo Semiconductor, Burbank, CA 91504-1052 818-768-7500
† Frequency & Time Systems, Inc., Datum, Inc., Beverly, MA 01915 508-927-8220
† Greenray Inds., Inc., Mechanicsburg, PA 17055 717-766-0223
† Hughes Microelectronic Circuits Division, Newport Beach, CA 92658-8903 714-759-2952
† Hytek Microsystems, Inc., Carson City, NV 89706 ..... 702 883-0820
International Crystal Mfg., Oklahoma City, OK 73126-0330 ..... 405-236-3741; 1-800-725-1426
† MITEQ Inc., Hauppauge, NY 11788 516-436-7400
§ NDK America, Inc., Fremont, CA 94539 415-623-6500
§ Oscilloquartz, B & J Marketing, Northridge, CA 91325 818-993-0048
Ovenaire-Audio-Carpenter, Oak Crystal Inc., Charlottesville, VA 22901 .. 804-977-8050
† Piezo Technology Inc., Orlando, FL 32804 407-298-2000
† Q-Tech Corp., Culver City, CA 90232-3510 310-836-7900
Spectrum Technology, Inc., DATUM, Incorporated, Santa Barbara, CA 93111 805-964-7791
† ST Microsonics Corp., Subsidiary of Signal Technology Corporation, Weymouth, MA 02188 617-337-4200
ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086 408-730-6300
Techtrol Cyclonetics, Inc., New Cumberland, PA 17070 717-774-2746
† Teledyne Microelectronics, Los Angeles, CA 90066 ..... 310-822-8229;310-305-0248
† Time and Frequency Ltd., Miami, FL 33172 305-593-8000
Valpey-Fisher:Matec Corp. Hopkinton, MA 01748 508-435-6831

Oscillators, Power (Module)-2300

Compact Power Company, Yorba Linda, CA 92686, 714-996-5826 ..... D•2256
† Control Sciences, Inc., Chatsworth, CA 91311, 818-709-5510 ..... D•1176-1177
Elgar Electronics Corporation, San Diego, CA 92121, 619-450-0085;800-733-5427 ..... D•2258
Julie Research Labs., New York, NY 10001, 212-633-6625 ..... D•1281
† Pacific Power Source Corp., Huntington Bch., CA 92649, 714-898-2691;800-854-2433 ..... D•2289
† Q-Tech Corp., Culver City, CA 90232-3510, 310-836-7900 ..... A•1456
† American Microwave Technology, Inc., Brea, CA 92621 714-993-0802
§ AT&T Microelectronics, Allentown, PA 18103 ..... 1-800-372-2447;In Can.:1-800-553-2448
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
Behlman Electronics Inc., Lake Success, NY 11042 516-328-1600
Behlman Electronics, Inc., Astrosystems, Ventura, CA 93003 805-642-0660
† Electronic Research Co., Overland Park, KS 66204 913-631-6700
Energy Systems, Vancouver, WA 98682 206-896-8310
EVI, Inc., Columbia, MD 21046 410-290-1919
† Greenray Inds., Inc., Mechanicsburg, PA 17055 717-766-0223
§ Industrial Test Equipment Co., Inc., Port Washington, NY 11050 516-883-1700
Integrated Technologies Solutions Inc., Farmingdale, NY 11735 516-420-9401
Isotemp Research, Inc., Charlottesville, VA 22903 ..... 804 295 3101
MF Elctrns. Corp., New Rochelle, NY 10801 914-576-6570
† MITEQ Inc., Hauppauge, NY 11788 516-436-7400
† Modular Devices, Shirley, NY 11967 516-345-3100
Ovenaire-Audio-Carpenter, Oak Crystal Inc., Charlottesville, VA 22901 .. 804-977-8050
† Piezo Crystal Co., Carlisle, PA 17013 717-249-2151
† Pro-Comm, Inc., Brick, NJ 08724 908-206-0660
ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086 408-730-6300
Transmagnetics, Farmingdale, NY 11735 516-293-3100
Trilithic, Inc., Indianapolis, IN 46236 800-344-2412
† Vectron Laboratories, Inc., Norwalk, CT 06856-5160 203-853-4433

Oscillators, Programmable-2300

§ Elgar Electronics Corporation, San Diego, CA 92121, 619-450-0085;800-733-5427 ..... D•2258
§ Epson America Inc., Component Sales Dept., Torrance, CA 90503, 310-782-5318 ..... A•1388,1390-1391,1394, B•1061
§ Fox Electronics, Ft. Myers, FL 33905, 813-693-0099 ..... A•1400-1401
Julie Research Labs., New York, NY 10001, 212-633-6625 ..... D•1281
Krohn-Hite Corp., Avon, MA 02322, 508-580-1660 ..... D•1291
MF Elctrns. Corp., New Rochelle, NY 10801, 914-576-6570 ..... A•1419
Programmed Test Sources, Littleton, MA 01460, 508-486-3008 ..... D•1316
† Q-Tech Corp., Culver City, CA 90232-3510, 310-836-7900 ..... A•1457
§† Statek Corp., Orange, CA 92668, 714-639-7810 ..... A•1483
Behlman Electronics Inc., Lake Success, NY 11042 516-328-1600
Behlman Electronics, Inc., Astrosystems, Ventura, CA 93003 805-642-0660
Datel, Inc., Mansfield, MA 02048-1194 508-339-3000
Ecliptek Corporation, Costa Mesa, CA 92626 714-433-1200

Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
† Frequency Electronics, Inc., Mitchel Field, NY 11553 516-794-4500
† General Microwave Corporation, Amityville, NY 11701 516-226-8900
† Greenray Inds., Inc., Mechanicsburg, PA 17055 717-766-0223
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
† Hybrids International, Frequency Products Div., Olathe, KS 66062 913-764-4544
Integrated Circuit Systems Inc., Valley Forge, PA 19482-0968 215-666-1900
Integrated Technologies Solutions Inc., Farmingdale, NY 11735 516-420-9401
§ NEL Frequency Controls, Inc., Burlington, WI 53105 414-763-3591
NF Electronic Instruments, State College, PA 16801 814-237-5580
† NH Research, Incorporated Instrumentation Products Division, Irvine, CA 92714 714-474-3900
Racal-Dana Instrs. Inc., Irvine, CA 92718 714-859-8999
ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086 408-730-6300
† Z Communications, Inc., San Diego, CA 92126 619-621-2700

Oscillators, Pulse (Module)-2300

Epson America Inc., Component Sales Dept., Torrance, CA 90503, 310-782-5318 ..... A•1394
Fox Electronics, Ft. Myers, FL 33905, 813-693-0099 ..... A•1399
FTS/AUSTRON, Austin, TX 78761-4766, 512-251-2341 ..... A•1405
Isotemp Research, Inc., Charlottesville, VA 22903, 804-295-3101 ... A•1410-1411
MF Elctrns. Corp., New Rochelle, NY 10801, 914-576-6570 ..... A•1419
Monitor Products Co., Inc., Oceanside, CA 92054, 619-433-4510 ..... A•1424
Oscillatek, A Dover Technologies Company, Olathe, KS 66062, 913-829-1777 ..... A•1443-1447
† Q-Tech Corp., Culver City, CA 90232-3510, 310-836-7900 ..... A•1456
† Reeves-Hoffman Div., Dynamics Corporation of America, Carlisle, PA 17013-2248, 717-243-5929 ..... A•1465-1466
† Vectron Laboratories, Inc., Norwalk, CT 06856-5160, 203-853-4433 ..... A•1504-1506,1508
Anderson Electronics, Hollidaysburg, PA 16648 814-695-4428
BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
† Berkeley Nucleonics Corp., Richmond, CA 94804 510-234-1100
Blackhawk Networks Corp., Janesville, WI 53545 608-752-8701
Comstron A Div. of Aeroflex, Plainview, NY 11803 516-752-2351
† Connor-Winfield Corp., Aurora, IL 60505-1335 708-851-4722
CTS Corporation, Elkhart, IN 46514 219-293-7511
CTS Corp., Frequency Controls, Sandwich, IL 60548 815-786-8411
† Electronic Research Co., Overland Park, KS 66204 913-631-6700
Elgar Electronics Corporation, San Diego, CA 92121 ..... 619-450-0085;800-733-5427
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Engineered Components Co., San Luis Obispo, CA 93403-8121 805-544-3800
† Greenray Inds., Inc., Mechanicsburg, PA 17055 717-766-0223
† Hughes Microelectronic Circuits Division, Newport Beach, CA 92658-8903 714-759-2952
Lucas Epsco, Inc., Hopkinton, MA 01748-2204 508-435-2400
† McCoy/Ovenaire/Spectrum, A Sub. of Oak Industries, Mt. Holly Springs, PA 17065 717-486-3411
§ Murata Erie North America, Inc., Smyrna, GA 30080 404-436-1300
Ovenaire-Audio-Carpenter, Oak Crystal Inc., Charlottesville, VA 22901 .. 804-977-8050
† Piezo Crystal Co., Carlisle, PA 17013 717-249-2151
† Pro-Comm, Inc., Brick, NJ 08724 908-206-0660
† Radio Research Instrument Co., Inc., Waterbury, CT 06704-3506 203-753-5840
§ Rhombus Industries, Huntington Bch., CA 92649-1595 714-898-0960
R X D Inc., Relm Communications, Norfolk, NE 68701 ... 402-379-0112;800-228-8108
Seiko Instruments U.S.A., Inc. Electronic Components, Torrance, CA 90505 310-517-7770
† Solid State Electronics Corp., Northridge, CA 91324 818-993-8257
Spectrum Technology, Inc., DATUM, Incorporated, Santa Barbara, CA 93111 805-964-7791
† Statek Corp., Orange, CA 92668 714-639-7810
ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086 408-730-6300
§ Syntest Corp., Marlboro, MA 01752-9973 508-481-7827
† TRAK Microwave Corp., Tampa, FL 33634 813-884-1411
Trilithic, Inc., Indianapolis, IN 46236 800-344-2412

Oscillators, Pulse (Test) — See Generators, Pulse (Vol. D)

Oscillators, RC (Module)-2300

Krohn-Hite Corp., Avon, MA 02322, 508-580-1660 ..... D•1291
† Vectron Laboratories, Inc., Norwalk, CT 06856-5160, 203-853-4433 ..... A•1503
# Alfa Electronics, Inc., Princeton, NJ 08543-8089 609-275-0220
§ AT&T Microelectronics, Allentown, PA 18103 ..... 1-800-372-2447;In Can.:1-800-553-2448
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
CTS Corporation, Elkhart, IN 46514 219-293-7511
CTS Corp., Frequency Controls, Sandwich, IL 60548 815-786-8411
Dantel, Fresno, CA 93727 209-292-1111
Elgar Electronics Corporation, San Diego, CA 92121 ..... 619-450-0085;800-733-5427
Engineered Components Co., San Luis Obispo, CA 93403-8121 805-544-3800
Frequency Devices, Inc., Haverhill, MA 01830 508-374-0761
† Greenray Inds., Inc., Mechanicsburg, PA 17055 717-766-0223
Hughes Microelectronic Circuits Division, Newport Beach, CA 92658-8903 714-759-2952
† Hybrids International, Frequency Products Div., Olathe, KS 66062 913-764-4544
Isotemp Research, Inc., Charlottesville, VA 22903 804-295-3101
† Modular Devices, Shirley, NY 11967 516-345-3100
Ovenaire-Audio-Carpenter, Oak Crystal Inc., Charlottesville, VA 22901 .. 804-977-8050
† Q-Tech Corp., Culver City, CA 90232-3510 310-836-7900
Tektronix, Inc., Wilsonville, OR 97070 800-835-9433

Oscillators, RF (Module)-2300

Continental Microwave Technology Inc., Glen Cove, NY 11542, 516-759-5600 ..... A•1357
CTS Corp., Frequency Controls, Sandwich, IL 60548, 815-786-8411 ..... A•1369-1372
§ Dale Electronics, Inc., Tempe Div., Tempe, AZ 85282-1883, 602-967-7874 ..... A•1379
Ecliptek Corporation, Costa Mesa, CA 92626, 714-433-1200 .. A•1383-1384,1386
Epson America Inc., Component Sales Dept., Torrance, CA 90503, 310-782-5318 ..... A•1388-1389,1395
§ Fox Electronics, Ft. Myers, FL 33905, 813-693-0099 ..... A•1397,1399,1401
† Frequency Electronics, Inc., Mitchel Field, NY 11553, 516-794-4500 ..... A•1403
Hy-Q International (USA) Inc., Erlanger, KY 41018, 606-283-5000 ..... A•1408
† Isotemp Research, Inc., Charlottesville, VA 22903, 804-295-3101 ... A•1410-1411
† Monitor Products Co., Inc., Oceanside, CA 92054, 619-433-4510 ..... A•1425
§† Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ..... A•1847
† Oscillatek, A Dover Technologies Company, Olathe, KS 66062, 913-829-1777 ..... A•1447
Pletronics, Inc., Lynnwood, WA 98036, 206-776-1880 ..... A•1449,1455
† Q-Tech Corp., Culver City, CA 90232-3510, 310-836-7900 ..... A•1458
† Reeves-Hoffman Div., Dynamics Corporation of America, Carlisle, PA 17013-2248, 717-243-5929 ..... A•1465-1467
§# R X D Inc., Relm Communications, Norfolk, NE 68701, 402-379-0112;800-228-8108 ..... A•1470-1471
§ SARONIX, Palo Alto, CA 94303, 415-856-6900 ..... A•1478
Seiko Instruments U.S.A., Inc. Electronic Components, Torrance, CA 90505, 310-517-7770 ..... A•1480
Standard Crystal Corporation, El Monte, CA 91731, 818-443-2121 ..... A•1481
TOYOCOM USA INC., Arlington Heights, IL 60005, 708-593-8780/1-800-TOYOCOM ..... A•1487-1488,1492
TTE Frequency Devices, Ltd., Bohemia, NY 11716, 516-589-7789 ... A•1497-1498
† Vectron Laboratories, Inc., Norwalk, CT 06856-5160, 203-853-4433 ..... A•1502
† Wenzel Associates, Inc., Austin, TX 78752, 512-450-1400 ..... A•1510
Xsis Electronics, Inc., Shawnee, KS 66216, 913-631-0448 ..... A•1511
AEL Defense Corp., Lansdale, PA 19446 215-822-2929
Anderson Electronics, Hollidaysburg, PA 16648 814-695-4428
§ AT&T Microelectronics, Allentown, PA 18103 ..... 1-800-372-2447;In Can.:1-800-553-2448
§† Avantek, Inc, A Subsidiary of Hewlett-Packard, Santa Clara, CA 95054 .. 408-727-0700
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
Blackhawk Networks Corp., Janesville, WI 53545 608-752-8701
† Bliley Electric Co., Erie, PA 16506 814-838-3571
§ Champion Technologies, Inc., Franklin Park, IL 60131 708-451-1000
Comstron A Div. of Aeroflex, Plainview, NY 11803 516-752-2351
† Connor-Winfield Corp., Aurora, IL 60505-1335 708-851-4722
CTS Corporation, Elkhart, IN 46514 219-293-7511
† EG & G Frequency Products Inc., EG & G Inc., Cincinnati, OH 45232 513-542-5555
† Electronic Research Co., Overland Park, KS 66204 913-631-6700
Engineered Components Co., San Luis Obispo, CA 93403-8121 805-544-3800
† FEI Microwave, Inc., Frequency Electronics, Inc., Sunnyvale, CA 94086 .. 408-732-0880
§† Gorman-Redlich Mfg. Co., Athens, OH 45701 614-593-3150
† Greenray Inds., Inc., Mechanicsburg, PA 17055 717-766-0223
HDS Inc., Reston, VA 22091 703-620-6200
† Hughes Microelectronic Circuits Division, Newport Beach, CA 92658-8903 714-759-2952
† Hybrids International, Frequency Products Div., Olathe, KS 66062 913-764-4544
Integrity Technology Corporation, Santa Clara, CA 95050 408-262-8640
International Crystal Mfg., Oklahoma City, OK 73126-0330 ..... 405-236-3741; 1-800-725-1426
† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
Lucas Zeta, Lucas Aerospace, Inc., San Jose, CA 95134 408-434-3600
§† M/A-COM Microelectroincs Division, M/A-COM, Lowell, MA 01853-3295 508-442-5000
† Magnum Microwave Corp., Fremont, CA 94538 510-657-9898
† McCoy/Ovenaire/Spectrum, A Sub. of Oak Industries, Mt. Holly Springs, PA 17065 717-486-3411
† MCL, Inc., Bolingbrook, IL 60440-4999 708-759-9500
MF Elctrns. Corp., New Rochelle, NY 10801 914-576-6570
† MITEQ Inc., Hauppauge, NY 11788 516-436-7400
§ M-Tron Industries, Yankton, SD 57078 605-665-9321
NEL Frequency Controls, Inc., Burlington, WI 53105 414-763-3591
Ovenaire-Audio-Carpenter, Oak Crystal Inc., Charlottesville, VA 22901 .. 804-977-8050
§† Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018 ..... 408-730-0300;800-PENSTOCK
† Piezo Crystal Co., Carlisle, PA 17013 717-249-2151
† Piezo Technology Inc., Orlando, FL 32804 407-298-2000
† Pro-Comm, Inc., Brick, NJ 08724 908-206-0660
† Racal-Dana Instrs. Inc., Irvine, CA 92718 714-859-8999
† RF Monolithics, Inc., Dallas, TX 75244 214-233-2903
† Servo Corporation of America, Hicksville, NY 11801-5259 516-938-9700
† Solid State Electronics Corp., Northridge, CA 91324 818-993-8257
Spectrum Technology, Inc., DATUM, Incorporated, Santa Barbara, CA 93111 805-964-7791
† Stanford Telecommunications, Inc., Santa Clara, CA 95056 408-748-1010
ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086 408-730-6300
§ Syntest Corp., Marlboro, MA 01752-9973 508-481-7827
† Techtrol Cyclonetics, Inc., New Cumberland, PA 17070 717-774-2746
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
† TRAK Microwave Corp., Tampa, FL 33634 813-884-1411
Trilithic, Inc., Indianapolis, IN 46236 800-344-2412
§ Valpey-Fisher:Matec Corp, Hopkinton, MA 01748 508-435-6831
† Z Communications, Inc., San Diego, CA 92126 619-621-2700

Oscillators, RF (Test) — See Generators, RF (Vol. D)

Oscillators, Sinusoidal (Module)-2300

† Bliley Electric Co., Erie, PA 16506, 814-838-3571 ..... A•1340-1343
§ Champion Technologies, Inc., Franklin Park, IL 60131, 708-451-1000 .... A•1347
Compact Power Company, Yorba Linda, CA 92686, 714-996-5826 ..... D•2256
† Connor-Winfield Corp., Aurora, IL 60505-1335, 708-851-4722 ..... A•1354-1355
† Control Sciences, Inc., Chatsworth, CA 91311, 818-709-5510 ..... D•1176-1177
Hy-Q International (USA) Inc., Erlanger, KY 41018, 606-283-5000 ..... A•1408
Isotemp Research, Inc., Charlottesville, VA 22903, 804-295-3101 ... A•1410-1411
† Monitor Products Co., Inc., Oceanside, CA 92054, 619-433-4510 ... A•1424-1426
§† Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ..... A•1434
† Oscillatek, A Dover Technologies Company, Olathe, KS 66062, 913-829-1777 ..... A•1443,1445-1448
† Pacific Power Source Corp., Huntington Bch., CA 92649, 714-898-2691;800-854-2433 ..... D•2289
† Q-Tech Corp., Culver City, CA 90232-3510, 310-836-7900 ..... A•1456,1458
† Reeves-Hoffman Div., Dynamics Corporation of America, Carlisle, PA 17013-2248, 717-243-5929 ..... A•1465-1467
R X D Inc., Reim Communications, Norfolk, NE 68701, 402-379-0112;800-228-8108 ..... A•1470-1471
§ SARONIX, Palo Alto, CA 94303, 415-856-6900 ..... A•1476-1478
TOYOCOM USA INC., Arlington Heights, IL 60005, 708-593-8780/1-800-TOYOCOM ..... A•1492
TTE Frequency Devices, Ltd., Bohemia, NY 11716, 516-589-7789 ..... A•1501
† Vectron Laboratories, Inc., Norwalk, CT 06856-5160, 203-853-4433 .. A•1502-1508
† Wenzel Associates, Inc., Austin, TX 78752, 512-450-1400 ..... A•1510
Xsis Electronics, Inc., Shawnee, KS 66216, 913-631-0448 ..... A•1511
Anderson Electronics, Hollidaysburg, PA 16648 814-695-4428
§ AT&T Microelectronics, Allentown, PA 18103 ..... 1-800-372-2447;In Can.:1-800-553-2448
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
Behlman Electronics Inc., Lake Success, NY 11042 516-328-1600
Behlman Electronics, Inc., Astrosystems, Ventura, CA 93003 805-642-0660
† Computer Conversions Corp., E. Northport, NY 11731 516-261-3300
Comstron A Div. of Aeroflex, Plainview, NY 11803 516-752-2351
CTS Corporation, Elkhart, IN 46514 219-293-7511
CTS Corp., Frequency Controls, Sandwich, IL 60548 815-786-8411
Ecliptek Corporation, Costa Mesa, CA 92626 714-433-1200
† EG & G Frequency Products Inc., EG & G Inc., Cincinnati, OH 45232 513-542-5555
† Electronic Research Co., Overland Park, KS 66204 913-631-6700
Elgar Electronics Corporation, San Diego, CA 92121 ..... 619-450-0085;800-733-5427
Energy Systems, Vancouver, WA 98682 206-896-8310
§ Fox Electronics, Ft. Myers, FL 33905 813-693-0099
Frequency Devices, Inc., Haverhill, MA 01830 508-374-0761
† Frequency Electronics, Inc., Mitchel Field, NY 11553 516-794-4500
† FSI/Fork Standards, Inc., Lombard, IL 60148-2097 ..... 708-932-9380;800-468-6009
§† Gorman-Redlich Mfg. Co., Athens, OH 45701 614-593-3150
† Greenray Inds., Inc., Mechanicsburg, PA 17055 717-766-0223
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
Hughes Microelectronic Circuits Division, Newport Beach, CA 92658-8903 714-759-2952
§ Industrial Test Equipment Co., Inc., Port Washington, NY 11050 516-883-1700
Integrated Technologies Solutions Inc., Farmingdale, NY 11735 516-420-9401
† McCoy/Ovenaire/Spectrum, A Sub. of Oak Industries, Mt. Holly Springs, PA 17065 717-486-3411
MF Elctrns. Corp., New Rochelle, NY 10801 914-576-6570
† Microsonics, Inc., Weymouth, MA 02188 617-337-4200
Modular Audio Products, Modular Devices, Inc., Shirley, NY 11967 516-345-3100
† Modular Devices, Shirley, NY 11967 516-345-3100
NF Electronic Instruments, State College, PA 16801 814-237-5580
Ovenaire-Audio-Carpenter, Oak Crystal Inc., Charlottesville, VA 22901 .. 804-977-8050
† Piezo Crystal Co., Carlisle, PA 17013 717-249-2151
† Piezo Technology Inc., Orlando, FL 32804 407-298-2000
† RF Monolithics, Inc., Dallas, TX 75244 214-233-2903
† Solid State Electronics Corp., Northridge, CA 91324 818-993-8257
Spectrum Technology, Inc., DATUM, Incorporated, Santa Barbara, CA 93111 805-964-7791
† Stanford Telecommunications, Inc., Santa Clara, CA 95056 408-748-1010
ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086 408-730-6300
Techtrol Cyclonetics, Inc., New Cumberland, PA 17070 717-774-2746
§† Thaler Corp., Tucson, AZ 85737 602-742-5572
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
† TRAK Microwave Corp., Tampa, FL 33634 813-884-1411
† Transmagnetics, Farmingdale, NY 11735 516-293-3100
Valpey-Fisher:Matec Corp, Hopkinton, MA 01748 508-435-6831

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Oscillators, Square Wave (Module)-2300

§ Champion Technologies, Inc., Franklin Park, IL 60131, 708-451-1000 .... A•1347
§ Comclok, Inc., Anaheim, CA 92801, 714-991-1580;800-333-9825 ..... A•1349
† Connor-Winfield Corp., Aurora, IL 60505-1335, 708-851-4722 ..... A•1351-1355
§ Dale Electronics, Inc., Tempe Div., Tempe, AZ 85282-1883, 602-967-7874 ..... A•1379
† Data Delay Devices, Clifton, NJ 07013-1915, 201-773-2299 ..... A•1529,1536
Epson America Inc., Component Sales Dept., Torrance, CA 90503, 310-782-5318 ..... A•1391, B•1061
§ Fox Electronics, Ft. Myers, FL 33905, 813-693-0099 ..... A•1397,1399
FTS/AUSTRON, Austin, TX 78761-4766, 512-251-2341 ..... A•1405
Hy-Q International (USA) Inc., Erlanger, KY 41018, 606-283-5000 ..... A•1408
Isotemp Research, Inc., Charlottesville, VA 22903, 804-295-3101 ... A•1410-1411
† McCoy/Ovenaire/Spectrum, A Sub. of Oak Industries, Mt. Holly Springs, PA 17065, 717-486-3411 ..... A•1416
§† MF Elctrns. Corp., New Rochelle, NY 10801, 914-576-6570 ..... A•1419
§† Monitor Products Co., Inc., Oceanside, CA 92054, 619-433-4510 ..... A•1426
§ Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ..... A•1434
† Oscillatek, A Dover Technologies Company, Olathe, KS 66062, 913-829-1777 ..... A•1443-1444,1446-1448
† Q-Tech Corp., Culver City, CA 90232-3510, 310-836-7900 ..... A•1456
† Reeves-Hoffman Div., Dynamics Corporation of America, Carlisle, PA 17013-2248, 717-243-5929 ..... A•1465-1467
§# R X D Inc., Reim Communications, Norfolk, NE 68701, 402-379-0112;800-228-8108 ..... A•1470-1471
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† Wenzel Associates, Inc., Austin, TX 78752, 512-450-1400 ..... A•1510
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Anderson Electronics, Hollidaysburg, PA 16648 814-695-4428
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† Automatic Coil Corp., Miami, FL 33147 305-696-6660
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† Berkeley Nucleonics Corp., Richmond, CA 94804 510-234-1100
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† Bliley Electric Co., Erie, PA 16506 814-838-3571
Cal Crystal Lab., Inc., Anaheim, CA 92801 ..... 714-991-1580;800-333-9825
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† EG & G Frequency Products Inc., EG & G Inc., Cincinnati, OH 45232 513-542-5555
† Electronic Research Co., Overland Park, KS 66204 913-631-6700
† Engineered Components Co., San Luis Obispo, CA 93403-8121 805-544-3800
† Frequency Electronics, Inc., Mitchel Field, NY 11553 516-794-4500
† FSI/Fork Standards, Inc., Lombard, IL 60148-2097 ..... 708-932-9380;800-468-6009
Φ Genstar Rentals, Inc., Calabasas, CA 91302 800-422-3300
† Greenray Inds., Inc., Mechanicsburg, PA 17055 717-766-0223
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§ Syntest Corp., Marlboro, MA 01752-9973 508-481-7827
§ Valpey-Fisher:Matec Corp, Hopkinton, MA 01748 508-435-6831

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† Bliley Electric Co., Erie, PA 16506, 814-838-3571 ..... A•1343,1345
§ Champion Technologies, Inc., Franklin Park, IL 60131, 708-451-1000 .... A•1347
† Connor-Winfield Corp., Aurora, IL 60505-1335, 708-851-4722 ..... A•1352,1355
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International Crystal Mfg., Oklahoma City, OK 73126-0330, 405-236-3741;1-800-725-1426 ..... A•1409
† Isotemp Research, Inc., Charlottesville, VA 22903, 804-295-3101 ..... A•1410
† McCoy/Ovenaire/Spectrum, A Sub. of Oak Industries, Mt. Holly Springs, PA 17065, 717-486-3411 ..... A•1412,1415-1416
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§† Monitor Products Co., Inc., Oceanside, CA 92054, 619-433-4510 ... A•1424-1429
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† Oscillatek, A Dover Technologies Company, Olathe, KS 66062, 913-829-1777 ..... A•1442,1446-1448
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† **TRAK Microwave Corp., Tampa, FL 33634, 813-884-1411** ..... **A•1852**
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AVX Corporation, A Kyocera Group Company, Myrtle Beach, SC 29577 803-448-9411
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† Hughes Microelectronic Circuits Division, Newport Beach, CA 92658-8903 714-759-2952
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† Hybrids International Ltd., Thick Film Division, Olathe, KS 66062 913-764-6400
§† KDS America, Daishinku Corp., Overland Pk., KS 66211 913-491-6825
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† Magnum Microwave Corp., Fremont, CA 94538 510-657-9898
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† Microsonics, Inc., Weymouth, MA 02188 617-337-4200
NEL Frequency Controls, Inc., Burlington, WI 53105 414-763-3591
§ Oscilloquartz, B & J Marketing, Northridge, CA 91325 818-993-0048
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† Time and Frequency Ltd., Miami, FL 33172 305-593-8000
§ Valpey-Fisher:Matec Corp, Hopkinton, MA 01748 508-435-6831

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† Berkeley Nucleonics Corp., Richmond, CA 94804 510-234-1100
† Q-Tech Corp., Culver City, CA 90232-3510 310-836-7900

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§ SARONIX, Palo Alto, CA 94303 415-856-6900
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§† Statek Corp., Orange, CA 92668 714-639-7810
† Z Communications, Inc., San Diego, CA 92126 619-621-2700

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§† **Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300** ..... **A•1434**
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Seiko Instruments U.S.A., Inc. Electronic Components, Torrance, CA 90505, 310-517-7770 ..... **A•1480**
§ **Standard Crystal Corporation, El Monte, CA 91731, 818-443-2121** ..... **A•1481**
TOYOCOM USA INC., Arlington Heights, IL 60005, 708-593-8780/1-800-TOYOCOM ..... **A•1488,1492**
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† Frequency Electronics, Inc., Mitchel Field, NY 11553 516-794-4500
† Gorman-Redlich Mfg. Co., Athens, OH 45701 614-593-3150
† Greenray Inds., Inc., Mechanicsburg, PA 17055 717-766-0223
Hughes Microelectronic Circuits Division, Newport Beach, CA 92658-8903 714-759-2952
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McCoy/Ovenaire/Spectrum, A Sub. of Oak Industries, Mt. Holly Springs, PA 17065 717-486-3411
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MITEQ Inc., Hauppauge, NY 11788 516-436-7400
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† Piezo Technology Inc., Orlando, FL 32804 407-298-2000
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§ Toko America, Inc., Mt. Prospect,, IL 60056 708-297-0070
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§† **Ball Corp., Efratom Division, Irvine, CA 92718-1605, 714-770-5000** ..... **A•1339**
† **Bliley Electric Co., Erie, PA 16506, 814-838-3571** ..... **A•1343**
§ **Champion Technologies, Inc., Franklin Park, IL 60131, 708-451-1000** ..... **A•1347**
† **Connor-Winfield Corp., Aurora, IL 60505-1335, 708-851-4722** ..... **A•1350-1351, 1355**
† **CTS Corp., Frequency Controls, Sandwich, IL 60548, 815-786-8411** ..... **A•1358-1368**
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§ **Fox Electronics, Ft. Myers, FL 33905, 813-693-0099** ..... **A•1397,1399-1401**
† **Frequency Electronics, Inc., Mitchel Field, NY 11553, 516-794-4500** ..... **A•1403**
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Hy-Q International (USA) Inc., Erlanger, KY 41018, 606-283-5000 ..... **A•1408**
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§† **Monitor Products Co., Inc., Oceanside, CA 92054, 619-433-4510** ..... **A•1424-1425,1427**
§† **M-Tron Industries, Yankton, SD 57078, 605-665-9321** ..... **A•1431**
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§ **NDK America, Inc., Fremont, CA 94539, 415-623-6500** ..... **A•1440**
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Micronetics, Hudson, NH 03051 603-883-2900
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† FTS Systems, Inc., Stone Ridge, NY 12484 914-687-0071
The Grieve Corporation, Round Lake, IL 60073-9989 708-546-8225
International Crystal Mfg., Oklahoma City, OK 73126-0330 ..... 405-236-3741; 1-800-725-1426
International Instrumentation, Inc., Westlake Vlg., CA 91361 805-495-7673
McCoy/Ovenaire/Spectrum, A Sub. of Oak Industries, Mt. Holly Springs, PA 17065 717-486-3411
† Ovenaire-Audio-Carpenter, Oak Crystal Inc., Charlottesville, VA 22901 .. 804-977-8050
Spectrum Technology, Inc., DATUM, Incorporated, Santa Barbara, CA 93111 805-964-7791
Sun Electronic Systems, Inc., Ft. Lauderdale, FL 33309 305-739-7004
† Trent, Inc., Philadelphia, PA 19127 215-482-5000

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§ Bivar, Inc., Irvine, CA 92718, 714-951-8808 ..... C•1537
§† Hybrids International Ltd., Thick Film Division, Olathe, KS 66062, 913-764-6400 ..... A•1699
† International Sensor Systems, Inc., Aurora, NE 68818, 402-694-6111 .... A•1704
† Mini-Systems, Inc., Electronic Package Div., Plainville, MA 02762, 508-695-2000 ..... A•1710
§ NTK Technical Ceramics, NGK Spark Plugs (USA), Mt. Prospect, IL 60056, 708-824-1133 ..... A•1665
† Reeves-Hoffman Div., Dynamics Corporation of America, Carlisle, PA 17013-2248, 717-243-5929 ..... A•1469
AT&T Microelectronics, Allentown, PA 18103 ..... 1-800-372-2447;In Can.:1-800-553-2448
† The Carborundum Company, Electric Products, Niagara Falls, NY 14302 716-278-2521
Coors Electronic Package Co., Chattanooga, TN 37405 615-755-5452
† Detoronics Corporation, S. El Monte, CA 91733 818-579-7130
ELMA Electronic Inc., Fremont, CA 94538 510-656-3400
FDK America, Inc., Fuji Electrochemical Co., Ltd., San Jose, CA 95134 .. 408-432-8331
Gennum Corp., Burlington, ON, CANADA L7R 3Y3 ..... 800-263-9353;416-632-2996
HEI, Inc., Hybrid Electronics Div., Victoria, MN 55386 612-443-2500
Hualon Microeletronics Corporation, Hualon Group, Hsin-Chu, TAIWAN 415-288-0390
Hudson Tool & Die Co., Ormond Beach, FL 32174 904-672-2000
Hybridyne, Inc., Tucson, AZ 85745 602-629-0001
International Instrumentation, Inc., Westlake Vlg., CA 91361 805-495-7673
§ International Rectifier Corp., El Segundo, CA 90245 310-322-3331
ISL Products Int'l, Ltd., Syosset, NY 11791-6093 ..... 516-937-3475;800-626-6116
§† LSI Logic Corp., Milpitas, CA 95035 408-433-8000
Milton Ross Co., Warrington, PA 18976 215-491-0600
Mini-Systems, Inc., Thick/Thin Film Division, North Attleboro, MA 02761 508-695-0203
Mini-Systems, Inc., Sunbelt Microelectronic Division, Deltona, FL 32725 407-574-0208
Moldtronics, Inc., Downers Grove, IL 60515 708-968-7000
National Manufacturing Co., Inc., Chatham, NJ 07928 201-635-8846
§ Nepenthe, Inc., Palo Alto, CA 94303 415-496-6666
Philips Technologies, Airpax Protector Group, Cambridge, MD 21613 ... 410-228-4600
§ Phoenix Contact Inc., Harrisburg, PA 17111 717-944-1300
Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013 615-641-2020
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006 214-466-6000
† Stevens Products, Inc., E. Orange, NJ 07019 201-672-2140
† United Supertek, Inc., San Jose, CA 95131-1101 408-922-0730
Vector Electronic Co., Inc., Sylmar, CA 91342 ..... 818-365-9661;800-423-5659

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Phototransistors, Surface Mount-4800

† Centronic, Inc., The Morgan Crucible Company plc, Newbury Park, CA 91320-1702, 805-499-5902 ..... **B•1312**
§ NEC Electronics, Inc., Mountain View, CA 94039-7241, 1-800-366-9782 ..... **B•1090,1332**
Zetex, Inc., Zetex plc., Commack, NY 11725, 516-543-7100 ..... **A•2227**
Clarostat Sensors and Controls Group, BYR, PLC, Plano, TX 75075 ..... 214-422-1844; 1-800-872-0044
Lite-On Inc., Milpitas, CA 95035 408-946-4873
Micropac Inds., Inc., Garland, TX 75040 214-272-3571
§† Optek Technology Inc., Carrollton, TX 75006 214-323-2200
Opto Diode Corp., Newbury Park, CA 91320 805-499-0335
§ Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98607 206-834-2500

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Bell, Floyd, Inc., Columbus, OH 43212, 614-294-4000 ..... **D•1026-1027**
International Components Corp., Melville, NY 11747, 516-293-1500 ..... **D•1035**
† Morgan-Matroc, Electro Ceramics Division, Bedford, OH 44146-5478, 216-232-8500 ..... **B•1974**
§ Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ..... **A•1435, D•1053-1055**
§ NTK Technical Ceramics, NGK Spark Plugs (USA), Mt. Prospect, IL 60056, 708-824-1133 ..... **A•1664,1667**
Projects Unlimited, Dayton, OH 45414, 513-890-1918 ..... **D•1057**
Star Micronics, Inc., OEM Division, Piscataway, NJ 08854, 908-572-9512 ..... **D•1068,1070**
Wilcoxon Research, Inc., Gaithersburg, MD 20878, 301-330-8811 ..... **B•2025**
§ Atomergic Chemetals Corp., Farmingdale, NY 11735-1718 516-694-9000
Burleigh Instruments, Fishers, NY 14453-0755 716-924-9355
† Channel Industries, Santa Barbara, CA 93111 805-967-0171
EDO Corporation, Acoustics Division, Salt Lake City, UT 84115 801-486-2115
Hokuriku USA Ltd., Madison, AL 35758 205-772-9620
JEMA, Wilmette, IL 60091 708-251-3600
§ KCK America Inc., Mitsubishi Materials Corporation, Rolling Meadows, IL 60008 708-577-0200
§† KDS America, Daishinku Corp., Overland Pk., KS 66211 913-491-6825
LZR Electronics, Inc., Gaithersburg, MD 20879 301-921-4600
§ Martin Sound Prods. Inc., Cleveland, OH 44143-2297 216-442-2286
§ Motorola Ceramic Products, Components Division, Albuquerque, NM 87113 505-822-8801
§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
North American Capacitor Co., Indianapolis, IN 46224 317-273-0090
§ Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404 407-881-3200
Philips Components Discrete Products Div., A North American Philips Co., Saugerties, NY 12477 914-246-2811
† Piezo Electric Products, Inc., Metuchen, NJ 08840 908-548-2800
† Piezo Kinetics Inc., Bellefonte, PA 16823 814-355-1593
Primo Company Limited, Tokyo, JAPAN 181 0422-43-3121
§ Raltron Electronics, Miami, FL 33172 305-593-6033
Seacor Piezo Ceramics, Huntington, CT 06484 203-925-1320
Shogyo International Corp., Great Neck, NY 11021-4799 516-466-0911
Sonicall, Inc., Signal Hill, CA 90806 213-490-2143
§ Stetco, Inc., Franklin Pk., IL 60131 708-671-4208
§ TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056 708-803-6100
§ Tokin America, Inc., San Jose, CA 95134 408-432-8020
Valpey-Fisher:Matec Corp, Hopkinton, MA 01748 508-435-6831

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Potentiometer Elements-4750

Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635, 714-447-2300 ..... **A•2057**
Duncan Electronics, Costa Mesa, CA 92626, 714-545-8261 ..... **A•2078-2079**
† **JDK Controls, Inc., Grass Valley, CA 95945-0512, 916-273-4608** ..... **A•2088-2091**
† **Maurey Instrument Corp., Chicago, IL 60629, 312-581-4555** ..... **A•2102**
† **Novotechnik U.S., Inc., Marlborough, MA 01752, 508-485-2244** ..... **A•2114**
Precision Control Manufacturing, Inc., Seattle, WA 98109, 206-281-9380 ..... **A•2116**
Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Schaumburg, IL 60173, 708-884-6664 ..... **A•2123**
† **Vishay Resistors, Malvern, PA 19355; 215-644-1300** ..... **A•2127**
† **Waters Manufacturing, Inc., Talley Industries, Wayland, MA 01778, 508-358-2777** ..... **A•2128**
† Carter Manufacturing Corporation, Bolton, MA 01740 508-779-5501
† CTS of Canada, Ltd., Streetsville, ONTARIO, CAN. L5M 1Y9 416-826-1141
Dynamation Transducers Corporation, Holliston, MA 01746 508-429-8440
The J. M. Ney Company, Bloomfield, CT 06002 203-242-2281
§ Piher International Corp., NACESA, Mt. Prospect, IL 60056 ..... 708-390-6680; 800-323-6693

Potentiometers, Air Operated-4750

Pres-Air-Trol Corp., Mamaroneck, NY 10543 ..... 914-698-2026;800-431-2625

Potentiometers, Carbon Ceramic-4750

Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635, 714-447-2300 ..... **A•2056**
§ **Clarostat Sensors and Controls Group, BYR, PLC, Plano, TX 75075, 214-422-1844;1-800-872-0044** ..... **A•2070**
ISL Products Int'l, Ltd., Syosset, NY 11791-6093, 516-937-3475;800-626-6116 ..... **A•2087**
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ..... **A•2118**
§ **Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Schaumburg, IL 60173, 708-884-6664** ..... **A•2122**
CTS Corporation, Elkhart, IN 46514 219-293-7511
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Hokuriku USA Ltd., Madison, AL 35758 205-772-9620
International Resistive Company, Boone, NC 28607 704-264-8861
§ ISKRA Electronics, Inc., Plainview, NY 11803 516-349-0222
§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 075-951-9111
Noble U.S.A., Inc., Rolling Meadows, IL 60008 708-364-6038
§ Piher International Corp., NACESA, Mt. Prospect, IL 60056 ..... 708-390-6680; 800-323-6693

Potentiometers, Carbon Film-4750

§ **Clarostat Sensors and Controls Group, BYR, PLC, Plano, TX 75075, 214-422-1844;1-800-872-0044** ..... **A•2070-2071**
IET Labs, Inc., Westbury, NY 11590, 516-334-5959;800-899-8438 ..... **D•1266,1269**
§ **ISKRA Electronics, Inc., Plainview, NY 11803, 516-349-0222** ..... **B•1364**
ISL Products Int'l, Ltd., Syosset, NY 11791-6093, 516-937-3475;800-626-6116 ..... **A•2087**
Maurey Instrument Corp., Chicago, IL 60629, 312-581-4555 ..... **A•2099**
Novotechnik U.S., Inc., Marlborough, MA 01752, 508-485-2244 ..... **A•2114**
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ..... **A•2118**
§ **Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Schaumburg, IL 60173, 708-884-6664** ..... **A•2122**
§ Bourns, Inc., Electronic Components Sls., Riverside, CA 92507-2114 ..... 909-781-5500; 801-750-7200
Carter Manufacturing Corporation, Bolton, MA 01740 508-779-5501
CRL Components, Inc., Roxboro Group, Fort Dodge, IA 50501 515-573-1300
† CTS of Canada, Ltd., Streetsville, ONTARIO, CAN. L5M 1Y9 416-826-1141
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Hokuriku USA Ltd., Madison, AL 35758 205-772-9620
International Microelectronics, Arlington, TX 76003 817-473-1730
Mouser Electronics, Santee, CA 92071 800-346-6873
Mouser Electronics, Mansfield, TX 76063 800-346-6873
Mouser Electronics, Gilroy, CA 95020 800-346-6873
Noble U.S.A., Inc., Rolling Meadows, IL 60008 708-364-6038
§ Piher International Corp., NACESA, Mt. Prospect, IL 60056 ..... 708-390-6680; 800-323-6693
RDI Elctrns., Inc., Mamaroneck, NY 10543 914-777-7000
† Shogyo International Corp., Great Neck, NY 11021-4799 516-466-0911

Potentiometers, Ceramic Metal (CERMET)-4750

§† **Bourns, Inc., Electronic Components Sls., Riverside, CA 92507-2114, 909-781-5500;801-750-7200** ..... **A•2058-2062,2066-2067**
§ **Clarostat Sensors and Controls Group, BYR, PLC, Plano, TX 75075, 214-422-1844;1-800-872-0044** ..... **A•2070**
§ **Dale Electronics, Inc., Tempe Div., Tempe, AZ 85282-1883, 602-967-7874** ..... **A•2072-2077**
§ **ISKRA Electronics, Inc., Plainview, NY 11803, 516-349-0222** ..... **B•1364**
ISL Products Int'l, Ltd., Syosset, NY 11791-6093, 516-937-3475;800-626-6116 ..... **A•2087**
KOA Speer Electronics, Bradford, PA 16701, 814-362-5536 ..... **A•1968**
§† **Mepcopal Company, San Diego, CA 92121-1307, 619-481-0210** ..... **A•2106-2107, B•1771**
§ **Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300** ..... **A•2110-2112**
Noble U.S.A., Inc., Rolling Meadows, IL 60008, 708-364-6038 ..... **A•2113**
† **Novotechnik U.S., Inc., Marlborough, MA 01752, 508-485-2244** ..... **A•2114**
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ..... **A•2118**
§† **Spectrol Electronics Corp., Ontario, CA 91761, 909-923-3313** ..... **A•2119-2121**
§ **Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Schaumburg, IL 60173, 708-884-6664** ..... **A•2122-2123**
§† **Vernitron Corp., Precision Comps. Group, St. Petersburg, FL 33710, 813-347-2181** ..... **A•2124-2126**
§† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635 714-447-2300
CRL Components, Inc., Roxboro Group, Fort Dodge, IA 50501 515-573-1300
§† CTS Corporation, Elkhart, IN 46514 219-293-7511
CTS Corp., Electrocomponents, Elkhart, IN 46514 219-295-3575
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 402-563-6506
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Hokuriku USA Ltd., Madison, AL 35758 205-772-9620
International Resistive Company, Boone, NC 28607 704-264-8861
§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 075-951-9111
§ Panasonic Indl. Co. Standard Comps. Sector, Matsushita Elec. Corp. of America, Secaucus, NJ 07094 201-392-4818
§ Piher International Corp., NACESA, Mt. Prospect, IL 60056 ..... 708-390-6680; 800-323-6693
§ Preh Electronic Industries, Inc., Lake Zurich, IL 60047-2578 708-438-4000
§ Raltron Electronics, Miami, FL 33172 305-593-6033
§† RCD Components, Inc., Manchester, NH 03109 603-669-0054
RDI Elctrns., Inc., Mamaroneck, NY 10543 914-777-7000
§ Silicon Sensors, Dodgeville, WI 53533 608-935-2707
§† Techno Division, Dale Electronics, Van Nuys, CA 91405-1139 818-781-1642

Potentiometers, Composition, Carbon-4750

§ **Clarostat Sensors and Controls Group, BYR, PLC, Plano, TX 75075, 214-422-1844;1-800-872-0044** ..... **A•2070-2071**
ISL Products Int'l, Ltd., Syosset, NY 11791-6093, 516-937-3475;800-626-6116 ..... **A•2087**
§ **Mepcopal Company, San Diego, CA 92121-1307, 619-481-0210** ..... **B•1771**
§ **Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300** ..... **A•2112**
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ..... **A•2118**
§ **Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Schaumburg, IL 60173, 708-884-6664** ..... **A•2122**
§ CRL Components, Inc., Roxboro Group, Fort Dodge, IA 50501 515-573-1300
§ CTS Corporation, Elkhart, IN 46514 219-293-7511
CTS Corp., Electrocomponents, Elkhart, IN 46514 219-295-3575
† CTS of Canada, Ltd., Streetsville, ONTARIO, CAN. L5M 1Y9 416-826-1141
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
§ Ohmite Manufacturing Co., Skokie, IL 60076 708-675-2600
§ Panasonic Indl. Co. Standard Comps. Sector, Matsushita Elec. Corp. of America, Secaucus, NJ 07094 201-392-4818
§ Philmore Manufacturing, Rockford, IL 61125-1386 815-229-7773
§ Preh Electronic Industries, Inc., Lake Zurich, IL 60047-2578 708-438-4000
† Shogyo International Corp., Great Neck, NY 11021-4799 516-466-0911

Potentiometers, Conductive Plastic-4750

§† **Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635, 714-447-2300** ..... **A•2056-2057**
§† **Bourns, Inc., Electronic Components Sls., Riverside, CA 92507-2114, 909-781-5500;801-750-7200** ..... **A•2058,2066-2067**
§† **Clarostat Sensors and Controls Group, BYR, PLC, Plano, TX 75075, 214-422-1844;1-800-872-0044** ..... **A•2070**
Dale Electronics, Inc., Tempe Div., Tempe, AZ 85282-1883, 602-967-7874 ..... **A•2072-2073**
† **Duncan Electronics, Costa Mesa, CA 92626, 714-545-8261** ..... **A•2079**
§ **ETI Systems, Polaris Indl. Entprs., Carlsbad, CA 92009, 619-929-0749** ..... **A•2084-2085**
† **JDK Controls, Inc., Grass Valley, CA 95945-0512, 916-273-4608** ..... **A•2088-2090**
§† **Maurey Instrument Corp., Chicago, IL 60629, 312-581-4555** ..... **A•2095,2097-2099,2102**
Midori America Corp., Fullerton, CA 92631, 714-449-0997 ..... **A•2109**
Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ..... **A•2112**
† **Novotechnik U.S., Inc., Marlborough, MA 01752, 508-485-2244** ..... **A•2114**
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ..... **A•2118**
§† **Spectrol Electronics Corp., Ontario, CA 91761, 909-923-3313** ..... **A•2119-2121**
§† **Vernitron Corp., Precision Comps. Group, St. Petersburg, FL 33710, 813-347-2181** ..... **A•2125**
† **Waters Manufacturing, Inc., Talley Industries, Wayland, MA 01778, 508-358-2777** ..... **A•2128-2129**
† Carter Manufacturing Corporation, Bolton, MA 01740 508-779-5501
Copal (USA), Inc., Torrance, CA 90501 310-618-0225
Dynamation Transducers Corporation, Holliston, MA 01746 508-429-8440
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
International Resistive Company, Boone, NC 28607 704-264-8861
† Penny & Giles, Santa Monica, CA 90401 310-393-1497
Penny & Giles Controls, Inc., Attleboro, MA 02703 508-226-3008

† Resistance Technology Inc., St. Paul, MN 55112 612-636-9770
† Samarius Precision Instruments, Inc., Ansonia, CT 06401 203-736-9805
Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Schaumburg, IL 60173 708-884-6664
Wilbrecht Electronics, St. Paul, MN 55107 612-222-2791

Potentiometers, Hot Molded-4750

Clarostat Sensors and Controls Group, BYR, PLC, Plano, TX 75075, 214-422-1844;1-800-872-0044 ..... A•2070-2071
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
International Resistive Company, Boone, NC 28607 704-264-8861
ISL Products Int'l, Ltd., Syosset, NY 11791-6093 ..... 516-937-3475;800-626-6116
§ Ohmite Manufacturing Co., Skokie, IL 60076 708-675-2600
Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Schaumburg, IL 60173 708-884-6664

Potentiometers, Hybrid-4750

§† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635, 714-447-2300 ..... A•2056
Bourns, Inc., Electronic Components Sls., Riverside, CA 92507-2114, 909-781-5500;801-750-7200 ..... A•2058
† Duncan Electronics, Costa Mesa, CA 92626, 714-545-8261 ..... A•2079
ETI Systems, Polaris Indl. Entprs., Carlsbad, CA 92009, 619-929-0749 ... A•2084
U. S. Digital Corp., Vancouver, WA 98682, 206-260-7451 ..... B•2020
Clarostat Sensors and Controls Group, BYR, PLC, Plano, TX 75075 ..... 214-422-1844; 1-800-872-0044
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
† Film Microelectronics Inc., Peabody, MA 01960 508-532-9913
Hokuriku USA Ltd., Madison, AL 35758 205-772-9620
† Penny & Giles, Santa Monica, CA 90401 310-393-1497
Penny & Giles Controls, Inc., Attleboro, MA 02703 508-226-3008
Vernitron Corp., Precision Comps. Group, St. Petersburg, FL 33710 813-347-2181

Potentiometers, Lab Type-4750

§ Bourns, Inc., Electronic Components Sls., Riverside, CA 92507-2114, 909-781-5500;801-750-7200 ..... A•2058
Duncan Electronics, Costa Mesa, CA 92626, 714-545-8261 ..... A•2079
ETI Systems, Polaris Indl. Entprs., Carlsbad, CA 92009, 619-929-0749 ... A•2084
IET Labs, Inc., Westbury, NY 11590, 516-334-5959;800-899-8438 ... D•1266,1269
Julie Research Labs., New York, NY 10001, 212-633-6625 ..... D•1278-1279
† Precision Control Manufacturing, Inc., Seattle, WA 98109, 206-281-9380 ..... A•2116
§† Spectrol Electronics Corp., Ontario, CA 91761, 909-923-3313 ..... A•2121
Waters Manufacturing, Inc., Talley Industries, Wayland, MA 01778, 508-358-2777 ..... A•2128
AVO Biddle Instruments, Blue Bell, PA 19422 215-646-9200
† Carter Manufacturing Corporation, Bolton, MA 01740 508-779-5501
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
§† Guildline Instruments, Lake Mary, FL 32746 407-333-3327
Leeds & Northrup, General Signal, North Wales, PA 19454 215-699-2000
Samarius Precision Instruments, Inc., Ansonia, CT 06401 203-736-9805
§† Vernitron Corp., Precision Comps. Group, St. Petersburg, FL 33710 813-347-2181

Potentiometers, Linear-4750

Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635, 714-447-2300 ..... A•2057
Bourns, Inc., Electronic Components Sls., Riverside, CA 92507-2114, 909-781-5500;801-750-7200 ..... A•2058,2067, B•1921
§ Clarostat Sensors and Controls Group, BYR, PLC, Plano, TX 75075, 214-422-1844;1-800-872-0044 ..... A•2070-2071
§ Dale Electronics, Inc., Tempe Div., Tempe, AZ 85282-1883, 602-967-7874 ..... A•2073-2075
† Duncan Electronics, Costa Mesa, CA 92626, 714-545-8261 ..... A•2078-2079
§ ETI Systems, Polaris Indl. Entprs., Carlsbad, CA 92009, 619-929-0749 ... A•2084
† Humphrey, Inc., San Diego, CA 92123, 619-565-6631 ..... B•1958
IET Labs, Inc., Westbury, NY 11590, 516-334-5959;800-899-8438 ... D•1266,1269
† JDK Controls, Inc., Grass Valley, CA 95945-0512, 916-273-4608 ... A•2088-2090
§† Maurey Instrument Corp., Chicago, IL 60629, 312-581-4555 .. A•2097-2098,2102
§ Mepcopal Company, San Diego, CA 92121-1307, 619-481-0210 ..... B•1771
Midori America Corp., Fullerton, CA 92631, 714-449-0997 ..... A•2109
§ Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ..... A•2112
† Novotechnik U.S., Inc., Marlborough, MA 01752, 508-485-2244 ..... A•2114
Penny & Giles Controls, Inc., Attleboro, MA 02703, 508-226-3008 ..... A•2115
† Precision Control Manufacturing, Inc., Seattle, WA 98109, 206-281-9380 ..... A•2116
RDI Elctrns., Inc., Mamaroneck, NY 10543, 914-777-7000 ..... A•2117
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ..... A•2118
§† Spectrol Electronics Corp., Ontario, CA 91761, 909-923-3313 ..... A•2121
† Waters Manufacturing, Inc., Talley Industries, Wayland, MA 01778, 508-358-2777 ..... A•2128
§ Astrosystems, Inc., Lake Success, NY 11042 516-328-1600
Barber-Colman Co., Indl. Instrs. Div., Loves Park, IL 61132-2940 815-637-3000
† Bourns Instruments Inc., Riverside, CA 92507 714-781-5148
† Carter Manufacturing Corporation, Bolton, MA 01740 508-779-5501
CRL Components, Inc., Roxboro Group, Fort Dodge, IA 50501 515-573-1300
§ CTS Corporation, Elkhart, IN 46514 219-293-7511
CTS Corp., Electrocomponents, Elkhart, IN 46514 219-295-3575
† CTS of Canada, Ltd., Streetsville, ONTARIO, CAN. L5M 1Y9 416-826-1141
Dynamation Transducers Corporation, Holliston, MA 01746 508-429-8440
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Hokuriku USA Ltd., Madison, AL 35758 205-772-9620
International Microelectronics, Arlington, TX 76003 817-473-1730
International Resistive Company, Boone, NC 28607 704-264-8861
§ ISKRA Electronics, Inc., Plainview, NY 11803 516-349-0222
ISL Products Int'l, Ltd., Syosset, NY 11791-6093 ..... 516-937-3475;800-626-6116
MagneTek, Transducer Products, Simi Valley, CA 93065 805-581-3985
§ Noble U.S.A., Inc., Rolling Meadows, IL 60008 708-364-6038
§† Ohmite Manufacturing Co., Skokie, IL 60076 708-675-2600
† Orbit Instrument Corp., Hauppauge, NY 11788 516-435-8300
§† Penny & Giles, Santa Monica, CA 90401 310-393-1497
§ Piher International Corp., NACESA, Mt. Prospect, IL 60056 ..... 708-390-6680; 800-323-6693
§ Preh Electronic Industries, Inc., Lake Zurich, IL 60047-2578 708-438-4000
Samarius Precision Instruments, Inc., Ansonia, CT 06401 203-736-9805
† Shogyo International Corp., Great Neck, NY 11021-4799 516-466-0911
§ Silicon Sensors, Dodgeville, WI 53533 608-935-2707
§† Techno Division, Dale Electronics, Van Nuys, CA 91405-1139 818-781-1642
§ Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Schaumburg, IL 60173 708-884-6664
§† Vernitron Corp., Precision Comps. Group, St. Petersburg, FL 33710 813-347-2181
§ Vishay Resistors, Malvern, PA 19355 215-644-1300

Potentiometers, Metal Film-4750

IET Labs, Inc., Westbury, NY 11590, 516-334-5959;800-899-8438 ... D•1266,1269
Noble U.S.A., Inc., Rolling Meadows, IL 60008, 708-364-6038 ..... A•2113
§† Vernitron Corp., Precision Comps. Group, St. Petersburg, FL 33710, 813-347-2181 ..... A•2126
§ Vishay Resistors, Malvern, PA 19355, 215-644-1300 ..... A•2127
§ Clarostat Sensors and Controls Group, BYR, PLC, Plano, TX 75075 ..... 214-422-1844; 1-800-872-0044
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 402-563-6506
Dale Electronics, Inc., Tempe Div., Tempe, AZ 85282-1883 602-967-7874
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
International Resistive Company, Boone, NC 28607 704-264-8861
Preh Electronic Industries, Inc., Lake Zurich, IL 60047-2578 708-438-4000
† Shogyo International Corp., Great Neck, NY 11021-4799 516-466-0911
§ Silicon Sensors, Dodgeville, WI 53533 608-935-2707
† Tech Laboratories Inc., Palisades Pk., NJ 07650 201-944-2221
§† Techno Division, Dale Electronics, Van Nuys, CA 91405-1139 818-781-1642
§ Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Schaumburg, IL 60173 708-884-6664
Topflight, York, PA 17404 ..... 717-843-9901;800-233-9386

Potentiometers, Metal, Glazed — See Potentiometers, Ceramic Metal (Vol. A)

Potentiometers, Motorized-4750

§ Clarostat Sensors and Controls Group, BYR, PLC, Plano, TX 75075, 214-422-1844;1-800-872-0044 ..... A•2070
§ ETI Systems, Polaris Indl. Entprs., Carlsbad, CA 92009, 619-929-0749 ... A•2085
† JDK Controls, Inc., Grass Valley, CA 95945-0512, 916-273-4608 ... A•2088-2089
† Maurey Instrument Corp., Chicago, IL 60629, 312-581-4555 .. A•2095,2099,2102
† Novotechnik U.S., Inc., Marlborough, MA 01752, 508-485-2244 ..... A•2114
Waters Manufacturing, Inc., Talley Industries, Wayland, MA 01778, 508-358-2777 ..... A•2128
§† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635 714-447-2300
† Carter Manufacturing Corporation, Bolton, MA 01740 508-779-5501
† Control Technology Co., Inc., Long Island City, NY 11101 718-361-2133
Dynamation Transducers Corporation, Holliston, MA 01746 508-429-8440
† Industrial Control Co., Rockledge, FL 32955 407-259-7105
Maxmar Controls Inc., Pleasantville, NY 10570 914-747-3540
† Ohmite Manufacturing Co., Skokie, IL 60076 708-675-2600

Potentiometers, Multiturn-4750

§† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635, 714-447-2300 ..... A•2056-2057
§† Bourns, Inc., Electronic Components Sls., Riverside, CA 92507-2114, 909-781-5500;801-750-7200 ..... A•2058,2060,2062,2066
§ Clarostat Sensors and Controls Group, BYR, PLC, Plano, TX 75075, 214-422-1844;1-800-872-0044 ..... A•2070
§ Dale Electronics, Inc., Tempe Div., Tempe, AZ 85282-1883, 602-967-7874 ..... A•2075,2077
† Duncan Electronics, Costa Mesa, CA 92626, 714-545-8261 ..... A•2078-2079
§ ETI Systems, Polaris Indl. Entprs., Carlsbad, CA 92009, 619-929-0749 ..... A•2084-2085
IET Labs, Inc., Westbury, NY 11590, 516-334-5959;800-899-8438 ... D•1266,1269
ISL Products Int'l, Ltd., Syosset, NY 11791-6093, 516-937-3475;800-626-6116 ..... A•2087
† Maurey Instrument Corp., Chicago, IL 60629, 312-581-4555 ..... A•2099
§ Mepcopal Company, San Diego, CA 92121-1307, 619-481-0210 ..... A•2106, B•1771
§ Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ..... A•2111
† Novotechnik U.S., Inc., Marlborough, MA 01752, 508-485-2244 ..... A•2114
Penny & Giles Controls, Inc., Attleboro, MA 02703, 508-226-3008 ..... A•2115
Precision Control Manufacturing, Inc., Seattle, WA 98109, 206-281-9380 ..... A•2116
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ..... A•2118
§† Spectrol Electronics Corp., Ontario, CA 91761, 909-923-3313 ..... A•2119,2121
§ Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Schaumburg, IL 60173, 708-884-6664 ..... A•2123
§† Vernitron Corp., Precision Comps. Group, St. Petersburg, FL 33710, 813-347-2181 ..... A•2125
CTS Corporation, Elkhart, IN 46514 219-293-7511
CTS Corp., Electrocomponents, Elkhart, IN 46514 219-295-3575
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639

International Microelectronics, Arlington, TX 76003 817-473-1730
§ ISKRA Electronics, Inc., Plainview, NY 11803 516-349-0222
Midori America Corp., Fullerton, CA 92631 714-449-0997
Mouser Electronics, Santee, CA 92071 800-346-6873
Mouser Electronics, Mansfield, TX 76063 800-346-6873
Mouser Electronics, Gilroy, CA 95020 800-346-6873
§† Penny & Giles, Santa Monica, CA 90401 310-393-1497
§ Preh Electronic Industries, Inc., Lake Zurich, IL 60047-2578 708-438-4000
§† Techno Division, Dale Electronics, Van Nuys, CA 91405-1139 818-781-1642
§ West Electronic Sales Team, Huntington Beach, CA 92647 ..... 714-375-6500; 310-495-5569

Potentiometers, Nonlinear-4750

Bourns, Inc., Electronic Components Sls., Riverside, CA 92507-2114, 909-781-5500;801-750-7200 ..... A•2067
§† Clarostat Sensors and Controls Group, BYR, PLC, Plano, TX 75075, 214-422-1844;1-800-872-0044 ..... A•2070
Dale Electronics, Inc., Tempe Div., Tempe, AZ 85282-1883, 602-967-7874 ..... A•2073
† Duncan Electronics, Costa Mesa, CA 92626, 714-545-8261 ..... A•2079
† JDK Controls, Inc., Grass Valley, CA 95945-0512, 916-273-4608 ..... A•2088
§ Mallory Controls, Emerson Electric Canada, Woodstock, Ont., CANADA N4S 7W8, 519-539-4891 ..... A•2092
† Maurey Instrument Corp., Chicago, IL 60629, 312-581-4555 ..... A•2099
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ..... A•2118
Waters Manufacturing, Inc., Talley Industries, Wayland, MA 01778, 508-358-2777 ..... A•2128
§† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635 714-447-2300
† Carter Manufacturing Corporation, Bolton, MA 01740 508-779-5501
CRL Components, Inc., Roxboro Group, Fort Dodge, IA 50501 515-573-1300
† CTS Corporation, Elkhart, IN 46514 219-293-7511
CTS Corp., Electrocomponents, Elkhart, IN 46514 219-295-3575
Dynamation Transducers Corporation, Holliston, MA 01746 508-429-8440
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
ETI Systems, Polaris Indl. Entprs., Carlsbad, CA 92009 619-929-0749
Hokuriku USA Ltd., Madison, AL 35758 205-772-9620
International Resistive Company, Boone, NC 28607 704-264-8861
§ ISKRA Electronics, Inc., Plainview, NY 11803 516-349-0222
Midori America Corp., Fullerton, CA 92631 714-449-0997
Noble U.S.A., Inc., Rolling Meadows, IL 60008 708-364-6038
† Ohmite Manufacturing Co., Skokie, IL 60076 708-675-2600
§† Penny & Giles, Santa Monica, CA 90401 310-393-1497
Penny & Giles Controls, Inc., Attleboro, MA 02703 508-226-3008
§ Piher International Corp., NACESA, Mt. Prospect, IL 60056 ..... 708-390-6680; 800-323-6693
§ Preh Electronic Industries, Inc., Lake Zurich, IL 60047-2578 708-438-4000
† Shogyo International Corp., Great Neck, NY 11021-4799 516-466-0911
§† Spectrol Electronics Corp., Ontario, CA 91761 909-923-3313
§† Techno Division, Dale Electronics, Van Nuys, CA 91405-1139 818-781-1642
§† Vernitron Corp., Precision Comps. Group, St. Petersburg, FL 33710 813-347-2181
Vishay Resistors, Malvern, PA 19355 215-644-1300
Wilbrecht Electronics, St. Paul, MN 55107 612-222-2791

Potentiometers, Power — See Rheostats (Vol. A)

Potentiometers, Pushbutton-4750

Bourns, Inc., Electronic Components Sls., Riverside, CA 92507-2114, 909-781-5500;801-750-7200 ..... A•2058,2066
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
ETI Systems, Polaris Indl. Entprs., Carlsbad, CA 92009 619-929-0749
Maurey Instrument Corp., Chicago, IL 60629 312-581-4555
J. R. Merritt Controls, Inc., Norwalk, CT 06854 ..... 203-855-9100;800-333-5762

Potentiometers, Rectilinear-4750

§ Bourns, Inc., Electronic Components Sls., Riverside, CA 92507-2114, 909-781-5500;801-750-7200 ..... A•2058-2060
Duncan Electronics, Costa Mesa, CA 92626, 714-545-8261 ..... A•2078-2079
§ ETI Systems, Polaris Indl. Entprs., Carlsbad, CA 92009, 619-929-0749 ..... A•2084
† Humphrey, Inc., San Diego, CA 92123, 619-565-6631 ..... B•1957-1958
† JDK Controls, Inc., Grass Valley, CA 95945-0512, 916-273-4608 ..... A•2088
Midori America Corp., Fullerton, CA 92631, 714-449-0997 ..... A•2109
† Novotechnik U.S., Inc., Marlborough, MA 01752, 508-485-2244 ..... A•2114
Penny & Giles Controls, Inc., Attleboro, MA 02703, 508-226-3008 ..... A•2115
RDI Elctrns., Inc., Mamaroneck, NY 10543, 914-777-7000 ..... A•2117
§† Spectrol Electronics Corp., Ontario, CA 91761, 909-923-3313 ..... A•2119
§ Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Schaumburg, IL 60173, 708-884-6664 ..... A•2122
§† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635 714-447-2300
† Bourns Instruments Inc., Riverside, CA 92507 714-781-5148
† Carter Manufacturing Corporation, Bolton, MA 01740 508-779-5501
§ Clarostat Sensors and Controls Group, BYR, PLC, Plano, TX 75075 ..... 214-422-1844; 1-800-872-0044
CTS Corporation, Elkhart, IN 46514 219-293-7511
Dynamation Transducers Corporation, Holliston, MA 01746 508-429-8440
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
International Microelectronics, Arlington, TX 76003 817-473-1730
§ ISKRA Electronics, Inc., Plainview, NY 11803 516-349-0222
Mouser Electronics, Santee, CA 92071 800-346-6873
Mouser Electronics, Mansfield, TX 76063 800-346-6873
Mouser Electronics, Gilroy, CA 95020 800-346-6873
† Penny & Giles, Santa Monica, CA 90401 310-393-1497
† Samarius Precision Instruments, Inc., Ansonia, CT 06401 203-736-9805
† Shogyo International Corp., Great Neck, NY 11021-4799 516-466-0911
§† Techno Division, Dale Electronics, Van Nuys, CA 91405-1139 818-781-1642
§† Vernitron Corp., Precision Comps. Group, St. Petersburg, FL 33710 813-347-2181
§ Vishay Resistors, Malvern, PA 19355 215-644-1300
Waters Manufacturing, Inc., Talley Industries, Wayland, MA 01778 508-358-2777

Potentiometers, Servo Mount-4750

§† Bourns, Inc., Electronic Components Sls., Riverside, CA 92507-2114, 909-781-5500;801-750-7200 ..... A•2058
† Duncan Electronics, Costa Mesa, CA 92626, 714-545-8261 ..... A•2079
§ ETI Systems, Polaris Indl. Entprs., Carlsbad, CA 92009, 619-929-0749 ..... A•2084-2085
† JDK Controls, Inc., Grass Valley, CA 95945-0512, 916-273-4608 ..... A•2088,2090
§† Maurey Instrument Corp., Chicago, IL 60629, 312-581-4555 ..... A•2095-2096
Midori America Corp., Fullerton, CA 92631, 714-449-0997 ..... A•2109
§† Spectrol Electronics Corp., Ontario, CA 91761, 909-923-3313 ..... A•2119-2121
§† Vernitron Corp., Precision Comps. Group, St. Petersburg, FL 33710, 813-347-2181 ..... A•2125
† Waters Manufacturing, Inc., Talley Industries, Wayland, MA 01778, 508-358-2777 ..... A•2129
§ Astrosystems, Inc., Lake Success, NY 11042 516-328-1600
§† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635 714-447-2300
† Carter Manufacturing Corporation, Bolton, MA 01740 508-779-5501
Dynamation Transducers Corporation, Holliston, MA 01746 508-429-8440
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
International Resistive Company, Boone, NC 28607 704-264-8861
† Novotechnik U.S., Inc., Marlborough, MA 01752 508-485-2244
† Penny & Giles, Santa Monica, CA 90401 310-393-1497
† Samarius Precision Instruments, Inc., Ansonia, CT 06401 203-736-9805
† Shogyo International Corp., Great Neck, NY 11021-4799 516-466-0911

Potentiometers, Sliding-4750

Bourns, Inc., Electronic Components Sls., Riverside, CA 92507-2114, 909-781-5500;801-750-7200 ..... A•2058
Duncan Electronics, Costa Mesa, CA 92626, 714-545-8261 ..... A•2078-2079
ETI Systems, Polaris Indl. Entprs., Carlsbad, CA 92009, 619-929-0749 ..... A•2084
ISL Products Int'l, Ltd., Syosset, NY 11791-6093, 516-937-3475;800-626-6116 ..... A•2087
Noble U.S.A., Inc., Rolling Meadows, IL 60008, 708-364-6038 ..... A•2113
RDI Elctrns., Inc., Mamaroneck, NY 10543, 914-777-7000 ..... A•2117
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ..... A•2118
§ Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Schaumburg, IL 60173, 708-884-6664 ..... A•2123
Waters Manufacturing, Inc., Talley Industries, Wayland, MA 01778, 508-358-2777 ..... A•2128
Dynamation Transducers Corporation, Holliston, MA 01746 508-429-8440
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
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International Microelectronics, Arlington, TX 76003 817-473-1730
§ ISKRA Electronics, Inc., Plainview, NY 11803 516-349-0222
Midori America Corp., Fullerton, CA 92631 714-449-0997
Mouser Electronics, Santee, CA 92071 800-346-6873
Mouser Electronics, Mansfield, TX 76063 800-346-6873
Mouser Electronics, Gilroy, CA 95020 800-346-6873
† Novotechnik U.S., Inc., Marlborough, MA 01752 508-485-2244
§ Panasonic Indl. Co. Standard Comps. Sector, Matsushita Elec. Corp. of America, Secaucus, NJ 07094 201-392-4818
§ Piher International Corp., NACESA, Mt. Prospect, IL 60056 ..... 708-390-6680; 800-323-6693
§ Preh Electronic Industries, Inc., Lake Zurich, IL 60047-2578 708-438-4000
§† Techno Division, Dale Electronics, Van Nuys, CA 91405-1139 818-781-1642

Potentiometers, Trimmer-4750

§† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635, 714-447-2300 ..... A•2057
§† Bourns, Inc., Electronic Components Sls., Riverside, CA 92507-2114, 909-781-5500;801-750-7200 ..... A•2058-2066
§ Clarostat Sensors and Controls Group, BYR, PLC, Plano, TX 75075, 214-422-1844;1-800-872-0044 ..... A•2070-2071
§ Dale Electronics, Inc., Tempe Div., Tempe, AZ 85282-1883, 602-967-7874 ..... A•2072,2074-2077
IET Labs, Inc., Westbury, NY 11590, 516-334-5959;800-899-8438 ... D•1266,1269
§ ISKRA Electronics, Inc., Plainview, NY 11803, 516-349-0222 ..... B•1364
ISL Products Int'l, Ltd., Syosset, NY 11791-6093, 516-937-3475;800-626-6116 ..... A•2087
KOA Speer Electronics, Bradford, PA 16701, 814-362-5536 ..... A•1968
§† Mepcopal Company, San Diego, CA 92121-1307, 619-481-0210 ..... A•2106-2107, B•1771
§ Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 .. A•2110-2112
§ Noble U.S.A., Inc., Rolling Meadows, IL 60008, 708-364-6038 ..... A•2113
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ..... A•2118
§† Spectrol Electronics Corp., Ontario, CA 91761, 909-923-3313 ..... A•2119
§ Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Schaumburg, IL 60173, 708-884-6664 ..... A•2122-2123
§† Vernitron Corp., Precision Comps. Group, St. Petersburg, FL 33710, 813-347-2181 ..... A•2124-2126
§† Vishay Resistors, Malvern, PA 19355, 215-644-1300 ..... A•2127
AVX Corporation, A Kyocera Group Company, Myrtle Beach, SC 29577 803-448-9411
§ CTS Corporation, Elkhart, IN 46514 219-293-7511
CTS Corp., Electrocomponents, Elkhart, IN 46514 219-295-3575
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 402-563-6506

Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Hokuriku USA Ltd., Madison, AL 35758 205-772-9620
International Microelectronics, Arlington, TX 76003 817-473-1730
§† Maurey Instrument Corp., Chicago, IL 60629 312-581-4555
Mel-Rain Controls, Paw Paw, MI 49079 616-657-2527
§ Midstates Marketing, Inc., Indianapolis, IN 46202 317-639-9999
Mouser Electronics, Santee, CA 92071 800-346-6873
Mouser Electronics, Mansfield, TX 76063 800-346-6873
Mouser Electronics, Gilroy, CA 95020 800-346-6873
§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
† Novotechnik U.S., Inc., Marlborough, MA 01752 508-485-2244
Ohmite Manufacturing Co., Skokie, IL 60076 708-675-2600
§ Panasonic Indl. Co. Standard Comps. Sector, Matsushita Elec. Corp. of America, Secaucus, NJ 07094 201-392-4818
§ Piher International Corp., NACESA, Mt. Prospect, IL 60056 ..... 708-390-6680; 800-323-6693
§ Preh Electronic Industries, Inc., Lake Zurich, IL 60047-2578 708-438-4000
† Resistance Technology Inc., St. Paul, MN 55112 612-636-9770
§ RF Electronics, Inc., Irvine, CA 92714-5517 714-263-0661
Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013 615-641-2020
† Shogyo International Corp., Great Neck, NY 11021-4799 516-466-0911
§ Silicon Sensors, Dodgeville, WI 53533 608-935-2707
§† Techno Division, Dale Electronics, Van Nuys, CA 91405-1139 818-781-1642
§ West Electronic Sales Team, Huntington Beach, CA 92647 ..... 714-375-6500; 310-495-5569
Wilbrecht Electronics, St. Paul, MN 55107 612-222-2791

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§† **Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635, 714-447-2300** ..... **A•2056**
§† **Bourns, Inc., Electronic Components Sls., Riverside, CA 92507-2114, 909-781-5500;801-750-7200** ..... **A•2058,2066**
§† **Clarostat Sensors and Controls Group, BYR, PLC, Plano, TX 75075, 214-422-1844;1-800-872-0044** ..... **A•2070-2071**
† **Duncan Electronics, Costa Mesa, CA 92626, 714-545-8261** ..... **A•2078-2079**
§ **ETI Systems, Polaris Indl. Entprs., Carlsbad, CA 92009, 619-929-0749** ..... **A•2084-2085**
† **Humphrey, Inc., San Diego, CA 92123, 619-565-6631** ..... **B•1957**
ISL Products Int'l, Ltd., Syosset, NY 11791-6093, 516-937-3475;800-626-6116 ..... **A•2087**
§ **Mallory Controls, Emerson Electric Canada, Woodstock, Ont., CANADA N4S 7W8, 519-539-4891** ..... **A•2092-2093**
§† **Maurey Instrument Corp., Chicago, IL 60629, 312-581-4555** ..... **A•2096-2099**
Memcor-Truohm, Inc., Huntington, IN 46750, 219-356-4300 ..... **A•2105**
§ **Mepcopal Company, San Diego, CA 92121-1307, 619-481-0210** ..... **A•2106, B•1771**
§† **Ohmite Manufacturing Co., Skokie, IL 60076, 708-675-2600** ..... **A•2000**
† **Precision Control Manufacturing, Inc., Seattle, WA 98109, 206-281-9380** ..... **A•2116**
RDI Elctrns., Inc., Mamaroneck, NY 10543, 914-777-7000 ..... **A•2117**
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ..... **A•2118**
§† **Spectrol Electronics Corp., Ontario, CA 91761, 909-923-3313** ..... **A•2119-2121**
§† **Vernitron Corp., Precision Comps. Group, St. Petersburg, FL 33710, 813-347-2181** ..... **A•2124-2125**
† Carter Manufacturing Corporation, Bolton, MA 01740 508-779-5501
CTS Corporation, Elkhart, IN 46514 219-293-7511
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 402-563-6506
Dale Electronics, Inc., Tempe Div., Tempe, AZ 85282-1883 602-967-7874
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
International Resistive Company, Boone, NC 28607 704-264-8861
§ Martin Sound Prods. Inc., Cleveland, OH 44143-2297 216-442-2286
† Mel-Rain Controls, Paw Paw, MI 49079 616-657-2527
J. R. Merritt Controls, Inc., Norwalk, CT 06854 ..... 203-855-9100;800-333-5762
Midori America Corp., Fullerton, CA 92631 714-449-0997
Noble U.S.A., Inc., Rolling Meadows, IL 60008 708-364-6038
† Novotechnik U.S., Inc., Marlborough, MA 01752 508-485-2244
† Penny & Giles, Santa Monica, CA 90401 310-393-1497
Penny & Giles Controls, Inc., Attleboro, MA 02703 508-226-3008
† Samarius Precision Instruments, Inc., Ansonia, CT 06401 203-736-9805
† Tech Laboratories Inc., Palisades Pk., NJ 07650 201-944-2221
§† Techno Division, Dale Electronics, Van Nuys, CA 91405-1139 818-781-1642
§ Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Schaumburg, IL 60173 708-884-6664
§† Vamistor Corp., Sevierville, TN 37862 615-453-0001
† Waters Manufacturing, Inc., Talley Industries, Wayland, MA 01778 508-358-2777

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§† **Microwave Filter Inc., East Syracuse, NY 13057-0486, 315-437-3953;800-448-1666** ..... A•1658-1659
KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
† Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710 813-347-2181
† Microlab. FXR, Livingston, NJ 07039 201-992-7700
† Microphase, Norwalk, CT 06856 203-866-8000
† Premier Microwave, Port Chester, NY 10573 914-939-8900
† ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086 408-730-6300
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291

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§ **AEMC Corporation, Boston, MA 02111, 617-451-0227;800-343-1391** ..... D•1223
Bell, F. W., Inc., Orlando, FL 32807, 407-678-6900 ... B•1918, D•1153,1236-1237
GMW Associates, Redwood City, CA 94064, 415-368-4884 ..... D•1261
Magnetic Instrumentation, Inc., Indianapolis, IN 46226, 317-545-2102 .... D•1295
Magnetic Shield Corporation, Perfection Mica Co., Bensenville, IL 60106, 708-766-7800 ..... C•1696
Magnos, Hudson, MA 01749, 508-562-1173 ..... D•1296
Ohio Semitronics, Inc., Columbus, OH 43212, 614-486-9561 ..... B•2002
Active Control Instrumentation, Key Largo, FL 33037 305-451-1000
Cryomagnetics, Inc., Oak Ridge, TN 37830 615-482-9551
§ John Fluke Mfg. Co, Inc, Everett, WA 98203 206-347-6100
LDJ Electronics, Troy, MI 48099-0219 313-528-2202
§ Micro Switch, A Honeywell Div., Freeport, IL 61032 1-800-537-6945
Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98607 206-834-2500
SinoTECH Made in China, Inc., Technology Communications Group, Inc., West Linn, OR 97068 503-638-1000
§ Walker Scientific, Worcester, MA 01606 ... 508-852-3674;508-853-3232;800-962-4638

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BEC Inc. Certified Calibration Labs, Horsham, PA 19044 800-523-3808
† General Microwave Corporation, Amityville, NY 11701 516-226-8900
GGB Industries, Inc., Picoprobe Division, Naples, FL 33941 813-643-4400
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
† Loral Microwave Narda, Hauppauge, NY 11788 516-231-1700
† Maury Microwave Corp., Ontario, CA 91764 909-987-4715
Probe-Rite, Inc., Santa Clara, CA 95052 408-727-0100
Tektronix, Inc., Wilsonville, OR 97070 800-835-9433
§† Telephonics Corporation/PRD Instruments, Huntington, NY 11743 ..... 516-549-6415/6428
Teleplex, Inc., Alford Division, Woburn, MA 01801 617-935-8610

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AT&T Capital Corporation, DFW Airport, TX 75261-9260, 800-874-7123 .. D•1231
Elan Systems, Inc., Morgan Hill, CA 95037, 800-541-3526 ..... A•1696, D•1087
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System General Corporation, Milpitas, CA 95035, 408-263-6667 ..... A•1717
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Advanced Micro Computer, Ft. Lauderdale, FL 33309 305-975-9515
Advantest America, Inc., Buffalo Grove, IL 60089-4503 800-441-0852
§ Advin Systems Inc., Sunnyvale, CA 94086 408-243-7000
§ Baradine Products Ltd., North Vancouver, B.C., CANADA V7L 4L3 604-988-9853
Barber-Colman Co., Indl. Instrs. Div., Loves Park, IL 61132-2940 815-637-3000
§† BYTEK Corp., Instrument Systems Div., Boca Raton, FL 33487-1323 407-994-3520

§ Contact East, N. Andover, MA 01845 508-682-2000
Epson America Inc., Component Sales Dept., Torrance, CA 90503 310-782-5318
Φ Genstar Rentals, Inc., Calabasas, CA 91302 800-422-3300
HMC/Hub Material Company, Canton, MA 02021 617-821-1870
§ International Instrumentation, Inc., Westlake Vlg., CA 91361 805-495-7673
§† International Microsystems, Milpitas, CA 95035 408-942-1001
Kontron Elektronik-US Kontron Elektronik GMBH-Sub. BM, Beverly, MA 01915 508-927-6575
Maxmar Controls Inc., Pleasantville, NY 10570 914-747-3540
§ Metermaster, Tempe, AZ 85282 602-431-0015
§ Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
MSD3, Morgan Hill, CA 95037 ..... 800-541-3526;408-778-7267
MSD3, Morgan Hill, CA 95037 ..... 800-541-3526;408-778-7267
§ Omation Inc., Richardson, TX 75081 ..... 214-231-5167;800-553-9119
PERX,Inc., Corte Madera, CA 94925 415-927-0155
§ Prologic Systems, Broomfield, CO 80020 303-460-0103
# Promac, United Exporters Company, San Francisco, CA 94013-1630 ... 415-255-9393
§ Red Square Company, Santa Ana, CA 92705 714-751-1373
§ Rockwell Int'l:Semiconductor Products Division, Newport Beach, CA 92660 714-833-4600
§ Southern Computer Corp., Atlanta, GA 30342 404-252-3340
§ Square D Co., Palatine, IL 60067 708-397-2600
§ Stag Microsystems Inc., Santa Clara, CA 95054 ..... 408-988-1118;1-800-227-8836
† Sunrise Electronics, Inc., Glendora, CA 91740 818-914-1926
§Φ Vail Silicon Tools, Deerfield Beach, FL 33442 305-570-5580
§ Xeltek, Sunnyvale, CA 94086 408-524-1935

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Quartz, Fused-2300

† Accumet Engineering, Hudson, MA 01749 508-568-8311
§† Atomergic Chemetals Corp., Farmingdale, NY 11735-1718 516-694-9000
# Quartzite Processing, Inc., Malden, MA 02148 617-322-3611
Richards, Arklay S., Co., Inc., Newton Highlands, MA 02161-1796 617-527-4385
Valpey-Fisher:Matec Corp, Hopkinton, MA 01748 508-435-6831

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Programmed Test Sources, Littleton, MA 01460, 508-486-3008 ..... D•1316
Raytheon Company, Quincy Operation, Quincy, MA 02269, 617-479-5300 ..... B•1108
AEL Defense Corp., Lansdale, PA 19446 215-822-2929
† AIL Systems, Inc., Eaton Corp., Deer Park, NY 11729 516-595-3094
† Alden Electronics, Inc., Westboro, MA 01581 508-366-8851
† Alpha Industries, Inc., Woburn, MA 01801 617-935-5150
§† Avantek, Inc, A Subsidiary of Hewlett-Packard, Santa Clara, CA 95054 .. 408-727-0700
Axel Electronics, Inc., Subsidiary of FPBSM Industries Inc., Rancho Dominquez, CA 90220 718-291-3900
Aydin Corp., Horsham, PA 19044 215-657-7510
† Cardion, Inc., A Siemens Company, Woodbury, NY 11797-2925 516-921-7300
Computer Systems Technical Support, Anaheim, CA 92807 714-632-1300
Comstron A Div. of Aeroflex, Plainview, NY 11803 516-752-2351
Continental Electronics Corporation, Dallas, TX 75227 214-381-7161
† Datron Systems Division, Simi Valley, CA 93065-1650 805-584-1717
† Electronic Space Systems Corp., Concord, MA 01742 508-369-7200
† Electro-Tec Corporation A Kaydon Company, Blackburg, VA 24060 703-552-2111
Epsilon-Lambda Elctrns. Corp., Geneva, IL 60134 708-232-9611
† FEI Microwave, Inc., Frequency Electronics, Inc., Sunnyvale, CA 94086 .. 408-732-0880
† GEC-Marconi Electronic Systems Corp., Wayne, NJ 07474-0975 201-633-6000
Hughes Aircraft Co., Electron Dynamics Div., Torrance, CA 90509-2999 310-517-6000
Instrument Research Co., Columbia, MD 21045 410-740-3411
† Integrated Microwave, San Diego, CA 92121-1009 619-259-2600
† Interface Engineering Inc., Holbrook, MA 02343 617-986-2600
† ITT Gilfillan, ITT Defense Inc., Van Nuys, CA 91409 818-988-2600
Lectronic Research Labs., Inc., Camden, NJ 08104 800-358-8378
† Loral Microwave Narda, Hauppauge, NY 11788 516-231-1700
MACOM, Inc., Lowell, MA 01851 617-272-3000
Mathematical Systems Design, Inc., Los Angeles, CA 90064 310-479-7180
† MCL, Inc., Bolingbrook, IL 60440-4999 708-759-9500
† Merrimac Industries, West Caldwell, NJ 07006 201-575-1300
† Metric Systems, Ft. Walton Beach, FL 32548-9990 904-244-9600
† Microwave Technology Div., JHP Industrial, Syracuse, NY 13202-3442 315-422-0050
§ Milliflect, Newark, CA 94560 510-791-5188
Orbit Advanced Technologies, Horsham, PA 19044 215-674-4220
† Premier Microwave, Port Chester, NY 10573 914-939-8900
† Pro-Comm, Inc., Brick, NJ 08724 908-206-0660
† Radio Research Instrument Co., Inc., Waterbury, CT 06704-3506 203-753-5840
† RHG Electronics Laboratory, Inc., Deer Park, NY 11729 516-242-1100
† Sage Laboratories, Inc., Natick, MA 01760 508-653-0844
† Servo Corporation of America, Hicksville, NY 11801-5259 516-938-9700
† Signatron, A Subsidiary of Meteor Communications Corp., Lexington, MA 02173 617-861-1500
ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086 408-730-6300
† Teledyne Microwave, Mountain View, CA 94043 415-968-2211
† Teledyne Ryan Electronics, San Diego, CA 92123 619-560-6400
† Thermacore Inc., Lancaster, PA 17601 717-569-6551
TIW Systems, Inc., Sunnyvale, CA 94089 408-734-3900
† TRAK Microwave Corp., Tampa, FL 33634 813-884-1411
Trilithic, Inc., Indianapolis, IN 46236 800-344-2412
§† Vega Precision Labs., Vienna, VA 22180 703-938-6300
† Watkins-Johnson Co., Palo Alto, CA 94304 415-493-4141

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† Alpha Industries, Inc., Woburn, MA 01801 617-935-5150
† Electronic Space Systems Corp., Concord, MA 01742 508-369-7200
† Gabriel Elctrns. Inc., Scarborough, ME 04070 207-883-5161
§ Milliflect, Newark, CA 94560 510-791-5188
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3 ..... 514-694-6666; 800-724-3911
† Teledyne Ryan Electronics, San Diego, CA 92123 619-560-6400
† Transco Products, Inc., Subsidiary of Datron Systems Inc., Camarillo, CA 93012 805-987-8007

Reactors, Charging-5600

NWL Transformers, Bordentown, NJ 08505, 609-298-7300 ..... A•2437, D•1851
AFP ISOREG, AFP Transformers, Inc., Littleton, MA 01460 508-486-9483
Axel Electronics, Inc., Subsidiary of FPBSM Industries Inc., Rancho Dominquez, CA 90220 718-291-3900
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
Basler Elec., Electronic Product Group, Highland, IL 62249 ..... 618-654-2341; 800-645-2074
† Del Electronics Corp., Valhalla, NY 10595 914-686-3600
Electrocom Industries, S. Bend, IN 46615 219-232-2743
Hipotronics Inc., Brewster, NY 10509 914-279-8091
† Hisonic, Inc., Olathe, KS 66051 913-782-0012
Hitran Corporation, Flemington, NJ 08822-1238 908-782-5525
Mag-Con, St. Paul, MN 55113 612-633-8820
† Magnecomp, Inc., Pickens, SC 29671 803-878-4700
† Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
† PTC Transformers, Bordentown, NJ 08505 609-298-8200
† Radio Research Instrument Co., Inc., Waterbury, CT 06704-3506 203-753-5840
Standard Magnetic Corp., Garden Grove, CA 92641 714-379-5671
† Thordarson Meissner, Components Corp. of Amer., Mt. Carmel, IL 62863 618-262-5121
† Torelco, Inc., Irvington, NJ 07111 ..... 201-374-8641;800-867-3526
§ Zambre Co., Inc., Mountain View, CA 94043 415-968-9176

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Reactors, Filter-5600

Hitran Corporation, Flemington, NJ 08822-1238, 908-782-5525 ..... A•2361
† Lenco Elctrns., Inc., McHenry, IL 60050, 815-344-2900 ..... A•2375
Mitchell Electronics Corp., Mt. Vernon, NY 10552, 914-699-3800 ..... A•2433
† NWL Transformers, Bordentown, NJ 08505, 609-298-7300 ..... A•2437, D•1851
† Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•1263
† Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314 ..... A•2594
Abacus Controls Inc., Somerville, NJ 08876 908-526-6010
AFP ISOREG, AFP Transformers, Inc., Littleton, MA 01460 508-486-9483
American Magnetics, Carterville, IL 62918 618-985-4838
Andover, Inc., Lafayette, IN 47904 317-447-1157
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
Basler Elec., Electronic Product Group, Highland, IL 62249 ..... 618-654-2341; 800-645-2074
Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
† Coast Coil Co., Coast Magnetics, Los Angeles, CA 90016 213-936-6188
† Del Electronics Corp., Valhalla, NY 10595 914-686-3600
Electrocom Industries, S. Bend, IN 46615 219-232-2743
† Electronic Transformer Corp., Paterson, NJ 07544-0487 201-942-2222
† Freed Transformer Co., Inc., Electronic Transformer Corp., Paterson, NJ 07544-0487 201-942-2222
† Genisco Electronics, A Division of GTC, Anaheim, CA 92805 714-563-4300
§ Hammond Manufacturing Co., Buffalo, NY 14225 716-894-5710
† Hisonic, Inc., Olathe, KS 66051 913-782-0012
Mag-Con, St. Paul, MN 55113 612-633-8820
† Magnecomp, Inc., Pickens, SC 29671 803-878-4700
§ Magnetek Triad, Huntington, IN 46750 219-356-7100
§† Microtran Co. Inc., Valley Stream, NY 11582-0236 516-561-6050
§ MTE Corp., Menomonee Falls, WI 53051 414-253-8200
† Northlake Engineering, Inc., Bristol, WI 53104-0370 414-857-9600
† Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
† PTC Transformers, Bordentown, NJ 08505 609-298-8200
† Raytheon Co., Electronic Components Division, Waltham, MA 02254 617-899-8400
Renco Electronics, Inc., Deer Pk., NY 11729 ..... 516-586-5566;1-800-645-5828
† Schott Corp., Wayzata, MN 55391 612-475-1173
Staco Transpower, Components Corp. of America, Mt. Carmel, IL 62863 618-262-5555
Standard Magnetic Corp., Garden Grove, CA 92641 714-379-5671
§† Thordarson Meissner, Components Corp. of Amer., Mt. Carmel, IL 62863 618-262-5121
TMP Inc., Santa Ana, CA 92705 714-558-8028
Todd Systems, Inc., Yonkers, NY 10701 914-963-3400
† Torelco, Inc., Irvington, NJ 07111 ..... 201-374-8641;800-867-3526
† Wirebenders, Inc., Phoenix, AZ 85021-2824 602-861-1856
§ Zambre Co., Inc., Mountain View, CA 94043 415-968-9176

Reactors (MIL)-2440 — ***See Vol. B***

Readers, Badge-2000 — ***See Vol. D***

Readers, Bar Code-2000 — ***See Vol. D***

Readers, Character-2000 — ***See Vol. D***

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Readers, Punched Card-2000 — ***See Vol. D***

Readers, Punched Tape-2000 — ***See Vol. D***

Readers, Static Card-2000 — ***See Vol. D***

Readers, Time Code-2000 — ***See Vol. D***

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Receivers, AM/FM (Incl. Precision Test)-2900 — ***See Vol. D***

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Receivers, Fiber Optic-2475 — ***See Vol. B***

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Receivers, Fixed Frequency-2900 — ***See Vol. D***

Receivers, Frequency Shift-1900 — ***See Vol. D***

Receivers, Global Positioning Satellite (GPS)-1900 — ***See Vol. D***

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Receivers, Laser-1900 — ***See Vol. D***

Receivers, Loran & Omega-1900 — ***See Vol. D***

Receivers, Microwave-3450

AEL Defense Corp., Lansdale, PA 19446 215-822-2929
† AIL Systems, Inc., Eaton Corp., Deer Park, NY 11729 516-595-3094
† Alpha Industries, Inc., Woburn, MA 01801 617-935-5150
† A.R.F. Prods., Boulder, CO 80307-3128 303-499-2946
Aydin Corp., Horsham, PA 19044 215-657-7510
Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328 215-968-4271
BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
Communication Solutions, Inc., Baltimore, MD 21237 410-574-4557
† Communications Sys. Technology, Inc., Hermosa Beach, CA 90254 213-374-3849
† Condor Systems, Inc., San Jose, CA 95124 408-371-9580
† Continental Microwave Technology Inc., Glen Cove, NY 11542 516-759-5600
Datum Timing, Datum Inc., Anaheim, CA 92806-5790 714-533-6333
Dowty Avionics, Arcadia, CA 91006 818-445-5955
Elecsys,Inc., Div. of C & C Jetronic, Princeton, NJ 08540 609-259-8866
§† Electro-Metrics, Incorporated, A Penril Corp., Amsterdam, NY 12010 518-843-2600
† E-Systems, Melpar Div., Falls Church, VA 22046 703-560-5000
† FEI Microwave, Inc., Frequency Electronics, Inc., Sunnyvale, CA 94086 408-732-0880
† Ferretec Inc., Fremont, CA 94538-6525 510-226-1216
† General Instrument, Govt. Systems, Hicksville, NY 11802-0709 516-933-3000
HDS Inc., Reston, VA 22091 703-620-6200
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
† LNR Communications, Inc., Hauppauge, NY 11788 516-273-7111
† Loral Microwave Narda, Hauppauge, NY 11788 516-231-1700
Loral TerraCom, Sub. of Loral Corp., San Diego, CA 92123-1595 619-278-4100
Lucas Weinschel, Gaithersburg, MD 20884-6001 301-948-3434
† Lucas Zeta, Lucas Aerospace, Inc., San Jose, CA 95134 408-434-3600
MACOM, Inc., Lowell, MA 01851 617-272-3000
† M/A COM Ltd., Bedfordshire, ENGLAND LU5 4SX, England ..... 44(582)471200
M/A-COM Microelectroincs Division, M/A-COM, Lowell, MA 01853-3295 508-442-5000
§ Micro-Now Instr. Co., Inc., Skokie, IL 60076 708-677-4700
† Microphase, Norwalk, CT 06856 203-866-8000
† Microwave Technology Div., JHP Industrial, Syracuse, NY 13202-3442 315-422-0050
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3 ..... 514-694-6666; 800-724-3911
† MITEQ Inc., Hauppauge, NY 11788 516-436-7400
Orbit Advanced Technologies, Horsham, PA 19044 215-674-4220
† Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018 ..... 408-730-0300;800-PENSTOCK
† Premier Microwave, Port Chester, NY 10573 914-939-8900
† RHG Electronics Laboratory, Inc., Deer Park, NY 11729 516-242-1100
Servo Corporation of America, Hicksville, NY 11801-5259 516-938-9700
ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086 408-730-6300
† Teledyne Microelectronics, Los Angeles, CA 90066 ..... 310-822-8229;310-305-0248
Telephonics Corporation/PRD Instruments, Huntington, NY 11743 ..... 516-549-6415 6428
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291
† TRAK Microwave Corp., Tampa, FL 33634 813-884-1411
Tucker Electronics, Dallas, TX 75355-1419 ..... 214-348-8800;800-527-4642
§† Vega Precision Labs., Vienna, VA 22180 703-938-6300
† Watkins-Johnson Co., Palo Alto, CA 94304 415-493-4141

Receivers, Monitoring, Communications-1900 — ***See Vol. D***

Receivers, NBS-2900 — ***See Vol. D***

Receivers, Telemetry-1900 — ***See Vol. D***

Receivers, Tone-1900 — ***See Vol. D***

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Receivers (MIL), ESM-2440 — ***See Vol. B***

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Receivers (MIL), Surveillance-2440 — ***See Vol. B***

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Recorders, Cartridge, Bubble Memory-2000 — ***See Vol. D***

Recorders, Cassette, Data-4000 — ***See Vol. D***

Recorders, Computer Data-2000 — ***See Vol. D***

Recorders, Electrostatic-3000 — ***See Vol. D***

Recorders, Event/Multievent-3000 — ***See Vol. D***

Recorders, FM — See Recorders, Magnetic Tape (Vol. D)

Recorders, Graphic-2900 — ***See Vol. D***

Recorders, Hard Disk-2000 — ***See Vol. D***

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Recorders, Strip Chart-3000 — *See Vol. D*

Recorders, Thermal Array-3000 — *See Vol. D*

Recorders, Vibration-3000 — *See Vol. D*

Recorders, Video-1900 — *See Vol. D*

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Recording Systems (MIL)-2440 — *See Vol. B*

Rectifiers, Bridges & Assemblies-4800

Collmer Semiconductor, Inc., Dallas, TX 75244, 800-527-0251;214-233-1589 ..... **A•2135, D•1630**
§ Crydom Company, Long Beach, CA 90805, 310-865-3536 ..... **A•2136-2138,2140-2142**
§ Electronic Devices, Inc., Yonkers, NY 10710, 914-965-4400 ..... **A•2143**
Farnell Advance Power, Solon, OH 44139, 216-349-0755 ..... **D•1702**
§ Frontier Electronics, Simi Valley, CA 93065, 805-522-9998 ..... **A•1236**
ISKRA Electronics, Inc., Plainview, NY 11803, 516-349-0222 ..... **A•1085,2146**
† NWL Transformers, Bordentown, NJ 08505, 609-298-7300 ..... **D•1851**
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... **A•2153**
§ Philips ECG, North American Philips Co., Williamsport, PA 17701, 717-323-4691 ..... **A•2173**
§ Powerex, Inc., Youngwood, PA 15697-1800, 412-925-7272 ..... **A•2175**
§ Semtech Corporation, Newbury Park, CA 91320, 805-498-2111 ..... **A•2180**
§ A E G Corporation, Basking Ridge, NJ 07920 908-204-8900
Allegro MicroSystems, Inc., formerly Sprague Semiconductor Grp., Worcester, MA 01605 508-795-1300
American Microsemiconductor, Inc., Madison, NJ 07940 201-377-9566
§ Baknor Industries Inc., Mississauga, ONT., CANADA L5L 1X1 416-828-2400
† Basic Electronics, Inc., Stanton, CA 90680 714-530-2400
BASISTA/NIEC, Richfield, OH 44286 216-659-9287
Central Semiconductor Corp., Hauppauge, NY 11788 516-435-1110
§ C-S Electronic Sales, Inc., Frankfort, IN 46041 317-659-1874
Darrah Electric Company, Cleveland, OH 44102 216-631-0912
Diodes Inc., Chatsworth, CA 91311 ..... 818-882-4920;800-821-1178
Diotec Electronics Corp., Gardena, CA 90248 310-767-1052
† Edal Industries, East Haven, CT 06512 203-467-2591
General Instrument, Power Semiconductor Div., Hicksville, NY 11802 ... 516-933-3333
Gentron Corporation, Scottsdale, AZ 85260 602-443-1288
§† Germanium Power Devices, Andover, MA 01810-3065 508-475-5982
Hitran Corporation, Flemington, NJ 08822-1238 908-782-5525
† HV Component Associates Inc., Farmingdale, NJ 07727 908-938-4499
§ International Components Corp., Melville, NY 11747 516-293-1500
International Microelectronics, Arlington, TX 76003 817-473-1730
§ International Rectifier Corp., El Segundo, CA 90245 310-322-3331
ISL Products Int'l, Ltd., Syosset, NY 11791-6093 ..... 516-937-3475;800-626-6116
Lark Electronics, Inc., New York, NY 10040 212-569-0430
§ Laube Technology, Woodland Hills, CA 91367 818-703-1188
† Mep Controls, Bordentown, NJ 08505 609-298-7300
§Φ Micro Quality Semiconductor, Inc., Microsemi Corp., Garland, TX 75042 214-272-7811
§† Microsemi Corp., Santa Ana, CA 92799-6890 714-979-8220
§ Microsemi Corp. Colorado, Microsemi Corp., Broomfield, CO 80020 303-469-2161
† Microsemi Corporation, Power Technology Components, Torrance, CA 90501 310-534-3737
§† Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
Mouser Electronics, Santee, CA 92071 800-346-6873
Mouser Electronics, Mansfield, TX 76063 800-346-6873
Mouser Electronics, Gilroy, CA 95020 800-346-6873
§ NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
# Peter Parts & Assocs., Webster, NY 14580 716-265-2540
§ Promax-Johnton Electronic Corp., Irvine, CA 92714 714-975-1245
§ QMI/NIEC, Twin Oaks, CA 93518 805-867-2555
Rectron, Industry, CA 91746 818-333-3802
Reliable Electronic Mfg., Wyvern Technologies, Santa Ana, CA 92705 ... 714-966-0710
Renard Manufacturing Company, Inc., Miami, FL 33122-1015 305-592-1500
§ RF Electronics, Inc., Irvine, CA 92714-5517 714-263-0661
Sanford-Miller Corp., Oceanside, NY 11572 ..... 516-763-0926;800-645-5900
Sanken Electric USA Corp., Hoffman Estates, IL 60195 708-519-1717
§ Semikron, Inc., Hudson, NH 03051-0066 ..... 603-883-8102;1-800-258-1308
Semtech Corpus Christi, Semtech Corporation, Corpus Christi, TX 78410 512-289-0403
§† Sensitron Semiconductor, RSM Electron Power Div., Deer Park, NY 11729 516-586-7600
§ Shindengen America Inc., Westlake Vl, CA 91362 800-634-3654
† Solid State Devices, La Mirada, CA 90638 714-670-7734
§† St-Semiconductors of Indiana, Inc., Bloomington, IN 47402-0609 812-332-1435
† Teledyne Microelectronics, Los Angeles, CA 90066 ..... 310-822-8229;310-305-0248
§† Unitrode Corp., Watertown, MA 02172 617-926-0404
† Voltage Multipliers, Inc., Visalia, CA 93291 209-651-1402

Rectifiers, Copper Oxide-4800

Edal Industries, East Haven, CT 06512 203-467-2591

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Rectifiers, General Purpose, Surface Mount-4800

§† BKC Semiconductors Incorporated., Lawrence, MA 01841, 508-681-0392 ..... **A•2132**
§ Collmer Semiconductor, Inc., Dallas, TX 75244, 800-527-0251;214-233-1589 ..... **A•2135**
§ Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... **A•2150,2153**
§ Semtech Corporation, Newbury Park, CA 91320, 805-498-2111 ..... **A•2180**
American Microsemiconductor, Inc., Madison, NJ 07940 201-377-9566
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
§ Baknor Industries Inc., Mississauga, ONT., CANADA L5L 1X1 416-828-2400
Central Semiconductor Corp., Hauppauge, NY 11788 516-435-1110
§ C-S Electronic Sales, Inc., Frankfort, IN 46041 317-659-1874
Diodes Inc., Chatsworth, CA 91311 ..... 818-882-4920;800-821-1178
Diotec Electronics Corp., Gardena, CA 90248 310-767-1052
Electronic Devices, Inc., Yonkers, NY 10710 914-965-4400
§ General Instrument, Power Semiconductor Div., Hicksville, NY 11802 ... 516-933-3333
§ International Rectifier Corp., El Segundo, CA 90245 310-322-3331
§ ITT Components, ITT Corporation, Irvine, CA 92718 714-727-3001
† Microsemi Corp., Santa Ana, CA 92799-6890 714-979-8220
Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
Nedco Electronics, Inc., Morton Grove, IL 60053 708-967-0500
§ Philips Components Discrete Products Div., Discrete Semiconductor Group, Slatersville, RI 02876-2078 401-762-3800
§ Promax-Johnton Electronic Corp., Irvine, CA 92714 714-975-1245
§ QMI/NIEC, Twin Oaks, CA 93518 805-867-2555
Rectron, Industry, CA 91746 818-333-3802
Renard Manufacturing Company, Inc., Miami, FL 33122-1015 305-592-1500
§ Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013 615-641-2020
§† Sensitron Semiconductor, RSM Electron Power Div., Deer Park, NY 11729 516-586-7600
§ Solid State, Inc., Bloomfield, NJ 07003-2596 201-429-8700
† Voltage Multipliers, Inc., Visalia, CA 93291 209-651-1402

Rectifiers, Germanium-4800

American Microsemiconductor, Inc., Madison, NJ 07940 201-377-9566
§† Germanium Power Devices, Andover, MA 01810-3065 508-475-5982
§ International Components Corp., Melville, NY 11747 516-293-1500
§ International Diode, Harrison, NJ 07029 201-482-6518
§ NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
§ Philips ECG, North American Philips Co., Williamsport, PA 17701 717-323-4691
§ Solid State, Inc., Bloomfield, NJ 07003-2596 201-429-8700

Rectifiers, Schottky, Surface Mount-4800

§† BKC Semiconductors Incorporated., Lawrence, MA 01841, 508-681-0392 ..... **A•2132**
§ Collmer Semiconductor, Inc., Dallas, TX 75244, 800-527-0251;214-233-1589 ..... **A•2135**
§ Frontier Electronics, Simi Valley, CA 93065, 805-522-9998 ..... **A•1236**
§ Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... **A•2150**
§ QMI/NIEC, Twin Oaks, CA 93518, 805-867-2555 ..... **A•2176-2177**
§ Allegro MicroSystems, Inc., formerly Sprague Semiconductor Grp., Worcester, MA 01605 508-795-1300
American Microsemiconductor, Inc., Madison, NJ 07940 201-377-9566
§† Compensated Devices Incorporated, Melrose, MA 02176 617-665-1071
§ C-S Electronic Sales, Inc., Frankfort, IN 46041 317-659-1874
Diodes Inc., Chatsworth, CA 91311 ..... 818-882-4920;800-821-1178
§ General Instrument, Power Semiconductor Div., Hicksville, NY 11802 ... 516-933-3333
Gentron Corporation, Scottsdale, AZ 85260 602-443-1288
§† Germanium Power Devices, Andover, MA 01810-3065 508-475-5982
§ International Rectifier Corp., El Segundo, CA 90245 310-322-3331
§ ITT Components, ITT Corporation, Irvine, CA 92718 714-727-3001
† Microsemi Corporation, Power Technology Components, Torrance, CA 90501 310-534-3737
§† Microsemi Corp. - Scottsdale, Microsemi Corporation, Scottsdale, AZ 85252-1390 602-941-6300
Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
§ Philips Components Discrete Products Div., Discrete Semiconductor Group, Slatersville, RI 02876-2078 401-762-3800
§ Promax-Johnton Electronic Corp., Irvine, CA 92714 714-975-1245
Rectron, Industry, CA 91746 818-333-3802
§ Sanyo Semiconductor Corp., Allendale, NJ 07401 201-825-8080
§† Sensitron Semiconductor, RSM Electron Power Div., Deer Park, NY 11729 516-586-7600
§ Shindengen America Inc., Westlake Vl, CA 91362 800-634-3654
† Solid State Devices, La Mirada, CA 90638 714-670-7734

Rectifiers, Selenium-4800

American Microsemiconductor, Inc., Madison, NJ 07940 201-377-9566
Darrah Electric Company, Cleveland, OH 44102 216-631-0912
† Edal Industries, East Haven, CT 06512 203-467-2591
§ International Components Corp., Melville, NY 11747 516-293-1500
Lark Electronics, Inc., New York, NY 10040 212-569-0430
§ NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
Power Conversion Products, Crystal Lake, IL 60014 815-459-9100
§ Semikron, Inc., Hudson, NH 03051-0066 ..... 603-883-8102;1-800-258-1308

Rectifiers, Silicon-4800

§† BKC Semiconductors Incorporated., Lawrence, MA 01841, 508-681-0392 ..... **A•2132**
§ Collmer Semiconductor, Inc., Dallas, TX 75244, 800-527-0251;214-233-1589 ..... **A•2135**
Douglas Randall, Pawcatuck, CT 06379, 203-599-2075 ..... **A•2144-2145**

§ ISKRA Electronics, Inc., Plainview, NY 11803, 516-349-0222 ..... A•1085,2146
§ Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... A•2150
§ Philips ECG, North American Philips Co., Williamsport, PA 17701, 717-323-4691 ..... A•2173
§† Powerex, Inc., Youngwood, PA 15697-1800, 412-925-7272 ..... A•2175
§ Semtech Corporation, Newbury Park, CA 91320, 805-498-2111 ..... A•2180
§† Solitron Devices, Inc., Semiconductor Group, West Palm Beach, FL 33407-4697, 407-848-4311 ..... A•2219
§ Teccor Electronics, Inc., Irving, TX 75038, 214-580-1515 ..... A•2220,2222-2223
§ Allegro MicroSystems, Inc., formerly Sprague Semiconductor Grp., Worcester, MA 01605 508-795-1300
American Microsemiconductor, Inc., Madison, NJ 07940 201-377-9566
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
§ Baknor Industries Inc., Mississauga, ONT., CANADA L5L 1X1 416-828-2400
BASISTA/NIEC, Richfield, OH 44286 216-659-9287
§ Continental Device India Limited, New Delhi, INDIA 110028 ..... 536150-53 (4 lines)
§ C-S Electronic Sales, Inc., Frankfort, IN 46041 317-659-1874
Darrah Electric Company, Cleveland, OH 44102 216-631-0912
Diodes Inc., Chatsworth, CA 91311 ..... 818-882-4920;800-821-1178
Diotec Electronics Corp., Gardena, CA 90248 310-767-1052
† Edal Industries, East Haven, CT 06512 203-467-2591
§ Electronic Devices, Inc., Yonkers, NY 10710 914-965-4400
§ Fagor Electronic Components, Inc., Fagor Electronica S. Coop., Elk Grove Village, IL 60007 708-981-0161
§ Frontier Electronics, Simi Valley, CA 93065 805-522-9998
§ General Instrument, Power Semiconductor Div., Hicksville, NY 11802 516-933-3333
§ Harris Semiconductor, Melbourne, FL 32902 ..... 1-800-4 HARRIS
† HV Component Associates Inc., Farmingdale, NJ 07727 908-938-4499
§ International Components Corp., Melville, NY 11747 516-293-1500
§ International Diode, Harrison, NJ 07029 201-482-6518
International Microelectronics, Arlington, TX 76003 817-473-1730
§ International Rectifier Corp., El Segundo, CA 90245 310-322-3331
ISL Products Int'l, Ltd., Syosset, NY 11791-6093 ..... 516-937-3475;800-626-6116
§ ITT Components, ITT Corporation, Irvine, CA 92718 714-727-3001
Lark Electronics, Inc., New York, NY 10040 212-569-0430
§ Laube Technology, Woodland Hills, CA 91367 818-703-1188
§Φ Micro Quality Semiconductor, Inc., Microsemi Corp., Garland, TX 75042 214-272-7811
§† Microsemi Corp., Santa Ana, CA 92799-6890 714-979-8220
§† Microsemi Corp. Colorado, Microsemi Corp., Broomfield, CO 80020 303-469-2161
† Microsemi Corporation, Power Technology Components, Torrance, CA 90501 310-534-3737
§† Microsemi Corp. - Scottsdale, Microsemi Corporation, Scottsdale, AZ 85252-1390 602-941-6300
§† Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
Mouser Electronics, Santee, CA 92071 800-346-6873
Mouser Electronics, Mansfield, TX 76063 800-346-6873
Mouser Electronics, Gilroy, CA 95020 800-346-6873
§ NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
§ Philips Components Discrete Products Div., Discrete Semiconductor Group, Slatersville, RI 02876-2078 401-762-3800
§ PPC Products Corporation, Riviera Beach, FL 33404 407-848-9606
§ Promax-Johnton Electronic Corp., Irvine, CA 92714 714-975-1245
§ QMI/NIEC, Twin Oaks, CA 93518 805-867-2555
Rectron, Industry, CA 91746 818-333-3802
§ Reliance Electric Co., Cleveland, OH 44117 800-245-4501
Renard Manufacturing Company, Inc., Miami, FL 33122-1015 305-592-1500
§ RF Electronics, Inc., Irvine, CA 92714-5517 714-263-0661
§ Sanyo Semiconductor Corp., Allendale, NJ 07401 201-825-8080
§ Semikron, Inc., Hudson, NH 03051-0066 ..... 603-883-8102;1-800-258-1308
§† Sensitron Semiconductor, RSM Electron Power Div., Deer Park, NY 11729 516-586-7600
§ Solid State, Inc., Bloomfield, NJ 07003-2596 201-429-8700
† Solid State Devices, La Mirada, CA 90638 714-670-7734
§† St-Semiconductors of Indiana, Inc., Bloomington, IN 47402-0609 812-332-1435
§† Unitrode Corp., Watertown, MA 02172 617-926-0404
† Voltage Multipliers, Inc., Visalia, CA 93291 209-651-1402

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Rectifiers, Surface Mount-4800

§† BKC Semiconductors Incorporated., Lawrence, MA 01841, 508-681-0392 ..... A•2132
§ Collmer Semiconductor, Inc., Dallas, TX 75244, 800-527-0251;214-233-1589 ..... A•2135
§ Allegro MicroSystems, Inc., formerly Sprague Semiconductor Grp., Worcester, MA 01605 508-795-1300
American Microsemiconductor, Inc., Madison, NJ 07940 201-377-9566
§ Baknor Industries Inc., Mississauga, ONT., CANADA L5L 1X1 416-828-2400
Central Semiconductor Corp., Hauppauge, NY 11788 516-435-1110
§ C-S Electronic Sales, Inc., Frankfort, IN 46041 317-659-1874
Diodes Inc., Chatsworth, CA 91311 ..... 818-882-4920;800-821-1178
Diotec Electronics Corp., Gardena, CA 90248 310-767-1052
Electronic Devices, Inc., Yonkers, NY 10710 914-965-4400
§ General Instrument, Power Semiconductor Div., Hicksville, NY 11802 516-933-3333
§ International Rectifier Corp., El Segundo, CA 90245 310-322-3331
§ ITT Components, ITT Corporation, Irvine, CA 92718 714-727-3001
† Microsemi Corp., Santa Ana, CA 92799-6890 714-979-8220
† Microsemi Corporation, Power Technology Components, Torrance, CA 90501 310-534-3737
§† Microsemi Corp. - Scottsdale, Microsemi Corporation, Scottsdale, AZ 85252-1390 602-941-6300
§ Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
§ Promax-Johnton Electronic Corp., Irvine, CA 92714 714-975-1245
§ QMI/NIEC, Twin Oaks, CA 93518 805-867-2555
Rectron, Industry, CA 91746 818-333-3802
Renard Manufacturing Company, Inc., Miami, FL 33122-1015 305-592-1500
RF Electronics, Inc., Irvine, CA 92714-5517 714-263-0661
§ Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013 615-641-2020
§ Sanyo Semiconductor Corp., Allendale, NJ 07401 201-825-8080
§† Sensitron Semiconductor, RSM Electron Power Div., Deer Park, NY 11729 516-586-7600
§ Shindengen America Inc., Westlake Vl, CA 91362 800-634-3654
† Voltage Multipliers, Inc., Visalia, CA 93291 209-651-1402

Rectifiers, Ultrafast-4800

§ Collmer Semiconductor, Inc., Dallas, TX 75244, 800-527-0251;214-233-1589 ..... A•2135
§ Frontier Electronics, Simi Valley, CA 93065, 805-522-9998 ..... A•1236
§ Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... A•2150,2153
§ Semtech Corporation, Newbury Park, CA 91320, 805-498-2111 ..... A•2180
BASISTA/NIEC, Richfield, OH 44286 216-659-9287
§† BKC Semiconductors Incorporated., Lawrence, MA 01841 508-681-0392
Central Semiconductor Corp., Hauppauge, NY 11788 516-435-1110
§ C-S Electronic Sales, Inc., Frankfort, IN 46041 317-659-1874
Darrah Electric Company, Cleveland, OH 44102 216-631-0912
Diodes Inc., Chatsworth, CA 91311 ..... 818-882-4920;800-821-1178
Diotec Electronics Corp., Gardena, CA 90248 310-767-1052
† Edal Industries, East Haven, CT 06512 203-467-2591
Electronic Devices, Inc., Yonkers, NY 10710 914-965-4400
§ General Instrument, Power Semiconductor Div., Hicksville, NY 11802 516-933-3333
§ Harris Semiconductor, Melbourne, FL 32902 ..... 1-800-4 HARRIS
§ HBS Equipment Corporation, Los Angeles, CA 90040 213-726-3033
§ Hitachi America, Ltd., Tarrytown, NY 10591 914-631-0600
† HV Component Associates Inc., Farmingdale, NJ 07727 908-938-4499
§ International Components Corp., Melville, NY 11747 516-293-1500
§ International Rectifier Corp., El Segundo, CA 90245 310-322-3331
§Φ Micro Quality Semiconductor, Inc., Microsemi Corp., Garland, TX 75042 214-272-7811
§† Microsemi Corp., Santa Ana, CA 92799-6890 714-979-8220
§† Microsemi Corp. Colorado, Microsemi Corp., Broomfield, CO 80020 303-469-2161
† Microsemi Corporation, Power Technology Components, Torrance, CA 90501 310-534-3737
Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
† Natel Engineering Co., Inc., Simi Valley, CA 93063-3449 805-581-3950
§ Philips Components Discrete Products Div., Discrete Semiconductor Group, Slatersville, RI 02876-2078 401-762-3800
§ PPC Products Corporation, Riviera Beach, FL 33404 407-848-9606
§ Promax-Johnton Electronic Corp., Irvine, CA 92714 714-975-1245
§ QMI/NIEC, Twin Oaks, CA 93518 805-867-2555
Rectron, Industry, CA 91746 818-333-3802
§ Sanyo Semiconductor Corp., Allendale, NJ 07401 201-825-8080
§† Sensitron Semiconductor, RSM Electron Power Div., Deer Park, NY 11729 516-586-7600
§† Silicon Transistor Corp., Chelmsford, MA 01824 508-256-3321
† Voltage Multipliers, Inc., Visalia, CA 93291 209-651-1402

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Julie Research Labs., New York, NY 10001, 212-633-6625 ..... D•1279
Semtech Corporation, Newbury Park, CA 91320, 805-498-2111 ..... A•2180
Zetex, Inc., Zetex plc., Commack, NY 11725, 516-543-7100 ..... A•2227
ACD-Elcor Products, Bethel, CT 06801 203-743-3510
§ A E G Corporation, Basking Ridge, NJ 07920 908-204-8900
Cherry Semiconductor Corp, East Greenwich, RI 02818 401-885-3600
§† Compensated Devices Incorporated, Melrose, MA 02176 617-665-1071
Datel, Inc., Mansfield, MA 02048-1194 508-339-3000
§ International Diode, Harrison, NJ 07029 201-482-6518
§† Linear Technology Corp., Milpitas, CA 95035-7487 408-432-1900
§† Microsemi Corp., Santa Ana, CA 92799-6890 714-979-8220
§† Microsemi Corp. - Scottsdale, Microsemi Corporation, Scottsdale, AZ 85252-1390 602-941-6300
§† Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
† Natel Engineering Co., Inc., Simi Valley, CA 93063-3449 805-581-3950
† Northwest Microcircuits, Inc., Philomath, OR 97370 503-929-6424
§ NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
† Semtech Corpus Christi, Semtech Corporation, Corpus Christi, TX 78410 512-289-0403
§† Silicon General, Garden Grove, CA 92641 714-898-8121
§† St-Semiconductors of Indiana, Inc., Bloomington, IN 47402-0609 812-332-1435
§† Teledyne Components, Mountain View, CA 94039-7267 415-968-9241

Regulators & Stabilizers, Voltage-Also See Transformers, Voltage Regulating-4000 — *See Vol. D*

Regulators, Pulse Width-3130

§ Semtech Corporation, Newbury Park, CA 91320, 805-498-2111 ..... A•2180
† Arnold Magnetics, Camarillo, CA 93012 805-484-4221
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
§ Computer Power Inc., High Bridge, NJ 08829 ..... 908-638-8000;800-526-5088
§ Linear Technology Corp., Milpitas, CA 95035-7487 408-432-1900
§† Teledyne Components, Mountain View, CA 94039-7267 415-968-9241

Regulators, Voltage, Surface Mount-4800

§ Semtech Corporation, Newbury Park, CA 91320, 805-498-2111 ..... A•2180
Todd Systems, Inc., Yonkers, NY 10701, 914-963-3400 ..... A•2585
Zetex, Inc., Zetex plc., Commack, NY 11725, 516-543-7100 ..... A•2227
§ Allegro MicroSystems, Inc., formerly Sprague Semiconductor Grp., Worcester, MA 01605 508-795-1300
† Arnold Magnetics, Camarillo, CA 93012 805-484-4221
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
§ Computer Power Inc., High Bridge, NJ 08829 ..... 908-638-8000;800-526-5088
† M.S. Kennedy Corp., Cicero, NY 13039 315-699-9201
§† Microsemi Corp. - Scottsdale, Microsemi Corporation, Scottsdale, AZ 85252-1390 602-941-6300
† Modular Devices, Shirley, NY 11967 516-345-3100
Power Trends, Inc., Batavia, IL 60510 708-406-0900
§ Renard Manufacturing Company, Inc., Miami, FL 33122-1015 305-592-1500
§ Seiko Instruments U.S.A., Inc. Electronic Components, Torrance, CA 90505 310-517-7770

Relays, Antenna — See Relays, RF (Incl. Antenna & Coaxial) (Vol. B)

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Relays, Mercury-Wetted Contacts-4500 — *See Vol. B*

Relays, Meter-4500 — *See Vol. B*

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Relays, Opto-isolated-4500 — *See Vol. B*

Relays, Phase Sensing-4500 — *See Vol. B*

Relays, Plug-in-4500 — *See Vol. B*

Relays, Power-4500 — *See Vol. B*

Relays, Printed Circuit Mounting (Incl. Transistor & DIP Case Types)-4500 — *See Vol. B*

Relays, Programmable-4500 — *See Vol. B*

Relays, RF (Incl. Antenna & Coaxial)-4500 — *See Vol. B*

Relays, Reed-4500 — *See Vol. B*

Relays, Reed, Surface Mount-4500 — *See Vol. B*

Relays, Sealed(Hermetic)-4500 — *See Vol. B*

Relays, Solid State-4500 — *See Vol. B*

Relays, Stepping-4500 — *See Vol. B*

Relays, Telephone-4500 — *See Vol. B*

Relays, Thermal-4500 — *See Vol. B*

Relays, Time Delay-4500 — *See Vol. B*

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Relays, Voltage Sensitive-4500 — *See Vol. B*

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Repair Services, Surface Mount Equipment-4100 — *See Vol. D*

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Repeaters, Servo-4900 — *See Vol. D*

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Resistor Networks, Surface Mount-4700

§ Allen Co., Inc., Robert G., N. Hollywood, CA 91605, 818-765-8300;800-827-7422 ..... A•1862-1863
§† AMITRON, American Micro-Tronix, Inc., North Andover, MA 01845, 508-686-1882 ..... A•1688,1865
† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635, 714-447-2300 ..... A•1868
§ Bourns, Inc., Electronic Components Sls., Riverside, CA 92507-2114, 909-781-5500;801-750-7200 ..... A•1869-1872
§ Caddock Electronics, Inc., Riverside, CA 92507, 909-788-1700 ..... A•1877
§ CTS Corp., Resistor Networks, Berne, IN 46711, 219-589-3111 ..... A•1908-1909
§ Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242, 402-371-0080 ..... A•1911
† Electro-Films, Inc., Warwick, RI 02886, 401-738-9150 ..... A•1932-1933
§† Hybrids International Ltd., Thick Film Division, Olathe, KS 66062, 913-764-6400 ..... A•1699
§ IRC, Inc., Boone, NC 28607, 704-264-8861 ..... A•1946-1947
§ KOA Speer Electronics, Bradford, PA 16701, 814-362-5536 ..... A•1968,1971
† Ohmtek Inc., Vishay, Niagara Falls, NY 14304, 716-283-4025 ..... A•2002-2004
Pacific Resistor Co., Tarzana, CA 91356, 818-345-7811 ..... A•2008
§† State of the Art, Inc., State College, PA 16803-1797, 814-355-8004 ..... A•2020,2025-2027
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201 414-382-2000
AVX Corporation, A Kyocera Group Company, Myrtle Beach, SC 29577 803-448-9411
§† California Micro Devices, Inc., Milpitas, CA 95035 408-263-3214
CTS Corporation, Elkhart, IN 46514 219-293-7511
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 402-563-6506
† EMC Technology Inc, Cherry Hill, NJ 08034 609-429-7800
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Fukushima Futaba Electric Co., R.G. Allen Co., N. Hollywood, CA 91605 818-765-8300
Hokuriku USA Ltd., Madison, AL 35758 205-772-9620
§† International Resistive Company, Boone, NC 28607 704-264-8861
IRC-Shallcross, Smithfield, NC 27577 919-934-5181
§ KCK America Inc., Mitsubishi Materials Corporation, Rolling Meadows, IL 60008 708-577-0200
Marc Enterprises, Laguna Niguel, CA 92677 714-249-0302
§ Murata Erie North America, Inc., Smyrna, GA 30080 404-436-1300
§ Nepenthe, Inc., Palo Alto, CA 94303 415-496-6666
NIC Components Corp., N. Amityville, NY 11701 516-226-7500
Noritake Co., Inc., Arlington Heights, IL 60005 708-439-9020
§ North American Capacitor Co., Indianapolis, IN 46224 317-273-0090
§ Panasonic Indl. Co. Standard Comps. Sector, Matsushita Elec. Corp. of America, Secaucus, NJ 07094 201-392-4818
§† RCD Components, Inc., Manchester, NH 03109 603-669-0054
§ Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013 615-641-2020
Solitron Devices, Inc., Semiconductor Group, West Palm Beach, FL 33407-4697 407-848-4311
§† Solitron/Microwave, Solitron Devices, Inc., West Palm Beach, FL 33407-4697 407-848-4311
Sprague, Hudson, NH 03051 ..... 603-881-7200; 603-883-9774 (Mktg)
† TH Electronics, Tong Hsing Electronic Ind., Ltd., Tucson, AZ 85745-1443 602-791-7825

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§ Clarostat Sensors and Controls Group, BYR, PLC, Plano, TX 75075, 214-422-1844;1-800-872-0044 ..... A•1906
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647, 402-563-6506 ..... A•1927,1931
§ Dale Electronics, Inc., Tempe Div., Tempe, AZ 85282-1883, 602-967-7874 ..... A•2072
IET Labs, Inc., Westbury, NY 11590, 516-334-5959;800-899-8438 ... D•1266-1270
KOA Speer Electronics, Bradford, PA 16701, 814-362-5536 ..... A•1962
§† Memcor-Truohm, Inc., Huntington, IN 46750, 219-356-4300 ..... A•1984
§† Mepcopal Company, San Diego, CA 92121-1307, 619-481-0210 ..... B•1771
† Milwaukee Resistor Corp., Milwaukee, WI 53204, 414-271-9900 ..... A•1988-1989,1991
§† Spectrol Electronics Corp., Ontario, CA 91761, 909-923-3313 ..... A•2121
§† Vernitron Corp., Precision Comps. Group, St. Petersburg, FL 33710, 813-347-2181 ..... A•2124

Allen Co., Inc., Robert G., N. Hollywood, CA 91605 ..... 818-765-8300;800-827-7422
Angstrohm Precision, Inc., Dale Electronics, Hagerstown, MD 21742 301-739-8722
Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635 714-447-2300
Bourns, Inc., Electronic Components Sls., Riverside, CA 92507-2114 ..... 909-781-5500; 801-750-7200
Carter Manufacturing Corporation, Bolton, MA 01740 508-779-5501
§† CTS Corporation, Elkhart, IN 46514 219-293-7511
CTS Corp., Electrocomponents, Elkhart, IN 46514 219-295-3575
CTS Corp., Resistor Networks, Berne, IN 46711 219-589-3111
† CTS of Canada, Ltd., Streetsville, ONTARIO, CAN. L5M 1Y9 416-826-1141
Duncan Electronics, Costa Mesa, CA 92626 714-545-8261
Dynamation Transducers Corporation, Holliston, MA 01746 508-429-8440
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Hokuriku USA Ltd., Madison, AL 35758 205-772-9620
Huntington Electric Inc., Huntington, IN 46750 219-356-0778
§ International Components Corp., Melville, NY 11747 516-293-1500
§ International Resistive Company, Boone, NC 28607 704-264-8861
§ IRC, Inc., Boone, NC 28607 704-264-8861
§ Jaro Components, Inc., Boca Raton, FL 33487-8295 407-241-8600
KRL/Bantry Components, Inc., Manchester, NH 03103 603-668-3210
§ Laube Technology, Woodland Hills, CA 91367 818-703-1188
† Maurey Instrument Corp., Chicago, IL 60629 312-581-4555
† Mel-Rain Controls, Paw Paw, MI 49079 616-657-2527
Noble U.S.A., Inc., Rolling Meadows, IL 60008 708-364-6038
§† Ohmite Manufacturing Co., Skokie, IL 60076 708-675-2600
§† RCD Components, Inc., Manchester, NH 03109 603-669-0054
† Resistance Technology Inc., St. Paul, MN 55112 612-636-9770
† Resistors, Inc., Chicago, IL 60650 708-652-7555
Samarius Precision Instruments, Inc., Ansonia, CT 06401 203-736-9805
† Shogyo International Corp., Great Neck, NY 11021-4799 516-466-0911
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
§† Techno Division, Dale Electronics, Van Nuys, CA 91405-1139 818-781-1642
§ Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., Schaumburg, IL 60173 708-884-6664
§† Vamistor Corp., Sevierville, TN 37862 615-453-0001
§ Vishay Resistors, Malvern, PA 19355 215-644-1300

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Huntington Electric Inc., Huntington, IN 46750, 219-356-0778 ..... A•1937-1938
§† Memcor-Truohm, Inc., Huntington, IN 46750, 219-356-4300 ..... A•1984
Mills Resistor Co., Los Alamitos, CA 90720, 310-598-2454 ..... A•1987
Milwaukee Resistor Corp., Milwaukee, WI 53204, 414-271-9900 ..... A•1988
§† Amperite Co., Inc., Union City, NJ 07087 201-864-9503
ATC-Frost Magnetics Inc., Oakville,Ont., CANADA L6H 2R4 416-844-6681
§ Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 402-563-6506
Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242 402-371-0080
EWC, Inc., Englishtown, NJ 07726 908-446-3110
International Resistive Company, Boone, NC 28607 704-264-8861
§ Jaro Components, Inc., Boca Raton, FL 33487-8295 407-241-8600
Ohmite Manufacturing Co., Skokie, IL 60076 708-675-2600
Precision Products Group, Inc., Rockford, IL 61108 815-395-2155
§† RCD Components, Inc., Manchester, NH 03109 603-669-0054

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Resistors, Bulk Ceramic-4700

† The Carborundum Company, Electric Products, Niagara Falls, NY 14302, 716-278-2521 ..... A•1904-1905
§ Allen Co., Inc., Robert G., N. Hollywood, CA 91605 ..... 818-765-8300;800-827-7422
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
§ Jaro Components, Inc., Boca Raton, FL 33487-8295 407-241-8600
§ KCK America Inc., Mitsubishi Materials Corporation, Rolling Meadows, IL 60008 708-577-0200
§ Martin Sound Prods. Inc., Cleveland, OH 44143-2297 216-442-2286
Microplex, Inc., Anaheim, CA 92806 714-634-1535
§† RCD Components, Inc., Manchester, NH 03109 603-669-0054
U.S. Resistor, Inc., St. Marys, PA 15857-1059 814-781-7679
§ Xicon Capacitors, Arlington, TX 76003 800-628-0544

Resistors, Carbon Film-4700

§ Allen Co., Inc., Robert G., N. Hollywood, CA 91605, 818-765-8300;800-827-7422 ..... A•1863
Cableform Inc., Troy, VA 22974, 804-589-8224 ..... A•1875
§ KOA Speer Electronics, Bradford, PA 16701, 814-362-5536 ..... A•1958,1960,1965,1970
§† Micro-Ohm Corp., Duarte, CA 91010, 818-3575377 ..... A•1985
Paccom Electronics, Redmond, WA 98052-5350, 206-883-9200;800-426-6254 ..... A•2005
§ Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... A•2010
§ Baknor Industries Inc., Mississauga, ONT., CANADA L5L 1X1 416-828-2400
Component General, Inc., Odessa, FL 33556 813-376-6655
C-S Electronic Sales, Inc., Frankfort, IN 46041 317-659-1874
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 402-563-6506
§ Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242 402-371-0080
# Douglas International, Inc., Geneva, IL 60134-0761 708-232-7419
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
§ Inmet Corporation, Ann Arbor, MI 48103 313-426-5553
§ International Components Corp., Melville, NY 11747 516-293-1500
International Microelectronics, Arlington, TX 76003 817-473-1730
§ International Resistive Company, Boone, NC 28607 704-264-8861
§# IRC, Inc., Boone, NC 28607 704-264-8861
§ Jaro Components, Inc., Boca Raton, FL 33487-8295 407-241-8600
§† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
§ Laube Technology, Woodland Hills, CA 91367 818-703-1188
Mouser Electronics, Santee, CA 92071 800-346-6873
Mouser Electronics, Mansfield, TX 76063 800-346-6873
Mouser Electronics, Gilroy, CA 95020 800-346-6873
§ NIC Components Corp., N. Amityville, NY 11701 516-226-7500
§ Ohmite Manufacturing Co., Skokie, IL 60076 708-675-2600
† Ovenaire-Audio-Carpenter, Oak Crystal Inc., Charlottesville, VA 22901 .. 804-977-8050
§ Panasonic Indl. Co. Standard Comps. Sector, Matsushita Elec. Corp. of America, Secaucus, NJ 07094 201-392-4818
§ Peter Parts & Assocs., Webster, NY 14580 716-265-2540
§ Philips Components Discrete Products Division, Mineral Wells, TX 76067 817-325-7871
§ Piher International Corp., NACESA, Mt. Prospect, IL 60056 ..... 708-390-6680; 800-323-6693
§ Projections Unlimited, Tustin, CA 92680 714-544-2700
§† RCD Components, Inc., Manchester, NH 03109 603-669-0054
§ RF Electronics, Inc., Irvine, CA 92714-5517 714-263-0661
§ Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013 615-641-2020
† Shogyo International Corp., Great Neck, NY 11021-4799 516-466-0911
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
Techno Division, Dale Electronics, Van Nuys, CA 91405-1139 818-781-1642
† Vamistor Corp., Sevierville, TN 37862 615-453-0001
§ Xicon Capacitors, Arlington, TX 76003 800-628-0544

Resistors, Ceramic Core-4700

§ Allen Co., Inc., Robert G., N. Hollywood, CA 91605, 818-765-8300;800-827-7422 ..... A•1860-1861
§ Caddock Electronics, Inc., Riverside, CA 92507, 909-788-1700 ..... A•1877
§ Colber Corp., Irvington, NJ 07111, 201-371-9500 ..... A•1907
CTS Corp., Resistor Networks, Berne, IN 46711, 219-589-3111 ..... A•1909
§† Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242, 402-371-0080 ..... A•1921-1922
Huntington Electric Inc., Huntington, IN 46750, 219-356-0778 ..... A•1936-1938
§ IRC, Inc., Boone, NC 28607, 704-264-8861 ..... A•1947-1948,1950-1951
K & M Electronics Inc., W. Springfield, MA 01089, 413-781-1350 ..... A•1957
§† KRL/Bantry Components, Inc., Manchester, NH 03103, 603-668-3210 ..... A•1976-1977
§† Memcor-Truohm, Inc., Huntington, IN 46750, 219-356-4300 ..... A•1984
§ Micro-Ohm Corp., Duarte, CA 91010, 818-3575377 ..... A•1985
Mills Resistor Co., Los Alamitos, CA 90720, 310-598-2454 ..... A•1987
† Milwaukee Resistor Corp., Milwaukee, WI 53204, 414-271-9900 .... A•1988-1989
Mini-Systems, Inc., Thick/Thin Film Division, North Attleboro, MA 02761, 508-695-0203 ..... A•1993
§† Ohmite Manufacturing Co., Skokie, IL 60076, 708-675-2600 ..... A•1996,1999
Ohmtek Inc., Vishay, Niagara Falls, NY 14304, 716-283-4025 ..... A•2003
Pacific Resistor Co., Tarzana, CA 91356, 818-345-7811 ..... A•2006-2007
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... A•2010
† Precision Resistor Co., Inc., Largo, FL 34647-1421, 813-541-5771 ..... A•2016
State of the Art, Inc., State College, PA 16803-1797, 814-355-8004 ..... A•2020
Tepro of Florida, Clearwater, FL 34623, 813-796-1044 ..... A•2028,2031
†# Vermont Precision Resistor, Codeco Corp. of Vermont, Stowe, VT 05672-1207, 802-253-8567;802-253-7649 ..... A•2037
Cableform Inc., Troy, VA 22974 804-589-8224
§ Clarostat Sensors and Controls Group, BYR, PLC, Plano, TX 75075 ..... 214-422-1844; 1-800-872-0044
Component General, Inc., Odessa, FL 33556 813-376-6655
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 402-563-6506
Detoronics Corporation, S. El Monte, CA 91733 818-579-7130
EMC Technology Inc, Cherry Hill, NJ 08034 609-429-7800
HY MEG Corp., Addison, IL 60101 708-543-9250
§ International Resistive Company, Boone, NC 28607 704-264-8861
§† IRC-Shallcross, Smithfield, NC 27577 919-934-5181
§ Jaro Components, Inc., Boca Raton, FL 33487-8295 407-241-8600
Meissner Industries, Dover, NJ 07801 201-366-1700
Micron Electric Co., R.G. Allen Co., N. Hollywood, CA 91605 818-765-8300
Mouser Electronics, Santee, CA 92071 800-346-6873
Mouser Electronics, Mansfield, TX 76063 800-346-6873
Mouser Electronics, Gilroy, CA 95020 800-346-6873
Noble U.S.A., Inc., Rolling Meadows, IL 60008 708-364-6038
§† Nytron Inductors, Inc.(VSD, Inc.), Offered by: Dale Electronics, Inc., Yankton, SD 57078-0180 605-665-9301
§ Precision Resistive Products, Inc., Mediapolis, IA 52637 319-394-9131
§† RCD Components, Inc., Manchester, NH 03109 603-669-0054
Resistors, Inc., Chicago, IL 60650 708-652-7555
§ RF Electronics, Inc., Irvine, CA 92714-5517 714-263-0661
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
Solitron/Microwave, Solitron Devices, Inc., West Palm Beach, FL 33407-4697 407-848-4311
§ Techno Division, Dale Electronics, Van Nuys, CA 91405-1139 818-781-1642
U.S. Resistor, Inc., St. Marys, PA 15857-1059 814-781-7679

Resistors, Ceramic Metal (Cermet)-4700

§ Allen Co., Inc., Robert G., N. Hollywood, CA 91605, 818-765-8300;800-827-7422 ..... A•1860-1861
§ CTS Corp., Resistor Networks, Berne, IN 46711, 219-589-3111 ..... A•1909
§ IRC, Inc., Boone, NC 28607, 704-264-8861 ..... A•1947-1948,1950-1951
K & M Electronics Inc., W. Springfield, MA 01089, 413-781-1350 ..... A•1957
KOA Speer Electronics, Bradford, PA 16701, 814-362-5536 ..... A•1958,1968
Micro-Ohm Corp., Duarte, CA 91010, 818-3575377 ..... A•1985
Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ..... A•1995
† Ohmtek Inc., Vishay, Niagara Falls, NY 14304, 716-283-4025 ..... A•2001-2003

Paccom Electronics, Redmond, WA 98052-5350, 206-883-9200;800-426-6254 ..... A•2005
§ **Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... A•2010**
§† **RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•2019**
State of the Art, Inc., State College, PA 16803-1797, 814-355-8004 .. A•2020-2021
§ **Techno Division, Dale Electronics, Van Nuys, CA 91405-1139, 818-781-1642 ..... A•1925**
† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635 714-447-2300
Clarostat Sensors and Controls Group, BYR, PLC, Plano, TX 75075 ..... 214-422-1844; 1-800-872-0044
§ Colber Corp., Irvington, NJ 07111 201-371-9500
Component General, Inc., Odessa, FL 33556 813-376-6655
§† CTS Corporation, Elkhart, IN 46514 219-293-7511
§ Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242 402-371-0080
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Ferro Corporation, Electronic Materials Div., Santa Barbara, CA 93117-3092 805-968-5000
Hokuriku USA Ltd., Madison, AL 35758 205-772-9620
HY MEG Corp., Addison, IL 60101 708-543-9250
International Manufacturing Services, Portsmouth, RI 02871-2418 401-683-9700
International Resistive Company, Boone, NC 28607 704-264-8861
§ Jaro Components, Inc., Boca Raton, FL 33487-8295 407-241-8600
Microplex, Inc., Anaheim, CA 92806 714-634-1535
Mini-Systems, Inc., Thick/Thin Film Division, North Attleboro, MA 02761 508-695-0203
Mouser Electronics, Santee, CA 92071 800-346-6873
Mouser Electronics, Mansfield, TX 76063 800-346-6873
Mouser Electronics, Gilroy, CA 95020 800-346-6873
NIC Components Corp., N. Amityville, NY 11701 516-226-7500
Noble U.S.A., Inc., Rolling Meadows, IL 60008 708-364-6038
Ohmite Manufacturing Co., Skokie, IL 60076 708-675-2600
§ Philips Components Discrete Products Division, Mineral Wells, TX 76067 817-325-7871
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500

Resistors, Chip (For Microcircuits)-4700

§ **Allen Co., Inc., Robert G., N. Hollywood, CA 91605, 818-765-8300;800-827-7422 ..... A•1863**
§† **AMITRON, American Micro-Tronix, Inc., North Andover, MA 01845, 508-686-1882 ..... A•1720,1865**
AVX Corporation, A Kyocera Group Company, Myrtle Beach, SC 29577, 803-448-9411 ..... A•1866-1867
† **Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635,** 714-447-2300 ..... **A•1868**
§ **Caddock Electronics, Inc., Riverside, CA 92507, 909-788-1700 ..... A•1877**
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647, 402-563-6506 ..... A•1926-1927
§† **Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242, 402-371-0080 ..... A•1917-1919**
§† **Electro-Films, Inc., Warwick, RI 02886, 401-738-9150 ..... A•1721,1932-1934**
Imperial Astronics, Andig Inc., Northridge, CA 91324, 818-886-7672 ..... A•1943
International Manufacturing Services, Portsmouth, RI 02871-2418, 401-683-9700 ..... A•1944-1945
§ **IRC, Inc., Boone, NC 28607, 704-264-8861 ..... A•1946,1948,1951**
§ **KCK America Inc., Mitsubishi Materials Corporation, Rolling Meadows, IL 60008,** 708-577-0200 ..... **A•1091**
§ **KOA Speer Electronics, Bradford, PA 16701, 814-362-5536 ..... A•1960-1961,1963-1964,1971**
§† **KRL/Bantry Components, Inc., Manchester, NH 03103, 603-668-3210 ... A•1974**
† **Micro-Precision Technologies, Inc., Salem, NH 03079, 603-893-7600 .... A•1703**
† **Mini-Systems, Inc., Thick/Thin Film Division, North Attleboro, MA 02761, 508-695-0203 ..... A•1993**
† **Ohmtek Inc., Vishay, Niagara Falls, NY 14304, 716-283-4025 ..... A•2001-2003**
§ **Paccom Electronics, Redmond, WA 98052-5350, 206-883-9200;800-426-6254 ..... A•2005**
§ **Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... A•2010-2011**
† **Piconics, Incorporated. Tyngsboro, MA 01879, 508-649-7501 ..... A•2013**
§† **RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•2019**
Solitron Devices, Inc., Semiconductor Group, West Palm Beach, FL 33407-4697, 407-848-4311 ..... **A•2219**
§† **State of the Art, Inc., State College, PA 16803-1797, 814-355-8004 .. A•2020-2024**
Tepro of Florida, Clearwater, FL 34623, 813-796-1044 ..... A•2028-2032
§† **Vishay Resistors, Malvern, PA 19355, 215-644-1300 .... A•2042,2044,2046-2048**
§ Baknor Industries Inc., Mississauga, ONT., CANADA L5L 1X1 416-828-2400
§† California Micro Devices, Inc., Milpitas, CA 95035 408-263-3214
Component General, Inc., Odessa, FL 33556 813-376-6655
Douglas International, Inc., Geneva, IL 60134-0761 708-232-7419
Eltec Instruments Inc., Daytona Bch., FL 32120 904-253-5328
† EMC Technology Inc, Cherry Hill, NJ 08034 609-429-7800
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
† Film Microelectronics Inc., Peabody, MA 01960 508-532-9913
Fukushima Futaba Electric Co., R.G. Allen Co., N. Hollywood, CA 91605 818-765-8300
Hokuriku USA Ltd., Madison, AL 35758 205-772-9620
† Hybrid Designs, Inc., Costa Mesa, CA 92626 714-557-9933
§† Hybrids International Ltd., Thick Film Division, Olathe, KS 66062 913-764-6400
† Hycomp, Inc., Marlborough, MA 01752 508-485-6300
§ International Components Corp., Melville, NY 11747 516-293-1500
International Microelectronics, Arlington, TX 76003 817-473-1730
§ International Resistive Company, Boone, NC 28607 704-264-8861
§ Jaro Components, Inc., Boca Raton, FL 33487-8295 407-241-8600
† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
Kelvin Industries, Inc., Sherman Oaks, CA 91403-3501 818-990-1192
§ Laube Technology, Woodland Hills, CA 91367 818-703-1188
§ Micro-Ohm Corp., Duarte, CA 91010 818-3575377
† Microplex, Inc., Anaheim, CA 92806 714-634-1535
Mini-Systems, Inc., Sunbelt Microelectronic Division, Deltona, FL 32725 407-574-0208
§ Morris Enterprises, Sepulveda, CA 91343 818-894-9103
Mouser Electronics, Santee, CA 92071 800-346-6873
Mouser Electronics, Mansfield, TX 76063 800-346-6873
Mouser Electronics, Gilroy, CA 95020 800-346-6873
§ NIC Components Corp., N. Amityville, NY 11701 516-226-7500
§ Panasonic Indl. Co. Standard Comps. Sector, Matsushita Elec. Corp. of America, Secaucus, NJ 07094 201-392-4818
§ Peter Parts & Assocs., Webster, NY 14580 716-265-2540
§ Philips Components Discrete Products Division, Mineral Wells, TX 76067 817-325-7871
§ Projections Unlimited, Tustin, CA 92680 714-544-2700
§ RF Electronics, Inc., Irvine, CA 92714-5517 714-263-0661
§ Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013 615-641-2020
§† Sipex Corp., Billerica, MA 01821 508-667-8700
§† Solitron/Microwave, Solitron Devices, Inc., West Palm Beach, FL 33407-4697 407-848-4311
Stetron International, Inc., Buffalo, NY 14203 716-854-3443
§ Techno Division, Dale Electronics, Van Nuys, CA 91405-1139 818-781-1642
† United Supertek, Inc., San Jose, CA 95131-1101 408-922-0730
USAPEX Corp., Santa Clara, CA 95051 408-982-9063
§ West Electronic Sales Team, Huntington Beach, CA 92647 ..... 714-375-6500; 310-495-5569
Wilbrecht Electronics, St. Paul, MN 55107 612-222-2791
§ Xicon Capacitors, Arlington, TX 76003 800-628-0544

Resistors, Composition, Carbon-4700

§ **Allen Co., Inc., Robert G., N. Hollywood, CA 91605, 818-765-8300;800-827-7422 ..... A•1863**
RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•2019
§ Allen- Bradley Co., Div. of Industrial Control Grp., Milwaukee, WI 53201 414-382-2000
§ International Components Corp., Melville, NY 11747 516-293-1500
International Microelectronics, Arlington, TX 76003 817-473-1730
§ International Resistive Company, Boone, NC 28607 704-264-8861
§# IRC, Inc., Boone, NC 28607 704-264-8861
§ KOA Speer Electronics, Bradford, PA 16701 814-362-5536
Mouser Electronics, Santee, CA 92071 800-346-6873
Mouser Electronics, Mansfield, TX 76063 800-346-6873
Mouser Electronics, Gilroy, CA 95020 800-346-6873
§ Ohmite Manufacturing Co., Skokie, IL 60076 708-675-2600
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
§ Xicon Capacitors, Arlington, TX 76003 800-628-0544

Resistors, Decade-4700

§ **Caddock Electronics, Inc., Riverside, CA 92507, 909-788-1700 ..... A•1877**
General Resistance, A Prime Technology Company, N. Branford, CT 06471, 203-481-5721 ..... A•1935, D•1264
IET Labs, Inc., Westbury, NY 11590, 516-334-5959;800-899-8438 ... D•1266-1271
Isotek Corporation, Swansea, MA 02777, 508-673-2900 ..... A•1953
Julie Research Labs., New York, NY 10001, 212-633-6625 ..... D•1280
Micro-Ohm Corp., Duarte, CA 91010, 818-3575377 ..... A•1985
Mills Resistor Co., Los Alamitos, CA 90720, 310-598-2454 ..... A•1987
† **PPM, Inc., Cleveland, OH 44122, 1-800-899-4776 ..... D•1315**
† **Precision Control Manufacturing, Inc., Seattle, WA 98109, 206-281-9380 ..... A•2116**
Shaltronix Corp., Selma, NC 27576, 919-965-6346 ..... D•1324
† **Tech Laboratories Inc., Palisades Pk., NJ 07650, 201-944-2221 ..... B•1815**
† The Carborundum Company, Electric Products, Niagara Falls, NY 14302 716-278-2521
§† Clarostat Sensors and Controls Group, BYR, PLC, Plano, TX 75075 ..... 214-422-1844; 1-800-872-0044
Colorado Data Systems, Tektronix, Englewood, CO 80110 ..... 303-762-1640; 800-237-2831
§† Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242 402-371-0080
Electro Scientific Industries, Inc. (ESI), Portland, OR 97229 503-641-4141
§ Jaro Components, Inc., Boca Raton, FL 33487-8295 407-241-8600
§† Kelvin Industries, Inc., Sherman Oaks, CA 91403-3501 818-990-1192
Meissner Industries, Dover, NJ 07801 201-366-1700
§ Ohmite Manufacturing Co., Skokie, IL 60076 708-675-2600
† Ohmtek Inc., Vishay, Niagara Falls, NY 14304 716-283-4025
† QuadTech, Inc., Formerly GenRad Instruments, Bolton, MA 01740-1107 800-253-1230
§† RCD Components, Inc., Manchester, NH 03109 603-669-0054
Tepro of Florida, Clearwater, FL 34623 813-796-1044
§ Vishay Resistors, Malvern, PA 19355 215-644-1300

Resistors, Deposited Carbon-4700

§ **Allen Co., Inc., Robert G., N. Hollywood, CA 91605, 818-765-8300;800-827-7422 ..... A•1863**
§ **Micro-Ohm Corp., Duarte, CA 91010, 818-3575377 ..... A•1985**
§† **RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•2019**
Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242 402-371-0080
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Hokuriku USA Ltd., Madison, AL 35758 205-772-9620
§ IRC, Inc., Boone, NC 28607 704-264-8861
§ Jaro Components, Inc., Boca Raton, FL 33487-8295 407-241-8600
§ KOA Speer Electronics, Bradford, PA 16701 814-362-5536
§ Ohmite Manufacturing Co., Skokie, IL 60076 708-675-2600

§ Techno Division, Dale Electronics, Van Nuys, CA 91405-1139 818-781-1642
Varistor Corp., Sevierville, TN 37862 615-453-0001

Resistors, Disk, Rod & Tube-4700

† The Carborundum Company, Electric Products, Niagara Falls, NY 14302, 716-278-2521 ..... A•1905
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647, 402-563-6506 ..... A•1927,1931
Huntington Electric Inc., Huntington, IN 46750, 219-356-0778 ..... A•1936-1938
§ K & M Electronics Inc., W. Springfield, MA 01089, 413-781-1350 ..... A•1957
§ Ketema/Rodan Division, Anaheim, CA 92806, 714-630-0081 ..... B•1876-1877
Memcor-Truohm, Inc., Huntington, IN 46750, 219-356-4300 ..... A•1984
Mills Resistor Co., Los Alamitos, CA 90720, 310-598-2454 ..... A•1987
Milwaukee Resistor Corp., Milwaukee, WI 53204, 414-271-9900 ..... A•1988
Cableform Inc., Troy, VA 22974 804-589-8224
Component General, Inc., Odessa, FL 33556 813-376-6655
§ Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242 402-371-0080
§ Inmet Corporation, Ann Arbor, MI 48103 313-426-5553
International Resistive Company, Boone, NC 28607 704-264-8861
† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
§† RCD Components, Inc., Manchester, NH 03109 603-669-0054
§† Solitron/Microwave, Solitron Devices, Inc., West Palm Beach, FL 33407-4697 407-848-4311
U.S. Resistor, Inc., St. Marys, PA 15857-1059 814-781-7679

Resistors, Film, Metallized & Nonmetallized-4700

§ Allen Co., Inc., Robert G., N. Hollywood, CA 91605, 818-765-8300;800-827-7422 ..... A•1862-1863
AVX Corporation, A Kyocera Group Company, Myrtle Beach, SC 29577, 803-448-9411 ..... A•1866-1867
Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635, 714-447-2300 ..... A•1868
§ Caddock Electronics, Inc., Riverside, CA 92507, 909-788-1700 ..... A•1877
§† Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242, 402-371-0080 ..... A•1910-1915,1917-1920
† Electro-Films, Inc., Warwick, RI 02886, 401-738-9150 ..... A•1721,1932,1934
§ IRC, Inc., Boone, NC 28607, 704-264-8861 ..... A•1946-1948
§† KOA Speer Electronics, Bradford, PA 16701, 814-362-5536 ..... A•1958,1960-1962,1965,1967-1968
KRL/Bantry Components, Inc., Manchester, NH 03103, 603-668-3210 ... A•1975
† Mini-Systems, Inc., Thick/Thin Film Division, North Attleboro, MA 02761, 508-695-0203 ..... A•1993
§† Ohmite Manufacturing Co., Skokie, IL 60076, 708-675-2600 ..... A•1998
Ohmtek Inc., Vishay, Niagara Falls, NY 14304, 716-283-4025 ..... A•2001-2002, 2004
§ Paccom Electronics, Redmond, WA 98052-5350, 206-883-9200;800-426-6254 ..... A•2005
§ Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... A•2010-2012
† Piconics, Incorporated, Tyngsboro, MA 01879, 508-649-7501 ..... A•2013
Precision Resistive Products, Inc., Mediapolis, IA 52637, 319-394-9131 ..... A•2014-2015
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•2019
State of the Art, Inc., State College, PA 16803-1797, 814-355-8004 ..... A•2020,2022-2024
Techno Division, Dale Electronics, Van Nuys, CA 91405-1139, 818-781-1642 ..... A•1925
Tepro of Florida, Clearwater, FL 34623, 813-796-1044 ..... A•2031,2034
Victoreen, Inc., Solon, OH 44139-3395, 216-248-9300;216-248-9043 ..... A•2039
§† Vishay Resistors, Malvern, PA 19355, 215-644-1300 ..... A•2046-2048
Angstrohm Precision, Inc., Dale Electronics, Hagerstown, MD 21742 301-739-8722
§ Colber Corp., Irvington, NJ 07111 201-371-9500
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 402-563-6506
Douglas International, Inc., Geneva, IL 60134-0761 708-232-7419
EBG, Inc., Camp Hill, PA 17011-4335 717-737-9877
EBG-Elektronische Bauelemente, Gesellschaft m.b.H., AUSTRIA ..... (43) 03116 2625
Eltec Instruments Inc., Daytona Bch., FL 32120 904-253-5328
EMC Technology Inc, Cherry Hill, NJ 08034 609-429-7800
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Ferro Corporation, Electronic Materials Div., Santa Barbara, CA 93117-3092 805-968-5000
Hokuriku USA Ltd., Madison, AL 35758 205-772-9620
† Hybrid Designs, Inc., Costa Mesa, CA 92626 714-557-9933
† Hycomp, Inc., Marlborough, MA 01752 508-485-6300
HY MEG Corp., Addison, IL 60101 708-543-9250
§ International Components Corp., Melville, NY 11747 516-293-1500
International Manufacturing Services, Portsmouth, RI 02871-2418 401-683-9700
§† International Resistive Company, Boone, NC 28607 704-264-8861
† International Sensor Systems, Inc., Aurora, NE 68818 402-694-6111
IRC-Shallcross, Smithfield, NC 27577 919-934-5181
§ Jaro Components, Inc., Boca Raton, FL 33487-8295 407-241-8600
† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
§† Micro-Ohm Corp., Duarte, CA 91010 818-3575377
Mini-Systems, Inc., Sunbelt Microelectronic Division, Deltona, FL 32725 407-574-0208
§ NIC Components Corp., N. Amityville, NY 11701 516-226-7500
Noble U.S.A., Inc., Rolling Meadows, IL 60008 708-364-6038
Peter Parts & Assocs., Webster, NY 14580 716-265-2540
§ Philips Components Discrete Products Division, Mineral Wells, TX 76067 817-325-7871
Raltron Electronics, Miami, FL 33172 305-593-6033
§ RF Electronics, Inc., Irvine, CA 92714-5517 714-263-0661
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
§† Solitron Devices, Inc., Semiconductor Group, West Palm Beach, FL 33407-4697 407-848-4311
§† Varistor Corp., Sevierville, TN 37862 615-453-0001
† Vermont Precision Resistor, Codeco Corp. of Vermont, Stowe, VT 05672-1207 ..... 802-253-8567;802-253-7649

Resistors, Flame Retardant-4700

§ Allen Co., Inc., Robert G., N. Hollywood, CA 91605, 818-765-8300;800-827-7422 ..... A•1861,1863
§ Caddock Electronics, Inc., Riverside, CA 92507, 909-788-1700 ..... A•1877
Colber Corp., Irvington, NJ 07111, 201-371-9500 ..... A•1907
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647, 402-563-6506 ..... A•1929
§ Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242, 402-371-0080 ..... A•1920-1922
General Resistance, A Prime Technology Company, N. Branford, CT 06471, 203-481-5721 ..... A•1935
Huntington Electric Inc., Huntington, IN 46750, 219-356-0778 ..... A•1936
§ IRC, Inc., Boone, NC 28607, 704-264-8861 ..... A•1950-1951
§ KOA Speer Electronics, Bradford, PA 16701, 814-362-5536 ..... A•1958,1960,1964,1970-1971
§† KRL/Bantry Components, Inc., Manchester, NH 03103, 603-668-3210 ..... A•1975-1978
§ Mills Resistor Co., Los Alamitos, CA 90720, 310-598-2454 ..... A•1987
Ohmite Manufacturing Co., Skokie, IL 60076, 708-675-2600 ..... A•1998-1999
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•2019
§ Baknor Industries Inc., Mississauga, ONT., CANADA L5L 1X1 416-828-2400
§† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635 714-447-2300
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Hokuriku USA Ltd., Madison, AL 35758 205-772-9620
§ ICO-RALLY Corporation, Palo Alto, CA 94303 415-856-9900
§ International Components Corp., Melville, NY 11747 516-293-1500
§† International Resistive Company, Boone, NC 28607 704-264-8861
ISL Products Int'l, Ltd., Syosset, NY 11791-6093 ..... 516-937-3475;800-626-6116
§ Jaro Components, Inc., Boca Raton, FL 33487-8295 407-241-8600
Kelvin Industries, Inc., Sherman Oaks, CA 91403-3501 818-990-1192
§ Laube Technology, Woodland Hills, CA 91367 818-703-1188
§† Memcor-Truohm, Inc., Huntington, IN 46750 219-356-4300
§ Micro-Ohm Corp., Duarte, CA 91010 818-3575377
NIC Components Corp., N. Amityville, NY 11701 516-226-7500
Noble U.S.A., Inc., Rolling Meadows, IL 60008 708-364-6038
§ NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
† Ohmtek Inc., Vishay, Niagara Falls, NY 14304 716-283-4025
§ Panasonic Indl. Co. Standard Comps. Sector, Matsushita Elec. Corp. of America, Secaucus, NJ 07094 201-392-4818
§ Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404 407-881-3200
§† Philips Components Discrete Products Division, Mineral Wells, TX 76067 817-325-7871
§ Philips ECG, North American Philips Co., Williamsport, PA 17701 717-323-4691
Precision Resistive Products, Inc., Mediapolis, IA 52637 319-394-9131
Resistors, Inc., Chicago, IL 60650 708-652-7555
§ RF Electronics, Inc., Irvine, CA 92714-5517 714-263-0661
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
§ Techno Division, Dale Electronics, Van Nuys, CA 91405-1139 818-781-1642
Tepro of Florida, Clearwater, FL 34623 813-796-1044
Varistor Corp., Sevierville, TN 37862 615-453-0001
†# Vermont Precision Resistor, Codeco Corp. of Vermont, Stowe, VT 05672-1207 ..... 802-253-8567;802-253-7649
Vishay Resistors, Malvern, PA 19355 215-644-1300

Resistors, Flux Sensitive-4700

§ Colber Corp., Irvington, NJ 07111 201-371-9500
§† RCD Components, Inc., Manchester, NH 03109 603-669-0054

Resistors, Foil, Ultraprecision-4700

§ Caddock Electronics, Inc., Riverside, CA 92507, 909-788-1700 ..... A•1877
Isotek Corporation, Swansea, MA 02777, 508-673-2900 ..... A•1953
KRL/Bantry Components, Inc., Manchester, NH 03103, 603-668-3210 ... A•1974
RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•2019
§† Vishay Resistors, Malvern, PA 19355, 215-644-1300 ..... A•2041-2047
Hokuriku USA Ltd., Madison, AL 35758 205-772-9620
§ Jaro Components, Inc., Boca Raton, FL 33487-8295 407-241-8600
Tepro of Florida, Clearwater, FL 34623 813-796-1044
† Wilbrecht Electronics, St. Paul, MN 55107 612-222-2791

Resistors, Four Terminal-4700

§ Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647, 402-563-6506 ..... A•1931
Huntington Electric Inc., Huntington, IN 46750, 219-356-0778 ..... A•1936
Isotek Corporation, Swansea, MA 02777, 508-673-2900 ..... A•1953,1955
§† KRL/Bantry Components, Inc., Manchester, NH 03103, 603-668-3210 ..... A•1976,1978
Pacific Resistor Co., Tarzana, CA 91356, 818-345-7811 ..... A•2008
Precision Resistor Co., Inc., Largo, FL 34647-1421, 813-541-5771 ..... A•2017
§† State of the Art, Inc., State College, PA 16803-1797, 814-355-8004 ..... A•2020
Tepro of Florida, Clearwater, FL 34623, 813-796-1044 ..... A•2030-2031
Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242 402-371-0080
§ International Resistive Company, Boone, NC 28607 704-264-8861
§ IRC, Inc., Boone, NC 28607 704-264-8861
§ Jaro Components, Inc., Boca Raton, FL 33487-8295 407-241-8600
Kelvin Industries, Inc., Sherman Oaks, CA 91403-3501 818-990-1192
Mills Resistor Co., Los Alamitos, CA 90720 310-598-2454
§† RCD Components, Inc., Manchester, NH 03109 603-669-0054

Resistors, Fuse-4300 — *See Vol. B*

Resistors, Glass-4700

Piconics, Incorporated, Tyngsboro, MA 01879, 508-649-7501 ..... A•2013
Victoreen, Inc., Solon, OH 44139-3395, 216-248-9300;216-248-9043 ..... A•2038
Angstrohm Precision, Inc., Dale Electronics, Hagerstown, MD 21742 301-739-8722
§ Colber Corp., Irvington, NJ 07111 201-371-9500
Component General, Inc., Odessa, FL 33556 813-376-6655
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 402-563-6506
Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242 402-371-0080
Eltec Instruments Inc., Daytona Bch., FL 32120 904-253-5328
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
† Ohmite Manufacturing Co., Skokie, IL 60076 708-675-2600
§† RCD Components, Inc., Manchester, NH 03109 603-669-0054
Solitron/Microwave, Solitron Devices, Inc., West Palm Beach, FL 33407-4697 407-848-4311
§ Techno Division, Dale Electronics, Van Nuys, CA 91405-1139 818-781-1642

Resistors, Heat Sink Encased — See Resistors, Integral Heat Dissipator (Vol. A)

Resistors, High Frequency-4700

Cableform Inc., Troy, VA 22974, 804-589-8224 ..... A•1875
§ Caddock Electronics, Inc., Riverside, CA 92507, 909-788-1700 ..... A•1877
† The Carborundum Company, Electric Products, Niagara Falls, NY 14302, 716-278-2521 ..... A•1904
§ Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242, 402-371-0080 ..... A•1921-1922
Huntington Electric Inc., Huntington, IN 46750, 219-356-0778 ..... A•1936-1938
Mills Resistor Co., Los Alamitos, CA 90720, 310-598-2454 ..... A•1987
§† State of the Art, Inc., State College, PA 16803-1797, 814-355-8004 ..... A•2020
Victoreen, Inc., Solon, OH 44139-3395, 216-248-9300;216-248-9043 ..... A•2040
§† Vishay Resistors, Malvern, PA 19355, 215-644-1300 ..... A•2043-2044
§ Allen Co., Inc., Robert G., N. Hollywood, CA 91605 ..... 818-765-8300;800-827-7422
† AMITRON, American Micro-Tronix, Inc., North Andover, MA 01845 508-686-1882
Component General, Inc., Odessa, FL 33556 813-376-6655
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 402-563-6506
EBG, Inc., Camp Hill, PA 17011-4335 717-737-9877
EBG-Elektronische Bauelemente, Gesellschaft m.b.H., AUSTRIA ..... (43) 03116 2625
† EMC Technology Inc, Cherry Hill, NJ 08034 609-429-7800
Hokuriku USA Ltd., Madison, AL 35758 205-772-9620
† Hycomp, Inc., Marlborough, MA 01752 508-485-6300
International Manufacturing Services, Portsmouth, RI 02871-2418 401-683-9700
§ International Resistive Company, Boone, NC 28607 704-264-8861
§ IRC, Inc., Boone, NC 28607 704-264-8861
IRC-Shallcross, Smithfield, NC 27577 919-934-5181
§ Jaro Components, Inc., Boca Raton, FL 33487-8295 407-241-8600
† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
Kelvin Industries, Inc., Sherman Oaks, CA 91403-3501 818-990-1192
† KRL/Bantry Components, Inc., Manchester, NH 03103 603-668-3210
§† Memcor-Truohm, Inc., Huntington, IN 46750 219-356-4300
† Mini-Systems, Inc., Thick/Thin Film Division, North Attleboro, MA 02761 508-695-0203
Mini-Systems, Inc., Sunbelt Microelectronic Division, Deltona, FL 32725 407-574-0208
§ Nepenthe, Inc., Palo Alto, CA 94303 415-496-6666
Ohmtek Inc., Vishay, Niagara Falls, NY 14304 716-283-4025
† Ovenaire-Audio-Carpenter, Oak Crystal Inc., Charlottesville, VA 22901 804-977-8050
§† RCD Components, Inc., Manchester, NH 03109 603-669-0054
Resistors, Inc., Chicago, IL 60650 708-652-7555
§† Solitron Devices, Inc., Semiconductor Group, West Palm Beach, FL 33407-4697 407-848-4311
§ Techno Division, Dale Electronics, Van Nuys, CA 91405-1139 818-781-1642
Tepro of Florida, Clearwater, FL 34623 813-796-1044
†# Vermont Precision Resistor, Codeco Corp. of Vermont, Stowe, VT 05672-1207 ..... 802-253-8567;802-253-7649

Resistors, High Megohm (Over 22 Megohms)-4700

Cableform Inc., Troy, VA 22974, 804-589-8224 ..... A•1875
§ Caddock Electronics, Inc., Riverside, CA 92507, 909-788-1700 ..... A•1877
International Manufacturing Services, Portsmouth, RI 02871-2418, 401-683-9700 ..... A•1944-1945
§ K & M Electronics Inc., W. Springfield, MA 01089, 413-781-1350 ..... A•1957
† Mini-Systems, Inc., Thick/Thin Film Division, North Attleboro, MA 02761, 508-695-0203 ..... A•1993
§† State of the Art, Inc., State College, PA 16803-1797, 814-355-8004 ..... A•2020-2021
Victoreen, Inc., Solon, OH 44139-3395, 216-248-9300;216-248-9043 ..... A•2038-2040
§ Allen Co., Inc., Robert G., N. Hollywood, CA 91605 ..... 818-765-8300;800-827-7422
† AMITRON, American Micro-Tronix, Inc., North Andover, MA 01845 508-686-1882
§† California Micro Devices, Inc., Milpitas, CA 95035 408-263-3214
§ Colber Corp., Irvington, NJ 07111 201-371-9500
Component General, Inc., Odessa, FL 33556 813-376-6655
CTS Corporation, Elkhart, IN 46514 219-293-7511
CTS Corp., Electrocomponents, Elkhart, IN 46514 219-295-3575
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 402-563-6506
Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242 402-371-0080
EBG, Inc., Camp Hill, PA 17011-4335 717-737-9877
EBG-Elektronische Bauelemente, Gesellschaft m.b.H., AUSTRIA ..... (43) 03116 2625
Eltec Instruments Inc., Daytona Bch., FL 32120 904-253-5328
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Hokuriku USA Ltd., Madison, AL 35758 205-772-9620
HY MEG Corp., Addison, IL 60101 708-543-9250
§† International Resistive Company, Boone, NC 28607 704-264-8861
§ IRC, Inc., Boone, NC 28607 704-264-8861
§ Jaro Components, Inc., Boca Raton, FL 33487-8295 407-241-8600
† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
Kelvin Industries, Inc., Sherman Oaks, CA 91403-3501 818-990-1192
† KRL/Bantry Components, Inc., Manchester, NH 03103 603-668-3210
† Microplex, Inc., Anaheim, CA 92806 714-634-1535
Mini-Systems, Inc., Sunbelt Microelectronic Division, Deltona, FL 32725 407-574-0208
Ohmtek Inc., Vishay, Niagara Falls, NY 14304 716-283-4025
† Ovenaire-Audio-Carpenter, Oak Crystal Inc., Charlottesville, VA 22901 804-977-8050
§ Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404 407-881-3200
§ Philips Components Discrete Products Division, Mineral Wells, TX 76067 817-325-7871
§† RCD Components, Inc., Manchester, NH 03109 603-669-0054
§ RF Electronics, Inc., Irvine, CA 92714-5517 714-263-0661
§ Techno Division, Dale Electronics, Van Nuys, CA 91405-1139 818-781-1642
U.S. Resistor, Inc., St. Marys, PA 15857-1059 814-781-7679
Vamistor Corp., Sevierville, TN 37862 615-453-0001

Resistors, High Temperature (Over 125°C)-4700

§ Caddock Electronics, Inc., Riverside, CA 92507, 909-788-1700 ..... A•1877
§† Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647, 402-563-6506 ..... A•1929-1931
§ Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242, 402-371-0080 ..... A•1920
Huntington Electric Inc., Huntington, IN 46750, 219-356-0778 ..... A•1936
Imperial Astronics, Andig Inc., Northridge, CA 91324, 818-886-7672 ..... A•1940,1943
KOA Speer Electronics, Bradford, PA 16701, 814-362-5536 ..... A•1959
† KRL/Bantry Components, Inc., Manchester, NH 03103, 603-668-3210 ..... A•1974
Mills Resistor Co., Los Alamitos, CA 90720, 310-598-2454 ..... A•1987
† Milwaukee Resistor Corp., Milwaukee, WI 53204, 414-271-9900 ..... A•1988-1989
† Pacific Resistor Co., Tarzana, CA 91356, 818-345-7811 ..... A•2006
† Piconics, Incorporated, Tyngsboro, MA 01879, 508-649-7501 ..... A•2013
Precision Resistive Products, Inc., Mediapolis, IA 52637, 319-394-9131 ..... A•2014
Precision Resistor Co., Inc., Largo, FL 34647-1421, 813-541-5771 ..... A•2016
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•2019
§† State of the Art, Inc., State College, PA 16803-1797, 814-355-8004 ..... A•2020-2022,2024
Victoreen, Inc., Solon, OH 44139-3395, 216-248-9300;216-248-9043 ..... A•2039-2040
† Aalpha Precision, Pacific Resistor Co., Tarzana, CA 91356 ..... 818-345-7811; 800-835-3355
§ Allen Co., Inc., Robert G., N. Hollywood, CA 91605 ..... 818-765-8300;800-827-7422
† The Carborundum Company, Electric Products, Niagara Falls, NY 14302 716-278-2521
Component General, Inc., Odessa, FL 33556 813-376-6655
EBG, Inc., Camp Hill, PA 17011-4335 717-737-9877
EBG-Elektronische Bauelemente, Gesellschaft m.b.H., AUSTRIA ..... (43) 03116 2625
† Electro-Films, Inc., Warwick, RI 02886 401-738-9150
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
§† Fenwal Electronics, Inc., Milford, MA 01757 508-478-6000
Ferro Corporation, Electronic Materials Div., Santa Barbara, CA 93117-3092 805-968-5000
Fukushima Futaba Electric Co., R.G. Allen Co., N. Hollywood, CA 91605 818-765-8300
Hokuriku USA Ltd., Madison, AL 35758 205-772-9620
† Hycomp, Inc., Marlborough, MA 01752 508-485-6300
HY MEG Corp., Addison, IL 60101 708-543-9250
International Manufacturing Services, Portsmouth, RI 02871-2418 401-683-9700
§ International Resistive Company, Boone, NC 28607 704-264-8861
§ IRC, Inc., Boone, NC 28607 704-264-8861
§† IRC-Shallcross, Smithfield, NC 27577 919-934-5181
§ Jaro Components, Inc., Boca Raton, FL 33487-8295 407-241-8600
† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
§ Kelvin Industries, Inc., Sherman Oaks, CA 91403-3501 818-990-1192
Meissner Industries, Dover, NJ 07801 201-366-1700
§† Memcor-Truohm, Inc., Huntington, IN 46750 219-356-4300
§† Micro-Ohm Corp., Duarte, CA 91010 818-3575377
† Mini-Systems, Inc., Thick/Thin Film Division, North Attleboro, MA 02761 508-695-0203
Mini-Systems, Inc., Sunbelt Microelectronic Division, Deltona, FL 32725 407-574-0208
Nytron Inductors, Inc.(VSD, Inc.), Offered by: Dale Electronics, Inc., Yankton, SD 57078-0180 605-665-9301
§† Ohmite Manufacturing Co., Skokie, IL 60076 708-675-2600
§ Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404 407-881-3200
§† Philips Components Discrete Products Division, Mineral Wells, TX 76067 817-325-7871
Resistors, Inc., Chicago, IL 60650 708-652-7555
§ Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013 615-641-2020
§† Solitron Devices, Inc., Semiconductor Group, West Palm Beach, FL 33407-4697 407-848-4311
§ Techno Division, Dale Electronics, Van Nuys, CA 91405-1139 818-781-1642
U.S. Resistor, Inc., St. Marys, PA 15857-1059 814-781-7679
†# Vermont Precision Resistor, Codeco Corp. of Vermont, Stowe, VT 05672-1207 ..... 802-253-8567;802-253-7649
§† Vishay Resistors, Malvern, PA 19355 215-644-1300

Resistors, High Voltage (1,000 Volts & Over)-4700

Cableform Inc., Troy, VA 22974, 804-589-8224 ..... A•1875
§ Caddock Electronics, Inc., Riverside, CA 92507, 909-788-1700 ..... A•1877
† The Carborundum Company, Electric Products, Niagara Falls, NY 14302, 716-278-2521 ..... A•1904-1905

§† **Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647, 402-563-6506** ..... **A•1931**
§ **Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242, 402-371-0080** ..... **A•1924**
§ **IRC, Inc., Boone, NC 28607, 704-264-8861** ..... **A•1950-1951**
Julie Research Labs., New York, NY 10001, 212-633-6625 ..... **A•1956**
§ **K & M Electronics Inc., W. Springfield, MA 01089, 413-781-1350** ..... **A•1957**
Memcor-Truohm, Inc., Huntington, IN 46750, 219-356-4300 ..... **A•1984**
Mills Resistor Co., Los Alamitos, CA 90720, 310-598-2454 ..... **A•1987**
Ohmite Manufacturing Co., Skokie, IL 60076, 708-675-2600 ..... **A•1997**
Piconics, Incorporated, Tyngsboro, MA 01879, 508-649-7501 ..... **A•2013**
† **Precision Resistor Co., Inc., Largo, FL 34647-1421, 813-541-5771** ..... **A•2016**
§† **RCD Components, Inc., Manchester, NH 03109, 603-669-0054** ..... **A•2019**
State of the Art, Inc., State College, PA 16803-1797, 814-355-8004 ..... **A•2020**
§ **Techno Division, Dale Electronics, Van Nuys, CA 91405-1139, 818-781-1642** ..... **A•1925**
Victoreen, Inc., Solon, OH 44139-3395, 216-248-9300;216-248-9043 ..... **A•2039-2040**
† Aalpha Precision, Pacific Resistor Co., Tarzana, CA 91356 ..... 818-345-7811; 800-835-3355
† Atlas Engineering Corp., Dorchester, MA 02121 617-445-7100
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
§ Colber Corp., Irvington, NJ 07111 201-371-9500
Component General, Inc., Odessa, FL 33556 813-376-6655
† CTS Corporation, Elkhart, IN 46514 219-293-7511
CTS Corp., Electrocomponents, Elkhart, IN 46514 219-295-3575
EBG, Inc., Camp Hill, PA 17011-4335 717-737-9877
EBG-Elektronische Bauelemente, Gesellschaft m.b.H., AUSTRIA ..... (43) 03116 2625
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Haefely, Inc., Woodbridge, VA 22192 703-494-1900
Hipotronics Inc., Brewster, NY 10509 914-279-8091
Hokuriku USA Ltd., Madison, AL 35758 205-772-9620
HY MEG Corp., Addison, IL 60101 708-543-9250
International Manufacturing Services, Portsmouth, RI 02871-2418 401-683-9700
§† International Resistive Company, Boone, NC 28607 704-264-8861
§† IRC-Shallcross, Smithfield, NC 27577 919-934-5181
§ Jaro Components, Inc., Boca Raton, FL 33487-8295 407-241-8600
† KDI Triangle Electronics, Whippany, NJ 07981 201-887-5700
Kelvin Industries, Inc., Sherman Oaks, CA 91403-3501 818-990-1192
KRL/Bantry Components, Inc., Manchester, NH 03103 603-668-3210
† Maxwell Laboratories, Inc., San Diego, CA 92123-1506 619-279-5100
Micro-Ohm Corp., Duarte, CA 91010 818-3575377
Mini-Systems, Inc., Thick/Thin Film Division, North Attleboro, MA 02761 508-695-0203
Mini-Systems, Inc., Sunbelt Microelectronic Division, Deltona, FL 32725 407-574-0208
§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 075-951-9111
Ohmtek Inc., Vishay, Niagara Falls, NY 14304 716-283-4025
† Ovenaire-Audio-Carpenter, Oak Crystal Inc., Charlottesville, VA 22901 804-977-8050
† Pacific Resistor Co., Tarzana, CA 91356 818-345-7811
Sensitive Research Instruments, Mt. Vernon, NY 10550 914-699-9717
§ Square D Co., Palatine, IL 60067 708-397-2600
† Vamistor Corp., Sevierville, TN 37862 615-453-0001
Vishay Resistors, Malvern, PA 19355 215-644-1300

Resistors, Hot Molded-4700

Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647, 402-563-6506 ..... **A•1930-1931**
§† **Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242, 402-371-0080** ..... **A•1910,1912-1914,1917,1924**
Imperial Astronics, Andig Inc., Northridge, CA 91324, 818-886-7672 ..... **A•1940,1943**
§† **KRL/Bantry Components, Inc., Manchester, NH 03103, 603-668-3210** ..... **A•1977-1978**
Memcor-Truohm, Inc., Huntington, IN 46750, 219-356-4300 ..... **A•1984**
§† **Ohmite Manufacturing Co., Skokie, IL 60076, 708-675-2600** ..... **A•1998-1999**
† **Pacific Resistor Co., Tarzana, CA 91356, 818-345-7811** ..... **A•2006-2008**
§† **RCD Components, Inc., Manchester, NH 03109, 603-669-0054** ..... **A•2019**
§ **Techno Division, Dale Electronics, Van Nuys, CA 91405-1139, 818-781-1642** ..... **A•1925**
§† **Vishay Resistors, Malvern, PA 19355, 215-644-1300** ..... **A•2045-2048**
† Aalpha Precision, Pacific Resistor Co., Tarzana, CA 91356 ..... 818-345-7811; 800-835-3355
EBG, Inc., Camp Hill, PA 17011-4335 717-737-9877
EBG-Elektronische Bauelemente, Gesellschaft m.b.H., AUSTRIA ..... (43) 03116 2625
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
§ International Components Corp., Melville, NY 11747 516-293-1500
§† International Resistive Company, Boone, NC 28607 704-264-8861
Kelvin Industries, Inc., Sherman Oaks, CA 91403-3501 818-990-1192
Tepro of Florida, Clearwater, FL 34623 813-796-1044

Resistors, Integral Heat Dissipator-4700

§ **Caddock Electronics, Inc., Riverside, CA 92507, 909-788-1700** ..... **A•1877**
Clarostat Sensors and Controls Group, BYR, PLC, Plano, TX 75075, 214-422-1844;1-800-872-0044 ..... **A•1906**
§† **Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647, 402-563-6506** ..... **A•1929,1931**
Huntington Electric Inc., Huntington, IN 46750, 219-356-0778 ..... **A•1936**
Isotek Corporation, Swansea, MA 02777, 508-673-2900 ..... **A•1953**
§† **KRL/Bantry Components, Inc., Manchester, NH 03103, 603-668-3210** ..... **A•1978-1979**
Milwaukee Resistor Corp., Milwaukee, WI 53204, 414-271-9900 ..... **A•1988-1991**
§† **Ohmite Manufacturing Co., Skokie, IL 60076, 708-675-2600** ..... **A•1996**
Pacific Resistor Co., Tarzana, CA 91356, 818-345-7811 ..... **A•2006-2007**
Vermont Precision Resistor, Codeco Corp. of Vermont, Stowe, VT 05672-1207, 802-253-8567;802-253-7649 ..... **A•2036**
Aalpha Precision, Pacific Resistor Co., Tarzana, CA 91356 ..... 818-345-7811; 800-835-3355
§ Colber Corp., Irvington, NJ 07111 201-371-9500
Component General, Inc., Odessa, FL 33556 813-376-6655
§ Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242 402-371-0080
International Resistive Company, Boone, NC 28607 704-264-8861
§† IRC-Shallcross, Smithfield, NC 27577 919-934-5181
§ Jaro Components, Inc., Boca Raton, FL 33487-8295 407-241-8600
Kelvin Industries, Inc., Sherman Oaks, CA 91403-3501 818-990-1192
§† Micro-Ohm Corp., Duarte, CA 91010 818-3575377
§ Mills Resistor Co., Los Alamitos, CA 90720 310-598-2454
Nytron Inductors, Inc.(VSD, Inc.), Offered by: Dale Electronics, Inc., Yankton, SD 57078-0180 605-665-9301
§† RCD Components, Inc., Manchester, NH 03109 603-669-0054
Resistors, Inc., Chicago, IL 60650 708-652-7555
Vishay Resistors, Malvern, PA 19355 215-644-1300

Resistors, Low Temperature Coefficient-4700

AVX Corporation, A Kyocera Group Company, Myrtle Beach, SC 29577, 803-448-9411 ..... **A•1866**
§ **Caddock Electronics, Inc., Riverside, CA 92507, 909-788-1700** ..... **A•1877**
§† **Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647, 402-563-6506** ..... **A•1928-1930**
§ **Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242, 402-371-0080** ..... **A•1910-1915,1917,1920-1921,1924**
General Resistance, A Prime Technology Company, N. Branford, CT 06471, 203-481-5721 ..... **A•1935**
Huntington Electric Inc., Huntington, IN 46750, 219-356-0778 ..... **A•1936**
† **Imperial Astronics, Andig Inc., Northridge, CA 91324, 818-886-7672** ..... **A•1942**
Isotek Corporation, Swansea, MA 02777, 508-673-2900 ..... **A•1953-1955**
Julie Research Labs., New York, NY 10001, 212-633-6625 ..... **A•1956**
§ **K & M Electronics Inc., W. Springfield, MA 01089, 413-781-1350** ..... **A•1957**
§† **KOA Speer Electronics, Bradford, PA 16701, 814-362-5536** ..... **A•1959**
† **KRL/Bantry Components, Inc., Manchester, NH 03103, 603-668-3210** ..... **A•1973-1974,1976,1978**
Mills Resistor Co., Los Alamitos, CA 90720, 310-598-2454 ..... **A•1987**
Milwaukee Resistor Corp., Milwaukee, WI 53204, 414-271-9900 ..... **A•1988**
§† **Ohmite Manufacturing Co., Skokie, IL 60076, 708-675-2600** ..... **A•1996**
Ohmtek Inc., Vishay, Niagara Falls, NY 14304, 716-283-4025 ..... **A•2003**
† **Pacific Resistor Co., Tarzana, CA 91356, 818-345-7811** ..... **A•2007-2008**
§ **Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200** ..... **A•2011-2012**
† **Piconics, Incorporated, Tyngsboro, MA 01879, 508-649-7501** ..... **A•2013**
§ **Precision Resistive Products, Inc., Mediapolis, IA 52637, 319-394-9131** ..... **A•2014-2015**
† **Precision Resistor Co., Inc., Largo, FL 34647-1421, 813-541-5771** ..... **A•2016-2017**
§† **State of the Art, Inc., State College, PA 16803-1797, 814-355-8004** ..... **A•2020,2022,2024**
Tepro of Florida, Clearwater, FL 34623, 813-796-1044 ..... **A•2028**
†# **Vermont Precision Resistor, Codeco Corp. of Vermont, Stowe, VT 05672-1207, 802-253-8567;802-253-7649** ..... **A•2036**
Victoreen, Inc., Solon, OH 44139-3395, 216-248-9300;216-248-9043 ..... **A•2040**
§† **Vishay Resistors, Malvern, PA 19355, 215-644-1300** ..... **A•2042-2044,2046**
† Aalpha Precision, Pacific Resistor Co., Tarzana, CA 91356 ..... 818-345-7811; 800-835-3355
† Ablestik Electronic Materials & Adhesives-EMCA-REMEX Products, Montgomeryville, PA 18936 215-855-1000
§ Allen Co., Inc., Robert G., N. Hollywood, CA 91605 ..... 818-765-8300 800-827-7422
§† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635 714-447-2300
† The Carborundum Company, Electric Products, Niagara Falls, NY 14302 716-278-2521
§† CTS Corporation, Elkhart, IN 46514 219-293-7511
EBG, Inc., Camp Hill, PA 17011-4335 717-737-9877
EBG-Elektronische Bauelemente, Gesellschaft m.b.H., AUSTRIA ..... (43) 03116 2625
† Electro-Films, Inc., Warwick, RI 02886 401-738-9150
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
§† Fenwal Electronics, Inc., Milford, MA 01757 508-478-6000
Ferro Corporation, Electronic Materials Div., Santa Barbara, CA 93117-3092 805-968-5000
§† Guildline Instruments, Lake Mary, FL 32746 407-333-3327
Hokuriku USA Ltd., Madison, AL 35758 205-772-9620
† Hycomp, Inc., Marlborough, MA 01752 508-485-6300
HY MEG Corp., Addison, IL 60101 708-543-9250
International Manufacturing Services, Portsmouth, RI 02871-2418 401-683-9700
§ International Resistive Company, Boone, NC 28607 704-264-8861
§ IRC, Inc., Boone, NC 28607 704-264-8861
§† IRC-Shallcross, Smithfield, NC 27577 919-934-5181
ISL Products Int'l, Ltd., Syosset, NY 11791-6093 ..... 516-937-3475;800-626-6116
§ Jaro Components, Inc., Boca Raton, FL 33487-8295 407-241-8600
† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
§† Kelvin Industries, Inc., Sherman Oaks, CA 91403-3501 818-990-1192
Meissner Industries, Dover, NJ 07801 201-366-1700
§† Memcor-Truohm, Inc., Huntington, IN 46750 219-356-4300
§† Micro-Ohm Corp., Duarte, CA 91010 818-3575377
† Mini-Systems, Inc., Thick/Thin Film Division, North Attleboro, MA 02761 508-695-0203
Mini-Systems, Inc., Sunbelt Microelectronic Division, Deltona, FL 32725 407-574-0208
Nytron Inductors, Inc.(VSD, Inc.), Offered by: Dale Electronics, Inc., Yankton, SD 57078-0180 605-665-9301
§ Philips Components Discrete Products Division, Mineral Wells, TX 76067 817-325-7871

§ Piher International Corp., NACESA, Mt. Prospect, IL 60056 ..... 708-390-6680; 800-323-6693
Raltron Electronics, Miami, FL 33172 305-593-6033
§† RCD Components, Inc., Manchester, NH 03109 603-669-0054
† Resistors, Inc., Chicago, IL 60650 708-652-7555
§ Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013 615-641-2020
§† Solitron Devices, Inc., Semiconductor Group, West Palm Beach, FL 33407-4697 407-848-4311
§ Techno Division, Dale Electronics, Van Nuys, CA 91405-1139 818-781-1642
§† Vamistor Corp., Sevierville, TN 37862 615-453-0001
Wilbrecht Electronics, St. Paul, MN 55107 612-222-2791

Resistors, Metal Film-4700

Allen Co., Inc., Robert G., N. Hollywood, CA 91605, 818-765-8300;800-827-7422 ..... A•1862
Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635, 714-447-2300 ..... A•1868
§ Caddock Electronics, Inc., Riverside, CA 92507, 909-788-1700 ..... A•1877
Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242, 402-371-0080 ..... A•1920-1922
§ IRC, Inc., Boone, NC 28607, 704-264-8861 ..... A•1946-1949,1951
KOA Speer Electronics, Bradford, PA 16701, 814-362-5536 ..... A•1965
Micro-Ohm Corp., Duarte, CA 91010, 818-3575377 ..... A•1985
§ Ohmite Manufacturing Co., Skokie, IL 60076, 708-675-2600 ..... A•1999
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•2019
Tepro of Florida, Clearwater, FL 34623, 813-796-1044 ..... A•2032-2033
Vermont Precision Resistor, Codeco Corp. of Vermont, Stowe, VT 05672-1207, 802-253-8567;802-253-7649 ..... A•2036-2037
Angstrohm Precision, Inc., Dale Electronics, Hagerstown, MD 21742 301-739-8722
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 402-563-6506
Douglas International, Inc., Geneva, IL 60134-0761 708-232-7419
EBG, Inc., Camp Hill, PA 17011-4335 717-737-9877
EBG-Elektronische Bauelemente, Gesellschaft m.b.H., AUSTRIA ..... (43) 03116 2625
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Hokuriku USA Ltd., Madison, AL 35758 205-772-9620
HY MEG Corp., Addison, IL 60101 708-543-9250
International Resistive Company, Boone, NC 28607 704-264-8861
§ Jaro Components, Inc., Boca Raton, FL 33487-8295 407-241-8600
§ Laube Technology, Woodland Hills, CA 91367 818-703-1188
§ Panasonic Indl. Co. Standard Comps. Sector, Matsushita Elec. Corp. of America, Secaucus, NJ 07094 201-392-4818
§ Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404 407-881-3200
Philips Components Discrete Products Division, Mineral Wells, TX 76067 817-325-7871
§ Piher International Corp., NACESA, Mt. Prospect, IL 60056 ..... 708-390-6680; 800-323-6693
§ RF Electronics, Inc., Irvine, CA 92714-5517 714-263-0661
Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013 615-641-2020
§ West Electronic Sales Team, Huntington Beach, CA 92647 ..... 714-375-6500; 310-495-5569
§ Xicon Capacitors, Arlington, TX 76003 800-628-0544

Resistors, Metal Glazed-4700

§ Allen Co., Inc., Robert G., N. Hollywood, CA 91605, 818-765-8300;800-827-7422 ..... A•1863
§ IRC, Inc., Boone, NC 28607, 704-264-8861 ..... A•1950
§ Micro-Ohm Corp., Duarte, CA 91010, 818-3575377 ..... A•1985
Ohmtek Inc., Vishay, Niagara Falls, NY 14304, 716-283-4025 ..... A•2002
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•2019
Victoreen, Inc., Solon, OH 44139-3395, 216-248-9300;216-248-9043 ..... A•2038
† Ablestik Electronic Materials & Adhesives-EMCA-REMEX Products, Montgomeryville, PA 18936 215-855-1000
§ Colber Corp., Irvington, NJ 07111 201-371-9500
§ Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242 402-371-0080
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
HY MEG Corp., Addison, IL 60101 708-543-9250
§† International Resistive Company, Boone, NC 28607 704-264-8861
IRC-Shallcross, Smithfield, NC 27577 919-934-5181
§ Jaro Components, Inc., Boca Raton, FL 33487-8295 407-241-8600
Mini-Systems, Inc., Thick/Thin Film Division, North Attleboro, MA 02761 508-695-0203
Mini-Systems, Inc., Sunbelt Microelectronic Division, Deltona, FL 32725 407-574-0208
Ohmite Manufacturing Co., Skokie, IL 60076 708-675-2600
§ Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013 615-641-2020
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
§ Techno Division, Dale Electronics, Van Nuys, CA 91405-1139 818-781-1642

Resistors, Metal Oxide-4700

§ Allen Co., Inc., Robert G., N. Hollywood, CA 91605, 818-765-8300;800-827-7422 ..... A•1863
Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242, 402-371-0080 ..... A•1924
§ IRC, Inc., Boone, NC 28607, 704-264-8861 ..... A•1950-1951
ISKRA Electronics, Inc., Plainview, NY 11803, 516-349-0222 ..... B•1364
K & M Electronics Inc., W. Springfield, MA 01089, 413-781-1350 ..... A•1957
§ KOA Speer Electronics, Bradford, PA 16701, 814-362-5536 ..... A•1958
§ KRL/Bantry Components, Inc., Manchester, NH 03103, 603-668-3210 ..... A•1973,1976
§ Maida Development Co., Hampton, VA 23663, 804-723-0785 .. A•1096,1980-1983
Micro-Ohm Corp., Duarte, CA 91010, 818-3575377 ..... A•1985
§ Paccom Electronics, Redmond, WA 98052-5350, 206-883-9200;800-426-6254 ..... A•2005
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•2019
Victoreen, Inc., Solon, OH 44139-3395, 216-248-9300;216-248-9043 ..... A•2038-2040
§ World Products Inc., Sonoma, CA 95476, 707-996-5201 ..... A•2050-2051
§ Caddock Electronics, Inc., Riverside, CA 92507 909-788-1700
Canadian Thermostats & Control Devices Ltd., Montreal, PQ, CANADA H4P2B8 514-739-3274
§ Colber Corp., Irvington, NJ 07111 201-371-9500
§ C-S Electronic Sales, Inc., Frankfort, IN 46041 317-659-1874
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 402-563-6506
Douglas International, Inc., Geneva, IL 60134-0761 708-232-7419
EBG, Inc., Camp Hill, PA 17011-4335 717-737-9877
EBG-Elektronische Bauelemente, Gesellschaft m.b.H., AUSTRIA ..... (43) 03116 2625
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Fukushima Futaba Electric Co., R.G. Allen Co., N. Hollywood, CA 91605 818-765-8300
General Protection Co., Inc., Circuit Protection Group, Chicago, IL 60659 312-761-0403
Hokuriku USA Ltd., Madison, AL 35758 205-772-9620
International Microelectronics, Arlington, TX 76003 817-473-1730
§ International Resistive Company, Boone, NC 28607 704-264-8861
IRC-Shallcross, Smithfield, NC 27577 919-934-5181
ISL Products Int'l, Ltd., Syosset, NY 11791-6093 ..... 516-937-3475;800-626-6116
§ Jaro Components, Inc., Boca Raton, FL 33487-8295 407-241-8600
Ketema/Rodan Division, Anaheim, CA 92806 714-630-0081
§ Laube Technology, Woodland Hills, CA 91367 818-703-1188
Mouser Electronics, Santee, CA 92071 800-346-6873
Mouser Electronics, Mansfield, TX 76063 800-346-6873
Mouser Electronics, Gilroy, CA 95020 800-346-6873
NIC Components Corp., N. Amityville, NY 11701 516-226-7500
§ NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
§ Panasonic Indl. Co. Standard Comps. Sector, Matsushita Elec. Corp. of America, Secaucus, NJ 07094 201-392-4818
§ RF Electronics, Inc., Irvine, CA 92714-5517 714-263-0661
§ Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013 615-641-2020
§ Techno Division, Dale Electronics, Van Nuys, CA 91405-1139 818-781-1642
Tepro of Florida, Clearwater, FL 34623 813-796-1044
†# Vermont Precision Resistor, Codeco Corp. of Vermont, Stowe, VT 05672-1207 ..... 802-253-8567;802-253-7649
World Products Inc., Systems Devices Grp., Sonoma 95476 707-996-5201
§ Xicon Capacitors, Arlington, TX 76003 800-628-0544

Resistors, Microwave-4700

§† AMITRON, American Micro-Tronix, Inc., North Andover, MA 01845, 508-686-1882 ..... A•1720,1865
§ Caddock Electronics, Inc., Riverside, CA 92507, 909-788-1700 ..... A•1877
† Electro-Films, Inc., Warwick, RI 02886, 401-738-9150 ..... A•1721
† Mini-Systems, Inc., Thick/Thin Film Division, North Attleboro, MA 02761, 508-695-0203 ..... A•1993
† Bird Electronic Corp., Cleveland, OH 44139-2794 216-248-1200
† The Carborundum Company, Electric Products, Niagara Falls, NY 14302 716-278-2521
§ Colber Corp., Irvington, NJ 07111 201-371-9500
Component General, Inc., Odessa, FL 33556 813-376-6655
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 402-563-6506
Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242 402-371-0080
§† EMC Technology Inc, Cherry Hill, NJ 08034 609-429-7800
Hokuriku USA Ltd., Madison, AL 35758 205-772-9620
§ Inmet Corporation, Ann Arbor, MI 48103 313-426-5553
International Manufacturing Services, Portsmouth, RI 02871-2418 401-683-9700
† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
§ Midwest Microwave, Saline, MI 48176-9569 ..... 313-429-4773;800-521-4410
Mini-Systems, Inc., Sunbelt Microelectronic Division, Deltona, FL 32725 407-574-0208
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3 ..... 514-694-6666; 800-724-3911
§ Precision Resistive Products, Inc., Mediapolis, IA 52637 319-394-9131
§† RCD Components, Inc., Manchester, NH 03109 603-669-0054
Solitron Devices, Inc., Semiconductor Group, West Palm Beach, FL 33407-4697 407-848-4311
Tepro of Florida, Clearwater, FL 34623 813-796-1044
Vamistor Corp., Sevierville, TN 37862 615-453-0001
†# Vermont Precision Resistor, Codeco Corp. of Vermont, Stowe, VT 05672-1207 ..... 802-253-8567;802-253-7649
§† Vishay Resistors, Malvern, PA 19355 215-644-1300

Resistors, Negative Temperature Coefficient-4700

† Betatherm Corp., Shrewsbury, MA 01545, 508-842-0516 ..... B•1864-1865, 1867-1869
Cableform Inc., Troy, VA 22974, 804-589-8224 ..... A•1875
§ Caddock Electronics, Inc., Riverside, CA 92507, 909-788-1700 ..... A•1877
† The Carborundum Company, Electric Products, Niagara Falls, NY 14302, 716-278-2521 ..... A•1905
§ Colber Corp., Irvington, NJ 07111, 201-371-9500 ..... A•1907
Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242, 402-371-0080 ..... A•1919
§† Fenwal Electronics, Inc., Milford, MA 01757, 508-478-6000 ..... B•1875
Huntington Electric Inc., Huntington, IN 46750, 219-356-0778 ..... A•1936
§ IRC, Inc., Boone, NC 28607, 704-264-8861 ..... A•1948
Julie Research Labs., New York, NY 10001, 212-633-6625 ..... A•1956
§ Ketema/Rodan Division, Anaheim, CA 92806, 714-630-0081 ..... B•1876-1878
§ Keystone Carbon, Thermistor Div., St. Marys, PA 15857, 814-781-1591 ..... B•1879-1881
KOA Speer Electronics, Bradford, PA 16701, 814-362-5536 ..... A•1965,1969
Mills Resistor Co., Los Alamitos, CA 90720, 310-598-2454 ..... A•1987

§ **Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200** ..... **B•1889**
§ **Precision Resistive Products, Inc., Mediapolis, IA 52637, 319-394-9131** ..... **A•2014-2015**
† **Quality Thermistor, Boise, ID 83709, 208-377-3373** ..... **B•1893**
† **Sensor Scientific, Inc., Fairfield, NJ 07004, 201-227-7790;800-524-1610** ..... **B•1898-1899,1901**
Tepro of Florida, Clearwater, FL 34623, 813-796-1044 ..... **A•2028,2033**
§ **Therm-O-Disc, Inc., Sub. Emerson Elec. Co., Mansfield, OH 44907-0538, 419-525-8500** ..... **B•1389**
§ **Therm-O-Disc, Inc., Midwest Components Product Grp., Mansfield, OH 44907-0538, 419-525-8450** ..... **B•1905**
† **Vermont Precision Resistor, Codeco Corp. of Vermont, Stowe, VT 05672-1207, 802-253-8567;802-253-7649** ..... **A•2036**
§† **Vishay Resistors, Malvern, PA 19355, 215-644-1300** ..... **A•2042**
† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635 714-447-2300
Canadian Thermostats & Control Devices Ltd., Montreal, PQ, CANADA H4P2B8 514-739-3274
Component General, Inc., Odessa, FL 33556 813-376-6655
† Electro-Films, Inc., Warwick, RI 02886 401-738-9150
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Ferro Corporation, Electronic Materials Div., Santa Barbara, CA 93117-3092 805-968-5000
† Hycomp, Inc., Marlborough, MA 01752 508-485-6300
International Components Corp., Melville, NY 11747 516-293-1500
International Microelectronics, Arlington, TX 76003 817-473-1730
§† International Resistive Company, Boone, NC 28607 704-264-8861
§ IRC-Shallcross, Smithfield, NC 27577 919-934-5181
ISL Products Int'l, Ltd., Syosset, NY 11791-6093 ..... 516-937-3475;800-626-6116
§ Jaro Components, Inc., Boca Raton, FL 33487-8295 407-241-8600
§† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
Memcor-Truohm, Inc., Huntington, IN 46750 219-356-4300
Mouser Electronics, Santee, CA 92071 800-346-6873
Mouser Electronics, Mansfield, TX 76063 800-346-6873
Mouser Electronics, Gilroy, CA 95020 800-346-6873
§ Peter Parts & Assocs., Webster, NY 14580 716-265-2540
§ Philips Components Discrete Products Division, Mineral Wells, TX 76067 817-325-7871
† Piezo Electric Products, Inc., Metuchen, NJ 08840 908-548-2800
§ Techno Division, Dale Electronics, Van Nuys, CA 91405-1139 818-781-1642
§† Varnistor Corp., Sevierville, TN 37862 615-453-0001

Resistors, Noninductive-4700

§ **Caddock Electronics, Inc., Riverside, CA 92507, 909-788-1700** ..... **A•1877**
† **The Carborundum Company, Electric Products, Niagara Falls, NY 14302, 716-278-2521** ..... **A•1904-1905**
Clarostat Sensors and Controls Group, BYR, PLC, Plano, TX 75075, 214-422-1844;1-800-872-0044 ..... **A•1906**
§† **Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647, 402-563-6506** ..... **A•1926,1930**
Huntington Electric Inc., Huntington, IN 46750, 219-356-0778 ..... **A•1936**
† **Imperial Astronics, Andig Inc., Northridge, CA 91324, 818-886-7672** ..... **A•1940-1941**
† **KRL/Bantry Components, Inc., Manchester, NH 03103, 603-668-3210** ..... **A•1974,1976-1977**
Mills Resistor Co., Los Alamitos, CA 90720, 310-598-2454 ..... **A•1987**
Milwaukee Resistor Corp., Milwaukee, WI 53204, 414-271-9900 ..... **A•1988**
† **Ohmite Manufacturing Co., Skokie, IL 60076, 708-675-2600** ..... **A•1996**
Ohmtek Inc., Vishay, Niagara Falls, NY 14304, 716-283-4025 ..... **A•2001**
† **Pacific Resistor Co., Tarzana, CA 91356, 818-345-7811** ..... **A•2007-2008**
† **Precision Resistor Co., Inc., Largo, FL 34647-1421, 813-541-5771** ..... **A•2016-2017**
†# **Vermont Precision Resistor, Codeco Corp. of Vermont, Stowe, VT 05672-1207, 802-253-8567;802-253-7649** ..... **A•2037**
Victoreen, Inc., Solon, OH 44139-3395, 216-248-9300;216-248-9043 ..... **A•2038**
† **Vishay Resistors, Malvern, PA 19355, 215-644-1300** ..... **A•2044**
† Aalpha Precision, Pacific Resistor Co., Tarzana, CA 91356 ..... 818-345-7811; 800-835-3355
§ Allen Co., Inc., Robert G., N. Hollywood, CA 91605 ..... 818-765-8300;800-827-7422
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
§ Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635 714-447-2300
Cableform Inc., Troy, VA 22974 804-589-8224
§ Colber Corp., Irvington, NJ 07111 201-371-9500
§ Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242 402-371-0080
EBG, Inc., Camp Hill, PA 17011-4335 717-737-9877
EBG-Elektronische Bauelemente, Gesellschaft m.b.H., AUSTRIA ..... (43) 03116 2625
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
HY MEG Corp., Addison, IL 60101 708-543-9250
§† International Resistive Company, Boone, NC 28607 704-264-8861
§ IRC, Inc., Boone, NC 28607 704-264-8861
§† IRC-Shallcross, Smithfield, NC 27577 919-934-5181
§ Jaro Components, Inc., Boca Raton, FL 33487-8295 407-241-8600
Julie Research Labs., New York, NY 10001 212-633-6625
§† Kelvin Industries, Inc., Sherman Oaks, CA 91403-3501 818-990-1192
Meissner Industries, Dover, NJ 07801 201-366-1700
§† Memcor-Truohm, Inc., Huntington, IN 46750 219-356-4300
§† Micro-Ohm Corp., Duarte, CA 91010 818-3575377
Mini-Systems, Inc., Thick/Thin Film Division, North Attleboro, MA 02761 508-695-0203
Mini-Systems, Inc., Sunbelt Microelectronic Division, Deltona, FL 32725 407-574-0208
§† Nytron Inductors, Inc.(VSD, Inc.), Offered by: Dale Electronics, Inc., Yankton, SD 57078-0180 605-665-9301
§ Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404 407-881-3200
§ Philips Components Discrete Products Division, Mineral Wells, TX 76067 817-325-7871
§ Precision Resistive Products, Inc., Mediapolis, IA 52637 319-394-9131
§† RCD Components, Inc., Manchester, NH 03109 603-669-0054
† Resistors, Inc., Chicago, IL 60650 708-652-7555
Samarius Precision Instruments, Inc., Ansonia, CT 06401 203-736-9805
Tepro of Florida, Clearwater, FL 34623 813-796-1044

Resistors, Oil Filled-4700

† **Julie Research Labs., New York, NY 10001, 212-633-6625** ..... **A•1956**
Mills Resistor Co., Los Alamitos, CA 90720, 310-598-2454 ..... **A•1987**
† Atlas Engineering Corp., Dorchester, MA 02121 617-445-7100
§ Jaro Components, Inc., Boca Raton, FL 33487-8295 407-241-8600
Kelvin Industries, Inc., Sherman Oaks, CA 91403-3501 818-990-1192
† KRL/Bantry Components, Inc., Manchester, NH 03103 603-668-3210
Meissner Industries, Dover, NJ 07801 201-366-1700
§† RCD Components, Inc., Manchester, NH 03109 603-669-0054
§ Vishay Resistors, Malvern, PA 19355 215-644-1300

Resistors, Plug-in-4700

§ **Caddock Electronics, Inc., Riverside, CA 92507, 909-788-1700** ..... **A•1877**
† **KRL/Bantry Components, Inc., Manchester, NH 03103, 603-668-3210** ..... **A•1973-1974**
Mills Resistor Co., Los Alamitos, CA 90720, 310-598-2454 ..... **A•1987**
§ Colber Corp., Irvington, NJ 07111 201-371-9500
§ Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 402-563-6506
§ Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242 402-371-0080
Imperial Astronics, Andig Inc., Northridge, CA 91324 818-886-7672
International Resistive Company, Boone, NC 28607 704-264-8861
§ IRC, Inc., Boone, NC 28607 704-264-8861
§ ITT Pomona Electronics, Pomona, CA 91766 909-469-2900
Julie Research Labs., New York, NY 10001 212-633-6625
Ohmtek Inc., Vishay, Niagara Falls, NY 14304 716-283-4025
§† RCD Components, Inc., Manchester, NH 03109 603-669-0054
Resistors, Inc., Chicago, IL 60650 708-652-7555
Vishay Resistors, Malvern, PA 19355 215-644-1300

Resistors, Positive Temperature Coefficient-4700

§ **Caddock Electronics, Inc., Riverside, CA 92507, 909-788-1700** ..... **A•1877**
§ **Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647, 402-563-6506** ..... **A•1928-1929**
Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242, 402-371-0080 ..... **A•1910-1911,1919-1920**
§† **Fenwal Electronics, Inc., Milford, MA 01757, 508-478-6000** ..... **B•1875**
Huntington Electric Inc., Huntington, IN 46750, 219-356-0778 ..... **A•1936**
§ **IRC, Inc., Boone, NC 28607, 704-264-8861** ..... **A•1948**
Julie Research Labs., New York, NY 10001, 212-633-6625 ..... **A•1956**
§ **Ketema/Rodan Division, Anaheim, CA 92806, 714-630-0081** ..... **B•1876-1878**
§ **Keystone Carbon, Thermistor Div., St. Marys, PA 15857, 814-781-1591** ..... **B•1881-1882**
§ **KOA Speer Electronics, Bradford, PA 16701, 814-362-5536** ..... **A•1960,1965-1966**
† **KRL/Bantry Components, Inc., Manchester, NH 03103, 603-668-3210** ..... **A•1973-1975**
§† **Micro-Ohm Corp., Duarte, CA 91010, 818-3575377** ..... **A•1985**
Mills Resistor Co., Los Alamitos, CA 90720, 310-598-2454 ..... **A•1987**
§ **Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300** ..... **A•1995**
§ **Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200** ..... **B•1888**
§ **Precision Resistive Products, Inc., Mediapolis, IA 52637, 319-394-9131** ..... **A•2014-2015**
† **Precision Resistor Co., Inc., Largo, FL 34647-1421, 813-541-5771** ..... **A•2017**
† **Quality Thermistor, Boise, ID 83709, 208-377-3373** ..... **B•1893**
§ **Raychem Corporation, Menlo Park, CA 94025, 415-361-3863;800-2-RAYCHEM/ext. 6900** ..... **A•2179, B•1384-1385,1894-1895, D•1466**
State of the Art, Inc., State College, PA 16803-1797, 814-355-8004 ..... **A•2020,2022,2024**
Tepro of Florida, Clearwater, FL 34623, 813-796-1044 ..... **A•2028**
§ **Therm-O-Disc, Inc., Sub. Emerson Elec. Co., Mansfield, OH 44907-0538, 419-525-8500** ..... **B•1389**
§ **Therm-O-Disc, Inc., Midwest Components Product Grp., Mansfield, OH 44907-0538, 419-525-8450** ..... **B•1905,1907**
†# **Vermont Precision Resistor, Codeco Corp. of Vermont, Stowe, VT 05672-1207, 802-253-8567;802-253-7649** ..... **A•2036**
§† **Vishay Resistors, Malvern, PA 19355, 215-644-1300** ..... **A•2042**
† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635 714-447-2300
§† Cera-Mite Corp., Grafton, WI 53024 414-377-3500
† Electro-Films, Inc., Warwick, RI 02886 401-738-9150
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Ferro Corporation, Electronic Materials Div., Santa Barbara, CA 93117-3092 805-968-5000
GTE Control Devices, Inc., Standish, ME 04084 207-642-4535
Hokuriku USA Ltd., Madison, AL 35758 205-772-9620
† Imperial Astronics, Andig Inc., Northridge, CA 91324 818-886-7672
§† International Resistive Company, Boone, NC 28607 704-264-8861
† International Sensor Systems, Inc., Aurora, NE 68818 402-694-6111
§ IRC-Shallcross, Smithfield, NC 27577 919-934-5181
§ Jaro Components, Inc., Boca Raton, FL 33487-8295 407-241-8600
§ Jumo Process Control, Inc., Coatsville, PA 19320 215-380-8002
§† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
Kelvin Industries, Inc., Sherman Oaks, CA 91403-3501 818-990-1192
Meissner Industries, Dover, NJ 07801 201-366-1700

§† Memcor-Truohm, Inc., Huntington, IN 46750 219-356-4300
Microplex, Inc., Anaheim, CA 92806 714-634-1535
Ohmtek Inc., Vishay, Niagara Falls, NY 14304 716-283-4025
Peter Parts & Assocs., Webster, NY 14580 716-265-2540
§ Philips Components Discrete Products Division, Mineral Wells, TX 76067 817-325-7871
§† RCD Components, Inc., Manchester, NH 03109 603-669-0054
§ TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056 708-803-6100
§† Varnistor Corp., Sevierville, TN 37862 615-453-0001
Wilbrecht Electronics, St. Paul, MN 55107 612-222-2791

Resistors, Power-4700

§ Allen Co., Inc., Robert G., N. Hollywood, CA 91605, 818-765-8300;800-827-7422 ..... A•1863
§ Caddock Electronics, Inc., Riverside, CA 92507, 909-788-1700 ..... A•1877
† The Carborundum Company, Electric Products, Niagara Falls, NY 14302, 716-278-2521 ..... A•1904-1905
§ Clarostat Sensors and Controls Group, BYR, PLC, Plano, TX 75075, 214-422-1844;1-800-872-0044 ..... A•1906
CTS Corp., Resistor Networks, Berne, IN 46711, 219-589-3111 ..... A•1908
§† Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647, 402-563-6506 ..... A•1926-1930
§ Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242, 402-371-0080 ..... A•1921-1922
Huntington Electric Inc., Huntington, IN 46750, 219-356-0778 ..... A•1936
† Imperial Astronics, Andig Inc., Northridge, CA 91324, 818-886-7672 ..... A•1940-1943
§ IRC, Inc., Boone, NC 28607, 704-264-8861 ..... A•1948,1950-1951
Julie Research Labs., New York, NY 10001, 212-633-6625 ..... A•1956
§ KOA Speer Electronics, Bradford, PA 16701, 814-362-5536 ..... A•1958
§† KRL/Bantry Components, Inc., Manchester, NH 03103, 603-668-3210 ..... A•1973-1974,1976,1978-1979
Maida Development Co., Hampton, VA 23663, 804-723-0785 ..... A•1983
§† Memcor-Truohm, Inc., Huntington, IN 46750, 219-356-4300 ..... A•1984
§† Micro-Ohm Corp., Duarte, CA 91010, 818-3575377 ..... A•1985
§ Mills Resistor Co., Los Alamitos, CA 90720, 310-598-2454 ..... A•1987
† Milwaukee Resistor Corp., Milwaukee, WI 53204, 414-271-9900 ..... A•1988-1992
† Mini-Systems, Inc., Thick/Thin Film Division, North Attleboro, MA 02761, 508-695-0203 ..... A•1993
§ NTE Electronics, Inc., Bloomfield, NJ 07003, 201-748-5089 ..... A•2149
§† Ohmite Manufacturing Co., Skokie, IL 60076, 708-675-2600 ..... A•1996-1999
† Pacific Resistor Co., Tarzana, CA 91356, 818-345-7811 ..... A•2006-2008
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... A•2012
† Precision Resistor Co., Inc., Largo, FL 34647-1421, 813-541-5771 ... A•2016-2017
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•2019
State of the Art, Inc., State College, PA 16803-1797, 814-355-8004 ..... A•2020,2022-2024
Tepro of Florida, Clearwater, FL 34623, 813-796-1044 ..... A•2028-2029,2031
†# Vermont Precision Resistor, Codeco Corp. of Vermont, Stowe, VT 05672-1207, 802-253-8567;802-253-7649 ..... A•2036
Victoreen, Inc., Solon, OH 44139-3395, 216-248-9300;216-248-9043 ..... A•2039
§ Vishay Resistors, Malvern, PA 19355, 215-644-1300 ..... A•2043,2045
† Aalpha Precision, Pacific Resistor Co., Tarzana, CA 91356 ..... 818-345-7811; 800-835-3355
Angstrohm Precision, Inc., Dale Electronics, Hagerstown, MD 21742 301-739-8722
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
† Bird Electronic Corp., Cleveland, OH 44139-2794 216-248-1200
Cableform Inc., Troy, VA 22974 804-589-8224
§ Colber Corp., Irvington, NJ 07111 201-371-9500
Component General, Inc., Odessa, FL 33556 813-376-6655
Douglas International, Inc., Geneva, IL 60134-0761 708-232-7419
EBG, Inc., Camp Hill, PA 17011-4335 717-737-9877
EBG-Elektronische Bauelemente, Gesellschaft m.b.H., AUSTRIA ..... (43) 03116 2625
EMC Technology Inc, Cherry Hill, NJ 08034 609-429-7800
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Ferraz Corporation, Parsippany, NJ 07054 ..... 201-428-8400;800-526-9067
HY MEG Corp., Addison, IL 60101 708-543-9250
International Manufacturing Services, Portsmouth, RI 02871-2418 401-683-9700
International Microelectronics, Arlington, TX 76003 817-473-1730
§† International Resistive Company, Boone, NC 28607 704-264-8861
§† IRC-Shallcross, Smithfield, NC 27577 919-934-5181
ISL Products Int'l, Ltd., Syosset, NY 11791-6093 ..... 516-937-3475;800-626-6116
§ Jaro Components, Inc., Boca Raton, FL 33487-8295 407-241-8600
§† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
§ Kelvin Industries, Inc., Sherman Oaks, CA 91403-3501 818-990-1192
† Maxwell Laboratories, Inc., San Diego, CA 92123-1506 619-279-5100
Meissner Industries, Dover, NJ 07801 201-366-1700
Micron Electric Co., R.G. Allen Co., N. Hollywood, CA 91605 818-765-8300
Mini-Systems, Inc., Sunbelt Microelectronic Division, Deltona, FL 32725 407-574-0208
Mouser Electronics, Santee, CA 92071 800-346-6873
Mouser Electronics, Mansfield, TX 76063 800-346-6873
Mouser Electronics, Gilroy, CA 95020 800-346-6873
Noble U.S.A., Inc., Rolling Meadows, IL 60008 708-364-6038
§† Nytron Inductors, Inc.(VSD, Inc.), Offered by: Dale Electronics, Inc., Yankton, SD 57078-0180 605-665-9301
Ohmtek Inc., Vishay, Niagara Falls, NY 14304 716-283-4025
† Resistors, Inc., Chicago, IL 60650 708-652-7555
§ RF Electronics, Inc., Irvine, CA 92714-5517 714-263-0661
Samarius Precision Instruments, Inc., Ansonia, CT 06401 203-736-9805
Sandman Electric Co., Inc., Braintree, MA 02184 617-848-2111
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
Solitron/Microwave, Solitron Devices, Inc., West Palm Beach, FL 33407-4697 407-848-4311
§ Techno Division, Dale Electronics, Van Nuys, CA 91405-1139 818-781-1642
U.S. Resistor, Inc., St. Marys, PA 15857-1059 814-781-7679
Varnistor Corp., Sevierville, TN 37862 615-453-0001
§ Xicon Capacitors, Arlington, TX 76003 800-628-0544

Resistors, Precision-4700

§ Allen Co., Inc., Robert G., N. Hollywood, CA 91605, 818-765-8300;800-827-7422 ..... A•1863
§ Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635, 714-447-2300 ..... A•1868
Cableform Inc., Troy, VA 22974, 804-589-8224 ..... A•1875
§ Caddock Electronics, Inc., Riverside, CA 92507, 909-788-1700 ..... A•1877
§† Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647, 402-563-6506 ..... A•1926
§† Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242, 402-371-0080 ..... A•1921
† Electro-Films, Inc., Warwick, RI 02886, 401-738-9150 ..... A•1721
§ General Resistance, A Prime Technology Company, N. Branford, CT 06471, 203-481-5721 ..... A•1935
IET Labs, Inc., Westbury, NY 11590, 516-334-5959;800-899-8438 ... D•1266-1271
† Imperial Astronics, Andig Inc., Northridge, CA 91324, 818-886-7672 ..... A•1940-1943
§ IRC, Inc., Boone, NC 28607, 704-264-8861 ..... A•1946-1950
Isotek Corporation, Swansea, MA 02777, 508-673-2900 ..... A•1953-1954
Julie Research Labs., New York, NY 10001, 212-633-6625 ..... A•1956
K & M Electronics Inc., W. Springfield, MA 01089, 413-781-1350 ..... A•1957
§† KOA Speer Electronics, Bradford, PA 16701, 814-362-5536 ..... A•1958,1962
§† KRL/Bantry Components, Inc., Manchester, NH 03103, 603-668-3210 ..... A•1973-1974
§† Micro-Ohm Corp., Duarte, CA 91010, 818-3575377 ..... A•1985
§ Mills Resistor Co., Los Alamitos, CA 90720, 310-598-2454 ..... A•1987
† Mini-Systems, Inc., Thick/Thin Film Division, North Attleboro, MA 02761, 508-695-0203 ..... A•1993
† Ohmtek Inc., Vishay, Niagara Falls, NY 14304, 716-283-4025 ..... A•2001,2003
† Pacific Resistor Co., Tarzana, CA 91356, 818-345-7811 ..... A•2006-2009
§ Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... A•2010-2012
† Piconics, Incorporated, Tyngsboro, MA 01879, 508-649-7501 ..... A•2013
§ Precision Resistive Products, Inc., Mediapolis, IA 52637, 319-394-9131 ..... A•2014-2015
† Precision Resistor Co., Inc., Largo, FL 34647-1421, 813-541-5771 ... A•2016-2017
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•2019
§† State of the Art, Inc., State College, PA 16803-1797, 814-355-8004 ..... A•2020,2022,2024
Tepro of Florida, Clearwater, FL 34623, 813-796-1044 ..... A•2029,2031-2034
†# Vermont Precision Resistor, Codeco Corp. of Vermont, Stowe, VT 05672-1207, 802-253-8567;802-253-7649 ..... A•2036-2037
Victoreen, Inc., Solon, OH 44139-3395, 216-248-9300;216-248-9043 ..... A•2038
§† Vishay Resistors, Malvern, PA 19355, 215-644-1300 ..... A•2041-2047
† Aalpha Precision, Pacific Resistor Co., Tarzana, CA 91356 ..... 818-345-7811; 800-835-3355
Angstrohm Precision, Inc., Dale Electronics, Hagerstown, MD 21742 301-739-8722
§† California Micro Devices, Inc., Milpitas, CA 95035 408-263-3214
§ Clarostat Sensors and Controls Group, BYR, PLC, Plano, TX 75075 ..... 214-422-1844; 1-800-872-0044
§ Colber Corp., Irvington, NJ 07111 201-371-9500
EBG, Inc., Camp Hill, PA 17011-4335 717-737-9877
EBG-Elektronische Bauelemente, Gesellschaft m.b.H., AUSTRIA ..... (43) 03116 2625
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
† Film Microelectronics Inc., Peabody, MA 01960 508-532-9913
† Hybrid Designs, Inc., Costa Mesa, CA 92626 714-557-9933
† Hycomp, Inc., Marlborough, MA 01752 508-485-6300
HY MEG Corp., Addison, IL 60101 708-543-9250
International Components Corp., Melville, NY 11747 516-293-1500
International Manufacturing Services, Portsmouth, RI 02871-2418 401-683-9700
§† International Resistive Company, Boone, NC 28607 704-264-8861
§† IRC-Shallcross, Smithfield, NC 27577 919-934-5181
ISL Products Int'l, Ltd., Syosset, NY 11791-6093 ..... 516-937-3475;800-626-6116
§ Jaro Components, Inc., Boca Raton, FL 33487-8295 407-241-8600
† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
§† Kelvin Industries, Inc., Sherman Oaks, CA 91403-3501 818-990-1192
Koep Precision Standards, Inc., Tuckerton, NJ 08087 609-296-9686
Meissner Industries, Dover, NJ 07801 201-366-1700
Mini-Systems, Inc., Sunbelt Microelectronic Division, Deltona, FL 32725 407-574-0208
Nytron Inductors, Inc.(VSD, Inc.), Offered by: Dale Electronics, Inc., Yankton, SD 57078-0180 605-665-9301
§† Ohmite Manufacturing Co., Skokie, IL 60076 708-675-2600
† Ovenaire-Audio-Carpenter, Oak Crystal Inc., Charlottesville, VA 22901 804-977-8050
§ Philips Components Discrete Products Division, Mineral Wells, TX 76067 817-325-7871
§ Piher International Corp., NACESA, Mt. Prospect, IL 60056 ..... 708-390-6680; 800-323-6693
Resistors, Inc., Chicago, IL 60650 708-652-7555
§ Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013 615-641-2020
† Samarius Precision Instruments, Inc., Ansonia, CT 06401 203-736-9805
§† Solitron Devices, Inc., Semiconductor Group, West Palm Beach, FL 33407-4697 407-848-4311
Techrid Division, Dale Electronics, Van Nuys, CA 91405-1139 818-781-1642
§† Varnistor Corp., Sevierville, TN 37862 615-453-0001
† Waters Manufacturing, Inc., Talley Industries, Wayland, MA 01778 508-358-2777

Resistors, Pressure Sensitive-4700

Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 402-563-6506
Topflight, York, PA 17404 ..... 717-843-9901;800-233-9386
Vishay Resistors, Malvern, PA 19355 215-644-1300

Resistors, Rectilinear-4700

§ Vishay Resistors, Malvern, PA 19355, 215-644-1300 ..... A•2042
† Bourns Instruments Inc., Riverside, CA 92507 714-781-5148
CTS Corporation, Elkhart, IN 46514 219-293-7511
CTS Corp., Electrocomponents, Elkhart, IN 46514 219-295-3575
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
† KRL/Bantry Components, Inc., Manchester, NH 03103 603-668-3210
§† RCD Components, Inc., Manchester, NH 03109 603-669-0054
† Samarius Precision Instruments, Inc., Ansonia, CT 06401 203-736-9805

Resistors, Standards — See Standards, Resistance (Vol. D)

Resistors, Strip-4700

§ Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647 402-563-6506
§† Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242 402-371-0080
EMC Technology Inc, Cherry Hill, NJ 08034 609-429-7800
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Huntington Electric Inc., Huntington, IN 46750 219-356-0778
International Manufacturing Services, Portsmouth, RI 02871-2418 401-683-9700
International Resistive Company, Boone, NC 28607 704-264-8861
§† RCD Components, Inc., Manchester, NH 03109 603-669-0054
Topflight, York, PA 17404 ..... 717-843-9901;800-233-9386
Vishay Resistors, Malvern, PA 19355 215-644-1300

Resistors, Suppressor-4700

Advanced Thermistor Div., U.S. Sensor Corp., Orange, CA 92667, 714-639-1000 ..... B•1860
† The Carborundum Company, Electric Products, Niagara Falls, NY 14302, 716-278-2521 ..... A•1905
Imperial Astronics, Andig Inc., Northridge, CA 91324, 818-886-7672 ..... A•1940
KRL/Bantry Components, Inc., Manchester, NH 03103, 603-668-3210 ..... A•1979
§ Maida Development Co., Hampton, VA 23663, 804-723-0785 .. A•1096,1980-1982
Mills Resistor Co., Los Alamitos, CA 90720, 310-598-2454 ..... A•1987
§ World Products Inc., Sonoma, CA 95476, 707-996-5201 ..... A•1177,2050-2051, B•1399
§† Control Concepts Corp., Liebert Corp., Binghamton, NY 13902-1380 607-724-2484
Electrostatic Consulting Assocs., Groton, MA 01450 508-448-5485
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
General Protection Co., Inc., Circuit Protection Group, Chicago, IL 60659 312-761-0403
International Resistive Company, Boone, NC 28607 704-264-8861
§† RCD Components, Inc., Manchester, NH 03109 603-669-0054
Tepro of Florida, Clearwater, FL 34623 813-796-1044
U.S. Resistor, Inc., St. Marys, PA 15857-1059 814-781-7679
U.S. Sensor Corp., Orange, CA 92667 714-639-1000
U.S. Sensor Corp., Orange, CA 92667 714-639-1000
Vishay Resistors, Malvern, PA 19355 215-644-1300
World Products Inc., Systems Devices Grp., Sonoma 95476 707-996-5201

Resistors, Surge-4700

Advanced Thermistor Div., U.S. Sensor Corp., Orange, CA 92667, 714-639-1000 ..... B•1860
§ Allen Co., Inc., Robert G., N. Hollywood, CA 91605, 818-765-8300;800-827-7422 ..... A•1861
§ Caddock Electronics, Inc., Riverside, CA 92507, 909-788-1700 ..... A•1877
CTS Corp., Resistor Networks, Berne, IN 46711, 219-589-3111 ..... A•1908
§ Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647, 402-563-6506 ..... A•1930
§ Ketema/Rodan Division, Anaheim, CA 92806, 714-630-0081 ..... B•1876-1878
KRL/Bantry Components, Inc., Manchester, NH 03103, 603-668-3210 ..... A•1978-1979
§ Maida Development Co., Hampton, VA 23663, 804-723-0785 .. A•1096,1980-1982
Milwaukee Resistor Corp., Milwaukee, WI 53204, 414-271-9900 .... A•1988,1991
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•2019
Tepro of Florida, Clearwater, FL 34623, 813-796-1044 ..... A•2031
Vishay Resistors, Malvern, PA 19355, 215-644-1300 ..... A•2045
§ World Products Inc., Sonoma, CA 95476, 707-996-5201 ..... A•1177,2050-2051
† The Carborundum Company, Electric Products, Niagara Falls, NY 14302 716-278-2521
§ Colber Corp., Irvington, NJ 07111 201-371-9500
§† Control Concepts Corp., Liebert Corp., Binghamton, NY 13902-1380 607-724-2484
Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242 402-371-0080
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
General Protection Co., Inc., Circuit Protection Group, Chicago, IL 60659 312-761-0403
Huntington Electric Inc., Huntington, IN 46750 219-356-0778
§ International Resistive Company, Boone, NC 28607 704-264-8861
§ IRC, Inc., Boone, NC 28607 704-264-8861
Kelvin Industries, Inc., Sherman Oaks, CA 91403-3501 818-990-1192
§ Keystone Carbon, Thermistor Div., St. Marys, PA 15857 814-781-1591
† Micro-Ohm Corp., Duarte, CA 91010 818-3575377
Mills Resistor Co., Los Alamitos, CA 90720 310-598-2454
Noble U.S.A., Inc., Rolling Meadows, IL 60008 708-364-6038
§ Ohmite Manufacturing Co., Skokie, IL 60076 708-675-2600
§ Philips Components Discrete Products Division, Mineral Wells, TX 76067 817-325-7871
§ Techno Division, Dale Electronics, Van Nuys, CA 91405-1139 818-781-1642
U.S. Sensor Corp., Orange, CA 92667 714-639-1000
U.S. Sensor Corp., Orange, CA 92667 714-639-1000
World Products Inc., Systems Devices Grp., Sonoma 95476 707-996-5201

Resistors, Surface Mount-4700

§ Allen Co., Inc., Robert G., N. Hollywood, CA 91605, 818-765-8300;800-827-7422 ..... A•1860,1863
§† AMITRON, American Micro-Tronix, Inc., North Andover, MA 01845, 508-686-1882 ..... A•1865
§† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635, 714-447-2300 ..... A•1868
Bourns, Inc., Electronic Components Sls., Riverside, CA 92507-2114, 909-781-5500;801-750-7200 ..... A•1869-1871
§ CTS Corp., Resistor Networks, Berne, IN 46711, 219-589-3111 ..... A•1908
§ Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647, 402-563-6506 ..... A•1926,1929-1930
§ Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242, 402-371-0080 ..... A•1912,1917-1919
† Electro-Films, Inc., Warwick, RI 02886, 401-738-9150 ..... A•1932
International Manufacturing Services, Portsmouth, RI 02871-2418, 401-683-9700 ..... A•1944-1945
§ IRC, Inc., Boone, NC 28607, 704-264-8861 ..... A•1946
Isotek Corporation, Swansea, MA 02777, 508-673-2900 ..... A•1953,1955
§ KOA Speer Electronics, Bradford, PA 16701, 814-362-5536 ..... A•1960-1964,1967,1970
§ KRL/Bantry Components, Inc., Manchester, NH 03103, 603-668-3210 ..... A•1973-1974
§ Mepcopal Company, San Diego, CA 92121-1307, 619-481-0210 ..... A•2107
§† Ohmite Manufacturing Co., Skokie, IL 60076, 708-675-2600 ..... A•1996
† Ohmtek Inc., Vishay, Niagara Falls, NY 14304, 716-283-4025 ..... A•2001-2002
§ Paccom Electronics, Redmond, WA 98052-5350, 206-883-9200;800-426-6254 ..... A•2005
Pacific Resistor Co., Tarzana, CA 91356, 818-345-7811 ..... A•2006-2007
§ Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... A•2010
† Piconics, Incorporated, Tyngsboro, MA 01879, 508-649-7501 ..... A•2013
Precision Resistor Co., Inc., Largo, FL 34647-1421, 813-541-5771 ..... A•2016
§† State of the Art, Inc., State College, PA 16803-1797, 814-355-8004 ..... A•2020,2023-2027
Tepro of Florida, Clearwater, FL 34623, 813-796-1044 ..... A•2030
Vishay Resistors, Malvern, PA 19355, 215-644-1300 ..... A•2042,2046,2048
Aalpha Precision, Pacific Resistor Co., Tarzana, CA 91356 ..... 818-345-7811; 800-835-3355
AVX Corporation, A Kyocera Group Company, Myrtle Beach, SC 29577 803-448-9411
§† California Micro Devices, Inc., Milpitas, CA 95035 408-263-3214
Clarostat Sensors and Controls Group, BYR, PLC, Plano, TX 75075 ..... 214-422-1844; 1-800-872-0044
EBG, Inc., Camp Hill, PA 17011-4335 717-737-9877
EBG-Elektronische Bauelemente, Gesellschaft m.b.H., AUSTRIA ..... (43) 03116 2625
† EMC Technology Inc, Cherry Hill, NJ 08034 609-429-7800
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
† Film Microelectronics Inc., Peabody, MA 01960 508-532-9913
General Protection Co., Inc., Circuit Protection Group, Chicago, IL 60659 312-761-0403
Hokuriku USA Ltd., Madison, AL 35758 205-772-9620
Imperial Astronics, Andig Inc., Northridge, CA 91324 818-886-7672
International Microelectronics, Arlington, TX 76003 817-473-1730
§† International Resistive Company, Boone, NC 28607 704-264-8861
† International Sensor Systems, Inc., Aurora, NE 68818 402-694-6111
§ Jaro Components, Inc., Boca Raton, FL 33487-8295 407-241-8600
§ KOK America Inc., Mitsubishi Materials Corporation, Rolling Meadows, IL 60008 708-577-0200
Kelvin Industries, Inc., Sherman Oaks, CA 91403-3501 818-990-1192
Micro-Ohm Corp., Duarte, CA 91010 818-3575377
Mills Resistor Co., Los Alamitos, CA 90720 310-598-2454
Mouser Electronics, Santee, CA 92071 800-346-6873
Mouser Electronics, Mansfield, TX 76063 800-346-6873
Mouser Electronics, Gilroy, CA 95020 800-346-6873
National Electronics Corp., Garden Grove, CA 92641 .... 714-892-7749;800-854-2451
NIC Components Corp., N. Amityville, NY 11701 516-226-7500
§ Philips Components Discrete Products Division, Mineral Wells, TX 76067 817-325-7871
§† RCD Components, Inc., Manchester, NH 03109 603-669-0054
§ RF Electronics, Inc., Irvine, CA 92714-5517 714-263-0661
§ Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013 615-641-2020
§ Techno Division, Dale Electronics, Van Nuys, CA 91405-1139 818-781-1642
§† Vamistor Corp., Sevierville, TN 37862 615-453-0001
Victoreen, Inc., Solon, OH 44139-3395 ..... 216-248-9300;216-248-9043
Wilbrecht Electronics, St. Paul, MN 55107 612-222-2791
§ Xicon Capacitors, Arlington, TX 76003 800-628-0544

Resistors, Tapped-4700

§† Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647, 402-563-6506 ..... A•1927
§† Memcor-Truohm, Inc., Huntington, IN 46750, 219-356-4300 ..... A•1984
§† Micro-Ohm Corp., Duarte, CA 91010, 818-3575377 ..... A•1985
† Milwaukee Resistor Corp., Milwaukee, WI 53204, 414-271-9900 ..... A•1988-1989,1991-1992
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•2019
§† State of the Art, Inc., State College, PA 16803-1797, 814-355-8004 ..... A•2020
§† California Micro Devices, Inc., Milpitas, CA 95035 408-263-3214
§ Colber Corp., Irvington, NJ 07111 201-371-9500
Component General, Inc., Odessa, FL 33556 813-376-6655
CTS Corporation, Elkhart, IN 46514 219-293-7511

CTS Corp., Electrocomponents, Elkhart, IN 46514 219-295-3575
§ Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242 402-371-0080
† Electro-Films, Inc., Warwick, RI 02886 401-738-9150
Huntington Electric Inc., Huntington, IN 46750 219-356-0778
§ International Components Corp., Melville, NY 11747 516-293-1500
International Resistive Company, Boone, NC 28607 704-264-8861
§ IRC, Inc., Boone, NC 28607 704-264-8861
IRC-Shallcross, Smithfield, NC 27577 919-934-5181
§ Jaro Components, Inc., Boca Raton, FL 33487-8295 407-241-8600
Kelvin Industries, Inc., Sherman Oaks, CA 91403-3501 818-990-1192
§† KRL/Bantry Components, Inc., Manchester, NH 03103 603-668-3210
§† Ohmite Manufacturing Co., Skokie, IL 60076 708-675-2600
Ohmtek Inc., Vishay, Niagara Falls, NY 14304 716-283-4025
† Resistors, Inc., Chicago, IL 60650 708-652-7555
§ Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013 615-641-2020
† Samarius Precision Instruments, Inc., Ansonia, CT 06401 203-736-9805
Tepro of Florida, Clearwater, FL 34623 813-796-1044
Victoreen, Inc., Solon, OH 44139-3395 ..... 216-248-9300;216-248-9043
Vishay Resistors, Malvern, PA 19355 215-644-1300

Resistors, Tin Oxide-4700

KRL/Bantry Components, Inc., Manchester, NH 03103, 603-668-3210 ... A•1976
§ Micro-Ohm Corp., Duarte, CA 91010, 818-3575377 ..... A•1985
§ Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242 402-371-0080
§ International Resistive Company, Boone, NC 28607 704-264-8861
§ KOA Speer Electronics, Bradford, PA 16701 814-362-5536
§† RCD Components, Inc., Manchester, NH 03109 603-669-0054
§ Techno Division, Dale Electronics, Van Nuys, CA 91405-1139 818-781-1642

Resistors, Variable — See Potentiometers (Vol. A), Rheostats (Vol. A), Resistors, Adjustable (Vol. A)

Resistors, Voltage Sensitive-4700

Corcom, Inc., Libertyville, IL 60048, 708-680-7400 ..... B•1352
Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647, 402-563-6506 ..... A•1931
§ ISKRA Electronics, Inc., Plainview, NY 11803, 516-349-0222 .... A•1085, B•1364
§ Maida Development Co., Hampton, VA 23663, 804-723-0785 .. A•1096,1980-1983
Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ..... A•1995
§ Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... A•2011-2012, B•1888-1889
Vishay Resistors, Malvern, PA 19355, 215-644-1300 ..... A•2043,2045
§ World Products Inc., Sonoma, CA 95476, 707-996-5201 ..... A•2050-2051
AVX Corporation, A Kyocera Group Company, Myrtle Beach, SC 29577 803-448-9411
† The Carborundum Company, Electric Products, Niagara Falls, NY 14302 716-278-2521
§ Colber Corp., Irvington, NJ 07111 201-371-9500
Electrostatic Consulting Assocs., Groton, MA 01450 508-448-5485
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
General Protection Co., Inc., Circuit Protection Group, Chicago, IL 60659 312-761-0403
§ GTE Supply, GTE, Irving, TX 75038 800-433-4837
Hokuriku USA Ltd., Madison, AL 35758 205-772-9620
§ International Components Corp., Melville, NY 11747 516-293-1500
International Resistive Company, Boone, NC 28607 704-264-8861
§ Marcon America Corp., Vernon Hills, IL 60061 708-913-9980
§ Panasonic Indl. Co. Standard Comps. Sector, Matsushita Elec. Corp. of America, Secaucus, NJ 07094 201-392-4818
§ Philips Components Discrete Products Division, Mineral Wells, TX 76067 817-325-7871
§ Philips ECG, North American Philips Co., Williamsport, PA 17701 717-323-4691
§ Raltron Electronics, Miami, FL 33172 305-593-6033
§† RCD Components, Inc., Manchester, NH 03109 603-669-0054
§ Schauer Manufacturing, Cincinnati, OH 45242 513-791-3030
Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
Stetron International, Inc., Buffalo, NY 14203 716-854-3443
Taiyo Yuden (USA) Inc., Arlington Heights, IL 60005-4493 708-364-6104
§ TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056 708-803-6100
§ Techno Division, Dale Electronics, Van Nuys, CA 91405-1139 818-781-1642
Therm-O-Disc, Inc., Sub. Emerson Elec. Co., Mansfield, OH 44907-0538 419-525-8500
§ Therm-O-Disc, Inc., Midwest Components Product Grp., Mansfield, OH 44907-0538 419-525-8450
§ Thomson Passive Components Corp., Woodland Hills, CA 91367 818-887-1010
§ Victory Engineering Corp., Springfield, NJ 07081 201-379-5900
World Products Inc., Systems Devices Grp., Sonoma 95476 707-996-5201

Resistors, Wirewound-4700

§ Allen Co., Inc., Robert G., N. Hollywood, CA 91605, 818-765-8300;800-827-7422 ..... A•1863
§ Clarostat Sensors and Controls Group, BYR, PLC, Plano, TX 75075, 214-422-1844;1-800-872-0044 ..... A•1906
Colber Corp., Irvington, NJ 07111, 201-371-9500 ..... A•1907
§† Dale Electronics, Inc., Columbus Div., Columbus, NE 68601-3647, 402-563-6506 ..... A•1926-1931
§ General Resistance, A Prime Technology Company, N. Branford, CT 06471, 203-481-5721 ..... A•1935
Huntington Electric Inc., Huntington, IN 46750, 219-356-0778 ..... A•1938
† Imperial Astronics, Andig Inc., Northridge, CA 91324, 818-886-7672 ..... A•1940-1943
§ IRC, Inc., Boone, NC 28607, 704-264-8861 ..... A•1946-1951
Julie Research Labs., New York, NY 10001, 212-633-6625 ..... A•1956
§† KRL/Bantry Components, Inc., Manchester, NH 03103, 603-668-3210 ..... A•1973-1978
§† Memcor-Truohm, Inc., Huntington, IN 46750, 219-356-4300 ..... A•1984
§† Micro-Ohm Corp., Duarte, CA 91010, 818-3575377 ..... A•1985
§ Mills Resistor Co., Los Alamitos, CA 90720, 310-598-2454 ..... A•1987
† Milwaukee Resistor Corp., Milwaukee, WI 53204, 414-271-9900 ..... A•1988-1989,1991
§ NTE Electronics, Inc., Bloomfield, NJ 07003, 201-748-5089 ..... A•2149
§† Ohmite Manufacturing Co., Skokie, IL 60076, 708-675-2600 ... A•1996,1998-1999
Ohmtek Inc., Vishay, Niagara Falls, NY 14304, 716-283-4025 ..... A•2001
Paccom Electronics, Redmond, WA 98052-5350, 206-883-9200;800-426-6254 ..... A•2005
† Pacific Resistor Co., Tarzana, CA 91356, 818-345-7811 ..... A•2006-2009
Precision Control Manufacturing, Inc., Seattle, WA 98109, 206-281-9380 ..... A•2116
† Precision Resistor Co., Inc., Largo, FL 34647-1421, 813-541-5771 ... A•2016-2017
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ..... A•2019
Tepro of Florida, Clearwater, FL 34623, 813-796-1044 ..... A•2028-2029,2031
†# Vermont Precision Resistor, Codeco Corp. of Vermont, Stowe, VT 05672-1207, 802-253-8567;802-253-7649 ..... A•2037
† Aalpha Precision, Pacific Resistor Co., Tarzana, CA 91356 ..... 818-345-7811; 800-835-3355
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
§ Bourns, Inc., Electronic Components Sls., Riverside, CA 92507-2114 ..... 909-781-5500; 801-750-7200
CTS Corporation, Elkhart, IN 46514 219-293-7511
CTS Corp., Electrocomponents, Elkhart, IN 46514 219-295-3575
Douglas International, Inc., Geneva, IL 60134-0761 708-232-7419
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
HY MEG Corp., Addison, IL 60101 708-543-9250
§ ICO-RALLY Corporation, Palo Alto, CA 94303 415-856-9900
International Microelectronics, Arlington, TX 76003 817-473-1730
§† International Resistive Company, Boone, NC 28607 704-264-8861
§† IRC-Shallcross, Smithfield, NC 27577 919-934-5181
ISL Products Int'l, Ltd., Syosset, NY 11791-6093 ..... 516-937-3475;800-626-6116
§ Jaro Components, Inc., Boca Raton, FL 33487-8295 407-241-8600
§† Kelvin Industries, Inc., Sherman Oaks, CA 91403-3501 818-990-1192
Meissner Industries, Dover, NJ 07801 201-366-1700
† Mel-Rain Controls, Paw Paw, MI 49079 616-657-2527
§ Mepcopal Company, San Diego, CA 92121-1307 619-481-0210
Mouser Electronics, Santee, CA 92071 800-346-6873
Mouser Electronics, Mansfield, TX 76063 800-346-6873
Mouser Electronics, Gilroy, CA 95020 800-346-6873
§ Nedco Electronics, Inc., Morton Grove, IL 60053 708-967-0500
NIC Components Corp., N. Amityville, NY 11701 516-226-7500
Noble U.S.A., Inc., Rolling Meadows, IL 60008 708-364-6038
§† Nytron Inductors, Inc.(VSD, Inc.), Offered by: Dale Electronics, Inc., Yankton, SD 57078-0180 605-665-9301
§ Panasonic Indl. Co. Standard Comps. Sector, Matsushita Elec. Corp. of America, Secaucus, NJ 07094 201-392-4818
§ Piher International Corp., NACESA, Mt. Prospect, IL 60056 ..... 708-390-6680; 800-323-6693
† Resistors, Inc., Chicago, IL 60650 708-652-7555
§ RF Electronics, Inc., Irvine, CA 92714-5517 714-263-0661
† Samarius Precision Instruments, Inc., Ansonia, CT 06401 203-736-9805
§ Techno Division, Dale Electronics, Van Nuys, CA 91405-1139 818-781-1642
§† Vamistor Corp., Sevierville, TN 37862 615-453-0001
† Waters Manufacturing, Inc., Talley Industries, Wayland, MA 01778 508-358-2777
§ Xicon Capacitors, Arlington, TX 76003 800-628-0544

Resistors, Zero-Ohm-4700

International Manufacturing Services, Portsmouth, RI 02871-2418, 401-683-9700 ..... A•1944
§ IRC, Inc., Boone, NC 28607, 704-264-8861 ..... A•1950-1951
Isotek Corporation, Swansea, MA 02777, 508-673-2900 ..... A•1953,1955
§ KOA Speer Electronics, Bradford, PA 16701, 814-362-5536 ... A•1960,1964,1966
§ Micro-Ohm Corp., Duarte, CA 91010, 818-3575377 ..... A•1985
§† State of the Art, Inc., State College, PA 16803-1797, 814-355-8004 ..... A•2020
Tepro of Florida, Clearwater, FL 34623, 813-796-1044 ..... A•2031
§ Colber Corp., Irvington, NJ 07111 201-371-9500
§ Dale Electronics, Inc., Norfolk Div., Norfolk, NE 68701-2242 402-371-0080
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Hokuriku USA Ltd., Madison, AL 35758 205-772-9620
§ International Components Corp., Melville, NY 11747 516-293-1500
International Microelectronics, Arlington, TX 76003 817-473-1730
§† International Resistive Company, Boone, NC 28607 704-264-8861
§ Jaro Components, Inc., Boca Raton, FL 33487-8295 407-241-8600
Kelvin Industries, Inc., Sherman Oaks, CA 91403-3501 818-990-1192
Mills Resistor Co., Los Alamitos, CA 90720 310-598-2454
Mouser Electronics, Santee, CA 92071 800-346-6873
Mouser Electronics, Mansfield, TX 76063 800-346-6873
Mouser Electronics, Gilroy, CA 95020 800-346-6873
§† Ohmite Manufacturing Co., Skokie, IL 60076 708-675-2600
§ Paccom Electronics, Redmond, WA 98052-5350 ..... 206-883-9200;800-426-6254
§ Piher International Corp., NACESA, Mt. Prospect, IL 60056 ..... 708-390-6680; 800-323-6693
§† RCD Components, Inc., Manchester, NH 03109 603-669-0054
§ RF Electronics, Inc., Irvine, CA 92714-5517 714-263-0661
§ Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013 615-641-2020
§ Xicon Capacitors, Arlington, TX 76003 800-628-0544

Resistors (MIL)-2440 — *See Vol. B*

Resolvers, Synchro-4900 — *See Vol. D*

Resonators, Ceramic-2300

Abracon Corporation, San Clemente, CA 92673, 714-498-4505 ..... A•1330
AVX Corporation, A Kyocera Group Company, Myrtle Beach, SC 29577, 803-448-9411 ..... A•1337
† Morgan-Matroc, Electro Ceramics Division, Bedford, OH 44146-5478, 216-232-8600 ..... B•1974
§ Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ..... A•1435
NTK Technical Ceramics, NGK Spark Plugs (USA), Mt. Prospect, IL 60056, 708-824-1133 ..... A•1667
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Fujitsu Microelectronics Inc., Component Division, San Jose, CA 95135 408-922-9000
Hughes Microelectronic Circuits Division, Newport Beach, CA 92658-8903 714-759-2952
Integrity Technology Corporation, Santa Clara, CA 95050 408-262-8640
ISL Products Int'l, Ltd., Syosset, NY 11791-6093 ..... 516-937-3475;800-626-6116
§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
Ohmite Manufacturing Co., Skokie, IL 60076 708-675-2600
§ Panasonic Indl. Co. Standard Comps. Sector, Matsushita Elec. Corp. of America, Secaucus, NJ 07094 201-392-4818
§ Raltron Electronics, Miami, FL 33172 305-593-6033
Savoy Electronics, Inc., Ft. Lauderdale, FL 33310 ..... 305-563-1333;800-359-5400
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070

Resonators, Ceramic, Surface Mount-2700

AVX Corporation, A Kyocera Group Company, Myrtle Beach, SC 29577, 803-448-9411 ..... A•1337
§ Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ..... A•1435
Abracon Corporation, San Clemente, CA 92673 714-498-4505
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
Fujitsu Microelectronics Inc., Component Division, San Jose, CA 95135 408-922-9000
§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
Savoy Electronics, Inc., Ft. Lauderdale, FL 33310 ..... 305-563-1333;800-359-5400
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
† Z Communications, Inc., San Diego, CA 92126 619-621-2700

Resonators, Microwave, Dielectric-3450

Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ..... A•1847
§ NTK Technical Ceramics, NGK Spark Plugs (USA), Mt. Prospect, IL 60056, 708-824-1133 ..... A•1849
GTE Control Devices, Inc., Standish, ME 04084 207-642-4535
Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
† Z Communications, Inc., San Diego, CA 92126 619-621-2700

Resonators, SAW-2300

AVX Corporation, A Kyocera Group Company, Myrtle Beach, SC 29577, 803-448-9411 ..... A•1336-1337
Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300 ..... A•1434
NTK Technical Ceramics, NGK Spark Plugs (USA), Mt. Prospect, IL 60056, 708-824-1133 ..... A•1664
TOYOCOM USA INC., Arlington Heights, IL 60005, 708-593-8780/1-800-TOYOCOM ..... A•1484,1494-1495
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
§ Panasonic Indl. Co. Standard Comps. Sector, Matsushita Elec. Corp. of America, Secaucus, NJ 07094 201-392-4818
† RF Monolithics, Inc., Dallas, TX 75244 214-233-2903
† Sawtek Inc., Orlando, FL 32860-9501 407-886-8860
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070

Retainers, Battery-2500 — ***See Vol. C***

Retainers, Relay-2500 — ***See Vol. C***

Retainers, Transistor & Diode-2500 — ***See Vol. C***

Retainers, Tube-2500 — ***See Vol. C***

Reticles-3700 — ***See Vol. B***

Retractors & Carriers — See Cable Retractors (Vol. C)

RFI Measuring Equipment-2900 — ***See Vol. D***

RFI Shielding — See Shields, RF (Vol. C)

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Clarostat Sensors and Controls Group, BYR, PLC, Plano, TX 75075, 214-422-1844;1-800-872-0044 ..... A•1906
§ Mallory Controls, Emerson Electric Canada, Woodstock, Ont., CANADA N4S 7W8, 519-539-4891 ..... A•2092-2093
§† Memcor-Truohm, Inc., Huntington, IN 46750, 219-356-4300 ..... A•2105
§† Ohmite Manufacturing Co., Skokie, IL 60076, 708-675-2600 ..... A•2000
† Precision Control Manufacturing, Inc., Seattle, WA 98109, 206-281-9380 ..... A•2116
Angstrohm Precision, Inc., Dale Electronics, Hagerstown, MD 21742 301-739-8722
AVO Biddle Instruments, Blue Bell, PA 19422 215-646-9200
Bourns, Inc., Electronic Components Sls., Riverside, CA 92507-2114 ..... 909-781-5500; 801-750-7200
Carter Manufacturing Corporation, Bolton, MA 01740 508-779-5501
§ Cole Hersee Co., Boston, MA 02127-2467 617-268-2100
† Maurey Instrument Corp., Chicago, IL 60629 312-581-4555
† Mel-Rain Controls, Paw Paw, MI 49079 616-657-2527
Noble U.S.A., Inc., Rolling Meadows, IL 60008 708-364-6038
Research Inc., Minneapolis, MN 55424 612-941-3300
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500

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§ ETI Systems, Polaris Indl. Entprs., Carlsbad, CA 92009, 619-929-0749 ... A•2085
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† Bacon Industries, Inc., Watertown, MA 02172-2399 617-926-2550
Ceramaseal, New Lebanon, NY 12125 518-794-7800
† Chomerics, Inc.:W.R. Grace & Co., Woburn, MA 01888 617-935-4850
† Conductive System, Inc., Amsterdam, NY 12010 518-843-5740
† Detoronics Corporation, S. El Monte, CA 91733 818-579-7130
Lectronic Research Labs., Inc., Camden, NJ 08104 800-358-8378
Microwave Development Laboratories, Natick, MA 01760 508-655-0060
Minor Rubber Co., Inc., Bloomfield, NJ 07003 ..... 201-338-6800;800-433-6886
Parker Hannifin Corporation, Seal Grp., Irvine, CA 92715 714-833-3000
† Premier Microwave, Port Chester, NY 10573 914-939-8900
† SAS Industries Inc., Manorville, NY 11949 ..... 516-727-1441;1-800-544-5238
§† Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
† Tecknit, Cranford, NJ 07016 908-272-5500

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† Microwave Applications Group, Santa Maria, CA 93455 805-928-5711

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† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950 201-539-5500
Amphenol RF Operations, Amphenol Corporation, Danbury, CT 06810 ... 203-743-9272; 800-627-7100
† Daico Industries, Inc., Rancho Dominguez, CA 90220 310-631-1143
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† General Microwave Corporation, Amityville, NY 11701 516-226-8900
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
Lectronic Research Labs., Inc., Camden, NJ 08104 800-358-8378
† Loral Microwave Narda, Hauppauge, NY 11788 516-231-1700
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MACOM, Inc., Lowell, MA 01851 617-272-3000
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† Merrimac Industries, West Caldwell, NJ 07006 201-575-1300
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§ Microwave Development Laboratories, Natick, MA 01760 508-655-0060
§ Midwest Microwave, Saline, MI 48176-9569 ..... 313-429-4773;800-521-4410
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3 ..... 514-694-6666; 800-724-3911
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§† Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
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† TRM, Inc., Manchester, NH 03110 603-627-6000
† UTE Microwave, Asbury Park, NJ 07712 908-922-1009
† Vectronics Microwave Corp., Middlesex, NJ 08846 908-356-2377

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Strip-Line Components, Microwave-3450

AMP, Harrisburg, PA 17105, 717-564-0100;800-522-6752 ..... **C•1163**
† American Etching & Mfg., Pacoima, CA 91331-2796 818-896-1187
§† Anaren Microwave, Inc., E. Syracuse, NY 13057 315-432-8930
§† Avantek, Inc. A Subsidiary of Hewlett-Packard, Santa Clara, CA 95054 .. 408-727-0700
† Continental Microwave Technology Inc., Glen Cove, NY 11542 516-759-5600
† Electro Magnetic Processes, Inc., Chatsworth, CA 91311-5371 818-882-6333
† EMC Technology Inc, Cherry Hill, NJ 08034 609-429-7800
† FEI Microwave, Inc., Frequency Electronics, Inc., Sunnyvale, CA 94086 .. 408-732-0880
Fifth Dimension, Inc., Trenton, NJ 08638 609-393-8350
International Resistive Company, Boone, NC 28607 704-264-8861
§† M/A-COM Microelectroincs Division, M/A-COM, Lowell, MA 01853-3295 508-442-5000
† Merrimac Industries, West Caldwell, NJ 07006 201-575-1300
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3 ..... 514-694-6666; 800-724-3911
RLC Electronics, Inc., Mt. Kisco, NY 10549 914-241-1334
† Rogers Corp., Rogers, CT 06263 203-774-9605
Telonic/Berkeley, Berkeley Inds. Inc., Laguna Beach, CA 92652 714-494-9401
† Transco Products, Inc., Subsidiary of Datron Systems Inc., Camarillo, CA 93012 805-987-8007
† TRM, Inc., Manchester, NH 03110 603-627-6000
† Tru-Connector Corp., Peabody, MA 01960 ..... 508-532-0775;1-800-262-9787; 1-800-COAXTRU

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Suppressors, Noise-2700

† Controlled Power Co., Troy, MI 48083, 313-528-3700;1-800-521-4792 ..... **D•2254-2255**
Corcom, Inc., Libertyville, IL 60048, 708-680-7400 ..... **C•1301**
Fee Fil-Mag, San Diego, CA 92123, 619-569-6577 ..... **A•1637**

† **Genisco Electronics, A Division of GTC, Anaheim, CA 92805, 714-563-4300** ..... **A•1641**
Hitran Corporation, Flemington, NJ 08822-1238, 908-782-5525 ..... **D•2267**
§ **ISKRA Electronics, Inc., Plainview, NY 11803, 516-349-0222** ..... **A•1085**
§ **KCK America Inc., Mitsubishi Materials Corporation, Rolling Meadows, IL 60008, 708-577-0200** ..... **B•1365**
MCG Elctrns., Deer Park, NY 11729, 516-586-5125 ..... **B•1368**
Metuchen Capacitors, Inc., Old Bridge, NJ 08857, 908-679-3366 ..... **A•1652, C•1419**
§ **Murata Erie North America, Inc., Smyrna, GA 30080, 404-436-1300** ..... **A•1660**
§ **Okaya Electric America, Inc., Okaya Electric Industries, Tokyo, Japan, Valparaiso, IN 46383, 219-477-4488** ..... **A•1139-1140,1598**
† **Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064** ..... **A•1263**
§ **Pulizzi Engineering, Inc., Santa Ana, CA 92704-6865, 714-540-4229** ..... **D•2300**
Tri-Mag, Inc., Visalia, CA 93291, 209-651-2222 ..... **A•1612**
§ **World Products Inc., Sonoma, CA 95476, 707-996-5201** ..... **A•1177,2224-2225, B•1399**
§ Aerovox Inc., North Dartmouth, MA 02747-1217 508-995-8000
Amber Inds., Inc., Carrollton, TX 75006 214-490-9801
APX Technologies Inc., Hicksville, NY 11801 516-433-1313
§ Brooks Electronics, Philadelphia, PA 19140 215-228-4433
§† Brooks Power Systems, Bensalem, PA 19020 ..... 215-244-0264;1-800-523-1551
† Chomerics, Inc.:W.R. Grace & Co., Woburn, MA 01888 617-935-4850
§ C.P. Clare Corp., Chicago, IL 60645 312-262-7700
§ C.P. Clare Corp., Chicago, IL 60645 312-262-7700
§ Contact East, N. Andover, MA 01845 508-682-2000
§ Control Cable, Inc., Baltimore, MD 21244 410-298-4411
§† Control Concepts Corp., Liebert Corp., Binghamton, NY 13902-1380 607-724-2484
† Dynamic Air Engrg., Inc., Santa Ana, CA 92705-5697 714-540-1000
Edal Industries, East Haven, CT 06512 203-467-2591
§† EFI Electronics Corp., Salt Lake City, UT 84119 ..... 801-977-9009;800-877-1174
§ Electrocube, Monrovia, CA 91016 818-301-0122
Engineered Components Co., San Luis Obispo, CA 93403-8121 805-544-3800
§† EPE Technologies, Inc., Subsidiary of Square D, Costa Mesa, CA 92627 714-557-1636
§ GC-Thorsen, Rockford, IL 61105-1209 815-968-9661
§ Kaiglo Elctrns. Co., Inc., Bethlehem, PA 18017-9359 215-837-0700
† LCR Electronics-Hopkins Engineering, Norristown, PA 19401 215-278-0840
Lenco Elctrns., Inc., McHenry, IL 60050 815-344-2900
† Loral Microwave Narda, Hauppauge, NY 11788 516-231-1700
§ Love Controls Division, Dwyer Instruments, Inc., Wheeling, IL 60090 708-541-3232
Marway Prods. Inc., Santa Ana, CA 92703 714-973-1800
3M-Electronic Products Division, Austin, TX 78726 ... 1-800-225-5373 Sls. & Prod. Info.
Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
Omega Engineering, Stamford, CT 06907 800-826-6342
§ Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018 ..... 408-730-0300;800-PENSTOCK
Perma Power Elctrns., Niles, IL 60714 312-763-0763
§† Power Integrity Corp., Greensboro, NC 27408 ..... 910-379-9773;800-237-6260
† RFI Corporation, Bay Shore, NY 11706 516-231-6400
† Ritron Corp., Skokie, IL 60076 708-679-7180
§ Schaffner EMC, Inc. Components Division, Springfield, NJ 07081 ..... 201-379-7778; 800-367-5566
§ Seacor, Inc., Westwood, NJ 07675 201-666-5600
§ Shape Electronics, Inc., The Wiremold Co., Lombard, IL 60148 ..... 708-620-8394; 1-800-367-5811
§ SL Waber, Inc., Mt. Laurel, NJ 08054 ..... 609-866-8888;800-257-8384
§ Sola, Elk Grove Village, IL 60007-5666 708-439-2800
§† Standard Condenser Corp., Skokie, IL 60076 708-675-3133
Stetron International, Inc., Buffalo, NY 14203 716-854-3443
§ Superior Electric, Warner Electric, Bristol, CT 06010 203-582-9561
§† Surgeonics Limited, Fort Edward, NY 12828 518-747-2156
Sutton Designs, Inc., Ithaca, NY 14850 800-326-8119
§ Tamura Corporation of America, Temecula, CA 92589-2230 909-699-1270
Telegenix/Grim Corp., Cherry Hill, NJ 08034 609-424-5220
§† Tycor International Inc., Calgary, Alberta, CANADA T2H 1L9 403-259-3200
§† The Wiremold Company, W. Hartford, CT 06110 203-233-6251
World Products Inc., Systems Devices Grp., Sonoma 95476 707-996-5201
Xentek, Inc., Taiyo Yuden USA, Inc., San Marcos, CA 92069 619-471-4001

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Surface Acoustic Wave Devices-2350

AVX Corporation, A Kyocera Group Company, Myrtle Beach, SC 29577, 803-448-9411 ..... **A•1337**
† **Raytheon Company, Quincy Operation, Quincy, MA 02269, 617-479-5300** ..... **A•1713-1715**
TOYOCOM USA INC., Arlington Heights, IL 60005, 708-593-8780/1-800-TOYOCOM ..... **A•1484,1494**
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
† Hoffman, P.R., Co., Materials Proc, Carlisle, PA 17013 717-243-2011
Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
NDK America, Inc., Fremont, CA 94539 415-623-6500
† Phonon Corporation, Simsbury, CT 06070 203-651-0211
† Raytheon Co., Electronic Components Division, Waltham, MA 02254 617-899-8400
† RF Monolithics, Inc., Dallas, TX 75244 214-233-2903
† Sawtek Inc., Orlando, FL 32860-9501 407-886-8860
Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
† Teledyne Microelectronics, Los Angeles, CA 90066 ..... 310-822-8229;310-305-0248
Valpey-Fisher:Matec Corp, Hopkinton, MA 01748 508-435-6831

Surface Acoustic Wave, Filter-2700

Raytheon Company, Quincy Operation, Quincy, MA 02269, 617-479-5300 ..... **A•1713-1715**
TOYOCOM USA INC., Arlington Heights, IL 60005, 708-593-8780/1-800-TOYOCOM ..... **A•1484,1494**
§ AT&T Microelectronics, Allentown, PA 18103 ..... 1-800-372-2447;In Can.:1-800-553-2448
# Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
§ Hitachi America, Ltd., Tarrytown, NY 10591 914-631-0600
§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
† Phonon Corporation, Simsbury, CT 06070 203-651-0211
† RF Monolithics, Inc., Dallas, TX 75244 214-233-2903
† Sawtek Inc., Orlando, FL 32860-9501 407-886-8860
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070

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Switched Filter Banks-3450

Datel, Inc., Mansfield, MA 02048-1194 508-339-3000
† Integrated Microwave, San Diego, CA 92121-1009 619-259-2600
K&L Microwave, Inc., Salisbury, MD 21801 410-749-2424
† Sawtek Inc., Orlando, FL 32860-9501 407-886-8860
† Teledyne Microwave, Mountain View, CA 94043 415-968-2211

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§† **Digitran Division, XCEL Corporation, Ontario, CA 91761, 909-391-4321** .. **B•1708**
Dow-Key Microwave Corporation, Ventura, CA 93003, 805-650-0260 ..... **B•1710**
Mepcopal Company, San Diego, CA 92121-1307, 619-481-0210 ..... **B•1770**
† **Micro-Precision Technologies, Inc., Salem, NH 03079, 603-893-7600** ..... **A•1703**
Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500 ..... **A•1725**
AEL Defense Corp., Lansdale, PA 19446 215-822-2929
† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950 201-539-5500
† Alpha Industries, Inc., Woburn, MA 01801 617-935-5150
§† Amplifonix, Inc., Philadelphia, PA 19154 215-464-4000
§ Augat Alcoswitch, Augat Inc., Attleboro Falls, MA 02763 508-699-9800
† Avantek, Inc, A Subsidiary of Hewlett-Packard, Santa Clara, CA 95054 ... 408-727-0700
† Aydin Vector Div., Aydin Corp., Newtown, PA 18940-0328 215-968-4271
§† Computron Display Systems, Excel Corporation, Elk Grove Village, IL 60007 708-952-8800
† Continental Microwave Technology Inc., Glen Cove, NY 11542 516-759-5600
Crosspoint, Div. of Info-Lite Corp., Fairview, NJ 07022 201-941-4455
† Daico Industries, Inc., Rancho Dominguez, CA 90220 310-631-1143
† Eastern Microwave, Winchester, MA 01890 617-721-9800
† EMC Technology Inc, Cherry Hill, NJ 08034 609-429-7800
Flann Microwave Inc., Cambridge, MA 02139 1-800-937-3772
† General Microwave Corporation, Amityville, NY 11701 516-226-8900
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
Hyletronics:Litton Industries, Lexington, MA 02173-3199 617-276-3298
† Integrated Microwave, San Diego, CA 92121-1009 619-259-2600
† JFW Industries, Inc., Indianapolis, IN 46237 317-887-1340
K&L Microwave, Inc., Salisbury, MD 21801 410-749-2424
† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
† Linear Integrated Systems, Milpitas, CA 95035 408-263-8401
† Loral Microwave Narda, Hauppauge, NY 11788 516-231-1700
MACOM, Inc., Lowell, MA 01851 617-272-3000
MarLee Switch Co., Upland, CA 91786 714-982-8988
† Micronetics, Hudson, NH 03051 603-883-2900
† Microsemi Corp., Santa Ana, CA 92799-6890 714-979-8220
† Microsemi Corp. - Scottsdale, Microsemi Corporation, Scottsdale, AZ 85252-1390 602-941-6300
† Microwave Device Tech., Westford, MA 01886 508-692-7800
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3 ..... 514-694-6666; 800-724-3911
Optotek Limited, Kanata, Ont., CANADA K2K 2A9 613-591-0336
Peca, Inc., Bensalem, PA 19020 215-245-1550
§ Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018 ..... 408-730-0300;800-PENSTOCK
Phoenix Microwave, Telford, PA 18969 215-723-6011
† RLC Electronics, Inc., Mt. Kisco, NY 10549 914-241-1334
Signal Switch Company, Corona, CA 91720 909-736-5404
ST Microwave Corp., Sub. of Signal Technlg. Corp., Sunnyvale, CA 94086 408-730-6300
§† Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
† Teledyne Microelectronics, Los Angeles, CA 90066 ..... 310-822-8229;310-305-0248
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291
Til-Tek Limited, Kemptville, Ontario, CANADA K0G 1J0 613-258-5928

† Vectronics Microwave Corp., Middlesex, NJ 08846 908-356-2377

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Tapes, Plastic Coated for Cable-2500 — *See Vol. C*
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Tees, Coaxial-3450

† Trompeter Electronics, Inc., Westlake Village, CA 91362-4047, 818-707-2020 ..... C•1500
§ Amphenol RF Operations, Amphenol Corporation, Danbury, CT 06810 ... 203-743-9272; 800-627-7100
§ AVA Electronics Corporation, Drexel Hill, PA 19026 215-284-2500
§ Concord Electronics Corporation, New York, NY 10012 1-212-777-6571
§ Control Cable, Inc., Baltimore, MD 21244 410-298-4411
Data Set Cable Co., Inc., Ridgefield, CT 06877 ..... 203-438-9684;800-344-9684
§ E-Z Hook, Tektest Inc., Arcadia, CA 91006 818-446-6175
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
§ ITT Pomona Electronics, Pomona, CA 91766 909-469-2900
L-Com Inc., N. Andover, MA 01845 508-682-6936
† Maury Microwave Corp., Ontario, CA 91764 909-987-4715
† Micro Mode Prods., El Cajon, CA 92020 619-449-3844
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3 ..... 514-694-6666; 800-724-3911
§ Panduit Corp., Tinley Park, IL 60477-0981 800-777-3300
§ Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018 ..... 408-730-0300;800-PENSTOCK
Picosecond Pulse Labs, Inc., Boulder, CO 80306 303-443-1249
§ Sinclair Radio Laboratories Ltd., Aurora, ONT., CANADA L4G 3G9 416-727-0165

Teleplex, Inc., Alford Division, Woburn, MA 01801 617-935-8610
† Tru-Connector Corp., Peabody, MA 01960 ..... 508-532-0775;1-800-262-9787; 1-800-COAXTRU
§ Wiltron, Morgan Hill, CA 95037-2809 408-778-2000

Tees, Waveguide-3450

† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950 201-539-5500
† Dielectric Communications, General Signal, Raymond, ME 04071 ..... 207-655-4555; 800-341-9678
† Eastern Microwave, Winchester, MA 01890 617-721-9800
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
Lectronic Research Labs., Inc., Camden, NJ 08104 800-358-8378
† Maury Microwave Corp., Ontario, CA 91764 909-987-4715
† Microlab/FXR, Livingston, NJ 07039 201-992-7700
§ Microwave Development Laboratories, Natick, MA 01760 508-655-0060
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3 ..... 514-694-6666; 800-724-3911
† Premier Microwave, Port Chester, NY 10573 914-939-8900
Sivers IMA AB, Culver City, CA 90230 213-306-4248
Tucker Electronics, Dallas, TX 75355-1419 ..... 214-348-8800;800-527-4642

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† Microwave Filter Inc., East Syracuse, NY 13057-0486, 315-437-3953;800-448-1666 ..... A•1656,1658-1659
TRAK Microwave Corp., Tampa, FL 33634, 813-884-1411 ..... A•1855
Trompeter Electronics, Inc., Westlake Village, CA 91362-4047, 818-707-2020 ..... C•1500
Advanced Technical Materials, Inc., Patchogue, NY 11772 ..... 516-363-9018; 516-289-0363
† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950 201-539-5500
† Alan Industries Inc., Columbus, IN 47202 812-372-8869
Amphenol Corporation, Corporate Headquarters, Wallingford, CT 06492 203-265-8910
§ Amphenol RF Operations, Amphenol Corporation, Danbury, CT 06810 ..... 203-743-9272; 800-627-7100
† Barth Electronics, Inc., Boulder City, NV 89005 702-293-1576
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
† Bird Electronic Corp., Cleveland, OH 44139-2794 216-248-1200
Coastcom, Concord, CA 94520 510-825-7500
† Compac, Holbrook, NY 11741 516-585-3400
Component General, Inc., Odessa, FL 33556 813-376-6655
† Connecticut Microwave Corp., Cheshire, CT 06410 203-250-9678
Continental Resources, Inc, Test Instruments Div., Bedford, MA 01730 ..... 617-275-0850; 800-937-4688
† Detoronics Corporation, S. El Monte, CA 91733 818-579-7130
† Eastern Microwave, Winchester, MA 01890 617-721-9800
† Elcom Systems, Inc., Boca Raton, FL 33487 407-994-1774
† EMC Technology Inc, Cherry Hill, NJ 08034 609-429-7800

Flann Microwave Inc., Cambridge, MA 02139 1-800-937-3772
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
§ Inmet Corporation, Ann Arbor, MI 48103 313-426-5553
International Manufacturing Services, Portsmouth, RI 02871-2418 401-683-9700
† International Telecommunications Components, Inc., Deer Park, NY 11729 516-243-1444
§ ITT Pomona Electronics, Pomona, CA 91766 909-469-2900
† JFW Industries, Inc., Indianapolis, IN 46237 317-887-1340
† KDI/Triangle Electronics, Whippany, NJ 07981 201-887-5700
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† Maury Microwave Corp., Ontario, CA 91764 909-987-4715
† Merrimac Industries, West Caldwell, NJ 07006 201-575-1300
Micro-Coax, Collegeville, PA 19426 215-489-3700
† Microlab/FXR, Livingston, NJ 07039 201-992-7700
† Micro Mode Prods., El Cajon, CA 92020 619-449-3844
† Microwave Applications Group, Santa Maria, CA 93455 805-928-5711
§ Microwave Development Laboratories, Natick, MA 01760 508-655-0060
§ Midwest Microwave, Saline, MI 48176-9569 ..... 313-429-4773;800-521-4410
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3 ..... 514-694-6666; 800-724-3911
§ Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018 ..... 408-730-0300;800-PENSTOCK
† Premier Microwave, Port Chester, NY 10573 914-939-8900
Pro Com Technology Inc., Plainview, NY 11803 ..... 516-293-4443;800-762-3785
† Quartzite Processing, Inc., Malden, MA 02148 617-322-3611
RLC Electronics, Inc., Mt. Kisco, NY 10549 914-241-1334
† Rowe Industries, Inc., Toledo, OH 43612 419-729-9761
† Sage Laboratories, Inc., Natick, MA 01760 508-653-0844
Servo Corporation of America, Hicksville, NY 11801-5259 516-938-9700
Sivers IMA AB, Culver City, CA 90230 213-306-4248
§† Solitron/Microwave, Solitron Devices, Inc., West Palm Beach, FL 33407-4697 407-848-4311
Teleplex, Inc., Alford Division, Woburn, MA 01801 617-935-8610
† Telonic/Berkeley, Berkeley Inds. Inc., Laguna Beach, CA 92652 714-494-9401
Tucker Electronics, Dallas, TX 75355-1419 ..... 214-348-8800;800-527-4642
† UTE Microwave, Asbury Park, NJ 07712 908-922-1009
§ Wiltron, Morgan Hill, CA 95037-2809 408-778-2000

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§ **Teccor Electronics, Inc., Irving, TX 75038, 214-580-1515** ..... **A•2220-2221,2223**
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Central Semiconductor Corp., Hauppauge, NY 11788 516-435-1110
Mastech, Inc., Lorlin Test Systems, Danbury, CT 06810 203-744-0096
§† Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
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§ **Philips ECG, North American Philips Co., Williamsport, PA 17701, 717-323-4691** ..... **A•2173**
§ **Powerex, Inc., Youngwood, PA 15697-1800, 412-925-7272** ..... **A•2175**
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American Microsemiconductor, Inc., Madison, NJ 07940 201-377-9566
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§ Continental Device India Limited, New Delhi, INDIA 110028 ..... 536150-53 (4 lines)
§ Crydom Company, Long Beach, CA 90805 310-865-3536
Darrah Electric Company, Cleveland, OH 44102 216-631-0912
General Instrument, Power Semiconductor Div., Hicksville, NY 11802 ... 516-933-3333
§ Hitachi America, Ltd., Tarrytown, NY 10591 914-631-0600
§† International Rectifier Corp., El Segundo, CA 90245 310-322-3331
§ IXYS Corp., San Jose, CA 95131-1109 408-435-1900
Mastech, Inc., Lorlin Test Systems, Danbury, CT 06810 203-744-0096
§ Microsemi Corp. Colorado, Microsemi Corp., Broomfield, CO 80020 303-469-2161
§† Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
§ Philips Components Discrete Products Div,, Discrete Semiconductor Group, Slatersville, RI 02876-2078 401-762-3800
Raytheon/TAG Semiconductors Ltd., Burlington, MA. 01803 ..... 617-272-3704 (3705)
§ Semikron, Inc., Hudson, NH 03051-0066 ..... 603-883-8102;1-800-258-1308
§† Silicon Transistor Corp., Chelmsford, MA 01824 508-256-3321
§ Solid State, Inc., Bloomfield, NJ 07003-2596 201-429-8700
§† Unitrode Corp., Watertown, MA 02172 617-926-0404

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Ensign Corp., Burr Ridge, IL 60521, 708-325-9343 ..... A•2326
International Configurations, Inc., Enfield, CT 06082, 203-749-6380 ..... C•1353
Mitchell Electronics Corp., Mt. Vernon, NY 10552, 914-699-3800 ..... A•2433
§ Stancor, White-Rodgers, Logansport, IN 46947, 219-722-2244 ..... A•2558-2559
§ Tamura Corporation of America, Temecula, CA 92589-2230, 909-699-1270 ..... A•2579
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Basler Electrics, Magnetics Product Grp., Highland, IL 62249 618-654-2341
† Corona Magnetics, Inc., Corona, CA 91719 909-735-7558
Dynage/Power & Magnetics, Division Of Oakleaf, inc., Canistota, SD 57012 605-296-3462
Integrity Technology Corporation, Santa Clara, CA 95050 408-262-8640
ISL Products Int'l, Ltd., Syosset, NY 11791-6093 ..... 516-937-3475;800-626-6116
Jerome Industries Corp., Elizabeth, NJ 07201 908-353-5700
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Microtran Co. Inc., Valley Stream, NY 11582-0236 516-561-6050
RAE Company Inc., Indianapolis, IN 46239 317-351-1774
Toltec Industries, Inc., San Diego, CA 92154 619-423-0700
Transformer Engineering Corporation, Cleveland, OH 44134 216-741-5282

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Albar, Inc., Lynnwood, WA 98036, 206-771-4006;800-822-5227 ..... A•2256
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† C & C Jetronic, Inc., Allentown, NJ 08501, 609-259-8855 ..... A•2302
† Coil-Q Corp., Bronxville, NY 10708, 914-337-4775 ..... A•1222
Cramer Coil & Transformer Co., Inc., Saukville, WI 53080, 414-268-2150;414-375-5700 ..... A•2308
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† Hisonic, Inc., Olathe, KS 66051, 913-782-0012 ..... A•2360
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§ Magnetek Triad, Huntington, IN 46750, 219-356-7100 ..... A•2383
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† Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314 ..... A•2594
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Abbott Technologies, Inc., Sun Valley, CA 91352 ..... 818-504-0644;1-800-367-8200
American Magnetics, Carterville, IL 62918 618-985-4838
† American Trans-Coil Corporation, Richmond Hill, NY 11419-1410 718-441-5207
Arrow Hart Controls, Products Unlimited Corp., Sterling, IL 61081 815-626-0300
§ AT&T Microelectronics, Allentown, PA 18103 ..... 1-800-372-2447;In Can.:1-800-553-2448
ATC-Frost Magnetics Inc., Oakville,Ont., CANADA L6H 2R4 416-844-6681
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§ Atlas/Soundolier, Commercial Sound Div., Atapco Security & Communications Group, Fenton, MO 63026 314-349-3110
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† Beta Transformer Tech. Corp., ILC Data Device Corp., Bohmia, NY 11716 516-244-7393
† BG Electronics, EPC Corp., Mt. Vernon, NY 10550-4430 914-664-5591
† B. G. Laboratories, Inc., Binghamton, NY 13904 607-722-2376
§ C-COR Elctrns., Inc., State College, PA 16801 ..... 814-238-2461;800-233-2267
CET Technology, Hudson, NH 03051 603-883-5912
Chloride Electro Networks, Chloride Power Electronics, Inc., Caledonia, NY 14423 716-538-4421
† Coast Coil Co., Coast Magnetics, Los Angeles, CA 90016 213-936-6188
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CUI Stack Inc., Beaverton, OR 97005 503-643-4899
Custom Bobbin Windings, A & K Corporation, Zanesville, OH 43702-2369 614-452-6973
Dantel, Fresno, CA 93727 209-292-1111
Datatronics, Inc., Romoland, CA 92585 909-928-7700
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† De Young Mfg., Inc., Kirkland, WA 98034 206-823-4798
† Dietz Design, Inc., Belton, MO 64012 816-331-4911
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§† Electromech, Inc., Irvington, NJ 07111 201-318-7999
Electronetics, Inc., Everett, WA 98204 206-355-1855
† Electronic Transformer Corp., Paterson, NJ 07544-0487 201-942-2222
† Elnetic Electronics, Inc.:Plant Locations, Gardena, CA 90247 310-515-1546
Endicott Coil Co., Inc., Binghamton, NY 13905 607-797-1263
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
† Freed Transformer Co., Inc., Electronic Transformer Corp., Paterson, NJ 07544-0487 201-942-2222
Gavagan Electronics, Danbury, CT 06810 203-748-5248
§ GC International Inc., Plano, TX 75074 214-423-8411
Gettysburg Transformer Corporation, Gettysburg, PA 17325 717-334-2191

† Hadley, Robert M. Co., Inc., Los Angeles, CA 90037 213-234-9091
§ Hammond Manufacturing Co., Buffalo, NY 14225 716-894-5710
† Hytronics Corporation, Clearwater, FL 34620 813-536-7861
Integrity Technology Corporation, Santa Clara, CA 95050 408-262-8640
International Microelectronics, Arlington, TX 76003 817-473-1730
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§† JB Electronic Transformers Inc., Chicago, IL 60647 312-342-0080
Keytronics, Inc., Endicott, NY 13760 607-754-5405
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Mouser Electronics, Santee, CA 92071 800-346-6873
Mouser Electronics, Mansfield, TX 76063 800-346-6873
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† MTE Corp., Menomonee Falls, WI 53051 414-253-8200
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§ Rye Industries, Inc., Fuquay-Varina, NC 27526 ..... 919-557-0511;800-626-1511
Schott Corp., Wayzata, MN 55391 612-475-1173
Schumacher Elect. Corp., Chicago, IL 60626 312-973-1600
Scientific Conversion, Inc., Novato, CA 94947 415-892-2323
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§ Sescom, Inc., Henderson, NV 89015-4249 702-565-3400
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† ZMAN Magnetics, Kent, WA 98032 206-251-8064

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American Monarch, Minneapolis, MN 55421 612-788-9161
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† ZMAN Magnetics, Kent, WA 98032 206-251-8064

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† American Monarch, Minneapolis, MN 55421 612-788-9161
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§ AT&T Microelectronics, Allentown, PA 18103 ..... 1-800-372-2447;In Can.:1-800-553-2448
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† Cramer Coil & Transformer Co., Inc., Saukville, WI 53080 ..... 414-268-2150;414-375-5700
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† Electronic Transformer Corp., Paterson, NJ 07544-0487 201-942-2222
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† Endicott Research Group, Endicott, NY 13760 607-754-9187
§ Fee Fil-Mag, San Diego, CA 92123 619-569-6577
† Freed Transformer Co., Inc., Electronic Transformer Corp., Paterson, NJ 07544-0487 201-942-2222
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§ GC International Inc., Plano, TX 75074 214-423-8411
§† Gowanda Electronics Corp., Gowanda, NY 14070 716-532-2234
† Hadley, Robert M. Co., Inc., Los Angeles, CA 90037 213-234-9091
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§ Hurricane Electronics Lab, Hurricane, UT 84737 801-635-2003
† Hytronics Corporation, Clearwater, FL 34620 813-536-7861
ISL Products Int'l, Ltd., Syosset, NY 11791-6093 ..... 516-937-3475;800-626-6116
Keytronics, Inc., Endicott, NY 13760 607-754-5405
KGS Electronics, Inc., Arcadia, CA 91006 818-574-1175
† Lenco Elctrns., Inc., McHenry, IL 60050 815-344-2900
LEPCO/Leonard Elec. Prods., Brownsville, TX 78521 210-546-1625
§ Love Controls Division, Dwyer Instruments, Inc., Wheeling, IL 60090 708-541-3232
Mag-Con, St. Paul, MN 55113 612-633-8820
† Magnecomp, Inc., Pickens, SC 29671 803-878-4700
† Magnetic Circuit Elements, Salinas, CA 93905 408-757-8752

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Multi Products International, West Paterson, NJ 07424 ... 201-890-1344
Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
†Neshaminy Transformer Corp., Furlong, PA 18925 ... 215-794-7411
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†Northlake Engineering, Inc., Bristol, WI 53104-0370 ... 414-857-9600
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†Pacific Electro Dynamics, Inc., Redmond, WA 98073-9745 ... 206-881-1700
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†Polyphase Instrument, Ft. Washington, PA 19034 ... 215-643-6950
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†Power Magne-Tech Corporation, Perth Amboy, NJ 08861 ... 908-826-4700
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†Preferred Electronics, Inc., Westfield, MA 01086 ... 413-568-2301;1-800-553-6374
†PTC Transformers, Bordentown, NJ 08505 ... 609-298-8200
Radio Television Products Corp., Douglas, AZ 85607 ... 602-364-4438
SAE Power, Inc., Santa Clara, CA 95050 ... 408-988-0700
Schott Corp., Wayzata, MN 55391 ... 612-475-1173
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Shokai Far East Ltd., Peekskill, NY 10566 ... 914-736-3500
†Sierra West Power Systems, Las Cruces, NM 88001 ... 505-522-8828
†Sigma Electronics Inc., Houston, TX 77099 ... 713-933-4700;800-874-7121
†Sigmapower, Inc. FPBSM Industries, Inc., Rancho Dominguez, CA 90220-6404 ... 310-884-5200
South American Development Corp., Poughkeepsie, NY 12590 ... 914-452-1305
Standard Magnetic Corp., Garden Grove, CA 92641 ... 714-379-5671
§TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056 ... 708-803-6100
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§†Thordarson Meissner, Components Corp. of Amer., Mt. Carmel, IL 62863 ... 618-262-5121
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†Transformer Technologies, Inc., Mt. Vernon, NY 10552 ... 914-668-1600
†Transistor Devices, Inc., Randolph, NJ 07869 ... 201-361-6622
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§Valor Electronics, San Diego, CA 92131-1642 ... 619-537-2500
†Vanguard Electronics Co., Gardena, CA 90248 ... 310-323-4100
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American Magnetics, Carterville, IL 62918 ... 618-985-4838
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† Elnetic Electronics, Inc.:Plant Locations, Gardena, CA 90247 ... 310-515-1546
† Freed Transformer Co., Inc., Electronic Transformer Corp., Paterson, NJ 07544-0487 ... 201-942-2222
Gavagan Electronics, Danbury, CT 06810 ... 203-748-5248
GC International Inc., Plano, TX 75074 ... 214-423-8411
Gowanda Electronics Corp., Gowanda, NY 14070 ... 716-532-2234
Grand Transformer, Inc., Grand Haven, MI 49417 ... 616-842-5430
† Hadley, Robert M. Co., Inc., Los Angeles, CA 90037 ... 213-234-9091
§ Hammond Manufacturing Co., Buffalo, NY 14225 ... 716-894-5710
† Hisonic, Inc., Olathe, KS 66051 ... 913-782-0012
§† JB Electronic Transformers Inc., Chicago, IL 60647 ... 312-342-0080
Jerome Industries Corp., Elizabeth, NJ 07201 ... 908-353-5700
KGS Electronics, Inc., Arcadia, CA 91006 ... 818-574-1175
† L/C Magnetics, Anaheim, CA 92806 ... 714-666-0787
† Lenco Elctrns., Inc., McHenry, IL 60050 ... 815-344-2900
LEPCO/Leonard Elec. Prods., Brownsville, TX 78521 ... 210-546-1625
Mag-Con, St. Paul, MN 55113 ... 612-633-8820
§ Magnetek Triad, Huntington, IN 46750 ... 219-356-7100
† Magnetic Circuit Elements, Salinas, CA 93905 ... 408-757-8752
Mech-Tronics, Mount Holly, NJ 08060 ... 609-267-0680
§† Microtran Co. Inc., Valley Stream, NY 11582-0236 ... 516-561-6050
OPT Industries, Inc., Phillipsburg, NJ 08865 ... 908-454-2600
Pacific Transformer Corp., Anaheim, CA 92807 ... 714-779-0450;1-800-325-0501
† Polyphase Instrument, Ft. Washington, PA 19034 ... 215-643-6950
† PTC Transformers, Bordentown, NJ 08505 ... 609-298-8200
Radio Television Products Corp., Douglas, AZ 85607 ... 602-364-4438
Schumacher Elect. Corp., Chicago, IL 60626 ... 312-973-1600
† Sigma Electronics Inc., Houston, TX 77099 ... 713-933-4700;800-874-7121
† Sigmapower, Inc, FPBSM Industries, Inc., Rancho Dominguez, CA 90220-6404 ... 310-884-5200
§† Skyway Magnetics, Warner Springs, CA 92086-9714 ... 619-782-3342
South American Development Corp., Poughkeepsie, NY 12590 ... 914-452-1305
Staco Transpower, Components Corp. of America, Mt. Carmel, IL 62863 ... 618-262-5555
§ Tamura Corporation of America, Temecula, CA 92589-2230 ... 909-699-1270
Texas Transformer Corp., Plano, TX 75086 ... 214-424-1581
§ Thordarson Meissner, Components Corp. of Amer., Mt. Carmel, IL 62863 ... 618-262-5121
† Torotel Prods. Inc., Grandview, MO 64030-3199 ... 816-761-6314
† Torwico Elctrns. Inc., Lakewood, NJ 08701 ... 908-364-1860
† Trans American Transformer, E. Setauket, NY 11733 ... 516-928-0762
Valor Electronics, San Diego, CA 92131-1642 ... 619-537-2500
Vernitron Corp., Precision Comps. Group, St. Petersburg, FL 33710 ... 813-347-2181
§ Vitec Electronics Corp., Visalia, CA 93291 ... 209-651-1535
Wirebenders, Inc., Phoenix, AZ 85021-2824 ... 602-861-1856
§† Zambre Co., Inc., Mountain View, CA 94043 ... 415-968-9176

Transformers, External Power Source-5600

Abbott Technologies, Inc., Sun Valley, CA 91352, 818-504-0644;1-800-367-8200 ... A•2234
Powertronix Corp., Foster City, CA 94404, 415-345-6800 ... A•2511
Basler Electrics, Magnetics Product Grp., Highland, IL 62249 ... 618-654-2341
C & C Jetronic, Inc., Allentown, NJ 08501 ... 609-259-8855
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012 ... 605-296-3462
Microtran Co. Inc., Valley Stream, NY 11582-0236 ... 516-561-6050
§† Schott Corp., Wayzata, MN 55391 ... 612-475-1173
Shogyo International Corp., Great Neck, NY 11021-4799 ... 516-466-0911

Transformers, Ferroresonant-5600

Abbott Technologies, Inc., Sun Valley, CA 91352, 818-504-0644;1-800-367-8200 ... A•2234
Albar, Inc., Lynnwood, WA 98036, 206-771-4006;800-822-5227 ... A•2256
Bey Electric, Inc., Lincoln Park, NJ 07035, 201-694-5000 ... A•2295
§ Controlled Power Co., Troy, MI 48083, 313-528-3700;1-800-521-4792 ... D•2254-2255
Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180, 605-665-9301 ... A•1225
§† Electromech, Inc., Irvington, NJ 07111, 201-318-7999 ... A•2324-2325
† Fernwood Transformer Co., Transistor Devices Inc., Belvidere, NJ 07823, 908-475-3207 ... A•2355
Hitran Corporation, Flemington, NJ 08822-1238, 908-782-5525 ... A•2361
† Lenco Elctrns., Inc., McHenry, IL 60050, 815-344-2900 ... A•2375
† Magnecomp, Inc., Pickens, SC 29671, 803-878-4700 ... A•2377
† NWL Transformers, Bordentown, NJ 08505, 609-298-7300 ... A•2437
PC Transformer Corp., West Babylon, NY 11704, 516-491-3300 ... A•2445
† Signal Transformer Co., Inc., Insilco Corporation, Inwood, NY 11696, 516-239-5777 ... A•2536
† ACD-Elcor Products, Bethel, CT 06801 ... 203-743-3510
§ Acme Transformer, Acme Electric Corporation, Lumberton, NC 28358 ... 919-738-1121
Actown-Electrocoil, Inc., Spring Grove, IL 60081 ... 815-675-6641
Advanced Components Inds., Inc., Div of Kaschke, Torrance, CA 90501 ... 310-328-0060
AFP ISOREG, AFP Transformers, Inc., Littleton, MA 01460 ... 508-486-9483
American Magnetics, Carterville, IL 62918 ... 618-985-4838
† American Monarch, Minneapolis, MN 55421 ... 612-788-9161
Andover, Inc., Lafayette, IN 47904 ... 317-447-1157
§ AT&T Microelectronics, Allentown, PA 18103 ... 1-800-372-2447;In Can.:1-800-553-2448
ATC-Frost Magnetics Inc., Oakville,Ont., CANADA L6H 2R4 ... 416-844-6681
Atlas Engineering Corp., Dorchester, MA 02121 ... 617-445-7100
§† Aydin Corporation (West), San Jose, CA 95119-1371 ... 408-629-1100
Berkshire Transformer Corp., Kent, CT 06757 ... 203-927-3541
C & C Jetronic, Inc., Allentown, NJ 08501 ... 609-259-8855
§ C-COR Elctrns., Inc., State College, PA 16801 ... 814-238-2461;800-233-2267
Chloride Electro Networks, Chloride Power Electronics, Inc., Caledonia, NY 14423 ... 716-538-4421
† Communication Coil Inc., Chicago, IL 60634 ... 312-637-1333
§ Computer Power Inc., High Bridge, NJ 08829 ... 908-638-8000;800-526-5088
† Del Electronics Corp., Valhalla, NY 10595 ... 914-686-3600
Deltona Transformer Corp., DeLand, FL 32724 ... 904-736-7900
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012 ... 605-296-3462
Elgar Electronics Corporation, San Diego, CA 92121 ... 619-450-0085;800-733-5427
Elma Engineering, Palo Alto, CA 94303 ... 415-494-7303
† Elnetic Electronics, Inc.:Plant Locations, Gardena, CA 90247 ... 310-515-1546
Endicott Coil Co., Inc., Binghamton, NY 13905 ... 607-797-1263
Epco Products Inc., Wallkill, NY 12589 ... 914-895-2033
Framar Metal Products Co., Inc., Kenilworth, NJ 07033 ... 908-241-0710
§ GC International Inc., Plano, TX 75074 ... 214-423-8411
Gettysburg Transformer Corporation, Gettysburg, PA 17325 ... 717-334-2191
Grand Transformer, Inc., Grand Haven, MI 49417 ... 616-842-5430
§ Hammond Manufacturing Co., Buffalo, NY 14225 ... 716-894-5710
Hipotronics Inc., Brewster, NY 10509 ... 914-279-8091
Hyperion Industries Corp., Watertown, MA 02172 ... 617-926-0140
Keytronics, Inc., Endicott, NY 13760 ... 607-754-5405
† KIP Transformers Inc., Wolcott, CT 06716 ... 203-758-7085
§ Micron Industries, Hillside, IL 60162 ... 708-547-0900
Mitchell Electronics Corp., Mt. Vernon, NY 10552 ... 914-699-3800

§† MTE Corp., Menomonee Falls, WI 53051 414-253-8200
† Neshaminy Transformer Corp., Furlong, PA 18925 215-794-7411
Newport Manufacturing Co., Santa Ana, CA 92704 800-726-0715
Nicollet Technologies Corp., Minneapolis, MN 55413 612-379-7919
† OPT Industries, Inc., Phillipsburg, NJ 08865 908-454-2600
Penn-Tran Corp.,Sub. of Spectrum Elctrns. Inc., Wingate, PA 16880 814-355-1521
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861 908-826-4700
† PTC Transformers, Bordentown, NJ 08505 609-298-8200
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
Ritter Coil, Inc., Easton, PA 18043-3130 215-258-6780
Schott Corp., Wayzata, MN 55391 612-475-1173
Schumacher Elect. Corp., Chicago, IL 60626 312-973-1600
§ Shape Electronics, Inc., The Wiremold Co., Lombard, IL 60148 ..... 708-620-8394; 1-800-367-5811
† Sigma Electronics Inc., Houston, TX 77099 ..... 713-933-4700;800-874-7121
§ Sola, Elk Grove Village, IL 60007-5666 708-439-2800
Staco Transpower, Components Corp. of America, Mt. Carmel, IL 62863 618-262-5555
Standard Magnetic Corp., Garden Grove, CA 92641 714-379-5671
† Stangenes Industries, Inc., Palo Alto, CA 94303 415-493-0814
Teco Corp., Winnisquam, NH 03289 603-524-1998
Texas Transformer Corp., Plano, TX 75086 214-424-1581
Torotron Corp., Mt. Vernon, NY 10550 914-664-2050
Transformer Engineering Corporation, Cleveland, OH 44134 216-741-5282
§† U.S. Power Converting Company/Relco, Leonard V. Snow & Assocs., Torrance, CA 90503 310-316-9984
U.S. Transformer and Inductor, Cheyenne, WY 82007 800-584-9339
Vitec Electronics Corp., Visalia, CA 93291 209-651-1535
WPI Group, Inc., Warner, NH 03278 603-456-3111
Xentek, Inc., Taiyo Yuden USA, Inc., San Marcos, CA 92069 619-471-4001
§ Zambre Co., Inc., Mountain View, CA 94043 415-968-9176

Transformers, Filament-5600

† Abbott Technologies, Inc., Sun Valley, CA 91352, 818-504-0644;1-800-367-8200 ..... A•2234
Albar, Inc., Lynnwood, WA 98036, 206-771-4006;800-822-5227 ..... A•2256
† Del Electronics Corp., Valhalla, NY 10595, 914-686-3600 ..... A•2315
Dormeyer Industries, A.F. Dormeyer Mfg. Co. Inc., Chicago, IL 60631-1521, 312-775-3600 ..... B•1635
§† Electromech, Inc., Irvington, NJ 07111, 201-318-7999 ..... A•2324
EWC, Inc., Englishtown, NJ 07726, 908-446-3110 ..... A•2331
Hitran Corporation, Flemington, NJ 08822-1238, 908-782-5525 ..... A•2361
JM Transformer Co., Inc., Farmingdale, NY 11735, 516-293-0475 ..... A•2364
† NWL Transformers, Bordentown, NJ 08505, 609-298-7300 ..... A•2437
† Oram High Voltage, Dayton, TX 77535, 409-258-5553 ..... D•1853
PC Transformer Corp., West Babylon, NY 11704, 516-491-3300 ..... A•2445,2447-2450
† Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2455
RFI Corporation, Bay Shore, NY 11706, 516-231-6400 ..... A•2532
† Signal Transformer Co., Inc., Insilco Corporation, Inwood, NY 11696, 516-239-5777 ..... A•2536
§ Stancor, White-Rodgers, Logansport, IN 46947, 219-722-2244 ..... A•2559-2561,2563
† Transformer Technologies, Inc., Mt. Vernon, NY 10552, 914-668-1600 ... A•2598
Actown-Electrocoil, Inc., Spring Grove, IL 60081 815-675-6641
American Magnetics, Carterville, IL 62918 618-985-4838
American Monarch, Minneapolis, MN 55421 612-788-9161
Andover, Inc., Lafayette, IN 47904 317-447-1157
APX Technologies Inc., Hicksville, NY 11801 516-433-1313
ATC-Frost Magnetics Inc., Oakville,Ont., CANADA L6H 2R4 416-844-6681
§ Atlantic Magnetics, Inc., Pompano Beach, FL 33069 305-979-7920
† Atlas Engineering Corp., Dorchester, MA 02121 617-445-7100
† Axel Electronics, Inc., Subsidiary of FPBSM Industries Inc., Rancho Dominquez, CA 90220 718-291-3900
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
Basler Electrics, Magnetics Product Grp., Highland, IL 62249 618-654-2341
Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
† Beta Transformer Tech. Corp., ILC Data Device Corp., Bohmia, NY 11716 516-244-7393
Bey Electric, Inc., Lincoln Park, NJ 07035 201-694-5000
† B. G. Laboratories, Inc., Binghamton, NY 13904 607-722-2376
† Bicron Electronics, Canaan, CT 06018 203-824-5125
C & C Jetronic, Inc., Allentown, NJ 08501 609-259-8855
† Coast Coil Co., Coast Magnetics, Los Angeles, CA 90016 213-936-6188
† Component Specialties Corp., Temple City, CA 91780 213-283-0015
Custom Coils Inc., Alcester, SD 57001-0348 605-934-2460
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 605-665-9301
Deltona Transformer Corp., DeLand, FL 32724 904-736-7900
† Dietz Design, Inc., Belton, MO 64012 816-331-4911
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012 605-296-3462
Electronetics, Inc., Everett, WA 98204 206-355-1855
† Electronic Transformer Corp., Paterson, NJ 07544-0487 201-942-2222
Elma Engineering, Palo Alto, CA 94303 415-494-7303
† Elnetic Electronics, Inc.:Plant Locations, Gardena, CA 90247 310-515-1546
Endicott Coil Co., Inc., Binghamton, NY 13905 607-797-1263
Epco Products Inc., Wallkill, NY 12589 914-895-2033
† Freed Transformer Co., Inc., Electronic Transformer Corp., Paterson, NJ 07544-0487 201-942-2222
Gavagan Electronics, Danbury, CT 06810 203-748-5248
GC International Inc., Plano, TX 75074 214-423-8411
Gettysburg Transformer Corporation, Gettysburg, PA 17325 717-334-2191
Grand Transformer, Inc., Grand Haven, MI 49417 616-842-5430
§ Hammond Manufacturing Co., Buffalo, NY 14225 716-894-5710
High Voltage Systems, Inc., Universal Designs Corp., Chappaqua, NY 10514 914-238-8462
Hipotronics Inc., Brewster, NY 10509 914-279-8091
§† JB Electronic Transformers Inc., Chicago, IL 60647 312-342-0080
Keytronics, Inc., Endicott, NY 13760 607-754-5405
KGS Electronics, Inc., Arcadia, CA 91006 818-574-1175
† KIP Transformers Inc., Wolcott, CT 06716 203-758-7085
† Lenco Elctrns., Inc., McHenry, IL 60050 815-344-2900
Mag-Con, St. Paul, MN 55113 612-633-8820
† Magnecomp, Inc., Pickens, SC 29671 803-878-4700
§ Magnetek Triad, Huntington, IN 46750 219-356-7100
† Magnetic Circuit Elements, Salinas, CA 93905 408-757-8752
† Magnetico Inc., Holtsville, NY 11742 516-654-1166
MCI Transformer Corporation, Babylon, NY 11704 516-587-0510
Mech-Tronics, Mount Holly, NJ 08060 609-267-0680
§† Microtran Co. Inc., Valley Stream, NY 11582-0236 516-561-6050
† MTE Corp., Menomonee Falls, WI 53051 414-253-8200
MultiComp., Inc., Beaverton, OR 97006 503-626-4200
† Neshaminy Transformer Corp., Furlong, PA 18925 215-794-7411
Nicollet Technologies Corp., Minneapolis, MN 55413 612-379-7919
† Northlake Engineering, Inc., Bristol, WI 53104-0370 414-857-9600
† OPT Industries, Inc., Phillipsburg, NJ 08865 908-454-2600
Pacific Transformer Corp., Anaheim, CA 92807 ..... 714-779-0450;1-800-325-0501
Para-Line Transformer Co., Inc., Alhambra, CA 91803 818-281-0222
Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
Precision Components, Inc., Wilmington, IL 60481 708-543-6448
Prem Magnetics, Inc., McHenry, IL 60050 815-385-2700
† PTC Transformers, Bordentown, NJ 08505 609-298-8200
Radio Television Products Corp., Douglas, AZ 85607 602-364-4438
RAE Company Inc., Indianapolis, IN 46239 317-351-1774
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
Rodale Technical Sales Inc., Islip, NY 11751 516-277-5454
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
† Sigma Electronics Inc., Houston, TX 77099 ..... 713-933-4700;800-874-7121
† Sigmapower, Inc, FPBSM Industries, Inc., Rancho Dominguez, CA 90220-6404 310-884-5200
§† Skyway Magnetics, Warner Springs, CA 92086-9714 619-782-3342
† Staco Transpower, Components Corp. of America, Mt. Carmel, IL 62863 618-262-5555
Standard Magnetic Corp., Garden Grove, CA 92641 714-379-5671
† Stangenes Industries, Inc., Palo Alto, CA 94303 415-493-0814
§ Tamura Corporation of America, Temecula, CA 92589-2230 909-699-1270
Teco Corp., Winnisquam, NH 03289 603-524-1998
Texas Transformer Corp., Plano, TX 75086 214-424-1581
§† Thordarson Meissner, Components Corp. of Amer., Mt. Carmel, IL 62863 618-262-5121
TMP Inc., Santa Ana, CA 92705 714-558-8028
§ Todd Systems, Inc., Yonkers, NY 10701 914-963-3400
† Torotel Prods. Inc., Grandview, MO 64030-3199 816-761-6314
† Torwico Elctrns. Inc., Lakewood, NJ 08701 908-364-1800
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
Transformer Engineering Corporation, Cleveland, OH 44134 216-741-5282
† Transistor Devices, Inc., Randolph, NJ 07869 201-361-6622
§ Zambre Co., Inc., Mountain View, CA 94043 415-968-9176

Transformers, Flyback-5600

Abbott Technologies, Inc., Sun Valley, CA 91352, 818-504-0644;1-800-367-8200 ..... A•2234
APX Technologies Inc., Hicksville, NY 11801, 516-433-1313 ..... A•2267
C & C Jetronic, Inc., Allentown, NJ 08501, 609-259-8855 ..... A•2302
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012, 605-296-3462 ..... A•2319-2320
† ESC Electronics Corp., Palisades Pk., NJ 07650, 201-947-0400 ..... A•2329
† Fernwood Transformer Co., Transistor Devices Inc., Belvidere, NJ 07823, 908-475-3207 ..... A•2355
† Magnecomp, Inc., Pickens, SC 29671, 803-878-4700 ..... A•2377
Magnelab, Boulder, CO 80301-4696, 303-442-6700 ..... A•2378
† Magnetico Inc., Holtsville, NY 11742, 516-654-1166 ..... A•2390-2391
MultiComp., Inc., Beaverton, OR 97006, 503-626-4200 ..... A•2434
† Penn-Tran Corp.,Sub. of Spectrum Elctrns. Inc., Wingate, PA 16880, 814-355-1521 ..... A•1261
† Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2455
Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314 ..... A•2594
Advanced Components Inds., Inc., Div of Kaschke, Torrance, CA 90501 310-328-0060
ATC-Frost Magnetics Inc., Oakville,Ont., CANADA L6H 2R4 416-844-6681
† Atlas Engineering Corp., Dorchester, MA 02121 617-445-7100
† Automatic Coil Corp., Miami, FL 33147 305-696-6660
Basler Electrics, Magnetics Product Grp., Highland, IL 62249 618-654-2341
† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635 714-447-2300
Bel Fuse, Jersey City, NJ 07302 201-432-0463
Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
† Beta Transformer Tech. Corp., ILC Data Device Corp., Bohmia, NY 11716 516-244-7393
† B. G. Laboratories, Inc., Binghamton, NY 13904 607-722-2376
BH Electronics, Inc., Burnsville, MN 55337 612-894-9590
CET Technology, Hudson, NH 03051 603-883-5912
† Communication Coil Inc., Chicago, IL 60634 312-637-1333
† Corona Magnetics, Inc., Corona, CA 91719 909-735-7558
Cramer Coil & Transformer Co., Inc., Saukville, WI 53080 .. 414-268-2150;414-375-5700
Custom Coils Inc., Alcester, SD 57001-0348 605-934-2460
Datatronics, Inc., Romoland, CA 92585 909-928-7700
Delta Products Corporation, Fremont, CA 94538 510-770-0660
† De Young Mfg., Inc., Kirkland, WA 98034 206-823-4798

Electronetics, Inc., Everett, WA 98204 206-355-1855
Fee Fil-Mag, San Diego, CA 92123 619-569-6577
GC International Inc., Plano, TX 75074 214-423-8411
†Hisonic, Inc., Olathe, KS 66051 913-782-0012
JB Electronic Transformers Inc., Chicago, IL 60647 312-342-0080
Keytronics, Inc., Endicott, NY 13760 607-754-5405
†Lenco Elctrns., Inc., McHenry, IL 60050 815-344-2900
LEPCO/Leonard Elec. Prods., Brownsville, TX 78521 210-546-1625
§Magnetek Triad, Huntington, IN 46750 219-356-7100
†Magnetic Circuit Elements, Salinas, CA 93905 408-757-8752
Mech-Tronics, Mount Holly, NJ 08060 609-267-0680
Microtran Co. Inc., Valley Stream, NY 11582-0236 516-561-6050
†MTE Corp., Menomonee Falls, WI 53051 414-253-8200
§Murata Erie North America, Inc., Smyrna, GA 30080 404-436-1300
§Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
Nedap N.V., Groenlo, HOLLAND 7140 AA ..... +31-5440-71111
†Neshaminy Transformer Corp., Furlong, PA 18925 215-794-7411
†OPT Industries, Inc., Phillipsburg, NJ 08865 908-454-2600
§Philips ECG, North American Philips Co., Williamsport, PA 17701 717-323-4691
†Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
Potrans International Inc., Potrans Electrical Corp., Ltd., Irvine, CA 92714 714-975-1222
†Power Magne-Tech Corporation, Perth Amboy, NJ 08861 908-826-4700
†Preferred Electronics, Inc., Westfield, MA 01086 ..... 413-568-2301;1-800-553-6374
†PTC Transformers, Bordentown, NJ 08505 609-298-8200
Radio Television Products Corp., Douglas, AZ 85607 602-364-4438
RAE Company Inc., Indianapolis, IN 46239 317-351-1774
RCD Components, Inc., Manchester, NH 03109 603-669-0054
§†Rhombus Industries, Huntington Bch., CA 92649-1595 714-898-0960
Schott Corp., Wayzata, MN 55391 612-475-1173
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
†Sigmapower, Inc, FPBSM Industries, Inc., Rancho Dominguez, CA 90220-6404 310-884-5200
§†Skyway Magnetics, Warner Springs, CA 92086-9714 619-782-3342
Texas Transformer Corp., Plano, TX 75086 214-424-1581
Toltec Industries, Inc., San Diego, CA 92154 619-423-0700
†Torwico Elctrns. Inc., Lakewood, NJ 08701 908-364-1800
†Trans American Transformer, E. Setauket, NY 11733 516-928-0762
Vernitron Corp., Precision Comps. Group, St. Petersburg, FL 33710 813-347-2181
#Video Display Corp., Tucker, GA 30084 404-938-2080,800241-5005
§†Vitec Electronics Corp., Visalia, CA 93291 209-651-1535
§Zambre Co., Inc., Mountain View, CA 94043 415-968-9176
†ZMAN Magnetics, Kent, WA 98032 206-251-8064

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Transformers, 400 Hz-5600

†Abbott Technologies, Inc., Sun Valley, CA 91352, 818-504-0644;1-800-367-8200 ..... A•2234
Advanced Components Inds., Inc., Div of Kaschke, Torrance, CA 90501, 310-328-0060 ..... A•2254
Albar, Inc., Lynnwood, WA 98036, 206-771-4006;800-822-5227 ..... A•2256
Altran Corporation, Crystal Lake, IL 60014, 815-455-5650 ..... A•2257
Amecon, Inc., Anaheim, CA 92805, 714-634-2220;800-392-2292 ..... A•2260-2261,2264-2265
Avel Transformers Inc., New Milford, CT 06776, 203-355-4711 ..... A•2272-2275
Bey Electric, Inc., Lincoln Park, NJ 07035, 201-694-5000 ..... A•2295
†Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ..... A•2305
†Del Electronics Corp., Valhalla, NY 10595, 914-686-3600 ..... A•2315
§†Electromech, Inc., Irvington, NJ 07111, 201-318-7999 ..... A•2324-2325
Ensign Corp., Burr Ridge, IL 60521, 708-325-9343 ..... A•2326,2328
†EWC, Inc., Englishtown, NJ 07726, 908-446-3110 ..... A•1235,2331-2333,2335,2340,2343-2344,2346-2347
†Fernwood Transformer Co., Transistor Devices Inc., Belvidere, NJ 07823, 908-475-3207 ..... A•2355
†Hisonic, Inc., Olathe, KS 66051, 913-782-0012 ..... A•2360
JM Transformer Co., Inc., Farmingdale, NY 11735, 516-293-0475 ..... A•2364
†Lenco Elctrns., Inc., McHenry, IL 60050, 815-344-2900 ..... A•2375
Magnelab, Boulder, CO 80301-4696, 303-442-6700 ..... A•2378
Magnetek Triad, Huntington, IN 46750, 219-356-7100 ..... A•2383
†Magnetico Inc., Holtsville, NY 11742, 516-654-1166 ..... A•2389-2390
MCI Transformer Corporation, Babylon, NY 11704, 516-587-0510 ..... A•2402
§†Microtran Co. Inc., Valley Stream, NY 11582-0236, 516-561-6050 ... A•2410-2411
Mitchell Electronics Corp., Mt. Vernon, NY 10552, 914-699-3800 ..... A•2433
MultiComp., Inc., Beaverton, OR 97006, 503-626-4200 ..... A•2434
†NWL Transformers, Bordentown, NJ 08505, 609-298-7300 ..... A•2437
Para-Line Transformer Co., Inc., Alhambra, CA 91803, 818-281-0222 ..... A•2444
PC Transformer Corp., West Babylon, NY 11704, 516-491-3300 ..... A•2452
†Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2455
Plitron Manufacturing, Inc., Downsview, Ont., CAN M3J 2N5, 416-667-9914 ..... A•2506
Prem Magnetics, Inc., McHenry, IL 60050, 815-385-2700 ..... A•2518-2520
†Signal Transformer Co., Inc., Insilco Corporation, Inwood, NY 11696, 516-239-5777 ..... A•2536
§Stancor, White-Rodgers, Logansport, IN 46947, 219-722-2244 ..... A•2559-2563
Talema Electronic, Inc., Saint James, MO 65559, 314-265-5500 ..... A•2566,2568-2570
§Tamura Corporation of America, Temecula, CA 92589-2230, 909-699-1270 ..... A•2571
Todd Systems, Inc., Yonkers, NY 10701, 914-963-3400 ..... A•2584
†Torelco, Inc., Irvington, NJ 07111, 201-374-8641;800-867-3526 ..... A•2581
†Toroid Corp. of Maryland, Salisbury, MD 21801, 410-860-0300 ..... A•2586-2587,2590
†Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314 ..... A•2594-2596
Tortran Inc., Bridgeport, CT 06608, 203-367-5188 ..... A•2593
†Trans American Transformer, E. Setauket, NY 11733, 516-928-0762 ..... A•2597
†Transformer Technologies, Inc., Mt. Vernon, NY 10552, 914-668-1600 ... A•2598
Ulveco, Inc., Houston, TX 77042, 1-800-527-7042 ..... A•2600-2601
Abacus Controls Inc., Somerville, NJ 08876 908-526-6010
§Acme Transformer, Acme Electric Corporation, Lumberton, NC 28358 ... 919-738-1121
Actown-Electrocoil, Inc., Spring Grove, IL 60081 815-675-6641
American Magnetics, Carterville, IL 62918 618-985-4838
†American Monarch, Minneapolis, MN 55421 612-788-9161
Andover, Inc., Lafayette, IN 47904 317-447-1157
†Astrosystems, Inc., Lake Success, NY 11042 516-328-1600
ATC-Frost Magnetics Inc., Oakville,Ont., CANADA L6H 2R4 416-844-6681
†Atlas Engineering Corp., Dorchester, MA 02121 617-445-7100
Automatic Coil Corp., Miami, FL 33147 305-696-6660
†Axel Electronics, Inc., Subsidiary of FPBSM Industries Inc., Rancho Dominquez, CA 90220 718-291-3900
§†Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
Basler Elec., Electronic Product Group, Highland, IL 62249 ..... 618-654-2341; 800-645-2074
Basler Electrics, Magnetics Product Grp., Highland, IL 62249 618-654-2341
Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
†Beta Transformer Tech. Corp., ILC Data Device Corp., Bohmia, NY 11716 516-244-7393
†B. G. Laboratories, Inc., Binghamton, NY 13904 607-722-2376
Bicron Electronics, Canaan, CT 06018 203-824-5125
†Cal-Power Corp., Standard Magnetic Corp., Garden Grove, CA 92641 ... 714-379-5672
Chloride Electro Networks, Chloride Power Electronics, Inc., Caledonia, NY 14423 716-538-4421
†Corona Magnetics, Inc., Corona, CA 91719 909-735-7558
Custom Coils Inc., Alcester, SD 57001-0348 605-934-2460
†Cypress Magnetics, Inc., Rancho Cucamonga, CA 91730 909-987-3570
§Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 605-665-9301
Deltona Transformer Corp., DeLand, FL 32724 904-736-7900
†De Young Mfg., Inc., Kirkland, WA 98034 206-823-4798
†Dietz Design, Inc., Belton, MO 64012 816-331-4911
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012 605-296-3462
§Electrocube, Monrovia, CA 91016 818-301-0122
Electronetics, Inc., Everett, WA 98204 206-355-1855
†Electronic Transformer Corp., Paterson, NJ 07544-0487 201-942-2222
†Elnetic Electronics, Inc.:Plant Locations, Gardena, CA 90247 310-515-1546
Epco Products Inc., Wallkill, NY 12589 914-895-2033
Fee Fil-Mag, San Diego, CA 92123 619-569-6577
†Freed Transformer Co., Inc., Electronic Transformer Corp., Paterson, NJ 07544-0487 201-942-2222
GAR Enterprises dba KGS Electronics, Arcadia, CA 91006 818-574-1175
Gavagan Electronics, Danbury, CT 06810 203-748-5248
GC International Inc., Plano, TX 75074 214-423-8411
Grand Transformer, Inc., Grand Haven, MI 49417 616-842-5430
†Hadley, Robert M. Co., Inc., Los Angeles, CA 90037 213-234-9091
§Hammond Manufacturing Co., Buffalo, NY 14225 716-894-5710
Hitran Corporation, Flemington, NJ 08822-1238 908-782-5525
†Hyperion Industries Corp., Watertown, MA 02172 617-926-0140
†Hytronics Corporation, Clearwater, FL 34620 813-536-7861
§†JB Electronic Transformers Inc., Chicago, IL 60647 312-342-0080
Jerome Industries Corp., Elizabeth, NJ 07201 908-353-5700
Keytronics, Inc., Endicott, NY 13760 607-754-5405
KGS Electronics, Inc., Arcadia, CA 91006 818-574-1175
†KIP Transformers Inc., Wolcott, CT 06716 203-758-7085
†L/C Magnetics, Anaheim, CA 92806 714-666-0787
Mag-Con, St. Paul, MN 55113 612-633-8820
†Magnecomp, Inc., Pickens, SC 29671 803-878-4700
MagneTek Power Conversion Systems, Teledyne, Inc., Anaheim, CA 92805 714-956-9200
†Magnetic Circuit Elements, Salinas, CA 93905 408-757-8752
Mech-Tronics, Mount Holly, NJ 08060 609-267-0680
†MTE Corp., Menomonee Falls, WI 53051 414-253-8200
Nedap N.V., Groenlo, HOLLAND 7140 AA ..... +31-5440-71111
†Neshaminy Transformer Corp., Furlong, PA 18925 215-794-7411
†Northlake Engineering, Inc., Bristol, WI 53104-0370 414-857-9600
Ohio Semitronics, Inc., Columbus, OH 43212 614-486-9561
†OPT Industries, Inc., Phillipsburg, NJ 08865 908-454-2600
Oram High Voltage, Dayton, TX 77535 409-258-5553
Pacific Transformer Corp., Anaheim, CA 92807 ..... 714-779-0450;1-800-325-0501
†PCA Electronics, Sepulveda, CA 91343 818-892-0761
†Performance Controls, Inc., Horsham, PA 19044 215-675-6500
†Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
Potrans International Inc., Potrans Electrical Corp., Ltd., Irvine, CA 92714 714-975-1222
†Power Magne-Tech Corporation, Perth Amboy, NJ 08861 908-826-4700
†PTC Transformers, Bordentown, NJ 08505 609-298-8200
RAE Company Inc., Indianapolis, IN 46239 317-351-1774
RCD Components, Inc., Manchester, NH 03109 603-669-0054
§†Rhombus Industries, Huntington Bch., CA 92649-1595 714-898-0960
Rodale Technical Sales Inc., Islip, NY 11751 516-277-5454
Royal Enterprises Co., Simi Valley, CA 93063 ..... 805-522-8730;818-998-2455
Schott Corp., Wayzata, MN 55391 612-475-1173
Schumacher Elect. Corp., Chicago, IL 60626 312-973-1600
†Scientific Technologies Inc., Control Components Div., Hayward, CA 94544-7831 ..... 510-471-9717 800-221-7060
†Sierra West Power Systems, Las Cruces, NM 88001 505-522-8828
Sigma Electronics Inc., Houston, TX 77099 ..... 713-933-4700;800-874-7121
†Sigmapower, Inc, FPBSM Industries, Inc., Rancho Dominguez, CA 90220-6404 310-884-5200
§†Skyway Magnetics, Warner Springs, CA 92086-9714 619-782-3342
§†Staco Energy Products Co., Dayton, OH 45403 513-253-1191

† Staco Transpower, Components Corp. of America, Mt. Carmel, IL 62863 618-262-5555
Standard Magnetic Corp., Garden Grove, CA 92641 714-379-5671
§† Technipower, A Penril Co., Danbury, CT 06813 203-748-7001
Teco Corp., Winnisquam, NH 03289 603-524-1998
Texas Transformer Corp., Plano, TX 75086 214-424-1581
TMP Inc., Santa Ana, CA 92705 714-558-8028
Toltec Industries, Inc., San Diego, CA 92154 619-423-0700
Torad Coil Co., Inc., Wayne, NJ 07470 201-835-6195
† Torema U.S.A., Inc., Houston, TX 77042 713-977-2500
† Torwico Elctrns. Inc., Lakewood, NJ 08701 908-364-1800
† Transformer Design , MTE Corporation, Menomonee Falls, WI 53051 414-253-8200
Transformer Engineering Corporation, Cleveland, OH 44134 216-741-5282
† Vanguard Electronics Co., Gardena, CA 90248 310-323-4100
WPI Group, Inc., Warner, NH 03278 603-456-3111
Xentek, Inc., Taiyo Yuden USA, Inc., San Marcos, CA 92069 619-471-4001
§ Zambre Co., Inc., Mountain View, CA 94043 415-968-9176

Transformers, High Voltage (1,000 Volts & Over)-5600

Albar, Inc., Lynnwood, WA 98036, 206-771-4006;800-822-5227 ..... A•2256
APX Technologies Inc., Hicksville, NY 11801, 516-433-1313 ..... A•2266
† C & C Jetronic, Inc., Allentown, NJ 08501, 609-259-8855 ..... A•2302
† Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ..... A•2305
† Cramer Coil & Transformer Co., Inc., Saukville, WI 53080, 414-268-2150;414-375-5700 ..... A•2307-2308
Custom Coils Inc., Alcester, SD 57001-0348, 605-934-2460 ..... A•2311
† Del Electronics Corp., Valhalla, NY 10595, 914-686-3600 ..... A•2315
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012, 605-296-3462 ..... A•2319-2320
EWC, Inc., Englishtown, NJ 07726, 908-446-3110 ..... A•2346
† Fernwood Transformer Co., Transistor Devices Inc., Belvidere, NJ 07823, 908-475-3207 ..... A•2355
§ Hitran Corporation, Flemington, NJ 08822-1238, 908-782-5525 ..... A•2361
JM Transformer Co., Inc., Farmingdale, NY 11735, 516-293-0475 ..... A•2364,2366
† Lenco Elctrns., Inc., McHenry, IL 60050, 815-344-2900 ..... A•2375
Magnelab, Boulder, CO 80301-4696, 303-442-6700 ..... A•2378
Magnetek Triad, Huntington, IN 46750, 219-356-7100 ..... A•2383
MCI Transformer Corporation, Babylon, NY 11704, 516-587-0510 ..... A•2392-2394,2398-2401,2403
§† Microtran Co. Inc., Valley Stream, NY 11582-0236, 516-561-6050 ..... A•2412
MultiComp., Inc., Beaverton, OR 97006, 503-626-4200 ..... A•2434
† NWL Transformers, Bordentown, NJ 08505, 609-298-7300 ..... A•2437
† Oram High Voltage, Dayton, TX 77535, 409-258-5553 ..... D•1853
† Pearson Electronics, Inc., Palo Alto, CA 94303, 415-494-6444 ..... A•2454
† Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2455
Polara Engineering Inc., Fullerton, CA 92633, 714-521-0900 ..... A•1576
Renco Electronics, Inc., Deer Pk., NY 11729, 516-586-5566;1-800-645-5828 ..... A•2528
RFI Corporation, Bay Shore, NY 11706, 516-231-6400 ..... A•2532
Spellman High Voltage Elctrns. Corp., Plainview, NY 11803, 516-349-8686 ..... D•1922
Tamura Corporation of America, Temecula, CA 92589-2230, 909-699-1270 ..... A•2572,2578
TMP Inc., Santa Ana, CA 92705, 714-558-8028 ..... A•2580
† Torelco, Inc., Irvington, NJ 07111, 201-374-8641;800-867-3526 ..... A•2581
Actown-Electrocoil, Inc., Spring Grove, IL 60081 815-675-6641
† Advanced Conversion Tech., Middletown, PA 17057 717-939-2300
AFP ISOREG, AFP Transformers, Inc., Littleton, MA 01460 508-486-9483
American Magnetics, Carterville, IL 62918 618-985-4838
American Monarch, Minneapolis, MN 55421 612-788-9161
Andover, Inc., Lafayette, IN 47904 317-447-1157
† Atlas Engineering Corp., Dorchester, MA 02121 617-445-7100
† Axel Electronics, Inc., Subsidiary of FPBSM Industries Inc., Rancho Dominquez, CA 90220 718-291-3900
† Aydin Corp., Horsham, PA 19044 215-657-7510
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
Basler Electrics, Magnetics Product Grp., Highland, IL 62249 618-654-2341
Bel Fuse, Jersey City, NJ 07302 201-432-0463
Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
† B. G. Laboratories, Inc., Binghamton, NY 13904 607-722-2376
Chloride Electro Networks, Chloride Power Electronics, Inc., Caledonia, NY 14423 716-538-4421
Controlled Power Co., Troy, MI 48083 ..... 313-528-3700;1-800-521-4792
† Corona Magnetics, Inc., Corona, CA 91719 909-735-7558
CR Magnetics, Inc. (Formerly Current Ring Co., Inc.), Fenton, MO 63026 314-343-8518
Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 605-665-9301
† Dietz Design, Inc., Belton, MO 64012 816-331-4911
Dormeyer Industries, A.F. Dormeyer Mfg. Co. Inc., Chicago, IL 60631-1521 312-775-3600
Douglas Randall, Pawcatuck, CT 06379 203-599-2075
Electro Assemblies Corp., Northbrook, IL 60062-2319 708-498-6520
Electronetics, Inc., Everett, WA 98204 206-355-1855
† Electronic Transformer Corp., Paterson, NJ 07544-0487 201-942-2222
Elma Engineering, Palo Alto, CA 94303 415-494-7303
† Elnetic Electronics, Inc.:Plant Locations, Gardena, CA 90247 310-515-1546
Fee Fil-Mag, San Diego, CA 92123 619-569-6577
† Freed Transformer Co., Inc., Electronic Transformer Corp., Paterson, NJ 07544-0487 201-942-2222
† Hadley, Robert M. Co., Inc., Los Angeles, CA 90037 213-234-9091
§ Hammond Manufacturing Co., Buffalo, NY 14225 716-894-5710
High Voltage Systems, Inc., Universal Designs Corp., Chappaqua, NY 10514 914-238-8462
Hipotronics Inc., Brewster, NY 10509 914-279-8091
† Hisonic, Inc., Olathe, KS 66051 913-782-0012
† Hytronics Corporation, Clearwater, FL 34620 813-536-7861
JB Electronic Transformers Inc., Chicago, IL 60647 312-342-0080
Jerome Industries Corp., Elizabeth, NJ 07201 908-353-5700
KGS Electronics, Inc., Arcadia, CA 91006 818-574-1175
† KIP Transformers Inc., Wolcott, CT 06716 203-758-7085
† L/C Magnetics, Anaheim, CA 92806 714-666-0787
Magna-Power Electronics, Inc., Whippany, NJ 07981 201-428-1197
† Magnecomp, Inc., Pickens, SC 29671 803-878-4700
† Magnetic Circuit Elements, Salinas, CA 93905 408-757-8752
† Magnetico Inc., Holtsville, NY 11742 516-654-1166
§ Micron Industries, Hillside, IL 60162 708-547-0900
† MTE Corp., Menomonee Falls, WI 53051 414-253-8200
Nedap N.V., Groenlo, HOLLAND 7140 AA ..... + 31-5440-71111
† Neshaminy Transformer Corp., Furlong, PA 18925 215-794-7411
† Newport Manufacturing Co., Santa Ana, CA 92704 800-726-0715
Nicollet Technologies Corp., Minneapolis, MN 55413 612-379-7919
† Northlake Engineering, Inc., Bristol, WI 53104-0370 414-857-9600
Oeco Corp., Milwaukie, OR 97222 503-659-7932
† OPT Industries, Inc., Phillipsburg, NJ 08865 908-454-2600
† Penn-Tran Corp.,Sub. of Spectrum Elctrns. Inc., Wingate, PA 16880 814-355-1521
Phenix Technologies, Accident, MD 21520 301-746-8118
† Plastic Capacitors, Inc., Chicago, IL 60639 312-489-2229
† Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861 908-826-4700
§† Preferred Electronics, Inc., Westfield, MA 01086 ..... 413-568-2301;1-800-553-6374
† PTC Transformers, Bordentown, NJ 08505 609-298-8200
RAE Company Inc., Indianapolis, IN 46239 317-351-1774
RCD Components, Inc., Manchester, NH 03109 603-669-0054
Ross Engineering Corp., Campbell, CA 95008 408-377-4621
Royal Enterprises Co., Simi Valley, CA 93063 ..... 805-522-8730;818-998-2455
Rutherford Research, Rutherford, NJ 07070 201-933-2091
§† Schott Corp., Wayzata, MN 55391 612-475-1173
Scientific Conversion, Inc., Novato, CA 94947 415-892-2323
Scientific Conversion, Inc., Novato, CA 94947 415-892-2323
† Scientific Technologies Inc., Control Components Div., Hayward, CA 94544-7831 ..... 510-471-9717;800-221-7060
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
† Sigmapower, Inc, FPBSM Industries, Inc., Rancho Dominguez, CA 90220-6404 310-884-5200
Simco Co., Hatfield, PA 19440 215-822-2171
§† Skyway Magnetics, Warner Springs, CA 92086-9714 619-782-3342
§ Square D Co., Palatine, IL 60067 708-397-2600
Standard Magnetic Corp., Garden Grove, CA 92641 714-379-5671
† Stangenes Industries, Inc., Palo Alto, CA 94303 415-493-0814
† Technitrol, Philadelphia, PA 19134 215-426-9105
Texas Transformer Corp., Plano, TX 75086 214-424-1581
Torad Coil Co., Inc., Wayne, NJ 07470 201-835-6195
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
Transformer Engineering Corporation, Cleveland, OH 44134 216-741-5282
Universal Voltronics Div., Thermo Voltek Corp., Mt. Kisco, NY 10549 914-241-1300
WPI Group, Inc., Warner, NH 03278 603-456-3111
§ Zambre Co., Inc., Mountain View, CA 94043 415-968-9176

Transformers, Horizontal Sweep-5600

MCI Transformer Corporation, Babylon, NY 11704, 516-587-0510 ..... A•2402
Prem Magnetics, Inc., McHenry, IL 60050, 815-385-2700 ..... A•2525
Actown-Electrocoil, Inc., Spring Grove, IL 60081 815-675-6641
Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
GC International Inc., Plano, TX 75074 214-423-8411
OPT Industries, Inc., Phillipsburg, NJ 08865 908-454-2600
† Penn-Tran Corp.,Sub. of Spectrum Elctrns. Inc., Wingate, PA 16880 814-355-1521
TMP Inc., Santa Ana, CA 92705 714-558-8028

Transformers, Hybrid-5600

Altran Corporation, Crystal Lake, IL 60014, 815-455-5650 ..... A•2258
APX Technologies Inc., Hicksville, NY 11801, 516-433-1313 ..... A•2266-2267
Bel Fuse, Jersey City, NJ 07302, 201-432-0463 ..... A•1512,2283,2287,2290-2293
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012, 605-296-3462 ..... A•2318-2320
† Magnecomp, Inc., Pickens, SC 29671, 803-878-4700 ..... A•2377
§† Microtran Co. Inc., Valley Stream, NY 11582-0236, 516-561-6050 ..... A•2415
Midcom, Inc., Watertown, SD 57201, 605-886-4385 ..... A•2425,2429,2431
MultiComp., Inc., Beaverton, OR 97006, 503-626-4200 ..... A•2434
† North Hills Signal Processing, Syosset, NY 11791, 516-682-7740 ..... A•2438
Para-Line Transformer Co., Inc., Alhambra, CA 91803, 818-281-0222 ..... A•2444
† Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2455
Prem Magnetics, Inc., McHenry, IL 60050, 815-385-2700 ..... A•2522,2524
§ Tamura Corporation of America, Temecula, CA 92589-2230, 909-699-1270 ..... A•2571
§ AT&T Microelectronics, Allentown, PA 18103 ..... 1-800-372-2447;In Can.:1-800-553-2448
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
† BG Electronics, EPC Corp., Mt. Vernon, NY 10550-4430 914-664-5591
† B. G. Laboratories, Inc., Binghamton, NY 13904 607-722-2376
C & C Jetronic, Inc., Allentown, NJ 08501 609-259-8855
† Corona Magnetics, Inc., Corona, CA 91719 909-735-7558
Custom Coils Inc., Alcester, SD 57001-0348 605-934-2460
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 605-665-9301
Delta Products Corporation, Fremont, CA 94538 510-770-0660
† De Young Mfg. Inc., Kirkland, WA 98034 206-823-4798
Electro Assemblies Corp., Northbrook, IL 60062-2319 708-498-6520
† Film Microelectronics Inc., Peabody, MA 01960 508-532-9913
§ James Electronics, Chicago, IL 60618 312-463-6500
JB Electronic Transformers Inc., Chicago, IL 60647 312-342-0080

§† OPT Industries, Inc., Phillipsburg, NJ 08865 908-454-2600
Radio Television Products Corp., Douglas, AZ 85607 602-364-4438
RCD Components, Inc., Manchester, NH 03109 603-669-0054
Schott Corp., Wayzata, MN 55391 612-475-1173
† Sigma Electronics Inc., Houston, TX 77099 ..... 713-933-4700;800-874-7121
South American Development Corp., Poughkeepsie, NY 12590 914-452-1305
Texas Transformer Corp., Plano, TX 75086 214-424-1581
TMP Inc., Santa Ana, CA 92705 714-558-8028
† Werlatone, Inc., Brewster, NY 10509 914-279-6187
Western Multiplex Corp., Belmont, CA 94002 415-592-8832

Transformers, IF-5600

Caddell-Burns Mfg., Mineola, NY 11501-3508, 516-746-2310 ..... A•1198
† Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ..... A•2305
† Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500 ..... A•1725
† Mitchell Electronics Corp., Mt. Vernon, NY 10552, 914-699-3800 ..... A•2433
† Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2455
† Shogyo International Corp., Great Neck, NY 11021-4799, 516-466-0911 ..... A•2534, D•1921
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ..... A•2118
Wilco Corp., Indianapolis, IN 46268, 317-293-9300 ..... A•2604
† American Trans-Coil Corporation, Richmond Hill, NY 11419-1410 718-441-5207
APX Technologies Inc., Hicksville, NY 11801 516-433-1313
† Automatic Coil Corp., Miami, FL 33147 305-696-6660
Bel Fuse, Jersey City, NJ 07302 201-432-0463
§ Bell Inds., J. W. Miller Div., Gardena, CA 90247-1059 310-515-1720
Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
† Caddell Coil Corp., Middletown Springs, VT 05757 802-235-2019
† C & C Jetronic, Inc., Allentown, NJ 08501 609-259-8855
Coast Coil Co., Coast Magnetics, Los Angeles, CA 90016 213-936-6188
Coilcraft, Cary, IL 60013 708-639-2361
Coil-Q Corp., Bronxville, NY 10708 914-337-4775
† Cramer Coil & Transformer Co., Inc., Saukville, WI 53080 .. 414-268-2150;414-375-5700
CUI Stack Inc., Beaverton, OR 97005 503-643-4899
† Delta Products Corporation, Fremont, CA 94538 510-770-0660
† De Young Mfg., Inc., Kirkland, WA 98034 206-823-4798
Electro Assemblies Corp., Northbrook, IL 60062-2319 708-498-6520
† Frequency Selective Networks, Woodside, NY 11377 718-424-7500
GC International Inc., Plano, TX 75074 214-423-8411
Integrity Technology Corporation, Santa Clara, CA 95050 408-262-8640
International Microelectronics, Arlington, TX 76003 817-473-1730
§† M/A-COM Microelectroincs Division, M/A-COM, Lowell, MA 01853-3295 508-442-5000
† Magnecomp, Inc., Pickens, SC 29671 803-878-4700
§ Magnetek Triad, Huntington, IN 46750 219-356-7100
† Magnetic Component Engineering, Inc., Inglewood, CA 90301 310-677-6600
† Merrimac Industries, West Caldwell, NJ 07006 201-575-1300
MicroSignals Inc., LIC, NY 11101 ..... 718-937-7955;718-937-0391;800-648-2252
Mouser Electronics, Santee, CA 92071 800-346-6873
Mouser Electronics, Mansfield, TX 76063 800-346-6873
Mouser Electronics, Gilroy, CA 95020 800-346-6873
OPT Industries, Inc., Phillipsburg, NJ 08865 908-454-2600
PC Transformer Corp., West Babylon, NY 11704 516-491-3300
† Piconics, Incorporated, Tyngsboro, MA 01879 508-649-7501
† Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861 908-826-4700
Radio Television Products Corp., Douglas, AZ 85607 602-364-4438
† ST Olektron Corporation, Subsidiary of Signal Technology Corp., Beverly, MA 01915 508-922-0019
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291
TMP Inc., Santa Ana, CA 92705 714-558-8028
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
† Torwico Elctrns. Inc., Lakewood, NJ 08701 908-364-1800
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
TTE, Incorporated, W. Los Angeles, CA 90064-1400 ..... 310-478-8224;800-776-7614
† Vanguard Electronics Co., Gardena, CA 90248 310-323-4100
† Wirebenders, Inc., Phoenix, AZ 85021-2824 602-861-1856

Transformers, Input-5600

Abbott Technologies, Inc., Sun Valley, CA 91352, 818-504-0644;1-800-367-8200 ..... A•2234
Albar, Inc., Lynnwood, WA 98036, 206-771-4006;800-822-5227 ..... A•2256
† Bicron Electronics, Canaan, CT 06018, 203-824-5125 ..... A•2299
† C & C Jetronic, Inc., Allentown, NJ 08501, 609-259-8855 ..... A•2302
† EWC, Inc., Englishtown, NJ 07726, 908-446-3110 ..... A•2331
JM Transformer Co., Inc., Farmingdale, NY 11735, 516-293-0475 ..... A•2364
Magnelab, Boulder, CO 80301-4696, 303-442-6700 ..... A•2378
MCI Transformer Corporation, Babylon, NY 11704, 516-587-0510 ..... A•2403
§† Microtran Co. Inc., Valley Stream, NY 11582-0236, 516-561-6050 ..... A•2406
† NWL Transformers, Bordentown, NJ 08505, 609-298-7300 ..... A•2437
PC Transformer Corp., West Babylon, NY 11704, 516-491-3300 .... A•2451,2453
† Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2455
§ Tamura Corporation of America, Temecula, CA 92589-2230, 909-699-1270 ..... A•2572
† Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314 ..... A•2594
Actown-Electrocoil, Inc., Spring Grove, IL 60081 815-675-6641
Advanced Components Inds., Inc., Div of Kaschke, Torrance, CA 90501 310-328-0060
American Magnetics, Carterville, IL 62918 618-985-4838
ATC-Frost Magnetics Inc., Oakville,Ont., CANADA L6H 2R4 416-844-6681
Basler Elec., Electronic Product Group, Highland, IL 62249 ..... 618-654-2341; 800-645-2074
Basler Electrics, Magnetics Product Grp., Highland, IL 62249 618-654-2341
Bel Fuse, Jersey City, NJ 07302 201-432-0463
Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
† Beta Transformer Tech. Corp., ILC Data Device Corp., Bohmia, NY 11716 516-244-7393
§ Bogen Communications, Inc., Sound Prods., Ramsey, NJ 07446 201-934-8500
† Caddell Coil Corp., Middletown Springs, VT 05757 802-235-2019
† Coast Coil Co., Coast Magnetics, Los Angeles, CA 90016 213-936-6188
† Coil-Q Corp., Bronxville, NY 10708 914-337-4775
† Communication Coil Inc., Chicago, IL 60634 312-637-1333
† Component Specialties Corp., Temple City, CA 91780 213-283-0015
§ Computer Power Inc., High Bridge, NJ 08829 ..... 908-638-8000;800-526-5088
† Corona Magnetics, Inc., Corona, CA 91719 909-735-7558
Custom Bobbin Windings, A & K Corporation, Zanesville, OH 43702-2369 614-452-6973
Custom Coils Inc., Alcester, SD 57001-0348 605-934-2460
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 605-665-9301
† Del Electronics Corp., Valhalla, NY 10595 914-686-3600
Deltona Transformer Corp., DeLand, FL 32724 904-736-7900
† De Young Mfg., Inc., Kirkland, WA 98034 206-823-4798
† Dietz Design, Inc., Belton, MO 64012 816-331-4911
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012 605-296-3462
Electro Assemblies Corp., Northbrook, IL 60062-2319 708-498-6520
§† Electromech, Inc., Irvington, NJ 07111 201-318-7999
Electronetics, Inc., Everett, WA 98204 206-355-1855
† Electronic Transformer Corp., Paterson, NJ 07544-0487 201-942-2222
† Elnetic Electronics, Inc.:Plant Locations, Gardena, CA 90247 310-515-1546
† Freed Transformer Co., Inc., Electronic Transformer Corp., Paterson, NJ 07544-0487 201-942-2222
Gavagan Electronics, Danbury, CT 06810 203-748-5248
§ GC International Inc., Plano, TX 75074 214-423-8411
Grand Transformer, Inc., Grand Haven, MI 49417 616-842-5430
§ Hammond Manufacturing Co., Buffalo, NY 14225 716-894-5710
† Hisonic, Inc., Olathe, KS 66051 913-782-0012
Hitran Corporation, Flemington, NJ 08822-1238 908-782-5525
Integrity Technology Corporation, Santa Clara, CA 95050 408-262-8640
§ James Electronics, Chicago, IL 60618 312-463-6500
† JB Electronic Transformers Inc., Chicago, IL 60647 312-342-0080
Jerome Industries Corp., Elizabeth, NJ 07201 908-353-5700
† Lenco Elctrns., Inc., McHenry, IL 60050 815-344-2900
Mag-Con, St. Paul, MN 55113 612-633-8820
† Magnecomp, Inc., Pickens, SC 29671 803-878-4700
§ Magnetek Triad, Huntington, IN 46750 219-356-7100
† Magnetic Circuit Elements, Salinas, CA 93905 408-757-8752
† Magnetico Inc., Holtsville, NY 11742 516-654-1166
Midcom, Inc., Watertown, SD 57201 605-886-4385
Mitchell Electronics Corp., Mt. Vernon, NY 10552 914-699-3800
† MTE Corp., Menomonee Falls, WI 53051 414-253-8200
MultiComp., Inc., Beaverton, OR 97006 503-626-4200
† Neshaminy Transformer Corp., Furlong, PA 18925 215-794-7411
Nicollet Technologies Corp., Minneapolis, MN 55413 612-379-7919
† Northlake Engineering, Inc., Bristol, WI 53104-0370 414-857-9600
Oeco Corp., Milwaukie, OR 97222 503-659-7932
OPT Industries, Inc., Phillipsburg, NJ 08865 908-454-2600
Para-Line Transformer Co., Inc., Alhambra, CA 91803 818-281-0222
† Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
Potrans International Inc., Potrans Electrical Corp., Ltd., Irvine, CA 92714 714-975-1222
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861 908-826-4700
Prem Magnetics, Inc., McHenry, IL 60050 815-385-2700
† PTC Transformers, Bordentown, NJ 08505 609-298-8200
Radio Television Products Corp., Douglas, AZ 85607 602-364-4438
RAE Company Inc., Indianapolis, IN 46239 317-351-1774
RCD Components, Inc., Manchester, NH 03109 603-669-0054
Ritter Coil, Inc., Easton, PA 18043-3130 215-258-6780
Schott Corp., Wayzata, MN 55391 612-475-1173
§ Sescom, Inc., Henderson, NV 89015-4249 702-565-3400
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
† Sigma Electronics Inc., Houston, TX 77099 ..... 713-933-4700;800-874-7121
† Sigmapower, Inc, FPBSM Industries, Inc., Rancho Dominguez, CA 90220-6404 310-884-5200
South American Development Corp., Poughkeepsie, NY 12590 914-452-1305
† Staco Transpower, Components Corp. of America, Mt. Carmel, IL 62863 618-262-5555
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291
Texas Transformer Corp., Plano, TX 75086 214-424-1581
§† Thordarson Meissner, Components Corp. of Amer., Mt. Carmel, IL 62863 618-262-5121
TMP Inc., Santa Ana, CA 92705 714-558-8028
Torema U.S.A., Inc., Houston, TX 77042 713-977-2500
Toroid Corp. of Maryland, Salisbury, MD 21801 410-860-0300
† Torwico Elctrns. Inc., Lakewood, NJ 08701 908-364-1800
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
Transformer Engineering Corporation, Cleveland, OH 44134 216-741-5282
§ Vitec Electronics Corp., Visalia, CA 93291 209-651-1535

Transformers, Instrument-5600

† Abbott Technologies, Inc., Sun Valley, CA 91352, 818-504-0644;1-800-367-8200 ..... A•2234
Advanced Components Inds., Inc., Div of Kaschke, Torrance, CA 90501, 310-328-0060 ..... A•2254
Amecon, Inc., Anaheim, CA 92805, 714-634-2220;800-392-2292 .... A•2260-2263
Bicron Electronics, Canaan, CT 06018, 203-824-5125 ..... A•2299, B•1919
† C & C Jetronic, Inc., Allentown, NJ 08501, 609-259-8855 ..... A•2302
† Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ..... A•2305
CR Magnetics, Inc. (Formerly Current Ring Co., Inc.), Fenton, MO 63026, 314-343-8518 ..... A•2309, B•1927

§† **Electromech, Inc., Irvington, NJ 07111, 201-318-7999** ... A•2324-2325
Ensign Corp., Burr Ridge, IL 60521, 708-325-9343 ... A•2326,2328
EWC, Inc., Englishtown, NJ 07726, 908-446-3110 ... A•2331
§ **Flex-Core Div., Morlan & Assocs., Inc., Worthington, OH 43235, 614-889-6152** ... A•2357
§† **FOX METER INC., DeKalb, IL 60115, 815-758-7000** ... D•1351
GMW Associates, Redwood City, CA 94064, 415-368-4884 ... B•1951
Lumintech Inc., Irvington, NJ 07111, 201-374-1091 ... A•2376
† **Magnecomp, Inc., Pickens, SC 29671, 803-878-4700** ... A•2377
Magnelab, Boulder, CO 80301-4696, 303-442-6700 ... A•2378-2379,2382
MCI Transformer Corporation, Babylon, NY 11704, 516-587-0510 ... A•2402
§† **Microtran Co. Inc., Valley Stream, NY 11582-0236, 516-561-6050** ... A•2407-2410,2412
MultiComp., Inc., Beaverton, OR 97006, 503-626-4200 ... A•2434-2435
† **NWL Transformers, Bordentown, NJ 08505, 609-298-7300** ... A•2437
Ohio Semitronics, Inc., Columbus, OH 43212, 614-486-9561 ... B•1991,2001
PC Transformer Corp., West Babylon, NY 11704, 516-491-3300 ... A•2448-2449
† **Pearson Electronics, Inc., Palo Alto, CA 94303, 415-494-6444** ... A•2454
† **Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064** ... A•2455
Plitron Manufacturing, Inc., Downsview, Ont., CAN M3J 2N5, 416-667-9914 ... A•2506
Powertronix Corp., Foster City, CA 94404, 415-345-6800 ... A•2511
Precision Electronics Inc., Copiague, NY 11726, 516-842-4900 ... A•2526
§† **RCD Components, Inc., Manchester, NH 03109, 603-669-0054** ... A•1282
Signal Transformer Co., Inc., Insilco Corporation, Inwood, NY 11696, 516-239-5777 ... A•2536
Talema Electronic, Inc., Saint James, MO 65559, 314-265-5500 ... A•2566,2570
Todd Systems, Inc., Yonkers, NY 10701, 914-963-3400 ... A•2582-2583
† **Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314** ... A•2594
Tortran Inc., Bridgeport, CT 06608, 203-367-5188 ... A•2593
† **Transformer Technologies, Inc., Mt. Vernon, NY 10552, 914-668-1600** ... A•2598
U.R.D. America, Laguna Nigel, CA 92607, 714-831-0111 ... D•1169
† **ZMAN Magnetics, Kent, WA 98032, 206-251-8064** ... A•2606
Actown-Electrocoil, Inc., Spring Grove, IL 60081 ... 815-675-6641
American Magnetics, Carterville, IL 62918 ... 618-985-4838
Andover, Inc., Lafayette, IN 47904 ... 317-447-1157
Angus Electronics Co., Indianapolis, IN 46224 ... 317-244-7611
ATC-Frost Magnetics Inc., Oakville,Ont., CANADA L6H 2R4 ... 416-844-6681
Automatic Coil Corp., Miami, FL 33147 ... 305-696-6660
AYA-Instruments, Inc., Pittsburgh, PA 15213 ... 412-622-5500
Berkshire Transformer Corp., Kent, CT 06757 ... 203-927-3541
† Beta Transformer Tech. Corp., ILC Data Device Corp., Bohmia, NY 11716 ... 516-244-7393
Bey Electric, Inc., Lincoln Park, NJ 07035 ... 201-694-5000
† BG Electronics, EPC Corp., Mt. Vernon, NY 10550-4430 ... 914-664-5591
† B. G. Laboratories, Inc., Binghamton, NY 13904 ... 607-722-2376
BH Electronics, Inc., Burnsville, MN 55337 ... 612-894-9590
Calex Mfg. Co., Inc., Concord, CA 94520 ... 510-687-4411
† Coast Coil Co., Coast Magnetics, Los Angeles, CA 90016 ... 213-936-6188
† Component Specialties Corp., Temple City, CA 91780 ... 213-283-0015
† Corona Magnetics, Inc., Corona, CA 91719 ... 909-735-7558
† Cramer Coil & Transformer Co., Inc., Saukville, WI 53080 ... 414-268-2150;414-375-5700
Crompton Modutec, Manchester, NH 03109 ... 603-669-5121;800-METERS-1
Custom Bobbin Windings, A & K Corporation, Zanesville, OH 43702-2369 ... 614-452-6973
Custom Coils Inc., Alcester, SD 57001-0348 ... 605-934-2460
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 ... 605-665-9301
† Del Electronics Corp., Valhalla, NY 10595 ... 914-686-3600
† De Young Mfg., Inc., Kirkland, WA 98034 ... 206-823-4798
† Dietz Design, Inc., Belton, MO 64012 ... 816-331-4911
Dormeyer Industries, A.F. Dormeyer Mfg. Co. Inc., Chicago, IL 60631-1521 ... 312-775-3600
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012 ... 605-296-3462
Electro Assemblies Corp., Northbrook, IL 60062-2319 ... 708-498-6520
§ Electromatic Controls Corp., Hoffman Estates, IL 60195-2010 ... 708-882-5757
Electronetics, Inc., Everett, WA 98204 ... 206-355-1855
Electronic Coil Corp., Bloomfield, CT 06002 ... 203-243-5233
† Electronic Transformer Corp., Paterson, NJ 07544-0487 ... 201-942-2222
† Elnetic Electronics, Inc.:Plant Locations, Gardena, CA 90247 ... 310-515-1546
Endicott Coil Co., Inc., Binghamton, NY 13905 ... 607-797-1263
§ Fee Fil-Mag, San Diego, CA 92123 ... 619-569-6577
† Freed Transformer Co., Inc., Electronic Transformer Corp., Paterson, NJ 07544-0487 ... 201-942-2222
Gavagan Electronics, Danbury, CT 06810 ... 203-748-5248
GC International Inc., Plano, TX 75074 ... 214-423-8411
Gettysburg Transformer Corporation, Gettysburg, PA 17325 ... 717-334-2191
Gowanda Electronics Corp., Gowanda, NY 14070 ... 716-532-2234
Grand Transformer, Inc., Grand Haven, MI 49417 ... 616-842-5430
† GreenLee Textron Inc.:Subsidiary of Textron Inc., Rockford, IL 61109 ... 815-397-7070
Haefely, Inc., Woodbridge, VA 22192 ... 703-494-1900
§ Hammond Manufacturing Co., Buffalo, NY 14225 ... 716-894-5710
† Hisonic, Inc., Olathe, KS 66051 ... 913-782-0012
§ Hurricane Electronics Lab, Hurricane, UT 84737 ... 801-635-2003
Ion Physics Corporation, Atkinson, NH 03811 ... 603-893-6687
§ James Electronics, Chicago, IL 60618 ... 312-463-6500
JB Electronic Transformers Inc., Chicago, IL 60647 ... 312-342-0080
Jerome Industries Corp., Elizabeth, NJ 07201 ... 908-353-5700
JM Transformer Co., Inc., Farmingdale, NY 11735 ... 516-293-0475
Keytronics, Inc., Endicott, NY 13760 ... 607-754-5405
KGS Electronics, Inc., Arcadia, CA 91006 ... 818-574-1175
† KIP Transformers Inc., Wolcott, CT 06716 ... 203-758-7085
§ Larson-Metercraft, El Cajon, CA 92020 ... 619-258-8990
Lem Dynamp Inc., Grove City, OH 43123 ... 614-871-6900
† Lenco Elctrns., Inc., McHenry, IL 60050 ... 815-344-2900
Mag-Con, St. Paul, MN 55113 ... 612-633-8820
§ Magnetek Triad, Huntington, IN 46750 ... 219-356-7100
† Magnetic Circuit Elements, Salinas, CA 93905 ... 408-757-8752
† Magnetico Inc., Holtsville, NY 11742 ... 516-654-1166
Mech-Tronics, Mount Holly, NJ 08060 ... 609-267-0680
§ Metermaster, Tempe, AZ 85282 ... 602-431-0015
Midcom, Inc., Watertown, SD 57201 ... 605-886-4385
Mitchell Electronics Corp., Mt. Vernon, NY 10552 ... 914-699-3800
MTE Corp., Menomonee Falls, WI 53051 ... 414-253-8200
Nedco Electronics, Inc., Morton Grove, IL 60053 ... 708-967-0500
† Neshaminy Transformer Corp., Furlong, PA 18925 ... 215-794-7411
† Newport Manufacturing Co., Santa Ana, CA 92704 ... 800-726-0715
OPT Industries, Inc., Phillipsburg, NJ 08865 ... 908-454-2600
Pacific Transformer Corp., Anaheim, CA 92807 ... 714-779-0450;1-800-325-0501
Para-Line Transformer Co., Inc., Alhambra, CA 91803 ... 818-281-0222
† Polyphase Instrument, Ft. Washington, PA 19034 ... 215-643-6950
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861 ... 908-826-4700
Premier Magnetics Inc., Aliso Viejo, CA 92656 ... 714-362-4211
Prem Magnetics, Inc., McHenry, IL 60050 ... 815-385-2700
† PTC Transformers, Bordentown, NJ 08505 ... 609-298-8200
Pulse Engineering, Inc., San Diego, CA 92128 ... 619-674-8100
RAE Company Inc., Indianapolis, IN 46239 ... 317-351-1774
§† Rhombus Industries, Huntington Bch., CA 92649-1595 ... 714-898-0960
Ritter Coil, Inc., Easton, PA 18043-3130 ... 215-258-6780
Rodale Technical Sales Inc., Islip, NY 11751 ... 516-277-5454
Schott Corp., Wayzata, MN 55391 ... 612-475-1173
Schumacher Elect. Corp., Chicago, IL 60626 ... 312-973-1600
† Scientific Technologies Inc., Control Components Div., Hayward, CA 94544-7831 ... 510-471-9717;800-221-7060
† Sigma Electronics Inc., Houston, TX 77099 ... 713-933-4700;800-874-7121
Simpson Electric Co., Elgin, IL 60120 ... 708-697-2260
South American Development Corp., Poughkeepsie, NY 12590 ... 914-452-1305
§ Square D Co., Palatine, IL 60067 ... 708-397-2600
† Square D Company, Clearwater, FL 34625 ... 813-447-2511
Staco Transpower, Components Corp. of America, Mt. Carmel, IL 62863 ... 618-262-5555
Standard Magnetic Corp., Garden Grove, CA 92641 ... 714-379-5671
† Stangenes Industries, Inc., Palo Alto, CA 94303 ... 415-493-0814
§ Tamura Corporation of America, Temecula, CA 92589-2230 ... 909-699-1270
Texas Transformer Corp., Plano, TX 75086 ... 214-424-1581
§ Time Mark Corp., Tulsa, OK 74116 ... 918-438-1220
Torad Coil Co., Inc., Wayne, NJ 07470 ... 201-835-6195
† Torelco, Inc., Irvington, NJ 07111 ... 201-374-8641;800-867-3526
† Torema U.S.A., Inc., Houston, TX 77042 ... 713-977-2500
† Toroid Corp. of Maryland, Salisbury, MD 21801 ... 410-860-0300
† Torotron Corp., Mt. Vernon, NY 10550 ... 914-664-2050
† Torwico Elctrns. Inc., Lakewood, NJ 08701 ... 908-364-1800
† Trans American Transformer, E. Setauket, NY 11733 ... 516-928-0762
† Transformer Design , MTE Corporation, Menomonee Falls, WI 53051 ... 414-253-8200
Transformer Engineering Corporation, Cleveland, OH 44134 ... 216-741-5282
Ulveco, Inc., Houston, TX 77042 ... 1-800-527-7042
U.S. Transformer and Inductor, Cheyenne, WY 82007 ... 800-584-9339
† Vanguard Electronics Co., Gardena, CA 90248 ... 310-323-4100
Vernitron Corp., Precision Comps. Group, St. Petersburg, FL 33710 ... 813-347-2181
§ Vitec Electronics Corp., Visalia, CA 93291 ... 209-651-1535
§ Western Electro-Mechanical Co., Inc., Oakland, CA 94607 ... 415-452-1936
Wirebenders, Inc., Phoenix, AZ 85021-2824 ... 602-861-1856
§† Zambre Co., Inc., Mountain View, CA 94043 ... 415-968-9176

Transformers, Interface & Coupling-5600

AT&T Microelectronics, Allentown, PA 18103, 1-800-372-2447;In Can.:1-800-553-2448 ... A•2268,2270-2271
† **Communication Coil Inc., Chicago, IL 60634, 312-637-1333** ... A•2305
Ensign Corp., Burr Ridge, IL 60521, 708-325-9343 ... A•2326-2327
FDK America, Inc., Fuji Electrochemical Co., Ltd., San Jose, CA 95134, 408-432-8331 ... A•2348
§ **Fee Fil-Mag, San Diego, CA 92123, 619-569-6577** ... A•1635-1636,2349-2351
JBM Electronics, Inc., Bedford, NH 03110-6802, 603-623-0222 ... A•2363
† **Magnecomp, Inc., Pickens, SC 29671, 803-878-4700** ... A•2377
MCI Transformer Corporation, Babylon, NY 11704, 516-587-0510 ... A•2395
Midcom, Inc., Watertown, SD 57201, 605-886-4385 ... A•2425-2426,2429-2430
§† **Rhombus Industries, Huntington Bch., CA 92649-1595, 714-898-0960** ... A•2533
Tamura Corporation of America, Temecula, CA 92589-2230, 909-699-1270 ... A•2572-2573
§ **Valor Electronics, San Diego, CA 92131-1642, 619-537-2500** ... A•2602-2603
Basler Electrics, Magnetics Product Grp., Highland, IL 62249 ... 618-654-2341
† Beta Transformer Tech. Corp., ILC Data Device Corp., Bohmia, NY 11716 ... 516-244-7393
BH Electronics, Inc., Burnsville, MN 55337 ... 612-894-9590
C & C Jetronic, Inc., Allentown, NJ 08501 ... 609-259-8855
Custom Coils Inc., Alcester, SD 57001-0348 ... 605-934-2460
Datatronics, Inc., Romoland, CA 92585 ... 909-928-7700
Deltona Transformer Corp., DeLand, FL 32724 ... 904-736-7900
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012 ... 605-296-3462
Gavagan Electronics, Danbury, CT 06810 ... 203-748-5248
§ GC International Inc., Plano, TX 75074 ... 214-423-8411
Hitran Corporation, Flemington, NJ 08822-1238 ... 908-782-5525
Integrity Technology Corporation, Santa Clara, CA 95050 ... 408-262-8640
† JB Electronic Transformers Inc., Chicago, IL 60647 ... 312-342-0080
Mech-Tronics, Mount Holly, NJ 08060 ... 609-267-0680
§† Microtran Co. Inc., Valley Stream, NY 11582-0236 ... 516-561-6050
Mitchell Electronics Corp., Mt. Vernon, NY 10552 ... 914-699-3800
§† OPT Industries, Inc., Phillipsburg, NJ 08865 ... 908-454-2600
Prem Magnetics, Inc., McHenry, IL 60050 ... 815-385-2700
Pulse Engineering, Inc., San Diego, CA 92128 ... 619-674-8100

RAE Company Inc., Indianapolis, IN 46239 317-351-1774
RCD Components, Inc., Manchester, NH 03109 603-669-0054
§ Schaffner EMC, Inc. Components Division, Springfield, NJ 07081 ..... 201-379-7778; 800-367-5566
Schott Corp., Wayzata, MN 55391 612-475-1173
Scientific Conversion, Inc., Novato, CA 94947 415-892-2323
Scientific Conversion, Inc., Novato, CA 94947 415-892-2323
TMP Inc., Santa Ana, CA 92705 714-558-8028
† Torotel Prods. Inc., Grandview, MO 64030-3199 816-761-6314
† Torwico Elctrns. Inc., Lakewood, NJ 08701 908-364-1800
Transformer Engineering Corporation, Cleveland, OH 44134 216-741-5282
TTE, Incorporated, W. Los Angeles, CA 90064-1400 ..... 310-478-8224;800-776-7614
Vernitron Corp., Precision Comps. Group, St. Petersburg, FL 33710 813-347-2181
Vitec Electronics Corp., Visalia, CA 93291 209-651-1535
Wirebenders, Inc., Phoenix, AZ 85021-2824 602-861-1856
† ZMAN Magnetics, Kent, WA 98032 206-251-8064

Transformers, Interstage-5600

Caddell-Burns Mfg., Mineola, NY 11501-3508, 516-746-2310 ..... A•1198
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012, 605-296-3462 ..... A•2318
Ensign Corp., Burr Ridge, IL 60521, 708-325-9343 ..... A•2326-2327
† **ESC Electronics Corp., Palisades Pk., NJ 07650, 201-947-0400 ..... A•2329**
† **EWC, Inc., Englishtown, NJ 07726, 908-446-3110 ..... A•2331,2345**
ISL Products Int'l, Ltd., Syosset, NY 11791-6093, 516-937-3475;800-626-6116 ..... A•2362
Magnelab, Boulder, CO 80301-4696, 303-442-6700 ..... A•2378
PC Transformer Corp., West Babylon, NY 11704, 516-491-3300 ..... A•2453
† **Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2455**
§ **Stancor, White-Rodgers, Logansport, IN 46947, 219-722-2244 ..... A•2558,2561**
† **Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314 ..... A•2594**
Advanced Components Inds., Inc., Div of Kaschke, Torrance, CA 90501 310-328-0060
American Magnetics, Carterville, IL 62918 618-985-4838
† American Trans-Coil Corporation, Richmond Hill, NY 11419-1410 718-441-5207
§ AT&T Microelectronics, Allentown, PA 18103 ..... 1-800-372-2447;In Can.:1-800-553-2448
ATC-Frost Magnetics Inc., Oakville,Ont., CANADA L6H 2R4 416-844-6681
Basler Elec., Electronic Product Group, Highland, IL 62249 ..... 618-654-2341; 800-645-2074
Bel Fuse, Jersey City, NJ 07302 201-432-0463
Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
† Beta Transformer Tech. Corp., ILC Data Device Corp., Bohmia, NY 11716 516-244-7393
CET Technology, Hudson, NH 03051 603-883-5912
† Coast Coil Co., Coast Magnetics, Los Angeles, CA 90016 213-936-6188
Coil-Q Corp., Bronxville, NY 10708 914-337-4775
† Communication Coil Inc., Chicago, IL 60634 312-637-1333
Custom Bobbin Windings, A & K Corporation, Zanesville, OH 43702-2369 614-452-6973
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 605-665-9301
† De Young Mfg., Inc., Kirkland, WA 98034 206-823-4798
† Dietz Design, Inc., Belton, MO 64012 816-331-4911
Electro Assemblies Corp., Northbrook, IL 60062-2319 708-498-6520
† Electronic Transformer Corp., Paterson, NJ 07544-0487 201-942-2222
† Elnetic Electronics, Inc.:Plant Locations, Gardena, CA 90247 310-515-1546
† Frequency Selective Networks, Woodside, NY 11377 718-424-7500
Gavagan Electronics, Danbury, CT 06810 203-748-5248
GC International Inc., Plano, TX 75074 214-423-8411
§ Hammond Manufacturing Co., Buffalo, NY 14225 716-894-5710
Hitran Corporation, Flemington, NJ 08822-1238 908-782-5525
International Microelectronics, Arlington, TX 76003 817-473-1730
† JB Electronic Transformers Inc., Chicago, IL 60647 312-342-0080
Jerome Industries Corp., Elizabeth, NJ 07201 908-353-5700
† Lenco Elctrns., Inc., McHenry, IL 60050 815-344-2900
Mag-Con, St. Paul, MN 55113 612-633-8820
§ Magnetek Triad, Huntington, IN 46750 219-356-7100
† Magnetic Circuit Elements, Salinas, CA 93905 408-757-8752
† Magnetico Inc., Holtsville, NY 11742 516-654-1166
§† Microtran Co. Inc., Valley Stream, NY 11582-0236 516-561-6050
Mouser Electronics, Santee, CA 92071 800-346-6873
Mouser Electronics, Mansfield, TX 76063 800-346-6873
Mouser Electronics, Gilroy, CA 95020 800-346-6873
† MTE Corp., Menomonee Falls, WI 53051 414-253-8200
† Neshaminy Transformer Corp., Furlong, PA 18925 215-794-7411
† Northlake Engineering, Inc., Bristol, WI 53104-0370 414-857-9600
OPT Industries, Inc., Phillipsburg, NJ 08865 908-454-2600
Pacific Transformer Corp., Anaheim, CA 92807 ..... 714-779-0450;1-800-325-0501
† Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
Prem Magnetics, Inc., McHenry, IL 60050 815-385-2700
† PTC Transformers, Bordentown, NJ 08505 609-298-8200
Radio Television Products Corp., Douglas, AZ 85607 602-364-4438
Renco Electronics, Inc., Deer Pk., NY 11729 ..... 516-586-5566;1-800-645-5828
† Sigma Electronics Inc., Houston, TX 77099 ..... 713-933-4700;800-874-7121
Skyway Magnetics, Warner Springs, CA 92086-9714 619-782-3342
South American Development Corp., Poughkeepsie, NY 12590 914-452-1305
Staco Transpower, Components Corp. of America, Mt. Carmel, IL 62863 618-262-5555
§ Tamura Corporation of America, Temecula, CA 92589-2230 909-699-1270
§ Thordarson Meissner, Components Corp. of Amer., Mt. Carmel, IL 62863 618-262-5121
TMP Inc., Santa Ana, CA 92705 714-558-8028
† Torwico Elctrns. Inc., Lakewood, NJ 08701 908-364-1800
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
TTE, Incorporated, W. Los Angeles, CA 90064-1400 ..... 310-478-8224;800-776-7614

Transformers, Inverter-5600

Albar, Inc., Lynnwood, WA 98036, 206-771-4006;800-822-5227 ..... A•2256
BH Electronics, Inc., Burnsville, MN 55337, 612-894-9590 ..... A•2297
† **Bicron Electronics, Canaan, CT 06018, 203-824-5125 ..... A•2299**
Caddell-Burns Mfg., Mineola, NY 11501-3508, 516-746-2310 ..... A•1198
† **C & C Jetronic, Inc., Allentown, NJ 08501, 609-259-8855 ..... A•2302**
† **ESC Electronics Corp., Palisades Pk., NJ 07650, 201-947-0400 ..... A•2329**
JM Transformer Co., Inc., Farmingdale, NY 11735, 516-293-0475 ..... A•2364
† **Magnecomp, Inc., Pickens, SC 29671, 803-878-4700 ..... A•2377**
Magnelab, Boulder, CO 80301-4696, 303-442-6700 ..... A•2378
† **Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2455**
Renco Electronics, Inc., Deer Pk., NY 11729, 516-586-5566;1-800-645-5828 ..... A•2527-2529
Signal Transformer Co., Inc., Insilco Corporation, Inwood, NY 11696, 516-239-5777 ..... A•2536
Talema Electronic, Inc., Saint James, MO 65559, 314-265-5500 ..... A•2570
§ **Tamura Corporation of America, Temecula, CA 92589-2230, 909-699-1270 ..... A•2571**
† **Torelco, Inc., Irvington, NJ 07111, 201-374-8641;800-867-3526 ..... A•2581**
† **Toroid Corp. of Maryland, Salisbury, MD 21801, 410-860-0300 ..... A•2586**
† **Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314 ..... A•2594**
† **Transformer Technologies, Inc., Mt. Vernon, NY 10552, 914-668-1600 ..... A•2598**
Abacus Controls Inc., Somerville, NJ 08876 908-526-6010
Abbott Technologies, Inc., Sun Valley, CA 91352 ..... 818-504-0644;1-800-367-8200
Actown-Electrocoil, Inc., Spring Grove, IL 60081 815-675-6641
Advanced Components Inds., Inc., Div of Kaschke, Torrance, CA 90501 310-328-0060
Amecon, Inc., Anaheim, CA 92805 ..... 714-634-2220;800-392-2292
† American Monarch, Minneapolis, MN 55421 612-788-9161
Andover, Inc., Lafayette, IN 47904 317-447-1157
ATC-Frost Magnetics Inc., Oakville,Ont., CANADA L6H 2R4 416-844-6681
Atlantic Magnetics, Inc., Pompano Beach, FL 33069 305-979-7920
† Automatic Coil Corp., Miami, FL 33147 305-696-6660
† Axel Electronics, Inc., Subsidiary of FPBSM Industries Inc., Rancho Dominquez, CA 90220 718-291-3900
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
Basler Electrics, Magnetics Product Grp., Highland, IL 62249 618-654-2341
† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635 714-447-2300
Bel Fuse, Jersey City, NJ 07302 201-432-0463
Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
† Beta Transformer Tech. Corp., ILC Data Device Corp., Bohmia, NY 11716 516-244-7393
† B. G. Laboratories, Inc., Binghamton, NY 13904 607-722-2376
† Cal-Power Corp., Standard Magnetic Corp., Garden Grove, CA 92641 714-379-5672
CET Technology, Hudson, NH 03051 603-883-5912
† Coast Magnetics, Adams-Maxwell Division, Inglewood, CA 90302-1284 310-673-3245
† Communication Coil Inc., Chicago, IL 60634 312-637-1333
§ Computer Power Inc., High Bridge, NJ 08829 ..... 908-638-8000;800-526-5088
† Corona Magnetics, Inc., Corona, CA 91719 909-735-7558
† Cramer Coil & Transformer Co., Inc., Saukville, WI 53080 .. 414-268-2150;414-375-5700
† Cypress Magnetics, Inc., Rancho Cucamonga, CA 91730 909-987-3570
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 605-665-9301
Datatronics, Inc., Romoland, CA 92585 909-928-7700
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012 605-296-3462
Electro Assemblies Corp., Northbrook, IL 60062-2319 708-498-6520
Electrocom Industries, S. Bend, IN 46615 219-232-2743
§† Electromech, Inc., Irvington, NJ 07111 201-318-7999
Electronetics, Inc., Everett, WA 98204 206-355-1855
† Electronic Transformer Corp., Paterson, NJ 07544-0487 201-942-2222
Elgar Electronics Corporation, San Diego, CA 92121 ..... 619-450-0085;800-733-5427
† Elnetic Electronics, Inc.:Plant Locations, Gardena, CA 90247 310-515-1546
Endicott Coil Co., Inc., Binghamton, NY 13905 607-797-1263
† Endicott Research Group, Endicott, NY 13760 607-754-9187
Energy, Ltd., Bladensburg, MD 20710 301-699-1144
Epco Products Inc., WAllkill, NY 12589 914-895-2033
Fee Fil-Mag, San Diego, CA 92123 619-569-6577
† Freed Transformer Co., Inc., Electronic Transformer Corp., Paterson, NJ 07544-0487 201-942-2222
Gavagan Electronics, Danbury, CT 06810 203-748-5248
GC International Inc., Plano, TX 75074 214-423-8411
Gowanda Electronics Corp., Gowanda, NY 14070 716-532-2234
† Hisonic, Inc., Olathe, KS 66051 913-782-0012
Hitran Corporation, Flemington, NJ 08822-1238 908-782-5525
† Hytronics Corporation, Clearwater, FL 34620 813-536-7861
§† JB Electronic Transformers Inc., Chicago, IL 60647 312-342-0080
Keytronics, Inc., Endicott, NY 13760 607-754-5405
† KIP Transformers Inc., Wolcott, CT 06716 203-758-7085
† Lenco Elctrns., Inc., McHenry, IL 60050 815-344-2900
Mag-Con, St. Paul, MN 55113 612-633-8820
MagneTek Power Technology Systems, MagneTek, Inc., Anaheim, CA 92805 714-956-9200
† Magnetico Inc., Holtsville, NY 11742 516-654-1166
MCI Transformer Corporation, Babylon, NY 11704 516-587-0510
§† Microtran Co. Inc., Valley Stream, NY 11582-0236 516-561-6050
† MTE Corp., Menomonee Falls, WI 53051 414-253-8200
MultiComp., Inc., Beaverton, OR 97006 503-626-4200
† Neshaminy Transformer Corp., Furlong, PA 18925 215-794-7411
† Northlake Engineering, Inc., Bristol, WI 53104-0370 414-857-9600
† OPT Industries, Inc., Phillipsburg, NJ 08865 908-454-2600
† Pacific Electro Dynamics, Inc., Redmond, WA 98073-9745 206-881-1700
Pacific Transformer Corp., Anaheim, CA 92807 ..... 714-779-0450;1-800-325-0501
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861 908-826-4700

§† Preferred Electronics, Inc., Westfield, MA 01086 ..... 413-568-2301;1-800-553-6374
† PTC Transformers, Bordentown, NJ 08505 609-298-8200
Pulse Engineering, Inc., San Diego, CA 92128 619-674-8100
Radio Television Products Corp., Douglas, AZ 85607 602-364-4438
RAE Company Inc., Indianapolis, IN 46239 317-351-1774
RCD Components, Inc., Manchester, NH 03109 603-669-0054
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
§† Rhombus Industries, Huntington Bch., CA 92649-1595 714-898-0960
SAE Power, Inc., Santa Clara, CA 95050 408-988-0700
Schott Corp., Wayzata, MN 55391 612-475-1173
Scientific Conversion, Inc., Novato, CA 94947 415-892-2323
Scientific Conversion, Inc., Novato, CA 94947 415-892-2323
† Sierra West Power Systems, Las Cruces, NM 88001 505-522-8828
† Sigma Electronics Inc., Houston, TX 77099 ..... 713-933-4700;800-874-7121
† Sigmapower, Inc, FPBSM Industries, Inc., Rancho Dominguez, CA 90220-6404 310-884-5200
§† Skyway Magnetics, Warner Springs, CA 92086-9714 619-782-3342
South American Development Corp., Poughkeepsie, NY 12590 914-452-1305
Standard Magnetic Corp., Garden Grove, CA 92641 714-379-5671
† Stangenes Industries, Inc., Palo Alto, CA 94303 415-493-0814
Texas Transformer Corp., Plano, TX 75086 214-424-1581
§† Thordarson Meissner, Components Corp. of Amer., Mt. Carmel, IL 62863 618-262-5121
§ Tokin America, Inc., San Jose, CA 95134 408-432-8020
Torad Coil Co., Inc., Wayne, NJ 07470 201-835-6195
† Torwico Elctrns. Inc., Lakewood, NJ 08701 908-364-1800
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
† Transformer Design , MTE Corporation, Menomonee Falls, WI 53051 414-253-8200
Transformer Engineering Corporation, Cleveland, OH 44134 216-741-5282
U.S. Transformer and Inductor, Cheyenne, WY 82007 800-584-9339
† Vanguard Electronics Co., Gardena, CA 90248 310-323-4100
Vernitron Corp., Precision Comps. Group, St. Petersburg, FL 33710 813-347-2181
§† Vitec Electronics Corp., Visalia, CA 93291 209-651-1535
† Wirebenders, Inc., Phoenix, AZ 85021-2824 602-861-1856
§† Zambre Co., Inc., Mountain View, CA 94043 415-968-9176
† ZMAN Magnetics, Kent, WA 98032 206-251-8064

Transformers, Isolation-5600

† Abbott Technologies, Inc., Sun Valley, CA 91352, 818-504-0644;1-800-367-8200 ..... A•2234
Advanced Components Inds., Inc., Div of Kaschke, Torrance, CA 90501, 310-328-0060 ..... A•2254
Albar, Inc., Lynnwood, WA 98036, 206-771-4006;800-822-5227 ..... A•2256
Allen Avionics, Inc., Mineola, NY 11501, 516-248-8080 ..... A•1514,1619
Altran Corporation, Crystal Lake, IL 60014, 815-455-5650 ..... A•2258
APX Technologies Inc., Hicksville, NY 11801, 516-433-1313 ..... A•2266
§ AT&T Microelectronics, Allentown, PA 18103, 1-800-372-2447;In Can.:1-800-553-2448 ..... A•2270
Bel Fuse, Jersey City, NJ 07302, 201-432-0463 ..... A•1515-1519,2276-2280,2283,2285-2287,2289-2291
BH Electronics, Inc., Burnsville, MN 55337, 612-894-9590 ..... A•2296-2297
† Bicron Electronics, Canaan, CT 06018, 203-824-5125 ..... A•2299-2300
† C & C Jetronic, Inc., Allentown, NJ 08501, 609-259-8855 ..... A•2302
Coilcraft, Cary, IL 60013, 708-639-2361 ..... A•1215
† Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ..... A•2305
§ Controlled Power Co., Troy, MI 48083, 313-528-3700;1-800-521-4792 ..... D•2254
Cramer Coil & Transformer Co., Inc., Saukville, WI 53080, 414-268-2150;414-375-5700 ..... A•2307
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180, 605-665-9301 ..... A•2312-2313
Datatronics, Inc., Romoland, CA 92585, 909-928-7700 ..... A•2314
† Del Electronics Corp., Valhalla, NY 10595, 914-686-3600 ..... A•2315
Eichhoff Electronics, Warwick, RI 02886, 401-738-1440;800-678-1040 ..... A•2323
§† Electromech, Inc., Irvington, NJ 07111, 201-318-7999 ..... A•2324-2325
Electro-Mech Co., Colorado Springs, CO 80915, 719-597-1620 ..... D•1673
Ensign Corp., Burr Ridge, IL 60521, 708-325-9343 ..... A•2326
† ESC Electronics Corp., Palisades Pk., NJ 07650, 201-947-0400 ..... A•2329
§† EWC, Inc., Englishtown, NJ 07726, 908-446-3110 ..... A•2331,2336,2338-2340,2342-2343,2345,2347
§ Hitran Corporation, Flemington, NJ 08822-1238, 908-782-5525 ..... A•2361
ISL Products Int'l, Ltd., Syosset, NY 11791-6093, 516-937-3475;800-626-6116 ..... A•2362
Jerome Industries Corp., Elizabeth, NJ 07201, 908-353-5700 ..... D•1760
JM Transformer Co., Inc., Farmingdale, NY 11735, 516-293-0475 ... A•2364-2366
† Kappa Technologies, Inc., Rahway, NJ 07065, 908-396-9400;1-800-223-0603 ..... A•2370-2373
† Lenco Elctrns., Inc., McHenry, IL 60050, 815-344-2900 ..... A•2375
Lumintech Inc., Irvington, NJ 07111, 201-374-1091 ..... A•2376
† Magnecomp, Inc., Pickens, SC 29671, 803-878-4700 ..... A•2377
Magnelab, Boulder, CO 80301-4696, 303-442-6700 ..... A•2378,2380,2382
§ Magnetek Triad, Huntington, IN 46750, 219-356-7100 ..... A•2383
† Magnetico Inc., Holtsville, NY 11742, 516-654-1166 ..... A•2391
MCI Transformer Corporation, Babylon, NY 11704, 516-587-0510 ..... A•2395,2397,2399-2403
§† Microtran Co. Inc., Valley Stream, NY 11582-0236, 516-561-6050 ..... A•2408,2411-2412,2414
† Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500 ..... A•1725
Mitchell Electronics Corp., Mt. Vernon, NY 10552, 914-699-3800 ..... A•2433
MultiComp., Inc., Beaverton, OR 97006, 503-626-4200 ..... A•2434-2435
Multi Products International, West Paterson, NJ 07424, 201-890-1344 ... A•2436
† North Hills Signal Processing, Syosset, NY 11791, 516-682-7740 ... A•2438-2440
† NWL Transformers, Bordentown, NJ 08505, 609-298-7300 ..... A•2437
† Oram High Voltage, Dayton, TX 77535, 409-258-5553 ..... D•1853
Panel Components Corp., Oskaloosa, IA 52577, 515-673-0097 ..... A•2443
PCA Electronics, Sepulveda, CA 91343, 818-892-0761 ..... A•1670-1671
PC Transformer Corp., West Babylon, NY 11704, 516-491-3300 .... A•2452-2453
† Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2455
Plitron Manufacturing, Inc., Downsview, Ont., CAN M3J 2N5, 416-667-9914 ..... A•2506
Powertronix Corp., Foster City, CA 94404, 415-345-6800 ..... A•2511
Prem Magnetics, Inc., McHenry, IL 60050, 815-385-2700 ..... A•2512
Renco Electronics, Inc., Deer Pk., NY 11729, 516-586-5566;1-800-645-5828 ..... A•2527-2529
RFI Corporation, Bay Shore, NY 11706, 516-231-6400 ..... A•2532
§† Rhombus Industries, Huntington Bch., CA 92649-1595, 714-898-0960 ... A•2533
† Signal Transformer Co., Inc., Insilco Corporation, Inwood, NY 11696, 516-239-5777 ..... A•2536
§† Staco Energy Products Co., Dayton, OH 45403, 513-253-1191 ..... A•2535
§ Stancor, White-Rodgers, Logansport, IN 46947, 219-722-2244 ..... A•2558,2564
Talema Electronic, Inc., Saint James, MO 65559, 314-265-5500 ..... A•2570
§ Tamura Corporation of America, Temecula, CA 92589-2230, 909-699-1270 ..... A•2571-2572,2577-2578
TMP Inc., Santa Ana, CA 92705, 714-558-8028 ..... A•2580
† Todd Systems, Inc., Yonkers, NY 10701, 914-963-3400 ..... A•2582,2584
† Toroid Corp. of Maryland, Salisbury, MD 21801, 410-860-0300 ..... A•2586,2590-2591
† Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314 ..... A•2594
† Transformer Technologies, Inc., Mt. Vernon, NY 10552, 914-668-1600 ... A•2598
Ulveco, Inc., Houston, TX 77042, 1-800-527-7042 ..... A•2601
Vernitron Corp., Precision Comps. Group, St. Petersburg, FL 33710, 813-347-2181 ..... A•2599
Wilco Corp., Indianapolis, IN 46268, 317-293-9300 ..... A•2605
† Xentek, Inc., Taiyo Yuden USA, Inc., San Marcos, CA 92069, 619-471-4001 ..... D•2308-2309
Abacus Controls Inc., Somerville, NJ 08876 908-526-6010
† ACD-Elcor Products, Bethel, CT 06801 203-743-3510
§ Acme Transformer, Acme Electric Corporation, Lumberton, NC 28358 ... 919-738-1121
Actown-Electrocoil, Inc., Spring Grove, IL 60081 815-675-6641
AFP ISOREG, AFP Transformers, Inc., Littleton, MA 01460 508-486-9483
American Magnetics, Carterville, IL 62918 618-985-4838
† American Monarch, Minneapolis, MN 55421 612-788-9161
Andover, Inc., Lafayette, IN 47904 317-447-1157
Arrow Hart Controls, Products Unlimited Corp., Sterling, IL 61081 815-626-0300
† Astrosystems, Inc., Lake Success, NY 11042 516-328-1600
ATC-Frost Magnetics Inc., Oakville,Ont., CANADA L6H 2R4 416-844-6681
§ Atlantic Magnetics, Inc., Pompano Beach, FL 33069 305-979-7920
Atlas Engineering Corp., Dorchester, MA 02121 617-445-7100
Automatic Coil Corp., Miami, FL 33147 305-696-6660
Avel Transformers Inc., New Milford, CT 06776 203-355-4711
† Axel Electronics, Inc., Subsidiary of FPBSM Industries Inc., Rancho Dominquez, CA 90220 718-291-3900
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
§ B & K Precision, Maxtec International Corp, Chicago, IL 60635 312-889-1448
Basler Electrics, Magnetics Product Grp., Highland, IL 62249 618-654-2341
Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
† Beta Transformer Tech. Corp., ILC Data Device Corp., Bohmia, NY 11716 516-244-7393
† B. G. Laboratories, Inc., Binghamton, NY 13904 607-722-2376
Caristrap International, Inc., Chomedey, Laval, QUEBEC, CANADA H7SIN8 1-800-361-9466
Carson Manufacturing Co., Inc., Indianapolis, IN 46220 317-257-3191
CET Technology, Hudson, NH 03051 603-883-5912
† Coast Coil Co., Coast Magnetics, Los Angeles, CA 90016 213-936-6188
§ Computer Power Inc., High Bridge, NJ 08829 ..... 908-638-8000;800-526-5088
† Corona Magnetics, Inc., Corona, CA 91719 909-735-7558
Custom Bobbin Windings, A & K Corporation, Zanesville, OH 43702-2369 614-452-6973
Dantel, Fresno, CA 93727 209-292-1111
Deltona Transformer Corp., DeLand, FL 32724 904-736-7900
† De Young Mfg., Inc., Kirkland, WA 98034 206-823-4798
† Dietz Design, Inc., Belton, MO 64012 816-331-4911
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012 605-296-3462
Dynapower Corporation, S. Burlington, VT 05407 802-860-7200
Electro Assemblies Corp., Northbrook, IL 60062-2319 708-498-6520
Electronetics, Inc., Everett, WA 98204 206-355-1855
† Electronic Transformer Corp., Paterson, NJ 07544-0487 201-942-2222
§ Elgar Electronics Corporation, San Diego, CA 92121 ..... 619-450-0085;800-733-5427
Elma Engineering, Palo Alto, CA 94303 415-494-7303
† Elnetic Electronics, Inc.:Plant Locations, Gardena, CA 90247 310-515-1546
Endicott Coil Co., Inc., Binghamton, NY 13905 607-797-1263
§ ENI, Div. of Astec America, Inc., Rochester, NY 14623 716-427-8300
Epco Products Inc., WAllkill, NY 12589 914-895-2033
§† EPE Technologies, Inc., Subsidiary of Square D, Costa Mesa, CA 92627 714-557-1636
Fee Fil-Mag, San Diego, CA 92123 619-569-6577
† Freed Transformer Co., Inc., Electronic Transformer Corp., Paterson, NJ 07544-0487 201-942-2222
GAR Enterprises dba KGS Electronics, Arcadia, CA 91006 818-574-1175
Gavagan Electronics, Danbury, CT 06810 203-748-5248
§ GC International Inc., Plano, TX 75074 214-423-8411
Gettysburg Transformer Corporation, Gettysburg, PA 17325 717-334-2191
Gowanda Electronics Corp., Gowanda, NY 14070 716-532-2234
Grand Transformer, Inc., Grand Haven, MI 49417 616-842-5430
§ Hammond Manufacturing Co., Buffalo, NY 14225 716-894-5710
High Voltage Systems, Inc., Universal Designs Corp., Chappaqua, NY 10514 914-238-8462
Hipotronics Inc., Brewster, NY 10509 914-279-8091
† Hisonic, Inc., Olathe, KS 66051 913-782-0012
Integrity Technology Corporation, Santa Clara, CA 95050 408-262-8640
§ James Electronics, Chicago, IL 60618 312-463-6500

† JB Electronic Transformers Inc., Chicago, IL 60647 312-342-0080
JBM Electronics, Inc., Bedford, NH 03110-6802 603-623-0222
§ Katronic Elektronic Ges.m.b.H., AUSTRIA 04762-5340
KGS Electronics, Inc., Arcadia, CA 91006 818-574-1175
† KIP Transformers Inc., Wolcott, CT 06716 203-758-7085
† L/C Magnetics, Anaheim, CA 92806 714-666-0787
LEPCO/Leonard Elec. Prods., Brownsville, TX 78521 210-546-1625
Long Island Transformer & Inductor, Baldwin, NY 11510 516-379-1465
Mag-Con, St. Paul, MN 55113 612-633-8820
MagneTek Power Conversion Systems, Teledyne, Inc., Anaheim, CA 92805 714-956-9200
† Magnetic Circuit Elements, Salinas, CA 93905 408-757-8752
§ Metermaster, Tempe, AZ 85282 602-431-0015
§ Micron Industries, Hillside, IL 60162 708-547-0900
Midcom, Inc., Watertown, SD 57201 605-886-4385
§ MTE Corp., Menomonee Falls, WI 53051 414-253-8200
† Neshaminy Transformer Corp., Furlong, PA 18925 215-794-7411
Nicollet Technologies Corp., Minneapolis, MN 55413 612-379-7919
† Northlake Engineering, Inc., Bristol, WI 53104-0370 414-857-9600
Oeco Corp., Milwaukie, OR 97222 503-659-7932
§ Opamp Labs, Inc., Los Angeles, CA 90038 213-934-3566
† OPT Industries, Inc., Phillipsburg, NJ 08865 908-454-2600
Pacific Transformer Corp., Anaheim, CA 92807 ..... 714-779-0450;1-800-325-0501
Para-Line Transformer Co., Inc., Alhambra, CA 91803 818-281-0222
Phenix Technologies, Accident, MD 21520 301-746-8118
† Plastic Capacitors, Inc., Chicago, IL 60639 312-489-2229
† Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
Potrans International Inc., Potrans Electrical Corp., Ltd., Irvine, CA 92714 714-975-1222
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861 908-826-4700
† Precision Components, Inc., Wilmington, IL 60481 708-543-6448
§† Preferred Electronics, Inc., Westfield, MA 01086 ..... 413-568-2301;1-800-553-6374
† PTC Transformers, Bordentown, NJ 08505 609-298-8200
Pulse Engineering, Inc., San Diego, CA 92128 619-674-8100
RAE Company Inc., Indianapolis, IN 46239 317-351-1774
RCD Components, Inc., Manchester, NH 03109 603-669-0054
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
Ritter Coil, Inc., Easton, PA 18043-3130 215-258-6780
Rutherford Research, Rutherford, NJ 07070 201-933-2091
SAE Power, Inc., Santa Clara, CA 95050 408-988-0700
Sanford-Miller Corp., Oceanside, NY 11572 ..... 516-763-0926;800-645-5900
Schauer Manufacturing, Cincinnati, OH 45242 513-791-3030
Schott Corp., Wayzata, MN 55391 612-475-1173
Schumacher Elect. Corp., Chicago, IL 60626 312-973-1600
† Scientific Technologies Inc., Control Components Div., Hayward, CA 94544-7831 ..... 510-471-9717;800-221-7060
Scientific Technologies Inc., Optical Sensor Div., Hayward, CA 94544 ... 510-471-9717
† Sencore, Sioux Falls, SD 57107 ..... 1-800-736-2673; 605-339-0100
§ Shape Electronics, Inc., The Wiremold Co., Lombard, IL 60148 ..... 708-620-8394; 1-800-367-5811
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
† Sigma Electronics Inc., Houston, TX 77099 ..... 713-933-4700;800-874-7121
† Sigmapower, Inc, FPBSM Industries, Inc., Rancho Dominguez, CA 90220-6404 310-884-5200
§† Skyway Magnetics, Warner Springs, CA 92086-9714 619-782-3342
§ Sola, Elk Grove Village, IL 60007-5666 708-439-2800
§ Square D Co., Palatine, IL 60067 708-397-2600
† Staco Transpower, Components Corp. of America, Mt. Carmel, IL 62863 618-262-5555
Standard Magnetic Corp., Garden Grove, CA 92641 714-379-5671
† Stangenes Industries, Inc., Palo Alto, CA 94303 415-493-0814
Sutton Designs, Inc., Ithaca, NY 14850 800-326-8119
† Technitrol, Philadelphia, PA 19134 215-426-9105
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291
Texas Transformer Corp., Plano, TX 75086 214-424-1581
§† Thordarson Meissner, Components Corp. of Amer., Mt. Carmel, IL 62863 618-262-5121
Toltec Industries, Inc., San Diego, CA 92154 619-423-0700
Torad Coil Co., Inc., Wayne, NJ 07470 201-835-6195
† Torema U.S.A., Inc., Houston, TX 77042 713-977-2500
Toroid Technologies, Inc., Woodbridge, Ont., CAN L4L 3P6 905-850-5122
† Torotron Corp., Mt. Vernon, NY 10550 914-664-2050
† Torwico Elctrns. Inc., Lakewood, NJ 08701 908-364-1800
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
† Transformer Design , MTE Corporation, Menomonee Falls, WI 53051 ... 414-253-8200
Transformer Engineering Corporation, Cleveland, OH 44134 216-741-5282
† Transmagnetics, Farmingdale, NY 11735 516-293-3100
† TTE, Incorporated, W. Los Angeles, CA 90064-1400 ..... 310-478-8224;800-776-7614
Universal Voltronics Div., Thermo Voltek Corp., Mt. Kisco, NY 10549 914-241-1300
U.R.D. America, Laguna Nigel, CA 92607 714-831-0111
The Vector Group, Inc., Horsham, PA 19044 1-800-523-3696
§† Vitec Electronics Corp., Visalia, CA 93291 209-651-1535
Vynckier, Inc., Hawthorne, NY 10532 714-896-0772
Western Multiplex Corp., Belmont, CA 94002 415-592-8832
The Winatic Corp., Electro-Technik Industries, Inc., Vestal, NY 13850 607-729-6318
WPI Group, Inc., Warner, NH 03278 603-456-3111
§† Zambre Co., Inc., Mountain View, CA 94043 415-968-9176

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§ Bel Fuse, Jersey City, NJ 07302, 201-432-0463 .... A•1515-1517,2276-2278,2283
† C & C Jetronic, Inc., Allentown, NJ 08501, 609-259-8855 ..... A•2302
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Advanced Components Inds., Inc., Div of Kaschke, Torrance, CA 90501 310-328-0060
† American Monarch, Minneapolis, MN 55421 612-788-9161
§ AT&T Microelectronics, Allentown, PA 18103 ..... 1-800-372-2447;In Can.:1-800-553-2448
Basler Electrics, Magnetics Product Grp., Highland, IL 62249 618-654-2341
BH Electronics, Inc., Burnsville, MN 55337 612-894-9590
CET Technology, Hudson, NH 03051 603-883-5912
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TMP Inc., Santa Ana, CA 92705 714-558-8028
Transformer Engineering Corporation, Cleveland, OH 44134 216-741-5282
§ Tripp Lite, Chicago, IL 60610-4188 312-329-1777
Ulveco, Inc., Houston, TX 77042 1-800-527-7042
§† Vitec Electronics Corp., Visalia, CA 93291 209-651-1535
§ Zambre Co., Inc., Mountain View, CA 94043 415-968-9176

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† Abbott Technologies, Inc., Sun Valley, CA 91352, 818-504-0644;1-800-367-8200 ..... A•2234
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† Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2455
† Shogyo International Corp., Great Neck, NY 11021-4799, 516-466-0911 .. A•2534
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§† Staco Energy Products Co., Dayton, OH 45403, 513-253-1191 ..... A•2535
§ Stancor, White-Rodgers, Logansport, IN 46947, 219-722-2244 ..... A•2558
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§ Todd Systems, Inc., Yonkers, NY 10701, 914-963-3400 ..... A•2582-2585
§ Acme Transformer, Acme Electric Corporation, Lumberton, NC 28358 ... 919-738-1121
Actown-Electrocoil, Inc., Spring Grove, IL 60081 815-675-6641
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ATC-Frost Magnetics Inc., Oakville,Ont., CANADA L6H 2R4 416-844-6681
† Avionic Instruments, REA International Inc., Avenel, NJ 07001 908-388-3500

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§† Aydin Corporation (West), San Jose, CA 95119-1371 ... 408-629-1100
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† Beta Transformer Tech. Corp., ILC Data Device Corp., Bohmia, NY 11716 ... 516-244-7393
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† Communication Coil Inc., Chicago, IL 60634 ... 312-637-1333
§ Computer Power Inc., High Bridge, NJ 08829 ... 908-638-8000;800-526-5088
† Controlled Power Co., Troy, MI 48083 ... 313-528-3700;1-800-521-4792
CUI Stack Inc., Beaverton, OR 97005 ... 503-643-4899
Custom Bobbin Windings, A & K Corporation, Zanesville, OH 43702-2369 ... 614-452-6973
† Cypress Magnetics, Inc., Rancho Cucamonga, CA 91730 ... 909-987-3570
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 ... 605-665-9301
Dantel, Fresno, CA 93727 ... 209-292-1111
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† De Young Mfg., Inc., Kirkland, WA 98034 ... 206-823-4798
† Dietz Design, Inc., Belton, MO 64012 ... 816-331-4911
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Electrocom Industries, S. Bend, IN 46615 ... 219-232-2743
§† Electromech, Inc., Irvington, NJ 07111 ... 201-318-7999
Electronetics, Inc., Everett, WA 98204 ... 206-355-1855
† Electronic Transformer Corp., Paterson, NJ 07544-0487 ... 201-942-2222
§ Elgar Electronics Corporation, San Diego, CA 92121 ... 619-450-0085;800-733-5427
Elma Engineering, Palo Alto, CA 94303 ... 415-494-7303
† Elnetic Electronics, Inc.:Plant Locations, Gardena, CA 90247 ... 310-515-1546
§† EPE Technologies, Inc., Subsidiary of Square D, Costa Mesa, CA 92627 ... 714-557-1636
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Integrity Technology Corporation, Santa Clara, CA 95050 ... 408-262-8640
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Relay Specialties, Oakland, NJ 07436 ... 201-337-1000
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§ Shure Brothers Inc., Evanston, IL 60202-3696 ... 708-866-2200
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§† Skyway Magnetics, Warner Springs, CA 92086-9714 ... 619-782-3342
South American Development Corp., Poughkeepsie, NY 12590 ... 914-452-1305
§ Speco Div., Components Specialties, Inc., Lindenhurst, NY 11757-0624 ... 516-957-8700;800-645-5516
§ Square D Co., Palatine, IL 60067 ... 708-397-2600
† Staco Transpower, Components Corp. of America, Mt. Carmel, IL 62863 ... 618-262-5555
Standard Magnetic Corp., Garden Grove, CA 92641 ... 714-379-5671
§ Tamura Corporation of America, Temecula, CA 92589-2230 ... 909-699-1270
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§† Thordarson Meissner, Components Corp. of Amer., Mt. Carmel, IL 62863 ... 618-262-5121
TMP Inc., Santa Ana, CA 92705 ... 714-558-8028
† Toroid Corp. of Maryland, Salisbury, MD 21801 ... 410-860-0300
† Torotel Prods. Inc., Grandview, MO 64030-3199 ... 816-761-6314
† Torwico Elctrns. Inc., Lakewood, NJ 08701 ... 908-364-1800
† Trans American Transformer, E. Setauket, NY 11733 ... 516-928-0762
Ulveco, Inc., Houston, TX 77042 ... 1-800-527-7042
U.R.D. America, Laguna Nigel, CA 92607 ... 714-831-0111
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The Winatic Corp., Electro-Technik Industries, Inc., Vestal, NY 13850 ... 607-729-6318
Wirebenders, Inc., Phoenix, AZ 85021-2824 ... 602-861-1856

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† Bicron Electronics, Canaan, CT 06018, 203-824-5125 ... A•2299
† Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ... A•2305
† Fernwood Transformer Co., Transistor Devices Inc., Belvidere, NJ 07823, 908-475-3207 ... A•2355
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† Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ... A•2455
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Abbott Technologies, Inc., Sun Valley, CA 91352 ... 818-504-0644;1-800-367-8200
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† Atlas Engineering Corp., Dorchester, MA 02121 ... 617-445-7100
† Axel Electronics, Inc., Subsidiary of FPBSM Industries Inc., Rancho Dominquez, CA 90220 ... 718-291-3900
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Basler Elec., Electronic Product Group, Highland, IL 62249 ... 618-654-2341; 800-645-2074
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Berkshire Transformer Corp., Kent, CT 06757 ... 203-927-3541
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† Coast Magnetics, Adams-Maxwell Division, Inglewood, CA 90302-1284 ... 310-673-3245
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Cross Electronics, Warrendale, PA 15086 ... 412-776-1591
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† Dietz Design, Inc., Belton, MO 64012 ... 816-331-4911
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† Sigmapower, Inc, FPBSM Industries, Inc., Rancho Dominguez, CA 90220-6404 ... 310-884-5200
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Tokin America, Inc., San Jose, CA 95134 ... 408-432-8020
Torad Coil Co., Inc., Wayne, NJ 07470 ... 201-835-6195
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† Trans American Transformer, E. Setauket, NY 11733 ... 516-928-0762
† Vanguard Electronics Co., Gardena, CA 90248 ... 310-323-4100
Vernitron Corp., Precision Comps. Group, St. Petersburg, FL 33710 ... 813-347-2181
The Winatic Corp., Electro-Technik Industries, Inc., Vestal, NY 13850 ... 607-729-6318
§† Zambre Co., Inc., Mountain View, CA 94043 ... 415-968-9176

Transformers, Matching-5600

Amplifier Research, Souderton, PA 18964-9990, 215-723-8181 ... D•1003
APX Technologies Inc., Hicksville, NY 11801, 516-433-1313 ... A•2267
Bel Fuse, Jersey City, NJ 07302, 201-432-0463 ... A•2285
BH Electronics, Inc., Burnsville, MN 55337, 612-894-9590 ... A•2297
Caddell-Burns Mfg., Mineola, NY 11501-3508, 516-746-2310 ... A•1198
† C & C Jetronic, Inc., Allentown, NJ 08501, 609-259-8855 ... A•2302
† Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ... A•2305
† Cramer Coil & Transformer Co., Inc., Saukville, WI 53080, 414-268-2150;414-375-5700 ... A•2306
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180, 605-665-9301 ... A•2312
Datatronics, Inc., Romoland, CA 92585, 909-928-7700 ... A•2314
Ensign Corp., Burr Ridge, IL 60521, 708-325-9343 ... A•2326
† ESC Electronics Corp., Palisades Pk., NJ 07650, 201-947-0400 ... A•2329
§† EWC, Inc., Englishtown, NJ 07726, 908-446-3110 ... A•2331
† Hisonic, Inc., Olathe, KS 66051, 913-782-0012 ... A•2360

IBM United States/US OEM Marketing, White Plains, NY 10604, 1-800-969-8643 ..... D•1117
ISL Products Int'l, Ltd., Syosset, NY 11791-6093, 516-937-3475;800-626-6116 ..... A•2362
JM Transformer Co., Inc., Farmingdale, NY 11735, 516-293-0475 ..... A•2364
Kappa Technologies, Inc., Rahway, NJ 07065, 908-396-9400;1-800-223-0603 ..... A•2370,2372
Krohn-Hite Corp., Avon, MA 02322, 508-580-1660 ..... D•1291
Magnelab, Boulder, CO 80301-4696, 303-442-6700 ..... A•2378
§† **Microtran Co. Inc., Valley Stream, NY 11582-0236, 516-561-6050** ..... A•2414
Mitchell Electronics Corp., Mt. Vernon, NY 10552, 914-699-3800 ..... A•2433
§ **Multi Products International, West Paterson, NJ 07424, 201-890-1344** ... A•2436
† **North Hills Signal Processing, Syosset, NY 11791, 516-682-7740** ... A•2438-2439
† **Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064** ..... A•2455
Plitron Manufacturing, Inc., Downsview, Ont., CAN M3J 2N5, 416-667-9914 ..... A•2506
Prem Magnetics, Inc., McHenry, IL 60050, 815-385-2700 ..... A•2518,2525
§† **Rhombus Industries, Huntington Bch., CA 92649-1595, 714-898-0960** ... A•2533
† **Shogyo International Corp., Great Neck, NY 11021-4799, 516-466-0911** ..... A•2534, D•1921
§ **Tamura Corporation of America, Temecula, CA 92589-2230, 909-699-1270** ..... A•2572
† **Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314** ..... A•2594
† **ZMAN Magnetics, Kent, WA 98032, 206-251-8064** ..... A•2606
Actown-Electrocoil, Inc., Spring Grove, IL 60081 815-675-6641
American Magnetics, Carterville, IL 62918 618-985-4838
§ AT&T Microelectronics, Allentown, PA 18103 ..... 1-800-372-2447;In Can.:1-800-553-2448
ATC-Frost Magnetics Inc., Oakville,Ont., CANADA L6H 2R4 416-844-6681
† Automatic Coil Corp., Miami, FL 33147 305-696-6660
† Axel Electronics, Inc., Subsidiary of FPBSM Industries Inc., Rancho Dominquez, CA 90220 718-291-3900
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
† BG Electronics, EPC Corp., Mt. Vernon, NY 10550-4430 914-664-5591
† B. G. Laboratories, Inc., Binghamton, NY 13904 607-722-2376
§ Bogen Communications, Inc., Sound Prods., Ramsey, NJ 07446 201-934-8500
† Caddell Coil Corp., Middletown Springs, VT 05757 802-235-2019
CET Technology, Hudson, NH 03051 603-883-5912
† Coast Coil Co., Coast Magnetics, Los Angeles, CA 90016 213-936-6188
† Coil-Q Corp., Bronxville, NY 10708 914-337-4775
# Computer System Products, Minneapolis, MN 55447 ..... 612-476-6866;800-422-2537
† Corona Magnetics, Inc., Corona, CA 91719 909-735-7558
CUI Stack Inc., Beaverton, OR 97005 503-643-4899
§ Damac Products, Inc., Santa Fe Springs, CA 90670 310-946-0881
Dantel, Fresno, CA 93727 209-292-1111
Data Set Cable Co., Inc., Ridgefield, CT 06877 ..... 203-438-9684;800-344-9684
Deltona Transformer Corp., DeLand, FL 32724 904-736-7900
† De Young Mfg., Inc., Kirkland, WA 98034 206-823-4798
† Dietz Design, Inc., Belton, MO 64012 816-331-4911
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012 605-296-3462
† Elcom Systems, Inc., Boca Raton, FL 33487 407-994-1774
Electro Assemblies Corp., Northbrook, IL 60062-2319 708-498-6520
Electrocom Industries, S. Bend, IN 46615 219-232-2743
Electronetics, Inc., Everett, WA 98204 206-355-1855
† Electronic Transformer Corp., Paterson, NJ 07544-0487 201-942-2222
† Elnetic Electronics, Inc.:Plant Locations, Gardena, CA 90247 310-515-1546
§ ENI, Div. of Astec America, Inc., Rochester, NY 14623 716-427-8300
§ Fee Fil-Mag, San Diego, CA 92123 619-569-6577
† Freed Transformer Co., Inc., Electronic Transformer Corp., Paterson, NJ 07544-0487 201-942-2222
† Frequency Selective Networks, Woodside, NY 11377 718-424-7500
Gavagan Electronics, Danbury, CT 06810 203-748-5248
§ GC International Inc., Plano, TX 75074 214-423-8411
§ GC-Thorsen, Rockford, IL 61105-1209 815-968-9661
§ Hammond Manufacturing Co., Buffalo, NY 14225 716-894-5710
Hitran Corporation, Flemington, NJ 08822-1238 908-782-5525
Integrity Technology Corporation, Santa Clara, CA 95050 408-262-8640
§ James Electronics, Chicago, IL 60618 312-463-6500
§† JB Electronic Transformers Inc., Chicago, IL 60647 312-342-0080
Jerome Industries Corp., Elizabeth, NJ 07201 908-353-5700
KGS Electronics, Inc., Arcadia, CA 91006 818-574-1175
† Lenco Elctrns., Inc., McHenry, IL 60050 815-344-2900
§ Leviton Telcom, Leviton Manufacturing, Bothell, WA 98021-4416 ..... 206-485-4288; 206-486-2222
Long Island Transformer & Inductor, Baldwin, NY 11510 516-379-1465
† Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710 813-347-2181
Mag-Con, St. Paul, MN 55113 612-633-8820
† Magnecomp, Inc., Pickens, SC 29671 803-878-4700
§ Magnetek Triad, Huntington, IN 46750 219-356-7100
† Magnetic Circuit Elements, Salinas, CA 93905 408-757-8752
† Magnetic Component Engineering, Inc., Inglewood, CA 90301 310-677-6600
† Magnetico Inc., Holtsville, NY 11742 516-654-1166
MCI Transformer Corporation, Babylon, NY 11704 516-587-0510
§ MG Electronics, Hauppauge, NY 11788 516-582-3400
Micro-Coax, Collegeville, PA 19426 215-489-3700
MicroSignals Inc., LIC, NY 11101 ..... 718-937-7955;718-937-0391;800-648-2252
Midcom, Inc., Watertown, SD 57201 605-886-4385
† MTE Corp., Menomonee Falls, WI 53051 414-253-8200
† Northlake Engineering, Inc., Bristol, WI 53104-0370 414-857-9600
Oeco Corp., Milwaukie, OR 97222 503-659-7932
† Onan Power/Electronics, Minneapolis, MN 55344-3577 612-943-4600
† OPT Industries, Inc., Phillipsburg, NJ 08865 908-454-2600
Pacific Transformer Corp., Anaheim, CA 92807 ..... 714-779-0450;1-800-325-0501
§ Palomar Engineers, Escondido, CA 92046 619-747-3343
§ Panduit Corp., Tinley Park, IL 60477-0981 800-777-3300
Para-Line Transformer Co., Inc., Alhambra, CA 91803 818-281-0222
PC Transformer Corp., West Babylon, NY 11704 516-491-3300
§ Philmore Manufacturing, Rockford, IL 61125-1386 815-229-7773
† Piconics, Incorporated, Tyngsboro, MA 01879 508-649-7501
† Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861 908-826-4700
† Precision Components, Inc., Wilmington, IL 60481 708-543-6448
† Premier Magnetics Inc., Aliso Viejo, CA 92656 714-362-4211
† PTC Transformers, Bordentown, NJ 08505 609-298-8200
Pulse Engineering, Inc., San Diego, CA 92128 619-674-8100
Radio Television Products Corp., Douglas, AZ 85607 602-364-4438
RAE Company Inc., Indianapolis, IN 46239 317-351-1774
† Sabre Communications Corp., Sioux City, IA 51102 712-258-6690
Schott Corp., Wayzata, MN 55391 612-475-1173
Servo Corporation of America, Hicksville, NY 11801-5259 516-938-9700
§ Sescom, Inc., Henderson, NV 89015-4249 702-565-3400
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
§ Shure Brothers Inc., Evanston, IL 60202-3696 708-866-2200
† Sigma Electronics Inc., Houston, TX 77099 ..... 713-933-4700;800-874-7121
§ Sitco Antennas Div.of Simplicity Tool Corp., Portland, OR 97220 503-253-2000
§† Skyway Magnetics, Warner Springs, CA 92086-9714 619-782-3342
South American Development Corp., Poughkeepsie, NY 12590 914-452-1305
§ Speco Div., Components Specialties, Inc., Lindenhurst, NY 11757-0624 ..... 516-957-8700;800-645-5516
† Staco Transpower, Components Corp. of America, Mt. Carmel, IL 62863 618-262-5555
§ Stancor, White-Rodgers, Logansport, IN 46947 219-722-2244
§ Terminal Data Corp., Rockville, MD 20855 301-921-8282
Texas Transformer Corp., Plano, TX 75086 214-424-1581
§† Thordarson Meissner, Components Corp. of Amer., Mt. Carmel, IL 62863 618-262-5121
TMP Inc., Santa Ana, CA 92705 714-558-8028
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
Toltec Industries, Inc., San Diego, CA 92154 619-423-0700
† Torema U.S.A., Inc., Houston, TX 77042 713-977-2500
† Torotron Corp., Mt. Vernon, NY 10550 914-664-2050
† Torwico Elctrns. Inc., Lakewood, NJ 08701 908-364-1800
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
† TTE, Incorporated, W. Los Angeles, CA 90064-1400 ..... 310-478-8224;800-776-7614
Unadilla Antenna Mfg. Co., Andover, MA 01810 508-475-7831
U.R.D. America, Laguna Nigel, CA 92607 714-831-0111
† Vanguard Electronics Co., Gardena, CA 90248 310-323-4100
Vernitron Corp., Precision Comps. Group, St. Petersburg, FL 33710 813-347-2181
§ Vitec Electronics Corp., Visalia, CA 93291 209-651-1535
Western Multiplex Corp., Belmont, CA 94002 415-592-8832
Wide Band Engineering Co., Inc., Phoenix, AZ 85036 602-254-1570
The Winatic Corp., Electro-Technik Industries, Inc., Vestal, NY 13850 607-729-6318
Wirebenders, Inc., Phoenix, AZ 85021-2824 602-861-1856
§ Zambre Co., Inc., Mountain View, CA 94043 415-968-9176

Transformers, Microphone-5600

APX Technologies Inc., Hicksville, NY 11801, 516-433-1313 ..... A•2267
ISL Products Int'l, Ltd., Syosset, NY 11791-6093, 516-937-3475;800-626-6116 ..... D•1041
Magnelab, Boulder, CO 80301-4696, 303-442-6700 ..... A•2380
§† **Microtran Co. Inc., Valley Stream, NY 11582-0236, 516-561-6050** ..... A•2406
† **Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064** ..... A•2455
† Accusonic Products, Global Market Development, New Hyde Park, NY 11040 516-437-6000
Actown-Electrocoil, Inc., Spring Grove, IL 60081 815-675-6641
American Magnetics, Carterville, IL 62918 618-985-4838
ATC-Frost Magnetics Inc., Oakville,Ont., CANADA L6H 2R4 416-844-6681
† Automatic Coil Corp., Miami, FL 33147 305-696-6660
Bel Fuse, Jersey City, NJ 07302 201-432-0463
† B. G. Laboratories, Inc., Binghamton, NY 13904 607-722-2376
CET Technology, Hudson, NH 03051 603-883-5912
† De Young Mfg., Inc., Kirkland, WA 98034 206-823-4798
§ Direct Sound Corporation, Boston, MA 02116 1-800-372-1616
Electro Assemblies Corp., Northbrook, IL 60062-2319 708-498-6520
Electronetics, Inc., Everett, WA 98204 206-355-1855
† Electronic Transformer Corp., Paterson, NJ 07544-0487 201-942-2222
† Elnetic Electronics, Inc.:Plant Locations, Gardena, CA 90247 310-515-1546
† Freed Transformer Co., Inc., Electronic Transformer Corp., Paterson, NJ 07544-0487 201-942-2222
§ Hammond Manufacturing Co., Buffalo, NY 14225 716-894-5710
§ James Electronics, Chicago, IL 60618 312-463-6500
JB Electronic Transformers Inc., Chicago, IL 60647 312-342-0080
Lenco Elctrns., Inc., McHenry, IL 60050 815-344-2900
§ Magnetek Triad, Huntington, IN 46750 219-356-7100
† Magnetico Inc., Holtsville, NY 11742 516-654-1166
Midcom, Inc., Watertown, SD 57201 605-886-4385
Mitchell Electronics Corp., Mt. Vernon, NY 10552 914-699-3800
Multi Products International, West Paterson, NJ 07424 201-890-1344
† OPT Industries, Inc., Phillipsburg, NJ 08865 908-454-2600
Para-Line Transformer Co., Inc., Alhambra, CA 91803 818-281-0222
§ Paso Sound Products, Pelham, NY 10803 914-738-4800
† Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861 908-826-4700
Prem Magnetics, Inc., McHenry, IL 60050 815-385-2700
† PTC Transformers, Bordentown, NJ 08505 609-298-8200
§ Sescom, Inc., Henderson, NV 89015-4249 702-565-3400
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
§ Shure Brothers Inc., Evanston, IL 60202-3696 708-866-2200

§† Skyway Magnetics, Warner Springs, CA 92086-9714 619-782-3342
§ Stancor, White-Rodgers, Logansport, IN 46947 219-722-2244
§ Tamura Corporation of America, Temecula, CA 92589-2230 909-699-1270
§ Thordarson Meissner, Components Corp. of Amer., Mt. Carmel, IL 62863 618-262-5121
† Torotel Prods. Inc., Grandview, MO 64030-3199 816-761-6314
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
Vitec Electronics Corp., Visalia, CA 93291 209-651-1535

Transformers, Mixing-5600

MCI Transformer Corporation, Babylon, NY 11704, 516-587-0510 ..... A•2402
† Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500 ..... A•1725
North Hills Signal Processing, Syosset, NY 11791, 516-682-7740 ..... A•2439
† Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2455
American Magnetics, Carterville, IL 62918 618-985-4838
§ Atlantic Magnetics, Inc., Pompano Beach, FL 33069 305-979-7920
Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
† B. G. Laboratories, Inc., Binghamton, NY 13904 607-722-2376
Coast Coil Co., Coast Magnetics, Los Angeles, CA 90016 213-936-6188
† Coil-Q Corp., Bronxville, NY 10708 914-337-4775
† Communication Coil Inc., Chicago, IL 60634 312-637-1333
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 605-665-9301
† De Young Mfg., Inc., Kirkland, WA 98034 206-823-4798
† Dietz Design, Inc., Belton, MO 64012 816-331-4911
Electro Assemblies Corp., Northbrook, IL 60062-2319 708-498-6520
† Electronic Transformer Corp., Paterson, NJ 07544-0487 201-942-2222
† Elnetic Electronics, Inc.:Plant Locations, Gardena, CA 90247 310-515-1546
† Freed Transformer Co., Inc., Electronic Transformer Corp., Paterson, NJ 07544-0487 201-942-2222
† Frequency Selective Networks, Woodside, NY 11377 718-424-7500
GC International Inc., Plano, TX 75074 214-423-8411
§ Hammond Manufacturing Co., Buffalo, NY 14225 716-894-5710
§ James Electronics, Chicago, IL 60618 312-463-6500
† Magnecomp, Inc., Pickens, SC 29671 803-878-4700
§ Magnetek Triad, Huntington, IN 46750 219-356-7100
† Magnetic Circuit Elements, Salinas, CA 93905 408-757-8752
§† Microtran Co. Inc., Valley Stream, NY 11582-0236 516-561-6050
Midcom, Inc., Watertown, SD 57201 605-886-4385
Mitchell Electronics Corp., Mt. Vernon, NY 10552 914-699-3800
Neshaminy Transformer Corp., Furlong, PA 18925 215-794-7411
† OPT Industries, Inc., Phillipsburg, NJ 08865 908-454-2600
† Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
† Sigma Electronics Inc., Houston, TX 77099 ..... 713-933-4700;800-874-7121
§ Tamura Corporation of America, Temecula, CA 92589-2230 909-699-1270
§ Thordarson Meissner, Components Corp. of Amer., Mt. Carmel, IL 62863 618-262-5121
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
† Torotel Prods. Inc., Grandview, MO 64030-3199 816-761-6314
† Torotron Corp., Mt. Vernon, NY 10550 914-664-2050
† Torwico Elctrns. Inc., Lakewood, NJ 08701 908-364-1800
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
† TTE, Incorporated, W. Los Angeles, CA 90064-1400 ..... 310-478-8224;800-776-7614
† Vanguard Electronics Co., Gardena, CA 90248 310-323-4100
Vitec Electronics Corp., Visalia, CA 93291 209-651-1535

Transformers, Modem/Coupler-5600

† Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ..... A•2305
Cramer Coil & Transformer Co., Inc., Saukville, WI 53080, 414-268-2150;414-375-5700 ..... A•2308
Fee Fil-Mag, San Diego, CA 92123, 619-569-6577 ..... A•2350
JBM Electronics, Inc., Bedford, NH 03110-6802, 603-623-0222 ..... A•2363
Midcom, Inc., Watertown, SD 57201, 605-886-4385 ..... A•2425-2427,2429-2431
§ Stancor, White-Rodgers, Logansport, IN 46947, 219-722-2244 ..... A•2564
Vernitron Corp., Precision Comps. Group, St. Petersburg, FL 33710, 813-347-2181 ..... A•2599
Advanced Components Inds., Inc., Div of Kaschke, Torrance, CA 90501 310-328-0060
ATC-Frost Magnetics Inc., Oakville,Ont., CANADA L6H 2R4 416-844-6681
C & C Jetronic, Inc., Allentown, NJ 08501 609-259-8855
CET Technology, Hudson, NH 03051 603-883-5912
CUI Stack Inc., Beaverton, OR 97005 503-643-4899
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012 605-296-3462
† Hytronics Corporation, Clearwater, FL 34620 813-536-7861
ISL Products Int'l, Ltd., Syosset, NY 11791-6093 ..... 516-937-3475;800-626-6116
§ James Electronics, Chicago, IL 60618 312-463-6500
§† Microtran Co. Inc., Valley Stream, NY 11582-0236 516-561-6050
† OPT Industries, Inc., Phillipsburg, NJ 08865 908-454-2600
Prem Magnetics, Inc., McHenry, IL 60050 815-385-2700
§† Rhombus Industries, Huntington Bch., CA 92649-1595 714-898-0960
Schott Corp., Wayzata, MN 55391 612-475-1173
Tamura Corporation of America, Temecula, CA 92589-2230 909-699-1270
TMP Inc., Santa Ana, CA 92705 714-558-8028

Transformers, Modulation-5600

Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012, 605-296-3462 ..... A•2319
Hitran Corporation, Flemington, NJ 08822-1238, 908-782-5525 ..... A•2361
Magnelab, Boulder, CO 80301-4696, 303-442-6700 ..... A•2380
† NWL Transformers, Bordentown, NJ 08505, 609-298-7300 ..... A•2437
† Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2455
American Magnetics, Carterville, IL 62918 618-985-4838
ATC-Frost Magnetics Inc., Oakville,Ont., CANADA L6H 2R4 416-844-6681
§ Atlantic Magnetics, Inc., Pompano Beach, FL 33069 305-979-7920
† Axel Electronics, Inc., Subsidiary of FPBSM Industries Inc., Rancho Dominquez, CA 90220 718-291-3900
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
† B. G. Laboratories, Inc., Binghamton, NY 13904 607-722-2376
C & C Jetronic, Inc., Allentown, NJ 08501 609-259-8855
CET Technology, Hudson, NH 03051 603-883-5912
† Communication Coil Inc., Chicago, IL 60634 312-637-1333
† Del Electronics Corp., Valhalla, NY 10595 914-686-3600
† De Young Mfg., Inc., Kirkland, WA 98034 206-823-4798
† Dietz Design, Inc., Belton, MO 64012 816-331-4911
† Electronic Transformer Corp., Paterson, NJ 07544-0487 201-942-2222
† Elnetic Electronics, Inc.:Plant Locations, Gardena, CA 90247 310-515-1546
† Freed Transformer Co., Inc., Electronic Transformer Corp., Paterson, NJ 07544-0487 201-942-2222
† Frequency Selective Networks, Woodside, NY 11377 718-424-7500
Gavagan Electronics, Danbury, CT 06810 203-748-5248
Grand Transformer, Inc., Grand Haven, MI 49417 616-842-5430
§ James Electronics, Chicago, IL 60618 312-463-6500
† Lenco Elctrns., Inc., McHenry, IL 60050 815-344-2900
Mag-Con, St. Paul, MN 55113 612-633-8820
§ Magnetek Triad, Huntington, IN 46750 219-356-7100
§† Microtran Co. Inc., Valley Stream, NY 11582-0236 516-561-6050
† Northlake Engineering, Inc., Bristol, WI 53104-0370 414-857-9600
Oeco Corp., Milwaukie, OR 97222 503-659-7932
† Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861 908-826-4700
Prem Magnetics, Inc., McHenry, IL 60050 815-385-2700
† PTC Transformers, Bordentown, NJ 08505 609-298-8200
Radio Television Products Corp., Douglas, AZ 85607 602-364-4438
§† Rhombus Industries, Huntington Bch., CA 92649-1595 714-898-0960
Schott Corp., Wayzata, MN 55391 612-475-1173
§† Skyway Magnetics, Warner Springs, CA 92086-9714 619-782-3342
Staco Transpower, Components Corp. of America, Mt. Carmel, IL 62863 618-262-5555
Standard Magnetic Corp., Garden Grove, CA 92641 714-379-5671
§ Thordarson Meissner, Components Corp. of Amer., Mt. Carmel, IL 62863 618-262-5121
† Torotel Prods. Inc., Grandview, MO 64030-3199 816-761-6314
† Torwico Elctrns. Inc., Lakewood, NJ 08701 908-364-1800
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
Vitec Electronics Corp., Visalia, CA 93291 209-651-1535
§† Zambre Co., Inc., Mountain View, CA 94043 415-968-9176

Transformers, Output-5600

APX Technologies Inc., Hicksville, NY 11801, 516-433-1313 ..... A•2266-2267
†# Cletronics Inc., Medina, OH 44256-9623, 216-722-3030 ..... A•2388
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012, 605-296-3462 ..... A•2318
Eichhoff Electronics, Warwick, RI 02886, 401-738-1440;800-678-1040 ..... A•2323
EWC, Inc., Englishtown, NJ 07726, 908-446-3110 ..... A•2331-2332,2338,2345
Industrial Test Equipment Co., Inc., Port Washington, NY 11050, 516-883-1700 ..... D•1012
ISL Products Int'l, Ltd., Syosset, NY 11791-6093, 516-937-3475;800-626-6116 ..... A•2362
JM Transformer Co., Inc., Farmingdale, NY 11735, 516-293-0475 ..... A•2364,2366-2367
† Lenco Elctrns., Inc., McHenry, IL 60050, 815-344-2900 ..... A•2374
† Magnecomp, Inc., Pickens, SC 29671, 803-878-4700 ..... A•2377
† Magnetico Inc., Holtsville, NY 11742, 516-654-1166 ..... A•2391
MCI Transformer Corporation, Babylon, NY 11704, 516-587-0510 ... A•2397,2401
§† Microtran Co. Inc., Valley Stream, NY 11582-0236, 516-561-6050 ..... A•2406,2410,2412,2421-2423
MultiComp., Inc., Beaverton, OR 97006, 503-626-4200 ..... A•2434-2435
† NWL Transformers, Bordentown, NJ 08505, 609-298-7300 ..... A•2437
Para-Line Transformer Co., Inc., Alhambra, CA 91803, 818-281-0222 ..... A•2444
PC Transformer Corp., West Babylon, NY 11704, 516-491-3300 ..... A•2447,2450,2453
† Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2455
Powertronix Corp., Foster City, CA 94404, 415-345-6800 ..... A•2509-2510
Prem Magnetics, Inc., McHenry, IL 60050, 815-385-2700 ..... A•2512
† Shogyo International Corp., Great Neck, NY 11021-4799, 516-466-0911 ..... A•2534, D•1921
§ Tamura Corporation of America, Temecula, CA 92589-2230, 909-699-1270 ..... A•2577
† Toroid Corp. of Maryland, Salisbury, MD 21801, 410-860-0300 ..... A•2586-2587
† Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314 ..... A•2595
Abacus Controls Inc., Somerville, NJ 08876 908-526-6010
Abbott Technologies, Inc., Sun Valley, CA 91352 ..... 818-504-0644;1-800-367-8200
Actown-Electrocoil, Inc., Spring Grove, IL 60081 815-675-6641
Amecon, Inc., Anaheim, CA 92805 ..... 714-634-2220;800-392-2292
American Magnetics, Carterville, IL 62918 618-985-4838
† American Monarch, Minneapolis, MN 55421 612-788-9161
§ AT&T Microelectronics, Allentown, PA 18103 ..... 1-800-372-2447;In Can.:1-800-553-2448
ATC-Frost Magnetics Inc., Oakville,Ont., CANADA L6H 2R4 416-844-6681
† Axel Electronics, Inc., Subsidiary of FPBSM Industries Inc., Rancho Dominquez, CA 90220 718-291-3900
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
Basler Elec., Electronic Product Group, Highland, IL 62249 ..... 618-654-2341; 800-645-2074
† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635 714-447-2300
Bel Fuse, Jersey City, NJ 07302 201-432-0463
Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
Bey Electric, Inc., Lincoln Park, NJ 07035 201-694-5000

† B. G. Laboratories, Inc., Binghamton, NY 13904 607-722-2376
C & C Jetronic, Inc., Allentown, NJ 08501 609-259-8855
† Coast Coil Co., Coast Magnetics, Los Angeles, CA 90016 213-936-6188
Coil-Q Corp., Bronxville, NY 10708 914-337-4775
† Communication Coil Inc., Chicago, IL 60634 312-637-1333
§ Computer Power Inc., High Bridge, NJ 08829 ..... 908-638-8000;800-526-5088
† Corona Magnetics, Inc., Corona, CA 91719 909-735-7558
Custom Bobbin Windings, A & K Corporation, Zanesville, OH 43702-2369 614-452-6973
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 605-665-9301
† Del Electronics Corp., Valhalla, NY 10595 914-686-3600
Deltona Transformer Corp., DeLand, FL 32724 904-736-7900
† De Young Mfg., Inc., Kirkland, WA 98034 206-823-4798
† Dietz Design, Inc., Belton, MO 64012 816-331-4911
§† Electromech, Inc., Irvington, NJ 07111 201-318-7999
Electronetics, Inc., Everett, WA 98204 206-355-1855
† Electronic Transformer Corp., Paterson, NJ 07544-0487 201-942-2222
† Elnetic Electronics, Inc.:Plant Locations, Gardena, CA 90247 310-515-1546
† Freed Transformer Co., Inc., Electronic Transformer Corp., Paterson, NJ 07544-0487 201-942-2222
Gavagan Electronics, Danbury, CT 06810 203-748-5248
§ GC International Inc., Plano, TX 75074 214-423-8411
Gettysburg Transformer Corporation, Gettysburg, PA 17325 717-334-2191
Gowanda Electronics Corp., Gowanda, NY 14070 716-532-2234
Grand Transformer, Inc., Grand Haven, MI 49417 616-842-5430
§ Hammond Manufacturing Co., Buffalo, NY 14225 716-894-5710
† Hisonic, Inc., Olathe, KS 66051 913-782-0012
Hitran Corporation, Flemington, NJ 08822-1238 908-782-5525
† Hytronics Corporation, Clearwater, FL 34620 813-536-7861
Integrity Technology Corporation, Santa Clara, CA 95050 408-262-8640
§ James Electronics, Chicago, IL 60618 312-463-6500
† JB Electronic Transformers Inc., Chicago, IL 60647 312-342-0080
Jerome Industries Corp., Elizabeth, NJ 07201 908-353-5700
Keytronics, Inc., Endicott, NY 13760 607-754-5405
KGS Electronics, Inc., Arcadia, CA 91006 818-574-1175
† KIP Transformers Inc., Wolcott, CT 06716 203-758-7085
Mag-Con, St. Paul, MN 55113 612-633-8820
§ Magnetek Triad, Huntington, IN 46750 219-356-7100
† Magnetic Circuit Elements, Salinas, CA 93905 408-757-8752
Midcom, Inc., Watertown, SD 57201 605-886-4385
Mitchell Electronics Corp., Mt. Vernon, NY 10552 914-699-3800
† MTE Corp., Menomonee Falls, WI 53051 414-253-8200
† Neshaminy Transformer Corp., Furlong, PA 18925 215-794-7411
Nicollet Technologies Corp., Minneapolis, MN 55413 612-379-7919
† Northlake Engineering, Inc., Bristol, WI 53104-0370 414-857-9600
Oeco Corp., Milwaukie, OR 97222 503-659-7932
† OPT Industries, Inc., Phillipsburg, NJ 08865 908-454-2600
Pacific Transformer Corp., Anaheim, CA 92807 ..... 714-779-0450;1-800-325-0501
† Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
Potrans International Inc., Potrans Electrical Corp., Ltd., Irvine, CA 92714 714-975-1222
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861 908-826-4700
Precision Components, Inc., Wilmington, IL 60481 708-543-6448
Radio Television Products Corp., Douglas, AZ 85607 602-364-4438
RAE Company Inc., Indianapolis, IN 46239 317-351-1774
Ritter Coil, Inc., Easton, PA 18043-3130 215-258-6780
Rodale Technical Sales Inc., Islip, NY 11751 516-277-5454
Schott Corp., Wayzata, MN 55391 612-475-1173
Schumacher Elect. Corp., Chicago, IL 60626 312-973-1600
† Scientific Technologies Inc., Control Components Div., Hayward, CA 94544-7831 ..... 510-471-9717;800-221-7060
† Sigma Electronics Inc., Houston, TX 77099 ..... 713-933-4700;800-874-7121
§† Skyway Magnetics, Warner Springs, CA 92086-9714 619-782-3342
Standard Magnetic Corp., Garden Grove, CA 92641 714-379-5671
Texas Transformer Corp., Plano, TX 75086 214-424-1581
§† Thordarson Meissner, Components Corp. of Amer., Mt. Carmel, IL 62863 618-262-5121
Toltec Industries, Inc., San Diego, CA 92154 619-423-0700
† Torema U.S.A., Inc., Houston, TX 77042 713-977-2500
Toroid Technologies, Inc., Woodbridge, Ont., CAN L4L 3P6 905-850-5122
† Torwico Elctms. Inc., Lakewood, NJ 08701 908-364-1800
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
Ulveco, Inc., Houston, TX 77042 1-800-527-7042
§† Vitec Electronics Corp., Visalia, CA 93291 209-651-1535
§ Zambre Co., Inc., Mountain View, CA 94043 415-968-9176

Transformers, Plate-5600

† Abbott Technologies, Inc., Sun Valley, CA 91352, 818-504-0644;1-800-367-8200 ..... A•2234
JM Transformer Co., Inc., Farmingdale, NY 11735, 516-293-0475 ..... A•2364
† Lenco Elctrns., Inc., McHenry, IL 60050, 815-344-2900 ..... A•2374
† NWL Transformers, Bordentown, NJ 08505, 609-298-7300 ..... A•2437
† Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2455
Signal Transformer Co., Inc., Insilco Corporation, Inwood, NY 11696, 516-239-5777 ..... A•2536
Actown-Electrocoil, Inc., Spring Grove, IL 60081 815-675-6641
American Magnetics, Carterville, IL 62918 618-985-4838
ATC-Frost Magnetics Inc., Oakville,Ont., CANADA L6H 2R4 416-844-6681
† Atlas Engineering Corp., Dorchester, MA 02121 617-445-7100
† Axel Electronics, Inc., Subsidiary of FPBSM Industries Inc., Rancho Dominquez, CA 90220 718-291-3900
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
Basler Electrics, Magnetics Product Grp., Highland, IL 62249 618-654-2341
Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
Bey Electric, Inc., Lincoln Park, NJ 07035 201-694-5000
† B. G. Laboratories, Inc., Binghamton, NY 13904 607-722-2376
† Coast Coil Co., Coast Magnetics, Los Angeles, CA 90016 213-936-6188
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 605-665-9301
† Del Electronics Corp., Valhalla, NY 10595 914-686-3600
Deltona Transformer Corp., DeLand, FL 32724 904-736-7900
† Dietz Design, Inc., Belton, MO 64012 816-331-4911
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012 605-296-3462
§† Electromech, Inc., Irvington, NJ 07111 201-318-7999
† Electronic Transformer Corp., Paterson, NJ 07544-0487 201-942-2222
Elma Engineering, Palo Alto, CA 94303 415-494-7303
† Elnetic Electronics, Inc.:Plant Locations, Gardena, CA 90247 310-515-1546
Epco Products Inc., WAllkill, NY 12589 914-895-2033
† Freed Transformer Co., Inc., Electronic Transformer Corp., Paterson, NJ 07544-0487 201-942-2222
Gavagan Electronics, Danbury, CT 06810 203-748-5248
Gettysburg Transformer Corporation, Gettysburg, PA 17325 717-334-2191
Grand Transformer, Inc., Grand Haven, MI 49417 616-842-5430
§ Hammond Manufacturing Co., Buffalo, NY 14225 716-894-5710
High Voltage Systems, Inc., Universal Designs Corp., Chappaqua, NY 10514 914-238-8462
Hitran Corporation, Flemington, NJ 08822-1238 908-782-5525
† JB Electronic Transformers Inc., Chicago, IL 60647 312-342-0080
Keytronics, Inc., Endicott, NY 13760 607-754-5405
KGS Electronics, Inc., Arcadia, CA 91006 818-574-1175
† KIP Transformers Inc., Wolcott, CT 06716 203-758-7085
Mag-Con, St. Paul, MN 55113 612-633-8820
§ Magnetek Triad, Huntington, IN 46750 219-356-7100
MCI Transformer Corporation, Babylon, NY 11704 516-587-0510
§† Microtran Co. Inc., Valley Stream, NY 11582-0236 516-561-6050
† Northlake Engineering, Inc., Bristol, WI 53104-0370 414-857-9600
OPT Industries, Inc., Phillipsburg, NJ 08865 908-454-2600
Pacific Transformer Corp., Anaheim, CA 92807 ..... 714-779-0450;1-800-325-0501
† Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
† PTC Transformers, Bordentown, NJ 08505 609-298-8200
Schott Corp., Wayzata, MN 55391 612-475-1173
† Sigma Electronics Inc., Houston, TX 77099 ..... 713-933-4700;800-874-7121
§† Skyway Magnetics, Warner Springs, CA 92086-9714 619-782-3342
Staco Transpower, Components Corp. of America, Mt. Carmel, IL 62863 618-262-5555
§ Stancor, White-Rodgers, Logansport, IN 46947 219-722-2244
Standard Magnetic Corp., Garden Grove, CA 92641 714-379-5671
† Stangenes Industries, Inc., Palo Alto, CA 94303 415-493-0814
Texas Transformer Corp., Plano, TX 75086 214-424-1581
§† Thordarson Meissner, Components Corp. of Amer., Mt. Carmel, IL 62863 618-262-5121
† Torwico Elctms. Inc., Lakewood, NJ 08701 908-364-1800
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
Transformer Engineering Corporation, Cleveland, OH 44134 216-741-5282
Universal Voltronics Div., Thermo Voltek Corp., Mt. Kisco, NY 10549 914-241-1300
WPI Group, Inc., Warner, NH 03278 603-456-3111
§ Zambre Co., Inc., Mountain View, CA 94043 415-968-9176

Transformers, Power-5600

† Abbott Technologies, Inc., Sun Valley, CA 91352, 818-504-0644;1-800-367-8200 ..... A•2234
Advanced Components Inds., Inc., Div of Kaschke, Torrance, CA 90501, 310-328-0060 ..... A•1318,2254-2255
Albar, Inc., Lynnwood, WA 98036, 206-771-4006;800-822-5227 ..... A•2256
Altran Corporation, Crystal Lake, IL 60014, 815-455-5650 ..... A•2257
Amecon, Inc., Anaheim, CA 92805, 714-634-2220;800-392-2292 ..... A•2263-2265
APX Technologies Inc., Hicksville, NY 11801, 516-433-1313 ..... A•2266, D•1583
§ AT&T Microelectronics, Allentown, PA 18103, 1-800-372-2447;In Can.:1-800-553-2448 ..... A•2270
§ Ault, Incorporated, Minneapolis, MN 55428, 612-493-1900 ..... D•1608-1609
Avel Transformers Inc., New Milford, CT 06776, 203-355-4711 ..... A•2272-2273,2275
Bey Electric, Inc., Lincoln Park, NJ 07035, 201-694-5000 ..... A•2295
BH Electronics, Inc., Burnsville, MN 55337, 612-894-9590 ..... A•2296-2297
Bicron Electronics, Canaan, CT 06018, 203-824-5125 ..... A•2299-2301, B•1919
§ C & C Jetronic, Inc., Allentown, NJ 08501, 609-259-8855 ..... A•2302
† Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ..... A•2305
Controlled Power Co., Troy, MI 48083, 313-528-3700;1-800-521-4792 ..... D•2255
† Cramer Coil & Transformer Co., Inc., Saukville, WI 53080, 414-268-2150;414-375-5700 ..... A•2306-2308
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† Del Electronics Corp., Valhalla, NY 10595, 914-686-3600 ..... A•2315
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012, 605-296-3462 ..... A•2318
Eichhoff Electronics, Warwick, RI 02886, 401-738-1440;800-678-1040 ..... A•2323
§† Electromech, Inc., Irvington, NJ 07111, 201-318-7999 ..... A•2324-2325
Electro-Mech Co., Colorado Springs, CO 80915, 719-597-1620 ..... D•1673
Ensign Corp., Burr Ridge, IL 60521, 708-325-9343 ..... A•2326-2328
§† EWC, Inc., Englishtown, NJ 07726, 908-446-3110 ..... A•1235,2331-2339,2341-2344,2346-2347
† Fernwood Transformer Co., Transistor Devices Inc., Belvidere, NJ 07823, 908-475-3207 ..... A•2355
Fetco, Sanford, FL 32773, 407-321-3800 ..... A•2353
§ GlobTek, Inc., Northvale, NJ 07647, 201-784-1000 ..... D•1732
† Hisonic, Inc., Olathe, KS 66051, 913-782-0012 ..... A•2360
Hitran Corporation, Flemington, NJ 08822-1238, 908-782-5525 ..... A•2361
International Configurations, Inc., Enfield, CT 06082, 203-749-6380 ..... C•1353
ISL Products Int'l, Ltd., Syosset, NY 11791-6093, 516-937-3475;800-626-6116 ..... A•2362
Jerome Industries Corp., Elizabeth, NJ 07201, 908-353-5700 ..... D•1756,1760

JM Transformer Co., Inc., Farmingdale, NY 11735, 516-293-0475 ... A•2364-2367
† **Lenco Elctrns., Inc., McHenry, IL 60050, 815-344-2900 ... A•2374-2375**
Lumintech Inc., Irvington, NJ 07111, 201-374-1091 ... A•2376
Magna-Power Electronics, Inc., Whippany, NJ 07981, 201-428-1197 ... D•1828
† **Magnecomp, Inc., Pickens, SC 29671, 803-878-4700 ... A•2377**
Magnelab, Boulder, CO 80301-4696, 303-442-6700 ... A•2378,2380-2382
§ **Magnetek Triad, Huntington, IN 46750, 219-356-7100 ... A•2383,2385-2387**
† **Magnetico Inc., Holtsville, NY 11742, 516-654-1166 ... A•2389-2391**
MCI Transformer Corporation, Babylon, NY 11704, 516-587-0510 ... A•2392,2394-2396,2400-2402
§† **Microtran Co. Inc., Valley Stream, NY 11582-0236, 516-561-6050 ... A•2404-2412,2414,2421-2423**
MultiComp., Inc., Beaverton, OR 97006, 503-626-4200 ... A•2434-2435
§ **Multi Products International, West Paterson, NJ 07424, 201-890-1344 ... A•2436**
North Hills Signal Processing, Syosset, NY 11791, 516-682-7740 ... A•2438-2439
† **NWL Transformers, Bordentown, NJ 08505, 609-298-7300 ... A•2437, D•1851**
Panel Components Corp., Oskaloosa, IA 52577, 515-673-0097 ... A•2443
Para-Line Transformer Co., Inc., Alhambra, CA 91803, 818-281-0222 ... A•2444
PC Transformer Corp., West Babylon, NY 11704, 516-491-3300 ... A•2445-2452
† **Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ... A•2455**
Plitron Manufacturing, Inc., Downsview, Ont., CAN M3J 2N5, 416-667-9914 ... A•2506-2507
Powertronix Corp., Foster City, CA 94404, 415-345-6800 ... A•2509-2511
Precision Electronics Inc., Copiague, NY 11726, 516-842-4900 ... A•2526
Prem Magnetics, Inc., McHenry, IL 60050, 815-385-2700 ... A•2512-2515,2525
Renco Electronics, Inc., Deer Pk., NY 11729, 516-586-5566;1-800-645-5828 ... A•2527-2531
† **Shogyo International Corp., Great Neck, NY 11021-4799, 516-466-0911 ... A•2534, D•1921**
† **Signal Transformer Co., Inc., Insilco Corporation, Inwood, NY 11696, 516-239-5777 ... A•2536**
§† **Staco Energy Products Co., Dayton, OH 45403, 513-253-1191 ... A•2535**
§ **Stancor, White-Rodgers, Logansport, IN 46947, 219-722-2244 ... A•2558-2562,2564**
§ **Superior Electric, Warner Electric, Bristol, CT 06010, 203-582-9561 ... A•2557**
Talema Electronic, Inc., Saint James, MO 65559, 314-265-5500 ... A•2566,2568,2570
§ **Tamura Corporation of America, Temecula, CA 92589-2230, 909-699-1270 ... A•2571,2576-2579**
# **Technical Devices, Dayton, OH 45414, 513-890-7881 ... D•1956**
§† **Todd Systems, Inc., Yonkers, NY 10701, 914-963-3400 ... A•2582-2584**
† **Torelco, Inc., Irvington, NJ 07111, 201-374-8641;800-867-3526 ... A•2581**
† **Toroid Corp. of Maryland, Salisbury, MD 21801, 410-860-0300 ... A•2586-2592**
† **Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314 ... A•2594-2596**
Tortran Inc., Bridgeport, CT 06608, 203-367-5188 ... A•2593
† **Transformer Technologies, Inc., Mt. Vernon, NY 10552, 914-668-1600 ... A•2598**
Ulveco, Inc., Houston, TX 77042, 1-800-527-7042 ... A•2600-2601
Vernitron Corp., Precision Comps. Group, St. Petersburg, FL 33710, 813-347-2181 ... A•2599
Wilco Corp., Indianapolis, IN 46268, 317-293-9300 ... A•2604-2605
† **ZMAN Magnetics, Kent, WA 98032, 206-251-8064 ... A•2606**
Abacus Controls Inc., Somerville, NJ 08876 ... 908-526-6010
§ Acme Transformer, Acme Electric Corporation, Lumberton, NC 28358 ... 919-738-1121
Actown-Electrocoil, Inc., Spring Grove, IL 60081 ... 815-675-6641
AFP ISOREG, AFP Transformers, Inc., Littleton, MA 01460 ... 508-486-9483
American Magnetics, Carterville, IL 62918 ... 618-985-4838
† American Monarch, Minneapolis, MN 55421 ... 612-788-9161
Andover, Inc., Lafayette, IN 47904 ... 317-447-1157
Arrow Hart Controls, Products Unlimited Corp., Sterling, IL 61081 ... 815-626-0300
ATC-Frost Magnetics Inc., Oakville,Ont., CANADA L6H 2R4 ... 416-844-6681
§ Atlantic Magnetics, Inc., Pompano Beach, FL 33069 ... 305-979-7920
† Atlas Engineering Corp., Dorchester, MA 02121 ... 617-445-7100
† Automatic Coil Corp., Miami, FL 33147 ... 305-696-6660
† Avionic Instruments, REA International Inc., Avenel, NJ 07001 ... 908-388-3500
† Axel Electronics, Inc., Subsidiary of FPBSM Industries Inc., Rancho Dominquez, CA 90220 ... 718-291-3900
§† Aydin Corporation (West), San Jose, CA 95119-1371 ... 408-629-1100
Basler Electrics, Magnetics Product Grp., Highland, IL 62249 ... 618-654-2341
† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635 ... 714-447-2300
Berkshire Transformer Corp., Kent, CT 06757 ... 203-927-3541
† Beta Transformer Tech. Corp., ILC Data Device Corp., Bohmia, NY 11716 ... 516-244-7393
† B. G. Laboratories, Inc., Binghamton, NY 13904 ... 607-722-2376
Carson Manufacturing Co., Inc., Indianapolis, IN 46220 ... 317-257-3191
§ C-COR Elctrns., Inc., State College, PA 16801 ... 814-238-2461;800-233-2267
CET Technology, Hudson, NH 03051 ... 603-883-5912
Chloride Electro Networks, Chloride Power Electronics, Inc., Caledonia, NY 14423 ... 716-538-4421
† Coast Coil Co., Coast Magnetics, Los Angeles, CA 90016 ... 213-936-6188
† Coast Magnetics, Adams-Maxwell Division, Inglewood, CA 90302-1284 ... 310-673-3245
Coilcraft, Cary, IL 60013 ... 708-639-2361
† Component Specialties Corp., Temple City, CA 91780 ... 213-283-0015
§ Computer Power Inc., High Bridge, NJ 08829 ... 908-638-8000;800-526-5088
† Corona Magnetics, Inc., Corona, CA 91719 ... 909-735-7558
Crompton Modutec, Manchester, NH 03109 ... 603-669-5121;800-METERS-1
C-S Electronic Sales, Inc., Frankfort, IN 46041 ... 317-659-1874
Custom Bobbin Windings, A & K Corporation, Zanesville, OH 43702-2369 ... 614-452-6973
† Cypress Magnetics, Inc., Rancho Cucamonga, CA 91730 ... 909-987-3570
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 ... 605-665-9301
Datatronics, Inc., Romoland, CA 92585 ... 909-928-7700
Deltona Transformer Corp., DeLand, FL 32724 ... 904-736-7900
† De Young Mfg., Inc., Kirkland, WA 98034 ... 206-823-4798
† Dietz Design, Inc., Belton, MO 64012 ... 816-331-4911
§ Dormeyer Industries. A.F. Dormeyer Mfg. Co. Inc., Chicago, IL 60631-1521 ... 312-775-3600
Dynapower Corporation, S. Burlington, VT 05407 ... 802-860-7200
† Electro Assemblies Corp., Northbrook, IL 60062-2319 ... 708-498-6520
Electronetics, Inc., Everett, WA 98204 ... 206-355-1855
† Electronic Transformer Corp., Paterson, NJ 07544-0487 ... 201-942-2222
§ Elgar Electronics Corporation, San Diego, CA 92121 ... 619-450-0085;800-733-5427
Elma Engineering, Palo Alto, CA 94303 ... 415-494-7303
† Elnetic Electronics, Inc.:Plant Locations, Gardena, CA 90247 ... 310-515-1546
Endicott Coil Co., Inc., Binghamton, NY 13905 ... 607-797-1263
Engineering Design & Sls., Danville, VA 24541 ... 804-792-6405
Epco Products Inc., WAllkill, NY 12589 ... 914-895-2033
§† EPE Technologies, Inc., Subsidiary of Square D, Costa Mesa, CA 92627 ... 714-557-1636
Fee Fil-Mag, San Diego, CA 92123 ... 619-569-6577
† Freed Transformer Co., Inc., Electronic Transformer Corp., Paterson, NJ 07544-0487 ... 201-942-2222
Gavagan Electronics, Danbury, CT 06810 ... 203-748-5248
§ GC International Inc., Plano, TX 75074 ... 214-423-8411
Gettysburg Transformer Corporation, Gettysburg, PA 17325 ... 717-334-2191
Golden Pacific Electronics, Inc, Placentia, CA 92670 ... 714-993-6970
Grand Transformer, Inc., Grand Haven, MI 49417 ... 616-842-5430
Haefely, Inc., Woodbridge, VA 22192 ... 703-494-1900
§ Hammond Manufacturing Co., Buffalo, NY 14225 ... 716-894-5710
High Voltage Systems, Inc., Universal Designs Corp., Chappaqua, NY 10514 ... 914-238-8462
Hipotronics Inc., Brewster, NY 10509 ... 914-279-8091
Integrity Technology Corporation, Santa Clara, CA 95050 ... 408-262-8640
International Microelectronics, Arlington, TX 76003 ... 817-473-1730
§ James Electronics, Chicago, IL 60618 ... 312-463-6500
† JB Electronic Transformers Inc., Chicago, IL 60647 ... 312-342-0080
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† L/C Magnetics, Anaheim, CA 92806 ... 714-666-0787
LEPCO/Leonard Elec. Prods., Brownsville, TX 78521 ... 210-546-1625
Long Island Transformer & Inductor, Baldwin, NY 11510 ... 516-379-1465
MACROAMP Inc., Ukiah, CA 95482 ... 800-458-8892
Mag-Con, St. Paul, MN 55113 ... 612-633-8820
† Magnetic Circuit Elements, Salinas, CA 93905 ... 408-757-8752
Mech-Tronics, Mount Holly, NJ 08060 ... 609-267-0680
§ Micron Industries, Hillside, IL 60162 ... 708-547-0900
Mitchell Electronics Corp., Mt. Vernon, NY 10552 ... 914-699-3800
† MTE Corp., Menomonee Falls, WI 53051 ... 414-253-8200
† Neshaminy Transformer Corp., Furlong, PA 18925 ... 215-794-7411
Nicollet Technologies Corp., Minneapolis, MN 55413 ... 612-379-7919
† Northlake Engineering, Inc., Bristol, WI 53104-0370 ... 414-857-9600
Oeco Corp., Milwaukie, OR 97222 ... 503-659-7932
§† OPT Industries, Inc., Phillipsburg, NJ 08865 ... 908-454-2600
Oram High Voltage, Dayton, TX 77535 ... 409-258-5553
Pacific Transformer Corp., Anaheim, CA 92807 ... 714-779-0450;1-800-325-0501
PCA Electronics, Sepulveda, CA 91343 ... 818-892-0761
† Polyphase Instrument, Ft. Washington, PA 19034 ... 215-643-6950
Potrans International Inc., Potrans Electrical Corp., Ltd., Irvine, CA 92714 ... 714-975-1222
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861 ... 908-826-4700
† Precision Components, Inc., Wilmington, IL 60481 ... 708-543-6448
† Preferred Electronics, Inc., Westfield, MA 01086 ... 413-568-2301;1-800-553-6374
† PTC Transformers, Bordentown, NJ 08505 ... 609-298-8200
Radio Television Products Corp., Douglas, AZ 85607 ... 602-364-4438
RAE Company Inc., Indianapolis, IN 46239 ... 317-351-1774
Ritter Coil, Inc., Easton, PA 18043-3130 ... 215-258-6780
Rodale Technical Sales Inc., Islip, NY 11751 ... 516-277-5454
Royal Enterprises Co., Simi Valley, CA 93063 ... 805-522-8730;818-998-2455
Sandman Electric Co., Inc., Braintree, MA 02184 ... 617-848-2111
Sanford-Miller Corp., Oceanside, NY 11572 ... 516-763-0926;800-645-5900
Schauer Manufacturing, Cincinnati, OH 45242 ... 513-791-3030
† Schott Corp., Wayzata, MN 55391 ... 612-475-1173
Schumacher Elect. Corp., Chicago, IL 60626 ... 312-973-1600
† Scientific Technologies Inc., Control Components Div., Hayward, CA 94544-7831 ... 510-471-9717;800-221-7060
Sescom, Inc., Henderson, NV 89015-4249 ... 702-565-3400
§ Shape Electronics, Inc., The Wiremold Co., Lombard, IL 60148 ... 708-620-8394; 1-800-367-5811
Shokai Far East Ltd., Peekskill, NY 10566 ... 914-736-3500
† Sierra West Power Systems, Las Cruces, NM 88001 ... 505-522-8828
† Sigma Electronics Inc., Houston, TX 77099 ... 713-933-4700;800-874-7121
† Sigmapower, Inc, FPBSM Industries, Inc., Rancho Dominguez, CA 90220-6404 ... 310-884-5200
SinoTECH Made in China, Inc., Technology Communications Group, Inc., West Linn, OR 97068 ... 503-638-1000
§† Skyway Magnetics, Warner Springs, CA 92086-9714 ... 619-782-3342
South American Development Corp., Poughkeepsie, NY 12590 ... 914-452-1305
§ Square D Co., Palatine, IL 60067 ... 708-397-2600
Square D Company, Clearwater, FL 34625 ... 813-447-2511
† Staco Transpower, Components Corp. of America, Mt. Carmel, IL 62863 ... 618-262-5555
Standard Magnetic Corp., Garden Grove, CA 92641 ... 714-379-5671
Sutton Designs, Inc., Ithaca, NY 14850 ... 800-326-8119
† Technitrol, Philadelphia, PA 19134 ... 215-426-9105
Teco Corp., Winnisquam, NH 03289 ... 603-524-1998
Texas Transformer Corp., Plano, TX 75086 ... 214-424-1581
§† Thordarson Meissner, Components Corp. of Amer., Mt. Carmel, IL 62863 ... 618-262-5121
TMP Inc., Santa Ana, CA 92705 ... 714-558-8028

§ Tokin America, Inc., San Jose, CA 95134 ... 408-432-8020
Toltec Industries, Inc., San Diego, CA 92154 ... 619-423-0700
Torad Coil Co., Inc., Wayne, NJ 07470 ... 201-835-6195
† Toreina U.S.A., Inc., Houston, TX 77042 ... 713-977-2500
Toroid Technologies, Inc., Woodbridge, Ont., CAN L4L 3P6 ... 905-850-5122
† Torwico Elctrns. Inc., Lakewood, NJ 08701 ... 908-364-1800
† Trans American Transformer, E. Setauket, NY 11733 ... 516-928-0762
† Transformer Design , MTE Corporation, Menomonee Falls, WI 53051 ... 414-253-8200
† Transistor Devices, Inc., Randolph, NJ 07869 ... 201-361-6622
Universal Voltronics Div., Thermo Voltek Corp., Mt. Kisco, NY 10549 ... 914-241-1300
U.R.D. America, Laguna Nigel, CA 92607 ... 714-831-0111
U.S. Transformer and Inductor, Cheyenne, WY 82007 ... 800-584-9339
† Vanguard Electronics Co., Gardena, CA 90248 ... 310-323-4100
§† Vitec Electronics Corp., Visalia, CA 93291 ... 209-651-1535
The Winatic Corp., Electro-Technik Industries, Inc., Vestal, NY 13850 ... 607-729-6318
WPI Group, Inc., Warner, NH 03278 ... 603-456-3111
Xentek, Inc., Taiyo Yuden USA, Inc., San Marcos, CA 92069 ... 619-471-4001
§ Zambre Co., Inc., Mountain View, CA 94043 ... 415-968-9176

Transformers, Power Distribution-5600

Advanced Components Inds., Inc., Div of Kaschke, Torrance, CA 90501, 310-328-0060 ... A•2254-2255
Altran Corporation, Crystal Lake, IL 60014, 815-455-5650 ... A•2257
Bey Electric, Inc., Lincoln Park, NJ 07035, 201-694-5000 ... A•2295
Eichhoff Electronics, Warwick, RI 02886, 401-738-1440;800-678-1040 ... A•2323
Electromech, Inc., Irvington, NJ 07111, 201-318-7999 ... A•2324-2325
GlobTek, Inc., Northvale, NJ 07647, 201-784-1000 ... D•1732
§ Hitran Corporation, Flemington, NJ 08822-1238, 908-782-5525 ... A•2361
Magnecomp, Inc., Pickens, SC 29671, 803-878-4700 ... A•2377
Magnetek Triad, Huntington, IN 46750, 219-356-7100 ... A•2383,2385-2387
Magnetico Inc., Holtsville, NY 11742, 516-654-1166 ... A•2391
MCI Transformer Corporation, Babylon, NY 11704, 516-587-0510 ... A•2395,2400,2402
Oram High Voltage, Dayton, TX 77535, 409-258-5553 ... D•1853
Signal Transformer Co., Inc., Insilco Corporation, Inwood, NY 11696, 516-239-5777 ... A•2536
Tamura Corporation of America, Temecula, CA 92589-2230, 909-699-1270 ... A•2577
Todd Systems, Inc., Yonkers, NY 10701, 914-963-3400 ... A•2582-2583
Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314 ... A•2594
Abbott Technologies, Inc., Sun Valley, CA 91352 ... 818-504-0644;1-800-367-8200
§ Acme Transformer, Acme Electric Corporation, Lumberton, NC 28358 ... 919-738-1121
AFP ISOREG, AFP Transformers, Inc., Littleton, MA 01460 ... 508-486-9483
American Zettler, Aliso Viejo, CA 92656 ... 714-831-5000
§† Aydin Corporation (West), San Jose, CA 95119-1371 ... 408-629-1100
Basler Electrics, Magnetics Product Grp., Highland, IL 62249 ... 618-654-2341
Berkshire Transformer Corp., Kent, CT 06757 ... 203-927-3541
C & C Jetronic, Inc., Allentown, NJ 08501 ... 609-259-8855
Chloride Electro Networks, Chloride Power Electronics, Inc., Caledonia, NY 14423 ... 716-538-4421
Controlled Power Co., Troy, MI 48083 ... 313-528-3700;1-800-521-4792
Cramer Coil & Transformer Co., Inc., Saukville, WI 53080 .. 414-268-2150;414-375-5700
Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 ... 605-665-9301
Dynapower Corporation, S. Burlington, VT 05407 ... 802-860-7200
Elma Engineering, Palo Alto, CA 94303 ... 415-494-7303
§† EPE Technologies, Inc., Subsidiary of Square D, Costa Mesa, CA 92627 ... 714-557-1636
EWC, Inc., Englishtown, NJ 07726 ... 908-446-3110
GC International Inc., Plano, TX 75074 ... 214-423-8411
§ Golden Pacific Electronics, Inc, Placentia, CA 92670 ... 714-993-6970
§ Hammond Manufacturing Co., Buffalo, NY 14225 ... 716-894-5710
† KIP Transformers Inc., Wolcott, CT 06716 ... 203-758-7085
† L/C Magnetics, Anaheim, CA 92806 ... 714-666-0787
MagneTek Power Conversion Systems, Teledyne, Inc., Anaheim, CA 92805 ... 714-956-9200
MagneTek Power Technology Systems, MagneTek, Inc., Anaheim, CA 92805 ... 714-956-9200
† Neshaminy Transformer Corp., Furlong, PA 18925 ... 215-794-7411
OPT Industries, Inc., Phillipsburg, NJ 08865 ... 908-454-2600
PCA Electronics, Sepulveda, CA 91343 ... 818-892-0761
Polyphase Instrument, Ft. Washington, PA 19034 ... 215-643-6950
§ Square D Co., Palatine, IL 60067 ... 708-397-2600
§† Staco Energy Products Co., Dayton, OH 45403 ... 513-253-1191
Staco Transpower, Components Corp. of America, Mt. Carmel, IL 62863 ... 618-262-5555
Texas Transformer Corp., Plano, TX 75086 ... 214-424-1581
Toltec Industries, Inc., San Diego, CA 92154 ... 619-423-0700
Torad Coil Co., Inc., Wayne, NJ 07470 ... 201-835-6195
† Torwico Elctrns. Inc., Lakewood, NJ 08701 ... 908-364-1800
§ Total Concept Sales, Glendale, CA 91202-2896 ... 818-547-9476
WPI Group, Inc., Warner, NH 03278 ... 603-456-3111
Xentek, Inc., Taiyo Yuden USA, Inc., San Marcos, CA 92069 ... 619-471-4001

Transformers, Pulse-5600

Advanced Components Inds., Inc., Div of Kaschke, Torrance, CA 90501, 310-328-0060 ... A•2254
APX Technologies Inc., Hicksville, NY 11801, 516-433-1313 ... A•2266-2267, D•1583
§ AT&T Microelectronics, Allentown, PA 18103, 1-800-372-2447;In Can.:1-800-553-2448 ... A•2268-2270
Avtech Electrosystems Ltd., Ottawa, Ontario, CANADA K2C 3H4, 613-226-5772 ... D•1234
§ Bel Fuse, Jersey City, NJ 07302, 201-432-0463 ... A•2283
† BH Electronics, Inc., Burnsville, MN 55337, 612-894-9590 ... A•2296-2297
† Bicron Electronics, Canaan, CT 06018, 203-824-5125 ... A•2299
Caddell-Burns Mfg., Mineola, NY 11501-3508, 516-746-2310 ... A•1198
§ C & C Jetronic, Inc., Allentown, NJ 08501, 609-259-8855 ... A•2302
† Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ... A•2305
† Cramer Coil & Transformer Co., Inc., Saukville, WI 53080, 414-268-2150;414-375-5700 ... A•2306
Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180, 605-665-9301 ... A•1225,2313
Datatronics, Inc., Romoland, CA 92585, 909-928-7700 ... A•2314
† Del Electronics Corp., Valhalla, NY 10595, 914-686-3600 ... A•2315
† ESC Electronics Corp., Palisades Pk., NJ 07650, 201-947-0400 ... A•2329
† EWC, Inc., Englishtown, NJ 07726, 908-446-3110 ... A•1235,2331
† Fernwood Transformer Co., Transistor Devices Inc., Belvidere, NJ 07823, 908-475-3207 ... A•2355
Fetco, Sanford, FL 32773, 407-321-3800 ... A•2353
† Hisonic, Inc., Olathe, KS 66051, 913-782-0012 ... A•2360
JBM Electronics, Inc., Bedford, NH 03110-6802, 603-623-0222 ... A•2363
† Kappa Technologies, Inc., Rahway, NJ 07065, 908-396-9400;1-800-223-0603 ... A•2370
† Magnecomp, Inc., Pickens, SC 29671, 803-878-4700 ... A•2377
Magnelab, Boulder, CO 80301-4696, 303-442-6700 ... A•2378
† Magnetico Inc., Holtsville, NY 11742, 516-654-1166 ... A•2390-2391
MCI Transformer Corporation, Babylon, NY 11704, 516-587-0510 ... A•2396,2402
Midcom, Inc., Watertown, SD 57201, 605-886-4385 ... A•2425,2428
Mitchell Electronics Corp., Mt. Vernon, NY 10552, 914-699-3800 ... A•2433
MultiComp., Inc., Beaverton, OR 97006, 503-626-4200 ... A•2434
PC Transformer Corp., West Babylon, NY 11704, 516-491-3300 ... A•2453
† Pearson Electronics, Inc., Palo Alto, CA 94303, 415-494-6444 ... A•2454
† Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ... A•2455
Precision Electronics Inc., Copiague, NY 11726, 516-842-4900 ... A•2526
† Premier Magnetics Inc., Aliso Viejo, CA 92656, 714-362-4211 ... A•2508
RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ... A•2019
Renco Electronics, Inc., Deer Pk., NY 11729, 516-586-5566;1-800-645-5828 ... A•2527-2529
RFI Corporation, Bay Shore, NY 11706, 516-231-6400 ... A•2532
§† Rhombus Industries, Huntington Bch., CA 92649-1595, 714-898-0960 ... A•2533
Signal Transformer Co., Inc., Insilco Corporation, Inwood, NY 11696, 516-239-5777 ... A•2536
§ Tamura Corporation of America, Temecula, CA 92589-2230, 909-699-1270 ... A•2571,2573,2578
Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314 ... A•2594
† Trans American Transformer, E. Setauket, NY 11733, 516-928-0762 ... A•2597
§ Valor Electronics, San Diego, CA 92131-1642, 619-537-2500 ... A•2602-2603
Vernitron Corp., Precision Comps. Group, St. Petersburg, FL 33710, 813-347-2181 ... A•2599
† ZMAN Magnetics, Kent, WA 98032, 206-251-8064 ... A•2606
Abbott Technologies, Inc., Sun Valley, CA 91352 ... 818-504-0644;1-800-367-8200
Actown-Electrocoil, Inc., Spring Grove, IL 60081 ... 815-675-6641
American Magnetics, Carterville, IL 62918 ... 618-985-4838
Amplifier Research, Souderton, PA 18964-9990 ... 215-723-8181
Andover, Inc., Lafayette, IN 47904 ... 317-447-1157
ATC-Frost Magnetics Inc., Oakville,Ont., CANADA L6H 2R4 ... 416-844-6681
§ Atlantic Magnetics, Inc., Pompano Beach, FL 33069 ... 305-979-7920
† Atlas Engineering Corp., Dorchester, MA 02121 ... 617-445-7100
† Automatic Coil Corp., Miami, FL 33147 ... 305-696-6660
† Axel Electronics, Inc., Subsidiary of FPBSM Industries Inc., Rancho Dominquez, CA 90220 ... 718-291-3900
§† Aydin Corporation (West), San Jose, CA 95119-1371 ... 408-629-1100
† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635 ... 714-447-2300
Berkshire Transformer Corp., Kent, CT 06757 ... 203-927-3541
† Beta Transformer Tech. Corp., ILC Data Device Corp., Bohmia, NY 11716 ... 516-244-7393
† B. G. Laboratories, Inc., Binghamton, NY 13904 ... 607-722-2376
CET Technology, Hudson, NH 03051 ... 603-883-5912
Chloride Electro Networks, Chloride Power Electronics, Inc., Caledonia, NY 14423 ... 716-538-4421
† Coast Coil Co., Coast Magnetics, Los Angeles, CA 90016 ... 213-936-6188
† Component Specialties Corp., Temple City, CA 91780 ... 213-283-0015
† Corona Magnetics, Inc., Corona, CA 91719 ... 909-735-7558
† Cypress Magnetics, Inc., Rancho Cucamonga, CA 91730 ... 909-987-3570
Delevan Div., American Precision Inds. Inc., E. Aurora, NY 14052-0449 .. 716-652-3600
† Delta Products Corporation, Fremont, CA 94538 ... 510-770-0660
† De Young Mfg., Inc., Kirkland, WA 98034 ... 206-823-4798
† Dietz Design, Inc., Belton, MO 64012 ... 816-331-4911
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012 ... 605-296-3462
Electrocom Industries, S. Bend, IN 46615 ... 219-232-2743
† Electronic Transformer Corp., Paterson, NJ 07544-0487 ... 201-942-2222
† Elnetic Electronics, Inc.:Plant Locations, Gardena, CA 90247 ... 310-515-1546
Endicott Coil Co., Inc., Binghamton, NY 13905 ... 607-797-1263
§ ENI, Div. of Astec America, Inc., Rochester, NY 14623 ... 716-427-8300
§ Fee Fil-Mag, San Diego, CA 92123 ... 619-569-6577
§ GC International Inc., Plano, TX 75074 ... 214-423-8411
Gettysburg Transformer Corporation, Gettysburg, PA 17325 ... 717-334-2191
GMW Associates, Redwood City, CA 94064 ... 415-368-4884
Gowanda Electronics Corp., Gowanda, NY 14070 ... 716-532-2234
Grand Transformer, Inc., Grand Haven, MI 49417 ... 616-842-5430
§ Hammond Manufacturing Co., Buffalo, NY 14225 ... 716-894-5710
Hipotronics Inc., Brewster, NY 10509 ... 914-279-8091
Hitran Corporation, Flemington, NJ 08822-1238 ... 908-782-5525
§ Hurricane Electronics Lab, Hurricane, UT 84737 ... 801-635-2003
§ ICO-RALLY Corporation, Palo Alto, CA 94303 ... 415-856-9900
† ILC Data Device Corp., Bohemia, NY 11716-2482 ... 516-567-5600
† Ion Physics Corporation, Atkinson, NH 03811 ... 603-893-6687
ISL Products Int'l, Ltd., Syosset, NY 11791-6093 ... 516-937-3475;800-626-6116
§ James Electronics, Chicago, IL 60618 ... 312-463-6500

† JB Electronic Transformers Inc., Chicago, IL 60647 312-342-0080
Keytronics, Inc., Endicott, NY 13760 607-754-5405
KGS Electronics, Inc., Arcadia, CA 91006 818-574-1175
† Lenco Elctrns., Inc., McHenry, IL 60050 815-344-2900
LEPCO/Leonard Elec. Prods., Brownsville, TX 78521 210-546-1625
Mag-Con, St. Paul, MN 55113 612-633-8820
§ Magnetek Triad, Huntington, IN 46750 219-356-7100
† Magnetic Component Engineering, Inc., Inglewood, CA 90301 310-677-6600
† Maxwell Laboratories, Inc., San Diego, CA 92123-1506 619-279-5100
Mech-Tronics, Mount Holly, NJ 08060 609-267-0680
MicroSignals Inc., L.I.C., NY 11101 ..... 718-937-7955;718-937-0391;800-648-2252
§† Microtran Co. Inc., Valley Stream, NY 11582-0236 516-561-6050
Multi Products International, West Paterson, NJ 07424 201-890-1344
Neshaminy Transformer Corp., Furlong, PA 18925 215-794-7411
† North Hills Signal Processing, Syosset, NY 11791 516-682-7740
Oeco Corp., Milwaukie, OR 97222 503-659-7932
§† OPT Industries, Inc., Phillipsburg, NJ 08865 908-454-2600
Oram High Voltage, Dayton, TX 77535 409-258-5553
Pacific Transformer Corp., Anaheim, CA 92807 ..... 714-779-0450;1-800-325-0501
§† PCA Electronics, Sepulveda, CA 91343 818-892-0761
† Piconics, Incorporated, Tyngsboro, MA 01879 508-649-7501
Picosecond Pulse Labs, Inc., Boulder, CO 80306 303-443-1249
† Polara Engineering Inc., Fullerton, CA 92633 714-521-0900
† Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861 908-826-4700
† Precision Components, Inc., Wilmington, IL 60481 708-543-6448
† PTC Transformers, Bordentown, NJ 08505 609-298-8200
Pulse Engineering, Inc., San Diego, CA 92128 619-674-8100
† Radio Research Instrument Co., Inc., Waterbury, CT 06704-3506 203-753-5840
Radio Television Products Corp., Douglas, AZ 85607 602-364-4438
† Raytheon Co., Electronic Components Division, Waltham, MA 02254 617-899-8400
RDI Elctrns., Inc., Mamaroneck, NY 10543 914-777-7000
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
SAE Power, Inc., Santa Clara, CA 95050 408-988-0700
§ Schaffner EMC, Inc. Components Division, Springfield, NJ 07081 ..... 201-379-7778; 800-367-5566
† Schott Corp., Wayzata, MN 55391 612-475-1173
Scientific Conversion, Inc., Novato, CA 94947 415-892-2323
Scientific Conversion, Inc., Novato, CA 94947 415-892-2323
† Scientific Technologies Inc., Control Components Div., Hayward, CA 94544-7831 ..... 510-471-9717;800-221-7060
§ Semikron, Inc., Hudson, NH 03051-0066 ..... 603-883-8102;1-800-258-1308
† Sierra West Power Systems, Las Cruces, NM 88001 505-522-8828
† Simmonds Precision Engine Systems, BF Goodrich Aerospace, Norwich, NY 13815 607-335-5000
South American Development Corp., Poughkeepsie, NY 12590 914-452-1305
Standard Magnetic Corp., Garden Grove, CA 92641 714-379-5671
† Stangenes Industries, Inc., Palo Alto, CA 94303 415-493-0814
§ TDK Corporation of America, Electronic Components & Material, Mount Prospect, IL 60056 ..... 708 803-6100
† Technitrol, Philadelphia, PA 19134 215-426-9105
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291
Texas Transformer Corp., Plano, TX 75086 214-424-1581
TMP Inc., Santa Ana, CA 92705 714-558-8028
§ Tokin America, Inc., San Jose, CA 95134 408-432-8020
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
Torad Coil Co., Inc., Wayne, NJ 07470 201-835-6195
† Torotron Corp., Mt. Vernon, NY 10550 914-664-2050
† Torwico Elctrns. Inc., Lakewood, NJ 08701 908-364-1800
Transformer Technologies, Inc., Mt. Vernon, NY 10552 914-668-1600
† Vanguard Electronics Co., Gardena, CA 90248 310-323-4100
§† Vitec Electronics Corp., Visalia, CA 93291 209-651-1535
The Winatic Corp., Electro-Technik Industries, Inc., Vestal, NY 13850 607-729-6318
† Wirebenders, Inc., Phoenix, AZ 85021-2824 602-861-1856
§† Zambre Co., Inc., Mountain View, CA 94043 415-968-9176

Transformers, Ratio-5600

CR Magnetics, Inc. (Formerly Current Ring Co., Inc.), Fenton, MO 63026, 314-343-8518 ..... A•2309
MCI Transformer Corporation, Babylon, NY 11704, 516-587-0510 ..... A•2396,2402
† Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2455
Renco Electronics, Inc., Deer Pk., NY 11729, 516-586-5566;1-800-645-5828 ..... A•2527
† Automatic Coil Corp., Miami, FL 33147 305-696-6660
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
Bel Fuse, Jersey City, NJ 07302 201-432-0463
Bell Inds., J. W. Miller Div., Gardena, CA 90247-1059 310-515-1720
Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
† B. G. Laboratories, Inc., Binghamton, NY 13904 607-722-2376
BH Electronics, Inc., Burnsville, MN 55337 612-894-9590
C & C Jetronic, Inc., Allentown, NJ 08501 609-259-8855
† Communication Coil Inc., Chicago, IL 60634 312-637-1333
† De Young Mfg., Inc., Kirkland, WA 98034 206-823-4798
§ GC International Inc., Plano, TX 75074 214-423-8411
Gertsch Instrumentation Div., Tegam, Inc., Madison, OH 44057 216-428-7505
Gettysburg Transformer Corporation, Gettysburg, PA 17325 717-334-2191
JB Electronic Transformers Inc., Chicago, IL 60647 312-342-0080
† Magnecomp, Inc., Pickens, SC 29671 803-878-4700
MicroSignals Inc., L.I.C., NY 11101 ..... 718-937-7955;718-937-0391;800-648-2252
§† Microtran Co. Inc., Valley Stream, NY 11582-0236 516-561-6050
Mitchell Electronics Corp., Mt. Vernon, NY 10552 914-699-3800
OPT Industries, Inc., Phillipsburg, NJ 08865 908-454-2600
Prem Magnetics, Inc., McHenry, IL 60050 815-385-2700
RAE Company Inc., Indianapolis, IN 46239 317-351-1774
RCD Components, Inc., Manchester, NH 03109 603-669-0054
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
§† Rhombus Industries, Huntington Bch., CA 92649-1595 714-898-0960
§† Skyway Magnetics, Warner Springs, CA 92086-9714 619-782-3342
§ Tamura Corporation of America, Temecula, CA 92589-2230 909-699-1270
TEGAM, Inc., Madison, OH 44057 800-666-1010
Torema U.S.A., Inc., Houston, TX 77042 713-977-2500
Transformer Engineering Corporation, Cleveland, OH 44134 216-741-5282

Transformers, RF-5600

Amplifier Research, Souderton, PA 18964-9990, 215-723-8181 ..... D•1003
APX Technologies Inc., Hicksville, NY 11801, 516-433-1313 ..... A•2267
Caddell-Burns Mfg., Mineola, NY 11501-3508, 516-746-2310 ..... A•1198
C & C Jetronic, Inc., Allentown, NJ 08501, 609-259-8855 ..... A•2302
Coilcraft, Cary, IL 60013, 708-639-2361 ..... A•1215
† Coil-Q Corp., Bronxville, NY 10708, 914-337-4775 ..... A•1222
† Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ..... A•2305
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† Shogyo International Corp., Great Neck, NY 11021-4799, 516-466-0911 ..... A•2534, D•1921
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† American Trans-Coil Corporation, Richmond Hill, NY 11419-1410 718-441-5207
§ Atlantic Magnetics, Inc., Pompano Beach, FL 33069 305-979-7920
† Atlas Engineering Corp., Dorchester, MA 02121 617-445-7100
† Automatic Coil Corp., Miami, FL 33147 305-696-6660
Avtech Electrosystems Ltd., Ottawa, Ontario, CANADA K2C 3H4 613-226-5772
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
§ Bel Fuse, Jersey City, NJ 07302 201-432-0463
§ Bell Inds., J. W. Miller Div., Gardena, CA 90247-1059 310-515-1720
Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
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† Caddell Coil Corp., Middletown Springs, VT 05757 802-235-2019
§ Ceramic Magnetics, Inc., Fairfield, NJ 07004 201-227-4222
CET Technology, Hudson, NH 03051 603-883-5912
† Corona Magnetics, Inc., Corona, CA 91719 909-735-7558
Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 605-665-9301
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Delta Products Corporation, Fremont, CA 94538 510-770-0660
† De Young Mfg., Inc., Kirkland, WA 98034 206-823-4798
Elcom Systems, Inc., Boca Raton, FL 33487 407-994-1774
Electro Assemblies Corp., Northbrook, IL 60062-2319 708-498-6520
† Electro Impulse, Neptune, NJ 07754-0278 908-776-5800
§ ENI, Div. of Astec America, Inc., Rochester, NY 14623 716-427-8300
§ Fee Fil-Mag, San Diego, CA 92123 619-569-6577
§ GC International Inc., Plano, TX 75074 214-423-8411
Gowanda Electronics Corp., Gowanda, NY 14070 716-532-2234
Grand Transformer, Inc., Grand Haven, MI 49417 616-842-5430
§ Hammond Manufacturing Co., Buffalo, NY 14225 716-894-5710
Integrity Technology Corporation, Santa Clara, CA 95050 408-262-8640
† Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710 813-347-2181
§† M/A-COM Microelectroincs Division, M/A-COM, Lowell, MA 01853-3295 508-442-5000
† Magnecomp, Inc., Pickens, SC 29671 803-878-4700
† Magnetic Component Engineering, Inc., Inglewood, CA 90301 310-677-6600
† Magnetico Inc., Holtsville, NY 11742 516-654-1166
Micro-Coax, Collegeville, PA 19426 215-489-3700
MicroSignals Inc., L.I.C., NY 11101 ..... 718-937-7955;718-937-0391;800-648-2252
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OPT Industries, Inc., Phillipsburg, NJ 08865 908-454-2600
Penny Technologies, Inc., Greenpoint, NY 11222 718-782-4149
§ Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018 ..... 408-730-0300;800-PENSTOCK
† Piconics, Incorporated, Tyngsboro, MA 01879 508-649-7501
Polara Engineering Inc., Fullerton, CA 92633 714-521-0900
† Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
† Premier Magnetics Inc., Aliso Viejo, CA 92656 714-362-4211
Prem Magnetics, Inc., McHenry, IL 60050 815-385-2700
Pulse Engineering, Inc., San Diego, CA 92128 619-674-8100
† Radio Research Instrument Co., Inc., Waterbury, CT 06704-3506 203-753-5840
Radio Television Products Corp., Douglas, AZ 85607 602-364-4438
RCD Components, Inc., Manchester, NH 03109 603-669-0054
§ Relay Specialties, Oakland, NJ 07436 201-337-1000
§ Sinclair Radio Laboratories Ltd., Aurora, ONT., CANADA L4G 3G9 416-727-0165
Standex Electronics, Standex International, Cincinnati, OH 45209 513-871-3777
ST Olektron Corporation Subsidiary of Signal Technology Corp., Beverly, MA 01915 508-922-0019

Synergy Microwave Corporation, Paterson, NJ 07504 201-881-8800
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291
Texas Transformer Corp., Plano, TX 75086 214-424-1581
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§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
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† Torotron Corp., Mt. Vernon, NY 10550 914-664-2050
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
† TRM, Inc., Manchester, NH 03110 603-627-6000
† TTE, Incorporated, W. Los Angeles, CA 90064-1400 ..... 310-478-8224;800-776-7614
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§ Valor Electronics, San Diego, CA 92131-1642 619-537-2500
† Vanguard Electronics Co., Gardena, CA 90248 310-323-4100
§ Vitec Electronics Corp., Visalia, CA 93291 209-651-1535
† Werlatone, Inc., Brewster, NY 10509 914-279-6187
† Wirebenders, Inc., Phoenix, AZ 85021-2824 602-861-1856
§ Zambre Co., Inc., Mountain View, CA 94043 415-968-9176
† ZMAN Magnetics, Kent, WA 98032 206-251-8064

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Actown-Electrocoil, Inc., Spring Grove, IL 60081 815-675-6641
Advanced Components Inds., Inc., Div of Kaschke, Torrance, CA 90501 310-328-0060
§† Alliedsignal Aerospace, Aerospace Systems & Equipment, Eatontown, NJ 07724 908-389-7761
American Magnetics, Carterville, IL 62918 618-985-4838
† American Monarch, Minneapolis, MN 55421 612-788-9161
ATC-Frost Magnetics Inc., Oakville,Ont., CANADA L6H 2R4 416-844-6681
Atlantic Magnetics, Inc., Pompano Beach, FL 33069 305-979-7920
† Automatic Coil Corp., Miami, FL 33147 305-696-6660
† Axel Electronics, Inc., Subsidiary of FPBSM Industries Inc., Rancho Dominquez, CA 90220 718-291-3900
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
Basler Elec., Electronic Product Group, Highland, IL 62249 ..... 618-654-2341; 800-645-2074
Basler Electrics, Magnetics Product Grp., Highland, IL 62249 618-654-2341
Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
† Beta Transformer Tech. Corp., ILC Data Device Corp., Bohmia, NY 11716 516-244-7393
† B. G. Laboratories, Inc., Binghamton, NY 13904 607-722-2376
C & C Jetronic, Inc., Allentown, NJ 08501 609-259-8855
† Coast Coil Co., Coast Magnetics, Los Angeles, CA 90016 213-936-6188
§ Computer Power Inc., High Bridge, NJ 08829 ..... 908-638-8000;800-526-5088
Controlled Power Co., Troy, MI 48083 ..... 313-528-3700;1-800-521-4792
† Corona Magnetics, Inc., Corona, CA 91719 909-735-7558
Custom Bobbin Windings, A & K Corporation, Zanesville, OH 43702-2369 614-452-6973
† Cypress Magnetics, Inc., Rancho Cucamonga, CA 91730 909-987-3570
† Del Electronics Corp., Valhalla, NY 10595 914-686-3600
Deltona Transformer Corp., DeLand, FL 32724 904-736-7900
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012 605-296-3462
Dynapower Corporation, S. Burlington, VT 05407 802-860-7200
Electronetics, Inc., Everett, WA 98204 206-355-1855
† Electronic Transformer Corp., Paterson, NJ 07544-0487 201-942-2222
Elgar Electronics Corporation, San Diego, CA 92121 ..... 619-450-0085;800-733-5427
Elma Engineering, Palo Alto, CA 94303 415-494-7303
† Elnetic Electronics, Inc.:Plant Locations, Gardena, CA 90247 310-515-1546
Endicott Coil Co., Inc., Binghamton, NY 13905 607-797-1263
Epco Products Inc., Wallkill, NY 12589 914-895-2033
† Freed Transformer Co., Inc., Electronic Transformer Corp., Paterson, NJ 07544-0487 201-942-2222
Gavagan Electronics, Danbury, CT 06810 203-748-5248
GC International Inc., Plano, TX 75074 214-423-8411
Gettysburg Transformer Corporation, Gettysburg, PA 17325 717-334-2191
§ GlobTek, Inc., Northvale, NJ 07647 201-784-1000
Grand Transformer, Inc., Grand Haven, MI 49417 616-842-5430
§ Hammond Manufacturing Co., Buffalo, NY 14225 716-894-5710
High Voltage Systems, Inc., Universal Designs Corp., Chappaqua, NY 10514 914-238-8462
Hipotronics Inc., Brewster, NY 10509 914-279-8091
§† JB Electronic Transformers Inc., Chicago, IL 60647 312-342-0080
Jerome Industries Corp., Elizabeth, NJ 07201 908-353-5700
KGS Electronics, Inc., Arcadia, CA 91006 818-574-1175
† KIP Transformers Inc., Wolcott, CT 06716 203-758-7085
† L/C Magnetics, Anaheim, CA 92806 714-666-0787
† Lenco Elctrns., Inc., McHenry, IL 60050 815-344-2900
Long Island Transformer & Inductor, Baldwin, NY 11510 516-379-1465
MACROAMP Inc., Ukiah, CA 95482 800-458-8892
Mag-Con, St. Paul, MN 55113 612-633-8820
† Magnecomp, Inc., Pickens, SC 29671 803-878-4700
† MagneTek Power Technology Systems, MagneTek, Inc., Anaheim, CA 92805 714-956-9200
§ Magnetek Triad, Huntington, IN 46750 219-356-7100
† Magnetic Circuit Elements, Salinas, CA 93905 408-757-8752
† Magnetico Inc., Holtsville, NY 11742 516-654-1166
MCI Transformer Corporation, Babylon, NY 11704 516-587-0510
§† Microtran Co. Inc., Valley Stream, NY 11582-0236 516-561-6050
† MTE Corp., Menomonee Falls, WI 53051 414-253-8200
MultiComp., Inc., Beaverton, OR 97006 503-626-4200
† Nesharniny Transformer Corp., Furlong, PA 18925 215-794-7411
Nicollet Technologies Corp., Minneapolis, MN 55413 612-379-7919
† Northlake Engineering, Inc., Bristol, WI 53104-0370 414-857-9600
Oeco Corp., Milwaukie, OR 97222 503-659-7362
† OPT Industries, Inc., Phillipsburg, NJ 08865 908-454-2600
† Pacific Scientific, Electro Kinetics Division, Santa Barbara, CA 93101 805-963-2055
Pacific Transformer Corp., Anaheim, CA 92807 ..... 714-779-0450;1-800-325-0501
† Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861 908-826-4700
Precision Components, Inc., Wilmington, IL 60481 708-543-6448
† PTC Transformers, Bordentown, NJ 08505 609-298-8200
Radio Television Products Corp., Douglas, AZ 85607 602-364-4438
Royal Enterprises Co., Simi Valley, CA 93063 ..... 805-522-8730;818-998-2455
Sanford-Miller Corp., Oceanside, NY 11572 ..... 516-763-0926;800-645-5900
Schauer Manufacturing, Cincinnati, OH 45242 513-791-3030
Schott Corp., Wayzata, MN 55391 612-475-1173
† Scientific Technologies Inc., Control Components Div., Hayward, CA 94544-7831 ..... 510-471-9717;800-221-7060
† Sierra West Power Systems, Las Cruces, NM 88001 505-522-8828
† Sigma Electronics Inc., Houston, TX 77099 ..... 713-933-4700;800-874-7121
† Sigmapower, Inc, FPBSM Industries, Inc., Rancho Dominguez, CA 90220-6404 310-884-5200
§† Skyway Magnetics, Warner Springs, CA 92086-9714 619-782-3342
Staco Energy Products Co., Dayton, OH 45403 513-253-1191
† Staco Transpower, Components Corp. of America, Mt. Carmel, IL 62863 618-262-5555
Standard Magnetic Corp., Garden Grove, CA 92641 714-379-5671
† Stangenes Industries, Inc., Palo Alto, CA 94303 415-493-0814
Teco Corp., Winnisquam, NH 03289 603-524-1998
Texas Transformer Corp., Plano, TX 75086 214-424-1581
§† Thordarson Meissner, Components Corp. of Amer., Mt. Carmel, IL 62863 618-262-5121
† Torelco, Inc., Irvington, NJ 07111 ..... 201-374-8641;800-867-3526
† Torwico Elctrns. Inc., Lakewood, NJ 08701 908-364-1800
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
Transformer Engineering Corporation, Cleveland, OH 44134 216-741-5282
Ulveco Inc., Houston, TX 77042 1-800-527-7042
WPI Group, Inc., Warner, NH 03278 603-456-3111
Xentek, Inc., Taiyo Yuden USA, Inc., San Marcos, CA 92069 619-471-4001
Xylog Corp., Hackensack, NJ 07601 201-489-4040
§† Zambre Co., Inc., Mountain View, CA 94043 415-968-9176

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† Control Sciences, Inc., Chatsworth, CA 91311, 818-709-5510 ..... D•1176,1178
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† Magnecomp, Inc., Pickens, SC 29671, 803-878-4700 ..... A•2377
† Magnetico Inc., Holtsville, NY 11742, 516-654-1166 ..... A•2390
† NWL Transformers, Bordentown, NJ 08505, 609-298-7300 ..... A•2437
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† Trans American Transformer, E. Setauket, NY 11733, 516-928-0762 ..... A•2597
Abbott Technologies, Inc., Sun Valley, CA 91352 ..... 818-504-0644;1-800-367-8200
American Magnetics, Carterville, IL 62918 618-985-4838
† Astrosystems, Inc., Lake Success, NY 11042 516-328-1600
Atlas Engineering Corp., Dorchester, MA 02121 617-445-7100
Basler Elec., Electronic Product Group, Highland, IL 62249 ..... 618-654-2341; 800-645-2074
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† Freed Transformer Co., Inc., Electronic Transformer Corp., Paterson, NJ 07544-0487 ... 201-942-2222
Gertsch Instrumentation Div., Tegam, Inc., Madison, OH 44057 ... 216-428-7505
† Hadley, Robert M. Co., Inc., Los Angeles, CA 90037 ... 213-234-9091
Hipotronics Inc., Brewster, NY 10509 ... 914-279-8091
† Hisonic, Inc., Olathe, KS 66051 ... 913-782-0012
Hitran Corporation, Flemington, NJ 08822-1238 ... 908-782-5525
† ILC Data Device Corp., Bohemia, NY 11716-2482 ... 516-567-5600
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† L/C Magnetics, Anaheim, CA 92806 ... 714-666-0787
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§† Microtran Co. Inc., Valley Stream, NY 11582-0236 ... 516-561-6050
† MTE Corp., Menomonee Falls, WI 53051 ... 414-253-8200
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† Transmagnetics, Farmingdale, NY 11735 ... 516-293-3100
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§† Zambre Co., Inc., Mountain View, CA 94043 ... 415-968-9176

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† Transformer Design , MTE Corporation, Menomonee Falls, WI 53051 ... 414-253-8200
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† L/C Magnetics, Anaheim, CA 92806 ... 714-666-0787
† Lenco Elctrns., Inc., McHenry, IL 60050 ... 815-344-2900
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† MTE Corp., Menomonee Falls, WI 53051 ... 414-253-8200
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OPT Industries, Inc., Phillipsburg, NJ 08865 ... 908-454-2600
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† Power Magne-Tech Corporation, Perth Amboy, NJ 08861 ... 908-826-4700
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† Sierra West Power Systems, Las Cruces, NM 88001 ... 505-522-8828
† Sigma Electronics Inc., Houston, TX 77099 ... 713-933-4700;800-874-7121
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† Trans American Transformer, E. Setauket, NY 11733 ... 516-928-0762
§† Vitec Electronics Corp., Visalia, CA 93291 ... 209-651-1535
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† Wirebenders, Inc., Phoenix, AZ 85021-2824 ... 602-861-1856
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§† RCD Components, Inc., Manchester, NH 03109 603-669-0054
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§† Skyway Magnetics, Warner Springs, CA 92086-9714 619-782-3342
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† Magtech Controls, Vernitron Corporation, San Diego, CA 92173 619-662-2235
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Para-Line Transformer Co., Inc., Alhambra, CA 91803, 818-281-0222 .... A•2444
PC Transformer Corp., West Babylon, NY 11704, 516-491-3300 ..... A•2453
† Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2455
Prem Magnetics, Inc., McHenry, IL 60050, 815-385-2700 .. A•2516-2521,2523-2525
Rhombus Industries, Huntington Bch., CA 92649-1595, 714-898-0960 ... A•2533
Shogyo International Corp., Great Neck, NY 11021-4799, 516-466-0911 ..... A•2534, D•1921
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ..... A•2118
Signal Transformer Co., Inc., Insilco Corporation, Inwood, NY 11696, 516-239-5777 ..... A•2536
§ Stancor, White-Rodgers, Logansport, IN 46947, 219-722-2244 ..... A•2558,2564
§ Tamura Corporation of America, Temecula, CA 92589-2230, 909-699-1270 ..... A•2571,2574-2575
 # Technical Devices, Dayton, OH 45414, 513-890-7881 ..... D•1956
TMP Inc., Santa Ana, CA 92705, 714-558-8028 ..... A•2580
Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314 ..... A•2594
§ Valor Electronics, San Diego, CA 92131-1642, 619-537-2500 ..... A•2602-2603
Vernitron Corp., Precision Comps. Group, St. Petersburg, FL 33710, 813-347-2181 ..... A•2599
Actown-Electrocoil, Inc., Spring Grove, IL 60081 815-675-6641
Advanced Components Inds., Inc., Div of Kaschke, Torrance, CA 90501 310-328-0060
§ AT&T Microelectronics, Allentown, PA 18103 ..... 1-800-372-2447;In Can.:1-800-553-2448
ATC-Frost Magnetics Inc., Oakville,Ont., CANADA L6H 2R4 416-844-6681
Automatic Coil Corp., Miami, FL 33147 305-696-6660
Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
† Beta Transformer Tech. Corp., ILC Data Device Corp., Bohmia, NY 11716 516-244-7393
† B. G. Laboratories, Inc., Binghamton, NY 13904 607-722-2376
CET Technology, Hudson, NH 03051 603-883-5912
CUI Stack Inc., Beaverton, OR 97005 503-643-4899
† Delta Products Corporation, Fremont, CA 94538 510-770-0660
Deltona Transformer Corp., DeLand, FL 32724 904-736-7900
† De Young Mfg., Inc., Kirkland, WA 98034 206-823-4798
Electrocom Industries, S. Bend, IN 46615 219-232-2743
† Electronic Transformer Corp., Paterson, NJ 07544-0487 201-942-2222
† Elnetic Electronics, Inc.:Plant Locations, Gardena, CA 90247 310-515-1546
Engineered Assemblies & Components Corp., Teterboro, NJ 07608 ..... 201-288-4477; 800-447-5639
† Freed Transformer Co., Inc., Electronic Transformer Corp., Paterson, NJ 07544-0487 201-942-2222
§ GC International Inc., Plano, TX 75074 214-423-8411
GlobTek, Inc., Northvale, NJ 07647 201-784-1000
§ Hammond Manufacturing Co., Buffalo, NY 14225 716-894-5710
† Hytronics Corporation, Clearwater, FL 34620 813-536-7861
Integrity Technology Corporation, Santa Clara, CA 95050 408-262-8640
§ James Electronics, Chicago, IL 60618 312-463-6500
§† JB Electronic Transformers Inc., Chicago, IL 60647 312-342-0080
† Lenco Elctrns., Inc., McHenry, IL 60050 815-344-2900
LEPCO/Leonard Elec. Prods., Brownsville, TX 78521 210-546-1625
LZR Electronics, Inc., Gaithersburg, MD 20879 301-921-4600
Mag-Con, St. Paul, MN 55113 612-633-8820
† Magnecomp, Inc., Pickens, SC 29671 803-878-4700
§ Magnetek Triad, Huntington, IN 46750 219-356-7100
† Magnetic Circuit Elements, Salinas, CA 93905 408-757-8752
† Magnetico Inc., Holtsville, NY 11742 516-654-1166
MTE Corp., Menomonee Falls, WI 53051 414-253-8200
Nedap N.V., Groenlo, HOLLAND 7140 AA ..... +31-5440-71111
† Neshaminy Transformer Corp., Furlong, PA 18925 215-794-7411
Onan Power/Electronics, Minneapolis, MN 55344-3577 612-943-4600
† OPT Industries, Inc., Phillipsburg, NJ 08865 908-454-2600
† Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861 908-826-4700
† Precision Components, Inc., Wilmington, IL 60481 708-543-6448
RCD Components, Inc., Manchester, NH 03109 603-669-0054
† Schott Corp., Wayzata, MN 55391 612-475-1173
† Sigma Electronics Inc., Houston, TX 77099 ..... 713-933-4700;800-874-7121
South American Development Corp., Poughkeepsie, NY 12590 914-452-1305
Texas Transformer Corp., Plano, TX 75086 214-424-1581
§ Thordarson Meissner, Components Corp. of Amer., Mt. Carmel, IL 62863 618-262-5121
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
§† Vitec Electronics Corp., Visalia, CA 93291 209-651-1535
Vynckier, Inc., Hawthorne, NY 10532 714-896-0772
The Winatic Corp., Electro-Technik Industries, Inc., Vestal, NY 13850 607-729-6318
Wirebenders, Inc., Phoenix, AZ 85021-2824 602-861-1856
§ Zambre Co., Inc., Mountain View, CA 94043 415-968-9176

Transformers, Toroidal-5600

† Abbott Technologies, Inc., Sun Valley, CA 91352, 818-504-0644;1-800-367-8200 ..... A•2234
Alber, Inc., Lynnwood, WA 98036, 206-771-4006;800-822-5227 ..... A•2256
Amecon, Inc., Anaheim, CA 92805, 714-634-2220;800-392-2292 .... A•2263-2265
APX Technologies Inc., Hicksville, NY 11801, 516-433-1313 ..... A•2267
Avel Transformers Inc., New Milford, CT 06776, 203-355-4711 ..... A•2272-2274
Bey Electric, Inc., Lincoln Park, NJ 07035, 201-694-5000 ..... A•2295
† BH Electronics, Inc., Burnsville, MN 55337, 612-894-9590 ..... A•2297
† Bicron Electronics, Canaan, CT 06018, 203-824-5125 ..... A•2299-2301, B•1919
Caddell-Burns Mfg., Mineola, NY 11501-3508, 516-746-2310 ..... A•1198
C & C Jetronic, Inc., Allentown, NJ 08501, 609-259-8855 ..... A•2302
†# Cletronics Inc., Medina, OH 44256-9623, 216-722-3030 ..... A•2388
† Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ..... A•2305
Cramer Coil & Transformer Co., Inc., Saukville, WI 53080, 414-268-2150;414-375-5700 ..... A•2306
CR Magnetics, Inc. (Formerly Current Ring Co., Inc.), Fenton, MO 63026, 314-343-8518 ..... A•2309, B•1927
Custom Coils Inc., Alcester, SD 57001-0348, 605-934-2460 ..... A•2311
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180, 605-665-9301 ..... A•1225
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012, 605-296-3462 ..... A•2318
Ensign Corp., Burr Ridge, IL 60521, 708-325-9343 ..... A•2326
† ESC Electronics Corp., Palisades Pk., NJ 07650, 201-947-0400 ..... A•2329
§† EWC, Inc., Englishtown, NJ 07726, 908-446-3110 ..... A•1235,2335,2346
† Fernwood Transformer Co., Transistor Devices Inc., Belvidere, NJ 07823, 908-475-3207 ..... A•2355
† Hisonic, Inc., Olathe, KS 66051, 913-782-0012 ..... A•2360
JM Transformer Co., Inc., Farmingdale, NY 11735, 516-293-0475 ... A•2364-2365
† Kappa Technologies, Inc., Rahway, NJ 07065, 908-396-9400;1-800-223-0603 ..... A•2370
Lumintech Inc., Irvington, NJ 07111, 201-374-1091 ..... A•2376
† Magnecomp, Inc., Pickens, SC 29671, 803-878-4700 ..... A•2377
Magnelab, Boulder, CO 80301-4696, 303-442-6700 ..... A•2378,2382
§ Magnetek Triad, Huntington, IN 46750, 219-356-7100 ..... A•2384
† Magnetico Inc., Holtsville, NY 11742, 516-654-1166 ..... A•2389-2391

§† Microtran Co. Inc., Valley Stream, NY 11582-0236, 516-561-6050 ... A•2404-2405,2410-2413,2417-2418
† Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500 ... A•1725
Mitchell Electronics Corp., Mt. Vernon, NY 10552, 914-699-3800 ... A•2433
† Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ... A•2455
Plitron Manufacturing, Inc., Downsview, Ont., CAN M3J 2N5, 416-667-9914 ... A•2506-2507
Powertronix Corp., Foster City, CA 94404, 415-345-6800 ... A•2509-2511
Prem Magnetics, Inc., McHenry, IL 60050, 815-385-2700 ... A•2525
§† RCD Components, Inc., Manchester, NH 03109, 603-669-0054 ... A•1282
Renco Electronics, Inc., Deer Pk., NY 11729, 516-586-5566;1-800-645-5828 ... A•2527,2529
§† Rhombus Industries, Huntington Bch., CA 92649-1595, 714-898-0960 ... A•2533
Shokai Far East Ltd., Peekskill, NY 10566, 914-736-3500 ... A•2118
† Signal Transformer Co., Inc., Insilco Corporation, Inwood, NY 11696, 516-239-5777 ... A•2536
Talema Electronic, Inc., Saint James, MO 65559, 314-265-5500 ... A•2566-2570
§ Tamura Corporation of America, Temecula, CA 92589-2230, 909-699-1270 ... A•2571
# Technical Devices, Dayton, OH 45414, 513-890-7881 ... D•1956
† Torelco, Inc., Irvington, NJ 07111, 201-374-8641;800-867-3526 ... A•2581
† Toroid Corp. of Maryland, Salisbury, MD 21801, 410-860-0300 ... A•2586-2592
† Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314 ... A•2594
Tortran Inc., Bridgeport, CT 06608, 203-367-5188 ... A•2593
† Trans American Transformer, E. Setauket, NY 11733, 516-928-0762 ... A•2597
† Transformer Technologies, Inc., Mt. Vernon, NY 10552, 914-668-1600 ... A•2598
Ulveco, Inc., Houston, TX 77042, 1-800-527-7042 ... A•2600-2601
Vernitron Corp., Precision Comps. Group, St. Petersburg, FL 33710, 813-347-2181 ... A•2599
Wilco Corp., Indianapolis, IN 46268, 317-293-9300 ... A•1309,2604
† ZMAN Magnetics, Kent, WA 98032, 206-251-8064 ... A•2606
Advanced Components Inds., Inc., Div of Kaschke, Torrance, CA 90501 ... 310-328-0060
† American Trans-Coil Corporation, Richmond Hill, NY 11419-1410 ... 718-441-5207
Andover, Inc., Lafayette, IN 47904 ... 317-447-1157
† Astrosystems, Inc., Lake Success, NY 11042 ... 516-328-1600
ATC-Frost Magnetics Inc., Oakville,Ont., CANADA L6H 2R4 ... 416-844-6681
Atlantic Magnetics, Inc., Pompano Beach, FL 33069 ... 305-979-7920
† Atlas Engineering Corp., Dorchester, MA 02121 ... 617-445-7100
† Automatic Coil Corp., Miami, FL 33147 ... 305-696-6660
† Axel Electronics, Inc., Subsidiary of FPBSM Industries Inc., Rancho Dominquez, CA 90220 ... 718-291-3900
§† Aydin Corporation (West), San Jose, CA 95119-1371 ... 408-629-1100
Basler Electrics, Magnetics Product Grp., Highland, IL 62249 ... 618-654-2341
† Beckman Industrial Corp., Affiliate of Emerson Electric Co., Fullerton, CA 92635 ... 714-447-2300
Bel Fuse, Jersey City, NJ 07302 ... 201-432-0463
§ Bell Inds., J. W. Miller Div., Gardena, CA 90247-1059 ... 310-515-1720
Berkshire Transformer Corp., Kent, CT 06757 ... 203-927-3541
† Beta Transformer Tech. Corp., ILC Data Device Corp., Bohmia, NY 11716 ... 516-244-7393
† B. G. Laboratories, Inc., Binghamton, NY 13904 ... 607-722-2376
† Caddell Coil Corp., Middletown Springs, VT 05757 ... 802-235-2019
Chloride Electro Networks, Chloride Power Electronics, Inc., Caledonia, NY 14423 ... 716-538-4421
† Coast Coil Co., Coast Magnetics, Los Angeles, CA 90016 ... 213-936-6188
† Coast Magnetics, Adams-Maxwell Division, Inglewood, CA 90302-1284 ... 310-673-3245
Coilcraft, Cary, IL 60013 ... 708-639-2361
† Coil-Q Corp., Bronxville, NY 10708 ... 914-337-4775
† Corona Magnetics, Inc., Corona, CA 91719 ... 909-735-7558
Crompton Modutec, Manchester, NH 03109 ... 603-669-5121;800-METERS-1
Cross Electronics, Warrendale, PA 15086 ... 412-776-1591
† Cypress Magnetics, Inc., Rancho Cucamonga, CA 91730 ... 909-987-3570
D & L Electronics, Langhorne, PA 19047 ... 800-942-3631
Datatronics, Inc., Romoland, CA 92585 ... 909-928-7700
† Delta Products Corporation, Fremont, CA 94538 ... 510-770-0660
Deltona Transformer Corp., DeLand, FL 32724 ... 904-736-7900
† De Young Mfg., Inc., Kirkland, WA 98034 ... 206-823-4798
† Dietz Design, Inc., Belton, MO 64012 ... 816-331-4911
EG&G Electro-Optics, EG&G Optoelectronics, EG&G Inc., Salem, MA 01970 ... 508-745-3200;1-800-950-3441
† Electro Assemblies Corp., Northbrook, IL 60062-2319 ... 708-498-6520
† Electrocom Industries, S. Bend, IN 46615 ... 219-232-2743
§† Electromech, Inc., Irvington, NJ 07111 ... 201-318-7999
† Electronic Transformer Corp., Paterson, NJ 07544-0487 ... 201-942-2222
Endicott Coil Co., Inc., Binghamton, NY 13905 ... 607-797-1263
§ Fee Fil-Mag, San Diego, CA 92123 ... 619-569-6577
† Freed Transformer Co., Inc., Electronic Transformer Corp., Paterson, NJ 07544-0487 ... 201-942-2222
† Frequency Selective Networks, Woodside, NY 11377 ... 718-424-7500
Gavagan Electronics, Danbury, CT 06810 ... 203-748-5248
§ GC International Inc., Plano, TX 75074 ... 214-423-8411
§† Gowanda Electronics Corp., Gowanda, NY 14070 ... 716-532-2234
Grand Transformer, Inc., Grand Haven, MI 49417 ... 616-842-5430
† Hadley, Robert M. Co., Inc., Los Angeles, CA 90037 ... 213-234-9091
§ Hammond Manufacturing Co., Buffalo, NY 14225 ... 716-894-5710
Hipotronics Inc., Brewster, NY 10509 ... 914-279-8091
§ Hurricane Electronics Lab, Hurricane, UT 84737 ... 801-635-2003
† Hyperion Industries Corp., Watertown, MA 02172 ... 617-926-0140
Integrity Technology Corporation, Santa Clara, CA 95050 ... 408-262-8640
ISKRA Electronics, Inc., Plainview, NY 11803 ... 516-349-0222
§ James Electronics, Chicago, IL 60618 ... 312-463-6500
§† JB Electronic Transformers Inc., Chicago, IL 60647 ... 312-342-0080
Keytronics, Inc., Endicott, NY 13760 ... 607-754-5405
KGS Electronics, Inc., Arcadia, CA 91006 ... 818-574-1175
† KIP Transformers Inc., Wolcott, CT 06716 ... 203-758-7085
† L/C Magnetics, Anaheim, CA 92806 ... 714-666-0787
† Lenco Elctrns., Inc., McHenry, IL 60050 ... 815-344-2900
LEPCO/Leonard Elec. Prods., Brownsville, TX 78521 ... 210-546-1625
Long Island Transformer & Inductor, Baldwin, NY 11510 ... 516-379-1465
§† M/A-COM Microelectroincs Division, M/A-COM, Lowell, MA 01853-3295 ... 508-442-5000
† Magnetic Circuit Elements, Salinas, CA 93905 ... 408-757-8752
† Magnetic Component Engineering, Inc., Inglewood, CA 90301 ... 310-677-6600
Mech-Tronics, Mount Holly, NJ 08060 ... 609-267-0680
† MTE Corp., Menomonee Falls, WI 53051 ... 414-253-8200
† Neshaminy Transformer Corp., Furlong, PA 18925 ... 215-794-7411
† North Hills Signal Processing, Syosset, NY 11791 ... 516-682-7740
Northlake Engineering, Inc., Bristol, WI 53104-0370 ... 414-857-9600
Oeco Corp., Milwaukie, OR 97222 ... 503-659-7932
§† OPT Industries, Inc., Phillipsburg, NJ 08865 ... 908-454-2600
Pacific Transformer Corp., Anaheim, CA 92807 ... 714-779-0450;1-800-325-0501
§† PCA Electronics, Sepulveda, CA 91343 ... 818-892-0761
† Piconics, Incorporated, Tyngsboro, MA 01879 ... 508-649-7501
Polara Engineering Inc., Fullerton, CA 92633 ... 714-521-0900
† Polyphase Instrument, Ft. Washington, PA 19034 ... 215-643-6950
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861 ... 908-826-4700
† Precision Components, Inc., Wilmington, IL 60481 ... 708-543-6448
† Preferred Electronics, Inc., Westfield, MA 01086 ... 413-568-2301;1-800-553-6374
† PTC Transformers, Bordentown, NJ 08505 ... 609-298-8200
Pulse Engineering, Inc., San Diego, CA 92128 ... 619-674-8100
§ Relay Specialties, Oakland, NJ 07436 ... 201-337-1000
RF Electronics, Inc., Irvine, CA 92714-5517 ... 714-263-0661
Ritter Coil, Inc., Easton, PA 18043-3130 ... 215-258-6780
Rodale Technical Sales Inc., Islip, NY 11751 ... 516-277-5454
† Rtron Corp., Skokie, IL 60076 ... 708-679-7180
SAE Power, Inc., Santa Clara, CA 95050 ... 408-988-0700
† Schott Corp., Wayzata, MN 55391 ... 612-475-1173
† Scientific Technologies Inc., Control Components Div., Hayward, CA 94544-7831 ... 510-471-9717;800-221-7060
§ Shape Electronics, Inc., The Wiremold Co., Lombard, IL 60148 ... 708-620-8394; 1-800-367-5811
Shogyo International Corp., Great Neck, NY 11021-4799 ... 516-466-0911
† Sigma Electronics Inc., Houston, TX 77099 ... 713-933-4700;800-874-7121
† Sigmapower, Inc, FPBSM Industries, Inc., Rancho Dominguez, CA 90220-6404 ... 310-884-5200
Simpson Electric Co., Elgin, IL 60120 ... 708-697-2260
South American Development Corp., Poughkeepsie, NY 12590 ... 914-452-1305
§ Square D Co., Palatine, IL 60067 ... 708-397-2600
§† Staco Energy Products Co., Dayton, OH 45403 ... 513-253-1191
Standard Magnetic Corp., Garden Grove, CA 92641 ... 714-379-5671
† Standex Electronics, Standex International, Cincinnati, OH 45209 ... 513-871-3777
Teco Corp., Winnisquam, NH 03289 ... 603-524-1998
Tele-Tech Corporation, Bozeman, MT 59715 ... 406-586-0291
Texas Transformer Corp., Plano, TX 75086 ... 214-424-1581
Toltec Industries, Inc., San Diego, CA 92154 ... 619-423-0700
Torad Coil Co., Inc., Wayne, NJ 07470 ... 201-835-6195
† Torema U.S.A., Inc., Houston, TX 77042 ... 713-977-2500
Toroid Technologies, Inc., Woodbridge, Ont., CAN L4L 3P6 ... 905-850-5122
† Torotron Corp., Mt. Vernon, NY 10550 ... 914-664-2050
† Torwico Elctrns. Inc., Lakewood, NJ 08701 ... 908-364-1800
† Transformer Design , MTE Corporation, Menomonee Falls, WI 53051 ... 414-253-8200
Transformer Engineering Corporation, Cleveland, OH 44134 ... 216-741-5282
United Technical Products, Fallsington, PA 19054 ... 800-553-5300
U.R.D. America, Laguna Nigel, CA 92607 ... 714-831-0111
§ Valor Electronics, San Diego, CA 92131-1642 ... 619-537-2500
† Vanguard Electronics Co., Gardena, CA 90248 ... 310-323-4100
§† Vitec Electronics Corp., Visalia, CA 93291 ... 209-651-1535
† Wirebenders, Inc., Phoenix, AZ 85021-2824 ... 602-861-1856
§† Zambre Co., Inc., Mountain View, CA 94043 ... 415-968-9176

Transformers, Transistor-5600

Altran Corporation, Crystal Lake, IL 60014, 815-455-5650 ... A•2258
Amecon, Inc., Anaheim, CA 92805, 714-634-2220;800-392-2292 ... A•2260-2261
APX Technologies Inc., Hicksville, NY 11801, 516-433-1313 ... A•2267
AT&T Microelectronics, Allentown, PA 18103, 1-800-372-2447;In Can.:1-800-553-2448 ... A•2268-2271
Avel Transformers Inc., New Milford, CT 06776, 203-355-4711 ... A•2275
§ Bell Inds., J. W. Miller Div., Gardena, CA 90247-1059, 310-515-1720 ... A•1195
C & C Jetronic, Inc., Allentown, NJ 08501, 609-259-8855 ... A•2302
Coil-Q Corp., Bronxville, NY 10708, 914-337-4775 ... A•1222
† Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ... A•2305
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180, 605-665-9301 ... A•2313
EWC, Inc., Englishtown, NJ 07726, 908-446-3110 ... A•2331-2332,2334
FDK America, Inc., Fuji Electrochemical Co., Ltd., San Jose, CA 95134, 408-432-8331 ... A•2348
† Magnecomp, Inc., Pickens, SC 29671, 803-878-4700 ... A•2377
† Magnetico Inc., Holtsville, NY 11742, 516-654-1166 ... A•2389-2390
MCI Transformer Corporation, Babylon, NY 11704, 516-587-0510 ... A•2392,2394,2398,2400
§† Microtran Co. Inc., Valley Stream, NY 11582-0236, 516-561-6050 ... A•2404,2406,2411-2412,2418,2420-2423
MultiComp., Inc., Beaverton, OR 97006, 503-626-4200 ... A•2435
Multi Products International, West Paterson, NJ 07424, 201-890-1344 ... A•2436
Para-Line Transformer Co., Inc., Alhambra, CA 91803, 818-281-0222 ... A•2444
† PCA Electronics, Sepulveda, CA 91343, 818-892-0761 ... A•1670
PC Transformer Corp., West Babylon, NY 11704, 516-491-3300 ... A•2447,2450
† Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ... A•2455

Prem Magnetics, Inc., McHenry, IL 60050, 815-385-2700 ..... **A•2512,2514-2515,2519,2523**
Renco Electronics, Inc., Deer Pk., NY 11729, 516-586-5566;1-800-645-5828 ..... **A•2530-2531**
§ Stancor, White-Rodgers, Logansport, IN 46947, 219-722-2244 ..... **A•2558-2564**
† Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314 ..... **A•2595-2596**
† Trans American Transformer, E. Setauket, NY 11733, 516-928-0762 ..... **A•2597**
Vernitron Corp., Precision Comps. Group, St. Petersburg, FL 33710, 813-347-2181 ..... **A•2599**
Wilco Corp., Indianapolis, IN 46268, 317-293-9300 ..... **A•2604**
Abbott Technologies, Inc., Sun Valley, CA 91352 ..... 818-504-0644;1-800-367-8200
Actown-Electrocoil, Inc., Spring Grove, IL 60081 815-675-6641
§ Atlantic Magnetics, Inc., Pompano Beach, FL 33069 305-979-7920
† Automatic Coil Corp., Miami, FL 33147 305-696-6660
Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
† Beta Transformer Tech. Corp., ILC Data Device Corp., Bohmia, NY 11716 516-244-7393
† B. G. Laboratories, Inc., Binghamton, NY 13904 607-722-2376
BH Electronics, Inc., Burnsville, MN 55337 612-894-9590
† Coast Coil Co., Coast Magnetics, Los Angeles, CA 90016 213-936-6188
Custom Bobbin Windings, A & K Corporation, Zanesville, OH 43702-2369 614-452-6973
Custom Coils Inc., Alcester, SD 57001-0348 605-934-2460
Datatronics, Inc., Romoland, CA 92585 909-928-7700
Delta Products Corporation, Fremont, CA 94538 510-770-0660
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† Freed Transformer Co., Inc., Electronic Transformer Corp., Paterson, NJ 07544-0487 201-942-2222
GC International Inc., Plano, TX 75074 214-423-8411
§ Hammond Manufacturing Co., Buffalo, NY 14225 716-894-5710
§† JB Electronic Transformers Inc., Chicago, IL 60647 312-342-0080
KGS Electronics, Inc., Arcadia, CA 91006 818-574-1175
† Lenco Elctrns., Inc., McHenry, IL 60050 815-344-2900
Mag-Con, St. Paul, MN 55113 612-633-8820
§ Magnetek Triad, Huntington, IN 46750 219-356-7100
† Magnetic Circuit Elements, Salinas, CA 93905 408-757-8752
MTE Corp., Menomonee Falls, WI 53051 414-253-8200
† Neshaminy Transformer Corp., Furlong, PA 18925 215-794-7411
† Northlake Engineering, Inc., Bristol, WI 53104-0370 414-857-9600
§† OPT Industries, Inc., Phillipsburg, NJ 08865 908-454-2600
Pacific Transformer Corp., Anaheim, CA 92807 ..... 714-779-0450 1-800-225-0501
† Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
† PTC Transformers, Bordentown, NJ 08505 609-298-8200
Radio Television Products Corp., Douglas, AZ 85607 602-364-4438
Schott Corp., Wayzata, MN 55391 612-475-1173
Shokai Far East Ltd., Peekskill, NY 10566 914-736-3500
South American Development Corp., Poughkeepsie, NY 12590 914-452-1305
Staco Transpower, Components Corp. of America, Mt. Carmel, IL 62863 618-262-5555
§ Tamura Corporation of America, Temecula, CA 92589-2230 909-699-1270
Texas Transformer Corp., Plano, TX 75086 214-424-1581
§ Thordarson Meissner, Components Corp. of Amer., Mt. Carmel, IL 62863 618-262-5121
† Vanguard Electronics Co., Gardena, CA 90248 310-323-4100
§ Zambre Co., Inc., Mountain View, CA 94043 415-968-9176

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Caddell-Burns Mfg., Mineola, NY 11501-3508, 516-746-2310 ..... **A•1198**
† Caddell Coil Corp., Middletown Springs, VT 05757, 802-235-2019 ..... **A•1213**
† C & C Jetronic, Inc., Allentown, NJ 08501, 609-259-8855 ..... **A•2302**
Lodestone Pacific, Anaheim, CA 92807, 714-630-1343 ..... **A•1244-1247**
Magnetek Triad, Huntington, IN 46750, 219-356-7100 ..... **A•2386**
MCI Transformer Corporation, Babylon, NY 11704, 516-587-0510 ..... **A•2396,2399,2401-2403**
MultiComp., Inc., Beaverton, OR 97006, 503-626-4200 ..... **A•2434**
† NWL Transformers, Bordentown, NJ 08505, 609-298-7300 ..... **A•2437**
§† Ohmite Manufacturing Co., Skokie, IL 60076, 708-675-2600 ..... **A•2442**
PC Transformer Corp., West Babylon, NY 11704, 516-491-3300 ..... **A•2452-2453**
Signal Transformer Co., Inc., Insilco Corporation, Inwood, NY 11696, 516-239-5777 ..... **A•2536**
§† Staco Energy Products Co., Dayton, OH 45403, 513-253-1191 ..... **A•2535**
§† Superior Electric, Warner Electric, Bristol, CT 06010, 203-582-9561 ..... **A•2557**
§† Technipower, A Penril Co., Danbury, CT 06813, 203-748-7001 .. **A•2565, D•1958**
† American Trans-Coil Corporation, Richmond Hill, NY 11419-1410 718-441-5207
† Astrosystems, Inc., Lake Success, NY 11042 516-328-1600
§ AT&T Microelectronics, Allentown, PA 18103 ..... 1-800-372-2447;In Can. 1-800-553-2448
Automatic Coil Corp., Miami, FL 33147 305-696-6660
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
† Columbia Resch. Labs., Woodlyn, PA 19094 215-872-3600
§ Contact East, N. Andover, MA 01845 508-682-2000
† Del Electronics Corp., Valhalla, NY 10595 914-686-3600
GC International Inc., Plano, TX 75074 214-423-8411
GlobTek, Inc., Northvale, NJ 07647 201-784-1000
Hipotronics Inc., Brewster, NY 10509 914-279-8091
J. R. Merritt Controls, Inc., Norwalk, CT 06854 ..... 203-855-9100;800-333-5762
Oeco Corp., Milwaukie, OR 97222 503-659-7932
Phenix Technologies, Accident, MD 21520 301-746-8118
† Piconics, Incorporated, Tyngsboro, MA 01879 508-649-7501
† Power Magne-Tech Corporation, Perth Amboy, NJ 08861 908-826-4700
Ritter Coil, Inc., Easton, PA 18043-3130 215-258-6780
Standex Electronics, Standex International, Cincinnati, OH 45209 513-871-3777
Texas Transformer Corp., Plano, TX 75086 214-424-1581
§ Thordarson Meissner, Components Corp. of Amer., Mt. Carmel, IL 62863 618-262-5121
Todd Systems, Inc., Yonkers, NY 10701 914-963-3400
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
† Vanguard Electronics Co., Gardena, CA 90248 310-323-4100
WPI Group, Inc., Warner, NH 03278 603-456-3111

Transformers, Variable, Motorized-5600

ETI Systems, Polaris Indl. Entprs., Carlsbad, CA 92009, 619-929-0749 ..... **A•2085**
§† Superior Electric, Warner Electric, Bristol, CT 06010, 203-582-9561 ..... **A•2557**
GC International Inc., Plano, TX 75074 214-423-8411
Hipotronics Inc., Brewster, NY 10509 914-279-8091
Phenix Technologies, Accident, MD 21520 301-746-8118

Transformers, Voltage Dividing-5600

† Abbott Technologies, Inc., Sun Valley, CA 91352, 818-504-0644;1-800-367-8200 ..... **A•2234**
† C & C Jetronic, Inc., Allentown, NJ 08501, 609-259-8855 ..... **A•2302**
† Communication Coil Inc., Chicago, IL 60634, 312-637-1333 ..... **A•2305**
JM Transformer Co., Inc., Farmingdale, NY 11735, 516-293-0475 ..... **A•2364**
† Lenco Elctrns., Inc., McHenry, IL 60050, 815-344-2900 ..... **A•2374**
MCI Transformer Corporation, Babylon, NY 11704, 516-587-0510 ..... **A•2399**
† NWL Transformers, Bordentown, NJ 08505, 609-298-7300 ..... **A•2437**
† Oram High Voltage, Dayton, TX 77535, 409-258-5553 ..... **D•1853**
† Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... **A•2455**
Signal Transformer Co., Inc., Insilco Corporation, Inwood, NY 11696, 516-239-5777 ..... **A•2536**
Staco Energy Products Co., Dayton, OH 45403, 513-253-1191 ..... **A•2535**
§ Tamura Corporation of America, Temecula, CA 92589-2230, 909-699-1270 ..... **A•2571**
† Torotel Prods. Inc., Grandview, MO 64030-3199, 816-761-6314 ..... **A•2595**
American Magnetics, Carterville, IL 62918 618-985-4838
† Astrosystems, Inc., Lake Success, NY 11042 ..... 516 328-1600
ATC-Frost Magnetics Inc., Oakville,Ont., CANADA L6H 2R4 416-844-6681
Automatic Coil Corp., Miami, FL 33147 305-696-6660
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
Basler Elec., Electronic Product Group, Highland, IL 62249 ..... 618-654-2341; 800-645-2074
Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
† B. G. Laboratories, Inc., Binghamton, NY 13904 607-722-2376
† Coast Coil Co., Coast Magnetics, Los Angeles, CA 90016 213-936-6188
† Coast Magnetics, Adams-Maxwell Division, Inglewood, CA 90302-1284 310-673-3245
† Corona Magnetics, Inc., Corona, CA 91719 909-735-7558
CR Magnetics, Inc. (Formerly Current Ring Co., Inc.), Fenton, MO 63026 314-343-8518
Custom Coils Inc., Alcester, SD 57001-0348 605-934-2460
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 605-665-9301
† Del Electronics Corp., Valhalla, NY 10595 914-686-3600
† De Young Mfg., Inc., Kirkland, WA 98034 206-823-4798
Electro Assemblies Corp., Northbrook, IL 60062-2319 708-498-6520
† Electronic Transformer Corp., Paterson, NJ 07544-0487 201-942-2222
Electro Scientific Industries, Inc. (ESI), Portland, OR 97229 503-641-4141
† Elnetic Electronics, Inc.:Plant Locations, Gardena, CA 90247 310-515-1546
† Freed Transformer Co., Inc., Electronic Transformer Corp., Paterson, NJ 07544-0487 201-942-2222
Gertsch Instrumentation Div., Tegam, Inc., Madison, OH 44057 216-428-7505
Hipotronics Inc., Brewster, NY 10509 914-279-8091
† Hisonic, Inc., Olathe, KS 66051 913-782-0012
† Joslyn Jennings Corporation, San Jose, CA 95122-2696 408-292-4025
Mag-Con, St. Paul, MN 55113 612-633-8820
† Magnecomp, Inc., Pickens, SC 29671 803-878-4700
† Magnetic Circuit Elements, Salinas, CA 93905 408-757-8752
† Magnetico Inc., Holtsville, NY 11742 516-654-1166
§† Microtran Co. Inc., Valley Stream, NY 11582-0236 516-561-6050
† MTE Corp., Menomonee Falls, WI 53051 414-253-8200
Nicollet Technologies Corp., Minneapolis, MN 55413 612-379-7919
North Hills Signal Processing, Syosset, NY 11791 ..... 516 682-7740
Oeco Corp., Milwaukie, OR 97222 503-659-7932
Para-Line Transformer Co., Inc., Alhambra, CA 91803 818-281-0222
† Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
Prem Magnetics, Inc., McHenry, IL 60050 815-385-2700
† PTC Transformers, Bordentown, NJ 08505 609-298-8200
RAE Company Inc., Indianapolis, IN 46239 317-351-1774
Ross Engineering Corp., Campbell, CA 95008 408-377-4621
Schott Corp., Wayzata, MN 55391 612-475-1173
Staco Transpower, Components Corp. of America, Mt. Carmel, IL 62863 618-262-5555
Technipower, A Penril Co., Danbury, CT 06813 203-748-7001
Teco Corp., Winnisquam, NH 03289 603-524-1998
TEGAM, Inc., Madison, OH 44057 800-666-1010
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291
§ Thordarson Meissner, Components Corp. of Amer., Mt. Carmel, IL 62863 618-262-5121
† Torema U.S.A., Inc., Houston, TX 77042 713-977-2500
† Torwico Elctrns. Inc., Lakewood, NJ 08701 908-364-1800
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
§ Zambre Co., Inc., Mountain View, CA 94043 415-968-9176

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Albar, Inc., Lynnwood, WA 98036, 206-771-4006;800-822-5227 ..... A•2256
† C & C Jetronic, Inc., Allentown, NJ 08501, 609-259-8855 ..... A•2302
† Controlled Power Co., Troy, MI 48083, 313-528-3700;1-800-521-4792 ..... D•2254-2255
§ Elgar Electronics Corporation, San Diego, CA 92121, 619-450-0085;800-733-5427 ..... D•2258
§ Hitran Corporation, Flemington, NJ 08822-1238, 908-782-5525 .. A•2361, D•2267
† Lenco Elctrns., Inc., McHenry, IL 60050, 815-344-2900 ..... A•2374
Magnetek Triad, Huntington, IN 46750, 219-356-7100 ..... A•2386-2387
MCI Transformer Corporation, Babylon, NY 11704, 516-587-0510 ... A•2393,2395
† NWL Transformers, Bordentown, NJ 08505, 609-298-7300 ..... A•2437, D•1851
§ Ohmite Manufacturing Co., Skokie, IL 60076, 708-675-2600 ..... A•2442
§ Pulizzi Engineering, Inc., Santa Ana, CA 92704-6865, 714-540-4229 ..... D•2300
Signal Transformer Co., Inc., Insilco Corporation, Inwood, NY 11696, 516-239-5777 ..... A•2536
§† Staco Energy Products Co., Dayton, OH 45403, 513-253-1191 ..... A•2535
§† Superior Electric, Warner Electric, Bristol, CT 06010, 203-582-9561 ..... A•2557
§† Technipower, A Penril Co., Danbury, CT 06813, 203-748-7001 .. A•2565, D•1958
§ Todd Systems, Inc., Yonkers, NY 10701, 914-963-3400 ..... A•2585
Ulveco, Inc., Houston, TX 77042, 1-800-527-7042 ..... A•2600-2601
Vernitron Corp., Precision Comps. Group, St. Petersburg, FL 33710, 813-347-2181 ..... A•2599
§ Acme Transformer, Acme Electric Corporation, Lumberton, NC 28358 ... 919-738-1121
Adtech Power Inc., Anaheim, CA 92806 714-634-9211
§ AFP ISOREG, AFP Transformers Inc., Littleton, MA 01460 508-486-9483
American Magnetics, Carterville, IL 62918 618-985-4838
† American Monarch, Minneapolis, MN 55421 612-788-9161
§ AT&T Microelectronics, Allentown, PA 18103 ..... 1-800-372-2447;In Can.:1-800-553-2448
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
§ Computer Power Inc., High Bridge, NJ 08829 ..... 908-638-8000;800-526-5088
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 605-665-9301
† Del Electronics Corp., Valhalla, NY 10595 914-686-3600
Dormeyer Industries, A.F. Dormeyer Mfg. Co. Inc., Chicago, IL 60631-1521 312-775-3600
Dynage/Power & Magnetics, Division Of Oakleaf, Inc., Canistota, SD 57012 605-296-3462
† Electronic Transformer Corp., Paterson, NJ 07544-0487 201-942-2222
§† EPE Technologies, Inc., Subsidiary of Square D, Costa Mesa, CA 92627 714-557-1636
† Freed Transformer Co., Inc., Electronic Transformer Corp., Paterson, NJ 07544-0487 201-942-2222
§ Hammond Manufacturing Co., Buffalo, NY 14225 716-894-5710
§ HDR Power Systems, Inc., Hilliard, OH 43026 614-771-5500
Hipotronics Inc., Brewster, NY 10509 914-279-8091
KGS Electronics, Inc., Arcadia, CA 91006 818-574-1175
† KIP Transformers Inc., Wolcott, CT 06716 203-758-7085
Mag-Con, St. Paul, MN 55113 612-633-8820
† Magnetico Inc., Holtsville, NY 11742 516-654-1166
§ Micron Industries, Hillside, IL 60162 708-547-0900
§† MTE Corp., Menomonee Falls, WI 53051 414-253-8200
† Neshaminy Transformer Corp., Furlong, PA 18925 215-794-7411
† Northlake Engineering, Inc., Bristol, WI 53104-0370 414-857-9600
OPT Industries, Inc., Phillipsburg, NJ 08865 908-454-2600
§ Perma Power Elctrns., Niles, IL 60714 312-763-0763
Phenix Technologies, Accident, MD 21520 301-746-8118
Power-One, Inc., Camarillo, CA 93012 805-987-8741
† Preferred Electronics, Inc., Westfield, MA 01086 ..... 413-568-2301;1-800-553-6374
† PTC Transformers, Bordentown, NJ 08505 609-298-8200
Schott Corp., Wayzata, MN 55391 612-475-1173
§ Shape Electronics, Inc., The Wiremold Co., Lombard, IL 60148 ..... 708-620-8394; 1-800-367-5811
§ Sola, Elk Grove Village, IL 60007-5666 708-439-2800
§ Square D Co., Palatine, IL 60067 708-397-2600
Staco Transpower, Components Corp. of America, Mt. Carmel, IL 62863 618-262-5555
§ Sunshine Instruments, Philadelphia, PA 19115 ..... 215-673-5600;800-343-1199
§ Techni-Tool, Plymouth Meeting, PA 19462 215-825-4990
Teco Corp., Winnisquam, NH 03289 603-524-1998
Texas Transformer Corp., Plano, TX 75086 214-424-1581
§ Thordarson Meissner, Components Corp. of Amer., Mt. Carmel, IL 62863 618-262-5121
Torad Coil Co., Inc., Wayne, NJ 07470 201-835-6195
† Torwico Elctrns. Inc., Lakewood, NJ 08701 908-364-1800
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
Transformer Engineering Corporation, Cleveland, OH 44134 216-741-5282
Universal Voltronics Div., Thermo Voltek Corp., Mt. Kisco, NY 10549 914-241-1300
WPI Group, Inc., Warner, NH 03278 603-456-3111
Xentek, Inc., Taiyo Yuden USA, Inc., San Marcos, CA 92069 619-471-4001
§ Zambre Co., Inc., Mountain View, CA 94043 415-968-9176

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Caddell-Burns Mfg., Mineola, NY 11501-3508, 516-746-2310 ..... A•1198
† C & C Jetronic, Inc., Allentown, NJ 08501, 609-259-8855 ..... A•2302
† ESC Electronics Corp., Palisades Pk., NJ 07650, 201-947-0400 ..... A•2329
EWC, Inc., Englishtown, NJ 07726, 908-446-3110 ..... A•2331
† Hisonic, Inc., Olathe, KS 66051, 913-782-0012 ..... A•2360
† Kappa Technologies, Inc., Rahway, NJ 07065, 908-396-9400;1-800-223-0603 ..... A•2370
Midcom, Inc., Watertown, SD 57201, 605-886-4385 ..... A•2430
† Mini-Circuits Lab., Brooklyn, NY 11235-0003, 718-934-4500 ..... A•1725
† North Hills Signal Processing, Syosset, NY 11791, 516-682-7740 ... A•2438-2440
† Pico Electronics, Inc., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2455
§† Rhombus Industries, Huntington Bch., CA 92649-1595, 714-898-0960 ... A•2533
§ Tamura Corporation of America, Temecula, CA 92589-2230, 909-699-1270 ..... A•2573
† ZMAN Magnetics, Kent, WA 98032, 206-251-8064 ..... A•2606
American Magnetics, Carterville, IL 62918 618-985-4838
§ AT&T Microelectronics, Allentown, PA 18103 ..... 1-800-372-2447;In Can.:1-800-553-2448
† Automatic Coil Corp., Miami, FL 33147 305-696-6660
† Axel Electronics, Inc., Subsidiary of FPBSM Industries Inc., Rancho Dominquez, CA 90220 718-291-3900
§† Aydin Corporation (West), San Jose, CA 95119-1371 408-629-1100
Bel Fuse, Jersey City, NJ 07302 201-432-0463
Berkshire Transformer Corp., Kent, CT 06757 203-927-3541
† Beta Transformer Tech. Corp., ILC Data Device Corp., Bohmia, NY 11716 516-244-7393
† B. G. Laboratories, Inc., Binghamton, NY 13904 607-722-2376
BH Electronics, Inc., Burnsville, MN 55337 612-894-9590
† Caddell Coil Corp., Middletown Springs, VT 05757 802-235-2019
§ C-COR Elctrns., Inc., State College, PA 16801 ..... 814-238-2461;800-233-2267
CET Technology, Hudson, NH 03051 603-883-5912
† Coast Coil Co., Coast Magnetics, Los Angeles, CA 90016 213-936-6188
Coilcraft, Cary, IL 60013 ..... 708 639-2361
† Coil-Q Corp., Bronxville, NY 10708 914-337-4775
† Communication Coil Inc., Chicago, IL 60634 312-637-1333
† Corona Magnetics, Inc., Corona, CA 91719 909-735-7558
§ Dale Electronics, Inc., Yankton Div., Yankton, SD 57078-0180 605-665-9301
Dantel, Fresno, CA 93727 209-292-1111
Datatronics, Inc., Romoland, CA 92585 909-928-7700
† Dietz Design, Inc., Belton, MO 64012 816-331-4911
† Electronic Transformer Corp., Paterson, NJ 07544-0487 201-942-2222
§ ENI, Div. of Astec America, Inc., Rochester, NY 14623 716-427-8300
§ Fee Fil-Mag, San Diego, CA 92123 619-569-6577
† Freed Transformer Co., Inc., Electronic Transformer Corp., Paterson, NJ 07544-0487 201-942-2222
† Frequency Selective Networks, Woodside, NY 11377 718-424-7500
§† JB Electronic Transformers Inc., Chicago, IL 60647 312-342-0080
§ Katronic Elektronic Ges.m.b.H., AUSTRIA 04762-5340
KGS Electronics, Inc., Arcadia, CA 91006 818-574-1175
† Lorch Electronics:Div. of Vernitron Corp., St. Petersburg, FL 33710 813-347-2181
Mag-Con, St. Paul, MN 55113 612-633-8820
† Magnecomp, Inc., Pickens, SC 29671 803-878-4700
Magnetek Triad, Huntington, IN 46750 219-356-7100
† Magnetic Circuit Elements, Salinas, CA 93905 408-757-8752
† Magnetico Inc., Holtsville, NY 11742 516-654-1166
MicroSignals Inc., L.I.C., NY 11101 ..... 718-937-7955;718-937-0391;800-648-2252
§† Microtran Co. Inc., Valley Stream, NY 11582-0236 516-561-6050
MTE Corp., Menomonee Falls, WI 53051 414-253-8200
MultiComp., Inc., Beaverton, OR 97006 503-626-4200
Neshaminy Transformer Corp., Furlong, PA 18925 215-794-7411
Onan Power Electronics, Minneapolis, MN 55344-3577 612-943-4600
OPT Industries, Inc., Phillipsburg, NJ 08865 908-454-2600
Pacific Transformer Corp., Anaheim, CA 92807 ..... 714-779-0450;1-800-325-0501
Picosecond Pulse Labs, Inc., Boulder, CO 80306 303-443-1249
† Polyphase Instrument, Ft. Washington, PA 19034 215-643-6950
Prem Magnetics, Inc., McHenry, IL 60050 815-385-2700
† PTC Transformers, Bordentown, NJ 08505 609-298-8200
Pulse Engineering, Inc., San Diego, CA 92128 ..... 619 674-8100
RCD Components, Inc., Manchester, NH 03109 603-669-0054
§ Sinclair Radio Laboratories Ltd., Aurora, ONT., CANADA L4G 3G9 416-727-0165
Skyway Magnetics, Warner Springs, CA 92086-9714 619-782-3342
South American Development Corp., Poughkeepsie, NY 12590 914-452-1305
Standex Electronics, Standex International, Cincinnati, OH 45209 513-871-3777
Tele-Tech Corporation, Bozeman, MT 59715 406-586-0291
§ Toko America, Inc., Mt. Prospect, IL 60056 708-297-0070
† Torotron Corp., Mt. Vernon, NY 10550 914-664-2050
† Trans American Transformer, E. Setauket, NY 11733 516-928-0762
† TRM, Inc., Manchester, NH 03110 603-627-6000
† TTE, Incorporated, W. Los Angeles, CA 90064-1400 ..... 310-478-8224;800-776-7614
§ Valor Electronics, San Diego, CA 92131-1642 619-537-2500
† Vanguard Electronics Co., Gardena, CA 90248 310-323-4100
Western Multiplex Corp., Belmont, CA 94002 415-592-8832
Wide Band Engineering Co., Inc., Phoenix, AZ 85036 602-254-1570
† Wirebenders, Inc., Phoenix, AZ 85021-2824 602-861-1856
§ Zambre Co., Inc., Mountain View, CA 94043 415-968-9176

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International Sensor Systems, Inc., Aurora, NE 68818, 402-694-6111 .... A•1704
§ Philips ECG, North American Philips Co., Williamsport, PA 17701, 717-323-4691 ..... A•2173
§ Zetex, Inc., Zetex plc., Commack, NY 11725, 516-543-7100 ..... A•2227
§ A E G Corporation, Basking Ridge, NJ 07920 908-204-8900
§† Allegro MicroSystems, Inc., formerly Sprague Semiconductor Grp., Worcester, MA 01605 508-795-1300
† A.S.I. Microsystems, Inc., (Formerly Andrich Systems, Inc.), Bohemia, NY 11716 516-589-5656
† Dionics, Westbury, NY 11590 516-997-7474

§† Exar Corp., San Jose, CA 95161-9007 408-434-6400
§ General Transistor Corp., GTC, Inglewood, CA 90301 310-673-8422
§ International Rectifier Corp., El Segundo, CA 90245 310-322-3331
† Micro Hybrids, Inc., Medford, NY 11763 516-732-3448
§† Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
Reliable Electronic Mfg., Wyvern Technologies, Santa Ana, CA 92705 ... 714-966-0710
§ Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013 615-641-2020
Sanken Electric USA Corp., Hoffman Estates, IL 60195 708-519-1717
§ Sanyo Semiconductor Corp., Allendale, NJ 07401 201-825-8080
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006 214-466-6000
§† Silicon General, Garden Grove, CA 92641 714-898-8121
§† Solitron Devices, Inc., Semiconductor Group, West Palm Beach, FL 33407-4697 407-848-4311

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Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... A•2157,2162
§ International Rectifier Corp., El Segundo, CA 90245 310-322-3331
§ Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013 615-641-2020
Sanken Electric USA Corp., Hoffman Estates, IL 60195 708-519-1717
§ Sanyo Semiconductor Corp., Allendale, NJ 07401 201-825-8080

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Collmer Semiconductor, Inc., Dallas, TX 75244, 800-527-0251;214-233-1589 ..... A•2135
§ Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... A•2161
§ Philips ECG, North American Philips Co., Williamsport, PA 17701, 717-323-4691 ..... A•2173
§ Zetex, Inc., Zetex plc., Commack, NY 11725, 516-543-7100 ..... A•2227
§ Allegro MicroSystems, Inc., formerly Sprague Semiconductor Grp., Worcester, MA 01605 508-795-1300
American Microsemiconductor, Inc., Madison, NJ 07940 201-377-9566
† California Eastern Labs. Inc., Santa Clara, CA 95056-0964 408-988-3500
Central Semiconductor Corp., Hauppauge, NY 11788 516-435-1110
§† Continental Device India Limited, New Delhi, INDIA 110028 ..... 536150-53 (4 lines)
§ C-S Electronic Sales, Inc., Frankfort, IN 46041 317-659-1874
Diodes Inc., Chatsworth, CA 91311 ..... 818-882-4920;800-821-1178
§ ITT Components, ITT Corporation, Irvine, CA 92718 714-727-3001
† Linear Integrated Systems, Milpitas, CA 95035 408-263-8401
† Microsemi Corporation, Power Technology Components, Torrance, CA 90501 310-534-3737
§† Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
† New England Semiconductor, Lawrence, MA 01841 ..... 508-794-1666;800-446-1158
§ NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
§ Philips Components Discrete Products Div., Discrete Semiconductor Group, Slatersville, RI 02876-2078 401-762-3800
§ Powerex, Inc., Youngwood, PA 15697-1800 412-925-7272
† PowerTech, Inc., Fair Lawn, NJ 07410 201-791-5050
§† PPC Products Corporation, Riviera Beach, FL 33404 407-848-9606
§† Raytheon Semiconductor, Mountain View, CA 94043 408-522-7068
Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013 615-641-2020
§ Sanyo Semiconductor Corp., Allendale, NJ 07401 201-825-8080
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006 214-466-6000
§ Shindengen America Inc., Westlake Vl, CA 91362 800-634-3654
§† Solitron Devices, Inc., Semiconductor Group, West Palm Beach, FL 33407-4697 407-848-4311

Transistors, Bipolar, Surface Mount-4800

§ Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... A•2161
§ Zetex, Inc., Zetex plc., Commack, NY 11725, 516-543-7100 ..... A•2227
§ Allegro MicroSystems, Inc., formerly Sprague Semiconductor Grp., Worcester, MA 01605 508-795-1300
American Microsemiconductor, Inc., Madison, NJ 07940 201-377-9566
Central Semiconductor Corp., Hauppauge, NY 11788 516-435-1110
Diodes Inc., Chatsworth, CA 91311 ..... 818-882-4920;800-821-1178
§ ITT Components, ITT Corporation, Irvine, CA 92718 714-727-3001
† Linear Integrated Systems, Milpitas, CA 95035 408-263-8401
MACOM, Inc., Lowell, MA 01851 617-272-3000
† Microsemi Corporation, Power Technology Components, Torrance, CA 90501 310-534-3737
§† Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
§ Philips Components Discrete Products Div., Discrete Semiconductor Group, Slatersville, RI 02876-2078 401-762-3800
Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013 615-641-2020
§ Sanyo Semiconductor Corp., Allendale, NJ 07401 201-825-8080
§† Solitron Devices, Inc., Semiconductor Group, West Palm Beach, FL 33407-4697 407-848-4311

Transistors, Chip, Unpackaged-4800

§ Zetex, Inc., Zetex plc., Commack, NY 11725, 516-543-7100 ..... A•2227
§† Advanced Linear Devices, Inc., Sunnyvale, CA 94086-4606 408-720-8737
§† Advanced Power Technology, Bend, OR 97702 503-382-8028
§ A E G Corporation, Basking Ridge, NJ 07920 908-204-8900
§† Allegro MicroSystems, Inc., formerly Sprague Semiconductor Grp., Worcester, MA 01605 508-795-1300
Alpha Industries, Inc., Woburn, MA 01801 617-935-5150
American Microsemiconductor, Inc., Madison, NJ 07940 201-377-9566
† California Eastern Labs. Inc., Santa Clara, CA 95056-0964 408-988-3500
† Dionics, Westbury, NY 11590 516-997-7474
EG & G Vactec, St. Louis, MO 63132 314-423-4900
§ General Transistor Corp., GTC, Inglewood, CA 90301 310-673-8422
† Harris Microwave Semiconductor, Harris Semiconductor, Milpitas, CA 95035 408-433-2222
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
§ International Rectifier Corp., El Segundo, CA 90245 310-322-3331
IXYS Corp., San Jose, CA 95131-1109 408-435-1900
† Linear Integrated Systems, Milpitas, CA 95035 408-263-8401
† Microsemi Corporation, Power Technology Components, Torrance, CA 90501 310-534-3737
§† Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
† New England Semiconductor, Lawrence, MA 01841 ..... 508-794-1666;800-446-1158
† PowerTech, Inc., Fair Lawn, NJ 07410 201-791-5050
§ PPC Products Corporation, Riviera Beach, FL 33404 407-848-9606
§† Raytheon Semiconductor, Mountain View, CA 94043 408-522-7068
§† Semiconductor Technology, Inc., Stuart, FL 34997 407-283-4500
† Semtech Corpus Christi, Semtech Corporation, Corpus Christi, TX 78410 512-289-0403
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006 214-466-6000
† Silicon Transistor Corp., Chelmsford, MA 01824 508-256-3321
† Solid State Devices, La Mirada, CA 90638 714-670-7734
§† Solitron Devices, Inc., Semiconductor Group, West Palm Beach, FL 33407-4697 407-848-4311
Unitrode Corp., Watertown, MA 02172 617-926-0404

Transistors, Darlington-4800

Collmer Semiconductor, Inc., Dallas, TX 75244, 800-527-0251;214-233-1589 ..... A•2135
NEC Electronics, Inc., Mountain View, CA 94039-7241, 1-800-366-9782 .. B•1333
§ Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 .... A•2152,2156-2157,2162
§ Philips ECG, North American Philips Co., Williamsport, PA 17701, 717-323-4691 ..... A•2173
§ Powerex, Inc., Youngwood, PA 15697-1800, 412-925-7272 ..... A•2175
§ Zetex, Inc., Zetex plc., Commack, NY 11725, 516-543-7100 ..... A•2227
§ Allegro MicroSystems, Inc., formerly Sprague Semiconductor Grp., Worcester, MA 01605 508-795-1300
American Microsemiconductor, Inc., Madison, NJ 07940 201-377-9566
§ Continental Device India Limited, New Delhi, INDIA 110028 ..... 536150-53 (4 lines)
C-S Electronic Sales, Inc., Frankfort, IN 46041 317-659-1874
EG & G Vactec, St. Louis, MO 63132 314-423-4900
§ General Transistor Corp., GTC, Inglewood, CA 90301 310-673-8422
§ Honeywell Microswitch Div., Richardson, TX 75081 214-470-4271
International Microelectronics, Arlington, TX 76003 817-473-1730
† Microsemi Corporation, Power Technology Components, Torrance, CA 90501 310-534-3737
§† Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
Mouser Electronics, Santee, CA 92071 800-346-6873
Mouser Electronics, Mansfield, TX 76063 800-346-6873
Mouser Electronics, Gilroy, CA 95020 800-346-6873
† New England Semiconductor, Lawrence, MA 01841 ..... 508-794-1666;800-446-1158
§ NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
§ Philips Components Discrete Products Div., Discrete Semiconductor Group, Slatersville, RI 02876-2078 401-762-3800
† PowerTech, Inc., Fair Lawn, NJ 07410 201-791-5050
§ PPC Products Corporation, Riviera Beach, FL 33404 407-848-9606
§† Raytheon Semiconductor, Mountain View, CA 94043 408-522-7068
§ Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013 615-641-2020
§ Sanyo Semiconductor Corp., Allendale, NJ 07401 201-825-8080
§† Semiconductor Technology, Inc., Stuart, FL 34997 407-283-4500
§ Semikron, Inc., Hudson, NH 03051-0066 ..... 603-883-8102;1-800-258-1308
† Semtech Corpus Christi, Semtech Corporation, Corpus Christi, TX 78410 512-289-0403
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006 214-466-6000
§ Shindengen America Inc., Westlake Vl, CA 91362 800-634-3654
§† Silicon General, Garden Grove, CA 92641 714-898-8121
† Silicon Sensors, Dodgeville, WI 53533 608-935-2707
§† Silicon Transistor Corp., Chelmsford, MA 01824 508-256-3321
§ Solid State, Inc., Bloomfield, NJ 07003-2596 201-429-8700
† Solid State Devices, La Mirada, CA 90638 714-670-7734
§† Solitron Devices, Inc., Semiconductor Group, West Palm Beach, FL 33407-4697 407-848-4311

Transistors, Darlington, Surface Mount-4800

§ Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... A•2162
§ Zetex, Inc., Zetex plc., Commack, NY 11725, 516-543-7100 ..... A•2227
§ Allegro MicroSystems, Inc., formerly Sprague Semiconductor Grp., Worcester, MA 01605 508-795-1300
† Microsemi Corporation, Power Technology Components, Torrance, CA 90501 310-534-3737
§† Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
§ Philips Components Discrete Products Div., Discrete Semiconductor Group, Slatersville, RI 02876-2078 401-762-3800
PowerTech, Inc., Fair Lawn, NJ 07410 201-791-5050
§ Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013 615-641-2020
§ Sanyo Semiconductor Corp., Allendale, NJ 07401 201-825-8080

Transistors, Dual-4800

Collmer Semiconductor, Inc., Dallas, TX 75244, 800-527-0251;214-233-1589 ..... A•2135
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... A•2154,2157
§ Zetex, Inc., Zetex plc., Commack, NY 11725, 516-543-7100 ..... A•2227
§† Advanced Linear Devices, Inc., Sunnyvale, CA 94086-4606 408-720-8737
American Microsemiconductor, Inc., Madison, NJ 07940 201-377-9566
§ Continental Device India Limited, New Delhi, INDIA 110028 ..... 536150-53 (4 lines)

† Dionics, Westbury, NY 11590 516-997-7474
§ General Transistor Corp., GTC, Inglewood, CA 90301 310-673-8422
§ International Rectifier Corp., El Segundo, CA 90245 310-322-3331
† Linear Integrated Systems, Milpitas, CA 95035 408-263-8401
† Microsemi Corporation, Power Technology Components, Torrance, CA 90501 310-534-3737
§† Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
§ NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
§ Philips ECG, North American Philips Co., Williamsport, PA 17701 717-323-4691
§† Raytheon Semiconductor, Mountain View, CA 94043 408-522-7068
§† Semiconductor Technology, Inc., Stuart, FL 34997 407-283-4500
† Silicon Sensors, Dodgeville, WI 53533 608-935-2707
§ Solid State, Inc., Bloomfield, NJ 07003-2596 201-429-8700
† Solid State Devices, La Mirada, CA 90638 714-670-7734
§† Solitron Devices, Inc., Semiconductor Group, West Palm Beach, FL 33407-4697 407-848-4311
§† Unitrode Corp., Watertown, MA 02172 617-926-0404

Transistors, Field Effect-4800

Collmer Semiconductor, Inc., Dallas, TX 75244, 800-527-0251;214-233-1589 ..... A•2135
Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 .... A•2151,2154,2156,2159
§ Philips ECG, North American Philips Co., Williamsport, PA 17701, 717-323-4691 ..... A•2173
§ Zetex, Inc., Zetex plc., Commack, NY 11725, 516-543-7100 ..... A•2227
§† Advanced Linear Devices, Inc., Sunnyvale, CA 94086-4606 408-720-8737
§† Advanced Power Technology, Bend, OR 97702 503-382-8028
§ Allegro MicroSystems, Inc., formerly Sprague Semiconductor Grp., Worcester, MA 01605 508-795-1300
American Microsemiconductor, Inc., Madison, NJ 07940 201-377-9566
† California Eastern Labs. Inc., Santa Clara, CA 95056-0964 408-988-3500
§ Continental Device India Limited, New Delhi, INDIA 110028 ..... 536150-53 (4 lines)
§ C-S Electronic Sales, Inc., Frankfort, IN 46041 317-659-1874
§ General Transistor Corp., GTC, Inglewood, CA 90301 310-673-8422
† Harris Microwave Semiconductor, Harris Semiconductor, Milpitas, CA 95035 408-433-2222
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
§† International Rectifier Corp., El Segundo, CA 90245 310-322-3331
§ ITT Components, ITT Corporation, Irvine, CA 92718 714-727-3001
IXYS Corp., San Jose, CA 95131-1109 408-435-1900
† Linear Integrated Systems, Milpitas, CA 95035 408-263-8401
MACOM, Inc., Lowell, MA 01851 617-272-3000
§ Mitsubishi Elctrns. America, Inc., Elctrn. Device Grp., Sunnyvale, CA 94086 408-730-5900
§† Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
§ NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
§ Philips Components Discrete Products Div., Discrete Semiconductor Group, Slatersville, RI 02876-2078 401-762-3800
§ QMI/NIEC, Twin Oaks, CA 93518 805-867-2555
§† Raytheon Semiconductor, Mountain View, CA 94043 408-522-7068
§ Semiconductor Technology, Inc., Stuart, FL 34997 407-283-4500
Semikron, Inc., Hudson, NH 03051-0066 ..... 603-883-8102;1-800-258-1308
§ Shindengen America Inc., Westlake Vl., CA 91362 800-634-3654
§ Solid State, Inc., Bloomfield, NJ 07003-2596 201-429-8700
§† Solitron Devices, Inc., Semiconductor Group, West Palm Beach, FL 33407-4697 407-848-4311
† Universal Semiconductor Inc., San Jose, CA 95112 408-436-1906

Transistors, Field Effect, Surface Mount-4800

§ **Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... A•2151,2154,2159**
§ **Zetex, Inc., Zetex plc., Commack, NY 11725, 516-543-7100 ..... A•2227**
§† Advanced Linear Devices, Inc., Sunnyvale, CA 94086-4606 408-720-8737
§ Allegro MicroSystems, Inc., formerly Sprague Semiconductor Grp., Worcester, MA 01605 508-795-1300
§† Avantek, Inc, A Subsidiary of Hewlett-Packard, Santa Clara, CA 95054 408-727-0700
Central Semiconductor Corp., Hauppauge, NY 11788 516-435-1110
§ C-S Electronic Sales, Inc., Frankfort, IN 46041 317-659-1874
§ International Rectifier Corp., El Segundo, CA 90245 310-322-3331
§ ITT Components, ITT Corporation, Irvine, CA 92718 714-727-3001
† Linear Integrated Systems, Milpitas, CA 95035 408-263-8401
§ Mitsubishi Elctrns. America, Inc., Elctrn. Device Grp., Sunnyvale, CA 94086 408-730-5900
§† Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
§ Philips Components Discrete Products Div., Discrete Semiconductor Group, Slatersville, RI 02876-2078 401-762-3800
§ QMI/NIEC, Twin Oaks, CA 93518 805-867-2555
§ Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013 615-641-2020
§ Shindengen America Inc., Westlake Vl., CA 91362 800-634-3654
† Universal Semiconductor Inc., San Jose, CA 95112 408-436-1906

Transistors, Germanium-4800

§ Philips ECG, North American Philips Co., Williamsport, PA 17701, 717-323-4691 ..... A•2173
American Microsemiconductor, Inc., Madison, NJ 07940 201-377-9566
§ General Transistor Corp., GTC, Inglewood, CA 90301 310-673-8422
§† Germanium Power Devices, Andover, MA 01810-3065 508-475-5982
§ International Components Corp., Melville, NY 11747 516-293-1500
§ International Diode, Harrison, NJ 07029 201-482-6518
§ NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
§ Semiconductor Technology, Inc., Stuart, FL 34997 407-283-4500
Solid State, Inc., Bloomfield, NJ 07003-2596 201-429-8700
† Solid State Devices, La Mirada, CA 90638 714-670-7734

Transistors, Insulated Gate Bipolar (IGBT)-4800

Collmer Semiconductor, Inc., Dallas, TX 75244, 800-527-0251;214-233-1589 ..... A•2135
Zetex, Inc., Zetex plc., Commack, NY 11725, 516-543-7100 ..... A•2227
§† Advanced Power Technology, Bend, OR 97702 503-382-8028
C-S Electronic Sales, Inc., Frankfort, IN 46041 317-659-1874
§† International Rectifier Corp., El Segundo, CA 90245 310-322-3331
§† IXYS Corp., San Jose, CA 95131-1109 408-435-1900
§ Powerex, Inc., Youngwood, PA 15697-1800 412-925-7272
Semikron, Inc., Hudson, NH 03051-0066 ..... 603-883-8102;1-800-258-1308

Transistors, Low Noise, GaAs, FETs - Also See Transistors, Microwave-4800

§ Philips ECG, North American Philips Co., Williamsport, PA 17701, 717-323-4691 ..... A•2173
Zetex, Inc., Zetex plc., Commack, NY 11725, 516-543-7100 ..... A•2227
§† Avantek, Inc, A Subsidiary of Hewlett-Packard, Santa Clara, CA 95054 408-727-0700
† California Eastern Labs. Inc., Santa Clara, CA 95056-0964 408-988-3500
† Harris Microwave Semiconductor, Harris Semiconductor, Milpitas, CA 95035 408-433-2222
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
MACOM, Inc., Lowell, MA 01851 617-272-3000
M/A-COM Microelectronics Division, M/A-COM, Lowell, MA 01853-3295 508-442-5000
§ Mitsubishi Elctrns. America, Inc., Elctrn. Device Grp., Sunnyvale, CA 94086 408-730-5900
§† Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
Optotek Limited, Kanata, Ont., CANADA K2K 2A9 613-591-0336
† Raytheon Co., Electronic Components Division, Waltham, MA 02254 617-899-8400
§ Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013 615-641-2020
§ Sanyo Semiconductor Corp., Allendale, NJ 07401 201-825-8080

Transistors, Microwave-4800

§ **Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... A•2160-2161**
§ Philips ECG, North American Philips Co., Williamsport, PA 17701, 717-323-4691 ..... A•2173
Zetex, Inc., Zetex plc., Commack, NY 11725, 516-543-7100 ..... A•2227
§† Avantek, Inc, A Subsidiary of Hewlett-Packard, Santa Clara, CA 95054 408-727-0700
† California Eastern Labs. Inc., Santa Clara, CA 95056-0964 408-988-3500
† Harris Microwave Semiconductor, Harris Semiconductor, Milpitas, CA 95035 408-433-2222
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
MACOM, Inc., Lowell, MA 01851 617-272-3000
M/A-COM Microelectronics Division, M/A-COM, Lowell, MA 01853-3295 508-442-5000
M/A-COM PHI, Inc., M/A-COM, Inc., Torrance, CA 90501 213-329-8160
§ Mitsubishi Elctrns. America, Inc., Elctrn. Device Grp., Sunnyvale, CA 94086 408-730-5900
§† Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
§ NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
Optotek Limited, Kanata, Ont., CANADA K2K 2A9 613-591-0336
§ Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018 ..... 408-730-0300;800-PENSTOCK
§ Philips Components Discrete Products Div., Discrete Semiconductor Group, Slatersville, RI 02876-2078 401-762-3800
Polyfet RF Devices, Newbury Park, CA 91320 805-498-4552

Transistors, NPN, Surface Mount-4800

§ **Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... A•2154-2155,2160,2162,2170**
§† **Solitron Devices, Inc., Semiconductor Group, West Palm Beach, FL 33407-4697, 407-848-4311 ..... A•2219**
§ Zetex, Inc., Zetex plc., Commack, NY 11725, 516-543-7100 ..... A•2227
§ Allegro MicroSystems, Inc., formerly Sprague Semiconductor Grp., Worcester, MA 01605 508-795-1300
Central Semiconductor Corp., Hauppauge, NY 11788 516-435-1110
Diodes Inc., Chatsworth, CA 91311 ..... 818-882-4920;800-821-1178
§ ITT Components, ITT Corporation, Irvine, CA 92718 714-727-3001
† Linear Integrated Systems, Milpitas, CA 95035 408-263-8401
† Microsemi Corporation, Power Technology Components, Torrance, CA 90501 310-534-3737
Mouser Electronics, Santee, CA 92071 800-346-6873
Mouser Electronics, Mansfield, TX 76063 800-346-6873
Mouser Electronics, Gilroy, CA 95020 800-346-6873
† New England Semiconductor, Lawrence, MA 01841 ..... 508-794-1666;800-446-1158
§† Optek Technology Inc., Carrollton, TX 75006 214-323-2200
§ Philips Components Discrete Products Div., Discrete Semiconductor Group, Slatersville, RI 02876-2078 401-762-3800
§ Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013 615-641-2020
§ Sanyo Semiconductor Corp., Allendale, NJ 07401 201-825-8080
§ Solid State, Inc., Bloomfield, NJ 07003-2596 201-429-8700

Transistors, Photo (Incl. Arrays)-3700 — *See Vol. B*

Transistors, PNP, Surface Mount-4800

§ **Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... A•2152,2155-2158,2160,2162,2170**
§† **Solitron Devices, Inc., Semiconductor Group, West Palm Beach, FL 33407-4697, 407-848-4311 ..... A•2219**
§ Zetex, Inc., Zetex plc., Commack, NY 11725, 516-543-7100 ..... A•2227

§ Allegro MicroSystems, Inc., formerly Sprague Semiconductor Grp., Worcester, MA 01605 508-795-1300
Central Semiconductor Corp., Hauppauge, NY 11788 516-435-1110
Diodes Inc., Chatsworth, CA 91311 ..... 818-882-4920;800-821-1178
§ ITT Components, ITT Corporation, Irvine, CA 92718 714-727-3001
† Linear Integrated Systems, Milpitas, CA 95035 408-263-8401
† Microsemi Corporation, Power Technology Components, Torrance, CA 90501 310-534-3737
† New England Semiconductor, Lawrence, MA 01841 ..... 508-794-1666;800-446-1158
§† Optek Technology Inc., Carrollton, TX 75006 214-323-2200
§ Philips Components Discrete Products Div., Discrete Semiconductor Group, Slatersville, RI 02876-2078 401-762-3800
§ Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013 615-641-2020
§ Sanyo Semiconductor Corp., Allendale, NJ 07401 201-825-8080
§ Solid State, Inc., Bloomfield, NJ 07003-2596 201-429-8700

Transistors, Power-4800

Collmer Semiconductor, Inc., Dallas, TX 75244, 800-527-0251;214-233-1589 ..... A•2135
§ Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... A•2152-2153,2155,2158,2164-2169
§ Philips ECG, North American Philips Co., Williamsport, PA 17701, 717-323-4691 ..... A•2173
§† Powerex, Inc., Youngwood, PA 15697-1800, 412-925-7272 ..... A•2175
§† Solitron Devices, Inc., Semiconductor Group, West Palm Beach, FL 33407-4697, 407-848-4311 ..... A•2219
Zetex, Inc., Zetex plc., Commack, NY 11725, 516-543-7100 ..... A•2227
§† Advanced Power Technology, Bend, OR 97702 503-382-8028
American Microsemiconductor, Inc., Madison, NJ 07940 201-377-9566
§† Avantek, Inc, A Subsidiary of Hewlett-Packard, Santa Clara, CA 95054 408-727-0700
BASISTA/NIEC, Richfield, OH 44286 216-659-9287
† California Eastern Labs. Inc., Santa Clara, CA 95056-0964 408-988-3500
Central Semiconductor Corp., Hauppauge, NY 11788 516-435-1110
§ Continental Device India Limited, New Delhi, INDIA 110028 ..... 536150-53 (4 lines)
C-S Electronic Sales, Inc., Frankfort, IN 46041 317-659-1874
Darrah Electric Company, Cleveland, OH 44102 216-631-0912
† Dionics, Westbury, NY 11590 516-997-7474
§ General Transistor Corp., GTC, Inglewood, CA 90301 310-673-8422
§† Germanium Power Devices, Andover, MA 01810-3065 508-475-5982
† Harris Microwave Semiconductor, Harris Semiconductor, Milpitas, CA 95035 408-433-2222
Industrial Test Equipment Co., Inc., Port Washington, NY 11050 516-883-1700
§ International Diode, Harrison, NJ 07029 201-482-6518
International Microelectronics, Arlington, TX 76003 817-473-1730
§† International Rectifier Corp., El Segundo, CA 90245 310-322-3331
MACOM, Inc., Lowell, MA 01851 617-272-3000
† Microsemi Corporation, Power Technology Components, Torrance, CA 90501 310-534-3737
§† Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
Mouser Electronics, Santee, CA 92071 800-346-6873
Mouser Electronics, Mansfield, TX 76063 800-346-6873
Mouser Electronics, Gilroy, CA 95020 800-346-6873
NEC Electronics, Inc., Mountain View, CA 94039-7241 1-800-366-9782
§ NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
§† Optek Technology Inc., Carrollton, TX 75006 214-323-2200
§ Philips Components Discrete Products Div., Discrete Semiconductor Group, Slatersville, RI 02876-2078 401-762-3800
† PowerTech, Inc., Fair Lawn, NJ 07410 201-791-5050
§† PPC Products Corporation, Riviera Beach, FL 33404 407-848-9606
§ Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013 615-641-2020
Sanken Electric USA Corp., Hoffman Estates, IL 60195 708-519-1717
§ Sanyo Semiconductor Corp., Allendale, NJ 07401 201-825-8080
§† Semiconductor Technology, Inc., Stuart, FL 34997 407-283-4500
§ Semikron, Inc., Hudson, NH 03051-0066 ..... 603-883-8102;1-800-258-1308
Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98607 206-834-2500
§ Shindengen America Inc., Westlake Vl., CA 91362 800-634-3654
§† Silicon Transistor Corp., Chelmsford, MA 01824 508-256-3321
§ Solid State, Inc., Bloomfield, NJ 07003-2596 201-429-8700
† Solid State Devices, La Mirada, CA 90638 714-670-7734
§† Unitrode Corp., Watertown, MA 02172 617-926-0404

Transistors, Power, Bipolar-4800

Collmer Semiconductor, Inc., Dallas, TX 75244, 800-527-0251;214-233-1589 ..... A•2135
§ Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... A•2152-2153,2155,2158,2161
§ Powerex, Inc., Youngwood, PA 15697-1800, 412-925-7272 ..... A•2175
§† Solitron Devices, Inc., Semiconductor Group, West Palm Beach, FL 33407-4697, 407-848-4311 ..... A•2219
Zetex, Inc., Zetex plc., Commack, NY 11725, 516-543-7100 ..... A•2227
American Microsemiconductor, Inc., Madison, NJ 07940 201-377-9566
† California Eastern Labs. Inc., Santa Clara, CA 95056-0964 408-988-3500
Central Semiconductor Corp., Hauppauge, NY 11788 516-435-1110
§† Continental Device India Limited, New Delhi, INDIA 110028 ..... 536150-53 (4 lines)
† Dionics, Westbury, NY 11590 516-997-7474
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
§ IXYS Corp., San Jose, CA 95131-1109 408-435-1900
MACOM, Inc., Lowell, MA 01851 617-272-3000
† Microsemi Corporation, Power Technology Components, Torrance, CA 90501 310-534-3737
§† Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
† New England Semiconductor, Lawrence, MA 01841 ..... 508-794-1666;800-446-1158
§ NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
§ Philips Components Discrete Products Div., Discrete Semiconductor Group, Slatersville, RI 02876-2078 401-762-3800
§ Philips ECG, North American Philips Co., Williamsport, PA 17701 717-323-4691
† PowerTech, Inc., Fair Lawn, NJ 07410 201-791-5050
§† PPC Products Corporation, Riviera Beach, FL 33404 407-848-9606
§ Sanyo Semiconductor Corp., Allendale, NJ 07401 201-825-8080
§ Semiconductor Technology, Inc., Stuart, FL 34997 407-283-4500
§ Semikron, Inc., Hudson, NH 03051-0066 ..... 603-883-8102;1-800-258-1308
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006 214-466-6000
§ Shindengen America Inc., Westlake Vl., CA 91362 800-634-3654
§† Silicon Transistor Corp., Chelmsford, MA 01824 508-256-3321
§† Unitrode Corp., Watertown, MA 02172 617-926-0404
§ Vortex, Inc., Solana Bch., CA 92075 619-259-5549

Transistors, Power, Bipolar, Surface Mount-4800

Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... A•2161
§ Powerex, Inc., Youngwood, PA 15697-1800, 412-925-7272 ..... A•2175
§† Solitron Devices, Inc., Semiconductor Group, West Palm Beach, FL 33407-4697, 407-848-4311 ..... A•2219
Zetex, Inc., Zetex plc., Commack, NY 11725, 516-543-7100 ..... A•2227
§† Avantek, Inc, A Subsidiary of Hewlett-Packard, Santa Clara, CA 95054 408-727-0700
Central Semiconductor Corp., Hauppauge, NY 11788 516-435-1110
IXYS Corp., San Jose, CA 95131-1109 408-435-1900
MACOM, Inc., Lowell, MA 01851 617-272-3000
† Microsemi Corporation, Power Technology Components, Torrance, CA 90501 310-534-3737
† New England Semiconductor, Lawrence, MA 01841 ..... 508-794-1666;800-446-1158
§† Optek Technology Inc., Carrollton, TX 75006 214-323-2200
§ Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013 615-641-2020
§ Sanyo Semiconductor Corp., Allendale, NJ 07401 201-825-8080

Transistors, Power, FET-4800

Collmer Semiconductor, Inc., Dallas, TX 75244, 800-527-0251;214-233-1589 ..... A•2135
§ Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... A•2151-2152,2154-2155,2157-2158
§ Powerex, Inc., Youngwood, PA 15697-1800, 412-925-7272 ..... A•2175
§† Solitron Devices, Inc., Semiconductor Group, West Palm Beach, FL 33407-4697, 407-848-4311 ..... A•2219
§† Advanced Power Technology, Bend, OR 97702 503-382-8028
American Microsemiconductor, Inc., Madison, NJ 07940 201-377-9566
† California Eastern Labs. Inc., Santa Clara, CA 95056-0964 408-988-3500
C-S Electronic Sales, Inc., Frankfort, IN 46041 317-659-1874
Darrah Electric Company, Cleveland, OH 44102 216-631-0912
† Harris Microwave Semiconductor, Harris Semiconductor, Milpitas, CA 95035 408-433-2222
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
§† International Rectifier Corp., El Segundo, CA 90245 310-322-3331
IXYS Corp., San Jose, CA 95131-1109 408-435-1900
MACOM, Inc., Lowell, MA 01851 617-272-3000
M/A-COM Microelectroincs Division, M/A-COM, Lowell, MA 01853-3295 508-442-5000
M/A-COM PHI, Inc., M/A COM, Inc., Torrance, CA 90501 213-320-6160
§† Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
§ Philips Components Discrete Products Div., Discrete Semiconductor Group, Slatersville, RI 02876-2078 401-762-3800
§ Philips ECG, North American Philips Co., Williamsport, PA 17701 717-323-4691
Polyfet RF Devices, Newbury Park, CA 91320 805-498-4552
§ QMI/NIEC, Twin Oaks, CA 93518 805-867-2555
RF Electronics, Inc., Irvine, CA 92714-5517 714-263-0661
§ Sanyo Semiconductor Corp., Allendale, NJ 07401 201-825-8080
§ Semiconductor Technology, Inc., Stuart, FL 34997 407-283-4500
Semikron, Inc., Hudson, NH 03051-0066 ..... 603-883-8102;1-800-258-1308
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006 214-466-6000
§ Shindengen America Inc., Westlake Vl., CA 91362 800-634-3654
Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
Tokin America, Inc., San Jose, CA 95134 408-432-8020
† Universal Semiconductor Inc., San Jose, CA 95112 408-436-1906

Transistors, Power, Field Effect, Surface Mount-4800

Zetex, Inc., Zetex plc., Commack, NY 11725, 516-543-7100 ..... A•2227
§ C-S Electronic Sales, Inc., Frankfort, IN 46041 317-659-1874
§ International Rectifier Corp., El Segundo, CA 90245 310-322-3331
§ IXYS Corp., San Jose, CA 95131-1109 408-435-1900
† M.S. Kennedy Corp., Cicero, NY 13039 315-699-9201
Polyfet RF Devices, Newbury Park, CA 91320 805-498-4552
§ QMI/NIEC, Twin Oaks, CA 93518 805-867-2555
§ Shindengen America Inc., Westlake Vl., CA 91362 800-634-3654
† Universal Semiconductor Inc., San Jose, CA 95112 408-436-1906

Transistors, Pressure Sensitive-4800

Omega Engineering, Stamford, CT 06907 800-826-6342

Transistors, RF-4800

§ Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... A•2156,2159-2161,2164-2169
§ Philips ECG, North American Philips Co., Williamsport, PA 17701, 717-323-4691 ..... A•2173
§ Zetex, Inc., Zetex plc., Commack, NY 11725, 516-543-7100 ..... A•2227
§ A E G Corporation, Basking Ridge, NJ 07920 908-204-8900
§ Allegro MicroSystems, Inc., formerly Sprague Semiconductor Grp., Worcester, MA 01605 508-795-1300
American Microsemiconductor, Inc., Madison, NJ 07940 201-377-9566

§† Avantek, Inc, A Subsidiary of Hewlett-Packard, Santa Clara, CA 95054 .. 408-727-0700
§ Continental Device India Limited, New Delhi, INDIA 110028 ..... 536150-53 (4 lines)
§ General Transistor Corp., GTC, Inglewood, CA 90301 310-673-8422
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
§ International Components Corp., Melville, NY 11747 516-293-1500
MACOM, Inc., Lowell, MA 01851 617-272-3000
M/A-COM Microelectroincs Division, M/A-COM, Lowell, MA 01853-3295 508-442-5000
§† Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
† New England Semiconductor, Lawrence, MA 01841 ..... 508-794-1666;800-446-1158
§ NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
§ Philips Components Discrete Products Div., Discrete Semiconductor Group, Slatersville, RI 02876-2078 401-762-3800
Polyfet RF Devices, Newbury Park, CA 91320 805-498-4552
§ Semiconductor Technology, Inc., Stuart, FL 34997 407-283-4500
§ Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
§ Solid State, Inc., Bloomfield, NJ 07003-2596 201-429-8700
† Solid State Devices, La Mirada, CA 90638 714-670-7734

Transistors, RF, Surface Mount-4800

§ Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 ..... A•2155,2159-2161
§ Zetex, Inc., Zetex plc., Commack, NY 11725, 516-543-7100 ..... A•2227
§ Allegro MicroSystems, Inc., formerly Sprague Semiconductor Grp., Worcester, MA 01605 508-795-1300
§† Avantek, Inc, A Subsidiary of Hewlett-Packard, Santa Clara, CA 95054 .. 408-727-0700
§ Katronic Elektronic Ges.m.b.H., AUSTRIA 04762-5340
M/A-COM Microelectroincs Division, M/A-COM, Lowell, MA 01853-3295 508-442-5000
§ Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
§ Philips Components Discrete Products Div., Discrete Semiconductor Group, Slatersville, RI 02876-2078 401-762-3800

Transistors, Silicon-4800

Colmer Semiconductor, Inc., Dallas, TX 75244, 800-527-0251;214-233-1589 ..... A•2135
§ Philips ECG, North American Philips Co., Williamsport, PA 17701, 717-323-4691 ..... A•2172-2173
§† Powerex, Inc., Youngwood, PA 15697-1800, 412-925-7272 ..... A•2175
§ Zetex, Inc., Zetex plc., Commack, NY 11725, 516-543-7100 ..... A•2227
§ A E G Corporation, Basking Ridge, NJ 07920 908-204-8900
§ Allegro MicroSystems, Inc., formerly Sprague Semiconductor Grp., Worcester, MA 01605 508-795-1300
American Microsemiconductor, Inc., Madison, NJ 07940 201-377-9566
† California Eastern Labs. Inc., Santa Clara, CA 95056-0964 408-988-3500
§† Continental Device India Limited, New Delhi, INDIA 110028 ..... 536150-53 (4 lines)
Diodes Inc., Chatsworth, CA 91311 ..... 818-882-4920;800-821-1178
† Dionics, Westbury, NY 11590 516-997-7474
§ General Transistor Corp., GTC, Inglewood, CA 90301 310-673-8422
§ International Components Corp., Melville, NY 11747 516-293-1500
§ International Diode, Harrison, NJ 07029 201-482-6518
§ ITT Components, ITT Corporation, Irvine, CA 92718 714-727-3001
§ IXYS Corp., San Jose, CA 95131-1109 408-435-1900
MACOM, Inc., Lowell, MA 01851 617-272-3000
† Microsemi Corporation, Power Technology Components, Torrance, CA 90501 310-534-3737
§ NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
§ Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404 407-881-3200
§ Philips Components Discrete Products Div., Discrete Semiconductor Group, Slatersville, RI 02876-2078 401-762-3800
† PowerTech, Inc., Fair Lawn, NJ 07410 201-791-5050
§† PPC Products Corporation, Riviera Beach, FL 33404 407-848-9606
§ Sanyo Semiconductor Corp., Allendale, NJ 07401 201-825-8080
§ Semiconductor Technology, Inc., Stuart, FL 34997 407-283-4500
Semikron, Inc., Hudson, NH 03051-0066 ..... 603-883-8102;1-800-258-1308
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006 214-466-6000
§† Silicon Transistor Corp., Chelmsford, MA 01824 508-256-3321
§ Solid State, Inc., Bloomfield, NJ 07003-2596 201-429-8700
† Solid State Devices, La Mirada, CA 90638 714-670-7734
§ Solid State Electronics Corp., Northridge, CA 91324 818-993-8257
§† Solitron Devices, Inc., Semiconductor Group, West Palm Beach, FL 33407-4697 407-848-4311
§† Unitrode Corp., Watertown, MA 02172 617-926-0404
† Universal Semiconductor Inc., San Jose, CA 95112 408-436-1906

Transistors, Switching-4800

Colmer Semiconductor, Inc., Dallas, TX 75244, 800-527-0251;214-233-1589 ..... A•2135
§ Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200 .... A•2156-2157,2164-2166
§ Philips ECG, North American Philips Co., Williamsport, PA 17701, 717-323-4691 ..... A•2172-2173
§† Powerex, Inc., Youngwood, PA 15697-1800, 412-925-7272 ..... A•2175
§ Zetex, Inc., Zetex plc., Commack, NY 11725, 516-543-7100 ..... A•2227
§ A E G Corporation, Basking Ridge, NJ 07920 908-204-8900
§ Allegro MicroSystems, Inc., formerly Sprague Semiconductor Grp., Worcester, MA 01605 508-795-1300
American Microsemiconductor, Inc., Madison, NJ 07940 201-377-9566
Central Semiconductor Corp., Hauppauge, NY 11788 516-435-1110
§ Continental Device India Limited, New Delhi, INDIA 110028 ..... 536150-53 (4 lines)
Delta Products Corporation, Fremont, CA 94538 510-770-0660
Diodes Inc., Chatsworth, CA 91311 ..... 818-882-4920;800-821-1178
† Dionics, Westbury, NY 11590 516-997-7474
§ General Transistor Corp., GTC, Inglewood, CA 90301 310-673-8422
§† Germanium Power Devices, Andover, MA 01810-3065 508-475-5982
Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
§ International Diode, Harrison, NJ 07029 201-482-6518
International Microelectronics, Arlington, TX 76003 817-473-1730
§† International Rectifier Corp., El Segundo, CA 90245 310-322-3331
§ ITT Components, ITT Corporation, Irvine, CA 92718 714-727-3001
IXYS Corp., San Jose, CA 95131-1109 408-435-1900
† Linear Integrated Systems, Milpitas, CA 95035 408-263-8401
† Microsemi Corporation, Power Technology Components, Torrance, CA 90501 310-534-3737
Mouser Electronics, Santee, CA 92071 800-346-6873
Mouser Electronics, Mansfield, TX 76063 800-346-6873
Mouser Electronics, Gilroy, CA 95020 800-346-6873
NEC Electronics, Inc., Mountain View, CA 94039-7241 1-800-366-9782
Nedco Electronics, Inc., Morton Grove, IL 60053 708-967-0500
† New England Semiconductor, Lawrence, MA 01841 ..... 508-794-1666;800-446-1158
§ NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
§ Philips Components Discrete Products Div., Discrete Semiconductor Group, Slatersville, RI 02876-2078 401-762-3800
† PowerTech, Inc., Fair Lawn, NJ 07410 201-791-5050
§ PPC Products Corporation, Riviera Beach, FL 33404 407-848-9606
§† Raytheon Semiconductor, Mountain View, CA 94043 408-522-7068
§ Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013 615-641-2020
§ Sanyo Semiconductor Corp., Allendale, NJ 07401 201-825-8080
§† Semiconductor Technology, Inc., Stuart, FL 34997 407-283-4500
Semikron, Inc., Hudson, NH 03051-0066 ..... 603-883-8102;1-800-258-1308
Semtech Corpus Christi, Semtech Corporation, Corpus Christi, TX 78410 512-289-0403
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006 214-466-6000
§ Shindengen America Inc., Westlake Vl., CA 91362 800-634-3654
§† Silicon Transistor Corp., Chelmsford, MA 01824 508-256-3321
§ Solid State, Inc., Bloomfield, NJ 07003-2596 201-429-8700
† Solid State Devices, La Mirada, CA 90638 714-670-7734
§† Solitron Devices, Inc., Semiconductor Group, West Palm Beach, FL 33407-4697 407-848-4311

Transistors, Switching, Surface Mount-4800

§ Allegro MicroSystems, Inc., formerly Sprague Semiconductor Grp., Worcester, MA 01605 508-795-1300
Central Semiconductor Corp., Hauppauge, NY 11788 516-435-1110
Diodes Inc., Chatsworth, CA 91311 ..... 818-882-4920;800-821-1178
§† International Rectifier Corp., El Segundo, CA 90245 310-322-3331
§ ITT Components, ITT Corporation, Irvine, CA 92718 714-727-3001
† Linear Integrated Systems, Milpitas, CA 95035 408-263-8401
† Microsemi Corporation, Power Technology Components, Torrance, CA 90501 310-534-3737
Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
§ Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404 407-881-3200
§ Philips Components Discrete Products Div., Discrete Semiconductor Group, Slatersville, RI 02876-2078 401-762-3800
§ Rohm Corporation, Rohm Electronics Division, Antioch, TN 37013 615-641-2020
§ Sanyo Semiconductor Corp., Allendale, NJ 07401 201-825-8080
§† Solitron Devices, Inc., Semiconductor Group, West Palm Beach, FL 33407-4697 407-848-4311
§ Zetex, Inc., Zetex plc., Commack, NY 11725 516-543-7100

Transistors, Unijunction-4800

§ Philips ECG, North American Philips Co., Williamsport, PA 17701, 717-323-4691 ..... A•2172
American Microsemiconductor, Inc., Madison, NJ 07940 201-377-9566
§ General Transistor Corp., GTC, Inglewood, CA 90301 310-673-8422
§† Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
† New England Semiconductor, Lawrence, MA 01841 ..... 508-794-1666;800-446-1158
§ NTE Electronics, Inc., Bloomfield, NJ 07003 201-748-5089
§ Solid State, Inc., Bloomfield, NJ 07003-2596 201-429-8700
§ Unitrode Corp., Watertown, MA 02172 617-926-0404

Transistors, Unijunction, Surface Mount-4800

Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
NWL Transformers, Bordentown, NJ 08505 609-298-7300

Transistors (MIL)-2440 — *See Vol. B*

Translators, Data-2325 — *See Vol. D*

Translators, Frequency Band-2750

Precision Filters, Inc., Ithaca, NY 14850, 607-277-3550 .... A•1673, D•1200-1201
† TRAK Microwave Corp., Tampa, FL 33634, 813-884-1411 ..... A•1853
§ C-COR Elctrns., Inc., State College, PA 16801 ..... 814-238-2461;800-233-2267
† General Microwave Corporation, Amityville, NY 11701 516-226-8900
§ Wavetek Corp., San Diego, CA 92123 619-279-2200
Western Multiplex Corp., Belmont, CA 94002 415-592-8832

Translators, Time Code-2000 — *See Vol. D*

Transmission Line, Data — See Cable, Data Transmission (Vol. C)

Transmission Line, Wire & Cable — See Cable, Transmission Line (Vol. C)

Transmission Lines (MIL), RF-2440 — *See Vol. B*

Transmission Systems, Data-2000 — *See Vol. D*

Transmitters, Fiber Optic-2475 — *See Vol. B*

Transmitters, Fixed Frequency-1900 — *See Vol. D*

Transmitters, Infrared remote control transmitters for satellite T.V. receivers-1900 — *See Vol. D*

Transmitters, Laser-3700 — *See Vol. B*

Transmitters, Position-1900 — *See Vol. D*

Transmitters, Process Control (Temperature, Pressure, Flow, etc.)-5500 — *See Vol. B*

Transmitters, Radar — See Radar System Components (Vol. A)

Transmitters, Telemetry-1900 — *See Vol. D*

Transmitters, Tone-1900 — *See Vol. D*

Transmitters (MIL)-2440 — *See Vol. B*

Transmitters (MIL), Fiber Optic-2440 — *See Vol. B*

Transponders-1900 — *See Vol. D*

Transports, Tape (all kinds)-2000 — *See Vol. D*

TRIACs-4800

§ **Crydom Company, Long Beach, CA 90805, 310-865-3536** ..... **B•1465**
§ **Philips Components Discrete Products Division, A North American Philips Company, Riviera Beach, FL 33404, 407-881-3200** ..... **A•2153,2158**
§ **Philips ECG, North American Philips Co., Williamsport, PA 17701, 717-323-4691** ..... **A•2173**
§ **Powerex, Inc., Youngwood, PA 15697-1800, 412-925-7272** ..... **A•2175**
§ **Teccor Electronics, Inc., Irving, TX 75038, 214-580-1515** ..... **A•2220-2223**
American Microsemiconductor, Inc., Madison, NJ 07940 201-377-9566
Central Semiconductor Corp., Hauppauge, NY 11788 516-435-1110
§ Continental Device India Limited, New Delhi, INDIA 110028 ..... 536150-53 (4 lines)
§ Hitachi America, Ltd., Tarrytown, NY 10591 914-631-0600
§ Motorola Semiconductor Prods. Sector, Tempe, AZ 85284 602-244-6900
§ Philips Components Discrete Products Div., Discrete Semiconductor Group, Slatersville, RI 02876-2078 401-762-3800
Raytheon/TAG Semiconductors Ltd., Burlington, MA 01803 ..... 617-272-3704 (3705)
SGS-THOMSON Microelectronics, Inc., Carrollton, TX 75006 214-466-6000
§ Sharp Electronics Corp., Microelectronics Grp., Camas, WA 98607 206-834-2500
Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400

Triggers, SCR — See Controls, SCR (Vol. D)

Trimmers, Capacitor — See Capacitors, Variable, Padders & Trimmers (Vol. A)

Trimmers, Potentiometer — See Potentiometers, Trimmer (Vol. A)

Tubes, Ballast — See Resistors, Ballast (Vol. A)

Tubes, Counting-2200 — *See Vol. D*

Tubes, Flash-3700 — *See Vol. B*

Tubes, Ignitron-2200 — *See Vol. D*

Tubes, Indicator — See Tubes, Readout (Vol. B)

Tubes, Magnetron — See Tubes, Microwave (Vol. A)

Tubes, Microwave-3450

§ A E G Corporation, Basking Ridge, NJ 07920 908-204-8900
† EEV Inc., Elmsford, NY 10523 914-592-6050
† Hughes Aircraft Co., Electron Dynamics Div., Torrance, CA 90509-2999 310-517-6000
† Litton Electron Devices, San Carlos, CA 94070 415-591-8411
Microdry, Inc., Crestwood, KENTUCKY 40014 502-241-8933
† Penta Laboratories, Inc., Chatsworth, CA 91311 ..... 818-882-3872;800-421-4213
† Radio Research Instrument Co., Inc., Waterbury, CT 06704-3506 203-753-5840
† Raytheon Co., Electronic Components Division, Waltham, MA 02254 617-899-8400
§ Siemens Components, Inc., Special Products Div., Iselin, NJ 08830 201-321-3400
Thomson Components & Tubes Corp., Thomson CSF, Totowa, NJ 07511 201-812-9000
† Varian Associates, Electron Device Business, Palo Alto, CA 94304 ..... 415-493-4000; 800-544-4636
Varian Microwave Equipment Products, Varian Assocs., Inc., Santa Clara, CA 95054 408-496-6273
† Wall, A. T., Co., Warwick, RI 02886 401-739-0740

Tubes, Photomultiplier-3700 — *See Vol. B*

Tubes, Readout (CRT, Cold-Cathode, Vacuum Fluorescent, Incandescent, etc.)-2450 — *See Vol. B*

Tubes, Strobe — See Lamps, Stroboscopic Source (Vol. B)

Tubes, TV Camera Pickup-3700 — *See Vol. B*

Tubes, Transmitting-1900 — *See Vol. D*

Tubes, X-ray-2200 — *See Vol. D*

Tubes (MIL), Indicator & Pickup-2440 — *See Vol. B*

Tubes (MIL), Microwave-2440 — *See Vol. B*

Tubes (MIL), Power & Gas, Planar-2440 — *See Vol. B*

Tubes (MIL), Receiving, & Tube Shields-2440 — *See Vol. B*

Tubing, Ceramic-2500 — *See Vol. C*

Tubing, Expandable-6000 — *See Vol. C*

Tubing, Fiberglass-2500 — *See Vol. C*

Tubing, Glass-2500 — *See Vol. C*

Tubing, Heat Shrinkable-Also See Caps, Forms & Tapes, Heat Shrinkable-2500 — *See Vol. C*

Tubing, Metal-2500 — *See Vol. C*

Tubing, Paper-2500 — *See Vol. C*

Tubing, Plastic-Also See Tubing, Spaghetti-2500 — *See Vol. C*

Tubing, Shrinkable-6000 — *See Vol. C*

Tubing, Spaghetti-2500 — *See Vol. C*

Tubing, Spiral Wrap-2500 — *See Vol. C*

Tubing, Waveguide-3450

† Airtron, Litton Industries, Inc., Morris Plains, NJ 07950 201-539-5500
§ Applied Plastics Technology, Bristol, RI 02809 401-253-0200
Flann Microwave Inc., Cambridge, MA 02139 1-800-937-3772
† Gabriel Elctrns. Inc., Scarborough, ME 04070 207-883-5161
§ Microwave Development Laboratories, Natick, MA 01760 508-655-0060
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3 ..... 514-694-6666; 800-724-3911
Pro Com Technology Inc., Plainview, NY 11803 ..... 516-293-4443;800-762-3785
† Radio Research Instrument Co., Inc., Waterbury, CT 06704-3506 203-753-5840
† Wall, A. T., Co., Warwick, RI 02886 401-739-0740

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EPD Electronics, Inc., Gardena, CA 90247, 310-515-4996 ..... **D•1073**
§† **Johanson Manufacturing Corporation, Boonton, NJ 07005, 201-334-2676** ..... **A•1088**
† Eastern Microwave, Winchester, MA 01890 617-721-9800
† FEI Microwave, Inc., Frequency Electronics, Inc., Sunnyvale, CA 94086 408-732-0880
† Ferretec Inc., Fremont, CA 94538-6525 510-226-1216
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† Mallory Controls, Emerson Electric Canada, Woodstock, Ont., CANADA N4S 7W8 519-539-4891
† Maury Microwave Corp., Ontario, CA 91764 909-987-4715
† Microlab/FXR, Livingston, NJ 07039 201-992-7700
† Microphase, Norwalk, CT 06856 203-866-8000
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3 ..... 514-694-6666; 800-724-3911
§ NEC Electronics, Inc., Mountain View, CA 94039-7241 1-800-366-9782
§† Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018 ..... 408 730-0300;800-PENSTOCK
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† Voltronics Corporation, Denville, NJ 07834 201-586-8585
† Watkins-Johnson Co., Palo Alto, CA 94304 415-493-4141

Tuning Circuits, Surface Mount-3130

Stetco, Inc., Franklin Pk., IL 60131 708-671-4208

Tuning Forks-2300

§ **SARONIX, Palo Alto, CA 94303, 415-856-6900** ..... **A•1474**
§ Fox Electronics, Ft. Myers, FL 33905 813-693-0099
§ Makk-O Industries, Yonkers, NY 10703 ..... 914-376-0160; 914-376-0161
† Savoy Electronics, Inc., Ft. Lauderdale, FL 33310 ..... 305-563-1333;800-359-5400

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MACOM, Inc., Lowell, MA 01851 617-272-3000
§ Zetex, Inc., Zetex plc, Commack, NY 11725 516-543-7100

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Andrew Corp., Orland Pk., IL 60462 800-255-1479
† Applied Plastics Technology, Bristol, RI 02809 401-253-0200
# BEC Inc./Certified Calibration Labs, Horsham, PA 19044 800-523-3808
Communications & Energy Corp., E. Syracuse, NY 13057 315-452-0709
† Dielectric Communications, General Signal, Raymond, ME 04071 ..... 207-655-4555; 800-341-9678
† Eastern Microwave, Winchester, MA 01890 617-721-9800
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† Gamma-f Corp., Vertex Communications, Torrance, CA 90505 310-539-6704
§ Hewlett-Packard Company, Direct Marketing Organization, Santa Clara, CA 95051-8059 800-452-4844
† International Telecommunications Components, Inc., Deer Park, NY 11729 516-243-1444
Lectronic Research Labs., Inc., Camden, NJ 08104 800-358-8378
† Loral Microwave Narda, Hauppauge, NY 11788 516-231-1700
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† Maury Microwave Corp., Ontario, CA 91764 909-987-4715
† Microlab/FXR, Livingston, NJ 07039 201-992-7700
† Micro Mode Prods., El Cajon, CA 92020 619-449-3844
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§ Microwave Development Laboratories, Natick, MA 01760 508-655-0060
§ Midwest Microwave, Saline, MI 48176-9569 ..... 313-429-4773;800 521-4410
† Mitec Electronics, Pointe Claire, QUEBEC, CANADA H9R 3X3 ..... 514-694-6666; 800-724-3911
§ Penstock Engineering Labs., Penstock, Inc., Sunnyvale, CA 94086-4018 ..... 408-730-0300;800-PENSTOCK
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§† Pro Com Technology Inc., Plainview, NY 11803 ..... 516-293-4443;800-762-3785
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§† Systron-Donner Microwave Div., Sylmar, CA 91342 818-362-9900
§† Telephonics Corporation/PRD Instruments, Huntington, NY 11743 ..... 516-549-6415/6428
Teleplex, Inc., Alford Division, Woburn, MA 01801 617-935-8610
† UTE Microwave, Asbury Park, NJ 07712 908-922-1009

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§† Telephonics Corporation/PRD Instruments, Huntington, NY 11743 ..... 516-549-6415/6428
Tucker Electronics, Dallas, TX 75355-1419 ..... 214-348-8800;800-527-4642

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APX Technologies Inc., Hicksville, NY 11801, 516-433-1313 ..... **A•2267**
C & C Jetronic, Inc., Allentown, NJ 08501, 609-259-8855 ..... A•2302
† Penn-Tran Corp.,Sub. of Spectrum Eictrns. Inc., Wingate, PA 16880, 814-355-1521 ..... **A•1260-1261**
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§ Murata Manufacturing Co., Ltd., Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 ... 075-951-9111
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Walker Scientific, Worcester, MA 01606 ... 508-852-3674;508-853-3232;800-962-4638

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MINIGLOSSARY FIBER OPTICS

Acceptance Angle
The maximum angle within which light will be accepted by an element such as a detector or waveguide. In the latter, it is quantified as half the vertex angle of the cone within which optical power may be coupled into bound modes of a fiber.

Aligned Bundle
An assembly of fibers in which the coordinates of each fiber are the same at the two ends of the bundle, also called *Coherent Bundle*.

Bend Radius
The radius of curvature that an optical fiber can bend without breaking.

Bundle
Multiple optical fibers in a single housing used to transmit light or images.

Cladding
The low refractive index material that surrounds the core of the fiber to contain core light while protecting against surface contaminant scattering. In all-glass fibers, the cladding is glass.

Effective Numerical Aperture
The real numerical aperture of a fiber when the computed NA is not valid due to a change in the glass indices during the drawing and fusion process.

Fiber Bundle
A rigid, or flexible, concentrated assembly of glass or plastic fibers used to transmit optical images or light.

Fiber Optic Light Guide
A bundle of optical fibers arranged randomly for the purpose of transmitting energy, not images.

Fiber Optic Probe
A flexible optical probe having a bundle of glass fiber arranged to transmit an image

Gap Loss
The optical power loss caused by space between axially aligned fibers.

Image Transducer
Any arrangement of a bundle of optical fibers that alters the shape of the image.

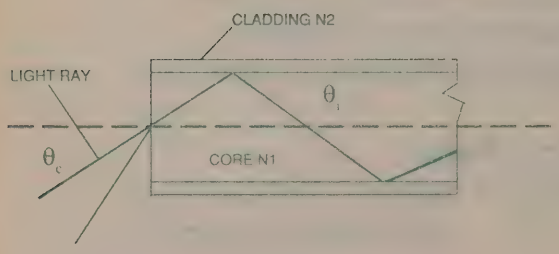
For example, by a systematic regulation of the spacing of the fibers from the entrance end to the exit end, a distortion of the image can occur that may be used to neutralize or compensate for the distortion introduced by the lens, prism or mirror components in an optical system.

Large-Core Fiber
Optical fiber with a large core, often a step-index fiber. "Large" is sometimes defined as greater than 85 μm.

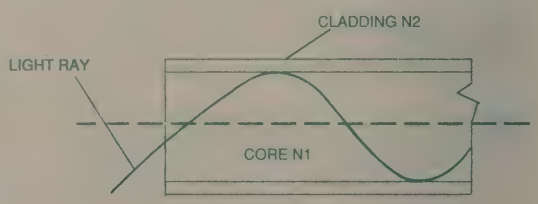
Multifibers
An array of optically distinct fibers that are fused into one strand. They are used to keep the resolution efficiency of the smaller single fibers and eliminate difficulty in handling. Their specific usage is determined by their flexibility or rigidity.

Packing Fraction
The ratio of the active core area of the fiber bundle to the total area at its light emitting or receiving end.

Plastic Fiber
Fiber in which both the core and cladding are made of plastic.



(a) Light propagation in a step index fiber.



(b) Path of light rays in a graded index fiber.

MINIGLOSSARY TIMERS

Accuracy
The variation of unit performance, i.e., time delay, voltage trip point, etc., over the specified conditions of ambient temperature, input voltage range, and time between operations.

Adjustability
The changing of a unit set point, within the specified range of unit operation, by means of internal or external adjustment mechanism (i.e., changing time delay with potentiometer).

Contact Rating
The electrical power-handling capability of relay contacts under specified environmental conditions and for a prescribed number of operations.

Delayed Interval Timing Function
Input voltage is applied continuously. The timing cycle is started by momentarily actuating the control circuit. The functions of separate Delay-On-Operate and interval type timers are combined in one package providing a single OFF-ON-OFF output cycles

Also called: single shot.

Delay-On-Operate Timing Function
Application of the input voltage starts the time delay. At completion of the time delay, the relay contacts transfer.

Also called: Delay-On-Make, On-Delay, Delay Relay, Delay-On-Pickup.

Delay-On-Release Timing Function
Input voltage must be supplied continuously to timer. Actuation of control circuit causes relay contacts to transfer immediately. Time delay starts when control circuit is released. The relay remains energized for the duration of the time delay—then de-energizes.

Also called: Delay-On-Break, Off-Delay, Delay-On-Dropout, Delay-On-Energization.

Frequency Sensor
A device that monitors a predetermined overfrequency and/or underfrequecy condition, and changes output state when these conditions exist.

Hysteresis
The difference between the response of a unit or system to an increasing and a decreasing signal (example: a voltage sensor).

Interval Timer Timing Function
Application of input voltage causes relay contacts to transfer and time delay to begin. At completion of the time delay, the relay contacts return to de-energized state.

Also called: Delay Interval, One Shot.

Output Control
The switching device, either solid-state or electromechanical, used in the unit to control the load connected to the output terminal(s).

Phase Sensor
A device that monitors for proper phase rotation in 3-phase systems.

Programmability
Ability to modify function, time delay or input voltage of a timer.

Recovery Timer

(Delay-On-Operate/Interval Timer)
The minimum time that input voltage must be interrupted *prior* to time-out to insure a successive timing cycle within the specified limits.

(Delay-On-Release)
The minimum duration of time that control circuit must be re-actuated to insure a new timing cycle when the control circuit is released.

Recycle Time

(Delay-On-Operate or Interval Timer)
The minimum time that input voltage must be interrupted after the timing cycle is completed to assure a successive timing cycle within the repeatability specified.

(Delay-On-Release)
The minimum duration of time that control circuit must be actuated to insure a successive timing cycle within the repeatability specified when the control circuit is released.

Repeat Cycle Timer Timing Function
Application of power automatically initiates continuous off-on cycling of the output relay.
Also called: flasher, intervalometer

Reset Time
The time required for the contacts to return to normal position when power is removed.

Reverse Polarity Protection
Blocking circuitry arrangement within the timer to prevent damage or output actuation if reverse polarity input voltage is applied.

Tolerance
The difference between specified and actual timing or sense point (factory setup tolerance).

Transient Protection
Prevents damage to unit if positive or negative transients are applied to the unit. Insures proper operation of the unit during and after transient occurrence. Max. transients are usually specified as to amplitude and duration, i.e., 1000V for 1 second.

Trip Point
The predetermined point at which a sensing device is set to change the output state.

Voltage Sensor
A device that monitors for a predetermined overvoltage and/or undervoltage condition, and changes output state when these conditions exist.

NOMOGRAPH VOLTAGE DROP

NOMOGRAPH OF VOLTAGE DROP ACROSS LOAD SUPPLY LEADS
(as a function of wire size and load current)

THIS NOMOGRAPH CAN BE USED TO FIND:

Maximum current carrying capacity recommended for any standard wire size.*

1) With a straight edge, connect from the wire size on Scale 2 to the point "A" on Scale 3.
2) Read I_{max} on Scale 1.

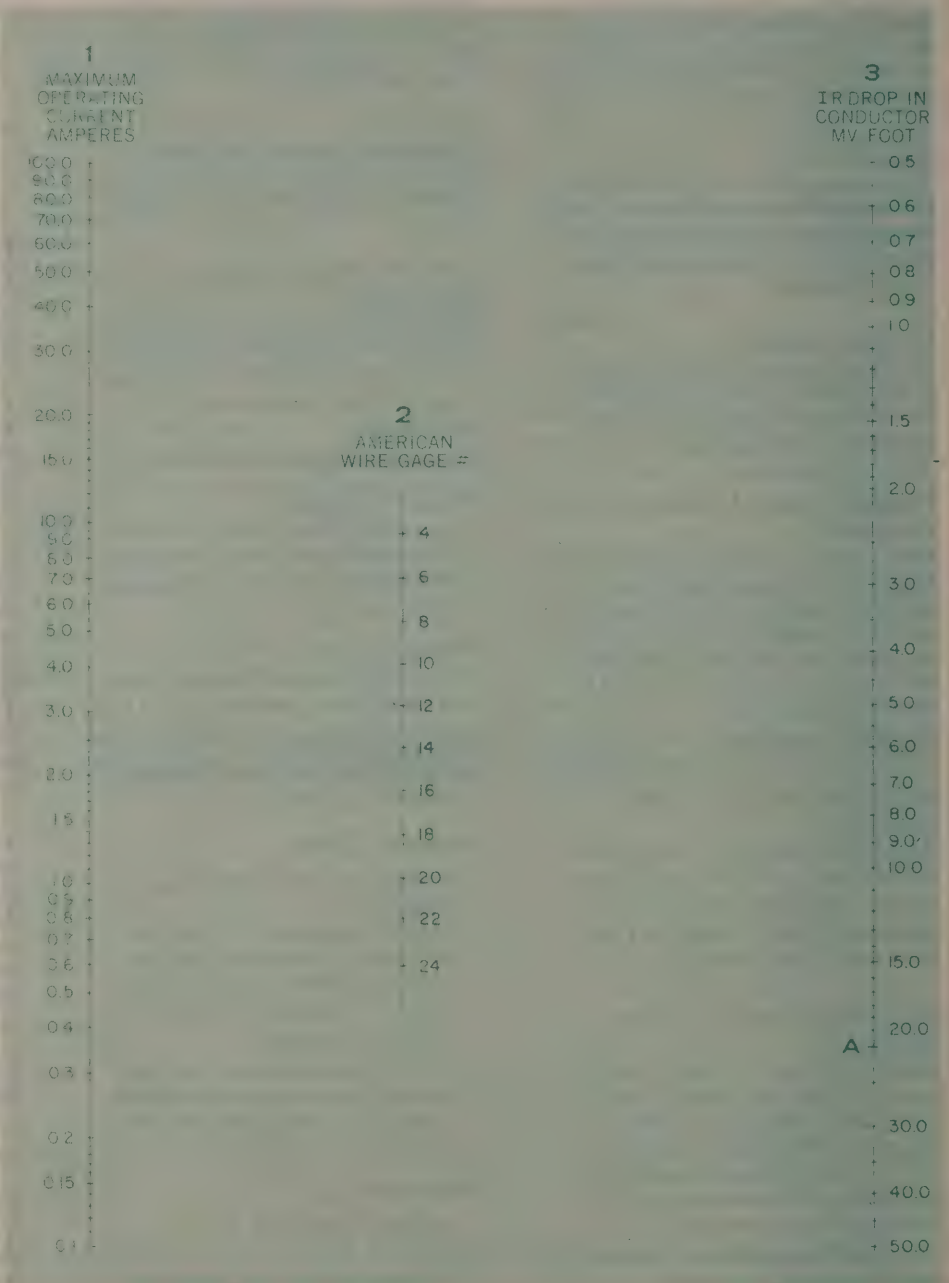
Voltage drop in millivolts per foot for known wire size and operating current.

1) With a straight edge, connect the known current on Scale 1 and the wire size on Scale 2.
2) Read voltage drop on Scale 3.

Wire size required for known operating current and known maximum tolerable voltage drop across supply leads.

1) Determine maximum tolerable drop in millivolts **per foot** of lead (sum of positive and negative leads).
2) Connect the value on Scale 3 (as determined in step 1) to the known current on Scale 1.
3) Read wire size on Scale 2.

** Based on an arbitrary minimum 500 circular mils per ampere. High-temperature class insulation will safely allow higher currents.*



NOTE: A voltage stabilized Power Supply controls the voltage across its output terminals. Hence, the wire conductors used to connect the load must be considered as part of the load. At high load currents, the voltage drop across the supply leads may appreciably degrade stabilization at the load. Kepco models equipped with the *remote error sensing* feature can automatically compensate for voltage drops of up to 500 mV across each load supply lead.

SYMBOLS USED BY INTERNATIONAL REGULATORY AGENCIES

These symbols appear on many electrical/electronic components distributed in the world market. They indicate that a country's standard-setting agency has approved the design of the component and/or a testing agency has approved the performance of the component in meeting the standard. This page lists only those countries that have a *symbol* to represent their authority.

Argentina (IRAM) Instituto Argentino de Racionalization de Materiales

Australia (SAA) Standards Association of Australia

Austria (ÖVE) Österreichischer Verband für Elektrotechnik

Belgium (CEB) Comité Electrotechnique Belge

Brazil (ABNT) Associação Brasileira de Normas Teonicas

Canada (CSA) Canadian Standards Association

Czechoslovakia Urad pro Normalizaci a Mereni (Office for Standards and Measurements)

Denmark (DEK) Dansk Elektroteknisk Komite (Danish Electrotechnical Committee)

Egypt (EOS) Egyptian Organization for Standardization and Quality Control

Finland (SETI) Electrical Inspectorate

France (UTE) Union Technique de l'Électricité

Germany, Democratic Republic of (East) (ASMW) Amt für Standardi-sierung Messwesen und Warenprufung (Office for Standardization, Metrology and Quality Control)

Germany, Federal Republic of (West) (DKE) Deutsche Electrotechnische Kommission im DIN und VDE (German Electrotechnical Commission of DIN and VDE)

Greece (ELOT) The Hellenic Organization of Standardization

Hong Kong Hong Kong Standards & Testing Centre

Hungary (MSZH) Magyar Szabvanyugi Hivatal (Hungarian Office for Standardization)

India (ISI) Indian Standards Institute "Manak Bhavan"

Indonesia Badan Kerjasama Standardisasi LIPI-YDNI (LIPI-YDNI Joint Standardization Committee)

Iran Institute of Standards and Industrial Research of Iran

Ireland (IIRS) Institute for Industrial Research and Standards

Israel (SII) Standards Institution of Israel

Italy (CEI) Comitato Elettrotecnico Italiano (Italian Electrotechnical Committee)

Japan (JISC) Japanese Industrial Standards Committee Agency of Industrial Science and Technology

Korea, Republic of (South) Industrial Advance Administration

Mexico (DGN) Dirección General de Normas Secretaria de Patrimonio y Fomento Industrial Puente de Tecamachalco

Netherlands (NEC) Nederlands Elektrotechnisch Comite

New Zealand (SANZ) Standards Association of New Zealand

Norway (NEK) Norsk Elektroteknisk Komite (Norwegian Electrotechnical Committee)

Pakistan Pakistan Standards Institution

Poland Polski Komitet Normalizacji Miar i Jakosci (Polish Committee for Standardization, Measures and Quality Control)

Portugal (CEP) Comissão Electrotécnica Portuguesa

Romania Institutul Roman de Standardizare (Romanian Standards Institute)

Singapore Singapore Institute of Standards and Industrial Research

South Africa (SABS) South African Bureau of Standards

Spain (IRANOR) Instituto Nacional de Racionalización y Normalización

Sweden (SEK) Svenska Elektriska Kommissionen (Swedish Electrotechnical Commission)

Switzerland (SEV) Schweizerischer Elektrotechnischer Verein Postfach

Turkey (TSE) Turk Standardlari Enstitusu (Turkish Standards Institution)

United Kingdom (BSI) British Standards Institution

United States Underwriters Laboratories Inc. Recognized Component Mark

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FL Tampa, Saber Assocs., Inc. 813-961-0689
GA Dacula, Saber Assocs., Inc. 404-962-8740
IN Fishers; Carter, McCormic & Peirce, Inc. 317-842-9277
MA N. Dartmouth, Elctrn. Sls. of New England 508-997-8016
MI Farmington Hills, Carter, McCormic & Peirce, Inc. 313-477-7700
NC Clayton, Saber Assocs., Inc. 919-553-5009
OH Englewood, Carter, McCormic & Peirce, Inc. 513-836-0951
OH Parma, Carter, McCormic & Peirce, Inc. 216-398-0400
PA Pittsburgh, Carter, McCormic & Peirce, Inc. 412-826-3800
TX Houston, Scientific Sls. Co. 713-645-6218
TX Richardson, Scientific Sls. Co. 214-231-6541

ABALON PRECISION MFG., 1040 Home Street, Bronx, NY 10459, Tel: 718-589-5682, 1-800-888-ABALON, FAX: 718-589-0300; Empl.: 25

ABATRON, INC., 33 Center Dr., Gilberts, IL 60136, Tel: 708-426-2200, 800-445-1754, FAX: 708-426-5966

ABB KENT-TAYLOR INC, Asea Brown Boveri, P.O. Box 20550, Rochester, NY 14602-0550, Tel: 716-292-6050, FAX: 716-273-6207; Empl.: 350; *Dist. Mgr.:* Jim Wicker

ABB SEMICONDUCTOR, See IXYS Corporation

abbott

FAX: 310-836-1027

ABBOTT ELECTRONICS, 2727 S. La Cienega Blvd., Los Angeles, CA 90034, Tel: 310-202-8820; FSC No.: 6130, 5999, 15755; Empl.: 120; *Sls. Mgr.:* William G. Standen ..... **D•1491-1511, 2226-2227**

Local Sales Offices & Reps

MA	Whitinsville, Power Factor & Assoc. ...	508-234-6415
NJ	Ft. Lee, Abbott Elctms.	201-461-4411
TX	Richardson, Abbott Elctms.	214-437-0697
Can	Ottawa, Subtec Ltd.	613-738-1470

Abbott TECHNOLOGIES INC

The Powerhouse of Quality

FAX: 818-768-0395/7

ABBOTT TECHNOLOGIES, INC., 8203 Vineland Ave., Sun Valley, CA 91352, Tel: 818-504-0644, 1-800-367-8200; FSC No.: 58910; Empl.: 62; *Sls. Mgr.:* Suresh Soni, Sls. Mgr. ..... **A•2234-2253; D•1512-1515, 2228-2229**

Local Sales Offices & Reps

CA	Sun Valley, Abbott Technlgs., Inc.	818-504-0644
NJ	Palisades Pk., Abbott Technlgs., Inc. ..	201-461-4005

ABBOTT TRANSISTOR LABS, Power Supplies, See Abbott Electronics, Power Supplies

AB CONTROLS & TECHNOLOGY INC., 1700 Rockville Pike, Rockville, MD 20852, Tel: 301-984-6020, FAX: 301-981-3270; *Sls. Mgr.:* Andrew Kassman

A.B. CONTROLS & TECHNOLOGY, INC., 255 Pennbright, Ste. 200, Houston, TX 77090, Tel: 713-876-3728, 301-984-6020, FAX: 713-876-4853; Empl.: 15; *Sls. Mgr.:* Andrew Kassman; *Dist. Mgr.:* Andrew Kassman

ABL ELECTRONICS SUPPLY, INC., 11 S. Broad St., Peekskill, NY 10566, Tel: 914-736-1010, 1-800-431-2103, FAX: 914-736-1899; Empl.: 18; *Sls. Mgr.:* George Wiesel ..... **C•1287, 1706-1709**

ABLESTIK ELECTRONIC MATERIALS & ADHESIVES-EMCA-REMEX PRODUCTS, 160 Commerce Dr., Montgomeryville, PA 18936, Tel: 215-855-1000, TWX: 710-566-1128, FAX: 215-855-8202; Empl.: 50; *Sls. Mgr.:* Jeff Gausepohl

ABLESTIK LABORATORIES, 20021 Susana Rd., Rancho Dominguez, CA 90221, Tel: 310-764-4600, FAX: 310-764-2545; FSC No.: 21109; Empl.: 150; *Sls. Mgr.:* J. Gausepohl

ABORN ELECTRONICS INC., 2108 D Bering Dr., San Jose, CA 95131, Tel: 408-436-5444, FAX: 408-436-0969; FSC No.: 8Z441; *Sls. Mgr.:* V. Lumba

ABRACON CORPORATION, 1010 Calle Cordillera Bldg. 103, San Clemente, CA 92673, Tel: 714-498-4505, FAX: 714-498-1714; *Sls. Mgr.:* Jeff Trusiak; *Dist. Mgr.:* Dean Nessen ..... **A•1180, 1330-1331**

ABRAMS INSTRUMENT CORP., 1322 Rensen St., Lansing, MI 48910-3688, Tel: 517-882-7211, FAX: 517-882-3136; FSC No.: 00048; *Sls. Mgr.:* Merlyn Gates

ABSOLUTE FILTER CO., P.O. Box 594, Ambler, PA 19002, Tel: 215-886-9176, FAX: 215-886-9179; Empl.: 2; *Sls. Mgr.:* Ed Borzelleca

ABSOPULSE ELECTRONICS LTD., 110 Walgreen Rd., Carp, Ont., Can K0A 1L0, Tel: 613-836-3511, FAX: 613-836-7488; Empl.: 31; *Sls. Mgr.:* Tony Plangger; *Dist. Mgr.:* Nanno Habets

ABWJ SYSTEMS CORP., 2700 Gateway Centre Blvd., Morrisville, NC 27560, Tel: 919-481-1001, FAX: 919-460-7664; Empl.: 25; *Sls. Mgr.:* Lino D'Andreti/Dieter Brammer; *Dist. Mgr.:* Max Bachofen

ABW SYSTEMS, CORPORATION, 2700 Gateway Centre Blvd., Morrisville, NC 27560, Tel: 919-481-1001, FAX: 919-460-7664; Empl.: 25; *Sls. Mgr.:* Lino D'Andreti / Dieter Brammer; *Dist. Mgr.:* Max Bachofen

ACC ELECTRONICS COMPANY, Echlin Inc., 1300 W. Oak, Independence, KS 67301, Tel: 316-331-1000, FAX: 316-331-0449; Empl.: 1000; *Sls. Mgr.:* Leon Allen

ACCEL INDUSTRIAL HEAT SINK CORP., 3709 Medford St., Los Angeles, CA 90063, Tel: 213-261-5156, FAX: 213-261-5159; FSC No.: 26701; *Sls. Mgr.:* Ron Ruby

ACCEL TECHNOLOGIES, INC., 6825 Flanders Dr., San Diego, CA 92121, Tel: 619-554-1000, FAX: 619-554-1019; Empl.: 33; *Sls. Mgr.:* Earl Therrien

ACCESSORIES FOR ELECTRONICS, INC., 800 Merrick Rd., Baldwin, NY 11510-3593, Tel: 516-546-1751, FAX: 516-867-1922; FSC No.: 54355; Empl.: 27; *Sls. Mgr.:* Bill Harris

ACC RELAYS, Echlin Inc., 1300 West Oak St., Independence, KS 67301-0778, Tel: 316-331-1000, FAX: 316-331-0449; Empl.: 900; *Sls. Mgr.:* Neil Heisler; *Dist. Mgr.:* Gary Ledbetter

ACCULEX CORPORATION, 440 Myles Standish Blvd., Taunton, MA 02780, Tel: 508-880-3660, TELEX: 503989, FAX: 508-880-0179; *Sls. Mgr.:* Richard A. Mullen

ACCULIN, INC., 209 W. Central St., Natick, MA 01760, Tel: 508-650-1012, FAX: 508-650-1457; Empl.: 5; *Sls. Mgr.:* Barry Hilton

ACCUMET ENGINEERING, 518 Main St., Hudson, MA 01749, Tel: 508-568-8311, FAX: 508-562-4384; *Sls. Mgr.:* C. T. Haering

ACCU-NOISE LAB, Marek Technology Inc., 23 Padanaram Rd., Ste. 5, Danbury, CT 06811, Tel: 203-743-3633; *Sls. Mgr.:* R. L. Longo; *Dist. Mgr.:* Robert L. Longo

ACCUPROBE, INC., 1 Harrison Ave, Box 1044, Salem, MA 01970, Tel: 508-745-7878, FAX: 508-745-7922; Empl.: 15; *Sls. Mgr.:* Thomas H. Murphy; *Dist. Mgr.:* T. H. Murphy

ACCURATE ELECTRONICS CORP., 169 S. Abbe Rd., P.O. Box 1287, Elyria, OH 44036, Tel: 216-366-6330, 1-800-334-5904, FAX: 216-366-0522; FSC No.: 11375; Empl.: 35; *Sls. Mgr.:* Roger M. Mahoney

ACCURIDE, 12311 Shoemaker, Santa Fe Springs, CA 90670, Tel: 310-903-0200, TWX: 910-586-1632, FAX: 310-903-0208

ACCUSONIC DIVISION, O.R.E. International Inc., Box 709, Falmouth, MA 02541, Tel: 508-548-5800, TELEX: 6817399 OREFAL UW, FAX: 508-540-3835; Empl.: 100; *Sls. Mgr.:* Robert Beede

ACCUSONIC PRODUCTS, Global Market Development, 2101 Jericho Turnpike, New Hyde Park, NY 11040, Tel: 516-437-6000, FAX: 516-358-2307; FSC No.: 11-3044326; Empl.: 11; *Sls. Mgr.:* Anthony W. Mazzeo; *Dist. Mgr.:* Anthony W. Mazzeo

ACCUTECH, Adaptive Instrs. Corp., 15 Bunazzoli Ave., Riverside Indl. Park, Hudson, MA 01749, Tel: 508-568-0500, FAX: 508-568-9085; *Sls. Mgr.:* Cliff Lewis

ACCUTECH BENCHMARK SERVICES, P.O. Box 252, Brick, NJ 08723, Tel: 1-908-206-0026, FAX: 908-206-0280

ACCU-TECH CORPORATION, 200 Hembree Park Dr., Roswell, GA 30076-3890, Tel: 404-751-9473, 800-221-4767, FAX: 404-475-4659; Empl.: 52; *Sls. Mgr.:* Randy Guhl; *Dist. Mgr.:* Dale Yarber

ACCUTRONICS/CONNOR-WINFIELD, See Connor-Winfield

ACCU-TRONICS MFG., INC., 4255 White Bear Pkwy., St. Paul, MN 55110, Tel: 612-653-1961, FAX: 612-653-1041; Empl.: 35; *Sls. Mgr.:* Jeffrey H. Zappa

ACDC ELECTRONICS, DIV. OF ASTEC AMERICA, See Astec America

ACD-ELCOR PRODUCTS, P.O. Box 244, Bethel, CT 06801, Tel: 203-743-3510; Empl.: 3

ACHESON COLLOIDS, Div. of Acheson Industries, Inc., P.O. Box 611747, Port Huron, MI 48061-1747, Tel: 313-984-5581, FAX: 313-984-1446; Empl.: 200

ACI COMPONENTS, INC., 23422 Peralta, Ste. D, Laguna Hills, CA 92653, Tel: 714-588-9611, FAX: 714-588-1855; FSC No.: 5930; Empl.: 5; *Sls. Mgr.:* Christian Dwyer

ACL INC., 1960 E. Devon Ave., Elk Grove Village, IL 60007, Tel: 708-981-9212, 1-800-782-8420, TELEX: 4330251, ESYLNK: 708-981-9212; Empl.: 12

ACME ELECTRIC CORPORATION, 20 Water Street, Cuba, NY 14727, Tel: 716-968-2400, FAX: 716-968-3948; *Sls. Mgr.:* Dale Guilford

ACME MODEL ENGINEERING CO., 654 Bergen Blvd., Ridgefield, NJ 07657, Tel: 201-943-7650, FAX: 201-943-0516; Empl.: 29

ACME TRANSFORMER, Acme Electric Corporation, 4815 West 5th St., Lumberton, NC 28358, Tel: 919-738-1121, FAX: 919-739-0024; *Sls. Mgr.:* George Mergel

ACME-URDC, INC., 7915 South 1530 West, Box 10, West Jordan, UT 84084, Tel: 801-561-9385, FAX: 801-562-9004; *Sls. Mgr.:* Al Haag

ACON, INC., 22 Bristol Dr., South Easton, MA 02375, Tel: 508-230-8022, FAX: 508-230-2371; Empl.: 15; *Sls. Mgr.:* Frank Gurley ..... **D•2058-2066**

Local Sales Offices & Reps

CA	Carlsbad, Zerimar Sls.	619-436-3379
CA	San Jose, Silicon Valley Sls.	408-432-1967
FL	Oldsmar, Suncoast Elctm. Sls.	813-787-9221
IN	Columbus, High Tech Assocs.	812-378-4835
MA	Tyngsboro, AMS Mktg.	508-263-9712
MI	Rochester Hills, Geotronix	313-373-4334
MN	Minneapolis, Electro-Serv Co.	612-338-3475
OH	Richfield, Geotronix	216-659-6100
OK	Tulsa, Advance Tech Sls.	918-664-0482
PA	Drexel Hill, DNE Sls.	215-789-6822
TX	Austin, Advance Tech. Sls.	512-331-9979
TX	Dallas, Advance Tech. Sls.	214-340-1300
TX	Houston, Advance Tech. Sls.	713-440-3888
Can	Don Mills, Ont., Canadian Source Corp.	416-445-0211

ACOPIAN TECHNICAL COMPANY, Box 638, Easton, PA 18044, Tel: 215-258-5441, FAX: 215-258-2842; FSC No.: 14749; *Sls. Mgr.:* T. Skopal ..... **D•1517-1548**

Local Sales Offices & Reps

FL	Melbourne, Acopian	407-727-1172

ACRODYNE CONTROLS, See Accudyne Corp.

ACROLOOP MOTION CONTROL SYSTEMS, INC., 7801 Park Dr., Chanhassen, MN 55317, Tel: 612-474-4500, FAX: 612-474-7674; Empl.: 13; *Sls. Mgr.:* Mike Wagner; *Dist. Mgr.:* Mike Wagner

ACROMAG INC., 30765 Wixom Rd., P.O. Box 437, Wixom, MI 48393-7037, Tel: 313-624-1541, FAX: 313-624-9234; Empl.: 75; *Sls. Mgr.:* L. Anderson

ACR SYSTEMS INC., 8561-132nd St., Surrey,B.C., Canada V3W 4N8, Tel: 604-591-1128, FAX: 604-591-2252; Empl.: 5; *Sls. Mgr.:* Rick Schellenberg; *Dist. Mgr.:* Rick Schellenberg

ACTEL CORPORATION, 955 E. Arques Ave., Sunnyvale, CA 94086, Tel: 408-739-1010, FAX: 408-739-1540; Empl.: 86; *Sls. Mgr.:* Bob Duyn

ACTION INSTRUMENTS, 8601 Aero Dr., San Diego, CA 92123, Tel: 619-279-5726, FAX: 619-279-6290; Empl.: 230; *Sls. Mgr.:* Frank Williams, Sls. VP

ACTION USA, 6 Brightwater Cir., St. Petersburg, FL 33704, Tel: 813-821-5000, 800-821-5001, FAX: 813-822-8800

ACTIVE CONTROL INSTRUMENTATION, P.O. Box 243-Wildwood Circle, Key Largo, FL 33037, Tel: 305-451-1000, FAX: 305-451-3232; FSC No.: 55116; Empl.: 6 ..... **D•1149**

ACTIVE ELECTRONICS, Future Electronics, 237 Hymus Blvd., Pointe-Claire, Que., Canada H9R 5C7, Tel: 514-694-7710, 1-800-677-8899, FAX: 514-697-8112; Empl.: 1700; *Dist. Mgr.:* Mike Zuppa (USA), Doug Kisway (CAN)

ACTOWN-ELECTROCOIL, INC., 2414 Highview, Spring Grove, IL 60081, Tel: 815-675-6641, FAX: 815-675-2050; Empl.: 200; *Sls. Mgr.:* Les Friedman; *Dist. Mgr.:* Bill Karmell

AC TRANSFORMER, 89 Madison St., Newark, NJ 07105, Tel: 201-589-8574, FAX: 201-589-3155; FSC No.: 3677; Empl.: 13; *Sls. Mgr.:* George Giangrande, Sls. Consit.

ADAC CORPORATION, 70 Tower Office Pk., Woburn, MA 01801, Tel: 617-935-6668, FAX: 617-938-6553; Empl.: 40

ADALET-PLM/DIV. OF SCOTT & FETZER CO., 4801 W. 150th St., Cleveland, OH 44135, Tel: 216-267-9000, TELEX: 98-5349, FAX: 216-267-1681; FSC No.: 73389; Empl.: 177

ADAMS RITE PRODUCTS, INC., 540 W. Chevy Chase Dr., Glendale, CA 91204, Tel: 818-241-5121, TELEX: 62262290, FAX: 818-500-7239; Empl.: 150; *Sls. Mgr.:* Jonas Williams

ADAM TECHNOLOGIES INC., 211 Clay Ave. W., Roselle Park, NJ 07204, Tel: 908-245-4000, FAX: 908-245-4455; Empl.: 152; *Sls. Mgr.:* Brett Hammerschmidt

ADAPTEC, INC., 691 South Milpitas Blvd., Milpitas, CA 95035, Tel: 408-945-8600, TELEX: 910-338-0060, FAX: 408-262-2533; Empl.: 6000; *Sls. Mgr.:* Wayne Gartin; *Dist. Mgr.:* Roy Safire

ADAPTIVE NETWORKS, P.O. Box 1020 Kendall Sq., Cambridge, MA 02142, Tel: 617-497-5150; Empl.: 20; *Sls. Mgr.:* Sumin Tchen

ADATEK, INC., 700 Airport Way, Sandpoint, ID 83864, Tel: 208-263-1471, 800-323-3343, TELEX: 62903932, FAX: 208-263-6596; Empl.: 18; *Sls. Mgr.:* William Chambers; *Dist. Mgr.:* Carolyn Pennington/Lynn LaDuca

ADCOUR, INC., 18 Billings St., PO Box 277, Sharon, MA 02067, Tel: 617-784-8123, FAX: 617-784-5563; Empl.: 16; *Sls. Mgr.:* William O'Connell; *Dist. Mgr.:* William O'Connell

ADC TELECOMMUNICATIONS, INC., 4900 W. 78th St., Minneapolis, MN 55435, Tel: 612-938-8080, TELEX: 290321, FAX: 612-946-3292; Empl.: 2000; *Sls. Mgr.:* Larry Asten

ADDACON GREENSBORO, 3702-C Alliance Dr., Greensboro, NC 27407, Tel: 919-852-6200, FAX: 919-852-6256; *Sls. Mgr.:* Lynn Cummings

A.D. DATA SYSTEMS CORP., Photographic Sciences Corp., 770 Basket Rd., Webster, NY 14580-0478, Tel: 716-265-1600, FAX: 716-872-6142; FSC No.: 23389; Empl.: 11; *Sls. Mgr.:* J. Cessna, J. Butters; *Dist. Mgr.:* Jack Petz

Local Sales Offices & Reps

CA Torrance, AMASCO-South 213-781-9494
FL Melbourne, Saber Assocs. 800-327-0853
MD Landover, Sel-Tronics 301-341-2700
MA Hopkinson, Eastern Sys. 508-435-2151
MN Minneapolis, Engineering Prods. Assoc. 612-835-9022
NJ Newark, Rical Assocs. 201-643-0880
NM Albuquerque, Trembly Assocs. 505-266-8616
OH Westlake, TMS, Inc. 216-327-3527
PA N. Wales, Scientific Devs. 215-699-7707
TX Richardson, Scientific Devs. (SW) 214-231-8106
WA Woodinville, Test & Measurement, Inc. 206-485-1111
EXP Leport Marly, France, Euromeasure, SA 33 160 131110
Intl Ramat-Gan, Isreal, IES 972 37526333
Intl Warwickshire, England, Fozmula Ltd. 926 335411
Can Quebec, Interfax Sys. 514-336-0392

ADE, INC., 1430 E. 130th St., Chicago, IL 60633, Tel: 312-646-3400, FAX: 312-646-3919; FSC No.: 62049

ADIRONDACK WIRE & CABLE, ACS Industries Inc., 160 Hamlet Ave., Woonsocket, RI 02895, Tel: 1-401-769-1600, FAX: 1-401-769-1607; Empl.: 650; *Sls. Mgr.:* Julian Caduto

ADTECH POWER

FAX: 714-634-0802

ADTECH POWER INC., 2220 S. Dupont Dr., Anaheim, CA 92806, Tel: 714-634-9211; FSC No.: 56410; Empl.: 55; *Sls. Mgr.:* Bernie Smilak; *Dist. Mgr.:* Bernie Smilak ..... **D•1549-1551**

Local Sales Offices & Reps

NY New York, Morgan Elctrn. Sls. 516-549-5180

Local Distributors

AL Birmingham, Industrial Elec. Supp. 205-956-8504
CA Palo Alto, Zack Elctrns. 415-326-5432
CA San Francisco, Zack Elctrns. 415-626-1444
LA Lafayette, Ralph's of Lafayette 318-233-0105
MD Gaithersburg, M S Elctrns. 301-921-0200
MA Woburn, Mac Bearing 617-933-2110
PA Philadelphia, Philadelphia Elctrns. 215-673-0400
TX Ft. Worth, Allied Elctrns. 1-800-433-5700

ADTRON CORPORATION, 3050 S. Country Club Dr., # 24, Mesa, AZ 85210, Tel: 602-926-9324, FAX: 602-926-9359; Empl.: 10; *Sls. Mgr.:* Tony Giallella

ADTRON INSTRUMENTS, 13801 N. 7th St., Ste. 201, Phoenix, AZ 85022, Tel: 602-863-2250, FAX: 602-863-0914; Empl.: 2; *Sls. Mgr.:* H. Painter

ADVACOM, INC., 5620 West Rd., McKean, PA 16426, Tel: 1-800-458-0512, 814-476-7774

ADVANCE CONVERSION DEVICES CO.UNIT OF TRANSITOR DVCS., INC., 85 Horsehill Rd., Cedar Knolls, NJ 07927, Tel: 201-267-1900, FAX: 201-267-2047; FSC No.: 52298; Empl.: 100; *Sls. Mgr.:* Ron Zeman ..... **D•2230-2231**

Local Sales Offices & Reps

AL Huntsville, Reynolds & Assocs., Inc. 205-539-1485
AZ Scottsdale, Dave Menegay & Assocs. 602-994-9519
AR El Dorado, Kemp Instrs. Co., Inc. 501-862-5869
CA Bakersfield, FLW, Inc. 805-398-0720
CA Campbell, SMA 408-370-6900
CA Canoga Park, FLW, Inc. 818-719-0037
CA Carlsbad, FLW, Inc. 619-434-5251
CA Costa Mesa, FLW Inc. 714-751-7513
CA Costa Mesa, FLW, Inc. 714-751-7512
CO Denver, Elcom, Inc. 303-337-2300
CT Watertown, May Technig. 203-274-3777
FL Ft. Lauderdale, Reynolds & Assocs., Inc. 305-344-4536
FL Melbourne, Reynolds & Assocs., Inc. .. 407-259-7000
FL Tampa, Reynolds & Assocs., Inc. 818-372-8369
GA Duluth, Reynolds & Assocs. 404-476-4992
IL Wheeling, Ed Joyner & Co. 708-520-1200
IA Cedar Rapids, Midwest Tech. Sls. 319-377-1688
KS Kansas City, MTS 913-888-5100
MD Hunt Valley, Elctrn. Resources, Inc. ... 301-584-8157
MA Lexington, E.F. Delfino,Inc. 617-862-1118
MI Ann Arbor, Ashby Assocs., Inc. 313-995-4082
MN St. Louis Pk., Elctrn. Innovation, Inc. ... 612-922-2945
MO Earth City, Midwest Tech. Sls. 314-298-8787
NY Endicott, Advanced Comp. Corp. 607-785-3191
NY Kingston, Advanced Comp. Corp. 914-339-1730
NY N. Syracuse, Advance Comps. 315-699-2671
NY Rochester, Advanced Comps. Corp. ... 716-544-7017
NY Scottsville, Advanced Comps. Corp. ... 716-889-1429
NC Raleigh, Reynolds & Assocs., Inc. 919-876-0282
OH Arcanum, Ashby Assocs., Inc. 513-692-8713
OH Cleveland, Ashby Assocs., Inc. 216-461-0826
OK Tulsa, Kemp Instrs.,Inc. 918-663-4501
PA Pittsburgh, Ashby Assocs., Inc. 412-343-5105
PA Southampton, Campbell Assocs. 215-322-6630
PA West Chester, Elctrn. Resources, Inc. 215-431-0198
SC Greenville, Reynolds & Assocs., Inc. .. 803-288-8701
TX Lewisville, J. Hughes Co. 214-221-1536, 214-221-1538
UT Murray, Elcom 801-262-2400,801-262-2472
VA Alexandria, Dyna-Rep Co. 703-354-1222
VA Harrisburg, Elctrn. Resources, Inc. 703-289-5571
VA Norfolk, Elctrn. Resources, Inc. 804-583-4859
EXP NY/New York, Roburn Agencies, Inc. 914-968-1016
Can Weston, Ont., Duncan Instrs., Canada Ltd. 416-742-4448

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ADVANCED ANALOG, Intech, 2270 Martin Ave., Santa Clara, CA 95050, Tel: 408-988-4930; FSC No.: 52467; Empl.: 200; *Sls. Mgr.:* Michael Sullivan ..... **D•2067**

Local Sales Offices & Reps

AL Huntsville, Sides Assocs. 205-859-9395, FAX:205-851-8785
AZ Tempe, Thor Engrg. 602-438-8494, FAX:602-438-6879
CA La Jolla, Keller-Simonsen Assocs. 619-453-5720, FAX:619-453-1695
CA Manhattan Bch., Pacific Edge 310-546-9009, FAX:310-546-3005
CA Sunnyvale, Pass Assocs. 408-735-9040, FAX:408-735-0882
FL Coral Springs, CBC Elctrns. 305-755-1111, FAX:305-341-8379
FL Longwood, CBC Elctrns. 407-831-5380, FAX:407-831-0965
FL Tampa, CBC Elctrns. 813-969-1901, FAX:813-264-2744
GA Lilburn, Adams Elctrns. Inc. 404-925-9115, FAX:404-925-4116
IL Berkeley, ESA Tech. Mktg. 708-544-0120, FAX:708-544-0266
IN Indianapolis, CC Electro Sls. 317-921-5000, FAX:317-921-5005
IA Cedar Rapids, Delltron 319-393-0075, FAX:319-393-0058
KS Wichita, Miller Aerospace 316-689-8292, FAX:316-689-8247
MD Randallstown, Beacon North 703-478-2480
MA Burlington, Kitchen & Kutchin 617-229-2660
MI Madison Hgts., Pine Sls. 313-589-0350, FAX:313-589-3420
MN Eden Prairie, Electro Mark 612-944-5850, FAX:612-944-5855
MO St. Louis, Acorn 314-421-1751,FAX:314-421-1752
NH Nashua, Bell Controls 603-882-6984, FAX:603-882-9049
NJ Elberon, Compar 908-229-3666, FAX:908-229-3687
NJ Woodridge, Compar 201-460-3569
NY Bellmore, Compar New York 516-221-7300, FAX:516-221-7600
NC Sanford, Adams Elctrns. Inc. 919-774-8816
OH Beachwood, Thompson & Assocs., Inc. 216-831-6277,FAX:216-831-2553
OH Dayton, Thompson & Assocs., Inc. 513-435-7733, FAX:513-435-1898
OH Orient, Thompson & Assocs., Inc. 614-877-4304, FAX:614-877-0872
OR Beaverton, Micro Sls. 503-645-2841, FAX:503-645-3754
PA Carnegie, Del Steffen & Assocs. 412-276-7366, FAX:412-276-4616
TX Dallas, Converter Elctrns. 214-333-2028, FAX:214-333-2028
UT Ogden, Taylor Mktg. 801-546-9570, FAX:801-546-9590
VA Sterling, Beacon North 703-478-2480, FAX:703-435-7115
WA Bellevue, Micro Sls. 206-451-0568, FAX:206-453-0092

ADVANCED CIRCUIT TECHNOLOGY, 118 Northeastern Blvd., Nashua, NH 03062, Tel: 603-880-6000, TWX: 710-228-8961, FAX: 603-880-1785; FSC No.: 57034; Empl.: 130; *Sls. Mgr.:* David Bouley, V.P. of Sls.

ADVANCED COMPONENTS INDUSTRIES, INC.

FAX: 310-328-0062

ADVANCED COMPONENTS INDS., INC., Div of Kaschke, 1308 Sartori Ave., No. 105, Torrance, CA 90501, Tel: 310-328-0060; *Sls. Mgr.:* Irma Spreitzer ..... **A•1318, 2254-2255; B•1403**

Local Sales Offices & Reps

CT Hopkinton, Berkshire Elctrns. 508-435-9356
IL Schaumburg, Terry McNulty & Assocs. 708-780-9868
MA Hopkinton, Berkshire Elctrns. 508-435-9356

ADVANCED CONNECTOR TECHNOLOGY, 2368 Eastman Ave., # 5, Ventura, CA 93003, Tel: 805-644-9990, FAX: 805-644-9664; Empl.: 5; *Sls. Mgr.:* Karin Kalli

ADVANCED CONTROL SYS., 10 Old Mine Rock Way, Hingham, MA 02043, Tel: 617-740-0223, FAX: 617-740-4227; Empl.: 13; *Sls. Mgr.:* Leopold Bric ..... **D•1150**

ADVANCED CONTROL SYSTEMS, 1117 Baker St., Ste. C, Costa Mesa, CA 92626-4114, Tel: 714-540-9010, FAX: 714-540-5313; Empl.: 7; *Sls. Mgr.:* Gary Rasmussen

ADVANCED CONVERSION TECH., 2001 Fulling Mill Rd. P.O.B. 70, Middletown, PA 17057, Tel: 717-939-2300, FAX: 717-939-7170; FSC No.: 60642; Empl.: 100; *Sls. Mgr.:* L.M. Reis

ADVANCED ELECTRONIC PACKAGING, 21562 Surveyor Circle, Huntington Beach, CA 92646, Tel: 714-969-1150, FAX: 714-536-0936; Empl.: 8; *Sls. Mgr.:* Douglas A. Hill

ADVANCED FILTER DEVICES, INC., 6241 Yarrow Dr., Ste. D, Carlsbad, CA 92009, Tel: 619-438-2074, FAX: 619-438-5937; FSC No.: 56620; Empl.: 45; *Sls. Mgr.:* Herbert Johnson

ADVANCED HARDWARE ARCHITECTURES, INC., P. O. Box 9669, Moscow, ID 83843, Tel: 208-883-8000, FAX: 208-883-8001; Empl.: 50; *Sls. Mgr.:* Jack Maynard

ADVANCED HARDWARE MANUFACTURING, INC., 925 Horan Drive, Fenton, MO 63026, Tel: 314-343-3850, FAX: 314-343-3937; Empl.: 16

ADVANCED HIGH VOLTAGE COMPANY, P.O. Box 32408, Tucson, AZ 85751, Tel: 602-721-2424, 818-997-7222, FAX: 602-721-2322; *Sls. Mgr.:* John Richardson ..... **D•1553**

ADVANCED INPUT DEVICES, W. 250 A.I.D. Dr., Coeur d'Alene, ID 83814, Tel: 208-765-8000, 800-444-5923, FAX: 208-772-7613; FSC No.: 95666; Empl.: 300; *Sls. Mgr.:* Jeff Petkevicius ..... **B•1819**

ADVANCED INTERCONNECTIONS CORP., P.O. Box 1019, West Warwick, RI 02893, Tel: 401-823-5200, TWX: 910-240-3454, FAX: 401 823-8723; FSC No.: 05-0394638; *Sls. Mgr.:* Max E. Rice

ADVANCED LINEAR DEVICES, INC., 1180F Miraloma Way, Sunnyvale, CA 94086-4606, Tel: 408-720-8737, FAX: 408-720-8297; Empl.: 10

ADVANCED MATERIALS SYSTEMS, See Handy & Harman Electronic Materials Corp.

ADVANCED METALLURGY, 1003 Corporate Dr., Murray Corp. Park, Export, PA 15632, Tel: 412-733-8332, FAX: 412-733-2880

ADVANCED MICRO COMPUTER, 1321 NW 65th Pl, Ft. Lauderdale, FL 33309, Tel: 305-975-9515, FAX: 305-975-9698; Empl.: 20; *Sls. Mgr.:* Lee Maxey

ADVANCED MICRO DEVICES, INC., 901 Thompson Place, Sunnyvale, CA 94088, Tel: 408-732-2400, TELEX: 34-6306

ADVANCED MICRO SYSTEMS, INC., 2 Townsend West, Nashua, NH 03063-1277, Tel: 603-882-1447, FAX: 603-881-7600; Empl.: 50

ADVANCED MOTION CONTROLS, INC., 518 W. Water St., P.O. Box 64, Princeton, WI 54968, Tel: 414-295-3500, FAX: 414-295-3504

ADVANCED PHOTONIX, INC., 1240 Avenida Acaso, Camarillo, CA 93012, Tel: 805-484-2884, FAX: 805-484-9935; Empl.: 90; *Sls. Mgr.:* D. Tingley, W. Bandel, R. Dahl

ADVANCED POWER DESIGNS INC., 17744 Skypark Circle No. 250, Irvine, CA 92714, Tel: 714-263-8605, FAX: 714-263-8607; Empl.: 23

ADVANCED POWER PRODUCTS, 32249 Murrieta Rd., Menifee, CA 92584, Tel: 714-672-7704; Empl.: 2

APS ADVANCED POWER SOLUTIONS

FAX: 510-460-5498

ADVANCED POWER SOLUTIONS, M & L Enterprises, 5994 W. Las Positas Blvd., Ste. 117, Pleasanton, CA 94588, Tel: 510-734-3060; Empl.: 15; *Sls. Mgr.:* Bill Smith; *Dist. Mgr.:* Bill Smith .... **D•1554-1556**

Local Sales Offices & Reps

CA	West Lake Village, MPL Assoc.	805-379-9251
FL	Del Ray Beach, Phelps Assoc.	407-276-7591
MA	Bellingham, OEM Mktg.	508-528-4983
MO	Bridgeton, Dytronix	314-291-4777
NH	Salem, OEM Mktg.	603-893-0009
NY	Hauppauge, Sticom	516-366-4221
PA	Pittsburgh, Catalyst Sls.	412-826-3434
UT	Layton, Taylor Mktg.	801-546-9570
VA	Vienna, The Walters Grp.	703-660-3799

ADVANCED POWER TECHNOLOGY, 405 S.W. Columbia Street, Bend, OR 97702, Tel: 503-382-8028, FAX: 503-388-0364; Empl.: 106; *Sls. Mgr.:* Tom Loder; *Dist. Mgr.:* Tom Loder

ADVANCED PROCESS CONTROLS, 500 West Cummings Park, Woburn, MA 01801, Tel: 617-932-9262, FAX: 617-932-0939; *Sls. Mgr.:* Richard Smith

ARC ADVANCED RUBBER CONCEPTS, INC.
P. O. BOX 489 · HWY. 77 SOUTH
PAULS VALLEY, OKLA. 73075

FAX: 405-238-3029

ADVANCED RUBBER CONCEPTS, Formerly Giolite Sales Ltd., Hwy 77 South, Pauls Valley, OK 73075, Tel: 405-238-5541, 800-654-3662; Empl.: 10 ..... **B•1820**

Local Sales Offices & Reps

AZ	Peoria, Sem of Arizona	602-486-1191
CA	Mission Viejo, Champa Assocs.	714-581-3459
IL	Berkeley, ESA Tech. Mktg.	708-544-0120
MD	Baltimore, Chesapeak Ind. Mktg.	410-653-0476
NY	Hauppauge, Aurora-Schmitt	516-434-1313

ADVANCED TECHNICAL MATERIALS, INC., 20 River Ave., Patchogue, NY 11772, Tel: 516-363-9018, 516-289-0363, FAX: 516-363-8002; FSC No.: OR8N4; *Sls. Mgr.:* Mike Geraci

FAX: 619-727-4436

ADVANCED TECHNOLOGY COMPANY, 1280 Liberty Way, Vista, CA 92083, Tel: 619-727-7430; Empl.: 10; *Sls. Mgr.:* Bill Linko ..... **C•1562-1573**

ADVANCED THERMAL PRODUCTS, INC., P.O. Box 249, St. Marys, PA 15857, Tel: 814-834-1541, FAX: 814-834-1556; Empl.: 22; *Sls. Mgr.:* John M. Sidoni ..... **B•1858-1859**

Local Sales Offices & Reps

GA	Atlanta, DHR Mktg.	404-564-0529
MA	Andover, Crawford & Assoc.	508-470-2122
NY	Syracuse, John R. Costello	315-472-0322
NC	Raleigh, DHR Mktg.	919-829-1970
TX	Dallas, Eatman Engineering	214-771-1903
WI	New Berlin, Thomas Labant	414-425-7157
Can	Dundas, Ontario, D.J. Hyslop & Co.	416-628-0266

ADVANCED THERMISTOR DIV.
U.S. SENSOR Corp.

FAX: 714-639-1220

ADVANCED THERMISTOR DIV., U.S. Sensor Corp., 1832 W. Collins Ave., Orange, CA 92667, Tel: 714-639-1000; Empl.: 25 ..... **B•1860-1862**

Local Sales Offices & Reps

AZ	Phoenix, Compass Mktg. & Sls. Inc.	602-996-0635
AZ	Tucson, Compass Mktg. & Sls. Inc.	602-577-0580
CA	Los Angeles, Landa & Assocs.	213-879-0770
CA	San Jose, Arnold Tech. Sls.	408-954-0400
CA	Santa Ana, Landa & Assocs.	714-543-7805
CO	Englewood, Compass Mktg. & Sls., Inc.	303-721-9663
FL	Orlando, Richmar Elctrns. Corp.	407-352-3755
IL	Downers Grove, Richmar Elctrns. Corp.	708-968-0118
IN	Indianapolis, Richmar Elctrns. Corp.	317-577-9950
IA	Iowa City, Richmar Elctrns. Corp.	319-354-8894
MA	Canton, John Ferrari Co.	617-821-4599
MI	Brighton, AP Assocs., Inc.	313-229-6550
NM	Albuquerque, Compass Mktg. & Sls., Inc.	505-344-9990
NY	North Syracuse, Entec Grp.	315-458-7936
OH	Rocky River, Hiltebrant Indl. Sls.	216-333-5600
PA	Downington, Grasso Tech. Sls.	215-458-8967
PA	Pipersville, Yax Assocs.	215-766-2100
TX	Plano, Richmar Elctrns. Corp.	214-424-8388
TX	Round Rock, Richmar Elctrns. Corp.	512-255-2551
WI	Butler, Richmar Elctrns. Corp.	414-781-1730

ADVANCED VIDEO PRODUCTS, E-Systems, 2 Robbins Rd., Westford, MA 01886, Tel: 508-692-2020, FAX: 508-692-2140; Empl.: 65; *Sls. Mgr.:* Christopher Mohen

AD-VANCE MAGNETICS, INC., 625 Monroe St., Rochester, IN 46975, Tel: 219-223-3158, FAX: 219-223-2524; FSC No.: 50788; Empl.: 31; *Sls. Mgr.:* Kay Nixon ..... **C•1682**

Local Sales Offices & Reps

CA	El Cajon, ATronix Technlg.	619-444-1501
CA	Mountain View, Frauman Assoc.	415-964-9464
CA	Solvang, ATronix Technlg.	805-686-4366
CO	Arvada, Arrowhead	303-423-5556
FL	Davie, DAN-Tech Sls., Inc.	305-581-2884
IL	Elk Grove, W. G. Brouillette & Assoc.	708-290-1313
KY	Frankfort, Fred A. Dorsey Assoc.	502-695-2250
NJ	Flanders, K & R Engrg. Sls. Corp.	201-584-5235, 800-631-9362
OR	Lake Oswego, Caruso & Assocs., Inc.	503-635-5282
PA	W. Conshohocken, Eastern Comps.	215-825-8610
MD	Baltimore, Eastern Comps. Sls. Corp.	301-788-7050
TX	Dallas, Materials Technlgy. Co.	214-484-4677
UT	Ogden, Arrowhead	801-479-7151
Can	Nepean, Ont., Subtec Ltd.	613-723-7720
WA	Bellevue, Caruso & Assocs.	206-455-8811

ADVANCE POWER SUPPLIES, INC., See Farnell Advance Power, Inc.

ADVANCE WIRE & CABLE ASSEMBLY, Electrical Insulation Suppliers, 1661 Industrial Way, Belmont, CA 94002, Tel: 415-592-4550, TELEX: 334475, FAX: 415-593-8859; FSC No.: 57775; Empl.: 158; *Sls. Mgr.:* Ed Mittelbusher; *Dist. Mgr.:* Ed Mittelbusher

ADVANTEST AMERICA, INC., 1100 Busch Parkway, Buffalo Grove, IL 60089-4503, Tel: 800-441-0852, FAX: 708-634-2610; Empl.: 233; *Sls. Mgr.:* Atlee Jacobson

Instruments

ADVANTEST CORPORATION, NS Bldg. 2-4-1, Nishi-Shinjuku, Tokyo 163, Japan, Tel: 03-3342-7500, TELEX: 232-4914 ADVAN, FAX: J:03-3342-7510; Empl.: 1827; *Sls. Mgr.:* Shinpei Takeshita

ADVIN SYSTEMS INC., 1050-L East Duane Ave., Sunnyvale, CA 94086, Tel: 408-243-7000, FAX: 408-736-2503; *Sls. Mgr.:* Wing Hui

ADVOTECH, INC., 422 North Main St., Butler, PA 16001, Tel: 412-283-4497, FAX: 412-283-8830

A E G CORPORATION, Mt. Airy Corners III, 180 Mt. Airy Rd., Basking Ridge, NJ 07920, Tel: 908-204-8900, FAX: 908-231-8353; Empl.: 200; *Dist. Mgr.:* Don Walsh

AEG TELEFUNKEN, SEMICONDUCTOR GRP., See AEG Corp.

AEL DEFENSE CORP., 305 Richardson Rd., Lansdale, PA 19446, Tel: 215-822-2929, FAX: 215-822-9165; FSC No.: 93346; Empl.: 1,600; *Sls. Mgr.:* Denis Ritchie

AEMC CORPORATION, 99 Chauncy Street, Boston, MA 02111, Tel: 617-451-0227, 800-343-1391, FAX: 617-423-2952; *Sls. Mgr.:* George Wood; *Dist. Mgr.:* Daniel Wiswell ..... **D•1223**

AEROCOM, 3090 S.W. 37th Ave., Miami, FL 33133, Tel: 305-448-6503, FAX: 305-448-6916; FSC No.: 81535; Empl.: 55; *Sls. Mgr.:* Wladimir Dorta

AERODYNE CONTROLS CORPORATION, 30 Haynes Court, Ronkonkoma, NY 11779, Tel: 516-737-1900, FAX: 516-737-1912; FSC No.: 14923; Empl.: 80; *Sls. Mgr.:* Anthony R. Pipitone

AEROFLEX LABORATORIES INC., ARX, Inc., 35 South Service Road, Plainview, NY 11803, Tel: 516-694-6700, TWX: 510-224-6417, FAX: 516-694-6771; FSC No.: 88379; Empl.: 490

AEROSPACE OPTICS, INC., 3201 Sandy La., Fort Worth, TX 76112, Tel: 817-451-1141, FAX: 817-654-3405; Empl.: 60; *Sls. Mgr.:* Ben L. Fryrear

AEROSPACE PRODUCTS DIV, A Subsidiary of Ametek, Inc., 50 Fordham Rd., Wilmington, MA 01887, Tel: 508-988-4947, FAX: 508-988-4944

AEROSPACE SYSTEMS, Communication Cable Inc., 1007 E. 10th St., Fairmont, MN 56031, Tel: 507-235-3355, FAX: 507-235-6088; FSC No.: 24600; Empl.: 170; *Sls. Mgr.:* Robert L. Johnson

AEROSPACE WIRE & CABLE INC., 129-09 18 Ave., College Point, NY 11356, Tel: 718-358-2345, 1-800-395-0200, FAX: 718-358-2522; Empl.: 15

AEROTECH, INC., 101 Zeta Dr., Pittsburgh, PA 15238, Tel: 412-963-7470, TWX: 710-795-3125, FAX: 412-963-7459; Empl.: 156; *Sls. Mgr.:* K. Wyman; *Dist. Mgr.:* K. Ross

AEROVOX INC., 370 Faunce Corner Rd., North Dartmouth, MA 02747-1217, Tel: 508-995-8000, FAX: 508-995-3000; FSC No.: 4K459; Empl.: 1500 Worldwide; *Sls. Mgr.:* Jack Chmura; *Dist. Mgr.:* Jack Chmura ..... **A•1008-1009, 1585**

Local Sales Offices & Reps

AL	Huntsville, 20th Century Mktg.	205-772-9999
AZ	Pheonix, Interstate Mktg.	602-263-8044
CA	Santa Clara, Ross Mktg.	408-988-8111
CA	Woodland Hills, Interstate Mktg.	818-883-7606
CO	Englewood, Elcom, Inc.	303-792-3330
CT	Wallingford, J.E. Boeing Co.	203-265-1318
DE	Greenville, H. Anderson	302-655-2917
FL	Margate, E.P.M. Corp.	305-977-0331
GA	Norcross, 20th Century Mktg.	404-446-1999
IL	Chicago, Rowe Mktg.	312-664-3744
IL	Elk Grove Vl, Carlson Elctrns. Sls.	708-956-8240
IN	Ft. Wayne, F.J. Campisano Co.	219-486-6443
IN	Indianapolis, F.J. Campisano Co.	317-577-0319
IA	Cedar Rapids, Carlson Elctrn. Sls.	319-378-1450
KS	Overland Park, Beneke & McCaul Inc.	913-765-2298
MA	Chelmsford, J.E. Boeing Co.	508-256-5800
MA	Marion, R.F. Swoish Co.	508-748-2536
MI	Farmington Hills, Carrier & Gable, Inc.	313-477-8700
MN	Minneapolis, Comstrand Inc.	612-574-9480
NJ	Cherry Hill, Trinkle Sls., Inc.	609-795-4200
NY	Ithaca, Bob Dean, Inc.	607-257-1111
NY	Ronkonkoma, Comtronic Assocs.	516-737-2400
NC	Raleigh, 20th Century Mktg.	919-790-9383
OH	Cincinnati, F.J. Campisano Co.	513-574-7111
OH	Columbus, F.J. Campisano Co.	614-538-1176
OH	Mentor, F.J. Campisano Co.	216-975-9300
OK	Tulsa, Ammon & Rizos Co.	918-749-6116
OR	Beaverton, Luscombe Engrg. Co.	503-636-6664
PA	Leechburg, F.J. Campisano Co.	412-845-2577
TN	Knoxville, 20th Century Mktg.	615-539-0676
TX	Austin, Ammon & Rizos Co.	512-454-5131
TX	El Paso, Ammon & Rizos Co.	915-534-7533
TX	Houston, Ammon & Rizos Co.	713-781-6240
TX	Richardson, Ammon & Rizos Co.	214-644-5591
TX	San Antonio, Welaire	210-666-1800
WA	Bellevue, Luscombe Engrg. Co.	206-223-1541
WI	Milwaukee, Carlson Elec. Sls.	414-476-2790
Can	Mississauga, Ont., Longman Sls.	416-670-8100

Local Distributors

AZ	Phoenix, Arizona Comp. Co.	602-269-5655
CA	Garden Grove, National Elctrns.	714-892-7749
CA	Milpitas, California Cap.	408-262-6000
CA	Milpitas, Projections Unltd.	408-942-1717
CA	Riverside, Elctrn. Supply Co.	714-683-7300
CA	Sacramento, IEC Sacremento	916-363-6030
CA	San Diego, Elctrn. Supply Co.	619-693-8222
CA	San Diego, Projections Unltd.	619-453-8444

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CA	Tustin, Jaco Elctrns.	714-258-9003
CA	Tustin, Projections Unltd.	714-544-2700
CA	Westlake Vlge., Jaco Elctrns.	805-495-9998
CO	Arvada, Denver Beta Wintronics	303-431-7161
CO	Denver, IEC Headquarters	303-292-5537
FL	Boca Raton, Jaco Elctrns.	407-241-7943
FL	Boca Raton, NRC Elctrns.	407-241-8600
IL	Hoffman Estates, IEC Chicago	708-843-2040
IL	Schaumburg, Marsh Elctrns.	708-240-9290
IN	Indianapolis, R.S. Elctrns.	800-488-9065
IA	Cedar Rapids, Dee Elctrns.	319-365-7551
KS	Overland Pk., R.S. Elctrns.	800-251-0067
MD	Columbia, Jaco Elctrns.	301-995-6620
MA	Andover, Bell Inds.	508-474-8880
MA	Tewksbury, Jaco Elctrns.	508-640-0010
MI	Grand Rapids, R.S. Elctrns.	800-776-1155
MI	Livonia, R.S. Elctrns.	800-366-7750
NM	Albuquerque, Bell Inds.	505-292-2700
NY	Rome, Rome Elctrns.	315-337-5400
NC	Raleigh, Jaco Elctrns.	919-876-7767
OH	Akron, Aesco Elctrns.	216-762-8818
OH	Columbus, Aesco Elctrns.	800-962-0191
OH	Maumee, R.S. Elctrns.	800-472-3231
OR	Beaverton, IEC Portland	503-641-1690
PA	McKean, Advacom	814-476-7774
TX	Austin, Jaco Elctrns.	512-835-0200
UT	W. Valley City, Salt Lake Beta Wintronics	801-966-0236
WA	Bellevue, IEC Seattle	206-455-2727
WI	Milwaukee, Marsh Elctrns.	414-475-6000

AERTECH INDS., See TRW Microwave

AES CORP., 285 Newbury St., Peabody, MA 01960, Tel: 508-535-7310, TELEX: 387852 AES CORP INTL, FAX: 508-535-7313; Empl.: 25; *Sls. Mgr.:* Brian Rockett

AETNA ENGINEERING, P.O. Box 7749, Van Nuys, CA 91409-7749, Tel: 818-831-0607, FAX: 818-363-6292; Empl.: 6; *Sls. Mgr.:* T. W. Collins

AFE TECHNOLOGIES INC., 3046A Berkmar Dr., Charlottesville, VA 22901, Tel: 804-974-7801, FAX: 804-974-7803; Empl.: 7(USA) 75(UK); *Sls. Mgr.:* Rob Brooks; *Dist. Mgr.:* Rob Brooks

AFI/DATATROL, See Datatrol, Div. of Data Card Corp.

AFP ISOREG, AFP Transformers, Inc., 234 Taylor St., P.O. Box 486, Littleton, MA 01460, Tel: 508-486-9483, FAX: 508-486-3539; FSC No.: 7Y052; Empl.: 75; *Sls. Mgr.:* Paul Foss; *Dist. Mgr.:* Paul Foss

AHAMTOR INC., 999 Inc., 27901 Front St., Temecula, CA 92589-9019, Tel: 714-676-4151, FAX: 714-676-3031; *Sls. Mgr.:* John Markley

AIL, DIV. CUTLER-HAMMER, See Eaton Corp. AIL Div.

AIL SYSTEMS, INC., Eaton Corp., Commack Rd., Deer Park, NY 11729, Tel: 516-595-3094, TWX: 510-227-6073; FSC No.: 00752; Empl.: 1700; *Sls. Mgr.:* J.B. Migliaccio

AILTEC DIV. CUTLER-HAMMER, See Eaton Corp., Elctrn. Instrmn. Div.

AIMSCO INC., Cheler Corp., 5707 Airport Way So., Seattle, WA 98108, Tel: 206-762-8014, 800-426-0244, TWX: 910-444-1333, FAX: 206-762-8394; FSC No.: 3D536; Empl.: 30; *Sls. Mgr.:* C. Ernst; *Dist. Mgr.:* Carl Teichman

AIPHONE, 1700 130th Ave. NE, Bellevue, WA 98005, Tel: 206-455-0510, FAX: 206-455-0071; Empl.: 44; *Sls. Mgr.:* Clyde Pfifer

AirBorn
FAX: 214-931-9305

AIRBORN, INC., 4321 AirBorn Dr., Addison, TX 75001-0519, Tel: 214-931-3200; FSC No.: 10400;Multiple; Empl.: 313; *Sls. Mgr.:* Win Clark; *Dist. Mgr.:* Win Clark ..... **C•1147**

Local Sales Offices & Reps

AL	Huntsville, South Design & Mktg.	205-880-3623
AZ	Tempe, Piper Sls. Co.	602-949-0048
CA	Downey, Buffa Co., Inc.	310-923-4618
CA	Sunnyvale, Advanced Tech. Sls.	510-847-2060
CO	Aurora, Piper Sls.	303-340-1300
MD	Hunt Valley, Eagle Sls. Corp.	410-666-3930
NH	Nashua, Solla - Tronics	603-882-7146
NY	Glen Cove, Dynorep	516-676-1598
NJ	Sommerville, Dynorep	908-874-4670
NY	Port Jefferson Sta., Dynorep	516-928-5135
OH	Kettering, Electro-Com	513-299-0864
OR	Tigard, Eltech, Inc.	503-684-3458
UT	Salt Lake City, Piper Sls.	801-466-9336
VA	Powhatan, Eagle Sls.	804-492-9027
WA	Bellevue, Eltech Inc.	206-643-4330
Can	Mississauga, Ont., Source Elctrns. Ltd.	416-676-0830
Can	Montreal, Source Elctrns. Ltd.	514-388-8979

Local Distributors

MD	Timonium, D.C. Elctrns.	410-252-6576
NY	Elmsford, Gemini Elect	914-592-5252
TX	Dallas, Hall Mark Elctrns.	214-343-5000
CA	Monrovia, Erik-A-Elect	818-574-1020
AZ	Scottsdale, Spirit Elctrns.	602-998-1533

AIR ELECTRO INC., 7700 Gloria Ave., Van Nuys, CA 91406, Tel: 213-873-6400, 818-988-4400, TELEX: 66-2459, TWX: 910-495-1794, FAX: 818-988-4746

AIR FILTRATION PRODUCTS, INC., 707 No. Main Ave., Tuscon, AZ 85705, Tel: 602-624-2272, FAX: 602-624-2279; Empl.: 10; *Sls. Mgr.:* Ike Campos .... **C•1612**

AIR/FLEX INDS. INC., 2422 Merced Ave., S. El Monte, CA 91733, Tel: 818-579-7060, FAX: 1-818-579-7063; FSC No.: 22782; *Sls. Mgr.:* Brett Hoffman

Airflyte ELECTRONICS CO.
FAX: 201-436-6024

AIRFLYTE ELCTRNS. CO., 56 New Hook Rd., P. O. Box 231, Bayonne, NJ 07002, Tel: 201-436-2230; Empl.: 85; *Sls. Mgr.:* John Piret ..... **B•1234-1239**

Local Sales Offices & Reps

CA	Mountain View, Thorson-West	415-964-9300
CA	Signal Hill, Thorson Co.	310-595-0361
CT	No. Haven, Kitchen & Kutchin	203-239-0212
FL	Naples, Techtron Sls. Corp.	813-566-3800
IL	Park Ridge, Probe Elctrns.	312-698-2044
MA	Lexington, Kitchen & Kutchin	617-862-8230
MN	St. Paul, Motion Technlg., Inc.	612-481-8691
NJ	Kinnelon, Avionics Equip.	201-838-8105
NY	Rochester, Milton C. Matthews Co.	716-271-1910
PA	Downingtown, Budd Elctrns. Corp.	215-458-8258
TX	Austin, Electra Reps., Inc.	512-339-1163
TX	Dallas, Electra Reps., Inc.	214-248-3852

AIRMAR TECHNOLOGY, 69 Meadowbrook Dr., Milford, NH 03055, Tel: 603-673-9570, FAX: 603-673-4624; Empl.: 75; *Sls. Mgr.:* Cindy Russell

AIR-O-TRONICS, Pelco Electronics, 2747 Rt 20 E., P.O. Box 326, Cazenovia, NY 13035, Tel: 315-655-2387, FAX: 315-655-3862; FSC No.: 16663; Empl.: 15; *Sls. Mgr.:* Randy Page, Dave Dice

AIRPAX-CAMBRIDGE DIV., See Philips Technologies, Airpax Protector Grp.

AIRPAX-CHESHIRE DIV., See Philips Technologies, Automotive Elctrns. Grp.

AIRPAX-FREDERICK DIV., See Philips Technologies, Airpax Protector Grp.

AIRPAX-INTERNATIONAL DIV., See Philips Technologies, Airpax Mechatronics Grp.

AIRPAX SENSOR DIV., See Philips Technologies, Sensor Prods.

AIRTRON, Litton Industries, Inc., 200 E. Hanover Ave., Morris Plains, NJ 07950, Tel: 201-539-5500, TWX: 710-986-7473, FAX: 201-539-0357; FSC No.: 80006; Empl.: 500; *Sls. Mgr.:* M. R. Grosso, Natl. Sls. Mgr.

AIR-VAC ENGRG., 100 Gulf St., Milford, CT 06460, Tel: 203-874-2541, FAX: 203-783-1383; Empl.: 40

AJAX MAGNETHERMIC CORP., 1745 Overland Ave., N.E., Warren, OH 44483, Tel: 216-372-8511, TELEX: 098-2482, FAX: 216-372-8644; Empl.: 500; *Sls. Mgr.:* Dan Gagliano V.P. Sls.

AJ'S POWER SOURCE, INC.

FAX: 813-996-5037

A.J.'S POWER SOURCE, INC., 4105 Cox Dr., Land-O-Lakes, FL 34639, Tel: 800-933-7725; Empl.: 10; *Sls. Mgr.:* Allen L. Johnson Jr. ..... **D•1557-1559**

Local Sales Offices & Reps

AZ	Phoenix, Hartland Sls.	602-492-0012
CA	Mission Viejo, Champa Assocs.	714-581-3459
CA	San Diego, Power Assocs.	619-275-0641
FL	Land O'Lakes, AJ's Power Source	813-996-2583
KS	Lenexa, The Beams Co.	913-541-9197
NH	Salem, OEM Mktg.	603-893-1197
NY	Pittsford, Franklin Sls.	716-248-8251
TX	Richmond, Jim D. Gray & Assoc., Inc.	713-342-1710
VA	Sterling, Beacon North, Inc.	703-478-2480

AKG ACOUSTICS, INC., 1525 Alvarado St., San Leandro, CA 94577, Tel: 510-351-3500, FAX: 510-351-0500; Empl.: 120; *Sls. Mgr.:* David Angress

AKRO-MILS, Myers Industries, 1293 S. Main St., Akron, OH 44301, Tel: 216-253-5593, TELEX: 98-6321, FAX: 216-253-9801; Empl.: 200; *Sls. Mgr.:* W. J. Tonachio; *Dist. Mgr.:* D. Martin

ALADDIN ELCTRNS., See AIE Div. of Vernitron

ALAN INDUSTRIES INC., P.O. Box 1203, Columbus, IN 47202, Tel: 812-372-8869, FAX: 812-372-5909; FSC No.: 52750; Empl.: 36; *Sls. Mgr.:* Blayde A. Kennedy

ALARM CONTROLS CORPORATION, P.O. Box 280, Deer Park, NY 11729, Tel: 516-586-4220, FAX: 516-586-6500; FSC No.: 55042; Empl.: 50; *Sls. Mgr.:* John Benedetto

ALASCO RUBBER & PLASTICS CORP., 617 Mountain View Ave. #7, Belmont, CA 94002, Tel: 415-595-4100, FAX: 415-595-0298; FSC No.: 13862; Empl.: 25

ALBAR, INC., 19013 36th Ave. W., Lynnwood, WA 98036, Tel: 206-771-4006, 800-822-5227, FAX: 206-771-2163; Empl.: 50 ..... **A•1181, 2256; D•1560**

Local Sales Offices & Reps

OR	Portland, Halbar RTS	503-244-4123
PA	Newtown, Indl. Sls. Assocs.	215-860-2076
WA	Redmond, Halboar RTS	206-882-0990

ALBEROX CORPORATION, New Bedford Ind'l. Pk., New Bedford, MA 02745, Tel: 508-995-1725, FAX: 508-995-6954; Empl.: 180

ALBION INDUSTRIES, 800 N. Clark St., Albion, MI 49224, Tel: 517-629-9441, FAX: 517-629-9501; *Sls. Mgr.:* Dale A. Bash

ALCATEL CANADA WIRE INC., 10376 Battleview Parkway, Manassas, VA 22024, Tel: 703-369-0440, FAX: 703-369-4087; Empl.: 5,000; *Sls. Mgr.:* John Murphy

ALCATEL CHESTER CABLE CORP., 15 Oakland Ave., Chester, NY 10918, Tel: 914-469-2141, FAX: 914-469-9935

ALCOMET, INC., 110 Mary Ann Rd., Beaver Dam, WI 53916, Tel: 414-885-9200, FAX: 414-885-5078; Empl.: 12; *Sls. Mgr.:* Philip F. Lauf

ALDEC, INC., 3525 Old Conejo Rd., , Newbury Park, CA 91320, Tel: 805-499-6867, TELEX: 239-447, FAX: 805-498-7945; Empl.: 57; *Sls. Mgr.:* Harry Tosado

ALDEN COMPUTER SYSTEMS, One Salem Green, Ste. 420, Salem, MA 01970, Tel: 508-744-1314; *Sls. Mgr.:* Donald O'Brien

ALDEN ELECTRONICS, INC., 40 Washington Street, Westboro, MA 01581, Tel: 508-366-8851, TELEX: 94-8404, FAX: 508-898-2427; Empl.: 125; *Sls. Mgr.:* L. A. Farrington

ALDEN PRODUCTS CO., P.O. Box 510, 117 N. Main St., Brockton, MA 02403, Tel: 508-583-0160, FAX: 508-583-0164; FSC No.: 01009; Empl.: 150; *Sls. Mgr.:* Donald J. Paul ..... **C•1148-1151**

ALDEN SYSTEMS, Alden Products Co., 262 N. Main St., P.O. Box 860, Brockton, MA 02403-0860, Tel: 508-583-0160, FAX: 508-583-0164; Empl.: 150; *Sls. Mgr.:* D. Paul

A. L. DESIGN, INC., 1411 Military Rd., Buffalo, NY 14217, Tel: 716-875-6240, FAX: 716-875-2404; Empl.: 25

ALEPH INTERNATIONAL®

FAX: 818-365-7274

ALEPH INTERNATIONAL CORP., 1026 Griswold Ave., San Fernando, CA 91340, Tel: 818-365-9856, 800-423-5622; Empl.: 15; *Sls. Mgr.:* Frank Mastrolonardo; *Dist. Mgr.:* Janis Dingman ..... **B•1404-1405, 1662**

Local Sales Offices & Reps

AL	Huntsville, Beacon Elctrns.	205-881-5031
AZ	Mesa, Sys. Sls. of Arizona	602-464-9989
CA	Garden Grove, ELSCO Elctrns.	714-891-4621
CA	San Jose, Arnold Tech. Sls.	408-954-0400
CO	Englewood, Omega Ltd.	303-762-1921
FL	Longwood, Beacon Elctrns.	407-332-1940
GA	Atlanta, Beacon Elctrns.	404-256-9640
IL	Chicago, Meca Sls.	312-334-4020
IA	Marian, MSB Assocs.	319-377-6261
KS	Roeland Park, MSB Assocs.	913-432-2131
MD	Randallstown, Beacon North	703-478-2480
MA	Taunton, Focus Sls.	508-824-2480
MI	Lathrup Village, RC Nordstrom & Co.	313-559-7373
MN	Minneapolis, Intl. Elctrns.	612-571-0000
MO	St. Louis, MSB Assocs.	314-946-5577
NM	Albuquerque, Sys. Sls. of Arizona	505-889-2901
NY	Fairport, TAC Sls.	716-223-7610
NY	Glencove, Dynorep	516-676-1598
NC	Raleigh, Beacon Elctrns.	919-787-0330
OH	Centerville, Engrg. Mktg. Assoc.	513-433-2800
SC	Greenville, Beacon Elctrns.	803-297-7830
TN	Knoxville, Beacon Elctrns.	615-691-0062
TX	Irving, Aid Elctrns.	214-790-4761
VA	Sterling, Beacon North	703-478-2480
WA	Redmond, Sls. & Engrg. Assoc.	206-883-4999
Can	Toronto, Deskin Sls.	416-475-1412

Local Distributors

AZ	Tempe, Acacia Sls.	602-894-2874
CA	Fremont (North), Acacia Sls.	510-623-7500
CA	Los Angeles, Bell Inds.	310-826-2355
CA	San Jose, Spectra Elctrns.	408-955-7800
CA	Santa Monica (South), Master Distrs.	310-452-1229
CO	Englewood, Comp. Distrs.	303-770-6214
CO	Wheatridge, Acacia Sls.	303-421-7004
CT	Hartford, Wes-Garde Comps.	203-527-7705
FL	Clearwater, Comp. Distrs.	813-796-0466
FL	Lakeland, Wes-Garde Comps.	813-644-7564
IL	Chicago, Leeds Electro Comps.	312-625-3800
IN	Indianapolis, Bell Inds.	317-875-8200
KS	Overland Park, Wes-Garde Comps.	913-262-2718
MA	Woburn, Control Design	317-932-9404
MI	Grand Rapids, SF Elctrns.	616-459-0216
MN	Plymouth, Leeds Electro Comps.	612-557-1277
MO	St. Louis, Wes-Garde Comps.	314-567-7776
NH	Nashua, Wes-Garde Comps.	603-880-1971
NJ	Mt. Laurel, Wes-Garde Comps.	609-778-8190
OH	Westerville, Wes-Garde Comps.	614-885-0319
OR	Wilsonville, Wes-Garde Comps.	503-682-1333
PA	Malvern, Control Design	215-296-0150
TX	Dallas, Off the Shelf	214-247-0052
TX	Richardson, RSC Elctrns.	214-644-3444
WA	Redmond, Acacia Sls.	206-881-5566

A.L.E. SYS., INC., 150 Homer Ave., Ashland, MA 01721, Tel: 508-881-5252, FAX: 617-235-6588; Empl.: 60; *Sls. Mgr.:* Tom Conklin/John Boyd; *Dist. Mgr.:* Tom Conklin/John Boyd

ALEXANDER BATTERIES, New Product/OEM Divison, P.O. Box 28880, San Diego, CA 92198, Tel: 619-480-4445, TELEX: 371-9855, FAX: 619-480-1351; Empl.: 390; *Sls. Mgr.:* Dave Zeman ..... **D•1423**

Local Sales Offices & Reps

CA	San Diego, Alexander Batteries;New Prod./OEM Div.	619-480-4445,,619-480-1351

ALEXANDER MANUFACTURING COMPANY, P.O. Box 1508, Mason City, IA 50402, Tel: 800-247-1821, 515-423-8955, TELEX: 3719855, FAX: 515-423-1644; Empl.: 350 ..... **D•1423**

ALEXANDRIA EXTRUSION CO., P.O. Box 847 Cty. Rd. 22 North, Alexandria, MN 56308, Tel: 612-763-6537, FAX: 612-763-6530; Empl.: 175; *Sls. Mgr.:* Brian L. Bloedorn

ALEXANDRIA METAL FINISHER, INC., 9418 Gunston Cove Rd., Lorton, VA 22079, Tel: 703-643-1636, FAX: 703-690-6731; Empl.: 75; *Sls. Mgr.:* Larry Capoccia

ALFA ELECTRONICS, INC., P. O. Box 8089, Princeton, NJ 08543-8089, Tel: 609-275-0220, FAX: 609-275-9536; Empl.: 9; *Sls. Mgr.:* Jeff Kao

ALFCO, Div. of Air Maze, 1000 Cindy Lane, Carpinteria, CA 93013, Tel: 805-684-7651, FAX: 805-684-3654; FSC No.: 17504; Empl.: 100; *Sls. Mgr.:* Barbara McIntyre

ALINABAL, 28 Woodmont Rd., Milford, CT 06460, Tel: 203-877-3241, FAX: 203-874-5063; Empl.: 255

ALLEGRO MICROSYSTEMS, INC., formerly Sprague Semiconductor Grp., 363 Plantation St., Worcester, MA 01605, Tel: 508-795-1300, FAX: 508-792-9024; FSC No.: OCVK3; Empl.: 2000; *Sls. Mgr.:* D. Ax; *Dist. Mgr.:* K. Gutkowski

ALLEN AVIONICS, INC., 224 E. 2nd St., Mineola, NY 11501, Tel: 516-248-8080, FAX: 516-747-6724; Empl.: 300; *Sls. Mgr.:* Jeffrey Buchman ..... **A•1514, 1619**

Local Sales Offices & Reps

AZ	Phoenix, J. F. Hurlbut Co.	602-952-2079
CA	Arcadia, Van Gott & Assocs.	818-445-9728
CA	Palo Alto, Adtek Assocs.	415-323-5414
CA	San Diego, Van Gott & Assocs.	619-308-0667
CO	Golden, J. F. Hurlbut Co.	303-279-7796
FL	Melbourne, Reynolds & Assocs., Inc.	407-259-7000
MA	Scituate, D&M Tech. Sls.	617-545-9369
MI	Ann Arbor, Tech. Sls. Assocs.	313-995-4082
OH	Cleveland, Tech. Sls. Assocs.	216-461-0826
OH	Dayton, Tech. Sls. Assocs.	513-298-2062
NC	Raleigh, Reynolds Assocs.	407-259-7000
PA	W. Conshohocken, Eastern Comp. Sls. Inc.	215-270-9530
TX	Dallas, Bradenco Corp.	214-352-3554
VA	Alexandria, Vanguard Engrg. Sls.	703-768-1660
WA	Seattle, Evergreen Mktg. Grp.	206-633-3160

ALLEN-BRADLEY CO., Div. of Industrial Control Grp., 1201 S. Second St., Milwaukee, WI 53201, Tel: 414-382-2000, TELEX: 26699, TWX: 4311016, FAX: 414-382-4444; Empl.: 1600; *Dist. Mgr.:* Dick Zajork

ACA

FAX: 818-765-2387

ALLEN CO., INC., ROBERT G., 7267 Coldwater Canyon, N. Hollywood, CA 91605, Tel: 818-765-8300, 800-827-7422; Empl.: 35; *Sls. Mgr.:* Brad Hammarquist ..... **A•1010-1013, 1860-1863**

Local Sales Offices & Reps

AL	Huntsville, JWL Assocs.	205-565-4019
AR	Little Rock, Design Mktg.	501-336-8122
CA	Cupertino, Prism Technical Sls., Inc.	408-435-7377, fx:408-257-8847
CA	Irvine, Gravley & Assocs., Inc.	714-852-9339
CT	Windsor, Janeco	203-688-4513
GA	Atlanta, JWL Assocs.	404-518-8500
IL	Chicago, Rendell Sls.	312-967-1513
IN	Indianapolis, Century Tech. Sls.	513-677-5088
MI	Warren, Burcaw Co.	313-573-4605
NJ	Cooper-Simon	201-428-0600
NY	Franklin Square, Cooper-Simon	516-489-0404
NC	JWL Assocs.	919-414-8887
NC	Charlotte, JWL Assocs.	704-541-5750
OH	Cincinnati, Century Tech. Sls.	513-677-5088
OK	Oklahoma, Design Mktg.	405-789-5911
MN	Oakdale, Complete Sls.	612-731-2923
TX	Austin, Design Mktg.	512-263-9151
TX	Houston, Design Mktg.	713-469-7949
WA	Redmond, Interstate Elctrns.	206-885-5257
WA	Seattle, Interstate Elctrns.	206-885-5257
EXP	Dublin, Ireland, Standard Comps. Ltd.	375-25025

Local Distributors

CA	Costa Mesa, Orange Ctny. Comps.	714-979-3597
CA	Oakland, Brill Elctrns.	405-834-5888
CA	San Diego, Mock III	619-560-0515
CA	San Jose, Spectra	408-955-7800
CA	Santa Clara, Bravo	408-980-8500
ID	Boise, Radar Elec. Co., Inc.	208-336-2227
IL	Itasca, Voyager Elctrns. Corp.	312-773-4900

MN	Hibbing, Minntech Elctrns.	218-262-5227
NJ	Garfield, B & R Elctrns.	201-470-0700
OR	Portland, Radar Elec. Co., Inc.	503-232-3404
WA	Richland, Radar Elec. Co., Inc.	509-943-8336
WA	Seattle, Radar Elec. Co., Inc.	206-282-2511
WA	Spokane, Radar Elec. Co., Inc.	509-747-3053

ALLEN DATAGRAPH, INC., 2 Industrial Way, Salem, NH 03079, Tel: 603-893-1983, FAX: 603-893-9042; *Sls. Mgr.:* Tom Allen

ALLEN SYSTEMS, 2346 Brandon Rd., Columbus, OH 43221, Tel: 614-488-7122; Empl.: 10

ALLEN TECHNOLOGY, PO Box 575, Sutton, NE 68979, Tel: 402-773-5285

ALLIANCE ELECTRONICS CORP., 8560 SW Salish Lane, Wilsonville, OR 97070-0503, Tel: 503-682-4976, FAX: 503-682-0390; Empl.: 21; *Sls. Mgr.:* Nate Olson

ALLIANCE LABORATORIES, INC., 555 Price Ave., Redwood City, CA 94063, Tel: 415-366-8220, FAX: 415-366-0634; Empl.: 10; *Sls. Mgr.:* Michael Munroe

ALLIED CONTROLS INCORPORATED, 562 Captain Neville Dr., Waterbury, CT 06705-3827, Tel: 203-757-4200, FAX: 203-757-4202; FSC No.: 5945; *Sls. Mgr.:* John T. Kryjak, VP Sls. & Mktg.; *Dist. Mgr.:* J. Kronenberger

ALLIED ELCTRNS., Subsidiary of Hall-Mark, 7410 Pebble, Fort Worth, TX 76118, Tel: 800-433-5700, FAX: 817-595-6470; Empl.: 250; *Sls. Mgr.:* Ed Bridges

ALLIEDSIGNAL AEROSPACE, Aerospace Systems & Equipment, 118 Hwy. 35, Eatontown, NJ 07724, Tel: 908-389-7761, TELEX: 132-444, FAX: 908-389-7301; FSC No.: 83298;Multiple; Empl.: 1,000; *Sls. Mgr.:* R. Freeman

ALLIEDSIGNAL INC., Communications Systems, 1300 E. Joppa Rd., Towson, MD 21286-5999, Tel: 410-583-4000, TWX: 710-232-1823, FAX: 410-337-7485; FSC No.: 06845; Empl.: 1500; *Sls. Mgr.:* Jack L. Shagena

ALLIGATOR TECHNOLOGIES, 17150 Newhope St., Ste. 114, Fountain Valley, CA 92708, Tel: 714-850-9984, FAX: 714-850-9987; Empl.: 10; *Sls. Mgr.:* Bertil Wanner

A-L-L MAGNETICS INC./THE MAGNET SOURCE, 930 S. Placentia Ave., Placentia, CA 92670, Tel: 800-262-4638, 800-525-3536, FAX: 714-632-1754,714-632-1757; FSC No.: 5999; Empl.: 43; *Sls. Mgr.:* Tim Pollett; *Dist. Mgr.:* Steve Alexander ..... **A•1319**

ALL-STATES, INC., 1801 W. Foster Ave., Chicago, IL 60640, Tel: 312-728-0525, TELEX: 317027, FAX: 312-728-6410; FSC No.: 26863

ALMOND INSTRUMENTS, See EG & G Almond Instruments

ALPHA COMPONENTS, 1106 E. Simpson Rd., Mechanicsburg, PA 17055, Tel: 717-697-8595, FAX: 717-697-8608; FSC No.: 52748; *Sls. Mgr.:* Jerry Buckwalter

ALPHA-CORE INC., 915 Pembroke St., Bridgeport, CT 06608, Tel: 203-335-6805, FAX: 203-384-8120; Empl.: 20; *Sls. Mgr.:* Sandu Pescaru

ALPHA DIST. CORP., 3554 Brecksville Rd., Richfield, OH 44286, Tel: 216-659-7100, 1-800-628-0841, FAX: 216-659-3459

ALPHA INDUSTRIES, INC., 20 Sylvan Rd., Woburn, MA 01801, Tel: 617-935-5150, TELEX: 949436, TWX: 710-393-1236; FSC No.: 17540; Empl.: 1400; *Sls. Mgr.:* David Barker

ALPHA-M CORP., 11518 Reeder Rd S.W., 115, Dallas, TX 75229, Tel: 214-406-0424, FAX: 214-241-6778; Empl.: 8; *Sls. Mgr.:* W. L. Cowley

ALPHA METALS, 600 Rte 440, Jersey City, NJ 07304, Tel: 201-434-6778, FAX: 201-434-7508; Empl.: 350; *Sls. Mgr.:* Dave Zerfoss, VP Assembly Prods.

ALPHA OMEGA COMPUTER SYSTEMS, 33815 Eastgate Circle, Corvallis, OR 97333, Tel: 503-754-1911, FAX: 503-754-1913; Empl.: 8; *Sls. Mgr.:* Gary Oliver; *Dist. Mgr.:* Gary Oliver

ALPHA PRODUCTS, INC., 5740 Corsa Ave. #104, Westlake Village, CA 91362, Tel: 818-889-9304, TELEX: 215-305, FAX: 818-706-8986

ALPHA-TECH INC., P.O. Box 209, Riverdale, NJ 07457, Tel: 201-838-1188, FAX: 201-838-1188; FSC No.: 1X300; Empl.: 8; *Sls. Mgr.:* M. Rice

ALPHATEST CORP., 557 E. Juanita Ave., # 6, Mesa, AZ 85204-6597, Tel: 602-545-5518, FAX: 602-545-5521; FSC No.: 07-411732-F; Empl.: 6; *Sls. Mgr.:* Dan Rodgers; *Dist. Mgr.:* Dan Rodgers

ALPHA THERMISTOR, INC., 7181 Construction Ct., San Diego, CA 92121, Tel: 619-549-4660, 800-235-5445, FAX: 619-549-4791; Empl.: 30; *Sls. Mgr.:* David Pyle

ALPHA WIRE CORP., 711 Lidgerwood Ave., P.O. Box 711, Elizabeth, NJ 07207-0711, Tel: 908-925-8000, TELEX: 6853017, TWX: 710-996-5895, FAX: 908-925-7938; Empl.: 376; *Sls. Mgr.:* Linda Smith

ALTAIR EXCHANGE CORPORATION, 24907 Avenue Tibbetts Unit-C, Valencia, CA 91355, Tel: 805-257-6964, FAX: 805-257-6490

ALTECH CORP., 35 Royal Rd., Flemington, NJ 08822-6000, Tel: 908-806-9400, FAX: 908-806-9490; Empl.: 35; *Sls. Mgr.:* Steve Stahovic, VP Sls.; *Dist. Mgr.:* Mort Gelfand, VP Opers. ... **B•1342; C•1006-1007, 1138, 1152-1159**

ALTEK CO., P.O. Box 1128, Torrington, CT 06790, Tel: 203-482-7626, FAX: 203-496-7113; FSC No.: 53939; Empl.: 65; *Sls. Mgr.:* Stephen Altschuler

ALTEK CORPORATION, 12210 Plum Orchard Dr., Silver Springs, MD 20904-7802, Tel: 301-572-2555, TWX: 710-825-0422, FAX: 301-572-2510; FSC No.: 7D336; Empl.: 46; *Sls. Mgr.:* Frank D. Augustino; *Dist. Mgr.:* Frank D. Augustino

ALTERA CORPORATION, 2610 Orchard Parkway, San Jose, CA 95134-2020, Tel: 408-894-7000, TELEX: 888496, FAX: 408-248-7097

ALTERNATIVE MANUFACTURING, INC., 8 Summer St., P.O. Box 200, Winthrop, ME 04364-200, Tel: 207-377-9377, FAX: 207-377-9379; Empl.: 20

FAX: 815-455-3171

ALTRAN CORPORATION, 6101 Factory Rd., Crystal Lake, IL 60014, Tel: 815-455-5650 ..... **A•2257-2259**

ALTRON, INC., 6700 Industry Ave., N.W., Anoka, MN 55303, Tel: 612-427-7735, FAX: 612-427-3980; Empl.: 185; *Sls. Mgr.:* Jim Ruid

AlumaPak

ALUMAPAK, Electronic Precepts of Florida, 11651 87th St., N., Largo, FL 34643, Tel: 800-775-6077; Empl.: 7; *Sls. Mgr.:* Roy Bloomquist ..... **C•1009**

Local Distributors

FL	Largo, Elctrn. Precepts of FL	800-367-4649

ALUSETT U.S.A., INC., 200 N. Water St., Peekskill, NY 10566, Tel: 914-737-0120, FAX: 914-737-8697; Empl.: 35

AMADOR, 1775 Old Highway 8, New Brighton, MN 55112-1891, Tel: 612-631-2487, TELEX: 5106007012, ESYLNK: 62911738, FAX: 612-631-3515; Empl.: 44; *Sls. Mgr.:* Gene A. Panger

AMASCO, 370 Amapola, Torrance, CA 90501, Tel: 310-781-9494, FAX: 310-781-9059; Empl.: 20; *Sls. Mgr.:* William Barten

AMATOM ELECTRONIC HARDWARE, 446 Blake St., New Haven, CT 06515, Tel: 203-397-3311, TELEX: 963-419, FAX: 203-387-4101; FSC No.: 06540; Empl.: 125; *Sls. Mgr.:* James Marshall

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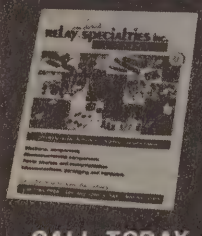

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WA Seattle, J. J. Assocs., Inc. 206-246-6619
Can Ottawa, Rohde & Schwarz Canada 613-592-8000

AMPLIFONIX, INC., 2707 Black Lake Place, Philadelphia, PA 19154, Tel: 215-464-4000, FAX: 215-464-4001; FSC No.: 60979; Empl.: 75; *Sls. Mgr.:* Michael Sonstein; *Dist. Mgr.:* Michael Sonstein

AMPROBE INSTRUMENT, Core Industries, Inc, 630 Merrick Rd., Lynbrook, NY 11563, Tel: 516-593-5600, FAX: 516-593-5682; Empl.: 200; *Sls. Mgr.:* Duncan Ladd, VP Sls.

AMPRO COMPUTERS,INC., 990 Almanor Ave., Sunnyvale, CA 94086, Tel: 408-522-2100, FAX: 408-720-1305; Empl.: 51; *Sls. Mgr.:* Victor Maccharoli/Brian McConnell

AMPTEC ELECTRONICS, 12650 Sabre Springs Pky., Ste. 207, San Diego, CA 92128, Tel: 619-578-7816, FAX: 619-578-7816; Empl.: 18

AMPTEK, INC., 6 De Angelo Dr., Bedford, MA 01730, Tel: 617-275-2242, FAX: 617-275-3470; Empl.: 17

AMPTRONIX, INC., P.O. Box 8146, Rowland Heights, CA 91748, Tel: 213-666-1564; *Sls. Mgr.:* Lou Lim; *Dist. Mgr.:* Ching Lim

AMRAD & TRANSCON MFG. CO., Div. of D.J. Assocs., Inc., 8411 South Zero St., Fort Smith, AR 72903-7097, Tel: 501-452-3987, FAX: 501-452-7752; FSC No.: 55943; Empl.: 5; *Sls. Mgr.:* M. P. Beck; *Dist. Mgr.:* M. P. Beck

A M SENSORS, INC., 26 Keewaydin Dr., Unit B, Salem, NH 03079-2839, Tel: 603-898-1543, FAX: 603-898-1638; Empl.: 10; *Sls. Mgr.:* Rocco Ciesco

AMSTAT INDUSTRIES, INC., 3012 N. Lake Terrace, Glenview, IL 60025, Tel: 708-998-6210, FAX: 708-998-6218

AMUNEAL MANUFACTORING CORP., 4737 Darrah St., Philadelphia, PA 19124, Tel: 215-535-3000, FAX: 215-743-1715; FSC No.: 23740; Empl.: 55; *Sls. Mgr.:* Larry Maltin ..... **C•1683**

Local Sales Offices & Reps

AZ Phoenix, Shefler-Kahn Co. 602-581-0884, FAX:602-581-3522
CA Banning, C.E.M., Inc. 714-845-1216
CA Fremont, Edward Blake Assocs., Inc. 510-770-9058,FAX:510-770-9698
CA San Diego, C.E.M., Inc. 619-583-8571, FAX:619-583-2718
CA Santa Ana, C.E.M., Inc. 714-835-2702, FAX:714-835-0851
CT Meriden, MPS Elctrns., Inc. 203-235-1414
MA Norwood, MPS Elctrns. 617-769-8700, FAX:617-769-7703
NY Yonkers, Sonkin Assocs. 914-968-8282, FAX:914-968-9187
OH Kettering, F.L. Ohmer & Assocs. 513-434-1454, FAX:513-434-2067
OR Tigard, Rep-West, Inc. 503-639-0325, FAX:503-684-9040
TX Austin, Eatman Engrg. 512-795-0920
TX Austin, Eatman Engrg., Co. 512-795-0920, FAX:512-795-0960
TX Rockwell, Eatman Engrg. 214-771-1903, FAX:214-722-3501
WA Seattle, Rep-West 206-283-8351, FAX:206-283-8699
Intl Israel, Ramat Hasharon, Star-Gal Engrg., Ltd. 011-972-3-5490226
Can Toronto, Ontario, Norgay Entrprs. Ltd. 416-234-8966,FAX:416-234-8970

ANACOM GEN. CORP., 1335 S. Claudina St., Anaheim, CA 92805-6235, Tel: 714-774-8080, FAX: 714-774-7388; Empl.: 95; *Sls. Mgr.:* Sye Keene; *Dist. Mgr.:* Sye Keene

ANADEX INC., 1080 Avenida Acaso, Camarillo, CA 93012, Tel: 805-987-9660, FAX: 805-388-0133; Empl.: 15

ANADYNE POWER SUPPLY DIVISION, 14005 Stage Road, Santa Fe Springs, CA 90670-5216, Tel: 213-921-9364, FAX: 213-921-8163; Empl.: 100

ANAHEIM AUTOMATION, 910 E. Orangefair La., Anaheim, CA 92801, Tel: 714-992-6990, FAX: 714-992-0471; Empl.: 35

ANALOG & DIGITAL PERIPHERALS, INC.(ADPI), P.O. Box 499, Troy, OH 45373, Tel: 513-339-2241, FAX: 513-339-0070; FSC No.: 31-0949-745; Empl.: 28; *Sls. Mgr.:* W. Rych Haynes; *Dist. Mgr.:* Lyle Ellicott

ANALOG DEVICES, INC., One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106, Tel: 617-329-4700, TWX: 710-394-6577, ESYLNK: 62896514, FAX: 617-326-8703; FSC No.: 24355; Empl.: 5200; *Sls. Mgr.:* Joe Reichbach; *Dist. Mgr.:* Ed Renola

ANALOG EQUIPMENT CORPORATION, 3780-9 Burns Rd., Palm Bch. Gardens, FL 33410, Tel: 407-622-3715; FSC No.: 67584; *Sls. Mgr.:* V. Ratner

ANALOGIC CORP., 8 Centennial Dr., Peabody, MA 01960, Tel: 508-977-3000, FAX: 508-531-7356; Empl.: 1200; *Sls. Mgr.:* Martyn Culverhouse ..... **D•1170**

Local Sales Offices & Reps

CA	San Diego, Analogic Corp.	619-484-7661
OH	Parma, Analogic Corp.	216-884-4420
PA	Chalfont, Analogic Corp.	215-997-1808

ANALOGIC CORP., Data Conversion Prods. Grp., 360 Audubon Rd., Wakefield, MA 01880, Tel: 508-977-3000, FAX: 617-245-1274; Empl.: 1200; *Sls. Mgr.:* D. Travers ..... **D•1170**

ANALOG MODULES INC.

FAX: 407-834-3806

ANALOG MODULES, INC., 126 Baywood Avenue, Longwood, FL 32750-3426, Tel: 407-339-4355; FSC No.: 61651; Empl.: 48; *Sls. Mgr.:* W.C. Hudson, Exec. VP; *Dist. Mgr.:* Mark Roberts ..... **B•1210; D•1005, 1573**

Local Sales Offices & Reps

NJ	Madison, DJ Assocs.	201-822-0002

ANALOG SYSTEMS, P.O. Box 17389, Tucson, AZ 85731-7389, Tel: 602-290-1818, FAX: 602-885-1189; Empl.: 9; *Sls. Mgr.:* Sharon Raban; *Dist. Mgr.:* Sharon Raban

ANALYTIC TECHNOLOGY CORP., 15233 N.E. 90th, Redmond, WA 98052, Tel: 206-883-2445, 800-428-2808, FAX: 206-882-2138; Empl.: 10; *Sls. Mgr.:* Jim Dooley

ANAREN MICROWAVE, INC., P.O. Box 178, 6635 Kirkville Rd., E. Syracuse, NY 13057, Tel: 315-432-8930, FAX: 315-432-9121; FSC No.: 31597; Empl.: 300

ANATECH ELECTRONICS, INC., 94 Jewell St., Garfield, NJ 07026, Tel: 201-772-4242, FAX: 201-772-4646; Empl.: 10

ANCO ELECTRONICS, INC., 9477 Archibald Avenue, Rancho Cucamonga, CA 91730, Tel: 1-800-545-ANCO, FAX: 714-989-9935

ANCOT, 115 Constitution Drive, Menlo Park, CA 94025, Tel: 415-322-5322, FAX: 415-322-0455; Empl.: 10; *Sls. Mgr.:* Chris Lynch

AND, William J. Purdy Co., 770 Airport Blvd., Burlingame, CA 94010, Tel: 415-347-9916, TELEX: 677-1439, FAX: 415-340-1670; FSC No.: (PURDY UW); Empl.: 32; *Sls. Mgr.:* Clarence Bruce

ANDEEN-HAGERLING, INC., 31200 Bainbridge Rd., Cleveland, OH 44139-2231, Tel: 216-349-0370, TELEX: 4931432, FAX: 216-349-0359; Empl.: 9; *Sls. Mgr.:* Eric Whitman

FAX: 814-696-0403

ANDERSON ELECTRONICS, P. O. Box 89, Hollidaysburg, PA 16648, Tel: 814-695-4428; Empl.: 60; *Sls. Mgr.:* Mike Martin ..... **A•1333**

Local Sales Offices & Reps

CA	Sunnyvale, Logan Sls	408-732-6020
GA	Lawrenceville, B. T. Funderburk, Inc.	404-963-9495
IL	South Elgin, R.K. Elctrn.	708-695-8552
KS	Westwood, E.P.I. Inc	913-432-1792
MA	Woburn, Microwave Comp. Mktg., Inc.	617-273-3106
MI	Southfield, R. C. Nordstrom & Co.	313-559-7373
MO	St. Louis, E.P.I. Inc.	314-962-1411
NC	Raleigh, B. T. Funderburk, Inc.	919-846-2373
OR	Beaverton, Harry Levinson Co.	503-690-1312
PA	Souderton, Intek, Inc.	215-723-0433
TX	Plano, GW Prods.	214-422-1746
WA	Seattle, Harry Levinson Co.	206-382-1300
Can	Hamilton, Ont., Cartwright Southall Assocs.	416-528-0294

ANDERSON POWER PRODUCTS, Div. of High Voltage Engineering, 145 Newton St., Boston, MA 02135, Tel: 617-787-5880, TELEX: 940453, FAX: 617-254-9217; Empl.: 110; *Sls. Mgr.:* Tom Fielding

AEC

FAX: 401-333-0287

ANDON ELCTRNS. CORP., 4 Court Dr., Lincoln, RI 02865, Tel: 401-333-0388; FSC No.: OEBT2; Empl.: 55; *Sls. Mgr.:* Jack Galinev; *Dist. Mgr.:* Peter Gallotello, Mktg. Mgr. ..... **C•1256-1259**

Local Sales Offices & Reps

AL	Huntsville, Dixie Tech. Mktg.	205-539-1405
AL	Huntsville, SACS	205-533-4229
CA	Los Angeles, TNT & Assocs.	714-830-6096
CA	San Jose, Integrated Tech. Sls.	408-727-3406
CO	Littleton, Con-Tek Mktg., Inc.	303-973-8490
CT	N. Bradford, Todino Engrg. Sls.	203-488-2896
FL	Boca Raton, SACS	407-391-1034
GA	Norcross, SAC	404-447-6154
IL	Arlington Heights, Greenslade Sls., Inc.	708-593-3450
MD	Baltimore, Baguol/Grimm Assocs.	410-719-0770
MN	Minneapolis, D.A. Case Assocs., Inc.	612-831-6777
NJ	Venture Quest, Inc.	201-377-4922
NY	Fairport, L-Mar Assocs., Inc.	715-425-9100
NC	Raleigh, SACS	919-859-9970
OH	Dayton, Dirckson & Assoc. Inc.	513-294-3657
OH	Richfield, Geotronix Inc.	216-659-6100
OK	Tulsa, Advance Tech. Sls.	918-664-0482
OR	McMinnville, Electro-Design	503-472-0481
PA	Ft. Washington, SMC	215-628-3394
RI	Smithfield, Todino Sls.	401-232-5656
TX	Dallas, Advance Tech. Sls.	214-340-1300
Can	Concord, Ont., Votron Elctrns., Inc.	416-699-9870

Local Distributors

CA	San Jose, Spectra Elctrns.	408-452-1590
CA	Santa Clara, Trinity Elctrns.	408-980-9011
MD	Gaithersbury, Axis Elctrns., Inc.	301-840-9640
NY	Rochester, Masline Elctrns.	716-546-5373
NY	Syracuse, Lead Elctrns.	315-454-4544
OH	Columbus, Spectra Elctrns.	614-265-2250
TX	Tomball, Wofford Elctrns.	713-351-2255
Can	Woodbridge, Ont., Ryantronics Sls. & Importing	416-856-2992

ANDOVER, INC., 310 North Earl Avenue, Lafayette, IN 47904, Tel: 317-447-1157, FAX: 317-447-1150; Empl.: 120; *Sls. Mgr.:* Harry O. Minns

ANDREW CORP., 10500 W. 153rd St., Orland Pk., IL 60462, Tel: 800-255-1479, TELEX: 25-3897, FAX: 708-349-5943; *Sls. Mgr.:* Henry Duvalsaint

ANDREW CORPORATION, 4301 Westbank Dr., Ste. A-100, Austin, TX 78746, Tel: 800-331-4144, 512-314-3000, FAX: 512-314-3193; Empl.: 350; *Sls. Mgr.:* John Chvatal, Dir of Sls.

ANDUFET DIGITAL CORP., 545 W. Allen Ave., San Dimas, CA 91773, Tel: 909-394-0171, FAX: 909-394-9931; Empl.: 3

ANGO ELECTRONICS CORP., 29 Ewing Ave., North Arlington, NJ 07031, Tel: 201-955-0800, FAX: 201-955-2332; *Sls. Mgr.:* John Ngo ..... **C•1014**

ANGSTROHM PRECISION, INC., Dale Electronics, 18400 Precision Place, Hagerstown, MD 21742, Tel: 301-739-8722, FAX: 301-797-6852; Empl.: 500; *Sls. Mgr.:* Don Hutzell ..... **A•1923**

ANGUS ELECTRONICS CO., Box 24000, Indianapolis, IN 46224, Tel: 317-244-7611, TELEX: 027-419, FAX: 317-247-4749; FSC No.: 72264; Empl.: 2000; *Sls. Mgr.:* Thomas W. Pilcher

ANNULUS TECHNICAL INDUSTRIES, INC., P.O. Box 1390, 101 Nelson St., Port Dover, Ont., CAN N0A 1N0, Tel: 519-583-3440, FAX: 519-583-3460; Empl.: 21; *Sls. Mgr.:* Don MacAdam

ANORAD CORP., 110 Oser Ave., Hauppauge, NY 11788, Tel: 516-231-1995, FAX: 516-435-1612; Empl.: 280; *Sls. Mgr.:* Amir Chitayat, VP Sls.

ANRITSU WILTRON SALES CO., 685 Jarvis Dr., Morgan Hill, CA 95037-2809, Tel: 408-776-8300, FAX: 408-776-1744; Empl.: 100; *Sls. Mgr.:* Bill Wiedemann

ANSONICS, INC., P.O. Box 910, Halfway, OR 97834, Tel: 503-742-7475, FAX: 503-742-2991; Empl.: 6

ANTENNA RESEARCH ASSOCIATES, 11317 Frederick Ave., Beltsville, MD 20705, Tel: 301-937-8888, FAX: 301-937-2796; FSC No.: 23360; Empl.: 30; *Sls. Mgr.:* H.W. Rapalus

ANTENNA SPECIALISTS, The Allen Group, 30500 Bruce Industrial Pkwy., Cleveland, OH 44139, Tel: 216-349-8400, TELEX: 4332133 (AS INTL CLV), FAX: 216-349-8407; Empl.: 1000; *Dist. Mgr.:* Patty Fritz, Natl. Distr. Sls. Mgr.

ANTEX DIVISION, 24 Tioga Way, P.O.Box 615, Marblehead, MA 01945, Tel: 617-631-7100, FAX: 617-631-8887; *Sls. Mgr.:* C. Loutrel; *Dist. Mgr.:* C. Loutrel

ANTEX ELECTRONICS CORP., 16100 S. Figueroa St., Gardena, CA 90248-2617, Tel: 310-532-3092, FAX: 310-532-8509; Empl.: 53; *Sls. Mgr.:* Richard Gross; *Dist. Mgr.:* Richard Gross

ANTONA CORP., 1643 1/2 Westwood Blvd., Los Angeles, CA 90024-5603, Tel: 310-473-8995, FAX: 310-473-7112; Empl.: 3; *Sls. Mgr.:* Katherine Capanna

ANVIL CASES, Subsidiary of Zero Corporation, 15650 Salt Lake Ave., City of Industry, CA 91745, Tel: 818-968-4100; FSC No.: 59288; Empl.: 109; *Sls. Mgr.:* Whitt Adams

AOFR, INC., 800 E. Campbell, Suite 108, Richardson, TX 75081, Tel: 214-644-1394, FAX: 214-480-9278; *Sls. Mgr.:* Dwain Lawhon

AOT ELECTRONICS, INC., 4000 Mac Arthur Blvd, Newport Beach, CA 92660, Tel: 714-852-9999, FAX: 714-261-9999; Empl.: 27; *Sls. Mgr.:* Jon Stevenson

A. P. CIRCUIT, 397 Linden St., Brooklyn, NY 11237, Tel: 718-456-2717, TELEX: 428759, FAX: 718-456-2717

A.P.C.S. AMERICA, 3286 Kentland Ct. SE, Grand Rapids, MI 49548, Tel: 616-247-1453; Empl.: 13; *Sls. Mgr.:* Julie A. Corby

A.P.E. CORPORATION, 142 Peconic Ave., Medford, NY 11763, Tel: 516-654-1197, TWX: 510-228-2120, FAX: 516-289-4735; FSC No.: 57216; Empl.: 25; *Sls. Mgr.:* Arthur Ayala

APEX® µtech

FAX: 602-888-3329

APEX MICROTECHNOLOGY CORP., 5980 N. Shannon Rd., Tucson, AZ 85741, Tel: 602-690-8600, TELEX: 170631; FSC No.: 60024; Empl.: 120; *Sls. Mgr.:* Greg L. Brennan ..... **D•1006-1009, 2068-2069**

Local Sales Offices & Reps

AZ	Tucson, Apex Microtechnology	602-690-8602
CA	Los Altos, Kolm Mktg.	415-948-2635
CA	Manhattan Beach, Com-Star	310-318-9803
CA	Rancho Cucamonga, Com-Star	909-944-5744
CT	Lebanon, Signal Sls. Engrg.	203-889-4050
FL	Seminole, Q Rep	813-397-8431
IL	Palatine, Vine Sls., Inc.	708-934-5476
MD	Ellicott, Nelson Elctrns.	410-747-7887
MA	Woburn, Signal Sls. Engrg.	617-938-7872
MN	Bloomington, Industrial Rep.	612-854-8027
NH	Newton, Signal Sls. Eng.	603-382-3669
NJ	Allendale, Eastec Assocs.	201-934-7135
WI	Appleton, Vine Sls., Inc.	414-731-9873

Local Distributors

AZ	Tuscon, Apex	602-742-8600
Can	Kanata, J-Squared Technlgs.	613-592-9540

Can Point-Claire, J-Squared Technlgs. 514-694-8330
Can Rexdale, J-Squared Technlgs. 416-674-0927

A.P.M. HEXSEAL CORPORATION, 44 Honeck St, Englewood, NJ 07631, Tel: 201-569-5700, TELEX: 13-3403, FAX: 201-569-4106; FSC No.: 97539; Empl.: 29; *Sls. Mgr.:* Riva Solins; *Dist. Mgr.:* Riva Solins ..... **B•1669**

Local Sales Offices & Reps

AL Huntsville, L & D Inc. 205-837-1469
AZ Scottsdale, Advent Comp. Corp. 602-481-0044
AR Hot Springs, ASI 501-624-4608
CA Belmont, Edward B. Hoin Assoc. 415-592-6401
CA Chatsworth, Porter Co. 818-700-0808
CO Englewood, Delltron Co. 303-741-2122
CT Meriden, Gerber Sls. Corp. 203-630-3477
FL Oviedo, Sunland Assocs. 407-365-9533
GA Atlanta, L & D Inc. 404-395-7079
IL Lombard, FF/Hill Gray 708-832-4101
KS Overland Park, Spectrum Sls. 913-648-6811
MD Silver Spring, N.K.A. Inc. 301-585-6141
MA Burlington, Gerber Sls. 617-229-1150
MI Troy, C.B. Jensen Co. 313-643-0506
MN Bloomington, Murnco 612-854-4161
NJ Hackensack, CBA/METRO 201-440-4114
NY Syracuse, Rep Tech. 315-437-2845
NC Raleigh, L & D Inc. 919-876-5301
OH Powell, Val Skol Sls. 614-889-0174
PA Paoli, Tyler Griffin 215-647-1550
WA Edmonds, Evergreen Mktg. Grp. 206-485-8063
Can Ontario, Deskin Inc. 416-475-1412

Local Distributors

CA Garden Grove, Richey Impact Elec. 714-895-0060
CO Littleton, Indelco 303-795-3431
CT New London, Jan Elctrns. 203-442-4386
FL Miami, Elctrn. Equip. 305-526-6000
IL Chicago, Newark Elctrns. 312-784-5100
IN South Bend, Pei-Genesis 219-287-2911
KS Wichita, Midwest Fasteners 316-267-3318
MD Kensington, Marine Air Supp. 301-949-9560
MA Hingham, Sager Elctrl. Sply. 617-749-6700
MI Grand Rapids, S-F Elctrns. 616-459-0216
MN Minneapolis, Aero-Space Computer 612-884-4725
MO Maryland Heights, LCOMP, Inc. 314-291-6200
NY Lynbrook, Peerless Radio 516-593-2121
OH Cincinnati, Hughes Peters 513-351-2000
PA Philadelphia, Sanson & Rowland 215-329-9264
WI Milwaukee, Indst. Elctrns. 414-276-1212

APOLLO DISPLAY TECHNOLOGIES, INC., 194-22 Morris Ave., Holtsville, NY 11742, Tel: 1-800-LCD-STOC, 516-654-1143, FAX: 516-654-1496; *Sls. Mgr.:* Richard Eicher ..... **B•1019**

APOLLO MAGNETICS CORP., 2720 W. Beverly Blvd, Los Angeles, CA 90057, Tel: 213-381-2500, TWX: 910-321-4348, FAX: 213-384-4067; Empl.: 420; *Sls. Mgr.:* Charles Williams

APPLIED CONTROLS CO., INC., 1275 Bloomfield Ave., Fairfield, NJ 07004, Tel: 201-227-5454, FAX: 201-882-1422; FSC No.: 4A725; Empl.: 20; *Sls. Mgr.:* W. Merel

APPLIED DATA SYSTEMS, INC., 409A East Preston St., Baltimore, MD 21202, Tel: 800-541-2003, 410-576-0335, FAX: 410-576-0338; Empl.: 6; *Sls. Mgr.:* Robert Kondner

APPLIED DESIGN COMPANY, 2010 E. Hennepin Ave., Minneapolis, MN 55413, Tel: 612-378-0094, FAX: 612-378-0733

APPLIED DISPLAY & CONTROL, 415 W. Golf Rd., Ste. 10, Arlington Heights, IL 60005, Tel: 708-228-9690, FAX: 708-228-9698 ..... **B•1020**

APPLIED DISPLAY TECHNOLOGY, INC., 2150 Anchor Court, Newbury Park, CA 91320, Tel: 805-498-4984, FAX: 805-376-2011; FSC No.: OM3A8; Empl.: 15; *Sls. Mgr.:* John Becker

APPLIED ELECTRO TECHNLG., INTL., See Scientific Technologies Inc.

APPLIED ENGINEERING PRODUCTS, P.O. Box 510, New Haven, CT 06513, Tel: 203-756-1669, FAX: 203-776-2813; FSC No.: 19505; Empl.: 105; *Sls. Mgr.:* Jeff Buccitti; *Dist. Mgr.:* Jeff Buccitti

APPLIED FIBEROPTICS, INC., East Main St., Southbridge, MA 01550, Tel: 508-765-9121, 800-225-7486, FAX: 508-764-3639; Empl.: 35; *Sls. Mgr.:* Charles P. Kiritsy

APPLIED INFORMATION SYSTEMS, INC., 100 Europa Dr., Ste. 555, Chapel Hill, NC 27514, Tel: 919-942-7801, 800-334-5510, FAX: 919-493-7563; *Sls. Mgr.:* Dawn Edgerton

APPLIED MAGNETICS, 75 Robin Hill Rd., Goleta, CA 93117, Tel: 805-683-5353, FAX: 805-967-8227; FSC No.: 11935; Empl.: 8,000; *Sls. Mgr.:* Steven E. Beal

APPLIED MICRO CIRCUITS CORP., 6195 Lusk Blvd., San Diego, CA 92121, Tel: 619-450-9333, FAX: 619-450-9885; FSC No.: 367 4112; Empl.: 250; *Sls. Mgr.:* Greg Barnhart; *Dist. Mgr.:* Greg Barnhart, V.P. Worldwide Sls.

APPLIED MICROSYSTEMS CORP., 5020 148th Ave NE, Redmond, WA 98052, Tel: 206-882-2000, TELEX: 185196, FAX: 206-883-3049; Empl.: 200; *Sls. Mgr.:* Joe Gomula

APPLIED PLASTICS TECHNOLOGY, 45 Broadcommon Rd., Bristol, RI 02809, Tel: 401-253-0200, FAX: 401-253-0474; FSC No.: 9330; Empl.: 30; *Sls. Mgr.:* John A. MacIntyre III

APPLIED POWER CONVERSION

FAX: 201-385-0702

APPLIED POWER CONVERSION, Technology Dynamics, Inc., 100 School St, Bergenfield, NJ 07621, Tel: 201-385-0500; Empl.: 70 ..... **D•1574-1578, 2056-2057**

Local Sales Offices & Reps

AL Huntsville, BCI 205-539-4411,FAX:205-539-4412
AK Contact The Factory Direct
CA Contact The Factory Direct
CA San Diego, Cirolia Elect. Sls. 619-743-3015, FAX:619-743-3804
CA Santa Clara, W.J. Elect. Sls. 408-982-9222, FAX:408-982-9224
CO Contact The Factory Direct
FL Clearwater, Tech-Rep Assoc. 813-872-9900, FAX:813-573-9370
FL Ft. Lauderdale, Tech-Rep. Assoc. 305-791-2708, FAX:813-573-9370
GA Lawrenceville, BCI 404-962-6826, FAX:404-962-6338
HI Contact The Factory Direct
ID Contact The Factory Direct
IL Contact The Factory Direct
IL Arlington Heights, Greenslade Sls. 708-593-3450, FAX:708-593-3468
IN Contact The Factory Direct
IA Contact The Factory Direct
KS Contact The Factory Direct
KY Contact The Factory Direct
MD Columbia, Delta III Assoc. 410-730-4700, FAX:410-730-0790
MA Topsfield, Whitehead Assoc. 508-887-8050, FAX:508-887-5434
MI Contact The Factory Direct
MN Minneapolis, Tec Team Sls. 612-854-6616, FAX:612-854-8031
MO Contact The Factory Direct
MT Contact The Factory Direct
NE Contact The Factory Direct
NV Contact The Factory Direct
NJ Bergenfield, Technology Dynamics Inc. 201-385-0500,FAX:201-385-0702
NM Albuquerque, IMEC 505-275-0936, FAX:505-294-1121
NY Elmont, Crane & Egert 516-872-0800, FAX:516-872-9074
NY Fayetteville, Tri-Tech Elctrns. 315-446-2881, FAX:315-446-3047
NC Contact The Factory Direct
OH Chagrin, J.J. Bair & Co. 216-543-8617, FAX:216-543-4406
OR Contact The Factory Direct
PA Contact The Factory Direct
SC Contact The Factory Direct
SD Contact The Factory Direct
TX Dallas, Tesco Elctrn. Sls. 214-553-1200, FAX:214-553-1299
UT Midvale, Christec 801-566-3694, FAX:801-506-6442
WA Contact The Factory Direct
WV Contact The Factory Direct
WI Wauwatosa, Greenslade Sls., Inc. 414-258-2727, FAX:414-258-7725
WY Contact The Factory Direct

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APSCO, INC., 5976 Heisley Road, Mentor, OH 44060, Tel: 216-352-8961, TELEX: 284580, FAX: 216-354-7306; Empl.: 200; *Sls. Mgr.:* Ian Davey-Turner

APS DYNAMICS, INC., 5731 Palmer Way, Ste. A, Carlsbad, CA 92008, Tel: 619-438-4848, TELEX: 4995113 (SHAKE), FAX: 619-438-8845; Empl.: 5

APTEK TECHNOLOGIES, INC., DBA Aptek Microsystems, 700 N. W. 12th Ave., Deerfield Beach, FL 33442, Tel: 305-421-8450, FAX: 305-421-8044; FSC No.: 36741; Empl.: 50; *Sls. Mgr.:* Dwain Jenkins; *Dist. Mgr.:* Dwain Jenkins

A.P.W. CO., INC., 72 W. Main, Rockaway, NJ 07866, Tel: 201-627-0643, FAX: 201-627-6396; Empl.: 14

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APX TECHNOLOGIES INC., 264 Duffy Ave., Hicksville, NY 11801, Tel: 516-433-1313; Empl.: 300; *Sls. Mgr.:* David Baum ..... **A•2266-2267; D•1580-1583**

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CA Pasadena, Electro Mech. Inst. 818-795-7193
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NM Albuquerque, Syntech 505-266-7951
NY Fulton, Jones/Sudders 315-598-6942
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SC Darlington, AERCO, Inc. 803-395-6575
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ARIES ELECTRONICS, Box 130, Frenchtown, NJ 08825, Tel: 908-996-6841; FSC No.: 51167; Empl.: 160; *Sls. Mgr.:* Frank Folmsbee ..... **A•1689-1691; B•1673; C•1260-1268**

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AL	Madison, Benchmark Tech. Sls.	205-464-0033
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CA	Westlake Vlg., Elkins & Assoc.	818-597-1075
CO	Denver, West Inc.	303-477-8180
FL	Melbourne, The R-Rep Co.	407-722-1900
GA	Norcross, Benchmark Tech. Sls.	404-446-1711
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WI	Hartland, Selective Sls.	414-367-1133
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MD	W. Friendship, Consolidated Techlgs., Co.	301-442-5827
MA	Harvard, Enterprise Tech.	508-772-6003
MI	Novi, Innovative Sls. & Mktg.	313-344-8860
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MO	Florissant, Delltron Co., Inc.	314-839-0033
MO	Kansas City, Delltron Co.	816-436-6445
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PA	West Chester, All-Tech Mktg.	215-344-0134
TX	Burleson, Bounty Elctrns.	817-447-9775
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MA	Middleboro, Glynn Elctrns.	508-947-4262
MA	Needham, Cronin Elctrns.	617-449-5000
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NC	Cary, Powell Elctrns.	919-467-1212
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TX	Dallas, Wofford	214-320-0294
TX	Richardson, Altair Co.	214-231-5155
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WI	Milwaukee, Progressive	414-321-4722
Can	Toronto, SEMAD	416-475-8500

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MO	Grandview, R. R. Burton Assocs.	816-763-5385
PA	Saegertown, Multi-Phase	814-763-3640

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GA	Atlanta, Beacon Elctrns. Assoc.	404-256-9640
IL	Elk Grove Village, Aromat Corp.	708-593-8535
IL	Elk Grove Village, Carlson Elctrn. Sls.	708-956-8240
IN	Indianapolis, Precision Elctrn. Comps.	317-842-3740
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IA	Davenport, Rush & West Assocs.	319-388-9494
KS	Olathe, Rush & West Assocs.	913-764-2700
MD	Manchester, Imagitron Sls.	410-374-5600
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MI	Detroit, R. P. Urban & Assocs.	313-535-2355
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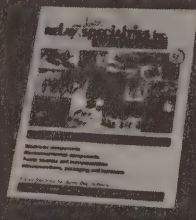
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TN	Gray, Dixie Elctrns.	615-477-2131
TN	Oak Ridge, Dixie Elctrns.	615-481-3393
TX	Austin, Newark Elctrns.	512-338-0287
TX	Austin, Norvell Elctrns.	512-837-5555
TX	Austin, Southwest Elctrns.	512-837-8971
TX	Corpus Christie, Douglas Elctrns.	512-883-5103
TX	Dallas, Computer Comps. Corp.	214-239-0271
TX	Dallas, Newark Elctrns.	214-340-3585
TX	Dallas, Norvell Elctrns.	214-233-0020
TX	Dallas, Southwest Elctrns.	214-234-3050
TX	Garland, Newark Elctrns.	214-494-5911
TX	Houston, Newark Elctrns.	713-782-4800
TX	Houston, Newark Elctrns.	713-827-0630
TX	Houston, Newark Elctrns.	713-827-7040
TX	Houston, Norvell Elctrns.	713-777-1666
TX	Irving, Newark Elctrns.	214-256-6585
TX	Richardson, Bell Inds.	214-690-0466
TX	San Antonio, Newark Elctrns.	512-349-2641
TX	Stafford, Southwest Elctrns.	713-240-4000
UT	Midvale, Bell Inds.	801-255-9611
VA	Roanoke, Mexitronics Corp.	703-342-4444
WA	Redmond, Bell Inds.	206-885-9963
WI	Mequon, Taylor Elec.	414-241-4321
WI	Waukesha, Bell Inds.	414-547-8879
Can	Calgary, Alberta, Zentronics	403-272-1021
Can	Edmonton, Alberta, Deskin Sls. Corp.	403-466-2106
Can	Markham, Ont., Deskin Sls. Corp.	416-496-2511
Can	Mississauga, Ont., Zentronics	416-564-9600
Can	Montreal, Que., Ferrotronics	514-341-3450
Can	Nepean, Ont., Carsten Elctrns.	613-726-9250
Can	Nepean, Ont., Zentronics	613-226-8840
Can	Richmond, BC, Zentronics	604-273-5575
Can	Scarborough, Ont., Carsten Elctrns.	416-495-7705
Can	St. Laurent, Que., Carsten Elctrns.	514-334-8321
Can	St. Laurent, Que., Zentronics	514-737-9700
Can	Vancouver, B.C., Deskin Sls. Corp.	604-324-8343

AROW COMPONENTS & FASTENERS, INC., 31012 Huntwood Ave., Hayward, CA 94544, Tel: 510-487-2100, FAX: 510-471-7018; FSC No.: 46467; Empl.: 52; *Sls. Mgr.:* James Sings, VP/Sls.

ARRAY CONNECTOR CORPORATION, 7400 N.W. 52nd St., Miami, FL 33166-5598, Tel: 305-591-7530, FAX: 305-592-2428; FSC No.: 5935; Empl.: 60; *Sls. Mgr.:* Roger Johnson

ARRAY MICROSYSTEMS, 1420 Quail Lake Loop, Colorado Springs, CO 80906, Tel: 719-540-7999, FAX: 719-540-7950; Empl.: 24; *Sls. Mgr.:* Douglas Mitchell; *Dist. Mgr.:* Douglas Mitchell

ARREM PLASTICS, INC., 502 Vista Ave., Addison, IL 60101, Tel: 708-628-2450, FAX: 708-628-1855; Empl.: 70; *Sls. Mgr.:* Jack Schrieffer

ARROW FASTENER, 271 Mayhill St., Saddlebrook, NJ 07662, Tel: 201-843-6900, FAX: 201-843-3911; Empl.: 600; *Sls. Mgr.:* Robert Hand

ARROW HART CONTROLS, Products Unlimited Corp., P.O. Box 413, Sterling, IL 61081, Tel: 815-626-0300, FAX: 815-626-8637; Empl.: 1000; *Sls. Mgr.:* Paul Schnackenberg; *Dist. Mgr.:* Paul Schnackenberg

ARS INC., 2400 Sand Lake Rd., Orlando, FL 32809, Tel: 1-800-950-5633, FAX: 407-856-1960; Empl.: 100; *Sls. Mgr.:* Jim Layne

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ARTEL COMMUNICATIONS CORP., 22 Kane Industrial Dr., Hudson, MA 01749, Tel: 508-562-2100, FAX: 508-562-6942; Empl.: 60; *Sls. Mgr.:* Edmund Govoni

ARTISAN CONTROLS CORP., P.O. Box 233, 5 Eastmans Rd.,Ste.100, Parsippany, NJ 07054, Tel: 201-428-1770, FAX: 201-428-1426; Empl.: 100

ARTRONICS CORPORATION, 124 Heritage Dr., P.O. Box 5070, Portsmouth, NH 03802-5070, Tel: 603-433-3111, FAX: 603-433-4684; Empl.: 10; *Sls. Mgr.:* Anthony Santomango

ASC® CAPACITORS

FAX: 308-284-8324

ASC CAPACITORS, 301 W O St, Ogallala, NE 69153, Tel: 308-284-3611; Empl.: 600; *Sls. Mgr.:* Jim Ratliff; *Dist. Mgr.:* Jim Ratliff ..... **A•1016-1023**

Local Sales Offices & Reps

AL	Huntsville, R. O. Whitesell & Assocs.	205-883-5110
AZ	Phoenix, Compass Mktg. & Sls., Inc.	602-996-0635
AZ	Scottsdale, Compass Mktg. & Sls.	602-585-0202
AZ	Tucson, Compass Mktg. & Sls., Inc.	602-293-1220
CA	Chatsworth, WCV-Raltech, Inc.	818-700-0933
CA	San Jose, Kottmeier Assocs.	408-371-8700
CO	Wheatridge, Waugaman Assocs.	303-423-1020
GA	Norcross, R. O. Whitesell & Assocs.	404-449-9190
IL	Itasca, Janus, Inc.	708-250-9650
IN	Ft. Wayne, R. O. Whitesell & Assocs.	219-432-5591
IN	Indianapolis, R. O. Whitesell & Assocs.	317-359-9283
IN	Kokomo, R. O. Whitesell & Assocs.	317-457-9127
IA	Cedar Rapids, C. H. Horn & Assocs.	319-393-8703
KY	Pewee Valley, R. O. Whitesell & Assocs.	502-241-1441
LA	Hammond, Design Mktg. & Assocs.	504-542-1115
MD	Annapolis, EES, Inc.	301-269-4234
MI	Grand Blanc, R. O. Whitesell & Assocs.	313-695-0770
MI	Grand Rapids, R. O. Whitesell & Assocs.	616-942-5420
MI	Southfield, R. O. Whitesell & Assocs.	313-559-5454
MI	St. Joseph, R. O. Whitesell & Assocs.	616-983-7337
MO	St. Louis, John G. Macke Co.	314-432-2830
NH	Salem, Sls. Engrg. Co.	603-893-5521
NM	Albuquerque, Compass Mktg. & Sls., Inc.	505-888-0800
NY	Buffalo, Quality Comps.	716-837-5430
NY	Manlius, Quality Comps.	315-682-8885
NY	Scotch Plains, Mil Comp.	908-322-7898
NJ	Marlton, BGR Assocs.	609-983-1020
OH	Cincinnati, R. O. Whitesell & Assocs.	513-521-2290
OH	Cleveland, R. O. Whitesell & Assocs.	216-447-9020
OH	Columbus, R. O. Whitesell & Assocs.	614-888-9396
OH	Dayton, R. O. Whitesell & Assocs.	513-298-9546
OR	Beaverton, Elctrn. Sources	503-627-0838
PA	Pittsburgh, R. O. Whitesell & Assocs.	412-936-6161
TN	Knoxville, R. O. Whitesell & Assocs.	615-694-9476
TN	Nashville, R.O. Whitesell & Assoc.	615-352-4760
TX	Austin, Design Mktg. & Assocs.	512-263-9151
TX	Dallas, Design Mktg. & Assocs.	214-480-8151
TX	Houston, Design Mktg. & Assocs.	713-550-3318
UT	Salt Lake City, Waugaman Assocs.	801-261-0802
VA	Midlothian, EES, Inc.	804-794-8939
WA	Bellevue, Elctrn. Sources	206-451-3500

Local Distributors

AL	Huntsville, Hall-Mark	205-837-8700
AZ	Phoenix, Arizona Comps.	602-269-5655
AZ	Phoenix, Hall-Mark	602-437-1200
AZ	Tempe, Bell Inds.	602-966-7800
AZ	Tucson, Hall-Mark	602-742-0515
CA	Agoura Hills, Bell Inds.	818-879-9494
CA	Chatsworth, Hall-Mark	818-713-4500
CA	Chatsworth, Passive Comps.	818-700-8838
CA	Chula Vista, Inter Elctrns.	619-476-0577 (US)
CA	Cypress, Bell	805-499-6821
CA	Irvine, Hall-Mark	714-727-6000
CA	Rocklin, Bell Inds.	916-652-0414
CA	Rocklin, Hall-Mark	916-624-9781
CA	San Diego, Bell	619-268-1277
CA	San Diego, Hall-Mark	619-268-1201
CA	San Jose, Hall-Mark	408-432-4000
CA	San Jose, Passive Comps.	408-441-1441
CA	San Jose, Passive Technlg.	408-435-5566
CA	Santa Fe Spg., Bell JIT/JDE	213-921-3611
CA	Sunnyvale, Bell Inds.	408-734-8570
CO	Denver, Bell Inds.	303-424-1985
CO	Englewood, Hall-Mark	303-790-1662
CT	Cheshire, Hall-Mark	203-271-2844
CT	Wallingford, Bell Inds.	203-269-6801
FL	Altamonte Spgs., Bell Inds.	407-339-0078
FL	Casselberry, Hall-Mark	407-830-5855
FL	Ft. Lauderdale, Bell Inds.	305-421-1997
FL	Largo, Hall-Mark	813-541-7440
FL	Melbourne, New Yorker Elect.	407-727-0955
FL	Pompano, Hall-Mark	305-971-9280
FL	Pompano Bch., Peerless	305-973-4141
FL	Tampa, Bell Inds.	813-541-4434
GA	Duluth, Hall-Mark	404-623-4400
GA	Norcross, Bell Inds.	404-662-0923
IL	Elk Grove Vlg., Bell Inds.	708-640-1910
IL	Urbana, Bell	217-328-1077
IL	Wood Dale, Hall-Mark	312-860-3800
IN	Ft. Wayne, Bell	219-423-3422
IN	Indianapolis, Bell	317-875-8200
IN	Indianapolis, Bell Inds. JIT	317-876-3740
IN	Indianapolis, Hall-Mark	317-872-8875
IN	Indianapolis, PEI/Genesis	317-879-0700
IN	South Bend, PEI/Genesis	219-287-2911
KS	Lenexa, Hall-Mark	913-888-4747
MD	Columbia, Hall-Mark	301-988-9800
MD	Columbia, Peerless Radio Corp.	301-997-1717
MD	Jessup, Bell Inds.	301-953-2566
MA	Andover, Bell Inds.	508-474-8880
MA	Billerica, Hall-Mark	617-935-9777
MA	Middleboro, Glynn Elctrns.	800-225-8684
MA	Middleboro, Glynn Elctrns.	800-427-4262
MI	Livonia, Hall-Mark	313-462-1205
MN	Bloomington, Hall-Mark	612-941-2600
MO	Earth City, Hall-Mark	314-291-5350
NJ	Fairfield, Bell Inds.	201-227-6060
NJ	Moorestown, Hall-Mark	609-235-1900
NJ	Parsippany, Hall-Mark	201-515-3000
NM	Albuquerque, Bell Inds.	505-292-2700
NY	Fairport, Hall-Mark	716-425-3300
NY	Lynbrook, Peerless Radio Corp.	516-593-2121
NY	Mamaroneck, New York Elctrn.	914-698-7600
NY	Penn Yann, Advacom Technlgs.	315-536-2221
NY	Ronkonkoma, Hall-Mark	516-737-0600
NC	Charlotte, EMC	704-394-6195
NC	Raleigh, Hall-Mark	919-872-0712
OH	Centerville, EMC	513-439-4711
OH	Cleveland, EMC	216-442-3441
OH	Columbus, EMC	614-299-4161
OH	Columbus, Hall-Mark	614-888-3313
OH	Dayton, Advacom Tech.	513-274-5900
OH	Dayton, Bell Inds.	513-434-8231
OH	Dayton, Bell Inds.	513-435-8660
OH	Solon, Hall-Mark	216-349-4632
OH	Worthington, Hall-Mark	614-888-3313
OH	Worthington, Hall-Mark	800-767-0392
OK	Tulsa, Hall-Mark	918-251-6110
OR	Lake Oswego, Bell Inds.	503-635-6500
PA	Bristol, Bell Inds.	215-788-5000
PA	McKean, Advacom Tech.	814-476-7774
PA	Philadelphia, Hall-Mark	215-355-7300
PA	Philadelphia, PEI-Genesis	215-673-0400
PA	Trevose, Bell Inds.	215-953-2800
TN	Jackson, Carlton-Bates	901-664-2714
TN	Nashville, Carlton-Bates	615-885-3232
TX	Austin, Hall-Mark	512-258-8848
TX	Dallas, Hall-Mark	214-553-4300
TX	Dallas, Hall-Mark (Corp.)	214-343-5000
TX	Houston, Hall-Mark	713-781-6100
TX	Richardson, Bell Inds.	214-690-0466
UT	Salt Lake City, Bell Inds.	801-255-9611
VT	Charlotte, Keiner Elctrns.	800-323-0460
WA	Redmond, Priebe Elctrns.	206-881-2363
WA	Seattle, Bell Inds.	206-867-5410
WA	Seattle, Hall-Mark	206-547-0415
WI	New Berlin, Hall-Mark	414-797-7844
WI	Waukesha, Bell	414-547-8879

Ascent POWER TECHNOLOGY INC.

FAX: 905-660-9567

ASCENT POWER TECHNOLOGY, 146 Adesso Dr., Concord, Ont., Canada L4K3C3, Tel: 905-660-9819; Empl.: 125; *Sls. Mgr.:* Howard Gang ..... **D•1592-1594**

Local Sales Offices & Reps

CA	Santa Clara, Computer Modules	408-496-1881
IA	Cedar Rapids, Rep Assocs. Corp.	319-373-0152
KY	Prospect, Keibler & Assocs.	502-228-7283
MD	Towson, Arbotek Assocs. Inc.	410-825-0775
MA	Burlington, New England Tech. Sls.	617-229-6387
NJ	Mahwah, North East Comps.	201-825-0233
NJ	Tintan Falls, McAdam Assocs.	908-870-8685
NY	E. Rochester, Empire Tech. Assoc.	716-381-8500
NY	Skaneateles, Empire Tech. Assoc.	315-685-5703
Can	Ontario, B.C., Current Mktg. Inc.	416-426-3413

ASC SYSTEMS, Box 566, St. Clair Shores, MI 48080, Tel: 313-882-1133; Empl.: 15; *Sls. Mgr.:* R. Martin; *Dist. Mgr.:* D. Leader

ASELCO, INC., 429 E. Diamond Ave., Suite E, Gaithersburg, MD 20877, Tel: 301-863-1937, FAX: 301-840-1382; Empl.: 7; *Sls. Mgr.:* Yoon Kim

ASHLAND ELEC. PRODS., INC., 10 Industrial Way,POB 1380, Rochester, NH 03867, Tel: 603-335-1100, FAX: 603-335-1120; FSC No.: 04810; Empl.: 30; *Sls. Mgr.:* T.G. Dolan, Jr.; *Dist. Mgr.:* Roxanne Ramsey

ASI INSTRUMENTS, INC., 8570 Katy Freeway, Suite 116, Houston, TX 77024, Tel: 800-245-7056, FAX: 713-461-7348; Empl.: 15; *Sls. Mgr.:* Bill Walker

A.S.I. MICROSYSTEMS, INC., (Formerly Andrich Systems, Inc.), 1531 Smithtown Ave., Bohemia, NY 11716, Tel: 516-589-5656, FAX: 516-589-6094; *Sls. Mgr.:* Robert G. Andrews

ASLAN COMPUTER CORPORATION, 10922 Klingerman Ave., Bldg.4, S. El Monte, CA 91733, Tel: 818-575-5271, FAX: 818-575-0394; Empl.: 20; *Sls. Mgr.:* Chris Witham

ASPECT ELECTRONICS INC., 12740 Earhart Ave., Auburn, CA 95602, Tel: 916-887-1008, FAX: 916-887-1108; Empl.: 42; *Sls. Mgr.:* Donald Roelands

ASPEN IMAGING, International, Inc., 555 Aspen Ridge Dr., Lafayette, CO 80026-9300, Tel: 303-666-5750, 1-800-955-5555, TELEX: 45-0055; FSC No.: 84-0724829; Empl.: 380; *Sls. Mgr.:* Elizabeth Ema

ASPEN SEMICONDUCTOR CORP., 4001 North First Street, San Jose, CA 95134, Tel: 408-456-1800

ASPEN TEST ENGRG., INC., 4665 Nautilus Ct., Boulder, CO 80301, Tel: 303-530-1466, FAX: 303-530-9383; Empl.: 25; *Sls. Mgr.:* Mark L. Buchheister

ASSEMBLED ELECTRONIC ENCLOSURES, 666-668 Tower Rd., Mundelein, IL 60060, Tel: 708-566-2030, FAX: 708-566-4712

ASSEMBLY SPECIALISTS, 14 Alpha Rd., Chelmsford, MA 01824, Tel: 508-250-5900, FAX: 508-250-5902; Empl.: 15

ASSMANN ELECTRONICS, INC., Assmann Electronics GMBH, 1849 W. Drake Dr. Ste. 101, Tempe, AZ 85283, Tel: 602-897-7001, FAX: 602-897-7255; Empl.: 22; *Sls. Mgr.:* Mitch Simpson

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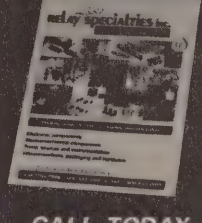
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ASSOCIATED RESEARCH, INC., 905 Carriage Pk. Ave., Lake Bluff, IL 60044, Tel: 708-295-3312; FSC No.: 04273; Empl.: 58; *Sls. Mgr.:* Joseph Guerriero ..... **D•1226-1227**

Local Sales Offices & Reps

CA Chatsworth, Techlgs. West 818-700-6426
CA Pleasanton, MMI 510-846-0377
CO Morrison, Energy Equip. Sls. 303-697-0662
IN Nobelsville, Loren Green Assocs. South 317-776-9473
NH Nashua, Intersell 603-880-6500
TX Richardson, J. Wisdom & Assocs., Inc. 214-470-9093
VA Fairfax, Sci. Assocs., Inc. 703-385-0600

ASSOCIATED SPRING, BARNES GRP., 10 Main St., Bristol, CT 06010, Tel: 203-583-1331, FAX: 203-584-0727; Empl.: 1920; *Sls. Mgr.:* D.G. Ammerman

ASSURANCE TECHNOLOGIES, INC., 495 Wegner Dr., West Chicago, IL 60185, Tel: 708-231-4800, FAX: 708-231-8844; Empl.: 25; *Dist. Mgr.:* Brian K. Bagan

ASTEC HIGH VOLTAGE, C/O 200 Butterfield Dr., Ashland, MA 01721, Tel: 508-881-8407, FAX: 508-879-8669; *Sls. Mgr.:* Jim Stedman ..... **D•1596-1597**

Local Sales Offices & Reps

AL Huntsville, Murcota 205-539-8476
AZ Scottsdale, Power-Up Elctrns. 602-955-1105
CA Dana Point, Electro Venture 714-496-5225
FL Palm Bch. Gdns., Graham Assocs., Inc. 407-622-4049
IL Arlington Heights, Berndt Assocs. 708-632-0900
IN Carmel, Berndt Assocs. 317-844-0114
KS Olathe, Tech. Sls. Assocs 913-829-2800
MD Hunt Valley, Eagle Sls. Corp. 301-666-3930
MA Bellingham, OEM Mktg. & Sls. 508-528-4983
MI Plymouth, EQS Sys. 313-455-7920
MN Minneapolis, Berndt Assocs. 612-546-2021
MO St. Louis, Tech. Sls. Assocs. 314-521-2044
NH Intersell 603-880-6500
NY Wantagh, Bytec 516-781-7400
NC Winston-Salem, Murcota 919-722-9445
PA Montgomeryville, Eastern Sci. Mktg. 215-368-4570
TX Richardson, Jim D. Gray & Assocs. 214-699-9976
UT Ogden, Taylor Mktg. 801-546-9570
WI Brookfield, McMahon Sls., Inc. 414-782-3335

Local Distributors

MA Ashland, Intl. Power Sources 508-881-7434
OH Chesterland, EQS Sys. 216-729-2222

ASTEC

FAX: 619-439-4243

ASTEC STANDARD POWER, 401 Jones Rd., Oceanside, CA 92054, Tel: 619-757-1880; Empl.: 600; *Sls. Mgr.:* Tom Szabo, Dir. of Sls.; *Dist. Mgr.:* Robert Claborne ..... **D•1598-1603, 2071-2073**

Local Sales Offices & Reps

AZ Tempe, Techni-Source Corp. 602-497-0711, FAX:602-497-1077
CA Englewood, Omega Ltd. 303-762-1921, FAX:303-762-1928
CA Los Gatos, Luscombe Engrg. 408-370-2020, FAX:408-374-8663
CO Colorado Springs, Omega Ltd. 719-598-6845, FAX:719-528-5729
FL Ft. Lauderdale, QXI, Inc. 305-978-0120, FAX:305-977-4752
FL St. Petersburg, QXI 813-894-4556, FAX:813-894-3989
IL Itasca, LTD Technlgs., Inc. 708-773-2900, FAX:708-773-0358
IA Cedar Rapids, Delltron Co., Inc. 319-393-0075, FAX:319-393-0058
MD Pasadena, Electronic Engrg. & Sls. 410-255-9686, FAX:410-255-9688
MA Needham, Com-Sls., Inc. 617-444-8071, FAX:617-449-8047
MN Edina, Ohms Technlg., Inc. 612-932-2920, FAX:612-932-2918
MO Florissant, Delltron Co. Inc. 314-839-0033, FAX:314-839-4290
MO Kansas City, Delltron Co., Inc. 816-436-6445, FAX:816-436-9982
NJ Moorestown, T.A.I. Corp. 609-778-5353, FAX:609-778-7828
NM Albuquerque, Techni-Source Corp. 505-268-4232, FAX:505-268-0451
NY Clarence Ctr., Leonard D. Allen 716-634-5403, FAX:716-634-5404
NY Melville, Parallax 516-351-1000, FAX:516-351-1606
NY Pittsford, Leonard D. Allen 716-377-3530
NY Syracuse, Leonard D. Allen 315-437-8387, FAX:315-437-3710
NC Raleigh, R.W. Mitscher Co., Inc. 919-848-0941, FAX:919-848-9156
OH Englewood, Carter, McCormic & Peirce 513-836-0951,FAX:513-836-2358
OR Portland, ES/Chase Co., Inc. 503-292-8840, FAX:503-292-8827
TX Austin, Milco Mktg., Inc. 512-343-1275, FAX:512-343-0980
TX Missouri City, Milco Mktg., Inc 713-261-7843, FAX:713-469-5156
TX Plano, Milco Mktg., Inc. 214-578-8827, FAX:214-578-7026
WA Kirkland, ES/Chase Co., Inc. 206-823-9535, FAX:206-821-7257
WI Milwaukee, LTD Technlgs., Inc. 414-774-1000, FAX:414-774-0593
Can Brampton,Ont., Cantec Reps. 416-791-5922, FAX:416-791-7940
Can Ottawa, Ont., Cantec Reps. 613-725-3704, FAX:613-725-0490
Can St. Eustache, Que., Cantec Reps. 514-623-5496, FAX:514-623-5482

Local Distributors

AL Birmingham, Newark 205-979-7003
AL Huntsville, Future 205-830-2322
AL Huntsville, Newark 205-837-9091
AL Huntsville, Reptron 205-722-9500
AL Mobile, Newark 205-471-6500
AL Montgomery, Newark 205-270-8074
AK Newark 800-321-8984
AZ Phoenix, Future 602-968-7140
AZ Phoenix, Newark 602-742-9905
AZ Tempe, RicheyCypress 602-966-8856
AR Little Rock, Newark 501-225-8130
CA Camarillo, Milgray 805-484-4055
CA Chatsworth, Future 818-772-6240
CA Citrus Hgts., Newark 916-721-1633
CA Corona, Compumech 714-278-4761
CA Dublin, Newark 415-572-8300
CA Garden Grove, RicheyCypress 714-895-0060
CA Garden Grove, RicheyCypress 714-898-8288
CA Irvine, Future 714-250-4141
CA Irvine, Milgray 714-753-1282
CA Los Angeles, Newark 213-664-5252
CA Los Angeles, Newark 818-242-1900
CA Milpitas, Compumech 408-945-9100
CA Orange, Newark 714-634-8224
CA San Diego, Future 619-625-2800
CA San Diego, Newark 619-453-8211
CA San Diego, RicheyCypress 619-271-4511
CA San Jose, Future 408-434-1122
CA San Jose, Milgray 408-456-0900
CA San Jose, Newark 408-559-6900
CA San Jose, RicheyCypress 408-956-8010
CA Sun Valley, RicheyCypress 818-768-0403
CA Thousand Oaks, Compumech 805-492-6299
CA Ventura, Newark 805-644-2265
CO Colorado Springs, Newark 719-576-2644
CO Denver, Newark 303-757-3351
CO Englewood, RicheyCypress 303-792-5829
CO Lakewood, Future 303-232-2008
CT Bethel, Future 203-743-9594
CT Bloomfield, Newark 203-243-1731
CT E. Hartford, Newark 203-289-1416
CT Meriden, Newark 203-630-2239
CT Milford, Milgray 203-878-5538
CT Newton, Target 203-426-4403
CT Seymore, Target 203-888-1480
FL Altamonte Springs, Future 407-767-8414
FL Boca Raton, Newark 407-241-0605
FL Bradenton, Newark 813-755-7910
FL Clearwater, Newark 813-443-0661
FL Ft. Lauderdale, Reptron 305-735-1112
FL Ft. Meyers, Newark 813-275-6310
FL Jacksonville, Newark 904-399-5041
FL Lake Mary, Milgray 407-321-2555
FL Largo, Future 813-530-1222
FL Melbourne, Newark 407-727-7308
FL Miami, Newark 305-593-2686
FL Orlando, Newark 407-896-8350
FL Plantation, Newark 305-424-1566
FL Tampa, Newark 813-287-1578
FL Tampa, Reptron 813-854-2000
FL Tampa, Reptron 813-854-2351
FL Tampa, Reptron 813-855-4650
GA Atlanta, Newark 404-448-8500
GA Atlanta, Newark 404-761-9902
GA Atlanta, Newark 404-951-2363
GA Macon, Newark 912-743-2446
GA Norcross, Future 404-441-7676
GA Norcross, Milgray 404-446-9777
GA Norcross, Newark 404-448-1300
GA Norcross, Reptron 404-446-1300
HI Aiea, Newark 806-487-8951
ID Boise, Newark 208-342-4311
IL Addison, Newark 708-495-7740
IL Arlington Hgts., Newark 708-392-9009
IL Aurora, Newark 708-820-2411
IL Chicago, Hallmark 708-860-3800
IL Chicago, Newark 312-792-8233
IL Chicago, Newark Elctrns. 312-784-5100
IL Decatur, Newark 217-875-4411
IL Glenview, Compumech 708-998-8264
IL Hoffman Estates, Future 708-882-1255
IL Libertyville, Newark 708-362-2248
IL Palatine, Milgray 708-202-1900
IL Palos Hills, Newark 708-430-0690
IL Peoria, Newark 309-693-3771
IL Rockford, Newark 815-229-0225
IL Schaumburg, Newark 708-310-8980
IL Schaumburg, Newark 708-843-0700
IL Schaumburg, Reptron 708-882-1700
IL Springfield, Newark 217-787-9972
IN Evansville, Newark 812-423-2552
IN Ft. Wayne, Newark 219-484-0766
IN Indianapolis, Custom Svc. Elec. 317-879-9119
IN Indianapolis, Newark 317-884-0047
IN Merriville, Newark 219-738-2787
IA Bettendor, Newark 319-359-3711
IA Cedar Rapids, Newark 319-393-3800
IA Des Moines, Newark 515-278-0670
KS Overland Park, Newark 913-677-0727
KS Overland Pk., Milgray 913-236-8800
KS Wichita, Newark 316-267-8755
KY Lexington, Newark 605-266-6446
KY Louisville, Newark 502-423-0280
LA Metairie, Newark 504-838-9771
MD Beltsville, Newark 301-604-1700
MD College Pk., Newark 301-982-9711
MD Columbia, Future 410-290-0600
MD Columbia, Milgray 410-995-6169
MD Columbia, Newark 301-964-4482
MD Hanover, Newark 410-712-6922
MD Timonium, Newark 410-560-2886
MD Wheaton, Newark 301-949-9665
MA Bolton, Future 508-779-3000
MA Braintree, Target 617-848-9330
MA Gardner, Computech 508-630-2909
MA Methuen, Newark 508-683-0913
MA Methuen, Newark 508-688-1837
MA W. Springfield, Newark 413-785-5851
MA Walpole, Newark 508-660-1071
MA Walpole, RicheyCypress 508-668-8200
MA Waltham, Newark 617-894-8050
MA Westwood, Target 617-329-2700
MA Wilmington, Milgray 508-657-5900
MA Woburn, Newark 617-932-9040
MA Woburn, Newark 617-935-8350
MA Worcester, Newark 508-757-4515
MI Detroit, Newark 313-967-0600
MI Farmington Hills, Newark 313-737-5150
MI Flint, Royalite 313-238-4641
MI Gaylord, Reptron/K-Byte 517-732-6244
MI Grand Rapids, Future 616-249-3200
MI Grand Rapids, Newark 616-455-9190
MI Livonia, Future 313-261-5270
MI Livonia, Reptron 313-525-2700
MI Oak Park, Newark 313-967-0600
MI Saginaw, Newark 517-799-0480
MI Traverse City, Newark 616-929-2313
MI Troy, Newark 313-680-9110
MN Burnsville, Newark 612-890-0584
MN Crystal Bay, Newark 612-535-4280
MN Duluth, Newark 218-727-4776
MN Eden Prairie, Future 612-944-2200
MN Eden Prairie, Richeycypress 612-934-2104
MN Minneapolis, Newark 612-331-6350
MN Minnetonka, Reptron 612-938-0000
MN St. Paul, Newark 612-631-2683
MN Vadnais Hgts., Reptron 612-481-0756
MS Jackson, Newark 601-956-3834

MS	Tupelo, Newark	601-840-0305
MO	Crestwood, Newark	314-821-7466
MO	Independence, Newark	816-478-0561
MO	Springfield, Newark	417-886-0092
MO	St. Louis, Future	314-469-6805
MO	St. Louis, Newark	314-296-2505
MT	Helena, Newark	406-443-6192
NE	Omaha, Newark	402-592-2423
NV	Las Vegas, Newark	702-597-0330
NV	Reno, Newark	702-322-6090
NH	Derry, Target	603-434-8440
NH	Nashua, Newark	603-888-5790
NH	Salem, Diamond	603-894-4420
NH	Salem, Sager	603-894-4420
NJ	Bordentown, Newark	609-298-4450
NJ	Clark, Newark	908-381-1343
NJ	E. Brunswick, Newark	908-937-6600
NJ	Fairfield, Newark	201-882-0300
NJ	Marlton, Future	609-596-4080
NJ	Marlton, Milgray	609-983-5010
NJ	Parsippany, Future	201-299-0400
NJ	Parsippany, Milgray	201-335-1766
NJ	Pennsauken, Newark	609-663-9490
NJ	Springfield, Newark	212-964-2556
NJ	Union, Newark	908-851-2290
NM	Albuquerque, Newark	505-828-1878
NY	Binghampton, Newark	607-771-8795
NY	Buffalo, Newark	716-862-9700
NY	Commack, Newark	516-499-1216
NY	Farmingdale, Milgray	516-391-3000
NY	Farmingdale, Milgray	516-420-9800
NY	Farmingdale, Milgray Elctrns.	516-420-9800
NY	Fishkill, Newark	914-896-4190
NY	Hauppauge, Future	516-234-4000
NY	Latham, Newark	518-783-0083
NY	Long Island, Sager Elctrns.	516-348-1300
NY	Pittsford, Milgray	716-381-9700
NY	Pittsford, Newark	716-381-4244
NY	Rochester, Future	716-272-1120
NY	Syracuse, Future	315-451-2371
NY	Syracuse, Newark	315-437-6611
NC	Charlotte, Newark	704-535-5650
NC	Concord, Future	704-455-9030
NC	Greensboro, Newark	919-292-7240
NC	Greensboro, Newark	919-294-2142
NC	High Point, Newark	919-884-8881
NC	Raleigh, Future	919-790-7111
NC	Raleigh, Milgray	919-790-8094
NC	Raleigh, Newark	919-781-7677
NC	Raleigh, Reptron	919-870-5189
NC	Wilmington, Newark	919-791-9393
OH	Akron, Newark	216-374-9987
OH	Cincinnati, Hughes Peters	513-351-2000
OH	Cincinnati, Hughes Peters	800-899-8228
OH	Cincinnati, Newark	513-771-9700
OH	Cincinnati, Newark	513-772-8181
OH	Cleveland, Milgray	216-447-1520
OH	Cleveland, Newark	216-391-9330
OH	Columbus, Hughes Peters	614-294-5351
OH	Columbus, Newark	614-431-0809
OH	Columbus, Newark	614-481-8141
OH	Dayton, Newark	513-294-8980
OH	Mayfield Hgts., Future	216-449-6996
OH	Parma Hgts., Newark	216-886-0505
OH	Solon, Reptron	216-349-1415
OH	Toledo, Newark	419-886-0404
OH	Valley View, Newark	216-447-8860
OH	Warrensville, Newark	216-587-1700
OH	Worthington, Reptron	614-436-6675
OH	Youngstown, Newark	216-793-6134
OH	Zanesville, Newark	614-454-6704
OK	Oklahoma City, Newark	405-495-5000
OK	Tulsa, Newark	918-252-5070
OR	Beaverton, Future	503-645-9454
OR	Portland, Newark	503-257-0741
PA	Allentown, Newark	609-434-7171
PA	Freeport, Newark	412-295-4400
PA	King of Prussia, Newark	215-265-0933
PA	Malvern, Newark	215-296-5522
PA	Philadelphia, Newark	215-245-7300
PA	Pittsburgh, Newark	412-367-2790
PA	Pittsburgh, Newark	412-788-4790
PA	Pittsburgh, Newark	412-823-5150
SC	Columbia, Newark	803-798-0198
SC	Greenville, Newark	803-288-9610
SC	N. Charleston, Newark	803-764-3091
TN	Brentwood, Newark	615-371-1341
TN	Chattanooga, Newark	615-899-0056
TN	Jackson, Newark	901-664-6076
TN	Knoxville, Newark	615-588-6493
TN	Memphis, Newark	901-365-8060
TX	Austin, Future	512-502-0991
TX	Austin, Newark	512-338-0287
TX	Dallas, Hall-Mark Elctrns.	214-553-4300
TX	Dallas, Milgray	214-248-1603
TX	El Paso, Newark	915-778-5322
TX	Ft. Worth, Newark	817-589-1295
TX	Houston, Future	713-556-8696
TX	Houston, Newark	713-270-4800
TX	Irving, RicheyCypress	214-255-0065
TX	Richardson, Future	214-437-2437
TX	Stafford, Milgray	713-240-5360
UT	Murray, Milgray	801-261-2999
UT	Salt Lake City, Future	801-972-8489
UT	Salt Lake City, Newark	801-261-5660
VT	Burlington, Newark	802-282-5671
VT	Burlington, Newark	802-860-1856
VA	Arlington, Newark	703-522-7552
VA	Chantilly, Newark	703-471-7447
VA	Richmond, Newark	802-282-5671
VA	Roanoke, Newark	703-345-7001
VA	Virginia Bch., Newark	804-499-0719
WA	Bellvue, Newark	206-641-9800
WA	Bothell, Future	206-489-3400
WA	Seattle, RicheyCypress	206-575-1910
WA	Spokane, Newark	509-327-1935
WV	Dunbar, Newark	304-768-6872
WI	Brookfield, Newark	414-783-6566
WI	Green Bay, Newark	414-494-1400
WI	Madison, Newark	608-221-4738
WI	Milwaukee, Newark	414-453-9100
WI	Waukesha, Future	414-786-1884
Can	Calgary, Alb., Future	403-250-5550
Can	Edmonton, Alb., Future	403-438-2858
Can	Laval, Que., Newark	514-681-6476
Can	London, Ont., Newark	519-685-4280
Can	Markham, Ont., Carsten	416-477-7705
Can	Mississauga, Ont., Future	416-612-9200
Can	Mississauga, Ont., Milgray	416-678-0958
Can	Mississauga, Ont., Newark	416-670-2888
Can	Mississauga, Ont., Newark	416-670-7799
Can	Montreal, Que., Newark	514-738-4488
Can	Nepean, Ont., Carsten	613-564-0622
Can	Ottawa, Ont., Future	613-820-8313
Can	Pointe Claire, Que., Future	514-426-5900
Can	Pointe Claire, Que., Future	514-694-7710
Can	Quebec, que., Future	418-877-6666
Can	St. Laurent, Que., Carsten	514-334-8321
Can	Vancouver, BC, Future	604-294-1166
Can	Westminster, BC, Newark	604-520-5721
Can	Winnipeg, Man., Future	204-786-7711

ASTER, a Porta Systems Company, 86 South Street, Hopkinton, MA 01748, Tel: 508-435-0101; *Sls. Mgr.:* Lou Maiolo

ASTRO DYNAMICS, INC., 2 Gill St., Woburn, MA 01801, Tel: 617-935-4944, FAX: 617-935-4982; Empl.: 50; *Sls. Mgr.:* Leo Donahue

ASTRO-GEO-MARINE, INC., 2186 Knoll Dr. B, Ventura, CA 93003, Tel: 805-654-8300, FAX: 805-654-8314; FSC No.: 51473; Empl.: 12

ASTRO INSTRUMENT CORP., 450 Goolsby Blvd., Deerfield, FL 33442-3019, Tel: 305-698-6000, FAX: 305-698-6011; FSC No.: 51761; *Sls. Mgr.:* Peter J. Sinatra, Jr.

ASTRO INTERNATIONAL CORP., 100 Park Ave., League City, TX 77573, Tel: 713-332-2484, FAX: 713-554-6795; Empl.: 50; *Sls. Mgr.:* Curt Nicholls

ASTROMEC, INC., 2950 Arrowhead Dr., Carson City, NV 89706, Tel: 702-883-9226, FAX: 702-883-9228; Empl.: 40; *Sls. Mgr.:* Ken Irvin

FAX: 401-822-2430

ASTRO-MED, INC., 600 East Greenwich Avenue, W. Warwick, RI 02893, Tel: 401-828-4000, TWX: 710-382-6409; FSC No.: 6625; Empl.: 225; *Sls. Mgr.:* Everett V. Pizzuti ..... **D•1410-1412**

ASTROSYSTEMS, INC., 6 Nevada Dr., Lake Success, NY 11042, Tel: 516-328-1600, FAX: 516-328-1658; *Sls. Mgr.:* Howard Lazarus; *Dist. Mgr.:* Roy Hartmann, Sls. Mgr. ..... **D•2244-2249**

ASTRO TOOL CORP., 21615 Southwest Tualatin Valley Hwy., Beaverton, OR 97006, Tel: 503-642-9853, FAX: 503-591-7766

A-SYSTEMS INC., 1500 Avon St. Extd., Charlottesville, VA 22902, Tel: 804-295-7200, FAX: 804-295-7201; Empl.: 45; *Sls. Mgr.:* F. M. Artrip

AT&T Capital Corporation

FAX: 214-456-4002

AT&T CAPITAL CORPORATION, 1830 West Airfield Dr., DFW Airport, TX 75261-9260, Tel: 800-874-7123; Empl.: 220 ..... **D•1228-1233**

AT&T Microelectronics

FAX: 215-778-4106

AT&T MICROELECTRONICS, 555 Union Blvd., 500404000, Allentown, PA 18103, Tel: 1-800-372-2447, In Can.:1-800-553-2448 ..... **A•1334-1335, 2268-2271; D•1604-1607**

Local Sales Offices & Reps

AZ	Phoenix, AT&T Microelectronics	602-844-6529
CA	Cypress, AT&T Microelectronics	714-220-6223
CA	Santa Clara, AT&T Microelectronics	408-980-3700
CO	Denver, AT&T Microelectronics	303-290-3708
GA	Norcross, AT&T Microelectronics	404-446-4700
IL	Itasca, AT&T Microelectronics	708-290-3335
MA	Framingham, AT&T Microelectronics	508-626-2161
MN	Bloomington, AT&T Microelectronics	612-885-4300
NY	Poughkeepsie, AT&T Microelectronics	914-485-7744
NC	Raleigh, AT&T Microelectronics	919-881-8023
OR	Portland, AT&T Microelectronics	503-244-3883
PA	Allentown, AT&T Microelectronics	215-770-3343
TX	Irving, AT&T Microelectronics	214-869-2040

Local Distributors

AL	Huntsville, Arrow/Schweber	205-837-6955
AZ	Tempe, Anthem	602-966-6600
AZ	Tempe, Arrow/Schweber	602-431-0030
CA	Calabasas, Arrow/Schweber	818-880-9686
CA	Chatsworth, Anthem	818-775-1333
CA	Irvine, Anthem	714-768-4444
CA	Rocklin, Anthem	916-624-9744
CA	San Diego, Anthem	619-453-9005
CA	San Diego, Arrow/Schweber	619-565-4800
CA	San Jose, Anthem	408-452-2219
CA	San Jose, Arrow/Schweber	408-441-9700
CA	San Jose, Capstone	408-453-9804
CA	San Jose, Merit	408-434-0800
CA	Tustin, Arrow/Schweber	714-587-0404
CA	Tustin, Capstone	714-730-0349
CO	Aurora, Capstone	303-375-1300
CO	Englewood, Anthem	303-790-4500
CO	Englewood, Arrow/Schweber	303-799-0258
CT	Wallingford, Arrow/Schweber	203-265-7741
CT	Waterbury, Anthem	203-575-1575
FL	Deerfield Beach, Arrow/Schweber	305-429-8200
FL	Lake Mary, Arrow/Schweber	407-333-9300
GA	Duluth, Arrow/Schweber	404-497-1300
IL	Itasca, Arrow/Schweber	708-250-0500
IL	Itasca, Capstone	708-250-0300
IL	Schaumburg, Anthem	708-884-0200
IN	Indianapolis, Arrow/Schweber	317-299-2071
IA	Cedar Rapids, Arrow/Schweber	319-395-7230
KS	Lenexa, Arrow/Schweber	913-541-9542
MD	Columbia, Anthem	301-995-6640
MD	Columbia, Arrow/Schweber	301-596-7800
MA	Wilmington, Anthem	508-657-5170
MA	Wilmington, Arrow/Schweber	508-658-0900
MA	Wilmington, Capstone	508-657-5874
MI	Livonia, Arrow/Schweber	313-462-2290
MN	Eden Prairie, Anthem	612-944-5454
MN	Eden Prairie, Arrow/Schweber	612-941-5280
NJ	Holmdel, Arrow/Schweber	908-949-4700
NJ	Marlton, Arrow/Schweber	609-596-8000
NJ	Marlton, Capstone	609-596-7500
NJ	Pine Brook, Anthem	201-227-7960
NJ	Pine Brook, Arrow/Schweber	201-227-7889
NY	Commack, Anthem	516-493-6600
NY	Hauppauge, Arrow/Schweber	516-231-1000
NY	Melville, Arrow/Schweber	516-391-1300
NY	Rochester, Arrow/Schweber	716-427-0300
NC	Raleigh, Arrow/Schweber	919-876-3132
NC	Raleigh, Capstone	919-954-0600
OH	Centerville, Arrow/Schweber	513-435-5563
OH	Solon, Arrow/Schweber	216-248-3990
OK	Tulsa, Arrow/Schweber	918-252-7537
OR	Beaverton, Anthem	503-643-1114

OR	Beaverton, Arrow/Schweber	503-629-8090
PA	Horsham, Anthem	215-443-5150
PA	Pittsburgh, Arrow/Schweber	412-963-6807
TX	Austin, Arrow/Schweber	512-835-4180
TX	Carrollton, Arrow/Schweber	214-380-6464
TX	Carrollton, Capstone	214-380-9049
TX	Houston, Arrow/Schweber	713-530-4700
TX	Richardson, Anthem	214-238-7100
UT	Salt Lake City, Anthem	801-973-8555
UT	Salt Lake City, Arrow/Schweber	801-973-6913
WA	Bellevue, Almac	206-643-9992
WI	Brookfield, Arrow/Schweber	414-792-0150
Can	Dorval, Que., Arrow/Schweber	514-421-7411
Can	Mississauga, Ont., Capstone	416-670-2010
Can	Nepean, Ont., Arrow/Schweber	416-670-7769

AT&T NETWORK SYSTEMS,NETWORK CABLE SYS. DIV., 111 Madison Ave., Morristown, NJ 07962, Tel: 1-800-344-0223, Ext. 1027

ATC-FROST MAGNETICS INC., 1130-Eighth Line, Oakville,Ont., Canada L6H 2R4, Tel: 416-844-6681, FAX: 416-844-6895; Empl.: 180; *Sls. Mgr.:* C.M. Webb

ATC POWER SYSTEMS, INC., 45 Depot St., Merrimack, NH 03054, Tel: 603-429-0391, FAX: 603-429-0795; FSC No.: 61814; Empl.: 40; *Sls. Mgr.:* Robert L. Grant, Jr. Sls. Mgr.

ATEC, INC., 8219 Kempwood Dr., Houston, TX 77055, Tel: 713-468-7971, FAX: 713-468-6585; FSC No.: 09552; Empl.: 70; *Sls. Mgr.:* R.L. Rainwater

ATE SUPER TECHS, 4031 NE 17 Terr., Pompano Beach, FL 33064, Tel: 800-780-6343, 305-941-6343, 305-973-0996, FAX: 305-941-9413; *Sls. Mgr.:* Desmond James

ATHENA CONTROLS, INC., 5145 Campus Dr., Whitemarsh Ind. Campus, Plymouth Meeting, PA 19462, Tel: 215-828-2490, FAX: 215-828-7084; Empl.: 70; *Sls. Mgr.:* Douglas Crowell

ATI (AHAM TOR INC.), 999 Company, P.O. Box 9019, Temecula, CA 92390-0739, Tel: 714-676-4151, FAX: 714-676-3031

ATI TECHNOLOGIES INC., 3761 Victoria Park Ave., Scarborough, Ont., Canada M1W 3S2, Tel: 416-756-0718, FAX: 416-756-0720; Empl.: 430; *Sls. Mgr.:* Jon Turner, VP-OEM Sls.

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ATKINS TECHNICAL INC., 3401 S.W. 40th Blvd, Gainesville, FL 32608, Tel: 904-378-5555, FAX: 904-335-6736; Empl.: 45; *Sls. Mgr.:* Robert M. Atkins; *Dist. Mgr.:* Kenneth A. Robinson

ATLANTA SIGNAL PROCESSORS, INC., 770 Spring Street N.W., Atlanta, GA 30308, Tel: 404-892-7265, FAX: 404-892-2512; Empl.: 20; *Sls. Mgr.:* William E. Jouris

ATLANTIC MAGNETICS, INC., 1441 S.W. 30th Ave., Pompano Beach, FL 33069, Tel: 305-979-7920, FAX: 305-978-3788; Empl.: 37; *Sls. Mgr.:* Edward Cammarata; *Dist. Mgr.:* Scott Thompson

ATLANTIC OPTICAL MOULDING, Ellis St., P.O. Box 309, Webster, MA 01570, Tel: 508-943-1746; Empl.: 6

ATLANTIC SCIENTIFIC CORPORATION, 4300 Fortune Pl, Ste. A, W. Melbourne, FL 32904, Tel: 1-800-544-4737, FAX: 407-727-0736; Empl.: 50; *Sls. Mgr.:* Bill Purcell, V.P.

ATLAS ENERGY SYSTEMS, INC., 713 W. Duarte Rd., Bldg. G299, Arcadia, CA 91007, Tel: 818-575-0755, FAX: 818-575-0665; Empl.: 30; *Sls. Mgr.:* James LoGudice; *Dist. Mgr.:* James LoGudice

ATLAS ENGINEERING CORP., 10 Cheney St., Dorchester, MA 02121, Tel: 617-445-7100, FAX: 617-445-4942; FSC No.: 07001; Empl.: 75; *Sls. Mgr.:* Levi Fears

ATLAS/SOUNDOLIER, COMMERCIAL SOUND DIV., Atapco Security & Communications Group, 1859 Intertech Dr., Fenton, MO 63026, Tel: 314-349-3110, FAX: 314-349-1251; *Sls. Mgr.:* Bud Waters, Natl. Sls. Mgr.

ATLAS/SOUNDOLIER, INDUSTRIAL CABINET DIV., Atapco Security & Communications Grp., 1859 Intertech Dr., Fenton, MO 63026, Tel: 314-349-3110, FAX: 314-349-1251; *Sls. Mgr.:* Gary Shamel, Indl. Cabinet Div./ Sls. Mgr.

ATLEE INC., 10 Bayfield Dr., North Andover, MA 01845, Tel: 508-681-1003, TELEX: 928252, FAX: 508-686-2934; FSC No.: 99378; Empl.: 20; *Sls. Mgr.:* Tom Fiocco; *Dist. Mgr.:* Tom Fiocco **C•1015, 1671**

Local Sales Offices & Reps

MA	Sharon, Cummings Assocs.	617-784-5600
PA	Paoli, Stitzer Assocs.	215-644-5500
TX	Arlington, Rem-Air Corp.	214-234-1069

Local Distributors

CA	Anaheim, Bisco Inds.	714-635-0380
CA	San Jose, Bisco Inds.	408-946-8980
IL	Franklin Pk., Bisco Inds.	312-451-1230
MA	Marlboro, Hardware Specialties	617-481-8622
MA	N. Andover, Atlee, Direct	508-681-1003
MA	Winchester, Webb	617-729-5800
MA	Woburn, Bisco Inds.	617-938-8590
MN	Minneapolis, Aerospace Computer	612-884-4725
NJ	Paramus, N.Y. Fastener	201-265-8770
NY	Long Island City, Hardware Specialty	212-361-9393
NY	Plainview, G & B Fasteners	516-694-0990

ATMEL CORPORATION, 2125 O'Nel Drive, San Jose, CA 95131, Tel: 408-441-0311, FAX: 408-436-4200; Empl.: 875; *Dist. Mgr.:* Dave Walton

ATOMERGIC CHEMETALS CORP., 222 Sherwood Ave., Farmingdale, NY 11735-1718, Tel: 516-694-9000, TWX: 6852289, FAX: 516-694-9177; Empl.: 30; *Sls. Mgr.:* A. Pensiero

ATV RESEARCH, INC., 1301 Broadway, Dakota City, NE 68731, Tel: 402-987-3771; *Sls. Mgr.:* Mel Shadbolt

THE AUBURN MANUFACTURING COMPANY, 29 Stack Street/P.O. Box 251, Middletown, CT 06457-0251, Tel: 203-346-6677, FAX: 203-346-1334; Empl.: 45; *Sls. Mgr.:* Gary L. Mittelman, VP

AUDIO PRECISION, INC., PO Box 2209, Beaverton, OR 97075-3070, Tel: 503-627-0832, TELEX: 283957 AUDIO UR, FAX: 503-641-8906; Empl.: 33; *Sls. Mgr.:* Thomas Mintner

AUDIOSEARS, South St., Stamford, NY 12167, Tel: 607-652-7305, 800-533-7863, FAX: 607-652-3653; FSC No.: 97101; Empl.: 120; *Sls. Mgr.:* Fred Rosscoe

AUDIOTRONICS CORP., 7428 Bellaire Ave., N. Hollywood, CA 91605, Tel: 818-765-2645, TELEX: 69-1241; Empl.: 14; *Sls. Mgr.:* Gordon Anderson

AUDRE, INC., 10915 Technology Place, San Diego, CA 92127, Tel: 619-451-2260, FAX: 619-451-0267; Empl.: 50

AUGAT ALCOSWITCH, Augat Inc., 452 John Dietsch Blvd., Attleboro Falls, MA 02763, Tel: 508-699-9800, FAX: 508-699-6717; FSC No.: 95146; Empl.: 150; *Sls. Mgr.:* Gillis Mellen

AUGAT, INC., Interconnection Products Group, 33 Perry Ave.,P.O. Box 779, Attleboro, MA 02703, Tel: 508-222-2202, TWX: 710-391-0644, FAX: 508-222-0693; *Sls. Mgr.:* Gillis Mellen; *Dist. Mgr.:* Dick Thorpe

AUGAT/RDI, 525 Randy Rd., Carol Stream, IL 60188, Tel: 708-682-4100, FAX: 708-682-4562; FSC No.: 53337; Empl.: 85; *Sls. Mgr.:* Jim Steranko, Prod. Mgr.; *Dist. Mgr.:* Jim Steranko, Prod. Mgr.

AULT
FAX: 612-493-1911

AULT, INCORPORATED, 7300 Boone Ave. N, Minneapolis, MN 55428, Tel: 612-493-1900; Empl.: 300; *Sls. Mgr.:* Greg Harris **D•1608-1609**

Local Sales Offices & Reps

AL	Huntsville, L & D, Inc.	205-837-1469
CA	Santa Clara, Magna Sls.	408-727-8753
CT	Wallingford, Marathon Sls., LTD	203-663-2734
FL	Deerfield Bch., Sls. Engrg. Concepts Inc.	305-426-4601
GA	Atlanta, L & D, Inc.	404-395-7079
IL	Itasca, MSI	708-285-1000
IA	Des Moines, Spectrum Sls.	913-648-6811
MA	Framingham, Marathon Sls., LTD	508-875-3566
MI	Plymouth, Jay Mktg. Assocs.	313-459-1200
MN	Minneapolis, Cahill, Schmitz & Cahill	612-646-7217
MO	St. Louis, Beams Co.	314-434-8448
NJ	Fairfield, T.A.M.	201-575-4130
NC	Raleigh, L & D, Inc.	919-876-5301
OH	Beachwood, Elctrn. Salesmasters, Inc.	216-831-9555
OR	Portland, Jas. J. Backer Co.	503-627-0775
PA	Philadelphia, All-Tech Mktg.	717-540-1204
TX	Austin, R. F. Kimball Co.	512-443-5284
TX	Richardson, R. F. Kimball Co.	214-231-3447
WA	Seattle, Jas. J. Backer Co.	206-285-1300
Can	Toronto, Deskin Sls.	416-475-1412

Local Distributors

CA	Huntington Bch., House of Batteries	800-432-3385
Can	Markham, Deskin Sls.	416-475-1412
CA	Santa Clara, Cypress Elctrns.	408-980-2500
CA	Van Nuys, Natl. Electro Sls. Corp.	800-423-2664
MA	Wilmington, North Star Elctrns.	508-657-5155
NJ	Clifton, Vantage Comps.	201-777-4100
OH	Cincinnati, Hughes Peters	513-351-2000
OH	Columbus, Promark/EMC	614-299-4161
TX	Fort Worth, Allied Elctrns.	800-433-5700
UT	Salt Lake City, Std. Supp. Co.	801-453-3371
WA	Seattle, Radar Elec.	206-282-2511

AURIC CORP., 470 Frelinghuysen Ave., Newark, NJ 07114, Tel: 201-242-4100, FAX: 201-242-5796; Empl.: 60; *Sls. Mgr.:* Michael Aleksinas

AUSTRIA MIKRO SYSTEME INTERNATIONAL, Schloss Premstaetten, Unterpremstaetten, Austria A-8141, Tel: (03136) 500, TELEX: 312547 AMS A, FAX: (03136)52501,53650; Empl.: 600; *Sls. Mgr.:* Mr. Wilfried Beie

AUSTRON, INC., See FTS Austron

AUTEC POWER SYSTEMS
FAX: 805-522-8777

AUTEC POWER SYSTEMS, 69 Moreland Rd., Simi Valley, CA 93065, Tel: 805-522-0888; Empl.: 100; *Sls. Mgr.:* Bill Glynn; *Dist. Mgr.:* Jeanne Hirsch **D•1610-1615**

Local Sales Offices & Reps

CA	Bonsall, Power Specialists	619-726-4799
CA	Los Alamitos, Power Specialists	310-594-9418
CA	Mountain View, Straube Assocs., Inc.	415-969-6060
CA	Simi Valley, Power Specialists	805-581-4785

OH Dayton, The Lyons Corp. 513-278-0714
OH Richfield, The Lyons Corp. 216-659-9224
OH Westerville, The Lyons Corp. 614-895-1447
OR Beaverton, Blair-Hirsh Co. 503-641-1875
WA Lynnwood, Blair-Hirsh Co. 206-774-8151
Can Kanata, Ont., CMT Renmark, Inc. 613-591-9555
Can Mississauga, Ont., CMT Renmark, Inc. 416-612-0900
Can Pointe Claire, Que., CMT Renmark, Inc. 514-694-6088

Local Distributors
CA Corona, Compumech Elctrns. 714-278-4761
CA Milpitas, Compumech Elctrns. 408-945-9100
CA Thousand Oaks, Compumech Elctrns. 805-495-6299
IL Glennview, Compumech Elctrns. 708-998-8264
MA Gardner, Compumech Elctrns. 508-630-2909

AUTOMATED PRODUCTION CONCEPTS, 63 Hillside Terrace, Wayne, NJ 07470, Tel: 201-831-8300, FAX: 201-633-7755; Empl.: 4

AUTOMATIC COIL CORP., 3545 N.W. 71st Street, Miami, FL 33147, Tel: 305-696-6660, FAX: 305-696-0626; FSC No.: 03765; Empl.: 245; *Sls. Mgr.:* Joseph Keith, VP, Sls. Mgr.

AUTOMATIC SWITCH CO., 50-60 Hanover Road, Florham Park, NJ 07932, Tel: 1-201-966-2000, TELEX: 136422, FAX: 1-201-966-2628; Empl.: 1,200; *Sls. Mgr.:* Wayne Bouchard

AUTOMATIC TIMING AND CONTROLS, Sycon Corp., 959 Cheney Ave., Marion, OH 43302, Tel: 614-387-8827; Empl.: 300; *Sls. Mgr.:* J.M. Tornetta

AUTOMATION COMPONENT TECHNOLOGY, 41305 Albrae At., Fremont, CA 94538, Tel: 510-226-0900, 510-490-3587 (Sales), FAX: 510-226-0769; Empl.: 28; *Sls. Mgr.:* George Holman, Sls. Mgr.

AUTOMATION DISPLAYS INC., 3533 N. White Ave., Eau Claire, WI 54703, Tel: 715-834-9595, FAX: 715-834-9596; Empl.: 21

AUTOMATION ELCTRNS., R.J.A. Inds., Inc., 9640 Topanga Cyn Pl., Chatsworth, CA 91311, Tel: 818-998-5124, FAX: 818-998-6654; Empl.: 25; *Sls. Mgr.:* Robert J. Aiani

AUTOMATION PRODS., INC., 3030 Max Roy, Houston, TX 77008, Tel: 713-869-0361, TELEX: 775-959, FAX: 713-869-7332

AUTOMATIX INC., 755 Middlesex Turnpike, Billerica, MA 01821, Tel: 506-667-7900, FAX: 508-663-5482; Empl.: 65; *Sls. Mgr.:* Peter Mayek, Dir. of Sls.

AUTOMOTION, INC., 683 Airport Blvd., Ann Arbor, MI 48108, Tel: 313-662-7771, FAX: 313-662-3707; Empl.: 25; *Sls. Mgr.:* David E. Drenning ..... **B•1240**

Local Sales Offices & Reps
CA Valencia, Blair Randle & Assoc. 805-259-3326
CA Watsonville, Techrep North 408-761-2244
CT Newtown, Sturdy Corp. 203-426-4403
CT Seymour, Sturdy Corp. 203-888-1480
IL St. Charles, Arrowhead Automation 708-584-0058
MA Braintree, Sturdy Corp. 617-848-9330
MA Westwood, Sturdy Corp. 617-326-8300
MN Little Canada, Assured Sls. 612-482-1309
NH Derry, Sturdy Corp. 603-434-8440
NY Sidney, Charles Co. 607-563-8064
OR Portland, D.A. Sullivan Co. 503-292-2448

AUTOROLL MACHINE CORPORATION, 11 River St., Middleton, MA 01949, Tel: 508-777-2160, TELEX: 940250, FAX: 508-777-9453; Empl.: 120

AUTOSPLICE, INC., 10121 Barnes Canyon Rd., San Diego, CA 92121, Tel: 619-535-0077, FAX: 619-535-0130; Empl.: 197; *Sls. Mgr.:* Ken Krone

AUTOSWAGE PRODUCTS, 726 River Rd., Shelton, CT 06484, Tel: 203-929-1401, FAX: 203-929-6187; *Sls. Mgr.:* Arthur DiFabbio

AUTRONICS CORP., 325 E. Live Oak Ave., Arcadia, CA 91006, Tel: 818-445-5470, FAX: 818-446-0014; FSC No.: 03972; Empl.: 100; *Sls. Mgr.:* Annabelle Cloud, Contracts Mgr.; *Dist. Mgr.:* Gary Noyes

AVA ELECTRONICS CORPORATION, P.O. Box 184, 4000 Bridge St., Drexel Hill, PA 19026, Tel: 215-284-2500, FAX: 215-259-8379; Empl.: 100

AVA INSTRUMENTATION, INC., 8010 Highway 9, Ben Lomond, CA 95005, Tel: 408-336-2281, FAX: 408-336-5049; FSC No.: 61933; Empl.: 4; *Sls. Mgr.:* Allan Hughes

AVANTEK, INC, A Subsidiary of Hewlett-Packard, 3175 Bowers Ave., Santa Clara, CA 95054, Tel: 408-727-0700, FAX: 408-970-6070; Empl.: 7600

AVANTI CIRCUITS, INC., 17650 N. 25th Ave., Phoenix, AZ 85023, Tel: 1-800-234-1556, FAX: 1-602-375-1909; Empl.: 65; *Sls. Mgr.:* Steve Tappan

AVASEM CORPORATION, 1271 Parkmoor Ave., San Jose, CA 95126, Tel: 408-297-1201, FAX: 408-925-9460; Empl.: 42; *Sls. Mgr.:* Richard Konrad

AVELEM, La Billardiere, Gargilesse, France 36190, Tel: 33-54478672, FAX: 33-54477799; Empl.: 12

AVEL TRANSFORMERS INC., 47 South End Plaza, New Milford, CT 06776, Tel: 203-355-4711, FAX: 203-354-8597; Empl.: 225; *Sls. Mgr.:* Melanie B. Roman ..... **A•2272-2275; D•1616**

AVENS SIGNAL EQUIPMENT, 85-08 Queens Blvd., Elmhurst, NY 11373, Tel: 718-335-1886, FAX: 718-429-5785; Empl.: 15; *Sls. Mgr.:* Peter Eng .... **A•1620-1622**

AVERY DENNISON, 1 Clarks Hill, Framingham, MA 01701, Tel: 508-879-0511, FAX: 508-879-5009; Empl.: 8000; *Sls. Mgr.:* George Curtis

AVEX ELECTRONICS, 1683 Winchester Rd., P.O. Box 1026, Bensalem, PA 19020, Tel: 215-638-1515, 800-345-1295, FAX: 215-638-9108; FSC No.: 58414; *Sls. Mgr.:* Dona Logan; *Dist. Mgr.:* Michael S. Batley VP/GM ..... **D•1424-1425**

Local Sales Offices & Reps
CO Denver, Tessco 303-778-1119
IL Cary, Bob Burns Assoc. 708-516-3322
IN Carmel, New Era 317-844-4530
NM Albuquerque, Genl. Mktg. 505-892-3426
PA Philadelphia, Allpower Tech. 215-289-6025
TX Rowlett, Campion Sls. 800-877-7623

AVIBANK MANUFACTURING, INC., 210 S. Victory Blvd, P.O. Box 391, Burbank, CA 91503-0391, Tel: 818-843-4330, TWX: 910-498-2215; FSC No.: 84256; Empl.: 485; *Sls. Mgr.:* D. Ladin

FAX: 908-382-4996

AVIONIC INSTRUMENTS, REA International Inc., 1414 Randolph Ave., Avenel, NJ 07001, Tel: 908-388-3500; FSC No.: 10933 (FSCM); Empl.: 150; *Sls. Mgr.:* Bryce Wiedeman; *Dist. Mgr.:* Mike Barnaba ..... **D•2232-2238**

Local Distributors
NJ Avenel, REA Intl. Ltd. 908-382-7100

AVO BIDDLE INSTRUMENTS, 510 Township Line Rd., Blue Bell, PA 19422, Tel: 215-646-9200, TELEX: 685 1045 JGBCO, FAX: 215-643-2670; Empl.: 285

AVO INTERNATIONAL, TBG, 4651 S. Westmoreland, Dallas, TX 75237, Tel: 214-333-3201, TELEX: 163548 MULAM DL, FAX: 214-333-3533; Empl.: 350; *Sls. Mgr.:* Hermann Michaeli

AVTECH

FAX: 613-226-2802

AVTECH ELECTROSYSTEMS LTD., P.O. Box 5120, Stn. F, Ottawa, Ontario, Canada K2C 3H4, Tel: 613-226-5772; Empl.: 8 ..... **D•1234**

Local Sales Offices & Reps
MA Westford, ICS Assocs, Inc. 508-692-3545
NM Albuquerque, Tech. Mktg. Specialists 505-291-1363
NY Ogdensburg, Avtech Electrosystems Ltd. 315-472-5270
Can Ottawa, Ont., Avtech Electrosystems Ltd. 613-226-5772

AVTEL/UNITRON, 10925 Miller Rd., Dallas, TX 75238, Tel: 214-340-8600, TELEX: 882511, FAX: 214-341-2099; FSC No.: 6130; Empl.: 75; *Sls. Mgr.:* Fred Cullum ..... **D•2241-2243**

Local Sales Offices & Reps
CA Sunland, JVC Assocs. (Jim Crevier) ... 818-352-7348
NC Charlotte, Bruster Lawing & Assocs. .. 803-831-1205
VA Midlothian, Bruster Lawing & Assocs. 804-794-3879

AVX
A Kyocera Group Company

FAX: 803-626-2442

AVX CORPORATION, A Kyocera Group Company, 801 17th Ave. South, Myrtle Beach, SC 29577, Tel: 803-448-9411, TWX: 810-661-2252; *Dist. Mgr.:* Mike Craven ..... **A•1024-1028, 1336-1337, 1866-1867**

Local Sales Offices & Reps
AL Huntsville, Beacon Elctrns. 205-881-5031
AZ Phoenix, Interstate Mktg. 602-263-8044/8241
CA Mountain View, Peninsula Tech Sls. .. 415-965-3636
CA San Diego, Interstate Mktg. 619-693-3220
CA San Jose, Quadrep Inc. 408-432-3300
CA Woodland Hills, Interstate Mktg. Assocs. 818-883-7606
CO Englewood, Thorson Rocky Mt. Inc. ... 303-773-6300
CT Wallingford, J.E. Boeing 203-265-1318
FL Belleair Bch., Beacon Elctrns. 813-593-2267
FL Casselbury, Dyne-A-Mark 407-831-2822
FL Ft. Lauderdale, Dyne-A-Mark 305-771-6508
GA Atlanta, Beacon Elctrns. 404-256-9640
IL Chicago, M. Gottlieb Assocs. 312-775-1151
IL Itasca, Janus, Inc. 708-250-9650
IN Ft. Wayne, F.J. Campisano Co. 219-486-6443
IN Indianapolis, Frank J. Campisano 317-577-0319
IN Kokomo, M. Gottlieb Assocs. 317-455-0444
IA Cedar Rapids, R.F. Welch 319-362-6824
KS Overland Park, Beneke & McCaul 816-765-2998
MA Chelmsford, J.E. Boeing Co. 508-256-5800
MI Flint, M. Gottlieb Assocs. 313-732-3922
MI Southfield, M. Gottlieb Assocs. 313-358-4151
MN Minneapolis, Comstrand Inc. 612-574-9480
NJ Cherry Hill, Trinkle Sls. 609-795-4200
NY Ithica, Bob Dean, Inc. 607-257-1111
NY Ronkonkoma, Comtronic Assocs. 516-737-2400
NY Wappingers Falls, Bob Dean, Inc. 914-297-6406
NC Greensboro, Beacon Elctrns. 919-674-0348
NC Raleigh, Beacon Elctrns. 919-787-0330
OH Beaverton, Western Tech Sls. 503-644-8860
OH Cincinnati, F.J. Campisano Co. 513-574-7111
OH Columbus, Frank J. Campisano 614-538-1176
OH Mentor, Frank J. Campisano 216-975-9300
OK Tulsa, Ammon & Rizos 918-749-6116
PA Coraopolis, F.J. Campisano Co. 412-264-5151
PA Leechburg, Frank J. Campisano 412-845-2577
SC Greenville, Beacon Elctrns. 803-297-7830
TX Austin, Ammon & Rizos Co. 512-454-5131
TX El Paso, Ammon & Rizos 915-534-7533
TX Houston, Ammon & Rizos Co. 713-781-6240
TX Richardson, Ammon & Rizos Co. 214-644-5591
UT Salt Lake City, Thorson Rocky Mt. Inc. 801-942-1683

BRILL ELECTRONICS
(510) 834-5888
810 E. 10th. St., Oakland, CA 94606
BIDDLE INSTRUMENTS
(310) 452-8002
1729 Olympic Bl., Santa Monica CA 90404

WA Bellevue, Western Tech Sls. 206-641-3900
WA Spokane, Western Tech. Sls. 509-922-7600
WI Delafield, Janus, Inc. 414-646-5420
PR Rio Piedras, J.E. Boeing 809-753-9805
Can Calgary, Alb., Tech-Trek 403-241-1719
Can Kanata, Ont., Tech-Trek 613-599-8787
Can Mississauga, Ont., Tech-Trek 416-238-0366
Can Richmond, BC, Tech-Trek 604-276-8735
Can St. Laurent, Que., Tech-Trek 514-337-7540

Local Distributors

AL Huntsville, Future Elctrns. Corp. 205-830-2322
AL Huntsville, Hallmark Elctrns. 205-830-2565
AL Huntsville, Marshall Inds. 205-881-9235
AZ Phoenix, Arizona Comps. 602-269-5655
AZ Phoenix, Future Elctrns. Corp. 602-968-7140
AZ Phoenix, Hallmark Elctrns. 602-437-1200
AZ Phoenix, Marshall Inds. 602-496-0290
AZ Phoenix, Wyle Elctrns. 602-437-2088
AZ Scottsdale, Kent Elctrns. 602-998-0399
AZ Scottsdale, Spirit Elctrns. 602-998-1533
AZ Tucson, Hallmark Elctrns. 602-742-0515
CA Calabasas, Kent Elctrns. 818-876-1800
CA Calabasas, Marshall Inds. 818-878-7000
CA Calabasas, Wyle Elctrns. 818-880-9000
CA Camarillo, Milgray Elctrns. 800-635-7812
CA Chatsworth, Future Elctrns. Corp. 818-772-6240
CA Chatsworth, Hallmark Elctrns. 818-773-4500
CA Costa Mesa, Eric Elctrns. 714-751-1185
CA El Monte, Marshall Inds. 818-307-6000
CA Irvine, Capstone Elctrns. 714-587-0638
CA Irvine, Future Elctrns. Corp. 714-250-4141
CA Irvine, Hallmark Elctrns. 714-727-6000
CA Irvine, Integrated Elctrns. Corp. 714-753-0127
CA Irvine, Marshall Inds. 714-458-5301
CA Irvine, Milgray Elctrns. 800-468-9277
CA Irvine, Wyle Elctrns. 714-863-9953
CA Milpitas, California Capacitor 408-262-6000
CA Milpitas, Kent Elctrns. 408-262-5300
CA Milpitas, Marshall Inds. 408-942-4600
CA Milpitas, Projections Unltd. 408-942-1717
CA Rancho Cordova, Marshall Inds. 916-635-9700
CA Rancho Cordova, Wyle Elctrns. 916-638-5282
CA Rocklin, Hallmark Elctrns. 916-624-9781
CA Sacramento, Integrated Elctrns. Corp. 916-363-6030
CA San Diego, Future Elctrns. Corp. 619-625-2800
CA San Diego, Hallmark Elctrns. 619-268-1201
CA San Diego, Kent Elctrns. 619-453-7133
CA San Diego, Marshall Inds. 619-627-4140
CA San Diego, Neumann Elctrns. 619-695-3005
CA San Diego, Wyle Elctrns. 619-565-9171
CA San Jose, Capstone Elctrns. 408-453-9804
CA San Jose, Eric Elctrns. 408-432-1111
CA San Jose, Future Elctrns. Corp. 408-434-1122
CA San Jose, Hallmark Elctrns. 408-432-4000
CA San Jose, Jaco Elctrns. 408-432-9290
CA San Jose, Milgray Elctrns. 408-456-0900
CA San Jose, Passive Technlg. 408-435-5566
CA Santa Clara, Wyle Elctrns. 408-727-2500
CA Torrance, Kent Elctrns. 310-320-2700
CA Tustin, Jaco Elctrns. 714-258-9003
CA Tustin, Projections Unltd. 714-544-2700
CA Yorba Linda, Corona 714-283-8185
CO Aurora, Capstone Elctrns. 303-375-2613
CO Denver, Integrated Elctrns. Corp. 303-292-6121
CO Denver, Integrated Elctrns. Corp. 303-292-9594
CO Englewood, Hallmark Elctrns. 303-790-1662
CO Englewood, Kent Elctrns. 303-792-9100
CO Thornton, Marshall Inds. 303-451-8383
CO Thornton, Wyle Elctrns. 303-457-9953
CT Berlin, Kent Elctrns. 203-829-2100
CT Bethel, Future Elctrns. Corp. 203-743-9594
CT Chesire, Hallmark Elctrns. 203-272-1704
CT Milford, Milgray Elctrns. 800-922-6911
CT Wallingford, Cronin Elctrns. 203-265-3134
CT Wallingford, GRS Elctrns. 203-265-2077
CT Wallingford, Marshall Inds. 203-265-3822
FL Altamonte Springs, Future Elctrns. Corp. 407-767-8414
FL Altamonte Springs, Marshall Inds. 407-767-8585
FL Boca Raton, Jaco Elctrns. 407-241-7943
FL Boca Raton, NRC Elctrns. 407-241-8600
FL Ft. Lauderdale, Hallmark Elctrns. 305-484-4740
FL Ft. Lauderdale, Marshall Inds. 407-767-8585
FL Lake Mary, Milgray Elctrns. 800-367-0780
FL Largo, Future Elctrns. Corp. 813-530-1222
FL Largo, Hallmark Elctrns. 813-544-4394
FL Largo, Kent Elctrns. 813-545-0057
FL Melbourne, Dove Elctrns. 407-242-6916
FL Melbourne, GRS Elctrns. 407-768-6966
FL St. Petersburg, Marshall Inds. 813-573-1399
GA Duluth, Hallmark Elctrns. 404-476-8206
GA Norcross, Future Elctrns. Corp. 404-441-7676
GA Norcross, Marshall Inds. 404-923-5750
GA Norcross, Milgray Elctrns. 800-241-5523
IL Elk Grove Vlg., Kent Elctrns. 708-364-1300
IL Gurnee, NEP Elctrns. 708-662-0185
IL Hoffman Estates, Future Elctrns. Corp. 708-882-1255
IL Hoffman Estates, Integrated Elctrns. Corp. 708-843-2040
IL Itasca, Capstone Elctrns. 708-250-0300
IL Lisle, Components, Inc. 708-852-7707
IL Palatine, Milgray Elctrns. 800-322-6271
IL Schaumburg, Marshall Inds. 708-490-0155
IL Wood Dale, Hallmark Elctrns. 703-860-0239
IL Wood Dale, NEP Elctrns. 708-595-8500
IN Indianapolis, Hallmark Elctrns. 317-876-7165
IN Indianapolis, Marshall Inds. 317-297-0483
IA Cedar Rapids, Kent Elctrns. 319-373-0525
KS Lenexa, Hallmark Elctrns. 913-888-0523
KS Lenexa, Marshall Inds. 913-291-4650
KS Overland Park, Milgray Elctrns. 800-255-6576
MD Baltimore, Resco Baltimore 301-931-8200
MD Beltsville, Resco Baltimore 301-937-9100
MD Columbia, Future Elctrns. Corp. 410-290-0600
MD Columbia, GRS Elctrns. 410-995-6744
MD Columbia, Hallmark Elctrns. 410-381-2036
MD Columbia, Jaco Elctrns. 410-995-6620
MD Columbia, Kent Elctrns. 410-720-6200
MD Columbia, Milgray Elctrns. 800-638-6658
MD Gaithersburg, M.S. Elctrns. 301-921-0200
MD Silver Spring, Marshall Inds. 301-622-1118
MA Billerica, Hallmark Elctrns. 508-667-0902
MA Bolton, Future Elctrns. Corp. 508-779-3000
MA Burlington, Wyle Elctrns. 617-272-7300
MA Chelmsford, Kent Elctrns. 508-250-9666
MA Needham, Cronin Elctrns. 617-449-5000
MA Springfield, C&D Elctrns. 413-781-1776
MA Tewksbury, Jaco Elctrns. 508-640-0010
MA Wilmington, Capstone Elctrns. 508-657-5874
MA Wilmington, Marshall Inds. 508-658-0810
MA Wilmington, Milgray Elctrns. 800-648-3595
MI Farmington hills, Key Elctrns. 313-489-5455
MI Livonia, Future Elctrns. Corp. 313-261-5270
MI Livonia, Marshall Inds. 313-525-5850
MI Plymouth, Hallmark Elctrns. 313-416-5811
MN Bloomington, Hallmark Elctrns. 612-881-9461
MN Eden Prairie, Future Elctrns. Corp. 612-944-2200
MN Plymouth, Marshall Inds. 612-559-2211
MN St. Paul, Kent Elctrns. 612-642-2828
MO Bridgeton, Marshall Inds. 314-291-4650
MO Earth City, Hallmark Elctrns. 913-888-0523
MO St. Louis, Future Elctrns. Corp. 314-469-6805
NH Manchester, Cronin Elctrns. 603-624-0105
NJ Camden, GRS Elctrns. 609-964-8560
NJ Denville, Kent Elctrns. 201-625-5500
NJ Edison, Dove Elctrns. 908-738-0321
NJ Fairfield, Marshall Inds. 201-882-0320
NJ Fairfield, Tri-Start Elctrns. 201-227-3500
NJ Marlton, Capstone Elctrns. 609-596-7500
NJ Marlton, Future Elctrns. Corp. 609-596-4080
NJ Marlton, Milgray Elctrns. 800-257-7111
NJ Moorestown, Hallmark Elctrns. 609-235-1900
NJ Mt. Laurel, Marshall Inds. 609-234-9100
NJ Parsippany, Future Elctrns. Corp. 201-299-0400
NJ Parsippany, Hallmark Elctrns. 201-515-4475
NJ Parsippany, Milgray Elctrns. 800-622-0291
NJ Teterboro, EAC Corp. 201-288-4477
NM Albuquerque, Hallmark Elctrns. 505-344-2454
NY E. Rochester, Rome Elctrns. 716-248-0160
NY E. Setauket, Dove Elctrns. 516-689-7733
NY Endicott, Marshall Inds. 607-785-2345
NY Fairport, Hallmark Elctrns. 716-425-7195
NY Farmingdale, Milgray Elctrns. 800-622-0291
NY Fayetteville, Tri-Start Elctrns. 315-637-1312
NY Hauppauge, Future Elctrns. Corp. 516-234-4000
NY Hauppauge, Jaco Elctrns. 516-273-5500
NY Hauppauge, Marshall Inds. 516-273-2695
NY Hauppauge, Vargas Elctrns. 516-273-1111
NY Penn Yan, Advacom, Inc. 315-536-2221
NY Pittsford, Milgray Elctrns. 716-381-9700
NY Rochester, Future Elctrns. Corp. 716-272-1120
NY Rochester, Marshall Inds. 716-235-7620
NY Rome, Rome Elctrns. 800-366-7663
NY Ronkonkoma, Hallmark Elctrns. 516-737-0838
NY Ronkonkoma, Tri-Start Elctrns. 516-737-2200
NY Williamsville, Rome Elctrns. 800-366-0118
NC Concord, Future Elctrns. Corp. 704-455-9030
NC Pleasant Garden, Tri-Start Elctrns. 919-674-5515
NC Raleigh, Capstone Elctrns. 919-954-0600
NC Raleigh, Future Elctrns. Corp. 919-790-7111
NC Raleigh, Hallmark Elctrns. 919-878-8729
NC Raleigh, Jaco Elctrns. 919-876-7767
NC Raleigh, Marshall Inds. 919-878-9882
NC Raleigh, Milgray Elctrns. 800-562-3118
OH Cleveland, Milgray Elctrns. 800-321-0008
OH Dayton, Advacom, Inc. 513-274-5900
OH Dayton, Marshall Inds. 513-898-4480
OH Mayfield Heights, Future Elctrns. Corp. 216-449-6996
OH Middleburg, Advacom, Inc. 216-826-3300
OH Solon, Hallmark Elctrns. 216-248-4803
OH Solon, Marshall Inds. 216-248-1788
OH Worthington, Hallmark Elctrns. 614-888-0767
OK Tulsa, Hallmark Elctrns. 918-254-6207
OR Beaverton, integrated Elctrns. Corp. 503-641-1690
OR Beaverton, Almac/Cap Elctrns. 503-629-8090
OR Beaverton, Future Elctrns. Corp. 503-645-9454
OR Beaverton, Kent Elctrns. 503-626-8300
OR Beaverton, Marshall Inds. 503-644-5050
OR Beaverton, Wyle Elctrns. 503-643-7900
PA Export, Advacom, Inc. 412-325-7551
PA McKean, Advacom, Inc. 814-476-7774
PA Warrington, Tri-Start Elctrns. 215-343-8384
TX Austin, Hallmark Elctrns. 512-258-3777
TX Austin, Jaco Elctrns. 512-835-0220
TX Austin, Kent Elctrns. 512-834-1900
TX Austin, Marshall Inds. 512-837-1991
TX Austin, Wyle Elctrns. 512-345-8853
TX Carrollton, Capstone Elctrns. 800-388-CAPS
TX Dallas, Hallmark Elctrns. 214-553-4295
TX Dallas, Milgray Elctrns. 800-637-7227
TX Houston, Future Elctrns. Corp. 713-556-8696
TX Houston, Hallmark Elctrns. 713-781-6100
TX Houston, Jaco Elctrns. 713-780-7770
TX Houston, Marshall Inds. 713-467-1666
TX Houston, Wyle Elctrns. 713-879-9953
TX Richardson, Future Elctrns. Corp. 214-437-2437
TX Richardson, Jaco Elctrns. 214-234-5565
TX Richardson, Kent Elctrns. 214-669-2600
TX Richardson, Marshall Inds. 214-705-0600
TX Richardson, Wyle Elctrns. 214-235-9953
TX Stafford, Milgray Elctrns. 800-952-1849
UT Murray, Milgray Elctrns. 800-537-9739
UT Salt Lake City, Future Elctrns. Corp. 801-972-8489
UT Salt Lake City, Hallmark Elctrns. 801-269-0416
UT Salt Lake City, Marshall Inds. 801-973-2288
UT W. Valley City, Integrated Elctrns. Corp. 801-977-9750
UT W. Valley City, Wyle Elctrns. 801-974-9953
VA Vienna, Dove Elctrns. 703-893-1821
WA Bellevue, Almac/Cap Elctrns. 206-643-9992
WA Bellevue, Integrated Elctrns. Corp. 206-455-2727
WA Bothell, Future Elctrns. Corp. 206-489-3400
WA Bothell, Marshall Inds. 206-486-5747
WA Everett, Hallmark Elctrns. 206-290-5324
WA Redmond, Kent Elctrns. 206-883-7200
WA Redmond, Wyle Elctrns. 206-881-1150
WI New Berlin, Hallmark Elctrns. 414-797-9259
WI New Berlin, NEP Elctrns. 414-785-9100
WI Waukesha, Future Elctrns. Corp. 414-786-1884
WI Waukesha, GRS Elctrns. 414-544-3193
WI Waukesha, Marshall Inds. 414-797-8400
PR Canovanas, Milgray Elctrns. 809-876-8200
Can Brampton, Ont., Marshall Inds. 416-458-8046
Can Calgary, Alb., Future Elctrns. Inc. 403-250-5550
Can Edmonton, Alb., Future Elctrns. Corp. 403-438-2858
Can Mississauga, Ont., Capstone Elctrns. 416-670-2010
Can Mississauga, Ont., Future Elctrns. Corp. 416-612-9200
Can Mississauga, Ont., Milgray Elctrns. 416-678-0958
Can Ottawa, Ont., Future Elctrns. Inc. 613-820-8313
Can Pointe Claire, Que., Future Elctrns. Corp. 514-694-7710
Can Pointe Claire, Que., Marshall Inds. 514-694-8142
Can Pointe Claire, Que., Milgray Elctrns. 514-426-5836
Can Quebec, Que., Future Elctrns. Inc. 418-877-6666
Can Vancouver, BC, Future Elctrns. Inc. 604-294-1166
Can Winnipeg, Man., Future Elctrns. Inc. 204-786-7711
KS Overland Park, Kent Elctrns. 913-338-4300
MD Baltimore, Micro-Comp 301-644-5700
CA Westlake Vlg., Jaco/Distel 805-495-9998
VA Lynchburg, Micro-Comp 804-239-2626

AVX FILTERS CORP., 11144 Penrose St., Sun Valley, CA 91352, Tel: 818-767-6770, TWX: 910-498-4998; FSC No.: 59942; Empl.: 160; *Sls. Mgr.:* Terry Cantine, Prod. Mktg. Mgr.

AXEL ELECTRONICS, INC., Subsidiary of FPBSM Industries Inc., 19060 Dominquez Hills Dr., Rancho Dominquez, CA 90220, Tel: 718-291-3900, FAX: 718-526-0248; FSC No.: 13058; Empl.: 160; *Sls. Mgr.:* H. Mordkoff

NORMAN N. AXELROD ASSOCS.:ELECTRO-OPTICAL, LASER, & MACHINE VISION DIV., 445 East 86th Street, New York, NY 10028, Tel: 212-228-0900

AXIAL MAGNETICS, Tencal Inc., 450 W. Los Angeles Ave., Simi Valley, CA 93065, Tel: 805-527-0900, FAX: 805-527-4968; *Sls. Mgr.:* K. G. Kroll

AXIOHM, INC., 1775 Hwy. 8, Ste. 107, New Brighton, MN 55112, Tel: 612-638-9856, FAX: 612-638-0758; Empl.: 130; *Sls. Mgr.:* Kieth Jentoff ..... **D•1078-1081**

AYA-INSTRUMENTS, INC., 5001 Baum Blvd., Pittsburgh, PA 15213, Tel: 412-622-5500, FAX: 412-681-3773; *Sls. Mgr.:* A. Anouchi

AYDIN CORP., 700 Dresher Rd., Horsham, PA 19044, Tel: 215-657-7510, TELEX: 685-1211, FAX: 215-657-3830; Empl.: 1400; *Sls. Mgr.:* John Politis

AYDIN CORPORATION (WEST), 30 Great Oaks Boulevard, San Jose, CA 95119-1371, Tel: 408-629-1100, TWX: 910-373-1238, FAX: 408-224-4625; FSC No.: ZV23-1686808; *Sls. Mgr.:* George Whitehill; *Dist. Mgr.:* Clarence Ruckriegel

AYDIN VECTOR DIV., Aydin Corp., Box 328, Newtown, PA 18940-0328, Tel: 215-968-4271, FAX: 215-968-3214; FSC No.: 13923; Empl.: 300

AZCO CORP., 385 Falmouth Ave., Elmwood Park, NJ 07407, Tel: 201-791-1428, FAX: 201-791-8420; Empl.: 15

AZ-COM, 12 Rose Lane, Ste. 104, Orinda, CA 94563-2206, Tel: 510-254-5400, FAX: 510-254-5400; FSC No.: 68-0283683; Empl.: 5; *Sls. Mgr.:* A. Hadas ..... **D•1235**

AZIMUTH ELECTRONICS, INC., 2605 So. El Camino Real, San Clemente, CA 92672, Tel: 714-492-6481, FAX: 714-492-0744; *Sls. Mgr.:* Kenneth C. Johnsen

A/Z-TECH, INC. R&D LAB, Indiana Institute of Technlg., 1600 East Washington Blvd., Fort Wayne, IN 46803, Tel: 219-422-5561, FAX: 219-422-7696; Empl.: 25

aztec INDUSTRIES

FAX: 602-844-9625

AZTEC INDUSTRIES, INC., 333 S. Nina Drive, Mesa, AZ 85210, Tel: 602-833-3131, 800-729-3132; Empl.: 40; *Sls. Mgr.:* Dan Harper ..... **B•1821**

Local Sales Offices & Reps

AL	Huntsville, Cartwright & Bean, Inc.	205-830-1540, FAX:205-830-1542
FL	Dearfield Beach, Cartwright & Bean, Inc.	305-429-3400,FAX:305-429-3402
FL	Orlando, Cartwright & Bean, Inc.	407-889-9100, FAX:407-889-2168
GA	Atlanta, Cartwright & Bean, Inc.	404-368-0160, FAX:404-368-0125
KS	Shawnee Mission, Marc E. Nelson Assoc.	913-268-9099
MS	Jackson, Cartwright & Bean, Inc.	601-981-1170, FAX:601-981-1171
NE	Omaha, Label Concepts	402-496-3997, FAX:402-496-3855
NE	Omaha, Label Concepts	402-592-5080, FAX:402-592-5088
NC	Charlotte, Cartwright & Bean, Inc.	704-536-0303, FAX:704-536-0313
NC	Raleigh, Cartwright & Bean, Inc.	919-876-4130, FAX:919-876-4132
TN	Knoxville, Cartwright & Bean, Inc.	615-693-7450
TX	Dallas, Kay Todd Assocs.	214-458-8833, FAX:214-458-8837

BABCOCK, INC., 1717 West Collins Ave., Orange, CA 92667, Tel: 714-633-3700, FAX: 714-538-9740; FSC No.: 56623; Empl.: 165; *Sls. Mgr.:* Bosie White; *Dist. Mgr.:* Bosie White ..... **B•1021**

Local Distributors

CA	Santa Ana, Norstan Elctrns.	714-667-7826

BABCOCK
DISPLAY PRODUCTS, INC.

FAX: 714-490-1368

BABCOCK DISPLAY PRODUCTS, INC., A Subsidiary of Babcock, Inc., 1051 S. East St., Anaheim, CA 92805, Tel: 714-491-5100; Empl.: 150 ..... **B•1021**

Local Sales Offices & Reps

AZ	Tempe, ETS	602-921-7122
CA	Cupertino, Costar Inc.	408-446-9339
CO	Denver, AKI Entprs.	303-756-0700
CT	Wallingford, Alpha Omega Sls. Corp. ...	203-949-0388
FL	N. Palm Beach, Universal Mktg. & Sls.	407-842-1440
GA	Norcross, Elctrns. Sls. Inc. (ESI)	404-448-6554
IL	Berkeley, ESA Tech. Mktg.	708-544-0120
IA	Des Moines, The Beams Co.	515-255-1148
KS	Lenexa, The Beams Co.	913-541-9197
MD	Baltimore, Eastern Comps. Sls.	410-788-7050
MA	North Reading, Alpha Omega Sls. Corp.	508-664-1118
MI	Farmington Hills, Rathsburg Assoc., Inc.	313-489-1500
MN	Minneapolis, Holmgren Assocs.	612-574-9983
MO	St. Louis, The Beams Co.	314-434-8448
NJ	Glen Rock, WD Sls., Inc.	201-447-8821
NM	Rio Rancho, Elctrn. Tech. Sls. Inc. (ETS)	602-921-7122
NY	Eastchester, WD Sls., Inc.	914-779-8738
NY	N. Syracuse, Entec Grp., Inc.	315-458-7936
NC	Cary, Elctrn. Sls. Inc. (ESI)	919-467-8486
OH	Columbus, Rathsburg Assoc., Inc.	614-457-2242
OR	Hillsboro, Temco Northwest	503-465-4030
PA	Norristown, Eastern Comps. Sls.	215-270-9530
TX	Richardson, Pro-Comp Sls. Co.	214-669-1500
WA	Bothell, Temco Northwest	206-481-6150
Can	Mississauga, Ont., bbd Elctrns.	416-821-7800

BACHI, INC., 1201 Ardmore, Itasca, IL 60143, Tel: 708-773-5600, FAX: 708-773-5621; Empl.: 95

BACON INDUSTRIES, INC., 192 Pleasant St., Watertown, MA 02172-2399, Tel: 617-926-2550, TWX: 710-327-6518, FAX: 617-926-2022; FSC No.: 99098; Empl.: 25; *Sls. Mgr.:* R. S. Cass

BAKER CO., INC., Drawer E - Sanford Airport, Sanford, ME 04073, Tel: 1-800-992-2537; Empl.: 150

BAKNOR INDUSTRIES INC., 2209 Dunwin Drive, Mississauga, Ont., Canada L5L 1X1, Tel: 416-828-2400, FAX: 416-828-5500; Empl.: 25; *Sls. Mgr.:* M. E. Sawicki

BALDOR ELECTRIC COMPANY, P.O. Box 2400, Fort Smith, AR 72902, Tel: 501-646-4711, FAX: 501-648-5792; Empl.: 2900; *Sls. Mgr.:* John McFarland V.P. Sls.

BALLANTINE LABORATORIES, 9 Saddle Rd., Cedar Knolls, NJ 07927, Tel: 201-984-1900, FAX: 201-984-1479; FSC No.: 50423; Empl.: 30

BALLARD TECHNOLOGY, 1216 NW 75th Street, Seattle, WA 98117, Tel: 206-782-8704, 1-800-829-1553, FAX: 206-782-8174; Empl.: 7; *Sls. Mgr.:* Kevin S. Christian

BALLCO ATLANTA, Conceptual Enterprises Intl. Ltd., P.O. Box 1078, Snellville, GA 30278-1078, Tel: 404-979-5900, FAX: 404-979-5900; Empl.: 49; *Sls. Mgr.:* W. Kann

BALL CORP., EFRATOM DIVISION, 3 Parker, Irvine, CA 92718-1605, Tel: 714-770-5000, TELEX: 68-5635, FAX: 714-770-2463; Empl.: 225 ..... **A•1339**

Local Sales Offices & Reps

CA	Dana Point, Geil Mktg.	714-489-7644
CA	Los Altos, Kolm Mktg. Assoc.	415-948-2635
CO	Parker, W. Howard Assoc.	303-841-5755
FL	Melbourne, Bass Assocs.	407-259-1866
GA	Norcross, Beacon Microwave	404-449-8464
IN	Fort Wayne, TX Sls. Indiana	219-489-4447
MD	Baltimore, Stemler Assoc., Inc.	410-944-8262
MA	Natick, Wayland Engrg. Sls.	617-655-6080
NM	Albuquerque, Mayco, Inc.	505-299-4002
NY	Huntington, CDB Entprs.	516-692-5200
TX	Dallas, Beacon Microwave	214-437-1505
CA	Huntington Bch., Scientific Dvcs.- West	714-840-3501
VA	Lynchburg, Incandescent Tech.	804-846-7391
WA	Bellevue, Syntek	206-462-7700

BALL CORPORATION, Industrial Systems Division, 3400 Gilchrist Rd., Mogadore, OH 44260, Tel: 216-784-4456, TELEX: 98-6327-PVI-AKR, FAX: 216-784-9854; Empl.: 130; *Sls. Mgr.:* George Gugliotta

BALL SCREWS & ACTUATORS CO., 3616 Snell Ave., San Jose, CA 95136-1305, Tel: 408-629-1132, FAX: 408-629-2620; Empl.: 63; *Sls. Mgr.:* Steve Trumbauer

BALSTON, 260 Neck Rd., Box 8223, Haverhill, MA 01835-0723, Tel: 508-374-7400, FAX: 508-374-7070; Empl.: 200; *Sls. Mgr.:* Scott Feenan

BAMBECK SYSTEMS INC., 1921 E. Carnegie Ave., Santa Ana, CA 92705, Tel: 714-250-3100, 800 334-3101, FAX: 714-757-1610; Empl.: 25; *Sls. Mgr.:* Robert Bambeck

B & B MOTOR & CONTROL CORP., B & B Long Island City, 1967 State Hwy 27 Ste. 32, Edison, NJ 08817, Tel: 908-819-7070, 908-572-0500, FAX: 908-819-7010; Empl.: 90; *Sls. Mgr.:* Thomas Miceli

BAND-IT - IDEX, INC., 4799 Dahlia Street, Denver, CO 80216, Tel: 303-320-4555, TELEX: 45-0009, FAX: 303-333-6549; *Sls. Mgr.:* Terry L. Joles; *Dist. Mgr.:* Ron Isherwood

B & K PRECISION, Maxtec International Corp, 6470 W. Cortland, Chicago, IL 60635, Tel: 312-889-1448, FAX: 312-794-9740; FSC No.: 08098, 18110, 48560, 30678; Empl.: 200; *Sls. Mgr.:* Richard Polak

BANNER ENGINEERING CORP., 9714 - 10th Ave. N., Minneapolis, MN 55441, Tel: 612-544-3164, FAX: 612-544-3631; *Sls. Mgr.:* Floyd Schneider

BARADINE PRODUCTS LTD., P.O. Box 86757, North Vancouver, B.C., Canada V7L 4L3, Tel: 604-988-9853, FAX: 604-988-9899; Empl.: 3; *Sls. Mgr.:* Garry J. Anderson; *Dist. Mgr.:* Garry J. Anderson

BARANTI GROUP INC., 2650 John St., Unit 22, Markham, Ont., Can L3R 2W6, Tel: 416-479-0148, FAX: 416-479-0149; *Sls. Mgr.:* Barry Papoff

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BARBER-COLMAN CO., Indl. Instrs. Div., P.O. Box 2940, 1354 Clifford Ave., Loves Park, IL 61132-2940, Tel: 815-637-3000, TELEX: 4330175 BC11; Empl.: 300; *Sls. Mgr.:* David Boxall ..... **B•1241**

Local Sales Offices & Reps

AZ	Tucson, Kachina Controls	602-886-4984
AK	Anchorage, Control Contractors	907-561-3044
CA	Anaheim, Instrument Lab.	714-236-7900
CA	San Jose, Instr. Lab.	408-434-0160
CA	Santa Clara, Johnson Assocs.	408-984-4626
CO	Denver, Tessco	303-778-1119
FL	Clearwater, J. J. Galleher Co.	813-461-7706
GA	Norcross, McGoff Pyrotech, Inc.	404-840-9811
GA	Roswell, Cascade Controls	404-664-9000
HI	Rockford, Barber-Colman	815-637-3000
IL	Arlington Hgts., Carlin Automation	708-981-0800
IL	Rock Island, Carlin Automation	309-788-1275
IN	Noblesville, Triangle Sls.	317-773-5480
KS	Goddard, Parker & Foster	316-794-2686
LA	Baton Rouge, Hahn/Enstocko, Inc. ...	504-926-9310
MI	Allendale, Applied Instr. Co.	616-895-9600
MI	Farmington, Applied Instrs.	313-476-9060
MN	Minneapolis, Temp-Tec	612-784-3306
MO	St. Louis, Temtron	314-968-5242
NV	Las Vegas, Kachina Controls	702-791-5666
NJ	Hackensack, AP Tech. Sls.	201-487-6222
NM	Albuquerque, Kachina Controls	505-260-1741
NY	Victor, Sanwal Technlgs.	716-924-1950
NC	Matthews, Carotek, Inc.	704-847-4406
OH	Cincinnati, Heat Equip. & Technlgs. ...	513-591-3000
PA	Frazer, Weiss Instrs. Inc.	215-647-4650
PA	Pittsburgh, Weiss Instr., Inc.	412-344-1500
RI	Providence, N.E.T.S.	401-454-2777
TN	Memphis, Industrial Process Controls	901-795-4200
TX	Fort Worth, ASKCO Instr. Corp.	817-568-0003
TX	Houston, ASKCO Instr. Co.	713-645-9898
WA	Redmond, Sales & Engrg. Assocs.	206-883-4999
WA	Vancouver, Sls. & Engrg. Assocs.	206-573-5161
WI	Appleton, Pyro-Matic	414-739-4247
WI	Wauwatosa, Pyro-Matic	414-453-1171

BARBER COLMAN CO. (A SIEBE CO.), Motor Division, P.O. Box 7040, Rockford, IL 61125-7040, Tel: 815-397-7400, FAX: 815-398-3885; Empl.: 350; *Sls. Mgr.:* Jeff Wagner; *Dist. Mgr.:* John Locarno ..... **B•1241**

Local Sales Offices & Reps

AR	Van Buren, Hightower Ind. Sls.	501-471-8116
CA	Corona Del Mar, Motion Control of So.CA.	714-675-0211
CA	Mission Viejo, PJS Assocs.	714-472-0856
CA	San Jose, O'Donnell Assoc. North	408-456-2856
CO	Denver, Motion Technlg.	303-757-3003
IL	Hinsdale, Patton Sls. Co.	708-325-2170
IA	Cedar Rapids, Lorenz Sls. Inc.	319-377-4666
MI	Grand Rapids, Russell Sls.	616-956-9111
MN	Minneapolis, Josco Melius, Inc.	612-861-3343
MO	Bridgeton, Dy-Tronix, Inc.	314-291-4777
NH	Salem, Sales Engrg.	603-893-5521
NJ	W. Caldwell, Grimm-Siegel Assoc.	201-575-9300
PA	Huntingdon Valley, Ed Leiby & Assocs.	215-659-8938
PA	Pittsford, Franklin Sls.	716-248-8251

WI Brookfield, Heartland Tech. Mktg. 414-792-0920
Can Vancouver, B.C., Madison Indl. Equip., Ltd. 604-872-8155

Local Distributors
CA Anaheim, Minarik Elec. Co. 714-994-2251
AZ Phoenix, Minarik Elec. Co. 602-233-3000
CA Fresno, Minarik Elec. Co. 209-255-8087
CA Glendale, Minarik Elec. Co. 818-507-6500
CA Ontario, Minarik Elec. Co. 714-391-0064
CA San Diego, Minarik Elec. 619-560-6632
CA Santa Clara, Minarik Elec. Co. 408-727-0575
MI Troy, B & B Motor & Control Corp. 313-583-7450
FL Winter Springs, B & B Motor & Control Corp. 407-696-4511
CO Commerce City, Minarik Elec. Co. 303-289-5800
NJ Edison, B & B Motor & Control Corp. .. 201-572-0500
IL Elk Grove Vlg., Genl. Controls 708-595-2152
NY Long Island City, B & B Motor & Control Corp. 718-784-1313
IL Schaumburg, Minarik Elec. Co. 708-885-9337
IN Indianapolis, B & B Motor & Control Corp. 317-248-0396
MD Silver Spring, B & B Motor & Control Corp. 301-685-5834
MA Somerville, Electro-Sls. Co., Inc. 617-666-0500
MN Eagan, N.W. Power Prods. Inc. 612-452-6467
NJ Edison, B & B Motor & Control Corp. .. 908-572-0500
NY Rochester, B & B Motor & Control Corp. 716-424-7040
NC Greensboro, B & B Motor & Control Corp. 919-379-8966
OR Portland, Minarik Elec. Co. 503-253-3402
OH Cincinnati, Cincinnati Belting & Transmission Co. 513-621-9050
OH Dayton, Cincinnati Belting & Transmission Co. 513-223-0653
TX Houston, Minarik Elec. Co. 713-748-0808
TX Irving, Minarik Elec. Co. 214-402-8188
TX San Antonio, Minarik Elec. Co. 512-822-7097
SC Taylors, B & B Motor & Control Corp. 803-268-5702
WA Redmond, Minarik Elec. Co. 206-885-0832

BARCO CHROMATICS, 2558 Mountain Ind. Blvd, Tucker, GA 30084, Tel: 404-493-7000, FAX: 404-493-1314; FSC No.: FSCM 59992; Empl.: 103; *Sls. Mgr.:* James Spencer

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(800) CAL-SWCH

BARKSDALE CONTROLS DIV., Imo Industries Inc., 3211 Fruitland Ave., P.O. Box 58843, Los Angeles, CA 90058, Tel: 213-589-6181; Empl.: 234; *Sls. Mgr.:* J. Douglas Holland

BARNES ENGINEERING, West Coast Sls. & Mktg., 3601 W. Macarthur Blvd., 904, Santa Ana, CA 92704, Tel: 714-533-7530, FAX: 714-533-4755; FSC No.: 53823, SIC 3400; Empl.: 47; *Sls. Mgr.:* Gordon Mackenzie

BARNES ENGINEERING DIV., EDO Corporation, 88 Long Hill Cross Rds., Shelton, CT 06484, Tel: 203-926-1777, TELEX: 6819115, FAX: 203-926-9285; Empl.: 250; *Sls. Mgr.:* M. L. Marusic

BARNES ENGINEERING COMPANY, 2715 Delta Pl, Colorado Springs, CO 80910, Tel: 719-390-6500, FAX: 719-390-6700; Empl.: 57

BARR ASSOCIATES, INC., 2 Lyberty Way, Westford, MA 01886, Tel: 508-692-7513, FAX: 508-692-7443; FSC No.: 65807; Empl.: 95

BARRINGTON PLASTICS, 3838 Church Road, Mt. Laurel, NJ 08054, Tel: 609-235-5151, FAX: 609-778-9032; Empl.: 120; *Sls. Mgr.:* Gary Brown

BARSOM INC., See IR Scientific

BARTH ELECTRONICS, INC., 1300 Wyoming St., Boulder City, NV 89005, Tel: 702-293-1576, FAX: 702-293-7024; Empl.: 9; *Sls. Mgr.:* Sue Smith

BARTLETT INSTRUMENT CO., 14th & Ave. 'M', P.O. Box 445, Ft. Madison, IA 52627, Tel: 319-372-8366; Empl.: 10; *Sls. Mgr.:* David P. Bartlett

BAS BLEU INDL. CO., LTD., Rm. 815, No.110, Han-Kow ST., Sec.1, Taipei, Taiwan 10008, Tel: (02)331-6519, TELEX: 23015 HJIC, FAX: 886-2-381-6812; Empl.: 20; *Sls. Mgr.:* Athena W.R. Lo, VP

BASIC ELECTRONICS, INC., 11762 Western Ave. "Q", Stanton, CA 90680, Tel: 714-530-2400; Empl.: 50; *Sls. Mgr.:* Tom Jones; *Dist. Mgr.:* Tom Jones

BASIC MEASURING INSTRUMENTS, 335 Lakeside Dr., Foster City, CA 94404, Tel: 415-570-5355, TWX: 910-374-3059, FAX: 415-574-2176; Empl.: 90; *Sls. Mgr.:* Craig Waterman

BASICON, INC., 14273 NW Science Park Drive, Portland, OR 97229, Tel: 503-626-1012, FAX: 503-643-4686

BASISTA/NIEC, 3401 Brecksville Rd 110, Richfield, OH 44286, Tel: 216-659-9287, FAX: 216-659-3580; Empl.: (NIEC-Japan) 1200 230M Sales

Basler Electric
Electronic Product Group
FAX: 618-654-2351

BASLER ELEC., Electronic Product Group, Rte. 143, Highland, IL 62249, Tel: 618-654-2341, 800-645-2074; Empl.: 1401; *Sls. Mgr.:* Dennis Faires .... **D•1617**

Local Sales Offices & Reps
AL Huntsville, Electro-Mech Sls. Engrg. Co. 205-880-0592
AZ Tempe, Trembly Assoc., Inc. 602-431-9417
CA Newport Beach, S.P.A. Inc. 714-863-1193
CA Santa Clara, Sourcetronics, Inc. 408-988-8801
CA Torrance, Printed Circuit Board Specialists 213-320-3022
CO Golden, Trembly Assocs., Inc. 303-421-8900
FL Clearwater, Sunland Assoc. 813-536-2955
FL Lauderhill, Sunland Assoc. 305-748-1303
FL Oviedo, Sunland Assocs. 407-365-9533
GA Norcross, Electro Mech Sls. Engrg. Co. 404-447-6478
IL Chicago, G. Mcl. Cole Co. 708-827-6040
IA Cedar Rapids, Thomas L. Dowell & Assoc., Inc. 313-393-7920
KS Overland Park, Thomas L. Dowell & Assocs., Inc. 913-722-4242
MD Baltimore, C.W. Bass & Assocs. 410-744-4611
MA Braintree, R. F. Duffy Assocs. 617-848-3550
MA Monson, R. F. Duffy Assocs. 413-267-9884
MA Whitinsville, Power Factor & Assocs. .. 508-234-6415
MN Apple Valley, Arkco Sls. 612-432-6593
MN St. Paul, Arkco Sls. 612-777-7454
MO St. Louis, Thomas L. Dowell & Assoc., Inc. 314-849-4234
NJ Scotch Plains, Mil-Com Sls. Assocs. .. 908-322-7898
NM Albuquerque, Trembly Assoc., Inc. 505-266-8616
NY Smithtown, T & K Sls. 516-724-3456
NC Raleigh, Electro Mech. Sls. Engrg. Co. 919-790-9300
OH Hillsboro, J. P. Woods & Assocs. 513-393-9582
OH Maineville, J. P. Woods & Assocs. 513-677-2120
PA Pittsburgh, Gormley Farrington 412-795-8010
TX Dallas, Weisler & Assoc., Inc. 214-437-2386
TX Houston, Weisler & Assoc., Inc. 713-467-1847
UT N. Salt Lake City, Trembly Assocs. 801-295-4703
VA Ashland, Glasscock & Assoc. 804-798-2125
WA Redmond, Elctrn. Mktg. Grp. 206-882-0962
WA Vancouver, Elctrn. Mktg. Grp. 206-944-0761
PR Rio Piedras, Klamco Elctrns. 809-748-5214

BASLER ELECTRICS, Magnetics Product Grp., Rt 143, Box 269, Highland, IL 62249, Tel: 618-654-2341, FAX: 618-654-2351; Empl.: 1500; *Sls. Mgr.:* Don Ginther ..... **D•1617**

FAX: 617-361-1835

BATTERY ENGINEERING, INC., 1636 Hyde Park Ave., Hyde Park, MA 02136, Tel: 617-361-7555; FSC No.: 60289; Empl.: 50; *Sls. Mgr.:* R. Fay ..... **D•1426**

BATTERY SPECIALTIES
FAX: 714-755-0889

BATTERY SPECIALTIES, 3530 Cadillac Ave., Costa Mesa, CA 92626, Tel: 714-755-0888, 1-800-352-3706 (Toll free in CA); Empl.: 30; *Sls. Mgr.:* Guy K. Hudson; *Dist. Mgr.:* Guy K. Hudson ..... **D•1427-1429**

BAXTER-INDUSTRIAL DIVISION, 27200 N. Tourney Rd., Valencia, CA 91355, Tel: 805-253-7466, FAX: 805-253-7634; Empl.: 50; *Sls. Mgr.:* Jeff Blair

BAY COMPONENTS, INC., 418 3rd St., Annapolis, MD 21403, Tel: 410-268-0122, FAX: 410-268-7909; Empl.: 1; *Sls. Mgr.:* Barbara Bunting

BAYLEY INSTRUMENT COMPANY, Box 357, Kenwood, CA 95452, Tel: 707-833-6014

BAYSTAT, 3575 Haven Ave., Menlo Park, CA 94025, Tel: 415-364-3205, FAX: 415-363-8079; Empl.: 100; *Sls. Mgr.:* James V. Travis

BAY TECHNICAL ASSOCIATES, INC., 200 N. 2nd St., Bay St. Louis, MS 39520, Tel: 800-523-2702, 601-467-8231, FAX: 601-467-4551; FSC No.: 64-0588860; Empl.: 100; *Sls. Mgr.:* Jackie La Fontaine

B C SYSTEMS, INC., 200 Terminal Road, Setauket, NY 11733, Tel: 516-751-9370, FAX: 516-751-9378; Empl.: 50; *Sls. Mgr.:* Joseph Small

BEAD INDUSTRIES, 110 Mountain Grove St., P.O. Box K, Dept. 100, Bridgeport, CT 06605-0571, Tel: 203-334-4124, FAX: 203-367-9957; Empl.: 175; *Sls. Mgr.:* Keith Lebo

BEA ELECTRO-OPTICS, INC., 640 Pearson, Ste. 200, Des Plaines, IL 60016, Tel: 708-298-1420, FAX: 708-298-1423; *Sls. Mgr.:* George E. Magerl; *Dist. Mgr.:* Vic Halkyn

BEARING INSPECTION, 10041 Shoemaker Ave., Santa Fe Springs, CA 90670, Tel: 310-944-6251, FAX: 310-946-9670; Empl.: 43

Beau Products
DIVISION OF VERNITRON CORPORATION
FAX: 603-524-1627

BEAU INTERCONNECT SYSTEMS, Vernitron Corp., Box 10, Laconia, NH 03247, Tel: 603-524-5102; FSC No.: 13150; Empl.: 150; *Sls. Mgr.:* Wayne Eshelman; *Dist. Mgr.:* Larry Murphy ..... **C•1269-1273**

Local Sales Offices & Reps

AL Huntsville, Electro-Mech Sls. Engrg. ... 205-880-0592
AZ Phoenix, Shefler-Kahn ... 602-581-0884
CA Garden Grove, Elsco Elect. Inc. ... 714-891-4621
GA Norcross, Electro-Mech Sls. Engrg. ... 404-447-6478
IL Lisle, W-G Controls ... 708-963-5954
IN Carmel, Green-Wissler Sls., Inc. ... 317-843-5785
IA Cedar Rapids, KKB and Co. ... 319-373-1730
MN Bloomington, PSI ... 612-944-8545
MO St. Louis, KKB & Co. ... 314-647-2400
NH Amherst, D.A.Crowley & Assoc. ... 603-673-7050
NJ Lawrenceville, DVS Co. ... 609-896-1112
NJ W. Caldwell, Grimm Siegel & Assoc. .. 201-575-9300
NY Syracuse, Pi'tronics, Inc. ... 315-455-7346
NC Raleigh, Electro-Mech Sls. Engrg. ... 919-790-9300
OH Beechwood, Electronic Salesmasters Inc. ... 216-831-9555
OR Beaverton, Pacific Mktg. Specialist, ... 503-641-9373
TX Irving, Comtech Sls. Inc. ... 214-751-1181
WA Redmond, Pacific Mktg. Specialists, ... 206-882-3144
Can Oakville, Ont., Haltronics, Ltd. ... 416-844-2121
Can West Vancouver, BC, Leister Blake Entprs. Ltd. ... 604-926-6127

BEAU TECH, 98 Elm Street, Portland, ME 04101, Tel: 207-775-6139, TELEX: 950-027 Attn Beau, FAX: 207-775-7710; Empl.: 6; *Sls. Mgr.:* Barbara Pike, Credit Mgr.; *Dist. Mgr.:* Barbara Pike

BEAVER LABS, P. O. Box 202, Kingston, MA 02364, Tel: 617-585-5666; Empl.: 5

BEC INC./CERTIFIED CALIBRATION LABS, 945 Horsham Rd., Horsham, PA 19044, Tel: 800-523-3808, FAX: 215-675-0966,800-523-3808; Empl.: 8; *Sls. Mgr.:* David Hines

BECKMAN INDUSTRIAL CORP., Affiliate of Emerson Electric Co., 4200 Bonita Pl, Fullerton, CA 92635, Tel: 714-447-2300, TELEX: 7607569, FAX: 714-447-2400; Empl.: 1900; *Sls. Mgr.:* Ron Sullivan, Sls. & Mktg. V.P. ... **A•1868, 2056-2057**

Local Sales Offices & Reps

AL Huntsville, Elctrn. Sls., Inc. ... 205-533-1735
AZ Scottsdale, Thom Luke Sls. ... 602-451-5400
CA Escondido, Clint Bradley Sls. ... 619-743-0138
CA Newport Beach, Jones & McGeoy Sls. ... 714-724-8080
CA Santa Clara, Criterion Sls. ... 408-988-6300
CO Littleton, Simpson Assocs. ... 303-794-8381
CT Cheshire, Datatrack Engrg., Inc. ... 203-271-1311
FL Ft. Lauderdale, QXI, Inc. ... 305-978-0120
FL St. Petersburgh, QXI, Inc. ... 813-894-4556
GA Norcross, Elctrn. Sls., Inc. ... 404-448-6554
ID Boise, Emerging Technlg. Sls., Inc. ... 208-378-4680
IL Elk Grove Village, Carlson Elctrn. Sls. Co. ... 708-956-8240
IN Indianapolis, Precision Elec. Comp. ... 317-842-3740
IA Cedar Rapids, Carlson Elctrns. ... 319-378-1450
KS Overland Park, Electri-Rep, Inc. ... 913-649-2168
MD Columbia, Robert Elctrn. Sls. ... 301-995-1900
MA Farmingham, Gallagher Assoc. ... 508-626-2346
MI Brighton, A.P. Assoc. ... 313-229-6550
MN Minneapolis, Comstrand, Inc. ... 612-574-9480
MO St. Louis, Electri-Rep ... 314-993-4421
NJ Fairfield, Tech. Applications & Mktg., Inc. ... 201-575-4130
NY Manlius, LamTec Sls. Corp. ... 315-682-4780
NC Cary, Electronic Sls., Inc. ... 919-467-8486
OH Centerville, Omega Sls., Inc. ... 513-434-5507
OH Cleveland, Omega Sls., Inc. ... 216-360-9400
OR Portland, Venture Elctrns., Inc. ... 503-624-0617
PA Trevose, Omega Sls. ... 215-244-4000
TX Austin, Norcom, Inc. ... 512-451-2757
TX Dallas, Norcom, Inc. ... 214-386-4888
TX Houston, Norcom, Inc. ... 713-778-0392
UT Midvale, Simpson Assoc. ... 801-566-3691
WA Bellevue, Venture Elctrns., Inc. ... 206-454-4594
WI Milwaukee, Carlson Elctrn. Sls. Co. ... 414-476-2790
Can Kanata, Ont., Electro Source, Inc. ... 613-592-3214
Can Pointe Claire, Que., Electro Source, Inc. ... 514-630-7486
Can Rexdale, Ont., Electro Source, Inc. ... 416-675-4490
Can Richmond, B.C., Blakewood Elctrn. Sys., Inc. ... 604-444-3344

BECK SYSTEMS INC., Beck Technology, 2354 Ave. C North, Saskatoon, SK, CAN S7L 5X5, Tel: 306-975-1080, FAX: 306-975-3993; Empl.: 7; *Sls. Mgr.:* Shane Simpson

BEEDE ELECTRICAL INSTRUMENT CO., INC., 175 South Main St., Penacook, NH 03303, Tel: 603-753-6362, FAX: 603-753-6201; FSC No.: 06555; Empl.: 350; *Sls. Mgr.:* Jeffrey L. Schindler; *Dist. Mgr.:* Diane Aldrich ... **D•1339**

Local Sales Offices & Reps

AL Huntsville, 20th Century Mktg. ... 205-772-9999
CA Carlsbad, FLW, Inc. ... 619-434-5251
CA Costa Mesa, F L W, Inc. ... 714-751-7512
CA Fremont, FLW, Inc. ... 510-651-6511
CA Oxnard, FLW, Inc. ... 805-984-0167
GA Norcross, 20th Century Mktg. ... 404-446-1999
IL Des Plaines, Saffro & Assocs. ... 708-299-7680
IN Carmel, Frank Kahsar Sls. ... 317-844-9353
MD Mt. Airy, Strayton Assocs., Inc. ... 301-831-7007
MA Canton, N.E.S. Elctrn. Rep. Co. ... 617-828-4835
MI Muskegon, Frank Kahsar Sls. ... 616-798-4451
MI Sterling Hghts., Frank Kahsar Sls. ... 313-795-3530
MO Independence, Gribble Sls. Engrg. Co. ... 816-796-4333
NJ Kenilworth, Shortess-Rawson & Assocs. ... 908-276-2525
NY Buffalo, NRM Mktg. ... 716-634-4300
NY Skaneateles, NRM Mktg. Grp. ... 315-685-8991
NY Spencerport, NRM Mktg. Grp. ... 716-352-9166
NC Raleigh, 20th Century Mktg. ... 919-790-9383
OH Cincinnati, Frank Kahsar Sls. ... 513-598-1484
OH Columbus, Frank Kahsar Sls. ... 614-252-4009
OH Elyria, Frank Kahsar Sls. ... 216-365-5219
OH Palma, Frank Kahsar Sls. ... 216-845-0103
PA Kulpsville, The James Dell Co. ... 215-584-4925
PA Pittsburg, Frank Kahsar Sls. ... 412-734-8797
TX Dallas, Southwest Elctrn. Industries ... 214-690-9881
TX Vidor, Southwest Elec. Ind. ... 409-786-1028
Can Brampton, Ont., Mod-Tronics, Ltd. ... 416-457-6322

Local Distributors

CA El Cajon, Meter Craft ... 619-258-8990
CA Hayward, Dynametron ... 510-786-9459
CA Los Angeles, EIL ... 213-685-7020
CA Sunnyvale, EIL ... 408-744-0271
CO Aurora, R & R Instrmn. ... 303-364-8325
CO Denver, EIL ... 303-534-4160
CO Denver, Process Meas. ... 303-937-7226
CT Middletown, E.I.L. Instrs. ... 203-346-6646
FL Edgewater, Southern Instrs. ... 904-427-3963
FL Hialeah, Kimball Elec. ... 305-822-5792
FL Palm Bay, EIL ... 407-725-8300
IL Bridge View, EIL ... 708-430-2292
IL Countryside, Inotek/Pacific Indicator .. 708-352-3500
IL Franklin Pk., Alca, Inc. ... 708-451-6644
KS Overland Pk., Brooks Elctrns. ... 913-648-3131
KY Louisville, E.I.L. Instrs. ... 502-454-3420
MD Hunt Valley, E.I.L. Instrs. ... 410-584-7400
MA Burlington, E.I.L. Instrs. ... 617-272-9450
MA Waltham, Calibron ... 617-894-6440
MI Ferndale, Ram Meter, Inc. ... 313-398-6767
NJ Pennsauken, EIL ... 609-488-0474
NJ Pompton Lakes, Instrument Masters .. 201-839-2876
NY Clarence, EIL ... 716-634-8500
NY Mastic Beach, Alternate Solution ... 516-399-7701
NC Charlotte, E.I.L. Instrs. ... 704-376-2237
OH Cleveland, Weschler Instr. ... 216-238-2550
OH Dayton, EIL ... 513-435-2134
OH Madison, Madison Elec. ... 216-428-6464
OH Middlefield, Bentronix ... 216-632-0606
PA Pittsburgh, E.I.L. Instrs. ... 412-823-2255
TN Knoxville, Brownell Elec. ... 615-966-3441
TX Beaumont, Straughn Elec. ... 409-838-4563
TX Dallas, Dallas Meter Tek ... 214-349-6044
TX Dallas, E.I.L. Instrs. ... 214-357-0297
TX Houston, American Analog ... 713-941-7265
TX Houston, E.I.L. Instrs. ... 713-271-3100
VA Norfolk, EIL ... 804-855-9553
VA Richmond, Meter Metrics ... 804-275-1431
WA Redmond, E.I.L. Instrs. ... 206-882-3222
WI Milwaukee, E-M Instrs. ... 414-272-7799
Can Ontario, Modtronics ... 416-457-6322
Can Quebec, Brunelle ... 819-563-9096
Can Toronto, EIL ... 416-624-6660

BEHLMAN
An Astrosystems Company

FAX: 516-328-1658

BEHLMAN ELECTRONICS INC., 6 Nevada Dr., Lake Success, NY 11042, Tel: 516-328-1600 ... **D•2244-2249**

Local Sales Offices & Reps

AZ Tempe, Trembly Assocs., Inc. ... 602-431-9417
CA Chatsworth (Southern), Technlgs. West ... 818-700-6426
CA San Francisco (Northern), RDX Corp. ... 510-568-5606
CA Ventura, Behlman Elctrns. ... 805-642-0660
CO Golden, Trembly Assocs., Inc. ... 303-279-3019
IL Wheeling, Ed Joyner & Co. ... 708-520-1200
KS Overland Park, Markline Technlgs. ... 913-681-8880
MD Hampstead, Tech. Instr. Sls. ... 301-239-4452
MI St. Claire Shores, Agren-Asher Co. ... 313-773-2220
MN Eden Prairie, Professional Mktg. ... 612-934-5939
MO Lake St. Louis, Markline Technlgs. ... 314-625-6222
NH Nashua, Intersell ... 603-880-6500
NM Albuquerque, Trembly Assocs., Inc. ... 505-266-8616
NY Lake Success, Behlman Elctrns. ... 516-328-1600
OK Tulsa, Acudata Inc. ... 918-743-1875
PA Lansdale (Eastern), Tech. Inst. Sls. ... 215-361-7850
PA Pittsburgh (Western), Instrmn. Sys. ... 412-823-7005
TX Houston, Acudata Inc. ... 713-580-2451
UT N. Salt Lake City, Trembly Assocs., Inc. ... 801-295-4703
WA Seattle, Datacom Assocs. ... 206-285-2525

BEHLMAN ELECTRONICS, INC., Astrosystems, 2021 Sperry Ave.,No. 18, Ventura, CA 93003, Tel: 805-642-0660, FAX: 805-642-0790; FSC No.: 53636 ... **D•2244-2249**

Local Sales Offices & Reps

AL Huntsville, Reynolds Assocs. ... 205-539-1485
AZ Tempe, Trembly Assocs. Inc. ... 602-431-9417
CA Chatsworth, Technlgs. West ... 818-700-6426
CA San Francisco, RDX Corp. ... 510-568-5606
CA Ventura, Behlman ... 805-642-0660
CO Golden, Trembly Assocs. Inc. ... 303-279-3019
FL Melbourne, Reynolds & Assocs. ... 407-259-7000
GA Duluth, Reynolds Assocs. ... 404-476-4992
IL Wheeling, Ed Joyner & Co. ... 708-520-1200
KS Overland Park, Markline Technlgs. ... 913-681-8880
MD Hampstead, Tech. Inst. Sls. ... 301-239-4452
MN Eden Prairie, Professional Mktg. Svcs. Inc. ... 612-934-5939
NH Nashua, Intersell ... 603-880-6500
NM Albuquerque, Trembly Assocs. Inc. ... 505-266-8616
NY Fayettsville, Martin P. Andrews ... 315-637-5291
OK Tulsa, Acudata Inc. ... 918-743-1875
PA Lansdale, Tech. Inst. Sls. ... 215-361-7850
PA Pittsburgh, Instrmn. Sys. Inc. ... 412-823-7005
TX Houston, Acudata Inc. ... 713-580-2451
TX Plano, Acudata, Inc. ... 214-424-3567
UT N. Salt Lake City, Trembly Assocs. Inc. ... 801-295-4703
WA Seattle, Datacom Assocs. ... 206-285-2525
Can Mississauga, Ont., Altus Technologies ... 416-670-0783

BEI

FAX: 619-931-1212

BEI MOTION SYSTEMS COMPANY, Corporate Off., 2111 Palomar Airport Rd., Ste. 250, Carlsbad, CA 92009, Tel: 619-931-1500; Empl.: 25 ... **B•1917**

Local Sales Offices & Reps

CA Garden Grove, BEI Motion Sys. Co. ... 714-534-5830
CA San Rafael, BEI Motion Sys. Co. ... 415-492-2840
CO Westminster, BEI Motion Sys. Co. ... 303-426-1566
GA Snellville, BEI Motions Sys. Co. ... 404-978-6301
IL Rockford, BEI Motion Sys. Co. ... 815-968-9528
MA Norwell, BEI Motion Sys. Co. ... 617-878-9820
MI Plymouth, BEI Motion Sys. Co. ... 313-451-0359
NJ Morristown, BEI Motion Sys. Co. ... 201-984-5600
OH Cincinnati, BEI Motion Sys. Co. ... 513-232-4545
PA Lancaster, BEI Motion Sys. Co. ... 717-299-6243
TX Cleburne, BEI Motion Sys. Co. ... 817-556-2211
WA Bellevue, Thorson Co. Northwest ... 206-455-9180
Can Willowdale, Willer Engrg., Ltd. ... 416-499-4421

BEI MOTION SYSTEMS COMPANY, Chatsworth Encoder Div., 9223 Deering Avenue, Chatsworth, CA 91311, Tel: 818-341-6161, FAX: 818-882-4553; Empl.: 120; *Sls. Mgr.:* Robert Kemp ... **B•1917**

Refer to BEI Motion Sys. Co., Corporate Off.,Carlsbad, CA for sales office information.

BEI MOTION SYSTEMS COMPANY, Computer Products Div., 1755 B La Costa Meadows Dr., San Marcos, CA 92069, Tel: 619-471-2600, FAX: 619-471-2675; Empl.: 30; *Sls. Mgr.:* Hank Robinson, Sls. Mgr. ... **B•1917**

Refer to BEI Motion Sys. Co., Corporate Off. Carlsbad, CA for sales off. info.

BEI MOTION SYSTEMS COMPANY, DIGITAL PRODS. DIV., See BEI Motion Systems Company,Prec. Sys. & Space Div.

BEI MOTION SYSTEMS COMPANY, Industrial Encoder Div., 7230 Hollister Ave., Goleta, CA 93117, Tel: 805-968-0782, FAX: 805-968-3154; Empl.: 60; *Sls. Mgr.:* Glenn Avolio ... **B•1917**

Refer to BEI Motion Sys. Co., Corporate Off., Carlsbad, CA for sales office information.

BEI MOTION SYSTEMS COMPANY, ITEK ENCODER DIV., See BEI Motion Systems Company, Prec. Sys. & Space Div.

BEI MOTION SYSTEMS COMPANY, Kimco Magnetics Div., 150 Vallecitos de Oro, San Marcos, CA 92069, Tel: 619-744-5671, FAX: 619-744-8815; Empl.: 60; *Sls. Mgr.:* Mike Lopez ..... **B•1917**

Refer to BEI Motion Systems Co., Corporate Off., Carlsbad, CA for sales office info.

BEI MOTION SYSTEMS COMPANY, Precision Systems & Space Division, 178 A Street, Needham Hgts., MA 02194, Tel: 617-455-1414, FAX: 617-455-6514; *Sls. Mgr.:* Marvin Kansky ..... **B•1917**

Refer to BEI Motion Systems Co., Corporate Off., Carlsbad, CA for sales office info.

BEI MOTION SYSTEMS COMPANY, Precision Systems & Space Division, P.O. Box 3838, Little Rock, AR 72203, Tel: 501-851-4000, FAX: 501-851-5476; Empl.: 80; *Sls. Mgr.:* Marvin Kansky, Sls. Mgr. ... **B•1917**

Refer to BEI Motion Sys. Co., Corporate Off., Carlsbad, CA for sales office information.

BELDEN WIRE AND CABLE COOPER INDS., See Cooper Industries/ Belden Div.

bel BEL FUSE INC.

FAX: 201-432-9542

BEL FUSE, 198 Van Vorst St., Jersey City, NJ 07302, Tel: 201-432-0463; Empl.: 225; *Sls. Mgr.:* A. Sutta; *Dist. Mgr.:* Dennis Ackerman ..... **A•1512, 1515-1523, 1692, 2276-2293; B•1340, 1344-1349; D•2074-2075**

Local Sales Offices & Reps

AL	Huntsville, INTEREP	205-881-1096
AZ	Phoenix, U.S. Sls.	602-451-1155
CA	Los Angeles, C & N Assocs.	805-254-5844
CA	San Jose, Meridian Tech Sls.	408-262-5474
CO	Boulder, Talisman Assoc.	303-444-7300
FL	Sanford, D Assocs.	407-321-9594
GA	Atlanta, Beacon Elctrns.	404-256-9640
IL	Chicago, LTD Tech.	708-773-2900
IN	Indianapolis, Insul Reps	317-469-1994
MN	St. Paul, Rockmore Sls.	612-941-1390
MO	Bridgeton, Dy-Tronix	314-291-4777
NJ	East Brunswick, Winch Sls.	908-613-1515
NM	Albuquerque, Syntech	602-264-7971
NY	Rochester, Tri-Tech	716-385-6500
NC	Raleigh, Beacon Elctns.	919-787-0330
OH	Columbus, A. Baier Co.	614-764-1144
PA	Hatboro, AQS Electro	215-674-3562
TN	Knoxville, Insul-Reps	615-691-7586
TX	Dallas, Oeler & Menelaides	214-361-8876
UT	Salt Lake City, Western Mktg.	801-268-9768
WI	Milwaukee, LTD Tech.	414-774-1006
Can	Toronto, Cantronics	416-297-8668
GA	Atlanta, Beacon Elect.	404-256-9640
IN	Indianapolis, Insul. Reps., Inc.	317-251-1994

BRILL ELECTRONICS
(510) 834-5888
[illegible] E. 10th St., Oakland, CA 94606
COOPER INDUSTRIES BELDEN
(310) 452-8002
1270 Olympic Bl., Santa Monica CA 90404

KS	Leawood, Dy-Tronix	913-339-6333
MN	St. Paul, Rockmore Sls.	612-941-1390
NY	Rochester, Tri-Tech Elec.	716-385-6500
NJ	New Brunswick, Winch Sls. Assocs.	201-613-1515
NC	Raleigh, Beacon Elect.	919-787-0330
OH	Cleveland, Arthur Baier Co.	216-461-6161
PA	Hatboro, AQS	215-674-3562
TN	Knoxville, Insul-Reps., Inc.	615-691-7586
PR	Hato Rey, Max Anderson Co., Inc.	809-751-2026
Can	Scarboro, Ont., Cantronics, Ltd.	416-297-8668

Delay Lines

FL	Longwood, D-Assocs., Inc.	407-830-8976
IL	Chicago, LTD	708-773-2900
GA	Atlanta, Beacon Elect.	404-256-9640
KS	Leawood, Dy-Tronix	913-339-6333
MN	S. St. Paul, Northport Engrg.	612-457-8000
IN	Indianapolis, Insul. Reps., Inc.	317-251-1994
NJ	E. Brunswick, Winch Sls. Assoc.	201-613-1515
MO	St. Louis, Dy-Tronix	314-291-4777
OH	Cleveland, Arthur Baier Co.	216-461-6161
NY	E. Rochester, Tri-Tech Elec.	716-385-6500
PA	Hatsboro, AQS	215-674-3562
NC	Raleigh, Beacon Elect.	919-787-0330
TX	Austin, Oeler & Menelaides	512-453-0275
TX	Dallas, Oeler & Menelaides	214-361-8876
TN	Knoxville, Insul. Reps.	615-691-7586
PR	Hato Rey, M. Anderson Co., Inc.	809-751-2020
Can	Scarboro, Ont., Cantronics, Ltd.	416-297-8668

Local Distributors

CT	Wallingford, Sager	203-265-4600
FL	Boca Raton, D & R	407-977-8751
FL	Orlando, Sager	407-240-3114
MD	Columbia, Sager	301-995-4900
MA	Hingham, Sager	617-749-6700
NH	Salem, Sager	603-898-1348
NJ	Sager	201-585-0029
NY	Hauppauge, Sager	516-348-1300
NC	Raleigh, Sager	919-850-9550
PA	Bristol, Aim Elctrns.	215-785-3500
PA	Philadelphia, Sager	215-464-4336
AL	Huntsville, CDI	205-883-7501
CA	El Segundo, Force Elctrns.	213-772-1324
CA	Hayward, Kea Elctrns.	415-887-2900
CA	San Diego, Sigma Elctrns.	619-565-2000
CA	San Jose, Force Elctrns.	408-943-1324
CT	Wallingford, Sager	203-265-4600
FL	Ft. Lauderdale, CDI	305-971-4950
FL	Orlando, Sager	407-240-3114
GA	Norcrosss, CDI	404-441-3320
MD	Columbia, Sager	301-995-4900
MA	Hingham, Sager	617-749-6700
MA	Marlboro, Hardware Specialty	617-481-8622
MN	New Brighton, Chris Elctrns.	612-631-2647
NH	Hudson, Bell Inds.	603-882-1133
NH	Salem, Sager	603-898-1348
NJ	Sager	201-585-0029
NY	Bohemia, Key Comps.	516-567-7500
NY	Hauppauge, Sager	516-348-1300
NC	Raleigh, CDI	919-787-7311
NC	Raleigh, Sager	919-850-9550
OR	Beaverton, Comp. Resources	503-641-8488
PA	Cornwall Hgts., Reliance Merchandising	215-638-8200
PA	Philadelphia, Sager	215-464-4336
VA	Falls Church, CDI	703-241-8227

BEL HYBRIDS & MAGNETICS, Bel Fuse Inc., 5362 W. 78TH St., Indianapolis, IN 46268, Tel: 317-876-0044, FAX: 317-876-0092; Empl.: 23; *Sls. Mgr.:* Warren Mitch ..... **A•1692**

Local Sales Offices & Reps

AL	Huntsville, Interep	205-881-1096
CA	Milpitas, Meridian	408-262-5474
FL	Longwood, D-Assocs.	407-830-8976
IL	Itasca, LTD Technlgs.	708-773-2900
IN	Indianapolis, Insul-Reps, Inc.	317-251-1994
IA	Cedar Rapids, Dy-Tronix	319-377-8275
KS	Wichita, Dy-Tronix Inc.	316-838-0884
MN	Eden Praire, Rockmore	612-941-1390
MO	Raytown, Dy-Tronix	913-229-6333
MO	St. Louis, Dy-Tronix	314-291-4777
NY	Hauppauge, CCI	516-273-5050
NC	Raleigh, Beacon Elctrns.	919-787-0330
OH	Cleveland, Arthur H. Baier, Inc.	216-461-6161
PA	Hatboro, AQS Electro	215-674-3562
TN	Knoxville, Insul-Reps	615-691-7586
TX	Austin, Oeler & Menelaides, Inc.	512-453-0275
VA	Charlottesville, DVS	804-973-0303
WI	Milwaukee, LTD Technlgs.	414-774-1000

BELL, FLOYD, INC., 897 Higgs Ave., Columbus, OH 43212, Tel: 614-294-4000, FAX: 614-291-0823; FSC No.: 56493; *Sls. Mgr.:* Tom Shain ..... **D•1026-1027**

Local Sales Offices & Reps

IL	Mt. Prospect, Robert Adams Sls. Co.	312-297-8733
MD	Columbia, Tyler Griffin Co.	301-995-1215
PA	Paoli, Tyler Griffin Co.	215-647-1550

F.W. BELL

FAX: 407-677-5765

BELL, F. W., INC., 6120 Hanging Moss Rd., Orlando, FL 32807, Tel: 407-678-6900; FSC No.: 18479; Empl.: 70; *Sls. Mgr.:* Stephen L. Dakel; *Dist. Mgr.:* Stephen L. Dakel ..... **B•1918; D•1152-1153, 1236-1237**

Local Sales Offices & Reps

AL	Birmingham, Southrep	205-304-8225
AZ	Tempe, Trembly Assoc.	602-431-9417
CA	Arcadia, Southwest Instr.	818-574-0049
CA	Milpitas, Maxim Electronic Sls.	408-946-6001
CO	Denver, Trembly Assoc.	303-279-3019
FL	Winter Springs, T Squared Mktg.	407-699-9992
GA	Newnan, South Rep	404-304-8225
IL	Palatine, Golbeck Milota Assoc.	708-705-0602
MD	Hampstead, Technical Instr. Sls.	301-239-4452
MA	Ashland, Sullivan Tech. Sls.	508-881-2215
NJ	Ridgewood, Ballou, Inc.	201-444-6990
NM	Albuquerque, Trembly Assoc.	505-266-8616
NC	Raleigh, Eastern Elctrns.	919-876-7591
OH	Beachwood, Electronic Salesmaster	216-831-9555
OR	Beaverton, NW Test & Measurement	503-645-9000
PA	Lansdale, Technical Instr. Sls.	215-361-7850
WA	Bellevue, NW Test & Measurement	206-881-8857
WI	Madison, Golbeck Milota Assoc.	608-222-7037
Can	Dorval, Que., Weiss Co.	514-685-6644

Local Distributors

AZ	Tempe, Trembly Assoc.	602-431-9417
ID	Boise, Radar Elec. Co. Inc.	208-336-2227
CA	Irwindale, Shafer Eng.	818-960-5402
CA	Milpitas, Maxim Electronic Sls.	408-946-6001
CA	Norco, Empire Instr.	714-279-6364
CA	Pomona, Inspection Tech.	714-626-2600
CA	San Marcos, Mitchell Instr.	619-744-2690
FL	Orlando, Brownell Electro	407-843-6776
OR	Portland, Radar Elec. Co.	503-232-3404
GA	Atlanta, P & R Instrs.	404-391-9117
GA	Forest Park, Brownell Electro	404-362-9009
GA	Marietta, Peach State Instr.	404-424-0447
IL	Crystal Lake, Right Distributors	815-459-0645
KY	Louisville, United Utility Supp.	502-451-2430
MD	Baltimore, Davis Instr.	410-358-3900
MD	Hunt Valley, E.L.L. Instrs.	410-584-7400
MA	N. Andover, Contact East	508-682-9844
MA	Sharon, Adcour	617-784-8123
MO	St. Louis, Indsl. Srv. Lab.	314-423-3141
NY	Rochester, Transcat	800-828-1470
NY	Whitestone, Power Electro Supply	718-767-1447
OH	Cleveland, Meter Master	216-351-1234
OH	Dayton, Electro Sls. Assoc.	513-426-5551
TX	Dallas, Seaton Elctrns.	214-980-9860
PA	McKeesport, Barno Radio Co.	412-751-5966
PA	Reading, Barbey Elctrns.	215-376-7451
SC	Charleston, Cameron Barkley Co.	803-745-2837
TN	Chattanooga, Edwin Bohr	615-877-8207
TN	Chattanooga, Edwin Bohr Elctrns.	615-877-8207
TX	Mesquite, Inspection Prods.	214-686-4275
VA	Richmond, Fidus	804-275-2302
WA	Seattle, Radar Elec. Co.	206-282-2511
Can	Mississauga, Ont., BCS Elctrns. Ltd.	416-602-8550
Can	Montreal, Que., Pro Jean	514-273-8331

J.W. MILLER

FAX: 310-515-1962

BELL INDS., J. W. Miller Div., 306 E. Alondra Blvd. P.O. Box 2859, Gardena, CA 90247-1059, Tel: 310-515-1720; FSC No.: 76493; Empl.: 30; *Sls. Mgr.:* Jeff Johnson ..... **A•1190-1195**

Local Sales Offices & Reps

AZ	Mesa, Fetty/Schoenduve, Inc.	602-844-8289
CA	J.W. Miller	310-515-1720
CA	Los Gatos, Shur Sls.	408-399-7487
CO	Denver, West, Inc.	303-477-8180
FL	Winter Park, HHP Assocs., Inc.	407-740-0320
GA	Buckhead, MFRS. Sls. & Mktg. Svcs.	404-342-3503
IL	Skokie, Specialized Mktg.	708-674-1111
IN	Carmel, Current Elctrn. Mktg., Inc.	317-844-1770
MD	Sykesville, DJC Elctrn. Sls., Inc.	410-795-7020
MA	Burlington, Conti-Younger Assocs., Inc.	617-273-1582

MI E. Detroit, Jack M. Thorpe Co. 313-779-6363
MN Eden Prairie, Electro Mark, Inc. 612-944-5850
MS Hattiesburg, Mfgs. Sls. & Mktg. Svcs. .. 601-264-4755
MO St. Louis, Lowell/Kangas Assocs. 314-821-4050
NJ Englewood, Epstein & Siebel Assoc. .. 201-569-7600
NY Marcellus, J.G. Welch Sales 315-673-1009
NY Rochester, J.G. Welch Sales 716-244-1100
NY Yonkers, Roburn Agencies, Inc. 914-968-1016
NC Raleigh, South Tech Sls. 919-571-1313
OH St. Mary's, Thomas Shelby & Co., Inc. 419-394-3377
OR Portland, Caruso-Camelleri Assoc. 503-246-5439
TN Memphis, MFRS. Sls. & Mktg. Svcs. ... 901-767-0801
TX Ft. Worth, Chet Wells & Co. 817-284-0261
WA Bellevue, Caruso-Camelleri Assoc. 206-455-8811
EXP N.Y., Yonkers, Roburn Agencies, Inc. .. 914-968-1016
Can Calgary, Alberta, Cana Rep Grp., Inc. .. 403-255-0294
Can Montreal, Que., Cana-Rep. Grp., Inc. 514-276-4477
Can Surrey, B.C., Cana Rep Grp., Inc. 604-599-1232

Local Distributors

CA Santa Clara, Cypress Elctrns. 408-980-2500
FL Ft. Lauderdale, Brothers Elctrns. 305-561-6700
IL Chicago, Newark Elctrns. 708-784-5100
IN Indianapolis, Custom Svc. Elctrn.
MN Thief River Falls, Digi-Key Corp. 218-681-6674
NJ E. Brunswick, Brothers Elctrns. 908-238-2200
WI Milwaukee, Marsh Elctrns. 414-475-6000
Can Willowdale, Ont., Electro Sonic, Inc. ... 416-494-1666

BELLOFRAM CORPORATION, State Route 2, Box 305, Newell, WV 26050, Tel: 304-387-1200, 1-800-733-2356, FAX: 304-387-1212; Empl.: 300; *Sls. Mgr.:* David Lewis; *Dist. Mgr.:* David Lewis

BELMONT INSTRUMENT CORP., Pinehurst Pk., 8 Cook St., Billerica, MA 01821, Tel: 508-663-0212, FAX: 508-663-0214

BELTING INDUSTRIES CO., INC., 20 Boright Ave., Kenilworth, NJ 07033, Tel: 908-272-8591, TELEX: 229854, FAX: 908-272-3825; Empl.: 125; *Sls. Mgr.:* Joseph Abramczyk

BEMCO, 2255 Union Place, Simi Valley, CA 93065, Tel: 805-583-4970, FAX: 805-583-5033; Empl.: 43; *Sls. Mgr.:* Glenn Elliott

BENCHMARQ MICROELECTRONICS, INC., 2611 Westgrove 109, Carrollton, TX 75006, Tel: 214-407-0011, FAX: 214-407-9845; Empl.: 120; *Sls. Mgr.:* Jim Vernon

BENDIX CONNECTOR OPERATIONS, See Amphenol, Bendix Connector Ops.

BENDIX CORP., MOTOR COMPS. DIV., See Facet Entprs.

BENJAMIN INTERNATIONAL, INC., 3677 23rd Ave. South, Lake Worth, FL 33461, Tel: 407-533-0064, FAX: 407-547-2844

BENTLY NEVADA CORP., P.O. Box 157, Minden, NV 89423, Tel: 800-227-5514, 702-782-3611, TELEX: 354437, FAX: 702-782-9253; FSC No.: 1561105

BERG ELECTRONICS

FAX: 302-892-1274,5

BERG ELECTRONICS, 150 Corporate Center Dr., Ste. 201, Camp Hill, PA 17011, Tel: 800-237-2374; *Dist. Mgr.:* Phil Raudensky, Dir. Natl. Distbn.

Local Sales Offices & Reps

PA Camp Hill, Berg Elctrns. 800-237-2374

Local Distributors

AL Huntsville, Hammond Elctrns. 205-830-4764
AZ Phoenix, Aerospace Computer SW ... 602-582-2779
AZ Phoenix, Bell Ind. 602-966-7800
AZ Phoenix, Force Elctrns. 602-437-1060
AZ Tempe, Deanco/Acacia Div. 602-894-2874
AZ Tempe, TTI 602-431-1191
CA El Segundo, Force Elctrns. 213-772-1324
CA Fremont, Deanco/Acacia Div. 510-623-7500
CA Hawthorne, Bell Inds. 213-757-8381
CA Irvine, Deanco/Acacia Div. 714-660-0834
CA Los Angeles, TTI 818-891-8885
CA LosAngeles, Bell Ind. 310-826-2355
CA Orange County, Bell Inds. 714-895-7801
CA Orange County, Capstone Elctrns. 714-730-0349
CA Orange County, TTI 714-641-9393
CA Sacramento, Bell Ind. 916-652-0414
CA San Carlos, LoDan West 415-592-4600
CA San Diego, Bell Ind. 619-268-1277
CA San Diego, Deanco/Acacia Div. 619-597-0577
CA San Diego, Force Elctrns. 619-569-9661
CA San Diego, TTI 619-748-2025
CA San Jose, Compass Comps. 408-432-7575
CA San Jose, TTI 408-946-5577
CA Santa Clara, Force Elctrns. 408-748-1324
CA Santa Fe Springs, Bell/Cable & Components 213-921-3611
CA Sante Fe Springs, Bell/Corp. Warehouse 213-921-3611
CA Sante Fe Springs, Bell/Just-In-Time .. 213-921-3611
CA Sunnyvale, Bell Inds. 408-734-8570
CA Ventura, Bell Inds. 818-879-9494
CO Denver, Bell Inds. 303-424-1985
CO Denver, Capstone Elctrns. 303-375-1300
CO Denver, TTI 303-429-6806
CO Lakewood, Deanco/Acacia Div. 303-375-1300
CT Danbury, Bell Inds. 203-269-6801
CT Wallingford, Sager Elctrns. 203-265-4600
CT Wallingford, TTI 203-284-7474
CT Yalesville, Deanco/Schaal Div. 203-265-4600
DC Washington, Resco/Washington 301-937-9100
FL Ft. Lauderdale, Hammond Elctrns. 305-973-7103
FL Largo, LoDan Elctrns. 813-538-2600
FL Orlando, Bell Inds. 407-339-0078
FL Orlando, Deanco Inc. 407-671-5100
FL Orlando, Hammond Elctrns. 407-849-6060
FL Orlando, Sager Elctrns. 407-354-1130
FL Orlando, TTI 407-859-1000
GA Atlanta, Bell Inds. 404-446-7167
GA Atlanta, Deanco Inc. 404-429-0126
GA Norcross, Hammond Elctrns. 800-241-5437
GA Norcross, TTI 404-662-0911
IL Addison, Belford Elctrns. Inc. 708-691-1100
IL Chicago, Bell Inds. 708-640-1910
IL Chicago, Capstone Elctrns. 708-250-0300
IL Chicago, LoDan Elctrns. 708-398-5311
IL Chicago, Newark Elctrns. 312-784-5100
IL Chicago, TTI 708-884-6500
IL Chicago, Waldom Elec. 312-585-1212
IL Wheaton, Deanco/Mega Div. 708-665-6214
IN Fort Wayne, Bell Inds. 219-423-3422
IN Indianapolis, Bell Inds. 317-875-8200
IN Indianapolis, Bell/Just-In-Time 317-876-3740
IN Indianapolis, Meunier Elctrn. Supply ... 317-635-3511
MD Baltimore, Bell Inds. 410-290-5100
MD Baltimore, Resco/Baltimore 410-931-8200
MD Columbia, Sager Elctrns. 301-995-4900
MD Columbia, TTI 410-995-1331
MD Gaithersburg, Deanco, Inc. 301-948-5444
MA Boston, Bell Inds. 508-474-8880
MA Boston, Capstone Elctrns. 800-388-2277
MA Burlington, Deanco/Schaal Div. 617-272-7940
MA Hingham, Sager Elctrns. 617-749-6700
MA Tewksbury, TTI 508-851-2000
MN Minneapolis, Aero-Space Computer Supp. 612-884-4725
MN Minnetonka, TTI 612-933-8555
NH Salem, Sager Elctrns. 603-898-1348
NJ Fairfield, Bell Inds. 201-227-6060
NJ Fairfield, Deanco Inc. 201-575-7960
NJ Mt. Laurel, TTI 609-234-6400
NM Albuquerque, Bell Inds. 505-292-2700
NY Hauppauge, Sager Elctrns. 516-348-1300
NY Ithaca, Deanco, Inc. 607-257-4444
NY Ronkonkoma, Conco Elctrns. 516-467-8200
NY Ronkonkoma, TTI 516-737-2000
NC Greensboro, Hammond Elctrns. 919-275-6391
NC Raleigh, Capstone Elctrns. 919-954-0600
NC Raleigh, Deanco, Inc. 919-851-2065
NC Raleigh, Sager Elctrns. 919-850-9550
OH Akron, AESCO Elctrns. 216-762-8818
OH Columbus, Aesco Elctrns. 614-882-6762
OH Dayton, Bell Inds. 513-435-8660
OH Dayton, TTI 513-898-8330
OH Independence, TTI 216-328-9755
OK Tulsa, Norvell Elctrns. 918-628-1916
OR Beaverton, Acacia/Deanco 503-646-3377
OR Beaverton, Almac/Arrow 503-629-8090
OR Beaverton, Component Resources Inc. 503-641-8488
OR Portland, Bell Inds. 503-635-6500
OR Tigard, TTI, Inc. 503-684-3707
PA Bristol, Bell/Wire & Cable 215-788-5000
PA Mars, Sager Elctrns. 412-772-2233
PA Philadelphia, Bell Inds. 215-953-2899
PA Philadelphia, Capstone Elctrns. 609-596-7500
PA Philadelphia, Sager Elctrns. 215-464-4336
PA Trevose, Bell/Cable & Components ... 215-990-9183
SC Greenville, Hammond/Emsco 803-233-4121
TX Austin, Norvell Elctrns. 512-343-2900
TX Dallas, Bell Inds. 214-690-0466
TX Dallas, Capstone Elctrns. 214-380-9049
TX Dallas, Force Elctrns. 214-247-9955
TX Dallas, Norvell Elctrns. 214-233-0020
TX Fort Worth, Allied 817-595-3500
TX Fort Worth, TTI 817-595-3100
TX Ft. Worth, TTI, Inc. 817-740-9000
TX Ft. Worth, TTI, Inc. (Connector Div.) ... 817-834-2202
TX Houston, Force Elctrns. 713-561-8644
TX Houston, Norvell Elctrns. 713-462-1666
UT Salt Lake City, Bell Inds. 801-255-9611
VA Charlottesville, Virginia Elctrn. Comp. 804-296-4184
WA Bellevue, Almac/Arrow 206-643-9992
WA Kent, Components Resources 206-454-8666
WA Redmond, Deanco/Acacia Div. 206-881-5566
WA Redmond, TTI 206-882-0291
WI Milwaukee, Bell Inds. 414-547-8879
Intl Ft. Worth, TX, TTI, Inc. 817-847-6666
Can Ottawa, Wackid Radio 613-728-1821

BERG, W. M., INC., 499 Ocean Ave., East Rockaway, NY 11518, Tel: 516-599-5010, TELEX: 9103506176, FAX: 516-599-3274; Empl.: 150; *Sls. Mgr.:* Carol McDevitt

THE BERGQUIST COMPANY

FAX: 612-835-4156

THE BERGQUIST CO., 5300 Edina Ind'l., Minneapolis, MN 55439, Tel: 800-347-4572; FSC No.: 55285; Empl.: 275; *Sls. Mgr.:* Bob Savage; *Dist. Mgr.:* Duane Dungey ..... **B•1822-1823; C•1654-1657, 1710-1711**

Local Sales Offices & Reps

CA Canyon Country, Bergquist Co. 805-252-9930
CA San Mateo, Larson Assoc. 415-358-9559
CO Westminister, Glennmar, Inc. 303-423-1572
DE Newark, Bergquist Co. 302-738-5080
GA Atlanta, Bergquist Co. 404-816-7113
MI Minneapolis, Bergquist 612-835-2322
MA Brookline, Harman Assocs. 617-232-6687
MN Eden Prairie, Hanna-Lind 612-942-8554
NY No. Syracuse, Leonard D. Allen 315-458-7470
OH Cleveland, Staff Co. 216-331-5100
OR Tigard, Elctrn. Comp. Sls. 503-245-2342
TX Lewisville, Bergquist 214-317-1502
WA Mercer Island, Elctrn. Comp. Sls. 206-232-9301

Local Distributors

AL Huntsville, Component Dist., Inc. 205-883-7501
CA Fountain Valley, Components Center 213-582-0667
CA Mtn. View, Energy Sls. 415-969-0800
CO Aurora, JET Elctrns. 303-364-1000
FL Ft. Lauderdale, Components Dist. Inc. 305-973-6915
GA Norcross, Components Dist. Inc. 404-441-3320
IL Chicago, NEP Elctrns. 312-625-8400
NC Raleigh, Components Dist. Inc. 919-834-9465
TX Dallas, Components Dist. Inc. 214-694-0373
WA Redwood, Murphy Elctrns. 206-881-1234

BNC DIGITAL DELAY AND LIGHT PULSE GENERATORS

FAX: 510-236-3105

BERKELEY NUCLEONICS CORP., 1121 Regatta Sq., Richmond, CA 94804, Tel: 510-234-1100; Empl.: 30; *Sls. Mgr.:* E. J. Buchs ..... **D•1239**

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BERKSHIRE TRANSFORMER CORP., 3 Segar Mtn. Rd., P O Box 129, Kent, CT 06757, Tel: 203-927-3541, FAX: 203-927-4583; FSC No.: 89870; Empl.: 45; *Sls. Mgr.:* George Kraemer

BERK-TEK INC., 132 White Oak Road, New Holland, PA 17557-9722, Tel: 717-354-6200, FAX: 717-354-7944; FSC No.: 19449; Empl.: 350; *Sls. Mgr.:* John Osborn, Sls. Mgr.; *Dist. Mgr.:* Allan Schoonover, V.P. Dist. Sls.

BERMAR CORP., P.O. Box 12844, Research Triangle Park, NC 27709, Tel: 919-489-4316, FAX: 919-419-1394; *Sls. Mgr.:* M. Conland

BERTAN
THE HIGH VOLTAGE PEOPLE

FAX: 516-935-1766

BERTAN HIGH VOLTAGE, 121 New South Rd., Hicksville, NY 11801, Tel: 516-433-3110; FSC No.: 6130; Empl.: 140; *Sls. Mgr.:* Paul Oranges ..... **D•1618-1623**

Local Sales Offices & Reps

AL	Huntsville, Currie, Peak, Frazier	205-536-1506
AZ	Phoenix, Thor Engrg.	602-437-1463
CA	Encino, King-Way Assoc.	818-788-4124
CA	Los Altos, Cain-White & Co.	415-948-6533
CO	Boulder, H. Bass Assocs.	303-530-7509
CT	Farmington, Ray Perron & Co., Inc.	203-673-4825
GA	Norcross, Currie, Peak, Frazier	404-449-7662
IL	Arlington Hgts., Coombs Assocs.	312-439-9810
KS	Lenexa, Midtec Assoc.	913-541-0505
MD	Randallstown, Beacon North	703-591-1300
MA	Needham, Ray Perron & Co., Inc.	617-449-6162
MI	Detroit, Geotronix, Inc.	216-659-6100
MN	Minneapolis, Electronic Instrs.	612-374-5628
MO	St. Louis, Midtec Assoc.	314-275-8666
NM	Albuquerque, Thorson/Desert States Co.	505-293-8555
NY	Elmont, Crane & Egert Corp.	516-872-0800
NY	Hicksville, Bertan Assocs., Inc.	516-433-3110
NY	Liverpool, Northern Tech. Sls. Co.	315-451-1091
OH	Cleveland, Geotronix	216-659-6100
PA	Audubon, Holmes Assocs.	215-666-0636
TX	Dallas, Automated Motion Control	214-340-4192
UT	Bountiful, H. Bass Assoc.	801-295-7100
VA	Fairfax, Beacon North	703-591-1300
WA	Bellevue, Cain-White & Co., Inc.	206-462-2118
WI	Milwaukee, Coombs Assocs.	414-351-6123

BERTSCH U.S.

FAX: 619-727-4436

BERTSCH U.S., 1280 Liberty Way, Vista, CA 92083, Tel: 619-727-7420; FSC No.: 619-727-4436; *Sls. Mgr.:* B. Linko ..... **B•1242-1243**

BEST POWER TECHNOLOGY, INC., P.O. Box 280, Necedah, WI 54646, Tel: 608-565-7200, 800-356-5794, TELEX: 701934, FAX: 608-565-2221; Empl.: 6000; *Sls. Mgr.:* Donald Soe

BEST TECHNOLOGY

FAX: 206-382-0186

BEST TECHNOLOGY INC., 400 Boren Ave. North, Seattle, WA 98109, Tel: 206-382-1300; Empl.: 8 ..... **B•1863**

Local Sales Offices & Reps

CA	Mountain View, Straube Assocs.	415-969-6060
CO	Westminster, Straube Assocs.	303-426-0890

BETA AUTOMATION, INC., 3541 Old Conejo Rd., Newbury Park, CA 91320, Tel: 805-499-5785, FAX: 805-499-9071; Empl.: 8

BETA PHASE, 1200 Chrysler Dr., Menlo Park, CA 94025, Tel: 415-494-8410, FAX: 415-853-8228

BETA REVIEW, INC., PO Box 38, Millwood, VA 22646, Tel: 703-837-1436, FAX: 703-837-3063; Empl.: 2; *Sls. Mgr.:* Norman M. Fine

BT

FAX: 508-842-0748

BETATHERM CORP., 910 Turnpike Rd. (Rte. 9), Shrewsbury, MA 01545, Tel: 508-842-0516; Empl.: 80 ..... **B•1864-1869**

BETA TRANSFORMER TECH. CORP., ILC Data Device Corp., 40 Orville Drive, Bohmia, NY 11716, Tel: 516-244-7393, FAX: 516-244-8893; FSC No.: 64948; Empl.: 80; *Sls. Mgr.:* Carol Sauer, V.P.

BEY ELECTRIC, INC., 362 Main St., Box 548, Lincoln Park, NJ 07035, Tel: 201-694-5000, FAX: 201-694-7975; *Sls. Mgr.:* Fred DeMauro, Gen. Mgr. ..... **A•2295**

BG ELECTRONICS, EPC Corp., 519 South 5th Avenue, Mt. Vernon, NY 10550-4430, Tel: 914-664-5591, FAX: 914-664-4729; FSC No.: 33791; Empl.: 6; *Sls. Mgr.:* Don Edwards

B-G INSTRUMENTS, INC., Route 1, Box 258, Mead, WA 99021, Tel: 206-567-5000, FAX: 509-238-4920; *Sls. Mgr.:* John Baum ..... **D•1083**

Local Sales Offices & Reps

WA	Spokane, B-G Instrs., Inc.	509-238-4757

B. G. LABORATORIES, INC., 75 Travis Ave., Binghamton, NY 13904, Tel: 607-722-2376, FAX: 607-722-4204; FSC No.: 26522; Empl.: 70

BH ELECTRONICS, INC., 12219 Wood Lk. Dr., Burnsville, MN 55337, Tel: 612-894-9590, FAX: 612-894-9380; FSC No.: 08450; Empl.: 300; *Sls. Mgr.:* Fred LaMarche ..... **A•1196-1197, 2296-2297**

Local Sales Offices & Reps

AZ	Fountain Hills, Halbar Assocs.	602-837-2464
CA	San Mateo, Halbar North, Inc.	415-349-4700
CA	Van Nuys, Halbar Assocs.	818-906-3941
CO	Denver, Electro Comp. Sys.	303-762-9576
IL	Wheaton, EMTronics	708-665-6222
MA	Norwood, Tom Maguire Assocs.	617-551-0500
MI	Southfield, Chapman Tech. Assocs.	313-352-1645
MN	Osseo, Gaffney Sls. Co.	612-425-5484
NJ	Montville, Astrum Sls.	201-263-8438
NC	Raleigh, Tingen Tech. Sls.	919-870-6670
OH	Worthington, R J Mktg.	614-888-7638
TX	Dallas, Precision Sls.	214-701-9031
WA	Redmond, Halbar PNW, Inc.	206-882-0990
WI	Theinsville, TFL Assoc.	414-242-6800

BIBCO, INC., 326 East Main, Benton Harbor, MI 49022, Tel: 616-925-8445, 800-851-5701, FAX: 616-925-3081; Empl.: 150; *Sls. Mgr.:* Phil Wilcox

BICC-VERO ELECTRONICS, INC., 1000 Sherman Ave, Hamden, CT 06514, Tel: 203-288-8001, 1-800-242-2863, TWX: 510-227-8890, FAX: 203-287-0062; Empl.: 50; *Sls. Mgr.:* Richard Milne

BICRON ELECTRONICS, 50 Barlow Street, Canaan, CT 06018, Tel: 203-824-5125, FAX: 203-824-1137; FSC No.: 10617; Empl.: 120; *Sls. Mgr.:* Frank Pierzga ..... **A•2299-2301; B•1627, 1919**

Local Sales Offices & Reps

AL	Madison, Southern Elec. Rep.	205-461-8925
CA	San Clemente, ATA Assocs.	714-661-9700
CO	Denver, Omega, Ltd.	303-762-1921
NH	Bow, George T. Molleur	603-228-0557
NY	Pittsford, W.A. Franklin Sls.	716-248-8251
PA	Pittsburgh, S.K.A. Co.	203-582-5897
UT	Salt Lake City, Omega, Ltd.	303-762-1921
WI	Milwaukee, KMA Sls. Co.	414-259-1771

BIKOR, Microsemi Corporation, 1504 W. 228th St, Torrance, CA 90501, Tel: 213-539-6320, FAX: 213-539-0296; FSC No.: 58996; Empl.: 70; *Sls. Mgr.:* James Rorke

BINDICATOR, P.O. Box 61009, 1915 Dove St., Port Huron, MI 48061-0009, Tel: 313-987-2700, TWX: 810-231-5261 BINICATOR P THY, FAX:; Empl.: 60; *Sls. Mgr.:* Rick Secord; *Dist. Mgr.:* Rick Ayers

BIOMATION INSTRUMENTS, 335 Perth St., PO Box 156, Almonte, Ont., Canada K0A1A0, Tel: 613-256-2821, FAX: 613-256-5872; FSC No.: OAG53; Empl.: 3; *Sls. Mgr.:* Andy Guest

BIOMATION, 19050 Pruneridge Ave., Cupertino, CA 95014-0718, Tel: 408-988-6800, FAX: 408-988-1647; *Sls. Mgr.:* John Adam; *Dist. Mgr.:* Walt Klees

BIOMEDICAL TECHNOLOGY, Triangle Biomedical Sciences, Inc., 2604G Carver St., Durham, NC 27705, Tel: 919-471-2237, FAX: 919-477-5883; Empl.: 8

BIOSOFT, Acropolis Computers Ltd., P.O. Box 10938, Ferguson, MO 63135, Tel: 314-524-8029, FAX: 314-524-8129

BIRD ELECTRONIC CORP., 30303 Aurora Rd., Cleveland, OH 44139-2794, Tel: 216-248-1200, TELEX: 706898 Bird Elec. UD, FAX: 216-248-5426; FSC No.: 70998; Empl.: 267; *Sls. Mgr.:* William Yochum, VP of Sls. & Mktg.; *Dist. Mgr.:* Greg Johns, Sls. Mgr.

BIRTCHER CORP., See EG & G Birtcher

BISHOP ELECTRONICS CORP., 3729 San Gabriel River Pkwy., Pico Rivera, CA 90660, Tel: 310-695-0446, 310-692-9391, FAX: 310-692-4008

BIT 3 COMPUTER CORPORATION, 8120 Penn Avenue S., Minneapolis, MN 55431-1393, Tel: 612-881-6955, FAX: 612-881-9674; FSC No.: 7Y590; *Sls. Mgr.:* Merle Lonnon

Bivar

FAX: 714-951-3974

BIVAR, INC., 4 Thomas, Irvine, CA 92718, Tel: 714-951-8808, TELEX: 852348; FSC No.: 32559; Empl.: 20; *Sls. Mgr.:* Thomas Silber; *Dist. Mgr.:* Thomas Silber ..... **C•1537**

Local Sales Offices & Reps

AZ	Phoenix, Jarko Assocs.	602-596-8533
AZ	Tempe, Jarko Assocs.	602-596-8533
CA	Chatsworth, Alatec	818-727-7800
CA	Cupertino, Prism Tech. Sls.	408-366-6766
CO	Englewood, Delltron Co.	303-741-2122
GA	Norcross, Electro-Mech Sls.	205-447-6478
IL	Downers Grove, Richmar Elec. Corp.	708-968-0118
IN	Indianapolis, Richmar Elec. Corp.	317-577-9950
IA	Iowa City, Richmar Elctrns.	319-354-8894
MN	Minneapolis, Holmgren Assocs.	612-574-9983
MA	Norwood, The MacInnis Co.	617-762-8090
NY	Fairport, Senntec Sls.	716-425-3954
NC	Raleigh, Electro-Mech Sls.	919-790-9300
OH	Cleveland, Marlow Assocs.	216-831-8232
NY	Glen Cove, Dyno Rep, Inc.	516-676-1598
OR	Beaverton, Eclipse Mktg. Grp.	503-642-1661
PA	West Chester, All-Tech Mktg.	215-344-0134
TX	Plano, Richmar Elec. Corp.	214-424-8388
WA	Redmond, Eclipse Mktg. Grp.	206-885-6991
WI	Butler, Richmar Elec. Corp.	414-781-1730
Can	Markham, Ont., Avotronics, LTD.	416-475-2024

Local Distributors

AL	Huntsville, All American	206-837-1555
AL	Huntsville, Century Fasteners	205-883-5344
AZ	Phoenix, Aero-Space SW.	602-582-2779
AZ	Phoenix, EKO Sales	602-437-4646
AZ	Tucson, PSN Distbn., Inc.	602-623-9800
AR	Little Rock, Carlton Bates Co.	501-562-9100
CA	Chatsworth, Jacon Fasteners	818-700-2901
CA	Fountain Valley, Components Ctr.	714-979-0433
CA	Fremont, Alatec	415-657-7701
CA	Fremont, Vic/Tal Sls.	415-651-6420
CA	Manhattan Beach, Prime Electro Prods.	213-379-3642
CA	Milpitas, MS Inserts	408-946-6565
CA	Mission Hills, Coast Air Inc.	818-898-2288
CA	Mission Viejo, Opto Plus, Inc.	714-380-8654
CA	Monrovia, Erik-A-Elctrn. Distb.	818-574-1020

CA North Hollywood, Elctrn. Hardware Ltd. 818-982-6100
CA Oxnard, R. C. Dudek 805-988-4882
CA San Diego, Western Fasteners 619-292-5115
CA San Jose, R. C. Dudek 408-321-9011
CA Santa Ana, BDS Elctrns. 714-662-1050
CA Santa Clara, Components Ctr. 408-988-3751
CA Torrance, MS Inserts 213-539-1530
CO Littleton, Indelco 303-795-3431
CO Wheatridge, Colorado Elctrn. Hdwr. ... 303-431-4334
CT Milford, Plastic & Metal Comps. Co. ... 203-877-2723
CT Wallingford, Midstate Elctrns. 203-265-9900
FL Apopka, Tropic Fasteners 407-880-4777
FL Delray Beach, Fastbolt Corp. 407-272-3100
FL Largo, Elctrn. Precepts of FL 813-544-3636
FL Pompano Bch., Peerless Radio 305-973-4141
FL Winter Park, Servtronics 407-677-5191
GA Norcross, Atlanta Hardware Specialty 404-449-3000
GA Peachtree City, Engineered Comps. ... 404-487-7600
IL Chicago, EMF 312-889-8323
IL Downers Grove, S.W. Anderson Co. ... 708-964-2600
IL Elmhurst, Miltex Sls. 708-941-7100
IL Lisle, Comps. Inc. 312-852-7707
IN Carmel, Altex Elctrns. 317-848-1323
IN Indianapolis, MAR Elctrns. 317-633-6699
MD Beltsville, Petricko Sls. 301-937-4960
MD Gaithersburg, Capital Fasteners 301-948-9310
MA Ashland, Quality Comps. 508-881-6504
MA Billerica, MS Inserts 508-670-5600
MA Marlborough, Hardware Spec. Co. 508-481-8622
MA Waltham, Electronic Fasteners 617-890-7780
MA Winchester, Webb Distbn. 617-729-5800
MI Livonia, Tri-West Prods. 313-422-7900
MN Bloomington, Aero-Space Computor Supp. 612-884-4725
MN Eden Prairie, S. W. Anderson Co. 612-934-2700
MN Hibbing, Minn-Tech Elctrns. 218-267-5228
MN New Brighton, Chris Elctrns. 612-631-2647
MO St. Peters, Heartland Elctrns. 314-928-6010
NH Manchester, Crown Comps. 603-626-1717
NJ So. Hackensack, Fastbolt Corp. 201-440-9100
NY Bohemia, Key Comps. 516-567-7500
NY Buffalo, Summit Dists. 716-887-2800
NY Elmhurst, Century Fasteners 718-446-5000
NY Holtsville, Tower Fastener Co. 516-289-8800
NY Long Island City, Hardware Specialty Co. 718-361-9393
NY Mt. Vernon, All American 914-699-2224
NY Rochester, Masline Elctrns. 716-546-5373
NC Raleigh, Century Elctrn. Comps. 919-782-2116
NC Raleigh, Century Fasteners 919-787-1800
OH Cincinnati, Hughes-Peters 513-351-2000
OH Columbus, Hughes-Peters 614-294-5351
OH Englewood, ADS 513-836-8636
OH Solon, Repco 216-248-8900
OR Beaverton, Component Resources 503-641-8488
OR Beaverton, Murphy Elctrns. 503-642-2001
PA Harrisburg, Ad-Tech Elctrns. 717-561-9905
PA Huntingdon Valley, Plastic & Metal Prods. 215-322-2000
PA Norristown, Century Elctrns. 215-631-5400
PA Philadelphia, Shap Elctrns. 215-969-3300
SC West Columbia, Century Fasteners ... 803-791-1800
TX Dallas, Global Fasteners 214-340-6068
TX Richardson, RSC Elctrns. 214-644-3444
WA Redmond, Murphy Elctrns. 206-881-1234
WA Seattle, Component Resources 206-454-8666
WA Seattle, Radar Elec. Co. Inc. 206-282-2511
EXP CA/Bakersfield, Gray-Weatherhead Equip. 805-397-4281
Can Mississauga, Ont., Gould Fasteners ... 416-677-8253
Can Ontario, Rush Elctrns. Ltd. 416-677-7280
Can Richmond Hill, Ont., Irwin Indl. 416-889-9100
Can Scarborough, Ont., Carsten Elctrns. ... 416-495-9999
Can St. Laurent, Quebec, Carsten Elctrns. 514-334-8321
Can Ste-Foy, Que., Crobel LTE 418-687-1171
Can Surry, British Columbia, Memco 604-590-1553

BIW CABLE SYSTEMS, INC., 22 Joseph E. Warner Blvd., N. Dighton, MA 02764, Tel: 508-520-1200, FAX: 508-541-8951; Empl.: 230; *Sls. Mgr.:* S. Adams

BKC SEMICONDUCTORS INCORPORATED., 6 Lake Street, Lawrence, MA 01841, Tel: 508-681-0392, FAX: 508-681-9135; FSC No.: 66891; Empl.: 110; *Sls. Mgr.:* Elizabeth J. Pucci; *Dist. Mgr.:* Patricia Sullivan ..... **A•2131-2133**

Local Sales Offices & Reps
AL Huntsville, Giesting 205-830-4554
AZ Scottsdale, BKC Western Sls. Off. 602-951-8010
CA Chatsworth, Wes-K Raltech 818-700-0933
CA San Jose, Loroco Sls. 408-436-8770
CO Englewood, Comp Sls. 303-779-8060
FL Altamonte Spr., Kinetic 407-339-3855
FL Deerfield Bch., Kinetic 305-480-6040
FL Palm Harbor, Kinetic 813-934-3768
GA Duluth, Giesting 404-476-0025
ID Meridan, Comp Sls. 208-888-3554
IL Elk Grove Vl., Oasis 708-640-1850
IN Carmel, Giesting 317-844-5222
IA Cedar Rapids, Oasis 319-377-8738
KY Versailles, Giesting 606-873-2330
MD Baltimore, Tai 410-732-5353
MA Salem, Diamond Ltd. 508-744-2050
MA Westborough, Anchor 508-898-2724
MI Coloma, Giesting 616-468-4200
MI Comstock Pk., Giesting 616-784-9437
MI Livonia, Giesting 313-478-8106
MN Burnsville, 2M Sls. 612-890-7774
NJ Moorestown, Tai 609-778-5353
NY N. Syracuse, Entec Grp. 315-458-7936
OH Cincinnati, Giesting 513-385-1105
OH Cleveland, Giesting 216-261-9705
OH Columbus, Giesting 614-459-4800
OR Tigard, Vantage 503-620-3280
PA Pittsburgh, Giesting 412-828-3553
TX Austin, Mrep 512-250-0820
TX Dallas, Mrep 214-484-5711
UT Midvale, Comp Sls. 801-561-5099
VA Charlottesville, Tai 804-971-7840
WA Bellevue, Vantage 206-455-3460
WI Brookfield, Oasis 414-782-6660
Can Kanata, Indigo 613-591-1053
Can Mississauga, Indigo 416-670-0284
Can Quebec, Indigo 514-696-6104

Local Distributors
AL Huntsville, Nu Horizons 205-722-9330
CA Agoura Hills, Zeus 818-889-3838
CA Costa Mesa, Hamilton/Avnet 714-641-4199
CA San Diego, Zeus 619-277-9681
CA San Jose, All American 408-943-1200
CA San Jose, Zeus 408-629-4789
CA Sunnyvale, Hamilton/Avnet 408-743-3300
CA Torrance, All American 310-320-0240
CA Walnut, ACI 714-594-1731
CA Woodland Hills, Hamilton/Avnet 818-594-0404
CA Yorba Linda, Zeus 714-921-9000
CT Killingworth, ACI 203-663-3311
CT Monroe, Nu Horizons 203-265-0162
FL Ft. Lauderdale, Nu Horizons 305-735-2555
FL Miami, All American 305-621-8282
FL Oviedo, Zeus 407-365-3000
FL Sunrise, All American 305-572-7999
FL Winter Park, Hamilton/Avnet 407-657-3300
GA Norcross, Nu Horizons 404-416-8666
IL Bensenville, Hamilton/Avnet 708-860-7780
MD Columbia, Nu Horizons 410-995-6330
MD Columbia, Zeus 301-997-1118
MA Peabody, Hamilton/Avnet 617-532-3701
MA Wakefield, All American 617-246-2300
MA Wakefield, Nu Horizons 617-246-4442
MA Wakefield, Zeus 617-246-8200
MA Woburn, ACI 617-935-7230
MN Eden Prairie, All American 612-944-2151
NJ Cherry Hill, Hamilton/Avnet 609-424-0110
NJ Mt. Laurel, Nu Horizons 609-231-0900
NJ Pine Brook, Nu Horizons 201-882-8300
NJ Totowa, ACI 201-812-0507
NY Amityville, Nu Horizons 516-226-6000
NY Plainview, ACI 516-293-6630
NY Port Chester, Zeus 914-937-7400
NY Rochester, Nu Horizons 716-292-0777
NY Ronkonkoma, All American 516-981-3935
NY Ronkonkoma, Zeus 516-737-4500
OH Dayton, Hamilton/Avnet 513-439-6730
OH Dayton, Zeus 513-293-6162
TX Addison, Hamilton/Avnet 214-308-8140
TX Richardson, All American 214-231-5300
TX Richardson, Zeus 214-783-7010
Can Ontario, Hamilton/Avnet 416-564-6060

BKL, 421 Feheley Dr., King of Prussia, PA 19406, Tel: 215-277-2910, FAX: 215-277-2956; Empl.: 40 ..... **B•1134**

BLACKHAWK NETWORKS CORP., 14 N. Parker Dr., P.O. Box 919, Janesville, WI 53545, Tel: 608-752-8701, FAX: 608-752-8701; FSC No.: 12724; Empl.: 10; *Sls. Mgr.:* D. Adee

BLACKHOLE TECHNOLOGY, 225 East St., Winchester, MA 01890, Tel: 617-721-7690, FAX: 617-721-7260; Empl.: 5; *Sls. Mgr.:* John W. McDonough, Jr.

BLATEK, INC., 2820 E. College Ave., Ste. F, State College, PA 16801, Tel: 814-231-2085, 814-231-2086, FAX: 814-231-2087; Empl.: 20

BLH ELECTRONICS, INC., 75 Shawmut Road, Canton, MA 02021-9111, Tel: 617-821-2000, FAX: 617-828-1451; FSC No.: 03089; Empl.: 170; *Sls. Mgr.:* Ron Burke

BLILEY ELECTRIC CO., 2545 W. Grandview Blvd., Erie, PA 16506, Tel: 814-838-3571, FAX: 814-833-2712; FSC No.: 71034;3098; Empl.: 140 ..... **A•1340-1345**

Local Sales Offices & Reps
AL Madison, R.W. Mitscher Co., Inc. 205-464-0745
CA Chatsworth, Cygnus Sls. Engrg. 818-727-0312
CA Los Altos, Jay Stone & Assocs. 415-948-4563
CO Boulder, Alfred A. Steinberg Rep Co. .. 303-442-6018
CT Plainfield, R. W. Mitscher Co., Inc. 203-564-1691
FL Lutz, R. W. Mitscher Co., Inc. 813-948-2351
FL Tequesta, R.W. Mitscher Co., Inc. 407-575-4485
GA Lawrenceville, R. W. Mitscher Co., Inc. 404-923-3239
MD Laurel, R. W. Mitscher Co., Inc. 301-498-6090
MA Needham, Sturgeon Tech. Sls. 617-444-6603
NJ Collingswood, R. W. Mitscher Co., Inc. 609-858-6440
NM Albuquerque, Border States Tech. Assocs. 505-884-9100
NY Binghamton, R. W. Mitscher Co., Inc. .. 607-724-6561
NY Clarence, R. W. Mitscher Co., Inc. 716-759-2350
NY Hauppauge, Aurora-Schmitt Assocs. ... 516-434-1313
NY Pittsford, R. W. Mitscher Co., Inc. 716-586-4012
NC Davidson, R.W. Mitscher Co., Inc. 704-896-7434
NC Raleigh, R. W. Mitscher Co., Inc. 919-848-0941
OH Alpha, Poliquin & Co., Inc. 513-426-8055
OR Portland, Temper Tech. Mktg. 503-292-8201
TN Johnson City, R. W. Mitscher Co., Inc. 615-929-7258
TX Austin, Electra Reps, Inc. 512-339-1163
TX Dallas, Electra Reps, Inc. 214-248-3852
VA Richmond, R. W. Mitscher Co., Inc. 804-320-7350
EXP CT, Stamford, Dage Corp. 203-324-3123

BLUE M, A GENERAL SIGNAL COMPANY, 2218 W. 138th St., Blue Island, IL 60406, Tel: 708-385-9000, FAX: 708-331-2515; Empl.: 300; *Sls. Mgr.:* Gary Carlin

BODINE ELECTRIC COMPANY, 2500 W. Bradley Pl., Chicago, IL 60618, Tel: 312-478-3515, FAX: 312-478-3232; *Sls. Mgr.:* James C. Stormont

BOGEN COMMUNICATIONS, INC. MPD PRODS., See Memory Protection Devices, Inc.

BOGEN COMMUNICATIONS, INC., Sound Prods., 50 Spring St., P.O. Box 575, Ramsey, NJ 07446, Tel: 201-934-8500, FAX: 201-934-9832; *Sls. Mgr.:* David A. Chambers; *Dist. Mgr.:* Christopher Wildfoerster

BOKER'S, INC., 3104 Snelling Ave., Minneapolis, MN 55406-1937, Tel: 612-729-9365, FAX: 612-729-8910; FSC No.: 85446; Empl.: 110; *Sls. Mgr.:* Andy Tscholl

BOMAR CRYSTAL COMPANY, 201 Blackford Ave., Middlesex, NJ 08846, Tel: 908-356-7787, 800-526-3935, FAX: 1-908-356-7362; Empl.: 40; *Sls. Mgr.:* Beth Shapiro, OEM Sls. Mgr. ..... **A•1346**

Local Distributors
NY E. Setauket, Dove Elctrn. Comps. 800-232-9825
TX Ft. Worth, Allied Elctrns. 1-800-433-5700

BOMAR INTERCONNECT PRODUCTS, 1850 Route 46, Ledgewood, NJ 07852, Tel: 201-347-4040, FAX: 201-347-2111; Empl.: 12; *Sls. Mgr.:* Don Cornelius; *Dist. Mgr.:* Don Cornelius

BOMCO, See MuShield Co.

BOMEM INC., 450 Ave. St-Jean Baptiste, Quebec, Canada G2E-5S5, Tel: 418-877-2944, 1-800-888-FTIR, TELEX: 051-31543, FAX: 418-877-2834; Empl.: 120; *Sls. Mgr.:* Henry Buijs

BONAR-KARD-O-LITE, See BKL (formerly Bonar-Kard-O-Lite)

BONDHUS CORPORATION, 1400 E. Broadway, Monticello, MN 55362, Tel: 612-295-2162, FAX: 612-295-4440; Empl.: 100; *Sls. Mgr.:* Hans Wegner

BOONTON ELECTRONICS CORP., 791 Route 10, Randolph, NJ 07869, Tel: 201-584-1077, FAX: 201-584-3037; FSC No.: 04901; Empl.: 74; *Sls. Mgr.:* Rich Anlas

BOPLA ENCLOSURES, 7330 Executive Way, Frederick, MD 21701-8353, Tel: 301-696-9300, FAX: 301-696-9494; FSC No.: 4Y520; Empl.: 35

BORG-WARNER THERMOELECTRICS, BORG-WARNER CORP., See TECA, ThermoElectric Cooling America Corp.

BOSCH

FAX: 708-865-5301

BOSCH, ROBERT, CORP. 2800 S. 25th Ave., Broadview, IL 60153, Tel: 708-865-5301; *Sls. Mgr.:* Dieter Bloecks; *Dist. Mgr.:* Dave Robson .....**B•1435**

Local Sales Offices & Reps

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IL	Lemont, Trend-Tronics, Inc.	708-972-1166
IA	Davenport, QIPS	319-388-0189
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OH	Richfield, Geotronix Inc.	216-659-6100
PA	Norristown, Brandon Assocs.	215-278-0500
TX	The Colony, Juliana Co.	214-625-1075

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AL	Huntsville, World Distrs.	205-539-0441
CA	Carson, Accele Elctrns.	213-637-3533
CA	Cerritos, David Levy Co.	800-421-3536
CA	N. Hollywood, Mobile Sound	213-668-1699
CA	Santa Monica, Distr. Specialties	213-452-3445

FL	Naranja, LES, Distrs.	305-248-6701
GA	Norcross, Whitehead Elctrns.	404-923-6667
IL	Lemont, Trend-Tronics, Inc.	708-972-1166
IL	N. Chicago, Sound Quest/Delta	708-473-1200
IL	Waukegan, Vanco	708-689-0210
MI	Livonia, Delta Supp. Co.	313-525-5858
MI	Troy, Terminal Supp. Co.	313-362-0790
MN	Minneapolis, Control Design Supp.	612-721-1628
MO	St. Louis, Wes Garde Comp.	314-567-7776
NY	Elmsford, Kin-Tronics, Inc.	914-968-7736
PA	Norristown, Brandon Assocs.	215-278-0500
TX	The Colony, The Juliana Co.	214-625-1075

BOSCHERT, INC., See Computer Products, Inc.

BOSTON GEAR, IMO Industries Inc., 14 Hayward St, Quincy, MA 02171, Tel: 617-328-3300, 1-800-225-5280, FAX: 617-479-6238; Empl.: 402

BOURNS, INC., Electronic Components Sls., 1200 Columbia Ave., Riverside, CA 92507-2114, Tel: 909-781-5500, 801-750-7200, FAX: 909-781-5273; Empl.: 4000; *Sls. Mgr.:* Dennis Lause; *Dist. Mgr.:* Patricia Moorman .. **A•1869-1874, 2052, 2058-2067; B•1656, 1675-1680, 1920-1923**

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AZ	Scottsdale, Summit Sls.	602-998-4850
CA	Auburn, QuadRep Inc.	916-269-2701
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CA	San Diego, QuadRep Southern	619-755-1188
CA	San Jose, QuadRep Inc.	408-432-3300
CO	Parker, Parker Webster Co.	303-841-4888
CT	Wallingford, John E. Boeing Co., Inc.	203-265-1318
FL	Casselberry, Dyne-A-Mark	407-831-2822
FL	Palm Bay, Dyne-A-Mark	407-725-7470
GA	Atlanta, CSR Elctrns.	404-396-3720
ID	Meridian, Intermountain Tech. Mktg., Inc.	208-888-6071
IL	Elk Grove Village, Oasis Sls. Corp.	708-640-1850
IN	Carmel, Technlg. Mktg. Corp.	317-844-8462
IN	Ft. Wayne, Technlg. Mktg. Corp.	219-432-5553
IN	Kokomo, Technlg. Mktg. Corp.	317-459-5152
IA	Cedar Rapids, Rep Assocs. Corp.	319-373-0152
KY	Louisville, Technlg. Mktg. Corp.	502-245-7411
MD	Baltimore, Micro-Comp, Inc.	410-644-5700
MA	Chelmsford, John E. Boeing Co., Inc.	508-256-5800
MI	Farmington Hills, Rathburg Assocs., Inc.	313-489-1500
MI	Troy, Epsco, Inc.	313-528-0983
MN	Edina, Mel Foster Tech. Sls. Inc.	612-941-9790
MO	Bridgeton, Centech, Inc.	314-291-4230
MO	Raytown, Centech, Inc.	816-358-8100
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NY	Wappingers Falls, Bob Dean, Inc.	914-297-6406
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OH	Richfield, Bear Mktg., Inc.	216-659-3131
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OR	Beaverton, J.J. Backer Co.	503-627-0775
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TX	Richardson, Ammon & Rizos Co.	214-644-5591
UT	Murray, Parker Webster Co.	801-266-9939
VA	Lynchburg, Micro-Comp, Inc.	804-239-2626
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CA	Riverside, Elctrn. Supp. Corp.	909-683-7300
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CA	Santa Ana, Teknopak	714-558-8840
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IL	Chicago, Newark Elctrns.	312-784-5100
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BRADY, W. H., CO., Xymox Div., 8225 W. Parkland Ct., P.O. Box 571, Milwaukee, WI 53201, Tel: 414-355-8300, TELEX: 26-677, TWX: 910-262-3151, FAX: 414-354-0453; FSC No.: 85480; *Sls. Mgr.:* R.F. Faustich

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BRANDYWINE ABRASIVES, 501 South Main St., Spring City, PA 19475, Tel: 215-948-7028, FAX: 215-948-8151; Empl.: 10

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BREEZE-ILLINOIS, See Transtechnology Electronics

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BREN-TRONICS, INC., 10 Brayton Ct., Commack, NY 11725, Tel: 516-499-5155, TELEX: 22-1213 TTCUR, FAX: 516-499-5504; FSC No.: 51828; Empl.: 75; *Sls. Mgr.:* Don Fagon

BRILL ELECTRONICS, P.O. Box 25905, Los Angeles, CA 90025, Tel: 310-452-8002, FAX: 310-392-9585; *Sls. Mgr.:* Sam Nizam; *Dist. Mgr.:* Kelly Garcia ..... **B•1390, 1454, 1591, 1692, 1874, 1934; C•1648, 1724, 1752; D•1258**

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BRINKMANN INSTRUMENTS, INC., One Cantiague Road, P.O. Box 1019, Westbury, NY 11590-0207, Tel: 516-334-7500, TELEX: WUI 6852174, FAX: 516-334-7506

BRISTOL BABCOCK INC., 1100 Buckingham St., Watertown, CT 06795, Tel: 203-575-3000, 800-395-5497, TELEX: 962417, FAX: 203-754-1477; FSC No.: 08664; Empl.: 500; *Sls. Mgr.:* Fred Merrill

BROOKS ELECTRONICS, 4001 N. American St., Philadelphia, PA 19140, Tel: 215-228-4433, FAX: 215-227-7687; Empl.: 100; *Sls. Mgr.:* Gary J. Brooks; *Dist. Mgr.:* Gary J. Brooks

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BROOKTREE CORPORATION, 9950 Barnes Canyon Road, San Diego, CA 92121, Tel: 619-535-3494, TELEX: 383596, FAX: 619-597-0673

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IL Inverness, Heartland Tech. 708-358-6622
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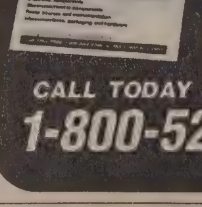

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CENTRONIC, INC., THE MORGAN CRUCIBLE COMPANY PLC, 2088 Anchor Ct., Dept. E, Newbury Park, CA 91320-1702, Tel: 805-499-5902; FSC No.: 63334; Empl.: 30; *Sls. Mgr.:* George Pankau, CEO; *Dist. Mgr.:* Yuval Tamari, Natl. Sls. Mgr. ..... **B•1312-1315**

Local Sales Offices & Reps
CA Newbury Pk., Centronic, Inc., E-O Comps. Div. 805-499-5902

Local Distributors
IL Des Plaines, BEA Electro-Optics 708-298-1420

CENTURION INTERNATIONAL, INC., 3425 N. 44 St., Lincoln, NE 68504, Tel: 800-228-4563, FAX: 800-848-3825; Empl.: 400; *Sls. Mgr.:* Steven C. Bowles; *Dist. Mgr.:* Bob Bonebright

C.E. PRECISION ASSEMBLIES, INC., 101 S. McKemy Ave., Chandler, AZ 85226, Tel: 602-940-0740, FAX: 602-961-4754; FSC No.: 67810; Empl.: 24; *Sls. Mgr.:* Henry Richards

CERAMASEAL, Box 260, New Lebanon, NY 12125, Tel: 518-794-7800, TELEX: 14-5442, FAX: 518-794-8080; FSC No.: 07601; Empl.: 78; *Sls. Mgr.:* Renee A. Nichols ..... **C•1279**

Local Sales Offices & Reps
AZ Phoenix, J. F. Hurlbut Co. 602-952-2079
CA Mission Viejo, Avtec 714-855-2800
CA San Jose, Exxus 408-249-3526
CO Golden, J. F. Hurlbut Co. 303-279-7796
IL Des Plaines, Byron Ellis Assoc., Inc. ... 708-298-7626
KS Lenexa, Midtec Assocs. 913-541-0505
MD Baltimore, Wafer, Spindler & Assoc. ... 410-744-1133
MA Plymouth, DC Assoc. 617-585-5085
MO St. Louis, Midtec Assocs. 314-275-8666
NJ Teaneck, DC Assocs. 201-692-7924
NY E. Syracuse, R.M. Scanlon Assoc. 315-463-7682
OH Middleburg Heights, Byron Ellis Assoc., Inc. 216-826-0559
PA Willow Grove, Tech. Sls. Assoc. 215-784-0170
TX Dallas, THT Sls. 214-783-1501
WA Seattle, J.J. Assocs. 206-246-6619

CERAMAWIRE, Box 1084, Cranford, NJ 07016, Tel: 908-276-1170; Empl.: 4; *Sls. Mgr.:* Edward Hamilton

CERAMIC DEVICES INC., 8145 Ronson Rd., San Diego, CA 92111, Tel: 619-560-7575, FAX: 619-560-4906; FSC No.: 66230; Empl.: 40; *Sls. Mgr.:* Dick Guerena

CERAMIC MAGNETICS, INC., 16 Law Dr., Fairfield, NJ 07004, Tel: 201-227-4222, FAX: 201-227-6735; Empl.: 90

CERA-MITE CORP., 1327 Sixth Ave., Grafton, WI 53024, Tel: 414-377-3500, FAX: 414-377-7309; Empl.: 215; *Sls. Mgr.:* Claude Marquardt

CET TECHNOLOGY, 26 Winslow Farm Road, Hudson, NH 03051, Tel: 603-883-5912, FAX: 603-882-8348; Empl.: 125

CGRS MICROTECH, P.O. Box 102L, Langhorne, PA 19047, Tel: 215-757-0284; Empl.: 5; *Sls. Mgr.:* J. Swope; *Dist. Mgr.:* J. Swope

CHACE PRECISION METALS, INC., 1704 Barnes St., Reidsville, NC 27320, Tel: 919-342-2381, TELEX: 574493, FAX: 919-342-4012; Empl.: 200; *Sls. Mgr.:* Pat J. Urban

CHA INDUSTRIES, 4201 Business Center Dr., Fremont, CA 94538, Tel: 510-683-8554, FAX: 510-683-3848; *Sls. Mgr.:* John Levin

CHALCO ENGRG. CORP., Chalco Industries, Inc., 15126 S. Broadway, Gardena, CA 90248-1898, Tel: 213-321-0121, 213-323-5525, FAX: 213-323-0405; Empl.: 95; *Sls. Mgr.:* Steven Kierman, Dir. Sls.

Champion Technologies, Inc.

FAX: 708-451-7585

CHAMPION TECHNOLOGIES, INC., 2553 N. Edgington, Franklin Park, IL 60131, Tel: 708-451-1000; Empl.: 140 ..... **A•1347**

Local Sales Offices & Reps
AZ Scottsdale, Integrated Sys. & Dvc. Sls. 602-951-1172
CA Orange, Prism Assocs. 714-283-8744
CA San Jose, Kottmeier Assocs. 408-371-8700
FL Orlando, Comp. Design Mkt. 407-240-3903
GA Atlanta, L & D, Inc. 404-395-7079
IL Glen Ellyn, Lincoln Hodges 708-469-6750
MD Columbia, Third Wave Solutions 301-290-5990
MA Natick, Wayland Engrg. Sls. 508-655-6080
MN Bloomington, Horizon 612-884-6515
CO Littleton, Contec Mktg., Inc. 303-973-8490
NY Great Neck, Trionic Assoc. 516-466-2300
PA Norristown, Rivco January Inc. 215-631-1414
TX Dallas, Sunbelt Comps. 214-248-8000
Can Brampton, Ont., Cantec Reps. Inc. 416-791-5922
WA Redmond, Electronic Mktg. Grp. 206-882-0962
IL Franklin Pk., Champion Technlgs. 708-451-1000

Local Distributors
CA Manhattan Bch., Prime Electro 310-379-3642
CA Reseda, Jan Dvcs. 818-708-1100
CA San Jose, Passive Technlgs. 408-435-5566
IL Palatine, OHM Elctrns. 708-359-5500
NY Bayshore, Brookdale Elctrns. 516-242-8033

CHAMPLAIN CABLE CORP., Huber & Suhner(USA)Corp., 12 Hercules Dr., Colchester, VT 05446, Tel: 802-655-2121, FAX: 802-655-2025; FSC No.: 05973; Empl.: 3000; *Sls. Mgr.:* M.Brennan; *Dist. Mgr.:* J. Brooks

CHANDLER PRODUCTS, 1491 Chardon Rd., Cleveland, OH 44117, Tel: 216-481-4400; *Sls. Mgr.:* Nick Andos

CHANNEL INDUSTRIES, 839 Ward Dr., Santa Barbara, CA 93111, Tel: 805-967-0171, TELEX: 658416, FAX: 805-683-3420; Empl.: 75

CHAPMAN CORP., P.O. Box 10700, 125 Presumpscot St., Portland, ME 04104, Tel: 207-773-4726, FAX: 207-775-1369; Empl.: 42; *Sls. Mgr.:* John Goodwin; *Dist. Mgr.:* Barry Godowsky

CHASSIS-TRAK, See General Devices

CHATHAM CONTROLS, 33 River Rd, Chatham, NJ 07928, Tel: 201-635-8892, FAX: 201-635-6345; FSC No.: 04814; Empl.: 11

CHATSWORTH DATA CORPORATION, 20710 Lassen St., Chatsworth, CA 91311, Tel: 818-341-9200; Empl.: 80; *Sls. Mgr.:* Hank Boehm ..... D•1243

CHAUVIN ARNOUX, Chauvin Arnoux-France, 15 Faraday Dr., Dover, NH 03820, Tel: 603-749-6434, FAX: 603-742-2346

CHEMTRONICS INC., 681 Old Willets Path, Hauppauge, NY 11788, Tel: 516-582-3322, 800-645-5244, TELEX: 968567, FAX: 516-582-3046; FSC No.: 21267; Empl.: 112; *Sls. Mgr.:* Louis Friedman; *Dist. Mgr.:* Scott Friedman

FAX: 714-838-4742

CHEROKEE INTERNATIONAL, INC., Core Industries, 2841 Dow Avenue, Tustin, CA 92680-7211, Tel: 714-544-6665, TWX: 510-101-0493; Empl.: 425; *Sls. Mgr.:* Dennis Pouliot ..... D•1625-1629

Local Sales Offices & Reps

FL	Del Ray Beach, Phelps Assoc.	407-276-7591
GA	Atlanta, Naylor Assoc.	404-373-5036
AZ	Phoenix, Chaparral Elctrns.	602-996-5909
IL	Downers Grove, Richmar Elctrns.	708-968-0118
IL	Prairie Vl, Crosslink Elctrns.	913-649-7100
IN	Indianapolis, Richmar Elctrns. Corp.	317-846-6383
KS	Prairie Village, Crosslink Elctrns.	913-649-7100
MN	Minneapolis, Robt. W. Marshall Co., Inc.	612-929-0457
NH	Amherst, Bennetron	603-880-7008
NJ	Englewood, Sprung/Nussbaum	201-569-5666
NJ	Lawrenceville, DVS Co.	609-896-1112
NC	Resch. Triangle Pk., Naylor Assocs., Inc.	919-544-6630
OH	Richfield, Geotronix	216-659-6100
OH	Trotwood, Geotronix, Inc.	216-659-6100
OR	Beaverton, R-Tron	503-645-4323
PA	Allison Pk., Geotronix, Inc.	412-487-1770
TX	Dallas, Richmar Elctrns.	214-424-8388
VA	Charlottesville, DVS Co.	804-973-0303
WA	Redmond, R-Tron	206-557-0851

CHERRY

FAX: 708-360-3566

CHERRY ELECTRICAL PRODUCTS, Cherry Corporation, 3600 Sunset Avenue, Waukegan, IL 60087, Tel: 708-662-9200; Empl.: 1,000; *Dist. Mgr.:* George Di Martino ..... B•1023, 1693-1698, 1824

Local Sales Offices & Reps

AZ	Phoenix, O'Donnell Assocs. S.W.	602-944-9542
AR	Little Rock, Carlton-Bates	501-562-9100
CA	Culver City, Combined Svcs.	213-558-2859
CA	San Diego, O'Donnell Assocs., Inc.	619-578-1645
CA	San Jose, O'Donnell Assocs. N., Inc.	408-456-2950
CA	Torrance, O'Donnell Assocs., Inc.	310-781-2255
CT	Branford, Coakley, Boyd & Abbett, Inc.	203-481-2218
FL	Orlando, So. Atlantic Comp. Sls.	407-857-3650
GA	Norcross, So. Atlantic Comp. Sls.	404-447-6154
IL	Schaumburg, Martan, Inc.	708-303-5660
IL	Waukegan, Cherry Elctrl. Prods.	708-662-9200
IN	Ft. Wayne, Menze Sls., Inc.	219-747-5616
IA	Cedar Rapids, Dy-Tronix, Inc.	319-377-8275
KS	Wichita, Dy-Tronix, Inc.	316-838-0884
MA	Framingham, Coakley, Boyd & Abbett, Inc.	508-820-0800
MI	Farmington Hills, Cherry Elctrl. Prods., Automotive	313-477-4477
MI	Kentwood, Miltimore Sls., Inc.	616-554-9292
MI	Novi, Miltimore Sls., Inc.	313-349-0260
MN	St. Paul, Cahill, Schmitz & Cahill	612-646-7217
MO	Bridgeton, Dy-Tronix, Inc.	314-291-4777
NJ	Pitman, Colrud Corp.	609-589-5866
NJ	W. Caldwell, Grimm, Siegel Assocs., Inc.	201-575-9300
NM	Albuquerque, O'Donnell Assocs., S.W.	505-889-4522
NY	Pittsford, Elcom Sls., Inc.	716-385-1400
NY	Skaneateles, Elcom Sls., Inc.	315-685-8967
NC	Raleigh, So. Atlantic Comp. Sls.	919-859-9970
OK	Catoosa, Comptech Sls., Inc.	918-266-1966
OR	Portland, Venture Elctrns.	503-624-0617
TX	Austin, Comptech Sls., Inc.	512-343-0300
TX	Houston, Comptech Sls., Inc.	713-492-0005
TX	Irving, Comptech Sls., Inc.	214-751-1181
VA	Chantilly, Colrud Corp.	703-904-0240
WA	Bellevue, Venture Elctrns.	206-454-4594
Can	Calgary, Alberta, r.n. Longman Sls., Inc.	403-295-6324
Can	Kirkland, Que., r.n. Longman Sls., Inc.	514-694-3911
Can	Mississauga, Ont., r.n. Longman Sls., Inc.	416-670-8100
Can	Neapean, Ont., r.n. Longman Sls., Inc.	613-564-0100

Local Distributors

AL	Birmingham, Ack Radio Supp. Co.	205-322-0588
AL	Huntsville, Powell Elctrns.	205-837-5300
AL	Huntsville, Time Elctrns.	205-721-1134
CA	Inglewood, Newark Elctrns.	213-671-7377
CA	San Jose, Powell Elctrns.	408-943-9020
AZ	Tempe, L Comp, Inc.	800-325-1393
AZ	Tempe, Time Elctrns.	602-967-2000
AR	Little Rock, Carlton-Bates	501-562-9100
CA	Agoura Hills, Time Elctrns.	818-707-2890
CA	Chatsworth, Time Elctrns.	818-998-7200
CA	Gardena, Cal Switch	310-770-2330
CA	Los Angeles, Elec. Switches	213-660-1310
CA	Oakland, Brill Elctrns.	510-834-5888
CA	Sacramento, Integrated Elec.	916-363-6030
CA	San Diego, Time Elctrns.	619-674-2800
CA	Sunnyvale, Target Elctrns.	408-733-0384
CA	Sunnyvale, Time Elctrns.	408-734-9888
CA	Torrance, Time Elctrns.	213-320-0880
CA	Tustin, Time Elctrns.	714-669-0100
CT	Wallingford, Cronin Elctrns.	203-265-3134
CT	Wallingford, Sager Elctrns.	203-265-4600
CA	Yorba Linda, Target Elctrns.	714-692-1630
CO	Arvada, Denver Beta Wintronics	303-431-7161
CO	Colorado Springs, Avnet/Ampex Store	719-637-0055
CO	Denver, Integrated Elec.	303-292-6121
CO	Denver, Newark Elctrns.	303-757-8531
CO	Englewood, Time Elctrns.	303-721-8882
CT	Hartford, Wes-Garde Comps. Grp.	203-527-7705
CT	Wallingford, G.R.S. Midan Elec. Inc.	203-265-2077
FL	Ft. Lauderdale, KSM Elctrns.	305-971-5900
FL	Ft. Lauderdale, Powell Elctrns.	305-484-8377
FL	Ft. Lauderdale, Reptron Elctrns.	305-979-8227
FL	Ft. Lauderdale, Time Elctrns.	305-484-1778
FL	Lakeland, Wes-Garde Comps. Grp.	813-644-7564
FL	Orlando, Sager Elctrns.	407-354-1130
FL	Orlando, Time Elctrns.	407-841-6565
FL	Tampa, Reptron Elctrns.	813-855-4656
GA	Atlanta, Ack Radio Supp. Co.	404-351-6340
GA	Atlanta, Electro Air Corp.	404-351-3545
GA	Norcross, Sager Elctrns.	404-446-0085
GA	Norcross, Time Elctrns.	404-368-0969
IL	Champaign, Klaus Radio, Inc.	217-356-1896
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Palatine, OHM Elctrns., Inc.	708-359-5500
IL	Schaumburg, Time Elctrns.	708-303-3000
IL	Wheeling, Hawk Elctrns.	708-459-4030
IN	Indianapolis, Bell Inds./Graham	317-875-8200
IN	Indianapolis, PEI Genesis Elec.	317-328-0700
IN	South Bend, PEI Genesis Elect.	219-287-2911
IA	Cedar Rapids, Advent Elec., Inc.	319-363-0221
GA	Norcross, Reptron Elctrns.	404-446-1300
MD	Annapolis Jct., Powell Elctrns.	301-953-3435
MD	Columbia, Sager Elctrns. Inc.	301-995-4900
MD	Columbia, Time Elctrns.	301-964-3090
MD	Savage, Pyttronic Inds., Inc.	301-792-0780
MA	Hingham, Sager Elctrns.	617-749-6700
MA	Needham, Cronin Elctrns., Inc.	617-449-5000
MA	Peabody, Time Elctrns.	508-532-6200
MI	Livonia, Reptron Elect., Inc.	313-525-2700
MI	Oak Park, Newark Elctrns.	313-967-0600
MN	Edina, Time Elctrns.	612-943-2433
MN	Minneapolis, Newark Elctrns.	612-331-6350
MN	Minneapolis, Stark Elctrns.	612-332-1325
MN	Minnetonka, Reptron Elctrns.	612-938-0000
MO	Kansas City, L Comp, Inc.	816-241-0111
MO	Manchester, Time Elctrns.	314-391-6444
MO	Maryland Hgts., L Comp, Inc.	314-291-6200
MO	St.Louis, Wes-Garde Comps. Grp.	314-567-7776
NH	Salem, Sager Elctrns.	603-898-1348
NJ	Little Falls, Powell Elctrns., Inc.	201-890-0010
NJ	Marlton, Time Elctrns.	609-596-6700
NJ	Oakland, Relay Specs.	800-526-5376
NJ	Wayne, Time Elctrns.	201-785-8250
NY	Buffalo, Summit Dists.	716-887-2800
NY	Hauppauge, Sager Elctrns.	516-348-1300
NY	Hauppauge, Time Elctrns.	516-273-0100
NY	Hauppauge, Time Elctrns.	516-434-3344
NY	Rochester, Masline Elctrns.	716-546-5373
NY	Rochester, Summit Dists.	716-334-8110
NY	Syracuse, Time Elctrns.	315-432-0355
NC	Cary, Powell Elctrns.	919-467-1212
NC	Oxford, Time Elctrns.	919-693-5166
NC	Raleigh, Sager Elctrns.	919-850-9550
NC	Raleigh, Time Elctrns.	919-847-9650
NC	Winston-Salem, Kirkman Elect.	919-722-9131
OH	Akron, Aesco Elctrns. Comps.	216-762-8818
OH	Cincinnati, Hughes-Peters, Inc.	513-351-2000
OH	Columbus, Hughes-Peters, Inc.	614-294-5351
OH	Columbus, Time Elctrns.	614-794-3301
OH	Dayton, Bell Inds.	513-435-5922
OH	Dayton, Stotts Friedman	513-298-5555
OH	Valley View, Newark Elctrns.	216-447-8860
OK	Tulsa, Radio, Inc.	918-587-9123
OR	Beaverton, Integrated Elec.	503-641-1690
OR	Portland, Radar Elec.	503-232-3404
OR	Portland, Tek-Elec.	503-246-5451
OR	Portland, Time Elctrns.	503-626-2979
PA	Mars, Sager Elctrns.	412-772-2233
PA	Montgomeryville, Pyttronics Inds., Inc.	215-643-2850
PA	Philadelphia, Powell Elctrns.	215-365-1900
PA	Philadelphia, PEI Genesis Elect.	800-523-0727, 800-222-1772
PA	Philadelphia, Sager Elctrns.	215-464-4336
TX	Austin, Time Elctrns.	512-346-7346
TX	Dallas, Wes-Garde Comps.	214-357-1768
TX	Ft. Worth, Allied Elctrns., Inc.	817-595-6477
TX	Ft. Worth, Carlton-Bates	817-293-5558
TX	Garland, Newark Elctrns.	214-487-8144
TX	Houston, Carlton-Bates	713-956-2244
TX	Houston, Newark Elctrns.	713-270-4800
TX	Richardson, Time Elctrns.	214-644-4644
TX	Stafford, Southwest Elec., Inc.	713-240-4000
UT	Salt Lake City, Stand. Supp. Co.	801-486-3371
UT	W. Valley City, Integrated Elctrns.	801-977-9750
UT	W. Valley City, Time Elctrns.	801-973-8494
WA	Bellevue, Integrated Elctrns., Inc.	206-455-2727
WA	Kirkland, Time Elctrns.	206-820-1525
WA	Seattle, Radar Elctrns.	206-282-2511
WI	Milwaukee, Marsh Elctrns., Inc.	414-475-6000
WI	Waukesha, Hawk Elctrns.	414-547-4457
Can	Burnaby, B.C., ITT/Rae Ind. Elect.	604-291-8866
Can	Calgary,Alberta, ITT/Rae Ind. Elect.	403-273-2780
Can	Concord, Ont., ITT/RAE Ind. Elect.	416-798-4884
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Can	London, Ont., Saynor Varah Inc.	519-649-1414

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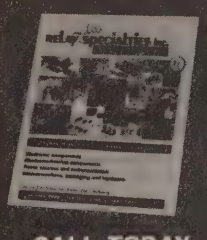
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CHESSELL EUROTHERM, EUROTHERM, INTL., 1 Pheasant Run, Newtown, PA 18940, Tel: 215-968-0660, FAX: 215-968-0662; Empl.: 82; *Sls. Mgr.:* Howard Sherer; *Dist. Mgr.:* Howard Sherer

CHESTEC CORPORATION, 21 Yennicock Ave., Port Washington, NY 11050, Tel: 516-883-1700, FAX: 516-883-7155; Empl.: 3; *Sls. Mgr.:* J.P. Schindler

CHESTERFIELD PRODUCTS, INC., Microwave Filter Co., Inc., 6743 Kinne St, East Syracuse, NY 13057, Tel: 800-666-9655, 315-463-2309, FAX: 315-463-1467; *Sls. Mgr.:* Marian Frair ..... **A•1655**

Local Sales Offices & Reps

CA Carlsbad, MTM Intl, Inc. 619-729-6338
IL Chicago, Tech. Sls. 312-237-7210
MD Baltimore, Advanced Tech. Sls. 301-323-3140
MA Framingham, Bengal Assocs. 617-877-2639
MA Randolph, Bengal Assocs. 617-961-4120
NJ Elmwood Park, L & M Assoc., Inc. 201-797-0441
NY Syracuse, Microwave Filter Co., Inc. ... 315-437-3953

CHICAGO BLOWER CORP., 1675 Glen Ellyn Rd, Glendale Heights, IL 60139, Tel: 708-858-2600, ESYLNK: 62912209, FAX: 708-858-7172; Empl.: 250; *Sls. Mgr.:* R.W. Wessel

CHICAGO CONDENSER CORP., 2900 West Chicago Ave., Chicago, IL 60622, Tel: 312-227-7070, FAX: 312-227-6646; FSC No.: 5910; *Sls. Mgr.:* Joan Looi ..... **A•1029**

CHICAGO LASER SYSTEMS, INC., 1798 Sherwin, Des Plaines, IL 60018, Tel: 708-827-9620, TELEX: 6505123515MCI UW, FAX: 708-827-9710; *Sls. Mgr.:* Bernard Alpiner, V.P.

CHICAGO LOCK CO., 4311 W. Belmont Ave., Chicago, IL 60641, Tel: 312-282-7177, TELEX: ITT 4994023, FAX: 312-282-8199; Empl.: 300; *Sls. Mgr.:* William R. Shinn

CHIPS AND TECHNOLOGIES, INCORPORATED, 3050 Zanker Road, San Jose, CA 95134, Tel: 408-434-0600, TWX: 272929 CHIPS UR

CHIU TECHNICAL CORP., 252 Indian Head Rd., Kings Park, NY 11754, Tel: 516-544-0606, FAX: 516-544-0809; FSC No.: 38-32, 38-41; Empl.: 25; *Sls. Mgr.:* Frank A. Denny, V.P. Mktg.

CHLORIDE ELECTRO NETWORKS, Chloride Power Electronics, Inc., 1 Technology Place, Caledonia, NY 14423, Tel: 716-538-4421, FAX: 716-538-6345; Empl.: 350; *Sls. Mgr.:* Gary Balfour

CHLORIDE EL PASO, Chloride Power Elctrns., 9-B Founders Blvd., El Paso, TX 79906, Tel: 915-592-9985, FAX: 915-595-1664; FSC No.: 08715; Empl.: 1000; *Sls. Mgr.:* Robin Lee

CHLORIDE POWER ELECTRONICS, One Technology Place, Caledonia, NY 14423, Tel: 716-538-4421, FAX: 716-538-6345; FSC No.: 3698; Empl.: 300; *Sls. Mgr.:* Steve Olson

CHOMERICS, INC.:W.R. GRACE & CO., 77 Dragon Ct., Woburn, MA 01888, Tel: 617-935-4850, FAX: 617-933-4318; Empl.: 650; *Sls. Mgr.:* William Lionetta; *Dist. Mgr.:* William Flanders ..... **C•1659-1661**

Local Sales Offices & Reps

AZ Mesa, Chomerics 602-964-0771
CA Carson, Chomerics 310-518-6921
CT Trumbull, Chomerics 203-452-0253
FL Longwood, Chomerics 407-876-5800
GA Kennesaw, Chomerics 404-928-4243
IL Chicago, Chomerics 708-458-0649
MA Woburn, Chomerics 617-935-4850
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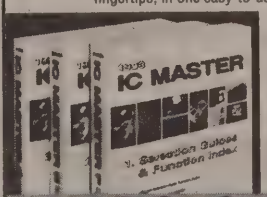

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Local Sales Offices & Reps

CA	Los Angeles, L & M Engrg. South	310-417-3044
CA	Mountain View, Bridge Mktg.	415-965-8045
MO	Florissant, Central Tech. Sls.	314-831-4069
NH	Merrimack, DBM Tech. Sls., Inc.	603-424-5700
NY	Buffalo, Upstate Engrg. Sls.	716-632-0011
NY	Rochester, Upstate Engrg. Sls.	716-225-2383
NY	Rye Brook, Tekmar Sls.	914-632-7464
TX	Dallas, Rep-Tec, Inc.	214-956-8700
EXP	Odessa, FL, Comp. Gen. Inc.	813-376-6655

COMPONENT MFG. SVC., INC., 1 Component Park, W. Bridgewater, MA 02379, Tel: 508-580-0111, FAX: 508-559-9893; Empl.: 600; *Sls. Mgr.:* Wayne Douglas; *Dist. Mgr.:* Wayne Douglas

COMPONENT RESEARCH CO. INC., 1655-26 St., Santa Monica, CA 90404, Tel: 310-829-3615, FAX: 310-829-9584; FSC No.: 12517;Multiple; Empl.: 230; *Sls. Mgr.:* Sylvia Kellerman ..... **A•1030-1057**

Local Sales Offices & Reps

SC	Greenville, Walter Lamphier	803-232-4687

COMPONENTS CORP., 6 Kinsey Pl., Denville, NJ 07834, Tel: 201-627-0290, FAX: 201-361-5801; FSC No.: 26364; Empl.: 20; *Sls. Mgr.:* Fred Bielenberg

COMPONENTS ELECTRONICS CORP., 629A Lowther Rd., Lewisberry, PA 17339, Tel: 717-938-4151, FAX: 717-938-5910; Empl.: 45; *Sls. Mgr.:* J.Galli; *Dist. Mgr.:* J.Galli

COMPONENT SPECIALTIES CORP., 9143 E. La Rosa Dr., Temple City, CA 91790, Tel: 213-283-0015, FAX: 818-287-7189; FSC No.: 28984; Empl.: 45; *Sls. Mgr.:* D.R. Heins

COMPTUS INC., 342 Lyndeboro Rd., New Boston, NH 03070, Tel: 603-487-5512, FAX: 603-487-5513; Empl.: 5; *Sls. Mgr.:* Leander Nichols; *Dist. Mgr.:* Leander Nichols

COMPUCART, Versa Tec, P.O. Box 2095, Tampa, FL 33601-2095, Tel: 800-237-9024, 813-251-2431; Empl.: 25

COMPUCRAFT FABRICATORS INC., 669 Mary St., Warminster, PA 18974, Tel: 215-443-7107, FAX: 215-443-7195; FSC No.: 76977; Empl.: 18; *Sls. Mgr.:* Stephen Dalton

COMPUMOTOR DIVISION, Parker Hannifin Corp., 5500 Business Park Dr., Rohnert Park, CA 94928, Tel: 707-584-7558, FAX: 707-584-8015; Empl.: 150; *Sls. Mgr.:* A. Statz; *Dist. Mgr.:* A. Statz

COMPUTER AVIONICS, See CAC Microcircuits, Inc.

COMPUTER COMPONENTS, INC., P.O. Box 1378, 18-B Kripes Rd., East Granby, CT 06026, Tel: 203-653-9909, FAX: 203-653-9901; FSC No.: 12965; Empl.: 25

COMPUTER CONVERSIONS CORP., 6 Dunton Ct., E. Northport, NY 11731, Tel: 516-261-3300, FAX: 516-261-3308; FSC No.: 51086; Empl.: 100; *Sls. Mgr.:* S. J. Renard ..... **D•1172-1175**

Local Sales Offices & Reps

MA	Brookline, Technology Prod. Grp.	617-731-0858
MI	Neewport, Industrial Sensors Inc.	313-383-8300
NY	Moravia, Electrotech Sys.	315-497-1598
NC	Charlotte, Motion Technology	704-525-9855
OH	Cincinnati, Rilco	513-271-0630
PA	Pittsburgh, Russell F. Clark Co.	412-242-9500
TX	Bedford, Automated Dynamics	817-267-5716
UT	Salt Lake City, Protronix	804-265-9105
Can	Downsview, Electromate Ind. Sls.	416-665-0221

COMPUTER DEVICES, 34 Linnell Cir., Nutting Lake, MA 01865, Tel: 508-663-4980, FAX: 508-667-8561; Empl.: 13; *Sls. Mgr.:* Sandra R. Clark

COMPUTER DOCTORS, 9204-B Baltimore Blvd., College Park, MD 20740, Tel: 1-800-RAM-STAR, 301-474-3095, FAX: 301-474-0805

COMPUTER DYNAMICS SALES, 107 S. Main St., Greer, SC 29650, Tel: 803-877-8700, FAX: 803-879-2030

COMPUTER INSTRUMENTS CORP., 1000 Shames Drive, Westbury, NY 11590, Tel: 516-876-8400, FAX: 516-876-9153; Empl.: 40

COMPUTER INSTRUMENTS DIV., 1000 Shames Drive, Westbury, NY 11590, Tel: 516-876-8400, FAX: 516-876-9153; Empl.: 42; *Sls. Mgr.:* Brian Peskin

COMPUTER KEYBOARD SYSTEMS, 1640 Fifth Street, Ste. 224, Santa Monica, CA 90401, Tel: 310-395-4639, FAX: 310-393-6040; Empl.: 25; *Sls. Mgr.:* Trevor Bray; *Dist. Mgr.:* Trevor Bray

COMPUTER PERIPHERALS INC., 667 Rancho Congo Blvd., Newbury Pk., CA 91320, Tel: 805-499-5751, 800-854-7600, TELEX: 759299CPI, FAX: 805-498-8848; Empl.: 100; *Sls. Mgr.:* Davius Antia; *Dist. Mgr.:* Mike Krunic

COMPUTER POWER INC., 124 W. Main St., High Bridge, NJ 08829, Tel: 908-638-8000, 800-526-5088, FAX: 908-638-4931; FSC No.: 3643; Empl.: 170; *Sls. Mgr.:* Leslie P. Listwa; *Dist. Mgr.:* Todd Smith

CPS

FAX: 503-684-8164

COMPUTER POWER SUPPLIES (CPS), 15800 Upper Boones Ferry Rd., #150, Lake Oswego, OR 97035, Tel: 503-684-8026; *Sls. Mgr.:* Clifford Gaw

COMPUTER PRODUCTS, INC, Process Automation, 2900 Gateway Dr., Pompano Beach, FL 33069, Tel: 305-974-5500, FAX: 305-979-7371; Empl.: 150; *Sls. Mgr.:* Jack Sloan, VP Sls.

COMPUTER PRODUCTS
POWER CONVERSION

FAX: 617-464-6612

COMPUTER PRODUCTS/POWER CONVERSION AMERICA, 7 Elkins Street, So. Boston, MA 02127, Tel: 800-733-9288, 617-464-6600; FSC No.: 62125; Empl.: 1050; *Dist. Mgr.:* Jim O'Sullivan, VP Distbn. & Sls. ..... **D•1486, 1631-1635, 2048, 2090-2095**

Local Sales Offices & Reps

AZ Phoenix, C.T. Carlberg 602-488-0750
CA Encinitas, Jones & McGeoy Sls. 619-753-6784
CA San Diego, Jones & McGeoy Sls. 714-756-6269
CA Santa Ana, Jones & McGeoy Sls. 714-547-6466
CA Santa Clara, Criterion Sls. 408-988-6300
CO Aurora, Electrodyne 303-695-8903
FL Altamonte Springs, Electra Mark 407-830-0844
FL Plantation, Electra Mark 305-452-2872
FL Tampa, Electramark 813-962-1882
GA Norcross, Mountain Electro Mktg. 404-448-5594
IL Itasca, Janus, Inc. 708-250-9650
IN Indianapolis, Leslie M. Devoe Co. 317-842-3245
IA Cedar Rapids, Dy-Tronix, Inc. 319-377-8275
KS Leawood, Dy-tronix, Inc. 913-339-6333
KS Wichita, Dy-tronix, Inc. 316-838-0884
MD Columbia, Third Wave Solutions, inc. 410-290-5990
MA N. Reading, Alpha-Omega Sls. 508-664-1118
MA North Reading, Alpha Omega Sls. 508-664-1118
MN Edina, Mel Foster 612-944-3456
MO Bridgeton, Dy-tronix, Inc. 314-291-4777
NJ Cherry Hill, Tritek 609-667-0200
NM Albuquerque, C.T. Carlberg 505-899-2155
NY Rochester, Empire Tech 719-381-8500
NY Rockville Centre, S-J Assocs. 516-536-4242
NY Skaneateles, Empire Tech 315-685-5703
NC Raleigh, Zucker Assocs., Inc. 919-782-8433
OH Cleveland, Elctrn. Salesmasters 216-831-9555
OK Tulsa, Ammon & Rizos 918-749-6116
OR Beaverton, Micro Sls., Inc. 503-645-2841
TX Austin, Ammon & Rizos 512-454-5131
TX Houston, Ammon & Rizos 713-781-6240
TX Richardson, Ammon & Rizos 214-644-5591
UT Salt Lake City, Electrodyne, Inc. 801-264-8050
WA Bellevue, Micro Sls., Inc. 206-451-0568
WI Delafield, Janus, Inc. 414-646-5420
Can Montreal, Electro Source 514-630-7486
Can Ottawa, Ont., Electro Source 613-592-3214
Can Toronto, Electro Source 416-675-4490

Local Distributors

AL Huntsville, Marshall Inds. 205-881-9235
AZ Phoenix, Marshall Inds. 602-496-0290
CA Calabasas, Marshall Inds. 818-878-7000
CA El Monte, Marshall Inds. 818-307-6000
CA Irvine, Capstone 714-587-0638
CA Irvine, Marshall Inds. 714-458-5380
CA Irvine, Milgray 800-466-9277
CA Milpitas, Marshall Inds. 408-943-4600
CA N. Hollywood, B. J. Wolfe Entprs. 213-877-5518
CA Sacramento, Marshall Inds. 916-635-9700
CA San Diego, Marshall Inds. 619-578-9600
CA San Jose, B.J. Wolfe Entprs. 408-371-3443
CA San Jose, Capstone Elctrns. 408-453-9804
CO Denver, Capstone Elctrns. 303-451-8383
CO Denver, Marshall Inds. 303-451-8383
CT Wallingford, Marshall Inds. 203-265-3822
FL Altamonte Springs, Marshall Inds. 407-767-8585
FL Ft. Lauderdale, Marshall Inds. 305-977-4880
FL St. Petersburg, Marshall Inds. 813-573-1399
GA Atlanta, Marshall Inds. 404-923-5750
GA Atlanta, Milgray 800-241-5523
IL Chicago, Capstone Elctrns. 708-250-0300
IL Chicago, Marshall Inds. 708-490-0155
IL Chicago, Milgray 800-322-6271
IN Indianapolis, Marshall Inds. 317-297-0483
KS Kansas City, Marshall Inds. 913-492-3121
KS Kansas City, Milgray 800-255-6576
MD Columbia, Capstone 609-596-7500
MD Columbia, Milgray 800-638-6656
MD Silver Springs, Marshall Inds. 301-622-1118
MD Spencerville, United States Elctrns. 301-384-3300
MD Spencerville, US Elctrns. 301-384-3300
MA Wilmington, Capstone Elctrns. 508-657-5874
MA Wilmington, Marshall Inds. 508-658-0810
MA Winchester, Webb Distbn. 617-729-6839
MI Detroit, LWC Distrs. 313-464-7700
MI Detroit, Marshall Inds. 313-525-5850
MN Minneapolis, Capstone 612-250-0300
MN Minneapolis, Marshall Inds. 612-559-2211
MO St. Louis, Marshall Inds. 314-291-4650
NJ Fairfield, Marshall Inds. 201-882-0320
NJ Marlton, Capstone Elctrns. 609-596-7500
NJ Marlton, Milgray 800-257-7111
NJ Mt. Laurel, Marshall Inds. 609-234-9100
NJ Parsippany, Milgray 800-622-0291
NY Farmingdale, Milgray 800-645-4729
NY Rochester, Marshall Inds. 716-235-7620
NY Syracuse, Marshall Inds. 607-785-2345
NC Raleigh, Capstone Elctrns. 919-954-0600
NC Raleigh, Century Elctrns. 919-596-2220
NC Raleigh, Marshall Inds. 919-878-9882
OH Cleveland, Electronic Mktg. Corp. (EMC) 800-366-3625
OH Cleveland, Marshall Inds. 216-248-1788
OH Columbus, Elctr. Mktg. (EMC) 800-366-3621
OH Dayton, Marshall Inds. 513-898-4480
OH Westerville, Marshall Inds. 614-891-7581
OK Tulsa, Norvell Elctrns. 918-254-8606
OR Beaverton, Almac Elctrns. 503-629-8090
OR Beaverton, Marshall Inds. 503-644-5050
PA Philadelphia, Century Elctrn. Comps. 215-631-5400
PA Pittsburgh, Marshall Inds. 412-788-0441
TX Austin, Marshall Inds. 512-837-1991
TX Austin, Norvell Elctrns. 512-343-2900
TX Carrollton, Capstone Elctrns. 214-380-9049
TX Dallas, Marshall Inds. 214-233-5200
TX Dallas, Norvell Elctrns. 214-233-0020
TX Houston, Marshall Inds. 713-467-1666
TX Houston, Milgray 800-962-1849
TX Houston, Norvell Elctrns. 713-777-1666
UT Salt Lake City, Marshall Inds. 801-485-1551
UT Salt Lake City, Milgray 800-537-9739
WA Seattle, Almac Elctrns. 206-643-9992
WA Seattle, Marshall Inds. 206-486-5747
WA Spokane, Almac Elctrns. 509-924-9500
WI Milwaukee, Marshall Inds. 414-797-8400
Can Brampton,Ont., Marshall Inds. 416-458-8046
Can Calgary, Alb., Zentronics 403-295-8838
Can Mississauga, Ont., Capstone Elctrns. 416-670-2010
Can Mississauga, Ont., Zentronics 416-451-9600
Can Montreal, Que., Zentronics 514-737-9700
Can Nepean, Ont., Zentronics 613-226-8840
Can Pointe Claire, Que, Marshall Inds. 514-694-8142
Can Richmond, B.C., Zentronics 604-273-5575

COMPUTER PRODUCTS/POWER CONVERSION, See Power Conversion America, Computer Prods.Inc.

COMPUTER SYSTEM PRODUCTS, 14305 21st Ave. N., Minneapolis, MN 55447, Tel: 612-476-6866, 800-422-2537, FAX: 612-476-6966; Empl.: 90; *Sls. Mgr.:* Mick Maher; *Dist. Mgr.:* Mick Maher

COMPUTER SYSTEMS TECHNICAL SUPPORT, 4015 E. Leaverton Ct., Anaheim, CA 92807, Tel: 714-632-1300, FAX: 714-632-1937; FSC No.: 9J740; Empl.: 13; *Sls. Mgr.:* Reuven Arad

COMPUTERWARE, INC., 8480-I Tyco Rd., Vienna, VA 22182-2266, Tel: 703-821-8200, FAX: 703-821-1746; Empl.: 18; *Sls. Mgr.:* John Dargo

COMPUTERWISE, 302 N. Winchester, Olathe, KS 66062, Tel: 913-829-0600, FAX: 913-829-0810; Empl.: 27; *Sls. Mgr.:* William W. Brown; *Dist. Mgr.:* William W. Brown

COMPUTRON DISPLAY SYSTEMS, Excel Corporation, 835 Bonnie Lane, Elk Grove Village, IL 60007, Tel: 708-952-8800, FAX: 708-952-0232; Empl.: 100; *Sls. Mgr.:* W. Miller ..... **B•1035**

Local Sales Offices & Reps

CA Ontario, Xcel Corp. 909-391-4321
CA San Diego, El-Com 619-578-0900
CO Littleton, Romulus 303-770-4888
FL Margate, EPM Corp. 305-977-0331
IL Palatine, Technlg. Sls. 708-991-6600
MI Troy, C.B. Jensen & Assoc. 313-643-0506
NJ Hasbrouk Hgts., Comp-Tech 201-288-7400
NJ Hasbrouk Hgts., Tory Sls. 201-288-5656
NJ Toms River, Xcel Corp. 908-830-7525
NY Rochester, Apex 716-272-7040
OH Cleveland, Xcel Corp. 216-239-4998
OR Beaverton, J.J. Backer 503-627-0775
PA Philadelphia, Powell Elctrns. 215-365-1900
TX Richardson, Pro-Comp 214-669-1500
WA Seattle, J.J. Backer 206-285-1300

Local Distributors

AL Huntsville, Comp. Distrs. 205-883-7501
AL Huntsville, Powell Elctrns. 205-539-2731
AZ Tempe, Powell Elctrns. 602-967-7538
AR Little Rock, Comp. Distrs. 501-227-6278
CA Cerritos, El-Com 213-404-2961
CA Fullerton, Pyramid 714-773-0781, 213-691-0561
CA San Jose, Powell Elctrns 408-943-9020
CA Santa Clara, Pyramid Elec. 408-727-9810
CT Hamden, Impact Elctrns. 203-281-1331
FL Ft. Lauderdale, Comp. Distrs. 305-971-4950
FL Ft. Lauderdale, Powell Elctrns./Fla. 305-972-4300
GA Norcross, Comp. Distrs. 404-441-3320
MD Columbia, Powell Elctrns. 301-621-4070
MA Canton, Impact Sls. Co. 617-821-1500
MA W. Borough, Powell Elctrns. 617-336-6100
MI St. Clair Shores, Specialties Mktg. 313-771-2700
NC Cary, Powell Elctrns. 919-467-1212
NC Raleigh, Comp. Distrs. 919-834-9465

COMSPEC DIGITAL PRODUCTS INC., 2313 W. Sam Houston Pkwy N.S. 141, Houston, TX 77043, Tel: 713-461-4487, FAX: 713-461-8846; Empl.: 3; *Sls. Mgr.:* T. A. Paine; *Dist. Mgr.:* T. A. Paine

COMSTRON A DIV. OF AEROFLEX, 35 S. Service Road, Plainview, NY 11803, Tel: 516-752-2351, TWX: 310-497-3525, FAX: 516-694-6771; Empl.: 120; *Sls. Mgr.:* William J. Meditz

COMTECH MICROWAVE CORP, Comtech Telecommunications Corp., 105 Baylis Rd., Melville, NY 11747, Tel: 516-777-8900, FAX: 516-777-8877; FSC No.: 31196; *Sls. Mgr.:* B. Diers

COM-2, INC., 1556 Woodland Dr., Saline, MI 48176, Tel: 313-429-9027, FAX: 313-429-1902; Empl.: 70; *Sls. Mgr.:* Robert Green

COMUS INTERNATIONAL, 263 Hillside Ave., Nutley, NJ 07110, Tel: 201-667-6200, 1-800-35-COMUS, FAX: 201-667-6837; *Sls. Mgr.:* Gene Moran ..... **B•1449, 1700**

Local Sales Offices & Reps

MA Sharon, Adcour 617-784-8123

Local Distributors

MA Sharon, Adcour 617-784-8123,FAX:617-784-5563

CONAP, INC., 1405 Buffalo St., Olean, NY 14760, Tel: 716-372-9650, FAX: 716-372-1594; Empl.: 135

CONAX BUFFALO CORPORATION, 2300 Walden Ave., Buffalo, NY 14225, Tel: 716-684-4500, FAX: 716-684-7433; FSC No.: 03688; Empl.: 190; *Sls. Mgr.:* R.C. Paluch

CONCORD ELECTRONICS CORPORATION, 30 Great Jones St., New York, NY 10012, Tel: 1-212-777-6571, TWX: 710-581-4930, FAX: 1-212-995-0161; FSC No.: MFR 18310; Empl.: 225; *Sls. Mgr.:* Josie Wheaton ..... **C•1290-1291, 1540**

Local Distributors

AL Huntsville, Century Fasteners 205-883-5344
AZ Tucson, PSN Distrbn. 602-623-9800
AR Little Rock, Carlton-Bates 501-562-9100
CA Mission Hills, Coast Air 818-898-2288
CA San Jose, Bisco 408-996-8420
CO Denver, CSID/Integrated 303-292-5538
CT Danbury, Heilind 208-797-8600
DE New Castle, Electronics Exchange 302-322-5401
FL Sanford, Electronic Fasteners 407-321-4000
GA Norcross, Atlanta Hardware Specialty 404-449-3000
HI AIEA, Newark Elctrns. 808-487-8951
ID Coeurd' Alene, A-I Consolidated 208-765-3280
IL Franklin Park, Bisco 312-451-1230
IN Indianapolis, Mar Elctrns. 317-633-6699
IA Cedar Rapids, Dee Elctrns. 319-365-7551
KS Wichita, RSC Elex 216-267-5213
KY Bowling Green, Crescent Elctrns. 502-842-2444
LA New Orleans, Radio Pts. 504-581-5959
MD Gaithersburg, MS Elctrns. 301-921-0200
MA Billerica, MS Inserts 508-670-5600
MI Farmington Hills, Advent Elctrns. 313-477-1650

MN New Brighton, Chris ELctms. 612-631-2647
MS Jackson, Newark Elctms. 601-956-3834
MO St. Charles, Finnegan Elctms. 314-946-6201
NE Omaha, Omaha Elctms. 402-341-3440
NV Reno, Richco 702-323-4939
NH Nashua, Brevan 603-889-7230
NJ Kenilworth, Federated Purchasers 201-272-0505
NM Albuquerque, Electronic Pts. 505-293-6161
NY Bohemia, Car-Lac 516-567-4200
NC Raleigh, Century Elec. Comp. 919-782-2116
OH Dayton, Stotts-Friedman 513-298-5555
OK Tulsa, Altair 918-252-5781
OR Beaverton, Comp. Resources 503-641-8488
PA Philadelphia, PEI Genesis 215-673-0400
RI Pawtucket, Major Edwards 401-725-7400
SC Charleston, Wholesale Indl. Elex 803-577-6388
TN Knoxville, Industrial Elect 615-573-7135
TX Richardson, Aero Glen 214-234-0984
UT Salt Lake City, Kimball Elctms. 801-328-2075
VT Colchester, Hooker Elctms. 802-864-0885
VA Springfield, Southern Fasteners 703-922-8048
WA Redmond, Olander 206-881-3488
WV Beckley, State Elec. 304-256-2219
WI Grafton, Lakeview Elex 414-377-8250
EXP Taipei, Taiwan, Gold-Tek Elec. Co. 20-717-2302
Can Mississauga, Ont., Rush Elctms. 416-677-7280

Condenser Products

FAX: 904-799-0221

CONDENSER PRODUCTS CORP., 2131 Broad St., Brooksville, FL 34609, Tel: 904-796-3561; FSC No.: 16727; Empl.: 22; *Sls. Mgr.:* Terry Baker ..... **A•1058-1060**

Local Sales Offices & Reps

TX Lewisville, Elctm. Prod. Reps. 214-436-4772

CONDOR
D.C. POWER SUPPLIES, INC.

FAX: 805-487-8911

CONDOR D.C. POWER SUPPLIES, INC., 2311 Statham Pkwy., Oxnard, CA 93033, Tel: 805-486-4565,; Empl.: 250; *Sls. Mgr.:* Michael F. Kirkowski, Exec. VP Mktg.; *Dist. Mgr.:* Mary Shaw ..... **D•1636-1645**

Local Sales Offices & Reps

AL Huntsville, Adams Elctms. 205-882-2988
AZ Phoenix, Howe & Howe 602-264-7971
CA San Dimas, AF Sls. 909-599-4412
CA Sunnyvale, Tritiny Technlg. 408-733-9000
CO Denver, AKI Entprs. 303-388-4488
CT Madison, Focus Elctms. Sls. 203-245-4314
FL Altamonte Springs, Semtronic Assoc. 407-831-8233
GA Lilburn, Adams Elctms. 404-925-9115
IL Elk Grove Vlg., Tristar 708-593-0200
IN Carmel, Current Elctms. Mktg. 317-844-1770
IA Cedar Rapids, Lorenz Sls., Inc. 319-377-4666
KS Overland Park, Lorenz Sls., Inc. 913-469-1312
MD Columbia, Delta III Assocs. 410-730-7400
MA Taunton, Focus Elctms. Sls., Inc. 508-824-3840
MI Plymouth, Jay Mktg. 313-459-1200
MN Minneapolis, ECS 612-933-2594
MO St. Louis, Lorenz Sls. Inc. 314-997-4558
NJ Marlton, BGR Assocs. 609-983-1020
NY Pittsford, C W Beach Co. 716-586-3200
NY Yonkers, Sonkin Assocs. 914-968-8282
OH Dayton, Thompson & Assocs. 513-435-7733
OR Beaverton, Eclipse Mktg. Grp. 503-642-1661
TX Austin, M Rep 512-205-0828
TX Dallas, M Rep 214-484-5711
WA Redmond, Eclipse Mktg. Grp. 206-885-6991
Can Mississauga, GMA, Inc. 416-671-6111

Local Distributors

AL Huntsville, Allied Elctms. 205-721-3500
AL Huntsville, Future Elctms. 205-830-2322
AL Huntsville, Hammond Elctms. 205-830-4764
AZ Phoenix, Aerospace S.W. 602-582-2779
AZ Phoenix, Allied Elctms. 602-437-9080
AZ Phoenix, Future Elctms. 602-968-7140
AZ Scottsdale, Kent Elctms. 602-998-0399
AZ Tempe, Cypress Elctms. 602-966-2256
AZ Tucson, SWS Elctms. 602-628-1613
CA Camarillo, Milgray 805-484-4055
CA Chatsworth, Allied Elctms. 818-882-6981
CA Chatsworth, Future 818-772-6240
CA Costa Mesa, Cypress Elctms. 714-549-2424
CA Costa Mesa, FLW 714-751-7512
CA Fremont, Allied Elctms. 510-505-0220
CA Fremont, FLW 415-651-6511
CA Irvine, Milgray 714-753-1282
CA Milpitas, Kent Elctms. 408-262-5300
CA San Diego, Allied Elctms. 619-279-2550
CA San Diego, Cypress Elctms. 619-535-0011
CA San Diego, Future 619-625-2800
CA San Diego, Kent Elctms. 619-453-7133
CA San Jose, Future Elctms. 408-434-1122
CA San Jose, Milgray 408-456-0900
CA Santa Ana, Foresight 714-833-2134
CA Santa Clara, Cypress Elctms. 408-980-2500
CA Santa Clara, Foresight 408-980-9700
CA Torrance, Kent Elctms. 310-320-2700
CO Broomfield, Future Elctms. 303-421-0123
CO Englewood, Allied Elc. 303-790-1664
CO Englewood, Cypress 303-792-5829
CO Englewood, Kent Elctms. 303-762-0670
CT Berlin, Kent Elctms. 203-829-2100
CT Bethel, Future Elctms. 203-743-9594
CT Cheshire, Allied Elctms. 203-272-7730
CT Milford, Milgray 203-878-5538
FL Altamonte Springs, Future 407-767-8414
FL Casselberry, Allied 800-433-5700
FL Deerfield Beach, Vantage Comp. 305-729-1001
FL Ft. Lauderdale, Hammond Elctms. 305-973-7103
FL Lake Mary, Milgray 800-367-0780
FL Largo, Future 813-530-1222
FL Largo, Kent Elctms. 813-545-0057
FL Orlando, Hammond Elctms. 407-841-1010
GA Duluth, Allied Elctms. 800-433-5700
GA Norcross, Future Elctms. 404-441-7676
GA Norcross, Hammond Elctms. 404-449-1996
GA Norcross, Milgray 404-446-9777
IL Chicago, Dalec Distrs. 312-283-0300
IL Elk Grove, Kent Elctms. 708-364-1300
IL Hoffman Estate, Future Elctms. 708-882-1255
IL Palatine, Milgray 708-202-1900
IL Schaumberg, Bortech Sls. 708-882-7640
IL Wood Dale, Allied Elctms. 800-433-5700
IN Indianapolis, Allied Elctms. 800-433-5700
IA Cedar Rapids, Kent Elctms. 319-373-0525
IA Des Moines, Allied Elctms. 800-433-5700
KS Lenexa, Allied Elctms. 800-433-5700
KS Overland Park, Kent Elctms. 913-338-4300
KS Overland Pk., Milgray 913-236-8800
KS Shawnee Mssn, Aerospace Comp. 913-432-8508
KY Louisville, Allied Elctms. 800-433-5700
LA Metairie, Allied Elctms. 800-433-5700
MD Columbia, Allied Elctms. 800-433-5700
MD Columbia, Future Elctms. 301-290-0600
MD Columbia, Kent Elctms. 301-720-6200
MD Columbia, Milgray 301-621-8169
MD Columbia, Vantage 410-720-5100
MD Gaitherburg, MS Elctms. 301-921-0200
MA Andover, Vantage Comp 508-687-3900
MA Billerica, Allied Elctms. 800-433-5700
MA Billerica, Mayor Elctms. 617-229-2255
MA Boston, Future Elctms. 508-779-3000
MA Chelmsford, Kent Elctms. 508-250-9666
MA Wilmington, Milgray 508-657-5900
MI Ann Arbor, McNaughton-McKay 313-995-9515
MI Livonia, Future Elctms. 313-261-5270
MI Madison Heights, McNaughton-McKay 313-399-7500
MI Plymouth, Allied Elctms. 800-433-5700
MN Bloomington, Allied Elctms. 800-433-5700
MN Eden Prairie, Cypress 612-934-2104
MN Eden Prairie, Future Elctms. 612-944-2200
MN Edina, Bortech Sls. 612-835-9005
MN Minneapolis, Aerospace Comp. Prod. 612-884-4725
MN St. Paul, Kent Elctms. 612-642-2828
MO Earth City, Allied 800-433-5700
MO Hazelwood, Kent Elctms. 314-895-1515
NE Omaha, Allied Elctms. 800-433-5700
NH Nashua, Allied Elctms. 800-433-5700
NJ Clifton, Vantage Comp. 201-777-4100
NJ Marlton, Future Elctms. 609-596-4080
NJ Marlton, Milgray 609-983-5010
NJ Parsippany, Allied Elctms. 800-433-5700
NJ Parsippany, Milgray 201-335-1766
NY All Cities, Allied Elctms. 800-433-5700
NY Farmingdale, Milgray 516-391-3000
NY Hauppauge, Future Elctms. 516-234-4000
NY Liverpool, Future Elctms. 315-451-2371
NY Mt. Sinai, Kent Elctms. 516-447-2000
NY Pittsford, Milgray 716-381-9700
NY Rochester, Future Elctms. 716-272-1120
NY Smithtown, Vantage Comp. 516-543-2000
NY Yonkers, Kintronics 914-347-2530
NC Concord, Future Elctms. 704-455-9030
NC Greensboro, Hammond Elctms. 919-275-6391
NC Raleigh, Allied 800-433-5700
NC Raleigh, Century Elctms. Comp. 919-596-2220
NC Raleigh, Future Elctms. 919-790-7111
NC Raleigh, Milgray 919-790-8094
OH All Cities, Allied Elec 800-433-5700
OH Cleveland, Milgray 216-447-1520
OH Mayfield Hts., Future Elec 216-449-6996
OK Tulsa, Allied Elctms. 800-433-5700
OK Tulsa, Norvell Elec. 918-628-1916
OR Beaverton, EOFF 503-645-9454
OR Beaverton, Kent Elctms. 503-626-8300
OR Bend, EOFF 503-388-1544
OR Eugene, EOFF 503-342-1277
OR Salem, Eoff 503-363-9251
PA All Cities, Allied Elctms. 800-433-5700
PA Norristown, Century Elctms. Comp. 215-631-5400
RI Pawtucket, Major Edwards 401-725-7400
SC Greenville, Allied Elctms. 800-433-5700
TN Memphis, Allied Elctms. 800-433-5700
TX All Cities, Allied Elctms. 800-433-5700
TX Austin, Kent Elctms. 512-834-1900
TX Austin, Norvell Elctms. 214-233-0020
TX Dallas, Milgray 214-248-1603
TX Dallas, Norvell Elctms. 214-233-0020
TX Houston, Future Elctms. 713-556-8696
TX Houston, Kent Elctms. 713-780-7770
TX Houston, Norvell Elctms. 713-462-1666
TX Irvine, Cypress Elctms. 214-255-0065
TX Richardson, Future Elctms. 214-437-2437
TX Richardson, Kent Elctms. 214-669-2600
TX Stafford, Milgray 713-240-5360
UT Salt Lake City, Allied Elctms. 800-433-5700
UT Salt Lake City, Milgray 801-261-2999
VA All Cities, Allied Elctms. 800-433-5700
WA Bothell, Cypress Elctms. 206-483-1144
WA Redmond, Future Elctms. 206-881-8199
WA Redmond, Kent Elctms. 206-883-7200
WA Seattle, Allied 800-433-5700
WA Vancouver, Eoff 206-694-7504
WI New Berlin, Allied Elctms. 414-796-1280
WI Waukesha, Future Elctms. 414-786-1884
Can Calgary, Alb., Future Elctms. 403-250-5550
Can Edmonton, Alb., Future Elctms. 403-438-2858
Can Mississauga, Ont., Future Elctms. 416-612-9200
Can Mississauga, Ont., Milgray 416-678-0955
Can Montreal, Que., Elctm. Wholesirs. 514-769-8851
Can Ottawa, Ont., Elctm. Wholesirs. 613-746-4413
Can Ottawa, Ont., Future Elctms. 613-820-8313
Can Pt. Claire, Que., Ferrotronic Comp. 514-426-0300
Can Pt. Claire, Que., Future Elctms. 514-694-7710
Can Pt. Claire, Que., Milgray 514-426-5900
Can Quebec, Que., Future Elctms. 418-877-6666
Can Toronto, Ont., Duncan Inst. Ltd. 416-742-4448
Can Vancouver, B.C., Future Elctms. 604-294-1166
Can Winnipeg, Man., Future Elctms. 204-786-7711

CONDOR PACIFIC INDS., INC., 8053 Deering Ave., Canoga Park, CA 91304, Tel: 818-347-8331, TELEX: 65-1442, FAX: 818-713-0162; FSC No.: 24321; Empl.: 110

CONDOR SYSTEMS, INC., 2133 Samaritan Dr., San Jose, CA 95124, Tel: 408-371-9580, FAX: 408-371-9589; FSC No.: 62065; Empl.: 318; *Sls. Mgr.:* Dave Klingler

CONDUCTIVE RUBBER TECHNOLOGY, INC., 22125 17th Ave. S.E. Ste. 117, Bothell, WA 98021, Tel: 206-486-8559, FAX: 206-487-0945; Empl.: 30; *Sls. Mgr.:* K. Grant

CONDUCTIVE SYSTEM, INC., R.D. No. 1, Box 1040, Rte. 5 South, Amsterdam, NY 12010, Tel: 518-843-5740, FAX: 518-843-5829; Empl.: 25; *Sls. Mgr.:* Walter G. Bruce

CONDUCTUS, INC., 969 W. Maude Ave., Sunnyvale, CA 94086, Tel: 408-737-6700, FAX: 408-737-6699; Empl.: 40

CONFORMING MATRIX, Box 5126, Pt. Pl. Sta., Toledo, OH 43611, Tel: 419-729-3777, FAX: 419-729-3779; Empl.: 35

CONKLIN INSTRUMENT CORP., West Rd., P.O. Box 650, Pleasant Valley, NY 12569, Tel: 914-635-2136, FAX: 914-635-2510; Empl.: 120; *Sls. Mgr.:* Steve A. Muise, VP Sls.

CONNECT-AIR INTERNATIONAL, INC., 50 37th St. N.E., Auburn, WA 98002, Tel: 206-939-4880, FAX: 206-939-4882; Empl.: 50; *Sls. Mgr.:* Ron Jones

CONNECTICUT HARD RUBBER CO., See CHR Inds.

CONNECTICUT MICROWAVE CORP., 10 B Trackside Business Park, Cheshire, CT 06410, Tel: 203-250-9678, FAX: 203-250-9688; FSC No.: 50974; Empl.: 15; *Sls. Mgr.:* Joseph W. Raines

CONNECTOR ACCESSORIES, INC., See Mueller Elec. Co.

CONNECTOR CORP., 6025 N. Keystone Ave., Chicago, IL 60646, Tel: 312-539-3108, TWX: 910-221-6059, FAX: 312-539-3825; *Sls. Mgr.:* Michael Gits ..... **C•1292**

CONNECTOR INDUSTRIES OF AMERICA DIV., Microdot Mfg., 10340 Julian Dr., Cincinnati, OH 45215, Tel: 513-772-3680; FSC No.: 32076; Empl.: 60; *Sls. Mgr.:* Bob Cain

Connectronics Corp.

FAX: 419-537-0007

CONNECTRONICS CORP., 2745 Avondale Ave., Toledo, OH 43607, Tel: 419-537-0020; FSC No.: 0LE36; Empl.: 15; *Sls. Mgr.:* Bruce A. Begitschke ..... **C•1293**

Local Sales Offices & Reps

AZ	Tucson, Blackhart Assocs.	602-579-0399
CA	Morgan Hill, Power Connection, Inc.	408-779-8888
CO	Silt, Blackhart Assocs.	303-876-5605
GA	Atlanta, Electro Technlg. Prods.	404-262-1522
MA	Lexington, Jesco, Inc.	617-863-1598
MN	Stillwater, Prof. Elctrn. Reps	612-436-1950
NJ	Summit, Intl. Cable Corp.	908-273-4470
NY	Victor, Kirby Mktg.	716-248-8750
OH	Toledo, Connectronics	419-537-0020

HCW

FAX: 708-851-5040

CONNOR-WINFIELD CORP., 1865 Selmarten Rd., Aurora, IL 60505-1335, Tel: 708-851-4722; FSC No.: 5955; Empl.: 45; *Sls. Mgr.:* Tom Grabowski ..... **A•1350-1355**

Local Sales Offices & Reps

AL	Huntsville, Macro Mktg.	205-883-9630
AZ	Scottsdale, Spectrum Mktg. Assoc.	602-890-9000
CA	Campbell, Shur Sls.	408-374-5577
CA	San Diego, A.T.A. Assoc.	619-792-6079
CA	Westlake Village, First Rep	805-373-0887
CO	Denver, Spectrum Mktg. Assoc.	303-480-9991
CT	Cheshire, Scientific Comps.	203-272-2963
FL	Boca Raton, APM Assoc.	407-395-7308
FL	Tampa, APM Assoc.	813-886-2457
FL	Winter Park, APM Assoc.	407-678-2777
ID	Boise, Q.R. Crown	208-344-9588
IN	Ft. Wayne, R.O. Whitesell	219-489-0588
IN	Indianapolis, R.O. Whitesell	317-876-9000
IN	Kokomo, R.O. Whitesell	317-457-9127
KY	Versailles, R.O. Whitesell	606-873-1182
MD	Kensington, Koebert Assocs.	301-493-8924
MA	Lexington, Kanan Technlgs.	617-861-7300
MI	Grand Blanc, R.O. Whitesell	313-695-0770
MI	Grand Rapids, R.O. Whitesell	616-942-5420
MI	Southfield, R.O. Whitesell	313-352-5454
MI	St. Joseph, R.O. Whitesell	616-983-7337
NC	Charlotte, Quantum Mktg.	704-523-8822
NC	Raleigh, Quantum Mktg.	919-846-5728
OH	Cincinnati, R.O. Whitesell	513-528-5644
OH	Cleveland, R.O.Whitesell	216-447-9020
OH	Columbus, R. O. Whitesell	614-888-9396
OH	Dayton, R.O.Whitesell	513—298-9546
OR	Portland, Q.R. Crown	503-620-8320
PA	Glenside, Koebert Assocs.	215-887-2310
PA	Pittsburgh, R.O. Whitesell	412-963-6161
TX	Austin, Synergistic Sls.	512-346-2122
TX	Houston, Synergistic Sls.	713-937-1990
TX	Richardson, Synergistic Sls.	214-644-3500
WA	Bellevue, Q.R. Crown	206-453-5100
WI	Mequon, Artmor Ltd.	414-242-4127
WI	Oconomowoc, Artmor Ltd.	414-367-8789
Can	Kanata, Ont., J-Squared Tech., Inc.	613-592-9540

Local Distributors

PA	Glenside, Mark Elctrns.	215-887-2317

CONRAC DISPLAY PRODUCTS, INC., 1724 S. Mountain Ave., Duarte, CA 91010, Tel: 818-303-0095, TELEX: 67-0437, TWX: 910-584-5913, FAX: 818-303-5484; Empl.: 96; *Sls. Mgr.:* G.L. Ives, Dir. Mktg. & Sls.

Consolidated electronic wire & cable

FAX: 708-455-8979

CONSOLIDATED ELECTRONIC WIRE & CABLE, 11044 King St., Franklin Park, IL 60131-1412, Tel: 708-455-8830; FSC No.: 73612; Empl.: 97; *Sls. Mgr.:* Karl Rankin; *Dist. Mgr.:* Steve Boynton ... **C•1294-1298, 1726-1739**

Local Sales Offices & Reps

AL	Huntsville, New Age Elctrns.	205-895-9400
AZ	Phoenix, Mercury Engrg. Sls.	602-265-0344
AR	N. Little Rock, Leo Baker Co.	501-834-2537
CA	Irvine, Vale Elctrns. Assoc.	714-551-4004
CA	San Diego, Vale Elctrns. Assocs.	619-487-7025
CA	San Jose, Westron Assoc.	408-264-4070
CO	Denver, Diversified Mktg. Grp.	303-231-6039
CT	Consolidated Elctrn. Wire	708-455-8830
FL	Winter Park, Technlg. Mktg. Assoc.	407-671-2245
GA	Newnan, New Age Elctrns.	404-476-0079
IL	Mt. Prospect, The Dombrow Co.	708-253-3326
IN	Carmel, Frank Kahsar Sls.	317-844-9353
IA	Cedar Rapids, R.W. Kunz	319-396-5386
IA	Des Moines, Jerry Bunch Elec. Sls.	515-287-7057
KS	Prairie Village, R.W. Kunz	913-648-3535
MI	Sterling Heights, Frank Kahsar Sls.	313-795-3530
MN	Minneapolis, Tecteam Sls., Inc.	612-854-6616
MO	St. Louis, R.W. Kunz	314-966-4977
NY	Mendon, Tech-Mark, Inc.	716-624-3840
NY	Woodside, Greater Metro Sls.	718-424-1911
NC	Raleigh, Vantage Mktg.	919-870-7123
OH	Cincinnati, Frank Kahsar Sls., Inc.	513-598-1484
OH	Columbus, Frank Kahsar Sls.	614-252-4009
OH	Elyria, Frank Kahsar Sls.	216-365-5219
OH	Mentor, Frank Kahsar Sls.	216-257-1166
PA	Horsham, Jacobsen Assoc.	215-674-2937
PA	Wexford, Frank Kahsar Sls.	412-935-8561
SC	Walhallia, Overton Assoc.	803-638-7101
TN	New Tazewell, Overton Assoc.	615-626-6009
TX	Plano, B&R Elctrn. Sls. Corp.	214-985-0028
VA	Merchanicsville, R.B. Marsland Assocs.	804-746-5770
WA	Redmond, Sls. & Engrg. Assoc.	206-883-4999
WI	Mequon, E.A. Dickinson	414-241-9140
Can	Con. Elctrn. Wire & Cable	800-621-4278

CONTACT, INC., Rte. 27 Box 2230, Edgecomb, ME 04556, Tel: 207-882-6116, FAX: 207-882-6122; FSC No.: MO7015; Empl.: 11; *Sls. Mgr.:* R.Reid; *Dist. Mgr.:* R.Reid

CONTACT EAST, 335 Willow St. S., N. Andover, MA 01845, Tel: 508-682-2000, FAX: 508-688-7829; *Sls. Mgr.:* Richard Sullivan

CONTAQ TECHNOLOGIES CORP., 15 Main St., Bristol, VT 05443, Tel: 802-453-3332, FAX: 802-453-4250; FSC No.: 6680

CONTEC MICROELECTRONICS USA, 2188 Bering Drive, San Jose, CA 95131, Tel: 408-434-6767, 1-800-888-8884, FAX: 408-434-6884; Empl.: 50; *Sls. Mgr.:* Nayan Pradhan

CONTINENTAL DEVICE INDIA LIMITED, C-120 Naraina Industrial Area, New Delhi, India 110028, Tel: 536150-53 (4 lines), TELEX: 031-76209, TWX: 031-76230; FSC No.: IJ.; Empl.: 1100; *Sls. Mgr.:* P. Gulati, Gen. Mgr. & VP Mfg.

CONTINENTAL ELECTRONICS CORPORATION, P.O. Box 270879, Dallas, TX 75227, Tel: 214-381-7161, TELEX: 73-398, FAX: 214-381-4949; FSC No.: 52151; Empl.: 270

CONTINENTAL MICROWAVE TECHNOLOGY INC., 7 Alexander Place, Glen Cove, NY 11542, Tel: 516-759-5600, FAX: 516-759-5603; *Sls. Mgr.:* Robert Herrmann, Gen. Mgr. ..... **A•1357**

Local Sales Offices & Reps

CA	Palo Alto, Microwave Mktg. Assoc.	415-326-4143
CA	Westlake VL, Westtech Microwave, Inc.	805-373-0033
FL	Melbourne Beach, EDSI Sls.	407-952-1240
MD	Laurel, CSDS, Inc.	301-953-7884
NY	Melville, R.F. Elctrn. Sls.	516-420-8890
MA	Wayland, High Tech Sls.	508-653-3838
TX	Richardson, SW Microwave Elctrns. Corp.	214-669-1195
Can	Montreal, Que., Solid State Engrg. Co.	514-481-3313

CONTINENTAL RESOURCES, Computer & Peripherals Div., 175 Middlesex Tpke., Bedford, MA 01730-1469, Tel: 617-275-0850, 800-937-4688, FAX: 617-275-6563; Empl.: 250; *Sls. Mgr.:* Mark Berling

CONTINENTAL RESOURCES, INC, Test Instruments Div., 175 Middlesex Tpke., Bedford, MA 01730, Tel: 617-275-0850, 800-937-4688, FAX: 617-275-2046; Empl.: 250

CONTROL CABLE, INC., 7261 Ambassador Rd., Baltimore, MD 21244, Tel: 410-298-4411, FAX: 410-265-1646; FSC No.: 510124759; Empl.: 90; *Sls. Mgr.:* Bill Cook; *Dist. Mgr.:* Bill Cook

CONTROL COMPONENTS & SYSTEMS, INC., 557 Long Road, Pittsburgh, PA 15235, Tel: 412-371-1111, FAX: 412-371-1112

CONTROL CONCEPTS CORP., Liebert Corp., P.O. Box 1380, Binghamton, NY 13902-1380, Tel: 607-724-2484, FAX: 607-722-8713; Empl.: 85; *Sls. Mgr.:* Pat Gillette, VP Sls.; *Dist. Mgr.:* Jim Harrison

CONTROL ELECTRONICS, Neurotech Corp., 139 Florida St., Farmingdale, NY 11735, Tel: 516-694-0125, FAX: 516-694-0133; FSC No.: 95924; Empl.: 25; *Sls. Mgr.:* Harold Goldstein; *Dist. Mgr.:* Sandy Walthers

CONTROL ENGRG., INC., 190 Doty Circle, West Springfield, MA 01089, Tel: 413-781-1330, FAX: 413-732-3367; Empl.: 7; *Sls. Mgr.:* Mark Kimball

CONTROL LASER CORP., 7503 Chancellor Dr., Orlando, FL 32809, Tel: 407-438-2500, TELEX: 514215; Empl.: 70; *Sls. Mgr.:* Steven Graham, Sls. Mgr.

CONTROLLED ENVIRONMENT EQUIPMENT CORP., 29 Sanford Dr., Gorham, ME 04038, Tel: 207-854-9126, TELEX: 62903721, FAX: 207-854-4357; FSC No.: 25254; Empl.: 10; *Sls. Mgr.:* M. F. Peck

CONTROLLED POWER COMPANY

FAX: 313-528-0411

CONTROLLED POWER CO., 1955 Stephenson Hwy, Troy, MI 48083, Tel: 313-528-3700, 1-800-521-4792, TWX: 810-2323401; Empl.: 160; *Sls. Mgr.:* Timothy Tazzia; *Dist. Mgr.:* Ken Krause ..... **D•2253-2255**

Local Sales Offices & Reps

AL	Controlled Power Co.	1-800-521-4792
AK	Anchorage, Alaska Computer Environment	907-248-7168
AZ	Phoenix, Controlled Power Co.	1-800-521-4792
CA	Foster City, Controlled Power Co.	1-800-521-4792
CO	Denver, Computer Facility Components	303-778-8488
DC	Quality Power Sys. (GSA)	1-800-521-4792
FL	Orlando, KO Power	1-800-229-4250
GA	Atlanta, Gallagher Electric	1-800-521-4792
IL	Controlled Power Co.	1-800-521-4792
IN	Indianapolis, C.M. Buck	317-293-5704
KS	Shawnee Mission, Maxima Elec. Sls.	913-722-1591
KY	Corydon, C.M. Buck	812-738-4373
LA	Metaire, Rapco Assocs.	1-800-521-4792
MD	Baltimore, Controlled Power Co.	1-800-521-4792
MI	Troy, Controlled Power Co.	1-800-521-4792
MN	Minnetonka, Automated Process Sys.	612-935-4766
MO	St. Louis, Controlled Power Co.	1-800-521-4792
NE	Omaha, Computer Protection	402-571-2322
NH	Bedford, Innovative Technologies, Inc.	603-624-4163
NJ	Nutley, Controlled Power Co.	1-800-521-4792
NM	Albuquerque, D.E.S.I.	505-292-1022
NY	Bay Shore, Controlled Power Co.	1-800-521-4792
NY	Buffalo, Controlled Power Co.	1-800-521-4792
NC	Charlottte, Glen & Larson Co.	704-847-7418
OH	Westerville, Power Com Systems	614-890-1124
OK	Oklahoma City, Controlled Power Co.	1-800-521-4792
OK	Tulsa, Controlled Power Co.	1-800-521-4792
OR	Portland, NRG	503-242-2506
PA	Philadelphia, Controlled Power Co.	1-800-521-4792
PA	Pittsburgh, Controlled Power Co.	1-800-521-4792
SC	Charleston, Glenn & Larson Co.	803-763-8640
TN	Memphis, Total Environmental Sys.	901-743-7154
TN	Memphis/Nashville, Controlled Power Co.	1-800-521-4792

TX	Dallas, Controlled Power Co.	1-800-521-4792
TX	Elpaso, Controlled Power Co.	1-800-521-4792
TX	Houston, Controlled Power Co.	1-800-521-4792
UT	Salt Lake City, Controlled Power Co.	1-800-521-4792
VA	Sterling, Quality Power Sys. (GSA)	703-709-2224, 1-800-521-4792
WA	Seattle, Tech Source	206-292-1656
WI	Wisconsin Rapids, Controlled Power Co.	1-800-521-4792
EXP	Various Offices, Controlled Power Co.	1-800-521-4792
PR	San Juan, RFF	809-755-5679
Can	Various Offices, Controlled Power Co.	1-800-521-4792

CONTROL LOGIC, See Hancock Electronics Corp.

CONTROL MODULE, 380 Enfield St., Enfield, CT 06082, Tel: 203-745-2433, TELEX: 643167, FAX: 203-741-6064; Empl.: 160; *Sls. Mgr.:* James W. Bianco

CONTROL PRODUCTS, INC., 280 Ridgedale Ave., E. Hanover, NJ 07936, Tel: 201-887-9400, FAX: 201-887-5083; FSC No.: 81901; Empl.: 62; *Sls. Mgr.:* H.M. Stuhler; *Dist. Mgr.:* H.M. Stuhler

CONTROL RESOURCES INC., 325 Ayer, Harvard, MA 01451, Tel: 508-772-4043, FAX: 508-772-4142; Empl.: 10; *Sls. Mgr.:* James Quirk ..... **C•1575**

CSI CONTROL SCIENCES INCORPORATED

FAX: 818-709-8546

CONTROL SCIENCES, INC., 9509 Vassar Ave., Chatsworth, CA 91311, Tel: 818-709-5510; FSC No.: 53317; Empl.: 20; *Sls. Mgr.:* Rhod Zimmerman ..... **D•1176-1181**

Local Sales Offices & Reps

CA	Luguna Niguel, Aktron Sls.	714-496-5057
FL	Oldsmar, Suncoast Elctrn. Sls.	813-787-9221

CAL SWITCH

CALIFORNIA SWITCH AND SIGNAL INC.

THE SOURCE FOR

COOPER Belden

[310] 538-9830
[213] 770-2330
[714] 525-6606
[415] 621-7386
[408] 279-8848
[510] 452-1009
[916] 448-6370
[209] 441-1725

(800) CAL-SWCH

IN	Ft. Wayne, Naunas Sls. Co.	219-432-4792
MD	Annapolis, Homersmith, Inc.	410-269-6493
MA	Salem, Forbes Engrg.	508-744-1693
MN	St. Paul, Northstar Motion & Control	612-770-5311
NJ	Williamstown, Homersmith, Inc.	609-567-7464
NC	Jamestown, Homersmith, Inc.	919-883-3999
PA	Springfield, Homersmith Inc.	215-543-2434
TX	Richardson, Beacon Microwave	214-437-1505
TX	Roundrock, Beacon Microwave	512-244-6675
VA	Shawsville, Homersmith Inc.	703-268-9720
WI	Cedarburg, Hi-Tech Dvcs. Corp.	414-375-9595

CONTROLS UNLIMITED, INC., 4823 North Ridge Rd., Perry, OH 44081, Tel: 216-259-2500, FAX: 216-259-5015; Empl.: 45; *Sls. Mgr.:* Paul Adams

CTC

FAX: Fax 718-361-6386

CONTROL TECHNOLOGY CO., INC., 41-16 29th St., Long Island City, NY 11101, Tel: 718-361-2133; FSC No.: 14545; Empl.: 35; *Sls. Mgr.:* H. Cooper ... **D•2314-2315**

Local Sales Offices & Reps

Can	Montreal, Que., Control Tech. Elctrns. CTC Canada	514-733-3279,FAX:514-733-2132

CONTROL TECHNOLOGY, INC., 7608 N. Hudson, Oklahoma City, OK 73116, Tel: 405-840-3163, FAX: 405-848-0489; *Sls. Mgr.:* Charles Weddington; *Dist. Mgr.:* Charles Weddington

CONTROLTEK, INC., 14201 NW Science Park Dr., Portland, OR 97229, Tel: 503-641-0876, FAX: 503-641-7349; Empl.: 16; *Sls. Mgr.:* Kevin Caswell

cdi CONVERSION DEVICES, INC.

EXCELLENCE IN POWER CONVERSION TECHNOLOGY

FAX: 508-559-9288

CONVERSION DEVICES, INC., 15 Jonathan Drive, Brockton, MA 02401, Tel: 508-559-0880; Empl.: 70; *Sls. Mgr.:* Wayne Carlson ..... **D•2096-2097**

Local Sales Offices & Reps

AL	Huntsville, South Tech. Sls.	205-880-8200
AZ	Phoenix, Howe & Howe, Sls.	602-264-7971
CA	Camarillo, The Tricamo Co.	805-388-0039
CA	Mountain View, L.S. Engrg.	415-967-5880
CA	San Diego, The Tricamo Co.	619-689-1000
CO	Englewood, Odyssey 1	303-773-8176
CT	Fairfield, Bossaco	203-255-2326
FL	Melbourne, Saber Assocs., Inc.	407-724-0920
FL	Oviedo, Conley & Assocs.	407-365-3283
GA	Lilburn, South Tech. Sls.	404-381-2088
IL	Elmhurst, Sector Engrg. Sls.	708-530-7850
IN	Indianapolis, Sector Engrg. Sls.	317-253-9221
IA	Cedar Rapids, M.I.N.K. Assocs.	319-393-0373
KS	Overland Park, M.I.N.K. Assocs.	919-341-8309
MD	Ellicott City, VPI	410-461-2525
MA	Brockton, Conversion Dvcs., Inc.	508-559-0880
MA	Scituate, N.E.A.R.	617-545-6327
MI	Livonia, Electro Sls. Assocs.	313-421-7500
MN	Minneapolis, Sector Engrg. Sls.	612-378-2123
MO	Bridgeton, M.I.N.K. Assocs.	315-291-5454
NJ	Paramus, Eltech Sls., Inc.	201-967-1309
NM	Albuquerque, H.E.R. Elctrns.	505-265-8609
NY	Liverpool, R & D Assocs.	315-457-0100
NC	Raleigh, South Tech. Sls.	919-571-1313
OH	Dayton, Electro Sls. Assocs.	513-426-5551
OK	Broken Arrow, D. J. Sls.	918-258-1445
OR	Lake Oswego, SPS Elctrns.	503-697-7768
PA	Pittsburgh, Electro Sls. Assocs.	412-322-9000
PA	Plymouth Meeting, CMS Sls. & Mktg.	215-834-6840
TX	Austin, D.J. Sls.	512-258-3002
TX	Dallas, D.J. Sls.	214-783-8876
UT	Salt Lake City, Odyssey 1	801-485-4728
WA	Mountlake Ter., SPS Elctrns.	206-323-4140
WI	Milwaukee, Sector Engrg. Sls.	414-352-8280
Can	Mississauga, Ont., Andy Baumen Assocs. Ltd.	416-828-2600

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Local Sales Offices & Reps

CA	San Jose, Vernexx & Assocs.	408-972-9072
FL	Clearwater, Dan-Tech Sls.	813-441-2609
FL	Davie, Dan-Tech Sls.	305-581-2884
MD	Kensington, Koebert Assocs.	301-439-8924
MA	Arlington, Interstate Sls. Assocs.	617-646-3914
MA	Chelmsford, Interstate Sls. Assocs.	508-256-2287
NY	Rochester, KLM Garner	716-385-2103
NY	Smithtown, Koebert Assocs.	516-979-6683
PA	Glenside, Koebert Assoc.	215-887-2310
RI	Warren, Interstate Sls. Assocs.	401-245-8364
TX	Houston, Scientific Sls. Co.	713-645-6218
TX	Richardson, Scientific Sls. Co.	214-231-6541
VA	Alexandria, Koebert Assocs.	703-461-3655
Can	Rexdale, Valtrie Mktg.	416-851-0335
Can	Vancouver, BC, Davetek Mktg.	604-430-3680

Local Distributors

AL	Huntsville, Comp. Distrs., Inc.	205-851-7800
CA	Santa Anna, Foresight Elctrns.	714-833-2134
CA	Santa Clara, Foresight	408-980-9700
CO	Englewood, Comp. Distrs.,Inc.	303-770-6214
FL	Clearwater, Comp. Distrs., Inc.	813-796-0466
FL	Palm Bay, Comp. Distrs., Inc.	407-724-9910
GA	Norcross, Comp. Distrs., Inc.	404-441-3320
IL	Roselle, Foresight Elctrns.	708-980-9890
PA	Glenside, Mark Elctrns.	215-887-2317
TX	Dallas, Comp. Distrs., Inc.	214-644-0373
Can	Markham, Ont., Wm. Saynor & Assocs.	416-415-1044
Can	Rexdale, Valtrie Mktg.	416-798-2555

CONVERTER POWER, INC., Locust Rd., Ipswich, MA 01938, Tel: 508-356-2558, FAX: 508-356-5729; *Sls. Mgr.:* Barry Essig

COOKE VACUUM PRODS., INC., 13 Merritt St., S. Norwalk, CT 06854, Tel: 203-853-9500, FAX: 203-838-9553; Empl.: 45; *Sls. Mgr.:* Louis W. Genuario

THE COOL-AMP CONDUCTO-LUBE CO., 15834 Upper Boones Ferry Rd., Lake Oswego, OR 97035, Tel: 503-624-6426, FAX: 503-624-6436; FSC No.: 31628; Empl.: 7; *Sls. Mgr.:* Marian Bomber

COOL CORPORATION, 14170 23rd Ave. N., Minneapolis, MN 55447, Tel: 1-612-559-3117, FAX: 1-612-559-9679; Empl.: 5; *Sls. Mgr.:* Will Mielenz

COONER WIRE CO., 9265 Owensmouth Ave., Chatsworth, CA 91311, Tel: 818-882-8311, FAX: 818-709-8281; *Sls. Mgr.:* Steven W. Smith

COOPER INDUSTRIES/BELDEN DIV., P.O. Box 1980, Richmond, IN 47375, Tel: 317-983-5200, 800-BELDEN-1, TWX: 810-345-1393, FAX: 317-983-5294; Empl.: 3500; *Sls. Mgr.:* Dan Trotta, Mgr. OEM Sls.; *Dist. Mgr.:* Rick Schneldewind, Mgr. Dist. Sls.

COOPER TOOLS, PO Box 30100, Raleigh, NC 27622, Tel: 919-781-7200, FAX: 919-783-2067

COORS CERAMICS CO., Electronics, 17750 W. 32nd Ave., Golden, CO 80401, Tel: 303-277-4591, FAX: 303-277-4779; Empl.: 1700

COORS ELECTRONIC PACKAGE CO., 511 Manufacturers Rd., Chattanooga, TN 37405, Tel: 615-755-5452, FAX: 615-755-5438; Empl.: 200; *Sls. Mgr.:* Jim F. Wade

COPAL (USA), INC., 2341 205th St., Ste 102, Torrance, CA 90501, Tel: 310-618-0225, FAX: 310-618-9984; *Sls. Mgr.:* Hugh Namekawa

CORBY INDUSTRIES, INC., 1501 E. Pennsylvania St., Allentown, PA 18103, Tel: 215-433-1412, FAX: 215-435-1963; Empl.: 31; *Sls. Mgr.:* Sharon Cain; *Dist. Mgr.:* Sharon Cain

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CORCOM, INC., 1600 Winchester Rd., Libertyville, IL 60048, Tel: 708-680-7400; FSC No.: 05245; Empl.: 800; *Sls. Mgr.:* Ken Bons ..... **A•1586-1587; B•1352; C•1300-1302**

Local Sales Offices & Reps

AL	Huntsville, R. O. Whitesell Assocs.	205-883-5110
AZ	Tempe, Westrep	602-820-9932
CA	Montrose, Luscombe	818-249-9000
CA	Mountain View, Straube Assocs.	415-969-6060
CA	San Diego, Westrep	619-566-6580
CO	Westminster, Straube Assocs.	303-426-0890
CT	Madison, Conti-Younger Assocs.	203-245-1136
FL	Altamonte Springs, Semtronic Assoc.	407-831-8233
GA	Norcross, Robert O. Whitesell	404-449-9190
ID	Boise, Jas J. Backer Co.	208-343-9831
IL	Itasca, Beta Technlg. Sls. Inc.	708-250-9586
IN	Ft. Wayne, Robert O. Whitesell	219-432-5591
IN	Indianapolis, Robert O. Whitesell	317-876-9000
IN	Kokomo, Robert O. Whitesell	317-457-9127
KS	Overland Pk., Spectrum Sls.	913-648-6811
KY	Versailles, Robert O. Whitesell	606-873-1182
MD	Columbia, Third Wave Solutions	301-290-5990
MA	Burlington, Conti-Younger Assocs.	617-273-1582
MI	Grand Rapids, Robert O. Whitesell	616-942-5420
MI	Southfield, Robert O. Whitesell	313-352-5454
MI	St. Joseph, Robert O. Whitesell	616-983-7337
MN	Edina, Mel Foster Co.	612-941-9790
MO	Florissant, Spectrum Sls.	314-921-1313
NJ	Englewood, MOS Mktg.	201-569-2071
NM	Albuquerque, Rontek, Inc.	505-299-4124
NY	Great Neck, MOS Mktg.	516-487-3966
NY	Skaneateles, Empire Tech Sls.	315-685-5703
NC	Raleigh, Zucker Assoc.	919-782-8433
OH	Cincinnati, Robert O. Whitesell	513-521-2290
OH	Cleveland, Robert O. Whitesell	216-447-9020
OH	Columbus, Robert O. Whitesell	614-888-9396
OH	Dayton, Robert O. Whitesell	513-298-9546
OR	Beaverton, Jas. J. Backer Co.	503-627-0775
PA	Pittsburgh, Robert O. Whitesell	412-963-6161
PA	Trevose, Professional Svc. Assoc.	215-245-0513
TN	Knoxville, Robert O. Whitesell	615-694-9476
TX	Plano, K & H Sls.	214-423-6520
UT	Salt Lake City, Straube Assocs.	801-263-2640
WA	Seattle, Jas. J. Backer Co.	206-285-1300
WI	Milwaukee, Beta Technlg. Sls. Inc.	414-543-6609
Can	Ontario, R.N. Longman	416-670-8100

CORECO, INC., 6969 Trans-Canada Hwy, Ste. 113, St. Laurent, Que., Canada H4T 1V8, Tel: 800-361-4914, 514-333-1301, FAX: 514-333-1388; Empl.: 32

CORLUND ELECTRONICS CORP., 2330 Teller Rd., Newbury Park, CA 91320, Tel: 805-499-6877, FAX: 805-499-4072; Empl.: 100; *Sls. Mgr.:* Bruce MacDonald

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Local Sales Offices & Reps

CA	San Diego, CK Assocs.	619-279-0420
CA	Valencia, C & N Assocs.	805-254-5844
CO	Littleton, Megatronix	303-730-6262
CT	Branford, Coakley, Boyd & Abbett	203-481-2218
FL	St. Petersburg, QXI Inc.	813-894-4556
KS	Overland Park, Electri-Rep	913-649-2168
MD	Gaithersburg, Naudain Assoc. Southern, Inc.	301-258-5040
MA	Framingham, Coakley, Boyd & Abbett	508-820-0800
MI	Madison Heights, Pine Sales, Inc.	313-589-0350
MN	Eden Praire, PWC Incorporated	612-934-1409
MO	St. Louis, Electra-Rep	314-993-4421
NJ	Leonia, Peter E. Schmitt Co., Inc.	201-944-2806
OH	Richfield, The Lyons Corp.	216-659-9224
OR	Beaverton, Elctrn. Sources, Inc.	503-620-0441
TN	Chattanooga, Indl. Mktg. & Sls., Inc.	615-894-2219
TX	Richardson, Comp. Partners, Inc.	214-644-1288
UT	Salt Lake City, Charles Fields & Assocs.	801-531-6177
WI	Waukesha, Eagle Tech. Sls.	414-896-0633
PR	San Juan, P.R., E.T.S. Inc.	809-798-1300
Can	Mississauga, Ont., Source Elctrns.	416-676-0830

Local Distributors

AZ	Phoenix, Arizona Comps.	602-269-5655
CA	Los Angeles, Bell Inds.	213-826-6778
CA	Milpitas, California Capacitor	408-262-6000
CA	Sunnyvale, Capsco Sls.	408-734-3020
CA	Tustin, Projections Unlimited	714-544-2700
CO	Aurora, Capstone Elctrns.	303-375-1300
CO	Denver, Integrated Elctrns. Corp.	303-292-5537
FL	Boca Raton, NRC Elctrns.	407-241-8600
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Chicago, Waldom Elctrns.	312-585-1212
IL	Palatine, OHM Elctrns.	708-359-5500
MA	Newton, The Greene-Shaw Co.	617-969-8900
MN	St. Paul, Kent/Shelley-Ragon ELctrns.	612-642-2828
NY	Hauppauge, JACO Elctrns.	516-273-5500
NY	Mamaroneck, New Yorker Elctrns.	914-698-7600
NY	Port Chester, Zeus Comps.	914-937-7400
NY	Rome, Rome Elctrns.	315-337-5400
OH	Cleveland, Pioneer-Standard	216-587-3600
PA	No. Versailles, CMD Elctrns.	412-678-6020
TX	Dallas, Hallmark Elctrns.	214-553-4300
TX	Fort Worth, TTI, Inc.	817-740-9000
WI	Milwaukee, Marsh Elctrns.	414-475-6000

CORNELL-DUBILIER ELCTRNS. (CORPORATE HEADQUARTERS), 1700 Route 23 North, Wayne, NJ 07470, Tel: 201-694-8600; Empl.: 500ö; *Sls. Mgr.:* A. Cavuto ..... **A•1062-1065**

Local Sales Offices & Reps

AZ	Tempe, Elctrn. Dev. Sls.	602-438-1547
CA	Los Altos, Ewing-Foley, Inc.	415-941-4525
CA	San Diego, CK Assocs.	619-279-0420
CA	Valencia, C & N Assocs.	805-254-5844
CO	Littleton, Megatronix	303-730-6262
CT	Branford, Coakley, Boyd & Abbett	203-481-2218
FL	St. Petersburg, QXI, Inc.	813-894-4556
IN	Indianapolis, M & L Elctrn. Sls.	317-359-4742
KS	Overland Park, Electri-Rep.	913-649-2168
MD	Gaithersburg, Naudain Assoc. Southern, Inc.	301-258-5040
MA	Framingham, Coakley, Boyd & Abbett	508-820-0800
MI	Madison Hgts., Pine Sls., Inc.	313-589-0350
MN	Eden Prairie, PWC Inc.	612-934-1409
MO	St. Louis, Electri-Rep	314-993-4421
NJ	Leonia, Peter E. Schmitt Co., Inc.	201-944-2806
NY	Syracuse, L.D. Allen	315-437-8387
OH	Richfield, The Lyons Corp.	216-659-9224
OR	Tigard, Earl & Brown Co., Inc.	503-639-2100
PA	Erdenheim, Omni Sls.	215-233-4600
TN	Chattanooga, Indl. Mktg. & Sls., Inc.	615-894-2219
TX	Richardson, Comps. Partners, Inc.	214-644-1288
UT	Salt Lake City, Charles Fields & Assocs.	801-531-6177
WA	Redmond, Earl & Brown Co., Inc.	206-885-5064
WI	Waukesha, Eagle Tech. Sls.	414-896-0633
PR	San Juan, E.T.S. Inc.	809-798-1300
Can	Mississauga, Ont., Source Elctrns.	416-676-0830
Can	N. Vancouver, B.C., Arwin Tech. Sls.	604-980-4557

Local Distributors

AZ	Phoenix, Arizona Comp. Co.	602-269-5655
CA	Los Angeles, Bell Inds.	213-826-6778
CA	Milpitas, California Capacitor	408-262-6000
CA	Sunnyvale, Capsco Sls.	408-734-3020
CA	Tustin, Projection Unlimited	714-544-2700
CO	Aurora, Capstone Elctrns.	303-375-1300
CO	Denver, Integrated Elctrns. Corp.	303-292-5537
FL	Boca Raton, NRC Elctrns.	407-241-8600
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Chicago, Waldom Elctrns.	312-585-1212
IL	Palatine, OHM Elctrns.	708-359-5500
MA	Newton, Greene-Shaw, Co.	617-969-8900
MN	St. Paul, Kent/Shelley-Ragon	612-642-2828
NY	Hauppauge, Jaco Elctrns., Inc.	516-273-5500
NY	Mamaroneck, New Yorker Elctrns.	914-698-7600
NY	Port Chester, Zeus Comps.	914-937-7400
NY	Rome, Rome Elctrns.	315-337-5400
OH	Cleveland, Pioneer-Standard	216-587-3600
PA	N. Versailles, CMD Elctrns.	412-678-6020
TX	Dallas, Hallmark Electronics	214-553-4300
TX	Ft. Worth, TTI, Inc.	817-740-9000
WI	Milwaukee, Marsh Elctrns.	414-475-6000

CORNELL MANUFACTURING, An Elgin Co., 25 Ramland Road, Orangeburg, NY 10962, Tel: 914-365-0400, FAX: 914-359-6809; Empl.: 50; *Sls. Mgr.:* Lou Schnur; *Dist. Mgr.:* Lou Schnur

CORNING INCORPORATED, Advanced Materials Business, Main Plant, MP 21-3, Corning, NY 14831, Tel: 607-974-7920, TELEX: 932498, FAX: 607-974-7618; *Sls. Mgr.:* Paul Marx; *Dist. Mgr.:* Brian Gray

CORNING INCORPORATED, Opto-Electronics Group, MP-RO-03, Corning, NY 14831, Tel: 1-800-525-2524, FAX: 607-974-7522; Empl.: 26,000

CORONA MAGNETICS, INC., 201 Corporate Terrace, Corona, CA 91719, Tel: 909-735-7558, FAX: 909-735-6753; Empl.: 60; *Sls. Mgr.:* Uwe Paasch

CORTEC, INC., 15672 Chemical La., Huntington Bch., CA 92649, Tel: 714-897-2529, FAX: 714-897-2170; Empl.: 35

CORTRON INC., 1 Aegean Dr., Methuen, MA 01844, Tel: 508-975-5445, FAX: 508-975-0357; Empl.: 75; *Sls. Mgr.:* Philip P. Bodoni

COSEL U.S.A. inc.

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COSEL U.S.A. INC., (Formerly U.S. Elco Inc.), 2930 Scott Blvd., Santa Clara, CA 95054, Tel: 408-980-5144; *Sls. Mgr.:* Bob Kitamura ..... **D•1648-1650, 2098**

Local Distributors

CA	Santa Clara, Foresight	408-980-9700,714-833-2134
CO	Englewood, CDI	303-770-6214
FL	Ft. Lauderdale, CDI	1-800-558-2351
GA	Duluth, Stelmack Power	404-441-7927
GA	Norcross, Applied Power	1-800-445-8316
IL	Schaumberg, Mar Lyn	708-924-9111
IA	W. Des Moines, Allied	1-800-433-5700
KS	Lenexa, Allied	1-800-433-5700
LA	Metairie, Allied	1-800-433-5700
MA	Lowell, Total Power	508-453-7272
MI	Brighton, Applied Power	1-800-624-5496
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NJ Lodi, TRC 201-779-8282
OH Cincinatti, Schuster 513-489-1400
PA McKean, Advacom 814-476-7774
TX Dallas, Allied 1-800-433-5700
UT Salt Lake City, CDI 801-261-5244

COSMO CORPORATION, 3239 W. 14th St, Cleveland, OH 44109, Tel: 216-861-5594, FAX: 216-861-0416; Empl.: 350; *Sls. Mgr.:* B. Gordon

COSMOS PLASTIC CO., 3239 W. 14th St., Cleveland, OH 44109, Tel: 216-861-5594

COTO WABASH, A Kearney National Company, 55 DuPont Drive, Providence, RI 02907, Tel: 401-943-2686, FAX: 401-942-0920; Empl.: 300; *Sls. Mgr.:* J. Lynch(East); *Dist. Mgr.:* Chris Cardin ..... **B•1451-1453**

Local Sales Offices & Reps
AL Owens Cross Rds., cmrCross Assocs. 205-883-5991
AZ Phoenix, Spectrum Mktg. Assocs., Inc. 602-890-9000

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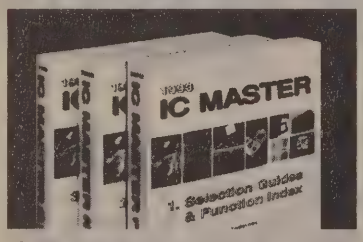

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FL Tampa, Standard Mktg. 813-933-5833
IL Arlington Hgts., M.J. Petersen & Assocs. 708-577-8200
IN Ft. Wayne, M/S Sls. & Assocs. 219-436-3023
IN Greenwood, M/S Sls. & Assocs. 317-881-0110
IA Cedar Rapids, Midwest Tech. Sls. Inc. 319-393-5115
KS Goddard, Midwest Tech. Sls. Inc. 316-794-8565
KS Lenexa, Midwest Tech. Sls. Inc. 913-888-5100
MD Columbia, Delta III Assoc., Inc. 301-730-4700
MA Andover, Crawford Assocs. 508-470-2122
MN Roseville, TLC 612-483-2226
MO Earth City, Midwest Tech. Sls. Inc. 314-298-8787
NY Clifton Pk., Net Sls. 518-371-6864
NY Cortland, Net Sls. 607-756-6592
NY Great Neck, MOS Mktg. Assocs. 516-487-3966
NY Victor, Net Sls. 716-924-1844
NC Charlotte, Godwin Assocs. 704-549-8500
NC Raleigh, Godwin & Assoc. 919-878-8000
OR Oregon City, Halbar Pacific 503-656-3714
PA Trevose, Omega Elctrn. Sls. 215-244-4000
TX Plano, Richmar Elctrns. 214-424-8388
TX Round Rock, Richmar Elctrns. 512-255-2551
UT Ogden, Spectrum Mktg. Assocs. Inc. 801-972-8552
WA Redmond, Halbar Pacific 206-882-0990
Can Pickering, Ont., Current Mktg. 416-428-3413
Can Pointe Claire, Que., A. R. Gray Assocs. 514-694-6378

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AL Huntsville, Resistacap, Inc. 205-883-4270
AR Little Rock, Carlton Bates Co. 501-562-9100
CA Santa Monica, Master Distrs. 213-452-1229
CA Saratoga, Testco Inc. 408-253-1900
CA Sunnyvale, Spirox 408-739-3334
CO Denver, Spectrum Distrbn. 303-480-9991
FL W. Melbourne, Astro Mktg. 407-727-8817
IL Bedsville, Voyager Elect. Corp. 708-860-1300
IL Chicago, Leeds Elctrns. 312-625-3800
IL Chicago, Newark Elctrns. 312-784-5100
IL Elk Grove Village, Nu-Way Elect. Dist., Inc. 708-437-7120
MA Methuen, Aved Elect. Inc. 508-688-3800
MN Fridley, Voyager Elect. Corp. 612-571-7766
NJ Oakland, Relay Specialties 201-337-1000
NY Rochester, Masline Elect., Inc. 716-546-5373
PA Philadelphia, SHAP Elect. Co. 215-969-3300
TX Ft. Worth, Allied Elec. 817-595-3500
TX Austin, Altair Co. 512-837-4970
TX Austin, Carlton Bates Co. 512-837-9098
TX Houston, Altair Co. 713-462-3029
TX Richardson, Altair Co. 214-231-5166

COTRONICS, 3379 Shore Pkwy., Brooklyn, NY 11235, Tel: 718-646-7996, FAX: 718-646-3028; Empl.: 15; *Sls. Mgr.:* Alan Marks

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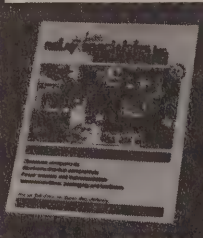
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CA Milpitas, Zack Elctrns. 408-942-5432
CA San Carlos, Logan Elctrns. 415-594-0700
CA San Diego, Shanks & Wright 619-239-0176
CT Danbury, Pilgram 203-792-7271
CT West Hartford, Signal Ctr. 203-233-8551
FL Altamonte, Royce 305-869-4700
FL Miami, Small Parts 305-751-0856
GA Atlanta, ACK Radio Supp. 404-351-6340
IA Marion, Brenneman & Assoc. 319-377-6394
LA Harahan, Elctrn. Parts & Supp. 504-734-0641
MD Gaithersburg, M S Elctrns. 301-921-0200
MA Carlisle, Davis Assoc. 617-434-6121
MA Needham, YDI Electronics 617-449-1005
MA Woburn, Pacer 617-935-8330
MN New Brighton, Chris 612-631-2647
NJ Bayville, Berkley Indl. 908-341-9366
NJ Cranford, GSI Elctrns. 908-272-6400
NJ Kenilworth, Federated Purchaser 908-272-0505
NY Albany, E. E. Taylor 518-438-7811
NY Buffalo, Summit Elctrns. 716-887-2800
NY Hauppauge, Broadline 516-231-4100
NY Rochester, Simcona 716-328-3230
PA Philadelphia, AC Radio 215-462-9379
RI Westerly, Ocean State El. 401-596-3080
WA Seattle, Westlake Elctrns. 206-622-6600
Can Markham, Ont., Arma 416-475-2024

DADEN ASSOCIATES, 1001 Calle Amanecer, San Clemente, CA 92673, Tel: 714-366-1522, FAX: 714-366-9600; FSC No.: 57032; Empl.: 49; *Sls. Mgr.:* Mark Fournier

DAGE-MTI, 701-N. Roeske Ave., Michigan City, IN 46360, Tel: 219-872-5514, FAX: 219-872-5559; Empl.: 51; *Sls. Mgr.:* Paul Thomas

DAGE PRECISION INDUSTRIES, INC., 46701 Fremont Blvd., Fremont, CA 94538, Tel: 510-683-3930, FAX: 510-683-3935; Empl.: 7; *Sls. Mgr.:* Bonnie Nichols

DAICO INDUSTRIES, INC., 2453 East Del Amo Blvd., Rancho Dominguez, CA 90220, Tel: 310-631-1143, FAX: 310-631-8078; FSC No.: 28983; Empl.: 130; *Sls. Mgr.:* Kevin Townsend; *Dist. Mgr.:* Diane Felando

DAIDO PRECISION ENGINEERED PRODUCTS/, Sumtak Electronics, 615 Pierce St., Somerset, NJ 08875, Tel: 908-805-1900, FAX: 908-805-0122; *Sls. Mgr.:* Phillip Giannini, Nat. Sls. Mgr.

DAITRON, INC., 7150 S.W. Hampton, Suite 130, Tigard, OR 97223, Tel: 503-620-2879, TELEX: 910-240-4863, FAX: 503-620-2942; Empl.: 13; *Sls. Mgr.:* Harry Iino; *Dist. Mgr.:* Karen Sempert

DALE ELECTRONICS, INC., Columbus Div., 1122 23rd Street, Columbus, NE 68601-3647, Tel: 402-563-6506, FAX: 402-563-6418; FSC No.: 91637; Empl.: 2800; *Sls. Mgr.:* Greg Mefford; *Dist. Mgr.:* Jon Trabert ..... **A•1225-1233, 1379-1381, 1910-1931, 2072-2077, 2312-2313; B•1024-1026, 1870-1871; C•1306-1308**

DALE ELECTRONICS, INC., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701-2242, Tel: 402-371-0080; FSC No.: 91637; Empl.: 1200; *Sls. Mgr.:* Mike Burns; *Dist. Mgr.:* Jon Trabert ..... **A•1910-1915, 1917-1924**

DALE ELECTRONICS, INC., Tempe Div., 1155 W. 23rd St., Tempe, AZ 85282-1883, Tel: 602-967-7874; FSC No.: 22929; Empl.: 139; *Sls. Mgr.:* Mike Brown; *Dist. Mgr.:* Jon Trabert ..... **A•1379-1381, 2072-2077**

DALE ELECTRONICS, INC., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078-0180, Tel: 605-665-9301; FSC No.: 09969; Empl.: 400; *Sls. Mgr.:* Mike Husman; *Dist. Mgr.:* Jon Trabert .. **A•1225-1230, 1232-1233, 2312-2313; C•1306-1308**

DALE WESTERN THERMISTOR DIVISION, See Dale Norfolk Division

DALLAS SEMICONDUCTOR, 4401 South Beltwood Pkwy., Dallas, TX 75244, Tel: 214-450-0400, FAX: 214-450-0470; Empl.: 700; *Sls. Mgr.:* Jack Mattis ..... **A•1525-1527**

Local Sales Offices & Reps

AL	Huntsville, Glen White & Assocs.	205-882-6751
AZ	Scottsdale, Haas & Assocs.	602-488-3662
CA	San Diego, Harvey King, Inc.	619-695-9300
CA	Santa Clara, Phase II	408-980-0414
CA	Thousand Oaks, S.C. Cubed	805-461-4675
CA	Tustin, S.C. Cubed	714-731-9206
CO	Wheat Ridge, Waugaman Assoc.	303-423-1020
CT	Wallingford, Technology Sls. Inc.	203-269-8853
FL	Altamonte Springs, Semitronic Assoc.	407-831-8233
FL	Clearwater, Semitronic Assoc.	813-461-4675
FL	Ft. Lauderdale, Semtronic Assoc., Inc.	305-731-2484
GA	Norcross, Glen White & Assocs.	404-441-1447
IL	Rolling Meadows, Sumer, Inc.	708-991-8500
IN	Indianapolis, Elctrn. Sls. & Eng.	317-849-4260
IA	Cedar Rapids, Cahill, Schmitz & Howe	319-377-8219
KS	Overland Park, Gibb Technlg. Sls.	913-451-6785
MA	Woburn, Mill-Bern Assocs.	617-932-3311
MI	Livonia, Geisting & Assocs.	313-478-8106
MN	St. Paul, Cahill, Schmitz & Cahill	612-646-7217
MO	Chesterfield, Gibb Technlg. Sls.	314-530-0495
NJ	Mt. Laurel, S-J Assocs.	609-866-1234
NY	Fairport, Technlg. Sls.	716-223-7500
NY	Rockville Centre, S-J Assocs.	516-536-4242
NC	Huntersville, Glen & White Assoc.	704-875-3777
NC	Raleigh, H & A Sls.	919-848-1931
OH	Cincinnati, Geisting & Assocs.	513-385-1105
OH	Cleveland, Geisting & Assoc.	216-261-9705
OH	Columbus, Geisting & Assoc.	614-459-4800
OK	Tulsa, West Assocs.	918-665-3465
OK	Tusla, West Assocs.	918-665-3465
OR	Beaverton, Western Tech. Sls.	503-644-8860
PA	Pittsburgh, Geisting & Assoc.	412-828-3553
TN	Gray, Glen White & Assoc.	615-477-8850
TX	Austin, West Assoc.	512-343-1199
TX	Houston, West Assocs.	713-621-5983
TX	Richardson, West Assoc.	214-680-2800
UT	Salt Lake City, Waugaman Assocs.	801-261-0802
VA	Falls Church, S-J Chesapeake	703-533-2233
WA	Bellevue, Western Tech. Sls.	206-641-3900
WA	Spokane, Western Tech. Sls.	509-922-7600
WI	Brookfield, Sumer, Inc.	414-784-6641
EXP	Hato Rey, PR, Semitronic Assoc.	809-766-0700
Can	Burnaby, B.C., Davetek Mktg.	604-430-3680
Can	Ottowa, Dynasty	613-596-9800
Can	Pointe Claire, Dynasty	514-695-7353

Local Distributors

AL	Huntsville, Hall-Mark Elctrns.	205-837-8700
AZ	Phoenix, Hall-Mark Elctrns.	602-437-1200
CA	Irvine, Insight Elctrns.	714-727-2111
CO	Wheat Ridge, Added Value Elect. Dist.	303-422-1701
CT	Wallingford, Sterling Elctrns.	203-265-9535
FL	Lake Mary, Milgray-Elctrns.	407-321-2555
GA	Duluth, Hall-Mark Elctrns.	404-623-4400
IL	Palatine, Milgray Elctrns.	708-202-1900
KS	Lenexa, Hall-Mark Elctrns.	913-888-4747
MA	Wilmington, Milgray Elctrns.	508-657-5900
MI	Livonia, Hall-Mark Elctrns.	313-462-1205
MN	Minneapolis, Sterling Elctrns.	612-831-2666
NJ	Marlton, Milgray Elctrns.	609-983-5010
NY	Farmingdale, Milgray Elctrns.	516-391-3000
NC	Raleigh, Hall-Mark Elctrns.	919-872-0712
OH	Solon, Hall-Mark Elctrns.	216-349-4632
OK	Tusla, Sterling Elctrns.	918-663-2410
OR	Beaverton, Anthem Elctrns.	503-643-1114
TX	Richardson, Anthem Elctrns.	214-238-7100
UT	Salt Lake City, Anthem Elctrns.	801-973-8555
VA	Richmond, Sterling Elctrns.	804-226-2190
WA	Bellevue, Almac Elctrns.	206-643-9992
Can	Ville St. Laurent, Que., ITT Multicomponents	514-335-7697

DALSA INC., 605 McMurray Road, Waterloo, Ont., Canada N2V 2E9, Tel: 519-886-6000, FAX: 519-886-8023; *Sls. Mgr.:* Ralph Beier

DAMAC PRODUCTS, INC., 10410-1 Pioneer Blvd., Santa Fe Springs, CA 90670, Tel: 310-946-0881, FAX: 310-946-2631; Empl.: 30; *Sls. Mgr.:* Melodie Eberhart

DANAHER CONTROLS, 1675 N. Delany Rd., Gurnee, IL 60031-1282, Tel: 708-662-2666; Empl.: 300; *Sls. Mgr.:* R. Lowry; *Dist. Mgr.:* S. Rosenthal

DANCER COMMUNICATIONS, INC., 649 South Ave., Bldg. 8, Secane, PA 19018, Tel: 215-543-8066, FAX: 215-543-2151; *Sls. Mgr.:* Joanne Gilligan

D & B POWER, INC.

FAX: 516-586-5952

D & B POWER, INC., 204 N. Fehr Way, Bayshore, NY 11706, Tel: 516-586-5955; FSC No.: 54337; Empl.: 25; *Sls. Mgr.:* Dan Hall ..... **D•1654-1655**

Local Sales Offices & Reps

CA	Pasadena, Electro Mecha. Instrs.	818-795-7193

D & L ELECTRONICS, Box 1236 540 Valley View Rd., Langhorne, PA 19047, Tel: 800-942-3631, FAX: 215-757-7391

D & P MFG. INC., 32 Hamilton St., Chalfont, PA 18914, Tel: 215-997-1200, FAX: 215-997-2380; Empl.: 7; *Sls. Mgr.:* Eugene Rane

DMC DANIELS MANUFACTURING CORPORATION

FAX: 407-855-6884

DANIELS MANUFACTURING CORP., 526 Thorpe Rd., Orlando, FL 32824, Tel: 407-855-6161, TELEX: 564321; FSC No.: 11851; Empl.: 180; *Sls. Mgr.:* Gary Moore; *Dist. Mgr.:* Don Malinovsky ..... **C•1700**

Local Sales Offices & Reps

CA	El Toro, DMC Western Reg.	407-855-6161

DAN-L INC., 229 Laurel Rd., E. Northport, NY 11731, Tel: 516-757-8000; FSC No.: 28327; Empl.: 22

DANMAR INDS., 11952 Challenger Court, Moorpark, CA 93021, Tel: 1-805-529-3788, FAX: 805-529-3837; FSC No.: 31690; Empl.: 10; *Sls. Mgr.:* Mukund Patel

DANTEL, 2991 N. Argyle Ave., Fresno, CA 93727, Tel: 209-292-1111, TELEX: 35-5457, FAX: 209-292-9355; FSC No.: 56960; Empl.: 205; *Sls. Mgr.:* Bob Long

DANTRONICS, INC., 3175 Hafner Ct., St. Paul, MN 55126, Tel: 612-484-2108; Empl.: 22

DA/PRO RUBBER, INC., 601 N. Poplar, Broken Arrow, OK 74012, Tel: 918-258-9386, FAX: 918-258-3286; Empl.: 260; *Sls. Mgr.:* Walter F. Sanders; *Dist. Mgr.:* Walter F. Sanders

DARE ELECTRONICS, INC., 3245 S. County Rd., 25A, Troy, OH 45373, Tel: 513-335-0031; FSC No.: 55901; Empl.: 20; *Sls. Mgr.:* Paul J. Gilmore

DARRAH ELECTRIC COMPANY, 5914 Merrill Ave., Cleveland, OH 44102, Tel: 216-631-0912, FAX: 216-631-0440; Empl.: 24; *Sls. Mgr.:* David J. Darrah; *Dist. Mgr.:* David J. Darrah

DATA, INC., 7702 Emerald Ave., Box 2071, Ft. Collins, CO 80525, Tel: 303-493-1222; Empl.: 3; *Sls. Mgr.:* Sharon Shilling; *Dist. Mgr.:* Sharon Shilling

DATA CHECK CORPORATION, 9918 Via Pasar, San Diego, CA 92126, Tel: 619-578-0101, FAX: 619-578-9215; FSC No.: 55792; Empl.: 40; *Sls. Mgr.:* Bill Acosta

DATACHRON INC., 1150 E. Stanford Court, Anaheim, CA 92805, Tel: 714-385-1705, FAX: 714-978-2514; FSC No.: 56259; Empl.: 19; *Sls. Mgr.:* Clyde Davis

DATACOM, INC., Box 278, Ft. Walton Beach, FL 32549, Tel: 904-244-6121, FAX: 904-244-6344; FSC No.: 32365; Empl.: 50

DATACON, INC., Interconnect Sub-Systems, 60 Blanchard Rd., Burlington, MA 01803, Tel: 617-273-5800, FAX: 617-273-4809; Empl.: 170; *Dist. Mgr.:* Lonise M. Silva

DATACUBE, INC., 300 Rosewood Drive, Danvers, MA 01923, Tel: 508-777-4200, FAX: 508-777-3117; Empl.: 130; *Sls. Mgr.:* David Lerner

FAX: 201-773-9672

DATA DELAY DEVICES, 3 Mount Prospect Ave., Clifton, NJ 07013-1915, Tel: 201-773-2299 ..... **A•1528-1544**

Local Sales Offices & Reps

AL	Huntsville, Hughes Assocs.	205-533-9108
AZ	Phoenix, Tech Sls., Inc.	602-246-1614
AR	R-Squared	713-820-3210
CA	Mountain View, Weseloh/Swanson & Assocs.	415-961-0565
CA	Yorba Linda, Target Elctrns.	714-692-1630
DE	Jack McCoy Assocs.	215-363-0350
GA	Norcross, Hughes Assocs., Inc.	404-662-1587
IN	Electro Mktg.	513-890-8322
KY	Electro Mktg.	513-890-8322
LA	R-Squared	713-820-3210
ME	Dynamic Sls., Inc.	617-272-5676
MA	Burlington, Dynamic Sls., Inc.	617-272-5676
MI	Livonia, Electro Mktg.	313-421-7590
MS	Corinth, Hughes Assocs., Inc.	601-287-2915
NH	Dynamic Sls., Inc.	617-272-5676
NJ	Medford, Jack McCoy Assocs.	609-953-0770
NY	Pittsford, James E. Zimmmerman Sls.	716-381-3186
NC	Raleigh, Hughes Assocs., Inc.	919-467-7029
OH	Dayton, Electro Mktg.	513-890-8322
OK	R-Squared	713-820-3210
PA	Downingtown, Jack McCoy, Inc.	215-363-0350
PA	Pittsburgh, Electro Mktg.	412-492-0688
RI	Dynamic Sls., Inc.	617-272-5676
SC	Hughes Assocs., Inc.	919-467-7029
TN	Morristown, Hughes Assocs., Inc.	615-587-2433
TX	Houston, R-Squared	713-820-3210
VT	Dynamic Sls., Inc.	617-272-5676
Can	Ont., Source Elctrns.	416-676-0830

Local Distributors

CA	Sunnyvale, Target Elctrns.	408-733-0384
TX	Carrollton, Omni Pro	214-713-9000

DATA DEVICE CORP., See ILC Data Device Corp.

ddp

Data Display Products

FAX: 310-640-7639

DATA DISPLAY PRODUCTS, 445 So. Douglas St., El Segundo, CA 90245-4630, Tel: 310-640-0442, 800-421-6815; FSC No.: 15513; Empl.: 40; *Sls. Mgr.:* Anthony Toniolo; *Dist. Mgr.:* Anthony Toniolo ..... **B•1136-1139**

Local Sales Offices & Reps

AL Madison, Southern Elctrn. Reps. 205-461-8925
CA Arcadia, HMC 818-447-0958
CA Cupertino, Codella Mktg. 408-248-3890
CO Broomfield, Summitwest Mktg. 303-460-9600
IL Lemont, Trend-Tronics 708-972-1166
MA Randolf, Hatch Assocs. 617-963-3306
MN Minneapolis, Amtek Mktg. 612-561-5371
NJ Flanders, K & R Engrg. 201-584-5235
OR Beaverton, WJ Sls. 503-626-3759
PA Allison Park, KW Elect. Sls 412-492-0777
PA Wynnewood, Metz-Benham Assoc. ... 215-896-7300
TX Freeport, Marathon Assoc. 409-233-7026

Local Distributors

CA Arcadia, Parco 818-447-0958,800-423-4892
CA Santa Clara, Bell Elctrn. Supp. 408-727-2355
CO Denver, Hardware Specialty 303-371-8553
IL Lemont, Trend-Tronics 708-972-1166, 800-323-1697
MD Burtonsville, U.S. Elctrns. 301-384-3300
MD Kensington, Marine Air Supp. 301-949-9560
MA Methuen, Aved Elctrns. 508-688-3800
NJ E. Hanover, State Elctrns. 201-887-2550
NJ Flanders, VKR Svcs. 201-584-5393,800-631-9362
NJ Rockaway, Tonar Inds. .. 201-586-9000,800-654-6246
NY Hauppauge, Vargas 516-273-1111,800-645-1402
NC Charlotte, EMC 704-394-6195
OH Cleveland, EMC 216-442-3441
OH Columbus, EMC 614-299-4161
OH Dayton, EMC 513-439-4711
OH Englewood, Argent Inds. 513-836-8633
PA Philadelphia, Shap Elctrns. 215-969-3300, 800-441-0375
PA York, ECI 717-846-5334
Can Burnaby, B.C., Intek Elctrns. 604-294-8100, FAX:604-294-6335
Can Calgary, Alb., Cardinal Ind. Elctrns. 403-259-6817, FAX:403-259-8699
Can Edmonton, Alb., Cardinal Ind. Elctrns. 403-483-6266,FAX:403-484-8926
Can Markham, Ont., Carsten Elctrns. 416-477-9898, FAX:416-477-7474
Can Pt. Claire, Que., Coba Elctrns. 514-694-1335, FAX:514-694-1337
Can Rexdale, Ont., Valtrie Mktg. 416-798-2555, FAX:416-798-2560

DATA ENGINEERING, INC., 2515 N. State Rd. 7 Ste. 207, Margate, FL 33063-3206, Tel: 305-971-0400; *Sls. Mgr.:* Mario M. Martinez

DATA ENVIRONMENT, INC., Box 91511, Portland, OR 97291, Tel: 503-531-0765

DATA INSTRUMENTS, INC., 100 Discovery Way, Acton, MA 01720, Tel: 800-332-3282, TELEX: 200081, FAX: 508-263-0630; Empl.: 300; *Sls. Mgr.:* Ernest C. Lutfy ..... **B•1928-1930**

Local Sales Offices & Reps

AL Fairhope, FLW Southeast 205-990-8989
AL Huntsville, FLW Southeast, Inc. 205-536-6207
AZ Phoenix, Trembly 602-431-9417
CA Laguna Hills, Elotek Sys., Inc. 714-830-4856
CA Santa Clara, Johnson Assoc. 408-984-4626
CO Highlands Ranch, Valcomp Elctrns., Inc. 303-791-0330
FL Orlando, FLW Southeast, Inc. 407-894-9671
GA Marietta, FLW Southeast, Inc. 404-424-1731
IL Bridgeview, Finn & Conway, Inc. 708-599-0103
IN Indianapolis, C.M. Buck & Assoc. Inc. 317-293-5704
IA Cedar Rapids, Delltron Co. 319-393-0075
MD Columbia, Delta III Assocs., Inc. 410-730-4700
MA Acton, Data Instrs., Inc. 617-264-9550
MI Rochester Hills, Geotronix, Inc. 313-373-4334
MN Minnetonka, Finn & Conway Inc. 612-593-1273
MO Kansas City, Delltron Co. 816-436-6445
MO Manchester, Midwest Control Prods. 314-394-8040
NM Albuquerque, Trembly Assocs. 505-266-8616
NY Albany, Expert Indl. Sys., Inc. 518-869-3355
NY N. Tonawanda, Expert Indl. Sys., Inc. .. 716-694-3935
NY Rochester, Expert Indl. Sys., Inc. 716-323-1305
NY Syracuse, Expert Indl. Sys., Inc. 315-455-2469
NC Charlotte, Emco, Inc. 704-372-8281
OH Richfield, Geotronix, Inc. 216-659-6100
OH Trotwood, Geotronix Inc. 513-854-5939
OK Oklahoma City, Bauman Instr. Corp. .. 405-631-8080
OK Tulsa, Bauman Instr. Corp. 918-492-8086
PA Allison Park, Geotronix, Inc. 412-487-1770
PA Richboro, Technical Dvcs. Inc. 215-953-1595
TX Grand Prairie, Collinsystems, Corp. ... 214-647-3569
TX Houston, Collinsystems, Corp. 713-464-9460
WA Redmond, S.E.A. Sls. 206-883-4999
WA Vancouver, S.E.A. Sls. 206-573-5161
WI Brookfield, Finn & Conway Inc. 414-784-3300
Can Richmond, BC, Maxwell Morton Assocs. 604-273-1337
Can Woodbridge, Ont., Technel Engrg. Inc. 416-851-4244

Local Distributors

CA Glendale, A. Biederman, Inc. 818-246-8431
CA Milpitas, A. Biederman, Inc. 408-435-0209
CO Lafayette, Big Horn Instrmn. 303-665-4054
CT Meriden, Meriden Cooper 203-237-8448
GA Norcross, AA Elec. Inc. 404-449-8670
IN Indianapolis, C & E Sls., Inc. 317-844-9799
MA Billerica, Tanyx Meas. Inc. 508-671-0183
MI Taylor, North Cen. Engrg., Inc. 313-942-0900
MN Minneapolis, Process Measurement Co. 612-544-4035
MN St. Paul, Power/mation 612-645-0781
MO St. Louis, ISL Corp. 314-423-3141
NJ Newark, Norman Bragar Co., Inc. 201-344-1100
NY Amherst, KOM Lamb Inc. 716-691-6400
NC Charlotte, EMCO 704-372-8281
OH Cincinnati, C & E Sls. Inc. 513-241-1069
OH Twinsburg, The Stanley M. Proctor Co. 216-425-7814
OR Portland, Branom Instr. 503-283-2555
PA Bensalem, Airline Hydraulics 215-638-4700
TX Dallas, Butler and Land 214-343-8800
TX Sugar Land, Alpha Process Sls. 713-240-4505
UT Salt Lake City, Rust Automation Equip. 801-486-9865
WA Seattle, Branom Instr. 206-762-6050
WI Waukesha, Power/mation 414-542-2868
Can Don Mills, Ont., Intertechnology, Inc. ... 416-445-5500

DATAK CORP., An LKG Company, 2240 15th St., Rockford, IL 61104, Tel: 815-229-7773, 1-800-645-2262, FAX: 815-229-7785; *Sls. Mgr.:* Wayne Timpe ... **C•1677**

Local Sales Offices & Reps

AL Alabaster, Rohr-Wanger-Roberts 205-879-7361
AZ Mesa, Yocum Mktg. 602-834-3334
CA Gardena, Bidwell-Schwartz Assoc. 213-770-0300
CA Irvine, English Damco Sls. 714-753-1950
CA So. San Francisco, Carelli-Ema, Inc. ... 415-873-2524
CT Lebanon, Adams McGregor Sales 203-537-5737
FL Altamonte Springs, DHR Mktg. 407-331-1199
FL Pompano Bch., DHR Mktg. 305-972-9157
GA Norcross, Rohr-Wanger-Roberts 404-463-9349
IL Addison, Elctrn. Specs. 708-250-9080
IA Cedar Rapids, Mink Assocs. 319-393-0373
KS Overland Park, M.I.N.K. Associates 913-341-8309
MD Silver Spring, Mid-Atlantic Sls. 301-593-7749
MN Minneapolis, Kodo Assocs., Inc. 612-881-1255
MO Bridgeton, M.I.N.K. Assocs. 314-291-5454
OH Akron, Buckeye Mktg. Grp. 216-836-7875
OR Portland, Jos. V. Belusko 503-222-4279
PA Philadelphia, Instrmn. Specialties 215-742-0898
PA Pittsburgh, Buckeye Mktg. Grp. 412-655-1519
RI Coventry, Adams McGregor 401-726-1300
SC Rock Hill, Rohr-Wanger-Roberts 803-324-5111
TX Rowlett, Campion Sls. Co., Inc. 214-475-8313
VA Charlottesville, Mid Atlantic Sales 804-973-8099
WI Waterford, Elctrn. Specs. 414-662-2859
Can Montreal, Cantronics Ltd./Cantronics Intl. Ltd. 514-848-7132
Can Scarborough, Ont., Cantronics Ltd./Cantronics Intl. Ltd. 416-297-8668,FAX:416-297-0107

Local Distributors

AL Birmingham, ACK Radio Supply Co. .. 205-322-0588
AZ Phoenix, Dalis Elctrns. 602-275-2885
AZ Phoenix, Tri-Tek, Inc. 602-371-0860
AZ Scottsdale, D.C. Elctrns. 602-945-7736
CA Belmont, Jameco 415-592-6718
CA Berkeley, Al Lasher's Elctrns. 510-843-5915
CA Canoga Pk., Sandys Elctrns. 818-346-8353
CA Concord, Pacific Valley Elctrns. 510-682-4700
CA Costa Mesa, Marvac-Dow Elctrns. 714-650-2001
CA Fremont, Easy Tech. 510-770-2300
CA Fresno, Sparky Elctrns. 209-227-2986
CA Fullerton, Orvac Elctrns. 714-871-1020
CA Hollywood, Pacific Radio Exchg. 213-462-1393
CA Manhattan Bch., Fry's Elctrns. 310-364-3789
CA Milpitas, Zack Elctrns. 408-942-5432
CA Mountain View, Haltek Elctrns. 415-969-0510
CA No. Hollywood, Sandy's Elctrns. 818-983-2550
CA Redwood City, HDB Elctrns. 415-368-1388
CA San Diego, Gateway Elctrns. 619-279-6802
CA San Jose, Quement Elctrns. 408-998-5900
CA Sunnyvale, Fry's Elctrns. 408-733-1770
CA Thousand Oaks, Pace Elctrns. 805-497-7515
CA Van Nuys, All Elctrns. 818-333-8009
CO Colorado Springs, Centennial Elctrns. 719-633-4666
CT Greenwich, Wise Comps. 203-531-4880
DE New Castle, Electronics Exch. 302-322-5401
FL Miami, Elctrn. Equip. 305-871-3500
GA Atlanta, Ack Radio Supply 404-351-6340
GA Macon, Fouraker Elctrns. 912-746-4325
GA Norcross, Austin Elctrns. 404-449-8697
ID Boise, Kimball Elctrns. 208-232-2201
IL Berwyn, B-B & W, Inc. 312-749-1710
IL Mt. Prospect, Tri-State Elec. 312-255-0600
IL Niles, Joseph Elec. 312-297-4200
IL Peoria, Klaus Radio 309-691-4840
IL S. Holland, Union Elctrns. 708-333-4100
IN Ft. Wayne, Warren Radio 219-426-5344
IN Indianapolis, Meunier Elctrns. 317-635-3511
KY Louisville, Peerless Elec. 502-637-7674
LA Lafayette, Ralph's 318-233-0105
MD Aberdeen, Harco Elctrns. 301-838-7990
MD Beltsville, Mark Elctrns. 301-595-5040
MD Gaithersburg, Capitol Radio Whlsrs. .. 301-881-2270
MA Lynn, Land Elctrns. Supp. 617-592-2220
MA Needham, You-Do-It Elctrns. 617-449-1005
MA Norwood, Gerber Elec. 617-769-6000
MI Flint, Shand Elctrns. 313-743-8940
MI Livonia, Norwest Elctrns. 313-261-4551
MN Minneapolis, AEI/Acme Elctrn Parts. .. 612-338-4754
MO Kansas City, Elctrn. Supp. 816-931-0250
MO St. Louis, Gateway Elec. 314-427-6116
MO St. Louis, Van Sickle 314-621-5000
MT Bozeman, Elctrn. Svc. & Distr. 406-587-4466
NE Lincoln, Scott Elec. Supp. 402-466-8221
NV Las Vegas, Sandy's Elctrns. 702-383-8353
NV Reno, Elect. Distr. Co. 702-323-2766
NJ Denville, Lashen Elctrns. 201-627-3783
NJ Greenbrook, Greenbrook Elctrns. 201-968-3500
NJ Kenilworth, Federated Purchasers, Inc. 201-272-0505
NM La Cruces, Elctrn. Parts Co. 505-523-4578
NY Buffalo, Summit Distr. 716-887-2800
NY Hauppauge, Broadline Elctrns. 516-231-4100
NY Plainview, Kelvin Elctrns. 516-349-7620
NY Rochester, Summit Elec. 716-334-8110
NC Greensboro, Guilford Elctrns. Supp. ... 919-275-1385
OH Warren, REM Elctrns. Supply 216-373-1300
OK Oklahoma City, Radio Supp. 405-232-6127
OR Portland, Radar Elec. 503-232-3404
PA Harrisburg, Cumberland Elctrns. 717-233-5883
PA Braddock, Leff Elctrns. 412-351-5000
PA Philadelphia, A.C. Radio 215-462-9379
PA Reading, Barbey Elctrns. 215-376-7451
RI Pawtucket, Jabbour Electronic Supply 401-728-4600
RI Providence, W. Dandreta & Co. 401-861-2800
RI Westerly, Ocean State Elctrns. 401-596-3080
SC Charleston, Wholesale Inds. Elctrns. .. 803-722-2634
TN Memphis, W & W Distbg. 901-527-4627
TX Houston, Elctrn. Parts Outlet 713-784-0140
TX Richardson, Off The Shelf Comps. 214-238-0808
TX Stafford, C.E.C. Elctrn. Parts 713-498-5573
UT Salt Lake City, Kimball Elec. 801-328-2075
UT Salt Lake City, Standard Supp. Co. 801-486-3371
VA Annadale, Arcade Elctrns. 703-256-4610
VA Norfolk, Priest Elctrns. 804-855-0105
WA Richland, Radar Elec. 509-943-8336
WA Seattle, Radar Elec. Co., Inc. 206-282-2511
WA Spokane, Radar Elec. 509-747-3053
WI Milwaukee, Indl. Elctrns. 414-276-1212
WI Wausau, Electronics Inc. 715-845-4671
NH Newton, Adams-McGregor 603-382-3669

DATAKEY, INC., 407 W. Travelers Trail, Burnsville, MN 55337, Tel: 612-890-6850, FAX: 612-890-2726; FSC No.: 7025; Empl.: 50; *Sls. Mgr.:* Jerry Cox

DATALUX CORP., 155 Aviation Dr., Winchester, VA 22602, Tel: 703-662-1500, FAX: 703-662-1682; Empl.: 25; *Sls. Mgr.:* R.H. Twyford

DATA MEGA INC., Mega Data, 790 Maple Lane, Bensenville, IL 60106, Tel: 708-860-6501, FAX: 708-860-3672

DATA POWER, See Beaver Labs

DATAPROBE, 170 Coolidge Ave., Englewood, NJ 07631, Tel: 201-569-6464; Empl.: 35; *Sls. Mgr.:* D. Weiss; *Dist. Mgr.:* S. Weiss

DATAPRODUCTS CORPORATION, 6200 Canoga Ave., Woodland Hills, CA 91367-2499, Tel: 818-888-4014, TELEX: 67-4734, FAX: 818-887-4789; Empl.: 3500; *Sls. Mgr.:* Paul Depa; *Dist. Mgr.:* John Thorse

DATAPRODUCTS NEW ENGLAND, INC., 50 Barnes Park North, Wallingford, CT 06492, Tel: 203-265-7151, FAX: 203-265-7801; FSC No.: 96238; Empl.: 200; *Sls. Mgr.:* Robert Griffith

DATAQ INSTRUMENTS, INC., 150 Springside Dr., Ste. B220, Akron, OH 44333, Tel: 216-668-1444, TELEX: 6502817028, FAX: 216-666-5434

DATARAM CORP., P. O. Box 7528, Princeton, NJ 08543-7528, Tel: 609-799-0071, 800-822-0071, TWX: 510-685-2542, FAX: 609-799-6734; Empl.: 150; *Sls. Mgr.:* Carl Anderson, Sls. V.P.

DATA RAY

FAX: 303-451-1143

DATA RAY CORP., 12300 Pecos, Westminster, CO 80234, Tel: 1-800-926-5556, 303-451-1300; Empl.: 100; *Sls. Mgr.:* A. Woodley ..... **B•1028-1031**

Local Sales Offices & Reps

CA	Seal Bch., Texel	213-596-9411

DATA SET CABLE CO., INC., 748 Danbury Rd., Ridgefield, CT 06877, Tel: 203-438-9684, 800-344-9684, FAX: 203-431-4657; Empl.: 70; *Sls. Mgr.:* T. Busch

DATA SPECIALTIES, INC., See Zebra Technologies Corp.

DATA TECH, DIV. OF PENRIL CORP., See Moisture Register Products Div., Aqua Measure Instrument Co.

DATA TECHNOLOGY, INC., 4 Gill St., Woburn, MA 01811, Tel: 617-935-8820, FAX: 617-935-9656; Empl.: 55; *Sls. Mgr.:* L. Rizzo ..... **B•1931**

Local Sales Offices & Reps

AK	El Dorado, Indl. Controls Assoc.	501-862-5978
CA	Anaheim, Direct Drives & Controls	714-993-3412
CO	Denver, Motion Tek	303-333-6050
IL	Geneva, The Fromm Co.	708-208-6100
MI	Troy, Kinetic Technlgs.	313-828-9700
NJ	Maywood, Concept 250 Inc.	201-488-7343
NY	Sidney, A.J.S. Controls	607-563-8978
OH	Cincinnatti, G.R. Fehr Co., Inc.	513-772-5700
PA	Wexford, Intek Sys.	412-935-4717
UT	Salt Lake City, Motion Tek, Inc.	801-268-9815

Local Distributors

NY	Sidney, AJS Controls	607-563-8978

DATATRAN CORP., 355 Yuma St., Denver, CO 80223, Tel: 303-778-0870, FAX: 303-778-0877; Empl.: 17; *Sls. Mgr.:* Cindi L. Kemper; *Dist. Mgr.:* Cindi L. Kemper

DATA TRANSLATION, INC., 100 Locke Dr., Marlboro, MA 01752, Tel: 508-481-3700, TELEX: 951646, FAX: 617-481-8620; FSC No.: 61867; Empl.: 270; *Sls. Mgr.:* Pam Nelson; *Dist. Mgr.:* Lori Dustin

FAX: 909-928-7701

DATATRONICS, INC., 28151 Highway 74, Romoland, CA 92585, Tel: 909-928-7700; FSC No.: 0F5M2 .... **A•2314**

For all states not listed, please contact factory in Romoland, CA 909-928-7700.

Local Sales Offices & Reps

AL	Huntsville, Bolton Assoc.	205-880-1164
CA	Riverside, Dalbeck-Vought, Inc.	909-243-1170
CA	San Jose, Fischer Assoc.	408-733-7350
CO	Denver, Megatronix	303-730-6262
FL	St. Petersburg, Bolton Assocs.	813-864-2294
GA	Dunwoody, Bolton Assoc.	404-671-9827
IL	Elgin, Selective Sls.	708-697-3757
IL	Park Ridge, Synmark Sls.,Inc.	312-390-9696
IN	Ft. Wayne, Gen.ll Mktg.,Inc.	219-436-4485
IA	Cedar Rapids, Dy-Tronix	319-377-8275
KS	Dy-Tronix	913-339-6333
KY	Louisville, Gen II Mktg.	502-491-5250
MA	Woburn, Radian Assocs.,Inc.	617-933-7386
MI	Kalamazoo, Midwestern Sls.	616-372-6133
MI	Troy, C.B. Jensen & Assocs.	313-643-0506
MN	Minneapolis, Tech. Solutions	612-785-9303
MO	Bridgeton, Dy-Tronix	314-291-3861
NJ	Kenilworth, Ventronics, Inc.	908-272-9262
OH	Columbus, N. Central Mktg.	419-884-9804
OR	Lake Oswego, Abacus Sls.	503-777-8111
SC	Greenwood, Bolton Assoc.	803-223-4018
TX	Plano, Vielock Assoc.	214-881-1940
UT	Bountiful, Anderson Assoc.	801-292-8991
WI	East, Selective Sls.	414-367-1133
Can	Quebec, Componetics	514-331-9930

Local Distributors

OH	N. Central Mktg.	419-884-9804
WI	Selective Sls.	414-367-1133

DATATRONIC SYSTEMS CORP., Computer Sciences Div., Bx 44128 EEM/NMR, Panorama City, CA 91412-0128, Tel: 818-988-5290; Empl.: 150

DATAWARE ELECTRONICS INC., 8227 44th Ave. West H, Mukilteo, WA 98275, Tel: 206-742-5000, FAX: 206-742-8900; Empl.: 50-100; *Sls. Mgr.:* William Bovermann

DATAWRAP, INC., 37 Water St., Wakefield, MA 01880, Tel: 617-246-5757, FAX: 617-246-5758; Empl.: 16; *Sls. Mgr.:* Tony Lockwood

DA-TECH CORP., 141 Railroad Drive, Ivyland, PA 18974, Tel: 215-322-9410, FAX: 215-322-9730; Empl.: 110; *Sls. Mgr.:* Bradford W. Bentz

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Local Sales Offices & Reps

AL	Huntsville, Hughes Assocs. Inc.	205-533-9108
AZ	Phoenix, Tech. Sls.	602-246-1614
CA	San Diego, Bestronics of San Diego	619-693-1111
CA	Santa Clara, W. J. Electrns.	408-982-9222
CO	Denver, Elcom, Inc.	303-337-2300
CA	La Mirada, Select Elctrns.	213-921-5159
FL	Largo, Q-Rep	813-397-8431
GA	Norcross, Hughes Assocs. Inc.	404-662-1587
IL	Inverness, Carvel Engrg. & Sls.	708-934-9600
IN	Indianapolis, Wilson Tech. Sales	317-872-2513
IA	Cedar Rapids, Midtec Assocs.	319-395-0028
KS	Lenexa, Midtec Assocs.	913-541-0505
MD	Burtonsville, Chesapeake Technlg., Inc.	301-236-0530
MI	W. Bloomfield, Infinity, Inc.	313-932-1179
MN	Minneapolis, George Russell & Assocs.	612-854-1166
MS	Corinth, Hughes Assocs., Inc.	601-287-2915
MO	St. Louis, Midtec Assocs.	314-275-8666
NJ	Haddenfield, G. L. Williams Assocs.	609-428-6060
NM	Albuquerque, Delta Elctrn. Sls.	505-271-3276
NY	Clark Mills, KLM-Garner	315-853-6126
NY	Elmont, Crane & Egert	516-872-0800
NC	Cary, Hughes Assocs., Inc.	919-467-7029
TN	Knoxville, Hughes Assocs, Inc.	615-558-0283
TX	Arlington, ION Assocs.	817-695-8000
TX	Austin, ION Assocs.	512-794-9006
TX	Houston, ION Assocs.	713-537-7717
UT	Murray, Elcom, Inc.	801-262-2400
WA	Bellevue, Advanced Power Comps.	206-747-9127
WA	Seattle, Advanced Power Comps.	206-527-7945
WA	Spokane, Advanced Power Comps.	206-928-7959
WA	Vancouver, Advanced Power Comps.	206-896-4239
WI	New Berlin, Carvel Engrg. & Sls.	414-784-7007
Can	Mississauga, Ont., Tracan Elctrns.	416-625-7752
Can	Montreal, Que., Tracan Elctrns.	514-955-8096
Can	Nepean, Ont., Tracan Elctrns.	613-596-9760
Can	Vancouver, B.C., Advanced Power Comps.	604-436-0522

DATRICON, Scientific Technologies, Inc., 31069 Genstar Rd., Hayward, CA 94544, Tel: 510-471-9717, FAX: 510-471-9752; Empl.: 42

DATRON SYSTEMS DIVISION, 200 West Los Angeles Ave., Simi Valley, CA 93065-1650, Tel: 805-584-1717, TWX: 910-494-2787, FAX: 805-526-0885; FSC No.: 32255; Empl.: 119; *Sls. Mgr.:* John Ricardi

DATUM TIMING, Datum Inc., 1363 S. State College Blvd., Anaheim, CA 92806-5790, Tel: 714-533-6333, ESYLNK: 714-533-6345; FSC No.: 31160; Empl.: 280; *Sls. Mgr.:* Charles Neumann ..... **D•1116, 1186-1189**

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Local Sales Offices & Reps

CA	BANCOMM	408-578-4161
AL	Huntsville, Southern Mktg. Assoss. Ltd.	205-534-6020
AK	Anchorage, Dryden Instrmn	907-344-4995
CA	Anaheim, Datum	714-533-6333
CA	Santa Clara, Ward/Davis Assocs.	408-245-3700
CO	Littleton, Vic Meyers Assocs. Inc.	303-730-7313
CT	Mt. Carmel, Scientific Dvcs.- Connecticut	203-248-9361
FL	Longwood, Southern Mktg. Assocs. Ltd.	407-682-7317
FL	Satellite, Southern Mktg. Assocs. Ltd.	407-777-3587
GA	Alpharetta, Southern Mktg. Assocs. Ltd.	404-664-9797
IL	Des Plaines, Marsland Assocs.	708-298-2620
IN	Brownsburg, Marsland Assocs.	317-852-8688
IA	Marion, Marsland	319-373-0566
LA	Metairie, Data Mktg. Assocs.	504-833-3655
MD	Columbia, Creative Mktg. Assocs.	301-880-4161
MA	Waltham, Scientific Devices-New England	617-890-2252
MN	Minneapolis, Marsland Assocs.	612-545-4481
MO	St. Louis, Marsland Assocs.	314-991-1399
NJ	Haddonfield, G. L. Williams Assocs.	609-428-6060
NJ	Union, Friedman Assocs., Inc.	908-964-6200
NM	Albuquerque, Vic Meyers Assocs. Inc.	505-884-6878
NY	Frankfort, Kapital Instr. Sls.	315-894-4245
OH	Dublin, Micro Sls. Corp.	614-792-9117
TX	Austin, Data Mktg. Assocs.	512-338-4701
TX	Dallas, Data Mktg. Assocs.	214-661-0300
TX	Houston, Data Mktg. Assocs.	713-579-2995
TX	San Antonio, Data Mktg. Assocs.	512-342-3031
WA	Seattle, Comptronics	206-784-9713
WI	New Berlin, Marsland Assocs.	414-786-6611

DAVIDGE CORPORATION, 94 Commerce Dr., Buellton, CA 93427, Tel: 805-688-9598, FAX: 805-688-3306; Empl.: 6; *Sls. Mgr.:* Dean Davidge

DAVIES MOLDING CO., 350 E. Kehoe Blvd., Carol Stream, IL 60188, Tel: 708-510-8188, FAX: 708-510-9944; FSC No.: 72512; Empl.: 130; *Sls. Mgr.:* Leo A. Sera; *Dist. Mgr.:* Leo A. Sera

Davis INSTRUMENTS

FAX: 410-358-0252

DAVIS INSTRUMENT MFG. CO., INC., 4701 Mt. Hope Drive, Baltimore, MD 21215, Tel: 800-368-2516 ..... **D•1251**

DAYCO PRODUCTS, INC., P.O. Box 1004, Dayton, OH 45401-1004, Tel: 513-226-5926, TELEX: 288219, TWX: 810-459-1822; Empl.: 6000

DAYTRONIC CORP., BTR Grp., 2589 Corporate Pl., Miamisburg, OH 45342, Tel: 513-866-3300, FAX: 513-866-3327; Empl.: 125; *Sls. Mgr.:* Ronald J. Toke

DAZIX, Intergraph, One Madison Industrial Park, Huntsville, AL 35894, Tel: 1-800-239-4111, 205-730-2000, FAX: 205-730-8344

DBA SYSTEMS, INC., P.O. Drawer 550, Melbourne, FL 32902-0550, Tel: 407-727-0660; Empl.: 337

DCI

FAX: 913-782-5766

DCI INC., 14812 W. 117th Street, Olathe, KS 66062, Tel: 913-782-5672; FSC No.: 58677; Empl.: 40; *Sls. Mgr.:* Larry Shelton ..... **B•1032; D•1344**

Local Sales Offices & Reps

AL	Huntsville, Cartwright & Bean, Inc.	205-830-1540
AZ	Phoenix, J. Smith & Assoc.	602-267-0981
CA	Lomita, Techrep Comps.	310-539-9070
CA	San Diego, Techrep - San Diego	714-361-7727
CO	Colorado Springs, J. Smith & Assoc.	719-597-5343
FL	Sarasota, REP USA	813-923-2897
GA	Norcross, Cartwright & Bean, Inc.	404-368-0160
IL	Deerfield, Jebco Sls. Ltd.	708-945-2102
IN	Ft. Wayne, M/S Sls. & Assoc.	219-463-3023
IA	Cedar Rapids, Dy-Tronix	319-377-8275
KS	Wichita, Dy-Tronix	316-838-0884
MA	Pembroke, R.G. Assocs., Inc.	617-293-5233
MS	Jackson, Cartwright & Bean, Inc.	601-981-1170
MO	St. Louis, Dy-Tronix	314-291-4777
MA	Lowell, R.G. Assocs., Inc.	508-458-9802
NY	Pittsford, L-Tron	716-383-0050
NC	Charlotte, Cartwright & Bean, Inc.	704-536-0303

NC	Raleigh, Cartwright & Bean, Inc.	919-876-4130
TN	Knoxville, Cartwright & Bean, Inc.	615-693-7450
TX	Dallas, H H & Assocs.	214-247-8308
TX	Houston, Talon Tech. Sls.	713-999-8588
VA	Alexandria, Dandelion-sk	703-722-4316
WA	Seattle, Brett Assocs., Inc.	206-328-6900
WA	Roy, Accu-Tec	206-843-9143
	Panel Meters	
AZ	Phoenix, J.Smith & Assoc.	602-267-0981
CO	Colorado Springs, J. Smith & Assoc.	719-597-5343
CT	Tolland, R.G. Assoc.	203-875-4201
FL	Sarasota, REP USA	813-923-2897
MO	Raytown, Vertec Assocs., Inc.	816-737-0377
MI	Clarkston, Aztech Sys., Inc.	313-325-0941
MN	Minneapolis, Instrmn. Resources	612-537-2434
NJ	Manchester, Vertec	314-394-6242
NV	Las Vegas, Jim Smith & Assocs., Inc.	702-798-5053
NM	Albuquerque, Jim Smith & Assocs., Inc.	505-345-6501
NC	Charlotte, Zelco Assocs., Inc.	704-541-6122
OH	Cleveland, Aztech Sys., Inc.	216-671-1200
Can	Montreal, Que., Morrison & Force Dvcs.	514-737-0072
FL	Longwood, CBC Elctrns.	407-831-5380
IL	Elmhurst, Utronix Sls. Inc.	312-834-1100
MI	Clarkston, Aztech Sys., Inc.	313-325-0941
NJ	Cherry Hill, Analectro, Inc.	800-247-3581
OH	Cleveland, Aztech Sys., Inc.	216-671-1200
RI	Warwick, Ertronics, Inc.	401-732-3567
TX	Dallas, Kay Todd Assocs.	214-458-8833
Can	St.Laurent, Que., Componetics	514-331-9930

DCT INSTRUMENTS, 1165 Chambers Road, Columbus, OH 43212, Tel: 1-800-328-1028, FAX: 614-481-7701; *Sls. Mgr.:* Joe Snell

DDI INC., 5 Dodge St., Ste. 310, Beverly, MA 01915-1703, Tel: 508-927-7976, FAX: 508-921-6388; Empl.: 4; *Sls. Mgr.:* Erik Valeur; *Dist. Mgr.:* Erik Valeur

DDK ELECTRONICS, INC., 401 Bentley Street, Markham, Ont., Canada L3R 9T2, Tel: 416-470-1346, FAX: 416-470-1479; Empl.: 25; *Sls. Mgr.:* Bill Anderson

DEAK TECHNOLOGY, INC., See Elpaz Instruments, Inc.

DE ANZA MFG. SVCS. INC., 1271 Reamwood Ave., Sunnyvale, CA 94089, Tel: 408-734-2020, FAX: 408-734-2580; FSC No.: 5935 & 5965; Empl.: 100; *Sls. Mgr.:* Michael A. Takahara

DEARBORN WIRE & CABLE, L.P., 250 W. Carpenter, Wheeling, IL 60090, Tel: 708-459-1000, 800-323-0198, FAX: 708-459-0170; FSC No.: 28105; Empl.: 135; *Sls. Mgr.:* Ray Grabowski; *Dist. Mgr.:* Scott Gauger

DE COURSEY ENGINEERING LABORATORY, 11828 W. Jefferson, Culver City, CA 90230, Tel: 1-310-397-9668; Empl.: 7

DEGUSSA CORP., Temperature Sensing Products, 104 New Era Drive, So. Plainfield, NJ 07080, TELEX: 4754247, FAX: 908-757-8561; FSC No.: 630673043; *Sls. Mgr.:* Ron Fichter

DEI, 230 N. Market Pl., Escondido, CA 92029, Tel: 619-743-8344, FAX: 619-743-5297; Empl.: 30; *Sls. Mgr.:* Matt Pedote

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Local Distributors

AL	Huntsville, Century Fastener	205-883-5344
AZ	Tempe, Ziptape ID Sys.	602-967-8888
CA	Huntington, HW Eckhardt Corp.	714-375-4926
CA	Riverside, Elctrn. Supply	714-683-7300
CA	San Fernando, Aleph Intl.	818-365-9856
CA	Santa Clare, The Wachtel Co.	408-982-0962
CO	Denver, Hardware Specs.	303-371-8553
CT	Milford, Plastic & Metal Comp.	203-877-2723
DE	Wilmington, Wholesale Elctrns.	302-652-3222
FL	Tampa, Century Fastener	813-886-5770
GA	Lawrenceville, Century Fastener	404-513-1620
GA	Suwanne, Arden Fastener	404-945-3105
IL	Addison, L-Comp	708-628-1400
IL	Bensenville, Vertex Computer Cable	708-766-7979
IL	Hillside, Zellerbach	708-448-8200
IN	Bloomington, Stansifer Radio Co., Inc.	812-336-6339
IN	Indianapolis, Wire Supplies, Inc.	317-786-4485
ME	Bangor, ICC North	207-942-2600
MD	Hanover, Vertex Computer Cable	301-796-5000
MA	Marlborough, Hardware Specs.	508-481-8622
MA	Woburn, Pacer Elctrns.	617-935-8330
MI	Muskegon, All Phase Elec.	616-733-3171
MN	Faribault, KGP Telecomm.	507-334-2269
MN	St. Paul, Arden Fasteners	612-483-6681
MO	St. Louis, L-Comp	314-291-6200
NV	Las Vegas, Kiesub	702-733-3888
NJ	Kenilworth, Federated Purch.	201-272-0505
NJ	Northvale, Glasgal Comm.	201-768-8082
NY	Farmingdale, Vertex Computer Cable	516-293-9880
NY	Holtsville, Tower Fastener Co.	516-289-8800
NY	Long Island City, Hardware Specs.	718-361-9393
NY	Rochester, Masline Elctrns.	716-546-5373
NC	Charlotte, Century Fastener	704-554-0444
NC	Charlotte, Texas Intl.	704-588-0004
NC	Raleigh, Century Fastener	919-787-1800
ND	Fargo, Border Sls.	701-239-2379
OH	Brookpark, Calvert Wire & Cable	216-433-7600
OH	Dayton, Vertex Wire & Cable	513-223-5333
PA	Philadelphia, PEI/Genesis	215-673-0400
SC	W. Columbia, Century Fastener	803-791-1800
TN	La Vergne, Arden Fastener	615-641-6661
TX	Dallas, Texas Intl.	512-366-3648
TX	Dallas, Wolford Elctrns.	713-331-2255
VA	Arlington, Arlington Elctrns.	703-524-2412
VA	Virginia Beach, Norfolk Wire & Elctrns.	804-499-1100
WA	Seattle, Radar Elctrn. Co., Inc.	206-282-2511
WI	New Berlin, Cable Comps., Inc.	414-785-1060
Can	Toronto, Cords Canada Ltd.	416-787-1114

DELBERT BLINN CO., INC., Box 2007, Pomona, CA 91769, Tel: 909-629-3900, FAX: 909-622-6218; Empl.: 6

FAX: 914-699-4005

DEL ELECTRONICS CORP., One Commerce Park, Valhalla, NY 10595, Tel: 914-686-3600; FSC No.: 01378; Empl.: 95 ..... **A•1157-1158, 1601, 1676, 2315, 2532; D•1656-1659**

Local Sales Offices & Reps

CA	Alambra (So. CA), James Gerry Co.	213-283-7694
CA	Gilroy, Armstrong & Assocs.	408-848-3221
CT	Redding, PCS	203-938-7013
MD	Kensington, Koebert Assoc.	301-493-8924
MA	Whitinsville, Power Factor & Assoc.	508-234-6415
NM	Albuquerque, Quality Technlg.	505-899-4565
PA	Glenside, Koebert Assoc.	215-887-2310

DELEVAN DIV., American Precision Inds. Inc., 270 Quaker Rd., E. Aurora, NY 14052-0449, Tel: 716-652-3600, FAX: 716-652-4814; FSC No.: 99800; Empl.: 300; *Sls. Mgr.:* Denis Kohlhagen ..... **A•1186-1189**

Local Sales Offices & Reps

AL	Decatur, El Tech	205-353-7899
AZ	Phoenix, Toward Engrg.	602-955-3193
CA	Chatsworth, First Rep. of S. CA	818-718-6155
CA	Milpitas, Advanced Technlg. Sls.	408-946-4111
CO	Parker, TMA	303-841-3435
FL	Orlando, CDM	407-240-3903
GA	Roswell, JWL Assoc.	404-518-8500
IL	Downers Grove, Momak Sls.	312-963-6400
IN	Fort Wayne, Liberty Sls.	317-888-8396
IN	New Albany, Liberty Sls.	317-888-8396
IA	Cedar Rapids, C. Horn & Asst.	319-393-8703
KS	Parker, S. W. Wollard	913-898-6552
MD	Lutherville, D. A. Dougherty Sls. Co.	301-321-7890
MA	Sterling, Compatible Comps.	508-422-3327
MN	Mendota Hgts., G-II Sls.	612-454-3086
NJ	Morrestown, TAI	609-778-5353
NJ	Ridgewood, Ballou	201-444-6990
NY	Manhassett, Ballou, Inc.	516-627-1151
NY	Mendon, Tech-Mark	716-624-3840
NY	Utica, Tech-Mark	315-733-0575
NC	Charlotte, JWL Assoc.	704-541-5750
OH	Mason, S-Tek	513-398-5843
TX	Irving, Kite Elctrn. Sls. Co.	214-986-0321
Can	Mississauga, J. G. Weiss Co. Ltd.	416-673-0011
Can	Nepean, J. G. Weiss Co. Ltd.	613-825-0545
Can	St. Laurent, J. G. Weiss Co. Ltd.	514-337-5022
Can	Vancouver, J. G. Weiss Co. Ltd.	604-873-1112
Can	Winnipeg, J. G. Weiss Co. Ltd.	204-783-4387

Local Distributors

CA	Fountain Valley, Ecliptek	714-963-4009
CA	Garden Grove, National Elctrns.	714-892-7749
CA	Irvine, ITT Multicomponents	714-727-4001
CA	San Diego, Neumann	619-695-3005
CA	Santa Clara, Trinity Elctrns.	408-980-9014
CA	Stanton, Inductive Comps.	716-828-3420
FL	Ft. Lauderdale, Bros. Elec. of FL	800-342-6700
MD	Savage, Pyttronics Ind.	301-792-0708
MA	Sterling, Compatible Comps.	617-422-6762
NJ	E. Brunswick, Brothers Elctrns.	201-238-2200
NJ	Fairfield, Micross Comps.	201-227-8007
NY	Bohemia, Car-Lac	516-567-4200
NY	Buffalo, Summit Distrs.	716-887-2800
NY	Farmingdale, Milgray/New York	800-645-4729
NY	Plainview, ACI Elctrns.	516-293-6630
PA	Norristown, Century Elctrn. Comp.	215-631-5400
TX	Fort Worth, Patco Supply	817-429-8596
Can	Burnaby, B.C., R-A-E Indl. Elctrns. Ltd.	604-291-8866
Can	Don Mills, Ont., Saynor Varah Elctrns.	416-445-2347
Can	Montreal, Que., Preico Elctrns. Ltd.	514-389-8051
Can	Pointe-Claire, Future Elctrn.	514-694-7710
Can	Willowdale, Ont., Milgray Elctrns.	416-756-4481

DELTA CONTROLS CORP., 585 Fortson St., Shreveport, LA 71107, Tel: 318-424-8471, TELEX: 784554, FAX: 318-425-2421; Empl.: 32; *Sls. Mgr.:* Steve Croom, VP Sls.

DELTA DESIGN, 5775 Kearny Villa Rd., San Diego, CA 92123-1111, Tel: 619-292-5000, FAX: 619-277-7884; Empl.: 227; *Sls. Mgr.:* Bob Williams

DELTA ELECTRONICS MFG. CORP., 416 Cabot St., Beverly, MA 01915, Tel: 508-927-1060, FAX: 508-922-6430; FSC No.: 00795; Empl.: 108; *Sls. Mgr.:* James Gillen; *Dist. Mgr.:* James Gillen

DELTA M CORPORATION, 525 Warehouse Rd., Oak Ridge, TN 37830, Tel: 615-483-1569, FAX: 615-483-1142; Empl.: 12

DELTA PRODUCTS CORPORATION, 3225 Laurelview Court, Fremont, CA 94538, Tel: 510-770-0660, FAX: 510-770-0122; Empl.: 5000; *Dist. Mgr.:* J.F. Amend

DELTA PRODUCTS CORPROATION(EAST COAST OFFICE), 2000 Aerial Center Pkwy., Morrisville, NC 27560, Tel: 919-380-8883, FAX: 919-380-8383

DELTA WIRE & CABLE CO., 2550 Commonwealth Ave., P.O. Box 833, North Chicago, IL 60064, Tel: 708-473-4990, FAX: 708-473-2425; Empl.: 12; *Sls. Mgr.:* Perry Stein

DELTEC CO., 13065 Tom White Way, Unit G, Norwalk, CA 90650, Tel: 310-926-2304, FAX: 310-926-8536; Empl.: 7; *Sls. Mgr.:* Dennis Orman

DELTEC ELCTRNS. CORP., 2727 Kurtz St., San Diego, CA 92110, Tel: 619-291-4211, 800-854-2658, TELEX: 910-335-1241, FAX: 619-296-8039; FSC No.: 52297; Empl.: 150; *Sls. Mgr.:* Jeff Frank; *Dist. Mgr.:* Rod Pullen

DEL-TELEPRODUCTS, See DEI

DELTONA TRANSFORMER CORP., 801 U.S. Hwy. 92, East, DeLand, FL 32724, Tel: 904-736-7900, FAX: 904-736-0379; Empl.: 140; *Sls. Mgr.:* Michael L. Prelec

DELTROL controls

FAX: 414-671-6809

DELTROL CONTROLS, 2745 S. 19th St., Milwaukee, WI 53215, Tel: 414-671-6800; Empl.: 180; *Sls. Mgr.:* Bill Wiberg; *Dist. Mgr.:* Frank Stadler .. **B•1480-1481, 1630**

Local Sales Offices & Reps

AL	Huntsville, JWL Assocs.	205-883-1712
AZ	Tucson, Earl Clemick & Assocs.	602-749-4003
CA	Santa Clara, Gagner-Toomey Assocs.	408-244-2200
CA	Santa Clarita, T&C Engrg.	805-254-8778
CT	Waterbury, Cannon Assocs., Inc.	203-597-0240
FL	Tampa, Florida Comp. Sls.	813-873-3622
GA	Roswell, JWL Assoc.	404-518-8500
IL	Elk Grove Village, Tristar Group	708-593-0200
IN	Ft. Wayne, Nationwide Comps.	219-423-9535
MN	St. Paul, Kencotronics, Inc.	612-645-7717
MO	Chesterfield, Weisler & Assocs.	314-537-0010
NY	Pt. Washington, Ashtec Inc.	516-767-0336
NY	Rochester, Omni Sls.	716-248-0340
NC	Charlotte, JWL Assocs.	704-541-5750
OH	Willoughby, Nationwide Comps.	216-946-3226
PA	Valley Forge, Providence Mktg.	215-935-3300
RI	Barrington, Cannon Assoc.	401-245-0850
TX	Houston, Weisler & Assocs.	713-467-1862
Can	Pointe Claire, Nobel-Teck Inc.	514-695-7498

Local Distributors

AL	Birmingham, American Elctrn. Supp.	205-942-4656
AL	Montgomery, Southern Controls	205-277-5030
AZ	Tempe, Control Design	602-829-7981
AR	Little Rock, Carlton-Bates Co.	501-562-9100
CA	Anaheim, Control Design	714-821-1516
CA	Canoga Park, C & A Elctrns.	818-340-6022
CA	San Jose, Consolidated Parts	408-435-1200
CA	Tustin, Western Switches	714-259-8144
CA	Van Nuys, Wes-Garde Comps.	213-873-4802
CO	Denver, Integrated Elctrns.	303-292-6121
CT	Waterbury, All-Phase Elec. Supply	203-755-0405
FL	Altamonte Springs, Control Des.	407-788-3220
FL	Ft. Lauderdale, SE Elctrns.	305-563-4131
FL	Lakeland, Wes-Garde Comps.	813-644-7564
FL	Orlando, EMSCO	407-849-6362
GA	Stone Mountain, Control Des.	404-979-3500
IL	Bensenville, Gould Elctrns.	708-860-7171
IN	Indianapolis, Control Design	317-788-4559
IA	Davenport, Warren Radio	319-322-5301
IA	Marion, Control Des.	319-373-2923
IA	West Des Moines, Ramco Co.	515-225-6933
KS	Kansas City, Kornfield Thorp Elec.	913-321-7070
KS	Wichita, Kriz-Davis Co.	316-267-4354
KY	Louisville, Peerless Elctrn. Equip.	502-637-7674
MD	Aberdeen, Harco Elctrns.	301-838-7990
MA	Brighton, Interstate Elctrns. Equip.	617-782-9000
MA	Westborough, In Stock Prods.	508-870-5750
MI	Jackson, Fulton Radio Supp.	517-784-6107
MI	Madison Hgts., Galco Indl. Elctrns.	313-542-9090
MN	Minneapolis, Control Design	612-721-6555
MO	St. Louis, Wes-Garde Comps.	314-567-7776
NH	Keene, Tradesmen Elctrl. Supp.	603-352-1205
NJ	Oakland, Relay Specialties	201-337-1000
NJ	Raritan, Masters Elctrn.	201-725-3533
NY	Hauppauge, Broadline Elctrns.	516-231-4100
NY	Rochester, Masline Elctrns.	716-546-5373
NY	Vestal, Wholesale Elec. Supp.	607-729-1526
ND	Fargo, WESCO	701-232-4446
ND	Minot, J.I. Company	801-852-4466
OH	Akron, AESCO Elctrns.	216-762-8818
OH	Willoughby, Gateway Megatech	216-953-0333
OK	Ardmore, Ardmore Elec. Supp.	405-223-3571
OK	Tulsa, Radio, Inc.	918-587-9123
OR	Portland, Dunn Elec.	503-285-0214
PA	Erie, Rem Elctrns.	814-453-5626
PA	Malvern, Control Design	215-296-0150
PA	Philadelphia, Lindley Elec.	215-329-7005
TX	Dallas, Control Design	214-358-1441
TX	Lubbock, R & R Elec. Co.	806-765-7727
TX	San Antonio, Blackburn Drives Controls	512-349-2621
UT	Salt Lake City, Kimball Elctrns.	801-328-2075
VA	Glen Allen, Hermitage Distrs.	804-550-3030
VA	Staunton, Southern Elec.	703-886-6218
WI	Manitowoc, Englewood Elec.	414-684-6653
WI	Milwaukee, Marsh Elctrns.	414-475-6000
WI	New Berlin, Control Design	414-784-1015

DELTRON, INC., 290 Wissahickon Ave., N. Wales, PA 19454-9990, Tel: 215-699-9261, FAX: 215-699-2310; Empl.: 120

DEL-TRON PRECISION, 5 Trowbridge Drive, Bethel, CT 06801, Tel: 800-245-5013, FAX: 203-778-2721; Empl.: 50; *Sls. Mgr.:* Emil Melvin

DENNIS CHEMICAL, 2700 Papin St., St. Louis, MO 63103, Tel: 314-771-1800, FAX: 314-771-8399; Empl.: 70; *Sls. Mgr.:* Charles F. Seger III; *Dist. Mgr.:* Charles F. Seger III

DENSEPAC MICROSYSTEMS, INC., 7321 Lincoln Way, Garden Grove, CA 92641-1428, Tel: 714-898-0007, 800-64-CHIPS, FAX: 714-897-1772; FSC No.: 66847; Empl.: 50; *Sls. Mgr.:* Al Kile, VP Sls.

DENSITRON CORPORATION, Densitron International, 3425 W. Lomita Blvd., Torrance, CA 90505, Tel: 310-530-3530, TWX: 910-349-6200, FAX: 310-534-8419; FSC No.: 62483; Empl.: 42; *Sls. Mgr.:* Richard Driscoll VP Sls./Mktg.; *Dist. Mgr.:* Richard Driscoll VP Sls./Mktg. **B•1033**

Local Sales Offices & Reps

AZ	Tempe, Techni-Source	602-730-8093
CA	Irvine, Comp. Mktg. Assocs.	714-727-0688
CA	Milpitas, Telesis Sls.	408-946-7300
CO	Englewood, Comp. Sls.	303-779-8060
CT	W. Hartford, M-R Tech. Sls.	203-521-2101
FL	Margate, EPM Corp.	305-977-0331
GA	Acworth, E.A.B., Inc.	404-975-3660
IL	Northbrook, Howard Benjamin Assoc.	708-272-2900
IN	Ft. Wayne, R.L. Bontempo Assocs.	219-478-1057
KS	Overland Pk., Markline Technigs.	913-681-8880
MA	Wellesley Hills, Sturdy Corp/Nova Assocs.	617-235-2330
MN	Minneapolis, Electro-Serv	612-338-3475
MO	St. Louis, Midtech Assocs.	314-275-8666
NY	Rochester, Mullahy-Welch Sls.	716-244-1100
NC	Raleigh, C-Tech Sls.	919-782-8100
OH	Centerville, Engrg. Mktg. Assocs.	513-433-2800
TX	Seagoville, Delta Comps.	214-287-6333
UT	Salt Lake City, Wasatch/Prorep Mktg.	801-268-3434
VA	Sterling, Beacon-North	703-478-2480
WA	Seattle, J. J. Assocs.	206-246-6619
Can	Mississauga, Ont., IntelaTech	416-629-0082

DEPAC CORP., 201 Mill St., Rome, NY 13440, Tel: 315-339-1265; Empl.: 3

DERINGER MFG. CO., 1250 Townline Road, Mundelein, IL 60060, Tel: 708-566-4100, TWX: 910-685-4231; *Sls. Mgr.:* W. Johnston

DESIGNATRONICS, INC., See Automatic Coil Corp., Sub. Designatronics, Inc.

DESIGN AUTOMATION, INC., 809 Massachusetts Ave., Lexington, MA 02173-3992, Tel: 617-862-8998, FAX: 617-862-3769; FSC No.: 4D417; Empl.: 5

DESIGN COMPONENTS, INC. (DCI), 1 Kenwood Circle, Franklin, MA 02038, Tel: 508-528-7300, 800-341-4811, FAX: 508-520-1424; Empl.: 50

DESIGN TECHNOLOGY, 11489 Woodside Ave., Santee, CA 92071, Tel: 619-448-2888, FAX: 619-448-3044; FSC No.: 619-440-8048; Empl.: 50; *Sls. Mgr.:* Jeff Jonas; *Dist. Mgr.:* Sherry Golden

DESIGN WORKSHOP, 4226 St. John's Blvd., Ste. 400, D.D.O., Que., Canada H9G 1X5, Tel: 514-696-4753, FAX: 514-696-5351; Empl.: 5

DESPATCH INDUSTRIES, 63 St. Anthony Parkway, P.O. Box 1320, Minneapolis, MN 55418, Tel: 612-781-5363, FAX: 612-781-5353; Empl.: 360; *Sls. Mgr.:* P. Olson

DETORONICS CORPORATION, 10660 E. Rush St., S. El Monte, CA 91733, Tel: 818-579-7130, TWX: 910-587-3436, FAX: 818-579-1936; FSC No.: 29867; Empl.: 45

DETROIT COIL CO., 2435 Hilton Rd., Ferndale, MI 48220, Tel: 313-398-5600, FAX: 313-398-0481; Empl.: 120; *Sls. Mgr.:* T. Dougherty

DETROIT TESTING LABORATORY, INC., 7111 E. Eleven Mile, P.O. Box 869, Warren, MI 48090-0869, Tel: 313-754-9000, FAX: 313-754-9045; FSC No.: 0739; Empl.: 125

DEUTSCH RELAYS, INC., 65 Daly Rd., East Northport, NY 11731, Tel: 516-499-6000, FAX: 516-499-6015; Empl.: 463; *Sls. Mgr.:* Glen Telshow

DEVAR, INC., 706 Bostwick Ave., Bridgeport, CT 06605, Tel: 203-368-6751, FAX: 203-368-3747; Empl.: 80; *Sls. Mgr.:* T. W. Tomasko

DEVELCO, INC., 175 Nortech Pkwy., San Jose, CA 95134-2306, Tel: 408-945-6500, TWX: 910-339-9295, FAX: 408-945-6504; Empl.: 50; *Sls. Mgr.:* W. J. Baker

DEVERE AND LAU COMPANY, 1767 South Norfolk Lane, Anaheim, CA 92802, Tel: 310-457-7912, FAX: 714-772-1934; FSC No.: 7302-8902; Empl.: 26; *Sls. Mgr.:* G. R. Bosworth

DEXTER RESEARCH CTR., INC., 7300 Huron River Dr., Dexter, MI 48130, Tel: 313-426-3921, FAX: 313-426-5090; Empl.: 35; *Sls. Mgr.:* Robert Toth Jr.

DEXTER SCIENTIFIC, 308 Benham St., Palatka, FL 32177, Tel: 904-328-2450; Empl.: 1

DE YOUNG MFG., INC., 12920 N.E. 125th Way, Kirkland, WA 98034, Tel: 206-823-4798, FAX: 206-821-8633; FSC No.: 54937; Empl.: 70; *Sls. Mgr.:* Ted Johnson

DGH CORPORATION, P. O. Box 5638, Manchester, NH 03108, Tel: 603-622-0452, FAX: 603-622-0487; Empl.: 10

DGS PRO AUDIO, P.O. Box 170426, Arlington, TX 76003, Tel: 800-292-2834, FAX: 817-473-7712; *Sls. Mgr.:* Drey Hayford; *Dist. Mgr.:* Mike Manzella

DH PRINT, DIV. OF DH TECHNOLOGY, 860 College View Dr., Riverton, WY 82501, Tel: 307-856-4821, FAX: 307-856-0412; Empl.: 280; *Sls. Mgr.:* Roger Rayburn; *Dist. Mgr.:* Roger Rayburn

DIAGOSTIC INSTRUMENT CORP., 4 Copeland Dr., Box J, Ayer, MA 01432, Tel: 508-772-4572, FAX: 508-772-5210; Empl.: 70; *Sls. Mgr.:* James F. Hashem

DIALIGHT CORPORATION, 1913 Atlantic Ave., Manasquan, NJ 08736, Tel: 908-223-9400, FAX: 908-223-8788; FSC No.: 83330; Empl.: 400; *Sls. Mgr.:* W. Moore; *Dist. Mgr.:* Gary Baker **B•1141-1147**

Local Sales Offices & Reps

AL	Huntsville, Cartwright & Bean	205-830-1540
AZ	Phoenix, Shefler-Kahn Co.	602-581-0884
CA	Garden Grove, Elsco	714-891-4621
CA	Pleasanton, Moulthrop Sls.	510-463-0450
CA	San Diego, Varigon San Diego	619-576-0100
CO	Boulder, Comp. Prods. Sls.	303-530-2800
CT	Wallingford, John E. Boeing Co., Inc.	203-265-1318
FL	Ft. Lauderdale, Panamtech, Inc.	305-587-3769
FL	Oviedo, Panamtech Inc.	407-679-5506
GA	Norcross, Cartwright & Bean	404-368-0160
IL	Chicago, Victory Sls.	708-490-0300
IN	Huntington, Electronic Reps.	219-356-3513
IN	Indianapolis, Elctrn. Reps.	317-894-1414
IA	Cedar Rapids, Lowell-Kangas & Assoc.	319-362-9290
KS	Shawnee, Lowell Kangas & Assocs.	913-631-3515
KY	Lexington, Electronic Reps.	606-277-0436
LA	Covington, Cartwright & Bean	504-892-1780
MA	Chelmsford, John E. Boeing Co., Inc.	508-256-5800
MI	Grand Rapids, Hilltronics, Inc.	616-364-0010
MI	Royal Oak, Hilltronics	313-435-0920
MN	Edina, Mel Foster Tech. Sls.	612-941-9790
MS	Jackson, Cartwright & Bean	601-981-1170
MO	St. Louis, Lowell Kangas & Assocs.	314-821-4050
NY	Liverpool, Gen-Tech	315-451-3480
NY	Melville, Parallax	516-351-1000
NY	Penfield, Gen-Tech Elctrns.	716-581-5159
NC	Charlotte, Cartwright & Bean	704-536-0303
NC	Raleigh, Cartwright & Bean	919-876-4130
OH	Dayton, Baehr, Greenleaf & Assocs.	513-439-0724
OH	Westlake, Baehr, Greenleaf & Assocs.	216-892-1770
OR	Tigard, Earl & Brown Assocs.	503-639-2100
PA	Broomall, L.D. Lowery	215-356-5300
PA	Warrendale, Baehr, Greenleaf & Assocs.	412-934-3088
TN	Germantown, Cartwright & Bean	901-758-8113
TN	Knoxville, Cartwright & Bean	615-693-7450
TX	Austin, Tesco	512-834-8374
TX	Dallas, Tesco	214-553-1200
TX	Houston, Tesco, Inc.	713-690-4909
VA	Earlysville, L.D. Lowery, Inc.	804-973-6672
WA	Redmond, Earl & Brown Assocs.	206-885-5064
WI	Brookfield, Victory Sls.	414-789-5770
Can	Kirkland, PQ, Longman Sls., Inc.	514-694-3911
Can	Mississauga, Ont., Longman Sls., Inc.	416-670-8100
Can	Nepean, Ontario, Longman Sls., Inc.	613-564-0100
Can	Vancouver, B.C., Arwin Tech. Ltd.	604-980-4557

Local Distributors

AR	Little Rock, Carlton Bates	501-562-9100
CA	Garden Grove, Richey Impact, Inc.	714-895-0060
CA	Gardena, California Switch	213-770-2330
CA	Los Angeles, Bell Inds.	213-826-6778
CO	Denver, CSID	303-292-9594
FL	Orlando, Hammond Elctrns.	407-849-6060
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Palatine, Ohm Elctrns.	708-359-5500
LA	Lafayette, Ralph's of Lafayette	318-233-0105
MD	Baltimore, Resco	301-931-8200
MA	Hingham, Sager Elctrns.	617-749-6700
MA	Norwood, Gerber Elctrns.	617-769-6000
MI	Livonia, Chelsea Ind/RS Elec.	313-525-1155
MN	St. Paul, Gopher Elctrns.	612-483-3322

MO	Maryland Hts., L Comp	314-291-6200
NJ	Kenilworth, Federated Purchaser	908-272-0505
NY	Buffalo, Summit Distrs.	716-887-2800
NY	Lynbrook, Peerless Radio Corp.	516-593-2121
NY	Melville, Arrow Elctrns.	516-391-1300
OH	Akron, Aesco Elctrns., Inc.	216-762-8818
OH	Columbus, Hughes-Peters, Inc.	614-294-5351
OH	Dayton, Stotts Friedman	513-298-5555
OH	Warren, Rem Elctrn. Supp.	216-373-1300
PA	Philadelphia, PEI/Genesis	215-673-0400
PA	Trevose, Bell	215-953-2800
TX	Dallas, Norvell Elec., Inc.	214-233-0020
TX	Houston, Harrison Equip. Co.	713-879-2600
VA	Charlottesville, Virginia Elctrns.	804-296-4184
WA	Bellevue, Almac/Arrow	206-643-9992
WI	Mitwaukee, Marsh Elctrns.	414-475-6000
Can	Edmonton, Alb., Cardinal Ind. Elec.	403-483-6266
Can	Willowdale, Ont., Electro Sonic	416-494-1666

DIANACHART INC., 101 Round Hill Dr., Rockaway, NJ 07866, Tel: 201-625-2299, FAX: 201-625-2449; Empl.: 10; *Sls. Mgr.:* B. McWilliams

DI/AN CONTROLS, INC., 16 Jonathan Drive, Brockton, MA 02401, Tel: 508-599-8000, FAX: 508-599-8658; FSC No.: 06900; Empl.: 25; *Sls. Mgr.:* John Sheehy

DIELECTRIC COMMUNICATIONS, General Signal, Tower Hill Rd., Raymond, ME 04071, Tel: 207-655-4555, 800-341-9678, TELEX: 710-229-6890, FAX: 207-655-4669; FSC No.: 08441; Empl.: 220; *Sls. Mgr.:* Rolf Olsen

DIELECTRIC LABS., Rte. 20 E., Cazenovia, NY 13035, Tel: 315-655-8710, TELEX: 882-691 Dielectric Labs., FAX: 315-655-8179; FSC No.: 55153; Empl.: 100; *Sls. Mgr.:* Gunter Vorlop

DIELECTRIC SCIENCES, INC., HVT Group, 88 Turnpike Road, Chelmsford, MA 01824, Tel: 508-250-1507, FAX: 508-250-1699; FSC No.: 50509; Empl.: 30; *Sls. Mgr.:* David J. Leary

DIE-TECH INC., 295 Sipe Rd., RDI, York Haven, PA 17370, Tel: 717-938-6771, FAX: 717-938-6099

DIETERICH STANDARD, A Dover Industries Company, P.O. Box 9000, Boulder, CO 80301, Tel: 303-530-9600, FAX: 303-530-7064; Empl.: 105; *Sls. Mgr.:* Robert Heiser; *Dist. Mgr.:* Robert Heiser

DIETZ DESIGN, INC., 100 Electronics Pkwy., Belton, MO 64012, Tel: 816-331-4911, FAX: 816-331-4914; FSC No.: 93652; Empl.: 40; *Sls. Mgr.:* L.M. Dietz

DIGALOG SYSTEMS, INC., 3180 South 166th St., New Berlin, WI 53151, Tel: 414-797-8000, FAX: 414-797-8003; Empl.: 35

DIGI-DATA CORP., 8580 Dorsey Run Rd., Jessup, MD 20794, Tel: 301-498-0200, FAX: 301-498-0771; Empl.: 40; *Sls. Mgr.:* Jim McLaughlin

DIGI-KEY CORP., 701 Brooks Ave. South, Thief River Falls, MN 56701-0677, Tel: 218-681-6674, 1-800-344-4539, FAX: 218-681-3380

DIGITAL DATA SYSTEMS, INC. (DDS), 1551 N.W. 65 Ave., Ft. Lauderdale, FL 33313, Tel: 305-792-3290, TWX: 910-997-4751 (Digital), ESYLNK: 62756087, FAX: 305-581-13; FSC No.: 65136; Empl.: 20

DIGITAL DESIGN ANALYSIS, 150 El Camino Real, Ste. 200, Tustin, CA 92680, Tel: 714-573-8730, FAX: 714-573-8736; Empl.: 6; *Sls. Mgr.:* Darlene Kindstrand; *Dist. Mgr.:* Darlene Kindstrand

DIGITAL DYNAMICS, INC., 5274 Scotts Valley Dr., Scotts Valley, CA 95066, Tel: 408-438-4444; FSC No.: (S.I.C. Code – 3823); Empl.: 15

DIGITAL MOTOR, INC., 1075 N.W. Murray Rd., Ste. No. 255, Portland, OR 97229-5501, Tel: 503-629-9692, FAX: 503-690-9876; Empl.: 6

DIGITAL PRODUCTS, INC., 411 Waverly Oaks Rd., Waltham, MA 02154, Tel: 617-647-1234, 800-243-2333, TELEX: 312345, FAX: 617-924-7814; Empl.: 100; *Dist. Mgr.:* Neil Peterson

DIGITAL RADIO CORP., 601 S. Pacific Coast Hwy., Redondo Beach, CA 90277, Tel: 213-316-4114, FAX: 213-543-1256; Empl.: 27; *Sls. Mgr.:* Arvin L. Perry

DIGITEC, 959 Cheney Ave., Marion, OH 43302, Tel: 614-387-3444, TELEX: 3775688; FSC No.: 16152; Empl.: 45; *Sls. Mgr.:* Bruce Poplin

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CA	Ontario, Xcel Corp.	909-391-4321
CO	Littleton, Romulus	303-770-4888
FL	Margate, EPM Corp.	305-977-0331
IL	Palatine, Technlg. Sls.	708-991-6600
MI	Troy, C.B. Jensen & Assoc.	313-643-0506
NJ	Hasbrouck Hgts., Comp-Tech	201-288-7400
NY	Rochester, Apex	716-272-7040
OR	Beaverton, J.J. Backer	503-627-0775
TX	Richardson, Pro-Comp	214-669-1500
WA	Seattle, J.J. Backer	206-285-1300

Local Distributors

AL	Huntsville, Comp. Distrs.	205-883-7501
AL	Huntsville, Powell Elec.	205-539-2731
AZ	Tempe, Powell Elctrns.	602-967-7538
AR	Little Rock, Comp. Distrs.	501-227-6278
CA	Cerritos, El-Com	213-404-2961
CA	Fullerton, Pyramid 714-773-0781,	213-691-0561
CA	Riverside, Xcel Corp.	909-275-0257
CA	San Diego, El-Com	619-578-0900
CA	San Jose, Powell Elctrns.	408-943-9020
CA	Santa Clara, Pyramid Elec.	408-727-9810
CT	Hamden, Impact Elctrns.	203-281-1331
FL	Ft. Lauderdale, Comp. Distrs.	305-971-4950
FL	Ft. Lauderdale, Powell Electr./Fla.	305-972-4300
GA	Norcross, Comp. Distrs.	404-441-3320
MD	Columbia, Powell Electr.	301-621-4070
MA	Canton, Impact Sls. Co.	617-821-1500
MA	West Borough, Powell Elctrns.	617-336-6100
MI	St. Clair Shores, Specialties Mfg.	313-771-2700
NJ	Hasbrouck Hgts., Tory Sls.	201-288-5656
NJ	Toms River, Xcel Corp.	908-830-7525
NC	Cary, Powell Elec.	919-467-1212
NC	Raleigh, Comp. Distrs.	919-834-9465
OH	Cleveland, Xcel Corp.	216-239-4998
PA	Philadelphia, Powell Electr.	215-365-1900

DILL INSTRUMENTS INC., 436 W. Willard, Kalamazoo, MI 49005, Tel: 616-388-5708, FAX: 616-388-5704; Empl.: 10; *Sls. Mgr.:* Terry Simpson; *Dist. Mgr.:* Robert Boyle

DILLON, Weigh-Tronix, Inc., 1000 Armstrong Dr., Fairmont, MN 56031, Tel: 507-238-4461, TELEX: 756594, FAX: 507-238-4195; Empl.: 500; *Sls. Mgr.:* Jim Rather

DILOG, 2652 McGaw, Irvine, CA 92714, Tel: 714-476-0303, FAX: 714-476-0633; FSC No.: 33-0243085; Empl.: 160; *Sls. Mgr.:* Dennis Edwards

DILWOL WIRE & CABLE INC., 435 Enfield Rd., Burlington, Ont., Canada L7T 2X5, Tel: 416-681-2343, FAX: 416-681-8440; *Sls. Mgr.:* J. R. Mattie

DIMCO-GRAY, 8200 S. Suburban Rd., Dayton, OH 45458, Tel: 513-433-7600, FAX: 513-433-0520; Empl.: 120; *Sls. Mgr.:* James L. Harl

DIMENSIONS UNLIMITED, INC., 1800 Buerkle Rd., St. Paul, MN 55110, Tel: 612-770-5630, FAX: 612-770-0847; *Sls. Mgr.:* David Flod

DIODES INC., 9957 Canoga Ave., Chatsworth, CA 91311, Tel: 818-882-4920, 800-821-1178, FAX: 818-341-1736; FSC No.: 12060; Empl.: 55; *Sls. Mgr.:* Marvin Zidel; *Dist. Mgr.:* Sue Reinish

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DIOTEC ELECTRONICS CORP., 18020 Hobart Blvd., Ste. B, Gardena, CA 90248, Tel: 310-767-1052, FAX: 310-767-7958; FSC No.: 4800; Empl.: 6; *Sls. Mgr.:* Joe S. Lin; *Dist. Mgr.:* Joe S. Lin

DIRECT CONVERSION TECHNIQUE, INC., 3132 N. Lowell Ave., Chicago, IL 60641, Tel: 312-283-1690, FAX: 1-800-282-3852; Empl.: 6; *Sls. Mgr.:* Thomas A. Ochal

DIRECT SOUND CORPORATION, The Park Square Bldg., 31 St. James Street, Ste. 901, Boston, MA 02116, Tel: 1-800-372-1616, FAX: 1-800-354-3317; Empl.: 3; *Sls. Mgr.:* A. Takayama ..... **B•1709; C•1309**

DISC INSTRUMENTS, Honeywell, 102 E. Baker St., Costa Mesa, CA 92626, Tel: 714-433-0343, TWX: 910-595-1987, FAX: 714-432-7567; Empl.: 150

DISPLAY DEVICES, INC., P.O. Box 230677, Encinitas, CA 92023, Tel: 619-753-0113; FSC No.: 26107

DISPLAYS, INC., 31 Industrial Park Rd., Lewistown, PA 17044, Tel: 717-242-2541, FAX: 717-248-8680; Empl.: 30; *Sls. Mgr.:* Kit Kennedy

DISPLAYTECH, INC., 2200 Central Ave., Boulder, CO 80301, Tel: 303-449-8933, FAX: 303-449-8934; Empl.: 24; *Sls. Mgr.:* Chris Sherman; *Dist. Mgr.:* Kelly J. Mannatt

DISPLAY TECHNOLOGIES, INC., 1355 Holmes Rd., Elgin, IL 60123, Tel: 708-931-2100, 1-800-544-8823, FAX: 708-931-2120; Empl.: 350; *Sls. Mgr.:* Robert Valentine; *Dist. Mgr.:* Timothy Knutsen

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DISTRIBUTED PROCESSING TECHNOLOGY CORP., 140 Candace Dr., Maitland, FL 32751, Tel: 407-830-5522, FAX: 407-260-5366; Empl.: 200; *Sls. Mgr.:* Jim Habuda; *Dist. Mgr.:* Tom Moch

DISTRIBUTOR SPECIALISTS, 1942 14th Street, Santa Monica, CA 90404-4606, Tel: 213-452-3445

DIVELBISS CORP., 9776 Mt. Gilead Road, Fredericktown, OH 43019, Tel: 614-694-9015, FAX: 614-694-9035; Empl.: 40; *Sls. Mgr.:* Terry Divelbiss; *Dist. Mgr.:* Tim Knaul

DIVERSIFIED ELECTRONICS, INC., P.O. Box 1140, Evansville, IN 47706-1140, Tel: 812-426-2806, FAX: 812-425-8930; Empl.: 55; *Sls. Mgr.:* John L. Smith

DIVERSIFIED OPTICAL PRODUCTS, INC., 282 Main St., Salem, NH 03079, Tel: 603-898-1880, FAX: 603-898-3970; FSC No.: IHT10; Empl.: 49; *Sls. Mgr.:* James A. Greene

DIVERSIFIED SYSTEMS, INC., 6232 La Pas Trail, Indianapolis, IN 46268, Tel: 317-299-9547, FAX: 317-298-2055; FSC No.: 5693;5999;R212;R498;R698;S901;S902;S903;S908; Empl.: 100ò; *Sls. Mgr.:* Paul Madden

DIVERSIFIED TECHNLG., P.O. Box 748, Ridgeland, MS 39157, Tel: 601-856-4121, TELEX: 585326, FAX: 601-856-2888; Empl.: 100ò; *Sls. Mgr.:* Barrie McArthur; *Dist. Mgr.:* Barrie McArthur

DIXSON, INC., 287 27 Rd., Grand Junction, CO 81503, Tel: 303-244-1241, FAX: 303-245-6267; Empl.: 250; *Sls. Mgr.:* Ray Carlson

DJ INSTRUMENTS, INC., 18 Republic Rd., N. Billerca, MA 01862, Tel: 508-667-5301, FAX: 508-667-6804; FSC No.: 57747; Empl.: 25; *Sls. Mgr.:* David First

D. L. CUSTOM, 7250 Victoria Park Ave., Markham, Ont, Canada L3R 2M5, Tel: 416-475-0275; *Sls. Mgr.:* Les Hull, Jr.

D. O. INDUSTRIES, 200 Commerce Dr., Rochester, NY 14623, Tel: 716-359-4000, TELEX: 200802, FAX: 716-359-4999; *Sls. Mgr.:* Jeremy Goldstein

DOLAN-JENNER INDS., Box 1020, Woburn, MA 01801, Tel: 617-935-7444, TELEX: 94-8161, FAX: 617-938-7219; Empl.: 120; *Sls. Mgr.:* B.J. Dolan; *Dist. Mgr.:* Frank Tiernan

DOLPH, JOHN C., CO., New Rd., Monmouth Junction, NJ 08852, Tel: 908-329-2333, FAX: 908-329-1143; *Sls. Mgr.:* W. Rumpa

DOMINO, INC., P.O. Box 9309, Fort Wayne, IN 46899, Tel: 219-456-5512; FSC No.: 9Y350; Empl.: 19; *Sls. Mgr.:* Rick Smith

D1 INTERNATIONAL, INC., 95 E. Main St., Huntington, NY 11743, Tel: 516-673-6866, FAX: 516-673-6893; Empl.: 24; *Sls. Mgr.:* Bron Kutny

DONTECH, INC., 700 Airport Industrial Blvd., Doylestown, PA 18901, Tel: 215-348-5010, TELEX: 685 1155 DONTK, FAX: 215-348-9959; FSC No.: 63009; *Sls. Mgr.:* Jeffrey S. Reid, Dir. Mktg. & Sls.; *Dist. Mgr.:* Leda Petrou, Sls.

DORAN MANUFACTURING CO., 2834 Sidney Ave., Cincinnati, OH 45225, Tel: 513-681-5424, FAX: 513-681-5604; Empl.: 60; *Sls. Mgr.:* Jeff Stegman

DORMEYER INDUSTRIES, A.F. Dormeyer Mfg. Co. Inc., 6585 N. Avondale Ave., Chicago, IL 60631-1521, Tel: 312-775-3600, FAX: 312-775-6495; Empl.: 150; *Sls. Mgr.:* R. Steinberg ..... **B•1632-1635**

Local Sales Offices & Reps

CA	Torrance, Universal Comps.	310-783-0220
CT	Guilford, Anchor Engrg.	203-458-7496
IL	Chicago, Dormeyer Inds.	312-775-3600
IA	Cedar Rapids, Dytronix	319-377-8275
KS	Wichita, Dytronix	316-838-0884
MA	Westborough, Anchor Engrg.	508-898-2724
MO	Bridgeton, Dytronix	314-291-4777
NY	Great Neck, Pacent Engrg.	516-482-4678
OH	Cleveland, KT/Depco	216-942-0051
PA	Glenshaw, Hollern Sls. Inc.	412-487-1246

Local Distributors

AL	Birmingham, W.W. Grainger	205-942-6741
AL	Huntsville, Reptron Elctrns.	205-722-9500
AZ	Phoenix, Minarik Elec.	602-233-3000
AR	Little Rock, W.W. Grainger	501-568-7800
CA	Glendale, Minarik Elec.	818-507-6500
CA	Los Angeles, Master Distr.	800-421-8153
CO	Commerce City, Minarik Elec.	303-289-5800
FL	Ft. Lauderdale, Reptron Elctrns.	305-735-1112
FL	Tampa, Reptron Elctrns.	813-855-4656
GA	Norcross, Reptron Elctrns.	404-446-1300
IL	Chicago, Leeds Elctrns.	312-625-3800
IL	Chicago, W.W. Grainger	312-486-9933
IL	Schaumburg, Reptron Elctrns.	708-882-1700
IN	Ft. Wayne, W.W. Grainger	219-484-9565
IA	Des Moines, W.W. Grainger	515-266-3460
KY	Louisville, W.W. Grainger	502-499-0001
MA	N. Billercia, Minarik Elec.	508-663-0740
MA	Sharon, Adcour Inc.	617-784-8123
MI	Detroit, W.W. Grainger	313-873-1200
MI	Livonia, Reptron Elctrns.	313-525-2700
MN	Minnetonka, Reptron Elctrns.	612-938-0000
MN	Plymouth, Leeds Elctrns.	612-557-1277
MO	Kansas City, W.W. Grainger	816-241-5600
MO	St. Louis, W.W. Grainger	314-231-5031
NJ	Newark, W.W. Grainger	201-648-0040
NC	Charlotte, W.W. Grainger	704-376-0785
NC	Raleigh, Reptron Elctrns.	919-870-5189
OH	Cleveland, W.W. Grainger	216-398-1880
OH	Solon, Reptron Elctrns.	216-349-1415
PA	Lansdale, Reptron/Pyttronic	215-855-0925
TX	Irving, Minarik Elec.	214-402-8188
WA	Redmond, Minarik Elec.	206-885-0832
WI	Milwaukee, Elctrn. Expeditors, Inc.	800-558-8547
WI	Milwaukee, Leeds Elctrns.	414-789-6995
Can	W.W. Grainger	800-633-8487

DOTRONIX, 160 First St. SE, New Brighton, MN 55112, Tel: 612-633-1742, TWX: 910-563-3541, FAX: 612-633-7025; Empl.: 200; *Sls. Mgr.:* D. Michael Hunter, Natl. Sls. Mgr.

DOUGLAS CORPORATION

FAX: 612-942-3125

DOUGLAS CORP., 7180 Washington Ave. So., Eden Prairie, MN 55344-3512, Tel: 612-941-3847, 1-800-728-3189; Empl.: 500 ..... **B•1826**

DOUGLAS ELECTRONICS, INC., 2777 Alvarado St., San Leandro, CA 94577, Tel: 510-483-8770, FAX: 510-483-6453; Empl.: 15

DOUGLAS INTERNATIONAL, INC., 312 West State Street, Geneva, IL 60134-0761, Tel: 708-232-7419, ESYLNK: 708-232-9394

DOUGLAS RANDALL INC.

FAX: 203-599-1754

DOUGLAS RANDALL, P.O. Box 506, 100 Mechanic St., Bldg. 26, Pawcatuck, CT 06379, Tel: 203-599-2075; Empl.: 50; *Sls. Mgr.:* Gil Yanishevsky ..... **A•2144-2145; B•1473-1478; D•1155-1157**

Local Sales Offices & Reps

AL	Madison, R.W. Mitscher	205-464-0745
CA	Torrnace, O'Donnell Assoc.	310-316-9445
FL	Lutz, R.W. Mitscher	813-948-2351
FL	Tequesta, R.W. Mitscher	407-575-4485
GA	Lawrenceville, R.W. Mitscher	404-923-3239
IL	Arlington Hgts., Thermek Inc.	708-577-6900
MD	Gaithersburg, Deltatronics	301-253-0615
MI	Ypsilanti, Allied Entprs.	313-434-7616
MN	Minneapolis, Automation, Inc.	612-571-3336
MN	Plymouth, R.C.O.M.	612-557-2801
MO	Bridgeton, HiTec Central	314-291-5920
MO	Independence, HiTec Central	816-796-6684
NJ	Mahwah, North East Comps	201-825-0233
NY	Penfield, Upstate Comps.	716-381-6070
NC	Raleigh, R.W. Mitscher	919-848-0941
OH	Cleveland, Allied Entprs.	216-779-0080
OR	Lake Oswego, SPS Elctrns.	503-697-7768
PA	Blue bell, Deltatronics	215-641-9930
TN	Johnson City, R.W. Mitscher	615-929-7258
TX	Austin, Electra Reps	512-339-1163
TX	Dallas, Electra Reps	214-248-3852
UT	Bountiful, Advance Control	801-298-8585
VA	Alexandria, Deltatronics	703-971-1733
WA	Kirkland, SPS Elctrns.	206-323-4140
Can	Mont., Que., Solid State Engrg. Co.	514-481-3313

Local Distributors

CA	Chatsworth, Mill-Comm Dist.	818-998-3111
CA	S. San Francisco, Steven Engrg.	415-588-9200
CT	Wallingford, Control Design	203-269-9955
FL	Hollywood, MRO Elctrn. Distrs.	305-966-4847
FL	Orlando, Accurate Temperature Controls.	407-292-6800
LA	Jefferson, Butler & Land	504-734-8888
MA	Middleboro, Glynn Elctrns.	508-947-4262
MN	Minneapolis, Automation, Inc.	612-571-3336
MN	Minneapolis, Control Design	612-721-1628
NC	Burlington, AC DC Elctrns.	919-226-0496
OH	Richfield, Alpha Distrs.	216-659-7100
OK	Tulsa, Butler & Land	918-665-7979
PA	Narberth, Power Modules	215-668-0664
PA	Norristown, Power Modules	215-292-8900
PA	Yeadon, Y-L Prods.	215-583-2800
TX	Dallas, Butler & Land	214-343-8800
TX	Ft. Worth, Butler & Land	817-838-9100
TX	Houston, Butler & Land	713-896-0808
TX	Tomball, Woffard Elctrns.	713-351-2255

DOVA CONTROLS, 4052 148th Ave. N.E., Redmond, WA 98052-5165, Tel: 206-881-7414, FAX: 206-861-8080; Empl.: 6; *Sls. Mgr.:* Phil Johnson

DOVER ELECTRONICS MANUFACTURING

FAX: 607-772-9274

DOVER ELECTRONICS MANUFACTURING, Kirkwood Industrial Park, P.O. Box 5212, Binghamton, NY 13902-5212, Tel: 607-772-7563, TWX: 510-252-1990; Empl.: 371; *Sls. Mgr.:* Robert P. Egan ..... **D•2310**

Local Sales Offices & Reps

NY	Binghamton, Dover Elctrns. Mfg.	607-772-7563

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Local Sales Offices & Reps

AZ	Scottsdale, Detomasi & Grupp., Inc.	602-947-3724
CA	Dow-Key	805-650-0260
CA	Mission Hills, Detomasi & Grupp Inc.	818-365-8285
CA	Mountain View, Peninsula Tech. Sls.	415-965-3636
CA	San Diego, Keller Simonsen Assocs.	619-453-5720
CA	Torrance, Detomasi & Grupp, Inc.	310-618-8898
CO	Parker, W. Howard Assoc.	303-841-5755
CT	Mount Carmel, Sci. Dvcs. Conn., Inc.	203-248-9361
FL	Indian Harbor Bch., South Eastern Comp. Sls.	407-773-3767
GA	Marietta, Gruber & Assocs.	404-993-6052
IL	Palatine, Wave Mktg.	708-934-8008
IN	Fort Wayne, Naunas Sls, Co.	219-432-4792
KS	Goddard, Midwest Tech. Sls.	316-794-8565
KS	Lenexa, Midwest Tech. Sls.	913-888-5100
MD	Columbia, Delta III Assocs.	410-730-4700
MN	Bloomington, Bill Deming & Assocs.	612-888-5000
MO	Earth City, Midwest Tech. Sls.	314-298-8787
NJ	Ridgefield Pk., Scientific Dvcs.	201-440-3430
NY	Rochester, Lamb Comps., Inc.	716-272-7720
OH	Miamisburg, Elctrns. Comps.	513-866-3340
TX	Richardson, Beacon Microwave	214-437-1505
TX	Round Rock, Beacon Microwave	512-244-6675
WA	Kirkland, Anzak Corp.	206-822-1510
Can	Nepean, Ont., Dynasty Comps.	613-723-0671

Local Distributors

MD	Beltsville, Allied Elctrns.	800-433-5700
MD	Beltsville, Applied Specs.	301-595-5393

DOWTY AVIONICS, 300 E. Live Oak Ave., Arcadia, CA 91006, Tel: 818-445-5955, FAX: 818-447-0880; FSC No.: 10412; Empl.: 164; *Sls. Mgr.:* Robert Taylor; *Dist. Mgr.:* Mgr. Business Dev.

DOWTY CUSTOM ELCTRNS. INC., THERMOCONTROL DIV., See Nexus Custom Elctrns., Thermocontrol Div.

DRACON DIV., See Harris Corp., Dracon Div.

DRANETZ TECHNOLOGIES, INC., 1000 New Durham Rd., P.O. Box 4019, Edison, NJ 08818-4019, Tel: 908-287-3680, TELEX: 499-708, TWX: 710-997-9553, FAX: 908-248-9240; FSC No.: 23207; Empl.: 230; *Sls. Mgr.:* Chris Fensham

DREEFS SWITCH, INC., 3782 Hawthorn Ct., Waukegan, IL 60087, Tel: 708-662-7667, 800-323-9605, FAX: 708-662-0906; Empl.: 29; *Sls. Mgr.:* Ed Magiera; *Dist. Mgr.:* Ed Magiera

DRESSER INSTRUMENT DIV., Dresser Industries, 250 East Main St., Stratford, CT 06497, Tel: 203-378-8281, FAX: 203-385-0408; Empl.: 1500; *Sls. Mgr.:* William Mahoney; *Dist. Mgr.:* Richard Gordon ..... **B•1933**

Local Sales Offices & Reps

AL	Mobile, District Sls. Off.	205-473-1692
CA	Long Beach, Pacific Reg. Sls. Off.	310-595-4691
IL	Roselle, Midwest Reg. Sls. Off.	708-980-9030
PA	WillowGrove, Atlantic Reg. Sls. Off.	215-657-2886
TX	Houston, Southwest Reg. Sls. Off.	713-590-1092

Local Distributors

AL	Mobile, Bell & Co.	205-432-5666
AZ	Mesa, Aztech Controls Corp.	602-966-4400
CA	San Francisco, Leighton Stone Corp.	415-285-3600
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MO St. Louis, O'Brien Equip. 314-781-6400
NJ Hohokus, Valley Tech. Sls. 201-670-8070
NY Orchard Park, David S. Reynolds 716-821-5921
NC Charlotte, Ind. Valve & Gauge 704-333-3786
OH Medina, Stress Anal. Svcs. 216-725-7733
OK Tulsa, Tulsa Gauge & Instr. 918-622-5061
OR Portland, Steam Sy. & Rubber 503-228-9625
RI Cranston, Intl. Supply 401-944-1600
SC Greer, Trask Instrumn. 803-848-3993
TN Memphis, Centro, Inc. 901-357-1261
TX Dallas, Inotek Corp. 214-243-8370
VA Midlothian, Associated Tech., Inc. 804-794-6094
WA Seattle, Steam Supp. & Rubber 206-622-4690
WI Mequon, Simone Engrg. 414-243-3600

DRI-DEK CORPORATION, 2706 South Horseshoe Dr., Naples, FL 33942, Tel: 800-348-2398, FAX: 800-828-4248; *Sls. Mgr.:* Carol Smykowski

DRIVECON CORPORATION, 1840 Industrial Dr., Ste. 220, Libertyville, IL 60048, Tel: 708-918-1406, FAX: 708-918-7427; Empl.: 8; *Sls. Mgr.:* Richard Parat; *Dist. Mgr.:* Richard Parat

DRUMLIN, Micro/Sys, Inc., 3447 Ocean View Blvd., Glendale, CA 91208, Tel: 818-244-4600, FAX: 818-244-4246

DSA, INC. DIRECT SOUND CORPORATION, See Direct Sound Corporation

DSP TECHNOLOGY, 48500 Kato Rd., Fremont, CA 94538-7338, Tel: 510-657-7555, TELEX: 263608, FAX: 510-657-7576; Empl.: 75; *Sls. Mgr.:* Robert LeBrun

DUBBELDEE HARRIS DIAMOND CORP.:D. DRUKKER & ZN. N.V., 100 Stierli Ct., Mt. Arlington, NJ 07856, Tel: 201-770-1420, TELEX: RCA 236064, FAX: 201-770-1549; *Sls. Mgr.:* Keith Harris

DUKANE CORP., Communications Sys. Div., 2900 Dukane Dr., St. Charles, IL 60174-9984, Tel: 708-584-2300, TELEX: 720426, FAX: 708-584-2792; FSC No.: 5830 Group 58; Empl.: 650; *Sls. Mgr.:* Warren Anderson, VP of Sls.; *Dist. Mgr.:* Sam Boskovich, Distr. Devel. Mgr.

DUMONT OSCILLOSCOPE, E & R Electronics, Inc., 323 New Road, Parsippany, NJ 07054, Tel: 201-575-8666, TELEX: 219236 DOLI-UR; FSC No.: 30669; Empl.: 30; *Sls. Mgr.:* Edward Petrasek

DUNCAN ELECTRONICS
A BEI Electronics Company

FAX: 714-557-6240

DUNCAN ELECTRONICS, 2865 Fairview Rd., Costa Mesa, CA 92626, Tel: 714-545-8261; FSC No.: 5905;Multiple; Empl.: 110; *Sls. Mgr.:* J. Colligan; *Dist. Mgr.:* S. Huntley ..... **A•2078-2079**

Local Sales Offices & Reps
AL Huntsville, L. & D., Inc. 205-837-1469
AZ Tempe, Southwest E/M Engrg. 602-831-1795
AR El Dorado, Kemp Instruments, Inc. 501-862-5869
CA Irvine, English/Damco Sls. 714-753-1950
CA Santa Clara, Caltron Comps. 408-980-0181
CT Bloomfield, SIR/DSA 203-243-9235
FL Boca Raton, R.O. Whitesell & Assoc. .. 407-393-6139
FL Longwood, R.O. Whitesell & Assoc. ... 407-682-6662
FL Palm Harbor, R.O. Whitesell & Assoc. 813-787-0898
GA Atlanta, L. & D., Inc. 404-395-7079
IL Arlington Hgts., KMA Sales Co. 708-398-5300
IN Indianapolis, Mktg. Engrs., Inc. 317-872-5665
KS Shawnee Mission, Florence & Meyer 913-722-5210
LA Lafayette, Kemp Instruments, Inc. 318-269-9452
MA Westford, SIR/DSA 508-692-2500
MI Walled Lake, Elcon O.E.M. Sls. 313-960-9680
MN New Brighton, The Mackubin Grp. 612-636-5533
NY Buffalo, Advanced Comps. 716-832-6791
NY Dix Hills, Sencor 516-499-7748
NY E. Syracuse, Advanced Comps. 315-437-6700
NY Endicott, Advanced Comps. 607-785-3191
NC Raleigh, L. & D., Inc. 919-876-5301
OH Dayton, Dolfuss-Root & Co. 513-433-6776
OH Westlake, Dolfuss-Root & Co. 216-899-9370
OH Worthington, Dolfuss-Root & Co. 614-885-4844
OK Tulsa, Kemp Instruments, Inc. 918-663-4501
PA Wynnewood, Metz-Jade Assoc., Inc ... 215-896-7300
TX Addison, Kemp Instrs., Inc. 214-931-7100
TX Houston, Kemp Instruments, Inc. 713-466-1465
TX Marble Falls, Kemp Instruments, Inc. .. 512-598-6115
WA Camas, Elctrn. Mktg. Grp. 206-834-6548
WA Redmond, Elctrn. Mktg. Grp. 206-882-0962
WI Milwaukee, KMA Sales Co. 414-259-1771

DUPLICON, INC., 516 E. Second St., S. Boston, MA 02127, Tel: 617-269-5859, FAX: 617-269-5484; FSC No.: 0ASD8; Empl.: 3; *Sls. Mgr.:* William A. Currier

DUPONT CONNECTOR SYSTEMS, See BERG Electronics

DUPONT ELECTRO-OPTIC PRODUCTS, Dupont Electronics, P.O. Box 13625, Research Triangle Park, NC 27709, Tel: 1-800-888-LAN1, 919-481-5100, FAX: 919-481-0753; Empl.: 65; *Sls. Mgr.:* Glenn R. Constable

DUPREE, INC., 14395 Ramona Ave., Chino, CA 91710, Tel: 909-597-4889, FAX: 909-597-3043; Empl.: 65

DURACELL®

FAX: 203-791-3273

DURACELL INC., OEM Sales & Marketing, Berkshire Corporate Park, Bethel, CT 06801, Tel: 203-791-3274; Empl.: 8000; *Sls. Mgr.:* Cal Nicholson, Natl. Sls. Mgr. ..... **D•1435-1438**

Local Sales Offices & Reps
CA Newport Beach, Duracell Inc. 714-720-8111
CT Danbury, Duracell Inc. 203-790-7541
IL Oak Brook, Duracell Inc. 708-954-2714

Local Distributors
CA Costa Mesa, Battery Specialties Inc. ... 714-755-0888, FAX:714-755-0889
CA Mtn. View, Energy Sales. Inc. 415-969-0800,F, 415-961-2000
CA San Diego, Tauber Elctrns. Inc. 619-274-7242, FAX:619-274-2220
IL Downers Grove, Telecommunication Dvcs. 312-971-3460,FAX:312-971-3903
MA Sharon, Adcour 617-784-8123,FAX:617-784-5565
MN St. Paul, DC Battery Prods. 612-646-7478, FAX:612-646-5018
NY Bohemia, Battery Assemblers, Inc. 516-567-8855, FAX:516-567-8278
NY Commack, Bren-Tronics Inc. 516-499-5155, FAX:516-499-5504
NY Mt. Kisco, Multiplier Industries. Corp. 914-241-9510,FAX:914-241-1103
NC Winston Salem, Progressive Technologies, Inc. 919-761-1375,FAX:919-748-0495
TX Stafford, Southwest Electronics Inc. 713-240-4000, FAX:713-240-5672

DURAKOOL, See American Electronic Components

DUREL CORPORATION, Affiliate of 3M & Rogers Corp., 645 W. 24th St., Tempe, AZ 85282, Tel: 602-731-6200, FAX: 602-731-6210

DURGIN & BROWNE, See Tridyne Process Systems, DBI Inds.

DURMITOR INC., Box 413, 23 Crossley Ct., King City, Ont., Canada LOG 1K0, Tel: 416-833-3148, FAX: 416-833-2112; FSC No.: IC560; Empl.: 6

DUTEC, INC., 4801 James McDivitt, P.O. Box 964, Jackson, MI 49204-0964, Tel: 800-248-1632, FAX: 517-750-4740; *Sls. Mgr.:* Bruce Reynolds, Gen. Mgr.

Local Sales Offices & Reps
FL Pompano Beach, Digital I/O Assocs. 305-785-1255
TN Knoxville, Will Hogue & Assocs. 615-691-9749
TX Missouri City, Ron Stewart & Assocs. 713-438-2565
VA Herndon, Instrulogic 703-318-0000

Local Distributors
AZ Phoenix, Summit Elec. 602-957-1100
CA Laguna Hills, Measurequipment 714-831-8766
CO Englewood, Applied Controls Equipmt. 303-799-9300
GA Dalton, Indl. Controls 706-275-4400
IL Chicago, Don Johns Engrg. 312-666-2210
MA Harvard, Douglas Lee Assocs. 508-772-9887
MI Burton, Fenton Sys., Inc. 313-742-3580
NV Sparks, Applied Indl. Ctrls. 702-356-7401
NM Albuquerque, Summit Elec. 505-884-4400
NY Oyster Bay, Cascade Grp. 516-624-9362
OH Chesterfield, EQS Sys. 800-729-8084
OR Portland, R & T Factors, Inc. 503-287-6114
UT Salt Lake City, Protronix Controls 800-464-2456
WI Waukesha, Wisconsin Controls, Inc. 414-542-1588
Can Edmonton, Alberta, Dycor Indl. Research 800-663-9267
Can Scarborough, Ont., Multitest Elctrns. 416-609-8396

DY 4 SYSTEMS INC., 21 Fitzgerald Rd., Nepean, Ont., Canada K2H 9J4, Tel: 613-596-9911, FAX: 613-596-0574; FSC No.: 0BYC3; Empl.: 200; *Sls. Mgr.:* Don Waterman

DYLON GRAPHITE COMPANY, Dylon Industries, Inc., 7700 Clinton Rd., Cleveland, OH 44144, Tel: 216-651-1300, FAX: 216-651-1777; Empl.: 45; *Sls. Mgr.:* K.A. Partee

DYMEC INC., 8 Lowell Ave., Winchester, MA 01890, Tel: 617-729-7870; Empl.: 50

DYNACAST INC., 1401 Front Street, Yorktown Heights, NY 10598, Tel: 914-962-6300, FAX: 914-245-7185; Empl.: 150; *Sls. Mgr.:* David Simas

DYNACIRCUITS MFG., CO., 11230 W. Addison, Franklin Park, IL 60131, Tel: 708-451-1700, FAX: 708-451-9266; Empl.: 300; *Sls. Mgr.:* Dennis A. Dworzak

DYNAGE/CONTROLS, INC., P.O. Box 95, 551 Third Avenue, Canistota, SD 57012, Tel: 605-296-3487, TELEX: 753243 (OAKLEAFINC), FAX: 605-296-3231; Empl.: 12; *Sls. Mgr.:* Sidney C. Oakleaf

DYNAGE/POWER & MAGNETICS, Division Of Oakleaf, Inc., P.O. Box 95, 551 Third Avenue, Canistota, SD 57012, Tel: 605-296-3462, TELEX: 753243 (OAKLEAFINC), FAX: 605-296-3231; FSC No.: 9Y852; Empl.: 25; *Sls. Mgr.:* Sidney C. Oakleaf ... **A•2318-2321; D•1650-1654**

DYNALCO CONTROLS, 3690 N.W. 53 St., Ft. Lauderdale, FL 33309, Tel: 305-739-4300, FAX: 305-484-3376; Empl.: 85; *Sls. Mgr.:* Duane Dement

DYNALLOY, INC., 18662 MacArthur Blvd., Ste.103, Irvine, CA 92715, Tel: 714-476-1206, FAX: 714-476-3167; Empl.: 25

DYNALOY, INC., 7 Great Meadow La., Hanover, NJ 07936, Tel: 201-887-9270, FAX: 201-887-3678; FSC No.: 27908; Empl.: 19; *Sls. Mgr.:* Jay Parton

DYNAMATION TRANSDUCERS CORPORATION, 348 Marshall St., Holliston, MA 01746, Tel: 508-429-8440, FAX: 508-429-1317 ..... **A•2081-2083**

DYNAMIC AIR ENGRG., INC., 620 E. Dyer Rd., Santa Ana, CA 92705-5697, Tel: 714-540-1000, FAX: 714-545-9145; FSC No.: 4140-6105; *Sls. Mgr.:* Carl A. Grisier

DYNAMIC POWER SYSTEMS, 12 Sunhill Road, Nesconset, NY 11767, Tel: 516-361-6771, 1-800-422-0708, FAX: 516-361-6361; Empl.: 5; *Sls. Mgr.:* Dorian Robins; *Dist. Mgr.:* Jim Nemec

DYNAMICS, Div. of Waugh Controls Corp., 9001 Fullbright Ave., Chatsworth, CA 91311, Tel: 818-998-8281, TELEX: 69-6171, FAX: 818-407-1320; Empl.: 30; *Sls. Mgr.:* Tony Mastroianni

DYNAMICS RESEARCH CORP., Encoder Division, 60 Concord St., Wilmington, MA 01887-2193, Tel: 508-658-6100, FAX: 508-658-0522; Empl.: 125; *Sls. Mgr.:* Joe Portada ..... **B•1935**

Local Sales Offices & Reps
CO Northglean, Jim Reid;Reg. Mgr. 303-457-9666
WI West Bend, Dennis Herr, Reg. Sls. Mgr. 414-675-2331

DYNAPAR, 1675 Delany Rd., Gurnee, IL 60031, Tel: 312-662-2666, TWX: 910-235-1865; Empl.: 150

DYNAPOWER CORPORATION, Box 9210, S. Burlington, VT 05407, Tel: 802-860-7200, FAX: 802-864-3782; Empl.: 100; *Sls. Mgr.:* John S. Hurst ..... **D•1665-1667**

Local Sales Offices & Reps
MI Farmington Hills, Dynapower Corp. ... 313-471-1800

DYNAROLL CORPORATION, 551 A Fifth St., San Fernando, CA 91340, Tel: 818-837-3456, FAX: 818-837-3466; *Sls. Mgr.:* Roy Wilson; *Dist. Mgr.:* Molly Kosmak

DYNISCO, 4 Commerical St., Sharon, MA 02067, Tel: 617-784-8400, TELEX: 174-292, FAX: 617-784-2902; FSC No.: 15687; Empl.: 153; *Sls. Mgr.:* Richard McQuiggan

DYTRONICS CO., See Ryan Intl. Corp.

DZUS FASTENER, 425 Union Blvd., W. Islip, NY 11795, Tel: 516-669-6000, FAX: 516-669-0785; FSC No.: 72794; Empl.: 140; *Sls. Mgr.:* John Scappatura; *Dist. Mgr.:* John Scappatura

EAGLE ELECTRIC MFG. CO. INC., 45-31 Court Square, Long Island City, NY 11101, Tel: 718-937-8000, FAX: 718-482-0160; Empl.: 3000; *Sls. Mgr.:* Joseph Mannarino; *Dist. Mgr.:* Bob Lofgren

EAGLE MAGNETIC COMPANY, INC., P.O. Box 24283, Indianapolis, IN 46224, Tel: 317-297-1030, FAX: 317-299-1323; FSC No.: 34718; Empl.: 34; *Sls. Mgr.:* Gary Noble

EAGLE EP PICHER

FAX: 417-623-5556

EAGLE-PICHER, Box 47, Joplin, MO 64801, Tel: 417-623-8000; FSC No.: 81855; Empl.: 700; *Sls. Mgr.:* Douglas Pennington ..... **D•1440-1445**

Local Sales Offices & Reps
AR Hot Springs, ASI Inc. 501-767-5444
CA Torrance, O'Donnell Assoc. 310-781-2235
OR Beaverton, Pacific Mktg. 503-641-9373
TX Irving, Space Elctrns. 214-251-3636
Can Toronto, CEA Associated 416-231-9717

EAGLE-PICHER, P.O. Box 130, Bethel Road, Seneca, MO 64865, Tel: 417-776-2256, FAX: 417-776-2257; FSC No.: 3L498; Empl.: 400; *Sls. Mgr.:* Earl Anderson; *Dist. Mgr.:* Earl Anderson ..... **D•1440-1442**

Local Sales Offices & Reps
AL Huntsville, L & D Inc. 205-837-1469
AZ Phoenix, Shefler-Kahn Co. Inc. 602-581-0884
AR Hot Springs, Automation Supp. Inc. (ASI) 501-767-5444
CA Orange, Prism Assocs. 714-283-8744
CA San Jose, O'Donnell Assocs.-North ... 408-263-6500
CA Santa Clara, Quorum Tech. Sls. 408-980-0812
CA Torrance, O'Donnell Assoc. 213-539-9664
CO Broomfield, Connors Co. 303-466-9628
CT Bloomfield, Zaslow Sls. Co. 203-242-7781
FL Longwood, NSL Assocs., Inc. 305-629-5226
GA Atlanta, Elctrn. Solutions, Inc. 404-396-2541
IL Woodbridge, Golten Assocs. 708-985-5100
KS Overland Park, Spectrum Sls. 913-648-6811
MA Westboro, Zaslow Sls. Co. 617-393-8150
MI Livonia, Electro-Mktg. Grp., Inc. 313-421-7590
MN Minneapolis, Ohlin Sls. Co. 612-929-6924
MO Florissant, Spectrum Sls. 314-921-1313
NH Londonderry, Zaslow Sls. Co. 603-432-8907
NH Nashua, Key Sls. of New England, Inc. 603-880-0110
NY Massapequa Pk., HC Assocs. 516-541-0262
NY Morrisville, Naylor Elec. Co. 315-684-9620
NC Raleigh, L & D Inc. 919-876-5301
OH Dayton, Electro-Mktg. Grp., Inc. 513-890-8322
OH Dayton, Lyons Corp. 513-278-0714
OR Beaverton, Pacific Mktg. Spec. 503-641-9373
TX Dallas, Rem Air Comps. 214-234-1069
WA Redmond, Pacific Mktg. Spec. 206-882-3144
Can Mississauga, Continental Elctrn. Assocs. 416-602-9717

Local Distributors
AZ Tempe, Lynntronics 602-433-0288
AR Hot Springs, Automation Supp. Inc. ... 501-767-5444
CA Anaheim, Carefree Unltd. 714-630-3433
CA Mountain View, The Power Source ... 415-960-0700
CO Denver, Car-Go Battery Co. 303-296-8763
FL Dunedin, Battery Powered Lighting & Sys. 813-734-9498
GA Smyrna, Mark C. Pope Assocs. 404-435-2471
IL Cincinnati, M & B Battery 513-385-5900
IL Villa Park, The Battery Shop 708-833-6300
KS Wichita, RSC Elctrns. 316-267-5213
LA New Orleans, William B. Allen 800-535-9593
MA Hingham, Sager Elctrns. 617-749-6700
MA Methuen, Generation Elctrns., Inc 508-683-1177
MN Minneapolis, Ohlin Sls. Co. 612-929-6924
NJ Teterboro, Engrd. Assemblies 201-288-4477
OH Cincinnati, M & B Battery 513-385-5900
PA Bensalem, Scotts Emergency Lighting 215-639-1777
TX Austin, Wofford Elctrns. 512-339-1131
TX Dallas, Wofford Elctrns. 214-320-0294
TX Houston, Wofford Elctrns. 713-847-3583
TX Lubbock, R & R Elctrn. Supply Co. ... 806-765-7727
UT Salt Lake City, Standard Supp. Co. 801-846-3371
WA Seattle, Radar Electric 206-282-2511
WI Milwaukee, Battery Shop 414-384-5410
Can New Westminster, B.C., Magnacharge Battery 604-525-0391
Can Toronto, Continental Elctrn. Assocs. ... 416-602-9717

EAGLE SIGNAL CONTROLS, Mark IV Industries, Inc., 8004 Cameron Rd., Austin, TX 78753, Tel: 512-837-8300, FAX: 512-837-8486; Empl.: 3000; *Sls. Mgr.:* Patrick Short

EAGLE WICHITA

FAX: 316-942-5190

EAGLE WICHITA, P.O. Box 9446, Wichita, KS 67277, Tel: 316-942-5100 ..... **A•1626-1632**

EALING ELECTRO-OPTICS, New Englander Industrial Park, Holliston, MA 01746, Tel: 508-429-8370, 1-800-343-4912, FAX: 508-429-7893; *Sls. Mgr.:* Brian Gaynor

E & L INSTRUMENTS, Interplex Electronics, Inc., 70 Fulton Terrace, New Haven, CT 06512, Tel: 800-368-0880, FAX: 203-468-0060; Empl.: 40; *Sls. Mgr.:* Katina Boulais

EAO SWITCH CORP., 198 Pepe's Farm Rd., P.O. Box 552 MO, Milford, CT 06460, Tel: 203-877-4577, TELEX: 96-4347, FAX: 203-877-3694; FSC No.: 61706; Empl.: 19; *Sls. Mgr.:* George T. Bracci ..... **B•1713**

Local Sales Offices & Reps
AZ Scottsdale, Luscombe Engrg. Co. of AZ 602-949-9333
CA Los Gatos, Luscombe Engrg. Co. of S.F. 408-370-2020
CA Montrose, Signal Entprs. 818-957-0640
CA San Diego, Signal Entprs. 619-679-5086
CO Longmont, Luscombe Engrg. Co. of CO 303-772-3342
CT Bethel, Ray Perron & Co. 203-798-0261
CT Waterbury, Ray Perron & Co., Inc. 203-756-9684
FL Tampa, Florida Comp. sls. 813-873-3622
GA Alpharetta, Pinnacle Mktg. 404-410-9980
IL Arlington Hgts., Brainard-Nielsen Mktg., Inc. 708-437-2700
IN Ft. Wayne, M/S Sls. & Assocs. 219-436-3023
IN Greenwood, M/S Sls. & Assocs. 317-881-0110
IA Cedar Rapids, Delltron Co., Inc. 319-393-0075
MD Columbia, Delta III Assocs., Inc. 410-730-4700
MA Needham, Ray Perron & Co., Inc. 617-449-6162
MI Plymouth, Jay Mktg. Assocs., Inc. 313-459-1200
MN Plymouth, Highland Elctrn. Sls. 612-557-7002
MO Florissant, Delltron Co., Inc. 314-839-0033
MO Kansas City, Delltron Co., Inc. 816-436-6445
NJ Englewood, Sprung/Nussbaum 201-569-5666
NY Rochester, Apex Assocs., Inc. 716-272-7040
NC Raleigh, Pinnacle Mktg. 919-848-0404
OR Lake Oswego, Luscombe Engrg. Northwest 503-636-6664
PA Horsham, Jacobsen Assocs. 215-674-2937
PA Pittsburgh, R. W. Kneip 412-823-0169
TX Dallas, Glidden Electro Equip. Co 214-341-0610
UT Salt Lake City, Luscombe Engrg. Utah 801-268-3434
WA Bellevue, Luscombe Engrg. N.W. 206-223-1541
WI Mequon, Badgerep 414-241-9200

Local Distributors
AZ Phoenix, Minarik Elec. 602-233-3000
AZ Scottsdale, Electronic Supp. 1-800-622-3726
CA Anaheim, Minarik Elec. Co. 714-994-2251
CA Cupertino, Cal. Switch & Signal 408-279-8848
CA Fremont, KEA Elctrns. 510-651-2600
CA Fresno, Minarik Elec. Co. 209-255-8089
CA Gardena, California Switch & Sig. 310-538-9830
CA Glendale, Minarik Elec. Co. 818-507-6500
CA Ontario, Minarik Elec. Co. 714-391-0064
CA Riverside, Electronic Supp. 909-683-7300
CA S. San Francisco, Bell Elctrl. Supp. 415-589-7055
CA Salinas, Bell Elctrl. Supp. 408-758-6110
CA San Diego, Electronic Supp. 619-693-8222
CA San Diego, Minarik Elec. Co. 619-560-6632
CA San Jose, Electronic Supp. 408-453-3770
CA San Jose, Minarik Elec. Co. 408-955-9030
CA Santa Clara, Bell Elctrl. Supp. 408-727-2355
CA Sunnyvale, Target Elctrns., Inc. 408-733-0384
CA Van Nuys, Wes-Garde Comp. Grp. 213-873-4802
CO Commerce City, Minarik Elec. Co. 303-289-5800
CO Denver, CSID, Inc. 303-292-9594
CT Hartford, Wes-Garde Comp. Grp. 203-525-6907
CT Wallingford, Sager Elec. Supp. co. 203-265-4600
FL Lakeland, Wes-Garde/Switch Controls, Inc. 813-644-7564
FL Orlando, Sager Elctrns. 407-354-1130
FL Oviedo, Dixie Sls. 407-365-5211
GA Atlanta, Motion Elctrns. 404-455-8262
GA Norcross, Sager Elctrns. 404-446-0085
IL Carol Stream, Wes-Garde Comp. Grp. 708-653-1460
IL Elk Grove, Martec Assoc. 708-956-8090
IL Rosemont, Advent Elctrns., Inc. 708-297-6200
IL Schaumburg, Marsh Elctrns. 708-240-9290
IL Schaumburg, Minarik Elec. Co. 708-885-9337
IN Indianapolis, Advent Elctrns. 317-872-4910
IN Indianapolis, Mar Elctrns. 317-633-6699
IA Cedar Rapids, Advent Elctrns., Inc. 319-363-0221
KY Louisville, Peerless Elctrns. 502-637-7674
LA Baton Rouge, Menard Elctrns. 504-355-0323
LA New Orleans, Menard Elctrns. 504-734-8445
ME Bar Mills, Nelson & Wright 207-929-8238
MD Columbia, Sager Elctrns. 410-995-4900
MD Gaithersburg, Axis Elctrns. 301-840-9640, 800-368-2815
MD Jessup, Treeko Sls. 410-470-3300
MA Hingham, Sager Elec. Supp. Co. 617-749-6700
MA N. Billerica, Minarik Elec. Co. 508-663-0740
MA Walpole, Richey Impact Elctrns. 508-668-8200
MI Farmington Hills, Advent Elctrns. 313-477-1650
MI St. Claire Shores, SPEMCO Switches 313-771-2700
MN Fridley, Voyager Elctrns. 612-571-7766
MO St. Louis, Beckwith, Inc. 314-343-6463
MO St. Louis, Wes-Garde Comp. Grp. 314-567-7776
NH Salem, Sager Elec. Supp. Co. 603-898-1348
NJ Cranford, Garden State Indl. Elctrns., Inc. 908-272-6400
NY Buffalo, Summit Distrs., Inc. 716-887-2800
NY Hauppauge, Sager Elctrl. Supp. 516-348-1300
NY New York, Sam Ash Professional 212-302-5114
NY Penn Yan, Advacom Tech., Inc. 315-536-2221

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NY	Rochester, Simcona Elctrns.	716-328-3230
NY	Rochester, Summit Elctrns., Inc.	716-334-8110
NY	Woodside, Switches Unlimited	718-478-5000
NC	Charlotte, Elctrns. Mktg. Corp.	704-394-6195
NC	Charlotte, Resource/Dixie Elctrns.	704-521-8682
NC	Raleigh, Sager Service Plus	919-850-9550
NC	Winston-Salem, Kirkman Elctrns., Inc.	919-722-9131,800-334-8688
OH	Columbus, Electronics Mktg. Corp.	614-299-4161
OH	Highland Hgts., Electronics Mktg. Corp.	216-442-3441
OH	Westerville, Wes-Garde Comp. Grp.	614-885-0319
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AL Huntsville, Over & Over, Inc. 205-837-7105
AZ Phoenix, Sanford Sls. Assoc. 602-957-3570
CA Huntington Bch., West Elctrn. Sls. Team 714-375-6500
CA Los Altos, Recht Assocs. 415-964-6321
CA San Diego, West Elctrns. Sls. Team 619-233-0236
CO Denver, Donohue Sls. 303-455-1719
CT Stamford, Francis J. Bigda 203-322-0240
FL Altamonte Springs, Over & Over, Inc. 407-332-1222
FL Brandon, Over & Over, Inc. 813-684-6486
FL Ft. Lauderdale, Over & Over Inc. 305-485-0115
GA Norcross, Over & Over, Inc. 404-449-6205
IL Rolling Meadows, Sumer, Inc. 708-991-8500
IA Cedar Rapids, C.H. Horn & Assoc. 319-393-8703
MI Farmington Hills, Luebbe Sls. Co. 313-489-8828
MN Bloomington, Prof. Sls. for Ind. 612-944-8545
MO Chesterfield, Weisler & Assocs., Inc. 314-537-0010
MO Kansas City, Weisler & Assocs. 816-421-1679
NY Commack, ERA, Inc. 516-543-0510
NY E. Rochester, Tri Tech Elctrns. 716-385-6500
NY Fayetteville, Tri Tech Elctrns. 315-446-2881
NY Fishkill, Tri Tech. Elctrns. 914-897-5611
NC Charlotte, Over & Over, Inc. 704-542-9111
NC Raleigh, Over & Over, Inc. 919-876-7338
OH Cincinnati, Luebbe Sls. Co. 513-530-0600
OH Dayton, Luebbe Sls. Co. 513-438-0490
OH Westlake, Luebbe Sls. Co. 216-899-0071
OR Tigard, Halbar-RTS Inc. 503-624-5741
PA Narbeth, Bresson Assocs. 215-664-6460
TX Austin, Milco Mktg. 512-835-5359
TX Houston, Milco Mktg. 713-469-5156
TX Plano, Milco Mktg. 214-578-1996
WA Redmond, Halbar-RTS Inc. 206-882-0990
WA Vashon, Halbar-RTS Inc. 206-463-2277
WI Brookfield, Sumer, Inc. 414-784-6641
Can Calgary, Alberta, Cana Rep Grp., Inc. 403-255-0294
Can Dartmouth, N.S., Cana Rep. Grp., Inc. 902-456-4400
Can Edmonton, Alb., Cana Rep. Grp., Inc. 403-487-5578
Can Markham, Ont., Cana Rep. Grp., Inc. 416-930-4621
Can Montreal, Que., Cana Rep. Grp., Inc. 514-276-4477
Can Oakville, Ont., Cana Rep. Grp., Inc. 416-338-3399
Can Otawa Manotick, Ont., Cana Rep. Grp., Inc. 613-692-4682
Can Surrey, B.C., Cana Rep. Grp., Inc. 604-599-1232

Local Distributors

AL Birmingham, Newark 205-979-7003
AZ Tempe, Bell 602-966-7800
AR Little Rock, Newark 501-225-8130
CA Agora Hills, Bell 818-879-9494
CA Belmont, Richardson 415-592-9225
CA Canoga Park, Caltronics 818-346-4936
CA Cypress, Bell 714-895-7801
CA Foster City, Newark 415-572-8300
CA Fountain Valley, Comps. Center 714-979-0433
CA Los Angeles, Newark 310-672-8548
CA Redwood City, Stotts Friedman 415-368-3800
CA Rocklin, Bell 916-652-0414
CA San Diego, Bell 619-268-1277
CA San Jose, Quement 408-998-5900
CA Santa Ana, Elcom 714-432-6630
CA Santa Clara, Comps. Center 408-988-3751
CA Santa Fe Spgs., Bell 310-921-3611
CA Sunnyvale, Capsco Sls. 408-734-3020
CA Woodland Hills, Richardson 818-347-5580
CO Denver, Newark 303-757-3351
CT Bloomfield, Newark 203-243-1731
CT Wallingford, Bell 203-269-6801
FL Altamonte Springs, Bell 407-339-0078
FL Ft. Lauderdale, Newark 305-587-2372
FL Miami, Elctrn. Equip. 305-526-6000
FL Orlando, Newark 407-896-8350
FL Sanford, Afcom 407-321-9225
FL Sanford, Elctrn. Fasteners 407-321-4000
FL Tampa, Reptron 813-854-2351
FL Winter Park, Richardson 407-644-1453
GA Norcross, Newark 404-448-1300
ID Boise, Newark 208-342-4311
IL Bensenville, Goold 708-860-7171
IL Chicago, Newark 312-784-5100
IL Elk Grove Village, Bell 708-640-1910
IL LaFox, Richardson 708-208-2200
IL Morton Grove, Nedco 708-967-0500
IN Carmel, Altex 317-848-1323
IN Ft. Wayne, Bell 219-423-3422
IN Indianapolis, Newark 317-844-0047
IA Cedar Rapids, Dee Elctrns. 319-365-7551
IA Cedar Rapids, Newark 319-393-3800
KS Overland Park, Newark 913-677-0727
KS Wichita, RSC 316-267-5213
KY Louisville, Newark 502-423-0280
LA Metarie, Newark 504-838-9771
LA Shreveport, Indl. Elctrn. Supp. 318-222-9459
MD Beltsville, Newark 301-604-1700
MD Columbia, Bell 410-290-5100
MD Gaithersburg, Capitol Radio 301-840-5700
MA Andover, Bell 508-474-8880
MA Ashland, Quality Comps. 508-881-6504
MA Tewksbury, Jaco 508-640-0010
MA Winchester, Webb Dist. Inc. 617-729-5800
MA Woburn, Newark 617-935-8350
MI Ann Arbor, Wedemeyer 313-665-8611
MI Flint, RS Elctrns. 313-742-5000
MI Grand Rapids, Newark 616-455-9190
MI Livonia, RS Elctrns. 313-525-1155
MN St. Paul, Gopher 612-490-4900
MS Jackson, Newark 601-956-3834
MO Maryland Heights, RS Elctrns. 314-997-7709
MO St. Louis, Newark 314-298-2505
MT Helena, Newark 406-443-6192
NE Omaha, Newark 402-592-2423
NV Las Vegas, Newark 702-796-5090
NH Nashua, Newark 603-888-5790
NH Salem, Tech Mark 603-893-8380
NJ Camden, G.R.S. 609-964-8560
NJ Mountainside, Route Elctrns. 908-654-8283
NJ Pennsauken, Newark 609-663-9490
NM Albuquerque, Bell 505-292-2700
NY Bohemia, Car-Lac 516-567-4200
NY Brooklyn, Richardson 718-646-6300
NY Buffalo, Summit 716-887-2800
NY Cheektowga, Newark 716-862-9700
NY Farmingdale, Semispecialists 516-293-2710
NY Hauppauge, Farrmont Elctrns. 516-231-3313
MI Madison Hgts., Galco 313-542-9090
NY Monsey, Nobel Elctrns. 914-352-0182
NY Penn Yan, Advacom Tech. 315-536-2221
NY Rochester, Summit 716-334-8110
NY Valley Stream, Newark 516-561-8400
NC Greensboro, Newark 919-292-7240
NC Raleigh, Cameron & Barkley 919-828-2311
NC Winston-Salem, Kirkman 919-722-9131
OH Cincinnati, Hughes Peters 513-351-2000
OH Cleveland, Cam Ohio 216-461-4700
OH Columbus, Newark 614-447-8282
OH Dayton, Stotts Friedman 513-298-5555
OH Toledo, RS Elctrns. 419-893-0721
OH Warren, REM Elctrns. 216-373-1300
OK Altair 918-252-5781
OK Oklahoma City, Newark 405-495-5000
OR Beaverton, Component Resources 503-641-8488
OR Portland, Newark 503-257-0741
PA Allentown, Newark 215-434-7171
PA Pittsburgh, Cam-RPC 412-963-6202
PA Trevose, Bell 215-953-2800
RI Walpole, Newark 401-943-3340
SC Columbia, Newark 803-798-0198
TN Knoxville, Newark 615-588-6493
TX Austin, Wofford 512-339-1131
TX Dallas, Richardson 214-239-3680
TX Garland, Newark 214-494-5911
TX Houston, Altair 713-462-3029
TX Richardson, Jaco/QC 214-234-5565
TX Stafford, Harrison Equip. 713-879-2727
UT Midvale, Bell 801-561-9691
UT Salt Lake City, Newark 801-484-8611
VT South Burlington, Newark 802-860-1856
VA Arlington, Newark 703-522-7552
VA Charlottesville, Virginia Elec. 804-296-4184
WA Bellevue, Newark 206-641-9800
WA Redmond, Bell 206-867-5410
WA Walpole, Richey Impact Elctrn. 508-668-8200
WV Dunbar, Newark 304-768-6872
WI Milwaukee, Newark 414-453-9100
WI Waukesha, Bell 414-547-8879
Can Calgary, Zentronics 403-295-8838
Can Montreal, Zentronics 514-737-9700
Can Ottowa, Electrosonic 613-728-8333
Can Quebec City, Zentronics 418-654-1077
Can Toronto, Electrosonic 416-494-1555
Can Vancouver, Electrosonic 604-273-2911
Can Winnipeg, Electrosonic 204-783-3105

EGIS CORPORATION, 655 Plum Tree Rd., Barrington Hills, IL 60010, Tel: 708-639-1555, FAX: 708-639-8710; Empl.: 6

EH ELECTRONICS, INC., See Wavetek San Diego, Inc.

EHRHORN TECHNOLOGICAL OPERS., INC., 4975. North 30th St., Colorado Springs, Colorado 80919-4101, Tel: 719-260-1191, FAX: 719-260-0395; FSC No.: 1106; Empl.: 5; *Sls. Mgr.:* Tim Coutts; *Dist. Mgr.:* Tim Coutts

EI & S, Prime Technology Inc., Twin Lakes Rd., P.O. Box 185, North Branford, CT 06471, Tel: 203-481-5721, TWX: 710-452-3092, FAX: 203-481-8937; FSC No.: 14908; Empl.: 60; *Sls. Mgr.:* J. L. Jamieson, Mktg. VP. ... **B•1482**

Local Sales Offices & Reps

AZ Phoenix, CPS Assocs. 602-589-0282
CA Canoga Pk., C & W Comps. Sls. 818-700-2684
CA Escondido, Cirolia Elctrn. Sls. 619-743-3015
CA Haywood, Pacific Mktg. Inc. 415-887-1620, 415-887-7595
CA Newbury Pk., Interconn Tech. Mktg. 805-499-4024
CO Golden, J. F. Hurlbut Co. 303-279-7796
CT N. Branford, EI&S 203-481-5721
DC Washington, AM-Tech Assoc. 301-461-5599
FL Lakeland, Munday Sls. 813-858-5606, 818-858-7257
IL Arlington Hgts., Mertons Assoc. 314-993-6600
IL Arlington Hgts., MB Sls. 708-392-9499
MD Ellicott City, Am-Tech Assoc. 301-461-5599
MA Norwell, Norris Assocs. 617-659-7988, 617-659-0790
MA Shrewsbury, Advanced Comps. Grp. 508-845-2023
MO St. Louis, Mertens Co. 314-993-6600, 314-993-6630
MO St. Charles, Microtronics 314-946-8500
NY Buffalo, Lynn Assocs., Inc. 716-631-0054, 716-631-0101
OH Cleveland, John O. Olsen Co. 216-838-0510
NY Hauppauge, Masin-Esco, Inc. 516-273-3500, 516-273-3516
PA Gibsonia (West), John O. Olsen Co. 216-838-0510
PA Malvern (East), Stitzer Assocs. 215-664-5500, 215-664-5503
OH Westlake, Advanced Technig. Assocs. 216-835-5050, 216-835-3599
TX The Colony, Juliana Co. 214-625-1075
WA Seattle, Datacom Assoc. 206-285-2525
Can St. Laurent,PQ, Electronique Versatech 514-335-3833

Local Distributors

AZ Phoenix, Keystone Electro Sls. 602-995-3005
CA San Jose, Spectra Elctrns. 408-452-1590
CA Canoga Pk., Acort Inds. 818-700-2991
MD Columbia, DK Elctrns. 301-995-1950
MA Billerica, A. W. Mayer Co. 508-229-2255
MA Newton, The Greene-Shaw Co. 617-969-8900
NJ Oakland, Relay Specialties 201-337-1000

FAX: 401-738-7154

EICHHOFF ELECTRONICS, 205 Hallene Rd., Warwick, RI 02886, Tel: 401-738-1440, 800-678-1040; Empl.: 2,000; *Sls. Mgr.:* Randall Jones ..... **A•1588-1591, 2323**

Local Sales Offices & Reps

AZ Scottsdale, Jackson Mktg. 602-998-0831
CA Arcadia, Van Gott & Assoc. 818-445-9728
CA Mountainview, The Pentagon Co. 415-961-3610
CT W. Simsbury, Electrotechnika 203-658-6762
FL W. Melbourne, Kennedy Assocs. 407-676-6875
IL Wheaton, CS Tech. Sls. 708-653-8126
IA Marion, MSB Assocs. 319-377-6261
KS Roeland Park, MSB Assocs. 913-432-2131
MD Annapolis, Rynone Assocs. 410-263-0794
MA Needham, Sturgeon Tech.Sls. 617-444-6603
MN Minneapolis, Electro-Serv Co. 612-338-3475
MO St. Charles, MSB Assocs. Inc. 314-946-5577
NJ Mt. Laurel, Paragon Sls. 609-778-1190
NY Fairport, Advanced Comps. 315-437-6700
NC New Hill, Tom Santel 919-362-4091
OH Mansfield, Rich Tech Sls. 419-756-1953
OR Mission Hills, Pentagon Co. 818-894-0299

E.I.L. INSTRUMENTS, INC., 10946A Golden West Drive, Hunt Valley, MD 21031-1320, Tel: 410-584-7400, FAX: 410-584-7561; Empl.: 500; *Sls. Mgr.:* Keith D. Hadley

EI MICROCIRCUITS, INC., 1651 Pohl Road, Mankato, MN 56001, Tel: 507-345-5786, FAX: 507-345-7559; Empl.: 60; *Sls. Mgr.:* Perry Eimers

EIP MICROWAVE, INC., 1589 Centre Pointe Dr., Milpitas, CA 95035, Tel: 408-945-1477, FAX: 408-945-0977; FSC No.: 34257; Empl.: 65; *Sls. Mgr.:* Rick Bush

EKTRON APPLIED IMAGING, INC., 23 Crosby Dr., Bedford, MA 01730, Tel: 617-271-1940, FAX: 617-271-1860; Empl.: 175; *Sls. Mgr.:* Richard Rollins

elan

FAX: 408-778-2597

ELAN SYSTEMS, INC., 365 Woodview Ave., Ste. 700, Morgan Hill, CA 95037, Tel: 800-541-3526; *Sls. Mgr.:* Bill White ..... **A•1696-1697; D•1087**

Local Sales Offices & Reps

CA	Morgan Hill, Elan Sys., Inc.	408-778-7267

ELAN TECHNICAL CORP., 35 Kings Highway East, Fairfield, CT 06430, Tel: 203-335-2115, FAX: 203-335-2723

ELANTEC, INC., 1996 Tarob Ct., Milpitas, CA 95035, Tel: 408-945-1323, 800-333-6314, FAX: 408-945-9305; FSC No.: 64762; Empl.: 112; *Sls. Mgr.:* Ralph Granchelli; *Dist. Mgr.:* Nancy Serdynski

ELASTOMERIC TECHNOLOGIES, INC., 2940 Turnpike Dr., Hatboro, PA 19040, Tel: 215-672-0787, 215-672-4741, TWX: 387-236, FAX: 215-672-4633; FSC No.: 64914; Empl.: 43; *Sls. Mgr.:* John Seibert (West)/George Glatts (East) ..... **C•1314**

Local Sales Offices & Reps

AL	Huntsville, Remco/Huntsville	205-533-3763
AZ	Scottsdale, TC Elctrn. Sls., Inc.	602-994-5153
CA	Orange, Libratronix	714-871-1513
CA	San Jose, W I N	408-559-8118
CO	Monument, Sunbird Inds.	719-481-2900
FL	Ft. Lauderdale, Synergistic Tech. Inc.	305-791-8255
FL	Melbourne, Synergistic Tech. Inc.	407-242-9661
FL	Odessa, Synergistic Tech.	813-920-5814
GA	Lilburn, Remco/Atlanta	404-447-6937
IL	Des Plaines, Lincoln, Hodges	708-297-3810
IN	Ft. Wayne, Outman Sls.	219-489-7699
KS	Wichita, Baka Corp.	316-682-8411
MD	Gaithersburg, Carwithen	301-921-9545
MA	Needham, Comp. Technlg., Inc.	617-449-8490
MI	Troy, C. B. Jensen & Assocs.	313-643-0506
MN	Bloomington, Northmark Assocs.	612-854-9299
MO	St. John, Baka Corp.	314-878-4224
NJ	Hasbrouck Hgts., Comp-Tech	201-288-7400
NY	Pittsford, Franklin Sls. Corp.	716-248-8251
NC	Raleigh, C-Tech Sls. Co.	919-782-8100
OH	Cleveland, Arthur Baier Co.	216-461-6161
OR	Tigard, L. D. Elctrns.	503-684-8221
PA	Hatboro, A.Q.S. Electro	215-674-3562
PA	Pittsburg, Arthur Baier Co.	412-367-7799
TX	Dallas, M-Rep	214-484-5711
TX	Houston, M-REP	713-271-5635
UT	Ogden, Sunbird Inds., Inc.	801-479-7151
WA	Snohomish, L. D. Elctrns.	206-568-0511
WA	Spokane, LD Elctrns.	509-922-4883
WI	Janesville, Lincoln,Hodges	608-754-4214

ELCO CORP., Electronic Connector Div., Huntingdon Ind'l. Park, Huntingdon, PA 16652, Tel: 814-643-0700, FAX: 814-643-0426; FSC No.: 91662; Empl.: 300; *Sls. Mgr.:* C. Demars; *Dist. Mgr.:* M. Grove

EL-COM CABLETEK, 22612 Albares, Mission Viejo, CA 92691, Tel: 714-432-6630

ELCOM INDUSTRIES, INC., 10268 Bach Blvd., St. Louis, MO 63132, Tel: 314-429-3100, FAX: 314-429-9706; Empl.: 25; *Sls. Mgr.:* Thomas C. Noel

ELCOM SYSTEMS, INC., 932 Clint Moore Rd., Boca Raton, FL 33487, Tel: 407-994-1774, FAX: 407-994-1770; FSC No.: 32424; Empl.: 8; *Sls. Mgr.:* D. Pollachek

ELCON INSTRUMENTS, INC., Whessoe, Plc, 137 Gibralter Street, Annapolis, MD 21401, Tel: 410-280-6686, FAX: 410-263-5790; Empl.: 10; *Sls. Mgr.:* Robert Siska

ELCON PRODUCTS INTERNATIONAL COMPANY, 42700 Lawrence Place, Fremont, CA 94538, Tel: 510-490-4200, FAX: 510-490-3740; FSC No.: 85901; Empl.: 120; *Sls. Mgr.:* Tom Johnson, Dir. of Sls.

ELDRE CORPORATION, 1500 Jefferson Rd., Rochester, NY 14623, Tel: 716-427-7280, FAX: 716-272-0018; FSC No.: 19648; Empl.: 220; *Sls. Mgr.:* James N. Fitzpatrick

Local Sales Offices & Reps

AL	Huntsville, Elctrn. Mktg. Assoc.	205-880-8050
AZ	Scottsdale, Fred Board Assocs.	602-994-9388
CA	Carlsbad, Tarco/Prime Source	619-434-1297
CA	Los Gatos, Norwest Elctrns.	408-356-7670
CO	Wheat Ridge, Waugaman Assocs.	303-423-1020
FL	Tampa, APM Assocs.	813-886-2457
GA	Atlanta, Electronic Mktg. Assoc.	404-448-1215
IN	Indianapolis, Mohrfield Mktg.	317-546-6969
MD	Towson, Arbotek Assocs.	410-825-0775
MA	Brookline, Harman Assocs.	617-232-6687
MI	Farmington, J P Bergin Assoc.	313-471-7940
MO	St. Louis, Cadon Techn. Sls.	314-645-8670
NJ	Cherry Hill, Tritek Sls.	609-667-0200
NY	Rochester, ELDRE Corp.	716-427-7280
NY	Yonkers, Sonkin Assocs.	914-968-8282
NC	Raleigh, Electronic Mktg. Assocs.	919-847-8800
NY	Syracuse, Leonard D. Allen, Inc.	315-437-8387
OH	Centerville, Omega Sls.	513-434-5507
Can	St. Laurent, Que., Componetics, Ltd.	514-331-9930
UT	Murray, Waugaman Assocs./Utah	801-261-0802
WA	Redmond, Electronic Mktg. Grp.	206-882-0962

ELECSYS,INC., Div. of C & C Jetronic, 370 Wall St., Princeton, NJ 08540, Tel: 609-259-8866, FAX: 609-259-9347; Empl.: 3; *Sls. Mgr.:* Edward Hwung ..... **A•1693**

ELECTRA-SSEMBLY, Lancer Chemical, 80 Cutter St. - Box 30, Warren, RI 02885, Tel: 401-245-5493

ELECTRA-TEC, INC., Div. of Impert Industries, Inc., 567 West M-89, Otsego, MI 49078, Tel: 800-225-3532, 616-694-2058, FAX: 616-694-5880; FSC No.: 4J966; Empl.: 20; *Sls. Mgr.:* William Robinson

ELECTRICAL INDUSTRIES CORP., 691 Central Ave., Murray Hill, NJ 07974, Tel: 908-464-3200, FAX: 908-464-7619; FSC No.: 20093; Empl.: 300; *Sls. Mgr.:* D.V. Wilson

ELECTRICAL INSTRUMENT SERVICE, 25 Dock St., Mt. Vernon, NY 10550, Tel: 914-699-9717, FAX: 914-699-9410; FSC No.: 32590;16034A; Empl.: 35 ..... **D•1252**

Local Sales Offices & Reps

AZ	Scottsdale, Williams Assocs.	602-494-0790
CO	Commerce City, Williams Assocs.	303-289-5647
IL	Lincolnwood, Saffro & Assocs.	708-677-9722
LA	Metairie, Data Mktg. Assocs.	504-833-3655
MA	Lexington, Zieco	617-861-8300
MI	Southfield, Comtel Instrs. Co.	313-358-2505
MN	Minneapolis, Hei-Lite Sls.	612-550-0506
NM	Albuquerque, Williams Assocs.	505-255-1638
NY	Mount Vernon, Elctrl. Instr. Svc.	914-699-9717
OH	Cleveland, Comtel Instrs. Co.	216-442-8080
OH	Columbus, Comtel Instrs. Co.	614-876-8305
OH	Dayton, Comtel Instrs. Co.	513-426-5310
OK	Tulsa, Data Mktg. Assocs.	918-494-2711
PA	Pittsburgh, Comtel Instrs. Co.	412-922-5720
TX	Austin, Data Mktg. Assocs.	512-338-4701
TX	Dallas, Data Mktg. Assocs.	214-661-0300
TX	Houston, Data Mktg. Assocs.	713-954-5020
TX	San Antonio, Data Mktg. Assocs.	512-342-3031
WI	Lake Mills, Saffro & Assocs.	1-800-327-0312
Can	Beaconsfield, Que., Mesurina Ltee/Ltd.	514-630-5990

ELECTRICAL INSULATION SUPPLIERS, INC., 300 N. Mannheim Road, Hillside, IL 60162, Tel: 708-547-5400, FAX: 708-544-7297; Empl.: 550; *Sls. Mgr.:* Mike Driscoll

ELECTRICAL STANDARDS DIV., E.S.R.S., Inc., 7337 Greenbush, N. Hollywood, CA 91605, Tel: 818-765-4224, FAX: 818-765-2939; Empl.: 6

ELECTRIC DEVICE, PO Box 337, Canfield, OH 44406, Tel: 216-533-1111, FAX: 216-533-2639

ELECTRIC INDICATOR COMPANY INC., 272 Main Ave., Norwalk, CT 06851, Tel: 203-847-5861, FAX: 203-846-3933; FSC No.: 73693; Empl.: 60

ELECTRIC MOTOR ENGINEERING, INC., 23362 Madero, Suite C, Mission Viejo, CA 92691, Tel: 714-583-9802, FAX: 714-583-9785; Empl.: 5; *Sls. Mgr.:* Frank Buday; *Dist. Mgr.:* Frank Buday

ELECTRIC SWITCHES, INC., 2478 Fletcher Dr., Los Angeles, CA 90039, Tel: 213-660-1310, TWX: 910-321-2971; Empl.: 42; *Sls. Mgr.:* Louis Lim ..... **B•1724-1725**

ELECTRIC TACHOMETER, 68th & Upland Sts., Philadelphia, PA 19142, Tel: 215-726-7723, FAX: 215-724-3682; FSC No.: 20049; Empl.: 50; *Sls. Mgr.:* F. M. Porter

ELECTRIC TIME COMPANY, INC., P.O. Box 466, Medfield, MA 02052, Tel: 508-359-4396, FAX: 508-359-4482; FSC No.: 6645; Empl.: 10

ELECTRO ASSEMBLIES CORP., 425 Huehl Rd., Bldg. 17, Northbrook, IL 60062-2319, Tel: 708-498-6520, FAX: 708-272-2915; FSC No.: 09250; Empl.: 60; *Sls. Mgr.:* Greg Andrews

FAX: 716-759-2562

ELECTROCHEM INDUSTRIES, Wilson Greatbatch Ltd., 10000 Wehrle, Clarence, NY 14031, Tel: 716-759-5428; FSC No.: 6U589; Empl.: 500; *Dist. Mgr.:* Mark Amatuzzo ..... **D•1447**

Local Sales Offices & Reps

NJ	Medford, Champion Elctrn. Sls., Inc.	609-983-0932
OH	Beachwood, Elctrn. Salesmasters Inc.	216-831-9555

Local Distributors

AZ	Scottsdale, Electro Mktg.	602-991-0110
CA	Costa Mesa, Battery Specialties	714-755-0888
CA	San Diego, Tauber Elctrns.	619-274-7242
CA	San Jose, Rose Elctrns.	408-943-0200
CO	Englewood, AVT, Inc.	303-795-1958
MA	Sutton, Engrd. Assemblies Corp.	508-865-0722
FL	St. Petersburg, Engrd. Assemblies Corp.	813-328-1970
GA	Norcross, Engrd. Assemblies & Comps. Corp.	404-446-3135
MI	Ann Arbor, Wedemeyer Elctrns. Supp. Co.	313-665-8611
NJ	Teterboro, Engrd. Assemblies Corp.	201-288-4477
NY	Penn Yan, Advacom Technlg., Inc.	315-536-2221
NC	Raleigh, Engrd. Assemblies Corp.	919-790-9700
OR	Beaverton, Micro Power	503-626-7086
PA	McKean, Advacom, Inc.	814-476-7774
TX	Houston, K Power Elctrns.	713-783-2288
WA	Redmond, Priebe Elctrns.	206-881-2363
Can	Brampton, Innovative Power Pak	416-791-2132
Can	Victoria, BC, Pacific Coast Elctrns. Ltd.	604-385-5111

ELECTROCOM INDUSTRIES, 1105 N. Ironwood Dr., S. Bend, IN 46615, Tel: 219-232-2743; FSC No.: 27114; *Sls. Mgr.:* B. Jaffe

ELECTROCUBE, 1307 S. Myrtle Ave., Monrovia, CA 91016, Tel: 818-301-0122, FAX: 818-357-8099; FSC No.: 14752; Empl.: 125; *Sls. Mgr.:* Harold Neubert ... **A•1067**

Local Sales Offices & Reps

AZ	Scottsdale, EDP & Assocs.	602-991-6119
CA	Mountain View, Westech Sls.	415-961-1422
CA	Newport Beach, Forbes Pacific, Inc.	714-722-6174
FL	Orlando, Richmar Elctrns.	407-352-3755
GA	Roswell, JWL Assocs.	404-518-8500
IL	Downers Grove, Richmar Elctrns.	708-968-0118

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MI	Brighton, W. R. Hummon & Assoc.	313-486-5333
MN	Minneapolis, Electro-Serv	612-338-3475
MO	Raytown, Centech Sls.	816-358-8100
NY	Great Neck, M. O. S. Assocs.	516-487-3966
NY	Rochester, Gislason Sls.	716-328-7400
NC	Charlotte, JWL Assocs.	704-541-5750
OH	Dayton, K. W. Elctrns.	513-890-2150
PA	Allison Park, K. W. Elctrns.	412-492-0777
PA	Paoli, Tyler Griffin Co.	215-647-1550
TX	Plano, Richmar Elctrns.	214-424-8388
WA	Kirkland, James Findlay Co.	206-822-1510
WI	Butler, Richmar Elctrns.	414-781-1730

Local Distributors

AL	Huntsville, Resistacap, Inc.	205-883-4270
AZ	Tempe, Acacia Sls., Inc.	602-894-2874
CA	Chatsworth, Mil-Comm Dist.	818-998-3111
CA	Fremont, Acacia Sls., Inc.	510-623-7500
CA	Santa Ana, BDS Elctrns.	714-662-1050
CA	Tustin, Projections Unltd.	714-544-2700
CO	Lakewood, Acacia Sls., Inc.	303-232-2882
FL	Largo, Elctrn. Precepts of FL	813-544-3636
IL	Elk Grove Village, Nu-Way Elctrns.	708-437-7120
IL	Morton Grove, Nedco	708-967-0500
MD	Gaithersburg, MS Elctrns.	301-921-0200
MI	Madison Heights, Galco Ind. Elctrns.	313-542-9090
NJ	Newark, Meltronics	201-242-1686
NY	Penn Yan, Advacom	315-536-2221
NY	Rochester, Masline Elctrns.	716-546-5373
OH	Englewood, ADS Electra	513-836-8636
OH	Solon, Repco Elctrns.	216-248-8900
OK	Tulsa, Altair Co.	918-252-5781
OR	Beaverton, Acacia Sls., Inc.	503-646-3377
PA	Levittown, Aim Elctrns.	215-946-3900
PA	McKean, Advacom	814-476-7774
TX	Houston, Altair Co.	713-462-3029
TX	Richardson, Altair Co.	214-231-5166
WA	Redmond, Acacia Sls., Inc.	206-881-5566

ELECTRODATA, INC., 23020 Miles Rd., Bedford Heights, OH 44128, Tel: 216-663-3333, TWX: 810-427-2280, FAX: 216-663-0507; FSC No.: 34-1173465; Empl.: 15; *Sls. Mgr.:* Anthony Cardone; *Dist. Mgr.:* Anthony Cardone

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FAX: 708-255-3827

ELECTRODYNAMICS, INC., A Talley Inds. Co., 1200 Hicks Rd., Rolling Meadows, IL 60008, Tel: 708-259-0740; FSC No.: 10236; Empl.: 200; *Sls. Mgr.:* Frank Rafferty ..... **D•1159**

Local Sales Offices & Reps

CA	Alameda, Liaison, Inc.	415-769-1991
CA	Alhambra, James Gerry Co.	213-283-7694
CO	Denver, West High-Tech, JV	303-477-8180
CT	Old Saybrook, FJS Assocs.	203-388-5374
FL	Altamonte Spgs., Quantum Sls.	407-788-0550
IA	Cedar Rapids, J.R. Sales Engrg.	319-393-2232
KS	Wichita, Magna Engrg. Sls.	316-744-0851
MD	Severna Park, Delmarva Engrg. Assocs., Ltd.	301-647-8007
MA	Burlington, FJS Assocs.	617-273-5959
MO	St. Louis, Magna Engrg. Sls.	314-849-6590
NJ	Basking Ridge, Churchill Assocs.	908-735-6626
NY	Larchmont, Hingston Walsh Assocs., Inc.	914-834-5781
OR	Tigard, ElTech, Inc.	503-684-3458
PA	Norristown, Rivco January Inc.	215-631-1414
TX	Dallas, Kruvand Assoc.	214-437-3355
UT	Centerville, West, Inc.	801-292-8787
WA	Bellevue, ElTech, Inc.	206-643-4330

ELECTRO-DYNAMICS DEV. CO., 475 Mt. Hood Dr. S.W., Issaquah, WA 98027-4038, Tel: 206-392-2493; FSC No.: 9J838; *Sls. Mgr.:* W. A. Pommer

ELECTRO-DYN ELECTRONICS, 1201-19th St., Niagara Falls, NY 14301, Tel: 716-284-8747, FAX: 716-284-9112; *Sls. Mgr.:* Paul Grzeskowiak

THE ELECTRODYNE COMPANY, INC., 4188 Taylor Rd., Batavia, OH 45013, Tel: 513-732-2822, TELEX: 241 463, FAX: 513-732-6953

ELECTROFILM, 25395 Rye Canyon Road, Valencia, CA 91355, Tel: 805-257-2242, FAX: 805-257-7738; FSC No.: 85932; Empl.: 77; *Sls. Mgr.:* Richard W. Pearson

ELECTRO-FILMS INCORPORATED

FAX: 401-738-4389

ELECTRO-FILMS, INC., 111 Gilbane St., Warwick Central Indl. Pk., Warwick, RI 02886, Tel: 401-738-9150; FSC No.: 57252; Empl.: 210; *Sls. Mgr.:* Jim Brush ..... **A•1721, 1932-1934**

Local Sales Offices & Reps

AL	Huntsville, BCI, Inc.	205-539-4411
CA	San Jose, NES Assocs.	408-437-9300
CA	Santa Ana, Weatherman Assocs.	714-544-1304
CA	Sunnyvale, NES Assocs.	408-738-3259
CO	Ft. Collins, Rep Sls.	303-226-1504
FL	Apopka, Micro Mktg., Inc.	407-889-2022
GA	Chamblee, BCI, Inc.	404-455-0405
IL	Palatine, M & S Sls.	708-934-1200
IN	Ft. Wayne, Corrao Marsh	219-482-2725
IN	Greenfield, Corrao Marsh, Inc.	317-462-4446
MA	Bedford, Vector Assocs.	617-271-0000
MN	Minneapolis, Ferrian Sls.	612-721-8915
NM	Albuquerque, Western High Tech. Mktg.	505-884-2256
NY	Clifton Park, Empire Technlg., Inc.	518-371-2480
NY	Plainview, Robert Smith Assocs.	516-681-3155
NC	Lewisville, Component Circuits, Inc.	919-945-5678
OH	Cincinnati, Arthur Baier Co.	513-779-2395
OH	Cleveland, Arthur Baier Co.	216-461-6161
OH	Columbus, Arthur Baier Co.	614-764-1144
OH	Toledo, Arthur Baier Co.	513-276-4128
OK	Broken Arrow, Merlin Elctrns.	918-251-2084
OR	Portland, Demarest Assocs., Inc.	503-645-4788
PA	Erdenheim, OMNI Sls.	215-233-4600
PA	Pittsburg, Arthur Baier Co.	412-367-7799
TX	Ft. Worth, Merlin Elctrns.,	817-429-4420
TX	Missouri City, Jackson Arnold Assocs.	713-261-0798
VA	Ashland, Glasscock Assocs.	804-798-2125
WA	Seattle, Demarest Assocs.	206-523-3210
Can	Montreal, Que., Solid State Engr. Co.	514-481-3313

ELECTRO FORCE CORP., 727 Oakstone Way, Anaheim, CA 92806, Tel: 714-774-3666; Empl.: 4

ELECTROHOME LIMITED, 809 Wellington St. N, Kitchener, Ontario, Canada N2G 4J6, Tel: 519-744-7111, FAX: 519-749-3136; *Sls. Mgr.:* Alan Caskey

ELECTROID CO., Div.of Valcor Engrg. Corp., 45 Fadem Rd., Springfield, NJ 07081, Tel: 201-467-8100, TELEX: 139241, FAX: 201-467-5656; Empl.: 100; *Sls. Mgr.:* E.D. Lazorchak

ELECTRO IMPULSE, 1805 Corlies Ave. Box 278, Neptune, NJ 07754-0278, Tel: 908-776-5800, FAX: 908-776-6793; FSC No.: 91161; Empl.: 48; *Sls. Mgr.:* Mark Rubin

ELECTRO INDUSTRIES, Div. E.I. Elctrns., Inc., 1800 Shames Drive, Westbury, NY 11590, Tel: 516-334-0870, TELEX: 4948652 ELECTRO, FAX: 516-338-4741; Empl.: 40; *Sls. Mgr.:* S. Kagan

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ELECTRO INSULATION CORP., 3921 Ventura Drive, Arlington Hgts., IL 60004, Tel: 708-632-1020, FAX: 708-632-1089; Empl.: 25; *Sls. Mgr.:* Mike Kamperschroer; *Dist. Mgr.:* Mike Kamperschroer

ELECTROL CO., 321 Dewey St., P.O. Box 29, York, PA 17405, Tel: 717-848-1722, FAX: 717-848-4514; Empl.: 30; *Sls. Mgr.:* Debra Dudley; *Dist. Mgr.:* Debra Dudley

ELECTROL, Hamlin, Inc., 612 East Lake St., Lake Mills, WI 53551, Tel: 414-648-3000, FAX: 414-648-3001; Empl.: 350; *Sls. Mgr.:* Mike Bucher ..... **B•1513**

Local Sales Offices & Reps

AZ	Tempe, Westrep	602-820-9932
CA	Irvine, Groh Assocs.	714-837-9871
CA	San Jose, Vernexx	408-972-4903
CO	Boulder, Design Tech. Sls.	303-440-5121
CT	Branford, Coakley, Boyd & Abbett	203-481-2218
FL	Tampa, Electramark, Inc.	813-889-7775
GA	Atlanta, Wallace Elec. (Sen/Sw only)	404-634-3159
GA	Norcross, Electramark, Inc. (Relays only)	404-446-7915
IL	Itasca, LTD Technlgs.	708-773-2900
IN	Carmel, Technlg. Mktg. Corp.	317-844-8462
IA	Davenport, Rush & West	319-388-9609
KS	Olathe, Rush & West	913-764-2700
KY	Louisville, Technlg. Mktg. Corp.	502-893-1377
MD	Gaithersburg, Naudain Assocs. South	301-258-5040
MA	Bridgewater, Coakley, Boyd & Abbett	508-559-6700
MA	Framingham, Coakley, Boyd & Abbett	508-820-0800
MI	Farmington Hills, J.L. Montgomery	313-489-0099
MN	Minneapolis, RK Sls.	612-571-1001
MO	St. Louis, Rush & West	314-965-3529
NJ	Hackensack, Coakley, Boyd, Abbett/Metro	201-440-4114
NJ	Marlton, Naudain Assocs.	609-983-5300
NY	Ithaca, Bob Dean, Inc.	607-257-1111
NC	Kernersville, Wallace Elctrn. Sls.	919-996-2742
OH	Richfield, Bear Mktg.	216-659-3131
OR	Tigard, Earl & Brown	503-639-2100
PA	Allison Pk., Bear Mktg.	412-492-1150
TN	Tullahoma, Wallace Elctrns. Sls.	615-455-0501
WA	Redmond, Earl & Brown	206-885-5064
WI	Watertown, Deaken Tech. Sls.	414-261-7600
Can	Ontario, Indigo	416-670-0284

Local Distributors

AL	Huntsville, Cypress Elctrns.	205-533-0783
AL	Huntsville, Hammond Elctrns.	205-830-4764
AZ	Phoenix, Force Elctrns.	602-437-1060
AZ	Tempe, Cypress Elctrns	602-966-2256
AR	Springdale, Radio Inc.	501-751-8200
CA	Agoura Hills, Cypress Elctrns.	881-597-9491
CA	Costa Mesa, Cypress Elctrns.	714-549-2424
CA	Los Angeles, Bell Inds.	213-826-6778
CA	Los Angeles, Master Distrs.	301-452-1229
CA	Milpitas, Sierra West Elctrns.	408-945-1050
CA	San Jose, Capstone	408-453-9804
CA	Santa Clara, Cypress Elctrns.	408-980-8400
CA	Santa Clara, Kent Elctrns.	408-727-9810
CA	Tustin, Capstone	714-730-0349
CO	Aurora, Capstone Elctrns.	303-375-2550
CO	Denver, Newark Elctrns.	303-757-3351
CO	Englewood, Cypress Elctrns.	303-792-5829
CO	Englewood, Harrison Equip. Co.	303-694-6320
CT	Southbury, Heilind Elctrns.	203-262-1700
CT	Wallingford, Sager Elec.	203-262-1700
FL	Ft. Lauderdale, Hammond Elctrns.	305-973-7103
FL	Lakeland, AA Elec.	813-665-6941
FL	Orlando, Hammond Elctrns.	407-849-6060
GA	Norcross, AA Elec.	404-449-8670

GA Norcross, EMSCO 404-925-8366
GA Norcross, Hammond Elctrns. 404-449-1996
ID Boise, Radar Elec. 208-336-2227
IL Bensenville, Cypress Elctrns. 708-350-2005
IL Chicago, Newark Elctrns. 312-784-5100
IL Itasca, Capstone 708-250-0300
IL Palatine, Ohm Elctrns. 708-359-5500
IN Ft. Wayne, Bell Inds. 219-423-3422
IN Indianapolis, Bell Inds. 317-875-8200
IN Indianapolis, Custom Svc. Elctrns. 317-879-9119
KS Wichita, Radio, Inc. 316-264-2798
MD Baltimore, Bell Inds. 301-953-2566
MD Columbia, DK Elctrns. 301-995-1950
MD Columbia, Peerless Radio 301-997-1717
MD Columbia, Sager Elec. 301-995-4900
MA Andover, Bell Inds. 508-474-8880
MA Hingham, Sager Elctrl. Supp. 617-749-6700
MA Wilmington, Capstone 508-657-5874
MA Wilmington, Heiland Elctrns. 508-657-4870
MI Livonia, RS Elctrns. 313-525-1155
MI Oak Pk., Newark Elctrns. 313-967-0600
MN Eden Prairie, Cypress Elctrns. 612-934-2104
MN Minneapolis, Newark Elctrns. 612-331-6350
MN Thief River Falls, Digi-Key Corp. 218-681-6674
MN Thief River Falls, Voyager Elctrns. 612-571-7766
NH Salem, Sager Elec. 603-898-1348
NJ Fairfield, Bell Inds. 201-227-6060
NJ Marlton, Capstone 609-596-7500
NJ Oakland, Relay Specs. 201-337-1000
NJ W. Berlin, Genl. Comps. 609-768-6767
NM Alburquerque, Bell Inds. 505-292-2700
NM Alburquerque, Harrison Intl. 505-291-9951
NM Los Alamos, Capstone 505-662-0745
NY Buffalo, Summit Distrs., Inc. 716-887-2800
NY Hauppauge, Sager Elec. 516-348-1300
NY Lynbrook, Peerless Radio 516-593-2121
NY Plainview, Astrex 516-433-1700
NY Rochester, Simcona Elctrns. Corp. 716-328-3230
NY Rome, Rome Elctrns. Inc. 315-337-5400
NC Greensboro, Hammond Elctrns. 919-275-6391
NC Raleigh, Capstone 919-954-0600
NC Winston-Salem, Kirkman Elctrns. 919-722-9131
OH Solon, Repco Elctrns. 216-248-8900
OH Valley View, Newark Elctrns. 216-447-8860
OK Oklahoma City, Radio Inc. 405-789-0741
OK Tulsa, Radio Inc. 918-587-9123
OR Oswego, Bell Inds. 503-635-6500
OR Portland, Cypress Elctrns. 503-223-8900
OR Portland, Radar Elec. 503-232-3404
PA McKean, Advacom Inc. 814-476-7774
PA Pittsburgh, Bell Inds. 412-787-3883
PA Trevosa, Bell Inds. 215-953-2899
SC Greenville, EMSCO Inc. 803-233-4121
TX Austin, Harrison Equip. Co. 512-258-1320
TX Carrollton, Capstone 214-380-9049
TX Dallas, Harrison Equip. Co. 214-239-2750
TX El Paso, Harrison Equip. Co. 915-598-3406
TX Farmers Branch, Force Elctrns. 214-247-9955
TX Ft. Worth, Allied Elctrns. 817-595-3500
TX Ft. Worth, Tandy Elctrns. 812-870-5614
TX Garland, Newark Elctrns. 214-494-5911
TX Houston, Kent Elctrns. 713-780-7770
TX Stafford, Harrison Equip. Co. 713-879-2727
WA Redmond, Kent Elctrns. 206-883-7200
WA Richland, Radar Elec Co. 509-943-8336
WA Seattle, Radar Elec. Co. 206-282-2511
WA Spokane, Radar Elec. Co. 509-747-3053
WI Cedarburg, Automation Engrg. 414-377-7500
WI Green Bay, Automation Engrg. 414-449-6000
WI Mequon, Taylor Elec. 414-241-4321
Can Burnaby, BC, ITT Multicomps. 604-291-8866
Can Calgary, Alb., ITT Multicomps. 403-273-2780
Can Concord, Ont., ITT Multicomps. 416-798-7884
Can Markham, Ont., Semad Elctrns. 416-475-8500
Can Mississauga, Ont., Capstone 416-670-2010
Can Nepean, Ont., ITT Multicomps. 613-596-6980
Can Ville St. Laurent, PQ, ITT Multicomps. 514-335-7697
Can Winnipeg, Manitoba, ITT Multicomps. 403-273-2780

ELECTRO MAGNETIC PROCESSES, INC., 20360 Plummer St., Chatsworth, CA 91311-5371, Tel: 818-882-6333, FAX: 818-709-4668; FSC No.: 51290; Empl.: 100

ELECTROMATIC CONTROLS CORP., 2495 Pembroke Road, Hoffman Estates, IL 60195-2010, Tel: 708-882-5757, TWX: 910-222-3452; FSC No.: 75203; Empl.: 400; *Sls. Mgr.:* Mike Meurer; *Dist. Mgr.:* Mike Meurer

ELECTRO MAZE AIR FILTERS, 5936 Don Way, Carmichael, CA 95608, Tel: 916-485-4079, FAX: 916-485-7925; Empl.: 7

ELECTROMECH, INC., 2 Cordier St., Irvington, NJ 07111, Tel: 201-318-7999, FAX: 201-318-7995; Empl.: 40; *Sls. Mgr.:* Soloman Ezra ..... **A•2324-2325; D•1672**

Local Sales Offices & Reps
NJ Irvington, Electromech, Inc. 201-318-7999

ELECTRO MECHANICAL SYSTEMS, INC., 801 W. Bradley Ave., Champaign, IL 61820, Tel: 217-359-7125, FAX: 217-359-2075; Empl.: 26; *Sls. Mgr.:* Julie L. Redman

ELECTRO-MECHANISMS, INC., 990 Amelia, San Dimas, CA 91773, Tel: 909-394-9953, FAX: 909-394-0782; FSC No.: 52592; Empl.: 27 ..... **B•1636-1637**

Local Sales Offices & Reps
OH Dayton, Harvey Teplitz 513-898-5282

ELECTRO-MECH CO., 707 Hathaway Dr., Colorado Springs, CO 80915, Tel: 719-597-1620, FAX: 719-597-1628 ..... **D•1673**

Local Sales Offices & Reps
AZ Phoenix, C.T. Carlberg & Assocs. 602-468-0782
CA Santa Clara, Caltronics 408-727-7552
GA Roswell, JWL Assocs. 404-518-8500
IL Cary, Bob Burns & Assocs. 708-516-3322
IA Cedar Rapids, KKB & Co. 319-373-7111
MN Minneapolis, Harold Mercer Co. 612-933-7111
MO Blue Springs, KKB & Co. 816-229-0001
MO St. Louis, KKB & Co. 314-647-2400
NJ Berkley Hgts., Cambridge Allen & Assocs. 908-464-0203
NM Albuquerque, C.T. Carlberg & Assocs. 505-899-2155
NC Charlotte, JWL Assocs. 704-541-5750
OR Lake Oswego, Abacus Sls. 503-777-8111

Local Distributors
AL Birmingham, Forbes Elctrns. 205-251-3941
AL Huntsville, Mock Elctrns. 205-539-2401
AL Montgomery, Handeys Elctrn. Ctr. 205-262-4885
FL Ft. Walton Bch., Key Elctrn. Supp. 904-863-2191
FL Pensacola, Pensacola Elctrns. 904-478-3771
FL Tampa, Applied Power 813-725-9587
GA Norcross, Applied Power 404-263-0421
IL Mount Prospect, Tri-State Elctrns. 708-255-0600
IA W. Des Moines, Ramco Elec. Co. 515-225-6933
MA Boston, IME 800-254-1700
MI Brighton, Applied Power 313-227-3604
MN St. Paul, DC Battery Prods. 612-646-7478
MO Kansas City, Elctrn. Supp., Inc. 816-931-0250
NC Greensboro, Guilford Elctrn. Supp. 919-275-1385
SC Spartanburg, Harley's Whlse. Elctrns. 803-582-7961
TN Clarksville, Randolph Hale & Mathews 615-647-2325
TN Columbia, Randolph & Williams 615-388-7686
TN Nashville, Randolph & Rice 615-255-5602
TN Tullohoma, Randolph & Vandergriff 616-455-4531
TX Dallas, Computer Comps. 214-239-0271
TX Richardson / Dallas, Off the Shelf Comps. 214-238-9625
UT Salt Lake City, Standard Supply 801-486-3371
WI Madison, Wisconsin Elctrn. Supp. 608-222-3400

ELECTRO-MECH COMPONENTS, INC., 1826 N. Floradale Ave., South El Monte, CA 91733-3689, Tel: 818-442-7180, FAX: 818-350-8070; FSC No.: 07150; Empl.: 15; *Sls. Mgr.:* Terry Trumbull; *Dist. Mgr.:* Terry Trumbull ..... **B•1714-1715**

Local Sales Offices & Reps
CA Irvine, Vale Elctrn. Assoc. 714-551-4004
CA San Diego, Qualtronics 619-695-0118
CA Santa Clara, Engrg. Assocs. 408-988-5001
CO Boulder, Design Technlg. Sls. 303-440-5121
FL Orlando, Publicover 407-898-9361
IL Chicago, IRI 708-967-8430
MD Baltimore, Callas Elctrns., Inc. 410-744-7711
MI Livonia, Leading Edge Sls. 313-478-6700
MN Minneapolis, D. A. Case Assocs. 612-831-6777
NJ Medford, Comp. Conslts. 609-654-5300
NY Mamaroneck, Bassin Tech. 914-698-9332
NY Orchard Pk., SHR 716-662-0589
OH Cincinnati, KCH Co. 513-931-1686
OR Hillsboro, Doran Sls. 503-640-4500
RI Smithfield, Todino Engr. Sls. 401-232-5656
TX Richardson, McCoy Assocs. 214-864-1838
WA Redmond, Doran Sls. 206-488-1200

Local Distributors
CA Los Angeles, Elec. Switches 213-660-1310
CA Los Angeles, Master Distrs. 310-452-1229
NY Mamaroneck, Logicomp Elctrns. 800-431-2625

ELECTRO-METRICS, INCORPORATED, A Penril Corp., 100 Church St., Amsterdam, NY 12010, Tel: 518-843-2600, TWX: 710-446-4798, FAX: 518-843-2812; FSC No.: 18581; Empl.: 80; *Sls. Mgr.:* Colleen M. DiCaprio

Electro-Miniatures Corp.

FAX: 201-935-8153

ELECTRO MINIATURES CORP., 68 West Commercial Ave., Moonachie, NJ 07074, Tel: 201-460-0510; FSC No.: 17399; Empl.: 45; *Sls. Mgr.:* Barbara Triolo ..... **B•1251-1253**

ELECTRO NATIONAL CORP., P.O. Box 402 Matthews Ave., Canton, MS 39046, Tel: 601-859-5511, FAX: 601-859-5518; FSC No.: M-54208; Empl.: 32; *Sls. Mgr.:* Patsy Hicks

ELECTRONETICS, INC., 3101-111th St. S.W., Everett, WA 98204, Tel: 206-355-1855, FAX: 206-355-1855; Empl.: 10

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FAX: 818-442-6873

ELECTRONIC APPLICATIONS CO., 4918 Santa Anita Ave., El Monte, CA 91734, Tel: 818-442-3212; Empl.: 92 ..... **B•1483**

ELECTRONIC COIL CORP., 125 Old Iron Ore Rd., Bloomfield, CT 06002, Tel: 203-243-5233, FAX: 203-243-2247; Empl.: 8; *Sls. Mgr.:* R.B. Gorski

ELECTRONIC COMPONENTS & MATERIALS, GTE Sylvania, 816 Lexington Ave., Warren, PA 16365, Tel: 814-726-6500, FAX: 814-726-6942; Empl.: 1800; *Sls. Mgr.:* Robert Scalise

FAX: 908-542-0524

ELECTRONIC CONCEPTS, INC., Box 1278, Eatontown, NJ 07724, Tel: 908-542-7880, TELEX: 7107226661; FSC No.: 50558; Empl.: 240; *Sls. Mgr.:* Philip N. Lepore ..... **A•1068-1073**

Local Sales Offices & Reps
CA La Mirada, Select Elctrns. 714-739-8891
CA Simi Valley, Elctrn. Concepts, Inc. 805-582-9501
CO Englewood, TMC 303-770-8995
IL Wheaton, Elctrn. Concepts, Inc. 312-668-8747
MN Minneapolis, Components Grp. 612-374-1250
MO Grandview, Harris-Hanson Co. 816-763-6200
NJ Eatontown, Elctrn. Concepts, Inc. 908-542-7880
MO St. Louis, Harris-Hanson Co. 314-432-3611

Local Distributors
NJ Clifton, Elcon Sls. 201-546-5022

ELECTRONIC CONNECTION CORP., 125 Old Iron Ore Rd., Bloomfield, CT 06002, Tel: 203-243-3356, FAX: 203-243-2247; Empl.: 15; *Sls. Mgr.:* Ray Gorski, Jr.

ELECTRONIC CONNECTORS, INC., 125 South Fifth St., Reading, PA 19602, Tel: 215-374-3796, FAX: 215-374-0630; FSC No.: 15971; Empl.: 34; *Sls. Mgr.:* D. E. Fronheiser; *Dist. Mgr.:* D. E. Fronheiser

ELECTRONIC CONTROLS DESIGN, 4287-A SE International Way, Milwaukie, OR 97222, Tel: 503-659-6100, FAX: 503-659-4422; Empl.: 100; *Sls. Mgr.:* Steven Glass

ELECTRONIC DESIGN ENGINEERING, 1820 Temescal Av., Norco, CA 91760, Tel: 909-735-1761; Empl.: 3

ELECTRONIC DESIGNS INC., 42 South Street, Hopkinton, MA 01748, Tel: 508-435-2341, TELEX: 948004, FAX: 508-435-6302

ELECTRONIC DEVELOPMENT ASSOCIATES, 1 Westcliff Drive, Dix Hills, New York 11746, Tel: 516-673-3881, FAX: 516-673-5979; FSC No.: 9V841

ELECTRONIC DEVELOPMENT CORP., EDC, 11 Hamlin St., Boston, MA 02127-4198, Tel: 617-268-9696, TELEX: 951596, FAX: 617-268-6754; FSC No.: 12619; Empl.: 25; *Sls. Mgr.:* R. B. Ross ..... **D•1253**

Local Sales Offices & Reps

AL	Huntsville, Jim Springer	205-883-4163
AZ	Tempe, Rusler Tech	602-897-2877
CA	All of CA, F.L.W.	800-339-6030
CO	Englewood, R. A. Mayes Co.	303-761-9447
FL	Cape Canaveral, Teqspec	407-783-3444
FL	Palm Harbor, Teqspec	813-942-6006
IL	Arlington Heights, Berndt Assoc.	708-632-0900
IN	Carmel, Berndt Assocs.	317-844-0114
KS	Overland Park, Ramsey Assocs.	913-541-1007
MA	Boston, Elctrn. Dev. Corp.	617-268-9696
MA	Needham, Addelco Corp.	617-444-4754
MI	Hazel Park, Tiby Co.	313-547-3550
MN	Minneapolis, The Mark Co.	612-933-3026
MO	Chesterfield, Ramsey Assocs.	314-532-9386
NJ	Union, Friedman Assocs.	908-964-6200
NM	Albuquerque, Mesa Technlg.	505-883-8833
NY	Victor, SAN WAL Technlg.	716-924-1950
NC	Raleigh, Teqspec	919-851-9112
OH	Cleveland, Tiby Co.	216-371-5335
OR	Portland, Topp Engrg. Sls.	503-244-7265
PA	Hatboro, Rhodes Technlg.	215-672-3336
TX	Richardson, Scientific Sls.	214-231-6541
VA	Richmond, Advance Control Equip.	804-282-9499
WI	Milwaukee, Berndt Assoc.	414-545-8400
Can	Mississauga, Ont., Omnitronix Ltd.	416-828-6221

ELECTRONIC DEVELOPMENT LABS., See EDL Inc.

ELECTRONIC DEVICES, INC., 21 Gray Oaks Ave., Yonkers, NY 10710, Tel: 914-965-4400, TELEX: 681-8047, FAX: 914-965-5531; Empl.: 200; *Sls. Mgr.:* Paul Dengler; *Dist. Mgr.:* Paul Dengler ..... **A•2143**

Local Sales Offices & Reps

CA	Northridge, Myco Sls.	818-886-7101
CA	San Jose, Nelson	408-437-9300
CO	Englewood, Dynatech	303-773-2830
FL	Melbourne, Kennedy	407-676-6875
GA	Lawrenceville, Funderburk	404-963-9495
IL	Arlington Hgts., Rozner Sls.	312-577-0067
IN	Carmel, Berndt Assoc.	317-844-0114
MA	Sharon, Cummings Assoc.	617-784-5600
MI	Livonia, Amtech	313-474-8300
MN	Burnsville, Xerotex Tech	612-894-5007
MO	St. Louis, Reptronics	314-997-4707
NY	Bohemia, Optimum Metro Sls.	516-244-5744
NY	Victor, Net Sls.	716-924-1844
NC	Raleigh, Funderburk	919-846-2373
OH	Willoughby Hills, Versatron	216-944-0082
OR	Portland, Index Inc.	503-289-9627
PA	Montgomeryville, Eastern Sci. Mktg.	215-368-4570
TX	Dallas, Kruvand Assoc.	214-437-3355
WI	Mequon, Stumm Sls.	414-241-8414
Can	Toronto, Norgay Entprs.	416-234-8966

Local Distributors

AL	Huntsville, Comp. Distrs.	205-851-7800
AZ	Costa Mesa, Orange Cnty. Comps.	714-979-3597
CA	San Jose, Compass	408-432-7515
CO	Englewood, Comp. Distrs.	303-770-6214
CT	Greenwich, Wise Comps.	203-531-4880
FL	Melbourne, Comp. Distrs.	407-724-9910
GA	Norcross, Comp. Distrs.	404-441-3320
IL	Chicago, E.M.D.	708-577-0067
IN	Indianapolis, Gateway Megatech	317-844-3906
KY	Louisville, Peerless Elctrns.	502-637-7672
MA	Billerica, Mayer Elctrns.	617-229-2255
MI	Grand Rapids, SF Elctrns. Supp.	616-459-0216
MN	Minneapolis, Berquist Inc.	612-835-2322
MO	St. Louis, Ric-Tronics	314-576-9816
NY	Albany, Ed Taylor Co.	518-438-7811
NY	Buffalo, Summit Distr.	716-887-2815
NY	Elmsford, Multimetrics	914-347-3666
NY	Mt. Vernon, Janesway	914-699-6710
NY	Rochester, Masline Elctrns.	716-546-5373
NC	Raleigh, Century Elctrns.	919-782-2116
NC	Raleigh, Comp. Distr,	919-787-7311
OH	Willoughby, Gateway Megatech	216-953-0333
OR	Portland, Radar Elec.	503-232-3404
PA	Pittsburgh, Advacom	814-476-7774
VA	Roanoke, Peoples Elctrns.	703-342-8933
WI	Racine, Badger Elctrns.	414-637-1256

ELECTRONIC DISPLAYS, INC., 780 Creel Dr., Wood Dale, IL 60191, Tel: 708-860-5838, FAX: 708-860-0502; *Sls. Mgr.:* Bob Holmberg ..... **B•1043**

ELECTRONIC ENCLOSURES, Div. Wyle Laboratories, 225 South Aviation Blvd., El Segundo, CA 90245, Tel: 310-643-8181, FAX: 310-643-8565; FSC No.: 09097; Empl.: 230; *Sls. Mgr.:* Robert Sproul

ELECTRONIC ENGRG. CO. OF CAL., See EECO

EEM/ELECTRONIC ENGINEERS MASTER, 645 Stewart Ave., Garden City, NY 11530, Tel: 516-227-1300, FAX: 516-227-1901

FAX: 203-755-0659

ELECTRONIC FILM CAPACITORS, INC., 41 Interstate Lane, Waterbury, CT 06705, Tel: 203-755-5629; Empl.: 65 ..... **A•1075**

Local Sales Offices & Reps

CA	San Carlos, Francisco & Assocs.	415-591-8009
CA	Torrance, Orion Eclipse	213-326-0999
FL	Melbourne, Phoenix Comps.	407-723-4414
FL	Palm Harbor, Phoenix Comps.	813-786-1391
IL	Schaumburg, ABC Elctrn. Sls.	708-924-9974
MD	Columbia, PSA, South	301-953-4884
MA	Hudson, Compak, Inc.	508-568-0331
MI	Milford, Elctrn. Comp. Sls.	313-360-3790
NJ	E. Brunswick, Winch Sls., Assocs.	908-613-1515
NY	Plainview, Winch Sls. Assocs.	516-681-3163
NC	Raleigh, Pinnacle Mktg.	919-848-0404
OH	Columbus, Elctrn. Comps. Inc.	614-231-2318
OH	Miamisburg, Elctrn. Comps., Inc.	513-866-3340
OH	Rocky River, Elctrn. Comps. Inc.	216-331-5330
OH	Westlake, Elctrn. Comps. Inc.	216-835-4856
PA	Exton, The Wright Rep Co.	215-594-9654
WA	Bellevue, Advanced Power Comps.	206-747-9127
WA	Seattle, Advanced Power Comps.	206-527-7945
WA	Spokane, Advanced Power Comps.	509-928-7959
WA	Vancouver, Advanced Power Comps.	206-896-4239
Can	Vancouver, B.C., Advanced Power Comps.	604-436-0552

Local Distributors

CA	Chatsworth, Passive Comps., Inc.	818-700-8838
CA	Garden Grove, Capacitor Supply	714-638-0510
CA	Irvine, IEC	714-837-9960
CA	Irvine, Kelex Elctrns.	714-863-1230
CA	Milpitas, California Capacitor, Inc.	408-262-6000
CA	San Jose, Stotts Friedman	800-869-5558
CA	Sunnyvale, Capsco Sls., Inc.	408-734-3020
FL	Boca Raton, NRC Elctrns.	407-241-8600
FL	Melbourne, Pridmore	407-727-2491
GA	Norcross, NRC Elctrns.-Dixie	404-729-0411
IN	Indianapolis, Mar Elctrns. Inc.	317-633-6699
MA	North Adams, Elctrn. Supp.	413-664-1086
MI	Grand Rapid, Calder Elctrns.	616-698-7400
MN	North Plymouth, Leeds Electro Comps.	612-557-1277
NH	Hampstead, Astrum Elctrns.	603-329-5656
NJ	Ft. Lee, ATI Inc.	201-592-8810
NJ	Rockaway, Tonar Inds.	201-586-9000
NY	Bohemia, RBD Elctrns.	516-589-7717
OH	Dayton, Stotts Friedman	513-298-5555
PA	Harrisburg, Ad Tech Elctrns.	717-561-9905
PA	Norristown, Century Elctrns.	215-631-5400
VT	Charlotte, Kellner Elctrns	802-425-3250
WI	Salem, Badger Capacitor Sls.	414-281-1330

FAX: 516-752-1971

ELECTRONIC HARDWARE CORP, Formerly Jan Hardware Mfg. Co., 320 Broad Hollow Rd., Farmingdale, NY 11735, Tel: 516-752-1950; FSC No.: 23480; Empl.: 75; *Sls. Mgr.:* John Powers ..... **C•1523-1529**

ELECTRONIC INDUSTRIES ASSOC., 2001 Pennsylvania Ave. NW, Washington, DC 20006, Tel: 202-457-4900, FAX: 202-457-4985

ELECTRONIC INNOVATIONS CORP. (E.I.C.), 3333 S. Wadsworth Blvd. C101, Lakewood, CO 80227, Tel: 303-987-2441, FAX: 303-988-5907; Empl.: 4

FAX: 908-922-9334

ELECTRONIC MEASUREMENTS, 405 Essex Rd., Neptune, NJ 07753, Tel: 908-922-9300; FSC No.: 89022; Empl.: 250; *Sls. Mgr.:* Charles Lehmann ..... **D•1674-1683, 2104-2105**

Local Sales Offices & Reps

AL	Currie, Peak & Frazier	205-536-1506
AZ	Tempe, Trembly Assoc.	602-431-9417
CA	Huntington Beach, Tri Tek	714-840-3501
CA	San Diego, Tri Tek	619-573-0157
CA	San Jose, Tri Tek/SD	408-554-0455
CO	Golden, Trembly Assoc.	303-279-3019
FL	Currie, Peak & Frazier	407-855-0843
IL	Elmhurst, Sector Engrg.	708-530-7850
IN	Indianapolis, Sector Engrg.	317-253-9221
MD	Landover, Seltronics	301-341-2700
MA	Winchester, FJS Assoc.	617-729-3135
MN	Edina, Dytec Instrs.	612-831-7169
NJ	Laurel Springs, Williams Assocs.	609-346-2876
NM	Albuquerque, Trembly Assoc.	505-266-8616
NY	Whitney Point, Tae Rep	607-692-3705
OH	Dayton, WKM Assoc.	513-434-7500
PA	Pittsburgh, WKM Assoc.	412-892-2953
TX	Houston, Kemp Instrs.	713-466-1465
WA	Redmond, Sci. Dvcs.	206-885-0004
WI	Milwaukee, Sector Engrg.	414-352-8280

ELECTRONIC MODULES, INC., 10410 Vista Park Rd., Dallas, TX 75238-1687, Tel: 214-340-6789; Empl.: 40-50; *Sls. Mgr.:* Leo Rios; *Dist. Mgr.:* Paul Stolar

ELECTRONIC NAVIGATION INDUSTRIES, See ENI, Div. of Astec America, Inc.

FAX: 319-377-3674

ELECTRONIC PACKAGING SYSTEM, 201 35th St., Marion, IA 52302, Tel: 319-377-3423; FSC No.: OH1KZ; Empl.: 5; *Sls. Mgr.:* G.R. Grishaber ..... **C•1023**

ELECTRONIC PRECISION COMPONENTS, 519 South 5th Ave., Mt. Vernon, NY 10550-4430, Tel: 914-664-2333, FAX: 914-664-4729; FSC No.: 59131; Empl.: 8; *Sls. Mgr.:* Don Edwards ..... **A•1633; D•1254**

FAX: 617-661-2989

ELECTRONIC PRECISION TECHNOLOGY INC., 126 Jackson St., Cambridge, MA 02140, Tel: 617-661-2454; Empl.: 4; *Sls. Mgr.:* Werner Christ ... **C•1315-1320**

Local Sales Offices & Reps

AL	Huntsville, Hughes Assocs.	205-533-9108, FAX:205-533-4667
AZ	Tempe, Phase 4, Inc.	602-966-2018, FAX:602-968-7565
CA	Campbell, PCA Mktg. & Sls. Engrg.	408-559-2866, FAX:408-559-8277
CA	Dana Point, P C A	714-493-9822, FAX:714-240-1894
CO	Boulder, Comp. Prod. Sls. Co., Inc.	303-530-2800, FAX:303-530-9568
FL	Hialeah, Hughes Assocs.	305-362-8167, FAX:305-823-9873
FL	Melbourne, Hughes Assocs.	407-253-3031, FAX:407-253-3031
FL	Palm Harbor, Hughes Assocs.	813-785-6696, FAX:813-533-9108
GA	Marietta, Hughes Assocs.	404-578-0064, FAX:404-578-0820
IL	Crystall Lake, Komac Entrprs., Inc.	815-459-7456, FAX:815-459-8612

IN Fishers, Carter, McCormic & Peirce Inc. 317-842-9277,FAX:317-577-2741
MD Randallstown, Chesepeak Indl. Mktg. 301-653-0476,FAX:301-653-4675
MA Concord, Noyes Assoc. 508-369-0425, FAX:508-371-2931
MI Farmington Hills, Carter, McCormic & Pierce Inc. 313-477-7700,FAX:313-477-4149
MS Corinth, Hughes Assocs. 601-287-2915, FAX:205-533-9108
MO St. Louis, Acorn Elctrns. 314-421-1751, FAX:314-421-1752
NY Peconic, HLJ Comp-Tech. 516-734-7760, FAX:516-734-7784
NC Gary, Hughes Assocs. 919-467-7029, FAX:919-460-8607
OH Englewood, Carter, McCormic & Peirce Inc. 513-836-0951,FAX:513-836-2358
OH Parma, Carter,McCormic & Peirce Inc. 216-398-0400,FAX:216-398-0766
PA Pittsburgh, Carter, McCormic & Peirce Inc. 412-826-3800,FAX:412-826-3800
PA Southampton, Campbell Assocs. 215-322-6630, FAX:215-322-2627
TX Plano, Connector Specs. 214-517-1207, FAX:214-517-3660
WA Edmonds, Advanced Comp. Des. Corp. 206-745-5445,FAX:206-745-5445

Local Distributors

CA Burbank, Atwater Elctrns., Co. 215-631-5404, FAX:215-631-5406
CA Costa Mesa, Eric Elctrns. 714-751-1185, FAX:619-236-9910
CA San Diego, Cableconn 619-571-7111, FAX:619-571-0309
CA San Jose, Eric Elctrns. 408-432-1111, FAX:408-433-0570
CA Santa Ana, BDS Elctrns., Inc. 714-662-1050, FAX:714-662-3929
CA Santa Anna, Elcom Cabletek 714-432-6630, FAX:714-556-0468
CA Sunnyvale, PSC ... 800-654-1518,FAX:408-737-0502
CO Denver, QPS Elctrns. 303-373-2766, FAX:303-373-4029
IL Crystal Lake, Sub-Sem, Inc. 815-459-4139
IL Schaumburg, QPS Elctrns. 708-884-6620, FAX:708-884-7573
MD Beltsville, PSC/Petricko Sls. 800-333-5292, FAX:301-937-5299
MD Gaithersburg, Axis Elctrns. 800-368-2815, FAX:301-840-9299
MA Ashland, Quality Components 508-881-6504, FAX:508-881-1704
NJ Burlington, Secom Elctrns. 609-386-9400, FAX:609-386-9333
PA Clifton Hgts., Tri-Com 215-259-7400, FAX:215-259-4785
TX Arlington, Bell Comp. Sls. Inc. 817-461-5303
Can Mississagua, Ont., R. Theta 416-890-0221, FAX:416-890-1628

ELECTRONIC PRODUCTS MAGAZINE, 645 Stewart Avenue, Garden City, NY 11530, Tel: 516-227-1300, FAX: 516-227-1444

ELECTRONIC RESEARCH CO., 7618 Wedd St, Overland Park, KS 66204, Tel: 913-631-6700, FAX: 913-631-7849; FSC No.: 13571; Empl.: 60; *Sls. Mgr.:* Charles Ditzler

THE ELECTRONICS GROUP, INC., 2828 Interstate St, Charlotte, NC 28208, Tel: 704-391-9500, FAX: 704-597-9500 Ext. 20; Empl.: 30; *Sls. Mgr.:* Doug Mckenzie

FAX: 619-452-9464

ELECTRONIC SOLUTIONS, Zero Corporation, 6790 Flanders Dr., San Diego, CA 92121, Tel: 800-854-7086, TELEX: 910-335-1169; FSC No.: 61081; Empl.: 150 ..... **C•1116-1117, 1128-1133**

Local Sales Offices & Reps

AL Huntsville, EMA 205-830-4030
AZ Tempe, Holder Hauer 602-431-1212
CA San Diego, Amasco 619-292-7666
CA Santa Clara, Amasco 408-987-7760
CA Simi Valley, Amasco 805-581-2031
CA Torrance, Amasco 310-781-9494
CO Denver, Holder Hauer 303-427-3443
CT Bethany, Trilogic 203-393-1040
FL Altamonte Springs, EMA 407-339-2333
FL Boca Raton, EMA 407-394-6709
GA Roswell, EMA 404-992-7240
IL Hoffman Estates, Micro-Tex, Inc. 708-765-3000
KS Lenexa, Midtec Assocs. 913-541-0505
MD Annapolis Junction, Stemler Assocs. 301-490-1078
MD Rockville, Spectro Assocs. 301-294-9770
MA Wilmington, Trilogic 508-658-3800
MI Ann Harbor, The Sys. Grp. 313-930-1800
MI Livonia, The Sys. Grp. 313-478-6700
MO St. Louis, Midtec Assocs. 314-275-8666
NH Nashua, Trilogic 603-595-9859
NJ Clementon, Systech Assocs., Inc. 609-784-8300
NJ Florham Pk., Gebhardt Mktg. 201-377-3696
NM Albuquerque, Holder Haver 505-888-9614
NM Albuquerque, Nelco Electronix 505-293-1399
NY Clarence Center, Tech-Mark, Inc. 716-741-9138
NY Mendon, Tech-Mark, Inc. 716-624-3840
NY Rochester, Gebhardt Mktg. 716-256-6240
NY Utica, Tech-Mark, Inc. 315-733-0575
NC Charlotte, EMA 704-553-0110
NC Raleigh, EMA 919-846-9317
OH Cincinnati, The Sys. Grp. 513-742-2700
OK Tulsa, Acudata, Inc. 918-743-1875
OR Portland, Thorson Co. NW 503-293-9001
PA Aston, Systech Assocs., Inc. 215-459-2223
PA Bala Cynwyd, Systech Assocs., Inc. 215-238-0267
TX Austin, Acudata, Inc. 512-478-1018
TX Houston, Acudata, Inc. 713-580-2451
TX Plano, Acudata, Inc. 214-424-3567
UT Salt Lake City, Holder Hauer 801-487-7077
WA Bellevue, Thorson Co. N.W. 206-455-9180
WA Lynnwood, Blair Hirsh Co., Inc. 206-774-8151
WI Waukesha, Micro-Tex 414-542-5352

Local Distributors

AL Huntsville, Hall-Mark Elctrns. 205-837-8700
AL Huntsville, RS Elctrns. 205-721-9999
AZ Phoenix, Force Elctrns. 602-437-1060
AR Phoenix, Hall-Mark Elctrns. 602-437-1200
CA Chatsworth, Hall-Mark Elctrns. 818-773-4500
CA El Segundo, Force Elctrns. 213-772-1324
CA Inglewood, Newark Elctrns. 310-672-8548
CA Irvine, Hall-Mark Elctrns. 714-727-6000
CA Rocklin, Hall-Mark Elctrns. 916-624-9781
CA San Diego, Force Elctrns. 619-569-9661
CA San Diego, Hall-Mark Elctrns. 619-268-1201
CA San Jose, Hall-Mark Elctrns. 408-432-4000
CA San Jose, Rose Elctrns. 408-263-9700
CA Santa Clara, Force Elctrns. 408-748-1324
CO Denver, Newark Elctrns. 303-757-8531
CO Englewood, Hall-Mark Elctrns. 303-790-1662
CO Enlgewood, Harrison Equip. Co., Inc. 303-694-6320
CT Cheshire, Hall-Mark Elctrns. 203-271-2844
CT Danbury, Heilind Elctrns., Inc. 800-243-1043
CT Danbury, Pilgram Elctrns. 203-792-7274
CT Wallingford, Greene-Shaw Co., Inc. 203-265-3333
FL Casselberry, Hall-Mark Elctrns. 407-830-5855
FL Largo, Hall-Mark Elctrns. 813-541-7440
FL Pompano Bch., Hall-Mark Elctrns. 305-971-9280
GA Duluth, Hall-Mark Elctrns. 404-623-4400
GA Norcross, RS Elctrns. 404-242-0520
IL Chicago, Newark Elctrns. 312-784-5100
IL Des Plaines, Advent Elctrns. 708-297-6200
IL Wood Dale, Hall-Mark Elctrns. 708-860-3800
IN Indianapolis, Advent Elctrns. 317-872-4910
IN Indianapolis, Chelsea Elctrn. Dist. Grp. 317-253-9065
IN Indianapolis, Hall-Mark Elctrns. 317-872-8875
IN Indianapolis, RS Elctrns. 317-253-9065
IA Cedar Rapids, Advent Elctrns. 319-363-0221
KS Lenexa, Hall-Mark Elctrns. 913-888-4747
KS Overland Pk., Olive Elctrns., Inc. 913-362-1923
MD Columbia, Hall-Mark Elctrns. 301-988-9800
MD Jessup, Treeko Elctrns., Inc. 301-470-3300
MA Billerica, Hall-Mark Elctrns. 617-935-9777
MA Newton, Greene-Shaw Co., Inc. 800-678-6876
MA Wilmington, Heilind Elctrns., Inc. 508-657-4870
MI flint, RS Elctrns. 313-742-5000
MI Farmington Hills, Advent Elctrns. 313-477-1650
MI Grand Rapids, RS Elctrns. 616-241-3483
MI Livonia, Hall-Mark Elctrns. 313-462-1205
MI Livonia, RS Elctrns. 313-525-1155
MI Oak Park, Newark Elctrns. 313-967-1570
MN Eden Prairie, Hall-Mark Elctrns. 612-881-2600
MN Minneapolis, Newark Elctrns. 612-331-6350
MO Earth City, Hall-Mark Elctrns. 314-291-5350
MO Maryland Hgts., Olive Elctrns., Inc. 314-997-7709
NJ Cranford, Garden State Ind. El., Inc. 908-272-6400
NJ Moorestown, Hall-Mark Elctrns. 609-235-1900
NJ Parsippany, Hall-Mark Elctrns. 201-515-3000
NM Albuquerque, Harrison Int. Elctrns. 505-291-9951
NY Bohemia, Car-Lac Elctrns. 516-567-4200
NY Buffalo, Summit Distrs., Inc. 716-887-2800
NY Fairport, Hall-Mark Elctrns. 716-425-3300
NY Hauppauge, Fairmont Elctrns. 516-231-3313
NY Lynbrook, Peerless Radio Corp. 516-593-2121
NY Rochester, Summit Distrs., Inc. 716-334-8110
NY Ronkonkoma, Hall-Mark Elctrns. 516-737-0600
NC Raleigh, Greene-Shaw Co., Inc. 508-791-7861
NC Raleigh, Hall-Mark Elctrns. 919-872-0712
OH Maumee, RS Elctrns. 419-893-0721
OH Solon, Hall-Mark Elctrns. 216-349-4632
OH Valley View, Newark Elctrns. 216-447-8866
OH Worthington, Hall-Mark Elctrns. 617-888-3313
OK Tulsa, Hall-Mark Elctrns. 918-254-6110
PA Clifton Hgts., Tri-Com, Inc. 215-259-7400
SC Gaffney, Newark Elctrns. 803-487-1900
TX Austin, Force Elctrns. 512-258-8848
TX Austin, Hall-Mark Elctrns. 512-258-8848
TX Austin, Harrison Equip. Co., Inc. 512-258-1320
TX Dallas, Hall-Mark Elctrns. 214-343-5000
TX Dallas, Hall-Mark Elctrns. 214-553-4300
TX Dallas, Harrison Equip. Co., Inc. 214-239-2750
TX El Paso, Harrison Int. Elctrns. 915-598-3406
TX Farmers Branch, Force Elctrns. 214-247-9955
TX Garland, Newark Elctrns. 214-487-8144
TX Houston, Force Elctrns. 512-476-2104
TX San Antonio, Harrison Equip. Co., Inc. 512-490-0615
TX Stafford, Harrison Equip. Co., Inc. 713-879-2789
WA Seattle, Hall-Mark Elctrns. 206-547-0415
WI Milwaukee, Marsh Elctrns., Inc. 414-475-6000
WI New Berlin, Hall-Mark Elctrns. 414-797-7844
WI West Allis, Advent Elctrns. 414-475-6860
Can Burnaby, BC, Semad 604-420-9889
Can Calgary, Alb., Semad 403-252-5661
Can Markham, Ont., Semad 416-475-8500
Can Ottawa, Ont., Semad 613-727-8325
Can Pt. Claire, Que., Semad 514-694-0864

ELECTRONIC SPACE SYSTEMS CORP., Old Powder Mill Rd., Concord, MA 01742, Tel: 508-369-7200, TELEX: 923480 ESSCO WCRD, FAX: 508-369-7641; FSC No.: 15175; Empl.: 140; *Sls. Mgr.:* Stephen J. Contons

ELECTRONIC SPECIALISTS, 171 South Main St., Natick, MA 01760, Tel: 508-655-1532, 800-225-4876, TELEX: 955-329 ATTN: ESP; Empl.: 42; *Sls. Mgr.:* Frank Brown

FAX: 206-573-4635

ELECTRONIC SPECIALTY CORP., 14511 N.E. 13th Ave., Vancouver, WA 98685, Tel: 206-574-5000; FSC No.: 98927; Empl.: 100; *Sls. Mgr.:* Leon Fuller ..... **B•1484-1485**

Local Sales Offices & Reps

MN Hopkins, The Kits Co. 612-933-1888
MN Stillwater, The Kits Co. 612-439-8088
OR Beaverton, Earl & Brown Co., Inc. 503-643-5500
WA Redmond, Earl & Brown Co., Inc. 206-885-5064

EP/ELECTRONICS PRODUCTS, 645 Stewart Ave., Garden City, NY 11530, Tel: 516-227-1300, TELEX: 516-227-1901

ELECTRONICS REPRESENTATIVE ASSOC., 20 E. Huron St., Chicago, IL 60611, Tel: 312-649-1333, FAX: 312-649-9509

ELECTRONIC SYSTEMS DIVISION, Boeing Defense & Space Grp., P.O. Box 3999, M/S 3E-WF, Seattle, WA 98124-2499, Tel: 206-657-7474, TELEX: 329430, FAX: 206-657-1439; FSC No.: 81205; Empl.: 4,000; *Sls. Mgr.:* A.M. Sullivan

ELECTRONICS SYSTEMS, INC., P.O. Box 5013, Sioux Falls, SD 57117, Tel: 605-338-6868, FAX: 605-338-5061; Empl.: 150; *Sls. Mgr.:* Leo Reynolds

ELECTRONICS TEST CENTRE, Alberta Research Council, 250 Karl Clark Road, Edmonton, AB, Canada T6N 1E4, Tel: 403-450-5370, TELEX: 0372147, FAX: 403-462-7285; Empl.: 16; *Sls. Mgr.:* Chris Talliss

ELECTRONIC TELE-COMMUNICATIONS, INC., 3605 Clearview Place, Atlanta, GA 30340-2178, Tel: 404-457-5600, FAX: 404-455-3822; Empl.: 200; *Sls. Mgr.:* Doug Altman; *Dist. Mgr.:* Doug Altman

ELECTRONIC TRANSFORMER CORP., P.O. Box 487, Paterson, NJ 07544-0487, Tel: 201-942-2222, FAX: 201-942-9014; FSC No.: 72149; Empl.: 130; *Sls. Mgr.:* Dan Rovine

ELECTRON PRODUCTS, 5367 Third St., Irwindale, CA 91706, Tel: 818-960-2299, ESYLNK: 910-333-9810, FAX: 818-814-4434; FSC No.: 99515; Empl.: 65; *Sls. Mgr.:* Cliff Sailor; *Dist. Mgr.:* Ann Meunier

FAX: 909-695-7246

ELECTRO-NUMERICS, INC., 42213 Sarah Way, Temecula, CA 92590, Tel: 909-699-2437; FSC No.: 51666; Empl.: 16; *Sls. Mgr.:* Ro Shultz ..... **D•1345**

Local Distributors

IL	Chicago, Dalec Distrs.	312-283-0300
CA	Costa Mesa, FLW, Inc.	714-751-7512
GA	Atlanta, FLW S.E., Inc.	404-424-1731
MI	Detroit, RAM Meter, Inc.	313-398-6767
NY	Syracuse, W.E.L, Inc.	315-437-4281
UT	Murray, Instr. Specialists, Inc.	801-261-0142
VA	Roanoke, Elctrl. Equip. Sls. Co.	703-985-0446

ELECTRO OPTICAL INDUSTRIES INC., 859 Ward Drive, Santa Barbara, CA 93111, Tel: 805-964-6701 (ext. 280), TELEX: 65-8427 EOIND SNC, FAX: 805-967-8590; Empl.: 50

ELECTRO PHYSICS CO., INC., 3009 Central Ave., Waukegan, IL 60085, Tel: 708-249-5801; Empl.: 6; *Sls. Mgr.:* Abe Siegelman

ELECTROPHYSICS CORP., 373 Route 46 West Bldg. E, Fairfield, NJ 07004, Tel: 201-882-0211; Empl.: 25; *Sls. Mgr.:* Frank J. Vallese

ELECTRO-PREP, INC., 14 Kendrick Rd, Unit 3, Wareham Ind. Park, Wareham, MA, MA 02571, Tel: 508-291-2880, FAX: 508-291-2882; Empl.: 10; *Sls. Mgr.:* R. M. Sullivan

ELECTRORACK PRODUCTS CO., 1443 S. Sunkist St., Anaheim, CA 92806, Tel: 714-776-5420, FAX: 714-776-9683; FSC No.: 26073; Empl.: 60; *Sls. Mgr.:* Chris Allen; *Dist. Mgr.:* Mike Deming, V.P. Mktg. ..... **C•1097**

Local Sales Offices & Reps

AL	Huntsville, DHR Mktg., Inc.	205-536-0242
AZ	Phoenix, Mercier & Assoc.	602-404-1318
CA	Los Gatos, Norwest Elctrns.	408-395-9019
CO	Littleton, Mercier & Assoc.	303-770-0666
FL	Altamonte Springs, DHR Mktg., Inc.	407-331-1199
GA	Duluth, DHR Mktg., Inc.	404-564-0529
NC	Statesville, DHR Mktg., Inc.	704-872-0242
SC	Greenville, DHR Mktg., Inc.	803-235-3594
TN	Knoxville, DHR Mktg., Inc.	615-690-0870
UT	Sandy, Mercier & Assoc.	801-942-2665
WA	Seattle, Horton Assoc.	206-365-2795

ELECTRO RENT CORP., 6060 Sepulveda Blvd., Van Nuys, CA 91411, Tel: 800-688-1111, FAX: 818-786-4224; Empl.: 460; *Sls. Mgr.:* Gary Phillips

ELECTRO-SCIENCE LABS., INC., 416 E. Church Rd., Po Box 1533, King of Prussia, PA 19406-1533, Tel: 215-272-8000, TELEX: 83-4788, FAX: 215-272-6759; Empl.: 120

ELECTRO SCIENTIFIC INDUSTRIES, INC. (ESI), 13900 N.W. Science Pk. Dr., Portland, OR 97229, Tel: 503-641-4141, TELEX: 474-2064; FSC No.: 11837; Empl.: 500; *Sls. Mgr.:* Dick Donaca, Sys.

Electro-Space Fabricators, Inc.

FAX: 215-682-2133

ELECTRO SPACE FABRICATORS, 300 W. High St., P.O. BOX 67, Topton, PA 19562-0067, Tel: 215-682-7181; Empl.: 205; *Sls. Mgr.:* Robert J. Flynn .... **C•1026-1029**

Local Sales Offices & Reps

CA	Anaheim, Alpha Electro Sls.	714-665-6580
CA	Los Gatos, Shursales	408-399-7487
CT	Bloomfield, Zaslow Sls. Co.	203-242-7781
FL	Davie, DTS Mechanical Sls.	305-581-2884
GA	Norcross, Benchmark Tech. Sls.	404-446-1711
IL	Northbrook, Howard Benjamin Assocs.	312-272-2900
MD	Manchester, Imagitron Sls. Co.	800-638-3592
NJ	Boonton, Winter Assocs.	201-334-3434
NM	Albuquerque, Trembly Assocs.	505-266-8616
NY	Tonawanda, Promark Elctrns., Inc.	716-877-6300
OH	Galion, James R. Bright	419-468-3787
PA	Trevose, Omega Elctrns. Sls.	215-244-4000
TX	Dallas, DJ Sls. & Assocs.	214-783-8876
WA	Issaquah, Elctrns. Northwest	206-557-0851

Local Distributors

CA	Irvine, McGillis Inds.	714-551-4004
CA	Redwood City, HdB Elctrns.	415-368-1388
MD	Columbia, DK Elctrns.	301-995-1950
NY	Baldwin, Accessories for Elctrns.	516-546-1751

ELECTROSPACE SYSTEMS, INC., P. O. Box 831359, Richardson, TX 75083-1359, Tel: 214-470-2106, TELEX: 163590 ESIUT, TWX: 910-867-4768, FAX: 214-470-2466; FSC No.: 33875; Empl.: 1047; *Sls. Mgr.:* Richard M. McCloskey

ELECTRO STANDARDS LAB., INC., Data Communications Products Div., 36 Western Industrial Dr., Cranston, RI 02921, Tel: 401-943-1164, FAX: 401-946-5790; Empl.: 40; *Sls. Mgr.:* R. B. Sepe; *Dist. Mgr.:* R. B. Sepe

ELECTROSTATIC CONSULTING ASSOCS., 556 Lowell Rd., P.O. Box 552, Groton, MA 01450, Tel: 508-448-5485, FAX: 508-448-5583; Empl.: 5; *Sls. Mgr.:* Paul Malinaric

ELECTROSTATICS, 7718 Clairemont Mesa Blvd., San Diego, CA 92111, Tel: 619-279-1414, FAX: 619-279-1126; FSC No.: 34538; Empl.: 6

ELECTRO-SUPPORT SYSTEMS, 43445 Business Park Dr., Temecula, CA 92590, Tel: 909-676-2751, FAX: 909-694-0097; FSC No.: 66760; Empl.: 37; *Sls. Mgr.:* Don Pretot

ELECTROSWITCH, Unit of Electro Switch Corp., 180 King Ave., Weymouth, MA 02188, Tel: 617-335-5200, FAX: 617-335-4253; FSC No.: 82121; Empl.: 290; *Sls. Mgr.:* W. M. Mello ..... **B•1716**

Local Sales Offices & Reps

AZ	Phoenix, Howe & Howe Sls.	602-264-7971
CA	Irvine, Vale Elctrns.	714-551-4004
CA	San Ramon, W. Nott & Co.	415-820-8102
CO	Boulder, Comp. Prods. Sls.	303-530-2800
FL	Apopka, Floritronics	407-886-4818
GA	Albany, Holman-Gillespie	912-883-5565
GA	Atlanta, Holman-Gillespie	404-992-8820
IL	Wheeling, Electroswitch	708-593-2225
MD	Baltimore, Eastern Comps. Sls.	301-788-7050
MD	Gaithersburg, Naudain Assocs.-Southern	301-258-5040
MA	Weymouth, Electroswitch	617-340-0066
MI	Grand Haven, Hilltronics, Inc.	616-847-1010
MI	Royal Oak, Hilltronics	313-435-0920
MN	Roseville, Pro Tech Power Sls., Inc.	612-483-0409
MO	Chesterfield, Weisler & Assocs.	314-537-0010
MO	Kansas City, Weisler & Assocs.	816-421-1679
NH	Salem, Sales Engrg. Co.	603-893-5521
NJ	Fairfield, Electroswitch	201-227-6559
NJ	Marlton, Naudain Assocs.	609-983-5300
NY	Buffalo, Upstate Engrg.	716-632-0011
NY	Johnson City, Upstate Engrg.	607-729-0827
NY	Rochester, Upstate Engrg. Sls.	716-225-2383
NC	Cary, L.G. White Co.	919-380-8084
NC	Winston-Salem, L.G. White Co.	919-765-1665
OH	Medina, Rockford Controls OH, Inc.	216-725-3705
PA	Pittsburgh, R. F. Clark	412-242-9500
PA	W. Conshohocken, Eastern Comps.	215-825-8610
SC	Greenville, L.G. White Co.	803-271-0630
TX	Plano, Brice Co.	214-442-9808
TX	Stafford, Brice Co.	713-240-1788
VA	Ashland, L.G. White Co.	804-752-7055
WA	Kent, C.B. Parsons & Co.	206-762-7373
WI	Wauwatosa, Larsen Assocs.	414-258-0529

Local Distributors

CA	Los Angeles, Electric Switches	213-660-1310
FL	Ft. Lauderdale, Peerless Radio Corp. of Fla.	305-973-4141
OH	Medina, R.C.O.	216-725-3705
TX	Stafford, Barclay Whls.	713-240-1788
WA	Seattle, C.B. Parsons Co.	206-762-7373

ELECTRO-TEC CORPORATION A KAYDON COMPANY, 1501 North Main St., Blackburg, VA 24060, Tel: 703-552-2111, FAX: 703-951-3832; Empl.: 200; *Sls. Mgr.:* John J. Daly

ELECTRO-TECH SYSTEMS, INC., 115 E. Glenside Ave., Glenside, PA 19038, Tel: 215-887-2196, TELEX: 797137, FAX: 215-887-0131; Empl.: 14; *Sls. Mgr.:* Brian E. Hohman; *Dist. Mgr.:* Brian E. Hohman

ELECTROVERT USA CORP., 805 W. North Carrier Pkwy., No. 200, Grand Prairie, TX 75050, Tel: 214-606-1900, FAX: 214-606-1700; Empl.: 500; *Sls. Mgr.:* Craig Biggs

ELECTROWEAVE, INC., 425 Shrewsbury St., Worcester, MA 01604, Tel: 508-752-8932, FAX: 508-753-2173; FSC No.: 54207; Empl.: 25; *Sls. Mgr.:* Peter Andrews

ELEKTRISOLA INC., 126 High Street, Boscawen N, NH 03303, Tel: 603-796-2114, FAX: 603-796-2119; Empl.: 150; *Sls. Mgr.:* John W. Mueller

ELETECH ELECTRONICS, INC., 1262 E. Katella Ave., Anaheim, CA 92805, Tel: 714-385-1707, FAX: 714-385-1708; Empl.: 5

ELF ATOCHEM NORTH AMERICA, Three Pkwy., Philadelphia, PA 19102, Tel: 215-587-7520, FAX: 215-587-7497

ELFORM, INC., P.O. Box 7362, Reno, NV 89510, Tel: 702-829-1905, FAX: 702-829-1693; *Sls. Mgr.:* Roger R. Reinke

ELGAR

FAX: 619-458-0267

ELGAR ELECTRONICS CORPORATION, 9250 Brown Deer Rd., San Diego, CA 92121, Tel: 619-450-0085, 800-733-5427, TELEX: 211063 ELSD UR; FSC No.: 25965; Empl.: 275 ..... **D•1684-1685, 2257-2259**

Local Sales Offices & Reps

AL	Huntsville, Southern Mktg. Assocs., Inc.	205-534-6020
AZ	Phoenix, Tech. Mktg. Spec.	602-678-4940
CA	Carpenteria, Elgar Corp.	805-684-4400
CA	Redondo Beach, Ward/Davis Assocs.	310-643-6977
CA	Santa Clara, Ward/Davis Assocs.	408-245-3700
CO	Englewood, Tech. Mktg. Spec.	303-781-8819
FL	Longwood, Southern Mktg. Assocs., Inc.	407-682-7317
FL	Satellite Bch., Southern Mktg. Assocs., Inc.	407-777-3587
GA	Alpharetta, Southen Mktg. Assocs., Inc.	404-664-9797
IL	Arlington Heights, Dytec/Midwest	708-255-3200
IN	Indianapolis, Dytec/Midwest	317 849-9898
KS	Lenexa, Dytec/South	913-888-0215
KS	Wichita, Dytec/South	316-262-3189
MD	Columbia, Creative Mktg. Assoc.	410-880-4161
MA	Beverly, P. Jenks Assocs.	508-921-4600
MI	Troy, WKM Assocs.	313-588-2300
MN	Edina, Dytec Instrs.	612-831-7169
MO	Maryland Heights, Dytec/South Inc.	314-739-0665
NJ	Ridgewood, Elgar East	201-652-2898
NJ	Wayne, Advanced Tech. Mktg.	201-633-7070
NM	Albuquerque, Tech. Mktg. Specialists	505-291-1363
NY	Syracuse, Labtronics	315-455-7314
NC	Greensboro, Southern Mktg. Assocs., Inc.	919-632-9370
OH	Dayton, WKM Assocs.	513-434-7500
OH	Independence, WKM Assocs.	216-524-5930
OR	Wilsonville, Syntek	503-682-2750
PA	Southampton, Eastern Instrmn. of PA	215-355-7700
PA	Wexford, WKM Assocs.	412-934-2730
TX	Austin, Testech	512-338-9246
TX	Euless, Testech, Inc.	817-540-1944
TX	Houston, Testech	713-893-9661
TX	Richardson, Testech, Inc.	214-644-5010
TX	San Antonio, Jack Howard Assoc.	512-828-5741
WA	Bellevue, Syntek	206-462-7700
WA	Nine Mile Falls, Syntek	509-466-0451
WI	Hartland, Dytec Midwest	414-367-4550
Intl	CA San Diego, Elgar Intl. Corp.	619-450-0085

ELGENCO, INC., Box 460, Hurricane, UT 84737, Tel: 801-635-4954, FAX: 801-635-2158; FSC No.: 15455; *Sls. Mgr.:* D. E. Beecher ..... **D•1255**

Local Sales Offices & Reps

CA	Sherman Oaks, Windsor Dynamics	818-990-4173
CA	Sunnyvale, N-S Westronics	408-745-1102
CT	Meriden, Polytek Assoc.	203-634-4499
MA	Ashland, Polytek Assoc.	508-881-4741
NJ	Marmore, SWR Tech., Inc.	609-390-0094
NM	Albuquerque, Technology Mktg. Assoc.	505-345-8921
PA	Broomall, SWR Tech., Inc.	215-353-6639

ELGIN ELECTRONICS, 5533 New Perry Hwy., Erie, PA 16509-3570, Tel: 814-864-4921, FAX: 814-864-1260; Empl.: 300; *Sls. Mgr.:* Paul R. Barlock; *Dist. Mgr.:* Stanley R. Carlburg

ELITE ELECTRONIC ENGINEERING CO., 1516 Centre Circle, Downers Grove, IL 60515, Tel: 708-495-9770, FAX: 708-495-9785; FSC No.: 099-9999; Empl.: 34

ELITE ELECTRONICS, INC., 1408 Summit - Suite #5, Plano, TX 75074, Tel: 214-881-0026, 800-553-4376, FAX: 214-424-7299; Empl.: 4

ELITE SOFTWARE DEVELOPMENT, INC., P.O. Drawer 1194, Bryan, TX 77806, Tel: 409-846-2340, FAX: 409-846-4367; Empl.: 9; *Sls. Mgr.:* Terri J. King

ELIWELL INC., 2121 Downer St, Baldwinsville, NY 13027, Tel: 315-638-9598, FAX: 315-638-9718; *Sls. Mgr.:* William Corcoran; *Dist. Mgr.:* Joseph Markert

ELMA

FAX: 510-656-3783

ELMA ELECTRONIC INC., 44350 Grimmer Blvd., Fremont, CA 94538, Tel: 510-656-3400; Empl.: 60; *Sls. Mgr.:* Kris Holla ..... **B•1148, 1718-1720, 1827; C•1031-1033, 1530**

Local Sales Offices & Reps

AZ	Scotsdale, I.M. Systems	602-948-1495
CA	Fremont, Bear Resources	510-793-1064
CA	Fremont, ELMA Elctrn. Inc.	510-656-3400
CA	La Habra, West Coast Reps	213-690-9960
CA	Ontario, Elma Elctrn. Inc.	714-986-3753
IL	Schaumburg, Martan, Inc.	708-303-5660
MI	Ann Arbor, The Systems Grp.	313-930-1800
MN	Medina, James R. Johnson & Assocs.	612-478-9442
NH	Nashua, Bell Controls Inc.	603-882-6984
NY	Port Chester, Radiation Elctrns., Inc.	914-937-2300
OH	Cincinnati, The Systems Grp.	513-742-2700
OH	Dayton, Dolfuss-Root & Co.	513-433-6776
OH	Lakewood, The Systems Grp.	216-226-6535
OH	West Lake, Dolfuss-Root & Co.	216-899-9370
OH	Worthington, Dolfuss-Root & Co.	614-885-4844
OR	Beaverton, Cascade Data Mktg.	503-626-9348
PA	Hatboro, Monument Tech. Assoc.	215-443-5493
TX	Austin, Strategic Solutions Inc.	512-343-6323
TX	Houston, Strategic Solutions Inc.	713-496-0363
TX	Lewisville, Strategic Solutions Inc.	214-434-1921
TX	Plano, Elma Elctrn. Inc.	214-964-1700
VA	Newington, Scott Data Corp.	703-550-1300
WA	Redmond, Cascade Data Mktg.	206-747-6190
WI	Mequon, Martan, Inc.	414-241-4955
Can	Mississauga, Ont., Tracan Elctrns. Corp.	416-625-7752
Can	N. Vancouver, Tracan Elctrns. Corp.	604-984-4141

ELMA ENGINEERING, 1066 E. Meadow Circle, Palo Alto, CA 94303, Tel: 415-494-7303, TELEX: 345-560, FAX: 415-494-1093; FSC No.: 59810; Empl.: 38; *Sls. Mgr.:* T. A. Beno; *Dist. Mgr.:* T. A. Beno

ELMEC, INC., Technautic Corp., 300 N. McKemy Ave., Chandler, AZ 85226, Tel: 602-961-7100, FAX: 602-961-7173; FSC No.: 50691; Empl.: 55; *Sls. Mgr.:* Jim Hunt

ELMEC®
Delay Lines

FAX: 415-341-2370

ELMEC TECHNOLOGY OF AMERICA, INC., 1875 South Grant St., Ste. 560, San Mateo, CA 94402, Tel: 415-341-1611; *Sls. Mgr.:* Thomas Y. Miracle ..... **A•1546-1551**

Local Sales Offices & Reps

CA	Seal Beach, TEXEL	213-596-9411
CA	Sunnyvale, Repron Assocs.	408-737-0510
CO	Denver, Promo Tech Sls.	303-692-8484
IL	Northfield, Feller Assocs. Inc.	708-446-8065
MA	Natick, Wayland Engrg. Sls.	508-655-6080
MN	Minneapolis, HMR Inc.	612-888-2122
OR	Portland, General Elctrns., Inc.	503-297-8500
WA	Stanwood, General Elctrns., Inc.	206-652-5917

Elmwood Sensors

FAX: 401-728-5390

ELMWOOD SENSORS, 500 Narragansett Park Drive, Pawtucket, RI 02861, Tel: 401-727-1300, TELEX: 6814066 ELMWOOD; Empl.: 1,000; *Sls. Mgr.:* Cesare Giammarco, Dir. of Sls. ..... **B•1872-1873**

Local Sales Offices & Reps

AL	Decatur, Tenn. Tech. Sls.	205-350-5548
AZ	Phoenix, O'Donnell SW	602-944-9542
CA	San Diego, O'Donnell South	619-578-1645
CA	San Jose, O'Donnell South	408-456-2950
CA	Torrance, O'Donnell South	301-781-2255
CO	Boulder, Front Range Mktg.	303-443-4780
FL	Coral Springs, CBC Electronics	305-755-1111
FL	Longwood, CBC Elctrns.	407-831-5380
FL	Tampa, CBC Elctrns.	813-969-1901
GA	Marietta, Tenn. Tech. Sls.	404-971-1419
IL	Arlington Heights, Thermek	708-577-6900
IN	Fort Wayne, O. H. Bromberg	219-456-6010
KY	Alexandria, O. H. Bromberg & Assocs.	606-635-3036
KY	Louisville, O. H. Bromberg	502-456-1498
MD	Towson, Arbotek	410-825-0775
MN	Mendota, G-II Sls.	612-454-3086
MO	Kansas City, Hill & Company	816-361-1669
MO	St. Louis, Hill & Co.	314-842-6868
NH	Barrington, Global Tech. Sls.	603-664-5780
NJ	Pitman, Colrud Corp.	609-589-5866
NM	Albuquerque, O'Donnell Assocs.	505-889-4522
NY	E. Syracuse, Bastian Sales Agency	315-437-1482
NY	Fairport, Bastian Sls.	716-223-0237
NY	Islip, Cogent Technlgs.	516-277-7101
NY	Katonah, Cogent Technlg. Assocs.	914-232-2500
NC	Garner, Tenn-Tech	919-779-3309
OH	Cleveland, Allied Entprs.	216-779-0080
OH	Dayton, O. H. Bromberg	513-434-8788
OR	Hillsboro, Temco-Northwest	503-645-2030
NJ	Pitman, Colrud Corp.	609-589-5866
PA	Pittsburgh, Allied Entprs. East	412-788-2992
TX	Arlington, Ion Assocs.	817-695-8000
TX	Austin, Ion Assocs.	512-331-7251
TX	Houston, Ion Assocs.	713-537-7717
WA	Birch Bay, Temco B.C.	206-371-0423
WA	Bothell, Temco Northwest	206-481-6150
WA	Spokane, Temco Northwest	509-927-9392
WI	Mequon, Dickson-Zingler Assoc.	414-241-9140
Can	Mississauga, Ont., Andy Baumen Assocs.	416-828-2600

ELNA AMERICA, INC., 5686 Corporate Ave., Cypress, CA 90630, Tel: 714-761-8600, FAX: 714-761-9188; Empl.: 3500; *Sls. Mgr.:* Barbara Andrews; *Dist. Mgr.:* Barbara Andrews

ELNA FERRITE LABORATORIES, INC., PO Box 395, 234 Tinker St., Woodstock, NY 12498, Tel: 800-553-2870, FAX: 914-679-7010; Empl.: 14; *Sls. Mgr.:* Deborah McIntosh

ELNETIC ELECTRONICS, INC.:PLANT LOCATIONS, 1332 130th St., Gardena, CA 90247, Tel: 310-515-1546; FSC No.: 98460; Empl.: 10; *Sls. Mgr.:* Ernest H. Carlson, Jr.

ELNIK SYSTEMS, IPM, Inc., 3 Edison Place, Fairfield, NJ 07004, Tel: 201-882-8033, FAX: 201-882-8037; Empl.: 8; *Sls. Mgr.:* Claus J. Joens

ELOGRAPHICS INC., 105 Randolph Rd., Oak Ridge, TN 37830, Tel: 615-482-4100, FAX: 615-482-4943; *Sls. Mgr.:* Joe Barresi

ELPAC COMPONENTS, Elpac Electronics, Inc., 1562 Reynolds, Irvine, CA 92714, Tel: 714-476-6070, FAX: 714-476-6085; FSC No.: 12406; Empl.: 130; *Sls. Mgr.:* Jim Degerstrom; *Dist. Mgr.:* Jim Degerstrom ..... **A•1076-1081**

Local Distributors

CA	Chatsworth, Mil-Comm	818-998-3111
CA	Irvine, Kelex	714-863-1230
CA	San Diego, Neumann Elctrns.	619-695-3005
CA	Santa Ana, BDS Elctrns.	714-662-1050
CA	Santa Clara, PSC Elctrns.	800-654-1518
FL	Melbourne, New Yorker	407-727-0955
IL	Northbrook, Classic Components	312-272-9650
IA	Cedar Rapids, Dee Elctrns.	319-365-7551
MA	Andover, Aved Elctrns.	508-688-3800
MN	Roseville, Parts 1	612-633-8079
NJ	S. Hackensack, Waltech	201-641-7300
NJ	Whippany, American Distr. Inc.	201-428-0510
NY	Mamaroneck, New Yorker Elec.	914-698-7600
NY	Elmsford, Ancar	914-592-7100
OH	Dayton, Electro Supply	513-299-5020
OK	Tulsa, Altair Co.	918-252-5781
TX	Houston, Altair Co.	713-462-3029
TX	Richardson, Altair	214-231-5166
VT	Charlotte, Kellner	802-425-3250
WA	Seattle, Kam Elec.	206-382-1300
WI	Milwaukee, Progressive Image	414-321-4722
WI	New Berlin, Classic	414-786-5300
WI	Racine, Badger Elctrns.	414-637-1256

ELPAC POWER SYSTEMS, Elpac Electronics, Inc., 1562 Reynolds, Irvine, CA 92714, Tel: 714-476-6070, FAX: 714-476-6075; Empl.: 115; *Sls. Mgr.:* H. Myers; *Dist. Mgr.:* H. Myers

ELPAKCO, INC., 70 Wilbur St., Lowell, MA 01851, Tel: 508-453-3000, FAX: 508-453-9348; Empl.: 10; *Dist. Mgr.:* Stephen Fallon

ELPAQ, Elmo Semiconductor, 7590 N. Glenoaks Blvd., Burbank, CA 91504-1052, Tel: 818-768-7500, FAX: 818-767-3195; Empl.: 150

ELPAZ INSTRUMENTS, INC., 3000 Reed Blvd., Murrysville, PA 15668, Tel: 412-327-8744, FAX: 412-733-7609; FSC No.: OA2J2; Empl.: 5; *Sls. Mgr.:* Jim Shipman; *Dist. Mgr.:* Jim Shipman

E-L PRODUCTS COMPANY, Sub. of Astronics Corporation, 77 Olean Rd., E. Aurora, NY 14224, Tel: 716-655-0800, FAX: 716-655-0309; FSC No.: 14550; Empl.: 75; *Sls. Mgr.:* Time Zeigler

ELTECH, 181 Gibraltar Rd., Horsham, PA 19044, Tel: 215-441-0404, FAX: 215-441-8299; Empl.: 50; *Sls. Mgr.:* Brad Lizotte ..... **B•1149**

Local Sales Offices & Reps

AZ	Tempe, Gassner & Clark	602-968-9037
CA	Anaheim, Gabriel & Assocs.	714-666-0660
CO	Golden, Cristee-Meade	303-279-5070
IL	Rolling Meadows, Staffco	708-259-8756
IN	Angola, Staffco	219-833-3323
MI	Rockford, Staffco	616-866-3070
OH	Cleveland, Staffco	216-331-5100
RI	Warwick, Ertronics	401-732-3567
TN	Brentwood, Staffco	615-377-9938

ELTEC INSTRUMENTS INC., P.O. Box 9610, Daytona Bch., FL 32120, Tel: 904-253-5328, TWX: 810-832-6294, FAX: 904-258-3791; Empl.: 75; *Sls. Mgr.:* Douglas S. Armstrong

ELTEK CORPORATION, 445 E. Main St., Hagerstown, IN 47346, Tel: 317-489-6121, FAX: 317-489-5491; Empl.: 7

ELTROL CORPORATION, 20942 Osborne Street, Bldg. I, Canoga Park, CA 91304, Tel: 818-709-0131, FAX: 818-709-0132; FSC No.: IER54; Empl.: 6; *Sls. Mgr.:* Terry E. Donovan ..... **B•1250**

Local Sales Offices & Reps

CA	Van Nuys, Halbar Assocs.	818-906-3941
OH	Broadview Hgts., Controlled Prods.	216-838-5700

ELVO:DIVISION OF ZUMBACH ELECTRONICS CORPORATION, 140 Kisco Avenue, Mt. Kisco, NY 10549-1407, Tel: 914-241-1008, FAX: 914-241-7096; *Sls. Mgr.:* Thomas O'Connor

E-MARK, INC., 4 Daniels Farm Rd., Ste. 328, Trumbull, CT 06611, Tel: 203-452-1003, FAX: 203-452-1135; FSC No.: 0L7X6; Empl.: 4; *Sls. Mgr.:* Bryan West

EMC GLOBAL TECHNOLOGIES INC., 4059 Skyron Dr., Doylestown, PA 18901, Tel: 215-340-0650, FAX: 215-340-1737; Empl.: 70; *Sls. Mgr.:* Joel Hayes

EMCO, Components Specialties Inc., 1172 Rte. 109, Lindenhurst, NY 11757, Tel: 516-957-8700, FAX: 516-957-9142; Empl.: 20; *Sls. Mgr.:* Eric Forman; *Dist. Mgr.:* Angela Carolan

EMCO HIGH VOLTAGE CO., 11126 Ridge Road, Sutter Creek, CA 95685, Tel: 209-223-3626, 800-546-3680, TELEX: 5101008006, FAX: 209-223-2779; FSC No.: 3T243; Empl.: 38; *Sls. Mgr.:* Jennifer Jackson ... **D•1686**

E/M CORPORATION, 2801 Kent Avenue, P.O. Box 2400, W. Lafayette, IN 47906, Tel: 317-497-6346, FAX: 317-497-6348; FSC No.: 11770; Empl.: 300; *Sls. Mgr.:* Nathan B. Barlow; *Dist. Mgr.:* Nathan B. Barlow

EMCOR PRODUCTS, Crenlo, Inc., 1600 Fourth Ave. NW, Rochester, MN 55901, Tel: 507-289-3371, FAX: 507-287-3405; *Sls. Mgr.:* Dan Estes ..... **C•1034-1037**

EMC TECHNOLOGY INC, 1971 Old Cuthbert Rd., Cherry Hill, NJ 08034, Tel: 609-429-7800, FAX: 609-429-6814; FSC No.: 24602; Empl.: 70; *Sls. Mgr.:* Peter Semitschew

E M D ELECTRONICS, Sigmatron L.P., 2201 Landmeier Rd., Elk Grove Village, IL 60007, Tel: 708-956-8000, FAX: 708-956-8082; Empl.: 150; *Sls. Mgr.:* Glen Holmes

EMDS, INC., 16618 Oakmont Ave., Gaithersburg, MD 20877, Tel: 301-840-5710, FAX: 301-840-8589; *Sls. Mgr.:* Anne Ledger ..... **D•1256**

EMERSON & CUMING, INC., 77 Dragon Court, Woburn, MA 01888, Tel: 617-938-8630

EMERSON COMPUTER POWER, 9650 Jeronimo Rd., Irvine, CA 92718, Tel: 714-457-3600, FAX: 714-457-3788; Empl.: 20; *Dist. Mgr.:* R. Braud

Please call factory for sales offices and nearest reps.

EMHART CANADA, LTD., See Mallory Components Div.

EMICO INC., 920 Candia Rd., Manchester, NH 03109, Tel: 603-669-5121, FAX: 603-669-5922; FSC No.: 85925; Empl.: 3000; *Sls. Mgr.:* Eileen M. Fagan

EMI TECHNOLOGY INC., See Penny & Giles Data Sys., Inc.

EMPIRE MAGNETICS, 5780 B LaBath Ave, Rohnert Park, CA 94928, Tel: 707-584-2801, FAX: 707-584-3418; Empl.: 10

Empro SHUNTS

FAX: 317-823-4835

EMPRO MANUFACTURING COMPANY, INC., P.O. Box 26060, Indianapolis, IN 46226, Tel: 317-823-4478; Empl.: 25 ..... **D•1257**

Local Sales Offices & Reps

CA	Montrose, Signal Entprs. Inc.	818-957-0640
GA	Atlanta, Brownell Electro Inc.	404-362-9009
IL	Chicago, Best Rep Co.	708-632-0473
MA	Burlington, E.I.L. Instr.	617-272-9450
NJ	Franklin, D. F. Tobias & Co.	201-209-8825
OH	Cleveland, Weschler Elec. Corp.	216-238-2550
PA	Philadelphia, Sunshine Sci. Instr. Inc.	215-673-5600
TX	Houston, Ev Smith Sls.	713-931-0403
WA	Seattle, Branom Instr. Co.	206-762-6050

Local Distributors

AZ	Tempe, Metermaster	602-431-0880
CA	Glendale, Instr. Meter Specialties	818-243-0416
CA	Livermore, Std. Meter Lab	510-449-0220
CA	Santa Fe Springs, Dae Instr. & Svc., Inc.	213-942-8843
FL	Miami Beach, PA Instrs., Inc.	305-868-5686
LA	Harahan, Indl. Instrs. Works	504-733-8355
MD	Hunt Valley, E.I.L. Instrs.	301-584-7400
NJ	Belleville, Miscorp	201-751-1190
OR	Portland, Westcon Inc.	503-283-0132
PA	Norristown, Kimberly-James	215-666-7286
TX	Beaumont, Straughn Elctrns.	409-838-4563
TX	Houston, American Analog	713-941-7265
TX	Houston, Meters & Instrs.	713-644-1631
WA	Seattle, Branom Instr. Co.	206-762-6050
WI	Milwaukee, E-M Instrs.	414-272-7799

E.M.S., Div. of Sandberg Industries, 14251 Chambers Rd., Tustin, CA 92680, Tel: 714-669-9473, FAX: 714-838-2967; Empl.: 125; *Sls. Mgr.:* Duane Halverson, VP Sls. ..... **C•1672**

Local Distributors

RI	Warwick, E.M.S.	401-884-4790

E M S DEVELOPMENT CORP., 100 Sea La., Farmingdale, NY 11735, Tel: 516-293-7900, FAX: 516-694-1093; FSC No.: 51435; Empl.: 100

ET Emulation Technology, Inc.

FAX: 408-982-0664

EMULATION TECHNOLOGY, INC., 2344 Walsh Ave., Bldg. F, Santa Clara, CA 95051, Tel: 408-982-0660, TELEX: 981866; Empl.: 18; *Sls. Mgr.:* Joseph J. Bagliere, Jr., Mktg. Mgr. ..... **C•1321**

Local Sales Offices & Reps

IL	Chicago, El/Mech Inc.	312-794-9100
OR	Beaverton, Blair Hirsh Co.	503-649-1007
TX	Carrollton, CTI Elctrns.	214-245-1266
WA	Kirland, Turn-A-Round	206-822-4634
Can	Ottawa, Ont., E.G. Lomas Ltd.	613-725-2177

Local Distributors

MI	Bloomfield Hills, Mackellar Assocs.	313-335-4440
NJ	Union, Meridian Supply Co.	908-687-6220
TX	Allen, Prime Distributing Co.	214-231-0170
TX	Richardson, Off The Shelf Comps., Inc.	214-238-0808

ENCLOSURE CORP., 2900 Wharton Rd., Bristol, PA 19007, Tel: 215-785-2900, FAX: 215-785-2960; FSC No.: 32360; Empl.: 75; *Sls. Mgr.:* Gene Goldner

ENCODER DIV., LITTON SYSTEMS, INC., See Litton Encoder Div.

ENCODER PRODUCTS, 1601 B Dover Rd.-Hwy.2, Sandpoint, ID 83864, Tel: 208-263-8541, FAX: 208-263-0541; Empl.: 100; *Sls. Mgr.:* Jim Burcham; *Dist. Mgr.:* Jim Burcham

ENCORE ELECTRONICS, INC., 4400 Route 50, Saratoga Springs, NY 12866, Tel: 518-584-5354, FAX: 518-584-5963; Empl.: 20

Local Sales Offices & Reps

CA	Huntington Beach, Transducer Sys.	714-969-7690
PA	Blairsville, Meas. Instrs. East, Inc.	412-459-8090

ENDECO, Leads Metal Products Inc., 1125-C Brookside Ave., Indianapolis, IN 46202-2748, Tel: 317-631-7200, FAX: 317-631-7237; Empl.: 6; *Sls. Mgr.:* Eileen Alexander; *Dist. Mgr.:* Eileen Alexander

ENDEVCO CORPORATION, Meggitt Aerospace, 30700 Rancho Viejo Rd., San Juan Capistrano, CA 92675, Tel: 714-493-8181, TELEX: 68-5608, FAX: 714-661-7231; FSC No.: 95411; Empl.: 400; *Sls. Mgr.:* B. Clark

ENDICOTT COIL CO., INC., 24 Charlotte St., Binghamton, NY 13905, Tel: 607-797-1263, FAX: 607-797-0151; Empl.: 110; *Sls. Mgr.:* Thomas E. Frank

ERG™ Endicott Research Group, Inc.

FAX: 607-754-9255

ENDICOTT RESEARCH GROUP, 2601 Wayne St., P.O. Box 269, Endicott, NY 13760, Tel: 607-754-9187; FSC No.: 63312; Empl.: 120 ... **B•1045-1048; D•1687, 2106-2107**

Local Sales Offices & Reps

AZ	Finn-Patt	602-954-8275
CA	Granada Hills, Plustronics	818-830-3304, FAX:714-475-0717
CA	Imperial Counties, Mesa Comps., Inc.	619-278-8021,FAX:619-576-0964
CA	Newport Beach, Plustronics	714-476-8009, FAX:714-475-0717
CA	Saratoga, Testco, Inc.	408-253-1900, FAX:408-253-3444
CO	Seale & Assocs.	303-695-1980,FAX:303-695-1984
CT	Bloomfield, Sir/DSA	203-243-9343, FAX:203-243-8346
IL	Elk Grove Village, Carlson Elctrn. Sls.	708-956-8240,FAX:708-956-8289
IA	Spectrum Sls.	319-366-0576,FAX:319-366-0635
KS	Overland Park, Spectrum Sls.	913-648-6811, FAX:913-648-6823
MD	Freedman-Malta Assocs.	301-879-3148, FAX:301-838-0789
MA	Westford, SIR/DSA	508-692-2500, FAX:508-692-9085
MN	Minneapolis, OEM Prods.	612-831-7373, FAX:612-831-7376
MO	Florissant, Spectrum Sls.	314-921-1313, FAX:314-921-0701
NJ	Budd Lake, Guido Assoc.	201-347-4643, FAX:201-691-1468
NC	Kernersville, Wallace Elctrns. Sls., Inc.	919-996-2742,FAX:919-996-1630
OH	EMA/DeMuesy	614-436-9452,FAX:614-436-0969
OH	EMA, Inc.	216-562-6104,FAX:216-562-7498
OH	Centerville, EMA, Inc.	513-433-2800, FAX:513-433-3147
PA	King of Prussia, Freedman-Malta Assocs.	215-337-9211,FAX:215-265-8764
WA	Bellevue, Testco, Inc.	206-454-7422, FAX:206-455-1706
WA	Vancouver, Testco, Inc.	206-693-7262, FAX:206-455-1706
WI	Milwaukee, Carlson Elctrn. Sls.	414-476-2790, FAX:414-476-2682
Can	Delta, B C, Norgay Entprs. Ltd.	604-275-1121
Can	New Foundland, Indigo Elctrns., Ltd.	613-831-3106, FAX:613-831-3107
Can	Ontario, Indigo Elctrns., Ltd.	416-670-0284, FAX:416-670-1743
Can	Ottawa, Ont., Norgay Entprs. Ltd.	613-745-4051, FAX:613-745-5626
Can	Quebec, Indigo Elctrns., Ltd.	514-696-6104, FAX:514-626-1244
Can	Sackville. NS, Norgay Entprs. Ltd.	902-864-4321, FAX:902-865-9044
Can	Toronto, Ont., Norgay Entprs.	416-234-8966, FAX:416-234-8970
Can	Westmount, Que., Norgay Entprs. Ltd.	514-932-3233,FAX:819-657-4337

ENDRESS & HAUSER INSTRUMENTS, 2350 Endress Place, Greenwood, IN 46143, Tel: 317-535-7138, 800-428-4344, TELEX: 27-2195, FAX: 317-535-8498; Empl.: 200; *Sls. Mgr.:* Mike Stilabower

ENERCO, INC., 9615 W. Marginal Way S., Seattle, WA 98108, Tel: 206-762-1422; Empl.: 5; *Sls. Mgr.:* Lee Rabie

ENERGY

FAX: 301-699-8107

ENERGY, LTD., 4714 Upshur Street, Bladensburg, MD 20710, Tel: 301-699-1144; Empl.: 10 ..... **D•2260**

Local Sales Offices & Reps

MD	Bladensburg, Energy, Ltd.	301-699-1144

Local Distributors

MD	Bladensburg, Energy, Ltd.	301-699-1144

ENERGY SYSTEMS, 12004 NE 95th St., No. 840, Vancouver, WA 98682, Tel: 206-896-8310, FAX: 206-896-8457; Empl.: 25

ENERTECH CONSULTANTS, 300 Orchard City Dr.,Ste. 132, Campbell, CA 95008, Tel: 408-866-7266, FAX: 408-866-7279; Empl.: 20; *Sls. Mgr.:* Carolyn J. Persall

ENGINEERED ASSEMBLIES & COMPONENTS CORP., 380 North St., Teterboro, NJ 07608, Tel: 201-288-4477, 800-447-5639, FAX: 201-288-1515; Empl.: 106; *Sls. Mgr.:* Tim Teem / Peter Hunkeler; *Dist. Mgr.:* John Deleodice ..... **D•1448-1449**

Local Sales Offices & Reps

FL	St. Petersburg, EAC-Engrd. Assemblies & Comp. Corp.	813-328-1970
GA	Norcross, EAC-Engrd. Assemblies & Comp. Corp.	404-446-3135
MA	Sutton, EAC-Engrd. Assemblies & Comp. Corp.	508-865-0722
NJ	Teterboro (Hdqtrs.), EAC-Engrd. Assemblies & Comp. Corp.	201-288-4477
NC	Raleigh, EAC-Engrg. Assemblies & Comp. Corp.	919-790-9700

ENGINEERED COMPONENTS CO., P. O. Box 8121, San Luis Obispo, CA 93403-8121, Tel: 805-544-3800, FAX: 805-544-8091; FSC No.: 32440; Empl.: 102

ENGINEERED MAGNETICS, INC., 18435 Susana Rd., Rancho Dominguez, CA 90221, Tel: 310-635-9555, TWX: 910-325-6208, ESYLNK: 310-631-0313; FSC No.: 06509; Empl.: 100; *Sls. Mgr.:* S. Miller

ENGINEERED SYSTEMS & DESIGNS, 119A Sandy Dr., Newark, DE 19713, Tel: 302-456-0446, FAX: 302-456-0441; Empl.: 12; *Sls. Mgr.:* Jamie C. Smith

ENGINEERING DESIGN & SLS., One E.D.S. Way, Danville, VA 24541, Tel: 804-792-6405, FAX: 804-792-6415; Empl.: 75; *Sls. Mgr.:* Mark Gignac

ENGLER INSTRUMENTS OPERATION, See Stemco Instruments, Colt Inds.

ENI, DIV. OF ASTEC AMERICA, INC., 100 Highpower Road, Rochester, NY 14623, Tel: 716-427-8300, ESYLNK: 62855365, FAX: 716-427-7839; Empl.: 300 ..... **D•1011**

Local Sales Offices & Reps

AZ	Tempe, Trembly Assocs.	602-967-2058
CA	Chatsworth, Technlgs. West	818-700-6426
CA	Santa Clara, ENI	408-727-0993

CO Golden, Trembly Assocs. 303-279-3019
FL Cocoa Beach, Teqspec 407-783-3444
FL Palm Harbor, Teqspec 813-942-6006
GA Snellville, Teqspec 404-972-7955
IL Elmhurst, Sector Engrg. 708-530-7850
IN Indianapolis, Sector Engrg. 317-253-9221
KS Overland Pk., Ramsey Assocs. 913-541-1007
MD Laurel, Elctm. Mktg. Assoc. 301-953-7800
MA Stow, HG Assocs. 508-897-3190
MI Troy, WKM Assocs. 313-588-2300
MN Minneapolis, Sector Engrg. 612-378-2123
MO St. Louis, Ramsey Assocs. 314-532-9386
NM Albuquerque, Trembly Assocs. 505-266-8616
NY Great Neck, RTI, Inc. 516-829-3770
NY Rochester, Taerep, Inc. 716-586-8710
NY Whitney Pt., Taerep, Inc. 607-692-3705
NC Winston Salem, Teqspec 919-765-5553
OH Dayton, WKM Assocs. 513-434-7500
OH Independence, WKM Assocs. 216-524-5930
OR Wilsonville, Syntek 503-682-2750
TX Houston, Lear Assocs. 713-488-7893
TX Richardson, Lear Assocs. 214-231-5388
UT N. Salt Lake, Trembly Assocs. 801-295-4703
WA Bellevue, Syntek 206-462-7700
WI Milwaukee, Sector Engrg. 414-352-8280
Can Dorval, Arritsu Wiltron Inst. 514-421-3737
Can Mississauga, Arritsu Wiltron Inst. 416-890-7799
Can Nepean, Arritsu Wiltron Inst. 613-828-4090
Can Richmond, Arritsu Wiltron Inst. 604-244-3815

ENM COMPANY, 5617 Northwest Highway, Chicago, IL 60646, Tel: 312-775-8400, TELEX: 25-4068, FAX: 312-775-5968; Empl.: 100ò; *Sls. Mgr.:* Lee Bryant

ENNOVATION OF WISCONSIN, INC., 806 Elm St.-P.O. Box 258, Watertown, WI 53094, Tel: 414-261-2996, FAX: 414-261-3432; Empl.: 5; *Sls. Mgr.:* Enno Knief; *Dist. Mgr.:* Enno Knief

ENPROTECH CORP., 445 West Michigan Ave., Kalamazoo, MI 49007, Tel: 616-381-0665, FAX: 616-381-9810; Empl.: 125

Ensign Corporation

CUSTOM & PRE-DESIGNED TRANSFORMERS

FAX: 708-789-3206

ENSIGN CORP., 7960 S. Madison Street, Burr Ridge, IL 60521, Tel: 708-325-9343; Empl.: 150; *Sls. Mgr.:* J. Darrel Ensign **A•2326-2328**

Local Sales Offices & Reps

AL Huntsville, El Tech 205-464-0599
AZ Tempe, Gassner-Clark 602-968-9037
CA Campbell, Kingway 408-866-5010
CA Huntington Bch., Kingway 714-846-3834
CA Tarzana, Kingway 818-609-1974
CO Denver, Donohue 303-455-1719
CT Meriden, Gerber 203-630-3477
FL Boynton Bch., D-Assocs., Inc. 305-492-8634
FL Orlando, D-Assocs., Inc. 407-321-9594
FL Tampa, D-Assocs., Inc. 813-960-0935
GA Lilburn, El Tech 404-564-1236
IL Godfrey, Crosslink 618-466-1118
IL Mt. Prospect, Dombrow 708-253-3326
IN Indianapolis, J.H. Weaver 317-849-1659
KS Prairie Vlg., Crosslink 913-649-7100
KY Ft. Wright, El Tech 606-331-3495
MA Burlington, Gerber 617-229-1150
MA Marlboro, Gerber 508-481-3130
MA S. Dartmouth, Gerber 617-990-3454
MI Bloomfield Hills, Mac Kellar 313-335-4440
MI Grand Haven, Mac Kellar 616-846-7990
MN Minneapolis, Tek Rep 612-832-0277
NH Hudson, Gerber 603-882-1566
NY Fairport, Promark 716-425-8100
NY Franklin Sq., Cooper-Simon 516-489-0404
NY Tonawanda, Promark 716-877-6300
NC Charlotte, El Tech 704-342-3648
OH Cleveland, L.H. Kaiser 216-461-4930
OK Tulsa, Comptech 918-266-1966
OR Beaverton, Luscombe 503-636-6664
PA Horsham, Jacobsen 215-674-2937
TX Austin, Comptech 512-343-0300
TX El Paso, Comptech 915-566-1022
TX Harlingen, Comptech 210-421-4501
TX Houston, Comptech 713-492-0005
TX Irving, Comptech 214-751-1181
TX San Antonio, Comptech 210-525-9913
VA Herndon, Metal Resources 703-318-8682
WA Bellevue, Luscombe 206-223-1541
WI Milwaukee, Dombrow 414-263-4116
Can Dorval, Que., Weiss 514-685-6644
Can Mississauga, Ont., Weiss 416-673-0011
Can Nepean, Ont., Weiss 613-225-1810
Can Vancouver, B.C., Weiss 604-873-1112
Can Winnipeg, Man., Weiss 204-772-3665

ENTECH CORP. OF VOLUSIA COUNTY, 8 Tower Circle West, Ormond Beach, FL 32174-8761, Tel: 904-672-7335, FAX: 904-672-7233

ENTECH SYSTEMS, INC., 17B Herman Dr., Simsbury, CT 06070, Tel: 203-651-9557, FAX: 203-658-2740; *Sls. Mgr.:* A. D. Jorczak

ENTERPRISE SYSTEMS CORP., PO Box 698, Dover, NH 03820, Tel: 603-742-7363, FAX: 603-742-7399; FSC No.: 79543; Empl.: 5; *Sls. Mgr.:* George Perrine

ENTRA CORPORATION, 8651 Castle Park Drive, Indianapolis, IN 46256, Tel: 317-849-8270, FAX: 317-849-7041; Empl.: 75; *Sls. Mgr.:* F. Paul McDonald; *Dist. Mgr.:* T.P. Wagner

ENTRAN DEVICES, 10 Washington Ave., Fairfield, NJ 07004, Tel: 201-227-1002, 800-635-0650, TELEX: 130-361, FAX: 201-227-6865; *Sls. Mgr.:* Robert L. Morrell **B•1936-1947**

ENTRELEC INC., 1950 Hurd Drive, Irving, TX 75038, Tel: 214-550-9025, FAX: 214-550-9215; Empl.: 50; *Sls. Mgr.:* F. D. Leynaert

ENVIRONMENTAL CONTAINER SYS., INC., See ECS Composites

ENVIRONMENTAL STRESS SYSTEMS, INC., 16310 N. Morris Rd., Sonora, CA 95370, Tel: 209-928-4900, FAX: 209-928-1117; *Sls. Mgr.:* Mel Ainsworth; *Dist. Mgr.:* Mel Ainsworth

ENVIRONMENTAL TELESIS & CONTROLS, P.O. Box 180206, Austin, TX 78718, Tel: 512-835-0330, FAX: 512-832-1775; Empl.: 12; *Sls. Mgr.:* Anna Diaz

ENVIROPLAN, 3 Becker Farm Rd., Roseland, NJ 07068, Tel: 201-994-2300, FAX: 201-994-5100; Empl.: 50; *Sls. Mgr.:* Robert Mullowney

EOG, INC., OMX, INC., 10947 Golden West Drive, Hunt Valley, MD 21031, Tel: 410-785-3000, FAX: 410-771-5814; FSC No.: 17521; Empl.: 175; *Sls. Mgr.:* John D. Fabrizio

EPC IDENTIFICATION SYS., 505 Martin Ave., Rohnert Park, CA 94928, Tel: 707-585-8811, TWX: 910-3382-311, FAX: 707-585-8688; FSC No.: 67041; Empl.: 16; *Sls. Mgr.:* William Bolster; *Dist. Mgr.:* William Bolster

EPCO PRODUCTS INC., P.O. Box N. Cottage St., WAllkill, NY 12589, Tel: 914-895-2033, FAX: 914-895-2279; Empl.: 45; *Sls. Mgr.:* Mark Giegel

EPD ELECTRONICS, INC., 16921 S. Western Ave.-Bldg. 300, Gardena, CA 90247, Tel: 310-515-4996, FAX: 310-515-5011; Empl.: 6 **D•1073, 1688**

Local Sales Offices & Reps

IA Burlington, JS Ridge Entprs., Inc. 319-754-8745
NJ Bricktown, Bryan Elctrn. Sls. Co. 201-840-8487
OR Portland, Dale G. Weber Co. 503-234-0686
TN White House, Apple Sls. & Mktg. 615-672-4498

EPE TECHNOLOGIES, INC., Subsidiary of Square D, 1660 Scenic Avenue, Costa Mesa, CA 92627, Tel: 714-557-1636, FAX: 714-957-1103; Empl.: 300; *Sls. Mgr.:* Dan Mathews, Dir. of Sls.; *Dist. Mgr.:* Dan Mathews, Dir. of Sls.

Please call factory for sales representative and distributor information.

EPH ENGINEERING ASSOCIATES, INC., 21 East 400 South, Orem, UT 84058, Tel: 801-226-1383, FAX: 801-226-1437

EPIC, INC., 150 Nassau St., New York, NY 10038, Tel: 212-349-2470, FAX: 212-406-2508; Empl.: 8; *Sls. Mgr.:* Kelly Irwin

EPIC RESINS, General Fiberglass Supply, Inc., 1415 Ellis St., Waukesha, WI 53186, Tel: 414-521-2255, FAX: 414-521-1320; Empl.: 20; *Sls. Mgr.:* Daniel Veenhuis

EPM CORPORATION, 8866 Kelso Dr., Baltimore, MD 21221, Tel: 410-686-7800, TELEX: 87569, FAX: 410-686-4662; Empl.: 75

EPOXY TECHNOLOGY, INC., 14 Fortune Dr., Billerica, MA 01821, Tel: 508-667-3805, 800-227-2201, FAX: 508-663-9782; FSC No.: 33246; Empl.: 26; *Sls. Mgr.:* Ann L. Delmarsh

Local Sales Offices & Reps

AZ Phoenix, Wadsworth/Pacific 602-994-4840
CA Atherton, Wadsworth/Pacific 415-321-3619
CA Fullerton, T.C. Rapp Co. 714-773-9350
CO Ft. Collins, Rep Sls. 303-226-1504
FL Tampa, Florida Elctron. Assoc. 813-972-7992
IL Palatine, Crimson Sls. Inc. 708-304-8250
MA Newton, Normell Assoc. 617-969-5478
MN Minneapolis, InterTec Assoc. 612-921-8443
NY Fair Haven, Feikert Assoc. 315-433-1124
OH Dayton, J. Stephenson & Assoc. 513-435-0745
OR Hillsboro, Ryan Tech. Svcs. 503-681-0790
PA Bethlehem, Microstar 215-867-0612

THE EPPLEY LABORATORY, INC., 12 Sheffield Avenue, Newport, RI 02840, Tel: 401-847-1020, FAX: 401-847-1031; Empl.: 25

EPSCO INCORPORATED, 1115 Hilltop Dr., Itasca, IL 60143-1120, Tel: 708-250-0410, FAX: 708-250-0521; FSC No.: 53003; Empl.: 8; *Sls. Mgr.:* Wendie Peters V.P. **D•1689**

Local Distributors

AR Little Rock, Carlton-Bates Co. 501-562-9100
CA Santa Barbara, Abbeon Cal Inc. 805-966-0810
CO Denver, Fisher Scientific 303-371-0888
CT Stanford, Aero Quality Sls. 1-800-288-1954
IL Chicago, Electro Inds. 312-736-0999
IL Countryside, Inotek/Pacific Indicator 708-352-3500
IL Elmhurst, McMaster-Carr Supp. 708-834-9600
IN East Chicago, Acro Elctrns. Corp. 219-397-8681
LA Lafayette, Ralph's Inc. 318-233-0105
LA New Orleans, Radio Parts Inc. 504-581-5959
MA Lynn, Land Elctrns. 617-592-2220
MI Jackson, Fulton Radio Supp. 517-784-6106
MN Minneapolis, Allied Elctrns. 612-881-0838
MO Olivette, Fryer Co. 314-997-6807
NJ Aberdeen, J.G. Elctrns. 908-583-5352
NJ Bridgeport, VWR Scientific 609-467-2600
NJ New Brunswick, McMaster-Carr Supp. Co. 908-329-3200
NM Albuquerque, Southwest Metals & Supps. 505-247-2111
NY Syracuse, Stewart Smith 315-437-7836
OH Warren, Rem Elctrns. Supp. 216-373-1300
SC Charleston, Wholesale Inds. Elec. 803-722-2634
TX Ft. Worth, Allied Elctrns. 817-595-3500
TX Houston, Angie Elctrns. 1-800-666-4616
WI Milwaukee, Industrial Elctrns. Supp. 414-276-1212

EPSILON-LAMBDA ELCTRNS. CORP., 427 Stevens St., Geneva, IL 60134, Tel: 708-232-9611, TELEX: 708-232-9613; Empl.: 20; *Sls. Mgr.:* R. Knox

EPSON®

FAX: 310-782-5350

EPSON AMERICA, INC./OEM DIV., 20770 Madrona Ave., Torrance, CA 90503, Tel: 310-787-6300; Empl.: 900; *Sls. Mgr.:* Walter Carlos, Dir. of Sls. **A•1388-1395; B•1050-1061; D•1088-1095**

Local Sales Offices & Reps

CA Los Angeles, Epson America, Inc./OEM Div. 714-768-7474
CA San Francisco, Epson America, Inc./OEM Div. 408-249-0710
IL Chicago, Epson America, Inc./OEM Div. 815-455-7630
MA Boston, Epson America, Inc./OEM Div. 617-245-8007

EPSON

FAX: 310-782-5320

EPSON AMERICA INC., Component Sales Dept., 20770 Madrona Ave., Torrance, CA 90503, Tel: 310-782-5318; *Sls. Mgr.:* Hideo Akiyama; *Dist. Mgr.:* Rob Turner **A•1388-1395; B•1050-1061; D•1088-1095**

Local Sales Offices & Reps

AL Madison, Concord Comp Reps 205-772-8883, FAX:205-772-8262
AZ Scottsdale, Fred Board Assocs. 602-994-9388, FAX:602-994-9477
AZ Tucson, Fred Board Assocs. 602-299-1508, FAX:602-797-1683
CA Cupertino, Costar, Inc. 408-446-9339, FAX:408-446-4885
CA Encinitas, Bager Elctrns. Inc. 619-632-8816, FAX:619-632-8810
CA Woodland Hills, Bager Elctrns.Inc. 818-712-0011, FAX:818-712-0160
CO Colorado Springs, Western Region Mktg. 719-548-8282,FAX:719-548-0462
CO Westminster, Western Region Mktg. ... 303-428-8088, FAX:303-426-8585
FL Casselberry, Dyne-A-Mark 407-831-2822, FAX:407-834-4524
FL Ft. Lauderdale, Dyne-A-Mark 305-771-6501, FAX:305-772-0114
GA Norcross, Concord Comp. Reps 404-416-9597, FAX:404-441-0790
IL Itasca, LTD Technlgs. 708-773-2900, FAX:708-773-0358
IN Indianapolis, C.C. Electro Sls. 317-921-5000, FAX:317-921-5005
KS Shawnee Mission, Microtronics, Inc. 913-262-1444, FAX:913-262-1445
MD Ellicott City, Technlg. Sls. Assocs. 301-461-7802, FAX:301-461-7888
MA Needham Heights, Rosen Assocs. Inc. 617-449-4700,FAX:617-449-5245
MN Eden Prairie, Electromark 612-944-5850, FAX:612-944-5855
NJ Parlin, JMR Sls; Inc. 201-525-8000, FAX:201-525-8805
NY Pittsford, Elcom Sls., Inc. 716-385-1400, FAX:716-248-8531
NY Skaneateles, Elcom Sls., Inc. 315-685-8967, FAX:315-685-6273
NY Wading River, Niktronics 516-929-4671, FAX:516-929-1683
NC Raleigh, WLA Assocs. 919-231-9939, FAX:919-231-9949
OH Sheffield, J.D. Babb 216-934-4454, FAX:216-934-4454
OR Tigard, Matrex Sls. 503-245-8080, FAX:503-246-1848
PA Trevose, Omega Sls. 215-244-4000, FAX:215-244-4104
TX Austin, Component Technlg. Sls. 512-250-2450, FAX:512-288-7328
TX Dallas, Component Technlg. Sls. 214-783-8831, FAX:214-783-4801
TX Houston, Component Technlg. Sls. 713-961-1262, FAX:713-462-9906
UT Salt Lake City, Western Region Mktg. 801-268-9768,FAX:801-268-9796
WA Bellevue, Matrex Sls. 206-643-0363, FAX:206-746-3672
WI Milwaukee, LTD Technlgs. 414-774-1000, FAX:414-774-0593

Local Distributors

AL Bell Inds., Inc. 205-837-1074,FAX:205-830-5598
AL Huntsville, Nu Horizons Elctrns. Corp. 205-722-9330,FAX:205-722-9348
AZ Tempe, Bell Inds., Inc. 602-966-7800, FAX:602-967-6584
CA Agoura Hills, Bell Inds., Inc. 818-879-9494, FAX:818-991-7695
CA Cypress, Bell Inds., Inc. 714-895-7801, FAX:714-891-4570
CA Irvine, IEC Irvine ... 714-837-9960,FAX:714-837-8308
CA Los Angeles, Bell Inds., Inc. 310-826-2355, FAX:310-820-8328
CA Riverside, Elctrns. Supp. 714-683-7300, FAX:714-781-0453
CA Rocklin, Bell Inds., Inc. 916-652-0414, FAX:916-652-0403
CA Sacramento, Integrated Elctrns. (IEC) 916-363-6030,FAX:916-362-6926
CA San Diego, Bell Inds., Inc. 619-268-1277, FAX:619-268-3733
CA San Diego, Elctrns. Supp. 619-693-8222
CA San Jose, Elctrns. Supp. 408-453-3770, FAX:408-453-0398
CA San Jose, IEC San Jose 408-734-8500, FAX:408-435-8709
CA San Jose, Merit Elctrns., Inc. 408-434-0800, FAX:408-434-0935
CA Sunnyvale, Bell Inds., Inc. 408-734-8570, FAX:408-734-8875
CA Vienna, Dove Elctrns. 703-893-1821, FAX:703-448-8598
CO Denver, Bell Inds., Inc. 303-691-9010, FAX:303-691-9036
CO Denver, Integrated Elctrns. (IEC) 303-292-5537, FAX:303-292-0114
CT Wallingford, Bell Inds., Inc. 203-269-6801, FAX:203-269-6527
CT Wallingford, Cronin Elctrns., Inc. 203-265-3134
CT Wallingford, Nu Horizons Elctrns. Corp. 203-265-0162
FL Altamonte Springs, Bell Inds., Inc. 407-339-0078, FAX:407-339-0139
FL Ft. Lauderdale, Bell Inds., Inc. 305-421-1997, FAX:305-421-5706
FL Ft. Lauderdale, Nu Horizons Elctrns. Corp. 305-735-2555,FAX:305-735-2880
FL Melbourne, Pro-Formance Elctrns., Inc. 407-768-2866,FAX:407-768-2526
FL Tampa, Bell Inds., Inc. 813-541-4434
GA Norcross, Bell Inds., Inc. 404-446-7167, FAX:404-446-7264
GA Norcross, Nu Horizons Elctrns. Corp. 404-416-8666,FAX:404-416-9060
IL Bensenville, Voyager Elctrns. 708-860-1300, FAX:708-860-1573
IL Elk Grove Village, Bell Inds., Inc. 708-640-1910, FAX:708-640-0474
IL Hoffman Estates, IEC IL (Hoffman Estates) 708-843-2040,FAX:708-843-2320
IL Urbana, Bell Inds., Inc. 217-328-1077, FAX:217-328-1148
IN Ft. Wayne, Bell Inds., Inc. 219-423-3422, FAX:219-424-2433
IN Indianapolis, Bell Inds., Inc. 317-875-8200, FAX:317-875-8219
IN Indianapolis, Custom Svc. Elect. 317-879-9119, FAX:317-879-9136
IA Bell Inds., Inc. 319-395-0730,FAX:317-875-8219
KS Olathe, ECS Inc. ... 913-782-7787,FAX:913-782-6991
KY East, Bell Inds., Inc. 800-582-7492
KY West, Bell Inds., Inc. 800-445-8795
MD Columbia, Nu Horizons Elctrns. Corp. 410-995-6330,FAX:410-995-6332
MD Jessup, Bell Inds., Inc. 301-290-5100, FAX:301-953-0039
MA Andover, Bell Inds., Inc. 508-474-8880, FAX:508-474-8902
MA Needham, Cronin Elctrns., Inc. 617-449-5000, FAX:617-444-8395
MA Wakefield, Nu Horizons Elctrns. Corp. 617-246-4442,FAX:617-246-4462
MI Wixon, Bell Inds., Inc. 800-937-2355, FAX:513-435-6765
MN Bell Inds., Inc. 612-941-1493,FAX:612-938-7410
MN Fridley, Voyager Elctrns. Corp. 612-571-7766, FAX:612-571-9519
MN Thief River Falls, Digi-Key Corp. 612-944-5855, FAX:612-344-4539
MO Bell Inds., Inc. 314-647-2355,FAX:317-875-8219
NJ Edison, Dove Elctrns. 908-738-0321, FAX:908-738-0507
NJ Fairfield, Bell Inds., Inc. 201-227-6060, FAX:201-227-2626
NJ Flanders, Dove Elctrns. 201-927-6339
NJ Mt. Laurel, Nu Horizons Elctrns. Corp. 609-231-0900,FAX:609-231-9510
NJ Pine Brook, Nu Horizons Elctrns. Corp. 201-882-8300,FAX:201-882-8398
NJ West berlin, G.C.I. Corp. 609-768-6767, FAX:609-768-4289
NM Albuquerque, Bell Inds., Inc. 505-292-2700, FAX:505-275-2819
NY Amityville, Nu Horizons Elctrns. Corp. 516-226-6000,FAX:516-227-0082
NY E. Setauket, Dove Elctrns. 516-689-7733, FAX:516-689-7362
NY Rochester, Nu Horizons Elctrns. Corp. 716-292-0777,FAX:716-292-0750
NC Bell Inds., Inc. 919-821-4041,FAX:919-821-4953
OH Dayton, Bell Inds., Inc. (Industrial) 513-435-8660, FAX:513-435-6765
OH Dayton, Bell Inds., Inc. (Military) 513-434-8231, FAX:513-434-8103
OR Beaverton, IEC Beaverton (OR) 503-641-1690, FAX:503-646-3737
OR Lake Oswego, Bell Inds., Inc. 503-635-6500, FAX:503-635-4095
PA Pittsburgh, Bell Inds., Inc. 412-787-3883, FAX:412-788-4035
PA Trevose, Bell Inds., Inc. 215-953-2800, FAX:215-364-4928
SC Bell Inds., Inc. 800-322-7908,FAX:407-339-0139
TN Bell Inds., Inc. 615-367-4400,FAX:205-837-1074
TX Austin, Norvell Austin 512-343-2900, FAX:512-343-9602
TX Austin, Omni Pro Elctrns. 512-794-9200, FAX:512-338-9576
TX Dallas, Norvell Elctrns., Inc. 214-233-0020, FAX:214-490-7245
TX Dallas, Omni Pro Elctrns. 214-713-9000, FAX:214-732-8743
TX Houston, Norvell Houston 713-462-1666, FAX:713-462-3210
TX Houston, Omni-Pro Elctrns. 713-270-1700, FAX:713-270-8020
TX Richardson, Bell Inds., Inc. 214-690-0466, FAX:214-690-0822
UT Midvale, Bell Inds., Inc. 801-255-9611, FAX:801-255-2477
UT West Valley City, IEC Utah (Salt Lake) 801-977-9750,FAX:801-975-1207
WA Bell Inds., Inc. 206-867-5410,FAX:206-867-5159
WA Bellevue (WA), IEC Bellevue (MA) 206-455-2727, FAX:206-453-2963
WI Waukesha, Bell Inds., Inc. 414-547-8879, FAX:414-547-6547

EQUIPMENT REMARKETING COMPANY, Boston Financial & Equity Corporation, 20 Overland Street, Boston, MA 02215, Tel: 617-267-8600, FAX: 617-267-2370

EQUIPTO, 225 S. Highland Ave., Aurora, IL 60506, Tel: 708-859-1000, 800-323-0801, TWX: 910-232-0845, FAX: 708-859-3255; Empl.: 300; *Sls. Mgr.:* Tom Nilles; *Dist. Mgr.:* Jerry Reidy

EQUIPTO ELECTRONICS CORP., 351 Woodlawn Ave., Aurora, IL 60506-9988, Tel: 708-897-4691, FAX: 708-897-5314; FSC No.: 14002;Multiple; Empl.: 78; *Sls. Mgr.:* Robert Golz ..... **C•1038-1041**

ERA POLY-PLANAR DIV., See Poly-Planar, Inc.

ERASER CO., Box 4961, Syracuse, NY 13221, Tel: 315-454-3237, TELEX: 93-7442, FAX: 315-454-3090; Empl.: 45; *Sls. Mgr.:* Linda S. Cahill

ERC, See Electronic Research Co.

ERCONA, 979 North Ocean Ave., Patchogue, NY 11772, Tel: 516-758-0700, FAX: 516-758-0422; Empl.: 10; *Sls. Mgr.:* G. Moore; *Dist. Mgr.:* L. Mills

ERCON INCORPORATED, 26 Emerson Road, Waltham, MA 02154, Tel: 617-899-1497, FAX: 617-899-2650; *Sls. Mgr.:* Dennis Ehrreich

ERGOTRON, INC., 3450 Yankee Dr., Eagan, MN 55121, Tel: 612-452-8135, TELEX: 4310015, FAX: 612-452-8346; Empl.: 24; *Sls. Mgr.:* Harry C. Sweere

ERICSSON

FAX: 214-680-1059

ERICSSON COMPONENTS, INC., 403 International Parkway, Richardson, TX 75081, Tel: 214-997-6561, TELEX: 735389 ERICS RCHN ..... **D•1691-1697**

Local Sales Offices & Reps

AL Huntsville, The Novus Grp.,Inc. 205-534-0044
AZ Scottsdale, Sun Tech Sls. 602-860-8262
CA Cupertino, PEI Assocs. Inc. 408-253-1960
CA Garden Grove, Elsco Elctrns. 714-891-4621
CA San Diego, Elsco Elctrns. 619-292-1771
CO Denver, AKI 303-388-4488
CT Greenwich, Ericsson Comps. Inc. 203-625-7300
FL Altamonte Springs, Kinetic Sls., Inc. ... 407-339-3855
GA Norcross, The Novus Grp., Inc. 404-263-0320
IL Elk Grove Village, Carlson Elctrns. Sls. 708-956-8240
KS Lenexa, Web Assoc./Elctrns., Inc 913-541-8585
MA Whitinsville, Power Factor & Assoc. ... 508-234-6415
MN Edina, Mel Foster Tech. Sls., Inc. 612-941-9790
MO Florissant, Web Assoc./Elctrns., Inc. ... 314-921-5720
NJ Marlton, Naudain Assocs., Inc. 609-983-5300
NJ Parlin, JMR Sls., Inc. 201-525-8000
NY Wading River, Niktronics 516-929-4671
NC Cary, The Novus Grp., Inc. 919-460-7771
OH Cleveland, RK Comp. Sls., Inc. 216-642-9312
TX Dallas, Dynamark 214-437-3333
VA Herndon, Stinson Assocs. 703-620-1331
WA Redmond, EMG-Elec. Mktg. Grp. 206-882-0962
WA Vancouver, EMG Elec. Mktg. Grp. 206-944-0761
WI Milwaukee, Carlson Elctrns., Sls. 414-476-2790

Local Distributors

Can Markham, Ont., Deskin Inc. 416-475-1412

ERICSON MANUFACTURING CO., 4215 Hamann Pkwy., Willoughby, OH 44094, Tel: 216-951-8000, TELEX: 98-5390, FAX: 216-951-1867; Empl.: 110; *Sls. Mgr.:* Dave Hardy

ERIE TECHN. PRODS., See Murata Erie No. Amer., Inc.

ERNI COMPONENTS, 520 Southlake Blvd., Richmond, VA 23236, Tel: 804-794-6367, FAX: 804-379-2109; Empl.: 700; *Sls. Mgr.:* Thomas Noack

ESC ELECTRONICS CORPORATION

FAX: 201-947-0406

ESC ELECTRONICS CORP., 534 Bergen Blvd., Palisades Pk., NJ 07650, Tel: 201-947-0400; Empl.: 120 ..... **A•1552-1565, 2329**

Local Sales Offices & Reps

AL Huntsville, Murcota Corp. 205-539-8476
AZ Mesa, Sedco Sls. 602-461-9069
CA Newbury Pk., Westaironics 805-499-9844
CA Santa Clara, Rodgers Assocs. 408-984-8110
CO Denver, Donohue Sls. Co. 303-455-1719
FL Palm Harbor, Sigma Tech. Assocs. 813-789-5522
IL Elk Grove, Carlson Elctrn. Sls. Co. 312-956-8240
IA Cedar Rapids, Carlson Elctrn. Sls. Co. 319-378-1450
KS Lenexa, Midwest Tech. Sls. 913-888-5100
MD Ellicott City, Saltech 410-461-7350
MA Swansea, Poisson Assocs., Inc. 508-677-3655
MN Minneapolis, R-J, Inc. 612-866-3661
MO Earth City, Midwest Tech. Sls. 314-298-8787
NC Winston-Salem, Murcota Corp. 919-722-9445
OR Beaverton, Ravencraft 503-579-9261
TX Plano, Zeus Engrg. 214-423-2027
WI Milwaukee, Carlson Elctrn. Sls. Co. 414-476-2790
EXP NJ, Palisades Pk., ESC Elctrns. Corp. 201-947-0400
Can Toronto, Ont., CEA Assocs. 416-231-9717

ESCOD INDUSTRIES, Insilco, 755 New Ludlow Rd., S. Hadley, MA 01075, Tel: 413-536-1800, FAX: 413-536-8425; Empl.: 875

ESC TECHNOLOGIES, INC., 14115 Chadron Ave., Hawthorne, CA 90250, Tel: 310-970-4090, FAX: 310-970-0820; Empl.: 35; *Sls. Mgr.:* Gary L. Peterson; *Dist. Mgr.:* Gary L. Peterson

ESE, 142 Sierra St., El Segundo, CA 90245, Tel: 310-322-2136, FAX: 310-322-8127; FSC No.: 58525; Empl.: 25; *Sls. Mgr.:* Brian Way; *Dist. Mgr.:* Brian Way

ESICO/TRITON, Triton Industries Inc., Box 247, Deep River, CT 06417, Tel: 203-526-5361, TELEX: 955439, FAX: 203-526-9524; FSC No.: 54195

ESP SOLDER PLUS, 14 Blackstone Valley Pl., Lincoln, RI 02865, Tel: 800-338-4353, 401-333-3800, FAX: 401-333-4954; Empl.: 40; *Sls. Mgr.:* Ms. Kim Ranallo

E-SQUARED TECHNOLOGY CORP., 4475 Dupont Ct #9, Ventura, CA 93003, Tel: 805-644-9544, FAX: 805-644-9584; Empl.: 19; *Sls. Mgr.:* Larry D. Emery, Pres. & G.M.

ESS, INC., 16310 No. Morris Rd., Sonora, CA 95370, Tel: 209-928-4900, FAX: 209-928-1117

E-SWITCH, Electronic Components Groupe, 26 North Fifth St., Minneapolis, MN 55403, Tel: 612-375-9639, FAX: 612-375-1900; *Sls. Mgr.:* Rick Hampton; *Dist. Mgr.:* Rick Hampton ..... **B•1722-1723**

Local Sales Offices & Reps

AL Huntsville, New Age Elctrns. 205-895-9400
AZ Tempe, ACS of Arizona 602-731-9711
CA Orange, RD & D Sls., Engrg., Inc. 714-771-6110
CA San Jose, Westron Assocs. 408-264-4070
CO Littleton, Romulus Elctrns., Inc. 303-770-4888
FL Melbourne, Phoenix Comps., Inc. 407-723-4414
GA Duluth, New Age Elctrns. 404-476-0079
IL Palatine, Golbeck Milota 708-705-0602
IN Fishers, Connect 21, Inc. 317-578-2121
KS Lenexa, Midtec Assocs. 913-541-0505
MI Madison Hgts., D.E.M. Sls., Inc. 313-583-1500
MN Oakdale, Complete Sls. 612-731-2923
MO St. Louis, Midtec Assocs. 314-275-8666
NH Nashau, Bennetron 603-880-7008
NY Syracuse, ADR Technigs., Inc. 315-437-7087
OH Cleveland, Comps. Inc. 216-243-9200
OK Atoka, AID Elctrns., Inc. 405-889-7638
OR Aloha, Turn-A-Round Sls. 503-649-1007
PA Ft. Washington, SMC, Inc. 215-628-3394
TX Irving, AID Elctrns. 214-790-4761
VA Sterling, Beacon North Inc. 703-470-2480
WA Kirkland, Turn-A-Round Sls. 206-822-4634
WI Madison, Golbeck Milota 608-222-7037
Can Burlington, Ont., White Radio, Ltd. 416-632-6894

E-SYSTEMS, Greenville Div., P.O. Box 6056, Greenville, TX 75403-6056, Tel: 903-455-3450, FAX: 903-457-4413; *Sls. Mgr.:* C. L. Byrom

E-SYSTEMS, Melpar Div., 7700 Arlington Blvd., Falls Church, VA 22046, Tel: 703-560-5000, FAX: 703-280-4627; Empl.: 2,180

E-SYSTEMS, See Memcor-Truohm, Inc.

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Local Sales Offices & Reps

AL Huntsville, South Tech Sls. 205-880-8200
AZ Phoenix, Chaparral Elctrns. 602-996-5909
CA Los Angeles, Sierra-Pacific Eng. 714-731-3411
CA Oceanside, Sierra-Pacific Engrg. 619-945-5917
CA San Francisco, Ross Mktg. 408-988-8111
CA Santa Clara, Ross Mktg. Assocs. 408-988-8111
CA Tustin, Sierra-Pacific Engrg. 714-731-3411
CO Denver, Promo Tech 303-692-8484
CT East Haven, Eagle Assocs. 203-467-6542
FL Winter Springs, Sunland Assocs. 407-365-9533
GA Atlanta, South Tech 404-822-1764
GA Lilburn, South Tech Sls. 404-381-2088
IN Ft. Wayne, Needler Sls. Co. 219-447-2123
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KS Lenexa, Midtec Assoc. 913-541-0505
MA Boston, Eagle Assocs. 617-444-3446
MI Grand Rapids, Hilltronics, Inc. 616-364-0010
MI Royal Oak, Hilltronics, Inc. 313-435-0920
MN Eden Prairie, PWC, Inc. 612-934-1409
MO St. Louis, Midtec Assoc. 314-275-8666
NH Raymond, Eagle Assocs. 617-444-3446
NM Albuquerque, Chaparral Elctrns. 505-271-2266
NY Hauppauge, Aurora-Schmitt Assocs. 516-434-1313
NY Rochester, Lamb Comps. 716-328-6350
NC Raleigh, Godwin Assocs. 919-878-8000
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OH Dayton, Thompson & Assoc., Inc. 513-435-7733
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Can Surrey, B.C., Cana Rep Grp., Inc. 604-599-1232

Local Distributors

CA Van Nuys, Wes-Garde 1-800-275-7101
CT Hartford, Wes-Garde 1-800-275-7091
FL Lakeland, Wes-Garde 1-800-275-7102
IL Carol Stream, Wes-Garde 1-800-275-7095
KS Overland Park, Wes-Garde 1-800-275-7099
MO St. Louis, Wes-Garde 1-800-275-7097
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OR Wilsonville, Wes-Garde 1-800-275-7073
TX Dallas, Wes-Garde 1-800-275-7103
Can Burnaby, B.C., Cesco Elctrl. Supps. 604-273-2911
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Can Calgary, Alb., Cardinal Indl. Elctrns. 403-259-6817
Can Calgary, Alb., Electro Sonic 403-255-9550
Can Calgary, Alb., Memco 403-258-3399
Can Calgary, Alb., R.L. Brews & Sons Ltd. 403-243-1144
Can Chomedey Laval, Que., Futech A.S.C. Inc. 514-668-8086
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Can Langley, B.C., Panda Indust. Prods. Ltd. 604-888-2220
Can Ottawa, Ont., Electro Sonic Inc. 613-728-8333
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ETA POWER, See JETA Power Systems

ETI SYSTEMS, Polaris Indl. Entprs., 2251 Las Palmas Dr., Carlsbad, CA 92009, Tel: 619-929-0749, FAX: 619-929-0748; FSC No.: 952 762672; *Sls. Mgr.:* Bill Tice; *Dist. Mgr.:* Debbie Marshall ..... **A•2084-2085**

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CA	San Diego, Allied Elctrns.	619-279-2550
CA	Torrance, Allied Elctrns.	310-373-8828
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CT	Cheshire, Allied Elctrns.	203-272-7730
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GA	Duluth, Allied Elctrns.	404-497-9544
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MA	Billerica, Allied Elctrns.	508-667-7921
NY	Mineola, Allied Elctrns.	516-248-2360
NC	Raleigh, Allied Elctrns.	919-876-5845
OH	Beachwood, Allied Elctrns.	216-831-4900
OK	Tulsa, Allied Elctrns.	918-664-0844
PA	Newton Square, QDI	215-359-1000
PA	Pittsburgh, Allied Elctrns.	412-367-4124
TX	Ft. Worth, Allied Elctrns.	817-595-3500
TX	Houston, Allied Elctrns.	713-455-3993
TX	Humble, Allied Elctrns.	713-446-8005
VA	Virginia Bch., Allied Elctrns.	804-363-8662
WA	Everett, Allied Elctrns.	206-353-7313
WI	New Berlin, Allied Elctrns.	414-796-1280

ETM ELECTROMATIC INC, 35451 Dumbarton Ct., Newark, CA 94560, Tel: 510-797-1100, FAX: 510-797-4358; Empl.: 85; *Sls. Mgr.:* Kenneth F. Lillis

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FAX: 704-283-7170

ETRI, INC., 1503 Rocky River Rd., North, Monroe, NC 28110, Tel: 704-289-5423; *Sls. Mgr.:* Peter Pignetti ..... **C•1585-1591**

Local Sales Offices & Reps

AL	Huntsville, New Age Elctrns.	205-895-9400
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CA	Cupertino, Prism Tech. Sls.	408-366-6766
CA	Irvine, Groh Assocs.	714-837-9871
CA	San Diego, Bestronics	619-693-1111
FL	Boca Raton, Electrocraft	407-394-9686
FL	Largo, Electrocraft	813-544-1766
GA	Duluth, New Age Elctrns.	404-476-0079
IL	Glen Ellyn, Lincoln, Hodges	708-469-6750
KS	Overland Pk., Spectrum Sls.	913-648-6811
MD	Pasadena, EES	410-255-9686
MI	Chelsea, Sean T. Sls.	313-475-2021
MN	Minneapolis, Milt Westlund Assocs.	612-866-5002
MO	Florissant, Spectrum Sls.	314-921-1313
NH	Salem, Sls. Engrg. Co.	603-893-5521
NJ	Medford, McCoy Grp.	609-953-0770
NY	Port Washington, Ashtec, Inc.	516-767-0336
OH	Dayton, K W Elctrns.	513-890-2150
OH	Shaker Hgts., K W Elctrns.	216-491-9177
PA	Pittsburgh, K W Elctrns.	412-492-0777
PA	Valley Forge, McCoy Grp.	215-783-1919
TX	Dallas, Fralia Co. & Assoc.	817-354-1144
VA	Remington, EES	703-439-2866
WA	Redmond, SEA	206-883-4999
WA	Vancouver, SEA	206-573-5161
Can	Mississauga, Ont., R-Theta	416-890-0221

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CA	Fremont, Acacia/Deanco	510-663-7500
CA	Irvine, Acacia/Deanco	714-660-0834
CA	Oakland, Brill	510-834-5888
CA	San Diego, Acacia/Deanco	619-597-0577
CA	Santa Clara, Components Ctr.	408-988-3751
CO	Lakewood, Acacia/Deanco	303-232-2882
CT	Milford, Milgray Elctrns.	203-878-5538
FL	Altamonte Springs, Pioneer Elctrns.	305-834-9090
FL	Deerfield Beach, Pioneer Elctrns.	305-428-8877
FL	Lake Mary, Milgray Elctrns.	407-321-2555
FL	Tampa, Reptron	813-855-4656
GA	Norcross, Milgray Elctrns.	404-446-9777
IL	Bensenville, Voyager Elctrns.	312-860-1300
IL	Palatine, Milgray Elctrns.	708-202-1900
IL	Palatine, OHM Elctrns.	312-359-5500
IN	Indianapolis, Advent Elctrns.	317-872-4910
KS	Overland Park, Milgray Elctrns.	913-236-8800
MD	Columbia, Milgray Elctrns.	301-621-8169
MD	Gaithersburg, MS Elctrns.	301-921-0200
MA	Andover, Bell Industries	508-474-8880
MA	Tewksbury, Jaco Elctrns., Inc.	508-640-0010
MA	Wilmington, MilGray Elctrns.	508-657-5900
MA	Winchester, Webb Distribution	617-729-5800
MI	Livonia, LWC Elctrns.	313-464-7700
MN	Minneapolis, Stark Elctrns.	612-332-1325
NJ	Marlton, Milgray Elctrns.	609-983-5010
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NY	Pittsford, Milgray Elctrns.	716-381-9700
NC	Raleigh, Milgray Elctrns.	919-790-8094
OH	Cleveland, Milgray Elctrns.	216-447-1520
OR	Beaverton, Acacia/Deanco	503-646-3377
PA	Allentown, P.A. Peters	215-434-5237
PA	Montgomeryville, Reptron	215-643-2850
TX	Dallas, Milgray Elctrns.	214-248-1603
TX	Dallas, Norvell Elctrns.	214-233-0020
UT	Midvale, Bell Inds.	801-255-9611
VA	Charlottesville, Virginia Elctrn. Comps.	804-296-4184
WA	Redmond, Acacia/Deanco	206-881-5566
Can	Mississauga, Ont., R-Theta	416-890-0221

EUBANKS ENGINEERING, 950 E. Royal Oaks Dr., Monrovia, CA 91016, Tel: 818-357-7011, TELEX: 675403, FAX: 818-357-4718; Empl.: 90; *Sls. Mgr.:* James Reed

EURO-DIP, See Mill-Max Manufacturing Corp.

EURO QUARZ GMBH, See Raltron Electronics Corp.

EVANS ELECTRONICS, Box 5055, Berkeley, CA 94705, Tel: 510-653-3083

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IL	Lisle	708-964-8668
MO	St. Louis	314-982-2000
NJ	Saddle Brook	201-845-5400
OH	Independence	216-447-1127
TX	Dallas	214-661-1351
WA	Battle Ground	206-687-0375

EVEREST ELECTRONIC EQUIPMENT, 2683 Hamilton Mill Rd., Buford, GA 30518, Tel: 404-932-2900, FAX: 404-932-5473; Empl.: 240; *Sls. Mgr.:* Barry Holman; *Dist. Mgr.:* Barry Holman

EVEREST ELECTRONIC EQUIPMENT, INC., 2100 E. Orangewood Avenue, Anaheim, CA 92806, Tel: 714-634-2200, FAX: 908-446-5362; Empl.: 200; *Sls. Mgr.:* Barry Holman; *Dist. Mgr.:* Barry Holman

EVEREST INTERSCIENCE, INC., P. O. Box 3640, Fullerton, CA 92634-3640, Tel: 800-422-4342, FAX: 714-992-0178; Empl.: 20; *Sls. Mgr.:* Patrick Cash; *Dist. Mgr.:* Marilyn M. Everest

EVERETT CHARLES TECHNOLOGIES, FIXTURE DIVISION, One Fairchild Square, Clifton Park, NY 12065, Tel: 518-877-7042; Empl.: 150; *Sls. Mgr.:* Jack Banyas

EVI, INC., 7138 Columbia Gateway Dr., Columbia, MD 21046, Tel: 410-290-1919, FAX: 410-290-1925; Empl.: 30

EVOX-RIFA INC., 100 Tri State Int'l, Ste 290, Lincolnshire, IL 60069, Tel: 708-948-9511, FAX: 708-948-9320; Empl.: 2000; *Sls. Mgr.:* George Sinnokrak; *Dist. Mgr.:* George Sinnokrak

EWALD INSTRUMENTS CORP., 28 Maple St., Kent, CT 06757, Tel: 203-927-3278, FAX: 203-927-3031

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EWC, INC., 385 Highway 33, Englishtown, NJ 07726, Tel: 908-446-3110; FSC No.: 15387;MIL-T-27D; Empl.: 120; *Sls. Mgr.:* Jay Stevenson; *Dist. Mgr.:* Jay Stevenson ..... **A•1235, 2331-2347**

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IL	Wooddale, Dab Elctrns.	708-595-9210
IA	Cedar Rapids, Pattison Sls.	319-395-9866
KS	Prairie Village, Clyde Logsdon & Assoc.	913-381-3833
MA	Chelmsford, ISA Sls.	508-256-2287
MO	St. Louis, Clyde Logsdon & Assocs.	314-849-5125
NJ	Allenwood, ACI Sls.	201-223-5895
NJ	E. Brunswick, Winch Assoc.	201-828-4615
NY	Pittsford, James E. Zimmerman Sls.	716-381-3186
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OH	Cincinnati, Frank E Kahsar Sls.	513-598-1484
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TX	Dallas, Rem Air Comps.	214-234-1069
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EXATRON AUTOMATIC TEST EQUIP., 2842 Aiello Dr., San Jose, CA 95111, Tel: 408-629-7600, 800-EXA-TRON, FAX: 408-629-2832; Empl.: 24; *Sls. Mgr.:* Kathryn Henderson

EXCEL SPECIALTY CORP., 6335 N. Broadway, Chicago, IL 60660, Tel: 312-262-4781, FAX: 312-262-1330; Empl.: 50

EXCEL TECHNOLOGY INTL. CORP., 5-4 Stryker La., Belle Mead, NJ 08502, Tel: 908-874-4747, ESYLNK: 908-874-3278; *Sls. Mgr.:* Michi Chen ..... **B•1062**

EXELTECH INC., 7018 Baker Blvd., Ft. Worth, TX 76118, Tel: 817-595-4969, FAX: 800-886-4683; Empl.: 12

EXFO. E.O. ENGINEERING, INC., 465 Godin Ave., Vanier, QC., Canada G1M 3G7, Tel: 418-683-0211, 1-800-663-EXFO, FAX: 418-683-2170; Empl.: 100; *Sls. Mgr.:* Germain Lamonde; *Dist. Mgr.:* John Spychka ... **B•1211**

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IL	Arlington Heights, EXFO E.O. Eng.	708-259-9440
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TX	Dallas, EXFO E.O. Eng.	214-692-9018

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MD	Chelmsford, Fico, Inc.	508-250-4445
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NJ	New Jersey, Thaw Sls. & Mktg.	908-757-8150

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NY New York, Codenoll Tech. Corp. 914-965-6300
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PA Southampton, W.A. Drobile Inc. 215-364-2501
TX Plano, Engrg. Equip. Sls. Inc. 214-578-1146
VA Fairfax, Schibley Assocs., Inc. 703-591-3008
WA Seattle, Radar Elec. Co., Inc. 206-282-2511

EXPRESS TEST CORP., 975 Benicia Ave., P.O. Box 3419, Sunnyvale, CA 94088-3419, Tel: 408-737-3555, TELEX: 4942091, FAX: 408-737-3558; *Sls. Mgr.:* Frank S. Gavin

EXSELECT ENGINEERING LTD., 355 Rayette Rd., Concord, Ont., Canada LK42G2, Tel: 416-738-4077, FAX: 416-738-6604; Empl.: 28

EXTECH INSTRUMENTS CORP., 335 Bear Hill Rd., Waltham, MA 02154, Tel: 617-890-7440, FAX: 617-890-7864

EXTRUSION TECHNOLOGY, INC., 82 Trim Way, Randolph, MA 02368, Tel: 617-963-7200, FAX: 617-963-7203; Empl.: 50; *Sls. Mgr.:* Matt Travers ..... **B•1828; C•1042-1043**

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E-Z HOOK, Tektest Inc., 225 N. Second Ave., Arcadia, CA 91006, Tel: 818-446-6175, FAX: 818-446-0972; FSC No.: 08505; Empl.: 23; *Sls. Mgr.:* P.C. Wood; *Dist. Mgr.:* P.C. Wood

FABRICAST, 2517 Seaman Ave., P.O. Box 3176, S. El Monte, CA 91733, Tel: 818-443-3247, FAX: 818-443-5594; FSC No.: 13345; *Sls. Mgr.:* Phelps Wood ..... **B•1254-1259**

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FAIR-RITE PRODS., PO Box J, Wallkill, NY 12589, Tel: 914-895-2055, FAX: 914-895-2629; FSC No.: 34899; Empl.: 200ö; *Sls. Mgr.:* B. G. Tolen

FALCON ELECTRIC, 1960 Walker Ave., Monrovia, CA 91016, Tel: 800-842-6940, FAX: 818-285-0102; Empl.: 10ö; *Sls. Mgr.:* Ron Seredian, Acct. Mgr.; *Dist. Mgr.:* Ron Seredian, Acct. Mgr.

FANCORT INDUSTRIES, INC., 31 Fairfield Place, W. Caldwell, NJ 07006, Tel: 201-575-0610, FAX: 201-575-9234; Empl.: 23; *Sls. Mgr.:* Robert Antonelli; *Dist. Mgr.:* Lucille Ott

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FARIA, THOMAS G., CORP., P.O. Box 983, Uncasville, CT 06382-0983, Tel: 203-848-9271, FAX: 203-848-2704; FSC No.: 09527; Empl.: 250; *Sls. Mgr.:* A. Knupp

FARNELL ADVANCE POWER, 32111 Aurora Rd., Solon, OH 44139, Tel: 216-349-0755, FAX: 216-349-0142; Empl.: 10 ..... **D•1699-1704**

Local Sales Offices & Reps

AZ Scottsdale, Fred Board Assocs. 602-994-9388, FAX:602-944-9477
CA Anaheim, Leonard P. Beckman 714-491-7441, FAX:714-491-2408
CA Long Beach, L.A. Sls. 213-491-0791
CA San Ramon, Synergy Sls. 510-830-0829, FAX:510-830-0951
CA San Ramon, Tim Joynson 510-735-8206, FAX:510-735-8207
CO Englewood, Comp. Sls., Inc. 303-779-8060, FAX:303-779-8357
FL Orlando, Aurora-Schmitt Assocs. 407-297-6039
IL Elk Grove, Carlson Elctrns. 708-956-8240, FAX:708-956-8289
MD Baltimore, Herman K. Kramer 410-528-9120, FAX:410-528-9116
MD Monkton, Imagitron Sls. Co; Inc. 301-374-5600, FAX:301-372-5888
MN Minneapolis, Comps. Grp. Corp. 612-374-1250, FAX:612-374-5434
NH Salem, Sls. Engrg. 603-893-5521, FAX:603-893-7680
NY Clarence, R.W. Mitscher Co. 716-759-2350, FAX:716-759-6976
NY Hauppauge, Aurora-Schmitt Assocs. 516-434-1313,FAX:516-434-1572
OH Dayton, The Lyons Corp. 512-278-0714, FAX:512-278-3609
PA Drexel Hill, DNE Sls. Co. 215-789-6822, FAX:215-789-3508
SC Walhalla, Overton Assocs. 803-638-7101, FAX:803-638-2830
TX Dallas, Blair Engrg., Inc. 214-241-5655, FAX:214-241-3642

FARRAND CONTROLS, Ruhle Companies, Inc., 99 Wall St., Valhalla, NY 10595, Tel: 914-761-2600, FAX: 914-761-0405; Empl.: 55 ..... **B•1949**

FASCO MOTORS GROUP, 500 Chesterfield Center No. 500, Chesterfield, MO 63017, Tel: 314-532-3505, FAX: 314-532-9306; Empl.: 4000; *Dist. Mgr.:* R. J. Darragh/D. Schmitt Merchandising Mgr.

FASTEX, Illinois Tool Works, 195 Algonquin Rd., Des Plaines, IL 60016, Tel: 708-299-2222, FAX: 708-390-6183; FSC No.: 02768; Empl.: 175; *Sls. Mgr.:* Andy Flis; *Dist. Mgr.:* Andy Flis

FASTEX DISTRIBUTOR BUSINESS, Illinois Tool Works, 195 Algonquin Rd., Des Plaines, IL 60016, Tel: 708-350-8200, FAX: 708-595-2141; Empl.: 170; *Sls. Mgr.:* Andy Flis

FDK

FAX: 408-435-7478

FDK AMERICA, INC., Fuji Electrochemical Co., Ltd., 3099 N. First St., San Jose, CA 95134, Tel: 408-432-8331; *Sls. Mgr.:* Sumio Watanabe ..... **A•1698, 2348; D•1096**

Local Sales Offices & Reps

CA San Jose, FDK America, Inc. 408-432-8331
MA Boston, FDK America, Inc. 617-487-3198
TX Dallas, FDK America, Inc. 214-650-7742

F-DYNE ELECTRONICS, See Southern Electronics F-Dyne

FEE FIL-MAG, 9445 Farnham Street, San Diego, CA 92123, Tel: 619-569-6577, FAX: 619-569-6073; Empl.: 1200; *Sls. Mgr.:* Marc Jay Lampert; *Dist. Mgr.:* Jim Seifert ..... **A•1634-1637, 2349-2351; D•2109**

Local Sales Offices & Reps

CA San Diego, FEE Fil-Mag 619-569-6577
CA Santa Clara, Fee Fil-Mag 408-562-6264
CO Englewood, FEE Fil-Mag 303-721-8513
GA Cummings, FEE Fil-Mag 404-889-8231
IL Des Plaines, FEE Fil-Mag 708-297-6937
MA Medfield, FEE Fil-Mag 508-359-9691
NJ Fairfield, TAM 201-575-4130
Can Don Mills, Ont., Canadian Source Corp. 416-445-0211

Local Distributors

CA San Jose, CAPSTONE 408-453-9804
CA Tustin, CAPSTONE 714-730-0349
CO Aurora, CAPSTONE 303-375-1300
IL Itasca, CAPSTONE 708-250-0300
MA Wilmington, CAPSTONE 508-657-5874
NJ Marlton, CAPSTONE 609-596-7500
NM Los Alamos, CAPSTONE 505-662-0745
NC Raleigh, CAPSTONE 919-954-0600
TX Carrollton, CAPSTONE 214-380-9049
Can Mississauga, Ont., CAPSTONE 416-670-2010

FEI MICROWAVE, INC., Frequency Electronics, Inc., 825 Stewart Dr., Sunnyvale, CA 94086, Tel: 408-732-0880, FAX: 408-730-1622; FSC No.: 21847; Empl.: 240; *Sls. Mgr.:* Joe Lee

FELLER US CORPORATION, AFN Div., 72 Veronica Ave./Unit 4, Somerset, NJ 08873, Tel: 908-247-7333, FAX: 908-247-7279; Empl.: 310; *Sls. Mgr.:* Elfie Schwarzinger

FEL-PRO CHEMICAL PRODUCTS L.P., 6120 E. 58th Ave., Commerce City, CO 80022, Tel: 303-289-5651, FAX: 303-289-5283; *Sls. Mgr.:* James R. Hallstrom

FEMA ELCTRNS. CORP., 12-6 Edgeboro Rd., E. Brunswick, NJ 08816, Tel: 908-238-1223, FAX: 908-238-7981; Empl.: 16 to 20; *Sls. Mgr.:* E. Wong; *Dist. Mgr.:* E. Wong ..... **B•1063**

FENWAL INC., 400 Main St., Ashland, MA 01721, Tel: 508-881-2000, TELEX: 948421, FAX: 508-881-6729; Empl.: 1000; *Sls. Mgr.:* D. Rieley

FENWAL ELECTRONICS INCORPORATED

FAX: 508-473-6035

FENWAL ELECTRONICS, INC., 450 Fortune Blvd., Milford, MA 01757, Tel: 508-478-6000, TELEX: 299550; Empl.: 450; *Sls. Mgr.:* Herb Holmstedt; *Dist. Mgr.:* Herb Holmstedt ..... **B•1875**

Local Sales Offices & Reps

CA Garden Grove, Elsco Elctrns., Inc. 714-891-4621
CO Denver, Spectrum Mktg. Assocs., Inc. 303-480-9991
FL Palm Beach Gardens, Graham Assoc., Inc. 407-622-4049
IL Itasca, Janus Inc. 708-250-9650
IN Indianapolis, CC Electro Sales, Inc. 317-921-5000
IA Cedar Rapids, Dy-Tronix, Inc. 319-377-8275
KS Wichita, Dy-Tronix, Inc. 316-838-0884
MD Gaithersburg, Naudain Assoc. So., Inc. 301-258-5040
MI Royal Oak, Hilltronics, Inc. 313-435-0920
MN So. St. Paul, Northport Engrg., Inc. 612-457-8000
MO Bridgeton, Dy-Tronix, Inc. 314-291-4777
KS Leawood, Dy-Tronix, Inc. 913-339-6333
NY Huntington, CDB Entprs. 516-692-5200
NY Penfield, Upstate Comps. Sls., Inc. 716-381-6070
NC Raleigh, Prime Comps., Inc. 919-850-9866
PA Allison Park, Bear Mktg., Inc. 412-492-1150
PA Wynnewood, Metz-Jade Assoc. 215-896-7300
TX Austin, W. Pat Fralia Co. & Assoc., Inc. 817-354-1144
TX Euless, W. Pat Fralia Co. & Assoc., Inc. 817-267-3577
TX Houston, W. Pat Fralia Co. & Assoc., Inc. 817-354-1144
UT Ogden, Spectrum Mktg. Assocs., Inc. .. 801-972-8552
WA Bellevue, Elctrn. Sources, Inc. 206-451-3500
EXP MA, Milford, Fenwal Elctrns. 508-478-5255
Can Que., John G. Weiss Co., Ltd. 514-685-6644

Local Distributors

CA Chatsworth, Mil-Comm Distr. 818-998-3111
CA San Jose, Rose Elctrn. Distr. 408-943-0200
CO Denver, Newark-Denver Elctrn. Supp. 303-757-3351
FL Clearwater, Newark Elctrns. 813-443-0661
GA Norcross, Newark Elctrns. 404-448-1300
IL Chicago, Newark Elctrns. Corp. 312-784-5100
MD Ellicott City, Newark Elctrns. 301-461-2300
MA Woburn, Newark Elctrns. 617-935-8350
MI Oak Park, Newark Elctrns. 313-967-0600
NJ Pennsauken, Newark Elctrns. 609-663-9490
NY Buffalo, Summit Dists. 716-887-2800
NY Rochester, Summit Elctrns. 716-334-8110
NC Winston-Salem, Kirkman Elctrns. 919-722-9131
OH Cleveland, Newark Elctrns. 216-391-9330
PA Wynnewood, Metz-Benham Assoc., Inc. 215-896-7300
TX Fort Worth, Patco Supply 817-429-8596
TX Garland, Newark Elctrns. 214-494-5911
Can Que., John G. Weiss Co., Ltd. 514-337-5022

FERNO-SALESMAKER, Ferno-Washington, Inc., 70 Weil Way, Wilmington, OH 45177, Tel: 513-382-1451, TELEX: 214282, FAX: 513-383-1157; Empl.: 600

FERNWOOD TRANSFORMER CO., Transistor Devices Inc., 560 Independence St., Belvidere, NJ 07823, Tel: 908-475-3207, FAX: 908-475-3242; FSC No.: 3S657; Empl.: 90 ..... **A•2355**

FERRANTI-PACKARD, See F-P Electronics

FERRANTI VENUS, INC., Ferranti International, 399 Smith St., Farmingdale, NY 11735, Tel: 516-293-4100, TWX: 510-224-6492, FAX: 516-752-7976; Empl.: 400; *Sls. Mgr.:* Thomas White

FERRAZ CORPORATION, 14 Eastmans Rd., Parsippany, NJ 07054, Tel: 201-428-8400, 800-526-9067, TELEX: 136045, FAX: 201-428-0599; Empl.: 100; *Sls. Mgr.:* Douglas L. Bennett; *Dist. Mgr.:* Douglas L. Bennett

FERRETEC INC., 3342 Gateway Blvd., Fremont, CA 94538-6525, Tel: 510-226-1216, FAX: 510-651-8771; FSC No.: 7W279; Empl.: 65; *Sls. Mgr.:* Dirk Hoekstra

FERRITE INTERNATIONAL, 15280 Wadsworth Rd., Wadsworth, IL 60083, Tel: 708-249-4900, FAX: 708-249-4988; Empl.: 60; *Sls. Mgr.:* George Orenchak

FERRO CORPORATION, Filled & Reinforced Plastics Div., 5001 O'Hara Dr., Evansville, IN 47711, Tel: 812-423-5218, FAX: 812-423-1864; *Sls. Mgr.:* J. C. Vaughn

FERRO CORPORATION, Electronic Glass Department, 4150 East 56th Street, Cleveland, OH 44101, Tel: 216-641-8580, FAX: 216-641-8857; *Sls. Mgr.:* Tack Whang, Bus. Mgr.

FERRO CORPORATION, Electronic Materials Div., 27 Castilian Dr., Santa Barbara, CA 93117-3092, Tel: 805-968-5000, TELEX: 98-0165, FAX: 805-968-8624; *Sls. Mgr.:* William T. Faix, Nat. Sls. Mgr.

FERRO CORPORATION, Frit Division, 4150 East 56th St., Cleveland, OH 44101, Tel: 216-641-8580, TELEX: 98-0165, FAX: 216-641-2049; *Sls. Mgr.:* James Stalder

FERRO CORPORATION, Powder Coatings Div., 4150 East 56th St., Cleveland, OH 44101, Tel: 216-641-8580, TELEX: 98-0165, FAX: 216-641-8596; Empl.: 300 ò

FERRO CORPORATION, Plastic Colorants & Dispersions, 3 Railroad Ave., P.O. Box 603, Stryker, OH 43557, Tel: 419-682-3311, TELEX: 419-682-4924; *Sls. Mgr.:* Robert T. Schneider

FERRO CORPORATION, Transelco Div., P.O. Box 217, Penn Yan, NY 14527-0127, Tel: 315-536-3357, FAX: 315-536-8091; *Sls. Mgr.:* J. F. Arthur/W. Germond

FERROFLUIDICS CORP., 40 Simon St., Nashua, NH 03061, Tel: 603-883-9800, FAX: 603-883-2308; Empl.: 221; *Dist. Mgr.:* Kurt J. Lesker Company

FERRONICS, 45 O'Connor Rd., Fairport, NY 14450, Tel: 716-388-1020, FAX: 716-388-0036; FSC No.: 33062; Empl.: 49; *Sls. Mgr.:* Tim Reeder

Local Sales Offices & Reps

AL	Huntsville, L & D	205-837-1469
AZ	Tempe, Gassner & Clark	602-968-9037
CA	San Diego, Texel	619-576-2162
CA	San Jose, Texel/North	408-272-6836
CA	Seal Beach, Texel	213-596-9411
FL	Oviedo, Comps. Co.	407-366-7399
GA	Atlanta, L & D	404-395-7079
IL	Rolling Meadows, Sumer, Inc.	708-991-8500
IN	Indianapolis, John H. Weaver Co. Inc.	317-257-7661
IA	Cedar Rapids, Dytronix Inc.	319-377-8275
KS	Leawood, Dytronix Inc.	913-339-6333
MA	Canton, New England Elctrn. Sls.	617-828-4835
MN	St. Paul, Countryman Assoc.	612-645-9151
MO	Bridgeton, Dytronix Inc.	314-291-4777
NC	Raleigh, L & D	919-876-5301
NC	Wilmington, L & D	919-256-8110
OH	Cleveland, C. J. Voneman Co.	216-226-8000
OR	Portland, General Elctrns.	503-297-8500
TX	Dallas, Comp. Tech.	214-783-8831
TX	Houston, Comp. Tech.	713-690-3011
WA	Stanwood, General Elctrns.	503-297-8500
WI	Brookfield, Sumer, Inc.	414-784-6641
Can	Don Mills, Ont., R.D. Assocs.	416-444-0959

Local Distributors

CA	Los Alamitos, Dexter Magnetic Materials	714-952-2091
CA	Sunnyvale, Dexter Magnetic Materials	408-738-1080
GA	Norcross, Dexter Magnetic Materials	404-448-4998
IL	Chicago, Dexter Magnetic Materials	708-956-1140
MA	Billerica, Dexter Magnetic Materials	508-663-7500
MN	Chanhassen, Dexter Magnetic Materials	612-934-4635
NY	Hicksville, Dexter Magnetic Materials	516-822-3311
OH	Toledo, Dexter Magnetic Materials	419-385-4621
TX	Richardson, Dexter Magnetic Materials	214-699-1121

FERROXCUBE, See Philips Components Discrete Products Division

FETCO, 421 Cornwall Rd., Sanford, FL 32773, Tel: 407-321-3800 ..... **A•2352-2354**

FIBERGUIDE INDUSTRIES INC., 1 Bay St., Stirling, NJ 07980, Tel: 908-647-6601, FAX: 908-647-8464; Empl.: 65; *Sls. Mgr.:* Allan Kreutzer; *Dist. Mgr.:* James Murray

FIBERLIGN, Preform Line Products, 24 Colonnade Rd., Nepean, ON, Canada K2E 7J6, Tel: 613-226-4000, FAX: 613-226-4602; Empl.: 55; *Sls. Mgr.:* Jean Paul Clermont

FIBEROPTICS TECHNOLOGY, INC., Quassett Rd., Pomfret, CT 06258, Tel: 203-928-0443, 800-433-5248, FAX: 203-928-7664, 800-543-2558

FIBEROPTIC SYSTEMS, INC., 4680-B E. Los Angeles Ave., Simi Valley, CA 93063, Tel: 805-583-2088, FAX: 805-583-4018; Empl.: 30; *Sls. Mgr.:* Richard Lockett

FIBERTEK INC., P.O. Box 4000, 305 Beasley Dr., Franklin, TN 37065, Tel: 615-794-1400, FAX: 615-790-8289; Empl.: 30; *Sls. Mgr.:* Pete Kutz; *Dist. Mgr.:* Jim Friel

FIBRONICS INTERNATIONAL INC., Communications Way, 33 Riverside Dr., Pembroke, MA 02359, Tel: 617-826-0099, FAX: 617-826-7745; Empl.: 500; *Sls. Mgr.:* Bruce Gilliat; *Dist. Mgr.:* Don Dorchester

FAX: 301-881-0530

FIC CORP., 12216 Parklawn Dr., Rockville, MD 20852, Tel: 301-881-8124, 800-638-6594, TWX: 710-828-9809; FSC No.: 3613; Empl.: 46; *Sls. Mgr.:* Robert E. Frye, V.P.; *Dist. Mgr.:* Raymond Vernon ..... **B•1359**

FIDELITY CHEMICAL PRODUCTS CORP., 472 Frelinghuysen Ave., Newark, NJ 07114, Tel: 201-242-4110, FAX: 201-242-5796; Empl.: 55; *Sls. Mgr.:* Michael Aleksinas

FIELDPIECE INSTRUMENTS, 8322 B Artesia, Buena Park, CA 90621, Tel: 714-992-1239, FAX: 714-992-1239; Empl.: 5; *Sls. Mgr.:* Jan Nall; *Dist. Mgr.:* Rey Harju

FAX: 609-599-9508

FIFTH DIMENSION, INC., 801 New York Ave., Trenton, NJ 08638, Tel: 609-393-8350; Empl.: 75; *Sls. Mgr.:* Mike Cioppi, Mktg. Mgr. ..... **B•1260-1261, 1486-1487, 1726-1727**

Local Sales Offices & Reps

NJ	Trenton, Fifth Dimension	609-393-8350

FILM MICROELECTRONICS, See General Microcircuits

FILM MICROELECTRONICS INC., 10 B Centennial Drive, Peabody, MA 01960, Tel: 508-532-9913, FAX: 508-532-9954; FSC No.: 27851; Empl.: 101; *Sls. Mgr.:* Karl Cyr

FILTER CONCEPTS INC., 2624 S. Rousselle, Santa Ana, CA 92707, Tel: 714-545-7003, FAX: 714-545-4607; *Sls. Mgr.:* Les Edelberg ..... **A•1592-1595**

FILTER PRODUCTS, Rockwell International, 2990 Airway Ave., Costa Mesa, CA 92626, Tel: 714-641-5311, TELEX: 685532(COLLINS CSMA), FAX: 714-641-5320; FSC No.: 2X491; Empl.: 60; *Sls. Mgr.:* Bob Johnson

FILTRON, RFI Corporation, 100 Pine Aire Dr., Bayshore, NY 11706, Tel: 516-231-6400, FAX: 516-231-6465; FSC No.: 81831; Empl.: 90; *Sls. Mgr.:* Richard Michelson

FILTRONETICS, INC., 6010 Parretta, Kansas City, MO 64120, Tel: 816-231-7375, FAX: 816-241-0368; FSC No.: 53733; Empl.: 70; *Sls. Mgr.:* Brenda Gabbert

FINETECH ENGINEERING, INC., 119 Northrup St., Bridgewater, CT 06752, Tel: 203-350-2882, FAX: 203-350-2878; Empl.: 3; *Sls. Mgr.:* John Porter

THE FIRST ELECTRONICS CORP., 71 Von Hillern St., Boston, MA 02125, Tel: 617-288-2430, FAX: 617-288-0332; FSC No.: 14532; Empl.: 70; *Sls. Mgr.:* Chris Nastopoulos

W.W. FISCHER INC
ELECTRONIC CONNECTORS

FAX: 404-551-6969

W.W. FISCHER ELECTRONIC CONNECTORS, 1040 Crown Pointe Pky., Ste. 560, Atlanta, GA 30338, Tel: 1-800-551-0121 ..... **C•1322-1329**

Local Sales Offices & Reps

CA	Los Angeles, W.W. Fischer	818-727-0277
CA	San Fransisco, W.W. Fischer	408-970-0631
MA	Boston, M.A. Oison Assocs.	617-244-4030

FISHERCAST, Fisher Gauge Limited, 194 Sophia St., Peterborough, Ont., Canada K9J 6Y9, Tel: 705-748-9522, FAX: 705-745-8818; Empl.: 400; *Sls. Mgr.:* Larry Hatfield

FISHERTECH, Fisher Gauge Limited, 194 Sophia Street, P.O. Box 179, Peterborough, Ontario, Canada K9J 6Y9, Tel: 705-748-9522, TELEX: 06-962838, FAX: 705-748-6312; Empl.: 200ò; *Sls. Mgr.:* Greg Patterson

FITCHBURG COATED PRODUCTS, Technographics, Inc., P.O. Box 1106, Scranton, PA 18501, Tel: 717-347-2035, FAX: 717-347-2507; Empl.: 300

FJA INDUSTRIES, P.O. Box 242, Santa Clara, CA 95052, Tel: 408-727-0100, FAX: 408-496-0117; *Sls. Mgr.:* Frank J. Ardezzone

FLANN MICROWAVE INC., Ste. 2200, One Kendall Square, Cambridge, MA 02139, Tel: 1-800-937-3772, FAX: 617-577-8234; Empl.: 80; *Sls. Mgr.:* Lawrie Lansdell

FLEX-CORE DIV., Morlan & Assocs., Inc., 6625 McVey Blvd., Worthington, OH 43235, Tel: 614-889-6152, FAX: 614-876-8538; Empl.: 11; *Sls. Mgr.:* D. Morlan ..... **A•2357**

MCi
FLEXIBLE FURNITURE DIVISION
METAL COMPONENTS INC.

FAX: 616-685-9195

FLEXIBLE FURNITURE DIVISION, Metal Components, Inc., 323 Acorn Street, Plainwell, MI 49080, Tel: 616-685-6831, 800-875-6836; Empl.: 32; *Sls. Mgr.:* Lynn D. Middlebrook ..... **C•1044**

Local Sales Offices & Reps

CO	Manhattan Beach, Fore Tec	1-800-344-3832
FL	Orlando, Imhoof & Assocs.	407-658-0807
IL	Bensenville, ESI	708-766-3667
KS	Overland Park, Corporate Environments	913-677-0603
MI	Livonia, Lowell-Wendt Mktg.	313-464-2722
NJ	Ringwood, Eastern Scientific Prods.	201-728-7200
OH	Cleveland, Tech. Sls. Assoc.	216-461-0826
VA	Vienna, Morgan Scientific	703-893-4306
WA	Bellevue, The Western Rep.	206-637-0945

FLEXIBLE TECHNOLOGIES, Arlon, P. O. Box 4305, 199 Amaral St., E. Providence, RI 02914, Tel: 401-434-2340, TELEX: 6972602, FAX: 401-434-2557; Empl.: 65; *Sls. Mgr.:* Herb Howard

For sales offices and reps. in the Northeastern region, call Ron Sencer- 401-434-2340 For sale offices and reps. in California, call Rick Kirchhoff- 714-540-2811 For sales offices and reps. in Michigan, Ohio, and Indiana, call STAFFCO- 216-331-5100 For sales offices and reps in Chicago, Minnesota, and Colorado, call Phil Hansen- 612-942-9902

FLEX-KEY CORPORATION, Emerson Ave., Gloucester, MA 01930, Tel: 508-281-2040, FAX: 508-281-4730; FSC No.: 51163; Empl.: 50; *Sls. Mgr.:* Robert Keane ..... **B•1829**

Local Sales Offices & Reps

AZ	Scottsdale, DGI	602-947-3724
CA	Santa Clara, Detomasi & Grupp	408-492-9266
CO	Denver, Advent Corp.	303-455-1985
DC	Rockville, Marktron	301-251-8990
IA	Cedar Rapids, Tech. Elctrns. Inc.	319-366-5443
MD	Hunt Valley, Marktron	301-628-1111
NY	Huntington, J. A. Keeneth Co.	516-351-7008

FLEX-LINK PRODUCTS, INC., 599 Fourth St., San Fernando, CA 91340, Tel: 818-898-1451, FAX: 818-365-3022; FSC No.: 6Z867; Empl.: 80; *Sls. Mgr.:* Al Wasserzug

FLEXSTAR TECHNOLOGY, 213 Hammond Ave., Fremont, CA 94539, Tel: 510-440-0170, TELEX: 510-440-0177; Empl.: 17; *Sls. Mgr.:* Jim Yasueda, VP Sls.

FLEXTRONICS INTERNATIONAL, 48001 Fremont Blvd., Fremont, CA 94538, Tel: 510-226-3539, FAX: 510-226-3535; Empl.: 1800

FLIGHT CONNECTOR, See Transtechnology Electronics

FLUID COMPONENTS, INC., 1755 La Costa Meadows Dr., San Marcos, CA 92069, Tel: 619-744-6950, TELEX: 695092, FAX: 619-736-6250; Empl.: 160; *Sls. Mgr.:* Glen Fishman

FLUKE®

FAX: 206-356-5962

JOHN FLUKE MFG. CO., INC., 6920 Seaway Blvd., Everett, WA 98203, Tel: 206-347-6100, TELEX: 185102, TWX: 810-445-2943; Empl.: 1925; *Sls. Mgr.:* R. Wambolt; *Dist. Mgr.:* R. Mewett ..... **D•1259, 1403**

Local Sales Offices & Reps

AZ	Phoenix, John Fluke Mfg. Inc.	602-438-8314
CA	Fremont, John Fluke Mfg. Co., Inc.	510-651-5112
CA	Irvine, John Fluke Mfg. Co., Inc.	714-863-9031
DC	Washington, John Fluke Mfg. Co., Inc.	301-770-1570
FL	Orlando, John Fluke Mfg. Co., Inc.	407-331-4881
GA	Atlanta, John Fluke Mfg. Co., Inc.	404-953-4747
IL	Chicago, John Fluke Mfg. Co., Inc.	708-705-0500
IN	Indianapolis, John Fluke Mfg. Co., Inc.	317-875-7870
MA	Boston, John Fluke Mfg. Co., Inc.	508-663-2400
NJ	Paramus, John Fluke Mfg. Co., Inc.	201-262-9550
NY	Rochester, John Fluke Mfg. Co., Inc.	716-323-1400
PA	Philadelphia, John Fluke Mfg. Co.,Inc.	215-647-9550
TX	Dallas, John Fluke Mfg. Co., Inc.	214-406-1000
WA	Seattle, Fluke Elctrns. Canada Inc.	206-356-5512
WA	Seattle, John Fluke Mfg. Co., Inc.	206-881-6966
Can	Mississauga, Ont., Fluke Elctrns. Canada Inc.	416-890-7600

Fluke Dist. Prods. are available from Fluke authorized dist. Call 800-443-5853 for your nearest dist.

FORCE, INC., 825 Park St., Christiansburg, VA 24073, Tel: 703-382-0462, FAX: 703-381-0392; FSC No.: 64871; Empl.: 52; *Sls. Mgr.:* James W. Vanhoozier

Local Sales Offices & Reps

CA	San Mateo, Epic Mktg.	1-800-727-9066
FL	Boca Raton, D & V Concepts, Inc.	407-451-4641
IL	South Holland, Fiber Specs., Inc.	708-339-2500
MA	Southbridge, Northern Fibercom	508-765-5131
NJ	Ho-Ho-Kus, D.J. Fisher Co., Inc.	201-652-0090
WA	Everett, Cunningham Sls., Inc.	206-348-4800
Can	Markham, Ont., Deskin, Inc.	1-800-268-9832

FOREDOM ELEC. CO., Blackstone Inds. Inc., 16 Stony Hill Rd., Bethel, CT 06801, Tel: 203-792-8622, FAX: 203-790-9832; Empl.: 80

FORMA SCIENTIFIC, INC., Box 649, Marietta, OH 45750, Tel: 614-373-4763, FAX: 614-373-6770; Empl.: 425; *Sls. Mgr.:* Art Fad, VP of Domestic Sls.

FORMAX, 1120 Federal Road, Brookfield, CT 06804, Tel: 203-775-9492, FAX: 203-775-4376; Empl.: 20; *Sls. Mgr.:* Frank Barbera

FORSTER ENTERPRISES, INC., 57 Bristol St., Waterbury, CT 06708, Tel: 203-574-3832, FAX: 203-755-2973; FSC No.: 3621; Empl.: 64; *Sls. Mgr.:* C. M. Colt

FORTE TECHNOLOGY, INC., 201 Carnegie Row, Norwood, MA 02062, Tel: 617-769-9150, FAX: 617-769-5308; Empl.: 20

FORTRON/SOURCE CORP., Power Supplies, 6818-G Patterson Pass Rd., Livermore, CA 94550, Tel: 415-373-1008, TELEX: 559291 FORTRON UD, FAX: 415-373-1168; Empl.: 150; *Sls. Mgr.:* Louie Aldama

FOURJAY INDUSTRIES, Box 14617 Northridge Br., Dayton, OH 45413-0617, Tel: 513-890-6444, FAX: 513-890-1692; Empl.: 42; *Sls. Mgr.:* M. W. Frawley

FOXCONN INTERNATIONAL, Hon Hai, 930 W. Maude Ave., Sunnyvale, CA 94086, Tel: 408-749-1228, FAX: 408-749-1266; Empl.: 120; *Sls. Mgr.:* S.C. Huang; *Dist. Mgr.:* Ted Ho

FOX ELECTRONICS

FAX: 813-693-1554

FOX ELECTRONICS, 5570 Enterprise Pkwy., Ft. Myers, FL 33905, Tel: 813-693-0099, TWX: 510-951-7386; FSC No.: 61429; Empl.: 75; *Sls. Mgr.:* Mike Huennekens/West; *Dist. Mgr.:* Ann Clark ..... **A•1397-1401**

Local Sales Offices & Reps

AL	Huntsville, Southeast Tech. Grp.	205-534-2376
AZ	Chandler, Techni-Source	602-497-0711
AZ	Conway, Design Mktg.	501-327-9303
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Can	Pointe Claire, PQ, Electro Source, Inc.	514-630-7486
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GENTRAN, Safetytek Corp., 49050 Milmont Dr., Fremont, CA 94538, Tel: 510-226-9343, FAX: 510-226-1112; Empl.: 12

GENTRON CORPORATION

FAX: 602-443-1408

GENTRON CORPORATION, 7345 E. Acoma, Ste. 101, Scottsdale, AZ 85260, Tel: 602-443-1288; Empl.: 50; *Sls. Mgr.:* Rick Heinz ..... **B•1504-1506**

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GEOPOWER INC., 50 Spring St., Ramsey, NJ 07446, Tel: TEL:201-236-0156, FAX: 201-236-0224 ..... **D•1858**

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OH Dublin, Robert S. Howley Co., Inc. 614-889-1123, FAX:614-889-1146
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TX Houston, King Mktg. Assocs. Co. 713-621-6915, FAX:713-621-7917
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GIC THERMODYNAMICS, 2611 Parmenter, Royal Oak, MI 48073, Tel: 313-280-1648, FAX: 313-280-0998; Empl.: 20; *Sls. Mgr.:* Denny Desmond

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GLOBAL SPECIALTIES, Interplex Electronics, Inc., 70 Fulton Terrace, P.O. Box 1942, New Haven, CT 06509, Tel: 203-624-3103, FAX: 203-468-0060; Empl.: 50; *Sls. Mgr.:* Rachael Fernicola; *Dist. Mgr.:* Rachael Fernicola

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GLOBE MOTORS, 2275 Stanley Avenue, Dayton, OH 45404, Tel: 513-228-3171, FAX: 513-229-8531; Empl.: 580; *Dist. Mgr.:* Derek Keegan

GLOBETRON ELECTRONICS CORP., 3175 Dundas St. West, Oakville, Ont., Can L6J 4Z3, Tel: 416-825-1335, 1-800-800-4606, FAX: 416-825-0475; Empl.: 4; *Sls. Mgr.:* Alan Montgomery

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GLOBTEK, INC., 186 Veterans Drive, Northvale, NJ 07647, Tel: 201-784-1000, FAX: 201-784-0111; Empl.: 20; *Sls. Mgr.:* Tom Devaney; *Dist. Mgr.:* Bob Siepmann ..... **C•1340, 1748; D•1730-1732**

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IL	Chicago, Meca Sls.	312-334-4020
MD	Lisbon, S. K. MacDonald	301-982-1088
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NH	Amherst, Bennetron	603-880-7008
NJ	Bay Head, Cuccaro Co.	903-892-2511
NC	Raleigh, Bestec	919-790-8988
OH	Dayton, Thompson and Assoc.	513-435-7733
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TN	New Tazewell, Overton Assocs.	615-626-6009
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GMW ASSOCIATES, P.O. Box 2578, Redwood City, CA 94064, Tel: 415-368-4884; Empl.: 7; *Sls. Mgr.:* Ian Walker ..... **B•1950-1951; D•1260-1263**

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CA	San Jose, Applied Eltcrns Mktg	408-441-9610
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OH	Cleveland, Tech. Sls. Assoc.	216-461-0826
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IA	W. Des Moines, HDI, Ltd.	515-225-3777
KS	Lenexa, Midtec Assocs.,Inc.	913-541-0505, FAX:913-541-1729
MA	Burlington, Anacon Sls. Assocs.	617-272-9080,FX, 617-272-9102
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MO	St. Louis, Midtec Assocs., Inc.	314-275-8666, FAX:314-275-8859
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Can	Montreal, Que., Crouzet Corp.	514-735-7926

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IN	Fishers, Couchman-Conant	317-849-9890
LA	New Orleans, Currier & Roser Inc.	504-734-1147
MI	Highland Park, Marsh Instrs.	313-869-9200
MI	Highland Pk., Marsh Instrs.	313-869-9200
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CA	Fremont, Ed Blake Assocs.	510-770-9058
CA	San Diego, Earle & Assocs.	619-278-5441
CA	Torrance, Orion-Eclipse	213-326-0999
CO	Parker, Parker-Webster Co.	303-841-4888
FL	Margate, EPM Corp.	305-977-0331
FL	Orlando, EPM Corp.	407-425-6149
GA	Atlanta, L & D, Inc.	404-395-7079
IL	Palatine, Key Entpr.	708-991-2144
IA	Cedar Rapids, Gavin Sales	319-366-1229
MD	Ellicott City, Nelson Elctrns.	301-747-7887
MA	N. Reading, Lincoln Assocs.	508-664-6800
MI	Madison Heights, D.E.M. Sls.	313-583-1500
MN	Chanhassen, Barnes Sls. Assocs.	612-934-2907
MO	Lee's Summit, Omni Tech. Sls.	816-578-4221
NY	Manhasset, Win-Cor Elctrn.	516-627-9474
NY	Pittsford, Andres Comps.	716-385-3818
NC	Raleigh, L. & D, Inc.	919-876-5301
OH	Cincinnati, Stegman Blaine Mktg.	513-729-1969
OH	Cleveland, Stegman Blaine Mktg.	216-572-0003
PA	Exton, Linear Sls.	215-524-8080
TX	Richardson, Texoma Tech. Sls.	214-238-8127
UT	Murray, Parker-Webster Co.	801-266-9939
WA	Olympia, Bergford & Assocs.	206-866-2001
WI	Milwaukee, Key Entpr.	414-762-2323
Can	St. Laurent, Componetics	514-331-9930

Local Distributors

AL	Huntsville, Component Distrs.	205-883-7501
CA	Chatsworth, Passive Comps.	818-700-8838
NJ	E. Brunswick, Brothers Electrns.	201-238-2200
CA	Fremont, KEA Elctrns.	510-651-2600
CA	Stanton, Inductive Comps.	714-828-3420
CT	Bridgeport, Park Distributors	203-366-7200
FL	Ft. Lauderdale, Component Distrs.	800-558-2351
MI	Grand Rapids, Calder Elctrns.	616-698-7400
MN	Chanhassen, G&F Distribution	612-934-2907
NY	Hauppauge, Broadline Electric	516-231-4100
PA	Exton, VSH Elctrns.	215-363-2250
VA	Charlottesville, Va. Elctrn. Comps.	804-296-4184
Can	Pointe Claire, Que., Ferrotronics	514-426-0300

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G P BATTERIES USA, Gold Peak International Ltd., 2772 Loker Ave. West, Carlsbad, CA 92008, Tel: 619-438-2202, TELEX: 01830, FAX: 619-438-0694; FSC No.: 01830; Empl.: 30; *Sls. Mgr.:* Gregg Kuehn; *Dist. Mgr.:* Bryan Myers

GP:50 NEW YORK, 2770 Long Rd., Grand Island, NY 14072, Tel: 716-773-9300, FAX: 716-773-5019; Empl.: 26; *Sls. Mgr.:* Pat Murphy

GP TRAINING SYSTEMS, GPS Technologies, Inc., 76 Robinson St., Pottstown, PA 19464, Tel: 215-327-8800, FAX: 215-327-1158; Empl.: 1681; *Sls. Mgr.:* Richard Smith; *Dist. Mgr.:* Stacey Jarlsberg

GRADO LABORATORIES, 4614 Seventh Ave., Brooklyn, NY 11220, Tel: 718-435-5340, FAX: 718-633-6941

GRAFOPLAST S.P.A., Wiremarkers, 13, Via Arrivabene, Genova, Italy 16154, Tel: ò10. 621687, TELEX: ò283828, FAX: ò10. 674448; Empl.: 45; *Sls. Mgr.:* Giorgio Patrone

GRAHAM ELECTRONIC MANUFACTURING INC., 109-State Pl., Escondido, CA 92025, Tel: 619-747-9177, 800-628-4095, FAX: 619-747-9326; Empl.: 14; *Sls. Mgr.:* Samuel L. Band

GRALEX INDUSTRIES, 70 Oak St., Ste. 204, Norwood, NJ 07648, Tel: 800-486-4499, FAX: 201-767-7015; FSC No.: 11332; Empl.: 15; *Dist. Mgr.:* Jan Noothout ..... **D•1353**

Local Sales Offices & Reps

CA	San Leandro, Coast	415-483-3774
IL	Franklin Park, Alca	708-451-6644
NJ	Norwood, Gralex Inds., Inc.	800-486-4499

Local Distributors

AZ	Phoenix, Metermaster	602-243-4111
AZ	Tempe, CMI Metermaster	602-431-0880
CA	Los Angeles, Crompton Metermaster	714-921-2101
CA	Los Angeles, Metermaster	213-685-4340
CA	Palo Alto, CMI Metermaster	415-960-8500
CA	Palo Alto, Metermaster	415-968-0313
GA	Atlanta, Metermaster	404-446-0166
GA	Atlanta, Metermaster	404-446-0188
IL	Chicago, Metermaster	312-593-8650
IL	Glendale Hgts., Crompton Metermaster	312-351-4554
MA	N.Billerica, Electra Test, Inc.	508-667-8541
MA	Waltham, Calibron Instrs.	617-894-6440
NJ	Somerset, CMI Metermaster	201-271-1277
NY	Great Neck, Instrument Mart	516-487-7430
OH	Cleveland, Crompton Metermaster	216-651-4100
TX	Dallas, Metermaster	214-271-5671
TX	Houston, Meters & Instrs.	713-644-1631

GRAND TRANSFORMER, INC., 1500 Marion St., Box 799, Grand Haven, MI 49417, Tel: 616-842-5430, FAX: 616-842-1780; Empl.: 125; *Sls. Mgr.:* Ted Jackson; *Dist. Mgr.:* G. V. Retzlaff, Exp. Sls. Mgr.

GRAPHICODE, INC., 19101 36th Ave. W., Ste.204, Lynnwood, WA 98036, Tel: 206-672-1980, FAX: 206-672-2705; Empl.: 5; *Sls. Mgr.:* Douglas M. Pratt

GRAPHICS MICROSYSTEMS, INC., 10375 Brockwood Rd., Dallas, TX 75225, Tel: 214-340-4584, 800-527-1207, TELEX: 506973; FSC No.: 20891; Empl.: 50; *Sls. Mgr.:* Eddie Deering

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Local Sales Offices & Reps

OR	Beaverton, Graphite Metallizing	503-646-9964

GRASEBY INFRARED, Graseby PLC, 12151 Research Parkway, Orlando, FL 32826, Tel: 407-282-7700, FAX: 407-273-9046; Empl.: 50

GRASSLIN CONTROLS CORP.:GRASSLIN GMBH & CO., K.G., 24 Park Way, Upper Saddle River, NJ 07458, Tel: 201-825-9696, FAX: 201-825-8694; Empl.: 7; *Sls. Mgr.:* Gene K. Manghi

GRAYHILL INC., 561 Hillgrove Ave., La Grange, IL 60525, Tel: 708-354-1040, FAX: 708-354-2820; FSC No.: 5930; Empl.: 615; *Sls. Mgr.:* Richard K. Neumann; *Dist. Mgr.:* Robert J. Ferrel .... **B•1507, 1729-1733, 1833; C•1341**

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AZ Phoenix, Mercury Engrg. Sls. 602-265-0344
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CA San Jose, Quadrep, Inc. 408-432-3300
CO Denver, Lindberg Co. 303-758-9033
CT Branford, Coakley Boyd & Abbett 203-481-2218
FL Clearwater, Sunland Assocs. 813-536-2955
FL Lauderhill, Sunland Assocs. 305-748-1303
FL Oviedo, Sunland Assocs. 407-365-9533
GA Tucker, Rep, Inc. 404-938-4358
IL Itasca, LTD Elctrns. 708-773-2900
IN Ft. Wayne, Menze Sls. 219-747-5616
IA Cedar Rapids, Lorenz Sls. 319-377-4666
KS Overland Pk., Spectrum Sls. 913-648-6811
MD Gaithersburg, Naudain Assocs. Southern 301-258-5040
MA Framingham, Coakley Boyd & Abbett 508-820-0800
MI Royal Oak, Hilltronics Inc. 313-435-0920
MN S. St. Paul, Northport Engrg. 612-457-8000
MO Florissant, Spectrum Sls. 314-921-1313
NE Lincoln, Lorenz Sls., Inc. 402-475-4660
NJ Hackensack, Coakley Boyd Abbett/Metro Div. 201-440-4114
NJ Marlton, Naudain Assocs. 609-983-5300
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NY Wappingers Falls, Bob Dean, Inc. 914-297-6406
NC Morrisville, Reps, Inc. 919-469-9997
OH Centerville, Bear Mktg. Inc. 513-436-2061
OH Richfield, Bear Mktg., Inc. 216-659-3131
OR Tigard, Eltech, Inc. 503-684-3458
PA Allison Park, Bear Mktg. 412-492-1151
TN Jefferson City, Rep, Inc. 615-475-9012
TX Austin, Fralia & Co. 512-835-7911
TX Euless, Fralia & Co. 817-267-3577
TX Houston, Fralia & Co. 713-772-1572
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AL Birmingham, Regan Controls 205-664-2877
AL Huntsville, Powell Elctrns. 205-837-5300
AL Huntsville, Time Elctrns. 205-721-1133
AZ Phoenix, Sterling Elctrns. 602-437-5565
AZ Tempe, LCOMP Inc. 602-730-1633
AZ Tempe, Time Elctrns. 602-967-2000
AR Little Rock, Carlton-Bates Co. 501-562-9100
CA Garden Grove, Richey/Impact Elctrns. 800-421-7258
CA Gardena, Calif. Switch & Signal 213-770-2330
CA Inglewood, Newark Elect. 213-671-7377
CA Los Angeles, Electric Switches 213-660-1310
CA Mission Viejo, Distributed Motion 714-855-9902
CA Novato, Westech Automation 415-382-2577
CA Riverside, Electronic Supply 714-683-7300
CA San Diego, Electronic Supply 619-693-8222
CA San Diego, Richey/Impact Elctrns. 619-271-4511
CA San Diego, Time Elctrns. 619-674-2800
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CA Woodland Hills, Time Elctrns. 818-593-8400
CO Denver, CSID, Inc. 303-292-9594
CO Denver, Newark Elctrns. 303-757-3351
CO Englewood, Cypress 303-792-5829
CO Englewood, Kent/Shelley Ragon, Inc. 303-792-9100
CO Englewood, Motion Solutions 303-792-5518
CO Englewood, Time Elctrns. 303-721-8882
CT Southbury, Time Elctrns. 203-271-3200
CT Southington, Electro Mechanical Drives, Inc. 203-621-7335
CT Wallingford, Sager 203-265-4600
FL Ft. Lauderdale, Hammond Elctrns. 305-973-7103
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FL Ft. Lauderdale, Time Elctrns. 305-484-1778
FL Orlando, Hammond Elctrns., Inc. 407-849-6060
FL Orlando, Sager Elctrns. 407-354-1130
FL Orlando, Time Elctrns. 407-841-6565
FL Pompano Beach, Peerless Radio 305-973-4141
GA Duluth, Pioneer Technlgs./Georgia 404-623-1003
GA Norcross, Hammond Elctrns., Inc. 404-449-1996
GA Norcross, Time Elctrns. 404-368-0969
ID Meridian, Pacific Control Sply. 208-286-7404
IL Batavia, Control Source 708-406-0880
IL Chicago, Newark Elctrns. 312-784-5100
IL Chicago, Waldom Elctrns. 312-585-1212
IL Northbrook, Classic Comp. Supp. 708-272-9650
IL Palatine, Ohm Elctrn. 708-359-5500
IL Schaumburg, Time Elctrns. 708-303-3000
IN Fort Wayne, Bell Inds. 219-423-3422
IN Indianapolis, Bell Inds. 317-875-8200
IN Indianapolis, Meunier Elctrn. Supp., Inc. 317-635-3511
IN Indianapolis, Pioneer Standard 317-573-0880
IN Indianapolis, Process Automation Devs. 317-879-1100
IA Cedar Rapids, Advent Elctrns. 319-363-0221
KS Overland Pk., Olive Elctrns. 913-362-1923
MD Annapolis Jct., Powell Elctrns. 301-953-3435
MD Baltimore, Resco/Baltimore 410-931-8200
MD Columbia, Sager Elctrns. Sply. 410-995-4900
MD Columbia, Time Elctrns. 410-964-3090
MD Gaithersburg, Pioneer Technlgs. 301-921-0660
MD Kensington, Marine Air Supp. 301-949-9560
MA Hingham, Sager Elctrns. 617-749-6700
MA Norwood, Gerber Elctrns. 617-329-2400
MA Peabody, Time Elctrns. 508-532-9900
MA Westborough, Powell Elctrns. 508-366-6100
MI Grand Rapids, Pioneer Standard 616-698-1800
MI Livonia, Pioneer/STD Elctrns. 313-525-1800
MI Livonia, R.S. Elctrns. 313-525-1155
MI Oak Park, Newark/Detroit Elctrns. 313-967-1570
MN Edina, Time Elctrns. 612-943-2433
MN Minneapolis, Electrol, Inc. 612-521-5051
MN Minneapolis, Newark Elec. 612-331-6350
MN St. Paul, Gopher Elctrns. 612-490-4900
MN St. Paul, Kent/Shelley-Ragon, Inc. 612-642-2828
MN Thief River Falls, Digi-Key Corp. 218-681-6674
MO Kansas City, LComp, Inc. 816-241-0111
MO Kansas City, Missouri Valley Elctrl. 816-471-5308
MO Manchester, Time Elctrns. 314-391-6444
MO Maryland Hgts., LComp, Inc. 314-291-6200
MO Maryland Hgts., Olive Elctrns. 314-997-7709
NE Omaha, Electrol, Inc. 402-691-0662
NH Merrimack, Brevan Elctrns., Inc. 603-429-1900
NH Salem, Sager Elect. Sply, Inc. 603-898-1348
NJ Cliffwood, Federated Purch. 908-290-2900
NJ Marlton, JRH Elctrns. 609-988-8696
NJ Marlton, Time Elctrns. 609-596-6700
NJ West Berlin, General Comps. 609-768-6767
NY Albany, Kom Lamb, Inc. 518-869-8746
NY Amherst, Kom Lamb, Inc. 716-691-6400
NY Binghamton, Pioneer STD Elctrns. 607-722-9300
NY Buffalo, Summit Distrs. 716-887-2800
NY East Syracuse, Time Elctrns. 315-432-0355
NY Fairport, Pioneer-Standard Elctrns., Inc. 716-381-7070
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NC Cary, Powell Elec. 919-467-1212
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NC Greensboro, Hammond Elctrns. 919-275-6391
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OH Cincinnati, Hughes-Peters, Inc. 513-351-2000
OH Cleveland, Pioneer STD Cleveland 216-587-3600
OH Columbus, Hughes-Peters 614-294-5351
OH Columbus, Time Elctrns. 614-794-3301
OH Dayton, Pioneer STD Elctrns. 513-236-9900
OH Dayton, Stotts-Friedman Co., Inc. 513-298-5555
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OR Eugene, Pacific Control Sply 503-342-7294
OR Portland, Pacific Control Supply, Inc. 503-249-2033
OR Portland, Radar Elec. Co. 503-232-3404
OR Portland, Time Elctrns. 503-626-2979
PA King of Prussia, Applied Controls, Inc. 215-265-3832
PA Mars, Sager Elect. Supply Co. 412-772-2233
PA McKean, Advacom 814-476-7774
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PA Philadelphia, Sager Elect. Supply Co. 215-464-4336
PA Pittsburgh, Exonic Sys. 412-967-9600
PA Pittsburgh, Pioneer STD Elctrns. Inc. 412-782-2300
PA Trevose, Bell Inds. Inc. 215-953-2800
RI Pawtucket, Major/Edwards 401-725-7400
SC Columbia, Regan Controls 803-736-3404
SC Columbia, Resource Elctrns. 803-779-5332
SC Gaffney, Newark Elect. Gaffney 803-487-3739
TN Knoxville, Tennessee Armature & Elect. Co. 615-524-3681
TN Memphis, The Genie Grp. 901-360-0200
TX Austin, Norvell Elctrns. 512-343-2900
TX Austin, Time Elctrns. 512-346-7346
TX Dallas, Harrison Equip. 214-239-2750
TX Dallas, Norvell Elctrns. 214-233-0020
TX Dallas, Stuart C. Irby Co. 214-934-3300
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UT Salt Lake City, Standard Supp. 801-486-3371
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GREIBACH INSTRUMENTS DIV., 25 Dock St., Mt. Vernon, NY 10550, Tel: 914-699-9717, FAX: 914-699-9410; FSC No.: 32590; Empl.: 35

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GRUNER, Advanced Components Industries, Inc., 1308 Sartori Ave., No. 105, Torrance, CA 90501, Tel: 310-328-0060, FAX: 310-328-0062; *Sls. Mgr.:* Irma Spreitzer ..... **B•1403**

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MA	Hopkinton, Berkshire Elctrns., Inc.	508-435-9356

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GSI CORP., 1917 Greenspring Dr., Timonium, MD 21093, Tel: 410-252-1768, FAX: 410-561-1768; FSC No.: 60990; Empl.: 50; *Sls. Mgr.:* T.B. Weadock ..... **C•1749-1751**

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AZ	Tempe, EDS	602-438-1547
CA	Bonita, The Bryson Co.	619-428-2788
CA	Canoga Pk., GLM	818-346-0224
CA	Pleasanton, Advanced Tech. Sls.	510-847-2060
FL	Miami, SMI	305-387-5955
FL	Orlando, SMI	407-856-4140
FL	Tampa, SMI	813-933-5833
GA	Duluth, DTM, Inc.	404-381-5592
IL	Cary, J. D. Noble & Assocs., Inc.	708-639-2440
MA	Clinton, CWS, Inc.	508-368-8753
MN	Eden Prairie, Aldridge Assocs. Inc.	612-944-8433
NJ	Ho-Ho-Kus, D. J. Fisher Co., Inc.	201-652-0090
NY	Pittsford, CCS, Inc.	716-383-0546
NC	Raleigh, DTM, Inc.	919-859-0025
NY	Syracuse, CCS Inc.	315-488-1250
TX	Allen, EDS	214-924-3753

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GTE ELECTRONIC REPAIR SERVICES, GTE Supply, GTE PL D03C39, West Airfield Dr., D/FW Airport, TX 75261, Tel: 214-615-7590, FAX: 214-456-3366

GTE GOVERNMENT SYSTEMS CORP., P.O. Box 7188, Mountain View, CA 94039, Tel: 415-966-2000, TWX: 910-379-6948, FAX: 415-966-2303; Empl.: 2,500; *Sls. Mgr.:* Evan S. Baker; *Dist. Mgr.:* Evan S. Baker

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GTE SYLVANIA, INC., STANDISH, ME, See Sylvania GTE Control Devices

GTE TESTMARK LABS, GTE Industry Sls., 700 Hidden Ridge, Irving, TX 75015, Tel: 214-718-7124, FAX: 214-718-1473; Empl.: 60; *Sls. Mgr.:* Clifton E. Miller

GTI/ELECTRONICS DIV., 2426 Perry Highway, Hadley, PA 16130-8815, Tel: 412-253-3161, FAX: 412-253-3853; Empl.: 130; *Sls. Mgr.:* Richard C. Kaufman

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HAMAMATSU PHOTONIC SYSTEMS CORP., Industrial Video, 47A Manning Rd., Billerica, MA 01821, Tel: 508-671-5000, FAX: 508-671-9415; Empl.: 25; *Sls. Mgr.:* Paul Roehrenbeck

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MO	St. Louis, Instru-Med (ICU)	314-845-2299
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TX	Dallas, Tucker Elctrns.	214-348-8800
PR	Rio Padres, J & R Elctrns.	809-757-6079
Can	Mississauga, BCS Elctrns.	416-602-8550

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FL	Tampa, Electramark	813-889-7775
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GA	Norcross, Electramark (Relays only)	404-446-7915
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IN	Carmel, Technlg. Mktg. Corp.	317-844-8462
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KS	Olathe, Rush & West	913-764-2700
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MI	Farmington Hills, J. L. Montgomery Assocs.	313-489-0099
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MO	St. Louis, Rush & West	314-965-3529
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PA	Allison Pk., Bear Mktg.	412-492-1150
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CO	Englewood, Harrison Equip. Co.	303-694-6320
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CT	Wallingford, Sager Elec.	203-262-1700
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HAMMOND MANUFACTURING

FAX: 716-894-1156

HAMMOND MANUFACTURING CO., 1690 Walden Ave., Buffalo, NY 14225, Tel: 716-894-5710; Empl.: 1,450; *Sls. Mgr.:* Ray Shatzel ..... **C•1049**

Local Sales Offices & Reps

AZ	Phoenix, Tritek	602-371-0860
CA	N. Hollywood, Bassett Sls. Corp.	818-766-2117
CA	San Carlos, Bridge Mktg.	415-965-8045
CO	Boulder, The Stratford Grp.	303-530-3194
FL	Tampa, SRT Mktg.	813-884-4805
GA	Atlanta, Millar Elctrns.	404-634-3350
IL	Highland Park, Bransky Sls.	312-433-2375
IN	Indianapolis, Schank Elctrns. Mktg.	317-842-6204
MD	Hunt Valley, S.K. McDonald	410-584-8631
MA	N. Scituate, W. A. Hendrickson Co.	617-545-0652
MI	Southfield, Component Assocs.	313-355-4110
MN	Golden Valley, Ambassador Inds. Mktg.	612-542-8437
MO	St. Louis, Kathrinus, Kelly & Baumhauer	314-647-2400
NY	Manhasset, Win-Cor Elctrn. Sls.	516-627-9474
NY	Victor, Net Sls.	716-924-1844
NC	Raleigh, Millar Elctrns.	919-828-8840
OH	Cincinnati, Frank E. Kahsar Sls.	513-922-3133
OR	Lake Oswego, Joseph Blancard Sls.	503-620-6888
TX	Dallas, J. Y. Schoonmaker Co., Inc.	214-349-1650

Local Distributors

AL	Birmingham, ACK, Inc.	205-322-0588
AZ	Phoenix, Electronic Parts Co.	602-277-7281
AZ	Phoenix, Tri-Tek	602-371-0860
AZ	Tucson, Southwest Sls.	602-628-1613
AR	Ft. Smith, Carlton Bates	501-646-8201
AR	Little Rock, Carlton Bates	501-562-9100
CA	Chatsworth, Poco Sls.	818-700-8727
CA	Milpitas, Zack Elctrns.	408-942-5432
CA	Redwood City, H.D.B.	415-368-1388
CA	San Diego, Western Radio Elec.	619-268-4400
CA	San Jose, Quement Elctrns.	408-998-5900
CA	San Rafael, Elctrns. Plus	415-457-0466
CA	Santa Ana, ITT Multicomponents	714-727-4001
CO	Denver, Fistell Elctrns.	303-629-1312
CT	Bridge Port, Park Distrbg.	203-366-7200
CT	Danbury, Pilgrim Elec.	203-792-7274
CT	Hartford, Hatry Elec.	203-527-1881
CT	New London, Jan Elctrn. Supp.	203-442-4386
CT	Norwalk, Cobra	203-847-6442
CT	Wallingford, Midstate Elec.	203-265-9900
DE	Wilmington, Whlsl. Elctrns.	302-652-3222
FL	Jacksonville, EMSCO	904-356-4851
FL	Orlando, EMSCO	407-849-6060
FL	Tampa, EMSCO	813-253-2684
FL	West Palm Beach, Atlantic Elect.	407-686-8553
GA	Atlanta, Ack, Inc.	404-351-6340
GA	Norcross, Emsco	404-925-8366
GA	Norcross, Whitehead Elctrns.	404-923-6667
GA	Norcross, Wholesale Inds. Elec.	404-447-8431
IL	Benenville, Goold Elctrns.	708-860-7171
IL	Chicago, Newark Elec.	312-784-5100
IL	Joliet, Mainline Elec.	815-436-3900
IL	Niles, Joseph Elec.	708-312-297-4200
IL	Wheeling, Hawk Elec.	708-459-4030
IN	Carmel, Altex Elctrns.	317-848-1323
IN	Indianapolis, Advent Elec.	317-872-4910
IN	Indianapolis, Mar Elec.	317-633-6699
IA	Cedar Rapids, Dee Elec.	319-365-7551
KY	Louisville, Peerless Elctrns.	502-637-7674
LA	New Orleans, W. B. Allen Supp.	504-525-8222
MD	Beltsville, Mark Elctrns.	301-595-5040
MD	Gaithersburg, M. S. Elec.	301-921-0200
MA	Haverhill, Spartan Elctrns.	508-373-1200
MA	Needham, Y.D.I.	617-449-1005
MA	Springfield, Signal Elctrn. Supp.	413-739-3893
MA	Wellesley Hills, Target Elctrns. Supp.	617-235-2545
MI	Farmington Hills, Advent Elctrns.	313-477-1650
MN	Eden Prairie, Cassidy Elctrns.	612-895-9026
MN	Minneapolis, Bergquist	612-835-2322
MN	Minneapolis, Tortec Corp.	612-866-3662
MO	Kansas City, Electronic Supp.	816-931-0250
MO	Kansas City, Walters Ind. Elec.	816-561-7015
MO	St. Louis, Van Sickle Radio	314-621-5000
NH	Dover, American Radio Corp.	603-335-3118
NJ	Oakland, Relay Specialties	201-337-1000
NJ	Randolph, Mouser Elctrns.	201-328-3322
NJ	Raritan, Masters Elctrn. Supp.	201-725-3533
NJ	Totowa, Route Elctrns.	201-256-8555
NM	Albuquerque, Beta Tron Elctrns.	505-821-1122
NY	Buffalo, Genesee Ind. Elec.	716-873-9661
NY	Buffalo, Summit Dist.	716-887-2800
NY	Long Island City, H.L. Dalis Inc.	718-361-8700
NY	Poughkeepsie, Chief Elctrns.	914-471-1300
NY	Rochester, Masline Elec.	716-546-5373
NY	Rochester, Simcona Elctrns.	716-328-3230
NY	Rome, Rome Elec.	315-337-5400
NY	Syracuse, Salina Elec.	315-422-2336
NY	Troy, Trojan Elec.	518-272-4481
NC	Greensboro, Hammond Elctrns.	919-275-6391
NC	Greensboro, Hammond Elec.	919-275-6391
NC	Winston-Salem, Kirkman Elctrns.	919-722-9131
OH	Cleveland, Roberts Elec.	216-238-1711
OH	Columbus, Thompson Elec. Supp.	614-228-6191
OH	Dayton, Stotts Friedman	513-298-5555
OH	Warren, Rem Elctrns. Supp.	216-373-1300
OK	Oklahoma City, Radio, Inc.	405-528-2391
OK	Tulsa, Radio, Inc.	918-587-9123
OR	Toledo, International Co.	503-336-2221
PA	Drexel Hill, Kass Elec.	215-449-2300
PA	Erie, REM Elctrns.	814-453-5626
PA	McKean, Advacom	814-476-7774
PA	Wayne, Peak Elec.	215-293-9000
RI	Pawtucket, Major Elec. Supp.	401-725-7400
SC	Charleston, Wholsale Inds. Elctrns.	803-722-2634
SC	Greenville, EMSCO	803-233-4121
SC	Taylors, Cantrell Wholesale	803-268-1194
TX	Corpus Christi, Douglas Elec.	512-883-5103
TX	Dallas, Off-the-Shelf Comps.	214-247-0052
TX	Dallas, Wholesale Elec.	214-969-9400
TX	Ft. Worth, Allied Elec.	817-336-5401
TX	Houston, Kent Elctrns.	713-780-7770
TX	Houston, The Altair Co.	713-462-3029
TX	Houston, Tri Star Eltrns.	713-667-7200
TX	Midland, ESI Supp.	915-694-9657
TX	San Antonio, Altex Elctrns.	512-828-0503
TX	San Antonio, Sherman Elec.	512-224-1001
UT	Salt Lake City, Standard Elec. Supp.	801-486-3371
VA	Annadale, Arcade Elctrns.	703-941-1074
VA	Annandale, Arcade Elctrns.	703-256-4610
VA	Arlington, Arlington Elctrns.	703-524-2412
VA	Virginia Beach, Norfolk Wire & Elctrns.	804-499-1100
WA	Bellevue, Integrated Elec.	206-455-2727
WI	Oshkosh, Elctrn. Inds.	414-235-8930
WI	Racine, Badger Elctrn. Supp.	414-637-1256
WI	Waukesha, Hawk Elctrns.	414-547-4457

HANCOCK ELECTRONICS CORP., 350 Lincoln St, Hingham, MA 02043, Tel: 617-740-4190, FAX: 617-740-4192; FSC No.: 66851; Empl.: 8; *Sls. Mgr.:* Robert H. Sturdy

HANDLES UNLIMITED, Vemaline Products Division, 333 Strawberry Field Rd., Warwick, RI 02887-6979, Tel: 800-227-0254, 401-739-7600, FAX: 401-732-6119; FSC No.: 08730; Empl.: 25; *Sls. Mgr.:* William Rife; *Dist. Mgr.:* William Rife

HAND HELD PRODUCTS, INC., 8008 Corporate Center Dr., Charlotte, NC 28226, Tel: 704-541-1380, TWX: 810-621-0380 PROTECH, FAX: 704-541-1333; *Sls. Mgr.:* Jim Trautwein; *Dist. Mgr.:* Jim Trautwein

H & L INSTRUMENTS, 1440 Rollins Road, Burlingame, CA 94010, Tel: 415-342-7850, FAX: 415-347-1065; Empl.: 7; *Sls. Mgr.:* Jenifer H. Landman

HANDY & HARMAN ELCTRN. MATLS. CORP., 72 Elm St., N. Attleboro, MA 02760, Tel: 508-695-1401, FAX: 508-695-7565; Empl.: 300; *Sls. Mgr.:* T. Longo

HANDY & HARMAN PRECIOUS METALS REFINING, 300 Rye Street, S. Windsor, CT 06074, Tel: 1-800-421-0411, 203-289-4327, FAX: 203-289-6494

HANIFY-KING PC, 1 Federal St., Ste. 13 Fl., Boston, MA 02110-2003, Tel: 617-492-0700, TELEX: 6714194, FAX: 617-492-7908; *Sls. Mgr.:* Paul Blumeufeld

HANKSCRAFT MOTORS, Sub of Gerber Prod. Co., P.O. Box 190, Reedsburg, WI 53959, Tel: 608-524-4341, FAX: 608-524-4342; Empl.: 75

HANOVIA, Canrad, 100 Chestnut St., Newark, NJ 07105, Tel: 201-589-4300, TELEX: 13-8531, FAX: 201-589-4430; Empl.: 250; *Sls. Mgr.:* Dennis M. Priscandaro; *Dist. Mgr.:* Dennis M. Priscandaro

HANSCOM, H. F., CO., INC., 225 Chapman St., Providence, RI 02905, Tel: 401-941-1455, FAX: 401-781-8835; Empl.: under 50; *Sls. Mgr.:* Allan Hanscom

HANSEN CORP., Box 23, Princeton, IN 47670-0023, Tel: 812-385-3415, FAX: 812-385-3013; Empl.: 400; *Sls. Mgr.:* Dennis E. Monforton

HANTRONIX INC.

FAX: 408-749-0477

HANTRONIX, INC., Liquid Crystal Display, 250 Santa Ana Ct., Sunnyvale, CA 94086, Tel: 408-736-3191, TELEX: 880165; Empl.: 25; *Sls. Mgr.:* Jake B. Yu; *Dist. Mgr.:* Ken Mc Reynolds ..... **B•1070-1071**

Local Sales Offices & Reps

AL	Madison, Benchmark Tech. Sls.	205-464-0033
AZ	Phoenix, Howe & Howe Sls.	602-264-7971
CA	Laguna Hills, 4 Star Elctrn. Sls.	714-583-9781
CA	Riverside, 4 Star Elctrn. Sls.	909-780-5146
CA	San Jose, Luscombe Engrg.	408-370-2020
CO	Longmont, Butler Tech. Sls.	303-651-7703
CT	Waterbury, Ray Perron & Co., Inc.	203-756-9684
FL	Davie, Dan-Tech. Sls.	305-581-2882
IL	Arlington Hghts., Coombs Assoc.	708-439-9810
IN	Indianapolis, C.M.P. Engrg./Sls.	317-849-9277
KS	Prairie Village, Crosslink	913-649-7100
MD	Ellicot City, Technology Sls.	410-461-7802

HAMMOND

CABINETS
ENCLOSURES

In Stock

POCO SALES
8925 Fullbright Avenue
Chatsworth, CA 91311
(818) 700-8727

POCO Sales

MA Needham, Ray Perron & Co., Inc. 617-449-6162
MI Detroit, C.M.P. Engrg./Sls. 313-477-7700
NJ Lebanon, Sylvester Sls. Assoc. 908-735-2488
NJ Medford, CEF Assoc. 609-953-8945
NY Manluis, Lamtec Sls. 315-682-4780
NC Raleigh, Benchmark Tech. Sls. 919-850-0633
OH Cleveland, C.M.P. Engrg./Sls. 216-398-0400
OH Dayton, C.M.P. Engrg./Sls. 513-836-0951
OR Hillsboro, Temco Northwest 503-645-2030
PA Pittsburgh, C.M.P. Engrg./Sls. 412-826-3800
TX Dallas, Innovative Tech. Sls. 214-699-3485
WA Birch Bay, Temco North West 206-371-0423
WA Bothell, Temco North West 206-481-6150
WI Milwaukee, Coombs Assoc. 414-351-6123

Local Distributors

CA Costa Mesa, Orange County Comps. 714-979-3597
CA Industry, Ital Elctrns Sls. 818-968-8515
CA Mission Viejo, Opto Plus 714-380-8654
CA San Diego, Deco Elctrns., Inc. 619-693-1595
CA San Diego, Mock 3 619-693-8230
CA San Jose, Spectra Elctrn. Inc. 408-955-7800
CO Aurora, Q P S 303-343-9260
CO Littleton, Displays Plus 303-730-7333
IL Chicago, Leed Elctrns., Inc. 312-625-2800
IL North Brook, Classic Comps. 708-272-9650
IL Schaumburg, Q.P.S. 708-884-6620
MA Wilmington, North Star Elec. 508-657-5155
MN Brooklyn Park, Tech. Comps. 612-561-5556
MN Plymouth, Leeds Elctrns., Inc. 612-557-1277
NJ Rockaway, Tonar Inds., Inc. 201-586-9000
NM Albuquerque, Betatron 505-821-1122
NY Rochester, North Star Elect. 716-244-9846
OR Salem, Light Wave Elctrns. 503-585-4770
PA Prairie Village, Crosslink 913-649-7100
TX Austin, Omni Pro 512-794-9200
TX Austin, Wofford 512-339-1131
TX Carrollton, Omni Pro 214-713-9000
TX Dallas, Omni Pro Elctrns. 214-233-0500
TX Dallas, Wofford 214-340-8555
TX Houston, Omni Pro 713-270-1700
TX Tomball, Wofford Elctrns. 713-351-2255
WI New Berlin, Classic Comps. 414-786-5300
Can Ontario, Intelatech, Inc. 416-629-0082

HARBIN ELCTRNS. CO., 3826 Old Getwell Rd., Memphis, TN 38118, Tel: 901-794-1667, FAX: 901-794-2515; Empl.: 15

HARBOUR IND. (CANADA) LTD., 1365 Industriel Blvd., Farnham, Quebec, Canada J2N 2X3, Tel: 514-293-5304, FAX: 514-293-2421; Empl.: 31; *Sls. Mgr.:* Marc Longpre

HARDIGG CASES, Hardigg Industries, 393 N. Main St. P.O. Box 201, South Deerfield, MA 01373, Tel: 413-665-2163, FAX: 413-665-8061; FSC No.: 11214; Empl.: 200; *Sls. Mgr.:* Stanley J. Morgan

HARDMAN: HARCROS CHEMICALS INC., 600 Cortlandt St, Belleville, NJ 07109, Tel: 201-751-3000, FAX: 201-751-8407; Empl.: 75; *Sls. Mgr.:* Donald J. Wirth

HAROWE SERVO CONTROLS, INC.:A FASCO CO., 110 Westtown Rd. P.O. Box 547, West Chester, PA 19380, Tel: 215-692-2700, FAX: 215-696-2264; FSC No.: 06989; Empl.: 300; *Sls. Mgr.:* William J. Cuff

HARREL, INC., 16 Fitch St., E. Norwalk, CT 06855, Tel: 203-866-2573; *Sls. Mgr.:* Richard Decew

HARRIS CORP., Dracon Div., 809 Calle Plano, Camarillo, CA 93012, Tel: 805-987-9511, TELEX: 182327, FAX: 805-987-2547; Empl.: 350; *Sls. Mgr.:* Tom Erdmann; *Dist. Mgr.:* Jeff Shaffer

HARRIS MICROWAVE SEMICONDUCTOR, Harris Semiconductor, 1530 McCarthy Blvd., Milpitas, CA 95035, Tel: 408-433-2222, TWX: 910-338-2247, FAX: 408-432-3268; *Sls. Mgr.:* Jim Klug

HARRIS SEMICONDUCTOR, Box 883, Melbourne, FL 32902, Tel: 1-800-4 HARRIS, FAX: 407-724-3937; FSC No.: 34371; Empl.: 9000; *Sls. Mgr.:* Carlton Smith; *Dist. Mgr.:* Valerie Lewis

HARTING ELEKTRONIK, INC., 2155 Stonington Ave., Ste. 212, Hoffman Estates, IL 60195, Tel: 708-519-7700, ext. 200, FAX: 708-519-9771; Empl.: 24; *Sls. Mgr.:* Donald G. Blummer, Natl. Sls. Mgr. ..... **C•1343-1345**

Local Distributors

AZ Phoenix, Beswitched 602-275-4805
AZ Phoenix, Dalis Elctrns. 602-272-2626
CA Irvine, Kensington 714-588-0575
CA San Jose, Compass Comps. 408-432-7575
CA Santa Clara, Foresight Elctrns. 408-980-9700
CA Santa Clara, Trinity Elctrns. 408-980-9011
CT Wallingford, Control Design Supp. 203-269-9955
IL Arlington Hgts., LoDan Elctrns. 708-398-5311
IL Schaumburg, Control Design Supp. 708-307-8900
IN Indianapolis, Control Design Supp. 317-788-4559
MA Woburn, Control Design Supp. 617-932-9404
MI Madison Hgts., Tracer Control Co. 313-545-7140
MO Maryland Hgts., French Gerleman Elec. Co. 314-569-3122
NM Albuquerque, Bestech Elctrn. Comp. Sls. 505-298-0034
NC Charlotte, Control Design Supp. 704-588-4410
OR Portland, Dunn Elctrns. 503-285-0214
PA Malvern, Control Design Supp. 215-296-0150
PA North Versailles, CMD Elctrns., Inc. 412-678-6020
TX Dallas, Control Design Supp. 214-358-1441
TX Dallas, Omni Pro Elctrns., Inc. 800-926-8926
TX Houston, TriStar Elctrns. Corp. 713-667-7200
WA Seattle, Radar Elec. Co., Inc. 206-282-2511
WI New Berlin, Control Design Supp. 414-784-1015
Can Kingston, Ont., Elctrn. Packaging Sys. Ltd. 613-384-1142
Can Victoria, B.C., Pacific Coast Elctrns., Ltd. 604-385-5111

HARTLEY PRODUCTS, 5732 Oleander Dr., P.O. Box 4794, Wilmington, NC 28406, Tel: 919-392-0500, FAX: 919-392-1077; *Sls. Mgr.:* R. Schmetterer

HARWIL CORPORATION, 1548 17th St., Santa Monica, CA 90404, Tel: 310-829-2310, FAX: 310-829-2259; Empl.: 14

HASCO COMPONENTS INTERNATIONAL CO., 247-40 Jericho Tpke., Bellrose Village, NY 11001, Tel: 516-328-9292, FAX: 516-326-9125; Empl.: 30; *Sls. Mgr.:* Tab Hauser; *Dist. Mgr.:* Chris Mennella ..... **B•1514-1520, 1735**

Local Sales Offices & Reps

AL Huntsville, Hasco Comps. Intl. Corp. 800-852-5050
AK Anchorage, Hasco Comps. Intl. Corp. 800-852-5050
AZ Phoenix, Hasco Comps. Intl. Corp. 800-852-5050
CA Irvine, Hasco Comps. Intl. Corp. 800-852-5050
CA Los Angeles, Hasco Comps. Intl. Corp. 800-852-5050
CA San Francisco, Hasco Comps. Intl. Corp. 800-852-5050
CT Hartford, Hasco Comps. Intl. Corp. 800-852-5050
GA Atlanta, Hasco Comps. Intl Corp. 800-852-5050
IL Chicago, Hasco Comps. Intl. Corp. 800-852-5050
KS Kansas City, Hasco Comps. Intl. Corp. 800-852-5050
LA New Orleans, Hasco Comps. Intl. Corp. 800-852-5050
MA Framingham, Hasco Comps. Intl. Corp. 800-852-5050
MO Kansas City, Hasco Comps. Intl. Corp. 800-852-5050
NM Albuquerque, Hasco Comps. Intl. Corp. 800-852-5050
NY Port Washington, Hasco Comp. Intl. Corp. 800-852-5050
NY Rochester, Hasco Comps. Intl. Corp. 800-852-5050
NC Raleigh, Hasco Comps. Intl. Corp. 800-852-5050
OH Cleveland, Hasco Comps. Intl. Corp. 800-852-5050
TX Dallas, Hasco Comps. Intl. Corp. 800-852-5050
VA Charlottesville, Hasco Comps. Intl. Corp. 800-852-5050
WA Seattle, Hasco Comps. Intl. Corp. 800-852-5050
WI Milwaukee, Hasco Comps. Intl. Corp. 800-852-5050

Local Distributors

AR N. Little Rock, Control Design 501-851-3137
CT Wallingford, Control Design 203-269-9955
FL Sanford, Control Design 407-328-8011
GA Stone Mountain, Control Design 800-432-0072
IL Carrol Stream, Lectro Comps. 800-323-2282
MA Woburn, Control Design 617-932-9404
MO St. Louis, Control Design 314-432-1116
NJ Rockaway, Tonar 201-586-9000
NY Hauppauge, Jaco Elctrns. 516-273-5500
NC Charlotte, Control Design 704-588-4410
PA Philadelphia, Sharp Elctrns. 215-969-3300
WI New Berlin, Control Design Supp. 414-784-1016
Can Mississauga, C.E.A. 416-602-9717

HATHAWAY CORPORATION:MOTION CONTROL DIV., 10827 E. Marshall, Tulsa, OK 74116, Tel: 918-438-7800, FAX: 918-438-7629; Empl.: 80; *Sls. Mgr.:* David Richards

HAUMAN, INC., 2031 Ringwood Avenue, San Jose, CA 95131, Tel: 408-434-0888, FAX: 408-434-9832; *Sls. Mgr.:* Willis Yeh ..... **D•1265, 1737**

Local Sales Offices & Reps

AL Huntsville, B & C Instruments, Inc. 205-883-6530
CA Sunnyvale, E.I.L. Instrs. 408-744-0271
CO Denver, E.I.L. Instrs. 303-534-4160
CT Cheshire, Allied Elctrns. 203-272-7730
FL Casselberry, Allied Elctrns. 407-831-3331
IL Wood Dale, Allied Elctrns. 708-860-0007
IN Indianapolis, Allied Elctrns. 317-875-0448
KY Louisville, Allied Elctrns. 502-452-2293
MD Columbia, Allied Elctrns. 301-381-1560
MA Boston, E.I.L. Instrs. 617-272-9450
MI Grand Rapids, Allied Elctrns. 616-949-8200
NJ Moorestown, Allied Elctrns. 609-234-7769
NY Rochester, E.I.L. Instrs. 716-586-8251
NC Raleigh, Allied Elctrns. 919-876-5845
OH Dayton, E.I.L. Instrs. 513-435-2134
OK Tulsa, Allied Elctrns. 918-664-0844
OR Portland, Westcon Inc. 503-283-0132
PA Pittsburgh, E.I.L. Instrs. 412-823-2255
SC Greenville, Allied Elctrns. 803-288-8835
TX Houston, E.I.L. Instrs. 713-271-3100
UT Salt Lake City, Allied Elctrns. 801-261-5244
VA McClean, E.I.L. Instrs. 703-569-2611
WA Seattle, Allied Elctrns. 206-547-2827
WI Milwaukee, Allied Elctrns. 414-796-1280

Local Distributors

AL Huntsville, Allied Elctrns. 205-721-3500
AK Anchorage, Alaska Elctrnc. Supp. 907-563-3774
AZ Phoenix, Allied Elctrns. 602-437-9080
CA Canoga Pk., RAG Elctrns. 818-998-6500
CO Englewood, Allied Elctrns. 303-790-1664
CT Newtown, Conn Cal Labs 203-270-1263
FL Melbourne, E.I.L. Instrs. 407-725-8300
GA Duluth, Allied Elctrns. 404-497-9544
ID Bridge View, E.I.L. Instrs. 708-430-2292
IL Oak Forest, Allied Elctrns. 708-918-0250
IN Indianapolis, E.I.L. Instrs. 317-545-1373
IA West Des Moines, Allied Elctrns. 515-223-6488
KS Lenexa, Allied Elctrns. 913-599-6227
KY Louisville, E.I.L. Instrs. 502-454-3420
LA Metaire, Allied Elctrns. 504-885-1195
MD Hunt Valley, Allied Elctrns. 410-584-7400
MA Billerica, Allied Elctrns. 508-667-7921
MI Livonia, Allied Elctrns. 313-462-0190
MN Bloomington, Allied Elctrns. 612-881-0838
MO Earth City, Allied Elctrns. 314-291-7031
NE Omaha, Allied Elctrns. 402-697-0038
NH Nashua, Allied Elctrns. 603-883-3006
NJ Clarksburg, Accutest Instrs. 800-524-0747
TX Garland, Tucker Elctrns. 800-527-4642
WA Bellevue, Vetco 206-869-7025

HAUEG DIVISION, A Subsidiary of Ametek Inc., 900 Greenbank Rd., Wilmington, DE 19808, Tel: 302-995-0400, 800-441-7777, FAX: 302-995-0491; *Sls. Mgr.:* Bill Wenner

HAVERLY SYSTEMS, INC., 12 Hinchman Ave., Box 919, Denville, NJ 07834, Tel: 201-627-1424, FAX: 201-625-2296; Empl.: 33; *Sls. Mgr.:* Ken Spencer

HAYDON SWITCH & INSTRUMENT, 1500 Meriden Rd., P.O. Box 3329, Waterbury, CT 06705, Tel: 203-756-7441, TELEX: 643852-HSIINTLWBY, FAX: 203-756-8724; FSC No.: 02005; Empl.: 100; *Sls. Mgr.:* Wendy Rossi

HAYES INSTRUMENT SERVICE INC., 530 Boston Rd., Billercia, MA 01821, Tel: 508-663-4800, FAX: 508-663-3812; Empl.: 25; *Sls. Mgr.:* Thomas P. Fitzgerald

HBM, INC., 19 Bartlett Street, Marlboro, MA 01752, Tel: 508-624-4500, FAX: 508-485-7480; Empl.: 105; *Sls. Mgr.:* Robert Gray

HBS EQUIPMENT CORPORATION, 3000 Supply Ave., Los Angeles, CA 90040, Tel: 213-726-3033, FAX: 213-888-9982; Empl.: 60; *Sls. Mgr.:* Sam Houston

HC Power, inc.

FAX: 714-261-6584

HC POWER INC., 17032 Armstrong Ave., Irvine, CA 92714-5716, Tel: 714-261-2200; FSC No.: 0D6P8; *Sls. Mgr.:* Jack Graham ..... **D•1738-1741**

Local Sales Offices & Reps

AL Huntsville, Murcota 205-539-8476
AZ Phoenix, Tektris 602-437-1915
CA Huntington Beach, Tektris 714-964-8560
CA La Mesa, Tektris 800-875-0855
CA San Diego, ATA Assocs. 619-792-6079
CA Santa Clara, Electro Venture 408-727-1553
CA Valencia, Tektris 805-295-8747
CO Englewood, Taylor Mktg. 303-850-0207

CO Littleton, Taylor Mktg. 303-850-0207
FL Oldsmar, Suncoast 813-787-9221
GA Lawrenceville, Murcota 404-513-8093
IL Elmhurst, Utronix 708-834-1100
IN Indianapolis, JC Hofstetter 317-897-7914
IA Des Moines, The Beams Co. 515-255-1148
KS Shawnee Mission, The Beams Co. 913-631-0300
MN Minneapolis, Electro-Serv 612-338-3475
MO St. Louis, The Beams Co. 314-434-8448
NH Londonderry, Power Solutions Mktg. 603-432-5476
NY Rochester, Power Conversion & Assoc. 716-426-3598
NC Winston-Salem, Murcota 919-722-9445
OH Dayton, JC Hofstetter 513-296-1010
OH Medina, JC Hofstetter 216-725-4477
OR Portland, Power Factor Assocs. 503-233-6969
PA Pittsburg, JC Hofstetter 412-356-2305
RI Barrington, Power Solutions Mktg. 401-245-5045
TX Dallas, Dynamark 214-437-3333
UT Ogden, Taylor Mktg. 801-546-9570
VA Sterling Park, Beacon North 703-478-2480
NY Spring Valley, Powertronics 914-735-3775
Can Lachine, Digidyne 514-631-1891
Can Napean, Digidyne 613-727-5632
Can Toronto, Digidyne 416-674-0444

HC PROTEK, 154 Veterans, Northvale, NJ 07647, Tel: 201-767-7242, FAX: 201-767-7343; *Sls. Mgr.:* Alex Orloff

HDR POWER SYSTEMS, INC., 4242 Reynolds Dr., Hilliard, OH 43026, Tel: 614-771-5500, FAX: 614-771-7219; Empl.: 90; *Sls. Mgr.:* Harlan W. Bates

HDS INC., 12310 Pinecrest Rd., Reston, VA 22091, Tel: 703-620-6200, TELEX: 64585, FAX: 703-620-3169; Empl.: 95

H D SYSTEMS, INC., 89 Cabot Court, Hauppauge, NY 11788, Tel: 516-231-6630, FAX: 516-231-6803; Empl.: 5; *Sls. Mgr.:* Tetsuo Ikuta

HEADWAY RESEARCH, INC., 3713 Forest La., Garland, TX 75042, Tel: 214-272-5431, FAX: 214-272-7817; Empl.: 45

HECON CORP., 15 Meridian Road, Eatontown, NJ 07724, Tel: 908-542-9200, TELEX: 13-2457; Empl.: 75; *Sls. Mgr.:* Kenneth W. Aurin

HEDRICH USA, INC., 4201-D Stuart Andrew Blvd., Charlotte, NC 28217, Tel: 704-522-0006, FAX: 704-522-0036

HEEGER, INC., 6400 Fleet St., City of Commerce, CA 90040, Tel: 213-728-5108, 728-4729, 728-6913, FAX: 213-728-4740; Empl.: 10; *Sls. Mgr.:* Robert A. Heeger

HEI CORPORATION, P.O. Box 88806, Carol Stream, IL 60188, Tel: 708-665-5500, FAX: 708-665-5769; Empl.: 20

HEIDENHAIN CORP., 115 Commerce Dr., Schaumberg, IL 60173, Tel: 708-490-1191, FAX: 708-490-3931; Empl.: 72; *Sls. Mgr.:* Rick Korte; *Dist. Mgr.:* Rick Glos

HEI, INC., Hybrid Electronics Div., 1495 Steiger Lake Ln., Victoria, MN 55386, Tel: 612-443-2500, ESYLNK: 62940281, FAX: 612-443-2668; Empl.: 200; *Sls. Mgr.:* Dale Nordquist ..... **A•1700-1702**

Local Sales Offices & Reps
MN Victoria, HEI Inc. 612-443-2500

HEI, INC., Optoelectronics Div., 1495 Steiger Lake La.,P.O.Box 5000, Victoria, MN 55386, Tel: 612-443-2500, TWX: 510-601-7785, ESYLNK: 62940281, FAX: 612-443-2668; Empl.: 150; *Sls. Mgr.:* Dale Nordquist

HEINEMANN PRODUCTS, Eaton Corporation, P.O. Box 6800, Lawrenceville, NJ 08648-0800, Tel: 609-896-0009, FAX: 609-896-1631; FSC No.: 74193; Empl.: 350; *Sls. Mgr.:* John McNamara ..... **B•1360-1363**

Local Sales Offices & Reps
AZ Phoenix, Mercury Engrg. Sls. 602-265-0344
CA San Diego, O'Donnell Assocs., Inc. 619-578-1645
CA San Jose, O'Donnell Assocs. No. 408-456-2950
CA Torrance, O'Donnell Assocs., Inc. 213-539-9664
CO Englewood, CompuTech Mktg. 303-773-3981
FL Oviedo, Conley & Assocs. 407-365-3283
FL Wellington, Conley & Assocs., Inc. 407-790-3926
GA Duluth, Dixie Mktg. 404-381-5592
IL Northbrook, D. Dolin Sls. 708-498-6770
IN Ft. Wayne, O.H. Bromberg & Assocs. 219-456-6010
IA Hiawatha, Ard Sls. Co. 319-393-6392
KY Alexandria, O.H. Bromberg & Assoc. 606-635-3063
KY Louisville, O.H. Bromberg & Assocs. 502-456-1498
MD Upperco, Imagitron Sls. Co., Inc. 301-374-5600
MA Ashland, Sullivan Tech. Sls. 508-881-2215
MI Southfield, L. H. Dickelman Co. 313-353-8210
MN Minneapolis, Furber Sls. Co., Inc. 612-881-3620
MO Kansas City, Hill & Co. 816-361-1669
MO St. Louis, Hill & Co. 314-842-6868
NJ Ridgewood, Ballou, Inc. 201-444-6990
NY Rochester, R. M. Scanlon & Assocs. 716-359-0773
NY Syracuse, R.M. Scanlon & Assoc., Inc. 315-463-7682
NC Charlotte, J. Rudisill Assocs. 704-377-6901
OH Cleveland, Brown Elect. Prod. 216-331-2072
OH Dayton, KW Elctrn. Sls. 513-890-2150
OH Dayton, O. H. Bromberg & Assocs. 513-434-8788
OR Beaverton, Westmark Elctrns., Inc. 503-641-8780
PA Allison Park, KW Electrn. Sls. 412-366-9396
NJ Lawrenceville, DVS Co. 609-896-1112
TX Dallas, Glidden Electro Equip. 214-341-0610
TX Houston, Glidden Electro Equip. 713-681-1415
WA Bellevue, Westmark Elctrns., Inc. 206-454-1944
WI Milwaukee, Key Entpr. 414-762-2323

Local Distributors
AL Montgomery, Southern Controls 205-277-5030
CA Chatsworth, POCO Sls. 818-700-8727
CA Inglewood, Newark Elctrns. 301-671-7370
CA Los Angeles, Master Distrs. 213-452-1229
CA Oakland, Brill Elctrns. 510-834-5888
CA San Carlos, Campbell & George 415-594-1994
CA Santa Clara, Cypress Elctrns. 408-980-8400
CA Van Nuys, Fuses, Unltd. 818-786-8111
CO Aurora, Jet Elctrns. 303-364-1000
CO Denver, CSID Inc. 303-292-9594
CO Denver, Newark Elctrns. 303-757-3351
CT Hartford, L. E. Whelan Co. 203-296-5000
CT Wallingford, Green Shaw Co. 203-265-3333
FL Oviedo, Dixie Sls. 407-365-1515
GA Atlanta, Georgia Control Cen. 404-767-6677
IL Chicago, Newark Elctrns. 312-784-5100
IL Morton Grove, Nedco Elctrns. 708-967-0500
IL Northbrook, Classic Comps. Supp. 708-272-9650
IN Carmel, Breakers Unltd. 317-896-5399
IN Indianapolis, Bell Inds. 317-875-8200
MD Columbia, DK Elctrns., Inc. 301-995-1950
MD Crofton, Custom Marine Svcs. 301-721-7354
MA Andover, Bell Inds. 508-474-8880
MA Needham, Power Electro Supp. 617-444-6866
MA Newton, Green Shaw Co. 617-969-8900
MA Woburn, Apparatus Svc. 617-933-5999
MI Oak Pk., Newark Elctrns. 313-967-1570
MI Southfield, Michigan Lectrols Corp. 313-353-1350
MN Minneapolis, Newark Elctrns. 612-331-6350
MO Maryland Heights, Lcomp, Inc. 314-291-6200
NJ Lawrenceville, Riverside Comps. Supp. 609-896-1611
NY Johnson City, Help Elctrns., Inc. 607-729-3528
NY New Hyde Park, I/O Corp. of NY 516-355-0135
NY Ronkonkoma, Arrow Elctrns. 516-467-1000
NY Whitestone, Power Electro Supp. Co. 718-767-1447
NC Charlotte, Motionex Inc. 704-377-1555
NC Raleigh, Greene-Shaw Co. 919-954-7138
OH Cleveland, I/O Corp. of Cleveland 216-642-7300
OH Dayton, Duellman Elec. 513-461-8022
OH Dayton, Stotts Friedman Co. 513-298-5555
OH Shandon, Cartessa Corp. 513-738-4477
OH Valley View, Newark Elctrns. 216-447-8860
OR Portland, Taylor Elec. 503-233-5321
PA Allison Park, Circuit Breakers, Inc. 412-487-9090
PA Erie, REM Elctrns. 814-453-5626
PA Fort Washington, I/O Corp. of Phila. 215-641-1870
PA West Chester, West Chester Elec. & Electrn. 215-696-7500
TN Chattanooga, Techni-Tronics, Inc. 615-332-2119
TX Dallas, Geeco Sls. Co. 214-341-2626
TX Garland, Newark Elctrns. 214-487-8144
TX Houston, Newark Elctrns. 713-782-4800
VA Ashland, Hanover Controls & Supp. Corp. 804-550-2449
VA Charlottesville, Va. Elctrn. Comps. 804-296-4184
WA Seattle, H. C. Campbell Co. 206-433-1900
WI Milwaukee, Hunt Co. 414-383-1781

HEITZ, KARL, INC., P.O. Box 427, Woodside, NY 11377, Tel: 718-565-0004, FAX: 718-565-2582; Empl.: 15

HELICAL PRODS. CO., INC., Box 1069, Santa Maria, CA 93456-1069, Tel: 805-928-3851, FAX: 805-928-2369; FSC No.: 13201; Empl.: 85

HELM INSTRUMENT CO., INC., 1387 Dussel Drive, Maumee, OH 43537, Tel: 419-893-4356, FAX: 419-893-1371; Empl.: 55; *Sls. Mgr.:* M. Wilhelm; *Dist. Mgr.:* N. Phillips

HENRICKS TECHNOLOGIES, INC., 365 College St., Forsyth, GA 31029, Tel: 912-993-1060, 800-241-0806, FAX: 912-993-1068; Empl.: 30; *Sls. Mgr.:* Paul D. Setters

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HERGA INC. HERGA ELECTRIC LIMITED, 602 Brandywine Parkway, West Chester, PA 19380, Tel: 215-430-1970, FAX: 215-430-7785; Empl.: 5

HERITAGE METAL FINISHING INC., 800 S. Market St. P.O. Box 446, Elizabethtown, PA 17022, Tel: 717-367-1561, FAX: 717-367-2474; Empl.: 43; *Sls. Mgr.:* Terry L. Rinesmith

HERMETIC SEAL CORP., 4232 Temple City Blvd., Rosemead, CA 91770, Tel: 213-283-0411, FAX: 818-443-6610; FSC No.: 04820; Empl.: 200

HERMETIC SWITCH, Box 1325, Hwy. 92, Chickasha, OK 73018, Tel: 405-224-4046, TELEX: 796125 Hermetic CKSA, FAX: 405-224-9423; FSC No.: 65623; Empl.: 200; *Sls. Mgr.:* R. Helms, Kim Baker ... **B•1737, 1954-1955**

Local Sales Offices & Reps

AZ	Phoenix, Toweard Engrg. Assocs.	602-955-3193
CA	Arcadia, V. Gott & Assocs.	818-445-9729
CA	Palo Alto, Adtek Assocs.	415-327-0300
CA	San Diego, V. Gott & Assocs.	619-489-0893
GA	Atlanta, Electro Technlg. Prods.	404-262-1522
IL	Lemont, Trend-Tronics, Inc.	708-972-1166
MA	Canton, New England Elctrn. Sls.	617-828-4835
MN	Minneapolis, Peterson Sls. & Assocs.	612-835-5281
NY	Oceanside, Current Inds.	516-678-3895
OR	Beaverton, Unicomp, Inc.	503-684-8221
PA	Furlong, Avenir	215-348-8290
TX	Austin, R. F. Kimball Co.	512-443-5284
TX	Houston, R. F. Kimball Co.	713-890-8810
TX	Richardson, R. F. Kimball Co.	214-231-3447
WA	Snohomish, Unicomp, Inc.	206-568-0511
WA	Spokane, Unicomp, Inc.	509-922-4883

Local Distributors

TX	Ft.Worth, Allied Elctrns. Inc.	817-595-3500

HERSEY MEASUREMENT CO., Flow Measurement, Inc., P.O. Box 4585, Spartanburg, SC 29305, Tel: 803-574-8960, 1-800-845-2102, FAX: 803-578-7308; Empl.: 80; *Sls. Mgr.:* Bob Hill

HERTNER DIV.:EXIDE CORP., 12690 Elmwood Ave., Cleveland, OH 44111, Tel: 216-252-4242, FAX: 216-941-4330; FSC No.: 28398; Empl.: 100; *Sls. Mgr.:* R.C. Wright

HEURISTICS INCORPORATED, 9845 Horn Rd., Ste. 100, Sacramento, CA 95827, Tel: 916-369-6606, FAX: 916-369-6175; Empl.: 70; *Sls. Mgr.:* Mike McMann, Genl. Mgr.

HEWLETT-PACKARD COMPANY, Direct Marketing Organization, P.O. Box 58059, MS 51L-SJ, Santa Clara, CA 95051-8059, Tel: 800-452-4844; Empl.: 93,100

HEXACON ELECTRIC CO., 161 W. Clay Ave., Roselle Park, NJ 07204, Tel: 908-245-6200, FAX: 908-245-6176; Empl.: 150; *Sls. Mgr.:* Robert L. Miller

HEYCO MOLDED PRODUCTS, INC., Box 160, Kenilworth, NJ 07033, Tel: 908-245-0033, 800-526-4182, FAX: 908-245-3238; FSC No.: 28520; Empl.: 135

HEYCO STAMPED PRODUCTS, See Cabletest International Inc.

HH CONTROLS CO., INC., 16 Frost St., Arlington, MA 02174, Tel: 617-646-2626, FAX: 617-646-2662; Empl.: 13

HIAC/ROYCO, Pacific Scientific Co., 11801 Tech Rd., Silver Spring, MD 20904, Tel: 301-680-7000, TELEX: 197635 PACSCIUT; Empl.: 125; *Sls. Mgr.:* Lou Sarto

HIBBING ELCTRNS. CORP., OECO Corp., 3125 East 14th Ave., P.O. Box 129, Hibbing, MN 55746-0129, Tel: 218-263-8971, FAX: 218-263-8970; Empl.: 405; *Sls. Mgr.:* Michael Walsh

HICKOK ELECTRICAL INSTRUMENT COMPANY, 10514 Dupont Ave., Cleveland, OH 44108, Tel: 216-541-8060, FAX: 216-761-9879; FSC No.: 28569; Empl.: 230; *Sls. Mgr.:* Bob Fiorille

HICO HORIZONS INTL CO., See Maxon Precision Motors

HI-G COMPANY SUB. OF NYTRONICS, See Struthers-Dunn, Inc. and Hi-G Co., Inc., Sub. of Nytronics.

HIGH ENERGY, Inductotherm Industries, Lower Valley Rd., Parkesburg, PA 19365, Tel: 215-593-2800, TELEX: 759888, FAX: 215-593-2985; FSC No.: 21052; Empl.: 50; *Sls. Mgr.:* Joseph F. Quinn

HIGHLAND TECHNOLOGY, INC., 320 Judah Street, San Francisco, CA 94122, Tel: 415-753-5814, FAX: 415-753-3301; Empl.: 12; *Sls. Mgr.:* David Taeler

HIGH REL GROUP, 2127 Ringwood Ave, San Jose, CA 95131, Tel: 408-321-6400, FAX: 408-321-6415; FSC No.: 4Y548; Empl.: 25; *Sls. Mgr.:* Beth Pagino

HIGH VOLTAGE SYSTEMS, INC., Universal Designs Corp., P.O. Box 649, Chappaqua, NY 10514, Tel: 914-238-8462, FAX: 914-238-8462; Empl.: 15; *Sls. Mgr.:* Vincent A. Gianguzzi

HIGH VOLTAGE TECHNOLOGY INC., 71 Alexander St., Yonkers, NY 10701, Tel: 914-423-6636, FAX: 914-968-0347; Empl.: 12

HILEVEL TECHNOLOGY, 2991 Dow Ave., Tustin, CA 92680, Tel: 714-573-1888, FAX: 714-573-1899; Empl.: 30; *Sls. Mgr.:* Dolores DeRosa

HILTON INDUSTRIES, INC., Subsidiary of Core Industries, 1177 Cattlemen Road, Sarasota, FL 34232, Tel: 813-371-2600, FAX: 813-371-7750; Empl.: 137; *Sls. Mgr.:* Larry Copenhaver; *Dist. Mgr.:* Larry Copenhaver

HIPOTRONICS INC., Rte. 22, P.O. Box 414, Brewster, NY 10509, Tel: 914-279-8091, TELEX: 425476, TWX: 710-574-2420, FAX: 914-279-2467; FSC No.: 25284; Empl.: 230; *Sls. Mgr.:* Kenneth Johnson

HIRAM JONES ELECTRONICS, 11607 Vanowen St., No. Hollywood, CA 91605, Tel: 213-875-0213, FAX: 818-982-7339; FSC No.: 04867; Empl.: 8

THE HIROL COMPANY, 1170 W. McNab Rd., Ft. Lauderdale, FL 33309, Tel: 305-974-4900, FAX: 305-975-4734; Empl.: 45; *Sls. Mgr.:* Richard Diefenderfer ... **B•1072; C•1664, 1685**

Local Sales Offices & Reps

CA	Laguna Nigel, E.J. Stanton & Sons	714-496-4027
MA	Norton, Paul Vincent	508-285-9037
Intl	Singapore, Dynamar Computer	011-65-2813388
Intl	United Kingdom, Read Cosine Ltd.	0202-632274/5

HIROSE ELECTRIC U.S.A., INC. (HRS), Div. of Hirose Electric Co. Ltd. (Japan), 2688 Westhills Ct., Simi Valley, CA 93065, Tel: 805-522-7958, FAX: 805-522-3217; Empl.: 55

RICHARD HIRSCHMANN OF AMERICA INC., Industrial Row, P.O. Box 229, Riverdale, NJ 07457, Tel: 201-835-5002, FAX: 201-835-8354; *Sls. Mgr.:* A. Hoell, Opers. Mgr. Connectors ... **C•1347**

Local Distributors

CA	Irvine, Kensington Elctrns.	714-583-0575
CA	San Diego, Instrument Engrs.	619-673-3644
CA	San Jose, Spectra Elctrns.	408-955-7800
CO	Aurora, Jet Elctrns. Supp.	303-364-1000
CT	Bridgeport, Park Distrs.	203-366-7200
IL	Addison, Belford Elctrns.	708-691-1100
IL	Glendale Hgts., Mac Gregor & Co.	708-469-4080
IN	Carmel, Altex Elctrns., Inc.	317-848-1323
MA	Westboro, In Stock Prods.	508-870-5750
MN	Minneapolis, Elec-Trol	612-521-5051
NH	Atkinson, Astrum Elctrns.	603-898-3399
NJ	Moorestown, Marlac Elctrns.	609-234-4200
NJ	Union, Meridian Supply Co.	908-687-6220
NC	Fuguay-Varina, Rye Inds., Inc.	919-557-0511
TX	Richardson (exc. El Paso City), Centurion Mktg.	214-783-6762
TX	Tomball, Wofford Elctrns.	713-351-2255
Can	Montreal, Que., Hooker Elctrns.	514-487-5151

HISONIC, INC., 310 North Marion, P.O. Box 1130, Olathe, KS 66051, Tel: 913-782-0012, FAX: 913-782-0562; FSC No.: 11402; Empl.: 185; *Sls. Mgr.:* Jack O. Cooper III ... **A•2360**

Local Sales Offices & Reps

AL	Huntsville, MacKay, Smith & Assocs.	205-539-8000
AZ	Scottsdale, Arcom Sls., Inc.	602-947-5745
FL	Ft. Lauderdale, MacKay, Smith & Assocs.	407-423-4353
FL	Orlando, MacKay, Smith & Assocs.	407-423-4353
FL	Palm Coast, MacKay, Smith & Assocs.	904-445-8328
FL	St. Petersburg, MacKay, Smith & Assocs.	407-423-4353
GA	Atlanta, MacKay, Smith & Assocs.	404-496-9913
KS	Shawnee Mission, Florence & Meyer	913-722-5210
MA	Boston, Rosen & Assocs.	617-449-4700
MO	St. Louis, Florence & Meyer	913-722-5210
NC	Charlotte, MacKay, Smith & Assocs.	919-847-2277
NC	Raleigh, MacKay, Smith & Assocs.	919-847-2277
TX	Austin, Aid Elctrns.	512-836-6724
TX	Irving, AID Elctrns.	214-790-4761

Local Distributors

FL		407-423-4353

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FAX: 404-409-3028

HITACHI AMERICA, LTD., Electron Tube Division, 3850 Holcomb Bridge Rd., Ste. 300, Norcross, GA 30092, Tel: 404-409-3000; Empl.: 50; *Sls. Mgr.:* Tim Patton; *Dist. Mgr.:* Steve Bubb ... **B•1073-1076**

Local Sales Offices & Reps

AL	Huntsville, Group 2000	205-536-2000
AL	Huntsville, Technlg. Mktg. Assoc.	205-883-7893
AZ	Mesa, System Sls. of Arizona	602-464-9989
CA	Agoura Hills, Quadrep Southern Inc.	818-597-0222
CA	Irvine, Quadrep	714-527-4222
CA	San Diego, Quadrep Southern Inc.	619-560-8330
CA	San Jose, Quadrep	408-432-3300
CO	Parker, Parker Webster	303-841-4888
CT	Wallingford, Technlg. Sls., Inc.	203-269-8853
FL	Deerfield Beach, Technlg. Mktg. Assoc.	305-427-1090
FL	Largo, Technlg. Mktg. Assoc.	813-531-4405
FL	Orlando, Technlg. Mktg. Assoc.	407-857-3760
FL	Winter Park, Technlg. Mktg. Assoc.	407-671-2245
GA	Norcross, Group 2000 Sls.	404-729-1889
ID	Ketchum, Crown Elctrns.	208-622-8125
IL	Chicago, Sumer Inc.	708-991-8500
IN	Indianapolis, Elctrn. Sls. & Engrg.	317-849-4260
IN	Kokomo, M. Gottleib Assoc. Inc.	317-455-0444
IA	Cedar Rapids, Wes Tech Assocs.	319-393-9790
KS	Overland Park, Electri Rep	913-649-2168
MD	Columbia, Robert Elctrn. Sls.	410-995-1900
MA	Waltham, Technlg. Sls. Inc.	617-890-5700
MI	Flint, M. Gottleib Assoc. Inc.	313-732-3922
MI	Plymouth, Jay Mktg.	313-459-1200
MN	Minneapolis, Tek Rep Inc.	612-832-0277
MO	St. Louis, Electri Rep	314-993-4421
NJ	Teaneck, Strategic Sls., Inc.	201-833-0099
NM	Albuquerque, System Sls. of AZ	505-889-2901
NY	Fairport, Technlg. Sls., Inc.	716-223-7500
NC	Cary, Group 2000 Sls.	919-481-1531
OH	Beachwood, Thompson & Assoc.	216-831-6277
OH	Dayton, Thompson & Assocs.	513-435-7733
OH	Orient, Thompson & Assoc.	614-877-4304
OK	Tulsa, West Assoc.	918-492-4300
OR	Portland, Crown Elctrns.	503-620-8320
PA	Warrington, Strategic Sls. Inc.	215-491-0340
PA	Willow Grove, Technlg. Sls., Inc.	215-784-0170
TX	Austin, West Assocs.	512-343-1199
TX	Houston, West Assocs.	713-621-5983
TX	Richardson, West Assoc.	214-680-2800
UT	Murray, Parker Webster	801-266-9939
WA	Bellevue, Crown Elctrns.	206-453-5100
WI	Brookfield, Sumer, Inc.	414-784-6641
Can	Kanata, Ont., Hitachi Canadian Ltd.	613-591-1990
Can	Mississuaga, Ont., Longman Sls.	416-670-8100

Local Distributors

AL	Huntsville, Marshall	205-881-9235
AL	Huntsville, Reptron	205-722-9500
AZ	Phoenix, Marshall	602-496-0290
AZ	Phoenix, Sterling	602-437-5565
CA	Agoura Hills, Western Micro	818-707-0377
CA	Calabasas, Marshall Inds.	818-878-7028
CA	Chatsworth, Sterling	818-407-8850
CA	El Monte, Marshall Inds.	808-307-6000
CA	Irvine, Marshall	714-458-5394
CA	Irvine, Marshall Ind.	714-458-5398
CA	Milpitas, Marshall	408-942-4600
CA	Milpitas, Marshall Inds.	408-942-4700
CA	Orange, Western Micro	714-637-0200
CA	Rancho Cordova, Marshall Inds.	916-635-9700
CA	San Diego, Marshall	619-578-9600
CA	San Diego, Sterling	619-271-6555
CA	San Diego, Western Micro	619-453-8430
CA	San Jose, Merit Elctrns.	408-434-0800
CA	Saratoga, Western Micro	408-725-4753
CA	Tustin, Sterling	714-259-0900
CO	Englewood, Sterling	303-792-3939
CO	Thornton, Marshall	303-451-8383
CT	Milford, Milgray	203-878-5538
CT	Wallingford, Cronin	203-265-3134

CT	Wallingford, Marshall	203-265-3822
CT	Wallingford, Sterling	203-265-9539
FL	Altamonte Springs, Marshall	407-767-8585
FL	Altamonte Springs, Vantage	305-429-1001
FL	Ft. Lauderdale, Marshall	305-977-4880
FL	Ft. Lauderdale, Reptron	305-735-1112
FL	Orlando, Milgray	407-647-5747
FL	Tampa, Reptron	813-854-2351
FL	Tampa, Reptron	813-855-4656
GA	Atlanta, Marshall	404-923-5750
GA	Atlanta, Milgray	404-446-9777
GA	Norcross, Reptron	404-446-1300
IL	Palatine, Milgray	708-202-1900
IL	Schaumburg, Marshall	708-490-0755
IL	Schaumburg, Reptron	312-882-1700
IN	Indianapolis, Marshall	317-297-0483
KS	Kansas City, Marshall	913-492-3121
KS	Lenexa, Sterling	913-492-5406
KS	Overland Park, Milgray	913-236-8800
MD	Baltimore, Resco	301-931-8200
MD	Beltsville, Resco	301-937-9100
MD	Columbia, Milgray	301-995-6169
MD	Columbia, Sterling	301-290-3800
MD	Columbia, Vantage	301-720-5100
MD	Silver Springs, Marshall	301-622-1118
MA	Andover, Vantage	508-687-3900
MA	Burlington, Western Micro	508-273-2800
MA	Needham, Cronin	617-449-5000
MA	New England, Milgray	508-657-5900
MA	Wilmington, Marshall	508-657-9064
MI	Livonia, Marshall	313-525-5850
MI	Livonia, Reptron	313-525-2700
MN	Minneapolis, Marshall	612-559-2211
MN	Minneapolis, Sterling	612-831-2666
MN	Minnetonka, Reptron	612-938-0000
MO	Bridgeton, Marshall	314-291-4650
NJ	Clifton, Vantage	201-777-4100
NJ	Edison, Sterling	908-417-1000
NJ	Fairfield, Marshall Inds.	201-882-0169
NJ	Marlton, Milgray	609-983-5010
NJ	Marlton, Western Micro	609-596-7775
NJ	Mt. Laurel, Marshall	609-234-9100
NJ	Parsippany, Milgray	201-335-1766
NM	Albuquerque, Sterling	505-884-1900
NY	Farmingdale, Milgray	516-420-9800
NY	Hauppauge, LI, Marshall	516-273-1515
NY	Johnson City, Marshall	607-798-1611
NY	Pittsford, Milgray	716-381-9700
NY	Rochester, Marshall	716-235-7620
NY	Smithtown, Vantage	516-543-2000
NC	Raleigh, Marshall	919-878-9882
NC	Raleigh, Milgray	919-790-8094
NC	Raleigh, Reptron	614-436-6675
OH	Dayton, Marshall	513-898-4480
OH	Solon, Marshall	216-248-1788
OH	Solon, Reptron	216-349-1415
OH	Worthington, Reptron	614-436-6675
OK	Tulsa, Sterling	918-663-2410
OR	Beaverton, Marshall	503-644-5050
OR	Beaverton, Western Micro	503-629-2087
PA	Pittsburgh, Marshall Inds.	412-788-0441
TX	Austin, Marshall	512-837-1991
TX	Austin, Sterling	512-836-1341
TX	Carrollton, Marshall	214-233-5200
TX	Carrollton, Sterling	214-243-1600
TX	Dallas, Milgray	214-248-1603
TX	Houston, Marshall	713-895-9200
TX	Houston, Sterling	713-627-9800
TX	Stafford, Milgray	713-240-5360
UT	Salt Lake City, Marshall	801-485-1551
UT	Salt Lake City, Milgray	801-272-4999
UT	Salt Lake City, Sterling	801-972-5444
VA	Richmond, Sterling	804-226-2190
WA	Bothel, Marshall Inds.	206-486-5747
WA	Redmond, Western Micro	206-881-6737
WI	Milwaukee, Marsh	414-475-6000
WI	Waukesha, Marshall	414-797-8400
Can	Alberta, ITT	403-273-2780
Can	Alberta, ITT	403-436-9555
Can	Brampton, Ont., Marshall Inds.	416-458-8046
Can	British Columbia, ITT	604-291-8866
Can	Manitoba, ITT	204-697-2300
Can	Ontario, ITT	416-736-1144
Can	Ontario, ITT	613-596-6980
Can	Pt. Claire, Que., Marshall Inds.	514-694-8142
Can	Quebec, ITT	514-335-7697

HITACHI AMERICA, LTD., 2000 Sierra Point Parkway, Brisbane, CA 94005, Tel: 415-589-8300, 1-800-HITACHI (Sales Offices), TELEX: 17-1581, TWX: 910-338-2103, FAX: 415-583-4207

HITACHI AMERICA, LTD., 220 White Plains Rd., Tarrytown, NY 10591, Tel: 914-631-0600, TELEX: 234553, FAX: 914-631-0672; *Sls. Mgr.:* William Porter; *Dist. Mgr.:* John McDonnell

HITACHI DENSHI AMERICA LTD., Test & Meas. Div., 371 Van Ness Way, Ste. 120, Torrance, CA 90501, Tel: 310-328-6116, FAX: 310-328-6252; Empl.: 110; *Sls. Mgr.:* Richard Westle, Natl. Sls. Mgr.

HITECH EQUIPMENT CORP., 9400 Activity Rd., San Diego, CA 92126, Tel: 619-566-1892, FAX: 619-530-1458; Empl.: 12

HI-TECH, INC., 3600 16th St., Zion, IL 60099, Tel: 708-746-2447, FAX: 708-746-4945; Empl.: 35; *Sls. Mgr.:* J. Gordon Johnson

HITEMP TECHNOLOGIES, INC., 118 Charcot Ave., San Jose, CA 95131-1101, Tel: 408-922-0740, FAX: 408-922-0534; Empl.: 15; *Sls. Mgr.:* Roger Meade

HITRAN

FAX: 908-782-9733

HITRAN CORPORATION, 362 Highway 31, Flemington, NJ 08822-1238, Tel: 908-782-5525; FSC No.: 27672; Empl.: 120; *Sls. Mgr.:* James Hindle ..... **A•2361; D•1744, 2266-2267**

Local Sales Offices & Reps

AL	Birmingham, Robertson Sls.	205-823-4187
AZ	Scottsdale, Electro Mktg.	602-991-0110
CT	Ridgefield, Manning & Assocs., Inc.	203-438-5027
CT	W. Reading, Vesco, Inc.	203-790-0702
IL	Addison, Hedge Assocs., Inc.	312-543-0888
LA	Metairie, RAPCO Assocs., Inc.	504-887-9500
NC	Charlotte, Servicon Sls. Corp.	704-588-1035
PA	Fort Washington, Hostvedt-Pavoni, Inc.	215-643-5757
PA	Pittsburgh, Greye Glass Assocs.	412-366-6664
WV	Sissonville, Interstate Ind. Sls. Corp.	304-988-3687
Can	Mississauga, Reemio	416-821-9375

Local Distributors

RI	Providence, WALCO Elec. Co.	401-467-6500,

HMC/HUB MATERIAL COMPANY, 33 Springdale Ave., Canton, MA 02021, Tel: 617-821-1870, FAX: 617-821-4133; FSC No.: SIC CODE 5085; Empl.: 20; *Sls. Mgr.:* Howard Chase

HMW ENTERPRISES, INC., 207 N. Franklin St., Waynesboro, PA 17268, Tel: 717-765-4690, FAX: 717-765-4660; FSC No.: 06A150; Empl.: 40; *Sls. Mgr.:* M. K. Ensminger

HOBART TAFA TECHNOLOGIES, Hobart Bros. Co., 146 Pembroke Rd., Concord, NH 03301, Tel: 603-224-9585, TELEX: 94-3424, FAX: 603-225-4342; Empl.: 60; *Sls. Mgr.:* Robert Unger; *Dist. Mgr.:* Robert Unger

HOBSON BROS., 4940 W. Lawrence Ave., Chicago, IL 60630-3884, Tel: 312-283-3600, FAX: 312-283-3606; Empl.: 75; *Sls. Mgr.:* Betty Maager

HODGE MANUFACTURING CO., INC., 55 Fisk Ave., Springfield, MA 01107, Tel: 413-781-6800, FAX: 413-733-6573; *Sls. Mgr.:* Edwin L. Kossoy

HOFFMAN, P.R., CO., MATERIALS PROC, 321 Cherry St., Carlisle, PA 17013, Tel: 717-243-2011, FAX: 717-243-1672; Empl.: 125; *Sls. Mgr.:* Galen Martin

HOFFMAN ENGINEERING, 900 Ehlen Dr., Anoka, MN 55303, Tel: 612-421-2240, FAX: 612-421-1556; *Dist. Mgr.:* Paul Premo

HOFFMAN ENGINEERING CORP., 20 Acosta St., Stamford, CT 06902, Tel: 203-325-8933, FAX: 203-327-4812; FSC No.: 06097; Empl.: 49; *Sls. Mgr.:* Jack DeSoye

HOKE INCORPORATED, 1 Tenakill Pk., Cresskill, NJ 07626, Tel: 201-568-9100, TELEX: 135428, FAX: 1-201-568-5913; *Sls. Mgr.:* Ray Pohlke; *Dist. Mgr.:* Ray Pohlke

HOKURIKU USA LTD., 117 Jetplex Circle, Ste. C-1, Madison, AL 35758, Tel: 205-772-9620, FAX: 205-772-3475; Empl.: 9; *Sls. Mgr.:* Kathleen Leverock

HOLADAY INDUSTRIES, INC., 14825 Martin Drive, Eden Prairie, MN 55344, Tel: 612-934-4920, FAX: 612-934-3604; Empl.: 29; *Sls. Mgr.:* David Baron

HOLD-HEET PRODUCTS CORP., 5011 N. Ravenswood Ave., Chicago, IL 60640, Tel: 312-728-4454, 312-728-4455, FAX: 312-728-2016; Empl.: 15; *Sls. Mgr.:* Dan Mundt; *Dist. Mgr.:* Dan Mundt

HOLLEX, INC., See Cabletest Products Co.

HOLLINGSEAD INTERNATIONAL, 13701 Excelsior Drive, Santa Fe Springs, CA 90670, Tel: 310-921-3438, FAX: 310-921-6313; FSC No.: 30528; Empl.: 85; *Sls. Mgr.:* Keith McKinney

HOLLIS AUTOMATION, Esterline Corporation, 15 Charron Ave., Nashua, NH 03063, Tel: 603-889-1121, FAX: 603-880-0939; FSC No.: RCA 294005; Empl.: 130; *Sls. Mgr.:* Brian Duffey; *Dist. Mgr.:* Jerry Vermette

HOLT INC., 9351 Jeronimo Rd., Irvine, CA 92718, Tel: 714-859-8800, TELEX: 182704, FAX: 714-859-9643; FSC No.: 44270; Empl.: 53; *Sls. Mgr.:* Keith Thayer

HOLT INSTRUMENT, C.P.D. Engineering, Inc., 126 Mott St., PO Box 230, Oconto, WI 54153, Tel: 414-834-2222, FAX: 414-834-5710; FSC No.: 09435; Empl.: 10; *Sls. Mgr.:* C. P. De Witt

Local Sales Offices & Reps

CA	Torrance, Cutlass Elctrns., Inc.	714-549-9358
IL	I & C Sls.	1-800-536-5555
IN	I & C Sls.	1-800-536-3333
MI	Southgate, I & C Sls.	1-800-536-5555
OH	Cincinnati, I & C Sls.	1-800-536-5555
Can	Ontario, Duncan Instrs. Canada Ltd.	416-742-4448

HOMALITE™

FAX: 302-652-4578

HOMALITE, Whitco, Inc., 11 Brookside Dr., Wilmington, DE 19804, Tel: 302-652-3686; FSC No.: 4330,4240,4710,6605; Empl.: 35; *Sls. Mgr.:* Jack Whittaker ..... **B•1077**

HOME AND BUILDING CONTROL, Honeywell Inc. MN 27-3176, Honeywell Plaza, Minneapolis, MN 55408, Tel: 1-800-328-5111; Empl.: 5000

HONDA CONNECTORS, See Mhotronics, Inc.

HONEYWELL INFORMATION SYSTEMS, 200 Smith St., MS 440, Waltham, MA 02154, Tel: 617-895-6000

HONEYWELL MICROSWITCH DIV., 830 E. Arapaho Dr., Richardson, TX 75081, Tel: 214-470-4271, TELEX: 73-0890, FAX: 214-470-4417; Empl.: 300; *Sls. Mgr.:* Tom Mabrey; *Dist. Mgr.:* Frank Davis

HOOSIER MAGNETICS, INC., 6545 W. Central Ave. Rm.203, Toledo, OH 43617, Tel: 419-841-7173, FAX: 419-841-7359; FSC No.: 3160; Empl.: 90

HOPPECKE BATTERY SYSTEMS, INC., 10 Park Place, Bulter, NJ 07405, Tel: 201-492-0045, FAX: 201-492-2714; *Sls. Mgr.:* Ted Czauski, Dir. Mktg. & Sls.

HOPPER ELECTRONICS, 1943 West North Lane, Ste.9, Phoenix, AZ 85021-1932, Tel: 602-870-3093, FAX: 602-944-6704; Empl.: 10

HOTPACK CORP., 10940 Dutton Rd., Philadelphia, PA 19154, Tel: 215-824-1700, 800-523-3608, TWX: 710-670-1694, FAX: 215-637-0519; FSC No.: 66; Empl.: 100; *Sls. Mgr.:* Hugh McKenna

Hotpack is a manufacturer and is sold direct. To contact the salesman in your area call 800-523-3608 or 215-824-1700.

HOUSE OF BATTERIES

FAX: 714-375-0235

HOUSE OF BATTERIES, 16512 Burke La., Huntington Beach, CA 92647, Tel: 1-800-432-3385, 714-375-0222; Empl.: 20; *Sls. Mgr.:* Pat Hoscoe ..... **D•1446**

Local Sales Offices & Reps

AZ Phoenix, JBS 602-893-2382
CA Cupertino, Prism Tech. Sls. 408-435-7377
CA Irvine, Atlas Tech. Sls. 714-474-9850
CA Martinez, Tech Sls. 415-686-2680
CA Norwalk, Ed Rivers Assoc. 310-868-1471
CA San Diego, Jack Murphy Co. 619-697-2150
CA Simi Valley, W.H. Daugherty Co. 213-622-2849
IL Schiller Park, Wm. R. Bolles Assoc. ... 708-678-7888
MN Afton, Real Elctrns. 612-436-1950
NY Newburgh, Anderson Sls. 914-565-2493
OR Portland, Roger Minthorne Co. 503-246-4556
TX Richardson, Krone & Assocs. 214-437-1892
WI Mequon, Wm. R. Bolles Assoc. 414-241-3320

HOUSTON ATLAS, Envirotech Controls, Inc., 22001 Northpark Dr., Kingwood, TX 77339-3804, Tel: 713-348-1000, TELEX: 6821159 BCAC UW, FAX: 713-462-1831; Empl.: 250; *Sls. Mgr.:* Marshall Brown

HOUSTON INSTRUMENT, AMETEK, Inc., 8500 Cameron Rd., Austin, TX 78753, Tel: 512-835-0900, TWX: 910-874-2022; Empl.: 450; *Dist. Mgr.:* Rod Schaffner

HOWARD INDUSTRIES, INC./BREVEL MOTORS, Box 287, One North Dixie Hwy., Milford, IL 60953, Tel: 815-889-4105, FAX: 815-889-4313; Empl.: 350; *Sls. Mgr.:* Hans Wolf; *Dist. Mgr.:* Dave Hotler

HP DIRECT, Hewlett-Packard, 1320 Kifer Rd., Sunnyvale, CA 94086, Tel: 800-538-8787; Empl.: 80,000

HUALON MICROELECTRONICS CORP., Chung Shan North Road, Taipei, Taiwan, Tel: 886-2-536-2151, FAX: 886-2-531-3241

HUALON MICROELETRONICS CORPORATION, Hualon Group, #1 R & D 4th Rd., S.B.I.P., Hsin-Chu, Taiwan, Tel: 415-288-0390, FAX: 415-288-0399; Empl.: 984; *Sls. Mgr.:* Mr. Tyrone Huang; *Dist. Mgr.:* Mr. Tyrone Huang

Local Sales Offices & Reps

CA San Francisco, The Summa Grp. Ltd. 415-288-0390

HUBBELL INDUSTRIAL CONTROLS INC., 50 Edwards St., Madison, OH 44057, Tel: 216-428-1161, ESYLNK: 980-439, FAX: 216-428-7635

HUDSON TOOL & DIE CO., 1327 U.S. Hwy 1, Ormond Beach, FL 32174, Tel: 904-672-2000, FAX: 904-676-6212; FSC No.: 02875; Empl.: 300

HUGHES AIRCRAFT CO., Interconnect Systems Div., 17150 Von Karman Ave., Irvine, CA 92714, Tel: 714-660-5772, FAX: 714-660-6981; FSC No.: 53669; *Sls. Mgr.:* Terry Jarnigan; *Dist. Mgr.:* Terry McCann

HUGHES AIRCRAFT CO., Electron Dynamics Div., 3100 W. Lomita Blvd., P.O. Box 2999, Torrance, CA 90509-2999, Tel: 310-517-6000, TELEX: 67-7064, TWX: 910-347-7321, FAX: 310-517-6714; Empl.: 1000; *Sls. Mgr.:* D.B. Giguere

HUGHES AIRCRAFT CO., Industrial Products Division, 2051 Palomar Airport Rd., Carlsbad, CA 92009, Tel: 619-931-3000, FAX: 619-931-3334

HUGHES ELECTRONICS PRODUCTS CORP., 34467 Industrial Rd., Livonia, MI 48150, Tel: 313-427-8310, FAX: 313-427-2282; Empl.: 20; *Sls. Mgr.:* Richard L. Smith

HUGHES MICROELECTRONIC CIRCUITS DIVISION, 500 Superior Ave., P.O. Box H, Newport Beach, CA 92658-8903, Tel: 714-759-2952, TWX: &, FAX: 714-759-2280

HUGHES SEMICONDUCTOR PRODUCTS CTR., M/S B1250, 500 Superior Ave., Newport Beach, CA 92663, Tel: 714-759-2665, FAX: 714-759-2913; FSC No.: 62458; Empl.: 328; *Sls. Mgr.:* Del Brand; *Dist. Mgr.:* Kathie Lake

HUGHEY & PHILLIPS, INC., 2162 Union Pl., P.O. Box 2167, Simi Valley, CA 93062, Tel: 805-581-5591, FAX: 805-581-5032; FSC No.: 94295; Empl.: 40; *Sls. Mgr.:* Peter H. Johnson; *Dist. Mgr.:* Peter H. Johnson

HUGIN INDUSTRIES INC., 745 Distel Dr., Los Altos, CA 94022, Tel: 415-961-2950, FAX: 415-961-6431; Empl.: 6; *Sls. Mgr.:* Peter Hugin

HUMISEAL DIV., CHASE Corporation, 26-60 BQE West, Woodside, NY 11377, Tel: 718-932-0800, FAX: 718-932-4345; FSC No.: 99109;46058; Empl.: 150; *Sls. Mgr.:* William G. Lott

Humphrey Inc.

FAX: 619-565-6873

HUMPHREY, INC., 9212 Balboa Ave., San Diego, CA 92123, Tel: 619-565-6631; Empl.: 325 .... **B•1956-1958**

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CA Granada Hills, LL. Stoakes, Inc. 818-368-6752, FAX:818-831-0015
CA Palo Alto, Harris Engrg. Assocs. 415-328-3370, FAX:415-328-4191
CA Playa Del Rey, LL. Stoakes, Inc. 310-822-8553, FAX:213-200-3662
CA San Diego, LL. Stoakes, Inc. 619-452-1600, FAX:619-452-0966
CA San Jose, ECC Products, Inc. 408-289-8545, FAX:408-289-9123
FL Orlando, Gra-Mar, Inc. 407-658-1971, FAX:407-658-4101
IN Fishers, Carter, McCormic & Peirce, Inc. 317-842-9277,FAX:317-577-2741
IA Cedar Rapids, Dy-Tronix Inc. 319-377-8275, FAX:319-377-9163
KS Leawood, Dy-Tronix Inc. 913-339-6333, FAX:913-339-9449
KS Wichita, Dy-Tronix Inc. 316-838-0884, FAX:316-838-2645
LA Broussard, The Instr. Shoppe 318-837-9976
MD Annapolis Junction, Stemler Assocs., inc. 301-490-1078,FAX:301-490-1073
MA Wayland, High Tech Sls., Inc. 508-653-3838, FAX:508-651-3784
MI Farmington Hills, Carter Technlg., Inc. 313-477-7700,FAX:313-477-4149
MO Bridgeton, Dy-Tronix Inc. 314-291-4777, FAX:314-291-3861
NY E. Setauket, Eastern Metro Assocs., Inc. 516-928-2726,FAX:516-928-3807
OH Englewood, Carter, McCormic & Peirce, Inc. 513-836-0951,FAX:513-836-2358
OH Parma, Carter, McCormic & Peirce, Inc. 216-398-0400,FAX:216-398-0766
PA Pittsburgh, Carter Technlg., Inc. 412-826-3800, FAX:412-826-5009
TX Dallas, W.N. Rider Co. 214-357-2246, FAX:214-357-2246
TX El PAso, Nokomis of El Paso, Inc. 915-778-2801

HUNTINGTON ELECTRIC INC., P.O. Box 366, Dept. EEM 87, Huntington, IN 46750, Tel: 219-356-0778, FAX: 219-356-7891; *Sls. Mgr.:* Michael Khorshid ..... **A•1936-1938**

Local Sales Offices & Reps

IN Huntington, HEI 219-356-0756
MA Burlington, Tri-Com Assocs., Inc. 617-272-8163
MN Roseville, Pro Tec Power Sls., Inc. 612-483-0409
MO St. Louis, Rep-Tronics 314-576-9816
PA Greensberg, Pro-Mark 412-832-3800

Local Distributors

CA Fountain Valley, Comp. Center 714-979-0433
CA Los Angeles, Cal State Elctrns. 213-933-8187
CA Monrovia, Daring 818-357-0021
FL Ft. Lauderdale, NRC Elctrns., Inc. 305-772-4500
MO St. Louis, Franklin Elctrns. 314-933-5333

HUNTSVILLE MICROSYSTEMS, INC., 3322 South Memorial Pkwy., Huntsville, AL 35801, Tel: 205-881-6005, TWX: 510-600-8258, FAX: 205-882-6701; Empl.: 50; *Sls. Mgr.:* Jim Bell

HURRICANE ELECTRONICS LAB, P.O. Box 1280, Hurricane, UT 84737, Tel: 801-635-2003, FAX: 801-635-2495; FSC No.: 64109; Empl.: 35; *Sls. Mgr.:* C. R. Reeve

Local Distributors

TX Fort Worth, Tandy Elctrns. Natl. Parts Div. 817-870-5600

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FAX: 812-386-7504

HURST MANUFACTURING DIV., Box 326, Princeton, IN 47670, Tel: 812-385-2564; Empl.: 200; *Sls. Mgr.:* Don Morrow ..... **B•1266-1270**

Local Sales Offices & Reps

AZ Phoenix, Sierra Ind. Eng. 602-272-0084
CA Fremont, Coherent Automation 510-657-2100
CA Los Angeles, Sierra Ind'l. Engrg. Co. ... 213-624-3123
IL Chicago, Golten Assocs. 708-512-0093
IN Indianapolis, Emerson Motor Div. 317-842-1342
MD Glen Arm, Hodgins Assoc. 301-592-7047
MA Lexington, Hathaway Elctrns. 617-861-7010
MI Grand Rapids, Emerson Motor Div. ... 616-942-9500
MN Wayzata, Cardinal Sls. Co. 612-475-0042
NJ Sussex, Carbone Assocs. 201-875-1882
NM Phoenix, Sierra Ind. Eng. 602-272-0084
NY Youngstown, D & O Engrg. 716-754-2091
NC Charlotte, Cartwright & Bean, Inc. 704-536-0303
OH Centerville, Omega Sls. Inc. 513-434-5507
OK Edmond, Emerson Motor Div. 405-340-8228
GA Norcross, Cartwright & Bean, Inc. 404-368-0160
TX Arlington, Emerson Motor Div. 213-380-2670
WA Seattle, Northmar 206-524-5170
WI Milwaukee, Badgerep Inc. 414-241-9200
EXP NY, Freeport, Churchin Assc. Ltd. 516-864-8589

Local Distributors

AZ Phoenix, Minarik Elec. 602-233-3000
CA Glendale, Minarik Elec. 818-507-6500
CA Santa Clara, Minarik Elec. 408-727-0575
CA Sunnyvale, Abacus Elctrns. 408-732-2000
CO Commerce City, Minarik Elec. 303-289-5800
FL Ft. Lauderdale, Powell Elctrns. 305-484-8377
FL Orlando, EMSCO 407-849-6362
GA Norcross, EMSCO 404-925-8366
IL Schaumburg, Minarik Elec. 708-885-9337
IN Indianapolis, Bell Inds. 317-875-8200
MA Somerville, Electro Sls. 617-666-0500
MN Mendota Hgts. 612-452-6467
NJ Fanwood, MacPherson Controls 201-757-5110
NY Long Island City, B & B Motor & Control 718-784-1313
NC Greensboro, EMSCO 919-275-8776
OH Solon, Repco Elctrns. 216-248-8900
OK Tulsa, Radio, Inc. 918-587-8123
OR Portland, Minarik Elec. 503-253-3402
PA Philadelphia, H & R Corp. 215-426-1700
SC Greenville, EMSCO 803-233-4121
TX Dallas, Mechanical Southwest 214-634-0921
TX Ft. Worth, Allied Elctrns. 817-595-3500
TX Irving, Minarik Elec. 214-402-8188
WA Redmond, Minarik Elec. 206-885-0832
Can Burlington, Ont., White Radio Ltd. 416-632-6894

HUTRONIX, INC., 101 W 11th Street, Douglas, AZ 85607, Tel: 602-364-2432, FAX: 602-364-6174; FSC No.: 70206; Empl.: 50; *Sls. Mgr.:* John Huls

HV COMPONENT ASSOCIATES INC., P O Box 2484, Farmingdale, NJ 07727, Tel: 908-938-4499, FAX: 908-938-4451; Empl.: 20; *Sls. Mgr.:* Dennis R. Dean

HYBRICON CORPORATION, 12 Willow Road, Ayer, MA 01432, Tel: 508-772-5422, TWX: 710-347-0654, FAX: 508-772-2963; Empl.: 74; *Sls. Mgr.:* Jim Gallagher

HYBRID DESIGNS, INC., 666 W. Baker, Costa Mesa, CA 92626, Tel: 714-557-9933, FAX: 714-557-0322; FSC No.: 16450; Empl.: 65; *Sls. Mgr.:* Bob Soberman

HYBRID ELECTRONICS CORP., 6 DeAngelo Dr., Bedford, MA 01730, Tel: 617-275-5350, FAX: 617-275-3470,617-275-0218; Empl.: 12; *Sls. Mgr.:* John Pantazis

HYBRIDS INTERNATIONAL, Frequency Products Div., 311 N. Lindenwood Dr., Olathe, KS 66062, Tel: 913-764-4544, TWX: 910-743-0029, FAX: 913-764-6400; Empl.: 20; *Sls. Mgr.:* Abdul Ghafoor

HYBRIDS INTERNATIONAL, LTD.

THICK FILM DIV.

FAX: 913-764-6409

HYBRIDS INTERNATIONAL LTD., Thick Film Division, 311 N. Lindenwood Dr., Olathe, KS 66062, Tel: 913-764-6400; Empl.: 45; *Sls. Mgr.:* Bob Goodwin ..... **A•1406-1407, 1699**

HYBRIDYNE, INC., 2155 N. Forbes Blvd., Tucson, AZ 85745, Tel: 602-629-0001, FAX: 602-791-3899; Empl.: 65; *Sls. Mgr.:* Tom Fern

HY-CAL ENGINEERING, Unit of General Signal, 9650 Telstar Ave., El Monte, CA 91731, Tel: 818-444-4000, FAX: 818-444-1314; FSC No.: 12199; Empl.: 98; *Sls. Mgr.:* Douglas W. Rasmussen

HYCOMP, INC., 165 Cedar Hill St, Marlborough, MA 01752, Tel: 508-485-6300, FAX: 508-481-1547; FSC No.: 34707; Empl.: 43; *Sls. Mgr.:* David Petros

HYDRO-GEN PRODUCTS INC., P.O. Box 1517, Fort Collins, CO 80522-1517, Tel: 800-779-0126, FAX: 303-498-0528; Empl.: 25; *Sls. Mgr.:* Derek Bobo; *Dist. Mgr.:* Derek Bobo

HYLETRONICS:LITTON INDUSTRIES, 10 Maguire Rd., Lexington, MA 02173-3199, Tel: 617-276-3298, FAX: 617-276-2127; FSC No.: ODZK6; Empl.: 48; *Sls. Mgr.:* Rodney Hsing

HY MEG CORP., 854 Westgate, Addison, IL 60101, Tel: 708-543-9250, FAX: 708-543-9260; Empl.: 24; *Sls. Mgr.:* Vincent Cupidro

HYPATIA INC., 15270 SW Holly Hill Rd., Hillsboro, OR 97123-9074, Tel: 503-628-2936, FAX: 503-628-2936; *Sls. Mgr.:* Bruce Campbell

HYPERION INDUSTRIES CORP., 134 Coolidge Ave., Watertown, MA 02172, Tel: 617-926-0140, FAX: 617-926-3707; FSC No.: 09448; Empl.: 130; *Sls. Mgr.:* Aldo Bussi

HYPERLOGIC CORPORATION, 1855 E. Valley Pkwy., Ste.210, Escondido, CA 92027, Tel: 619-746-2765, FAX: 619-746-4089

HYPERTRONICS CORP., 16 Brent Dr., Hudson, MA 01749, Tel: 508-568-0451, 800-225-9228, FAX: 508-568-0680; FSC No.: 50541; Empl.: 145; *Sls. Mgr.:* E. Dalrymple ..... **C•1348-1352**

Local Sales Offices & Reps

AL	Huntsville, Elec. Mktg. Assoc.	205-880-8050
AZ	Scottsdale, TC Elctrns. Sls., Inc.	602-994-5153
CA	Newbury Park, Interconn	805-499-4024
CA	Pleasanton, Leddy Assocs.	510-417-1033
CO	Commerce City, Williams Assocs.	303-289-5647
CT	Bethany, Reps. Corp.	203-393-0024
DC	Washington, Tyler Griffin Co.	215-647-1550
FL	Melbourne, Synergistic Technlgs.	407-242-9661
GA	Atlanta, Elec. Mktg. Assoc.	404-448-1215
IL	Northbrook, Howard Benjamin Assoc.	708-272-2900
IN	Indianapolis, CC Elctrns.	317-921-5000
MD	Baltimore, Tyler Griffin Co.	301-995-1215
MD	Columbia, Tyler Griffin Co.	301-995-1215
MA	Wellesley, Reps. Corp.	617-237-6476
MA	Wellesley, The Reps	617-237-6476
MN	Bloomington, Mumco, Inc.	612-854-4161
NJ	Wayne, G.T. Assocs.	201-694-6040
NM	Albuquerque, Williams Assocs.	505-255-1638
NY	E. Syracuse, R. D. Sherman	315-433-1165
NC	Raleigh, Elec. Mktg. Assoc.	919-847-8800
SC	Greenville, Elec. Mktg. Assoc.	803-233-4637
TX	Irving, Trice Mktg.	214-255-1877
UT	Salt Lake City, Williams Assocs.	801-485-6511
WA	Bellevue, A.I.E. Inc.	206-455-4697

HY-Q INTERNATIONAL (USA) INC., 1438 Cox Rd., Erlanger, KY 41018, Tel: 606-283-5000, FAX: 606-283-0883; FSC No.: 1CU70; Empl.: 35; *Sls. Mgr.:* Pam Deshler ..... **A•1408**

HYTEK MICROSYSTEMS, INC., 400 Hot Springs Rd., Carson City, NV 89706, Tel: 702-883-0820, FAX: 702-883-0827; FSC No.: 0ANM4; Empl.: 40; *Sls. Mgr.:* Jon Presnell

HYTRONICS CORPORATION, 15401 Roosevelt Blv., Clearwater, FL 34620, Tel: 813-536-7861; Empl.: 50; *Sls. Mgr.:* Jack Colgan

HYUNDAI ELECTRONICS AMERICA, Semiconductor Division, 166 Baypointe Parkway, San Jose, CA 95134, Tel: 408-473-9200, TELEX: 278841 HEA UR, FAX: 408-943-9567

HYUNDAI ELECTRONICS INDUSTRIES CO. LTD., San 136-1, Ami-ri, Bubal-eub, 1 Chon-Kun, Kyoungki-do, Korea, Tel: (0336)30-4114,(02)741-0661, FAX: (0336)30-2077/8,(02)744-3526

IBI SYSTEMS INC., 6842 NW 20 Ave., Ft. Lauderdale, FL 33309, Tel: 305-978-9225, FAX: 305-978-9226; Empl.: 7

IBM®

IBM UNITED STATES/US OEM MARKETING, 1133 Westchester Ave., White Plains, NY 10604, Tel: 1-800-969-8643 ..... **D•1117-1141**

ICI INC., 1901 Petra La., Placentia, CA 92670, Tel: 714-579-7575, FAX: 714-579-3127; Empl.: 8

IC MASTER, 645 Stewart Ave., Garden City, NY 11530, Tel: 516-227-1300, FAX: 516-227-1901

ICO-RALLY CORPORATION, 2575 E. Bayshore Rd., Palo Alto, CA 94303, Tel: 415-856-9900, FAX: 415-856-8378; FSC No.: 51705; Empl.: 45; *Dist. Mgr.:* B. Enad/A. Bourassa

ICS ELECTRONICS CORP., 744 S. Hillview Dr., Milpitas, CA 95035-5545, Tel: 408-263-5500, 1-800-952-4499, FAX: 408-263-5896; FSC No.: 58558; Empl.: 15; *Sls. Mgr.:* Bill Wallace; *Dist. Mgr.:* Jerry Mercola

Local Sales Offices & Reps

AL	Huntsville, Saber Assocs.	800-327-0853
AZ	Phoenix, Scientific Dvcs.-Mtn.	602-839-6626
CA	Los Alamitos, Tritek Solutions	714-236-1190
CA	San Diego, Tritek Solutions	619-455-1911
CA	San Jose, Tritek Solutions	408-554-0455
CO	Denver, Scientific Dvcs.-Mtn	303-665-8089
CT	Mt. Carmel, Scientific Dvcs.-New Eng.	203-248-9361
FL	Ft. Lauderdale, Saber Assocs.	305-792-7280
FL	Melbourne, Saber Assocs.	407-724-0920
FL	Orlando, Saber Assocs.	407-724-0920
FL	Tampa, Saber Assocs.	407-724-0920
GA	Atlanta, Saber Assocs.	800-327-0853
IL	Chicago, Berndt Assocs.	708-632-0900
IN	Carmel, Berndt Assocs.	317-844-0114
IA	Cedar Rapids, KJS Mktg.	816-578-4751
MD	Burtonsville, Eastern Instrmn. Corp.	301-384-8500
MA	Waltham, Scientific Dvcs.-New Eng.	617-890-2252
MI	Detroit, TMS Inc.	313-462-2100
MN	Minneapolis, Berndt Assocs.	612-546-2021
MO	St. Louis, KJS Mktg.	314-770-1412
NJ	Teaneck, Scientific Dvcs.-East	201-440-3430
NM	Albuquerque, Scientific Dvcs.-Mtn	505-883-3668
NY	Liverpool, Northern Tech. Sls.	315-451-1091
NC	Raleigh, Saber Assocs.	800-327-0853
OH	Cleveland, TMS Inc.	216-327-3527
OH	Dayton, TMS Inc.	513-429-1142
PA	Horsham, Scientific Dvcs.-East	215-956-0700
PA	Pittsburg, TMS Inc.	412-221-2338
WA	Bellevue, The Western Rep	206-746-1127
WI	Milwaukee, Berndt Assocs.	414-545-8400

Local Distributors

Can	Montreal, Que., Multitest Elctrns.	514-337-0723
Can	Ottowa, Ont., Multitest Elctrns.	613-727-0848
Can	Toronto, Ont., Multitest Elctrns.	416-609-8396
Can	Vancouver, B.C., Jerome & Francis	604-986-1286

IC SENSORS, INC., 1701 McCarthy Blvd., Milpitas, CA 95035, Tel: 800-767-1888, FAX: 408-432-7322; Empl.: 160; *Sls. Mgr.:* Richard A. Auxer

idea

FAX: 310-690-1352

IDEA, INC., 1300 Pioneer St, Ste. B, Brea, CA 92621, Tel: 310-697-4332; *Dist. Mgr.:* Desiree A. Owsian ..... **B•1164-1165**

Local Sales Offices & Reps

AL	Madison, E-Squared Mktg.	205-464-0392
CO	Longmont, Butler Tech. Sls.	303-651-7703
GA	Marietta, E-Squared Mktg.	404-565-2088
IA	Cedar Rapids, Tech. Elect., Inc.	319-366-5443
KS	Andover, QDC South	316-733-9756
KS	Overland Park, QDC Inds.	913-341-2214
MN	Eagan, QDC North	612-454-0893
MO	Ballwin, QDC East	314-458-1896
NH	Nashua, Bennetron	603-880-7008
OH	Columbus, The Bill Romine Co.	614-436-0565
TX	Carrollton, All Tech. Sls. & Mktg.	214-418-0850

Local Distributors

AL	Huntsville, CRI	205-722-0038
CA	Buena Park, Ford Elctrns., Inc.	714-521-8080
CA	San Jose, Rose Elctrn. Distrbg.	408-943-0200
CO	Denver, QPS Elctrns., Inc.	303-373-2766
FL	Delray Beach, Fastbolt Florida Corp.	407-272-3100
IL	Chicago, Leeds Electro Comps.	312-625-3800
IL	Schaumburg, QPS Elctrns., Inc.	708-884-6620
MN	Plymouth, Leeds Electro Comp.	612-557-1277
NH	Atkinson, Astrum Elec., Inc.	603-898-3399
NY	Farmingdale, Bulbtronics	516-249-2272
OH	Columbus, Elctrns. Mktg. Corp.	614-299-4161
TX	Austin, Applied Prods.	512-832-9804
WI	Brookfield, Leeds Electro Comp.	414-789-6995
Can	Calgary, Alb., Memco Corp.	403-258-3399
Can	Markham, Ont., Carsten Elctrns.	416-477-9898
Can	St. Laurent, Que., Carsten Elctrns.	514-334-8321
Can	Surrey, B.C., Memco Corp.	604-590-1553

IDEAL INDUSTRIES, INC., Becker Place, Sycamore, IL 60178, Tel: 815-895-5181, TWX: 910-639-0613; Empl.: 700; *Sls. Mgr.:* Bob Bukowsky

IDEAL PRECISION METER, 214 Franklin St., Brooklyn, NY 11222, Tel: 212-383-6904, TWX: 710-584-2160; FSC No.: 11707;10304-41; Empl.: 150; *Sls. Mgr.:* T. Bell

IDEAL SEMICONDUCTOR, 46721 Fremont Blvd., Fremont, CA 94538, Tel: 510-226-7000, FAX: 510-226-1564

IDEAL TAPE CO., American Biltrite Inc., 1400 Middlesex St., Lowell, MA 01851, Tel: 508-458-6833, FAX: 508-458-0302

idec

FAX: 408-744-9055

IDEC CORPORATION, 1213 Elko Drive, Sunnyvale, CA 94089-2211, Tel: 408-747-0550, TELEX: 34-0601, TWX: 910-339-9383; FSC No.: 60886; Empl.: 90; *Sls. Mgr.:* Wallace Baldwin, Genl. Sls. Mgr. ..... **B•1522-1523, 1738-1740**

Local Sales Offices & Reps

AL	Birmingham, Bryco Co.	205-672-9760
AZ	Phoenix, Western Automation	602-265-2788
CA	Laguna Hills, Western Automation	714-859-6988
CA	Sunnyvale, Idec Corp.	408-747-0550
CO	Lakewood, T.M.M.I.	303-232-1516
IL	South Barrington, Bu-Nell Engrg.	312-551-9000
IN	Indianapolis, Ronald Ray & Assoc.	317-841-9144
KS	Overland Park, TMW	913-383-1818
MA	Norwood, Hyland Assocs.	617-762-0345
MI	Detroit, IDEC Corp.	313-795-0291
MI	Farmington, Nova Elctrl. Assocs., Inc.	313-553-0100
MN	Minnetonka, S. J. Collins & Assocs.	612-933-7661
MO	St. Louis, TMW Co.	314-664-4005
NM	Albuquerque, T.M.M.I.	505-298-6893
NY	Patchogue, Optimum Sls. Co.	516-758-0644
NY	Syracuse, Lachut Elctrl. Sls. Inc.	315-458-6480
NC	Kernersville, Heritage Sls. Assocs.	919-996-4374
OH	Cleveland, Matthew Haley Co.	216-892-1820
OH	Perrysburg, Matthew Haley Co.	419-874-0488
OK	Tulsa, Don Plummer Sls. Co.	918-835-0979
PA	Cuddy, Brown-Yates Elec.Equip. Co.	412-221-4200
PA	Philadelphia, Fite-Walker, Inc.	215-233-2100
SC	Taylors, Heritage Sls. Assocs.	803-292-1723
TN	Knoxville, Tubbs Agy.	615-577-0689
TN	Memphis, Winstead Tech. Svcs.	901-372-4550
TX	Dallas, SW Mktg. Assocs.	214-341-8631
TX	Houston, SW Mktg. Assocs.	713-537-8166
UT	Salt Lake City, T.M.M.I.	801-487-7676
VA	Northboro, IDEC Corp.	508-393-2474
VA	Richmond, Dunnington & Assocs.	804-282-8383
WI	Appleton, Bu-Nell Engrg.	414-733-4242
WI	Waukesha, Bu-Nell Engrg.	414-784-0994

IDENTATRONICS, INC., 425 Lively Blvd., Elk Grove Village, IL 60007-2082, Tel: 708-437-2654, 1-800-323-5403, TELEX: 754319 CARD UD, FAX: 708-437-2660; Empl.: 50; *Sls. Mgr.:* Mike Sloe

BRILL ELECTRONICS
(510) 834-5888
610 E. 10th. St., Oakland, CA 94606
idec CORPORATION
(310) 452-8002
1220 Olympic Bl., Santa Monica CA 90404

IDM (INTERNATIONAL DESIGN MODELING), 43 Smith Rd., Bedford, NH 03110, Tel: 603-472-7068, FAX: 603-472-7043

IEC ELECTRONICS CORP., 105 Norton St., Newark, NY 14513, Tel: 315-331-7742, FAX: 315-331-3547; Empl.: 900; *Sls. Mgr.:* Stephen Hotchkiss; *Dist. Mgr.:* Stephen Hotchkiss

IEE (INDUSTRIAL ELECTRONIC ENGINEER, INC.), 7740 Lemona Ave., Van Nuys, CA 91409, Tel: 818-787-0311, FAX: 818-787-3953; Empl.: 300; *Sls. Mgr.:* R. Nisar ..... **B•1078-1079, 1835**

Local Sales Offices & Reps

AL Huntsville, TMA Technlg. Mktg. Assocs. 205-883-7893,FAX:205-882-6162
AZ Phoenix, Howe & Howe Sls., Inc. 602-264-7971, FAX:602-263-8914
CA Campbell, LCO Tech. Sls. 408-378-9900, FAX:408-370-0447
CA Carlsbad, Zerimar Sls; Inc. 619-436-3379
CA Woodland Hills, Varigon, Inc. 818-594-5080
CO Golden, Cristee-Meade Co. 303-279-5070, FAX:303-232-0323
CT North Haven, Kitchen & Kutchin, Inc. 203-239-0212,FAX:203-234-9108
FL Deerfield, TMA Tech. Mktg. Assocs. 305-427-1090, FAX:305-427-1626
FL Largo, TMA Technlg. Mktg. Assocs. 813-531-4405, FAX:813-545-8617
FL Winter Park, TMA Tech. Mktg. Assocs. 407-671-2245,FAX:407-857-6412
GA Norcross, TMA Tech. Mktg. Assocs. 404-446-3565, FAX:404-446-0569
IL Highland Park, Bransky Sls. 708-433-2375, FAX:708-433-2377
IN Indianapolis, Wilson Tech. Sls. 317-872-2513, FAX:317-872-0664
KS Lenexa, Midtec 913-541-0505,FAX:913-541-1729
MA Burlington, Kitchen & Kutchin, Inc. 617-229-2660, FAX:617-273-5895
MI Southfield, L. H. Dickelman Co. 313-353-8210, FAX:313-353-1433
MN Burnsville, 2M Sales, Inc. 612-890-7774, FAX:612-894-9342
MO St. Louis, Midtec 314-275-8666,FAX:314-275-8859
NY Buffalo, Advanced Comps., Inc. 716-832-6791
NY E. Syracuse, Advanced Comps. Corp., Inc. 315-437-6700,FAX:315-699-4611
NY Endicott, Advanced Comps. Comp. Inc. 607-785-3191
NY Manhasset, Win-Cor elctrn. Sls. 516-627-9474
OH Richfield, Geotronix, Inc. 216-659-6100, FAX:216-659-3435
OH Trotwood, Geotronix, Inc. 513-854-5939, FAX:513-837-0537
OR Beaverton, Olson Tech. Sls. Corp. 503-643-9488, FAX:503-626-1985
PA Allison Pk., Geotronix, Inc. 412-487-1770, FAX:412-487-1331
PA Norristown, RJI 215-631-1414,FAX:215-631-1640
TX Dallas, M-Rep, Inc. 214-484-5711
VA Springfield, Pantech 703-451-5700, FAX:703-451-5949
WA Bellevue, Olson Tech. Sls. Corp. 206-883-7792, FAX:206-883-9478
WI Cedarburg, Bransky Sls. 414-377-6837, FAX:414-377-6837

Local Distributors

AZ Phoenix, Tri-Tek, Inc. 602-371-0860, FAX:602-371-0874
CA Garden Grove, Richey/Impact Elctrns. 714-895-0060,FAX:714-891-3563
CA Gardena, California Switch & Signal Co. 213-538-9830,FAX:213-327-2741
CO Denver, Integrated Elctrns. (IEC) 303-292-6121, FAX:303-297-2053
FL Miami, Electronic Equip. Co., Inc. 305-526-6000, FAX:305-871-3736
IL Bensenville, Voyager Elctrns. Corp. 708-860-1300, FAX:708-860-1573
IL Chicago, Newark Elctrns. 312-784-5100, FAX:312-784-5100
MA Needham, Cronin Elctrns. Inc. 617-449-5000, FAX:617-444-8395
MI Southfield, Michigan Lectrols Corp. 313-353-1350, FAX:313-353-1433
MN Minneapolis, Stark Elctrns. 612-332-1325, FAX:612-332-1783
NM Albuquerque, Betatron Elctrns. 505-821-1122, FAX:505-828-0450
NY Mamaroneck, Logicomp Elctrncs. 914-698-9332, FAX:914-698-9456
NY Rochester, Masline Elctrns. 716-546-5373, FAX:716-546-2004
NC Raleigh, So. Eastern Elctrns. 919-828-2311, FAX:919-828-2311
OH Dayton, The Stotts-Friedman Co. 513-298-5555, FAX:513-298-3046
OH Richfield, Alpha Distr. Corp. 216-659-7100, FAX:216-659-3459
SC Taylors, Cantrell Whlsls. 803-268-1194, FAX:803-244-9080
TX Richardson, The Altair Co. 214-231-4665, FAX:214-699-3207
TX Stafford, Southwest Elctrns. 713-240-4000, FAX:713-240-5672

IEH CORP., 140 West 58th St.-8E, Bay Ridge, NY 11220, Tel: 718-492-4440, FAX: 718-492-9897; FSC No.: 97913; Empl.: 100; *Sls. Mgr.:* Terry Hart; *Dist. Mgr.:* Jenny Heredia

IEM-FUSION INC., 30275 Bainbridge Rd., Cleveland, OH 44139, Tel: 216-349-1960, FAX: 216-349-2206; Empl.: 4; *Sls. Mgr.:* Larry Shindell

IERC, 135 W. Magnolia Blvd., Burbank, CA 91502, Tel: 213-849-2481, TWX: 910-498-2206, ESYLNK: 62951515, FAX: 818-848-8872; FSC No.: 98978; Empl.: 97; *Sls. Mgr.:* George S. Ollen ..... **C•1592**

Local Sales Offices & Reps

AL Huntsville, Mtn. Electro Mktg. 205-881-3937
AZ Scottsdale, Faser Tech. Sls. 602-948-4404
CA Chatsworth, Wes-K/Raltech 818-700-0933
CA La Jolla, Coastal Elctrn. Sls. 619-459-4148
CA Santa Clara, Pinnacle Sls. 408-249-7400
CO Boulder, R.F. Mayo Assocs. 303-422-2155
CT Danbury, Hathaway Elctrns. 203-790-6993
FL Maitland, Hawkins-Frederickson 407-831-2474
GA Norcross, Mtn. Electro Mktg. 404-448-5594
IL Park Ridge, Synmark Sls. Inc. 708-390-9696
IN Indianapolis, Elctrn. Rep., Inc. 317-894-1414
KS Wichita, Thunderbird Tech. Sls. 316-636-5777
KY East, Catalyst Sls. Co. 800-873-0170
KY Lexington, Elctrn. Reps., Inc. 606-277-0436
MD Silver Springs, Mid-Atlantic Sls. Co. 301-593-7749
MA Lexington, Hathaway Elctrns., Inc. 617-861-7010
MI Canton, Techrep, Inc. 313-981-1950
MN Minneapolis, Elec. Comp. Sls., Inc. 612-933-2594
MO Maryland Heights, Thunderbird Tech. Sls. 314-298-8940
NJ E. Brunswick, Shepard & Assocs. 908-254-5757
NJ Marlton, BGR Assocs. 609-983-1020
NM Albuquerque, C.T. Carlberg & Assoc. 505-899-2155
NY E. Syracuse, Advanced Comps. Corp. 315-437-6700
NC Raleigh, Mtn. Electro Mktg. 919-839-8662
OH Hamilton, Catalyst Sls. Corp. 800-873-0170
OR Portland, Temper Tech. Mktg. 503-292-8201
PA Pittsburgh, Catalyst Sls. Co. 412-826-3434
TX Houston, R.J. Powers & Assocs., Inc. 713-784-5860
VA Charlottesville, Mid-Atlantic Sls. Co. 804-973-8099
Can Mississauga, R-Theta Mfg. 416-890-0221

Local Distributors

AZ Scottsdale, Spirit Elctrns. 602-998-1533
CA Burbank, IERC 818-842-7277
CA San Jose, Rose Elctrns. 408-943-0200
CA Sunnyvale, PSC 408-737-1333
CO Littleton, Indelco 303-795-3431
FL Clearwater, Lynch Gentry Assocs. 813-433-2697
FL Coral Springs, HAI Elctrns. 305-752-7551
FL Sunrise, QAR/All American 305-572-7999
GA Atlanta, Motion Elctrns., Inc. 404-455-8262
IL Addison, Belford Elctrns. 708-691-1100
IN Carmel, Altex Elctrn., Inc. 317-848-1323
MD Gaithersburg, M.S. Elctrns. 301-921-0200
MD Rockville, QAR/All American 301-251-1205
MA Billerica, A.W. Mayer Elctrns. 617-229-2255
MI Wyoming, North Coast Comps., Inc. 616-452-0800
MN Eden Prairie, QAR/All American 612-944-2151
NM Albuquerque, Walker Elctrns. Supp. 505-883-2992
NY Bohemia, Car-Lac Elctrns. 516-567-4200
NY Bohemia, March Elctrns. 516-563-6000
NY Mt. Vernon, QAR/All American 914-699-2240
NC Raleigh, Resco-Raleigh 919-781-5700
OH Cleveland, Advacom, Inc. 216-688-5311
OR Portland, Radar Elec. Co., Inc. 503-232-3404
OR Portland, United Radio Supp. 503-233-5341
PA Bristol, Aim Elctrns. 215-946-3900
RI Pawtucket, Major Edwards Elctrns. 401-725-7400
TX Ft. Worth, Carlton-Bates 817-293-5558
TX Houston, Lenert Co. 713-225-1465
TX Mansfield, Mouser Elctrns. 817-483-0165

IET

FAX: 516-334-5988

IET LABS, INC., 534 Main St., Westbury, NY 11590, Tel: 516-334-5959, 800-899-8438; FSC No.: 62015; *Sls. Mgr.:* Sam Sheena ..... **D•1214, 1266-1273**

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AZ Tuscon, Fred Board Assocs. 602-994-9388
CA Fallbrook, Gary Chilcote & Assocs. 619-728-7678
CA Garden Grove, ILC Data Dvcs. Corp. 714-895-9777
CA Woodland Hills, ILC Data Dvcs. Corp. 818-992-1772
CO Englewood, Quorum 3 Sls. Grp. 303-799-8100
CT Canton Center, Dynamic Sls. of New Eng. 203-693-6567
FL Boca Raton, Perrott Assocs. 407-362-0191
FL Cassleberry, Perrott Assocs. 407-830-0094
FL Melbourne, Perrott Assocs. 407-676-0305
FL Palm Harbor, Perrott Assocs. 813-789-9393
GA Norcross, Montgomery Mktg., Inc. 404-447-6124
IL Itasca, Janus, Inc. 708-250-9650
IN Carmel, Giesting & Assocs. 317-844-5222
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MA Burlington, Dynamic Sls. of New Eng. 617-272-5676
MI Comstock Pk., Giesting & Assocs. 616-784-9437
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TX Richardson, Bonser-Philhower Sls. 214-234-8438
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WA Bellevue, Venture Elctrns. 206-454-4594
WI Waukesha, Janus, Inc. 414-542-7575
Can Ontario, Cantec Rep., Inc. 416-791-5922
Can Ontario, Cantec Rep., Inc. 613-725-3704
Can Quebec, Cantec Rep., Inc. 514-623-5496

ILC TECHNOLOGY, INC., 399 Java Dr., Sunnyvale, CA 94089, Tel: 408-745-7900, FAX: 408-744-0829; Empl.: 375; *Sls. Mgr.:* Lynn Reiter; *Dist. Mgr.:* John Reilly

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WI Milwaukee, Erdman Sls. Co. ... 414-281-1330

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AR Little Rock, Carlton Bates ... 501-562-9100
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CA Milpitas, California Capacitor ... 408-262-6000
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CA San Diego, Neumann Elctrns. ... 619-695-3005
CA San Diego, Projections Unltd. ... 619-453-7900
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PA Exton, VSH Elctrns. ... 215-363-2250
PA No. Versailles, CMD ... 412-678-6020
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WA Bellevue, Integrated Elctrns., Corp. ... 206-455-2727
WI Milwaukee, Badger Capacitor Sls. ... 414-281-1330
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IMC MAGNETICS CORP., NMB Corp., 475 Wireless Blvd, Hauppauge, NY 11788, Tel: 516-231-8100, FAX: 516-231-0477; Empl.: 150; *Sls. Mgr.:* Bob Baker, Dir. of Sls.

IMC POWER SOURCES, 1435 Koll Circle, Ste. 102, San Jose, CA 95112, Tel: 408-441-9614, FAX: 408-441-7912; Empl.: 12; *Sls. Mgr.:* B. Burres

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MN Apple Valley, Comm-Link Inc. ... 612-322-1595
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NJ Lakewood, Atek ... 908-905-4443
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OH Cleveland, John O. Olsen Co. Inc. ... 216-838-0510
TX Dallas, Weisler & Assoc. Inc. ... 214-437-2386

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FL Melbourne, Hughes Assocs. ... 407-253-3031
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IN Valparaiso, Catalyst Sls. ... 219-477-4004
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OH Columbus, Time Elctrns. 614-794-3301
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TX Houston, Force Electronics 713-561-8644
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WA Kirkland, Time Elctrns. 206-820-1525
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Can Pointe Claire, Que., Ferrotronic Comps. 514-426-0300

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INDUCTOR SUPPLY, 1849 W. Sequoia Ave., Orange, CA 92668-1017, Tel: 714-978-2277, 800-854-1881, 800-472-8421, FAX: 714-978-2411; Empl.: 25; *Sls. Mgr.:* Neal McDonald

INDUSTRIAL COMPUTER DESIGNS, INC., 31264 Labaya Dr., Westlake Village, CA 91362, Tel: 818-889-3179, FAX: 818-889-1490; Empl.: 10; *Sls. Mgr.:* L. Webb

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INDUSTRIAL CONTROL CO., 3100 Suntree Blvd., Rockledge, FL 32955, Tel: 407-259-7105; FSC No.: 90081; Empl.: 15; *Sls. Mgr.:* I. Nobilio

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INDUSTRIAL DEVICES CORPORATION, 64 Digital Drive, Novato, CA 94949-5728, Tel: 415-883-3535, 800-747-0064, FAX: 415-883-2094; Empl.: 60; *Sls. Mgr.:* Louis Walton; *Dist. Mgr.:* Alan Statz

FAX: 201-489-6911

INDUSTRIAL DEVICES, INC., 260 Railroad Ave., Hackensack, NJ 07601, Tel: 201-489-8989; FSC No.: 91802; Empl.: 275; *Sls. Mgr.:* Paul Flynn ..... **B•1166-1167**

Local Sales Offices & Reps

AL Huntsville, Electro-Mech Sls. Engrg. Co., Inc. 205-880-0592
CA San Diego, Universal Comps. Co. 310-783-0220
CA Santa Clara, WestRep 408-988-8833
CA Torrance, Universal Comps. 213-783-0220
CO Littleton, Harthun Assocs., Inc. 303-792-5545
FL Tampa, APM Assocs. 813-886-2457
GA Norcross, Electro-Mech Sls. Engrg. Co., Inc. 404-447-6478
IN Indianapolis, Needler Sls. Co., Inc. 317-255-8056
IA Cedar Rapids, KKB, Inc. 313-373-1730
MD Columbia, PSA, Inc. 215-245-0513
MA Westborough, Anchor Engrg. 617-870-0573
MI E. Detroit, Fred Harris & Assocs. 313-776-5430
MN Minneapolis, Elec. Comp. Sls. 612-933-2594
MO Blue Springs, KKB, Inc. 816-229-0001
MO St. Louis, KKB, Inc. 314-647-2000
NY Glen Cove, Dyno-Rep 516-676-1598
NY Rochester, Apex Assocs. 716-254-6050
NC Raleigh, Electro-Mech Sls. Engrg. Co., Inc. 919-790-9300
OH Dayton, J. C. Hofstetter Co. 513-296-1010
OH Medina, J. C. Hofstetter Co. 216-241-4880
OR Hillsboro, Temco Northwest 503-649-8375
PA Hickory, J. C. Hofstetter Co. 412-356-2305
PA Trevose, PSA, Inc. 215-245-0513
TX Austin, R. F. Kimball Co. 512-443-5284
TX Houston, R. F. Kimball Co. 713-580-5754
TX Richardson, R. F. Kimball Co. 214-231-3447
VA Oakton, PSA, Inc. 301-953-4884
WA Bothell, Temco Northwest 206-821-5434
WA Hillsboro, Temco Northwest 503-645-2030

Local Distributors

AL Huntsville, Allied Elctrns. 205-721-3500
AZ Phoenix, Dalis Elctrn. Supp. 602-275-2885
CA Fremont, Allied Elctrns. 415-487-5250
CA Gardena, Calif. Switch & Signal 213-770-2330
CA Los Angeles, Elec. Switches 213-664-1141
CA Milpitas, Zack Elctrns. 408-942-5432
CA S. San Francisco, Steven Engrg. 415-588-9200
CA Sacramento, Zack Elctrns. 916-446-3131
CA San Diego, Shanks & Wright 619-239-0176
CA San Francisco, Zack Elctrns. 415-626-1444
CA San Jose, Quement Elctrns. 408-998-5900
CA San Jose, Rose Elctrn. Distrbg. Co. 408-943-0255
CA Santa Ana, Sunray Lighting, Inc. 714-556-3630
CA Santa Clara, Cypress Elctrns. 408-980-2500
CA Tustin, Allied Elctrns. 714-669-4190
CO Arvada, Denver Beta 303-431-7161
CO Denver, Allied Elctrns. 303-790-1662
CO Denver, Con. Parts 303-623-5313
CT Wallingford, Sager Electrical Supp. 203-265-4600
FL Orlando, Sager Elctrns. 407-354-1130
FL Pompano Bch., Allied Elctrns. 305-978-3008
FL W. Palm Beach, Atlantic Elctrns. 407-686-8553
GA Norcross, Whitehead Elctrns. 404-923-6667
ID Boise, Radar/Elec. 208-336-2322
IL Elgin, Allied Elctrns. 312-697-8200
IL Rockford, Mid-West Associated 815-962-8036
IL Wheeling, Hawk Elctrns. 800-843-4295
IL Wood Dale, Electro-Kinetics 312-595-6700
IN East Chicago, ACRO Elctrns. 312-375-1269
IN Evansville, Hutch & Son 812-425-7201
IN Fort Wayne, Bell Inds. 219-423-3422
IN Indianapolis, Allied Elctrns. 317-875-0448
IN Indianapolis, Bell Inds. 317-634-8202
IN Indianapolis, MAR Elctrns., Inc. 317-633-6699
IN South Bend, Genesis Elctrns. 219-287-2911
IA Cedar Rapids, Dee Elctrns. 319-365-7551
LA Lafayette, Ralph's 318-234-4507
MD Baltimore, PEI/Genesis 301-931-8280
MD Columbia, Sager Elctrns. 301-995-6580
MD Gaithersburg, Capitol Radio Whlsrs. 301-881-2270
MD Jessup, Treeko Elctrns. 301-792-0112
MA Hingham, Sager Elec. Supp. 617-749-6700
MA Norwood, Gerber Elctrns. 617-329-2400
MA Worcester, Coghlin Elect. 617-756-8311
MI Flint, Shand Elctrns. 313-743-8940
MI Livonia, RS Elctrns. 313-525-1155
MI Livonia, Shand Elctrns. 313-422-7000
MI Saginaw, Shand Elctrns. 517-753-9900
MN Minneapolis, Bergquist Co. 612-835-2322
MN Minneapolis, Control Des. Supp. 612-721-1628
MN Minneapolis, Stark Elctrns. 612-332-1325
MS Tupelo, Bluff City Elctrns. 601-842-6923
MO Kansas City, RS/Olive Elctrns. 913-362-1923
MO Maryland Hgts., RS/Olive Elctrns. 314-997-7709
MO St. Louis, Van Sickle Radio-Elec. 314-621-5000
NE Lincoln, Scott Elctrn. Supp. 402-466-8221
NH Salem, Sager Elctrns. 603-898-1348
NJ Hanover, State Elctrns. Parts 201-887-2550

NJ	Oakland, Relay Spec.	201-337-1000
NY	Albany, E. E. Taylor Co.	518-438-7811
NY	Buffalo, Summit Distrs.	716-887-2800
NY	Hauppauge, Broadline Elctrns.	516-231-4100
NY	Hauppauge, Sager Elctrl. Supply Co.	516-348-1300
NY	Rochester, Simcona Elctrns.	716-328-3230
NY	Rochester, Summit Elctrns.	716-334-8110
NC	Raleigh, Cameron & Barkley	919-828-2311
NC	Raleigh, Sager	919-850-9550
OH	Cincinnati, Hughes-Peters	513-351-2000
OH	Columbus, Hughes Peters	614-294-5351
OH	Dayton, Stotts-Friedman Co.	513-298-5555
OH	Warren, REM Elctrns.	216-373-1300
OK	Tulsa, PEI Genesis	918-622-8520
OR	Portland, United Radio Supp.	503-233-7151
PA	Harrisburg, Cumberland Elctrns.	717-233-5883
PA	Mars, Sager Elctrns.	412-772-2233
PA	McKean, Advacom, Inc.	814-476-7774
PA	Philadelphia, PE/Genesis	215-673-0400
PA	Philadelphia, PEI/Genesis	215-673-0400
SC	Columbia, Dixie Radio Supp.	803-779-5332
TN	Memphis, Bluff City Elctrns.	901-345-9500
TN	Nashville, Randolph & Rice	615-255-5601
TX	Fort Worth, Swieco Elctrns.	800-255-9319
TX	Ft. Worth, Allied Elctrns.	817-336-5401
TX	Houston, Altair Co.	713-462-3029
TX	Richardson, Altair Co.	214-231-5166
TX	San Antonio, Sherman Elctrns. Supp.	512-224-1004
UT	Salt Lake City, Standard Supp.	801-486-3371
VA	Glen Allen, Hermitage Distrs.	804-798-3830
WA	Seattle, Allied Elctrns.	206-547-2827
WA	Seattle, Radar Elec.	206-282-2511
WA	Spokane, Radar Elec.	509-747-3053
WI	Milwaukee, Marsh Elctrns.	414-475-6000

INDUSTRIAL DIELECTRICS, INC., P.O. Box 357, Noblesville, IN 46060, Tel: 317-773-1766, FAX: 317-773-3877; Empl.: 250; *Sls. Mgr.:* Tom Merrell; *Dist. Mgr.:* Tom Merrell

INDUSTRIAL ELECTRONIC RESOURCES, 172 Business Center Drive, Corona, CA 91720, Tel: 909-734-1111, 800-433-5160, FAX: 909-734-2710; Empl.: 14

INDUSTRIAL ELECTRONICS CORP., 24175 Gibson Drive, Warren, MI 48089, Tel: 313-759-4450, FAX: 313-759-1589; Empl.: 30; *Sls. Mgr.:* Allen A. Russell

INDUSTRIAL INDEXING SYSTEMS, INC., 626 Fishers Run, Victor, NY 14564, Tel: 716-924-9181, FAX: 716-924-2169; Empl.: 40; *Sls. Mgr.:* David Dunnill; *Dist. Mgr.:* David Dunnill

INDUSTRIAL MIDWEC CAPACITOR, See Charles Inds. Ltd.

INDUSTRIAL MONITORING INSTRUMENTATION, PCB Piezotronics Inc., 3425 Walden Ave., Depew, NY 14043, Tel: 716-684-0003, FAX: 716-684-3823

INDUSTRIAL SERVICE TECHNOLOGY, 3286 Kentland Ct. SE, Grand Rapids, MI 49548, Tel: 616-247-1033, 800-835-2611; Empl.: 13; *Sls. Mgr.:* Mark Welscott

Powertron

FAX: 516-883-7155

INDUSTRIAL TEST EQUIPMENT CO., Inc., 21 Yennicock Ave., Port Washington, NY 11050, Tel: 516-883-1700; FSC No.: 99074; *Sls. Mgr.:* Jay Monroe **D•1012, 2268-2271**

INDUSTRIAL TIMER CO., 30 Industrial Park Rd., P.O. Box 307, Centerbrook, CT 06705, Tel: 203-767-7130, FAX: 203-767-9137; Empl.: 55; *Sls. Mgr.:* Ann Fraser Carroll

INERTIAL MOTORS, 280 N. Broad St., Doylestown, PA 18901, Tel: 215-345-1010, FAX: 215-345-0111; FSC No.: 6115; Empl.: 14; *Sls. Mgr.:* Joanne Dorr; *Dist. Mgr.:* D. E. Sanderson

INFICON LEYBOLD-HERAEUS, INC., See Leybold Inficon, Inc.

INFINETICS INC., Friskem Div., 201 Vandever Ave., Wilmington, DE 19802, Tel: 302-658-2471, FAX: 302-658-2475; *Sls. Mgr.:* M. Schwartz

INFODEX

DISPLAY SYSTEMS TECHNOLOGIES

FAX: 203-879-3404

INFODEX, INC., 10 Venus Dr., Wolcott, CT 06716, Tel: 203-879-4944; FSC No.: 09087; Empl.: 44; *Sls. Mgr.:* Robert Vance **B•1012-1013, 1080**

Local Sales Offices & Reps

MA	Medfield, Nortech Engrg. Sls.	508-359-6063

INFO-LITE CORP., See Dio-Rey and Crosspoint

INFOMETRIX, 2200 Sixth Ave. No. 833, Seattle, WA 98121, Tel: 206-441-4696, FAX: 206-441-0841; Empl.: 10; *Sls. Mgr.:* Paul Bailey

INFOPRINT, INC., Micro Electronic Business, Inc., 4315 N. Elston Ave., Chicago, IL 60641, Tel: 312-539-6045, FAX: 312-539-6645

INFORMATION RETRIEVAL SYSTEMS, INC., 1705 Second Ave. Ste. 3N, New York, NY 10128, Tel: 212-348-6268; Empl.: 3; *Sls. Mgr.:* Lynne McNamara

INFORMATION TRANSFER INC., Box 357, Bloomfield, NY 14469, Tel: 716-657-7074, FAX: 716-657-7432; FSC No.: 55137; Empl.: 50; *Sls. Mgr.:* John Dillman **D•1192-1193**

Local Sales Offices & Reps

AL	Huntsville, Burnette Techno-Metrics	205-830-2832
AZ	Chandler, VIC Myers Assocs.	602-345-6449
CO	Denver, VIC Myers Assocs.	303-730-7313
CA	Sunnyvale, Westech	408-735-8647
FL	Winter Park, Wade H. Boggs, Inc.	407-647-2226
MD	Baltimore, Stemler Assocs.	301-944-8262
NJ	Cherry Hill, Stemler Assocs.	609-966-4070
NM	Albuquerque, VIC Myers Assocs.	505-884-6878
UT	Salt Lake City, Vic Myers Assocs.	801-581-1760

INFRANOR, 45E Great Hill Road, Naugatuck, CT 06770, Tel: 203-729-8258, 800-BE-SERVO, FAX: 203-729-6969; Empl.: 11 **B•1271**

INJECTO MOLD INC., Crellin International, 2601 N. Pulaski Rd., Chicago, IL 60639, Tel: 312-384-6000, FAX: 312-384-8910; Empl.: 170; *Sls. Mgr.:* Thomas R. Sund

INJECTORALL ELECTRONICS (WOMAN OWNED), 110 Keyland Court, Bohemia, NY 11716, Tel: 516-563-3388, FAX: 516-563-3389; *Sls. Mgr.:* Adam P. Friedman **C•1136**

Local Distributors

AL	Birmingham, ACK Radio Supp.	205-322-0588
AZ	Tucson, Electronic City	602-622-1173
CA	San Luis Obispo, Midstate Elctrns. Supp.	805-543-2770
CA	San Rafael, Elctrns. Plus	415-457-0466
CA	Sunnyvale, Halted Specialties	408-732-1573
IL	Lombard, NyTron Elctrns.	312-691-8900
IN	Evansville, Tri-State Supp. Co.	812-423-4257
IA	Cedar Rapids, Iowa Radio Supp. Co.	800-332-5296
KY	Louisville, P.I. Burkes	502-589-3960
MD	Rockville, Capitol Radio Whlsrs.	301-881-2270
MA	Needham, Y.D.I.	617-449-1005
MI	Canton, The Elctrn. Connection	313-595-6655
NY	Lindenhurst, RNJ Elctrns.	516-226-2700
NY	Long Island City, Typeco	718-706-6666
NY	Richmond Hill, Anchor	212-846-2420
NC	Charlotte, Slayton Elctrns.	704-375-6600
OK	Oklahoma City, Radio Supp., Inc.	405-332-6127
OR	Beaverton, Norvac	503-644-1025
SC	Charleston, Wholesale Indl. Elctrns.	803-722-2634
TX	Fort Worth, Sweico	817-335-6521
VA	Roanoke, H. C. Baker	703-344-9209

INLAND MOTOR, Kollmorgen Corp., 501 First St., Radford, VA 24141, Tel: 703-639-9045, FAX: 703-731-4193; FSC No.: 11384; Empl.: 580

INMARK CORP., 4 Byington Pl., Norwalk, CT 06850, Tel: 203-866-8474, FAX: 203-866-0918; *Sls. Mgr.:* Roger Hibbert

INMET CORPORATION, 300 Dino Drive, Ann Arbor, MI 48103, Tel: 313-426-5553, FAX: 313-426-5557; FSC No.: 64671; Empl.: 40; *Sls. Mgr.:* Tim Solomon

INNOVATEK MICROSYSTEMS, INC., Smithfield Rd., R1 Box 104, Millerton, NY 12546-9720, Tel: 914-373-9003; Empl.: 8; *Sls. Mgr.:* Paul F. Fitts

INNOVATIVE ELECTRONICS, INC., Dynatech Corporation, 10110 USA Today Way, Miramar, FL 33025, Tel: 305-432-0300, FAX: 305-432-0705; Empl.: 40; *Sls. Mgr.:* Marshall Roper

INRECO, See Ransco Industries

INRESCO, INC., 2411 Atlantic Avenue, Manasquan, NJ 08736, Tel: 908-223-6330, FAX: 908-223-2571; Empl.: 8

INSERVCO, INC., 128 Commerce Drive, Box 110, LaGrange, OH 44050, Tel: 1-216-355-5102, FAX: 1-216-355-5342; Empl.: 100; *Sls. Mgr.:* C. Scott Sudnick

INSTEK CORPORATION, 1205 John Reed Ct., City of Industry, CA 91745, Tel: 818-336-6537, FAX: 818-369-1748; Empl.: 350; *Sls. Mgr.:* Michael Silverstein, National **D•1745**

Local Sales Offices & Reps

AL	Hoover, Henry Phillips Co., Inc.	205-733-0043
AZ	Tempe, Sertek, Inc.	800-334-7127
CO	Englewood, Sertek, Inc.	800-334-7127
GA	Roswell, Henry Phillips, Co., Inc.	404-992-3070
IL	Addison, Elctrn. Specs.	708-250-9080
IN	Mulberry, Maish Sls.	317-296-2322
MI	Warren, Burcaw Co.	313-573-4605
MN	Minneapolis, MSJ Mktg., Inc.	612-755-1865
NM	Sertek, Inc.	800-334-7127
NY	Little Neck, M S Sls.	718-224-9746
NC	Statesville, Henry Phillips Co., Inc.	704-876-0730
SC	Henry Phillips Co., Inc.	800-877-3070
TN	Henry Phillips Co., Inc.	800-877-3070
UT	Sertek, Inc.	800-334-7127

INSTRULAB, P.O. B. 98, Dayton, OH 45404, Tel: 513-223-2241; Empl.: 22; *Sls. Mgr.:* Fred Pummill

INSTRUM, 176 W. Pomona Ave., Monrovia, CA 91016, Tel: 818-303-4210, FAX: 818-303-4210; Empl.: 5; *Sls. Mgr.:* Ralph Morrison

ICS

FAX: 708-543-6244

INSTRUMENTATION & CONTROL SYS., ICS.Inc., 520 Interstate Rd, Addison, IL 60101, Tel: 708-543-6200, TELEX: 271503 ICS UR; Empl.: 20; *Sls. Mgr.:* Harold Miller **B•1524-1525; D•2272-2273**

Local Sales Offices & Reps

MA	Topsfield, Whitehead Assocs., Inc.	508-887-8050

UPS Representatives

TX	Dallas, Adair & Assocs.	214-321-9970
TX	Houston, Adair & Assocs.	713-827-7155

Local Distributors

AL	Huntsville, Allied Elctrns.	205-721-3500
AL	Mobile, Allied Elctrns.	205-476-1875
AZ	Phoenix, Allied Elctrns.	602-437-9080
CA	Chatsworth, Allied Elctrns.	818-882-6981
CA	Fremont, Allied Elctrns.	510-770-0590
CA	Irvine, Allied Elctrns.	714-727-3010
CA	Rocklin, Allied Elctrns.	916-632-3104
CA	San Diego, Allied Elctrns.	619-279-2550
CA	San Francisco, Allied Elctrns.	415-952-9599
CA	Torrance, Allied Elctrns.	310-373-8828
CO	Englewood, Allied Elctrns.	303-790-1664
CT	Cheshire, Allied Elctrns.	203-272-7730
FL	Casselberry, Allied Elctrns.	407-831-3331
FL	Jacksonville, Allied Elctrns.	904-346-0761
FL	Largo, Allied Elctrns.	813-541-4660
FL	Pompano Bch., Allied Elctrns.	305-978-3008
GA	Duluth, Allied Elctrns.	404-497-9544
GA	Roswell, Henderson Ind. Equip.	404-552-0185
IL	Des Plaines, Allied Elctrns	708-803-1040
IL	Libertyville, Allied Elctrns.	708-918-0250
IL	New Lenox, Allied Elctrns.	815-485-1511
IL	Oak Forest, Allied Elctrns.	708-535-0038
IL	Rockford, Powermation	815-397-0510
IL	Wood Dale, Allied Elctrns.	708-860-0007
IN	Indianapolis, Allied Elctrns.	317-875-0448
IA	W. Des Moines, Allied Elctrns.	515-223-6488
KS	Lenexa, Allied Elctrns.	913-599-6227
KY	Louisville, Allied Elctrns.	502-452-2293
LA	Metairie, Allied Elctrns.	504-885-1195
MD	Columbia, Allied Elctrns.	301-381-1560
MA	Billerica, Allied Elctrns.	508-667-7921
MA	Norwood, Allied Elctrns.	617-255-0361
MI	Grand Rapids, Allied Elctrns.	616-949-8200
MI	Plymouth, Allied Elctrns.	313-416-9300

MN Bloomington, Allied Elctrns. 612-881-0838
MN St. Paul, Powermation 612-645-0781
MO Earth City, Allied Elctrns. 314-291-7031
NE Omaha, Allied Elctrns. 402-697-0238
NH Nashua, Allied Elctrns. 603-883-3006
NJ Audubon, Universal Elctrn. Supp. ... 1-800-327-3529
NJ Edison, Allied Elctrns. 908-572-9600
NJ Moorestown, Allied Elctrns. 609-234-7769
NJ Parsippany, Allied Elctrns. 201-428-3350
NY Fairport, Allied Elctrns. 716-425-3850
NY Lagrangeville, Allied Elctrns. 914-452-1470
NY Mineola, Allied Elctrns. 516-248-2360
NC Raleigh, Allied Elctrns. 919-876-5845
OH Cincinnati, Allied Elctrns. 513-771-6990
OH Solon, Allied Elctrns. 216-248-4200
OH Worthington, Allied Elctrns. 614-785-1270
OK Tulsa, Allied Elctrns. 918-664-0844
OR Portland, Allied Elctrns. 503-252-0335
PA Camp Hill, Allied Elctrns. 717-975-3570
PA Pittsburgh, Allied Elctrns. 412-367-4124
SC Greenville, Allied Elctrns. 803-288-8835
TN Memphis, Allied Elctrns. 901-367-2895
TX Austin, Allied Elctrns. 214-553-4370
TX Austin, Allied Elctrns. 512-219-7171
TX El Paso, Allied Elctrns. 915-779-6294
TX Ft. Worth, Allied Elctrns. 817-595-3500
TX Houston, Allied Elctrns. 713-455-3993
TX Humble, Allied Elctrns. 713-466-8005
UT Salt Lake City, Allied Elctrns. 801-261-5244
VA Alexandria, Allied Elctrns. 703-750-8206
VA Springfield, Allied Elctrns. 703-644-9515
VA Virginia Beach, Allied Elctrns. 804-363-8662
WA Seattle, Allied Elctrns. 206-547-2827
WI Allied Elctrns. 1-800-433-5700
WI Green BAy, Powermation 414-496-0944
WI New Berlin, Allied Elctrns. 414-796-1280
WI Waukesha, Powermation 414-523-0600

INSTRUMENTATION NORTHWEST, 14972 N.E. 31st Circle, Redmond, WA 98052, Tel: 206-885-3729, FAX: 206-867-0404; Empl.: 26; *Sls. Mgr.:* Robert Shea

INSTRUMENTATION SERVICES, INC., 957 Winnetka Ave. N., Minneapolis, MN 55427, Tel: 612-544-8916, FAX: 612-544-4887; Empl.: 30; *Sls. Mgr.:* G. Ryan

INSTRUMENT DESIGN ENGINEERING ASSOCS., INC., See IDEA, Inc.

INSTRUMENTED SENSOR TECHNOLOGY, INC., 4704 Moore St., Okemos, MI 48864, Tel: 517-349-8487, FAX: 517-349-8469; Empl.: 10

INSTRUMENT ENCLOSURES, 4088 South K St., Tulare, CA 93274, Tel: 209-688-1100, FAX: 209-688-1193; FSC No.: 62012; Empl.: 40; *Sls. Mgr.:* Mike Love

INSTRUMENT RESEARCH CO., Box 40207, Santa Barbara, CA 93103, Tel: 805-962-8336; Empl.: 6

INSTRUMENT RESEARCH CO., 6420A Dobbin Rd., Columbia, MD 21045, Tel: 410-740-3411, FAX: 410-740-2928; Empl.: 10

INSTRUMENTS, INC., 7263 Engineer Rd., Ste. G, San Diego, CA 92111, Tel: 619-571-1111, FAX: 619-571-0188; FSC No.: 34563; Empl.: 28; *Sls. Mgr.:* Ken Kalbfell

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FAX: 516-467-8558

INSTRUMENTS FOR INDUSTRY, INC., 731 Union Parkway, Ronkonkoma, NY 11779, Tel: 516-467-8400; Empl.: 25 ..... **D•1013**

Local Sales Offices & Reps

AL Eva, Barr Elctrn. Instrs. 205-796-7533
AZ Mesa, DJM Elctrns. 602-821-1440
CA Fremont, DJM Elctrns. 415-490-7406
CA Sunnyvale, DJM Elctrns. 408-749-8936
CA Valencia, DJM Elctrns. 805-254-2677
CO Englewood, R.A. Mayes Co. 303-761-9447
FL Barr Elctrns. 800-242-7138
KS Lenexa, KJS Mktg. 913-962-1795
MD Centerville, EMC Technologists 301-758-3510
MO Maryland Heights, KJS Mktg. 314-770-1412
NH Brookline, EMC Sls., Inc. 603-672-4455
NJ N. Plainfield, Brady Co. 908-755-7900
NM Albuquerque, Mesa Tech. Corp. 505-883-8833
PA Sewickley, Teplitz/Byrne Assocs. 412-741-3628
TX Richardson, Scientific Dvcs. 214-231-8106
VA Sterling, EMC Technologists 703-450-7988
WA Bothell, Del Black Assocs. 206-487-4396
Can Nepean, Ont., Multilek, Inc. 613-226-2365

INSTRUMENT SOCIETY OF AMERICA, P.O. Box 12277, Research Triangle Park, NC 27709, Tel: 919-549-8411, TELEX: 802-540, FAX: 919-549-8288; Empl.: 102

Instrument Specialties Co., Inc.

FAX: 717-424-6213

INSTRUMENT SPECIALTIES CO. HEADQUARTERS, P.O. Box A, Delaware Water Gap, PA 18327-0136, Tel: 717-424-8510, TWX: 510-671-4526; Empl.: 330; *Sls. Mgr.:* John Blazejewski ... **C•1687-1694**

Local Sales Offices & Reps

AZ Phoenix, O'Donnell Assocs. 602-944-9542
CA San Jose, O'Donnell Assocs. 408-456-2950
CA Torrance, O'Donnell Assocs. 310-781-2255
CO Littleton, D. M. Harthun Assocs. 303-795-5545
FL Altamonte Springs, Kinetic Sls., Inc. ... 407-339-3855
FL Deerfield Bch., Kinetic Sls., Inc. 305-480-6040
FL Palm Harbor, Kinetic Sls., Inc. 813-934-3768
KS Prairie Village, Thunderbird Tech. Sls. & Svcs. 913-642-7220
KS Wichita, Thunderbird Tech. Sls. & Svcs. 316-636-5018
MI Howell, Great Lakes Comps. 517-548-9100
MN St. Paul, Arkco Sls. 612-777-7454
MO Maryland Heights, Thunderbird Tech. Sls. & Svcs. 314-298-8940
NM Albuquerque, O'Donnell Assocs. 505-889-4522
TN Franklin, D. L. Clark & Assocs. 615-790-7457
TX Dallas, Materials Technlg. 214-484-4677
WA Bothell, Temco Northwest 206-481-6150
WA Spokane, Temco Northwest 509-927-9392
Can Pickering, Ont., A. C. Simmonds & Sons 416-839-8041

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AZ Chandler, ELEC-COM 602-893-2930
CA Corona, Diane Ward 909-279-2838
CA San Ramon, Synergy Sls. 510-830-0829
CO Denver, Motion Technlg. 303-757-3003
FL Maitland, Hawkins Fredrickson Assocs. 407-831-2474
FL Pompano Beach, Hawkins Frederickson Assoc. 305-979-0330
FL Tampa, Hawkins Frederickson Assoc. 813-651-1063
GA Norcross, Macro Mktg. 404-662-5580
IL Chicago, M. Gottlieb Assocs. 312-775-8620
IA Cedar Rapids, Lorenz Sls. 319-377-4666
MA Lexington, Kanan Technlgs. 617-861-7300
MN Minneapolis, Stan Clothier Co. 612-944-6904
NJ Glen Gardner, Daner-Hayes 800-225-8760
NJ Haddonfield, Sunday O'Brien 609-429-4013
NY Massapequa, Daner-Hayes 800-225-8760
NY Rochester, Indl. Tech. Sls. 716-872-1628
NC Raleigh, C-Tech Sls. 919-782-8100
OH Dayton, Electro-Mktg., Inc. 800-338-6856
OR Beaverton, Pacific Mktg. Specialists Inc. 503-641-9373
TX Dallas, Seaton Corp. 214-980-9860
TX Houston, Seaton Corp. 713-731-2649
VA Richmond, Glasscock Assocs. 804-798-2125
Can Kanata, Ont., Canadian Mktg. Techlgs. 613-591-9555
Can Mississauga, Ont., Canadian Mktg. Technlgs. 416-612-0900
Can Pointe Claire, Que., Canadian Mktg. Technlgs. 514-694-6088

Local Distributors
AL Huntsville, Future Elctrns., Corp. 205-830-2322
AZ Phoenix, Future Elctrns., Corp. 602-968-7140
AZ Tempe, Bell Inds. 602-966-7800
CA Agoura Hills, Bell Industries 818-879-9494
CA Chatsworth, Future Elctrns., Corp. 818-772-6240
CA Cypress, Bell Inds. 714-895-7801
CA Irvine, Future Elctrns., Corp. 714-250-4141
CA Los Angeles, Bell Inds. 310-826-6778
CA Rocklin, Bell Inds. 916-652-0418
CA San Diego, Future Elctrns., Corp. 619-625-2800
CA San Jose, Future Elctrns., Corp. 408-434-1122
CA Santa Anna, Foresight Elctrns. 714-833-2134
CA Santa Clara, ForeSight Elctrns. 408-980-9700
CA Sunnyvale, Bell Inds. 408-734-8570
CO Denver, Bell Inds. 303-691-9270
CO Denver, Future Elctrns., Corp. 303-232-2008
CT Bethel, Future Elctrns., Corp. 203-743-9594
CT Wallingford, Bell Inds. 203-269-6801
FL Altamonte Springs, Bell Inds. 407-339-0078
FL Altamonte Springs, Future Elctrns., Corp. 407-767-8414
FL Largo, Future Elctrncs. 813-530-1222
FL Oldsmar, Applied Power 813-854-4004
GA Norcross, Applied Power, Inc. 404-263-0421
GA Norcross, Future Elctrns., Corp. 404-441-7676
IL Elk Grove Village, Bell Inds. 708-640-1910
IL Hoffman Estates, Future Electronics .. 708-882-1255
IL Roselle, Foresight Elctrns. 708-980-9890
IN Fort Wayne, Bell Inds. 219-423-3422
IN Indianapolis, Bell Inds. 317-875-8200
MD Columbia, Bell Inds. 410-290-5100
MD Columbia, Future Elctrns., Corp. 410-290-0600
MA Andover, Bell Inds. 508-474-8880
MA Bolton, Future Electronics 508-779-3000
MI Brighton, Applied Power, Inc. 313-227-3604
MI Detroit, Future Elctrns., Corp. 313-261-5270
MI Livonia, L.W.C. Distributors 313-464-7700
MN Eden Prairie, Future Elctrns., Corp. 612-944-2200
MO St. Louis, Future Elctrns., Corp. 314-469-6805
NH Windham, Orion Inds. 603-437-4446
NJ Marlton, Future Elctrns., Corp. 609-596-4080
NJ Parsippany, Future Elctrns. 201-299-0400
NM Albuquerque, Bell Inds. 505-292-2700
NY Hauppauge, Future Elctrns., Corp. 516-234-4000
NY Rochester, Future Elctrns., Corp. 716-272-1120
NY Syracuse, Future Elctrns., Corp. 315-451-2371
NC Charlotte, Future Elctrns., Corp. 704-455-9030
NC Raleigh, Future Elctrns., Corp. 919-790-7111
OH Dayton, Bell Inds. 513-435-8660
OH Mayfield Heights, Future Elctrns. 216-449-6996
OR Beaverton, Bell Inds. 503-644-3444
OR Beaverton, Future Elctrns., Corp. 503-645-9454
PA Philadelphia, Future Elctrns., Corp. 609-778-7600
PA Trevose, Bell Inds. 215-953-2800
TX Dallas, Future Elctrns., Corp. 214-437-2437
TX Dallas, Seaton Elctrns. 214-980-9860
TX Houston, Future Elctrns., Corp. 713-556-8696
TX Houston, Seaton Elctrns. 713-731-2649
UT Midvale, Bell Inds. 801-561-9691
UT Salt Lake City, Future Elctrns., Corp. .. 801-972-8489
WA Bothell, Future Elctrns., Corp. 206-489-3400
WI Waukesha, Bell Inds. 414-547-8879
WI Waukesha, Future Elctrns., Corp. 414-786-1884
Can Calgary, Alb., Future Elctrns., Corp. 403-250-5550
Can Edmonton, Alb., Future Elctrns., Corp. 403-438-2858
Can Mississauga, Future Electronics 416-612-9200
Can Montreal, Que., Future Elctrns. Corp. .. 514-694-7710
Can Ottawa, Ont., Future Elctrns., Corp. 613-820-8313
Can Quebec City, Que., Future Elctrns., Corp. 418-877-6666
Can Vancouver, B.C., Future Elctrns., Corp. 604-294-1166

INTERNATIONAL POWER MACHINES, 2975 Miller Park North, Garland, TX 75042, Tel: 800-527-1208, FAX: 214-494-2690; Empl.: 200; *Sls. Mgr.:* Barry Papermaster, Mktg. VP

International Power Sources, Inc.

FAX: 508-879-8669

INTERNATIONAL POWER SOURCES, INC., 200 Butterfield Dr., Ashland, MA 01721, Tel: 508-881-7434 ..... **D•2110-2111**

Local Sales Offices & Reps
AL Huntsville, Murcota 205-539-8476
AZ Scottsdale, Power Up Elctrns. 602-955-1105
CA Dana Point, Electro Venture South 714-496-5225
CA Los Altos Hills, H B Mktg. 415-941-4080
FL Palm Beach Gardens, Graham Assocs., Inc. 407-622-4049
IL Arlington Hgts., Phoenix Elctrn. Sls. ... 708-394-4422
KS Olathe, Tech. Sls. Assocs. 913-829-2800
MD Hunt Valley, Eagle Sls. Corp. 410-666-3930
MA Bellingham, OEM Mktg. & Sls. 508-528-4983
MI Brighton, A P Assocs. 313-229-6550
MN Minneapolis, Engineering Prods. Assoc., Inc. 612-835-9022
MO St. Louis, Tech. Sls. Assocs. 314-521-2044
NH Salem, OEM Mktg. & Sls. 603-893-0009
NY Jericho, J-Square Mktg. 516-935-3200
NY Manlius, Smith Tech. Sls. 315-682-1777
NC Winston-Salem, Murcota 919-722-9445
OH Cincinnati, KCH Co. 513-931-1686
OR Portland, Caruso & Camelleri Assocs. 503-246-5439
PA Montgomeryville, Eastern Sci. Mktg. ... 215-368-4570
TX Richardson, Jim D. Gray & Assocs. ... 214-699-9976
UT Ogden, Taylor Mktg. 801-546-9570
WA Bellevue, Caruso & Camelleri Assoc. 206-455-8811
WI Brookfield, McMahon Sls., Inc. 414-782-3335

Local Distributors

CA	Redwood City, HdB Elctrns.	415-368-1388
GA	Norcross, Applied Power, Inc.	404-263-0421
MI	Brighton, Applied Power, Inc.	313-227-3604
NH	Windham, Orion Inds., Inc.	603-437-4446
TX	Stafford, Southwest Elctrns.	713-240-4000
TX	Tomball, Wofford Elctrns. Inc.	713-351-2255

International IOR Rectifier

FAX: 310-322-3332

INTERNATIONAL RECTIFIER CORP., 233 Kansas St., El Segundo, CA 90245, Tel: 310-322-3331; Empl.: 2400; *Sls. Mgr.:* Curtis Jones, V.P.; *Dist. Mgr.:* Don Prescott, V.P. **B•1526**

Local Sales Offices & Reps

AL	Huntsville, Montgomery Mktg., Inc.	205-830-0498
AZ	Phoenix, Sun State Tech. Sls.	602-220-0595
CA	Fair Oaks, Brooks Tech. Grp.	916-965-3255
CA	Gilroy, Intl. Rectifier	408-848-8467
CA	Mtn. View, Brooks Tech. Grp.	415-960-3880
CA	San Diego, Harvey King, Inc.	619-695-9300
CA	Westlake Village, First Rep	805-373-0887
CO	Englewood, Thorson Rocky Mountain, Inc.	303-773-6300
CT	Fairfield, N.R.G. Ltd., Inc.	203-384-1112
FL	Altamonte Springs, Kinetic Sls., Inc.	407-339-3855
FL	Kissimmee, Intl. Rectifier	407-933-2383
GA	Norcross, Montgomery Mktg., Inc.	404-447-6124
IL	Rolling Meadows, International Rectifier	708-934-0020
IL	Rolling Meadows, Phase II Mktg., Inc.	708-806-1330
IN	Carmel, Tech. Mktg. Corp.	317-844-8462
IN	Ft. Wayne, Tech. Mktg. Corp.	219-432-5553
IN	Kokomo, Tech. Mktg. Corp.	317-459-5152
KY	Louisville, Tech. Mktg. Corp.	502-245-7411
MA	Burlington, Nova Sls., Inc.	617-272-5221
MA	Tewksbury, A/D Sls., Inc.	508-851-5400
MI	Farmington Hills, Luebbe Sls.	313-489-8828
MN	Edina, Mel Foster Tech. Sls.	612-941-9790
MO	Bridgeton, Hitec Central, Inc.	314-291-5920
MO	Independence, Hitec Central, Inc.	816-796-6684
NJ	W. Caldwell, Tech. Mktg. Grp.	201-226-3300
NM	Albuquerque, Reptronix Ltd.	505-292-1718
NY	Bohemia, Intl. Rectifier	516-244-8047
NY	E. Syracuse, Nycom, Inc.	315-437-8343
NY	Fishkill, Intl. Rectifier	914-896-4262
NY	Melville, Tech. Mktg. Grp.	516-351-8833
NC	Burlington, Intl. Rectifier	919-584-0340
NC	Cary, Montgomery Mktg., Inc.	919-467-6319
NC	Raleigh, Montgomery Mktg., Inc.	919-851-0010
OH	Cincinnati, Luebbe Sls. Co.	513-530-0600
OH	Dayton, Luebbe Sls. Co.	513-438-0490
OH	Northfield, Intl. Rectifier	216-467-0852
OH	Westlake, Luebbe Sls. Co.	216-899-0071
OR	Beaverton, Electra Tech. Sls., Inc.	503-643-5074
PA	Boothwyn, Intl. Rectifier	215-494-5080
PA	Broomal, L. D. Lowery, Inc.	215-356-5300
PA	Pittsburgh, Luebbe Sls. Co.	412-364-0490
TX	Austin, BP Sls.	512-346-9186
TX	Houston, BP Sls.	713-782-4144
TX	Richardson, BP Sls.	214-234-8438
UT	Salt Lake City, Thorson Rocky Mtn., Inc.	801-942-1683
WA	Kirkland, Electra Tech. Sls., Inc.	206-821-7442
WI	Brookfield, International Rectifier	414-784-2480
WI	Wauwatosa, Phase II Mktg., Inc.	414-771-9986
Can	Markham, Ont., Intl. Rectifier	416-475-1897

INTERNATIONAL RESISTIVE COMPANY, P.O. Box 1860, Boone, NC 28607, Tel: 704-264-8861, TELEX: 46-9902, FAX: 704-264-8865; Empl.: 1700; *Sls. Mgr.:* Hugh Bolen; *Dist. Mgr.:* Hugh Bolen

INTERNATIONAL RESOURCE SVCS., 7792 N.W. 72nd Ave., Miami, FL 33166, Tel: 305-884-2924, FAX: 305-885-3127; Empl.: 5; *Sls. Mgr.:* Richard L. Winn

INTERNATIONAL SENSOR SYSTEMS, INC., Aurora Industrial Pk., Box 345, Aurora, NE 68818, Tel: 402-694-6111, FAX: 402-694-6180; Empl.: 45; *Sls. Mgr.:* Wayne Roblee **A•1704-1705**

Local Sales Offices & Reps

AZ	Phoenix, Toward Engrg.	602-955-3193
CA	Mission Viejo, EAB Assocs. Inc	714-859-7701
CO	Longmont, Tri-Tech Sls.	303-440-7862
IL	Lemont, Trend Tronics, Inc.	708-972-1166
MD	Laurel, CSDS	301-953-7884
MA	Scituate, Olsen Tech Sls. Inc.	617-545-5101
MI	Milford, Elctrn. Comp. Sls.	313-360-3790
MN	Elk River, Ertech, Inc.	612-441-0602
NE	Omaha, IONEB	402-895-4431
NJ	Manalapan, DMR Mktg.	908-303-0510
NC	Summerfield, Harrington Inds.	919-643-9293
OR	Portland, Elctrn. Engrg. Sls.	503-639-3978
PA	Southampton, Campbell Assocs.	215-322-6630
TN	McMinnville, B & D Mktg.	615-473-7155
TX	Ft. Worth, Merlin Elctrns.	817-429-4420

INTERNATIONAL SENSOR TECHNOLOGY, 17771 Fitch St., Irvine, CA 92714, Tel: 714-863-9999, FAX: 714-474-7417; *Sls. Mgr.:* Jack McCann

INTERNATIONAL TECHNOLOGIES, INC., 68 Albany Rd., Warwick, RI 02888, Tel: 401-781-5595, FAX: 401-467-5885; Empl.: 15; *Sls. Mgr.:* R.W. Elsdoerfer

INTERNATIONAL TELECOMMUNICATIONS COMPONENTS, INC., 94 B East Jefryn Blvd., Deer Park, NY 11729, Tel: 516-243-1444, FAX: 516-595-9160; FSC No.: 0E6J8; Empl.: 10; *Sls. Mgr.:* Lloyd Estin

INTERNATIONAL TEST INSTRUMENTS, 3002 Dow Ave., Ste. 110, Tustin, CA 92680, Tel: 714-573-9000, FAX: 714-573-9500; Empl.: 10; *Sls. Mgr.:* Hank Pselos

INTERNATIONAL TRANSDUCER CORP., Channel Technologies, Inc., 869 Ward Dr., Santa Barbara, CA 93111, Tel: 805-683-2575, TELEX: 658 495, FAX: 805-967-8199; FSC No.: ID 532; Empl.: 65; *Sls. Mgr.:* Christine M. Bashforth, Mktg. Mgr.

INTEROPTICS, Purdy Group, 770 Airport Blvd, Burlingame, CA 94010, Tel: 415-347-7727, TELEX: 677-1439 (PURDY UW), FAX: 415-340-1670; Empl.: 35

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FAX: 206-882-1990

INTERPOINT CORPORATION, 10301 Willows Roads, P.O. Box 97005, Redmond, WA 98052, Tel: 206-882-3100; FSC No.: 50821; Empl.: 500; *Sls. Mgr.:* D.T. Baughman, Dir. of Sls. **A•1706-1707; D•2112-2123**

Local Sales Offices & Reps

AL	Huntsville, Novus Grp.	205-534-0044
AZ	Tempe, Gassner & Clark	602-968-9037
TX	Irving, Kite Elctrn. Sls.	214-986-0321
CA	Los Altos, Cain-White & Co.	415-948-6533, 415-948-0115
CA	San Diego, Varigon San Diego	619-576-0100
CA	Woodland Hills, Varigon Inc.	818-594-5080
CO	Parker, TMA/Colorado	303-841-3435
FL	Lighthouse Point, Krutek & Assocs.	305-783-2501
GA	Norcross, Novus Grp.	404-263-0320
IL	Elgin, Elctrn. Comp. Intl. Ltd.	708-888-0099, 708-888-0998
IN	Ft. Wayne, Corrao Marsh Inc.	219-482-2725
IN	Greenfield, Corrao Marsh Inc.	317-462-4446
FL	Maitland, Jack Krutek & Assoc.	407-628-4837
MD	Marriotsville, Neal Deoul Assoc.	410-795-5775
MD	Owings Mills, Neal Deoul Assocs.	410-363-4311
MA	Wakefield, Howard C. Jappe Co.	617-245-9359
MN	Minneapolis, Intertec	612-921-8443
KS	Lenexa, Midwest Tech. Sls.	913-888-5100
NJ	Flanders, K & R Engrg. Sls.	201-584-5235, 800-631-9362
NY	Quality Comps.	315-682-8885
NC	Cary, Novus Grp.	919-460-7771
OH	Mayfield Village, Arthur H. Baier Co.	216-292-7500
PA	Pipersville, Yax Assocs.	215-766-2100
TX	Houston, Kite Electrn. Sls.	713-469-6729
Can	Calgary, Alb., Cana Rep. Grp. Inc.	403-243-5148
Can	Montreal, Que., Cana Rep Grp. Inc.	514-276-4477
Can	Surrey, BC, Cana Rep Grp. Inc.	604-589-8595
Can	Willowdale, Ont., Cana Rep. Grp. Inc.	416-250-6683

Local Distributors

IA	Cedar Rapids, Midwest Tech. Sls.	319-377-1688
KS	Goddard, Midwest Tech. Sls.	316-794-8565
MO	Earth City, Midwest Tech. Sls.	314-298-8787
UT	Salt Lake City, TMA/Colorado	801-483-1009

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INTERSWITCH, Wm. J. Purdy Co., 770 Airport Blvd., Burlingame, CA 94010, Tel: 415-347-8217, TELEX: 677-1439, FAX: 415-340-1670; FSC No.: (Purdy UW); Empl.: 32; *Sls. Mgr.:* Clarence Bruce

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INTER-TECHNICAL GROUP INC., WIMA Div., 2269 Saw Mill River Rd., Ste. 400, P.O. Box 217, Elmsford, NY 10523, Tel: 914-347-2474; Empl.: 17; *Sls. Mgr.:* Gary M. Fey; *Dist. Mgr.:* Andrev E. Dvorscak **A•1084**

Local Sales Offices & Reps

AL	Huntsville, J. R. Assocs.	205-830-2130
AZ	Scottsdale, Jackson Mktg.	602-998-0831
CA	Los Gatos, Shur Sls.	408-399-7487
CO	Arvada, Arrowhead Sls. Corp.	303-423-5556
FL	Largo, Electrocraft, Inc.	813-544-1766
IL	Palatine, North Central Sls.	708-359-5556
IN	Indianapolis, Gen II Mktg., Inc.	317-848-3083
MA	Milford, Selmark Assocs., Inc.	508-478-9088
MN	Minneapolis, Holmgren Assocs.	612-574-9983
MO	Bridgeton, AEM, Inc.	314-298-9900
NY	Manhasset, Win-Cor Elctrn. Sls. Corp.	516-627-9474
NY	Rochester, BKT Assocs., Inc.	716-461-9880
OH	Cincinnati, Applied Data Management	513-579-8108
PA	Allison Park, Elctrn. Mktg. Consultant, Inc.	412-366-7187
TX	Plano, Richmar Elctrns. Corp.	214-424-8388
VA	Ashland, Glasscock Assocs.	804-798-2125
WA	Seattle, Harry Levinson Co.	206-382-1300

Local Distributors

AL	Huntsville, Resistacap, Inc.	205-883-4270
CA	Milpitas, Kent Elctrn. Corp.	408-956-5300
CA	Sunnyvale, Capsco Sls., Inc.	408-734-3020
CO	Littleton, Indelco, Inc.	303-795-3431
CT	Bridgeport, Park Distrs. Inc.	203-366-7200
CT	Wallingford, Midstate Elctrns.	203-265-9900
FL	Melbourne, Pridmore Corp.	407-727-2491
IL	Rosemont, Advent Elctrns., Inc.	708-297-6200
MA	Ashland, March Elctrns.	508-881-6715
MN	Eitzen, Capacitor Assocs.	507-495-3306
MN	Roseville, Chris Elctrns. Distr.	612-631-2647
MO	St. Charles, Finnigan Elctrns.	314-946-6201
NJ	East Brunswick, Brothers Elctrns.	908-238-2200
NM	Albuquerque, Betatron Elctrns.	505-821-1122
NY	Bohemia, March Elctrns.	516-563-6000
NY	Penn Yan, Advacom Technlg., Inc.	315-536-2221
OH	Englewood, Argent Inds., Inc.	513-836-8633
OH	Englewood, ADS Electra, Inc.	513-836-8636
PA	Exton, VSH Elctrns.	215-363-2250
PA	McKean, Advacom, Inc.	800-678-0512
PA	North Versailles, CMD Elctrns., Inc.	412-678-6020
TX	Allen, Prime Distrbg. Co.	214-231-0170
WA	Seattle, Harry Levinson Co.	206-382-1300
WI	Oconomowoc, GW Elctrns. Ltd.	414-567-9445

INTRA-COMPUTER INC., 87-46 Van Wyck Expwy., Jamacia, NY 11418, Tel: 718-297-5500, FAX: 718-297-5518; Empl.: 9; *Sls. Mgr.:* Art Yaglian

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Local Sales Offices & Reps

AL	Huntsville, Currier, Peak & Frazier	205-536-1506
AZ	Phoenix, Shefler-Kahn	602-581-0884
CA	Los Alamitos, Power Specialists	213-594-9418
CA	San Jose, O'Donnell Assocs.	408-456-2950
FL	Orlando, Currier, Peak & Frazier	407-855-0843
GA	Duluth, Currie, Peak & Frazier	404-497-9404
IL	Arlington Hgts., Coombs Assocs.	312-439-9810
MD	Columbia, Delta III	301-730-4700
MA	Canton, Intronics	617-828-4992
MO	Webster Grove, EPI, Inc.	314-962-1411
NC	Greensboro, Currie, Peak & Frazier	919-373-0380
OH	Dayton, Thompson & Assocs.	513-435-7733
PA	Camp Hill, Quick Response Tech Sls.	717-763-9577
PA	Camp Hill, Quick Response Tech. Sls.	717-763-9577
TN	Smyrna, Currie, Peak & Frazier	615-459-0743
TX	Richardson, Scientific Sls.	214-231-6541
VA	Midlothian, Delta III	804-379-1816
WI	Milwaukee, Coombs Assoc.	414-351-6123
Can	Toronto, Strategic Elctrns.	416-620-5381

ION PHYSICS CORPORATION, 11 Industrial Way, Atkinson, NH 03811, Tel: 603-893-6687, FAX: 603-893-6729

IPAC GRP., 3047 Indl. Blvd., Bethel Pk., PA 15102, Tel: 412-831-9200, TWX: 510-697-3935, FAX: 412-831-9580; Empl.: 50; *Sls. Mgr.:* Larry Swift

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Local Sales Offices & Reps

AL	Huntsville, RO Whitesell	205-883-5110
AZ	Mesa, SW Sls.	602-345-8080
CA	Los Gatos, Luscombe Engrg. Co. North	408-370-2020
CA	Montrose, Luscombe Engrg. Co. South	818-249-9000
CO	Westminster, Straube	303-426-0890
CT	Branford, Coakley Boyd & Abbett Inc.	203-481-2218
FL	Boca Raton, South Atlantic Comp. Sls.	407-391-1034
FL	Orlando, South Atlantic Comp. Sls.	407-857-3650
FL	Seminole, South Atlantic Comp. Sls.	813-595-6397
GA	Norcross, South Atlantic Comp. Sls.	404-447-6154
IL	Itasca, Circuit Sls. Inc.	708-773-0200
IN	Ft. Wayne, RO Whitesell	219-489-0588
IN	Indianapolis, RO Whitesell	317-876-9000
IN	Kokomo, RO Whitesell	317-457-9127
IA	Cedar Rapids, CH Horn & Assocs.	319-393-8703
KS	Lenexa, Midtec Assocs. Inc.	913-541-0505
MA	Framingham, Coakley Boyd & Abbett Inc.	508-820-0800
MA	W. Bridgewater, Coakley Boyd & Abbett Inc.	508-559-6700
MI	Grand Blanc, RO Whitesell	313-695-0770
MI	Grand Rapids, RO Whitesell	616-942-5420
MI	Southfield, RO Whitesell	313-352-5454
MI	St. Joseph, RO Whitesell	616-983-7337
MN	Minneapolis, Tecteam Sls.	612-854-6616
MO	St. Louis, J G Macke Co.	314-432-2830
NJ	Hackensack, Coakley Boyd & Abbett Inc.	201-440-4114
NM	Albuquerque, SW Sls.	505-899-9005
NY	E. Syracuse, Electra Sls. Corp.	315-463-1248
NY	Rochester, Electra Sls. Corp.	716-427-7860
NC	Charlotte, South Atlantic Comp. Sls.	704-525-0510
NC	Raleigh, South Atlantic Comp. Sls.	919-859-9970
OH	Cincinnati, RO Whitesell	513-528-5644
OH	Cleveland, RO Whitesell	216-447-9020
OH	Columbus, RO Whitesell	614-888-9396
OH	Dayton, RO Whitesell	513-298-9546
OR	Tigard, Halbar-RTS Inc.	503-624-6862
PA	Broomall, LD Lowery Inc.	215-356-5300
PA	Pittsburgh, RO Whitesell	412-963-6161
TN	Knoxville, RO Whitesell	615-694-9476
TX	Arlington, ION Assocs., Inc.	817-695-8000
TX	Austin, ION Assocs., Inc.	512-794-9006
TX	Houston, ION Assocs., Inc.	713-537-7717
UT	Salt Lake City, Straube	801-263-2640
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WI	Brookfield, Circuit Sls. Inc.	414-784-7773
Can	Mississauga, Ont., CMT Renmark	416-612-0900

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AZ	Scottsdale, Spirit Elctrns. Inc.	602-998-1533
CA	Chatsworth, Passive Comps. Inc.	800-634-3462
CA	San Diego, Neumann Elctrns.	619-695-3005
CO	Aurora, Capstone	303-375-1300
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OH	Columbus, Elctrns. Mktg. Corp.	614-299-4161
OH	Dayton, Bell Inds. Inc.	513-435-8660
OH	Dayton, Stotts Friedman	513-298-5555
PA	Philadelphia, PEI-Genesis	215-673-0400
TX	Addison, JACO Elctrns.	214-733-4300
TX	Richardson, Bell Inds. Inc.	214-690-0466
WA	Redmond, Priebe Elctrns.	206-881-2363
Can	Pointe-Claire, Que., Future Elctrns.	514-694-7710
KY	Versailles, RO Whitesell	605-873-1182

IRC-SHALLCROSS, U.S. Hwy. 70 East, Smithfield, NC 27577, Tel: 919-934-5181, TWX: 510-939-1463, FAX: 919-934-5186; FSC No.: 54294; Empl.: 150; *Sls. Mgr.:* Hugh Bolen

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IR SCIENTIFIC, Box 110, Carlisle, MA 01741, Tel: 508-667-7110; Empl.: 10

ISC CARDIAN ELECTRONICS INC., See Cardion, Inc., A Siemens Co.

ISKRA ELECTRONICS, INC., 155 Dupont St., Plainview, NY 11803, Tel: 516-349-0222, TELEX: 221527, FAX: 516-349-7642; *Sls. Mgr.:* Debbie Gremito ... **A•1085, 2146; B•1364**

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CA	Chula Vista, Inter Elctrns.	619-476-0577
CT	Groton, Primary Source	203-445-4968
NM	Albuquerque, FP Sls.	505-345-5553
IN	Indianapolis, Insul Reps.	317-251-1994
LA	Hammond, Design Mktg. of LA, Inc.	504-542-1115
MA	Lawrence, Primary Source	508-682-5600
AZ	Tempe, F P Sls.	602-894-5303
MO	Grandview, R.R. Burton & Assoc.	816-763-5385
NH	Hampton, Primary Source	603-926-8044
GA	Alpharetta, R A Sls.	404-442-6749
NY	North Port, R. P. Luce & Co.	516-754-5064
NC	New Bern, R A Sls.	919-244-2672
OH	Mentor, Sales Plus	216-942-7811
PA	Montgomeryville, Quick Response	215-362-9225
SC	Easley, R A Sls.	803-859-1859
TN	Knoxville, Insul Reps	615-691-7586

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NJ	Westwood, Seacor	201-666-5600
NY	Ronkonkoma, Baldwin Comps.	516-588-5700

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ISL PRODUCTS INT'L, LTD., 235 Robbins La., Ste. 270, Syosset, NY 11791-6093, Tel: 516-937-3475, 800-626-6116; Empl.: 10; *Sls. Mgr.:* Ken Kawaller ..... **A•2087, 2362; C•1354, 1753; D•1041**

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ISOCOM INC., 274 E. Hamilton Ave., Ste.E, Campbell, CA 95008, Tel: 408-370-2212, FAX: 408-370-2309; *Sls. Mgr.:* Stephen Parry; *Dist. Mgr.:* Glenda Rees

ISOLATION PRODUCTS, INC., 157 San Lazaro Ave., Sunnyvale, CA 94086, Tel: 408-730-4672; Empl.: 5

ISOTEK CORPORATION, 566 Wilbur Ave., Swansea, MA 02777, Tel: 508-673-2900, FAX: 508-676-0885; Empl.: 4; *Sls. Mgr.:* William Poisson ..... **A•1953-1955**

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CA	Fremont, Edward Blake Assocs.	510-770-9058
CA	Fremont, Wm. Parks & Assocs.	415-796-0875
CA	San Diego, Qualtronics	619-695-0118

IL Lemont, Trend-Tronics 708-972-1166
IL Woodridge, Trend-Tronics 312-985-0626
KS Lenexa, Mid-Tec Assocs. 913-541-0505
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MN Columbia, G Squared Technlgs. 301-730-9209
MO St. Louis, Mid-Tec Assocs. 314-275-8666

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ITHACO, INC., Meas. & Control Instrs. Div., 735 W. Clinton St., P.O. Box 6437, Ithaca, NY 14851-6437, Tel: 607-272-7640, FAX: 607-272-4550; Empl.: 100

ITI FERROTEC, 131 Stedman St., Chelmsford, MA 01824, Tel: 508-452-0212, FAX: 508-452-0104 ..... **C•1597**

ITL CIRCUITS, 90 Don Park Road, Markham, Ontario, Canada L3R 1C4, Tel: 416-475-6658, 416-492-9307, FAX: 416-475-5097; FSC No.: FSCM 38747; Empl.: 104; *Sls. Mgr.:* Derk Wissink

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ITT CANNON/SEALECTRO, 585 East Main St., New Britian, CT 06051, Tel: 203-223-2700, TELEX: 71-425-501, FAX: 203-225-2781; FSC No.: 98291; Empl.: 350; *Sls. Mgr.:* Ray Champi; *Dist. Mgr.:* Karen Muratori

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FAX: 714-727-2109

ITT COMPONENTS, ITT Corporation, 18 Technology Dr., Ste. 200, Irvine, CA 92718, Tel: 714-727-3001; FSC No.: 61725; Empl.: 10; *Dist. Mgr.:* J. Harrison ..... **A•2147; B•1527-1535**

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AL Huntsville, Mtn. Mktg. 205-881-3937
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CA Burbank, Darco 818-504-2425
CA San Jose, Vernexx 408-972-9072
CA San Marcos, Falcon 619-591-0504
CO Denver, Promotech 303-692-8484
CT Guilford, Data Mark, Inc. 203-453-0575
FL Orlando, Bolton 407-856-0612
FL St. Petersburg, Bolton 813-864-2294
GA Norcross, Mtn. Mktg. 404-448-5594
IL Inverness, Heartland Tech. Sls. 708-358-6622
IN Ft. Wayne, M/S Sls. 219-436-3023
IN Indianapolis, M/S 317-881-0110
KS Wichita, Thunderbird Tech. Sls. 316-684-3941
MD Lutherville, DGR 301-583-1360
MA Sudbury, KSA of New England 508-443-5881
MI Brighton, Elctrn. Sources Inc. 313-227-3598
MN St. Louis Pk., Neotech 612-545-5656
MO Maryland Hgts., Thunderbird Tech. Sls. 314-298-8940
NJ Mt. Laurel, Wyck Mktg. 609-727-1070
NY Manhasset, Win Cor Elctrns. 516-627-9474
NY Victor, Net Sls. Co. 716-924-1844
NC Chapel Hill, Mtn. Mktg. 919-933-0388
OH Centerville, Omega Sls. 513-434-5507
OH Cleveland, Omega Sls. 216-360-9400
OK Broken Arrow, DJ Sls. 918-258-1445
TX Austin, DJ Sls. 512-258-3002
TX Dallas, DJ Sls. 214-783-8876
TX Houston, DJ Sls. 713-690-2640
UT Bountiful, Anderson Assoc. 801-292-8991
WA Camas, EMG 206-834-6548
WA Redmond, EMG 206-882-0962
WI Brookfield, Heartland 414-789-6860

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AL Huntsville, Time 800-772-8638
AL Madison, Gateway Megatech 205-464-9300
AZ Tempe, Cypress 602-966-2256
AZ Tempe, Richey Impact Elctrns. 800-421-7258
AZ Tempe, Time 800-772-8638
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CA Costa Mesa, Cypress 714-549-2424
CA Garden Grove, Capacitor Supp. 714-638-0510
CA Garden Grove, Richey Impact Elctrns. 714-895-0060
CA Irvine, Integrated Elctrns. 714-837-9960
CA Irvine, ITT Multi Comps. 714-727-4001
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CA Oakland, Brill 510-834-5888
CA Sacramento, Integrated Elctrns. 916-363-6030
CA San Diego, Cypress 619-535-0011
CA San Diego, Richey Impact Elctrns. 800-772-8638
CA San Diego, Time/Harper 800-772-8638
CA San Jose, Integrated Elctrns. 408-435-1000
CA San Jose, ITT Multicomps. 408-453-1404
CA Santa Clara, Cypress 408-980-8400
CA Santa Clara, Richey Impact Elctrns. 408-727-7411
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CA Sunnyvale, Time 800-772-8638
CA Tustin, Time 800-772-8638
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CO Denver, Integrated Elctrns. 303-292-6121
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GA Atlanta, Peerless Radio 404-612-9090
GA Norcross, Time 800-772-8638
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IL Chicago, Leeds Electro Comps. 312-625-3800
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MA Woburn, Control Design Supp. 617-932-9404
MI Livonia, Key Elctrns. 313-489-5455
MN Eden Prairie, All American 612-944-2151
MN Eden Prairie, Cypress 612-934-2104
MN Edina, Time 800-772-8638
MN Minneapolis, Bergquist 612-835-2322
MN Minneapolis, Control Design Supp. 612-721-1628
MN Plymouth, Leeds 612-557-1277
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NJ Rockaway, Tonar Inds. 201-586-9000
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NJ Wayne, Time 800-772-8638
NY E. Syracuse, Time 800-772-8638
NY Hauppauge, Time 800-772-8638
NY Lynbrook, Peerless Radio 516-593-2121
NY Rochester, Masline 716-546-5373
NY Rome, Rome Elctrns. 800-366-7663
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NC Raleigh, Resco 919-781-5700
NC Raleigh, Time 800-772-8638
OH Cincinnati, Schuster 513-489-1400
OH Cleveland, Schuster 216-425-8134
OH Columbus, Time 800-772-8638
OH Willoughby, Gateway Megatech 216-953-0333
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WA Bothell, Cypress 206-483-1144
WA Kirkland, Time 800-772-8638
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WI Brookfield, Leeds Electro Comps. 414-789-6995
WI New Berlin, NEP Elctrns. 414-785-9100

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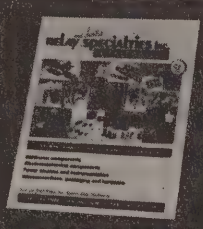

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AR	Mablevale, Erickson Sls., Inc.	501-455-0618
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CA	Irvine, Vale Elctrn. Assocs.	714-551-4004
CA	Santa Clara, Engrg. Assocs. Corp.	408-988-5001
CA	So. San Francisco, Carelli/EMA	415-873-2524
CO	Broomfield, Connors Co.	303-466-9628
FL	Maitland, EIR Inc.	407-660-9600
IL	Barrington, W. M. Linz	708-382-9720
IN	Indianapolis, Blind Elctrn. Sls. Co.	317-273-9063
IA	West Des Moines, Nevco	515-225-9866
LA	Chalmette, Erickson Sls., Inc.	504-271-1976
MD	Baltimore, David S. Linz, Inc.	410-882-6289
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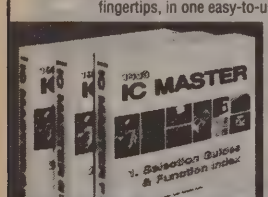

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FL	Clearwater, Dyne-A-Mark	813-441-4702
FL	Ft. Lauderdale, Dyne-A-Mark	305-771-6501
GA	Norcross, ACM, Inc.	404-448-7025
IN	Indianapolis, Central Regional Off.	317-257-3704
IN	Indianapolis, Leslie M. Devoe	317-842-3245
IA	West Des Moines, SPS Assocs., Ltd.	515-225-0607
KS	Olathe, SPS Assocs., Ltd.	913-764-4460
MA	Randolph, Hatch Assocs.	617-963-3306
MI	Oak Pk., A. Blumenberg Assocs. Inc.	313-968-3230
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MO	Earth City, SPS Assocs., Ltd.	314-291-0520
NE	Panama, SPS Assocs.	402-788-2536
NY	E. Rochester, L-Mar Assocs., Inc.	716-681-9100
NY	Poughkeepsie, L-Mar Assoc. Inc.	914-462-8025
NC	Raleigh, C-Tech	919-782-8100
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IL	Schaumburg, Future Elctrns.	312-882-1255
IN	Indianapolis, Advent Elctrns.	317-872-4910
IN	Indianapolis, Custom Svcs. Elec.	317-879-9119
IA	Cedar Rapids, Dee Elctrns.	319-365-7551
MD	Columbia, Future Elctrns.	301-290-0600
MD	Jessup, Treeko Sls.	301-470-3300
MD	Spencerville, U.S. Elctrns.	301-384-3300
MA	Billerica, Mayer Elctrns.	508-667-6900
MA	Westboro, Future Elctrns.	617-366-2400
MI	Livonia, Future Elctrns.	313-261-5270
MN	Eden Prairie, Future Elctrns.	612-944-2200
MN	Eitzen, Capacitor Assocs.	507-495-3306
MN	St. Paul, Gopher Elctrns.	612-483-3322
MO	St. Charles, Finnigan Elctrns.	314-946-6201
NJ	Bellmaur, Mid Atlantic Elctrns.	609-931-5303
NJ	E. Hanover, State Elctrns.	201-887-2550
NJ	Fairfield, Future Elctrns.	201-227-4346
NJ	Mt. Laurel, Future Elctrns.	609-778-7600
NY	Farmingdale, Pride Elctrns.	516-293-4020
NY	Hauppauge, Broadline Elctrns.	516-231-4100
NY	Hauppauge, Future Elctrns. Inc.	516-234-4000
NY	Liverpool, Future Elctrns.	315-451-2371
NY	Rochester, Future Elctrns.	716-272-1120
NY	Rochester, Simcona Elctrns.	716-328-3230
NC	Charlotte, Dixie Elctrns.	704-377-5413
NC	Charlotte, Elctrn. Mktg. Corp.	704-394-6195
NC	Charlotte, Future Elctrns.	704-529-5500
NC	Greensboro, Golden Elctrns.	919-294-4653
NC	Winston-Salem, Dixie Elctrns.	919-724-5961
OH	Columbus, Elctrn. Mktg. Corp.	614-299-4161
OH	Dayton, Elctrn. Mktg. Corp.	513-439-4711
OH	Highland Heights, Elctrn. Mktg. Corp.	216-442-3441
OK	Tulsa, Altair Co.	918-252-5781
OR	Beaverton, Future Elctrns.	503-646-9454
PA	McKean, Advacom, Inc.	814-476-7774
SC	Columbia, Dixie Elctrns., Inc.	803-779-5332
SC	Greenville, Dixie Elctrns., Inc.	803-297-1435
SC	N. Charleston, Dixie Elctrns.	803-552-2671
TN	Gray, Dixie Elctrns., Inc.	615-477-3838
TN	Knoxville, Dixie Elctrns., Inc.	615-938-4131
TX	Austin, Altair Co.	512-837-4970
TX	Houston, Altair Co.	713-462-3029
TX	Richardson, Altair Co.	214-231-5166
TX	Richardson, Future Elctrns., Inc.	214-437-2437
UT	Salt Lake City, Future Elctrns. Inc.	801-972-8489
WA	Redmond, Future Elctrns., Inc.	206-881-8199
WI	Mequon, Taylor Elec.	414-241-4321
WI	Racine, Badger Elctrns. Co. Inc.	414-637-1256
WI	Waukesha, Bell Inds.	414-547-8879
EXP	Bucks, Eng., C & CD Ltd.	494-882-848
Can	Calgary, Alberta, Future Elctrns.	403-235-5325
Can	Downsview, Ont., Future Elctrns.	416-638-4771
Can	Edmonton, Future Elctrns.	403-438-2858
Can	Ottawa, Ont., Future Elctrns.	613-820-8313
Can	Point Claire, Que., Future Elctrns.	514-694-7710
Can	St. Foy, Que., Future Elctrns.	418-682-8092
Can	Vancouver, B.C., Future Elctrns.	604-294-1166
Can	Winnipeg, Manitoba, Future Elctrns.	204-786-7711

ITW Switches
FAX: 312-545-4450

ITW SWITCHES, Illinois Tool Works, 6615 W. Irving Park Rd., Chicago, IL 60634, Tel: 312-282-4040; Empl.: 500; *Dist. Mgr.:* P. Smentek ..... **B•1746-1755**

Local Sales Offices & Reps

AL	Huntsville, Electro Mech	205-880-0592
AZ	Glendale, The Knight Co.	602-433-2166
CA	Los Angeles, The Knight Co.	310-670-2833
CA	Santa Clara, ITW Switches	312-282-4040
CO	Parker, ITW Switches	312-282-4040
CT	Clinton, Selmark Assoc.	203-573-9088
FL	Coral Springs, HHP Assocs.	305-753-8389
FL	Palm Bay, HHP Assocs.	407-951-9236
FL	Tarpon Springs, HHP Assocs.	813-937-6099
FL	Winter Park, HHP Assocs.	407-740-0320
GA	Atlanta, Electro Mech.	404-447-6478
IL	Downer's Cove, Golten Assoc.	708-985-5100
IA	Cedar Rapids, R. F. Welch Co.	319-362-6824
MD	Baltimore, Chesapeake Tech.	301-236-0530
MD	Burtonsville, Chesapeake Tech.	301-236-0530
MA	Milford, Selmark Assoc.	508-478-9088
MI	Grand Rapids, Urban & Assoc.	616-245-0511
MN	Minneapolis, Comstrand	612-788-9234
MO	St. Louis, ITW Switches	312-282-4040
NJ	Red Bank, Varrelman-Gorman Co.	908-219-0088
NY	E. Syracuse, Fountain, Young & Co.	315-437-7733
NC	Raleigh, Electro Mech	919-790-9300
OH	Medina, Rockford Controls	216-725-3705
OR	Tigard, Earl & Brown Co.	503-639-2100
PA	Oreland, Precision Mktg.	215-233-9233
TX	Richardson, ITW Switches	214-235-9515
WA	Redmond, Earl & Brown Co.	206-885-5064

Local Distributors

AL	Huntsville, Powell Elctrns.	205-837-5300
AZ	Tempe, Control Design	602-829-7981
CA	Brea, Aero Flight	714-773-4251
CA	Fremont, Kea Elctrns.	510-651-2600
CA	Garden Grove, Richey/Impact	714-895-0060
CA	Gardena, Cal Switch	213-538-9830
CA	Los Angeles, Elec. Switches	213-660-1310
CA	Torrance, Time	213-320-0880
CO	Denver, CSID	303-292-9594
CT	Hartford, L.E. Whelan	203-296-5000
CT	Wallingford, Sager Elctrns.	203-265-4600
FL	Ft. Lauderdale, Powell Elctrns.	305-484-8377
FL	Maitland, Elctrns. Equipmt.	407-539-0888
FL	Miami, Elctrn. Equip.	305-526-6000
FL	Orlando, Sager Elctrns.	407-354-1130

FL	Wellington, Wings Electro Sls.	407-798-6606
IL	Chicago, Newark Distrs.	312-784-5100
IL	Wheeling, Hawk Elctrns.	708-459-4030
IL	Wheeling, Hawk Electronics	708-459-4030
IN	Indianapolis, R.S. Elctrns.	317-253-9065
KS	Overland Park, Olive Elctrns.	913-362-1923
KS	Wichita, R.S.C. Elctrns.	316-267-5213
MD	Annapolis Junction, Powell Elctrns.	301-880-3255
MD	Columbia, Sager Elctrns.	301-995-4900
MD	Gaithersburg, MS Elctrns.	301-921-0200
MD	Kensington, Marine Air Supply	301-949-9560
MA	Hingham, Sager	617-749-6700
MA	Westborough, Powell Elctrns.	508-336-6100
MI	Livonia, R.S. Elctrns.	313-525-1155
MN	Fridley, Voyager Elctrns.	612-571-7766
MN	Minneapolis, Newark Elctrns.	612-331-6350
MO	Maryland Heights, R.S. Elctrns.	314-997-7709
NH	Salem, Sager	603-898-1348
NJ	Little Falls, Powell	201-890-0010
NY	Buffalo, Summit	716-887-2800
NY	Endwell, Astrex/ASI	607-754-3823
NY	Farmingdale, Iris Elctrns.	516-420-8400
NY	Hauppauge, Sager	516-348-1300
NC	Winston Salem, Kirkman	919-722-9131
OH	Akron, Aesco	216-762-8818
OH	Columbus, Aesco Elctrns.	614-882-6762
OH	Dayton, Advacom	513-274-5900
OR	Beaverton, Comp. Resources	503-641-8488
PA	Mars, Sager Elctrns.	412-772-2233
PA	Mc Kean, Advacom	814-476-7774
PA	Montgomeryville, Pyttronic	215-643-2850
PA	Philadelphia, Powell	215-365-1900
TX	Austin, Wofford Elctrns.	512-339-1131
TX	Dallas, Wes Garde	214-357-1768
TX	Dallas, Wofford Elctrns.	214-340-8555
TX	Irving, Powell Elctrns.	214-550-0547
TX	Tomball, Wofford	713-351-2255
WA	Kent, Comp. Resources	206-454-8666
WI	Milwaukee, Elctrn. Expeditors	414-228-8100
Can	Markham, Ont., Semad	416-475-8500

IVEK CORP., Fairbanks Rd., N. Springfield, VT 05150, Tel: 802-886-2238, FAX: 802-886-8274; Empl.: 25; *Sls. Mgr.:* Mark Tanny

IVO

FAX: 908-542-2938

IVO INDUSTRIES, INC., 201 Industrial Way W., Eatontown, NJ 07724, Tel: 908-542-5151, 800-932-0489; Empl.: 10; *Sls. Mgr.:* Frederick Hickey ..... **B•1756, 1960-1962; D•1162**

Local Distributors

CA	Long Beach, Elect. Power Controls	310-498-6699
FL	Clearwater, General Controls	813-446-6622
SC	Greenville, Automation Supply	803-233-2145

IXYS CORP., 2355 Zanker Rd., San Jose, CA 95131-1109, Tel: 408-435-1900, FAX: 408-435-0670; Empl.: 350; *Sls. Mgr.:* Scott Lodor; *Dist. Mgr.:* Cliff Knudsen

JAE Electronics

FAX: 714-753-2699

JAE ELECTRONICS INC., 142 Technology Drive, Irvine, CA 92718, Tel: 714-753-2600; Empl.: 3400 (Worldwide); *Sls. Mgr.:* David Shaff, Dir. Field Sls. ..... **C•1356-1357**

Local Sales Offices & Reps

CA	Santa Clara, Pinnacle Sls.	408-249-7400
FL	Ft. Lauderdale, JAE Elctrns.	305-563-3484, 800-248-0737

JAICO PRODUCTS, Jaidinger Mfg. Co., Inc., 1921 W. Hubbard St., Chicago, IL 60622, Tel: 312-421-1090, FAX: 312-421-1165; Empl.: 25; *Sls. Mgr.:* John S. Jaidinger

JAMES ELECTRONICS, 4050 N. Rockwell, Chicago, IL 60618, Tel: 312-463-6500, FAX: 312-463-1504; Empl.: 220; *Sls. Mgr.:* Vincent Kennedy

JANCO AN ESOP CORP.

FAX: 818-842-3396

JANCO CORP., Box 3038-Glenoaks Sta., Burbank, CA 91508, Tel: 818-846-1800; FSC No.: 91812; Empl.: 144; *Sls. Mgr.:* Gary Smith ..... **B•1758-1759**

Local Sales Offices & Reps

AZ	Mesa, Sys. Sls. of AZ. Inc.	602-464-9989
CA	San Diego, Zerimar Sls.	619-436-3379
CA	San Jose, Wes Tron Assocs.	408-264-4070
CA	So. Calif., Gabriel & Assoc.	714-666-0660
CO	Aurora, Key Specs.	303-690-6106
FL	Orlando, MacKay, Smith & Assocs.	305-423-4353
GA	Atlanta, MacKay, Smith & Assocs.	404-449-7444
IL	Addison, Vikeland Sls.	708-832-8425
IN	Greenwood, Valentine & Assocs.	317-888-2260
KS	Wichita, Dy-Tronix Inc.	316-838-2645
MD	Ellicott, Tech. Sls. Inc.	800-225-4335
MA	Swansea, Eastrep Co.	617-672-0788
MN	St. Paul, Debeck-Hays Assocs.	612-835-3610
MO	Bridgeton, Dy-Tronix Inc.	314-291-4777
NJ	Kenvil, CFE/GRAY	201-927-6662
NY	Fairport, TAC Sls. Inc.	716-377-2250
NC	Charlotte, MacKay, Smith & Assocs.	704-372-1188
OH	Columbus, Rathsburg Assocs., Inc.	614-457-2242
PA	Southeastern, Quality Comps.	215-687-3553
TX	Irving, Trice Mktg. Corp.	214-255-1877
WA	Seattle, Norwest	206-827-9562

Local Distributors

CA	Burbank, Merit Comp. Supp.	818-842-7607
CA	Westlake Village, Tech-Cable Prods.	818-991-4697

JAN CRYSTALS, Bob Whan and Son Electronics, 2341 Crystal Dr., Ft. Myers, FL 33907, Tel: 813-936-2397, 1-800-526-9825, FAX: 813-936-3750; Empl.: 28

JAN HARDWARE MFG. CO., See Electronics Hardware

JAPANESE PRODUCTS CORP., 7 Westchester Plaza, Elmsford, NY 10523, Tel: 914-592-8880, TELEX: 516929 ANS BACK ENFD, FAX: 914-592-7001; Empl.: 8; *Sls. Mgr.:* Don Cassalia

JARO COMPONENTS, INC., 6600 Park of Commerce Blvd., Boca Raton, FL 33487-8295, Tel: 407-241-8600, FAX: 407-241-3328; Empl.: 30; *Sls. Mgr.:* Floyd Burwell; *Dist. Mgr.:* Floyd Burwell

J.A.W. INDUSTRIES, INC., 1750-A Costner Dr., Warrington, PA 18976, Tel: 215-343-8990, FAX: 215-343-8942; Empl.: 20; *Sls. Mgr.:* J. McLaughlin; *Dist. Mgr.:* J. McLaughlin

JAYCO

FAX: 714-998-4954

JAYCO INTERFACE TECHNOLOGY, 507 W. Blueridge Ave., Orange, CA 92665, Tel: 714-974-1701; Empl.: 33 ..... **B•1840-1841**

Local Sales Offices & Reps

AZ	Scottsdale, Michael J. Dildine Assoc.	602-966-4200
CA	Los Angeles, Satori Elec.	310-214-1791
CA	San Diego, Coastal Elctrn. Sls.	619-459-4148
CA	Sunnyvale, Pass Assocs.	408-735-9040
CO	Denver, AKI Enterprises	303-756-0700
GA	Atlanta, Satori Elec.	404-242-0606
IL	Elgin, MacKellar Assoc.	708-468-8900
MI	Bloomfield Hills, MacKellar Assoc.	313-335-4440
NJ	Wayne, Breen Assoc.	201-696-8683
NY	New York, Breen Assocs.	201-696-8683
OH	Columbus, MacKellar Assoc.	614-848-3552
OR	Portland, TAC Assoc.	503-648-6110
TX	Dallas, REM Comps.	214-234-1069

JAYCOR, P.O. Box 85154, San Diego, CA 92186, Tel: 619-453-6580, FAX: 619-535-9763; FSC No.: 3M687; Empl.: 800; *Sls. Mgr.* Steven Lutjens

JB ELECTRONIC TRANSFORMERS INC., 2310 W. Armitage Ave., Chicago, IL 60647, Tel: 312-342-0080, FAX: 312-342-9098; FSC No.: 11700; Empl.: 150; *Sls. Mgr.:* Donald M. Gould

JBM ELECTRONICS, INC., 1 Commerce Drive, Bedford, NH 03110-6802, Tel: 603-623-0222, FAX: 603-623-0446; FSC No.: 62694; Empl.: 40; *Sls. Mgr.:* Susan Bennett; *Dist. Mgr.:* Susan Bennett ..... **A•1567, 2363; D•2127**

Local Distributors

FL	Casselberry, Aerco, Inc.	407-695-0600
IN	Indianapolis, Custom Svc. Elctrns.	317-879-9119
NH	Atkinson, Astrum Elctrns.	603-898-3399
SC	Lamar, Aerco, Inc.	803-326-5463
Can	Markham, Ont., SEMAD;Div. of DGW	416-475-8500

J-B-T INSTRUMENTS, INC., Box 1818, New Haven, CT 06508-1818, Tel: 203-776-1111, FAX: 203-624-8142; Empl.: 25; *Sls. Mgr.:* Lillian Sharron

JC SYSTEMS, INC., 11535 Sorrento Valley Rd. Ste. 400, San Diego, CA 92121, Tel: 619-793-7117, FAX: 619-793-1931; Empl.: 12; *Sls. Mgr.:* Ralph Aniunas

JDK CONTROLS, INC., 424 Crown Point Circle, Grass Valley, CA 95945-0512, Tel: 916-273-4608, FAX: 916-273-0769; Empl.: 50; *Sls. Mgr.:* Reece Kendall ..... **A•2088-2091**

Local Sales Offices & Reps

NJ	Matawan, Tim Reilly Assocs.	908-566-4555

JEFFERS ELECTRONICS, 1331 W. Fairway Dr., Nogales, AZ 85621, Tel: 602-281-4925, FAX: 602-281-0090; FSC No.: 59474; Empl.: 400; *Sls. Mgr.:* Ken Shobert; *Dist. Mgr.:* Steve Morris

JEMA

FAX: 708-251-3738

JEMA, 1000 Skokie Blvd., Wilmette, IL 60091, Tel: 708-251-3600; Empl.: 10; *Sls. Mgr.:* Dale R. Thompson; *Dist. Mgr.:* Chris Gantz ..... **D•1024-1025, 1042-1047**

JEMTEC ELECTRONICS CO.,SEE SCIENTIFIC COLUMBUS CO.

W. S. JENKS & SON, 1933 Montana Ave. NE, Washington, DC 20002, Tel: 202-529-6020, 800-673-8199, FAX: 202-832-3411

JENSEN TOOLS, INC., Stanley Works, 7815 S. 46th St., Phoenix, AZ 85044, Tel: 602-968-6241, FAX: 800-366-9662; Empl.: 250; *Sls. Mgr.:* Patrick Acton

JEROME INDUSTRIES CORP., 730 E. Division St., Elizabeth, NJ 07201, Tel: 908-353-5700, FAX: 908-353-1021; Empl.: 150; *Sls. Mgr.:* Anthony Di Girolamo ..... **D•1756-1760**

JERSEY SPECIALTY CO., See JSC Wire & Cable

JETA POWER SYSTEMS, INC

FAX: 310-426-2417

JETA POWER SYSTEMS, INC., 2675 Junipero, Signal Hill, CA 90806, Tel: 310-427-0095; Empl.: 110 ..... **D•1762-1763**

Local Sales Offices & Reps

AZ	Scottsdale, Summit Sls.	602-998-4850
CA	Santa Clara, Gagner-Toomey Assoc.	408-244-2200
CO	Golden, J.F. Hurlbut Co.	303-279-7796
CT	Vernon, George Urban & Assocs.	617-329-4068
IA	Cedar Rapids, Advanced Tech. Sls.	319-393-8280
KS	Olathe, ATS, Inc.	913-782-8702
MA	Dover, The Urban Grp.	617-329-4068
MN	Minneapolis, Engrg. Prods. Assocs.	612-835-9022
MO	Bridgeton, Advanced Tech. Sls.	314-291-5003
NY	Fairport, Hi-Tec Sls.	716-223-5922
NY	Franklin Square, Cooper-Simon Emtec	516-489-0404
OH	Mentor, Sls. Plus	216-942-7811
TX	Dallas, MGR Elctrns.	214-238-5246
Can	Montreal, Empro Sls.	514-341-6420

JETTRON PRODUCTS INC., P.O. Box 337, E. Hanover, NJ 07936, Tel: 201-887-0571, FAX: 201-887-4182; FSC No.: 04435; Empl.: 30; *Sls. Mgr.:* Ben Latawiec ..... **C•1358-1359**

Local Sales Offices & Reps

CA El Cajon, A-Tronics 619-444-1501

JFD ELCTRNS., See Murata Erie No. Amer., Inc.

JF MICROSYSTEMS, 3641 Frontier Road, Pasco, WA 99301-9619, Tel: 509-297-4294, 800-532-2737; Empl.: 2; *Sls. Mgr.:* Jim Follansbee

JFW INDUSTRIES, INC., 5134 Commerce Sq. Dr., Indianapolis, IN 46237, Tel: 317-887-1340, FAX: 317-881-6790; FSC No.: 61162; Empl.: 125; *Sls. Mgr.:* Carrie Glover ..... **A•1722-1723; D•1275**

Local Sales Offices & Reps

AZ Scottsdale, TDSI/AZ 602-998-2444
CA Coronado, RF Assocs. 619-575-9011
CA San Jose, MC Microwave, Inc. 408-446-4100
CO Franktown, Exelcis 303-841-4305
FL Stuart, Microwave Comps. 407-286-4455
KS Lenexa, Midwest Tech. Sls. 913-888-5100
MA Chelmsford, Matrix Sls. 508-459-4000
NY Melville, RF Elctrn. Sls. 516-420-8890
TX Dallas, Bradenco Corp. 214-352-3554
VA Alexandria, Clifton Elctrns. 703-360-9129
WA Seattle, Datacom Assocs. 206-285-2525
Can Ottawa, Ont., Giga-Tron Assocs., Ltd. 613-225-4090

Local Distributors

MA New England Area, East Coast Microwave 617-279-0900

JH AMERICA, INC., JBT International, Inc., 20809 Higgins Court, Torrance, CA 90501, Tel: 310-328-0051, FAX: 310-328-0057; *Sls. Mgr.:* Mark Zimmermann ..... **C•1754-1755**

Local Sales Offices & Reps

CA Palm Springs, R D Sls. 619-324-5044
CA Sunnyvale, Logan Sls. 408-732-6020
FL Longboat Key, VSI, Inc. 813-383-1440
MI Ann Arbor, VSI, Inc. 313-995-1200
NY Rochester, VSI, Inc.
NC Raleigh, VSI, Inc. 919-870-0060
RI Coventry, VSI, Inc. 401-826-0040

Local Distributors

AZ Scottsdale, Memory Plus Dist. 602-820-8819
AZ Tempe, Comtel Corp. 602-829-9471
CA Anaheim, Deco Elctrns. 714-630-8252
CA Chula Vista, Sonika Elctrn. 619-424-9190
CA San Diego, Deco Elctrns. 619-693-1595
FL Orlando, Computel 407-682-3957
IL Elk Grove Vlg., Lutubusiness Sys. 708-803-6466
NJ Kennilworth, Computel 201-241-5400
NC Charlotte, Computel 704-376-4414
OH Dayton, Tech. Dvc. 513-890-6811

JKL COMPONENTS CORPORATION

FAX: 818-897-3056

JKL COMPONENTS CORPORATION, 13343 Paxton St., Pacoima, CA 91331-2376, Tel: 818-896-0019; FSC No.: 55335; Empl.: 35; *Sls. Mgr.:* Ernie Soares; *Dist. Mgr.:* Ernie Soares ..... **B•1168**

Local Sales Offices & Reps

AL Huntsville, Southern Sls. 205-830-9322
CA Burbank, Darco Elctrn. Sls. 818-504-2425
CT W. Hartford, Conti-Younger & Assoc. 203-521-0602
IL Elk Grove, Control Sls. 708-595-2110
NY Henrietta, CMJ, Inc. 716-334-3277
MD Baltimore, Universal Elctrns. 301-461-9946
MA Burlington, Conti-Younger 617-273-1582
MI Farmington Hills, Clark Sls. 313-553-0610
MN Bloomington, Murnco 612-854-4161
OH Cincinnati, Clark Sls. Co. 513-922-7555
OH Painsville, Clark Sls. Co. 216-247-7848
PA Philadelphia, Check Assoc. 215-487-3007
TX Irving, Kite Elec. Sls. 214-986-0321

Local Distributors

AL Huntsville, Powell Elec. 205-539-2731
CA San Diego, Richie/Impact Sls. 619-271-4511
AZ Phoenix, Capital Elctrns. 602-252-5897
CA Garden Grove, Richey Western 714-895-0060
CA Gardena, Cal. Switch & Signal 213-770-2330
CA San Diego, Richie/Impact Sls. 619-271-4511
CA Santa Clara, Richey/Western Elec. 408-727-7411
CA Sunnyvale, Target Elec. 415-961-1170
CT Wallingford, Sager Elec. 203-265-4600
FL Ft. Lauderdale, Powell Elec. 305-484-8377
GA Norcross, Specialty Distrbg. Co. 404-446-3190
IL Wheeling, Hawk Elec. 312-459-4030
IN Indianapolis, Meunier Elctrns. 317-635-3511
KS Lenexa, Amer. Elec. & Cable 913-469-0099
MD Kensington, Marine Air Supp. 301-949-1353
MD Rockville, M S Elctrns. 301-340-6400
MA Hingham, Sager Elec. 617-749-6700
MA Westborough, Powell Elec. 617-366-6100
MN Minneapolis, Bergquist Co. 612-835-2322
MO Richland, ATR Ent. 314-765-5219
MN Fridley, Voyager Elec. 612-571-7766
NJ Clifton, Vantage Comps. 201-777-4100
NM Albuquerque, Walker Elec. Supply 505-883-2992
NY Apalachin, Rogan Elec. 607-625-2949
NH Salem, Sager Elec. 603-898-1348
NC Greensboro, Hammond 919-275-6391
OH Cincinnati, Schuster Elec. 216-425-8134
OK Oklahoma City, Radio Supp. Inc. 405-232-6127
PA Bristol, Aim Elec. 215-785-3500
PA Philadelphia, Powell Elec. 215-365-1900
TN Chattanooga, Specialty Distr. Co. 615-624-1040
OH Yellow Springs, Electro-Shield 513-767-1054
TX Ft. Worth, T & S. Supp. 817-248-4781
WA Seattle, Radar Elec. Co. 206-282-2511
WI Oshkosh, Electronic Inds. 414-235-8930

JMJ TECHNICAL PRODS., 517 Kimball Turn, Westfield, NJ 07090, Tel: 201-589-4257, FAX: 908-789-2447; Empl.: 8; *Sls. Mgr.:* Kevin Kolenut ..... **C•1531**

JMK INCORPORATED

FAX: 603-886-4115

JMK, INC., 15 Caldwell Dr., Amherst, NH 03031, Tel: 603-886-4100; Empl.: 100; *Sls. Mgr.:* J. Kennedy ..... **A•1596-1597**

Local Sales Offices & Reps

CA Woodland Hills, Cummings & Assoc. South 818-340-6035
MN St. Paul, Arko Sls. 612-777-7454

JM TRANSFORMER CO., INC., 112 Florida St., Farmingdale, NY 11735, Tel: 516-293-0475, FAX: 516-293-3923; Empl.: 18; *Sls. Mgr.:* J. Millman ..... **A•2354-2369**

JOBMASTER CORP., 9010 Liberty Rd., P.O. Box 207E, Randallstown, MD 21133-0207, Tel: 410-655-1400, 1-800-642-1400, FAX: 410-521-5461; Empl.: 16 ..... **A•1320**

JOEMEX ELECTRICS, 19 Hammond 508, Irvine, CA 92718, Tel: 714-855-4472

JOHANSON DIELECTRICS, INC., 15191 Bledsoe St., Sylmar, CA 91342, Tel: 818-364-9800, FAX: 818-364-6100; Empl.: 300 ..... **A•1089**

Local Sales Offices & Reps

AL Huntsville, Elctrn. Sls. Inc. 205-533-1735
AZ Tempe, Reptronix, Inc. 602-230-2630
CA Costa Mesa, Richland Tech. Sls. 714-646-6640
CA Mountain View, Straube Assocs. 415-969-6060
CO Westminster, Straube Assocs. 303-426-0890
CT Waterbury, Compak Inc. 203-753-6431
FL Ft. Lauderdale, VG Sales Co. 305-938-4333
FL Altamonte Springs, VG Sales Co. 407-831-8688
FL Largo, VG Sales Co. 813-536-7787
GA Norcross, Elctrn. Sls. Inc. 404-448-6554
IL Lisle, WG Controls 708-963-5954
IN Indianapolis, M & L Elctrns. 317-359-4742
IA Cedar Rapids, Spectrum Sls. 319-366-0576
KS Overland Pk., Spectrum Sls. 913-648-6811
MD Columbia, PSA South 301-730-0359
MA Hudson, Compak Inc. 508-568-0331
MI Farmington, JP Bergin Assocs. 313-471-7940
MN St. Paul, Cahill, Schmitz & Cahill, Inc. 612-646-7217
MO Florissant, Spectrum Sls. 314-921-1313
NM Albuquerque, Reptronix, Inc. 505-292-1718
NY Apalachin, T Squared Elctrns. 607-625-3983
NY Bellmore, Compar New York Inc. 516-221-7300
NY Syracuse, T Squared Elctrns. 315-463-8592
NY Victor, T Squared Elctrns. 716-924-9101
NC Cary, Elctrn. Sls., Inc. 919-467-8486
NC Charlotte, Elctrn. Sls., Inc. 704-543-8705
OH Columbus, Dolfuss-Root & Co. 614-885-4844
OH Dayton, Dolfuss-Root & Co. 513-433-6776
OH Westlake, Dolfuss-Root & Co. 216-899-9370
OR Portland, Caruso & Camelleri Assoc. 503-246-5439
PA Trevose, PSA, Inc. 215-245-0513
TX Arlington, Ion Assocs., Inc. 817-695-4905
TX Austin, Ion Assocs., Inc. 512-794-9006
TX Houston, Ion Assocs., Inc. 713-537-7717
UT Salt Lake City, Straube Assocs. 801-263-2640
VA Oakton, PSA South 703-281-1806
PR Mayaquez, V.G. Sls. 809-831-4050
Can Kanata, Ont., J-Squared Technlgs. 613-592-9540
Can Rexdale, Ont., J-Squared Technlgs. 416-674-0927

Local Distributors

AZ Tempe, Bell Inds. 602-966-7800
CA Agoura Hills, Bell Inds. 818-879-9494
CA Carson, Newark Elctrns. 213-516-6511
CA Cypress, Bell Inds. 714-895-7801
CA El Toro, Pace Elctrns. 714-588-2345
CA Foster City, Newark Elctrns. 415-572-8300
CA Inglewood, Newark Elctrns. 213-671-7377
CA Irvine, Kelex 714-863-1230
CA Los Alamitos, SEMI DICE 213-594-4631, 714-952-2216
CA Los Angeles, Penstock 213-383-6100
CA Rocklin, Bell Inds. 916-652-0414
CA San Diego, Bell Industries 619-268-1277
CA San Diego, Neumann Elctrns. 619-695-3005
CA San Jose, Co-Linear Sls. 408-441-6566
CA Santa Clara, Pace Elctrns. 408-748-3748
CA Santa Clara, SEMI DICE 408-980-9777
CA Sunnyvale, Bell Inds. 408-734-8570
CA Sunnyvale, Capacitor Connection 408-737-8985
CA Sunnyvale, Penstock 408-730-0300
CA Van Nuys, C.W. Swift 818-989-1133
CA Yorba Linda, Corona Elctrns. 714-283-8185
CO Denver, Bell Inds. 303-691-9010
CO Denver, Newark Elctrns. 303-757-8531
CT Bloomfield, Newark Elctrns. 203-243-1731
CT Wallingford, Bell Inds. 203-269-6801
FL Altamonte Springs, Bell Inds. 407-339-0078
FL Orlando, Newark Elctrns. 407-896-8350
FL Palm Bay, Penstock 407-724-5300
FL Pompano Bch., ASAP Elctrns. 305-975-2477
GA Atlanta, Penstock 404-951-0300
GA Norcross, Bell Inds. 404-446-7167
IL Chicago, Newark 312-784-5100
IL Elk Grove Village, Bell Inds. 708-640-1910
IL Palatine, Penstock 708-934-3700
IN Ft. Wayne, Bell Inds. 219-423-3422
IN Indianapolis, Bell Inds. 317-875-8200
KS Olathe, Penstock 913-829-9330
MD Columbia, Bell Inds. 410-290-5100
MA Andover, Bell Inds. 508-474-8880
MA Marborough, Penstock 508-624-7300
MA Middleboro, Glynn Elec. Inc. 508-947-4262
MA South Easton, Semi Dice 508-238-8344
MN Hibbins, Minntech 218-262-5227
MN Minneapolis, Newark Elctrns. 612-331-6350
MS Jackson, Newark Elctrns. 601-956-8300
NH Atkinson, Astrum 603-898-3399
NJ Fairfield, Bell Inds. 201-625-7777
NJ Fairfield, Micross Comps. 201-227-8007
NJ Fairfield, Penstock 201-808-1414
NJ Fairfield, Prime Comps. 516-244-8190
NJ Rockaway, NASCO 201-227-6060
NM Albuquerque, Bell Inds. 505-292-2700
NY Central Islip, Semi Dice, Inc. 516-234-7676
NY Mt. Vernon, ASAP Elctrns. 914-699-2727, 415-961-5414
NY Sodus, Pace Elctrns. 800-228-7223
OH Dayton, Bell Inds. 513-435-8660
OR Beaverton, Bell Industries 503-644-1500
PA Trevose, Bell Inds. 215-953-2800
TX Allen, Prime Distr. 214-542-7915
TX Allen, Prime Distribution 214-542-7915
TX Dallas, Penstock 214-701-9555
TX Garland, Newark Elctrns. 214-487-8144
TX Richardson, Bell Inds. 214-690-0466
UT Midvale, Bell Inds. 801-561-9691
WA Bellevue, Penstock 206-454-2371
WA Redmond, Bell Inds. 206-867-5410
WI Waukesha, Bell Industries 414-547-8879

JOHANSON MANUFACTURING CORPORATION, 400 Rockaway Valley Rd., Boonton, NJ 07005, Tel: 201-334-2676, FAX: 201-334-2954; FSC No.: 91293; Empl.: 200 ..... **A•1088**

Local Sales Offices & Reps

AL Huntsville, Murcota Corp. 205-539-8476
AZ Phoenix, Reptronix, Ltd. 602-230-2630
CA Los Angeles, RF Assocs., Inc. 213-478-1586
CA Mountain View, Straube Assocs. 415-969-6060
CO Westminster, Straube Assoc., Mt. States ..... 303-426-0890,801-263-2640(UT
CT Waterbury, Compak, Inc. 203-753-6431
FL Ft. Lauderdale, VG Sls. 305-938-4333
FL Largo, VG Sls. 813-536-7787

IL Lisle, W.G. Controls 708-963-5954
IN Kokomo, Schillinger Assocs. 317-457-7241
IA Hiawatha/Cedar Rapids, ARD Sales Co. 319-393-6392
KS Lenexa, Midtec Assocs. 913-541-0505
MA Hudson, Compak, Inc. 508-568-0331
MN St. Paul, Cahill, Schmirz & Cahill, Inc. 612-646-7217
MO St. Louis, Midtec Assocs. 314-275-8666
NM Albuquerque, Reptronix Inc. 505-292-1718
NY Boonton, Johanson Mfg. Corp. 201-334-2676
NY Syracuse, L.D. Allen, Inc. 315-487-8387
NC Winston-Salem, Murcota Corp. 919-722-9445
OH Dayton, Scott Elect. Inc. 513-294-0539
PA Trevose, P.S.A. 215-245-0513
TX Austin, W. Pat Fralia & Assocs. 512-835-7911
TX Euless/Ft. Worth, W. Pat Fralia & Assocs. 817-267-3577
TX Houston, W. Pat Fralia & Assocs. 713-772-1572
VA Oakton, PSA South 301-953-4884
WA Seattle, Northmar 206-524-5170
Can Montreal, A. C. Simmonds, LTD. 514-466-5250
Can Toronto, A. C. Simmonds, LTD. 416-839-8041

Local Distributors

CA Sunnyvale, Penstock 408-730-0300
CA Van Nuys, C.W. Swift 818-989-1133
FL Miami, All American 305-621-8282
FL Winter Pk., Pelcor 407-644-1594
IL Chicago, Newark Elctrns. 312-784-5100
IN Indianapolis, Bell Inds. 317-875-8200
MD Beltsville, Resco/Washington 301-937-9100
MA Seekonk, M-Squared 508-761-5490
MO Baltimore, Resco/Baltimore 301-931-8200
NJ Rockaway, Tonar 201-586-9000
NY Hauppauge, Jaco Elctrns. 516-273-5500
NY Mt. Vernon, ASAP Elctrns. 914-699-2727
PA Philadelphia, PEI-Genesis 215-673-0400
TX Ft. Worth, PATCO Supplies 817-429-8596
Can St. Laurent, Q.C., Braydon Elctrns. 514-332-5650
Can Willowdale, Electro Sonic 416-494-1555

JOHNSON, E. F., CO., 299 Johnson Ave., Waseca, MN 56093, Tel: 1-800-247-8256, FAX: 507-835-6287; Empl.: 800; *Sls. Mgr.:* Kevin Lohmann; *Dist. Mgr.:* Kevin Lohmann

JOHNSON CONTROLS BATTERY GROUP, INC., 900 East Keefe Ave., Milwaukee, WI 53212, Tel: 414-961-6500, FAX: 414-961-6506; Empl.: 250; *Sls. Mgr.:* James L. Winistorfer, Dir. Sls. & Mktg.

JOHNSON YOKOGAWA CORP., 4 Dart Road, Newnan, GA 30265, Tel: 404-254-0400, FAX: 404-254-0928; Empl.: 700; *Sls. Mgr.:* Chuck Micallef

JOLO INDUSTRIES, INC., 13921 Nautilus Dr., Garden Grove, CA 92643, Tel: 714-554-6840, FAX: 714-554-0306; FSC No.: 30035; Empl.: 20; *Sls. Mgr.:* J.S. Giampiccolo, Jr. ..... **C•1360-1361**

Local Sales Offices & Reps

AZ Scottsdale, JK & Assocs. 602-990-8804
CA Los Angeles, Quattro Sls. Assocs. 213-372-4221
CA Orange County, Quattro Sls. Assocs. 800-735-4510
CA Pleasanton, Leddy Assocs. 510-417-1033
CA San Diego, Quattro Sls. Assocs. 619-581-3093
CA San Fernando Valley, Quattro Sls. Assocs. 805-523-2978
FL Longwood, Mathias Assocs., Inc. 407-682-1700
IL Schaumburg, Terry McNulty & Assocs. 708-980-9868
MA Reading, Lincoln Tech. Sls. 617-944-9594
MI Rochester Hills, Geotronix, Inc. 313-373-4334
NJ Fairfield, Brunetta Mktg. Svcs. 201-227-2522
OH Cleveland, Geotronix Mktg. Assocs. 216-659-6100
OH Trotwood, Geotronix, Inc. 513-854-5939
OR Portland, Evergreen Mktg. Grp. 503-598-7667
PA Allison Park, Geotronix, Inc. 412-487-1770
WA Edmonds, Evergreen Mktg. Grp. Inc. 206-485-8063
Can Nepean, Ont., Tech-Trad, Inc. 613-727-1272

Local Distributors

FL Miami, Elec. Equip. 305-526-6060
OH Richfield, Alpha Distr. Corp. 216-659-7100

JONARD INDUSTRIES CORP., 134 Marbledale Rd., Tuckahoe, NY 10707, Tel: 914-793-0700, FAX: 914-793-4527; Empl.: 65; *Sls. Mgr.:* Rich Gerszberg

JONATHAN MANUFACTURING CORP., 1101 So. Acacia Ave., Fullerton, CA 92631, Tel: 714-526-4651, FAX: 714-773-5582; Empl.: 275; *Sls. Mgr.:* Todd Leverich

JONES, HIRAM, ELCTRNS. INC., See Hiram Jones Elctrns. Inc.

JORI RESOURCES, 2128 Knoll Dr., Ventura, CA 93003, Tel: 805-642-2266, FAX: 805-642-5978; Empl.: 4

JOSLYN ELECTRONIC SYSTEMS CORP., P.O. Box 817, 6868 Cortona Dr., Goleta, CA 93116, Tel: 800-752-8068, 805-968-3551, FAX: 805-968-2335; FSC No.: 23663; Empl.: 240; *Sls. Mgr.:* M. Young

JOSLYN JENNINGS CORPORATION

FAX: 408-286-1789

JOSLYN JENNINGS CORPORATION, 970 McLaughlin Ave., San Jose, CA 95122-2696, Tel: 408-292-4025, TELEX: 34-6311, TWX: 910-338-0159; FSC No.: 73905; Empl.: 350; *Sls. Mgr.:* Dwane Gisi ..... **A•1090; B•1536-1538; D•1277**

Local Sales Offices & Reps

AL Huntsville, Brandel-Stephens 205-883-0445
AZ Phoenix, Crown Systems 602-274-3180
CA Encino, King-Way Assocs. 818-788-4124
CA San Jose, H. W. Assocs. 408-996-9940
CO Denver, Lindberg Co. 303-758-9033
FL Deerfield Beach, Brandel-Stephens 305-427-8558
FL Orlando, Brandel-Stephens 305-425-3202
GA Atlanta, Brandel-Stephens 404-261-7579
IL Arlington Hgts., Berndt Assocs. 312-632-0900
IN Carmel, Berndt Assocs. 317-844-0114
KS Shawnee Mission, Lowell-Kangas & Assoc. 913-631-3515
MD Hunt Valley, Marktron 301-628-1111
MD Rockville, Marktron 301-251-8990
MA Haverhill, L.K. Assocs. 617-373-1313
MN Minneapolis, Berndt Assocs. 612-546-2021
MO St. Louis, Lowell-Kangas & Assoc. 314-821-4050
NJ Flanders, K&R Engrg. Sls. 201-584-5235
NM Albuquerque, Lindberg Co. 505-881-1006
NY Kingston, Leonard D. Allen, Inc. 914-338-7588
NY Syracuse, Leonard D. Allen, Inc. 315-437-8387
NC Greensboro, Brandel-Stephens 919-274-6952
OH Centerville, Bear Mktg., Inc. 513-436-2061
OH Richfield, Bear Mktg., Inc. 216-659-3131
PA Huntingdon Valley, Omega Elctrns. 215-947-4135
PA Pittsburgh, Bear Mktg., Inc. 412-531-2002
TX Houston, Barry Sales 713-784-5860
TX Richardson, Barry Sales 214-234-0255
UT Salt Lake City, Lindberg Co. 801-277-2643
WI Milwaukee, Berndt Assocs. 414-545-8400

Local Distributors

CA Carlsbad, Surcom Assocs. 619-438-4420
IL La Fox, Richardson Elctrns., Ltd. 312-456-0600
TN Bristol, Kintronics 615-878-3141

JOULE POWER, INC., Joyce Industrial Pk., Summer Rd., Boxborough, MA 01719, Tel: 508-263-9712, FAX: 508-263-9071 ..... **D•1765**

Local Sales Offices & Reps

AL Huntsville, Over & Over 205-837-7105
AZ Scottsdale, Sun Tech Mktg. 602-483-1082
CA San Jose, Silicon Valley Sls. 408-432-1967
FL Altamonte Springs, Over & Over 407-332-1222
GA Norcross, Over & Over 404-449-6205
MA Tyngsboro, AMS Mktg. 508-649-3383
NY Commack, RC Eng. Sls. 516-543-3325
NC Raleigh, Over & Over 919-876-7338
OH Cincinnati, Century Tech. Sls. 513-677-5088
PA Wayne, John Lyons Mktg. 215-687-2277
TX Plano, Aticus 214-964-0663
UT Ogden, Doug Taylor & Assocs. 801-546-9570
VA Alexandria, Mid-States Mktg. 703-370-2600
WA Lake Oswego, SPS Elctrns. 503-697-7768
Can Montreal, Que., Solid State Engrg. 514-481-3313

JOVIL MANUFACTURING CO., INC., Precision Rd., Danbury, CT 06810, Tel: 203-792-6700, TELEX: 969634, FAX: 203-790-8645; Empl.: 25; *Sls. Mgr.:* Keith Fredlund

JRW INDUSTRIES, INC., 2312 N Second St., Harrisburg, PA 17110, Tel: 717-236-1418, FAX: 717-236-1895; Empl.: 4; *Sls. Mgr.:* Kevin J. Williams, Sls. Mgr.

JSC WIRE & CABLE, Box 248, Burgess Pl., Wayne, NJ 07474-0248, Tel: 201-694-6200, 1-800-572-9473, FAX: 201-694-8297; Empl.: 40; *Sls. Mgr.:* Richard Wojtovitz

J.S.T. CORP., 1200 Business Ctr. Dr., Ste. 400, Mt. Prospect, IL 60056, Tel: 1-800-947-1110, FAX: 708-803-4918; *Sls. Mgr.:* Ron Lesky; *Dist. Mgr.:* Ron Lesky ..... **C•1363**

Local Sales Offices & Reps

AL Huntsville, Over & Over, Inc 205-837-7105, FAX:205-837-7305
AZ Scottsdale, Carefree Elctrns. 602-951-9121, FAX:602-951-1381
CA Canyon Country, Interconn Tech. Mktg. 805-298-3199,FAX:805-298-3883
CA Cupertino, Prism Tech. Sls. Co. 408-257-6766, FAX:408-257-8847
CA Newsbury Park, Interconn Tech. Mktg. 805-499-4024,FAX:805-499-7937
CA San Marcos, Falcon Sls. & Technlg. 619-591-0504, FAX:619-591-4241
CA Trabuco Canyon, Interconn Tech. Mktg. 714-589-4655,FAX:714-589-3793
FL Altamonte Spgs., Over & Over, Inc. 407-332-1222, FAX:407-332-4433
FL Brandon, Over & Over, Inc. 813-684-6486, FAX:813-684-6486
FL Ft. Lauderdale, Over & Over, Inc. 305-485-0115, FAX:305-484-8131
GA Norcross, Over & Over, Inc. 404-449-6205, FAX:404-449-6177
IL Itasca, Circuit Sls. 708-773-0200, FAX:708-773-2721
IN Indianapolis, Elctrn. Sls. & Engrg. Co. 317-849-4260,FAX:317-841-0231
IA Blue Grass, Acorn Elctrns. 319-381-2702, FAX:319-381-2702
KS Overland Pk, Acorn Elctrns. 913-649-6402, FAX:913-649-8005
MA Canton, The T.M.R. Grp. 617-828-1848, FAX:617-828-2459
MI Bloomfield Hills, Trilogy Mktg., Inc. 313-338-2470, FAX:313-338-6720
MN St. Paul, Countryman Assoc. Co. 612-645-9151, FAX:612-641-6153
MO St. Louis, Acorn Elctrns. 314-421-1751, FAX:314-421-1752
NJ Madsion, Venture Quest, Inc. 201-377-4922, FAX:201-377-0453
NY Holbrook, Venture Quest, Inc. 516-588-5130, FAX:516-588-4424
NY Marcellus, Franklin Sls. Corp. 315-673-1009, FAX:315-673-4428
NY New Hartford, Franklin Sls. Corp. 315-793-3161, FAX:315-793-3139
NY Pittsford, Franklin Sls. 716-248-8251, FAX:716-248-3866
NC Charlotte, Over & Over, Inc. 704-542-9111, FAX:704-542-9937
NC Raleigh, Over & Over 919-876-7338, FAX:919-876-8098
OH Cincinnati, Stegman Blaine Mktg., Inc. 513-729-1969,FAX:513-729-1984
OH Cleveland, Stegman Blaine Mktg., Inc. 216-572-0003,FAX:216-238-3229
OH Stow, Stegman Blaine Mktg., Inc. 216-688-9603, FAX:216-688-6421
OH Vandalia, Stegman Blaine Mktg., Inc. 513-890-7975,FAX:513-890-5191
OR Aloha, Turn-A-Round Sls. 503-649-1007, FAX:503-649-1008
OR Hillsboro, Turn-A-Round Sls. 503-640-4641, FAX:503-640-4640
PA Fort Washington, SMC Inc. 215-628-3394, FAX:215-628-3395
TX Arlington, T-Tec Sls. 817-274-0505, FAX:817-274-9662
TX El Paso, T-Tec Sls. 915-581-7920, FAX:915-585-1886
TX Gilmer, T-Tec Sls. 903-734-4526, FAX:903-734-5316
TX Houston, T-Tec Sales 713-578-9666, FAX:713-578-5666
VA Fairfax Station, Sac Communications Inc. 703-643-2344,FAX:703-643-1842
WA Kirkland, Turn-A-Round Sls. 206-822-4634, FAX:206-828-0633
WI Brookfield, Circuit Sls. 414-784-7773, FAX:414-784-4528
EXP Mexico, Guadalajara, T-Tec Sls. 011-523-6353
Can St. Lazare, Que, Atkinson & Ross Assoc. 514-424-5679,FAX:514-424-5678
Can Vancouver, BC, Fairwest Sls. 604-685-1473, FAX:604-681-7712
Can Whitby, Ont., Atkinson & Ross Assoc. 416-666-8359,FAX:416-666-8360

Local Distributors

AL Huntsville, Comp. Distrs. Inc. 205-851-7800, FAX:205-859-2249
AZ Tucson, SWS Elctrns; Inc. 602-628-1613, FAX:602-628-1921
CA Brea, I.S.I. 714-961-7955,FAX:714-996-9537
CA Campbell, Prime Electro 408-374-0707, FAX:408-374-7711
CA Fremont, Vic/Tal Sls. 510-651-6420, FAX:510-651-8795
CA Huntington Bch., On-Line Elctrns. 714-847-5111, FAX:714-847-4485
CA Irvine, Kensington Elctrns. 714-588-0575, FAX:714-588-0176

CA Manhattan Bch., Prime Electro. 310-379-3642, FAX:310-379-7768
CA Norwalk, Myco Elctrn. Supp. 213-404-2053, FAX:310-926-8536
CA S. San Francisco, Peters-De Laet Inc. 415-873-6671,FAX:415-873-1680
CA San Carlos, Logan Elctrns. 415-594-0700, FAX:415-594-1687
CA San Diego, Deco Elctrns. 619-693-1595, FAX:619-693-0245
CA San Diego, Mock III 619-693-8230, FAX:619-693-3355
CA San Diego, Western Fastener 619-292-5115, FAX:619-292-0427
CA San Jose, Spectra Elctrns. 408-955-7800, FAX:408-955-7810
CA Santa Clara, Bravo Foresight Elctrns. 408-980-9700,FAX:408-980-8805
CA Santa Clara, Trinty Elctrns. 408-980-9011, FAX:408-980-9014
CO Englewood, Comp. Distrs. Inc. 303-770-6214, FAX:303-770-6057
CO Littleton, Indelco ... 303-795-3431,FAX:303-794-8298
CT Wallingford, Midstate Elctrns. 203-265-9900, FAX:203-269-2374
FL Clearwater, Comp. Distrs. Inc. 813-796-0466, FAX:813-796-0846
FL Ft. Lauderdale, Comp. Distrs. 305-973-6175, FAX:305-973-6915
FL Ft. Lauderdale, KSM Elctrns. 305-971-5900, FAX:305-977-0489
GA Athens, Dixie Elctrns. 706-613-7755, FAX:706-613-7856
GA Atlanta, KSM Elctrns. 404-458-2013, FAX:404-451-0891
GA Norcross, Comp. Distrs. Inc. 404-441-3320, FAX:404-449-1712
IL Addison, Belford Elctrns. 708-691-1100, FAX:708-691-1118
IL Bensenville, Voyager I 708-860-1300, FAX:708-860-1572
IL Glendale Hgts., KSM Elctrns. 708-529-1700, FAX:708-529-3668
IL Palatine, OHM Elctrns. 708-359-5500, FAX:708-359-9686
IL Wood Dale, NEP Elctrns. 708-595-8500, FAX:708-595-8706
IN Beech Grove, Wire Supp. Inc. 317-786-4485, FAX:317-787-0706
IN Carmel, Altex Elctrns. 317-848-1323, FAX:317-844-6593
IN Indianapolis, Mar Elctrns. 317-633-6699, FAX:317-633-6687
IA Cedar Rapids, Dee Elctrns. 319-365-7551, FAX:319-365-8506
MD Gaithersburg, Axis Elctrns., Inc. 301-840-9640, FAX:301-840-9299
MA Franklin, JEM Elctrns. 508-520-3105, FAX:508-520-3109
MA Nutting Lake, QPL Elctrns. Distrs. 508-671-9473, FAX:508-671-0006
MA Westborough, In-Stock Prods. 508-870-5750, FAX:508-898-3616
MI Grand Rapids, S.F. Elctrn. Supp. Inc. ... 616-459-0216, FAX:616-459-5601
MI Livonia, Michigan Lectrols Corp. 313-427-0300, FAX:313-427-4045
MI Wyoming, E.C. Elctrns. 616-530-0576, FAX:616-530-8598
MN Fridley, Voyager II 612-571-7766, FAX:612-571-9519
MN Roseville, Chris Elctrn. Distrs. 612-631-2647, FAX:612-631-3071

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NV Reno, Peters-De Laet Inc. 702-827-5599, FAX:702-827-4150
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NY Rochester, Simcona Elctrns. 716-328-3230, FAX:716-436-5926
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NC Charlotte, Dixie Elctrns. 704-521-0602, FAX:704-558-4696
NC Hickory, Dixie Elctrns. 704-328-1130, FAX:704-328-8318
NC Raleigh, Dixie Elctrns. 919-829-0704, FAX:919-829-0375
NC Winston-Salem, Dixie Elctrns. 919-724-5961, FAX:919-723-7024
OH Columbus, Spectra Elctrns. 614-885-8881, FAX:614-885-3233
OH Dayton, Advacom 513-274-5900, FAX:513-274-9124
OH Midpark, Advacom 216-826-3300, FAX:216-826-1669
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OK Tulsa, Wofford Elctrns. 918-622-9555, FAX:918-622-3999
OR Beaverton, Micro Power Elctrns. 503-626-7086, FAX:503-643-1556
PA East York, Advacom 717-741-9277, FAX:717-741-9462
PA Export, Advacom 412-325-7551, FAX:412-733-9826
PA McKean, Advacom 814-476-7774, FAX:814-476-7724
PA Philadelphia, Shap Elctrns. 215-969-3300, FAX:215-934-5539
SC Columbia, Dixie Elctrns. 803-779-5332, FAX:803-765-9276
SC Greenville, Dixie Elctrns. 803-297-1430, FAX:803-297-1439
SC N. Charleston, Dixie Elctrns. 803-552-2671, FAX:803-552-2676
TN Gray, Dixie Elctrns. 615-477-2131, FAX:615-477-4407
TN Oak Ridge, Dixie Elctrns. 615-481-3393, FAX:615-481-3397
TX Austin, Wofford Elctrns. 512-339-1131, FAX:512-853-7351
TX Dallas, Comp. Distrs. Inc. 214-644-0373, FAX:214-644-1115
TX Dallas, Wofford Elctrns. 214-320-0294, FAX:214-320-2017
TX El Paso, Schick Entprs. 915-772-3283, FAX:915-772-3034
TX Laredo, Indux S.A. Mexico 512-727-5935
TX N. Richland Hills, Swieco Elctrns (Dixie) 817-281-1811,FAX:817-281-1783
TX Tomball, Wofford Elctrns. 713-351-2255, FAX:713-351-2722
WA Redmond, Priebe Elctrns. 206-881-2363, FAX:206-881-0508
WI New Berlin, NEP Elctrns. 414-785-9100, FAX:414-785-9131
Can Burnaby, BC, Brockton Elctrns. Ltd. 604-291-6665, FAX:604-291-6664
Can Darthmouth, NS, Arcom Elctrns. 902-464-1600, FAX:902-469-6825
Can Edmonton, AB, Elctrn. Connections 403-469-7222, FAX:403-463-8149
Can Markham, Ont., ARMA Elctrns. Sls., Inc. 416-475-1858,FAX:416-475-2019
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AZ Tempe, Optimum Assembly 602-968-2335, FAX:602-968-2337

CA Anaheim, Sophic Inds. 714-632-2460, FAX:714-632-1941
CA Santa Ana, Paul Kaplin Co. 714-556-7007, FAX:714-751-6003
CA Tracy, Ferreira Inds. 209-832-0114, FAX:209-832-0412
IL Addison, Belford Elctrns. 708-691-1100, FAX:708-691-1118
IN Plainfield, AES Interconnections 317-272-2551, FAX:317-272-3082
MD Columbia, Custom Cables 301-290-9777, D:301-381-2036
MA Westborough, In-Stock Prods. 503-970-5750, FAX:503-898-3616
MI Livonia, Michigan Lectrols Corp. 313-427-0300, FAX:313-427-4045
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NJ Madison, Pyxis Corp. 201-377-4922, FAX:201-377-0453
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NY Dryden, Sturges Elctrns. 607-844-8604, FAX:607-844-8416
NC Kernsville, EDC Inc. 919-993-0468, FAX:919-993-0368
OH Dayton, Cables To Go 513-224-8646, FAX:800-331-2841
OR Beaverton, ACA Mfg. 503-646-3377, FAX:503-646-1671
TN Franklin, Telco 615-377-9910,FAX:615-377-9940
TN Greenville, Precision Wire Assemblies Inc. 615-636-1416,FAX:615-638-9078
TX El Paso, Border Grp. 915-581-7920, FAX:915-585-1886
WA Vancouver, Unitrek Corp. 206-699-2765, FAX:206-694-9230
Can Mississauga, Ont., Sycor Technlg. 416-821-3591, FAX:416-821-7260

JUDCO MFG. INC., P.O. Box 487-E84, 1429 240th St., Harbor City, CA 90710, Tel: 310-534-0959; *Sls. Mgr.:* Kevin Johnson

JUDD WIRE INC.
1-800-545-5833

FAX: 413-863-2305

JUDD WIRE INC., 57 Turnpike Rd., Turners Falls, MA 01376, Tel: 413-863-4357, 800-545-5833; FSC No.: 3357; Empl.: 148 ..... **C•1756**

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AL Huntsville, Innovative Sls. 205-772-7500
AZ Phoenix, O'Donnell Associates 602-944-9542
CA Laguna Hills, Bart Budge Assoc. 714-582-8720
CA Los Altos, Ewing Foley 415-941-4525
CO Boulder, Stratford Grp. 303-530-3194
FL Largo, Q Rep. 813-397-8431
ID Boise, Jas. J. Backer 208-378-4680
IL Arlington Heights, Rozner Sls. Co. 708-577-0067
IA Cedar Rapids, Lowell-Kangas 319-362-9290
KS Shawnee, Lowell-Kangas 913-631-3515
MD Baltimore, Spindler & Wafer 301-744-1133
MA Hudson, O.K. Engrg. 508-562-1010
MN Hopkins, Pathway Sls. 612-933-8267
MO St. Louis, Lowell-Kangas 314-821-4050
NJ Middletown, Elctrn. Mktg. 908-615-9484
NM Albuquerque, O'Donnell Assocs. 505-889-4522
NY Fairport, Senntec Sls. 716-425-3954
NC Greensboro, Reynolds Whitlock 919-691-1138
OH Worthington, Simcox Assocs. 614-885-8776
OR Beaverton, Jas. J. Backer Co. 503-627-0775
PA Willow Grove, Meldena Sls. 215-657-7760
SC Greenwood, Reynolds Whitlock 803-229-6801
TX Dallas, Stevens Sls. Co. 214-702-0132
WA Seattle, Jas. J. Backer Co. 206-285-1300

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FL Ft. Lauderdale, Pacer Elctrns. 305-749-1910
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MA Woburn, Pacer Elctrns. 617-935-8330
MN Bloomington, K. L. Tannehill 612-881-6700
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NY Rochester, Simcona Elctrn. 716-328-3230
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Refer to Judd Wire, Turners Falls, MA for sales office and distributor information.

JULIE RESEARCH LABORATORIES, INC.

FAX: 212-691-3320

JULIE RESEARCH LABS., 508 West 26 Street, New York, NY 10001, Tel: 212-633-6625; FSC No.: 07062; Empl.: 35; *Sls. Mgr.:* Pamela Spencer; *Dist. Mgr.:* Pamela Spencer ..... **A•1956; D•1278-1281**

JUMO PROCESS CONTROL, INC., 735 Fox Chase, Coatsville, PA 19320, Tel: 215-380-8002, FAX: 215-380-8009; *Sls. Mgr.:* Gunnar Oberg

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FAX: 508-922-8374

KAISER SYSTEMS, INC., Inductotherm Industries, Inc., 126 Sohier Road, Beverly, MA 01915, Tel: 508-922-9300; FSC No.: IFD78; Empl.: 100; *Sls. Mgr.:* Steve Swech ..... **D•1766-1769**

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CA Agoura Hills, Griot Group Inc. 818-706-7601
CA Irvine, Griot Group Inc. 714-727-4110
CA Santa Clara, Groit Group Inc. 408-727-2880
CO Denver, Griot Group Inc. 303-427-1111
NM Albuquerque, Griot Group Inc. 505-883-1022
OR Beaverton, Griot Group Inc. 503-646-5627
UT Salt Lake City, Griot Group Inc. 801-328-9471
WA Seattle, Griot Group Inc. 206-454-8592

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KALGLO ELCTRNS. CO., INC., 6584 Ruch Rd., E. Allen Twp., Bethlehem, PA 18017-9359, Tel: 215-837-0700, TWX: 510-651-2101, FAX: 215-837-7978; FSC No.: 64521; Empl.: 8; *Sls. Mgr.:* Charles Kerchner; *Dist. Mgr.:* Charles Kerchner

KALMUS & ASSOCS., INC., 2424 S. 25th Ave., Broadview, IL 60153, Tel: 708-343-7004, FAX: 708-343-7016; Empl.: 250; *Sls. Mgr.:* Kent Prather

KAMAN INSTRUMENTATION, 1500 Garden of the Gods, P.O. Box 7463, Colo Springs, CO 80907, Tel: 719-599-1132, FAX: 719-599-1823; FSC No.: 21732; Empl.: 100; *Sls. Mgr.:* Steve Perry

KAM COMPONENTS, INC., P. O. Box 192-EEM, Nesconset, NY 11767, Tel: 516-585-0666, FAX: 516-585-1580; Empl.: 29; *Sls. Mgr.:* Cheryl Day

K&L MICROWAVE, INC., 408 Coles Circle, Salisbury, MD 21801, Tel: 410-749-2424, FAX: 410-749-5725; FSC No.: 50140; Empl.: 425; *Sls. Mgr.:* Jim Price

K & L OSCILLATEK, A DOVER TECHNOLOGY CO., See Oscillatek, A Dover Technology Co.

K & M ELECTRONICS INC., 11 Interstate Dr., W. Springfield, MA 01089, Tel: 413-781-1350, FAX: 413-737-0608; FSC No.: 66613; Empl.: 300 ò; *Sls. Mgr.:* Robert Patrick ..... **A•1957**

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CA Fremont, C/G Assocs., Inc. 415-790-1193
OH Akron, Augnat Assoc. 216-666-2819

KAPPA TECHNOLOGIES INC

FAX: 908-388-4786

KAPPA TECHNOLOGIES, INC., 1443 Pinewood St., Rahway, NJ 07065, Tel: 908-396-9400, 1-800-223-0603; FSC No.: 20933; Empl.: 175; *Sls. Mgr.:* D. Pearl ..' **A•1568-1569, 1642-1645, 2370-2373; D•2128-2129**

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AL Huntsville, Advanced Comps. Mktg. ... 205-881-5493
CA Sunnyvale, Matek Sls. 408-245-5300
CA West Hills, Bennet Tech. Sls. 818-385-8974
CO Wheatridge, Wescom Mktg. 408-422-8957
CT Plainville, Northeast Reps. 203-747-2423
GA Norcross, Advanced Comps. Mktg. 404-448-7025
KS Andover, QDC Inds. 316-733-9756
KS Overland Park, QDC Inds. 913-341-2214
MD Middletown, S.T. Woolard Co. 301-371-4500
MD Middletown, S.T./Woolard Co., Inc. 301-371-4500
MA Hingham, Northeast Reps. 617-749-8700
MN Eagan, QDC Inds. 612-454-0893
MO Ballwin, QDC Inds. 314-458-1896
NH Mt. Vernon, Northeast Reps. 603-673-1406
NY Cazenovia, S.T. Woolard Co., Inc. 315-655-8145
NY Plainview, Neptune Elctrns. Co. 516-349-1600
PA Ft. Washington, SMC, Inc. 215-628-3394
TX Austin, Gardin-Moore Sls. 512-794-2900
TX Dallas, Gardin-Moore Sls. 214-985-1193
TX Houston, Gardin-Moores Sls. 713-496-7651
TX Plano, Gardin-Moore Sls. 214-985-1193
TX Stafford, Gardin-Moore Sls. 713-240-6767
UT Salt Lake City, Wescom Mktg. Inc. 801-269-0419

Local Distributors

CA Sherman Oaks, DLDI ... 818-986-9455,800-624-2617

KATRONIC ELEKTRONIC GES.M.B.H., OrtenburgerstraBe 28, Austria, Tel: 04762-5340, FAX: 534075; Empl.: 74; *Sls. Mgr.:* Herbert Sandner

KAUT & BUX MANUFACTURING CO., 675 Tower Rd., P.O. Box 867, Mundelein, IL 60060, Tel: 708-949-8505, TELEX: 6871289 KBM UN/, FAX: 1-708-949-4250; *Sls. Mgr.:* Gene Larson

KAVLICO CORP., 14501 Los Angeles Ave., Moorpark, CA 93021, Tel: 805-523-2000, TELEX: 65-1481, FAX: 805-523-7125; Empl.: 500; *Dist. Mgr.:* Bill Fry

KAY ELEMETRICS CORP., 12 Maple Ave., P.O. Box 2025, Pine Brook, NJ 07058-2025, Tel: 201-227-2000, FAX: 201-227-7760; FSC No.: 80138; Empl.: 50; *Sls. Mgr.:* Stephen P. Crump ..... **A•1846**

KAY-RAY/SENSALL, INC., 1400 Business Center Drive, Mt. Prospect, IL 60056, Tel: 708-803-5100; Empl.: 170

KB ELECTRONICS, 73 Wortman Ave., Brooklyn, NY 11207, Tel: 718-257-3300, FAX: 718-257-4740; Empl.: 100; *Sls. Mgr.:* A Bueller

KCK

FAX: 708-577-0201

KCK AMERICA INC., Mitsubishi Materials Corporation, 4080 Winnetka Ave., Rolling Meadows, IL 60008, Tel: 708-577-0200; Empl.: 500; *Sls. Mgr.:* K. G. Such, V.P. ..... **A•1091, 1647; B•1365**

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AL Southern Elctrn. Reps. 205-461-8925
AZ Inmark 602-830-9104
CA Los Angeles, English/Damco Sls. Co., Inc. 213-772-7272
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CA San Diego, English/Damco Sls. Co., inc. 619-271-0333
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GA Atlanta, Advantage Comp. Sls. 404-458-3577
ID Sierra Tech. Sls. 801-566-9719
IL BNI Elctrns., Inc. 708-595-9210
IN J & B Engry. Sls. Co., Inc. 219-483-2813
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MD Karr Assocs. 410-280-2448
MA JMG Inc. 617-762-5333
MI DEM Sls., Inc. 313-583-1500
MN E.I. Sls. Co. 507-345-5786
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MT Sierra Tech. Sls. 801-566-9719
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NY Metropolitan, JMR Sls., Inc. 908-525-8000
NY Upstate, R Squared 315-457-3754
NC Raleigh, Vantage Mktg. Inc. 919-870-7123
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OH Southern, J & B Engrg. Sls. Co., Inc. ... 513-848-2626
PA Eastern, Check Assocs. 215-487-3007
PA Western, J & B Engrg. Sls. Co., Inc. 216-766-5754
TN Eastern, Electronic Comp. Mktg. 615-828-5741
TN Western, Southern Elctrn. Reps. 205-461-8925
TX Passive Comps. Assocs. 214-824-6162
UT Sierra Tech Sls. 801-566-9719
WI Larsen Assocs., Inc. 414-258-0529
WY Eastern, Tech. Mktg. Co. 303-989-3611
WY Western, Sierra Tech. Sls. 801-566-9719
Can JRL Assocs. 416-754-3280

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AZ Fountain Hills, RCD Inds., Inc. 602-837-9387
CA Chatsworth, Passive Comps., Inc. 818-700-8838
CA Huntington Beach, Surface Mount Distbn. 714-841-4556
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CA Milpitas, California Capacitor 408-262-6000
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CA San Jose, Passive Comps. 408-441-1441
CA San Jose, Surface Mount Distbn. 408-451-9200
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FL Longwood, RM Elctrns Co., Inc. 407-767-8005
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IL Schaumburg, QPS Elctrns., Inc. 708-884-6620
IL Wheeling, Alpha Tek Elctrns. 800-798-2277
IN Indianapolis, Custom Srvc. Elctrns., Inc. 317-879-9119
MI Farmington Hills, Key Elctrns. 313-489-5455
MI Grand Rapids, Calder Elctrns. 616-698-7400
MI Grand Rapids, RM Elctrns. Co., Inc. 616-531-9300
MN Eitzen, Capacitor Assocs. 507-495-3130
MN Roseville, Parts 1 612-633-8079
NH Derry, Brothers Elctrns. 603-437-8437
NH Nashua, Brevan Elctrns. 603-429-1900
NJ Bloomfield, Solid State, Inc. 201-429-8700
NJ East Brunswick, Brothers Elctrns., inc. 908-238-2200
NM Albuquerque, Betatron Elctrns. 505-821-1122
NY East Rochester, Rome Elctrns., Inc. ... 716-248-0160
NY Rome, Rome Elctrns., Inc. 315-337-5400
NY Syracuse, ADR Tech., Inc. 315-437-7087
NY Williamsville, Rome Elctrns., Inc. 716-626-1602
NC Raleigh, Century Elctrnic Comps., inc. 919-782-2116
OH Solon, Repco Elctrns. 800-544-1858
OR Portland, Radar Elec. Co., Inc. 503-232-3404
PA Norristown, Century Elctrn. Comps., Inc. 215-631-5400
TX Arlington, Bell Comps. 817-461-5303
TX Austin, SMEC 800-336-7632
TX Richardson, CTC 214-437-2211
WA Richland, Radar Elec. Co., Inc. 509-943-8336
WA Seattle, Radar Elec. Co., Inc. 206-282-2511
WA Spokane, Radar Elec. Co., Inc. 509-747-3053
Can Nepean, Ont., Carsten Elctrns. 613-726-9250
Can Scarborough, Ont., Carsten Elctrns. ... 416-477-9898
Can Scarborough, Ont., U-Tech Elctrns. 416-609-2900
Can St. Laurent, Que., Carsten Elctrns. 514-334-8321

KD COMPONENTS, INC., 2151 Challenger Way, Carson City, NV 89706, Tel: 702-883-8003, FAX: 702-883-1150; FSC No.: 58421; Empl.: 44; *Sls. Mgr.:* John Horn

KDI/TRIANGLE ELECTRONICS, 60 S. Jefferson Rd., Whippany, NJ 07981, Tel: 201-887-5700; FSC No.: 64537; Empl.: 385

KDS AMERICA, Daishinku Corp., 10901 Granada Ln., Overland Pk., KS 66211, Tel: 913-491-6825, FAX: 913-491-6812; Empl.: 12; *Sls. Mgr.:* Tom Lawrence-East. Reg.; *Dist. Mgr.:* Sara Peterson, Claudia Broome

KEDMAN CO., Box 25667, Salt Lake City, UT 84125, Tel: 801-973-9112, FAX: 801-972-2756; Empl.: 100

KEITHLEY

FAX: 216-248-6168

KEITHLEY INSTRS., 28775 Aurora Rd., Cleveland, OH 44139, Tel: 800-552-1115; Empl.: 750; *Sls. Mgr.:* David Brock ..... **D•1283-1288**

Local Sales Offices & Reps

AL	Huntsville, W. A. Brown Instrs.	205-830-9224
AZ	Tempe, Aztec Entprs.	602-431-8401
CA	Los Alamitos, Tritek Solutions	714-236-1190
CO	Denver, Aztec Entprs.	303-779-5285
FL	Orlando, W. A. Brown Instrs.	407-648-9660
IL	Buffalo Grove, Torkelson	708-520-0710
IN	Indianapolis, Torkelson	317-244-7867
IA	Cedar Rapids, Torkelson	319-373-0200
KS	Lenexa, Midtec Assocs.	913-541-0505
MA	Lynnfield, Keithley	800-552-1115
MI	Detroit, EQS Sys.	313-455-7920
MN	Minneapolis, Torkelson	612-835-2414
NJ	Paramus, Keithley	800-552-1115
NM	Albuquerque, Aztec Entprs.	505-262-1688
NY	Melville, Keithley	800-552-1115
NY	Syracuse, Labtronics	315-455-7314
NC	Cary, W.A. Brown Instrs.	919-460-1120
OH	Chesterland, EQS Sys.	216-729-2222
OR	Wilsonville, Syntek	503-682-2750
PA	Huntington Valley, Sci-Rep	215-322-6500
TX	Austin, Testech	512-338-9246
TX	Houston, Testech	713-893-9661
TX	Richardson, Testech	214-644-5010
VA	Fairfax, Sci-Rep	703-385-0600
WA	Bellevue, Syntek	206-462-7700
WI	Waukesha, Torkelson Assocs., Inc.	414-784-7736

KEITHLEY METRABYTE, 440 Myles Standish Blvd., Taunton, MA 02780, Tel: 508-880-3000, TELEX: 503989, FAX: 508-880-0179; FSC No.: 1 FG 11; Empl.: 140; *Sls. Mgr.:* Gary Marraccini; *Dist. Mgr.:* Gary Marraccini

KEL AM, See Teltec, Inc.

KELLER-PSI, 503 No. 11 Vista Bella, Oceanside, CA 92056, Tel: 619-967-6066, FAX: 619-967-0563; Empl.: 8; *Sls. Mgr.:* Dick Grove; *Dist. Mgr.:* Dick Grove

KEL CONNECTORS, INC., KEL Corp., 1250 Oakmead Pkwy., No. 105, Sunnyvale, CA 94086, Tel: 408-720-9044, FAX: 408-720-1989; *Sls. Mgr.:* Jim Eilers

KELLY AMERICAN, INC., 640 Federal Rd., Brookfield, CT 06804, Tel: 203-775-2590, TELEX: 4750159ELECABUL, FAX: 203-775-9048; *Sls. Mgr.:* Robert Buckley

KELMET, INC., 569 W. Covina Blvd., San Dimas, CA 91773, Tel: 714-599-0954, FAX: 714-599-2835; Empl.: 6; *Sls. Mgr.:* Paul Hodge

KELTECH INC., 7508 Hitech Rd., Roanoke, VA 24019, Tel: 703-362-8466, FAX: 703-362-3957; Empl.: 35; *Sls. Mgr.:* William Sinclair

KELTRON CORPORATION

FAX: 617-899-9602

KELTRON CORP., High Voltage Power Supplies & Industrial Printers, 225 Crescent St., Waltham, MA 02154, Tel: 617-894-8700; Empl.: 170; *Sls. Mgr.:* T. Chadurjian, Power Supp., D. Raymond, Printers ..... **D•1098, 1770-1771**

Local Sales Offices & Reps

IL	Park Ridge, Probe Elec.	312-696-2828
NY	Commack, R.C. Engrg.	516-543-3325
PA	Glenside, Koebert Assoc.	215-887-2310

KELTRON CORP., Miniprinter/Security Systems Div., 225 Crescent St., Waltham, MA 02154, Tel: 617-894-8700, FAX: 617-899-9602; FSC No.: 18662; Empl.: 250; *Sls. Mgr.:* Steven P. Sargent ..... **D•1098**

Local Sales Offices & Reps

IL	Palatine, Key Entprs.	708-991-2144
MD	Baltimore, Advanced Tech. Sls., Inc.	301-323-3140
NY	Amsterdam, Traxonics	518-843-1445
PA	Oreland, Precision Mktg. Grp.	215-233-9233
WI	South Milwauke, Key Entprs.	414-762-2323

Local Distributors

AL	Decatur, Mgt. Security, Inc.	205-355-3030
CA	San Francisco, SF Fire & Burg.	415-861-0994
DC	District of Columbia, Ellenco Inc.	301-927-4370
FL	Miami, Glanz Technlg., Inc.	305-893-1269
GA	Albany, Tri-L Sys.	912-888-1266
IL	Chicago, Natl. Guardian Alarm	312-775-8600
MA	Georgetown, B & B Engrg.	508-352-6402
MI	Bloomfield Hills, W.E. Healy & Assocs.	313-335-9245
NC	Raleigh, National Security	919-821-1150
OK	Tulsa, Pendergraph, Inc.	918-835-8403
TX	Amarillo, Firehawk Safety Sys.	806-374-9613
WI	Brookfield, John Guetzke & Assocs., Inc.	414-784-5929

KELVIN INDUSTRIES, INC., 14724 Ventura Blvd., No. 1003, Sherman Oaks, CA 91403-3501, Tel: 818-990-1192, FAX: 818-995-6460; FSC No.: 19587; Empl.: 180; *Sls. Mgr.:* R. A. Featherston

KEMET®

FAX: 803-963-6521

KEMET ELECTRONICS CORPORATION, Box 5928, Greenville, SC 29606, Tel: 803-963-6621, TELEX: 57-0496, TWX: 810-287-2536; FSC No.: 31433; Empl.: 6,200; *Sls. Mgr.:* Robert Taylor, VP-Domestic Sls.; *Dist. Mgr.:* Dan Manly ..... **A•1092-1093**

Local Sales Offices & Reps

AL	Huntsville	205-830-1090
AZ	Tempe	602-831-2151
CA	Newport Beach	714-640-9320
CA	Santa Clara	408-986-0424
CO	Englewood	303-220-0759
FL	Orlando	407-855-8886
GA	Norcross	404-441-7701
IL	Schaumburg	708-517-1030
IN	Carmel	317-844-7756
MD	Columbia	410-992-5600
MA	Wakefield	617-245-4646
MI	Farmington Hills	313-489-5850
NY	Elmsford	914-347-4390
NC	Raleigh	919-872-2877
OH	Columbus	614-885-3330
PA	Exton	215-363-8310
SC	Greenville	803-242-5789
TX	Irving	214-556-0009
WA	Kirkland	206-828-4853
Can	Montreal	514-694-9525
Can	Ontario	416-542-7930

Local Distributors

CA	Agoura Hills, Time Elctrns.	818-707-2890
CA	Culver City, Hamilton/Avnet Elctrns.	213-558-2100
CA	Los Angeles, Bell Inds.	310-826-6778
CA	Sunnyvale, Capsco Sls., Inc.	408-734-3020
CO	Denver, Integrated Elctrns.	303-292-5537
GA	Duluth, Pioneer Technlgs.	404-623-1003
IL	Chicago, Newark Elctrns.	312-784-5100
MD	Columbia, TTI	301-955-1331
NJ	Old Bridge, Arm Bar Inds.	908-679-3377
NM	Albuquerque, Alliance Elctrns.	505-292-3360
NY	Buffalo, Summit Distrs., Inc.	716-887-2800
NY	Central Islip, Semicap Elctrns.	516-582-4400
NY	Hauppauge, L.I., Jaco Elctrns.	516-273-5500
NY	Westbury, Hamilton-Avnet	516-997-6868
NC	Greensboro, Golden Elctrns.	919-294-4653
NC	Greensboro, Hammond Elctrns.	919-275-6391
OH	Cleveland, Pioneer Elctrns.	216-587-3600
TX	Fort Worth, TTI Elctrns.	817-740-9000
Can	Vancouver, B.C., Deskin Sls.	604-324-8343

KEMLON PRODUCTS & DEVELOPMENT COMPANY, 6310 Sidney, Houston, TX 77021, Tel: 713-747-5020, FAX: 713-747-0049; Empl.: 165; *Sls. Mgr.:* Bob Horton

KEMTRON CIRCUITS & ELCTRNS. CORP., 110 S. Long Bch. Rd., Rockville Centre, NY 11570, Tel: 516-766-2772; Empl.: 7; *Sls. Mgr.:* Walter Carlock

KENMAR/TSI, 3020 Barrow Drive, Raleigh, NC 27604, Tel: 919-876-6049, FAX: 919-876-6292; Empl.: 110

M.S. KENNEDY CORP., 8170 Thompson Rd., Cicero, NY 13039, Tel: 315-699-9201, FAX: 315-699-8023; FSC No.: 51651; Empl.: 60; *Sls. Mgr.:* Greg Overend

KENTRON, INC., P.O. Box 142, Cedarburg, WI 53012-0142, Tel: 414-377-3733; *Sls. Mgr.:* Kenneth L. Krolski

KEN-TRON MFG., INC., 610 Industrial Dr., Owensboro, KY 42301, Tel: 502-684-0431, TELEX: 20-4305, FAX: 502-684-0435; Empl.: 100; *Sls. Mgr.:* R. Thompson

KENWOOD

FAX: 310-537-8235

KENWOOD U.S.A., 2201 E. Dominguez St., Long Beach, CA 90810, Tel: 310-761-8295 ..... **D•1406-1407, 1772-1775**

Local Sales Offices & Reps

CA	Belmont, Western Digital & Instrmn.	415-591-6535, FAX:415-591-9180
CA	Long Beach, Kenwood U.S.A.	310-761-8295, FAX:310-761-8246
CO	Lakewood, Tech. Mktg. Co.	303-989-3611, FAX:303-989-7225
CT	Killingworth, Paul Gallagher	203-663-2338, FAX:203-663-2338
GA	Marietta, Adams	404-973-0853,FAX:404-973-1903
IL	Mt. Prospect, Best Rep	708-632-0473, FAX:708-632-0475
IN	Carmel, New Era Sls.	317-844-4530, FAX:317-844-4534
IA	Cedar Rapids, KKB & Co.	319-373-1730, FAX:319-373-2019
MD	Hampstead, Technical Instr. Sls.	410-239-4452, FAX:410-239-4440
MA	Framingham, Paul Gallagher	508-626-2346, FAX:508-872-5677
MI	Warren, Burcaw	313-573-4605,FAX:313-573-6048
MI	Wyoming, Burcaw	616-532-2756, FAX:616-532-3847
MN	Apple Valley, Alliance Tech Prods.	612-432-2111, FAX:612-432-5060
MN	St. Paul, Alliance Tech Prods.	612-481-0518
MO	Blue Springs, KKB & Co.	816-229-0001, FAX:816-228-1466
MO	St. Louis, KKB & Co.	314-647-2400, FAX:314-647-3773
NY	Woodside, Greater Metro Sls.	718-424-1911, FAX:718-458-6791
NC	Greensboro, Adams	919-272-6838, FAX:919-273-6850
NC	Raleigh, Adams	919-972-0410,FAX:919-972-0410
OH	Cincinnati, Dietrich	513-984-8924, FAX:513-984-5351
OH	Cleveland, Dietrich	216-642-7965, FAX:216-642-3080
OK	Tulsa, Jim Wisdom & Assocs.	918-665-8899, FAX:918-665-9456
OR	Aloha, Cain Sweet	503-591-0647, FAX:503-591-0856
PA	Lansdale, Technical Instr. Sls.	215-361-7850, FAX:215-361-7803
PA	Pittsburgh, Dietrich	412-892-2992
TX	Richardson, Jim Wisdom & Assocs.	214-470-9093, FAX:214-470-9122
VA	Woodford, Technical Instr. Sls.	804-633-4586, FAX:804-633-4586
WA	Bellevue, Cain Sweet	206-462-2118, FAX:206-451-9418

Local Distributors

CA	Chatsworth, Testek Corp.	818-701-9911, FAX:818-701-6011
CA	El Monte, Marshall Inds.	818-307-6393, FAX:818-307-6299
CA	Los Alamitos, Power Specialists	310-594-9418
CA	Milpitas, R & D Elctrn. Parts	408-262-7144, FAX:408-262-7154
CO	Aurora, R & R Instrmn.	303-340-8228
FL	Orlando, Emsco	407-849-6362,FAX:407-843-0909
FL	Tampa, Sunex Elctrn. Supp., Inc.	813-885-4074, FAX:813-888-6487
IL	Niles, Joseph Elctrns.	708-297-4240, FAX:408-297-6923
IN	Indianapolis, Meunier Elctrns.	317-635-3511, FAX:317-631-4707
MD	Baltimore, Davis Instrs.	410-358-3900, FAX:410-358-0252
MD	Hunt Valley, E.I.L. Instrs., Inc.	410-584-7400, FAX:410-584-7561
MA	N. Andover, Contact East	508-682-2000, FAX:508-688-7829
MN	Minneapolis, Stark Elctrns., Inc.	612-332-1325, FAX:612-332-1783

MO St. Louis, Scherrer Instrs. 314-644-5362, FAX:314-644-3530
NJ Elizabeth, NEI 800-248-1634
NJ Mickleton, Total Video Prods., Inc. 609-423-7400, FAX:609-423-4742
NY Bayside, Technimart 718-479-1890
NY Rochester, Transcat 800-828-1470, FAX:800-395-0543
PA Philadelphia, Sunshine Instrs. 215-673-5600, FAX:215-673-5609
TN Columbia, Randolph & Williams, Inc. 615-388-7566,FAX:615-381-7516
TX Dallas, Inotek 214-243-2924,FAX:214-243-7814
TX Dallas, M. Hutton & Co. 214-239-0580, FAX:214-239-5264
TX Laredo, Franco Sls. 512-727-0003, FAX:512-727-0364
VA Richmond, Avec Elctrns. 804-359-6071, FAX:804-359-5609
WA Seattle, Radar Elec. 206-282-2511, FAX:206-282-1598
WI Appleton, Appleton Elctrns. 414-734-5767, FAX:414-734-5172

KEPCO
THE POWER SUPPLIER™
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KEPCO, INC., 131-38 Sanford Ave., Flushing, NY 11352, Tel: 718-461-7000, TWX: 710-582-2631; Empl.: 300; *Sls. Mgr.:* Frank Toich ..... **D•1777-1806**

Local Sales Offices & Reps

AL Huntsville, W. A. Brown, Inc. 205-830-9224
AZ Mesa, Aztec Entprs. 602-649-9158
CA Arcadia, Synertek Mktg. 818-357-0371
CA San Diego, Earle Assocs., Inc. 619-278-5441
CA Sunnyvale, N-S Westronics 408-745-1102
CO Denver, Aztec Entprs. 303-779-5285
CT Bethel, Ray Perron & Co., Inc. 203-798-0261
CT Waterbury, R. Perron Co. 203-756-9684
DC Washington, Eastern Instrmn. Corp. 301-384-8500
FL Melbourne, W. A. Brown Instrs., Inc. 407-723-0766
FL Orlando, W. A. Brown Instrs., Inc. 407-648-9660
GA Atlanta, W. A. Brown Instrs., Inc. 404-449-7160
IL Plainfield, Kepco, Inc.- Illinois 815-436-8808
LA Metairie, Data Mktg. Assocs., Inc. 504-833-3655
MD Baltimore, Eastern Instrmn. Corp. 301-792-7039
MA Boston, R. Perron Co. 617-449-6162
MI Plymouth, EQS 313-455-7920
MN Plymouth, Kepco Inc. 612-559-1128
MO St. Louis, Ramsey Assocs. 314-532-9388
NM Albuquerque, Aztec Entprs. 505-262-1688
NY Holbrook, Kepco Inc.-Long Island 516-472-5688
NY Liverpool, NTS Assocs., Inc. 315-451-1091
NY Port Chester, Radiation Elctrns., Inc. 914-937-2300
NC Cary, W. A. Brown Instrs., Inc. 919-460-1120
OH Chesterland, EQS 216-729-2222
OH Dayton, EQS 513-236-7676
OR Beaverton, H. Levinson Co. 503-690-1312
PA West Chester, Kepco,-Pennsylvania 215-594-0856
PA Wexford, EQS 412-935-0455
TX Austin, Data Mktg. Assocs., Inc. 512-338-4701
TX Dallas, Data Mktg. Assocs., Inc. 214-661-0300
TX Houston, Data Mktg. Assocs., Inc. 713-579-2995
TX San Antonio, Data Mktg. Assocs., Inc. 210-342-3031
UT Salt Lake City, Aztec Entprs., Inc. 801-467-4675
WA Seattle, H. Levinson Co. 206-382-1300
WA Seattle, KAM Elctrns. 206-382-1300
WI Milwaukee, Star Engineering 414-645-3680
Can Montreal, P.Q., Multitest Elctrns., Inc. 514-337-0723
Can Ottawa, Multitest Elctrns., Inc. 613-727-0848
Can Scarborough, Ont., Multitest Elctrns., Inc. 416-609-8396

KEPRO CIRCUIT SYSTEMS, 630 Axminister Dr., Fenton, MO 63026-2992, Tel: 314-343-1630, FAX: 314-343-0668; FSC No.: 5999; Empl.: 17; *Sls. Mgr.:* Jeff R. Keil; *Dist. Mgr.:* Jeff R. Keil

KESSLER-ELLIS PRODS., 120 1st Ave., Atlantic Highlands, NJ 07716, Tel: 908-291-0500, 800-631-2165, FAX: 908-291-8097; FSC No.: 28222; Empl.: 55

KESTER SOLDER DIV., Litton Sys., Inc., 515 E. Touhy Ave, Des Plaines, IL 60018, Tel: 708-297-1600, FAX: 708-390-9338; Empl.: 425; *Sls. Mgr.:* Nick Bohun; *Dist. Mgr.:* Carl Voelkel

KESTREL SYSTEMS CO., 948 N. Hwy 101 74, Leucadia, CA 92024, Tel: 619-944-2957, FAX: 619-944-6010; Empl.: 6; *Sls. Mgr.:* Mark J. Prager

KETEMA

FAX: 714-630-4131

KETEMA/RODAN DIVISION, 2900 Blue Star St., Anaheim, CA 92806, Tel: 714-630-0081; FSC No.: 15454;DESC-EQP-75-1387; Empl.: 100; *Sls. Mgr.:* Helen Hannah ..... **B•1876-1878**

Local Sales Offices & Reps

AL Madison, Benchmark Tech. Sls. 205-464-0033
AZ Scottsdale, TC Elctrn. Sls., Inc. 602-994-5153
CA Alpine, Wes-K/Raltech 619-445-1126
CA Chatsworth, Wes-K/Raltech 818-700-0933
CA Los Altos, W.W. Posey Co. 415-969-7635
CO Westminster, Straube Assocs. 303-426-0890
FL Winter Springs, T-Squared Mktg. 407-699-9992
GA Norcross, Benchmark Tech. Sls. 404-446-1711
IL Inverness, Heartland Tech. Mktg. 708-358-6622
IN Ft. Wayne, Menze Sls. Co. 219-747-5616
IA Cedar Rapids, M.I.N.K. Assocs. Inc. 319-393-0373
KS Overland Park, M.I.N.K. Assocs., Inc. 913-341-8309
MA Framingham, Marathon Sls. Ltd. 508-875-3566
MN Mendota Hgts., G-II Sls. 612-454-3086
MO Bridgeton, M.I.N.K. Assocs., Inc. 314-291-5454
NJ Moorestown, TAI Corp. 609-778-5353
NY Islip, Cogent Technlg. Assoc. 516-277-7101
NY Katonah, Cogent Technlg. Assocs. 914-232-2500
NY Rochester, R.M. Scanlon & Assoc. 716-646-1349
NY Syracuse, R.M.-Scanlon Assocs. 315-463-7682
NY Webster, R.M. Scanlon Assocs. 716-671-6809
NC Raleigh, Benchmark Tech. Sls. 919-850-0633
OR Beaverton, Blair-Hirsh Co. 503-641-1875
TX Bedford, R-Squared/El-Tec 817-268-2896
TX Dallas, R-Squared/El-Tec 214-702-8566
TX Houston, R-Squared/El-Tec 713-820-3210
TX Round Rock, R-Squared/El-Tec 512-255-4245
UT Salt Lake City, Straube Assocs. 801-263-2640
WA Lynnwood, Blair-Hirsh Co. 206-774-8151
WI Brookfield, Heartland Tech. Mktg. 414-789-6860
Can Mississauga, Ont., Bestec Elctrns. Ltd. 416-671-1077

Local Distributors

CA Chatsworth, Passive Comps. 818-700-8838
CA Los Alamitos, Dexter Magnetic Matls. 714-952-2091
CA Riverside, Elctrn. Supp. 714-683-7300
CA San Diego, Elctrn. Supp. 619-693-8222
CA San Jose, Elctrn. Supp. 408-453-3770
CA Sunnyvale, Dexter Magnetic Matls. 408-738-1080
CA Torrance, TSC Elctrns. Ltd. 310-534-2739
GA Norcross, Dexter Magnetic Matls. 404-448-4998
IL Chicago, Leeds Elctrns., Inc. 312-625-3800
IL Elk Grove Vl, Dexter Magnetic Matls. 708-956-1140
MA Billerica, Dexter Magnetic Matls. 508-663-7500
MA Wilmington, North Star Elctrns. 508-657-5155
MN Chanhassen, Dexter Magnetic Matls. 612-934-4635
MN Plymouth, Leeds Elctrns., Inc. 612-557-1277
NY Hicksville, Dexter Magnetic Matls. 516-822-3311
NY Rochester, North Star Elctrns. 716-244-9846
OH Toledo, Dexter Magnetic Matls. 419-385-4621
TX Carrollton, North Star Elctrns. 214-980-2999
TX Richardson, Dexter Magnetic Matls. 214-699-1121
WI Brookfield, Leeds Elctrns., Inc. 414-789-6995
Can Mississauga, Ont., R-Theta, Inc. 416-890-0221

KEWAUNEE SCIENTIFIC CORP., Technical Workstation Div., 901 FM 20, P.O. Box 930, Lockhart, TX 78644, Tel: 512-398-5292, TELEX: 752706, FAX: 512-398-5104; Empl.: 165 (This Location) 800 (Company Wide); *Sls. Mgr.:* Frank Johnson, Dir. Sls./Mktg.

KEYMARC ELECTRONICS, INC., 2310 205th St., Ste. 101, Torrance, CA 90501, Tel: 310-212-7724, FAX: 310-212-6545; Empl.: 35; *Sls. Mgr.:* Robert Chan; *Dist. Mgr.:* James A. Sia ..... **C•1595-1601**

Local Sales Offices & Reps

AL Huntsville, L & D Sls. 205-837-1469
AZ Scottsdale, Summit Sls. 602-998-4850
CA Santa Clara, Cindel 408-988-8331
CT Bloomfield, Zaslow Sls. 203-242-7781
DE Denver, TechRep Sls. 303-758-7031
FL Del Ray Bch., Phelps Assocs., Inc. 407-276-7591
GA Dunwoody, L & D Sls. 404-395-7079
IL Palatine, Vine Sls. 708-934-5476
MN Minneapolis, Holmgren & Assocs. 612-574-9983
NY Islip, Cogent Tech. Assoc. 516-277-7101
NC Raleigh, L & D Sls. 919-879-5301
OR Beaverton, Elctrn. Sources 503-627-0838
TX Dallas, Rem Air Comps. Corp. 214-234-1069
WA Bellevue, Elctrn. Sources, Inc. 206-451-3500
Can Vancouver, Fairwest Sls. 604-685-1473

Local Distributors

CA Gardena, California Switch & Signal 310-538-9830
CO Littleton, Display Plus 303-730-7333
NH Atkinson, Astrum Elctrns. 603-898-3399
OR Beaverton, Comp. Resources, Inc. 503-641-8488
TX Tomball, Wofford Elctrns., Inc. 713-351-2255

KEYSTONE CARBON, Thermistor Div., 1935 State Street, St. Marys, PA 15857, Tel: 814-781-1591, FAX: 814-781-7648; FSC No.: 75-263; Empl.: 1200; *Sls. Mgr.:* John A. Brock; *Dist. Mgr.:* John A. Brock ..... **B•1879-1883**

Local Sales Offices & Reps

AZ Tempe, Border States Tech. 602-839-1053
CA Arcadia, Van Gott & Assoc. 818-445-9728
CA San Jose, Westron Assoc. 408-264-4070
CA Santee, ProSales 619-596-2190
CT Wethersfield, L.J. Labant 203-529-0048
GA Marietta, J.J. Arnold 404-427-1062
IL Crystal Lake, David J. Brock 815-477-8966
IN Fort Wayne, R.O. Whitesell & Assocs. 219-489-0588
IN Indianapolis, R.O. Whitesell & Assocs. 317-876-9000
IN Kokomo, R.O. Whitesell & Assocs. 317-457-9127
MI Farmington Hills, J.L. Montgomery Assocs. 313-489-0099
MN Minneapolis, Dave Marrone 612-566-6573
NM Albuquerque, Border States Tech. 505-292-7400
NY Rochester, Foster & Wager 716-385-7744
OH Cincinnati, R.O. Whitesell & Assocs. 513-528-5644
OH Cleveland, R.O. Whitesell & Assocs. 216-447-9020
OH Columbus, R.O. Whitesell & Assocs. 614-888-9396
OH Dayton, R.O. Whitesell & Assocs. 513-298-9546
NC Cary, J. E. Shea 919-481-2475
PA Pittsburgh, R.O. Whitesell & Assocs. 412-963-6161
TX Dallas, Benson Engrg. 214-342-0438
TX Houston, Benson Engrg. 713-333-3112
Can Birmingham, Mi, Gregory J. Lukas 313-642-9155

Keystone's Natl. Distrs. for all locations

Local Distributors

AL Huntsville, Newark Elctrns. 205-837-9091
AZ Phoenix, Allied Elctrns. 602-437-9080
CA Los Angeles, Newark Elctrns. 800-367-3573
CO Denver, Newark Elctrns. 303-757-3351
CT Cheshire, Allied Elctrns. 203-272-7730
FL Plantation, Newark Elctrns. 305-424-4400
GA Atlanta, Dexter Corp. 404-448-4998
IL Newark Elctrns. 800-367-3573
IL Elk Grove Vlg., Dexter Corp. 800-345-4082
IN Indianapolis, Allied Elctrns. 317-875-0448
KY Louisville, Allied Elctrns. 502-452-2293
MA Billerica, Dexter Corp. 508-663-7500
MI Farmington Hills, Newark Elctrns. 313-737-5150
MN Digi-Key Corp. 800-344-4539
MN Thief River Falls, Digi Key 800-344-4539
MO St. Louis, Newark Elctrns. 314-291-7031
NY Buffalo, Summit Distrs. 800-678-6648
OH Toledo, Dexter Corp. 419-385-4621
PA Summit Distrs. 800-678-6648
TX Fort Worth, Allied Elctrns. 800-433-5700
EXP Germany, Dexter Corp. 089-857-3071
Can Summit Distrs. 800-678-6648
Can Mississauga, Ont., Newark Elctrns. 416-670-7799

KEYSTONE ELECTRONICS CORP., 31-07 20th Rd., Astoria, NY 11105-2017, Tel: 718-956-8900, TELEX: 35-3700, FAX: 718-956-9040; FSC No.: 91833; Empl.: 80; *Sls. Mgr.:* Charles Gold

KEYTEK INSTRUMENT CORP., 260 Fordham Rd., Wilmington, MA 01887, Tel: 508-658-0880, TELEX: 951389 KEYTEK BURL, FAX: 508-657-4803; *Sls. Mgr.:* Michael Hopkins

KEYTEK KEYBOARDS CANADA INC., 16 Mary St., Units 3 & 4, Aurora, Ontario, Canada L4G 3W8, Tel: 416-727-9491, FAX: 416-727-7118; Empl.: 20

KEYTRONICS, INC., 707 North St., Endicott, NY 13760, Tel: 607-754-5405, FAX: 607-754-9791; FSC No.: 51181; Empl.: 75; *Sls. Mgr.:* Judith M. Olson

KGS ELECTRONICS, INC., 418-A E. Live Oak Ave., Arcadia, CA 91006, Tel: 818-574-1175, FAX: 818-574-0553; Empl.: 60 ..... **D•1807, 2276**

Local Sales Offices & Reps

NJ Wayne, BIZ Intl. 201-694-2417
TX Hurst, McGarrah & Assocs. 817-268-3557

KIKUSUI

KIKUSUI INTERNATIONAL CORP.

FAX: 310-986-1624

KIKUSUI INTERNATIONAL CORP., 1980 Orizaba Ave., Signal Hill, CA 90804-1203, Tel: 310-986-1677, 800-545-8784; *Sls. Mgr.:* Joe Engler; *Dist. Mgr.:* Tom Haygarth ..... **D•1289, 1409, 1808-1809**

Local Sales Offices & Reps

AZ	Chandler, Vic Myers Assocs.	602-345-6449
CA	Santa Clara, W-J Elctms. Sls.	408-982-9222
CA	Torrance, Amasco South	213-781-9494
CO	Littleton, Vic Myers Assocs.	303-730-7313
FL	W. Melbourne, Trilogic Sunforce	407-722-1324
HI	Honolulu, Honolulu Elctrns.	808-949-5564
IL	Elmhurst, Sector Engrg. Sls.	708-530-7850
IN	Indianapolis, Sector Engrg. Sls.	317-253-9221
MD	Wheaton, KMA Sls.	301-460-8876
MA	Billerica, Eastronix	508-670-2400
MI	Bloomfield Hills, MacKellar Assoc. Inc.	313-335-4440
MN	Minneapolis, Sector Engrg. Sls.	612-378-2123
NJ	Ridgefield Park, Scientific Dvcs. East	201-440-1400
NM	Albuquerque, Vic Myers Assocs., Inc.	505-884-6878
NC	Raleigh, Trilogic Sunforce	919-233-0270
OH	Columbus, MacKellar Assoc. Inc.	614-848-3552
OR	Wilsonville, Syntek, Inc.	503-682-2750
PA	Horsham, PA Scientific Dvcs.	215-956-0700
UT	Salt Lake City, Vic Myers Assoc. Inc.	801-581-1760
WA	Bellevue, Syntek, Inc.	206-462-7700
WI	Milwaukee, Sector Engrg. Sls.	414-352-8280
PR	San Juan, David S. Tement	809-762-2688
Can	Burnaby, BC, Interfax Sys., Inc.	604-430-1410
Can	Nepean, Ont., Interfax Sys., Inc.	613-726-8888
Can	Rexdale, Ont., Interfax Sys., Inc.	416-674-8970
Can	St. Laurent, Que., Interfax Sys., Inc.	514-336-0392

KILO INTERNATIONAL, 1952 Ironton Blvd., Provo, UT 84606, Tel: 801-377-5530, FAX: 801-377-5573; FSC No.: 05129; Empl.: 50; *Sls. Mgr.:* James T. Davis; *Dist. Mgr.:* James T. Davis

Kilovac®

Corporation

FAX: 805-684-9679

KILOVAC CORP., Box 4422, Santa Barbara, CA 93140-4422, Tel: 805-684-4560, App. Hot Line 800-253-4560; FSC No.: 18741; Empl.: 107; *Sls. Mgr.:* Patrick McPherson, VP Sls. & Mktg. ..... **B•1540-1545**

Local Sales Offices & Reps

CA	Chatsworth, Cygnus Sls. Engrg. Corp.	818-727-0312
CA	Morgan Hill, Power Connection	408-779-8888
CO	Englewood, Omega Limited	303-762-1921
FL	Orlando, Comp. Design Mktg.	407-240-3903
GA	Atlanta, Electro Tech	404-262-1522
GA	Norcross, Benchmark Technical	404-446-1711

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IL	Elgin, Gassner & Clark, Inc.	708-695-9540
IA	Cedar Rapids, Seltec Sls. Corp.	319-364-7660
KS	Wichita, Baka Corp.	316-682-8411
MN	Bloomington, Jay Borman Sls.	612-830-1337
MO	St. Louis, Baka Corp.	314-569-1250
NH	Nashua, Bell Controls	603-882-6984
NY	Great Neck, Trionic Assocs.	516-466-2300
NC	Raleigh, Benchmark Tech.	919-850-0633
OH	Cleveland, Electronic Components, Inc.	216-331-5330
OH	Columbus, Electronic Comp., Inc.	614-231-2318
OH	Miamisburgh, Electronic Comps., Inc.	513-866-3340
OR	Beaverton, Components West, Inc.	503-642-9110
PA	Trevose, PSA North	215-245-0513
TX	Dallas, Caton Sls. Co.	214-350-1612
WA	Redmond, Components West, Inc.	206-885-5880
Can	Brit. Columbia, Macom Agencies, Ltd.	604-271-2661

KIMBALL ELECTRONIC LAB. INC., 8081 W. 21 Lane, Hialeah, FL 33016, Tel: 305-822-5792, FAX: 305-362-3125; Empl.: 15; *Sls. Mgr.:* Brenda Wright

KINEMETRICS, INC., 222 Vista Ave., Pasadena, CA 91107, Tel: 818-795-2220, TELEX: 67-5402, FAX: 818-795-0868; Empl.: 75; *Sls. Mgr.:* Mel Lund ,

KINETICSYSTEMS CORP., 900 N. State St., Lockport, IL 60441, Tel: 815-838-0005, TWX: 910-638-2831, FAX: 815-838-4424; Empl.: 100; *Sls. Mgr.:* Norman R. Ellison, Dir. Domestic Sls.

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FAX: 909-468-0505

KINGBRIGHT USA CORP., Kingbright Elec. Co., Ltd., 225 Brea Canyon Rd., City of Industry, CA 91789, Tel: 909-468-0500 ..... **B•1180**

For all states not listed contact Mfr. at 909-468-0500

Local Sales Offices & Reps

AL	Madison, Contact Manufacturer	909-468-0500
AZ	Tempe, ACS of Arizona	602-731-9711
CO	Denver, Parker-Webster	303-841-4888
CO	Parker, Parker Wesbster Sls.	303-841-4888
FL	Ft. Lauderdale, Solutions	305-989-2931
IL	Buffalo Grove, Service Technlgs.	708-634-4995
IN	M/S Sls.	219-436-3023
IN	Greenwood, M/S Sls.	317-881-0110
IA	Davenport, Rush & West	319-388-9494
KS	Olathe, Rush & West	913-764-2700
MD	Gaithersburg, KSA of New England	508-443-5881
MA	Sudbury, KSA of New England	508-443-5881
MN	Oakdale, Complete Sls.	612-731-2923
MO	St. Louis, Rush & West Assocs.	314-965-3322
NJ	N. Brunswick, Unirep	908-940-1851
NJ	Tenafly, Michel Assocs.	201-894-8964
NY	East Syracuse, Fountain, Young & Co.	315-437-7733
OH	Cleveland, RK Comps. Sls.	216-642-9312
PA	Pittsburgh, RK Comps. Sls.	412-775-0747
UT	Murray, Parker Webster Sls.	801-266-9939
WI	Colgate, Svc. Technlgs., Inc.	708-634-4995
Can	Churchill, Ont., Rystyn	705-456-3213

Local Distributors

AZ	Tempe, CDS/AZ	602-829-7981
AR	N. Little Rock, CDS/AR	501-851-3137
CA	Chatsworth, Passive Comps. Inc.	818-700-8838
CA	Costa Mesa, Orange Cnty. Comps.	909-979-3597
CA	Los Angeles, Electric Switches Inc.	213-660-1310
CA	Milpitas, Sierra West Elctms.	408-945-1050
FL	Lauderdale, Lantern Elctrns.	305-979-3188
FL	W. Palm Bch., Atlantic Elctrns., Inc.	813-531-5900
IL	Morton Grove, Nedco Elctrns.	708-967-0500
IA	Des Moines, Mid-State Distbg. Co.	515-244-7231
MN	Eitzen, Capacitor Assoc.	507-495-3306
MO	St. Louis, Ric-Tronics, Inc.	314-997-4707
NJ	Bloomfield, Solid State, Inc.	201-429-8700
NY	East Syracuse, ADR Technlgs., Inc.	315-437-7087
NY	Melville, Kelvin Elec.	516-433-1700
OH	Twinsburg, Schuster Elec.	216-425-8134
OR	Salem, Light-Waves Elec.	503-585-4770
TX	Carrollton, LCD Elctrns., Inc.	214-245-0600
TX	Houston, CDS/Houston	713-868-4018
TX	Richardson, Ewing Elctrns., Inc.	214-231-6725
UT	Nephi, CDS/UT	801-623-2908
WA	Kent, Shannon Indl.	206-575-8600
EXP	City of Industry, Kingbright USA Corp.	909-468-0500

Can Montreal, Megastar Electroniques, Inc. 514-329-0042

KINGS ELECTRONICS CO., INC., 40 Marbledale Rd., Tuckahoe, NY 10707, Tel: 914-793-5000, TELEX: 6818293, FAX: 914-793-5092; Empl.: 308; *Sls. Mgr.:* E. Lagarto; *Dist. Mgr.:* Joel Cohn

KIPP & ZONEN, Enraf-Nonius, 390 Central Ave., Bohemia, NY 11716, Tel: 516-589-2885, 800-645-1025, FAX: 516-589-2068; Empl.: 25; *Sls. Mgr.:* Joe Carlin; *Dist. Mgr.:* Joe Carlin

KIP TRANSFORMERS INC., P.O. Box 6162, 13 Town Line Rd., Wolcott, CT 06716, Tel: 203-758-7085, FAX: 203-596-8041

KIRKWOOD INDUSTRIES INC., 4855 West 130 St., Cleveland, OH 44135, Tel: 216-267-6200, TELEX: 980630, FAX: 216-362-3804; *Sls. Mgr.:* Tom Bauer

KISTLER INSTRUMENTS CORP., 75 John Glenn Dr., Amherst, NY 14228-2171, Tel: 716-691-5100, FAX: 716-691-5226; Empl.: 67; *Sls. Mgr.:* Mike Murphy

KISTLER-MORSE, P.O. Box 3009, Redmond, WA 98073, Tel: 206-881-8000, FAX: 206-883-4893; *Sls. Mgr.:* Stan Isenhath, Jack Smith

KIT MASTER, 11 South Broad St., Peekskill, NY 10566, Tel: 914-736-1010, FAX: 914-736-1899 ..... **C•1541**

KLC/KARL LAMBRECHT CORP., 4204 N. Lincoln Ave., Chicago, IL 60618, Tel: 312-472-5442, FAX: 312-472-2724; Empl.: 29; *Sls. Mgr.:* Raymond Lambrecht

KLEIN TOOLS, INC., 7200 McCormick Blvd., P.O. Box 599033, Chicago, IL 60659-9033, Tel: 708-677-9500, TELEX: 72-4431; Empl.: 1000; *Sls. Mgr.:* Ron Bost

KLOCKNER MOELLER, 25 Forge Pkwy., Franklin, MA 02038, Tel: 508-520-7080, FAX: 508-520-7084; Empl.: 250; *Sls. Mgr.:* T. Thornton; *Dist. Mgr.:* P. Feruglio

KMC SYSTEMS, INC., 140 Greenwood Ave. (Bldg. 3), Midland Pk., NJ 07432, Tel: 201-447-0007, FAX: 201-447-0014; Empl.: 35; *Sls. Mgr.:* E. Verder

KMS ADVANCED PRODUCTS, INC., 700 KMS Place, P.O. Box 1868, Ann Arbor, MI 48106-1868, Tel: 313-769-1780, FAX: 313-769-8660; Empl.: 50; *Sls. Mgr.:* Bill McManus

KNIGHTFIRE TECHNOLOGY, 2139 University Dr., Ste.211, Coral Springs, FL 33071, Tel: 305-344-3682, FAX: 305-752-4353; FSC No.: FSC 6130; Empl.: 4; *Sls. Mgr.:* Sue Pantelakis

KNOWLEDGEWARE, INC., 3340 Peachtree Rd., N.E., Atlanta, GA 30326, Tel: 404-231-8575, TELEX: 544080; FSC No.: 7030-0003; Empl.: 780; *Sls. Mgr.:* Robert Chamberlain, Sr. V.P., Sls.

KNOWLES ELECTRONICS, INC., 1151 Maplewood Dr., Itasca, IL 60143, Tel: 708-250-5100, TELEX: 433-0330, FAX: 708-250-0575; *Sls. Mgr.:* W. Jeff Taylor

KNURR

FAX: 805-584-8371

KNURR USA INC., Knurr A.G., 1890 N. Voyager Ave., Simi Valley, CA 93063, Tel: 805-526-7733; Empl.: 20; *Sls. Mgr.:* Georg Wolf (acting) ..... **C•1050-1052**

Local Sales Offices & Reps

AL	Huntsville, Jim Springer Inc.	205-883-4163
AZ	Phoenix, Facilutions	602-581-5253
CA	Daly City, Knurr USA	415-878-3300
CA	Laguna Hills, Knurr USA	714-581-8350
CA	Sherman Oaks, Knurr USA	818-986-3455
CA	Simi Valley, Knurr USA, Inc.	805-526-7733
CO	Englewood, Elctm. Comp. Sys.	303-762-9576
FL	Longwood, Mathias Assocs. Inc.	407-682-1700
IL	Barrington, MCT Elctms.	708-438-3200
MA	Bellingham, OEM Mktg. & Sls.	508-528-4983
MI	Ann Arbor, Lintott Assoc.	313-662-1611
MN	Brunsville, Schneiberg Co.	612-890-2416
NH	Salem, OEM Mktg. & Sls.	603-893-0009
NJ	Fair Lawn, The Jette Grp.	201-794-9610

NY Babylon, The Jette Grp. 516-669-6788
NY Rochester, Tech. Comp. Sls. 716-342-2406
OH Westlake, KRW Sls. 216-871-7521
PA West Chester, Pantech Inc. 215-436-5440
SC Columbia, Knurr USA East 803-871-6147
TX Dallas, Kite 214-986-0321
VA Springfield, Pantech Inc. 703-451-5700
WA Seattle, Temper Tech. Mktg. 503-292-8201
Can Oakville, Ont., Elctrn. Design Consulting 416-827-5398

Local Distributors

CO Aurora, Ty Henkin 303-364-1000
OR Portland, Radar Elec. Co., Inc. 503-232-3404
WA Seattle, Radar Elec. Co., Inc. 206-282-2511

KOA

FAX: 814-362-8883

KOA SPEER ELECTRONICS, Bolivar Dr., P.O. Box 547, Bradford, PA 16701, Tel: 814-362-5536; FSC No.: 09021; Empl.: 3000; *Sls. Mgr.:* L. G. Holzwarth; *Dist. Mgr.:* Fred L. Schenfield ... **A•1002, 1095, 1242-1243, 1858, 1958-1971**

Local Sales Offices & Reps

AL Huntsville, Cartwright & Bean 205-830-1540
AZ Phoenix, Howe & Howe Sls. 602-264-7971
CA Garden Grove, ELSCO Elctrns. 714-891-4621
Can Mississauga, Ont., Indigo Elctrns. 416-670-0284
CA San Diego, Elsco Elctrns., Inc. 619-292-1771
CA Santa Clara, Caltron Comps. 408-980-0181
CO Boulder, R. G. Entprs. 303-447-9211
CT Plainville, Northeast Representatives 203-747-2423
FL Boca Raton, APM Assocs. 407-395-7308
FL Tampa, APM Assocs. 813-886-2457
FL Winter Park, APM Assocs. 407-678-2777
GA Norcross, Cartwright & Bean 404-368-0160
IL Arlington Hgts., C. L. Greenslade Sls. 708-593-3450
IN Fort Wayne, John F. Kilfoil 219-483-6208
IA Cedar Rapids, Spectrum Sls. 319-366-0576
KS Overland Pk., Spectrum Sls. 913-648-6811
LA Covington, Cartwright & Bean 504-892-1780
MA Hingham, Northeast Representatives 617-749-8700
MI Troy, C. B. Jensen & Assocs. 313-643-0506
MN Edina, Grayden & Flemmer 612-941-1120
MS Jackson, Cartwright & Bean 601-981-1170
MO Florissant, Spectrum Sls. 314-921-1313
NH Mont Vernon, Northeast Representatives 603-880-8199
NJ Cherry Hill, Metz-Benham Assoc. 609-424-0404
NM Albuquerque, SynTech 505-266-7951
NY East Rochester, Tri-Tech Elctrns. 716-385-6500
NY Fayetteville, Tri-Tech Elctrns. 315-446-2881
NY Fishkill, Tri-Tech Elctrns. 914-897-5611
NY Great Neck, MOS Assocs. 516-487-3966
NC Charlotte, Cartwright & Bean 704-536-0303
NC Raleigh, Cartwright & Bean 919-876-4130
OH Cincinnati, John F. Kilfoil 513-791-6150
OR Tigard, Earl & Brown Co. 503-639-2100
PA Pittsburgh, Catalyst Sls. Co. 412-826-3434
PA Wynnewood, Metz-Benham Assocs. 215-896-7300
TN Knoxville, Cartwright & Bean 615-693-7450
TN Memphis, Cartwright & Bean 901-362-8345
TX Lewisville, Jim Hughes 214-221-1536
WA Redmond, Earl & Brown Co. 206-885-5064
PR San German, Digit-Tech Sls. 809-892-4260
Can Kanata, Ont., Indigo Elctrns. 613-591-1053
Can Montreal, Que., Indigo Elctrns. 514-696-6104

Local Distributors

AL Huntsville, Reptron 205-722-9500
AZ Ftn. Hill, RCD Inds. 602-483-6412
AZ Scottsdale, Shelley- Ragon 602-998-0399
AZ Tempe, T.T.I. 602-431-1191
AR Little Rock, Carlton-Bates 501-562-9100
CA Campbell, Lartronics 408-379-6454
CA Chatsworth, MIL-Comm Distrs. 818-998-3111
CA Chatsworth, Shelley-Ragon 818-998-3333
CA Costa Mesa, Eric Elctrns. 714-751-1185
CA Fountain Valley, Comps. Ctr. 714-979-0433
CA Garden Grove, Natl. Elctrns. 714-892-7749
CA Huntington Beach, SMD, Inc. 714-841-4556
CA Irvine, KELEX 714-863-1230
CA Milpitas, T.T.I. 408-946-5577
CA Mission Hills, T.T.I. 818-891-8885
CA San Diego, Shelley-Ragon 619-453-7133
CA San Diego, T.T.I. 619-748-2025
CA San Jose, Capstone Elctrns. 408-453-9804
CA San Jose, Eric Elctrns. 408-432-1111
CA San Jose, Jaco 408-432-9290
CA San Jose, Shelley Ragon 408-432-0600
CA San Jose, Surface Mount Distrs. 408-432-7274
CA Santa Ana, TTI 714-641-9393
CA Santa Clara, Components Ctr. 408-988-3751
CA Tustin, Capstone Elctrns. 714-730-0349
CA Tustin, Jaco Elctrns. 714-258-9003
CA Westlake Village, Jaco 805-495-9998
CO Aurora, Capstone Elctrns. 303-375-1300
CO Boulder, R. G. Entprs. 303-447-9211
CO Denver, T.T.I. 303-429-6806
CO Englewood, Shelly-Ragon Elec. Parts 303-762-0670
CT Wallingford, Midstate Elctrns. 203-265-9900
CT Wallingford, T.T.I. 203-284-7474
CT Wallingford, Utronics 203-265-2724
FL Boca Raton, Jaco Elctrns. 407-241-7943
FL Clearwater, Atlantic Elctrns. 813-531-5900
FL Ft. Lauderdale, Reptron Elctrns. 305-735-1112
FL Largo, Shelley-Ragon 813-545-0057
FL Orlando, TTI 407-859-1000
FL Tampa, Reptron 813-855-4656
FL Tampa, Reptron Elec. 813-854-2351
FL W. Palm Beach, Atlantic Elctrns. 407-686-8553
GA Norcross, Reptron 404-446-1300
GA Norcross, T.T.I. 404-662-0911
IL Bensenville, Goold Elctrns. 708-860-7171
IL Glendale Heights, Shelley-Ragon 708-529-9977
IL Itasca, Capstone Elctrns. 708-250-0300
IL Northbrook, Classic Comp. Supp. 708-272-9650
IL Rosemont, Advent Elctrns. 708-298-4210
IL Schaumburg, Reptron Elctrns. 708-882-1700
IL Schaumburg, TTI 708-884-6500
IN Indianapolis, Advent Elctrns. 317-872-4910
IA Cedar Rapids, Advent Elctrns. 319-363-0221
IA Cedar Rapids, Dee Elctrns. 319-365-7551
MD Baltimore, Radio Elec. Svc. Co. 301-931-8200
MD Beltsville, Radio Elec. Svc. 301-937-9100
MD Columbia, Jaco Comps. 301-995-6620
MD Columbia, T.T.I. 301-995-1331
MA Billerica, Baldwin Comp. Ctr. 617-667-6710
MA Chelmsford, Shelly-Ragon 508-250-9666
MA Norwood, EMTEL Electronics 617-769-9500
MA Wilmington, Capstone Elctrns. 508-657-5874
MA Wilmington, North Star Elect. 508-657-5155
MA Wilmington, T.T.I. 508-658-4700
MI Ann Arbor, Wedemeyer 313-665-8611
MI Farmington Hills, Advent Elctrns. 313-477-1650
MI Farmington Hills, Key Elctrns. 313-489-5455
MI Livonia, Reptron Elctrns. 313-525-2700
MN Hibbing, Minn Tech Elctrns. 218-262-5228
MN Minnetonka, Reptron 612-938-0000
MN Minnetonka, T.T.I. 612-933-8555
MN St. Paul, Shelley-Ragon Elctrns. 612-642-2828
MO Independence, Shelley-Ragon Elctrns. 816-254-3410
MO St. Louis, Franklin Elctrns. 314-429-3111
NE Lincoln, Scott Elctrns. 402-466-8221
NV Las Vegas, Kiesub Corp. 702-733-3888
NH Nashua, Brevan Elctrns. 603-889-7230
NJ Mount Laurel, TTI Inc. 609-234-6400
NJ Mt. Laurel, Capstone Elctrns. 609-727-7800
NJ Rockaway, Nasco 201-625-7777
NM Albuquerque, Betatron 505-821-1122
NY Amherst, Standard Elctrns. 716-691-3801
NY Bohemia, Prime Comps. 516-244-8190
NY Buffalo, Summit Distrs. 716-887-2845
NY Hauppauge, Jaco 516-273-5500
NY Rochester, Summit Distrs. 716-334-8110
NY Ronkonkoma, Baldwin Comp. Ctr. 516-588-5700
NY Ronkonkoma, T.T.I. 516-737-2000
NC Greensboro, Golden Elctrns. 919-294-4653
NC Raleigh, Capstone Elctrns. 919-954-0600
NC Raleigh, Jaco 919-876-7767
NC Raleigh, Reptron 919-832-3117
NC Raleigh, Resco-Raleigh 919-781-5700
OH Cleveland, Roberts Elect. Corp. 216-238-1711
OH Dayton, T.T.I. 513-898-8330
OH Independence, TTI 216-328-9755
OH Solon, Reptron 216-349-1415
OK Tulsa, Altair Co. 918-252-5781
OR Beaverton, Murphy Elctrns. 503-642-2001
PA Erie, Rem Elctrns. 814-453-5626
PA Harrisburg, Cumberland Elctrns. 717-233-5883
PA Philadelphia, PEI/Genesis 215-673-0400
PA Philadelphia, Sager Electronics 215-464-4336
PA Philadelphia, Shap 215-969-3300
RI Pawtucket, Major Edwards 401-725-7400
TX Addison, Jaco/QC Elctrns. 214-733-4300
TX Carrollton, Capstone Elctrns. 214-380-9049
TX Fort Worth, Chaparral Elctrns. 817-232-2777
TX Fort Worth, TTI 817-847-6666
TX Ft. Worth, Carlton Bates 817-293-5558
TX Ft. Worth, T.T.I. 817-740-9000
TX Ft. Worth, T.T.I. Inc. 817-595-3100
TX Houston, Altair Co. 713-462-3029
WA Redmond, Murphy Elctrns. 206-881-1234
WA Redmond, Shelley-Ragon 206-883-2220
WA Redmond, T.T.I. 206-882-0291
WI Oconomowac, G W Elctrns. 414-567-9445
Can Calgary, Alb., A. Deskin Sls. 403-270-4440
Can Edmonton, Alb., A. Deskin Sls. 403-466-2106
Can Markham, Ontario, Semad 416-475-8500
Can Transcona, Manit., A. Deskin Sls. 204-224-1321
Can Vancouver, B.C., A. Deskin Sls. 604-324-8343

KOBOLD INSTRUMENTS INC., 1810 Parkway View Dr., Pittsburgh, PA 15205, Tel: 412-788-2830, 800-998-1020, FAX: 412-788-4890; *Sls. Mgr.:* James M. Hall

KOEP PRECISION STANDARDS, INC., 500 B Great Bay Blvd., Tuckerton, NJ 08087, Tel: 609-296-9686, FAX: 609-296-9733; FSC No.: 57114; Empl.: 3; *Dist. Mgr.:* N/A

KOLIN INDS., INC., Box 300, Dept. EEM, Pound Ridge, NY 10576, Tel: 914-764-5775, FAX: 914-764-5785; Empl.: 30; *Sls. Mgr.:* J. Kolinsky

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FAX: 703-731-0847

KOLLMORGEN MOTION TECHNOLOGIES GROUP, 201 Rock Rd., Radford, VA 24141, Tel: 800-77-SERVO; FSC No.: 11384; Empl.: 343; *Sls. Mgr.:* Pete Dougherty ... **B•1273-1277**

Local Sales Offices & Reps

AZ Mesa, Western Automation Inc. 602-830-6315
AZ Tempe, Thor Engrg. 602-438-8494
CA Corona, Western Automation, Inc. 714-278-1900
CA Hermosa Bch., Western Automation Inc. 310-798-8532
CA La Jolla, KSA Inc. 619-453-5720
CA Laguna Hills, Industrial Drives 714-581-3626
CA Laguna Hills, Western Automation 714-859-6988
CA Meadow Vista, O'Donnell Assocs. North 916-878-9087
CA Milpitas, Maxim Elctrn. Sls. 408-946-6001
CA San Jose, O'Donnell Assocs. North 408-456-2950
CA San Marcos, Western Automation Inc. 619-727-8895
CA Valencia, Western Automation, Inc. 805-254-7845
CO Westminster, MJM Mktg. Inc. 303-428-9611
FL Lakeland, Ludlum Assoc., Co. Inc. 813-683-0200, 800-525-1354
GA Atlanta, Industrial Apparatus Co. 404-875-8086
IL Skokie, Koepke & Assoc. Inc. 708-581-0000
MD Annapolis, Homersmith, Inc. 301-269-6493
MA Wellesley, Electro Kinetics 617-235-9415
MI Sterling Hgts., Alliance Sls. Co. 313-726-8670
MN New Brighton, The Mackubin Grp. 612-636-5533
NJ Williamstown, Homersmith Inc. 609-567-7464
NY Commack, Indl. Drives PMI Motion Technlgs. 516-864-1000
NY E. Rochester, A&D Devices 716-385-2778
NY Plainview, Motion Control Sls. 516-756-5656
NC Charlotte, Motion Technlg. Inc. 704-525-9855, 800-438-1380
OH Columbus, Exonic Sys. 614-337-8883
OH Dayton, Exonic Sys. 513-434-4100
OH Farmersville, The Kilroy Corp. 513-696-2277
OH Medina, Cygnus 216-725-1663
OH Toledo, Exonic Sys. 419-866-8600
OH Twinsburg, Exonic Sys. 216-425-2100
OK Broken Arrow, DJ Sls. 918-258-1445
PA Downingtown, Homersmith, Inc. 215-269-3637
PA Media, Homersmith, Inc. 215-543-2434
PA Pittsburgh, Exonic Sys. 215-825-6797
TX Austin, DJ Sls. 512-258-3002
TX Dallas, DJ Sls. 214-783-8876
TX Dallas, EC Sys. Inc. 214-960-1961
TX Houston, DJ Sls. 713-690-2640
VA Radford, The Hatfield Co. 703-639-5471
WA Bellevue, Thorson Co. N.W. 206-455-9180
Can Rexdale, Ont., Canadian Drives, Inc. 416-745-1137

Local Distributors

CA Anaheim, Minarik Elec. Co. 714-994-2251
CA S. San Francisco, Steven Engrg. 800-258-9200
CO Denver, Tech Sls. Inc. 303-935-0109
CO Denver, Warren Fluid Power 303-377-2736
DE New Castle, J.C. Bennington Co. 302-322-3700
FL Orlando, Ross Equip. 407-872-0874
IL Chicago, Kelburn Engrg. Co. 312-775-8383
IN Indianapolis, J. N. Fauver Co. 317-872-3060
KY Louisville, J.N. Fauver Co. 502-267-7461
MI Madison Heights, J. N. Fauver Co. 313-585-5252
NJ Fairfield, Dodge Newark 201-575-7033
NY Rochester, Magna Prods. Corp. 716-647-2280

NC	Jamestown, HSI-Piedmont Inc.	919-883-3999
OH	Twinsburg, Exonic Sys.	216-425-2100
PA	Pittsburgh, Exonic Sys.	215-825-6797
TX	Dallas, Cates Drives & Controls	214-960-1961
TX	Houston, Cates Control Sys.	713-644-3911
TX	Houston, Resch. Des. Inc.	713-995-8591
WA	Fall City, Pacific Motion Grp.	206-222-7387
WI	Elm Grove, Triphase Automation	414-821-5099
WI	Oneida, MCL Inds. Inc.	414-434-4100

KONTES, Kimble Div. of Owens/IL, 1001 Spruce St., Vineland, NJ 08360, Tel: 800-223-7150, TWX: 510-687-8967

KONTRON ELEKTRONIK-US KONTRON ELEKTRONIK GMBH-SUB. BM, 66 Cherry Hill Dr., Beverly, MA 01915, Tel: 508-927-6575, FAX: 508-927-6511; Empl.: 30

KOOLTRONIC, INC., P.O. Box 300, Hopewell, NJ 08525, Tel: 609-466-3400, FAX: 609-466-1114; Empl.: 200; *Sls. Mgr.:* John J. Drages

KOOLTRONIC, INC., 1700 Morse Avenue, Ventura, CA 93003, Tel: 805-642-8521, FAX: 805-658-2901; Empl.: 200

KRAFT DYNATRONIX, INC., 105 Power St., Amery, WI 54001, Tel: 715-268-8118, 800-826-7172, FAX: 715-268-8183; Empl.: 25; *Sls. Mgr.:* R. W. Kappler; *Dist. Mgr.:* R. W. Kappler, Natl. Sls. Mgr.

KRECKMAN, HERB, CO., 27 Spruce Cabin Road, Cresco, PA 18326, Tel: 717-595-2212, FAX: 717-595-2024; Empl.: 4

KR ELECTRONICS, INC., 91 Avenel St., Avenel, NJ 07001, Tel: 908-636-1900, FAX: 908-636-1982; FSC No.: 55259; Empl.: 15; *Sls. Mgr.:* Bob Fiordalisi **A•1648-1649**

Local Sales Offices & Reps

CA	Anaheim, Texel	714-998-2941
CA	San Diego, Texel	619-576-2162
CA	Seal Beach, Texel	310-596-9411
CA	Simi Valley, Texel	805-582-1223
CO	Englewood, Tech. Mktg. Co.	303-989-3611
FL	Longwood, J-Squared Mktg., Inc.	407-884-0810
IL	Chicago, Tech. Sls.	312-237-7210
KS	Kansas City, Abrams & Assocs.	913-432-2303
MO	St. Louis, Abrams & Assocs.	314-569-0447
NJ	Glen Gardner, F & M Tech. Sls.	908-537-7888
OH	Kettering, Frank Bold & Assocs.	513-298-6145
TX	Richardson, Carl Tinch Sls. Co.	214-231-1322

KRENZ INSTRUMENTS, INC., 7234 Via Mariposa, Bonsall, CA 92003, Tel: 619-630-3488, FAX: 619-630-4267; Empl.: 35; *Sls. Mgr.:* Michael Merget, G.M.

KRISTEL CORPORATION, 833 Industrial Dr., West Chicago, IL 60185, Tel: 708-293-0850, FAX: 708-293-1255; Empl.: 35; *Sls. Mgr.:* Kevin Michael

Bantry Components, Inc.

FAX: 603-624-0634

KRL/BANTRY COMPONENTS, INC., 160 Bouchard St., Manchester, NH 03103, Tel: 603-668-3210; FSC No.: 18235; Empl.: 100; *Sls. Mgr.:* Bert A. Spiller **A•1973-1979**

Local Sales Offices & Reps

CA	Copperopolis, Francisco & Assocs.	800-759-9607
FL	Boca Raton, Sls. Specialists	813-754-1329
MI	Milford, Elctrn. Comp. Sls.	313-360-3790
NH	Amherst, D. A. Crowley & Assocs.	603-673-7050
NY	Port Washington, Ashtec	516-767-0336
NY	Rochester, H. C. Johnson Agencies	716-586-0777
OH	Aurora, EMA Inc.	216-562-6104
OH	Centerville, EMA Inc.	513-433-2800
OR	Beaverton, Olsen Tech. Sls. Corp.	503-643-9488
TX	Austin, Southwest Sys. Technlg.	512-467-2040
TX	Dallas, Southwest Sys. Technlg.	214-443-2688
WA	Bellevue, Olsen Tech. Sls. Corp.	206-883-7792

Local Distributors

FL	Boca Raton, NRC Elctrns.	407-241-8600
MA	Billerica, Baldwin Comps.	617-667-6710
NY	Ronkonkoma, Baldwin Comps. Center	516-588-5700,800-645-5608
PA	Harrisburg, Ad-Tech	717-939-8337

KROHN-HITE CORP., Avon Indl. Pk., Bodwell St., Avon, MA 02322, Tel: 508-580-1660, FAX: 508-583-8989; Empl.: 35 **A•1650; D•1291**

Local Sales Offices & Reps

AL	Huntsville, Gentry Assocs.	205-883-8455
AZ	Phoenix, Odyssey 1	505-345-9659
CA	Huntington Bch., Sci-Dev West	714-236-1190
CA	San Jose, Scientific Devs. West	408-554-0455
FL	Orlando, Gentry Elctrns., Inc.	407-859-4422
FL	Tampa, Gentry Elctrns., Inc.	813-888-9218
GA	Atlanta, Gentry Elctrns., Inc.	404-315-0092
IL	Chicago, Berndt Assocs.	708-632-0900
IN	Carmel, Berndt Assocs.	317-844-0114
KS	Overland Park, Ramsey Assocs.	913-541-1007
MD	Baltimore, Sci-Rep	703-385-0600
MI	Detroit, EQS Sys.	313-961-3042
MN	Minneapolis, Berndt Assocs.	612-546-2021
MO	St. Louis, Ramsey Assocs.	314-532-9386
NJ	Ridgefield Park, Scientific Dvcs. East	201-440-3430
NM	Albuquerque, Odyssey 1	505-265-6645
NY	Syracuse, Labtronics	315-455-7314
OH	Chesterland, EQS Sys.	216-729-2222
OH	Columbus, EQS Sys.	614-228-3453
PA	Pittsburgh, EQS Sys.	216-729-2222
PA	Spring House, Scientific Devices East	215-643-3335
RI	Narragansett, Pat Assocs.	401-783-9598
SC	Columbia, Gentry Elctrns., Inc.	803-772-6786
TN	Knoxville, Gentry Elctrns., Inc.	615-584-0281
TX	Richardson, Scientific Sls. Co.	214-231-6541
VA	Fairfax, Sci-Rep, Inc.	703-385-0600
WA	Bellevue, Sci. Dvcs. N. W.	206-747-5169
WI	Milwaukee, Berndt Assocs.	414-545-8400

KRUEGER COMPANY, 1544 W. Mineral Rd., Tempe, AZ 85283, Tel: 800-245-2235,602-820-5330, FAX: 602-820-1707

KSI, See Kaiser Systems, Inc.

K-TRONICS, See U. S. Elco Inc. (Under Elco)

KULITE SEMICONDUCTOR PRODS., INC., One Willow Tree Rd., Leonia, NJ 07605, Tel: 201-461-0900, TELEX: 685-3296, FAX: 201-461-0990; Empl.: 320; *Sls. Mgr.:* George Boctor

Local Sales Offices & Reps

AL	Huntsville, Jim Springer, Inc.	205-883-4163
AZ	Scottsdale, Dave Menegey Assocs.	602-994-9519
CA	Montrose, Luscombe Engrg.	818-249-9000
CA	Walnut Creek, Dale-Dahl Assocs.	415-933-9595
CO	Boulder, Measurement Cnsltn.	303-449-7506
MA	Brockton, JHL Assocs.	508-580-1703
MN	Minneapolis, Instrmn. Resources, Inc.	612-537-2434
MO	St. Louis, Ozark Elctrn. Mktg.	314-423-7200
NM	Albuquerque, Amonette Entprs.	505-344-4143
OH	Dayton, Kulite Midwest	513-439-1958
PA	Philadelphia, Rabal Assocs., Inc.	215-922-6914
TX	Webster, Kulite Southwest	713-486-9748
UT	Centerville, MC 2	801-298-3388
WA	Seattle, Brett Assocs.	206-431-8090

KURZ INSTRUMENTS INC., 2411 Garden Rd., Monterey, CA 93940, Tel: 800-424-7356, TELEX: 172275; FSC No.: 94-24-11681; Empl.: 72; *Sls. Mgr.:* Tom Setliff

K-W MANUFACTURING CO., INC., P. O. Box 508, Prague, OK 74864, Tel: 405-567-2285, FAX: 405-567-4153; Empl.: 60; *Sls. Mgr.:* Freda Pickard

KYCON

FAX: 408-295-8054

KYCON CABLE & CONNECTOR, INC., 1810 Little Orchard St., San Jose, CA 95125, Tel: 408-295-1110, 800-544-6941; Empl.: 16; *Sls. Mgr.:* Wendy Wuerth; *Dist. Mgr.:* Wendy Wuerth **C•1364-1367, 1757**

Local Sales Offices & Reps

AZ	Tempe, ACS of Arizona	602-731-9711
CA	Aliso Viejo, Pro Assocs.	714-588-2700
CA	San Diego, Pro-Assocs.	714-588-2700
CA	San Jose, Kycon Sls. Off.	408-295-1110
CA	Sunnyvale, Repron	408-737-0510
GA	Alpharetta, Pinnacle	404-410-9980
MA	Sudbury, KSA of New England	508-443-5881
MN	Burnsville, Vermilyea Sls.	612-435-1726
MO	Chesterfield, Weisler and Assocs.	314-537-0010
NJ	Middletown, Varrelman-Gorman	908-219-0088
NY	Smithtown, Varrelman-Gorman	516-724-0907
NY	Webster, Frank J. Muto	716-671-2387
NC	Raleigh, Pinnacle Mktg.	919-848-0404
OR	Beaverton, Quest Mktg.	503-641-7377
PA	Frazer, Industrial Comps., Inc.	215-889-0650
TX	Dallas, Weisler and Assocs.	214-437-2386
TX	Houston, Weisler & Assocs.	713-849-3799
WA	Bellvue, Quest Mktg.	206-747-9424
Can	Laval, Que., Interep Technlgs. Ltd.	514-667-1444

Local Distributors

AL	Huntsville, Resistacap	205-883-4270
AZ	Tempe, Team Elctrns.	602-731-9712
CA	San Diego, Cableconn	619-571-7111
CA	San Diego, Mock III Sls. Co.	619-693-8230
CA	Sunnyvale, Capsco Sls.	408-734-3020
CA	Sunnyvale, PSC Elctrns.	408-737-1333
CO	Denver, Southwest Elctrns., Inc.	303-430-4000
FL	Orlando, Wallace Elctrns.	407-578-1000
MA	Ashland, Quality	508-881-6500
MA	Wilmington, North Star Elctrns.	508-657-5155
NY	Hauppauge, Century Elctrns. Comps.	516-273-1551
NY	Rochester, North Star Elctrns.	716-244-9846
NC	Raleigh, Century Elctrns. Comps.	919-596-2220
OR	Beaverton, Murphy Elctrns.	503-642-2001
PA	Norristown, Century Elctrns. Comps.	215-631-5400
TX	Austin, Southwest Elctrns.	512-837-8971
TX	Austin, Wallace Elctrns.	512-469-0400
TX	Carrollton, North Star Elctrns.	214-980-2999
TX	Dallas, Wallace Elctrns.	214-340-0400
TX	Ft. Worth, Southwest Elctrns., Inc.	817-338-1497
TX	Richardson, Southwest Elctrns., Inc.	214-234-3050
TX	San Antonio, Southwest Elctrns.	512-222-2425
TX	San Antonio, Wallace Elctrns.	512-342-2314
TX	Stafford, Southwest Elctrns.	800-231-3612
WA	Redmond, Murphy Elctrns.	206-881-1234
Can	St. Laurent, Que., Ferrotronic Comps., Inc.	514-333-7288

KYOCERA INDUSTRIAL CERAMICS CORP., 8611 Balboa Avenue, San Diego, CA 92123, Tel: 619-576-2688, TELEX: 4723069 (KYOSDGO), ESYLNK: 619-569-9412; Empl.: 100; *Sls. Mgr.:* Lyle Gibson

KYOCERA NORTHWEST, See AVX Corp.

LAB-LINE INSTRUMENTS, 15th & Bloomingdale, Melrose Park, IL 60160, Tel: 708-450-2600, TELEX: 6781028, FAX: 708-450-0943; Empl.: 225

LABORATORY TECHNOLOGIES CORP., 400 Research Drive, Wilmington, MA 01887, Tel: 508-657-5400, TELEX: 989695, FAX: 508-658-9972; Empl.: 32; *Sls. Mgr.:* Neil Parmenter, Dir. of Sls.

LABTRONICS INC., 75 Rickson Ave., Guelph, Ont., Canada N1G 3B6, Tel: 519-767-1061, FAX: 519-836-4431

LAFRANCE CORP., 8425 Executive Ave., Philadelphia, PA 19153-3893, Tel: 215-365-8000, FAX: 215-365-4420; Empl.: 300; *Sls. Mgr.:* Brian Mc Henry

LAFRANCE CORP., PACTEC DIV., See PacTec Div., LaFrance Corp.

LAKE SHORE CRYOTRONICS, INC., 64 E. Walnut St., Westerville, OH 43081, Tel: 614-891-2243, TELEX: 24-5415, FAX: 614-891-1392; *Sls. Mgr.:* Michael Swartz

LAMBDA ELECTRONICS INC., 515 Broad Hollow Rd., Melville, NY 11747-3700, Tel: 516-694-4200, FAX: 516-293-0519; Empl.: 1100; *Sls. Mgr.:* John Valenti

LAMBDA Qualidyne Inc.

FAX: 619-575-7185

LAMBDA QUALIDYNE INC., Lambda Group of Unitech, plc, 3055 Del Sol Blvd., San Diego, CA 92154, Tel: 619-575-1100; Empl.: 400; *Sls. Mgr.:* Barry A.Chenes, Dir. of Mktg. **D•1810-1815**

LAMB ELECTRIC DIVISION, A Subsidiary of Ametek Inc., 627 Lake St., Kent, OH 44240, Tel: 216-673-3451, FAX: 216-673-8994

LAMBERT ENGINEERING INC., 1155 S.W. Division, Ste. B-13, Bend, OR 97702-2181, Tel: 503-388-2623, FAX: 503-388-1794; Empl.: 9

LAMB INDUSTRIES, INC., 4826 S.W. Scholls Ferry Rd., Portland, OR 97225, Tel: 503-297-8878,800-824-9374, FAX: 503-297-8879; Empl.: 6; *Dist. Mgr.:* Andrew Semon ..... **B•1760-1765**

Local Sales Offices & Reps

IL Chicago, Meca Sls. Inc. 312-334-3201, FAX:312-334-4020
MN Stillwater, Prof. Elctrns. 612-439-8088, FAX:612-439-1061
OR Portland, Lamb Inds., Inc. 503-297-8878, FAX:503-297-8879

Local Distributors

AL Mobile, Control Design/AL 205-666-6693
AZ Tempe, Control Design/AZ 602-829-7981
AR Maumet, Control Design/AR 501-851-3137
CA Anaheim, Control Design/S. CA 714-821-1516
CA Chatsworth, EW Elctrns. 818-718-2500
CA Industry, Ital Elctrns. 818-968-8515
CA Irvine, Kelex Elctrns. 800-422-7224
CA Irvine, Mann SW 800-553-5543
CA San Carlos, Control Design/N. CA 415-592-4806
CA San Carlos, Logan Elctrns. 415-594-0700
CA Tustin, Western Switches 800-454-8144
CA Van Nuys, Wes-Garde/CA 213-873-4802
CO Denver, Control Design/CO. 303-296-1922
CT Hartford, Wes-Garde/CT 203-527-7705
CT Wallingford, Control Design/CT 203-269-9955
FL Altamonte Springs, Control Design/FL 305-788-3220
FL Ft. Lauderdale, Reptron Elctrns. 305-735-1112
FL Lakeland, Wes-Garde/FL 800-275-7102
FL Pompano Bch., Control Design/FL 305-782-1311
FL Tampa, Reptron Elctrns. 800-659-1361
GA Stone Mountain, Control Design/GA 404-979-3500
IL Carrol Stream, Wes-Garde/IL 800-275-7095
IL Franklin Park, Stetco Inc. 800-251-4558
IL Schaumburg, Control Design/IL 708-307-8900
IN Indianapolis, Control Design/IN 317-788-4559
IA Marion, Control Design/IA 319-373-2923
KS Kansas City, Control Design/KS 913-362-4248
MA Woburn, Control Design/MA 617-932-9404
MI St. Clair Shore, Spemco 800-482-2828
MN Fridley, Voyager Elctrns. II 612-571-7766
MN Minneapolis, Control Design/MN 612-721-1628
MN Minneapolis, Tortec Corp. 612-866-3662
MN Roseville, Parts One 612-633-8079
MO St. Louis, Control Design/MO 314-426-3150
MO St. Louis, Wes-Garde/MO 314-567-7776
NH Nashua, Wes-Garde/NH 603-880-1971
NJ Mt. Laurel, Wes-Garde/NJ 609-778-8190
NJ Wycoff, B & R Elect. 201-670-7200
NY Woodside, Switches Unlimited 800-221-0487
NC Charlotte, Control Design/NC 704-588-4410
OH Westerville, Wes-Garde/OH 614-885-0319
OR Portland, Radar Elctrns. 503-232-3404
PA Malvern, Control Design/PA 215-296-0150
TX Dallas, Control Design/TX 214-358-1441
TX Dallas, Wes-Garde/TX 800-275-7103
UT Nephi, Control Design/UT 801-623-2908
WA Redmond, Priebe Elctrns. 800-426-9911
WA Seattle, Radar Elctrns. 206-282-2511
WI Milwaukee, Badger Sls. 414-281-1330
WI New Berlin, Control Design/WI 414-784-1015

LAMINATION SPECIALTIES CORP., 235 N. Artesian, Chicago, IL 60612, Tel: 312-243-2181, FAX: 312-243-2873; *Sls. Mgr.:* James R. Barth

LAMP TECHNOLOGY, INC., 1645 Sycamore Ave., Bohemia, NY 11716, Tel: 516-567-1800, FAX: 516-567-1806; Empl.: 15; *Sls. Mgr.:* Janet Connolly

LAMPTRONIX CO. LTD., 81 N. Williams St, Crystal Lake, IL 60014-4443, Tel: 815-455-0400, FAX: 815-455-7916; FSC No.: 61342

Local Sales Offices & Reps

IN Indianapolis, D-M Assocs. 317-842-4424
CA Westlake V1., Casco 818-889-7889
PA Phonexville, Richter Co. 215-495-7543

LANCE INDUSTRIES, 13001 Bradley Avenue, Sylmar, CA 91342-3832, Tel: 818-367-1811, FAX: 818-362-3594; *Sls. Mgr.:* Jerry Updyke; *Dist. Mgr.:* Joe Barris

LANCE INTERNATIONAL, 380 Treadwell St., Hamden, CT 06514, Tel: 203-281-6365, FAX: 203-248-0256; Empl.: 50; *Sls. Mgr.:* Ralph Turley

LAND INFRARED, Land Instruments Intl. Inc., 2525 Pearl Buck Road, Bristol, PA 19007, Tel: 215-781-0700, 800-523-8989, FAX: 215-781-0723; Empl.: 25; *Sls. Mgr.:* Richard Parello

LANDIS & GYR, INC., See Maxmar Controls Inc.

L & L SPECIAL FURNACE, 20 Kent Rd., Aston, PA 19014, Tel: 610-459-9216, FAX: 610-459-3689; Empl.: 20; *Sls. Mgr.:* Greg Lewicki; *Dist. Mgr.:* Stephen Lewicki

L & R MFG. CO., 577 Elm St., Kearny, NJ 07032, Tel: 201-991-5330, FAX: 201-991-5870; Empl.: 180; *Sls. Mgr.:* John Rosendahl

LANSDALE SEMICONDUCTOR, INC., 2929 So. 48th St., Ste. 2, Tempe, AZ 85282, Tel: 602-438-0123, FAX: 602-438-0138

LANGLEY:FLEET AEROSPACE, INC., P.O. Box 2911, San Diego, CA 92112, Tel: 619-264-3181, FAX: 619-264-4329; FSC No.: 83549; Empl.: 110; *Sls. Mgr.:* H.J. Sauer

LANSING INSTRUMENT CORP., P.O. Box 730, Ithaca, NY 14851-0730, Tel: 607-272-3265, 800-847-3535, FAX: 607-277-1953; *Sls. Mgr.:* Fred B. Widding ..... **C•1054-1055**

LARK ELECTRONICS, INC., Box 390, New York, NY 10040, Tel: 212-569-0430; FSC No.: 52682

LARK ENGINEERING CO., Baier & Baier Inc., 27151 Calle Delgado, San Juan Capistrano, CA 92675, Tel: 714-240-1233, FAX: 714-240-7910; FSC No.: 33174; Empl.: 40

LARSON-METERCRAFT, 1250 Fayette St., El Cajon, CA 92020, Tel: 619-258-8990, FAX: 619-258-5610; Empl.: 15; *Sls. Mgr.:* A.D. Stephens; *Dist. Mgr.:* R.L. Larson

LASER CONCEPTS, Omega Organization Intl., P.O. Box 33623 EE, Seattle, WA 98133, Tel: 206-364-7881; Empl.: 15; *Sls. Mgr.:* Roberta Forsythe

LASER DIODE, INC., A Morgan Crucible Company, 4 Olsen Ave., Edison, NJ 08820, Tel: 908-549-9001, FAX: 908-906-1559; Empl.: 65 ..... **B•1213-1215**

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LASER IMAGING SYSTEMS INC., 204-A E. McKenzie St., Punta Gorda, FL 33950, Tel: 813-639-3533, FAX: 813-639-6458; Empl.: 5; *Sls. Mgr.:* Paul Pedigo

LASER MAGNETICS, 88 Turnpike Rd., Chelmsford, MA 01824, Tel: 508-250-1507, FAX: 508-250-1699; Empl.: 10; *Sls. Mgr.:* Jerry A. Goldlust

LASER PRECISION CORP., 109 N. Genesee St., Utica, NY 13502, Tel: 315-797-4449, TELEX: 646803, FAX: 315-798-4038; Empl.: 165; *Sls. Mgr.:* Bruce Bonini

LASER TECH INC., 14860 Deveau Place, Minnetonka, MN 55345, Tel: 612-935-9277, FAX: 612-935-0433; Empl.: 28; *Sls. Mgr.:* Jerry Peterson

LASERTECHNICS, INC., 5500 Wilshire Ave.,N.E., Albuquerque, NM 87113, Tel: 505-822-1123, TELEX: 757222, FAX: 505-821-2213; Empl.: 66; *Sls. Mgr.:* Keith Green; *Dist. Mgr.:* Keith Green

LASER TECHNOLOGY, INC., 10624 Ventura Blvd., N. Hollywood, CA 91604-3593, Tel: 818-763-7091, TELEX: Cable-LASTEC (No. Hollywood), FAX: 818-763-7382; Empl.: 9

LATTICE SEMICONDUCTOR CORP., 5555 NE Moore Ct., Hillsboro, OR 97124, Tel: 1-800-FASTGAL, FAX: 503-681-3037

LAUBE TECHNOLOGY, 6400 Variel Ave., Woodland Hills, CA 91367, Tel: 818-703-1188, FAX: 818-716-0422; Empl.: 20; *Sls. Mgr.:* Arnold Aloi; *Dist. Mgr.:* Teri Harrington

LAUREL

FAX: 714-645-1239

LAUREL ELECTRONICS, INC., 709 Kings Rd., Newport Beach, CA 92663, Tel: 714-646-6846; Empl.: 4 ..... **D•1355-1357**

LAZERDATA CORPORATION, 2400 Diversified Way, Orlando, FL 32804, Tel: 1-800-843-2700, FAX: 407-425-6530; Empl.: 75; *Sls. Mgr.:* Jack Cochran

L/C MAGNETICS, 1139 N. Kraemer Pl., Anaheim, CA 92806, Tel: 714-666-0787, FAX: 714-666-1939; Empl.: 4; *Sls. Mgr.:* Zak Bhaijeewala

L-COM INC., 1755 Osgood St., N. Andover, MA 01845, Tel: 508-682-6936, FAX: 508-689-9484; Empl.: 23; *Sls. Mgr.:* Richard McGravey

LCR ELECTRONICS-HOPKINS ENGINEERING, 9 South Forest Ave., Norristown, PA 19401, Tel: 215-278-0840, FAX: 215-278-0935; FSC No.: OAM43; Empl.: 71; *Sls. Mgr.:* Sue Manalo

LCT ELECTRONICS CORPORATION, 700 N.Valley St., Suite K, Anaheim, CA 92801, Tel: 714-991-7317, FAX: 714-991-3661; FSC No.: 3613, 3643, 3861; Empl.: 9; *Sls. Mgr.:* Lee R. Couts

LDJ ELECTRONICS, 1280 E. Big Beaver, P.O. 219, Troy, MI 48099-0219, Tel: 313-528-2202, FAX: 313-689-2525; Empl.: 48; *Sls. Mgr.:* Leon Jackson

LEACH® CORPORATION

FAX: 714-670-1145

LEACH CORPORATION, 6900 Orangethorpe, P.O. Box 5032, Buena Pk., CA 90622-5032, Tel: 714-739-0770; FSC No.: 58657; Empl.: 500; *Sls. Mgr.:* R. P. Zimmerman; *Dist. Mgr.:* Frank Winer ..... **B•1547-1555**

Local Sales Offices & Reps

AL Huntsville, R & G Assocs. 205-880-8020
CA Buena Pk., Leach Corp. 714-739-0770
CA San Mateo, Halbar Assocs. 415-349-4700
FL Oviedo, Conley & Assocs. 407-365-3283
MA Needham, Component Technlg., Inc. 617-449-8490
MN Edina, Mel Foster Tech. Sls. 612-941-9790
MO St. Louis, BAKA Corp. 314-429-2252
NY Commack, Leach Corp. 516-499-2449
OH Dayton, Leach Corp. 513-434-8151
TX Dallas, Leach Corp. 214-341-0811
KS Wichita, BAKA Corp. 316-682-8411
WA Bellevue, Leach Corp. 206-746-7236
Can Kirkland, Que., Robin Aerospace Prods., Ltd. 514-694-1315
Can Mississauga, Ont., Robin Aerospace Prods., Ltd. 416-673-1666
Can Ottawa, Robin Aerospace Prods., Ltd. 613-594-8884

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OH	Columbus, The Bill Romine Co.	614-436-0565
PA	Dowingtown, Grasso Tech. Sls.	215-458-8967
TX	Austin, THT Sls.	512-835-2794
TX	Dallas, THT Sls.	214-783-1501
TX	Houston, THT Sls.	713-981-4277
VA	Herndon, Eastern Elctrns.	703-904-7272
WA	Redmond, VMI	206-882-2999
WI	Janesville, Antek Mktg. Corp.	608-754-4214
Can	Toronto, RepTech	416-863-9510
Can	W. Vancouver, Leister Blake Entpr.	604-926-6127

LUMITRON, PO Box 267, Summit, NJ 07902-0267, Tel: 908-273-8998, FAX: 908-273-0853; FSC No.: 51702; Empl.: 20; *Sls. Mgr.:* Gil Chassie

LUNAIRE ENVIRONMENTAL, INC., Lunaire Limited, 4 Quality St., Williamsport, PA 17701, Tel: 717-326-1770, FAX: 717-326-7304; Empl.: 130; *Sls. Mgr.:* Stu Lunick

LUNDAHL INSTRUMENTS, INC., Ezra C. Lundahl Inc., 429 South Main, Logan, UT 84321, Tel: 801-753-7300, FAX: 801-753-7490; Empl.: 17; *Sls. Mgr.:* Val Potter

LUTRON ELECTRONICS CO., 7200 Suter Rd., Coopersburg, PA 18036, Tel: 215-282-3800, TELEX: 847475, TWX: 510-651-3755; Empl.: 378; *Sls. Mgr.:* John McKiernan; *Dist. Mgr.:* Robert Van Horne

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LUXO CORPORATION, P.O. Box 951, Port Chester, NY 10573, Tel: 914-937-4433, 800-222-5896, FAX: 914-937-7016; Empl.: 150; *Sls. Mgr.:* Robert H. Newton

LUXTRON INC., 15 Hale St., Haverhill, MA 01830-4803, Tel: 508-372-5211, FAX: 508-372-7051; *Sls. Mgr.:* Bruce F. Morse

LXD

FAX: 216-786-8711

LXD, INC., 7650 First Place, Cleveland, OH 44146, Tel: 216-786-8700; FSC No.: 66706; Empl.: 100; *Sls. Mgr.:* Patrick Bowen; *Dist. Mgr.:* Patrick Bowen ..... **B•1086-1087**

Local Sales Offices & Reps

AL	Huntsville, Tronex Grp.	205-859-5609
AZ	Phoenix, FP Sls.	602-894-5303
CA	Los Angeles, Universal Comps.	310-783-0220
CA	Milpitas, Telesis Sls.	408-946-7300
CA	San Diego, Universal Comps.	619-232-5163
CO	Denver, Tri-Tec Sls.	303-440-7862
CT	New Haven, Sturdy Corp.	203-888-1480
CT	Newton, Sturdy Corp.	203-426-4403
FL	Plantation, Tronex Grp.	305-587-4797
GA	Alpharetta, Tronex Grp.	404-751-0794
ID	Coeur D'Alene, Matrex Mktg.	208-765-5810
IL	Northbrook, Howard Benjamin Assoc.	708-272-2900
IN	Fort Wayne, RL Bontempo Assoc.	219-478-1057
IN	Indianapolis, R. L. Bontempo Assocs.	317-843-2142
IA	Cedar Rapids, KKB & Co.	319-373-1730
MA	Wellesley Hills, Sturdy Corp.	617-235-2330
MN	Minneapolis, George Russell & Assocs.	612-854-1166
MO	Kansas City, KKB & Co.	816-229-0001
MO	St. Louis, KKB & Co.	314-647-2400
NH	Derry, Sturdy Corp.	603-434-8440

NJ	Haddon Field, Sunday O'Brein	609-429-4013
NJ	Tenafly, November Sls.	201-894-8964
NY	Rochester, J.G. Welch Assoc.	716-244-1100
NC	Raleigh, EEI Corp.	919-876-7591
NC	Raleigh, Tronex Grp.	919-859-2117
OH	Cleveland, Electronics Mktg. Corp.	216-442-3441
OH	Columbus, Electronics Mktg. Corp.	614-299-4161
OH	Dayton, Midwest Mktg.	513-433-2511
OR	Tigard, Matrex Mktg. & Sls.	503-245-8080
TX	Austin, THT Sls.	512-835-2796
TX	Dallas, THT Sls.	214-783-1501
TX	Houston, THT Sls.	713-981-4277
WA	Bellevue, Matrex Mktg. & Sls.	206-643-0363
Can	Concord, Ont., ITT Multicomponents	416-736-1144

Local Distributors

NC	Charlotte, EMC Inc.	704-394-6195
OH	Columbus, EMC Inc.	614-299-4161
OK	Tulsa, Merlin Elctrns.	918-251-2084
TX	Austin, Omnipro Elctrns.	512-794-9200
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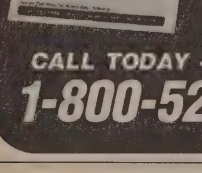

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LYNTRONICS, INC., 569 Acorn St., Unit 5, Deer Park, NY 11729, Tel: 516-243-6397, FAX: 516-243-0232; FSC No.: OBSY 9; Empl.: 20; *Sls. Mgr.:* Gary L. Miller

LYN-TRON, INC., 3150 Damon Way, Burbank, CA 91505, Tel: 213-849-6211, 800-423-2734, FAX: 818-840-9581; FSC No.: 05791; Empl.: 85; *Sls. Mgr.:* Kory L. Wardle; *Dist. Mgr.:* Kory L. Wardle

LYON METAL PRODUCTS, INC., Box 671, Aurora, IL 60507, Tel: 708-892-8941, FAX: 1-800-367-6681; FSC No.: 1-800-323-0082; Empl.: 600; *Sls. Mgr.:* J. L. Wiebusch

LYTRON INCORPORATED, Dragon Court, Woburn, MA 01801, Tel: 617-933-7300, TELEX: 951-934, FAX: 617-935-4529; Empl.: 90

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FAX: 301-921-0705

LZR ELECTRONICS, INC., 8051 Cessna Ave., Gaithersburg, MD 20879, Tel: 301-921-4600; Empl.: 35; *Sls. Mgr.:* John Andreoli; *Dist. Mgr.:* Greg Mozingo ..... **B•1844; C•1400-1414, 1758-1761; D•1048-1050, 1818-1827, 2277**

Local Sales Offices & Reps

AL	Madison, Lamons Sls. Co.	205-461-7871
AZ	Tempe, Elctrn. Tech. Sls.	602-921-7122
CA	Los Alamitos, Power Specialists	310-594-9418
CA	San Jose, Bytec Sls.	408-435-8004
CA	Simi Valley, Power Specialists	805-581-4785
CO	Littleton, Megatronix	303-730-6262
CT	Guilford, Data Mark, Inc.	203-453-0575
FL	Boca Raton, Tech. Sls. Specialists	407-391-3718
GA	Norcross, Lamons Sls. Co.	404-242-2610
IL	Palatine, Vine Sls., Inc.	708-934-5476
KS	Overland, Acorn Elctrns.	913-649-6402
MD	Lutherville, DGR	410-583-1360
MA	Norwood, JMG, Inc.	617-762-5333
MI	Warren, Burcaw Co.	313-573-4605
MO	St. Louis, Acorn Elctrns.	314-421-1751
NJ	Clifton, R.O.I. Sls.	201-340-1515
NJ	Totowa, R.O.I. Sls.	201-812-9606
NM	Albuquerque, Nelco Electronix	505-293-1399
NC	Raleigh, Lamons Sls. Co.	919-846-1652
OR	Beaverton, Blair Hirsh Co.	503-641-1875
PA	Hatboro, AQS Electro	215-674-4421
TN	Greenville, Lamons Sls.	615-639-8711
TX	Plano, Connector Specs.	214-517-1207
UT	Bountiful, Charles Fields & Assocs.	801-299-8228
WA	Lynnwood, Blair Hirsch Co.	206-774-8151
WI	Genoa City, Vine Sales, Inc.	414-279-3871

Local Distributors

CA	Brea, J.I.T. Supp.	714-256-9100
FL	Ft. Lauderdale, Stock Elctrns.	305-978-9875
IL	Bensenville, Voyager Elctrns.	708-860-1300
MD	Gaithersburg, MS Elctrns.	301-921-0200
MN	Minneapolis, Voyager Elctrns.	612-571-7766
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WA	Redmond, Murphy Elctrns.	206-881-1234

MABUCHI MOTOR AMERICA CORP., 475 Park Ave. South, New York, NY 10016, Tel: 212-686-3622, TELEX: 23-4374, TWX: MABU, FAX: 212-532-4263; Empl.: 10,000 ..... **B•1293**

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MI	Detroit, Mabuchi Motor America Corp.	313-370-9090

MACCOR, INC., 2805 W. 40th Street, Tulsa, OK 74107, Tel: 918-446-1874, FAX: 918-445-1496; FSC No.: 6625; *Sls. Mgr.:* Andrew D. MacKay

MACHINE COMPONENTS CORP., 70 Newtown Rd., Plainview, NY 11803, Tel: 516-694-7222, FAX: 516-694-7252; FSC No.: 15531; Empl.: 46; *Sls. Mgr.:* D. L. Dubov

MACOM, INC., 100 Chelmsford St., Lowell, MA 01851, Tel: 617-272-3000

M/A-COM, INC., Antenna & Cable Division, 110 Haverhill Rd., Amesbury, MA 01913, Tel: 508-388-5210, FAX: 508-388-9758; FSC No.: 11556; Empl.: 400; *Sls. Mgr.:* H. Adjemian

M/A-COM LASER DIODE, INC., See Laser Diode, Inc., Div. of Morgan Crucible

M/A COM LTD., Humphrey Rd., Dunstable, Bedfordshire, England LU5 4SX, England, Tel: 44(582)471200, TELEX: 82295; Empl.: 300

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M/A-COM OMNI SPECTRA, INC., 140 Fourth Avenue, Waltham, MA 02254-9101, Tel: 617-890-4750, FAX: 617-890-2381; FSC No.: 26805; Empl.: 750

M/A-COM PHI, INC., M/A COM, Inc., 1742 Crenshaw Blvd., Torrance, CA 90501, Tel: 213-320-6160, TWX: 910-349-6651, FAX: 213-618-9191; FSC No.: 50998; Empl.: 260; *Sls. Mgr.:* Charlie Hancock

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MACRONETICS, See Veeco Instrs. Inc.

MAG-CON, 1626 Terrace Dr., St. Paul, MN 55113, Tel: 612-633-8820, FAX: 612-633-1851; Empl.: 40; *Sls. Mgr.:* Mark Crellin

MAG-HEAD ENGINEERING CO., 686-Mendelssohn Ave., Minneapolis, MN 55427, Tel: 612-545-1321, FAX: 612-545-0335; FSC No.: (Cage) 0DU70; Empl.: 30; *Sls. Mgr.:* Gary Hoonsbeen

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Local Sales Offices & Reps

AL	Huntsville, Jim Springer, Inc.	205-883-4163
CA	Sunnyvale, N-S Westronics	408-745-1102
CA	Ventura, Power Partners	805-966-3309
IL	Park Ridge, Elctrn. Instr.	708-298-2290
LA	Metairie, Data Mktg. Assoc.	504-883-3655
MI	Ann Arbor, Tech. Sls. Assoc.	313-995-4082
MN	Minnetonka, Elctrn. Instr.	612-933-7793
OH	Cleveland, Tech. Sls. Assoc.	216-461-0826
OH	Dayton, Tech. Sls. Assoc.	513-298-2062
OH	Piqua, Tech. Sls. Assoc.	513-778-0247
TX	Austin, Data Mktg.	512-338-4701
TX	Dallas, Data Mktg.	214-661-0300
TX	Houston, Data Mktg.	713-579-2995
TX	San Antonio, Data Mktg.	210-342-3031

Local Distributors

CA	Jamul, Power Partners, Inc.	619-560-0099
CA	Los Angeles, Power Partners, Inc.	310-215-0800
FL	Land O'Lakes, AJ's Power Source	813-996-2583

MAGNATROL VALVE CORP., 67 Fifth Ave., Hawthorne, NJ 07507, Tel: 201-427-4341, FAX: 201-427-7611; *Sls. Mgr.:* R. Kretschmer

MAGNECOMP

FAX: 803-878-0507

MAGNECOMP, INC., P.O. Box 625, Gravley Rd., Pickens, SC 29671, Tel: 803-878-4700; Empl.: 10; *Sls. Mgr.:* T. Sullivan ..... **A•2377**

MAGNECRAFT ELECTRIC CO., 1910 Techny Road, Northbrook, IL 60062-5376, Tel: 708-564-8800, FAX: 708-564-3027; FSC No.: 94696; Empl.: 400; *Sls. Mgr.:* G.W. Edwards

MAGNELAB CORPORATION

FAX: 303-447-1588

MAGNELAB, 7315 Red Deer Dr., Boulder, CO 80301-4696, Tel: 303-442-6700; FSC No.: 58439; Empl.: 25; *Sls. Mgr.:* Cheryl Junge ..... **A•2378-2382**

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MAGNETEK POWER CONVERSION SYSTEMS, Teledyne, Inc., 901 E. Ball Rd., Anaheim, CA 92805, Tel: 714-956-9200, FAX: 714-956-5397; FSC No.: 90911; *Sls. Mgr.:* Fred Tamjidi

MAGNETEK POWER TECHNOLOGY SYSTEMS, MagneTek, Inc., 901 E. Ball Road, Anaheim, CA 92805, Tel: 714-956-9200, FAX: 714-956-5397; Empl.: 450; *Sls. Mgr.:* Robert Swette

MagneTek

FAX: 219-356-0311

MAGNETEK TRIAD, 1124 E. Franklin St., Huntington, IN 46750, Tel: 219-356-7100; Empl.: 963; *Sls. Mgr.:* Mike Dorton ..... **A•1248-1249, 2383-2387**

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MAGNETIC COILS, INC., See MCI Transformer Corporation

MAGNETIC COMPONENT ENGINEERING, INC., 213 N. Cedar Ave., Inglewood, CA 90301, Tel: 310-677-6600, FAX: 310-677-7100; FSC No.: 52634; Empl.: 15; *Sls. Mgr.:* C. Nanji ..... **A•1251-1253, 1321**

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MAGNETICO INC., 182 Morris Ave., Holtsville, NY 11742, Tel: 516-654-1166, FAX: 516-758-7408; FSC No.: 10581; Empl.: 65 ..... **A•2389-2391**

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AZ	Phoenix, Toward Engr. Assocs.	602-955-3193
CA	Woodland Hills, Southern Calif. Sls.	818-704-9087

MAGNETIC RADIATION LABS, 690 Hilltop Drive, Itasca, IL 60143, Tel: 708-285-0800, FAX: 708-285-0807; Empl.: 43; *Sls. Mgr.:* Jack White

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CA	Morgan Hill, J. Nelson	408-779-2090
CA	San Diego, R.N. Blair	619-225-0780
CA	San Marino, L.H. Lutz	818-799-2074
CT	Berlin, D.S. Miga	203-828-7765
FL	Lake Worth, A. R. Opitz	407-967-5929
IL	Elgin, R.J. Harris	708-888-2175
IN	Martinsville, W.E. Heacock	317-349-1254
KS	Lenexa, D. J. McCarl	913-492-6719
MA	Acton, S. Feldhusen	508-264-4850
NJ	Chatham, K. E. Murphy	201-635-5793
NY	Huntington Sta., W.H. Stephan	516-424-9330
NY	Rush, R.C. Moore	716-533-9336
NC	Greensboro, E. A. Siebenaler	919-288-3669
OH	Findlay, H. A. Beck	419-424-0592
PA	Coopersburg, J.J. Whitney	215-965-1150
TX	Garland, F. H. Hall	214-475-8066
VA	Falls Church, BFI Int'l	703-847-6815

Local Distributors

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MAGNETIC SHIELD CORPORATION, Perfection Mica Co., 750 North Thomas Dr., Bensenville, IL 60106, Tel: 708-766-7800, FAX: 708-766-2813; FSC No.: 06682; Empl.: 43 ..... **C•1696-1697**

Local Sales Offices & Reps

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CA	Woodland Hills, Cal-Ward Sls. Co.	818-883-2202
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GA	Suwanee, Overton Assocs.	404-497-0166
MD	Baltimore, Bernard White & Co.	410-484-5400
MA	Brookline, Technl. Prods. Grp.	617-731-0858
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MN	Minneapolis, Josco-Meluis & Assocs.	612-861-3343
NM	Albuquerque, IMEC	505-275-0936
NJ	Morristown, Kenneth L. Love Assocs.	201-540-0204
NY	Plainview, Robert Smith Assoc.	516-932-3975
NC	Raleigh, Overton Assoc.	919-783-6565
PA	Hatboro, AQS Electro	215-674-4421
PA	Sewickley, Teplitz-Byrne Assoc.	412-741-3628
SC	Walhalla, Overton Assoc.	803-638-7101
TN	New Tazewell, Overton Assoc.	615-626-6009
TX	Dallas, Southwest Elctrn. Ind.	214-690-9881
WA	Olympia, Bergford & Assocs.	206-866-2001

MAGNETIC TECHNOLOGIES CORP., 770 Linden Avenue, Rochester, NY 14625, Tel: 716-385-9010, FAX: 716-385-5625; Empl.: 80; *Sls. Mgr.:* Gordon H. McNeil

MAGNETOELASTIC DEVICES, 17 Downing Three, 2C, Pittsfield, MA 01201, Tel: 413-445-5608, FAX: 413-442-3750

MAGNETROL INTERNATIONAL, 5300 Belmont Rd., Downers Grove, IL 60515-4499, Tel: 708-969-4000, FAX: 708-969-9489; *Sls. Mgr.:* Roger T. Piegza, Natl. Sls. Mgr.

MAGNET SALES & MFG., INC., 11248 Playa Court, Culver City, CA 90230-6162, Tel: 310-391-7213, 800-421-6692 (N. CA and out of state), FAX: 310-390-4357; FSC No.: 17853; Empl.: 50; *Sls. Mgr.:* Chuma Ho; *Dist. Mgr.:* Anil Nanji

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Local Sales Offices & Reps

AZ	Phoenix, Wistech Controls	602-243-4361
CA	San Jose, Ruppert Sls. & Engrg.	408-998-8717
CA	Valencia, DJM Elctrns. Inc.	805-254-2677
CO	Denver, Neil Binge & Assocs.	303-698-1481
CT	Woodbury, Mark-Rep Assocs.	203-263-3047
GA	Tucker, Hile Assocs.	404-939-9560
IL	Downers Grove, Richmar Elctrns. Corp.	312-968-0118
IL	Westmont, Regdon Solenoid, Inc.	708-789-0600
IN	Indianapolis, Richmar Elctrns.	317-577-9950
IA	Iowa City, Richmar Elctrns.	319-354-8894
MA	Mattapoisett, Mark-Rep Assocs.	508-758-2318
MI	Ada, Erin Engrg.	616-676-0665
MN	Minneapolis, Holmgren	612-574-9983
NH	Plaistow, Mark-Rep Assocs.	603-382-9563
NJ	Red Bank, Varrelman-Gorman Co.	201-219-0088
NM	Albuquerque, Wistech	505-883-2552
NC	Greensboro, Hile Assocs.	919-288-1500
OH	Dayton, Electro. Mktg. Grp.	513-890-8322
OR	Portland, D.A. Sullivan Co.	503-292-2448
PA	Huntingdon Valley, Edwin Leiby & Assocs.	215-659-8938
TX	Plano, K & H Sales	214-423-6520
VA	Alexandria, Edwin Leiby & Assocs.	703-360-9039
WI	Butler, Richmar Elctrns.	414-781-1730
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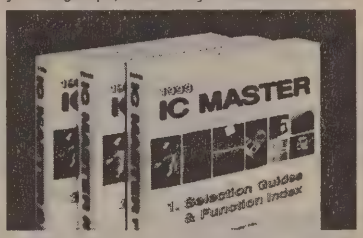

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WA Redmond, Elctrn. Mktg. Grp., Inc. 206-882-0962

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CA	Santa Ana, Marway Prods., Inc.	714-973-1800
CO	Monument, Sunbird Inds., Inc.	719-481-2900
CT	Meriden, PCS-Power Conversion Sys.	203-235-4886
FL	Land O' Lakes, AJ's Power Source, Inc.	813-996-2583
MD	Landover, Sel-Tronics, Inc.	301-341-2700
NH	Londonderry, PCS- Power Conversion Sys.	603-434-2371
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WA	Seattle, Underwood Assocs.	206-870-7475
WA	Vancouver, Underwood Assocs.	206-695-2311

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CA	Los Angeles, Master Distrs.	310-829-4656
CA	Santa Monica, Master Distrs.	310-452-1229

Local Distributors

AZ	Phoenix, Master Distrs.	602-267-1111
CA	Los Angeles, Brill Elctrns.	310-452-8002
CA	Oakland, Brill Elctrns.	510-834-5888
CA	Oakland, Master Distrs.	510-835-1500
CA	Santa Monica, Master Distrs.	310-452-1336

MASTER MAGNETICS INC., The Magnet Source, 607 S. Gilbert St., Castle Rock, CO 80104, Tel: 800-525-3536, FAX: 303-688-5303; FSC No.: 5999; Empl.: 47; *Sls. Mgr.:* Jennifer Brown; *Dist. Mgr.:* Ed J. Hocks ... **A•1319**

Local Sales Offices & Reps

CA	Placentia, A-L-L Magnetics	714-632-1754
CO	Castle Rock, The Magnet Source	303-688-3966
FL	Miami, Miami Magnet Co., Inc.	305-823-1603

MATEC INSTRUMENTS, INC., 75 South St., Hopkinton, MA 01748, Tel: 508-435-9039, FAX: 508-435-5311; Empl.: 55; *Sls. Mgr.:* Ken Bishop

MATERIALS RESEARCH CORPORATION, 560 Rte. 303, Orangeburg, NY 10962, Tel: 914-359-4200, FAX: 914-359-3454; Empl.: 780; *Sls. Mgr.:* Edward Erny

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TX	Dallas	214-235-9008

MATH ASSOCS. INC., General Microwave Corp., 5500 New Horizons Blvd., Amityville, NY 11701, Tel: 516-226-8950, FAX: 516-226-8966; *Sls. Mgr.:* Bruce Berman

MATHEMATICAL SYSTEMS DESIGN, INC., 11835 W. Olympic Blvd., Suite 745, Los Angeles, CA 90064, Tel: 310-479-7180, FAX: 310-479-0942; *Sls. Mgr.:* Lorr Kramer

THE MATHWORKS, INC., Cochituate Pl., 24 Prime Park Way, Natick, MA 01760, Tel: 508-653-1415, FAX: 508-653-2997

MATRIX CORP., 2260 Distributors Dr., Indianapolis, IN 46241, Tel: 317-248-2036, FAX: 317-248-8369; Empl.: 10 ..... **D•1195**

MATRIX CORP., 1203 New Hope Rd., Raleigh, NC 27610, Tel: 919-231-8000, FAX: 919-231-8001; Empl.: 65; *Sls. Mgr.:* Sheldon Shapiro

MATRIX SYSTEMS CORP., 5177 N. Douglas Fir Rd., Calabasas, CA 91302, Tel: 818-222-2301, FAX: 818-222-2304; FSC No.: 33281; Empl.: 47; *Sls. Mgr.:* Randy Sue Rabideau ..... **B•1562-1565**

Local Sales Offices & Reps

AL	Huntsville, Reynolds Assoc., Inc.	800-255-1965
AZ	Scottsdale, Faser Techn. Sls.	602-948-4404
CA	Los Alamitos, Tritek Solutions, Inc.	714-236-1190
CA	San Diego, Tritek Solutions, Inc.	619-455-1911
CA	San Jose, Tritek Solutions, Inc.	408-554-0455
CO	Louisville, Mountain States Reps.	303-665-8089
CT	Meriden, Polytek Assocs.	800-358-7348
FL	Melbourne, Reynolds Assocs., Inc.	800-251-1965
FL	Newport Richey, Reynolds Assocs.	800-255-1965
GA	Duluth, Reynolds Assoc., Inc.	800-255-1965
IL	Arlington Hgts., Comtel Midwest	708-392-4040
IN	Indianapolis, Comtel Midwest	317-253-1681
KS	Shawnee Mission, Comtel Midwest	913-268-0762
ME	Polytek Assocs.	800-358-7348
MA	Ashland, Polytek Assocs.	800-358-7348
MA	Falmouth Hgts., RJC Assocs.	508-540-8832
MI	Southfield, Comtel Instr.	313-358-2505
MN	Wayzata, Comtel Midwest	612-476-1551
MO	Manchester, Comtel Midwest	314-227-7220
MT	Westcon, Inc.	800-547-4515
NH	Polytek Assocs.	800-358-7348
NY	Polytek Assocs.	800-358-7348
NC	Raleigh, Polytek Assocs.	800-255-1965
OH	Cleveland, Comtel Instr.	216-442-8080
OH	Columbus, Comtel Instr.	614-876-8305
OH	Dayton, Comtel Instr.	513-426-5310
OR	Portland, Westcon, Inc.	800-547-4515
PA	Polytek Assocs.	800-358-7348
PA	Pittsburgh, Comtel Instr.	412-922-5720
SC	Reynolds & Assocs.	800-255-1965
TN	Reynolds Assocs., Inc.	800-255-1965
TX	Carrollton, Seaton Corp.	214-980-9860
UT	Mountain States Reps.	303-665-8089
VT	Polytek Assocs.	800-358-7348
VA	Fairfax, Schibley Assocs.	703-591-3008
WA	Kent, Westcon, Inc.	800-547-4515
WI	New Berlin, Comtel Midwest	414-544-6042
Can	St. Laurent, Que., Electrodesign Ltd.	514-331-3202

MATROX ELECTRONIC SYSTEMS, LTD., 1055 St. Regis Blvd., Dorval, Que., Canada H9P 2T4, Tel: 514-685-2630, TELEX: 05-822798, FAX: 514-685-2853; Empl.: 400; *Sls. Mgr.:* Ed Dwyer, VP Sls.

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MATSUO ELECTRONICS, 2134 Main Street, Suite 200, Huntington Beach, CA 92648, Tel: 714-969-2491; Empl.: 654; *Sls. Mgr.:* Ted Wiltse/John Carpenter ..... **A•1100-1105**

Local Sales Offices & Reps

AL	Huntsville, South Tech. Sls.	205-880-8200
CA	Los Altos, Recht Assocs.	415-964-6231
CA	Mission Viejo, Angle Assocs.	714-582-8858
FL	Plantation, Gallagher	305-473-2101
GA	Lilburn, South Tech. Sls.	404-381-2088
IL	Des Plaines, ESCO Assocs.	708-298-5310
IN	Crawfordsville, Ed Mar Rep Assocs.	317-364-1871
MD	Randallstown, Chesapeake Mktg.	301-922-5997
MA	Randolph, Hatch Assocs.	617-963-3306
MI	Madison Hgts., D.E.M. Sls.	313-583-1500
MN	St. Paul, Proud Inds.	612-646-9428
NJ	Medford, Champion Elctrn. Sls.	609-983-0932
NM	Albuquerque, FP Sls.	505-345-5553
NY	Plainview, Neptune Elctrns.	516-349-1600
NC	Raleigh, South Tech. Sls.	919-573-1313
OH	Columbus, Ed Mar Rep Assocs.	614-431-5151
OR	Beaverton, Elctrn. Sources, Inc.	503-627-0838
TX	Plano, RAM Elctrns.	214-578-5400
WA	Bellevue, Elctrn. Sources, Inc.	206-451-3500
Can	Scarborough, Ont., Bach-Simpson	416-288-9932

Local Distributors

CA	Garden Grove, Capacitor Supp.	714-638-0510
CA	Garden Grove, National Elctrns.	714-892-7749
CA	San Jose, Passive Technlg.	408-435-5566
CA	Santa Maria, Garrett Instrs.	805-922-0594
CA	W. Covina, CSI	818-960-4761
CA	Yorba Linda, Corona Elctrns.	714-283-8185
FL	Boca Raton, NRC Elctrns.	407-241-8600
GA	Norcross, NRC-Jaro	404-729-0411
GA	Norcross, Spectrum Elctrns.	404-448-1516
IL	Arlington Heights, Mar/Lyn	312-364-0444
IN	Indianapolis, Mar Elctrns.	317-633-6699
MD	Gaithersburg, Axis Elctrns.	301-840-9640
MA	Billerica, A. W. Mayer Co.	617-229-2255
MA	Billerica, Baldwin Comps.	617-667-6710
MA	Wilmington, Aved Elctrns.	617-657-6310
MI	Farmington Hills, Key Elctrns.	313-489-5455
MN	New Brighton, Parts 1	612-633-8079
NJ	Fairfield, C.H.P.S., Inc.	201-882-0997
NJ	Kenilworth, Ventronics	201-272-9262
NY	Buffalo, Summit	716-887-2800
NY	Ronkonkoma, Baldwin Comps.	516-588-5700
OH	Cleveland, Repco	216-248-8900
PA	McKean, Advacom	814-476-7774
PA	Norristown, Century Elctrn. Comps.	215-631-5400
TN	Knoxville, Venture Elctrns. Sls.	615-544-0723
TX	Dallas, Omni-Pro	214-233-0500
VA	Charlottesville, Virginia Elctrns.	804-296-4184
Can	Willowdale, Ont., Electro Sonic	416-494-1666

MAUELL CORP., 31 Old Cabin Hollow Rd., P.O. Box 339, Dillsburg, PA 17019-0339, Tel: 717-432-8686, FAX: 717-432-8688; Empl.: 25; *Sls. Mgr.:* Frank A. Ulrich; *Dist. Mgr.:* Frank A. Ulrich

MAUREY INSTRUMENT CORP., 4555 W. 60th St., Chicago, IL 60629, Tel: 312-581-4555, FAX: 312-581-2576; FSC No.: 03942; Empl.: 50; *Sls. Mgr.:* E. Maurey; *Dist. Mgr.:* Louis Derdzinski ..... **A•2095-2103**

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CT	Killingworth, Gallagher Assocs.	203-663-2338
MA	Framingham, Gallagher Assocs.	617-626-2346
TX	Dallas, THT Sls. Co.	214-783-1501

Local Distributors

CA	Garden Grove, Allied Elctrns.	714-554-0731
CA	Santa Clara, Allied Elctrns.	408-727-1690
CO	Wheatridge, Allied Elctrns.	303-425-7144
FL	Margate, Allied Elctrns.	305-973-3070
LA	Lafayette, Ralphs Elctrns. Supply	800-825-4507
MA	Wilmington, Allied Elctrns.	617-942-0150
MI	Battle Creek, Great Lakes Elctrns.	616-963-6282
MI	Grand Rapids, SF Elctrn. Supp.	616-459-0216
MI	Westland, Allied Elctrns.	313-595-6565
MO	St. Louis, Allied Elctrns.	314-878-1229
NJ	Montville, Servo Sys. Co.	800-922-1103
NY	Mineola, Allied Elctrns.	516-248-2360
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PA	Bala Cynwyd, Allied Elctrns.	215-267-6940
TN	Knoxville, Shields Elctrns.	615-588-2421
TX	Ft. Worth, Allied Elctrns.	817-336-5401
TX	Houston, Allied Elctrns.	713-932-7321
VA	Alexandria, Allied Elctrns.	703-836-5002
WA	Seattle, Allied Elctrns.	206-767-5772
WI	Appleton, Appleton Elctrns.	414-734-5767

MAURY MICROWAVE CORP., 2900 Inland Empire Blvd., Ontario, CA 91764, Tel: 909-987-4715, FAX: 909-987-1112; FSC No.: 13047; Empl.: 75; *Sls. Mgr.:* M. A. Maury, Jr.

MAXELL CORP. OF AMERICA, 22-08 Rte. 208 S., Fair Lawn, NJ 07410, Tel: 201-794-5900, FAX: 201-796-8790; *Sls. Mgr.:* Ian D. Irving

MAXIM INTEGRATED PRODUCTS, 120 San Gabriel Dr., Sunnyvale, CA 94086, Tel: 408-737-7600, FAX: 408-737-7194

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MAXMAR CONTROLS INC., 99 Castleton St., Pleasantville, NY 10570, Tel: 914-747-3540, FAX: 914-747-3567; *Sls. Mgr.:* Max Birrer; *Dist. Mgr.:* Max Birrer

MAXON PRECISION MOTORS, INC., 838 Mitten Rd., Burlingame, CA 94010, Tel: 415-697-9614, FAX: 415-697-2887; *Sls. Mgr.:* Sam Robinson

MAXUS ELECTRONIC CORP., 2760 29th St., Boulder, CO 80301, Tel: 303-447-1226, FAX: 303-447-1446; Empl.: 6; *Sls. Mgr.:* Cory J. Gates

MAXWELL LABORATORIES, INC., 8888 Balboa Avenue, San Diego, CA 92123-1506, Tel: 619-279-5100, FAX: 619-279-1554; Empl.: 600; *Sls. Mgr.:* Michael M. Plum, V.P. Mktg.

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MB DYNAMICS INC., 25865 Richmond Rd., Cleveland, OH 44146-1483, Tel: 216-292-5850, TELEX: 510-601, FAX: 216-292-5614; Empl.: 45; *Sls. Mgr.:* Ed Peterson

MCCOY/OVENAIRE/SPECTRUM, A Sub. of Oak Industries, 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065, Tel: 717-486-3411, TWX: 510-650-3548, FAX: 717-486-5920; FSC No.: 00136; Empl.: 450 ..... **A•1412-1417**

Local Sales Offices & Reps

AL	Madison, Arthur, Harris, Assocs.	205-461-9896, FAX:205-461-9897
AZ	Mesa, Sedco Sls.	602-461-9069, FAX:602-461-1695
CA	Chatsworth, Wes-K/Raltech, Inc.	818-700-0933, FAX:818-709-9832
CA	Goleta, Thorson Co.	805-964-8751, FAX:805-964-8753
CA	San Diego, Thorson Co.	619-292-8525, FAX:619-292-9052
CA	San Mateo, Melvin Sls.	415-349-7445, FAX:415-349-6340
CA	Signal Hill, Thorson Co.	310-595-0361, FAX:310-595-1389
CO	Grand Function, Krebill Comp. Sls.	303-243-8220, FAX:303-243-7939
CO	Littleton, Advanced Tech Mktg.	303-798-4200
FL	Longwood, Septer & Assocs., Inc.	407-774-3161, FAX:407-774-2585
FL	Oviedo, Conley & Assocs.	407-365-3283, FAX:407-365-3727
GA	Marietta, Arthur, Harris, Assocs.	404-565-5506, FAX:404-971-9778
IL	Glendale Heights, Beta Technlg. Sls., Inc.	312-790-9886
IL	Northfield, Feller Assoc.	708-446-8065
IN	Ft. Wayne, Skyline Sls. & Assocs., Inc.	219-489-4992,FAX:219-489-6194
IN	Kokomo, Skyline Sls. & Assocs., Inc.	317-452-6500, FAX:317-452-6006
IA	Cedar Rapids, Jack L. Tucker & Assoc.	319-395-7616,FAX:319-395-7873
KY	Lexington, Skyline Sls. & Assocs., Inc.	606-276-5061,FAX:606-276-5142
MD	Towson, Dickison Sls.	410-823-0923, FAX:410-321-9664
MA	Norwood, Naton Assoc.	617-762-3224, FAX:617-769-4849
MN	Minneapolis, Dunlop Consits.	612-557-1076
NM	Albuquerque, Sunwest Mktg.	505-898-6471
NY	East Amherst, Foster & Wager, Inc.	716-688-7864
NY	Endicott, Foster & Wager, Inc.	607-748-5963, FAX:607-748-5965
NY	Liverpool, Foster & Wager, Inc.	315-457-7954, FAX:315-457-7076
NY	New Rochelle, Ascor Elctrns.	914-235-8838, FAX:914-235-2690
NY	Rochester, Foster & Wager, Inc.	716-385-7744, FAX:716-586-1359
NC	Greensboro, Arthur, Harris, Assocs.	919-275-3030, FAX:919-275-3877
NC	Matthews, Arthur, Harris, Assocs.	704-845-1085, FAX:704-845-1086
OR	Tigard, Eltech Incorp.	503-684-3458, FAX:503-684-6043
PA	Ft. Washington, Beta Sls.	215-643-6650, FAX:215-643-6651
TX	Austin, R. F. Kimball Co.	512-443-5284
TX	Richardson, R. F. Kimball Co.	214-231-3447, FAX:214-231-8314
VA	Charlottesville, PDQ Sls.	804-979-7085, FAX:804-979-2155
WA	Bellevue, Eltech. Incorp.	206-643-4330, FAX:206-643-0525
EXP	NJ, Oradell, Sylvan Ginsbury Ltd.	201-261-3200
EXP	Oradell, NJ, Sylvan Ginsbury	201-261-3200, FAX:201-261-2729
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Can	Scarborough, Ont., Elctrns. Sls. Prof. (ESP)	416-321-9693,FAX:416-321-9794

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MCG ELCTRNS., 12 Burt Dr., Deer Park, NY 11729, Tel: 516-586-5125, FAX: 516-586-5120; FSC No.: 29779; Empl.: 45; *Sls. Mgr.:* Don Worden ..... **B•1368**

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CA	Ventura, Power Partners	805-659-5356
CO	Denver, Computer Power & Air	303-534-4235
FL	Vero Bch., E.J. Ruth Assoc.	407-234-5460
IL	Crystal Lake, Carzoli Engr. Sls.	815-459-4397
IN	Fort Wayne, Progressive Controls	219-482-1409
LA	New Orleans, Indcom Sys.	504-486-4455
MA	Woburn, EMS	617-229-6686
MN	St. Louis Pk., Electro Midwest	612-922-7017
NJ	Oakland, Midlantic Mktg.	201-848-1144
OK	Oklahoma City, Circa Inc.	405-236-2606
OK	Tulsa, Allan & Assoc.	918-451-2962
TN	Ramona, Powerforce Sys.	615-681-6255
TX	Houston, Koenig & Assoc.	713-453-8844
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WV	Huntington, Seco, Inc.	304-522-9732

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AL	Huntsville, James E. Heusser Agy.	205-836-3896
CA	Cotati, Joseph Foster	707-792-4392
CA	Downey, Sierra Indl. Eng. Co.	310-803-6330
CO	Northglenn, Dan Ryall	303-452-8185
CT	Bristol, Eric Peterson	203-297-7464
IN	Bremen, Jan Richard Stahly	219-282-3592
IA	Des Moines, Jerry Bunch Electrical Sls.	515-287-7057
MI	Chelsea, Rick Mayday	313-995-2965
MN	Eagan, Stan Lock	612-890-9347
MS	Brandon, Service Electrical Sls.	601-992-9122
MO	St. Peters, Neil Klocke	314-947-2259
NJ	Plainfield, Don MacGillivray	908-753-4890
NM	Albuquerque, Paul Atkinson	505-292-1222
NY	Rochester, Integra Sls., Inc.	716-328-2110
OH	Euclid, Joe Ciulla	216-574-7164
PA	Coatesville, Emmett Ferra	215-380-8289
SC	Columbia, Harold Heaton	803-733-0941
TN	Nashville, Richard Hardy	615-748-1150
TX	Dallas, Raley Sls. Co.	214-368-1683
UT	Salt Lake City, Kev Paul	801-484-9941
VA	Richmond, Wynn Meredith	804-275-7970
WI	Kenosha, Wally Coats	312-299-2354
Can	Mississauga, Ont., Marr Elec. Ltd.	416-277-9481

Local Distributors

AL	Birmingham, Control Comps., Inc.	205-942-3760
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CA	Gardena, California Switch & Signal	213-770-2330
CA	Tustin, Western Switches	714-259-8144
CT	Wallingford, Cronin Elctrns.	203-624-3134
FL	Pompano Beach, Peerless Radio Corp.	305-973-4141
FL	Tampa, Raybro Elec. Supplies, Inc.	813-228-8571
IL	Wheeling, Hawk Elctrns.	708-459-4050
IL	Wood Dale, Nep Elctrns.	708-595-8500
IN	Indianapolis, Bell Inds.	317-875-8200
MA	Needham, Cronin Elctrns.	617-449-5000
MI	Livonia, RS Elctrns.	313-525-1155
MI	St. Clair Shores, SPEMCO	313-771-2700
MN	Minneapolis, Bergquist Co.	612-835-2322
MO	Maryland Heights, Olive Elctrns.	314-997-7709
NJ	Oakland, Relay Specialties Inc.	201-337-1000
NY	Rochester, Simcona Elctrns.	716-328-3230
NY	Woodside, Switches Unltd., Inc.	718-478-5000
NC	Charlotte, Southeastern Elctrns.	704-523-1122
OH	Maumee, RS Elctrns.	419-893-0721
OR	Portland, Dunn Elctrns.	503-285-0214
PA	Erie, Seaway Elec. Supp.	814-455-1304
WA	Renton, Dunn Elctrns.	206-271-6213
WI	Milwaukee, Marsh Elctrns.	414-475-6000

MCGUIRK ELECTRONICS CO. INC., 212 So. Main St, P. O. Box 853, Middleton, MA 01949, Tel: 617-933-3500; FSC No.: 55902; Empl.: 10; *Sls. Mgr.:* R. O'Neill

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MCI TRANSFORMER CORPORATION, 411 Manhattan Ave., Babylon, NY 11704, Tel: 516-587-0510; Empl.: 50; *Sls. Mgr.:* Timothy J. Williams ..... **A•2392-2403**

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MCKENZIE TECHNOLOGY, 910 Page Ave., Fremont, CA 94538, Tel: 510-651-2700; FSC No.: 5938; Empl.: 175; *Sls. Mgr.:* Kari Trautman; *Dist. Mgr.:* Vicky Wodopianov ..... **C•1415**

Local Sales Offices & Reps

AL	Huntsville, Cartwright & Bean, Inc.	205-830-1540
AZ	Scottsdale, Thom Luke Sls.	602-451-5400
CA	Pleasanton (N), Moulthrop Sls.	510-463-0450
CA	San Marcos, Falcon	619-591-0504
CO	Aurora, Interconnect Sls.	303-751-8777
CT	Waterbury, Compak, Inc.	203-753-6431
FL	Apopka, Cartwright & Bean, Inc.	407-889-9100
FL	Deerfield, Cartwright & Bean, Inc.	305-429-3400
GA	Norcross, Cartwright & Bean, Inc.	404-368-0160
IL	Woodbridge, Golten Assocs., Inc.	708-985-5100
IN	Fishers, Connect 21	317-578-2121
MD	Ellicott City, Tech. Sls.	410-461-2400
MA	Hudson, Compak Inc.	508-568-0331
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OH Loveland, Centruy Tech. Sls. 513-677-5088
OR Beaverton, Westmark Elctrns. 503-641-8780
TN Knoxville, Cartwright & Bean, Inc. 615-693-7450
TX Dallas, JYSCO. 214-349-1650
WA Bellevue, Westmark Elctrns. 206-454-1944
Can Ontario, Cana Rep Grp. 613-692-4682

Local Distributors

AZ Phoenix, Force Elctrns. 602-437-1060
AZ Tempe, D.C. Elctrns. 602-438-1234
AZ Tempe, TTI 602-431-1191
CA El Segundo, Force Elctrns. 213-772-1324
CA Fountain Valley, Comps Ctr., Inc. 714-979-0433
CA Milpitas, Kent Elctrns. 408-262-5300
CA Milpitas, R&D Elctrn. Parts 408-262-7144
CA Milpitas, TTI 408-946-5577
CA Mission Hills, TTI 818-891-8885
CA San Diego, Force Elctrns. 619-569-9661
CA San Diego, Kent Elctrns. 619-453-7133
CA San Diego, TTI 619-748-2025
CA San Jose, D.C. Elctrns. 408-453-2400
CA Santa Ana, TTI 714-641-9393
CA Sunnyvale, Abacus Elctrns. 408-732-2000
CA Torrence, Kent Elctrns. 714-773-0781
CA Tustin, D.C. Elctrns. 714-259-9066
CO Denver, Alliance Elctrns. 303-433-1648
CO Englewood, Kent Elctrns. 303-762-0670
CT South Bay, Heilind Elctrns. 203-262-1700
CT Wallingford, TTI 203-284-7474
FL Largo, Electronic Precepts of FL, Inc. 813-544-3636
FL Largo, Kent Elctrns. 813-545-0057
FL Longwood, RM Elctrns. 407-767-8005
FL Orlando, TTI 407-859-1000
GA Norcross, TTI 404-662-0911
IL Elk Grove Vlg., Kent Elctrns. 708-529-9977
IL Schaumburg, TTI 708-884-6500
IN Indianapolis, RM Elctrns. 317-843-9403
IA Cedar Rapids, Kent Elctrns. 319-373-0525
MD Columbia, Kent Elctrns. 301-720-6000
MD Columbia, TTI 410-995-1331
MA Chelmsford, Kent Elctrns. 508-250-9666
MA Tewksbury, TTI 508-857-2000
MA Wilmington, Heilind Elctrns. 800-800-1666
MI Grand Rapids, RM Elctrns. 616-531-9300
MN Duluth, Parts 1 218-624-0651
MN Minnetonka, TTI 612-933-8555
MN Roseville, Parts 1 612-633-8079
MN St. Paul, Kent Elctrns. 612-642-2828
MN Stillwater, Elctrn. Depot Supp. Co. 612-439-9409
MO Hazelwood, Kent Elctrns. 314-895-1515
MO Independence, Kent Elctrns. 816-254-3410
NH Atkinson, Astrum Elctrns. 603-898-3399
NJ Mt. Laurel, TTI 609-234-6400
NY Rochester, Cam RPC Elctrns. 800-827-2650
NY Ronkonkoma, TTI 516-737-2000
NC Raleigh, Century Elctrns. 919-596-2220
OH Dayton, TTI 513-898-8330
OH Independence, TTI 216-328-9755
OR Beaverton, Comp. Resources, Inc. 503-641-8488
OR Beaverton, Kent Elctrns. 503-626-8300
PA Pittsburgh, CAM RPC Elctrns. 412-782-3770
TX Austin, Kent Elctrns. 512-834-1900
TX Farmers Branch, Force Elctrns. 214-247-9955
TX Ft. Worth, Allied Elctrns. 817-595-3500
TX Ft. Worth, TTI 817-834-2202
TX Houston, Force Elctrns. 713-561-8644
TX Houston, Kent Elctrns. 713-780-7770
TX Houston, TTI 713-879-5800
TX Richardson, Kent 214-669-2600
WA Redmond, TTI 206-882-0291
WA Kent, Comp. Resources, Inc. 206-340-1646

MCL, INC., 501 S. Woodcreek Rd., Bolingbrook, IL 60440-4999, Tel: 708-759-9500, TWX: 910-683-1899, FAX: 708-759-5018 FSC No.: 16469; Empl.: 127; *Sls. Mgr.:* Ron Adamson

McLEAN ENGINEERING
DIVISION OF ZERO CORPORATION

FAX: 609-799-1081

MCLEAN ENGINEERING, Zero Corporation, 70 Washington Rd., Princeton Junction, NJ 08550, Tel: 609-799-0100, TWX: 510-685-2543; FSC No.: 03522; Empl.: 118; *Sls. Mgr.:* Craig A. Reed; *Dist. Mgr.:* Craig A. Reed ..... **C•1606-1607**

Local Sales Offices & Reps

AL Huntsville, Raycom 205-895-9264
AZ Fountain Hills, Halbar Assocs. 602-837-2464
CA San Mateo, Halbar Assocs. 415-349-4700
CA Van Nuys, Halbar Assocs. 818-906-3941
CO Boulder, Comps. Prods. Sls. 303-530-2800
FL Orlando, Raycom 407-859-5504
IL Elmhurst, Scott Assocs. 708-279-5681
MD Rockville, Marktron 301-251-8990
MA Chelmsford, JEBCO 508-256-5800
MI Farmington, Marlow Assocs. 313-478-2240
MN Minneapolis, Scott Elctrn. Sls. 612-929-2985
MO Grandview, Harris-Hanson 816-763-6200
MO St. Louis, Harris-Hanson 314-432-3611
NJ Lebanon, Sylvester Sls. Assocs. 201-735-2488
NM Albuquerque, S & S Technlgs. 505-298-7177
NY Rochester, Talty Assocs. 716-323-1210
NC Raleigh, Raycom 919-266-9827
OH Cleveland, Marlow Assoc. 216-831-8232
OH Dayton, Marlow Assoc. 513-274-9666
OR Tigard, Halbar-RTS 503-624-5741
PA Allison Park, Marlow Assoc. 412-487-0664
PA Huntingdon Valley, Inacker Sls. 215-947-5660
TX Dallas, REM-AIR 214-234-1069
WA Redmond, Halbar-RTS 206-882-0990
Can Guelph, Ont., Hammond Mfg. Co. 519-822-2960

Local Distributors

FL Ft. Lauderdale, Component Distrs. 305-971-4950
GA Norcross, Component Distrs. 404-441-3320
MI Ann Arbor, Wedemeyer Elctrn. Supp. Co. 313-665-8611
NC Raleigh, Component Distrs. 919-834-9465
TX Dallas, Component Distrs. 214-644-0373
Can Guelph, Ontario, Hammond Mfg. Co. 519-822-2960

McLEAN MIDWEST
SUBSIDIARY OF ZERO CORPORATION

FAX: 612-569-0533

MCLEAN MIDWEST, Sub. of Zero Corporation, 4000 83rd Ave. N., Brooklyn Pk., MN 55443, Tel: 612-561-9400; *Sls. Mgr.:* J. Buyse; *Dist. Mgr.:* D. Walker, Distr. Sls. Dir. ..... **C•1608-1609**

Local Sales Offices & Reps

AZ Tempe, Border States Tech. Assocs. Inc. 602-839-0248
CA Laguna Hills, Western Automation 714-859-6988
CA Oakland, Powermatic Assocs. 510-635-6825
CO Boulder, Comp. Prod. Sls. Co. 303-530-2800
FL Winter Pk., Southland Comps. Inc. 407-629-5550
GA Norcross, F & J Squared Assocs. 404-368-9191
IL Elmhurst, Scott Assocs., Inc. 708-279-5681
MD Rockville, Marktron, Inc. 301-251-8990
MA Chelmsford, John E. Boeing Co. 508-256-5800
MI Sterling Hgts., Alliance Sls. Co. 313-726-8670
MN Minneapolis, Scott Elctrn. Sls. 612-929-2985
MO St. Louis, Harris-Hanson Co. 314-432-3611
NJ Totowa, R.O.I. Sls. Co. 201-812-9606
NY Endwell, Reagan/Compar, Inc. 607-754-2171
NC Charlotte, F & J Squared Assocs. 803-548-2133
OH Cleveland, Marlow Assocs. 216-831-8232
PA Huntingdon Valley, Inacker Sls. Inc. 215-947-5660
PA Pittsburgh, Marlow Assocs., Inc. 412-487-0664
TX Dallas, The Power Connection 214-401-3490
WA Redmond, HALBAR-RTS, Inc. 206-882-0990

MCSI, 2598-G Fortune Way, Vista, CA 92083, Tel: 619-598-2177, FAX: 619-598-2450; Empl.: 25; *Sls. Mgr.:* Jim Edwards

Local Sales Offices & Reps

CA Laguna Hills, Computech Assocs. 714-837-8421
CA Sunnyvale, Qualtech Assocs. 408-732-4800
CT Orange, Isdale Assocs. 203-387-2704
GA Duluth, Dixie Tech. Mktg. 404-381-5592
IL Arlington Heights, Coombs Assocs., Inc. 708-439-9892

3M AUDIO AND VIDEO MARKETS DIVISION, 223-5N-01, St. Paul, MN 55144-1000, Tel: 612-733-7644, FAX: 612-737-5583; Empl.: 38,351

In any city, 1-800-752-0732 In area code 703, Call 1-800-831-8726

3M DYNATEL SYSTEMS DIVISION, See 3M Telecom Markets Division

3M

FAX: 512-984-2211

3M ELECTRICAL SPECIALITIES DIVISION, 6801 River Place Blvd., Bldg. 130-3N-56, Austin, TX 78726-9000, Tel: 800-328-1368; *Sls. Mgr.:* Mike Martin ..... **C•1667; D•2311**

Local Sales Offices & Reps

CA Los Angeles 213-726-6563
GA Atlanta 404-447-7000
MN St. Paul 612-736-3269
PA Philadelphia 215-638-6300

3M PHOTODYNE PRODUCTS, See 3M Telecom Markets Divison

3M-ELECTRONIC PRODUCTS DIVISION, 6801 River Place Blvd., Austin, TX 78726, Tel: 1-800-225-5373 Sls. & Prod. Info., TELEX: 29-7023, FAX: 512-984-6972; *Sls. Mgr.:* Joe Bruzzone ..... **C•1667; D•2311**

Local Sales Offices & Reps

CA Campbell, Olsheski & Assoc. 408-378-6003
CA Danville, Olsheski & Assoc. 415-820-9144
CA Valencia, Cessing Assocs. 805-295-0225
CO Wheatridge, Cluff & Assoc. 303-425-6604
CT Chesire, The Macinnis Co. 203-372-3797
FL Apopka, Cartwright & Bean, Inc. 407-889-2168
FL Deerfield Beach, Cartwright & Bean, Inc. 305-429-3400
GA Atlanta, Wallace Elctrn. Sls. 800-334-3518
IL Lombard, RMP/McBride Corp. 312-932-9090
IN Indianapolis, M & L Elctrn. Sls. 317-359-4742
IA Cedar Rapids, T. Dowell & Assoc. 319-364-3880
KS Overland Park, T. Dowell & Assoc. 913-599-1100
LA Slidell, Wallace Elctrn. Sls. 504-643-4751
MD Lisbon, S.K. MacDonald, Inc. 301-442-1590
MA Norwood, The Macinnis Co. 617-762-8090
MI Warren, Burcaw Co. 313-573-6048
MI Wyoming, Burcaw Co. 313-573-4605
MN Edina, Restronics, Inc. 612-941-9135
MO St. Louis, T. Dowell & Assoc. 314-849-4334
NJ Cherry Hill, S.K. MacDonald, Inc. 609-482-2666
NY Hauppauge, Aurora-Schmitt Assoc. 516-434-1572
NY Syracuse, T-Squared Elctrns., Co. 315-463-8592
NY Victor, T-Squared Elctrns. Co. 716-924-9101
NC Kernersville, Wallace Elctrn. Sls. 919-996-2742
OH Beachwood, Elctrns. Salemasters 216-831-9555
OR Beaverton, Pacific Mktg. Specialists 503-641-9373
PA Monroeville, S.K. MacDonald, Inc. 412-373-1723
TN Tullahoma, Wallace Elctrn. Sls. 800-334-3518
TX Dallas, Elcom Mktg. 214-241-2166
TX Houston, Elcom Mktg. 713-350-8064
WA Redmond, Pacific Mktg. Specialists 206-882-3144
Can London, Ont., David Allen

Local Distributors

AL Huntsville, Hall-Mark 205-837-8700
AL Huntsville, Powell Elctrns. 205-539-2731
AZ Phoenix, Arizona Comps. Co. 602-269-5655
AZ Phoenix, Hall-Mark 602-437-1200
AZ Tempe, Acacia/Deanco, Inc. 602-894-2874, 602-882-9054
AZ Tempe, Shelley-Ragon, Inc. 602-894-2058
CA Chatsworth, Hall-Mark 818-773-4500
CA Chatsworth, Shelley-Ragon, Inc. 818-998-3333
CA Costa Mesa, Powell Elctrns. 714-754-1717
CA Fremont, Acacia/Deanco, Inc. 415-623-7500
CA Garden Grove, Richey/Impact Elctrns. 714-895-0060
CA Irvine, Acacia/Deanco, Inc. 714-660-0834, 213-971-2428
CA Rocklin, Hall-Mark 916-624-9718
CA San Diego, Acacia/Deanco, Inc. 619-565-4365
CA San Diego, Hall-Mark 619-268-1201
CA San Diego, Richey/Impact Elctrns., Inc. 619-271-4511
CA San Diego, Shelley-Ragon, Inc. 619-453-7133
CA San Jose, Hall-Mark 408-432-0900
CA San Jose, Powell Elctrns., Inc. 408-943-9020
CA San Jose, Richey/Impact Elctrns., Inc. 408-432-7100
CA San Jose, Shelley/Ragon 408-432-0600
CA Santa Clara, DC Elctrn. Supp. 408-980-1199
CA Torrance, Kent Elctrns. 213-320-2700
CA Tustin, DC Elctrns. 714-259-9066
CA Tustin, Hall-Mark 714-669-4700
CO Denver, CSID/Integrated Fastn. Inc. 303-292-9594
CO Englewood, Hall-Mark .. 303-790-1662,303-790-4991
CO Englewood, Shelley-Ragon, Inc. 303-762-0670
CO Englewood, Shelley/Ragon 303-762-0670

CT Cheshire, Hall-Mark 203-271-1704
CT East Haven, JV Elctrns. 203-469-2321
CT Yalesville, Schaal Assocs., Inc. 203-269-3779
FL Casselberry, Hall-Mark 407-830-5855
FL Ft. Lauderdale, Powell Elctrns. 305-484-8377
FL Largo, Hall-Mark 813-541-7440
FL Pompano Beach, Hall-Mark 305-971-9280
FL Tampa, Shelley-Ragon, Inc. 813-623-6560
FL Winter Park, Deanco 305-671-5100
GA Marietta, Deanco 404-429-0126
GA Norcross, Hall-Mark 404-447-8000
IL Bensenville, Magnuson Elctrns. 312-595-7575
IL Wood Dale, Hall-Mark .. 312-860-3800,312-860-0239
IL Wood Dale, NEP Elctrns., Inc. 312-595-8500
IN Ft. Wayne, Bell Inds., Inc. 219-423-3422
IN Indianapolis, Bell Inds., Inc. 317-875-8200, 800-622-4814,
IN Indianapolis, Hall-Mark 317-872-8875
IN Indianapolis, Magnuson Elctrns., Inc. .. 317-247-5108
IA Cedar Rapids, Shelley-Ragon, Inc. 319-373-0525
KS Lenexa, Hall-Mark 913-888-4747
MD Annapolis Jct., Powell Elctrns., Inc. 301-880-3255, 301-953-3435
MD Columbia, Aztech Elctrns. 301-995-6800, 800-777-5977
MD Columbia, Hall-Mark 301-998-9800
MD Gaithersburg, Deanco 301-948-5444
MA Billerica, Hall-Mark 508-667-0902
MA Burlington, Schaal Assocs./Deanco ... 617-272-1506
MA Canton, Richey/Impact Elctrns. 617-821-1500
MA Westboro, Powell Elctrns. 508-366-6100
MI Grand Rapids, RM Elctrns. 616-531-9300
MI Livonia, Hall-Mark 313-462-1205
MI Southfield, Michigan Lectrols 313-353-1350
MN Eden Prairie, Hall-Mark 612-941-2600
MN St. Paul, Shelley/Ragon Elctrns. 612-642-2828
MO Earth City, Hall-Mark 314-291-5350
MO Hazelwood, Shelley-Ragon, Inc. 314-895-1515
MO Independence, Shelley/Ragon Inc. 816-254-3410
MO St. Charles, Lectronix, Inc. 314-946-6424, 800-325-3348
NJ Englewood, Powell Elctrns. 201-894-0800
NJ Fairfield, Deanco 201-575-7960
NJ Parsippany, Hall-Mark 201-515-4475
NJ Teterboro, EAC 201-772-6400,201-288-4477
NJ Mt. Laurel, Hall-Mark 609-235-1900
NY Fairport, Hall-Mark 716-425-3300
NY Farmingdale, Addem Distrs. 516-752-9303
NY Hauppauge, Schaal Assocs., Inc. 516-434-7100
NY Ithaca, Deanco 607-257-4444
NY Medford, Shelley-Ragon, Inc. 516-447-2000
NY Ronkonkoma, Hall-Mark 516-737-0600
NC Cary, Powell Elctrns. 919-467-1212
NC Charlotte, Elctrns. Mktg. Corp. 704-394-6195
NC Raleigh, Deanco, Inc. 919-851-2065
NC Raleigh, Hall-Mark 919-872-0712
OH Columbus, Elctrns. Mktg. Corp. 614-299-4161
OH Dayton, Elctrns. Mktg. Corp. 513-439-4711
OH Dayton, Stotts-Friedman 513-298-5555
OH Highland Heights, Elctrns. Mktg. Corp. 216-442-3441
OH Solon, Hall-Mark 216-349-4632
OH Worthington, Hall-Mark 614-888-3313
OK Tulsa, Hall-Mark 918-254-6110
OK Tulsa, Norvell Elctrns. 918-663-1247
OR Beaverton, Acacia/Deanco, Inc. 503-646-3377
OR Beaverton, Shelley/Ragon 503-641-1691
OR Tualatin, Moore Elctrns., Inc. 503-692-5333
TX Houston, Hall-Mark 713-781-6100
PA Philadelphia, Powell Elctrns. 215-365-1900
TX Richardson, Kent Electrns. 214-669-2600
TX Austin, Hall-Mark 512-258-8848
TX Austin, Kent Elctrns. 512-834-1900
TX Austin, Norvell Elctrns., Inc. 512-837-5555
TX Dallas, Hall-Mark 214-553-4300
TX Dallas, Norvell Elctrns. 214-233-0020
TX El Paso, ERA Elctrns. 915-855-3600
TX Houston, Kent Elctrns. 713-780-7770
TX Houston, Norvell Elctrns. 713-777-1666
TX Plano, Tactic Elctrns. 214-422-0777
UT W. Valley City, Hall-Mark 801-972-1008
WA Redmond, Acacia/Deanco, Inc. 206-881-5566
WA Redmond, Shelley/Ragon Elctrns. 206-883-2220
WA Seattle, Hall-Mark 206-547-0415
WA Tukwila, Carlyle Inc. 206-251-0700
WI Milwaukee, Elctrn. Expeditors, Inc. 414-228-8100
WI New Berlin, Hall-Mark 414-797-7844

3M PRIVATE NETWORK PRODUCTS, 3M, 6801 River Place Blvd., Austin, TX 78726, Tel: 512-984-3400, 800-426-8626, FAX: 512-984-6628; Empl.: 50; *Sls. Mgr.:* R.C. Ware

3M TELECOM MARKETS DIVISION, 6801 River Place, Austin, TX 78726, Tel: 512-984-3400, 800-426-8626, FAX: 512-984-3408; *Sls. Mgr.:* W.E. Metzler

MDF PRODUCTS INC., 7 Johnson Dr., Danbury, CT 06811, Tel: 203-743-3579, TELEX: 499-8051, FAX: 203-744-2704; FSC No.: 60628

MDM, INC., 9601 Irondale Ave., Chatsworth, CA 91311, Tel: 818-700-8400, FAX: 818-700-1938; FSC No.: 60994; Empl.: 150; *Sls. Mgr.:* Steven J. LaLonde

MDS CALIBRATION LAB. INC., 437-H Mary Esther Cutoff, Ft. Walton Beach, FL 32548, Tel: 904-664-1234, FAX: 904-664-6789; *Sls. Mgr.:* Gerry Doiron

MEA DIV., See Mechanized Elctrn. Assembly Div., Universal Instrs. Corp.

MEASUREMENTS GROUP, INC., Box 27777, Raleigh, NC 27611, Tel: 919-365-3800, TELEX: 62919594, FAX: 919-365-3945

MEASUREMENT SYSTEMS, INC., 777 Commerce Dr., Fairfield, CT 06430, Tel: 203-336-4590, FAX: 203-336-5945; Empl.: 97; *Sls. Mgr.:* Gerard M. Lacrocque, Nat'l. Sls. Mgr. ..... **D•1163**

Local Sales Offices & Reps
AZ Scottsdale, Advent Comps. 602-481-0044
CA Anaheim, Gabriel & Assoc. 714-531-7674
IA Cedar Rapids, S & O Sls. 319-393-7331
MD Columbia, Robert Elctrn. Sls. 301-995-1900
MA Hudson, Data Rep 508-481-0333
MN Edina, Elctrn. Sls., Inc. 612-933-9070
MO St. Louis, J. S. DeWeese Co. 314-469-7350
OH Medina, J. C. Hofstetter Co. 216-241-4880
PA Hickory, J. C. Hofstetter Co. 412-356-2305
TX Richardson, Scientific Sls. Co. 214-231-6541
VA Richmond, Robert Elctrn. Sls. 804-276-3979

MEC A/S, Industriparken 23, Ballerup, Denmark DK-2750, Tel: 011-45-44973366, FAX: 011-4544681514; Empl.: 50

Local Sales Offices & Reps
CA San Rafael, Wright Assocs. 415-457-9940
AZ Scottsdale, Advent Comps. Corp. 602-481-0044
CA Tustin, Schoenbachler-Dobson 715-544-1888
FL Tampa, Florida Comps. Sls. 813-873-3622
IL Schiller Park, W.R.B. Inc. 708-678-7888
IN Ft. Wayne, Menze Sale 219-747-5616
KS Overland Park, M.I.N.K. Assocs., Inc. ... 913-341-8309
MD Gaithersburg, Naudian Assoc. Southern 301-258-5040
MA Hopkinton, Berkshire Elctrns. 508-435-9356
MI Dearborn, Pitcher-Poulin 313-582-5450
MN Minneapolis, Tech. Comps. Grp. 612-536-9512
MO Bridgeton, M.I.N.K. Assocs., Inc. 314-291-5454
NY Great Neck, Pacent Engrg. 516-482-4678
NJ Union, Pacent Engrg. 201-687-7197
NJ Burlington, VDE Elctrns. 609-387-9331
NC Silver City, Crossroads Elctrns. 919-742-2372
TX Richardson, R.F. Kimball Co. 214-231-3447
WI Mequon, W M Bolles Assoc. Inc. 414-241-3320

Local Distributors
CA Gardena, California Switch & Signal .. 310-538-9830
CA Los Angeles, Electric Switch 213-660-1310
CA Sunnyvale, Target Elctrns. 408-733-0384
CA Van Nuys, Wes-Garde Comp. Grp. 213-873-4802
CT Hartford, Wes-Garde Comp. Grp. 203-527-7705
FL Lakeland, Switch Controls, Inc. 813-644-7564
IL Carol Stream, Wes-Garde Comps. 708-653-1460
KS Overland Park, Wes-Garde Comps. ... 913-262-2718
MA Canton, Xenell 617-828-2948
MI St. Clair Shores, Spemco Inc. 313-771-2700
MN Minneapolis, Carl Bergquist Co. 612-835-2322
MO St. Louis, Wes-Garde Comp. 314-567-7776
NH Nashua, Wes-Garde Comp. 603-880-1971
NJ Mt. Laurel, Wes-Garde Comps. 609-778-8190
OH Westerville, Wes-Garde Comps. 614-885-0319
TX Dallas, Wes-Garde Comps. 214-357-1768
WI Milwaukee, Progressive Image 414-321-4722

FAX: 517-782-2810

MECHANICAL PRODUCTS INC., 1824 River St. P. O. Box 729E, Jackson, MI 49204, Tel: 517-782-0391, TWX: 810-253-0827; *Sls. Mgr.:* Dave Olson .... **B•1369-1374**

Local Sales Offices & Reps
AL Decatur, Tenn Tech. 205-350-0630
AZ Scottsdale, Advent Comps. Corp. 602-481-0044
CA Los Angeles, Universal Components Co. 213-641-4255
CA Sunnyvale, Pass Associates 408-735-9040
CO Denver, Advent Comps. Corp. 303-455-1985
FL Tampa, Florida Comp. Sls., Inc. 813-873-3622
GA Marietta, Tenn Tech. 404-971-1419
IL Barrington, Perhats Assocs. 708-381-6360
IN Indianapolis, Rockford Controls Ohio 317-251-2866
KS Prairie Village, C. Logsdon & Assoc. .. 913-381-3833
MD Pikesville, Muncy Sls. 301-484-6376
MA Danvers, Global Technical Sales 508-774-0111
MN St. Paul, Mackubin Grp. 612-636-5686
MO St.Louis, C. Logsdon & Assoc. 314-849-5125
NJ Pitman, Colrud Corp. 609-589-5866
NY Port Washington, Ashtec, Inc. 516-267-0981
NC Garner, Tenn Tech. 919-779-3309
OH Medina, Rockford Controls Ohio, Inc. 216-725-3705
OK Barrington, Global Technical Sales ... 603-664-5780
OR Hillsboro, Doran Sales Assoc. 503-640-4500
RI Lincoln, Global Technical Sales 401-334-3830
TX Dallas, Control Comps. Corp. 214-458-8877
WA Redmond, Doran Sales Assoc. 206-448-1200
Can Downsview, Ont., Har Tech 416-665-7773
Can Pointe Claire, Que., Har Tech 514-694-6110

Local Distributors
CA Gardena, Cal Switch ... 213-770-2330/213-538-9830
CA San Carlos, Campbell & George Co. .. 415-594-1994
CO Denver, Consolidated Parts 800-748-2963
FL Ft. Lauderdale, Zelcon, Inc. 305-565-2555/6
FL Lakeland, Wes-Garde Comps. Grp. ... 800-282-7619
IL Carol Stream, Wes-Garde Comps. Grp. 800-323-9431
IL Chicago, Nep Elctrns. 708-625-8400
MA Danvers, RCI 617-777-4441
MI St. Clair Shore, Spemco Switch, Inc. .. 313-771-2700
MN Minneapolis, Berquist 612-835-2322
NY Bohemia, Genelco 800-645-9802
NY Plainview, Linrose Elctrns. 516-293-2520
NY Woodside, Switches Unlimited 800-221-0487
OH Euclid, Rockford Controls Ohio, Inc. ... 216-731-5250
TX Arlington, Bell Components Sls., Inc. .. 817-461-5303
Can Scarborough, Ont., Carsten Elctrns. Ltd. 416-495-9999
Can St. Laurent, Que., Tara Inds. Corp. 514-331-6550

MECHANIZED ELCTRN. ASSEMBLEY DIV., UNIVERSAL INSTRS. CORP., See Dover Electronics Manufacturing

MECHATRONICS INC., 2835 82nd Ave. S.E., P.O. Box 20, Mercer Island, WA 98040, Tel: 206-232-4800, FAX: 206-236-5480; Empl.: 40; *Sls. Mgr.:* Jim Innes ..... **C•1610-1611**

Local Sales Offices & Reps
WA Mercer Island, Mechatronics Inc. 206-232-4800

MECH-TRONICS, 100 Campus Dr., RR 30, Mount Holly, NJ 08060, Tel: 609-267-0680, FAX: 609-267-7621; *Sls. Mgr.:* Peter Reed

MECO PRECISION/INDS. INC., 955 Connecticut Ave., Bridgeport, CT 06607, Tel: 203-333-4900, FAX: 203-333-4519; FSC No.: OSBC1; Empl.: 10

MEDA, INC., Macintyre Electronics Design Assocs., 485 Spring Pk. Pl., Ste 350, Herndon, VA 22070, Tel: 703-471-1445, FAX: 703-471-9130; Empl.: 6; *Sls. Mgr.:* Barbara Vayda

Local Distributors
CA Carlsbad, ASC Scientific 619-431-2655
MA Worcester, Walker Scientific Inc. 508-852-3674
PA Media, Phase Two Technlgs., Inc. 215-340-0313

MEDIA RECOVERY INC., Box 1407, Graham, TX 76450, Tel: 800-527-9497, 817-549-5462 (Texas), TELEX: 73-2561; Empl.: 130; *Sls. Mgr.:* J. Ricciardi

MEDICAM TECHNOLOGIES INC., 35 Sagamore Park Dr., Hudson, NH 03051, Tel: 603-886-9460, FAX: 603-886-0372; Empl.: 4; *Sls. Mgr.:* Robert C. Rush

MEGA CIRCUIT, INC., 1040 S. Westgate, Addison, IL 60101, Tel: 708-629-1800, FAX: 708-629-1800; Empl.: 45; *Sls. Mgr.:* Jim Malavia

MEGADATA CORP., 35 Orville Dr., Bohemia, NY 11716, Tel: 516-589-6800, FAX: 516-589-6858; FSC No.: 53436; Empl.: 40; *Sls. Mgr.:* Steve Sloan

MEGA SYSTEMS & CHEMICALS, 4828 S. 40th St., Phoenix, AZ 85040, Tel: 602-437-9105, FAX: 602-437-2613; Empl.: 15

Local Sales Offices & Reps

OR Portland, Mega Sys. & Chemicals 503-228-4773
EXP Milano, Italy, High Purity Tech. 02-26821604
EXP Swindon, England, Wessex Semicon 602-437-9105

(MEI) MARPET ENTERPRISES, INC., 107 Audubon Rd., Wakefield, MA 01880, Tel: 617-246-2040, FAX: 617-246-0603; Empl.: 30; *Sls. Mgr.:* John A. Pope

MEISSNER INDUSTRIES, 551 Rte. 10, Dover, NJ 07801, Tel: 201-366-1700; Empl.: 10

MEKTRONIX TECHNOLOGY, INC., 507 N. Milwaukee Ave., Libertyville, IL 60048-2000, Tel: 708-680-3300, FAX: 708-680-1868; Empl.: 5; *Sls. Mgr.:* Gregory Mayworm

MELCHER

Tel: 800-828-9712

MELCHER, INC., Melcher AG, 187 Billerica Rd., Chelmsford, MA 01824, FAX: 508-256-4642 ; Empl.: 280; *Sls. Mgr.:* Rob Sinclair ..... **D•2131-2135**

Local Sales Offices & Reps

AL Huntsville, Currie, Peak & Frazier 205-536-1506
AZ Scottsdale, Power Up Elctrns. 602-955-1105
CA Cupertino, PEI Assocs. 408-253-1960
CA La Habra, West Coast Reps. 213-690-9960
CO Parker, TMA 303-841-3435
FL Orlando, Currie, Peak & Frazier 407-855-0843
GA Duluth, Currie, Peak & Frazier 404-497-9404
IL Arlington Hgts., Coombs Assocs., Inc. 708-439-9810
IA Cedar Rapids, Tech. Sls. Assoc. 319-373-0686
KS Olathe, Tech. Sls. Assocs. 913-829-2800
MA Chelmsford, Melcher, Inc. 800-828-9712
MA Whitinsville, Power Factor Assoc. 508-234-6415
MI Troy, CB Jensen & Assocs. 313-643-0506
MN Wayzata, Cardinal Sls. 612-475-0042
MO St. Louis, Tech. Sls. Assocs. 314-521-2044
NY Wantagh, Bytec Reps. 516-781-7400
NC Greensboro, Currie, Peak & Frazier ... 919-373-0380
OH Centerville, EMA, Inc. 513-433-2800
PA Nottingham, Excel Tech 717-529-6059
TX Richardson, Jim D. Gray & Assocs., Inc. 214-699-9976
WA Bellevue, Advanced Power Comps. ... 206-747-9127
WA Spokane, APC 509-922-7959
WI Brookfield, McMahon Inc. 414-782-3335
Can Ontario, Melcher Corp. 416-727-9341

meLCOR

FAX: 609-393-9461

MELCOR/MATERIALS ELCTRN. PRODS., 1040 Spruce St., Trenton, NJ 08648, Tel: 609-393-4178; FSC No.: 32333; Empl.: 275; *Sls. Mgr.:* M.A. Levine ..... **C•1613-1616**

Local Sales Offices & Reps

CA San Jose, Shaw Tech, Inc. 408-866-6628
CO Fort Collins, Rep Sls., Inc. 303-226-1504
NY W. Henrietta, Exogray Tech. Sls. 716-334-1340

PERIPHERAL RESOURCES, 9911 W. Pico Blvd., Ste. B-215, Los Angeles, CA 90035, Tel: 310-552-3888, 800-533-2297, FAX: 310-552-2806; Empl.: 11; *Sls. Mgr.:* Bil Dwyer

MELFESS FIVE INC., See Peripheral Resources

MEL-RAIN CONTROLS, 42974 M-43 Hwy., Paw Paw, MI 49079, Tel: 616-657-2527, FAX: 616-657-2528; FSC No.: 639; Empl.: 20; *Sls. Mgr.:* Howard F. Walter

MEMCOR-TRUOHM INC.

FAX: 219-356-7376

MEMCOR-TRUOHM, INC., 1320 Flaxmill Rd., Huntington, IN 46750, Tel: 219-356-4300; FSC No.: 24681; Empl.: 250; *Sls. Mgr.:* Ray Vanderspool ..... **A•1984, 2105**

Local Sales Offices & Reps

AL Huntsville, Murcota 205-539-8476
CA American Canyon, Jacobson & Assoc. 707-552-4412
CA Huntington Bch., Mil-Com Sls. 714-840-2424
FL Indialantic, Raycom 305-727-8860
GA Atlanta, Murcota 404-875-2525
IL Chicago, D. Dolin Sls. 312-286-6200
IN Ft. Wayne, Menze Sls. 219-747-5616
MI St. Clair Shores, J.M. Thorpe 313-779-6363
MO St. Charles, Hayes Elec. Sls. Co. 314-946-6677
NH Atkinson, Mark Rep Assoc. 603-382-9563
NJ Englewood Cliffs, Masin Esco 201-569-8868
NY Hauppauge, Masin Esco 516-273-3500
NY Marcellus, Mullahy Sls. Inc. 315-685-6280
NC Burlington, Murcota 919-585-1577
NC Winston-Salem, Murcota 919-723-1001
OH Cleveland, Glover Sls. 216-842-4520
PA Newtown Square, G.M. Conneen 215-353-2241
TX Dallas, SW Elctrn. Ind. 214-233-9816
TX Houston, SW Elctrn. Ind. 713-729-1670

MEMODYNE, 20 Ossipee Rd., Newton, MA 02164, Tel: 617-964-6556 (in MA), 800-255-1510, FAX: 617-964-2444; Empl.: 40; *Sls. Mgr.:* Leonard Sacon

MEMORY PROTECTION DEVICES, INC., 320 Broad Hollow Rd., Farmingdale, NY 11735, Tel: 516-293-5891, FAX: 516-752-1971; *Sls. Mgr.:* Thomas Blaha ..... **D•1455**

Local Sales Offices & Reps

CA Irvine, English/Damco Sls. Co., Inc. ... 714-753-1950
CA Mountain View, Griffith, Nunley & Assocs. 415-961-6740
FL Tampa, SRT Mktg. 813-884-4805
IL Downers Grove, Momak Sls. 708-963-6400
MD Lisbon, S.K. MacDonald, Inc. 301-982-1088
MI Brighton, A.P. Assocs., Inc. 313-229-6550
MN Eden Prairie, Electro Mark, Inc. 612-944-5850
NH Hampton, Primary Source 603-926-8044
NJ Cherry Hill, S.K. MacDonald, Inc. 609-482-2666
NJ New Brunswick, Synergy Sls. 908-828-5090
OR Beaverton, Advanced Power Prods., Inc. 503-646-0994
OR Monroeville, S.K. MacDonald, Inc, ... 412-373-1723
WI Fontana, Momak Sls. 414-363-7744

Local Distributors

AL Huntsville, Cypress Elctrns. 205-533-0783
AL Huntsville, Powell Elctrns. 205-837-5300
AL Huntsville, Resistacap, Inc. 205-883-4270
AZ Phoenix, Lynntronics 602-841-3900
CA Costa Mesa, Battery Specialties 800-854-5759
CA Costa Mesa, Cypress Elctrns. 714-549-2424
CA Huntington Beach, House of Batteries 714-642-8222
CA Irvine, Powell Elctrns. 714-263-9363
CA San Diego, Tauber Elctrns. 619-274-7242
CA San Jose, Powell Elctrns. 408-943-6438
CA San Jose, Rose Elctrns. 408-263-9700
CA Santa Clara, Cypress Elctrns. 408-980-2500
CA Van Nuys, Nesco Battery Sys. 818-781-0505
CO Arvada, Denver Beta Wintronics 303-431-7161
CO Englewood, AVT, Inc. 303-779-8056
CO Englewood, Cypress Elctrns. 303-792-5829
FL Fort Lauderdale, Powell Elctrns. 305-484-8377
FL St. Petersberg, Engrd. Assemblies & Comps. Corp. 813-328-1970
GA Norcross, Applied Power 404-263-0421
GA Norcross, Engrd. Assemplies & Comps. Corp. 404-446-3135
IL Morton Grove, Power Pak 312-966-6000
MD Annapolis Junction, Powell Elctrns. ... 301-880-3255
MA Methuen, Generation Elctrns. 508-683-1177
MA Sutton, Engrd. Assembilies and Comp. Corp. 508-865-0722
MA Westborough, Powell Elctrns. 508-366-6100
MI Brighton, Applied Power 313-227-3604
MN Eden Prairie, Cypress Elctrns. 612-934-2104
MN Minneapolis, Stark Elctrns. 612-332-1325
MN Thief River Falls, Digi Key Corp. 218-681-6674
NJ Little Falls, Powell Elctrns. 201-890-0010
NJ Mountainside, Mars Elctrns. 908-233-0044
NJ Teterboro, Engrd. Assembilies & Comp. Corp. 201-288-4477
NY Buffalo, Summit Distrs. 716-887-2800
NC Cary, Powell Elctrns. 919-467-1212
NC Raleigh, Engrd. Assembilies & Comps. Corp. 919-790-9700
OH Columbus, Promark Elctrns. 614-351-2191
OR Beaverton, Micro Power 503-626-7086
PA Philadelphia, Powell Elctrns. 215-365-1900
TX Dallas, Cypress Elctrns. 214-255-0065
TX Ft. Worth, Tandy Natl. Parts 817-870-5600
TX Irving, Powell Elctrns. 214-550-0457
UT W. Valley City, Denver Beta Wintronics 801-966-0378
WA Bothell, Cypress Elctrns. 206-483-1144
WA Seattle, Powell Elctrns. 206-439-8550
WI Milwaukee, Taylor Elctrns. 414-241-4321
Can Calgary, Alberta, Electro Sonic, Inc. ... 403-255-9550
Can Ottawa, Ont., Electro Sonic, Inc. 613-728-8333
Can Richmond, B.C., Electro Sonic, Inc. 604-273-2911
Can Willow Dale, Ont., Electro Sonic Inc. ... 416-494-1666
Can Winnipeg, Man., ELectro Sonic, Inc. ... 204-783-3105

MEMTEC CORP., 19-B Keewaydin Dr., Salem, NH 03079, Tel: 603-893-8080, FAX: 603-893-8699; Empl.: 35

MEMTRON®

FAX: 517-652-2659

MEMTRON TECHNOLOGIES, INC., 530 N.Franklin, Frankenmuth, MI 48734, Tel: 517-652-2656, 800-234-7525; FSC No.: 6 V 417; Empl.: 130; *Sls. Mgr.:* Daniel T. Ortner ..... **B•1845**

Local Sales Offices & Reps

AZ Tucson, Multi-Innovations 602-326-8997
CA San Diego, Champa Assocs. 714-581-3459
CA Saratoga, Edward King & Assocs. 408-741-0434
CO Westminister, Glennmar 303-423-1572
FL Mount Dora, Hedrick, Walker 904-735-2600
GA Lawrenceville, Tek-Rep Mktg., Inc. 404-804-0358
IL Wheaton, CS Tech. Sls. 312-653-8126
IN Noblesville, Phoenix Mktg. 317-776-1871
MA Framingham, Stone Comp. Sls. Corp. 508-875-3266
MN Oakdale, Complete Sls. 612-731-2923
MO Saint Charles, Buckman & Assocs. 314-946-6201
NY Islip, Cogent Tech. 516-277-7101
NY Liverpool, Alfred Lee Sls. 315-451-0968
NY Victor, Net Sls. 716-924-1844
OH Delaware, Bill Romine Co. 614-363-1600
PA Southampton, Campbell Assocs. 215-322-6630
TX Richardson, Zonk & Assocs. 214-238-7651, 512-346-7651
WA Renton, K. R. Jensen Sls. 206-277-2772
EXP Corpus Christi, TX, Radesa Co. 512-993-4528
Can Toronto, Ont., Reptech 416-863-9510

MENSOR CORPORATION, 2230 IH-35 South, San Marcos, TX 78666, Tel: 512-396-4200, FAX: 512-396-1820

MEPCO/CENTRALAB CORP., See Philips Components Discrete Products Division

MEP CONTROLS, Rising Sun Rd., Bordentown, NJ 08505, Tel: 609-298-7300, FAX: 609-298-1982; Empl.: 25

MEPCOPAL

FAX: 619-481-1123

MEPCOPAL COMPANY, 11525 Sorrento Valley Rd., San Diego, CA 92121-1307, Tel: 619-481-0210; Empl.: 160 ..... **A•2106-2107; B•1770-1771**

Potentiometers (Cermet, Carbon) Industrial & Military

Local Sales Offices & Reps

AL	Huntsville, Over & Over, Inc.	205-837-7105
AZ	Tempe, Philips Comps.	602-820-2225
CA	Irvine, Harper & Strong	714-261-7233
CA	Sacramento, TSI	916-451-9068
CA	San Diego, Harper & Strong	619-549-5360
CA	Santa Clara, Technlg. Sls.	408-727-7200
CO	Englewood, Philips Comps.	303-779-9696
FL	Altamonte Springs, Over & Over	407-339-5073
FL	Ft. Lauderdale, Over & Over	305-485-0115
GA	Norcross, Over & Over Inc.	404-449-6205
GA	Roswell, Philips Comps.	404-992-0150
IL	Rolling Meadows, Philips Comps.	708-670-9494
IN	Ft. Wayne, Corrao Marsh	219-482-2725
IN	Green Field, Corrao Marsh, Inc.	317-462-4446
IA	Cedar Rapids, Lorenz Sls. Inc.	319-377-4666
KS	Overland Pk, Lorenz Sls. Inc.	913-469-1312
KS	Wichita, Lorenz Sls., Inc.	316-721-0500
MD	Columbia, Delta III Assocs.	301-730-4700
MA	Woburn, Philips Comps.	617-932-4748
MI	Farmington Hills, Philips Comps.	313-553-6010
MN	Minneapolis, Elec. Comps. Sls., Inc.	612-933-2594
MO	St. Louis, Lorenz Sls. Inc.	314-997-4558
NE	Lincoln, Lorenz Sls. Inc.	402-475-4660
NJ	Englewood Cliff, Ed Glass Assoc.	201-592-0200
NY	E. Rochester, Empire Tech. Assocs.	716-381-8500
NY	Endwell, Empire Tech. Assoc., Inc.	607-754-8756
NY	Skaneateles, Empire Tech. Assocs.	315-685-5703
NC	Charlotte, Over & Over Inc.	704-542-9111
NC	Raleigh, Over & Over, Inc.	919-876-7338
OH	Dayton, Philips Comps.	513-436-0066
OH	Wickliffe, Philips Comps.	216-731-7721
OR	Beaverton, Eclipse Mktg. Grp.	503-642-1661
PA	Willow Grove, Philips Comps.	215-659-6096
TX	Austin, Philips Comps.	512-832-9819
TX	Houston, Philips Comps.	713-272-8086
TX	Richardson, Philips Comps.	214-231-8274
WA	Redmond, Eclipse Mktg. Grp.	206-885-6991
WA	Spokane, Eclipse Mktg. Grp.	509-922-3972
WI	New Berlin, Philips Comps.	414-785-6509
Can	Alberta, Philips Comps.	403-239-7075
Can	Scarborough, Ont., Philips Comps.	416-292-5161

Local Distributors

AL	Huntsville, Hall-Mark Elctrns.	205-837-8700
AZ	Tempe, TTI, Inc.	602-431-1191
CA	Sunnyvale, Hamilton/Avnet	408-743-3300
CO	Englewood, Kent, Shelley-Ragon	303-762-0670
CT	Wallingford, Marshall Inds.	203-265-3822
FL	Orlando, TTI, Inc.	407-859-1000
GA	Norcross, TTI, Inc.	404-662-0911
IL	Chicago, Nep Elctrns.	708-595-8500
IN	Indianapolis, Marshall Inds.	317-297-0483
MD	Columbia, TTI, Inc.	301-995-1331
MA	Peabody, Hamilton/Avnet	508-532-3701
MI	Livonia, Marshall Inds.	313-525-5850
MN	St. Paul, Kent, Shelley-Ragon	612-642-2828
NE	Omaha, Scott Elctrns.	402-734-6750
NJ	Mt. Laurel, TTI, Inc.	609-234-6400
NY	Ronkonkoma, TTI, Inc.	516-737-2000
NC	Raleigh, Hall-Mark	919-872-0712
OH	Independence, TTI, Inc.	216-328-9755
OK	Tulsa, Hamilton/Avnet	918-252-7297
OR	Beaverton, Kent, Shelley-Ragon	503-641-1691
PA	Mars, Hamilton/Avnet	412-772-1881
TX	Ft. Worth, TTI, Inc.	817-595-3100
WA	Redmond, Hamilton/Avnet	206-881-6697
WI	New Berlin, Nep Electronics	414-785-9131
Can	Nepean, Ont., Hamilton/Avnet	613-226-1700

MERCOTAC INC., 6195 Corte del Cedro E, Carlsbad, CA 92009, Tel: 619-431-7723, FAX: 619-431-0905; Empl.: 19; *Sls. Mgr.:* Bruce Enigenburg; *Dist. Mgr.:* Bruce Enigenburg

MERCURY COMPUTER SYSTEMS, INC., 199 Riverneck Rd., Chelmsford, MA 01824, Tel: 508-256-1300, FAX: 508-256-3599; Empl.: 160; *Sls. Mgr.:* Ed Hennessy

MERCURY PLASTICS, A UNIT OF ZERO CORP., See Zero Plastics, A Unit of Zero Corp.

MERECO PRODUCTS DIV., Metachem Resins Corp., 1505 Main St., West Warwick, RI 02893, Tel: 401-822-9300, FAX: 401-822-9311; Empl.: 25; *Sls. Mgr.:* John E. Powell, Jr.

MERET OPTICAL COMMUNICATIONS, INC., An Amoco Co., 1800 Stewart St., Santa Monica, CA 90404-4998, Tel: 310-828-7496, FAX: 310-828-7567; FSC No.: 53071; Empl.: 85

For all states not listed call Meret MN. Ofc. 310-828-7496

MERIAM INSTRUMENT, Scott Fetzer, 10920 Madison Ave., Cleveland, OH 44102, Tel: 216-281-1100, FAX: 216-281-0228; Empl.: 85; *Sls. Mgr.:* Russ Arslanian; *Dist. Mgr.:* Russ Arslanian

MERITEC, Associated Enterprises, 1359 W. Jackson St., P.O. Box 8003, Painesville, OH 44077, Tel: 216-354-3148, FAX: 216-354-0509; Empl.: 200; *Sls. Mgr.:* Richard Wilkinson; *Dist. Mgr.:* Craig Fosnaught

MERIX CHEMICAL CO., 2234 East 75th St., Chicago, IL 60649, Tel: 312-221-8242, FAX: 312-221-3047; Empl.: 15; *Sls. Mgr.:* E. O. Sonneman; *Dist. Mgr.:* E. O. Sonneman

MERRILL, INC., P.O. Box 2751, Bonita Springs, FL 33959, Tel: 813-591-1626, FAX: 813-947-1821; FSC No.: 58624; Empl.: 10; *Sls. Mgr.:* J. Fournier

MERRIMAC INDUSTRIES, 41 Fairfield Pl, West Caldwell, NJ 07006, Tel: 201-575-1300, FAX: 201-575-0531; FSC No.: 12457; Empl.: 150; *Sls. Mgr.:* Tom Cox

J. R. MERRITT CONTROLS, INC., 320 Martin Luther King Dr., Norwalk, CT 06854, Tel: 203-855-9100, 800-333-5762, FAX: 203-855-1038; *Sls. Mgr.:* Douglas Holzwarth

MESA POWER SYSTEMS, 2350 Meyers Ave., Escondido, CA 92029, Tel: 619-489-8162, FAX: 619-489-5718; FSC No.: 46937; Empl.: 20

MESA TECHNOLOGY, Peak Technologies, 8990 Old Annapolis Road, Columbia, MD 21045, Tel: 410-992-0516, 410-992-0517, FAX: 410-290-9171; Empl.: 364; *Sls. Mgr.:* Howard Parker

MES INDUSTRIES CO., LTD., Fl. No. 93 Lo-Li Rd., Taipei, Tel: 886-2-2180302, FAX: 886-2-2181480; Empl.: 25

MESUR-MATIC ELCTRNS., 309 Lowell St., Peabody, MA 01960, Tel: 508-745-7000; Empl.: 18; *Sls. Mgr.:* Kosma L. Evangelidis

METALINK CORPORATION, P.O. Box 1329, Chandler, AZ 85244, Tel: 602-926-0797, TELEX: 4998050, FAX: 602-926-1198

METCAL, INC., 1530 O'Brien Dr., Menlo Park, CA 94025, Tel: 800-776-1778, FAX: 415-325-5932; Empl.: 100; *Sls. Mgr.:* Bob Simpson; *Dist. Mgr.:* Bob Simpson

METERMASTER, 2507 W. Erie Dr., Tempe, AZ 85282, Tel: 602-431-0015, FAX: 602-431-1836; *Sls. Mgr.:* Steve Alexander

METHODE ELECTRONICS, INC., 7444 W. Wilson Ave., Chicago, IL 60656, Tel: 708-867-9600, FAX: 708-867-9130; Empl.: 2000; *Sls. Mgr.:* S. Landeene; *Dist. Mgr.:* Suzi Landeene

METHODE ELECTRONICS, INC., Interconnect Prods Div, 1700 Hicks Rd, Rolling Meadows, IL 60008, Tel: 708-392-3500, FAX: 708-392-9404; FSC No.: 95354; Empl.: 250; *Sls. Mgr.:* Suzi Landeene; *Dist. Mgr.:* Suzi Landeene

METRA CORPORATION, 1874 Lundy Ave., San Jose, CA 95131, Tel: 408-432-1110, FAX: 408-432-9644; Empl.: 24

METRAPLEX CORP., 5305 Spectrum Dr., Frederick, MD 21701, Tel: 301-662-8000, TELEX: 697-4248 MPX CORP, FAX: 301-695-8099; Empl.: 105; *Sls. Mgr.:* Charles Weaver

METRICOR, INC., 18800 - 142nd Ave. NE, Woodinville, WA 98072, Tel: 206-483-5577, FAX: 206-485-2592; Empl.: 42

METRIC SYSTEMS, 645 Anchors St., Ft. Walton Beach, FL 32548-9990, Tel: 904-244-9600, FAX: 904-863-6371; FSC No.: 12339; Empl.: 700

METRIX INSTRUMENT CO., 1711 Townhurst, Houston, TX 77043, Tel: 713-461-2131, TELEX: 77-5486, FAX: 713-461-8223; Empl.: 60; *Sls. Mgr.:* W. B. Brown

METRO CIRCUITS, PJC Technologies, Inc., 205 LaGrange Ave., Rochester, NY 14613, Tel: 716-254-2980, FAX: 716-254-4614; Empl.: 36; *Sls. Mgr.:* Burhan Capar

METROLAB INSTRUMENTS SA, 110,Chemin du Pont-du-Centenaire, Geneva, Switzerland CH-1228, Tel: ò41(22)7941121, FAX: ò41(22)7941120

METRO-MARK INC., 11574 Encore Circle, Minnetonka, MN 55343, Tel: 612-935-8844, FAX: 612-935-5718 ..... **B•1846**

METRON OPTICS INC., P.O. Box 690, Solana Beach, CA 92075-0690, Tel: 619-755-4477, FAX: 619-755-4752; Empl.: 10

METROPOLE PRODUCTS INC., P. O. Box 309, Stafford, VA 22554, Tel: 703-659-2132, FAX: 703-659-2133; FSC No.: 55908; *Sls. Mgr.:* John Tarsia

METROSONICS, INC., Box 23075, Rochester, NY 14692-3075, Tel: 716-334-7300, TELEX: 853348, FAX: 716-334-2635; FSC No.: 55381; Empl.: 80; *Sls. Mgr.:* R. Ginsberg; *Dist. Mgr.:* R. Brauch

METRUM, P.O. Box 5227, Denver, CO 80217-5227, Tel: 303-773-4700, FAX: 303-773-4762; Empl.: 350; *Sls. Mgr.:* J. Smith

FAX: 908-679-3222

METUCHEN CAPACITORS, INC., 139 White Oak Ln., P.O. Box 499, Old Bridge, NJ 08857, Tel: 908-679-3366, TWX: 710-998-0892; FSC No.: 55969; Empl.: 25; *Sls. Mgr.:* George Wolter ..... **A•1106-1114, 1651-1653; C•1416-1419, 1617**

Local Sales Offices & Reps

AL	Huntsville, Elctrn. Prods.	205-880-1156
CA	Pleasanton, CFMC	510-417-0450
MD	Rockville, C.E. Tech. Elctrns.	301-666-0315
MD	Rockville, Metuchen Capacitors	301-590-0094
MA	Lowell, Underwood Sls.	617-256-8191
MO	Grandview, R. R. Burton Assocs.	816-763-5385
PA	Saegertown, Multi-Phase Comps.	814-763-3640

MEXITRONIX (WOMAN OWNED), 2651 Airway Ave., Ste. A, Kingman, AZ 86401, Tel: 602-757-9798, FAX: 602-757-8741; Empl.: 5

MEYER WIRE & CABLE CO., Div. of Cole Hersee Co., 1072 Sherman Avenue, Hamden, CT 06514, Tel: 203-281-0817, FAX: 203-281-9648; Empl.: 25; *Sls. Mgr.:* Brian Meyer

MEYLAN CORPORATION, 543 Valley Rd., Upper Montclair, NJ 07043-1844, Tel: 201-744-6400, FAX: 201-744-1011; Empl.: 8; *Sls. Mgr.:* Stanley Mills

MFE INSTRUMENTS, Stocker & Yale, Inc., 133 Brimbal Ave., PO Box 490, Beverly, MA 01915-0490, Tel: 508-921-9104, 800-472-4633, ESYLNK: 953145, FAX: 508-921-9110; FSC No.: 6640,6685,6625,6660; *Sls. Mgr.:* John Lepore; *Dist. Mgr.:* John Lepore

Local Distributors

CA	Los Angeles, E.I.L. Instrs.	213-685-7020
MD	Baltimore, E.I.L. Instrs.	410-584-7400

MF ELCTRNS. CORP., 10 Commerce Dr., New Rochelle, NY 10801, Tel: 914-576-6570, FAX: 914-576-6570; FSC No.: 08111; Empl.: 100; *Sls. Mgr.:* Zaw Nawaday ..... **A•1419**

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CA	San Jose, Mac Tron	408-446-8224
AL	Madison, Benchmark Tech. Sls.	205-464-0033
CT	Southington, Orion Group	203-621-8371
GA	Norcross, Benchmark Tech. Sls.	404-446-1711
MA	Peabody, The Orion Group	508-532-6266
MD	Annapolis, Rynone Assocs.	301-263-0794
NY	Smithtown, T & K Sls.	516-724-3456
MN	Minneapolis, Ferrian Sls. & Assocs.	612-721-8915
NC	Raleigh, Benchmark Tech. Sls.	919-850-0633
OR	Beaverton, Core II Mktg.	503-649-0877
OR	Portland, Core II	503-649-0871
PA	Prospect Park, Elf Sls. Co.	215-534-3340
PA	Prospect Park, ELF Sls.	215-534-3340
TX	Austin, Matthews & Assocs.	512-346-2969
TX	Dallas, Matthews & Assocs.	214-248-7881
UT	Salt Lake City, R 2 Mktg. Inc.	801-595-0631

Local Distributors

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CA	San Jose, Turbo Elctrns.	408-441-6616
CA	Sunnyvale, PSC Elctrns.	408-737-1333
NJ	Bellmawr, Mid Atlantic	609-931-5303
NY	Bohemia, RBD Elec.	516-589-7717
NY	Mt. Vernon, Janesway Elec.	914-699-6710

MFG, Parabam Div., 1130 Watsoncenter Rd., Carson, CA 90745, Tel: 213-549-5044; Empl.: 85

MFI, 12304 Santa Monica Blvd., Ste. 121, Los Angeles, CA 90025, Tel: 310-447-6633, 800-533-2297, FAX: 310-820-[illegible]

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An Affiliate of UNITRODE Corporation

FAX: 516-467-5176

MFM TECHNOLOGY, INC., Affiliate of Unitrode Corp., 200 Thirteenth Ave., Ronkonkoma, NY 11779, Tel: 516-467-5151; Empl.: 25 ..... **B•1298**

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TX	Dallas, Automated Motion Ctrl. Inc.	214-340-4192
WI	Brookfield, Automation Prods. Co.	414-785-6668
Can	Downsview, Ont., Newsonian Mechtronics, Inc.	416-663-2516
CA	San Jose, Motion Control-North	408-997-0544

MG ELECTRONICS

FAX: 516-582-3229

MG ELECTRONICS, 32 Ranick Rd., Hauppauge, NY 11788, Tel: 516-582-3400; Empl.: 14; *Sls. Mgr.:* John Kibbit; *Dist. Mgr.:* Stan Grey ..... **D•1051**

MGR INDUSTRIES INC., 450B Industrial Dr., Ft. Collins, CO 80524, Tel: 303-221-2201, FAX: 303-484-4078; Empl.: 2; *Sls. Mgr.:* R. Vangermeersch

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FL	Miami, The Magnet Source	305-823-0641

MICHIGAN MAGNETICS, 203 W. Third St., Vermontville, MI 49096, Tel: 517-726-0590, FAX: 517-726-0078; Empl.: 50; *Sls. Mgr.:* Tom Krul

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MICRO ALLIANCE, INC., 1384-A Poinsettia Dr., Vista, CA 92083, Tel: 619-598-1900; Empl.: 10; *Sls. Mgr.:* Ed Larson

MICROAVIONICS CORP., 3198-K Airport Loop Dr., Costa Mesa, CA 92626, Tel: 714-957-6904, FAX: 714-957-1614; Empl.: 15; *Sls. Mgr.:* B. H. Corzine

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MICRO-CERAMX TECHNOLOGY, A MicroSemi Company, 501 South Andreasen Dr., Escondido, CA 92029, Tel: 619-480-1906, FAX: 619-480-6741; Empl.: 65; *Sls. Mgr.:* Ken Miller, Sls. Mgr.

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FL	Winter Park, HHP Assocs.	407-740-0320
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IN	Fort Wayne, M/S Sls. and Assocs., Inc.	219-436-3023
IN	Greenwood, M/S Sls. and Assocs., Inc.	317-881-0110
MD	Kensington, Koebert Assocs., Inc.	301-493-8924
MN	Afton, Real Elctrns. Sls. Assocs.	612-436-1950
NH	Nashua, Bell Controls	603-882-6984
OK	Broken Arrow, Merlin Elctrns.	918-251-2084
PA	Glenside, Koebert Assocs.	215-887-2310
TX	Fort Worth, Merlin Elctrns.	817-429-4420
TX	Grapevine, Merlin Elctrns.	817-329-8922

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MICRODOT, INTERCONNECT SYSTEMS DIVISION, 201 Progress Dr., Montgomeryville, PA 18936, Tel: 215-699-5373, FAX: 215-699-5536; FSC No.: 91886; *Sls. Mgr.:* K. A. Neumuller

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KS	Overland Pk., Q.D.C. Inds.	913-341-2214
MA	Bedford, Vector Assoc.	617-271-0000
MN	Maple Grove, Elctrn. Prods. For Ind.	612-784-5554
TN	Nashville, Strategic Mktg. Inc.	615-883-7882

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CA	Costa Mesa, Orange County Comps.	714-979-3597
CA	Huntington Bch., Wyle Labs	714-891-8008
CA	San Diego, Neumann Elctrns.	619-695-3005
CA	San Diego, Shelley-Ragon	619-453-7133
CA	San Jose, Rose Elctrns.	408-943-0255
CO	Englewood, Arrow Elctrns.	303-790-4444
IL	Carol Stream, American Precision Elec.	708-510-8080
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NY	Oceanside, Tritech	516-678-6222
PA	McKean, Advacom	814-476-7774
TX	Ft. Worth, Industrial Elect.	817-731-7321
UT	Provo, Central Utah Elctrns. Supp.	801-373-7522
UT	Salt Lake City, Kimball Elctrns.	801-328-2075
EXP	Basle, Switzerland, Siabalco W. Siegrist & Co. AG	845-962851
EXP	Huntingdale, Australia, Stewart Elctrn. Comps. Pty.	790-AA36908

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CA	San Jose, Loroco Sls.	408-436-8770
CO	Boulder, Al Steinberg	303-442-6018
GA	Norcross, Summit Mktg.	404-498-4530
MD	Laurel, CSDS	301-792-9850
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NC	Cary, Summit Mktg.	919-233-1836
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VA	Fairfax, CSDS	703-385-0139

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MICROSEMI CORP. COLORADO, Microsemi Corp., 800 Hoyt St., Broomfield, CO 80020, Tel: 303-469-2161, FAX: 303-466-3775; Empl.: 180; *Sls. Mgr.:* Virginia Shatto; *Dist. Mgr.:* George Avila

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MICROTEC RESEARCH, INC., 2350 Mission College Blvd., Santa Clara, CA 95054, Tel: 408-980-1300, FAX: 408-982-8266; Empl.: 100; *Sls. Mgr.:* Derek Taylor; *Dist. Mgr.:* Derek Taylor

MICROTEK, INC., 63 1/2 Main St., Chicopee, MA 01020, Tel: 413-594-5116, FAX: 413-592-9736; Empl.: 35; *Sls. Mgr.:* Ann Paradis

MICROTEK INTERNATIONAL/DEV. SYS. DIV., 3300 N.W. 211th Terrace, Hillsboro, OR 97124, Tel: 503-645-7333, FAX: 503-629-8460; Empl.: 120; *Sls. Mgr.:* Chris Bednarek

MICROTOUCH SYSTEMS, INC., 300 Griffin Park, Methuen, MA 01844, Tel: 508-659-9000, FAX: 508-659-9100; FSC No.: 935-0133; Empl.: 200; *Sls. Mgr.:* Alison Forsythe; *Dist. Mgr.:* Janet Pannier

MICROTRAN company, inc.

FAX: 516-561-1117

MICROTRAN CO. INC., 145 E. Mineola Ave., P. O. Box 236, Valley Stream, NY 11582-0236, Tel: 516-561-6050; FSC No.: 00348; Empl.: 75; *Sls. Mgr.:* John Eisenberg **A•1254, 2228, 2404-2423**

Local Sales Offices & Reps

AL	Madison, Arthur-Harris & Assoc.	205-461-9896
AZ	Scottsdale, F. Schoeffler Assoc.	602-948-1004
CA	San Jose, Kottmeier Assocs.	408-371-8700
CA	Torrance, Universal Comp. Co.	310-783-0220
CO	Englewood, Omega, Ltd.	303-762-1921
FL	Winter Pk., HPP Assoc. Inc.	407-740-0320
IL	Wheaton, CS Tech. Sls.	708-653-8126
IN	Fishers, R & D Elctrn. Sls.	317-849-2026
IA	Marion, AEM, Inc.	319-377-1129
KS	Lenexa, AEM, Inc.	913-888-0022
MD	Baltimore, Burgin-Kreh Assocs.	301-265-8500
MA	Wellesley, Logan Sls.	617-235-6868
MN	Minnneapolis, RK Sales	612-571-1001
MO	St. Louis, AEM, Inc.	314-298-9900
NJ	Englewood Cliffs, E. Glass Assocs.	201-592-0200
NM	Albuquerque, C.T. Carlberg & Assocs.	505-899-2155
NY	Marcellus, Mullahy-Welch Sls.	315-673-3891
NY	Rochester, Mullahy-Welch Sls.	716-244-1100
NC	Cary, Arthur, Harris & Assoc.	919-460-8660
OH	Cleveland, J.O. Olsen Co.	216-838-0510
OH	Goshen, J.O. Olsen Co.	513-722-3320
PA	Pittsburgh, J.O. Olsen Co.	412-381-4254
PA	Wynnewood, Metz-Benham Assoc.	215-896-7300
TX	Houston, Spectra Sls. Corp.	713-270-8212
TX	Richardson, Spectra Sls. Corp.	214-234-3600
Can	Brampton, Ont., Reemco Inc.	416-624-2730

Local Distributors

AL	Birmingham, MG Elctrns. & Equip.	205-328-4525
CA	Milpitas, Sierra West Elctrns.	408-945-1050
CA	Oakland, Brill Elctrns.	510-834-5888
CA	San Diego, Kent Electronics	619-471-9561
CA	Santa Clara, Kent Elctrns.	408-727-9810
CA	Santa Monica, Master Distrs.	310-452-1229
CA	Torrance, Kent Elctrns.	310-320-2700
CO	Englewood, Kent/Shelley-Ragon	303-762-0670
FL	Largo, Elctrn. Precepts of Florida	813-544-3636
FL	Pompano Beach, Peerless Radio Corp.	800-327-4993
IL	Northbrook, Classic Comp. Supp.	708-272-9650
IA	Cedar Rapids, Dee Elctrns.	319-365-7551
MD	Columbia, Sager	410-995-4900
MA	Hingham, Sager Elec. Supp.	617-749-6700
MN	Minneapolis, Bergquist	612-835-2322
MN	Thief River Falls, Digi-Key Corp.	800-344-4539
NJ	Oakland, Relay Specialties	800-526-5376
NM	Albuquerque, Walker Elctrn. Supp.	505-883-2992
NY	Buffalo, Summit Distrs.	716-887-2800
NY	Hauppauge, Sager	516-348-1300
NY	Johnson City, Help Elctrns.	607-729-3528
NY	Lynbrook, Peerless Radio	516-593-2121
NY	Rochester, Summit Distrs.	716-334-8110
NC	Raleigh, Southeastern Elctrns.	919-828-2311
OH	Dayton, J.A. Becker Co.	513-226-1341
PA	Philadelphia, Shap Elctrns.	215-969-3300
PA	Pittsburgh, Sager	412-772-2233
TX	Houston, Kent Elctrns.	713-780-7770
TX	Houston, Lenert Co.	713-225-1465
WA	Redmond, Priebe Elctrns.	206-881-2363
WI	New Berlin, Classic Comp.	414-786-5300

MICROVISION CORP., 180 Knowles Dr. Ste. 100, Los Gatos, CA 95008, Tel: 408-374-3158, FAX: 408-374-9394; Empl.: 15; *Sls. Mgr.:* Stan Buckstad

MICROWAVE APPLICATIONS GROUP, 3030 Industrial Pkwy., Santa Maria, CA 93455, Tel: 805-928-5711, TWX: 910-351-5808, FAX: 805-925-5903; FSC No.: 26357; Empl.: 51; *Sls. Mgr.:* T. Janzen

MICROWAVE COMMUNICATIONS CORP., 26007 Huntington Lane, Bldg. 11, Valencia, CA 91355, Tel: 805-257-1948, FAX: 805-257-0557; FSC No.: 57757; Empl.: 10; *Sls. Mgr.:* Michael Claggett

MICROWAVE DESIGN SVCS., INC., 437-H Mary Esther Cutoff, Ft. Walton Beach, FL 32548, Tel: 904-664-1234, FAX: 904-664-6789

MICROWAVE DEVELOPMENT LABORATORIES, 10 Michigan Dr., Natick, MA 01760, Tel: 508-655-0060, FAX: 508-655-6972; Empl.: 180; *Sls. Mgr.:* R. Tucker

MICROWAVE DEVICE TECH., 4 Liberty Way, Westford, MA 01886, Tel: 508-692-7800, FAX: 508-688-6220; FSC No.: ODRE6; Empl.: 11; *Sls. Mgr.:* Murthy S. Ayyagari

MFC
MICROWAVE FILTER COMPANY

FAX: 315-463-1467

MICROWAVE FILTER INC., 6743 Kinne St., East Syracuse, NY 13057-0486, Tel: 315-437-3953, 800-448-1666, TELEX: 249-613; FSC No.: 27834; Empl.: 98; *Sls. Mgr.:* Dave Headley **A•1655-1659**

Local Sales Offices & Reps

CA	Oceanside, The House of Reps.	619-967-2712
MA	Randolph, Bengal Assocs.	617-961-3120
OH	Bellbrook, Tom Herman & Assocs.	513-372-5707
VA	Fairfax, Schibley Assocs., Inc.	703-591-3008

Local Distributors

AZ	Mesa, Antenna Techlg. Corp.	602-898-7667
CA	Campbell, Signal Sources	408-866-0600
CA	Downey, Montero Intl., Inc.	310-862-0116
CA	Sacramento, Audiolab Elctrns.	800-624-1903
CA	Torrance, Western CATV	213-539-8030
CO	Englewood, Midwest CATV	303-799-4343
FL	Boca Raton, Passive Dvcs., Inc.	407-998-0600
FL	Hialeah, Hero Comm.	305-887-3203
FL	Miami, Centennial So.	800-468-5465
FL	Miami, Gendra Intl.	305-372-8845
FL	Mt. Dora, FM Technlg. Assoc., Inc.	904-383-3682
FL	Ocala, Broadcasters Gen. Store	904-622-9058
FL	Panama City, Bay Elctrns. Supp.	904-785-7258
GA	Lawrenceville, John Weeks Entprs.	404-963-7870
IL	Rolling Meadows, Antec Comm.	708-677-2600
IN	Richmond, Allied Broadcast Equip.	317-962-8596
LA	Mamou, Satellite Earth Stas.	318-468-2203
MI	Bloomfield Hills, Nat. Satellite Corp.	313-644-4052
MS	Raymond, Broadcast Equip. Engrg. Sls.	601-857-8578
NE	Dakota City, ATV Research, Inc.	402-987-3771
NH	Bow, Earth Terminal, Inc.	603-224-5166
NJ	Union, Avanti Elctrns.	201-964-0333
NY	New York, Universal Elctrns. Tech. Corp.	212-262-7200
NC	Pineville, S.C.M.S., Inc.	704-889-4508
OR	Beaver Creek, Northwest Comms.	503-266-7266
PA	Horsham, Toner Cable	215-675-2053
PA	Willow Grove, NCS Inds.	215-657-4690
TX	Bedford, Spectrum Megahertz	817-267-2288
TX	Houston, Elctrn. Comps. Dist.	713-529-8806
UT	Salt Lake City, RIA Corp.	801-486-8822
VA	Charlottesville, Hall Elctrncs.	804-974-6466
WA	Edmonds, Glade Comms.	206-771-6891
WA	Seattle, RF Specialties of Wash.	206-546-6546
WV	Dunbar, Seneca Comm., Inc.	304-766-8740
WI	Plymouth, Hi-Tech.	414-892-6210
Can	Boucherville, Que., Planon Telexpertise	514-449-6481
Can	Calgary, Alberta, AVR Comms. Ltd.	403-251-0707
Can	Lavel, Que., Incospec Elctrns.	514-686-0033
Can	Markham, Ont., Cabletel Comms.	416-475-1030
Can	Markham, Ont., Deskin Sls.	416-475-1412
Can	Montreal, Que., Comega Technigs.	514-355-3105
Can	Oshawa, Ont., Comlink Sys.	416-436-1075
Can	St. Leonard, Que., Trispec Comms.	514-328-2025

MICROWAVE SOLUTIONS, INC., 3200 Highland Ave., Ste 3A, National City, CA 91950, Tel: 800-967-4267, FAX: 619-474-7003; FSC No.: 65151; Empl.: 12; *Sls. Mgr.:* Edward M. Teyssier

MICROWAVE TECHNOLOGY DIV., JHP Industrial, 405 West Taylor St., Syracuse, NY 13202-3442, Tel: 315-422-0050, FAX: 315-422-3331; FSC No.: 0G5J9; Empl.: 8; *Sls. Mgr.:* Emanuel Henderson, Jr.

MICROWAY INC. RESEARCH PARK, Research Park, P.O. Box 79, Kingston, MA 02364, Tel: 508-746-7341, FAX: 508-746-4678; Empl.: 35; *Sls. Mgr.:* Maryann Strassel; *Dist. Mgr.:* Maryann Strassel

MIDAMERICA DESIGN SERVICE, Spirit of America Corp., 10206 Lima Rd., Fort Wayne, IN 46818, Tel: 219-489-2511, FAX: 219-489-2295; Empl.: 350; *Sls. Mgr.:* Bob Croup

MIDCOM, INC., 121 Airport Dr., Watertown, SD 57201, Tel: 605-886-4385, FAX: 605-886-4486; FSC No.: 0GP22; Empl.: 300; *Sls. Mgr.:* Dean Ward ..... **A•2425-2431**

Local Sales Offices & Reps

CA	Huntington Beach, Solutech	714-374-0130
FL	Orlando, Richmar Elctrns. Corp.	407-352-3755
FL	Pompano Bch., Richmar Elctrns. Corp.	305-783-9214
FL	Valrico, Richmar Elctrns. Corp.	813-654-8032
IL	Downers Grove, Richmar Elctrns. Corp.	708-968-0118
IN	Indianapolis, Richmar Elctrns. Corp.	317-577-9950
IA	Iowa City, Richmar Elctrns. Corp.	319-354-8894
MD	Hunt Valley, Eagle Sls. Corp.	410-666-3930
MN	N. Mankato, E.I. Sls.	507-345-5786
TX	Plano, Richmar Elctrns. Corp.	214-424-8388
TX	Round Rock, Richmar Elctrns. Corp.	512-255-2551
VA	Powhatan, Eagle Sls. Corp.	804-492-9027
WI	Butler, Richmar Elctrns. Corp.	414-781-1730

MID-EASTERN INDUSTRIES, Technology Dynamics Inc., 100 School Street, Bergenfield, NJ 07621-2915, Tel: 201-385-0500, FAX: 201-385-0702; FSC No.: 06179; Empl.: 15; *Sls. Mgr.:* Daniel Ellenback ..... **D•1832-1835**

Local Sales Offices & Reps

AL	Huntsville, BCI	205-539-4411
FL	Clearwater, Tech-Rep Assocs.	813-872-9900
GA	Lawrenceville, BCI	404-962-6826
IL	Arlington Hgts., Greenslade Sls. Inc.	708-593-3450
MD	Columbia, Delta III Assocs.	410-730-4700
MA	Topsfield, Whitehead Assocs., Inc.	508-887-8050
MN	Minneapolis, Tecteam Sls. Inc.	612-854-6616
NM	Albuquerque, IMEC	505-275-0936
NY	Elmont, Crane & Egert	516-872-0800
OH	Chagrin, J.J. Bair & Co.	216-543-8617
TX	Dallas, Tesco Elctrn. Sls. Co.	214-553-1200
UT	Midvale, Christec	801-566-3694
WI	Wauwatosa, Greenslade Sls. Inc.	414-258-2727

MIDGET LOUVER, 800 Main Ave., Norwalk, CT 06851, Tel: 203-866-2342, FAX: 203-847-7147; Empl.: 10; *Sls. Mgr.:* Helen Monroe; *Dist. Mgr.:* Helen Monroe

MIDLAND-ROSS CORP., NEL UNIT, See NEL Frequency Controls, Inc.

MIDORI

FAX: 714-449-0139

MIDORI AMERICA CORP., 2555 E. Chapman Ave., Ste. 400, Fullerton, CA 92631, Tel: 714-449-0997; Empl.: 3 ..... **A•2109**

MIDSTATES MARKETING, INC., 1122 E. Washington St., Ste 100, Indianapolis, IN 46202, Tel: 317-639-9999; Empl.: 3

MIDTEX RELAYS, INC., 9B2 Butterfield Trail, El Paso, TX 79906, Tel: 915-772-1061, 1-800-MIDTEX1, FAX: 915-772-1116; Empl.: 275, *Sls. Mgr.:* Craig Law; *Dist. Mgr.:* Bob Walasiak

MIDWEST COMPONENTS,INC., See Therm-O-Disc, Div. Midwest Component Product Group

MIDWEST CONTAINER SYSTEMS, 5604 Intl. Pkwy., Minneapolis, MN 55428, Tel: 612-533-4532, FAX: 612-533-9260; Empl.: 3; *Sls. Mgr.:* John Poyer

MIDWEST MICROWAVE, 6564 South State Rd., Saline, MI 48176-9569, Tel: 313-429-4773, 800-521-4410, FAX: 313-429-1415; FSC No.: 34078; Empl.: 120; *Sls. Mgr.:* William H. Lavery

MIKRON INSTRUMENT COMPANY, INC., 445 W. Main St., Wyckoff, NJ 07481, Tel: 201-891-7330, FAX: 201-891-1205; Empl.: 50; *Sls. Mgr.:* John Merchant

MIL-COMM DISTRIBUTORS, INC., 9400 Lurline Ave. # C, Chatsworth, CA 91311, Tel: 818-998-3111

MIL ELECTRONICS, INC., One Chestnut St., Nashua, NH 03060, Tel: 603-882-3200, FAX: 603-881-8661; FSC No.: 07862; Empl.: 40

MILES PLATTS INC., 901 Touhy Ave., Elk Grove Village, IL 60007, Tel: 1-708-364-0363, FAX: 708-364-0614; Empl.: 7; *Sls. Mgr.:* J. L. Packwood

JAMES MILLEN ELCTRNS., Caywood Elec. Inc., 87 Belmont St., No. Andover, MA 01845, Tel: 508-975-2711, FAX: 508-474-8949; Empl.: 6; *Sls. Mgr.:* R. Jannini

MILLER DIAL CORP., 4400 N. Temple City Blvd., El Monte, CA 91731, Tel: 818-444-4555, FAX: 818-443-3267; FSC No.: 91345; Empl.: 200; *Sls. Mgr.:* P. J. Wener, V.P. Membrane

MILLER, J.W., CO., See Bell Inds.

MILLER, L.C., CO., 717 Monterey Pass Rd., Monterey Pk., CA 91754, Tel: 213-268-3611, FAX: 213-264-3203; Empl.: 45

MILLER, SANFORD, CORP., See Sanford-Miller Corp.

MILLER, W. A., CO., Mingo Loop, P.O. Box 337, Oquossoc, ME 04964-0337, Tel: 207-864-3344, 800-227-1415, FAX: 207-864-3344; Empl.: 8

MILLER-STEPHENSON CHEM. CO., INC., George Washington Hwy., Danbury, CT 06810-0950, Tel: 203-743-4447; *Sls. Mgr.:* Mrs. Fran Bounar

MILLIFLECT, 37444 Sycamore St., Bldg. A, Newark, CA 94560, Tel: 510-791-5188, TELEX: 466465, FAX: 510-791-5237; FSC No.: 52426; Empl.: 42; *Sls. Mgr.:* Philip Hamad; *Dist. Mgr.:* Philip Hamad

MILLIVAC INSTRUMENTS, INC., Box 997, Curry Rd. Ext., Schenectady, NY 12301, Tel: 518-355-8300, FAX: 518-356-5161; FSC No.: 85711; Empl.: 30; *Sls. Mgr.:* Jan B. Metzger ..... **D•1299**

Local Sales Offices & Reps

CA	San Diego, Advanced Prods. Sls.	619-530-0200
CA	Westlake Vl., Advanced Prods. Sls.	818-706-8351
MD	Laurel, CSDS Inc.	301-490-3800
MA	Needham, Addelco Corp.	617-444-4754
NY	Fayetteville, Martin P. Andrews	315-637-5291
TX	Houston, Scientific Sls.	713-645-6218
TX	Richardson, Scientific Sls. Co.	214-231-6541
VA	Fairfax, CSDS Inc.	703-385-0139
Can	Downsview, Ont., Tradeport Elctrns. Grp.	416-736-0866

MILL-MAX MANUFACTURING CORP., P.O. Box 300, Oyster Bay, NY 11771-0300, Tel: 516-922-6000, FAX: 516-922-9253; FSC No.: 3N087; Empl.: 200; *Sls. Mgr.:* Richard M. Weiner ..... **C•1421**

Local Sales Offices & Reps

AL	Huntsville, DHR Mkyg., Inc.	205-536-9775, FAX:205-539-8313
AZ	Scottsdale, Trinity Sls.	602-483-1943, FAX:602-483-2038
AR	Mabelvale, Erickson Sls., Inc.	501-455-0618
CA	Campbell, PCA	408-559-2866,FAX:408-559-8277
CA	Dana Point, PCA	714-493-9822,FAX:714-240-1894
CO	Englewood, Omega Ltd.	303-762-1921, FAX:303-762-1928
CT	Hartford, D.A. Crowley & Assocs.	203-956-9007, FAX:203-956-5351
FL	Boca Raton, Tech Sls. Specialists	407-391-3718, FAX:407-750-1178
GA	Duluth, DHR Mktg., Inc.	404-564-0529, FAX:404-564-1127
GA	Roswell, Contact Factory	516-922-6000, FAX:516-922-9253
IL	Elk Grove Village, Control Sls.	708-595-2110, FAX:708-595-9592
IN	Indianapolis, M & L Sls.,Inc.	317-359-4742, FAX:317-359-0320
IN	Valparaiso, Catalyst Sls.	219-477-4004, FAX:219-477-4355
KS	Overland Park, Acorn Elctrns., Inc.	913-649-6402, FAX:913-649-8005
LA	Chalmette, Erickson Sls., Inc.	504-271-1976
MN	St. Paul, Johnson Co.	612-429-2544, FAX:612-429-3104
MO	St. Louis, Acorn Elctrns., Inc.	314-421-1751, FAX:314-421-1752
NH	Amherst, D.A. Crowley & Assocs.	603-673-7050, FAX:603-672-0817
NJ	Ft. Lee, Nexus Technlg.	201-947-0151, FAX:201-947-0163
NY	Fairport, Senntec	716-425-3954, FAX:716-425-7933
NC	Raleigh, Contact Factory	516-922-6000, FAX:516-922-9253
OH	Dayton, Catalyst Sls. Co.	513-256-3344, FAX:513-256-1173
OR	Tigard, Halbar-RTS, Inc.	503-624-5741, FAX:503-684-1803
PA	Doylestown, G. A. Recentio Assocs.	215-348-7577, FAX:215-348-8458
PA	Pittsburgh, Catalyst Sls. Co.	412-826-3434, FAX:412-826-3436
TX	Dallas, Erickson Sls., Inc.	214-739-5833, FAX:214-739-2329
WA	Redmond, Halbar-RTS, Inc.	206-882-0990, FAX:206-881-3323
WI	Brookfield, Control Sls.	414-797-9500, FAX:414-797-0784
Can	Mississauga, True North Technlg.	416-677-9788, FAX:416-677-8048
Can	Montreal, Que., True North Technlg.	514-343-9393, FAX:514-343-9390
Can	Ottawa, True North Technlg.	613-564-0629

Local Distributors

AL	Huntsville, Electronic Fasteners	205-430-0400
AL	Huntsville, Nu Horizons	205-722-9330
AZ	Phoenix, Aero-Space Southwest	602-582-2779
AZ	Phoenix, Arizona Comps.	602-269-5655
AZ	Phoenix, Force Elctrns.	602-437-1060
AZ	Tempe, Acacia/Deanco	602-894-2874
AZ	Tucson, Pioneer Screw & Nut	602-623-9800
AR	Little Rock, Carlton-Bates	501-562-9100
CA	Anaheim, Bisco	714-635-0380
CA	Chatsworth, Alatec Prods.	818-727-7800
CA	Costa Mesa, Eric Elctrns.	714-751-1185
CA	El Segundo, Force Elctrns.	213-772-1324
CA	Fremont, Acacia/Deanco	510-623-7500
CA	Fremont, Alatec Prods.	510-657-7701
CA	Irvine, Acacia/Deanco	714-660-0834
CA	Los Gatos, Gourmet Elctrns.	408-374-0552
CA	North Hollywood, Electronic Hardware	818-982-6100
CA	San Diego, Acacia/Deanco	619-597-0577
CA	San Diego, Force Elctrns.	619-569-9661
CA	San Jose, Bisco	408-435-8980
CA	San Jose, Eric Elctrns.	408-432-1111
CA	San Jose, Pro-Fasteners	408-943-9177
CA	Santa Ana, BDS Elctrns.	714-662-1050
CA	Santa Clara, Force Elctrns.	408-748-1324
CA	Sunnyvale, PSC	408-737-1333
CO	Denver, Hardware Specialty	303-371-8553
CO	Wheatridge, Acacia/Deanco	303-421-7004
CT	Southbury, Heilind Elctrns	203-262-1700
CT	Wallingford, Cronin Elctrns.	203-265-3134
FL	Ft. Lauderdale, Nu Horizons	305-735-2555
FL	Sanford, Elctrn Fasteners	407-321-4000
FL	Sunrise, All American	305-572-7999
FL	Tampa, Century Fasteners	813-886-5770
GA	Norcross, Atlanta Hardware Specialty	404-449-3000
GA	Norcross, Nu Horizons	404-416-8666
IL	Addison, Belford Elctrns.	708-691-1100

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IN	Indianapolis, PEI/Genesis Elctrns.	317-328-7700
IN	South Bend, PEI/Genesis Elctrns.	800-348-2996
LA	Shreveport, Carlton-Bates	318-636-9975
MD	Columbia, Nu Horizons	301-995-6330
MD	Gaitherburg, Capitol Fasteners	301-948-9310
MD	Gaithersburg, MS Elctrns.	301-921-0200
MD	Hunt Valley, Alatec Prods.	301-667-0063
MD	Ijamsville, Hardware Specialty	301-831-1212
MA	Marlborough, Hardware Specialty	508-481-8622
MA	Needham, Cronin Elctrns.	617-449-5000
MA	Wakefield, Nu Horizons	617-246-4442
MA	Wilmington, Heilind Elctrns.	508-657-4870
MI	Wyoming, North Coast Comps.	616-452-0800
MN	Minneapolis, Aero-Space Computer	612-884-4725
MN	Roseville, Chris Elctrns.	612-631-2647
MO	Kansas City, Aero-Space Computer	913-432-8508
MO	Springfield, Carlton-Bates	417-862-1699
NH	Atkinson, Astrum Elctrns.	603-898-3399
NJ	Blackwood, Hardware Specialty	609-228-6800
NJ	Mt. Laurel, Nu Horizons	609-231-0900
NJ	Pine Brook, Nu Horizons	201-882-8300
NJ	Union, Meridian Supply	908-687-6220
NM	Albuquerque, Bestech Sls.	505-298-0034
NY	Amityville, Nu Horizons	516-226-6000
NY	Bohemia, Car-Lac	516-567-4200
NY	Bohemia, Edge Elctrns.	516-567-6300
NY	Buffalo, Rome Elctrns.	716-626-1602
NY	Johnson City, Help Elctrns.	607-729-3528
NY	Mineola, Hardware Specialty	516-741-7100
NY	Penn Yan, Advacom	315-536-2221
NY	Rochester, Help Elctrns.	716-475-0850
NY	Rochester, Nu Horizons	716-292-0777
NY	Rochester, Rome Elctrns.	716-248-0160
NY	Rochester, Simcona Elctrns.	716-328-3230
NY	Rome, Rome Elctrns.	315-337-5400
NY	Ronkonkoma, All American	516-981-3935
NY	Ronkonkoma, Jet Comps.	516-471-3124
NY	Syracuse, Hardware Specialty	315-434-9093
NC	Raleigh, Century Fasteners	919-787-1800
OH	Akron, Aesco Elctrns.	216-762-8818
OH	Columbus, Aesco Elctrns.	614-882-6762
OH	Dayton, Advacom	513-274-5900
OH	Warren, REM Elctrns.	216-373-1300
OK	Oklahoma City, Carlton-Bates	405-681-4446
OK	Tulsa, Carlton-Bates	918-250-1626
OR	Beaverton, Acacia/Deanco	503-646-3377
OR	Beaverton, Comp. Resources	503-641-8488
PA	Erie, REM Elctrns.	814-453-5626
PA	Export, Advacom	412-325-7551
PA	Harrisburg, Ad-Tech	717-561-9905
PA	McKean, Advacom	814-476-7774
PA	North Huntingdon, REM Elctrns.	412-864-7423
PA	Philadelphia, PEI/Genesis	800-523-0727
TN	Memphis, Carlton-Bates	901-365-3539
TX	Allen, Prime Distbg.	214-231-0170
TX	Austin, Wofford Elctrns.	512-339-1131
TX	Dallas, Wofford Elctrns.	214-340-8555
TX	El Paso, McNicol Elctrns.	915-566-2936
TX	Farmers Branch, Force Elctrns.	214-247-9955
TX	Houston, Carlton-Bates	713-956-2244
TX	Houston, Force Elctrns.	713-561-8644
TX	Houston, Wofford Elctrns.	713-351-2255
TX	Richardson, Off The Shelf Comp.	214-238-0808
UT	Salt Lake City, Standard Supply	801-486-3371
WA	Kent, Comp. Resources	206-340-1646
WA	Redmond, Acacia/Deanco	206-881-5566
WI	Brookfield, Bisco Inds.	414-789-7325
WI	Milwaukee, Progressive Image	414-321-4722

FAX: 310-430-8309

MILLS RESISTOR CO., 3840 Catalina St., Los Alamitos, CA 90720, Tel: 310-598-2454; FSC No.: 34238; Empl.: 50; *Sls. Mgr.:* S. Kistner; *Dist. Mgr.:* C. Brown ..... **A•1987**

Local Sales Offices & Reps

CA	Los Altos, Frauman Assocs.	415-941-0660
CA	Sacramento, Mills Resistor Co.	916-422-5461
CT	Rocky Hill, Jim McPhail	203-721-1802
MA	Waltham, Dynasel Assocs.	617-890-6777
MI	Milford, Elctrn. Comp. Sls., Inc.	313-360-3790
OR	Gaston, SPS Elctrns.	206-323-4140
PA	Montgomeryville, Quick Response Tech. Sls.	215-362-9225
TX	Houston, Ev Smith Co.	713-649-5756
WA	Seattle, SPS Elctrns.	206-323-4140

Local Distributors

FL	Ft. Lauderdale, Jaro Elctrns.	800-327-5551
PA	Harrisburg, ADTECH	717-939-8337
PA	McKean, Advacom	814-476-7774

MILTON ROSS CO., 262 Valley Rd., Warrington, PA 18976, Tel: 215-491-0600, FAX: 215-491-9479; FSC No.: 07047; Empl.: 100; *Sls. Mgr.:* Marianne Skukowski

MILTOPE BUSINESS PRODUCTS, Miltope Grp., 1770 Walt Whitman Rd., Melville, NY 11747, Tel: 516-420-0200, 516-756-7650, TWX: 510-221-1803, FAX: 516-756-7606; Empl.: 650; *Sls. Mgr.:* Robert Ceonzo

MILTOPE CORP., 1770 Walt Whitman Rd., Melville, NY 11747, Tel: 516-420-0200, TWX: 510-221-1803; Empl.: 750; *Sls. Mgr.:* Frederick S. Korb; *Dist. Mgr.:* William Jennings

FAX: 414-271-9876

MILWAUKEE RESISTOR CORP., 700 W. Virginia St., Milwaukee, WI 53204, Tel: 414-271-9900; FSC No.: 82807;15109; Empl.: 75; *Sls. Mgr.:* John Dorsha ..... **A•1988-1992**

Local Sales Offices & Reps

CA	San Carlos, Electro Pacific	415-441-5541
IL	Arlington Heights, Kettner & Assocs.	708-364-0830
NC	Kernersville, Heritage Elctrl. Sls.	919-996-4484
MA	Stoughton, EECS-Mel Botsian	617-344-5139
MN	Plymouth, Kettner & Assocs.	612-559-5150
NY	Rochester, Gislason Sls.	716-328-7400
NY	Whitestone, M. H. Lynn co.	718-352-9233
NC	Kernersville, Heritage Electrical Assoc.	800-877-4372
OH	Westlake, Assocd. Elctrl. Comps.	216-835-9960
WI	Mequon, Kettner & Assocs.	414-241-4697

MIMIC, INC., P. O. Box 705, Islington, MA 02090-0705, Tel: 617-329-9593; Empl.: 5; *Sls. Mgr.:* S. Thurston

MINC INCORPORATED, 6755 Earl Dr., Colorado Springs, CO 80918, Tel: 719-590-1155, FAX: 719-590-7330; *Sls. Mgr.:* David Niehaus

MINCO PRODUCTS, 7300 Commerce La., Minneapolis, MN 55432, Tel: 612-571-3121, FAX: 612-571-0927; FSC No.: 09359; Empl.: 575; *Sls. Mgr.:* J. Anderson

MIN-E-CON, 3160 Pullman, Costa Mesa, CA 92626, Tel: 714-434-7312, FAX: 714-434-7431; FSC No.: 54455

MINELCO INC. | Talley™ Industries

FAX: 203-283-6527

MINELCO INC. - A TALLEY IND., 135 S. Main St., Thomaston, CT 06787-0459, Tel: 203-283-8261; FSC No.: 07479; Empl.: 70; *Sls. Mgr.:* James A. Myles ... **B•1175**

Local Sales Offices & Reps

AL	Huntsville, L & D Inc.	205-837-1469
AZ	Phoenix, James Gerry Co.	213-283-7694
CA	Alhambra, James Gerry Co.	213-283-7694
CO	Centerville, West Inc.	208-888-6227
CO	Denver, West Inc.	303-477-8180
CT	Old Saybrook, FJS Assocs.	203-388-5374
FL	Longwood, Delmac	407-831-0040
GA	Atlanta, L & D, Inc.	404-395-7079
IA	Cedar Rapids, J.R. Sls. Engrg.	319-393-2232
KS	Wichita, Magna Eng. Sls. Co.	316-744-0851
MD	North East, Magna Eng. Sls. Co.	410-398-4215
MA	Burlington, F.J.S. Assocs.	617-273-5959
MO	St. Louis, Magna Eng. Sls. Co. Inc.	314-849-6590
NJ	Hasbrouck Hgts., Comp-Tech Sls.	201-288-7400
NY	New Hyde Park, Comp-Tech Sls.	516-593-2628
NC	Raleigh, L & D, Inc.	919-876-5301
OH	Dayton, Electro Mktg. Grp.	513-890-8322
OR	Lake Oswego, Caruso & Assocs.	503-635-5282
TX	Dallas, Kruvand Assoc., Inc.	214-437-3355
WA	Bellevue, Caruso & Co.	206-455-8811

MINGSTON ELECTRONICS, INC., MEC Inc.(Taiwan), 14145 Proctor Ave. Unit 8, City of Industry, CA 91746, Tel: 818-330-2086, FAX: 818-330-9988; Empl.: 3; *Sls. Mgr.:* Johnny Chao

Mini-Circuits

FAX: 718-332-4661

MINI-CIRCUITS LAB., 13 Neptune Avenue, P.O. Box 350166, Brooklyn, NY 11235-0003, Tel: 718-934-4500, TELEX: 125460, 620156 (Intl.); FSC No.: 15542 ..... **A•1724-1845**

Local Sales Offices & Reps

AZ	Scottsdale, Thorson Desert States, Inc.	602-998-2444
CA	Los Altos, Cain-White & Co.	415-948-6533
CA	Tustin, Youngewirth & Olenick Assocs.	714-838-5144
CO	Parker, W. Howard Assocs.	303-841-5755
FL	Clearwater, Beacon Microwave & Instrmn., Inc.	813-796-2378
FL	Longwood, Beacon Microwave & Instrs.	407-332-1940
GA	Atlanta, Beacon Microwave & Instrmn., Inc.	404-256-9640
IL	Mundelein, Cain-Forlaw, Inc.	708-540-9962
IN	Wolcottville, Cain-Forlaw Co., Inc.	219-854-2632
MD	Columbia, M. Lader Co.	800-442-3177
MA	Chelmsford, Advanced Technig. Mktg., Inc.	508-458-0200
MO	Mini-Circuits	417-335-5935,FAX:417-335-5945
NM	Albuquerque, Thorson Desert States, Inc.	505-883-4343
NY	Bklyn (Distbn. Ctr.), Mini-Circuits	800-654-7949
NY	Hartsdale, Spectrum Sls., Inc.	914-472-8600
NY	Skaneateles, Robtron, Inc.	315-685-5731
NC	Greensboro, M. Lader Co.	800-442-3177
OH	Worthington, Cain-Forlaw Co. Inc.	614-436-3004
OR	Aloha, Cain-Sweet Co.	503-591-0647
PA	Conshohocken, M. Lader Co.	215-825-3177, 800-442-3177
TX	Richardson, Beacon Microwave & Instrn., Inc.	214-437-1505
TX	Round Rock, Beacon Microwave & Instrmn. Inc.	512-244-6675
VA	Strasburg, M. Lader Co.	800-442-3177
WA	Bellevue, Cain-Sweet Co.	206-462-2118
Can	Burnaby, B.C., Giga-Tron Assocs. Ltd.	604-299-4244
Can	Burnaby, BC, Cain-Sweet Co.	604-420-6886
Can	Ottawa, Ont., Giga-Tron Assocs., Ltd.	613-225-4090

Local Distributors

AL	Huntsville, Component Distrs., Inc.	205-851-7800, 800-888-0331
AZ	Arizona/New Mexico, Mini-Circuits	800-654-7949
CA	Los Altos, Mini-Circuits	415-948-6533, 800-654-7949
CA	Tustin, Mini-Circuits	714-838-5144,800-654-7949
FL	Palm Bay, Component Distrs., Inc.	407-724-9910, 800-558-2351
GA	Norcross, Component Distrs., Inc.	404-441-3320, 800-874-7209
IL	Mundelein, CFC Distrs., Inc.	708-540-9962
MD	Columbia, MLC Distrs.	800-442-3177
MO	Mini-Circuits	417-335-5935
NM	Mini-Circuits	800-654-7949
NC	Greensboro, MLC Distrs.	800-442-3177
PA	Conshohocken, MLC Distrs.	215-825-3177, 800-442-3177
TX	Dallas, Comp. Distrs., Inc.	214-644-0373, 800-848-4234
WA	Bellevue, Mini-Circuits	206-462-2118,800-654-7949

MSI

FAX: 508-695-8758

MINI-SYSTEMS, INC., Electronic Package Div., 168 E. Bacon St., P.O. Box 1597, Plainville, MA 02762, Tel: 508-695-2000; *Sls. Mgr.:* Heather Edwards ..... **A•1710, 1993**

Local Sales Offices & Reps

CA L.S. Engrg. 415-967-5880,FAX:415-967-5884
CA S. California Tech. Sls. 818-704-9087, FAX:818-704-8632
FL JDM Assocs. 407-725-2823,FAX:407-725-7861
IL ABC Elctrn. Sls. 708-924-9974,FAX:708-924-9975
MN InterTec Associates 612-921-8443, FAX:612-929-4488
NH Shain Assocs. 603-881-4881,FAX:603-880-8924
NY LFG Micro 516-399-3199,FAX:516-399-3182
VA Glasscock Assocs. 804-798-2125, FAX:804-798-2109
WA Bellevue, Advanced Power Comps. 206-641-9127, FAX:206-641-8655
Can Ontario, ON, Intrade Canada 613-727-1272, FAX:613-727-0246

MSI

FAX: 508-695-6076

MINI-SYSTEMS, INC., Thick/Thin Film Division, 20 David Rd., North Attleboro, MA 02761, Tel: 508-695-0203, TWX: 710-348-0564; FSC No.: 50316; Empl.: 163 ..... **A•1993**

Local Sales Offices & Reps

AZ Scottsdale, IMA Sls., Inc. 602-946-4940, FAX:602-947-7638
CA Brea, S.C.T.S. 213-691-1114,FAX:213-690-0504
CA Mountain View, L.S. Engrg. 415-967-5880, FAX:415-967-5884
CA Woodland Hills, S.C.T.S. 818-704-9087, FAX:818-704-8632
FL Palm Bay, JDM Assocs. 407-725-2823, FAX:407-725-7861
FL Pompano Beach, J.P. Elctrns. 305-782-6830, FAX:305-782-1640
IL Elk Grove, ABC Elctrns. 708-228-1204, FAX:708-228-1249
ME Bethel, Shain Assocs., Inc. 207-836-3200
MA Norwell, Shain Assocs., Inc. 617-982-1474, FAX:617-740-2680
MN Minneapolis, Intertec Assocs. 612-921-8443, FAX:612-929-4488
NH Nashua, Shain Assocs., Inc. 603-881-4881, FAX:603-880-8924
NJ Princeton, Wexler-Court Sls. Co. 609-452-8670, FAX:609-452-9213
NY Mastic Beach, LFG Micro 516-399-3199, FAX:516-399-3182
NY Rochester, Phase Two Sls. 716-235-3889, FAX:716-235-1351
NY Rockville Centre, Milano Bros. Intl. 516-764-2200, FAX:516-764-4006
TX Richardson, Barry Sls. 214-234-0255, FAX:214-235-0271
VA Ashland, Glasscock Assoc. 804-798-2125, FAX:804-798-2109
WA Bellevue, Advanced Power Comps. 206-747-9127, FAX:206-641-8655
Can Nepean, Ont., Intrade Canada 613-727-1272, FAX:613-727-0246

MINI-SYSTEMS, INC., Sunbelt Microelectronic Division, 237 Enterprise Rd., Deltona, FL 32725, Tel: 407-574-0208, FAX: 407-574-8262 ..... **A•1993**

MINNESOTA WIRE & CABLE CO., 1835 Energy Park Drive, St. Paul, MN 55108-2721, Tel: 612-642-1800 , 1-800-258-6922(MWCC), FAX: 612-642-9201; Empl.: 165; *Sls. Mgr.:* Paul Wagner

MINOR RUBBER CO., INC., Ackerman St., Bloomfield, NJ 07003, Tel: 201-338-6800, 800-433-6886, FAX: 201-893-1399; *Sls. Mgr.:* Tom Fitzhenry

MINT SYSTEMS CORPORATION, 1633 South Main Street, Milpitas, CA 95035-6262, Tel: 408-262-7171, FAX: 408-262-5387; *Sls. Mgr.:* Rudy Juang ..... **D•1300-1301, 2283**

MIRAGE/KLM, 16890 Church St., P.O. Box 1000, Morgan Hill, CA 95037, Tel: 408-779-7363, FAX: 408-779-8845; Empl.: 50; *Sls. Mgr.:* Nancy Nykaza

MISCO

FAX: 612-825-7010

MISCO/MINNEAPOLIS SPEAKER CO., INC., 3806 Grand Avenue, Minneapolis, MN 55409, Tel: 612-825-1010; FSC No.: 14208; *Sls. Mgr.:* Tad Thompson ..... **D•1052**

Local Sales Offices & Reps

CA Newport Bch., Spa Elctrn. Sls. 714-863-1193
FL Longwood, M & H Assocs. 407-332-7912
OH Brecksville, Audio Mktg. Assocs. 216-526-2426
TX Arlington, Electronic Prod. Reps. 817-467-0377
WA Lynnwood, Pacnor Mktg., Inc. 206-771-6016

MITCHELL ELECTRONICS CORP., 84 West Grand Street, Mt. Vernon, NY 10552, Tel: 914-699-3800, TELEX: 914-699-1022; Empl.: 25; *Sls. Mgr.:* Jonathan Lerner ..... **A•2433**

MITEC ELECTRONICS, 104 Gun Avenue, Pointe Claire, Quebec, Canada H9R 3X3, Tel: 514-694-6666, 800-724-3911, FAX: 514-694-3814; FSC No.: FSCM 38494; Empl.: 115; *Sls. Mgr.:* J. Robinson

MITECH ELECTRONICS CORP., 411 Washington St., Otsego, MI 49078, Tel: 616-694-9471, FAX: 616-692-2651; Empl.: 78; *Sls. Mgr.:* Kendall Meyer

MITEL SEMICONDUCTOR DIV. OF MITEL CORP., 360 Legget Dr., P.O. Box 13089, Kanata, Ont., Canada K2K 1X3, Tel: 613-592-2122, TELEX: 053-3221, TWX: 613-562-8529; Empl.: 1000; *Sls. Mgr.:* Ron Chon

MITEQ INC., 100 Davids Drive, Hauppauge, NY 11788, Tel: 516-436-7400, TELEX: 6718148, FAX: 516-436-7430; Empl.: 350

MITRONICS, P.O. Box 2129, Rolling Hills, CA 90274, Tel: 310-377-2022

MITSUBISHI ELECTRONICS, 991 Knox Street, Torrance, CA 90502, Tel: 213-515-3993, TELEX: 06-4703-M USA LSA, TWX: 66-4787-MELA TRNC; Empl.: 423; *Sls. Mgr.:* Bob Crooks, V.P. Sls.; *Dist. Mgr.:* Bob Crooks, V.P. Sls.

MITSUBISHI ELCTRNS. AMERICA, INC., Elctrn. Device Grp., 1050 East Arques Ave., Sunnyvale, CA 94086, Tel: 408-730-5900, TELEX: 172296, TWX: 910-339-9549, FAX: 408-730-4972; Empl.: 200; *Sls. Mgr.:* Mike Bocian; *Dist. Mgr.:* Tom Zellman

Local Sales Offices & Reps

CA Cypress, Mitsubishi Elctrns. Sls. Reg. Off. 714-236-6270
CA San Diego, Mitsubishi Elctrns. Reg. Sls. Off. 619-451-9618
CA Sunnyvale, Mitsubishi Elctrns.-Reg. Sls. Off. 408-730-5900
CA Torrance, Mitsubishi Elctrns. (Southwest) 213-515-3993
CO Denver, Mitsubishi Elctrns. (Rocky Mtn.) 303-740-6775
CO Englewood, Mitsubishi Elctrns. Reg. Sls. Off. 303-220-0744
FL Boca Raton, Mitsubishi Elctrns. 407-487-7747
GA Mitsubishi Elctrns. (S. Atlantic) 404-368-4850
GA Norcross, Mitsubishi Elctrns. Reg. Sls. Off. 404-448-1263
IL Mt. Prospect, Mitsubishi Elctrns.-Reg. Sls. Off. 708-298-9223
MA Woburn, Mitsubishi Elctrns. (Northeast) 617-932-5700
MA Woburn, Mitsubishi Elctrns. Sls. Reg. Off. 617-937-4300
MN Minnetonka, Mitsubishi Elctrns.-Reg. Sls. Off. 612-938-7779
NJ Somerset, Mitsubishi Elctrns.-Reg. Sls. Off. 201-469-8833
NY Fishkill, Mitsubishi Elctrns. Reg. Sls. Off. 914-896-0896
NC Cary, Mitsubishi Elctrns. Reg. Sls. Off. 919-460-0404
TX Carrollton, Mitsubishi Elctrns. Reg. Sls. Off. 214-245-0047
TX Carrollton, Mitsubishi Elctrns.-Reg. Sls. Off. 214-484-1919
TX Irving, Mitsubishi Elctrns. Sls. Reg. Off. 214-929-0046
Can Kanata, Ont., Mitsubishi Elec. Sls. Canada, Inc. 613-591-3348
Can Mississauga, Mitsubishi Elctrns.Reg. Sls. Off. 416-670-8711

MKC ELECTRONICS CORP., 9205 Quivira Road, Overland Park, KS 66215, Tel: 913-894-9711, FAX: 913-894-9713; Empl.: 26

MKS INSTRUMENTS, INC., Six Shattuck Road, Andover, MA 01810, Tel: 508-975-2350, 800-227-8766, TELEX: 94-9375, FAX: 508-975-0094; Empl.: 500

MLT/MICRO-LITE TECHNOLOGY, 1811 S. 39th St., Ste. 99, Mesa, AZ 85206, Tel: 602-545-1113, FAX: 602-545-0072; *Sls. Mgr.:* R.L. Dohanian, Dir. Sls. Dev.

MLT/MICRO-LITE TECHNOLOGY, 1811 S. 39th St., Ste 99, Mesa, AZ 85206, Tel: 602-545-1113, FAX: 602-545-0072; *Sls. Mgr.:* R. L. Dohanian, Dir. Sls. Dev.

MMG-NORTH AMERICA, 126 Pennsylvania Ave., Paterson, NJ 07509, Tel: 201-345-8900, FAX: 201-345-1172; Empl.: 150

MOBILE-TRONICS CO., INC., Box 1147, San Clemente, CA 92674, Tel: 714-361-4305, FAX: 714-361-4356; Empl.: 2

MODOR TECHNICAL PRODUCTS INC., 13400 Wright Cir., Tampa, FL 33626, Tel: 813-855-5736, FAX: 813-855-7942; Empl.: 13; *Sls. Mgr.:* S. James Bottone

MODULAR AUDIO PRODUCTS, Modular Devices, Inc., Brookhaven R & D Plaza, One Roned Road, Shirley, NY 11967, Tel: 516-345-3100, FAX: 516-345-3106; *Sls. Mgr.:* C. Liptman

MODULAR DEVICES, Brookhaven R & D Plaza, 1 Roned Rd., Shirley, NY 11967, Tel: 516-345-3100, FAX: 516-345-3106; FSC No.: 52202; Empl.: 65; *Sls. Mgr.:* C. Liptman ..... **D•1837-1844, 2136**

Local Sales Offices & Reps

CA Murrieta, MIL-COM Sls., Inc. 714-677-2097
CA Santa Clara, Integrated Tech Sls. 408-727-3406
CT Bloomfield, Zaslow Sls. Co. 203-242-7781
FL Clearwater, CM Mktg. 813-443-6390
KS Prairie Village, Thunderbird Tech. Sls. 913-642-7220
KS Wichita, Thunderbird Tech. Sls. 316-636-5777
MD Towson, Advanced Tech. Sls., Inc. 410-296-9360
MN St. Paul, K-Rep 612-681-9510
MO Maryland Heights, Thunderbird Tech. Sls. 314-298-8940
NY Great Neck, F & F Metro Inc. 516-482-4080
NY Williamsville, NV Elect. Assoc. 716-632-1347
OH Dover, A-J Assocs. 216-343-2224
PA Norristown, Rivco January Inc. 215-631-1414
TX Dallas, M-Rep Co. 214-484-5711

MODULAR DEVICES INC., 4115 Spencer St., Torrance, CA 90503, Tel: 310-542-8561, FAX: 310-371-6331; Empl.: 250; *Sls. Mgr.:* Tom Miller

MODULAR MINING SYSTEMS, INC., 3289 E. Hemisphere Loop, Tuscon, AZ 85706, Tel: 602-746-9127, FAX: 602-889-5790; Empl.: 60; *Sls. Mgr.:* J.Michael Canty

MODULAR SYSTEMS, INC., 905 Albemarle St., Charlottesville, VA 22901, Tel: 804-295-7882; Empl.: 5; *Sls. Mgr.:* H. N. Patel

MODUPOWER BY SEMTECH

MODUPOWER, INC., See Semtech Corporation

MOHAWK/CDT, 9 Mohawk Dr., Leominster, MA 01453, Tel: 508-537-9961, 800-422-9961, FAX: 508-537-4358; Empl.: 140

MOISTURE REGISTER PRODUCTS DIV., Aqua Measure Instrument Co., P.O. Box 369, LaVerne, CA 91750-0369, Tel: 909-392-5833, FAX: 909-392-5838; Empl.: 25; *Sls. Mgr.:* Gabriel Cote, Jr.

MOLDCON DIV. OF CONTEX ELECTRONICS, 221 Interstate Dr., W. Springfield, MA 01089, Tel: 413-736-0371, FAX: 413-736-9716; Empl.: 158; *Sls. Mgr.:* Chris Stone

MOLDTRONICS, INC., 703 Rogers St., Downers Grove, IL 60515, Tel: 708-968-7000, FAX: 708-968-5068; Empl.: 100; *Sls. Mgr.:* J.D. Wilson

MOLECU-WIRE, P.O. Box 495, Farmingdale, NJ 07727, Tel: 908-938-9473, TWX: 710-723-6943; Empl.: 125

MOLEX, INC., 2222 Wellington Ct, Lisle, IL 60532, Tel: 708-969-4550, TELEX: 25-4069, FAX: 708-969-1352; Empl.: 7,483; *Sls. Mgr.:* Bill Cox; *Dist. Mgr.:* Bill Hickey

MOLI ENERGY LIMITED, 20000 Stewart Crescent, Maple Ridge, B.C., Canada V2X 9E7, Tel: 604-465-7911/1-800-663-MOLI, TELEX: 04-356708, FAX: 604-465-4398; FSC No.: 6140; Empl.: 160; *Sls. Mgr.:* Mary Connolly; *Dist. Mgr.:* Mary Connolly

MOLON MOTOR & COIL CORPORATION, 3737 Industrial Avenue, Rolling Meadows, IL 60008, Tel: 708-253-6000, FAX: 708 259-5491; *Sls. Mgr.:* Timothy Wiemer

MONARCH INSTRUMENT, Monarch International Inc., 11 Columbia Drive, Amherst, NH 03031, Tel: 603-883-3390, 800-999-3390, FAX: 603-886-3300; FSC No.: Cage Code 1Z500; Empl.: 26; *Sls. Mgr.:* Richard Peters, Paul Coughlin, Prod. Mgrs.; *Dist. Mgr.:* Myron Kasok

MONICOR ELECTRONIC CORP., 2964 N.W. 60th St., Ft. Lauderdale, FL 33309, Tel: 305-979-1907, FAX: 305-979-2611; Empl.: 6

MONITOR PC

FAX: 619-434-0255

MONITOR PRODUCTS CO., INC., 502 Via Del Monte, Oceanside, CA 92054, Tel: 619-433-4510; FSC No.: Cage Number 54331; *Sls. Mgr.:* Pat Courington, East. Reg. Mgr.; *Dist. Mgr.:* Robert Blasier, West. Reg. Sls. Mgr. **A•1324, 1424-1429**

Local Sales Offices & Reps

AL	Huntsville, CSR Elctrns.	205-533-2444
AZ	Phoenix, Eltron	602-266-2164
CA	Mountain View, Straube Assocs.	415-969-6060
CA	Oceanside, Monitor Prods. Co.	619-433-4510
CO	Westminster, Straube Assocs.	303-426-0890
FL	Coral Springs, Graham Assocs.	305-341-5102
FL	Jacksonville, Monitor Prods. Co.	904-725-4384
FL	Largo, Graham Assocs.	904-523-0996
FL	Melbourne, Graham Assocs.	407-773-6631
FL	Palm Beach, Graham Assocs.	407-622-4049
FL	Winter Garden, Graham Assocs.	407-656-9369
GA	Atlanta, CSR Elctrns.	404-396-3720
ID	Boise, Jas. J. Backer Co.	208-378-4680
IL	Northbrook, Howard Benjamin Assoc.	708-272-2900
KS	Overland Park, Markline Tech.	913-681-8880
MD	Baltimore, Muncy Sls. Assocs.	410-484-6376
MA	Chelmsford, Technlg. Reps.	508-250-4762
MN	Anoka, Technical Solutions, Inc.	612-785-9303
NH	Technlg. Reps.	603-774-6323
NC	Matthews, CSR Elctrns.	704-847-5806
NC	Raleigh, CSR Elctrns.	919-878-9200
OR	Beaverton, Jas. J. Backer Co.	503-627-0168
RI	Technlg. Reps.	401-789-7530
TN	Knoxville, CSR Elctrns.	615-637-0293
TX	Austin, Mil-Rep Assocs.	512-346-6331
TX	Houston, Mil-Rep Assocs.	713-444-2557
TX	Richardson, Mil-Rep Assocs.	214-644-6731
UT	Salt Lake City, Straube Assocs.	801-263-2640
WA	Seattle, Jas. J. Backer Co.	206-285-1300

Local Distributors

AL	Huntsville, Component Distr.	205-851-7800
AL	Huntsville, Resistacap, Inc.	205-883-4270
AL	Huntsville, Time Elctrns.	205-721-1134
AZ	Phoenix, Force Elctrns.	602-437-1060
AZ	Scottsdale, Added Value Elec.	602-951-9788
AZ	Tempe, Timer	602-967-2000
CA	Agoura Hills, Time Elctrns.	818-707-6223
CA	Chatsworth, Passive Technlg.	818-882-2277
CA	Chatsworth, Time Elctrns.	818-998-7200
CA	Culver City, Combined Services	213-558-2859
CA	Culver City, Time Elctrns.	213-558-2859
CA	El Segundo, Force Elctrns.	213-522-1324
CA	San Diego, Added Value Elec.	619-558-8890
CA	San Diego, Force Elctrns.	619-569-9661
CA	San Diego, Neumann Elctrns.	619-695-3005
CA	San Diego, Time Elctrns.	619-674-2800
CA	San Jose, Passive Technlg.	408-435-5566
CA	Santa Clara, Force Elctrns.	408-748-1324
CA	Sherman Oaks, Delay Line Distrs.	818-986-9455
CA	Sunnyvale, PSC Elctrns.	408-737-1333
CA	Sunnyvale, Time Elctrns.	408-734-9888
CA	Torrance, Time Elctrns.	310-320-0880
CA	Tustin, Added Value Elctrns.	714-259-7986
CA	Tustin, Time Elctrns.	714-669-8719
CA	Westlake Village, Added Value Elec.	818-889-2861
CO	Colorado Springs, Time Elctrns.	719-637-0055
CO	Engelwood, Component Distrib.	303-770-6214
CO	Engelwood, Time Elctrns.	303-721-8882
CO	Wheatridge, Added Value Elctrn.	303-422-1701
CT	Bridgeport, Park Distrs.	203-366-7200
FL	Boca Raton, NRC Elctrns.	507-241-8600
FL	Clearwater, Component Distrib.	813-796-0466
FL	Ft. Lauderdale, Component Distrib.	305-973-6175
FL	Ft. Lauderdale, Time Elctrns.	305-484-1778
FL	Melbourne, Comp. Dist.	407-724-9910
FL	Melbourne, Rome Elctrns.	407-242-8151
FL	Orlando, Time Elctrns.	407-841-6565
GA	Atlanta, Time Elctrns.	404-984-0126
GA	Norcross, Component Distrib.	404-441-3320
GA	Norcross, Time Elctrns.	404-368-0969
IL	Franklin Park, Stetco, Inc.	708-671-4208
IL	Schaumberg, Time Elctrns.	708-303-3000
MD	Columbia, Time Elctrns.	301-964-3090
MA	Pepperell, DSC, Inc.	508-433-9524
MN	Edina, Time Elctrns.	612-830-1252
MN	Fridley, Voyager Elctrns.	612-571-7766
MO	Manchester, Time Elctrns.	314-391-6444
MO	St. Louis, Rictronics, Inc.	314-997-4707
NH	Salem, Diamond Elect.	603-894-4420
NJ	Edison, Dove Elctrns.	908-738-0321
NJ	Marlton, Time Elctrns.	609-596-6700
NJ	Wayne, Time Elctrns.	201-685-8250
NY	Deer Park, Brookdale Elec.	516-242-8033
NY	E. Setauket, Dove Elctrns.	516-689-7733
NY	Hauppauge, Time Elctrns.	516-434-3344, 516-273-0100
NY	Johnson City, Help Elctrns.	607-729-3528
NY	Rome, Rome Elctrns.	315-337-5400
NY	Syracuse, Time Elctrns.	315-432-0355
NC	Oxford, Time Elctrns.	919-693-5166
NC	Raleigh, Time Elctrns.	919-847-9650
OH	Columbus, Time Elctrns.	614-794-3301
OK	Tulsa, Carlton-Bates	918-250-1626
OR	Portland, Time Elctrns.	503-626-2979
PA	Levittown, Aim Elctrns.	215-946-3900
TX	Allen, Sunbelt Elctrns.	214-235-0587
TX	Austin, Carlton-Bates	512-837-9098
TX	Austin, Time Elctrns.	512-346-7346
TX	Dallas, Component Distrs., Inc.	214-644-0373
TX	Farmers Branch, Force Elctrns.	214-247-9955
TX	Ft. Worth, Carlton-Bates	817-831-0395
TX	Richardson, Time Elctrns.	214-644-4644
UT	W. Valley City, Added Value Elec.	801-975-9500
UT	W. Valley City, Time Elctrns.	801-973-8494
WA	Kirkland, Time Elctrns.	206-820-1525
Can	Time Elctrns.	416-672-5300

MONOLITHIC SYS. CORP., 7050 South Tuscan Way, Englewood, CO 80112, Tel: 303-790-7400, FAX: 303-790-7118; Empl.: 50; *Sls. Mgr.:* C. Edward O'Neal; *Dist. Mgr.:* C. Edward O'Neal

MONROE ELECTRONICS, INC., 100 Housel Ave., Lyndonville, NY 14098, Tel: 716-765-2254, FAX: 716-765-9330; Empl.: 50; *Sls. Mgr.:* Steven D. Kelly

MONSANTO CO., 800 N. Lindbergh Blvd., St. Louis, MO 63167, Tel: 314-694-1000, TELEX: 650-397-7820, FAX: 314-694-7625; Empl.: 39,281

MONTROSE/CDT, Cable Design Technologies, 28 Sword Street, Auburn, MA 01501, Tel: 508-791-3161, FAX: 508-793-9862; Empl.: 250; *Sls. Mgr.:* Michael McLaughlin, OEM Sls. Mgr.; *Dist. Mgr.:* Bill Wilmot

MOODY TOOLS, INC., 43 Crompton Ave., E. Greenwich, RI 02818-0230, Tel: 401-885-0911, FAX: 401-885-4565; FSC No.: 5120,5180; Empl.: 11; *Sls. Mgr.:* J. H. Moody; *Dist. Mgr.:* D .H. Moody

MOORE PRODUCTS CO., Sumneytown Pike, Spring House, PA 19477, Tel: 215-646-7400, FAX: 215-283-6358; Empl.: 1000ó; *Sls. Mgr.:* E.M. Coll

MOORE REED & CO. LTD., Southway Walworth, Andover, Hampshire SP 105AB, Tel: 0264-324155, TELEX: 47654, FAX: 0264-356561; Empl.: 150; *Sls. Mgr.:* W. North

MORGAN-MATROC, Electro Ceramics Division, 232 Forbes Rd., Bedford, OH 44146-5478, Tel: 216-232-8600, FAX: 216-232-8731; Empl.: 100; *Sls. Mgr.:* D.W. Bacso **B•1974**

Local Sales Offices & Reps

CA	El Toro, Morgan Matroc, Inc.	714-768-8672

MORRIS, J. I., CO., 372 Elm St., Southbridge, MA 01550, Tel: 508-764-4394, FAX: 508-764-7350; FSC No.: 95548; Empl.: 25

MORRIS ENTERPRISES, 16799 Schoenborn St, Sepulveda, CA 91343, Tel: 818-894-9103, TELEX: 6-74681, TWX: 910-496-1525, FAX: 818-894-5791; FSC No.: 54918; Empl.: 50; *Sls. Mgr.:* J. Dumpert

MORS ASC

FAX: 617-245-4531

MORS COMPONENTS, 134 Water St., PO Box 544, Wakefield, MA 01880-4444, Tel: 617-246-1007; FSC No.: 54659; Empl.: 40; *Sls. Mgr.:* Mike Palmerino **B•1778-1781; C•1532**

Local Sales Offices & Reps

AZ	Phoenix, More Sls., Inc.	602-331-8115
AR	Van Buren, Hightower Ind. Sls.	501-471-8116
CA	Arcadia, HMC, Inc.	818-447-0958
CA	San Jose, Vernexx	408-972-9072
CO	Boulder, Stratford Grp.	303-530-3194
FL	Lighthouse Point, Krutek & Assocs.	305-783-2501
GA	Norcross, Mountain Electro Mktg.	404-448-5594
IL	Wheaton, CS Technical Sls.	708-653-8126
IN	Fort Wayne, Nationwide Comps., Inc.	219-436-6095
IA	Marion, MSB Assocs.	319-377-6261
KS	Roeland Park, MSB Assocs.	913-432-2131
MD	Frederick, Glasscock Assoc. Inc.	301-694-5048
MA	Andover, Crawford Assocs.	508-470-2122
MI	Brighton, W. R. Hummon	313-486-5333
MN	St. Paul, Countryman Assocs. Co.	612-645-9151
MO	St. Charles, MSB Assocs.	314-946-5577
NJ	Edison, R.E. Breuer Co., Inc.	908-561-6161
NY	Rochester, Lamb Comps.	716-328-6350
OH	Willoughby, Nationwide Comps.	216-946-3226
OR	Portland, Elctrn. Solutions.	503-292-8204
PA	Trevose, PSA, Inc.	215-245-0513
TX	Houston, Aticus	713-466-9994
TX	Plano, Aticus	214-964-0663
VA	Ashland, Glasscock Assoc.	804-798-2125
WA	Bellevue, E2	206-637-0302
WV	New Town, Nationwide Comps., Inc.	304-343-3167
EXP	Singapore, JFL Elctrns. Pte. Ltd.	65-382-5551
Can	Mississauga, Ont., InTELaTECH	416-629-0882

Local Distributors

AZ	Phoenix, Control Design Supp.	602-829-7981
AR	Little Rock, Carlton-Bates Co.	800-482-9313
CA	Burbank, Switching Devices	213-849-3211
CA	Fremont, KEA Elctrns.	510-651-2691
CA	Hayward, Electro Comps.	415-783-5800
CA	Los Angeles, Elec. Switches	213-660-1310
CA	Milpitas, Sierra West	408-945-1050
CA	Milpitas, Zack Elctrns.	408-942-5432
CA	Santa Monica, Master Dists.	213-452-1229
CA	Tustin, Western Switches	714-259-8144
CO	Denver, Control Design	303-296-2010
CO	Littleton, Indelco	303-795-3431
CT	Wallingford, Control Design	203-269-9955
FL	Ft. Lauderdale, Brothers Elctrns.	305-561-6700
FL	Largo, Electronic Precepts	813-544-3636
GA	Atlanta, Motion Elctrns.	404-455-8262
GA	Roswell, Gateway Megatech	404-642-8787
IL	Bensenville, Voyager Elctrns.	708-860-1300
IL	Chicago, Leeds Elctrns.	312-625-3800
IL	Wheeling, Hawk Elctrns.	708-459-4030
IL	Wood Dale, Nep Elctrns.	708-595-8500
IN	Carmel, Altex Elctrns.	317-848-1323
IA	Desmoines, Mid-State Distrbg.	515-244-7231
IA	W. Des Moines, Ramco Co.	515-225-6933
KS	Wichita, Radio, Inc.	316-264-2798
MD	Beltsville, PSI/Petricko Sls.	301-937-4960
MD	Kensington, Marine Air Supp.	301-949-9560
MA	Marlboro, Hardware Specialty Co.	508-481-8622
MA	Westborough, In Stock Prods.	508-870-5750
MA	Wilmington, North Star Elec.	508-657-5155
MA	Woburn, Control Design	617-932-9404
MI	Battle Creek, Great Lakes Elctrns.	616-963-6282
MI	St. Clair Shores, Spemco	313-771-2700
MN	Fridley, Voyager Elctrns.	612-571-7766
MN	Hibbing, MinnTech Elctrns.	218-262-5228
MN	Minneapolis, Tortec Corp.	612-866-3662
MO	St. Louis, Wes-Garde Comps.	314-567-7776
NJ	E. Brunswick, Brothers Elctrns.	908-238-2200
NJ	Oakland, Relay Specialties	201-337-1000
NY	Rochester, Masline Elctrns.	716-546-5373
NY	Woodside, Switches Unltd.	718-478-5000
NC	Raleigh, Century Elctrns	919-596-2220
NC	Winston-Salem, Kirkman Elctrns.	919-722-9131
OH	Willoughby, Gateway Megatech	216-953-0333
OK	Tulsa, Radio Inc.	918-587-9123
OR	Portland, Radar Elctrns.	503-232-3404
PA	McKean, Advacom	814-476-7724

PA Norristown, Century Elctrns. 215-631-5404
PA Philadelphia, Shap Elctrns. 215-969-3300
RI Pawtucket, Major/Edwards 401-725-7400
TX Carrollton, LCD Elctrns. 214-245-0600
TX Carrollton, North Star Elctrns. 214-980-2999
TX Dallas, Omni Pro Elctrns. 214-233-0500
TX Houston, Wofford Elctrns. 713-351-2255
UT Nephi, Control Design Supply 801-530-4845
WA Seattle, Radar Elec. Co. 206-282-2511
WI Milwaukee, Progressive Image 414-321-4722
WI New Berlin, Nep Elctrns. 414-785-9100
WI Waukesha, Hawk Elctrns. 414-547-4457
Can Mississauga, Ont., InTELaTECH 416-629-0082

MORS TECHNOLOGIES INC., Mors Group-France, 225 Industrielle, Delson, Quebec, Canada J0L 1G0, Tel: 514-638-4150, FAX: 514-638-2270

MOSAIC SEMICONDUCTOR INC., Implex Inc., 7420 Carroll Rd., San Diego, CA 92121, Tel: 619-271-4565, FAX: 619-271-6058; Empl.: 45; *Sls. Mgr.:* Steve Fallaize, Bob Lindskog; *Dist. Mgr.:* Ron Larose

MOSEL-VITELIC, 3910 N. First St., San Jose, CA 95134-1501, Tel: 408-433-6000, FAX: 408-433-0331

MOTION ENGINEERING, INC., 520 E. Montecito St., Santa Barbara, CA 93103, Tel: 805-962-5409, FAX: 805-962-8001; Empl.: 6; *Sls. Mgr.:* Matt Cheresh

MOTION SCIENCE INC., 830-6 Jury Ct., San Jose, CA 95112, Tel: 408-993-0300, FAX: 408-993-0123; Empl.: 27

MOTION SENSORS, INC., 12 Park Street, Cranford, NJ 07701, Tel: 908-709-0025, FAX: 908-709-1144; Empl.: 6; *Sls. Mgr.:* Arthur Bergman

MOTOR CAPACITORS, INC., 6655 N. Avondale Ave., Chicago, IL 60631, Tel: 312-631-0713, FAX: 312-774-8778; Empl.: 14 ..... **A•1116**

Local Sales Offices & Reps
CA Santa Clarita, T & C Engrg. 805-254-8778
NY Garden City, Maximum Sls. 516-294-5029
OH Cincinnati, Technicol Engrg. 513-851-8549
PA Pittsburgh, EJ Sls. Co. 412-967-0360
WI Milwaukee, KMA Sls. Co. 414-259-1771

MOTOROLA CERAMIC PRODUCTS, Components Division, 4800 Alameda Blvd. N.E., Albuquerque, NM 87113, Tel: 505-822-8801, FAX: 505-822-8812; Empl.: 600; *Sls. Mgr.:* Tom Gilder

MOTOROLA INC., Auto. & Indl. Elctrns., Elctrn. Sys. Comps. Div., 4000 Commerical Ave., Northbrook, IL 60062, Tel: 708-205-2867, TELEX: 671-5420 MOT APD; Empl.: 2500

MOTOROLA SEMICONDUCTOR PRODS. SECTOR, 2100 East Elliot, Tempe, AZ 85284, Tel: 602-244-6900, TWX: 910-951-1334; FSC No.: 04713; *Sls. Mgr.:* Ted Jaros; *Dist. Mgr.:* Brian Hilton

MOTOR TECHNOLOGY, INC., 2798 Culver Ave., Dayton, OH 45429, Tel: 513-294-1041, FAX: 513-294-8336; Empl.: 35 ..... **B•1299-1301**

Local Sales Offices & Reps
OH Dayton, Motor Technology, Inc. 513-294-1041

MOTORTEST, INC., PO Box 292633, Columbus, OH 43229, Tel: 614-882-7821, FAX: 614-841-9007

MOTOR-TRONICS, INC., 1280 Liberty Way, Vista, CA 92083, Tel: 619-727-7425, FAX: 619-727-4436; *Sls. Mgr.:* Bill Linko

MOUSER ELECTRONICS, 11433 Woodside Ave., Santee, CA 92071, Tel: 800-346-6873, FAX: 619-449-6041; Empl.: 300; *Sls. Mgr.:* G. Rye; *Dist. Mgr.:* C. Degurse

MOUSER ELECTRONICS, 2401 Hwy. 287 North, Mansfield, TX 76063, Tel: 800-346-6873, FAX: 817-483-0931; Empl.: 300; *Sls. Mgr.:* G. Rye; *Dist. Mgr.:* K. Jenkins

MOUSER ELECTRONICS, 370 Tomkins Court, Gilroy, CA 95020, Tel: 800-346-6873, FAX: 408-842-7375; Empl.: 300; *Sls. Mgr.:* G. Rye; *Dist. Mgr.:* J. Treadway

MOUSER ELECTRONICS, 12 Emery Ave., Randolph, NJ 07869, Tel: 800-346-6873, FAX: 201-328-7120; Empl.: 300

MOXNESS PRODUCTS, INC., Versa Technologies, 1914 Indiana St., Racine, WI 53405, Tel: 414-554-5050, 800-558-5706, FAX: 414-554-2321; Empl.: 250

MPB CORP., Miniature Precision Bearings Div., Precision Park, Keene, NH 03431, Tel: 603-352-0310, TWX: 710-366-1801; FSC No.: 40920; Empl.: 1900; *Sls. Mgr.:* T. A. Rudzienski; *Dist. Mgr.:* R. F. Chartier

MPC, Div. of Consulting Systems, 638 Main St., Danville, NH 03819, Tel: 603-642-5913, 1-800-238-8380, FAX: 603-642-5913; *Sls. Mgr.:* W. Morse ..... **D•1846**

Local Distributors
TN Knoxville, Indl. Elctrns. 615-573-7135

MP/CAPAR, Multi Products International, 250 Lackawanna Ave., P.O. Box 737, West Paterson, NJ 07424, Tel: 201-890-1344, FAX: 201-890-1677; *Sls. Mgr.:* Irwin Wolberg, VP Sls. & Mktg.

MSC AUTOMATION, Miller Sales Co., 1111 Old Rand Rd., Wauconda, IL 60084, Tel: 708-526-9200, 800-323-5294, FAX: 708-526-9206; Empl.: 23; *Sls. Mgr.:* Paula Bilinski; *Dist. Mgr.:* Dan de Ramos

Local Sales Offices & Reps
MN Golden Valley, MSC Minn. 612-544-1045

MSD, INC., Magnecraft, 700 Orange St., Darlington, SC 29532, Tel: 803-393-5421, FAX: 803-393-4123; Empl.: 210; *Sls. Mgr.:* Bob Forbes

MSD3, 365 Woodview Ave., Ste. 700, Morgan Hill, CA 95037, Tel: 800-541-3526, 408-778-7267, FAX: 408-778-2597; *Sls. Mgr.:* Bill White

MSD3

FAX: 408-778-2597

MSD3, 365 Woodview Ave., Morgan Hill, CA 95037, Tel: 800-541-3526, 408-778-7267; *Sls. Mgr.:* Bill White ..... **A•1696-1697; D•1087**

MSI ELECTRONICS, INC., 34-32 57th St., Woodside, NY 11377, Tel: 718-672-6500, FAX: 718-397-0972; FSC No.: 18518; Empl.: 18; *Sls. Mgr.:* A. Lederman

Local Sales Offices & Reps
AL Huntsville, Murcota 205-539-8476
AZ Phoenix, Toward Engr. Assocs. 602-955-3193
CA Los Angeles, RF Assocs. 213-478-1586
CA Redwood City, Tri-Rep 415-364-2550
FL Casselberry, Perrott Assoc. 407-830-0094
FL Tampa, Perrott Assoc. 813-985-1900
IL Chicago, Technical Sls. 312-237-7210
IN Ft. Wayne, Menze Sls. 219-747-5616
MD Laurel, CSDS Inc. 301-792-9850
MA Chelmsford, BBC 508-937-3400
NC Winston-Salem, Murcota 919-722-9445
WA Bellevue, Caruso & Camelleri Assocs. 206-455-8811

MSI MICRO-MACHINING SYSTEMS INC., P. O. Box 242, Santa Clara, CA 95052, Tel: 408-727-0100, FAX: 408-496-0117; Empl.: 4; *Sls. Mgr.:* Frank J. Andezzone

M. SYSTEM TECHNOLOGY, INC., 15028 Beltway Dr., Dallas, TX 75244, Tel: 800-544-3181, FAX: 214-385-2299; Empl.: 10; *Sls. Mgr.:* Jeff Blair

MTE CORP., W147 N 9525 Held Dr., Menomonee Falls, WI 53051, Tel: 414-253-8200, TELEX: 62939600, ESYLNK: 414-253-8222; FSC No.: 5950; Empl.: 120; *Sls. Mgr.:* John Houdek; *Dist. Mgr.:* John Houdek

M-TEK, 2419 Smallman St., Pittsburgh, PA 15222, Tel: 800-245-5101 , 412-261-9030, FAX: 412-261-7220; FSC No.: 56452; Empl.: 20; *Sls. Mgr.:* John Hartnett

MTI INTERNATIONAL INC., W133 N5139 Campbell Dr., Menomonee Falls, WI 53051, Tel: 414-783-6080, FAX: 414-783-4959; Empl.: 210

M-TRON INDUSTRIES, P.O. Box 630, E. Hwy. 50, Yankton, SD 57078, Tel: 605-665-9321, TWX: 910-668-3603, FAX: 605-665-1709; FSC No.: 23875; Empl.: 200; *Sls. Mgr.:* Larry Barbary; *Dist. Mgr.:* Les Jensen ..... **A•1431**

Local Sales Offices & Reps
AZ Phoenix, Howe & Howe Sls., Inc. 602-264-7971
CA Mountain View, Bridge Mktg. 415-965-8045
CO Denver, Promotech Sls. 303-692-8484
CT Middletown, Gerber Sls. Corp. 203-347-3000
FL Altomonte Springs, Ram Elctrns. Sls. Inc. 407-260-0904
IL Arlington Hgts., KMA Sales 708-398-5300
IN Ft. Wayne, Arete Sls., Inc. 219-423-1478
IN Greenwood, Arete Sls., Inc. 317-882-4407
MA Burlington, Gerber Sls., Inc. 617-229-1150
MA Everett, Gerber Sls. 617-389-1957
MA Marlboro, Gerber Sls., Inc. 508-460-9588
MA Waltham, Gerber Sls. Corp. 617-893-1009
MA Woburn, Gerber Sls., Inc. 617-933-8797
MI Farmington Hills, Tritech Sales, Inc. 313-442-1200
MN Edina, OHMS Technology Inc. 612-932-2920
NH Hudson, Gerber Sls., Inc. 603-595-6568
NJ E. Brunswick, Winch Sales Associates 201-613-1515
NJ Medford, McCoy Grp. Inc. 609-953-0770
NJ Mountain Lakes, Ergodyne Corp. 201-263-4585
NY Pittsford, James E. Zimmerman Sales 716-381-3186
NY Plainview, Winch Sales Associates 516-681-3163
NC Raleigh, Tingen Tecn. Sls., Inc. 919-870-6670
OH Dayton, Lyons Corporation 513-278-0714
OH Richfield, Lyons Corporation 216-659-9224
OH Westerville, Lyons Corporation 614-895-1447
OR Portland, K-Tek Intl. Inc. 503-624-0315
TX Austin, Ram Electronics Sales, Inc. 512-250-5082
TX Houston, Ram Electronics Sales, Inc. 713-580-7394
TX Plano, Ram Electronic Sales, Inc. 214-578-5400
UT Midvale, Component Sales, Inc. 801-561-5099
WA Redmond, S.E.A. 206-883-4999
WA Vancouver, S.E.A. 503-643-3093
WI Milwaukee, KMA Sales 414-259-1771
Can Burnaby, BC., Kaytronics 604-294-2000
Can Concord, Ont., Kaytronics 416-669-2262
Can Kantata, Ont., Kaytronics 613-564-0080
Can Ville St. Laurent, Que., Kaytronics 514-745-5800
Can Vit Laurent, Que., Kaytronics 514-745-5800

Local Distributors
AZ Phoenix, Sterling Electronics 602-437-5565
CA Fremont, Acacia 510-623-7500
CA Los Angeles, Bell Industries 310-447-6340
CA Santa Clara, Kent, Shelly-Ragon Inc. 619-471-9561
CA Sunnyvale, Bell Industries 408-745-0400
CO Lakewood, Acacia 303-232-2882
FL Miami, All American 305-621-8282
GA Duluth, Pioneer Electronics 404-623-1003
IL Elk Grove Vl, Bell Industries 708-640-1910
IN Indianapolis, Pioneer Electronics 317-573-0880
MD Columbia, Sterling 301-251-1205
MA Andover, Bell Industries 508-474-8880
MN Eden Prairie, Pioneer 612-944-3355
MN Minneapolis, Stark Electronics 612-332-1325
MO St Louis, Ric-tronics 314-997-4707
NJ W. Berlin, GCI 609-768-6767
NY Ronkonoma, M-tron Components 516-467-5100
OH Dayton, Pioneer Electronics 513-236-9900
OR Lake Oswego, Bell Industries 503-644-1500
NM Betatron, Albuquerque 505-821-1122
TX Houston, Kent, Shelly-Ragon Inc. 713-780-7770
TX Houston, Sterling 713-627-9800
WA Redmond, Kent, Shelly-Ragon Inc. 206-883-7200
WA Redmond, Priebe Electronics 800-426-9911
Can Mississauga, Ont., Zentronics 416-564-9600

MTS SENSORS DIVISION, MTS Sys. Corp., P.O. Box 13218, Research Triangle Park, NC 27709, Tel: 919-677-0100, FAX: 919-677-0200

MTS SYSTEMS, 14000 Technology Dr., Eden Prairie, MN 55344, Tel: 612-937-4000, TELEX: 163548 MULAM DL, FAX: 612-937-4515; Empl.: 1300; *Sls. Mgr.:* Ted Beaudoin

MTX OAKTRON, 700-30th St., Monroe, WI 53566, Tel: 608-328-5560, FAX: 608-328-5575; FSC No.: 07109; Empl.: 120; *Sls. Mgr.:* J. F. Disch

MUELLER ELEC. CO., 1583 E. 31st St., Cleveland, OH 44114, Tel: 216-771-5225, FAX: 216-771-3068; Empl.: 100; *Sls. Mgr.:* J. E. Wisneski

MULTICOMP., INC., 3005 S.W. 154th No. 3, Beaverton, OR 97006, Tel: 503-626-4200, FAX: 503-643-4889; Empl.: 150 ..... **A•1255, 2434-2435**

Local Sales Offices & Reps
OR Portland, Intertech Sls. 503-775-7885

MC USA

FAX: 707-575-7573

MULTI-CONTACT USA, 5560 Skylane Blvd., Santa Rosa, CA 95403, Tel: 707-575-7575; *Sls. Mgr.:* Herbie Gander, West Coast Sls.; *Dist. Mgr.:* Walter Roberts, Genl. Mgr. ..... **C•1422-1424**

Local Sales Offices & Reps

IL Chicago, Multi-Contact 312-286-1666
MA Woburn, Multi-Contact 617-935-4104
TX Arlington, Multi-Contact 817-943-0031

MULTICORE SOLDERS, INC., 1751 Jay Ell Drive, Richardson, TX 75081, Tel: 214-238-1224, FAX: 214-437-0288; Empl.: 1000

MULTINATIONAL RESOURCES, INC., 19 Harvey Rd., Ste. 17, Bedford, NH 03110, Tel: 603-622-3550, FAX: 603-641-6991 ... **B•1044, 1853-1854; C•1584; D•1850**

MULTIPOWER, INC., Spectrum Electronics Corp., 3005 S.W. 154th Terrace No. 1, Beaverton, OR 97006, Tel: 503-646-4700, FAX: 503-643-4889; FSC No.: 75498; Empl.: 33 ..... **D•1847**

MULTI PRODUCTS INTERNATIONAL, 250 Lackawanna Ave., West Paterson, NJ 07424, Tel: 201-890-1344, FAX: 201-890-1677; Empl.: 28; *Sls. Mgr.:* Irv Wolberg ..... **A•2436; D•1848**

Local Sales Offices & Reps

AZ Phoenix, JBS Assocs. 602-893-2382
CA Santa Clara, Nova Tronix 408-727-9530
CO Denver, Comp. Prods. Sls. 303-530-2800
FL Melbourne, Phoenix Comps. 407-723-4414
GA Lawrenceville, Tek Rep Mktg. 404-963-1600
IL Des Plaines, Esco Assocs. 312-298-5310
IN Frankfort, C-S Elctms. Sls. 317-659-1874
KS Lenexa, Midtec Assocs. 913-541-0505
MD Sterling, Beacon North 703-478-2480
MA Harvard, Cycle Sls. 508-456-6868
MI Lathrup Vl., R. C. Nordstrom & Co. 313-559-7373
MN St. Paul, Proud Inds. 612-646-9428
NY Rochester, Ontec Elctms. 714-464-8636
OH Dayton, K.W. Elctm. 513-890-2150
PA Langhorne, Beacon North 703-478-2480
PA Pittsburgh, KW Elctms. 412-366-9396
TX Dallas, AID Elctms. 214-790-4761
WA Bellevue, Eltech 206-643-4330
Can Burlington, Ont., White Radio Ltd. 416-632-6894

MULTISENS INC, 2633 Blv. Le Corbusier, Laval, Que., Canada H7S 2E8, Tel: 514-973-8228, FAX: 514-973-1966; Empl.: 20; *Sls. Mgr.:* Jean-Francois Olivier; *Dist. Mgr.:* Alain Saint-Louis

MULTI-TECH INDUSTRIES, INC., 64 S. Main St., P.O. Box A, Marlboro, NJ 07746, Tel: 908-462-6100, TELEX: 908-409-6695; FSC No.: 74217; Empl.: 40; *Sls. Mgr.:* J. L. Bernard

MULTI-TECH SYSTEMS, INC., 2205 Woodale Dr., Mounds View, MN 55112, Tel: 612-785-3500, 800-328-9717, FAX: 612-785-9874; Empl.: 235; *Sls. Mgr.:* Thomas Heimerman; *Dist. Mgr.:* Peter Hanlon/Jan Hubbard/Jim Stacklie

MUPAC CORP., Carlo Gavazzi Co., 10 Mupac Dr., Brockton, MA 02401, Tel: 508-588-6110, FAX: 508-588-0498; FSC No.: 51398; Empl.: 180; *Sls. Mgr.:* Ted Brewster

muRata ERiE
MURATA ERIE NORTH AMERICA

FAX: 404-436-3030

MURATA ERIE NORTH AMERICA, INC., 2200 Lake Park Dr., Smyrna, GA 30080, Tel: 404-436-1300, TELEX: 26-1301; Empl.: 1250; *Sls. Mgr.:* Jack Driscoll; *Dist. Mgr.:* Barbara Buckalew, Dist. Mktg. Mgr.
..... **A•1117-1121, 1256-1257, 1432-1436, 1571, 1660-1663, 1708-1709, 1847, 1995, 2110-2112; B•1326, 1885, 1976-1977; C•1425; D•1053-1055**

Local Sales Offices & Reps

AL Huntsville, Jack Harvey & Assoc., Inc. 205-461-8591
AZ Scottsdale, Thom Luke Sls. 602-451-5400
CA Fountain Valley, Bager Elctms.;Inc. 714-957-3367
CA Long Beach, Murata Erie 310-436-8700
CA Los Altos, Recht Assocs. 415-964-6321
CA San Diego, CK Assocs. 619-279-0420
CA Woodland Hills, Bager Elctrns., Inc. 818-712-0011
CO Englewood, Thom Luke Sls. 303-649-9717
FL Deerfield Beach, Glen White Assocs. 305-570-8545
FL Palm Harbor, Glen White Assoc. 813-787-8503
FL Sanford, Glen White Assoc. 407-322-4875
GA Alpharetta, Jack Harvey & Assocs. 404-475-2654
GA Smyrna, Murata Erie 404-433-7867
IL Park Ridge, Metcom Assoc. Corp. 708-696-1490
IN Carmel, Jack Harvey & Assocs., Inc. 317-575-4600
IN Kokomo, Jack Harvey & Assoc., Inc. 317-453-4260
IA Cedar Rapids, Stan Clothier Co., Inc. 319-393-1576
KS Lenexa, Stan Clothier Co., Inc. 913-492-2124
KY Prospect, Jack Harvey & Assoc., Inc. 502-228-4100
MD Bowie, Glen White Assoc. 301-805-1989
MD Glen Arm, Glen White Assoc. 410-592-9105
MD Townson, Glen White Assoc. 301-337-7008
MA Braintree, Murata Erie 617-356-4155
MA Needham, Apex Assocs. 617-444-8070
MI Hudsonville, Jack Harvey & Assoc., Inc. 616-669-7980
MI W. Bloomfield, Jack Harvey & Assoc., Inc. 313-737-9122
MN Eden Prairie, Stan Clothier Co., Inc. 612-944-3456
MO St. Charles, Stan Clothier Co., Inc. 314-928-8078
NJ Springfield, Radix, Inc. 201-467-4970
NY Fairport, Technology Sls., Inc. 716-223-7500
NY Ithaca, Technlg. Sls., Inc. 607-257-7070
NY Pleasant Valley, Jack Harvey & Assoc., Inc. 914-635-2711
NC Huntersville, Glen White Assoc. 704-875-3777
NC Raleigh, Glen White Assoc. 919-848-1931
OH Dayton, KW Electrn. Sls., Inc. 513-890-2150
OH Shaker Hgts., KW Elctrn. Sls., Inc. 216-491-9177
OR Beaverton, Murata Erie 503-646-4973
OR Beaverton, Westmark Elec., Inc. 503-641-8780
PA Allison Park, KW Elctrn. Sls., Inc. 412-492-0777
TN Gray, Glen White Assoc. 615-477-8850
TN Knoxville, Jack Harvey & Assoc., Inc. 615-694-7541
TX Austin, RAM Elec. Sls., Inc. 512-250-5082
TX Houston, RAM Elec. Sls., Inc. 713-580-7394
TX Plano, RAM Elec. Sls., Inc. 214-578-5400
VA Lynchburg, Glen White Assocs. 804-385-6110
WA Bellevue, Westmark Elect., Inc. 206-454-1944
WI West Allis, Metcom Assoc. Corp. 414-476-1300
PR Hato Rey, Semtronic Assocs., Inc. 809-766-0700
Can Mississauga, Ont., Gidden Morton Assocs. 416-671-8111
Can Nepean, Ont., Gidden Morton Assocs. 613-820-3822
Can St. Laurent, Que., Gidden Morton Assocs. 514-335-9572

Local Distributors

AL Huntsville, Future Elctms. 205-830-2322
AL Huntsville, Time Elctms. 205-721-1133
AZ Phoenix, Future Elctms. 602-968-7140
AZ Phoenix, Sterling Elctms. 602-437-5565
AZ Phoenix, Time Elctms. 602-967-2000
AZ Phoenix, TTI, Inc. 602-861-0222
AZ Tempe, Acacia Sls./Deanco 602-894-2874, 602-882-9054
AZ Tempe, Time Elctms. 602-967-2000
AZ Tempe, TTI, Inc. 602-431-1191
CA Agoura Hills, Time Elctms. 818-707-2890
CA Camarillo, Milgray Elctms. 805-484-4055
CA Chatsworth, Future Elctms. 818-772-6240
CA Chatsworth, Sterling Elctms. 818-407-8850
CA Culver City, Avnet, Inc. 310-558-2973
CA Fremont, Acacia/Deanco 510-623-7500
CA Garden Grove, Natl. Elctms. Corp. 800-854-2451
CA Inglewood, Newark Elctms., Inc. 310-672-8548
CA Irvine, Acacia/Deanco .. 213-971-2428,714-660-0834
CA Irvine, Future Elctms. 714-250-4141
CA Irvine, Milgray Elctms. 714-753-1282
CA Milpitas, TTI, Inc. 408-946-5577
CA Mission Hills, TTI, Inc. 818-891-8885
CA San Diego, Acacia/Deanco 619-597-0577
CA San Diego, Future Elctms. 619-625-2800
CA San Diego, Sterling Elctms. 619-560-8097
CA San Diego, Time Elctms. 619-674-2800
CA San Diego, TTI, Inc. 619-748-2025
CA San Jose, Compass Comps. 408-432-7575
CA San Jose, Future Elctms. 408-434-1122, 408-434-1114
CA San Jose, Passive Technlg. 408-435-5566
CA San Jose, TTI, Inc. 408-946-5577
CA Santa Ana, TTI, Inc. 714-641-9393
CA Sunnyvale, Capsco Sls., Inc. 408-734-3020
CA Sunnyvale, Time Elctms. 408-734-9888
CA Tustin, Sterling Elctms. 714-259-0900
CA Tustin, Time Elctms. 714-669-0100
CA Woodland Hills, Time Elctms. 310-320-6372
CO Denver, Newark Elctms. 303-757-3351
CO Englewood, Sterling Elctms. 303-792-3939
CO Englewood, Time Elctms. 303-721-8882
CO Lakewood, Future Elctms. 303-232-2008
CO Westminister, TTI, Inc. 303-429-6806
CO Wheatridge, Acacia/Deanco 303-421-7004
CT Bethel, Future Elctms. 203-743-9594
CT Milford, Milgray Elctms. 203-878-5538
CT Wallingford, Sterling Elctms. 203-265-9535
CT Wallingford, TTI, Inc. 203-284-7474
DC D.C. Area, TTI, Inc. 301-621-5335
FL Altamonte Springs, Future Elctms. 800-950-0168
FL Lake Mary, Milgray Elctms. 407-321-2555
FL Largo, Future Elctms. 813-530-1222
FL Orlando, Time Elctms. 407-841-6565
FL Orlando, TTI, Inc. 407-859-1000
GA Athens, Dixie Elctms. 706-613-7755
GA Norcross, Future Elctms. 404-441-7676
GA Norcross, Milgray Elctms. 404-446-9777
GA Norcross, TTI, Inc. 404-662-0911
IL Chicago, Newark Elctms. 312-784-5100
IL Hoffman Estates, Future Elctms. 708-882-1255
IL Palatine, Milgray Elctms. 708-202-1900
IL Rosemont, Advent Elctms., Inc. 708-297-6200
IL Schaumburg, Sterling Elctms. 708-303-9900
IL Schaumburg, Time Elctms. 708-303-3000
IL Schaumburg, TTI, Inc. 708-884-6500
IN Time Elctms. 800-331-5114
IN Indianapolis, Advent Elctms., Inc. 317-872-4910
IA Time Elctms. 800-325-9085
IA Cedar Rapids, Advent Elctms., Inc. 319-363-0221
KS Time Elctms. 800-325-9085
KS Lenexa, Sterling Elctms. 913-492-5406
KS Overland Park, Milgray Elctms. 913-236-8800
KY Time Elctms. 800-331-5114
MD Baltimore, Resco(Baltimore) 410-931-8200
MD Beltsville, Resco(Washington) 301-937-9100
MD Columbia, Future Elctms. 301-290-0600
MD Columbia, Milgray Elctms. 410-995-6169
MD Columbia, Sterling Elctms. 301-290-3800
MD Columbia, Time Elctms. 301-964-3090
MD Columbia, TTI, Inc. 410-995-1331
MA Bolton, Future Elctms. 508-799-3000
MA Hopkinton, Interface Elctms. Corp. 508-435-0100
MA Peabody, Time Elctms. 508-532-9900
MA Wilmington, Milgray Elctms. 508-657-5900
MA Wilmington, TTI, Inc. 508-658-4700
MA Woburn, Sterling Elctms. 617-938-6200
MI Time Elctms. 800-331-5114
MI Farmington Hills, Advent Elctms., Inc. 313-477-1650
MI Livonia, Future Elctms. 313-261-5279
MI Oak Park, Newark Elctms. 313-967-1570
MN Eden Prairie, Future Elctms. 612-944-2200
MN Edina, Time Elctms. 612-943-2433
MN Minneapolis, Newark Elctms. 612-331-6350
MN Minneapolis, Sterling Elctms. 612-831-2666
MN Minnetonka, TTI, Inc. 612-933-8555
MO Manchester, Time Elctms. 314-230-7500
MO St. Louis, Future Elctms. 314-469-6805
NE Time Elctms. 800-325-9085
NJ Edison, Sterling Elctms. 201-417-1000
NJ Marlton, Future Elctms. 609-596-4080
NJ Marlton, Interface Elctms. 609-988-5448
NJ Marlton, Milgray Elctms. 609-983-5010
NJ Marlton, Time Elctms. 609-596-6700
NJ Mt. Laurel, TTI, Inc. 609-234-6400
NJ Parsippany, Future Elctms. 201-299-0400
NJ Parsippany, Milgray Elctms. 201-335-1766
NJ Rockaway, Tonar Inds. 201-586-9000
NM Albuquerque, Sterling Elctms. 505-884-1900
NY Farmingdale, Milgray Elctms. 516-420-9800
NY Hauppauge, Future Elctms. 516-234-4000
NY Hauppauge, Time Elctms. 516-273-0100
NY Pittsford, Milgray Elctms. 716-381-9700
NY Rochester, Future Elctms. 716-272-1120
NY Rochester, Time Elctms. 716-383-8853
NY Ronkonkoma, TTI, Inc. 516-737-2000
NY Syracuse, Future Elctms. 315-451-2371
NY Syracuse, Time Elctms. 315-432-0355
NC Charlotte, Dixie Elctms. 704-377-5413
NC Charlotte, Elctrn. Mktg. Corp. 704-394-6195
NC Concord, Future Elctms. 704-455-9030
NC Hickory, Dixie Elctms. 704-328-1130
NC Raleigh, Future Elctms. 919-790-7111
NC Raleigh, Milgray Elctms. 800-562-3118, 919-790-8094
NC Raleigh, Sterling Elctms. 819-790-8634
NC Raleigh, Time Elctms. 800-638-1812
NC Winston Salem, Dixie Elctms. 919-724-5961
OH Centerville, Elctrn. Mktg. Corp. 513-439-4711
OH Cleveland, Milgray Elctms. 216-447-1520
OH Cleveland, Newark Elctms. 216-391-9330
OH Cleveland, Newark Elctms. 216-886-6463
OH Columbus, Elctrn. Mktg. Corp. 614-299-4161
OH Columbus, Time Elctms. 614-794-3301
OH Columbus, Time Elctms. 800-331-5114
OH Dayton, TTI, Inc. 513-898-8330
OH Highland Hgts., Elctrn. Mktg. Corp. 216-442-3441
OH Independence, TTI, Inc. 216-328-9755
OH Mayfield Heights, Future Elctms. 216-449-6996
OH Solon, Sterling Elctms. 216-248-1122
OK Tulsa, Sterling Elctms. 918-663-2410
OR Beaverton, Acacia/Deanco 503-646-3377
OR Beaverton, Future Elctms. 503-645-9454
OR Portland, Time Elctms. 503-684-3780
OR Tualatin, Moore Elctms. 503-692-5333
PA Time Elctms. 215-337-0900

SC	Columbia, Dixie Elctrns.	803-779-5332
SC	Gaffney, Newark Elctrns.	803-487-1982
SC	Greenville, Dixie Elctrns.	803-297-1430
SC	N. Charleston, Dixie Elctrns.	803-552-2671
SD	Time Elctrns.	800-331-5114
TN	Gray, Dixie Elctrns.	615-477-2131
TN	Oak Ridge, Dixie Elctrns.	615-481-3393
TX	Austin, Sterling Elctrns.	512-836-1341
TX	Austin, Time Elctrns.	512-346-7346
TX	Carrollton, Sterling Elctrns.	214-243-1600
TX	Dallas, Milgray Elctrns.	214-248-1603
TX	Ft. Worth, TTI, Inc.	817-595-3100
TX	Ft. Worth, TTI, Inc.	817-740-9000
TX	Ft. Worth, TTI, Inc.	817-834-2202
TX	Ft. Worth, TTI, Inc. Intl.	817-740-9191
TX	Garland, Newark Elctrns.	214-494-5911
TX	Houston, Future Elctrns.	713-556-8696
TX	Houston, Newark Elctrns.	713-270-4800
TX	Houston, Sterling Elctrns.	713-627-9800
TX	Houston, Time Elctrns.	713-530-0800
TX	Richardson, Future Elctrns.	214-437-2437
TX	Richardson, Time Elctrns.	214-644-6668
TX	Stafford, Milgray Elctrns.	713-240-5360
UT	Murray, Milgray Elctrns.	801-261-2999
UT	Salt Lake City, Future Elctrns.	801-972-8489
UT	Salt Lake City, Sterling Elctrns.	801-972-5444
UT	W. Valley City, Time Elctrns.	801-973-8494
VA	Richmond, Sterling Elctrns.	804-323-5510
WA	Bothell, Future Elctrns.	206-489-3400
WA	Kirkland, Time Elctrns.	206-820-1525
WA	Redmond, Acacia/Deanco	206-881-5566
WA	Redmond, TTI, Inc.	206-882-0291
WI	Time Elctrns.	800-331-5114
WI	Mequon, Taylor Elec. Co., Inc.	414-241-4321
WI	Yaukesha, Future Elctrns.	414-786-1884
Can	Calgary, Alberta, Future Elctrns.	403-250-5555
Can	Edmonton, Alb., Future Elctrns.	403-438-2858
Can	Mississauga, Ont., Future Elctrns.	416-612-9200
Can	Mississauga, Ont., Migray Elctrns.	416-678-0958
Can	Mississauga, Ont., Time Elctrns.	416-601-4368
Can	Montreal, Que., Future Elctrns.	514-694-7710
Can	Ottawa, Ont., Future Elctrns.	613-820-8313
Can	Pointe Claire, Que., Tonar Inds.	514-694-5293
Can	Pointe-Claire, PQ, Milgray Elctrns.	514-426-5900
Can	Quebec, PQ, Future Elctrns.	418-877-6666
Can	Vancouver, BC, Future Elctrns.	604-294-1166
Can	Winnipeg, Man., Future Elctrns.	204-786-7711

MURATA MANUFACTURING CO., LTD., 26-10, Tenjin 2 Chome, Nagaoka-Kyo-Shi, Kyoto, Japan 617, Tel: 075-951-9111, TELEX: MURATA J 64270, FAX: 075-955-6526; Empl.: 21,696; *Sls. Mgr.:* O. Otaka

MUSASHINO Corporation

FAX: 714-458-1166

MUSASHINO CORPORATION, 22612 Albares, Mission Viejo, CA 92691, Tel: 714-458-1155 ..... **A•1437-1439; C•1649-1651**

THE MUSHIELD CO. INC., P.O. Box 439, 5 Springfield Rd., Goffstown, NH 03045, Tel: 603-666-4433, TELEX: 95-5439, FAX: 603-666-4013; FSC No.: 57284; Empl.: 8 ..... **C•1698**

MUTUAL INDUSTRIES, INC., 707 West Grange Street, Philadelphia, PA 19120, Tel: 215-927-6000, FAX: 215-927-3388

MWS Wire Industries

FAX: 818-706-0911

MWS WIRE INDUSTRIES, 31200 Cedar Valley Dr., Westlake Village, CA 91362, Tel: 818-991-8553; FSC No.: 51668; Empl.: 65; *Sls. Mgr.:* Greg Fancon ..... **C•1764-1767**

NAMCO CONTROLS CORPORATION, 7567 Tyler Blvd., Mentor, OH 44060, Tel: 216-946-9900, TELEX: 24-1566, FAX: 216-946-1228; Empl.: 200; *Sls. Mgr.:* Jon Slaybaugh, Pres.; *Dist. Mgr.:* Bill Carson, Bill O'Brien

NAMIKI, Precision of America, Inc., 201 West Passaic St., Rochelle Park, NJ 07662, Tel: 201-368-0123, FAX: 201-368-2244

NANONICS CORPORATION, 21636 N. 14th Ave., Phoenix, AZ 85027, Tel: 602-581-6188, FAX: 602-581-8242; Empl.: 15

NATEL

FAX: 805-584-4357

NATEL ENGINEERING CO., INC., 4550 Runway St., Simi Valley, CA 93063-3449, Tel: 805-581-3950, TWX: 910-494-1959; Empl.: 171; *Sls. Mgr.:* Tom Guerriere ..... **D•1196-1197**

Local Sales Offices & Reps

AL	Huntsville, Saber Assocs.	800-327-0853
CA	Newbury Park, Natel Engrg. Co., Inc.	805-376-5500
CA	Simi Valley, Natel Engrg. Co., Inc.	805-581-3950
CO	Grand Junction, Krebill Comp. Sls.	303-243-8220
FL	Melbourne, Saber Assocs.	800-432-6288
MA	Topsfield, Natel Engrg. Co., Inc.	508-887-7939
NY	Bohemia, Natel Engrg. Co., Inc.	516-563-4911
OH	Dayton, Rixan Assocs., Inc.	513-222-0011
OH	Stow, Rixan Assocs., Inc.	216-686-2909
TX	Houston, Lear Assocs.	713-488-7893
TX	Richardson, Lear Assocs.	214-231-5388
UT	Salt Lake City, Krebill Comp. Sls.	801-943-5311
WA	Mercer Island, Eagle Entprs., Inc.	206-232-7401

Local Distributors

FL	Orlando, Florida Electro Comps.	407-282-3454
MO	Florissant, Central Tech Sls.	314-831-4069
UT	Sandy, Krebill Comp. Sls.	801-943-5311
WA	Bellevue, Advanced Power Comps., Inc.	206-747-9217

NATIONAL CONTROLS CORP., 1725 Western Dr., W. Chicago, IL 60185, Tel: 708-231-5900, FAX: 708-231-1377; Empl.: 250; *Dist. Mgr.:* Cy Pfeifer

NATIONAL ELECTRONICS CORP., 11731 Markon Dr., Garden Grove, CA 92641, Tel: 714-892-7749, 800-854-2451, FAX: 714-898-6769; Empl.: 50

NATIONAL INFORMATION SYSTEMS, INC., 4040 Moorpark Ave., San Jose, CA 95117-1852, Tel: 408-985-7100, 800-441-5758, FAX: 408-246-3127; Empl.: 50

NATIONAL INSTRUMENTS, 6504 Bridge Point Pkwy., Austin, TX 78730-5039, Tel: 512-794-0100, TELEX: 756737 Nat Inst Aus, FAX: 512-794-8411; Empl.: 7000; *Sls. Mgr.:* Don Nadon, VP Sls. ..... **D•1147, 1198, 1302**

Local Sales Offices & Reps

CA	Manhattan Beach, Natl. Instrs.	310-546-8591
CA	Milpitas, Natl. Instrs.	408-453-3120
CA	Ontario, Natl. Instrs.	714-360-3565
CA	Riverside, Natl. Instrs.	714-275-0655
CO	Colorado Springs, Natl. Instrs.	719-542-3036
CT	Southington, Natl. Instrs.	203-276-8176
FL	Orlando, Natl. Instrs.	407-438-8700
GA	Kennesaw, Natl. Instrs.	404-499-0505
IL	Plainfield, Natl. Instrs.	815-436-7775
MD	Rockville, Natl. Instrs.	301-258-0125
MA	Norwell, Natl. Instrs.	617-659-9444
MA	Woburn, Natl. Instrs.	617-938-8508
MI	Brighton, Natl. Instrs.	313-227-9773
MN	Minneapolis, Natl. Instrs.	612-374-5488
NJ	Rutherford, Natl. Instrs.	201-460-7883
NY	Bayshore, Natl. Instrs.	516-666-0062
NY	Rochester, Natl. Instrs.	716-227-7530
OH	Mogadore, Natl. Instrs.	216-325-3156
TX	Austin, Natl. Instrs.	512-261-6338
TX	Richardson, Natl. Instrs.	214-699-7474
WA	Bellevue, Natl. Instrs.	206-451-9161
Can	Cambridge, Ont., Natl. Instrs.	519-622-9310
Can	Pointe-Claire, Que., Natl. Instrs.	514-694-8521

Local Distributors

Can	Mississauga, Ont., Allan Crawford Assocs.	416-890-2010
Can	N. Vancouver, BC, Allan Crawford Assocs.	604-988-2195
Can	Ottawa, Ont., Allan Crawford Assocs.	613-596-9300
Can	Pointe-Claire, PQ, Allan Crawford Assocs.	514-697-3333

NATIONAL LAMINATION CO., National Material Ltd., 555 Santa Rosa Dr., Des Plaines, IL 60018, Tel: 708-298-7676, FAX: 708-635-8624; Empl.: 225; *Sls. Mgr.:* J. Timothy Bross

NATIONAL MANUFACTURING CO., INC., 12 River Rd., Chatham, NJ 07928, Tel: 201-635-8846, FAX: 201-635-7810; Empl.: 150; *Sls. Mgr.:* Otto Stahl, Jr.

NATIONAL POWER TECHNLG., See Intelligence Power Technology

NATIONAL SEMICONDUCTOR, 2900 Semiconductor Dr., Santa Clara, CA 95052-8090, Tel: 800-272-9959, FAX: 800-432-9673; Empl.: 26,000

NATIONAL SEMICONDUCTORS, LTD., See Silonex Inc.

NATIONAL TELEPHONE & ELECTRONICS INC., 2350 N.W. 96 Avenue, Miami, FL 33172, Tel: 305-592-0551, FAX: 305-599-0948; Empl.: 50

FAX: 213-225-4630

NATIONAL WIRE & CABLE CORP., 136 San Fernando Rd., Los Angeles, CA 90031-1780, Tel: 213-225-5611; FSC No.: 04569; Empl.: 225 ..... **C•1768-1790**

Local Sales Offices & Reps

AZ	Mesa, System Sls.	602-464-9989
AR	Mt. Home, P.M.I. Sls. Co.	501-425-4101
CA	San Diego, C.K. Sales	619-279-0420
CA	Santa Clara, Ross Mktg.	408-988-8111
CO	Arvada, Arrowhead Sls. Co.	303-423-5597
CT	Avon, Tom Maguire Assoc.	203-673-3019
GA	Lawrenceville, Tek-Rep Mktg.	404-963-1600
IL	Northfield, H. S. Tollaksen	708-441-6644
MD	Glen Burnie, Faion Lott	410-744-4611
MA	Norwood, Tom Maguire Assocs., Inc.	617-551-0500
MI	Brighton, W.R. Hummon & Assocs.	313-486-5333
NH	Windham, Tom Maguire Assocs.	603-437-1245
NJ	Wayne, GT Assoc.	201-694-6040
NM	Albuquerque, Sys. Sls. of New Mexico	505-889-2901
NY	Sodus, S.T. Woolard	315-655-8145
OH	Cincinnati, Century Tech. Sls., Inc.	513-677-1788
OH	Cleveland, Century Tech. Sls., Inc.	216-871-2854
PA	Hatboro, Jacobsen Assocs.	215-674-2937
TX	Austin, Tesco, Inc.	512-834-8374
TX	Dallas, Tesco, Inc.	214-553-1200
TX	Houston, Tesco, Inc.	713-690-4909
UT	Odgen, Summit Mktg.	801-479-7151
WA	Redmond, Halbar Assocs.	206-882-0990

NATIONWIDE ELECTRONIC SYSTEMS, See Weschler Instruments, Hughes Corp.

NAVAN CORPORATION, P.O. Box 1329, Media, PA 19063, Tel: 215-352-8464; FSC No.: 7042; Empl.: 6; *Sls. Mgr.:* Howland St. Clair

NCE:NATIONAL CUSTOM ENTERPRISES, INC., 400 Gateway Blvd., Burnsville, MN 55337-2559, Tel: 612-890-1360, FAX: 612-890-1014; FSC No.: 25441; Empl.: 25; *Sls. Mgr.:* J. A. Carlson

NCGI/STRUTHERS-DUNN, INC., INDUSTRIAL/COMMERCIAL RELAYS, See MSD, Div. of Magnecraft

NCI, 6438 University Drive, Huntsville, AL 35806, Tel: 205-837-6667, FAX: 205-837-5221; Empl.: 8; *Sls. Mgr.:* Hal Newcomb; *Dist. Mgr.:* David Newcomb

NCR COMTEN, INC., NCR Corp., 2700 Snelling Avenue N., St. Paul, MN 55113, Tel: 612-638-7777, TELEX: 6879018 Comten, FAX: 612-638-8573; FSC No.: 7025-0010; Empl.: 1000; *Sls. Mgr.:* Gerry Fisher; *Dist. Mgr.:* Gerry Fisher

NCR CORPORATION, Microelectronics Products Division, 2001 Danfield Court, Fort Collins, CO 80525, Tel: 303-226-9500, FAX: 303-226-9556

NDK

FAX: 415-623-6590

NDK AMERICA, INC., 47671 Westinghouse Dr., Fremont, CA 94539, Tel: 415-623-6500; Empl.: 28; *Sls. Mgr.:* Mike Kurihara, VP ..... **A•1440-1441**

Local Sales Offices & Reps

AL Huntsville, Elctrn. Mktg. Assoc. 205-880-8050
AZ Scottsdale, Carefree 602-951-9121
CA Irvine, Quad-Rep South, Inc. 714-727-4222
CA Orangevalle, I Square, Inc. 916-989-0843
CA San Diego, Quad-Rep. 619-560-8330
CA Santa Clara, I Square, Inc. 408-988-3400
CO Englewood, CSI 303-779-8060
CT Woodbury, Anacon 203-266-0707
GA Atlanta, Elctrn. Mktg. Assoc. 404-448-1215
ID Boise, Intermountain Tech. 208-888-6071
IL Chicago, M. Gottlieb & Assocs. 312-775-1151
IN Carmel, Fred A. Dorsey & Assocs. 317-844-4842
IA Davenport, Rush & West Assocs. 319-388-9494
KS Olathe, Rush & West Assocs. 913-764-2700
MD Annapolis, E.E.S Assoc. 301-269-4234
MA Burlington, Anacon Sls. Assocs., Inc. .. 617-272-9080
MI Grand Rapids, Miltimore Sls. 616-942-9721
MI Novi, Miltimore Sls. 313-349-0260
MO St. Louis, Rush & West Assocs. 314-965-3322
MT Boise, Inter-Mtn. Tech. 208-888-6071
NE Davenport, Rush & West 319-388-9494
NV Santa Clara, I Squared 408-988-3400
NY Syracuse, Rep Tech., Inc. 315-437-2845
NJ Fairfield, Tech. Applications & Mktg. ... 201-575-4130
NY Fairfield, TAM 201-575-4130
NC Raleigh, Elctrn. Mktg. Assoc. 919-847-8800
OH Cincinnati, Makin Assocs. 513-871-2424
OH Columbus, Makin Assocs. 614-848-5424
OH Solon, Makin Assocs. 216-248-7370
OR Tigard, Comps. West 503-684-1671
PA Solon, Makin Assocs. 216-248-7370
SC Greenville, Elctrn. Mktg. Assoc. 803-233-4637
TX Dallas, T.L. Mktg. 214-490-9300
UT Boise, Inter-Mtn Tech. 208-888-6071
VT Wilmington, Anacon 617-270-3712
WA Redmond, Comps. West 206-885-5880
WI Chicago, M. Gottlieb Assocs. 312-775-1151

Local Distributors

AL Huntsville, Time Elctrns. 214-721-1134
AZ Tempe, Time Elctrns. 602-967-2000
CA Chatsworth, Time Elctrns. 818-988-7200
CA Orange, Capstone Elctrns. 714-730-0349
CA San Diego, Time Elctrns. 619-986-0129
CA San Jose, Capstone Elctrns. 408-453-9804
CA Sunnyvale, Time Elctrns. 408-734-9888
CA Torrance, Time Elctrns. 213-320-0880
CO Aurora, Capstone Elctrns. 303-375-1300
CO Englewood, Time Elctrns. 303-721-8882
FL Ft. Lauderdale, Time Elctrns. 305-484-7778
GA Norcross, Time Elctrns. 404-448-4488
IL Chicago, Capstone Elctrns. 708-250-0300
MD Columbia, Time Elctrns. 301-964-3090
MA Boston, Capstone Elctrns. 508-657-5874
MA Peabody, Time Elctrns. 508-532-9900
MN Edina, Time Elctrns. 612-943-2433
MO St. Louis, Time Elctrns. 314-391-6444
NJ Marlton, Capstone Elctrns. 609-596-7500
NJ Marlton, Time Elctrns. 609-996-6700
NM Los Alamos, Capstone Elctrns. 505-662-0745
NY E. Syracuse, Time Elctrns. 315-432-0355
NY Hauppauge, Time Elctrns. 516-434-3344
NC Raleigh, Capstone Elctrns. 919-954-0600
OH Columbus, Time Elctrns. 614-794-3309
OR Portland, Time Elctrns. 503-684-3782
TX Austin, Time Elctrns. 512-346-7346
TX Dallas, Capstone Elctrns. 214-380-9049
UT West Valley City, Time Elctrns. 801-973-8494
WA Kirkland, Time Elctrns. 206-820-1525
Can Ontario, Capstone Elctrns. 416-670-2010
Can Ontario, Time Elctrns. 416-672-5300

NEARFIELD SYSTEMS, INC., 1330 E. 223rd St. 524, Carson, CA 90745, Tel: 310-518-4277, FAX: 310-518-4279; Empl.: 6

NEC

FAX: 1-800-729-9288

NEC ELECTRONICS, INC., 475 Ellis Street, Mountain View, CA 94039-7241, Tel: 1-800-366-9782, TWX: 910-379-6985; Empl.: 1650; *Sls. Mgr.:* Mike Despotes, Sls. V.P.; *Dist. Mgr.:* Richard Calogero ..... **A•1122-1129; B•1088-1090, 1327-1335, 1566-1570**

Local Sales Offices & Reps

AL Huntsville, 20th Century Mktg. 205-772-9999, FAX:205-464-0895
AZ Phoenix, Oasis Sls., Inc. 602-277-2714, FAX:602-263-9352
CA Encino, NEC Elctrns., Inc. 818-342-3112, FAX:818-342-0842
CA San Diego, Mission Technlg. 619-674-6191, FAX:619-674-6196
CA San Jose, Exis 408-456-1650,FAX:408-433-0450
CA Santa Ana, NEC Elctrns. 714-546-0501, FAX:714-432-8793
CA Santa Clara, NEC Elctrns. 408-986-1020, FAX:408-988-4165
CO Aurora, NEC Elctrns. 303-755-6353, FAX:303-755-6728
CO Englewood, Compass Mktg. & Sls., Inc. of Colo. 303-721-9663,FAX:303-721-0195
CT Cheshire, Datatrack Engrg., Inc. 203-271-1311, FAX:203-272-7672
FL Altamonte Springs, V.G. Sls., Inc. 407-831-8688, FAX:407-830-0627
FL Cooper City, NEC Elctrns., Inc. 305-436-8114, FAX:305-436-8116
FL Ft. Lauderdale, V.G. Sls. Inc. 305-938-4333, FAX:305-938-4331
FL Largo, V.G. Sls. Co., Inc. 813-536-7787, FAX:813-530-9126
FL Maitland, NEC Elctrns. 407-875-1145, FAX:407-875-0962
GA Norcross, NEC Elctrns. 404-447-4409, FAX:404-447-8228
GA Norcross, 20th Century Mktg. Inc. 404-446-1999, FAX:404-662-8128
IL Arlington Hgts., NEC Elctrns. 708-577-9090, FAX:708-577-2147
IL Schaumburg, Martan Inc. 708-303-5660, FAX:708-303-5745
IN Carmel, Technlg. Mktg. Corp. 317-844-8462, FAX:317-573-5472
IN Ft. Wayne, Technlg. Mktg. Corp. 219-432-5553, FAX:219-432-5555
IN Kokomo, Technlg. Mktg. Corp. 317-459-5152, FAX:317-457-3822
IA Cedar Rapids, Stan Clothier Co. 319-393-1576, FAX:319-393-7317
KS Overland Pk., AME Sls. 913-492-3971, FAX:913-492-4002
KY Louisville, Technlg. Mktg. Corp. 502-245-7411, FAX:502-245-4818
MD Glen Burnie, TRI-MARK Inc. 301-761-6000, FAX:301-761-6006
MA Natick, NEC Elctrns. 508-650-4100, FAX:508-655-1605
MA Woburn, Compass Technlg. 617-933-3336, FAX:617-932-3354
MI Dearborn, NEC Elctrns., Inc. 313-336-5225, FAX:313-336-7922
MI Kentwood, Miltimore Sls. 616-554-9292, FAX:616-554-9210
MI Novi, Miltimore Sls. 313-349-0260, FAX:313-349-0756
MI Troy, NEC Elctrns. 313-680-0506, FAX:313-680-1015
MN Eden Prairie, Stan Clothier Co. 612-944-3456, FAX:612-944-6904
MN Minneapolis, NEC Elctrns. 612-844-0209, FAX:612-844-0509
MO St. Charles, AME Sls. 314-928-2599, FAX:314-447-8797
NJ Fairfield, Metro Logic Corp. 201-575-5585, FAX:201-575-8023
NJ Moorestown, TAI Corp. 609-778-5353, FAX:609-778-7828
NY Fairport, NEC Elctrns. 716-425-4590, FAX:716-425-4594
NY Fishkill, NEC Elctrns. 914-897-2101, FAX:914-897-2215
NY Pittsford, Elcom Sls. 716-385-1400, FAX:716-248-8531
NY Skaneateles, Elcom Sls. 315-685-8245, FAX:315-685-6273
NC Cary, NEC Elctrns. 919-460-1890, FAX:919-469-5926
NC Charlotte, Quantum Mktg. Inc. 704-523-8822, FAX:704-527-3222
NC Raleigh, Quantum Mktg. Inc. 919-846-5728, FAX:919-847-8271
OH Centerville, TMC of Ohio 513-898-8867, FAX:513-271-6321
OH Cincinnati, TMC of Ohio 513-271-3860, FAX:513-271-6321
OH Columbus, NEC Elctrns. 614-436-1778, FAX:614-436-1769
OH Middleburg Hgts., TMC of Ohio 216-885-5544, FAX:216-885-5011
OH Pepper Pike, NEC Elctrns. 216-831-0067, FAX:216-831-0758
OR Portland, Venture Elctrns. 503-624-0617, FAX:503-620-4682
OR Tigard, NEC Elctrns. 503-671-0177, FAX:503-643-5911
PA Allentown, NEC Elctrns. 215-391-9094, FAX:215-391-9107
PA Trevose, NEC Elctrns., Inc. 215-244-8196, FAX:215-244-9071
TN Erwin, 20th Century Mktg. 615-531-6854, FAX:615-539-0676
TX Austin, TL Mktg., Inc. 512-837-7272, FAX:512-837-6886
TX Dallas, NEC Elctrns. 214-931-0641, FAX:214-931-1182
TX Dallas, TL Mktg., Inc. 214-490-9300, FAX:214-960-6075
TX Houston, NEC Elctrns. 713-320-0524, FAX:713-320-0574
TX Houston, TL Mktg., Inc. 713-587-8100, FAX:713-580-7517
UT Salt Lake City, Compass Mktg. & Sls., Inc. 801-355-9663,FAX:801-264-6607
WA Bellevue, Venture Elctrns. 206-454-4594, FAX:206-454-9003
WI Mequon, Martan Inc. 414-241-4955, FAX:414-241-8365
PR Mayaguez, V. G. Sls. Co., Inc. 809-831-4150, FAX:809-831-4050
Can Burnaby, BC, Kaytronics Western 604-294-2000, FAX:604-294-4585
Can Calgary, B.C., Kaytronics 403-275-7000, FAX:403-295-0732
Can Kanata, Ont., Kaytronics 613-592-6606, FAX:613-592-0373
Can Mississauga, Ont., Kaytronics 416-507-6400, FAX:416-507-6444
Can Ville St.-Laurent, Que., Kaytronics 514-745-5800, FAX:514-745-5858

Local Distributors

AL Huntsville, Marshall Inds. 205-881-9235, FAX:205-881-1490
AL Huntsville, Reptron Elctrns. 205-722-9500, FAX:205-722-9565
AZ Phoenix, Marshall Inds. 602-496-0290, FAX:602-893-9029
AZ Phoenix, Sterling Elctrns. 602-437-5565, FAX:602-437-5588
AZ Tempe, Insight Elctrns. 602-829-1800, FAX:602-967-2658
CA Agoura Hills, Western Microtechnology 818-707-0731,FAX:818-706-7651
CA Calabasas, Marshall Inds. 818-878-7000, FAX:818-880-6846
CA Camarillo, Milgray Elctrns. 805-484-4055, FAX:805-388-8169
CA Chatsworth, Sterling Elctrns. 818-407-8850, FAX:818-407-1837
CA Costa Mesa, Eric Elctrns. 714-751-1185, FAX:714-432-7365
CA El Monte, Marshall Inds. Corp. 818-307-6000, FAX:818-307-6297
CA Fountain Valley, Bell Microproducts 714-963-0667, FAX:714-968-3195
CA Irvine, Insight Elctrns. 714-727-3291, FAX:714-727-1804
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CA Irvine, Milgray Elctrns. 714-753-1282, FAX:714-753-1682
CA Milpitas, Bell Micro Corp. 408-434-1150
CA Milpitas, Marshall INds. 408-942-4600, FAX:408-262-1224
CA Orange, Western Microtechnology 714-637-0200, FAX:714-998-1883
CA Rancho Cordova, Marshall Inds. 916-635-9700, FAX:916-635-6044
CA San Diego, Insight Elctrns. Corp. 619-587-9757, FAX:619-587-1380
CA San Diego, Marshall Inds. 619-578-9600, FAX:619-586-0469
CA San Diego, Western Microtechnology 619-453-8430,FAX:619-453-1465
CA San Jose, Bell Microproducts 408-451-9400, FAX:408-451-1600
CA San Jose, Eric Elctrns. Corp. 408-432-1111, FAX:408-434-0309
CA San Jose, Merit Elctrns., Corp. 408-434-0800, FAX:408-434-0935
CA San Jose, Milgray Elctrns. 408-456-0900, FAX:408-456-0300
CA San Jose, Sterling Elctrns. 408-435-0835, FAX:408-428-0108
CA Saratoga, Western Micotechnlg. Corp. 408-725-1660,FAX:408-255-6491
CA Sunnyvale, Insight Elctrns. 408-720-9222, FAX:408-720-8390
CA Tustin, Sterling Elctrns. 714-259-0900, FAX:714-259-0946
CA Westgate Vlg., Bell Microproducts 805-496-2606, FAX:805-496-6119
CA Westlake, Insight Elctrns. 818-707-2101, FAX:818-707-0321

CO Englewood, Sterling Elctrns. 303-792-3939, FAX:303-792-3433
CO Thornton, Marshall Inds. 303-451-8383, FAX:303-457-2899
CT Milford, Milgray Elctrns. 203-878-5538, FAX:203-878-6970
CT Wallingford, Marshall Inds. 203-265-3822, FAX:203-284-9285
CT Wallingford, Sterling Elctrns. 203-265-9535, FAX:203-269-9742
FL Altamonte Springs, Marshall Inds. 407-767-8585, FAX:407-767-8676
FL Ft. Lauderdale, Marshall Inds. 305-977-4880, FAX:305-977-4887
FL Ft. Lauderdale, Reptron Elctrns. 305-735-1112, FAX:305-735-1121
FL Lake Mary, Milgray Elctrns. 407-321-2555, FAX:407-322-4225
FL St. Petersburg, Marshall Inds. 813-573-1399, FAX:813-573-0069
FL Tampa, Reptron Elctrns. Corp. 813-854-2351, FAX:813-855-0942
GA Norcross, Marshall Inds. 404-923-5750, FAX:404-923-2743
GA Norcross, Milgray Elctrns. 404-446-9777, FAX:404-446-1186
GA Norcross, Reptron Elctrns. 404-446-1300, FAX:404-446-2991
IL Palatine, Milgray Elctrns. 708-202-1900, FAX:708-202-1985
IL Schaumburg, Marshall Inds. 708-490-0155, FAX:708-490-0569
IL Schaumburg, Reptron Elctrns. 708-882-1700, FAX:708-882-8904
IL Schaumburg, Sterling Elctrns. 708-303-9900, FAX:708-303-9933
IN Indianapolis, Marshall Inds. 317-297-0483, FAX:317-297-2787
KS Lenexa, Marshall Inds. 913-492-3121, FAX:913-492-6205
KS Lenexa, Sterling Elctrns. 913-492-5406, FAX:913-492-6681
KS Overland Park, Milgray Elctrns. 913-236-8800, FAX:913-384-6825
MD Columbia, Milgray Elctrns. 301-995-6169, FAX:301-381-3066
MD Columbia, Sterling Elctrns. 301-290-3800, FAX:301-290-3876
MD Columbia, Vantage Comps. 301-720-5100, FAX:301-381-2172
MD Silver Springs, Marshall Inds. 301-622-1118, FAX:301-622-0451
MA Burlington, Western Microtechnology 617-273-2800,FAX:617-229-2815
MA Hopkinton, Interface Elctrns. Corp. 508-435-0100, FAX:508-435-6516
MA Wilmington, Bell Microproducts 508-658-0222, FAX:508-694-9987
MA Wilmington, Marshall Inds. 508-658-0810, FAX:508-657-5931
MA Wilmington, Milgray Elctrns. 508-657-5900, FAX:508-658-7989
MA Woburn, Sterling Elctrns. 617-938-6200, FAX:617-933-5468
MI Livonia, Marshall Inds. 313-525-5850, FAX:313-525-5855
MI Livonia, Reptron Elctrns. 313-525-2700, FAX:313-525-3209
MN Minneapolis, Sterling Elctrns. 612-831-2666, FAX:612-831-3043
MN Minnetonka, Reptron Elctrns. 612-938-0000, FAX:612-938-3995
MN Plymouth, Marshall Inds. 612-559-2211, FAX:612-559-8321
MO Bridgeton, Marshall Inds. 314-291-4650, FAX:314-291-5391
NJ Clifton, Vantage Comps. Corp. 201-777-4100, FAX:201-777-6194
NJ Edison, Sterling Elctrns. 908-417-1000, FAX:908-417-1017
NJ Fairfield, Marshall Inds. 201-882-0320, FAX:201-882-0095
NJ Marlton, Interface Elctrns. 609-988-5448, FAX:609-988-5566
NJ Marlton, Milgray Elctrns. 609-983-5010, FAX:609-985-1607
NJ Marlton, Western Microtechnology 609-596-7775, FAX:609-985-2797
NJ Mt. Laurel, Marshall Inds. 609-234-9100, FAX:609-778-1819
NJ Parsippany, Milgray Elctrns. 201-335-1766, FAX:201-335-2110
NM Albuquerque, Sterling Elctrns. 505-884-1900, FAX:505-884-1904
NY Bohemia, Edge Elctrns. Corp. 516-567-6300, FAX:516-567-0611
NY Endicott, Marshall Inds. 800-678-0010, FAX:607-785-5546
NY Farmingdale, Milgray Elctrns. 516-420-9800, FAX:516-752-9870
NY Pittsford, Milgray Elctrns. 716-381-9700, FAX:716-381-9495
NY Rochester, Marshall Inds. 716-235-7620, FAX:716-235-0052
NY Smithtown, Vantage Comps. 516-543-2000, FAX:516-543-2030
NC Raleigh, Marshall Inds. 919-878-9882, FAX:919-872-2431
NC Raleigh, Milgray Elctrns. 919-790-8094, FAX:919-872-8851
NC Raleigh, Reptron Elctrns. 919-870-5189, FAX:919-870-5210
OH Columbus, EMC (Elctrn. Mktg.) Corp. 614-299-4161, FAX:614-299-4121
OH Dayton, Marshall Inds. 513-898-4480, FAX:513-898-9363
OH Highland Heights, Electronic Mktg. 216-442-3441, FAX:216-442-8122
OH Independence, Milgray Elctrns. 216-447-1520, FAX:216-447-1761
OH Solon, Marshall Inds. 216-248-1788, FAX:216-248-2312
OH Solon, Reptron Elctrns. 216-349-1415, FAX:216-349-1634
OH Solon, Sterling Elctrns. 216-248-1122, FAX:216-248-0554
OH West Chester, Sterling Elctrns. 513-779-0418, FAX:513-779-0418
OK Tulsa, Sterling Elctrns. 918-663-2410, FAX:918-663-6212
OR Beaverton, Insight Elctrns. 503-644-3300, FAX:503-641-4530
OR Beaverton, Marshall Inds. 503-644-5050, FAX:503-646-8256
OR Beaverton, Western Microtechnology 503-629-2082,FAX:503-629-8645
PA Pittsburgh, Marshall Inds. 412-788-0441, FAX:412-788-0447
TX Austin, Marshall Inds. 512-837-1991, FAX:512-832-9810
TX Austin, Sterling Elctrns. 512-836-1341, FAX:512-836-3279
TX Carrollton, Sterling Elctrns. 214-243-1600, FAX:214-243-4091
TX Dallas, Milgray Elctrns. 214-248-1603, FAX:214-248-0218
TX Houston, Marshall Inds. 713-467-1666, FAX:713-467-9805
TX Houston, Sterling Elctrns. Corp. 713-627-9800, FAX:713-629-3939
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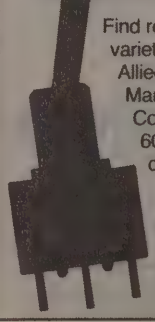

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NM	Albuquerque, C.T. Carlberg & Assocs., Inc.	505-899-2155
NY	Fairport, LamTec Sls. Corp.	716-377-1210
NY	Hauppauge, Aurora Mktg., Inc.	516-434-1313
NY	Manlius, LamTec Sls. Corp.	315-682-4780
NC	Wendell, Mtn. Electro Mktg.	919-365-5674
OH	Beachwood, Elctm. Salesmasters, Inc.	216-831-9555
TX	Hurst, Pro-Comp Sls. Co.	817-589-0336
TX	Richardson, Pro-Comp Sls. Co.	214-669-1500
Can	Pickering, Ont., A. C. Simmonds & Sons	416-839-8041

Local Distributors

NJ	Lawrenceville, DVS Co.	609-896-1112
OR	Beaverton, Jas. J. Backer	503-627-0775
WA	Seattle, Jas. J. Backer	206-285-1300

NORTH AMERICAN PHILIPS CONTROLS CORP., See Airpax Corporation, Cheshire Div.

NAC

FAX: 516-567-1823

NORTH ATLANTIC INSTRUMENTS, INC., 170 Wilbur Place, Bohemia, NY 11716-2416, Tel: 516-567-1100; FSC No.: 0VGU1; Empl.: 30; *Sls. Mgr.:* William Cullum ..... **D•1312**

Local Sales Offices & Reps

AL	Huntsville, Teqspec, Inc.	205-883-6699
AZ	Mesa, SDW Moutain States	602-839-6626
CA	Los Alamitos, Tritek-SDW Inc.	714-236-1190
CA	San Diego, Tritek-SDW, Inc.	619-455-1911
CA	Santa Clara, Tritek-SDW, Inc.	408-554-0455
CO	Louisville, SDW Mountain States	303-665-8089
FL	Cape Canaveral, TeqSpec	407-783-3444
FL	Palm Harbor, Teqspec	813-942-6006
GA	Snellville, Teqspec	404-972-7955
IL	Chicago, Pat Lind Elctrns.	312-726-3513
IN	Indianapolis, Pat Lind Elctrns.	317-632-7444
KS	Lenexa, Midtec Assocs., Inc.	913-541-0505
MI	Madison Heights, WKM Assoc.	313-588-2300
MI	Troy, WKM Assocs., Inc.	313-588-2300
MN	Circle Pines, Pat Lind Elctrns.	612-786-5770
MO	St. Louis, Midtec Assocs., Inc.	314-275-8666
NH	Nashua, Intersell	603-880-6500
NM	Albuquerque, SDW Mountain States	505-883-3668
NC	Winston-Salem, Teqspec III	919-765-5553
OH	Dayton, WKM Assoc.	513-434-7500
OH	Independence, WKM Assocs., Inc.	216-524-5930
OR	Wilsonville, Syntek	503-682-2750
PA	Pittsburgh, WKM Assocs., Inc.	412-892-2953
PA	Southampton, Eastern Instrmn. of PA	215-355-3469
TX	Austin, Testech, Inc.	512-338-9246
TX	Euless, Testech, Inc.	817-540-1944
TX	Houston, Testech, Inc.	713-893-9661
TX	Richardson, Testech, Inc.	214-644-5010
VA	Fairfax, Scientific Assocs., Inc.	703-385-0600
WA	Bellevue, Syntek, Inc.	206-462-7700
WI	Milwaukee, Pat Lind Elctrns.	414-224-0146

NORTHEAST INNOVATIONS, INC., PO Box 1214, Concord, NH 03302, Tel: 603-736-8260, FAX: 603-736-4506; Empl.: 15; *Sls. Mgr.:* Robert Shipione

NORTHERN AMPOWER CORP., 47087 Grand River, Novi, MI 48374, Tel: 313-349-4860, FAX: 313-349-5692; Empl.: 30; *Sls. Mgr.:* Ronald Kirsch

NORTHERN MAGNETICS INC., 16124 Wyandotte, Van Nuys, CA 91406, Tel: 818-997-8675, FAX: 818-997-3935; Empl.: 12

NORTHERN PRECISION LABS., 11 Madison Rd., Fairfield, NJ 07006, Tel: 201-227-4800, FAX: 201-575-5973; Empl.: 95; *Sls. Mgr.:* P. Pytal

NORTHERN TECHNOLOGIES INC., 35 Rivera Dr., Unit No. 5, Markham, Ont., CAN L3R 8N4, Tel: 416-475-9320, 1-800-456-1875, FAX: 416-475-5719; Empl.: 95; *Sls. Mgr.:* Mark A. Finlay

North Hills
A Porta Systems Company

FAX: 516-682-7704

NORTH HILLS SIGNAL PROCESSING, 575 Underhill Blvd., Syosset, NY 11791, Tel: 516-682-7740; FSC No.: 98821; Empl.: 40; *Sls. Mgr.:* Steve Muth ..... **A•2438-2441**

Local Sales Offices & Reps

AZ	Phoenix, Mercury Eng. Sls.	602-265-0344
CA	Campbell, Sedillo Co., Inc.	408-374-5222
CA	North Palo Alto, Tri-Rep	415-965-1822
CA	Palo Alto, Tri Rep	415-965-1822
CA	South El Toro, Par Mktg.	714-768-6021
CO	Littleton, Mercier & Assoc.	303-770-0666
CT	Wethersfield, Underwood Sls. Corp.	203-563-3046
FL	Clearwater, Brennan Assocs.	813-446-5006
IL	Wheaton, Vine Tech. Sls.	913-642-7220
IA	Cedar Rapids, Tech Alliance	319-373-0686
MD	Baltimore, Stemler Assocs. Inc.	410-944-8080
MD	Laurel, CSDS	301-953-7884
MA	Lowell, Underwood Sls. Corp.	617-256-8191
MI	Farmington Hills, Rathsburg Assoc. Inc.	313-489-1500
MN	Eden Prairie, COM-TEK Sls.	612-941-7181
MN	Minneapolis, Hei-Lite Sls.	612-861-6051
MO	St. Louis, Alpha Tech. Sls.	314-537-2647
MO	St. Louis, Thunderbird Tech. Sls.	314-298-8984
NJ	Kenville, CFE Gray	201-927-6662
NY	Whitney Point, T.A.E. Reps	607-692-3705
PA	Philadelphia, Paragon Sls.	215-778-6328
TX	Argyle, Milestek, Inc.	817-455-7444
TX	Boerne, Max Lipscomb & Assoc.	512-981-8708
TX	Dallas, C.J. Tellier	214-231-6348
TX	Houston, Ocean Electric	713-441-1481
WI	Genoa City, Vine Tech. Sls.	414-279-3871
Can	Montreal, Componetics Ltd.	514-331-9930

Local Distributors

MD	Laurel, Rayma	1-800-447-2962
TX	Argyle, Miles Tek, Inc.	817-455-7444

NORTH IOWA ELECTRONICS, INC., Winnebago Industries, Inc., 325 N. State St., Garner, IA 50438, Tel: 515-923-3751, FAX: 515-923-2325; Empl.: 90

NORTHLAKE ENGINEERING, INC., 8320 193 Rd., Bristol, WI 53104-0370, Tel: 414-857-9600, FAX: 414-857-6819; FSC No.: 50638; Empl.: 120; *Sls. Mgr.:* W. A. Hardt

NORTH TEXAS CIRCUIT BOARD, 1501 W. Shady Grove Rd., Grand Prairie, TX 75050, Tel: 214-790-7610, FAX: 214-986-2381; FSC No.: 5S424; Empl.: 70; *Sls. Mgr.:* Keith Larson; *Dist. Mgr.:* Keith Larson

NORTHWEST ANALYTICAL INC., 520 N. W. Davis St., Portland, OR 97209, Tel: 503-224-7727, FAX: 503-224-5236; Empl.: 26; *Sls. Mgr.:* Lynn Theis; *Dist. Mgr.:* Kathryn Botsford

NORTHWEST ETCH TECHNOLOGY, 2601 So. Hood St., Tacoma, WA 98409, Tel: 206-572-2401, 1-800-343-2401, FAX: 206-383-8325; Empl.: 30

NWμ

FAX: 503-929-6428

NORTHWEST MICROCIRCUITS, INC., 211 S. 9th - P.O. Box 1479, Philomath, OR 97370, Tel: 503-929-6424; Empl.: 15; *Sls. Mgr.:* Matt Graham ..... **A•1712**

NORTON ASSOCIATES, INC., 9 Endo Blvd., Garden City, NY 11530, Tel: 516-745-1411, FAX: 516-745-1412; FSC No.: 08739

NORWESCO, INC., See Norwesco Interconnect Devices

NORWESCO INTERCONNECT DEVICES, 2633 Plastics Drive, Gastonia, NC 28053, Tel: 704-868-3581, FAX: 704-867-0577; Empl.: 80; *Sls. Mgr.:* Gary Munn

NOVA ELECTRIC CORP., Technology Dynamics, Inc., 100 School St., Bergenfield, NJ 07621-2915, Tel: 201-385-0500, FAX: 201-385-0702; FSC No.: 29019; Empl.: 50; *Sls. Mgr.:* Kenneth Niovitch ..... **D•2284-2285**

Local Sales Offices & Reps

CO	Englewood, Odyssey 1	303-773-8176
CT	W. Hartford, Power Factor Assoc.	203-233-0600
FL	Orlando, Truex Assoc.	407-859-2160
KS	Kansas City, Harris-Hansen Co.	816-763-6200
MD	Columbia, Delta III Assoc.	410-730-4700
MA	Whitinsville, Power Factor Assoc.	508-234-6415
MI	Detroit, Comtel	313-358-2505
OH	Cleveland, Comtel Assoc.	216-442-8080
PA	Philadelphia, Rabal Assoc.	215-922-6914
TX	Dallas, Carey McMahill Assoc.	214-681-1414
UT	Odyssey 1.	801-485-4728
WA	Bellevue, Topp	206-747-5400
Can	Ottawa, Ont., Subtec	613-723-7720

NOVOTECHNIK U.S., INC., 237 Cedar Hill St., Marlborough, MA 01752, Tel: 508-485-2244, FAX: 508-485-2430; FSC No.: MULTIPLE; Empl.: 8 ..... **A•2114**

NRD INC., Subsidiary of Mark IV Inds., Inc., 2937 Alt Blvd. N., Grand Island, NY 14072, Tel: 716-773-7634, FAX: 716-773-7744; Empl.: 100; *Sls. Mgr.:* James Curtis; *Dist. Mgr.:* Larry Keating

NTE ELECTRONICS, INC., 44 Farrand St., Bloomfield, NJ 07003, Tel: 201-748-5089, FAX: 201-748-6224; FSC No.: 7T184; Empl.: 60; *Sls. Mgr.:* Cindy Habick; *Dist. Mgr.:* Mary Damiano ..... **A•2149; B•1572-1576**

NTK
TECHNICAL CERAMICS

FAX: 708-390-6482

NTK TECHNICAL CERAMICS, NGK Spark Plugs (USA), 1200 Business Ctr. Dr., Suite 300, Mt. Prospect, IL 60056, Tel: 708-824-1133; FSC No.: 95-246-1286; *Sls. Mgr.:* Ted Kato, Sls. Mgr.; *Dist. Mgr.:* Manabu Sato ..... **A•1664-1667, 1849**

Local Sales Offices & Reps

AZ	Mesa, NTK Tech. Ceramics	602-820-4900
CA	San Jose, NTK Tech. Ceramics	408-727-5180
FL	Longwood, D-Assocs.	407-321-9594
IL	Mt. Prospect, NTK Tech. Ceramics	708-824-1133
IN	Ft. Wayne, T.X. Sls.	219-489-4447
MA	Farmingham, NTK Tech. Ceramics	508-820-0220
MI	Detroit, NTK Tech. Ceramics	313-489-0123
NJ	Millburn, NTK Tech. Ceramics	201-376-6070
TX	Dallas, NTK Tech. Ceramics	214-404-1173
Can	Ontario, NGK Spark Plugs Canada	416-291-9746

NUCLEAR MEASUREMENTS GROUP, Oxford Instruments, Inc., PO Box 2560, Oak Ridge, TN 37831-2560, Tel: 615-483-8405, TELEX: 557482, TWX: 810-572-1018, FAX: 615-483-5891; Empl.: 120; *Sls. Mgr.:* Roger Stevens

NUCLEAR RESEARCH CORP., 125 Titus Ave., Box H, Warrington, PA 18976, Tel: 215-343-5900, TELEX: 510-665-8525 NRC WNTN, FAX: 215-343-4670; FSC No.: 96696; Empl.: 130; *Sls. Mgr.:* Tom O'Malley; *Dist. Mgr.:* Tom O'Malley

NUCLEONIC PRODS., See Thomson Electron Tube & Devices Corp. Thomson CSF

NU-CONCEPT SYSTEMS, 2725 Advance La.,P. O. Box 587, Colmar, PA 18915, Tel: 215-822-8400, 800-762-4278, FAX: 215-822-1427; FSC No.: 58561; Empl.: 10; *Sls. Mgr.:* Robert F. Scheuerle

NU DATA, INC., 32 Fairview Ave., Little Silver, NJ 07739, Tel: 908-842-5757, FAX: 908-842-1161; Empl.: 20; *Sls. Mgr.:* Mark Leiberman; *Dist. Mgr.:* George Serbe

NWL CAPACITORS, NWL Transformers, 1 Industrial Drive, Snow Hill, NC 28580, Tel: 919-747-5943, FAX: 919-747-8979; Empl.: 39; *Sls. Mgr.:* Gary W. Greiser ..... **A•1136-1138**

Local Sales Offices & Reps

CA	Los Gatos, Estronics Co.	408-356-2968
CA	Marrieta, Mil-Com Sls.	714-677-2097
CT	Darien, C.W. Assocs.	203-656-2339
FL	Tampa, SRT Mktg.	813-884-4805
IL	Arlington Heights., Berndt Assocs., Inc.	708-632-0900

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[916] 448-6370
[209] 441-1725
[800] CAL-SWCH

MI	Livonia, Amtech Reps., Inc.	313-474-8300
NJ	Haddonfield, M&S Mesa Inc.	609-429-7055
NM	Albuquerque, TMMI Westfahl	505-268-1433
NY	Nassau, Jones Sudders	518-766-9575
OH	Maineville, George Barnett & Co.	513-677-0922
OR	Lake Oswego, Salestech Assocs.	503-636-9559
TX	Euless, Fralia Co. & Assocs.	817-354-1144
VT	White River Jct., Cornerstone Inds.	802-295-5260
WA	Redmond, Salestech Assocs.	206-869-5412
WI	Milwaukee, Berndt Assocs., Inc.	414-545-8400

NWL TRANSFORMERS, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505, Tel: 609-298-7300, FAX: 609-298-1982; Empl.: 225; *Sls. Mgr.:* Helmut Herder ..... **A•1136-1138, 2437; D•1851**

Local Sales Offices & Reps

CA	Los Gatos, Estronics Co.	408-356-2968
CA	Murrieta, Mil Com Sls.	714-677-2097
NJ	Princeton, Mutronics Assocs.	609-394-3737
NM	Albuquerque, Westfahl & Assocs.	505-268-1433
WA	Redmond, Salestech Assocs.	206-869-5412

WILLIAM F. NYE, INC., P.O. Box 8927, New Bedford, MA 02742-8927, Tel: 508-996-6721, TELEX: 940807, FAX: 508-997-5285; Empl.: 36; *Sls. Mgr.:* Donald R. Fairbanks ..... **C•1134**

Local Sales Offices & Reps

IL	Elgin, Mark C. Biteler	708-697-5446
MI	Pleasant Ridge, Brian C. Holley	313-542-2720

NY-GLASS PLASTICS INC., Calnetics Corp., 1255 Railroad St., Corona, CA 91720, Tel: 909-737-9110, FAX: 909-737-9815; Empl.: 90; *Sls. Mgr.:* Chris Ward

NYTRON INDUCTORS, INC.(VSD, INC.), Offered by: Dale Electronics, Inc., E. Hwy. 50, P.O. Box 180, Yankton, SD 57078-0180, Tel: 605-665-9301, FAX: 605-665-1627; FSC No.: 83125; Empl.: 450; *Sls. Mgr.:* Mike Husman ..... **A•1231**

OAKGRIGSBY
FAX: 708-556-4216

OAKGRIGSBY INC., 88 N. Dugan Rd., Sugar Grove, IL 60554, Tel: 708-556-4200; FSC No.: 76854; Empl.: 300; *Sls. Mgr.:* Lou Falco ..... **B•1654, 1790-1795, 1979**

Local Sales Offices & Reps

AL	Huntsville, New Age Elctrns.	205-895-9400
AZ	Scottsdale, Carefree Elctrns. Sls.	602-951-9121
CA	Laguna Hills, Fitch Assocs.	714-951-0196
CA	San Jose, Vernex & Assocs.	408-972-9072
FL	Longwood, Septer & Assocs.	407-774-3161
GA	Duluth, New Age Elctrns.	404-476-0079
IL	Rolling Meadows, Sumer, Inc.	708-991-8500
IL	Sugar Grove, OakGrigsby, Inc.	708-556-4200
IN	Indianapolis, HI-Tek Sls.	317-887-2564
IA	Cedar Rapids, Pattison Sls.	319-395-9866
KS	Parker, S.W. Wollard Assocs.	913-898-6552
MA	Acton, James Inds. East	508-264-4456
MN	Bloomington, Murnco & Assocs.	612-854-4161
NY	Fairport, A.C.S.	716-223-2430
OH	Beachwood, Elctrn. Sls. Masters, Inc.	216-831-8647
PA	Plymouth Meeting, CMS Sls. & Mktg., inc.	215-834-6840
TX	Dallas, Dal/Tex Rep., Inc.	214-991-7799
Can	Mississauga. Ont., GMA (Toronto)	416-671-8111
Can	Nepean, Ont., GMA (Ottawa)	613-820-3822
Can	St. Laurent, Que., GMA (Montreal)	514-335-9572

Local Distributors

AZ	Tempe, L-Comp.	602-730-1633
CA	Fremont, KEA Elctrns.	510-651-2600
CA	Gardena, Cal Switch	310-538-9830
FL	Pompano, Peerless	305-973-4141
FL	W. Palm Bch., Wings Electro Sls. Co.	407-798-6606
GA	Atlanta, Peerless	404-612-9090
ID	Boise, Radar	208-336-2227
IL	Addison, L Comp	708-628-1400
IL	Chicago, Newark	312-907-5453
IL	Crystal Lake, Sub Sem	815-459-4139
IL	Crystal Lake, Sub-Sem, Inc.	815-459-4139
IL	Rosemont, Advent Elctrns.	708-297-6200
IA	Cedar Rapids, Advent Elctrns.	319-363-0221
IN	Indianapolis, Advent Elctrns.	317-872-4910
MD	Columbia, Peerless	410-997-1717
MA	Canton, Richey/Impact Elctrns.	617-821-1500
MA	Walpole, Richey Impact	508-668-8200
MA	Westborough, In-Stock Prods.	508-870-5750
MA	Wilmington, North Star	508-657-5155
MA	Wilmington, North Star Elctrns.	508-657-5155
MI	Farmington Hills, Advent Elctrns.	313-477-1650
MN	Minneapolis, Berquist	800-328-3882
MO	Kansas City, L-Comp	816-241-0111, FAX:816-241-7373
MO	Maryland, L-Comp	314-291-6200, FAX:314-298-7231
NY	Hauppauge, Fairmont Elec.	516-231-3313
NY	Lynbrook, Peerless Radio Corp.	516-593-2121, FAX:516-593-2179
NY	Rockville Centre, Advantage Elctrns.	516-678-6956,FAX:516-678-7966
NC	Raleigh, Component Distr.	919-787-7311
OH	Centerville, IPD	513-435-2086
OR	Portland, Radar Electric Co., Inc.	503-232-3404, FAX:503-235-0428
TX	Austin, Wofford Elctrns., Inc.	512-339-1131, FAX:512-835-7351
TX	Carrolton, Northstar Elctrns.	214-980-2999, FAX:214-980-2997
TX	Dallas, Component Distr.	214-644-0373
TX	Dallas, Wofford Elctrns., Inc.	214-340-8555, FAX:214-340-9555
TX	El Paso, Ideal Indl. Elctrns.	915-779-6647, FAX:915-779-0617
TX	El Paso, Ideal Indl. Elec.	915-779-6647
TX	Houston, Wofford Elctrns., Inc.	713-351-2255, FAX:713-351-2722
WI	Milwaukee, Progressive Image, Inc.	414-321-4722
WA	Richland, Radar Electric Co., Inc.	509-943-8336, FAX:509-943-6790
WA	Seattle, Radar Electric Co., Inc.	206-282-2511, FAX:206-282-1598
WA	Spokane, Radar Electric Co., Inc.	509-747-3053, FAX:509-456-8069
WI	Milwaukee, Progressive Image	414-321-4722, FAX:414-321-4665
Can	Downsview, Ont., Westburne Elctrns.	416-635-2980,FAX:416-635-0019
Can	Downsview, Ont., Westburne Elec. Supp.	416-635-2980
AZ	Tucson, Carefree Elctrns. Sls.	602-882-8642

OAK SWITCH SYSTEMS, See OakGrigsby, Inc.

OAL ASSOCIATES, INC., 16744 W. Bernardo Dr., Rancho Bernardo, CA 92127-1904, Tel: 619-451-1799, FAX: 619-451-2799; Empl.: 18; *Sls. Mgr.:* Dave Dorfman

OAS INC., See Optimum Applied Systems

OCEAN MOTIONS CO., P.O. Box 130, Barrington, RI 02806, Tel: 401-246-1394, FAX: 401-246-0075; FSC No.: 64654; *Sls. Mgr.:* C. Thorp ..... **B•1980**

Local Sales Offices & Reps

CO	Denver, Control Agcy., Inc.	303-694-9214
UT	Salt Lake City, Control Agcy.	801-268-9880, FAX:801-268-9924

OCE GRAPHICS USA, INC., 385 Ravendale Dr., Mountain View, CA 94039-7169, Tel: 415-964-7900, FAX: 415-961-6152; *Sls. Mgr.:* Gary Gedeon; *Dist. Mgr.:* Gary Gedeon

OCTAGON SYSTEMS, 6510 W. 91st Ave., Westminster, CO 80030, Tel: 303-430-1500, FAX: 303-426-8126

OCULAR INC., 746 Lingco Dr., Richardson, TX 75081, Tel: 214-437-3888, FAX: 214-437-2562; Empl.: 110; *Sls. Mgr.:* Marvin Smith ..... **B•1096-1097**

Local Sales Offices & Reps

AL	Madison, Southern Elctrn. Reps.	205-461-8925
AZ	Phoenix, JBS Assocs., Inc.	602-244-1212
CA	Huntington Beach, Solutech, Inc.	714-374-0130
CA	San Jose, Kottmeier Assocs.	408-371-8700
CO	Arvada, Arrowhead Sls.	303-423-5556
FL	Hollywood, Advantage Comp.	305-962-2255
FL	Hollywood, Advantage Comps.	305-962-2255
GA	Atlanta, Southern Elctrn. Reps.	404-458-3577
IL	Arlington Hgts., Coombs & Assocs.	708-439-9810
IN	Fort Wayne, Menze Sls.	219-747-5616
KS	Kansas City, EPI, Inc.	913-432-1792
MD	Hunt Valley, Eagle Sls. Corp.	410-666-3930
MA	Swansea, Wm. Poisson & Assocs.	508-677-3655
MN	Hopkins, Pathway Sls.	612-891-4841
NV	Sacramento, Kottmeier Assocs.	408-371-8700
NJ	Wayne, Breen Assocs.	201-696-8683
NM	Albuquerque, Nelco Electronix	505-293-1399
PA	Newtown, Industrial Sls. Assocs.	215-860-2076
TX	Dallas, Component Technlg.	214-783-8831
WA	Renton, K.R. Jensen Sls. Co.	206-277-2772
WI	Milwaukee, Coombs & Assocs.	414-351-6123
Can	Montreal, A.R. Greg & Assocs.	514-694-6378

ODU-USA, INC., ODU-Kontakt GmbH, Germany, 4620 Calle Quetzal, Camarillo, CA 93012, Tel: 805-484-0540, FAX: 805-484-7458; Empl.: 5; *Sls. Mgr.:* Ona Collins; *Dist. Mgr.:* Kenneth E. Rhines

OECO CORP., 4607 S.E. International Way, Milwaukie, OR 97222, Tel: 503-659-7932, TELEX: 36-0350, FAX: 503-653-6310; FSC No.: 95266; Empl.: 700; *Sls. Mgr.:* Dave Fuller, VP Sls.

OFTI, 2 Liberty Way, Westford, MA 01886, Tel: 508-692-6606, FAX: 508-692-6620; Empl.: 72

OGALLALA ELCTRNS., Div. Arnold Engrg. Co., Box 59, Ogallala, NE 69153, Tel: 308-284-4093, FAX: 308-284-4740; Empl.: 51; *Sls. Mgr.:* Doug Groteluschen

OGDEN MANUFACTURING CO., 48 W. Seegers Road, Arlington Heights, IL 60005, Tel: 708-593-8050, FAX: 708-593-8062; Empl.: 250; *Dist. Mgr.:* Gordon D. Hollander

OSI

FAX: 614-486-0743

OHIO SEMITRONICS, INC., 1205 Chesapeake Ave., Columbus, OH 43212, Tel: 614-486-9561; FSC No.: 12066; Empl.: 47; *Sls. Mgr.:* G. Clagett .. **B•1982-2003; D•1313**

Local Sales Offices & Reps

AL	Huntsville, Datarep Inc.	205-881-0361
CA	Costa Mesa, FLW of Northern CA	510-651-6511
CA	Fremont, FLW of Southern CA	714-751-7512
CO	Denver, MC Squared Inc.	303-286-1414
FL	Margate, Datarep	305-968-6568
FL	Orlando, Datarep	407-843-5224
GA	Marietta, FLW	404-424-1731
IL	Columbia, R.L. Weisheimer & Assocs.	314-487-7328
IL	Park Ridge, Elctrn. Instr. Assocs.	708-298-2290
KS	Kansas City, R.L. Weisheimer & Assocs.	816-561-1711
MD	Mt. Airy, Strayton Assocs., Inc.	301-831-7007
MI	Livonia, TMS Inc.	313-462-2100
MN	Minneapolis, The Mark Co.	612-933-3026
NJ	Garwood, E.R. Mertz, Inc.	201-232-4643
NJ	Haddonfield, G.L. Williams & Assoc.	609-428-6060
NY	Latham, L-Tron Corp.	518-785-5032
OH	Columbus, Ohio Semitronics Inc.	614-486-9561
OH	Dayton, Mohawk Intronics	513-434-8873
OH	No. Ridgeville, TMS, Inc.	216-327-3527
OK	Stillwater, Acudata Inc.	405-743-1886
PA	Pittsburg, TMS	412-221-2338
RI	Narragansett, Pat Assocs.	401-783-9598
SC	Marion, Zelco Assocs.	803-423-0299
TX	Austin, Acudata Inc.	214-424-3561
TX	Houston, Acudata Inc.	713-580-2451
TX	Plano, Acudata Inc.	512-478-1018
WA	Bellevue, Syntek	206-462-7700
WA	Nine Mile Falls, Syntek	509-466-0451
WA	Vancouver, Syntek	206-737-2957
Can	Brossard, Ont., CTH Industrial Controls.	514-671-2181
Can	Edmonton, Alb., CTH Instrs.	403-466-2900
Can	Sarnia, Ont., Armatek Controls	519-332-0100
Can	Toronto, Ont., Armatek Controls	416-251-3111

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Local Sales Offices & Reps

AL	Huntsville, Over & Over	205-837-7105
AZ	Tempe, Elctrn. Dev. Sls.	602-438-1547
CA	Los Angeles, Wiley Co.	213-666-1611
CA	Santa Clara, Ross Mktg.	408-988-8111
CO	Denver, West, Inc.	303-477-8180
FL	Altamonte Spgs., Over & Over	407-332-1222
GA	Norcross, Over & Over	404-449-6205
IL	Mt. Prospect, Dombrow Co.	708-253-3326
IN	Indianapolis, Leslie M. DeVoe Co.	317-842-3245
IA	Cedar Rapids, Spectrum Sls.	319-366-0576
KS	Overland Pk., Spectrum Sls.	913-648-6811
MA	Norwood, MacInnis Co.	617-762-8090
MI	Farmington Hills, R.C. Merchant Co.	313-476-4600
MN	Minneapolis, Elec. Comp. Sls.	612-933-2594
MO	Florissant, Spectrum Sls.	314-921-1313
NY	Manhasset, Win-Cor Sls.	516-627-9474
NY	Victor, Net Sls.	716-924-1844
NC	Charlotte, Over & Over	704-542-9111
NC	Raleigh, Over & Over	919-876-7338
OH	Westlake, Baehr Greenleaf & Assoc.	216-892-1770
OR	Portland, Caruso & Camelleri Assoc.	503-246-5439
PA	Narbeth, Bresson Assocs.	215-664-6460
PA	Warrendale, Baehr Greenleaf & Assoc.	412-934-3088
TX	Richardson, Pro-Comp Sls.	214-669-1500
WA	Bellevue, Caruso & Camelleri Assoc.	206-455-8811
EXP	Skokie, IL, Ohmite Mfg. Co.	708-675-2600
Can	Pickering, Ont., A.C. Simmonds & Sons	416-839-8041

Local Distributors

AR	Ft. Smith, Carlton Bates	501-646-8201
CA	El Monte, Kimball & Stark	818-444-2594
CA	Fountain Valley, Component Ctr.	800-879-3550
CA	Oakland, Brill Elctrns.	415-834-5888
FL	Orlando, Hammond Elctrns.	407-849-6060
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Palatine, Ohm Elctrns.	708-359-5500
IN	Indianapolis, Bell Inds.	317-875-8200
MA	Hingham, Sager Elctrns.	617-749-6700
MI	Livonia, RS Elctrns.	313-525-1155
MN	St. Paul, Gopher Elctrns.	612-490-4900
NJ	Camden, GRS Elctrns.	609-964-8560
NY	Buffalo, Summit Distrs.	716-887-2800
NY	Lynbrook, Peerless Radio Corp.	516-593-2121
NY	Rome, Rome Elctrns.	315-337-5400
OH	Akron, AESCO Elctrns.	216-762-8818
OH	Dayton, Stotts-Friedman Co.	513-298-5555
OH	Warren, REM Elctrns. Supp.	216-373-1300
SC	Columbia, Dixie Elctrns.	803-779-5332
TX	Richardson, Altair Co.	214-231-5166
TX	Stafford, Harrison Equip.	713-879-2600
WA	Richland, Radar Elec.	509-943-8336
WI	Milwaukee, Marsh Elctrns.	414-475-6000
Can	Don Mills, Ont., Saynor Varah	416-445-2340
Can	Willowdale, Ont., Electro-Sonic	416-494-1666

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Local Sales Offices & Reps

AL	Huntsville, JWL Assocs.	205-883-1712
CA	Glendale, Mission Mktg. Grp.	818-247-9110
CA	Redwood City, James S. Heaton Co.	415-367-9000
CA	San Diego, V.E.C.	619-535-9080
CA	Tustin, V.E.C.-Los Angeles	714-544-7024
CO	Loveland, V.E.C.-Rocky Mtn.	303-667-7500
GA	Roswell, JWL Assocs.	404-518-8500
IL	Skokie, IRI-Illinois	708-967-8430
IN	Ft. Wayne, Scott Elctrns.	219-489-5690
IN	Indianapolis, Scott Elctrns.	317-841-0010
MA	Sterling, Compatable Comps. Inc.	508-422-7641
MI	Plymouth, Jay Mktg. Assoc.	313-459-1200
MN	Bloomington, IRI of MN.	612-854-8027
NJ	Flanders, K & R Eng. Sls., Inc.	201-584-5235
NY	Fairport, L-Mar Assocs.	716-425-9103
NC	Charlotte, JWL Assocs.	704-541-5750
NC	Raleigh, JWL Assocs.	919-787-4826
OH	Cincinnati, Scott Elctrns.	513-791-2513
OH	Cleveland, Scott Elctrns.	216-473-5050
OH	Dayton, Scott Elctrns.	513-294-0539
OR	Beaverton, Unicomp., Inc.	503-643-1645
PA	Horsham, TMI, Inc.	215-441-4300
TX	Austin, BPA, Inc.	512-346-9186
TX	Richardson, BPA, Inc.	214-234-8438
WA	Snohomish, UniComp	206-568-0511
WI	Brookfield, IRI-Wisconsin	414-789-9393
Can	Burnaby, B.C., Kaytronics	604-294-2000
Can	Calgary, Alberta, Kaytronics	403-275-7000
Can	Kanata, Ont., Kaytronics, Inc.	613-564-0080
Can	Mississauga, Kaytronics, Inc.	416-669-2262
Can	Ville St. Laurent, Que., Kaytronics, Inc.	514-745-5800

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OKAYA ELECTRIC AMERICA, INC., Okaya Electric Industries, Tokyo, Japan, 503 Wall Street, Valparaiso, IN 46383, Tel: 219-477-4488; Empl.: 11; *Sls. Mgr.:* David Rickards; *Dist. Mgr.:* David Rickards ..... **A•1139-1140, 1598-1599; B•1098-1099**

Local Sales Offices & Reps

AL	Huntsville, Hughes Assoc., Inc.	205-533-9108, FAX:205-533-4667
AZ	Scottsdale, Lindberg Co.	602-998-2944, FAX:602-998-2356
CA	Huntington Beach, Regan-Munro Sls.	714-841-1411,FAX:714-841-3598
CO	Denver, Lindberg Co.	303-758-9033, FAX:303-758-5863
IL	Highland Park, Bransky Sls.	708-433-2375, FAX:708-433-2377
IA	Cedar Rapids, Advanced Technical	319-393-8280, FAX:319-393-8273
KS	Olathe, Advanced Technical	913-782-8702, FAX:913-782-8641
MD	Cazenovia, St. Woolard Co., Inc.	301-371-4500, FAX:301-371-7353
MA	Milford, AFM Grp.	508-478-3355, FAX:508-478-4084
MI	Southfield, R.C. Nordstrom	313-559-7373, FAX:313-559-0075
MN	Minneapolis, Electro-Serv	612-338-3475, FAX:612-338-6048
MO	Bridgeton, Advanced Technical	314-291-5003, FAX:314-291-7958
NM	Albuquerque, Lindberg Co.	505-881-1006, FAX:505-881-1007
NY	Islip, Cogent Technlg. Assoc.	516-277-7101, FAX:516-277-7614
NC	Raleigh, Vantage Mktg.	919-870-7123, FAX:919-870-7772
OH	Cincinnati, Stegman Blaine	513-729-1969, FAX:513-729-1984
OH	Cleveland, Stegman Blaine	216-572-0003, FAX:216-238-3229
OH	Vandalia, Stegman Blaine	513-890-7975, FAX:513-890-5191
OH	Westerville, Stegman Blaine	614-523-1300, FAX:614-523-1333
OK	Tulsa, Delta Comps.	918-592-7711, FAX:918-587-9437
PA	Harleysville, Thomas Jackson Assoc.	215-256-8877,FAX:215-256-9255
TX	Seagoville, Delta Comps.	214-287-6333, FAX:214-287-1453
UT	Salt Lake City, Lindberg Co.	801-484-8689, FAX:801-484-9691
WA	Seattle, J.J. Assocs.	206-246-6619, FAX:206-241-8120
Can	Calgary, Alberta, Cana Rep. Grp.	403-255-0294, FAX:403-255-4902
Can	Montreal, Quebec, Cana Rep. Grp.	514-276-4477, FAX:514-276-3646
Can	Surrey, BC, Cana Rep. Grp.	604-599-1232, FAX:604-599-3616
Can	Willowdale, Ont., Cana Rep.Grp.	416-250-6683, FAX:416-250-6684

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CA	Chatsworth, E W Elctrns.	818-718-2500, FAX:818-718-9007
CA	Huntington Bch, Capacitor Assocs.	714-843-1815, FAX:714-843-0947
CA	Manhattan Bch., Prime Electro Prods.	310-379-3642,FAX:310-379-7768
CA	Santa Ana, BDS Elctrns.	714-662-1050, FAX:714-662-3929
CA	Santa Clara, Bravo Elctrns.	408-980-8500, FAX:408-980-0299
CO	Arvada, Denver Beta Wintronic Co.	303-431-7161, FAX:303-431-4964
CO	Littleton, Indelco, Inc.	303-795-3431, FAX:303-795-8298

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FL Orlando, ATCOM 407-354-0435, FAX:407-354-0438
IL Franklin Pk., Stetco Inc. 708-671-4208, FAX:708-671-5270
IL Hillside, Schuten Elctrns. 708-544-9600, FAX:708-544-9684
IL Morton Grove, Nedco Elctrns. 708-967-0500, FAX:708-967-0505
IN Indianapolis, Mar Elctrns., Inc. 317-633-6699, FAX:317-633-6687
MA Burlington, Atlantic Comps. Supp. (ATCOM) 617-270-0051,FAX:617-270-4056
MA Sharon, Adcour, Inc. 617-784-8123, FAX:617-784-5563
MI Battle Creek, Great Lakes Elctrns. Supp. 616-963-6282,FAX:616-963-3432
MI Madison Hgts., Galco Indl. Elctrns., Inc. 313-542-9090,FAX:313-542-8031
MN Eagan, Capacitor Assocs. 800-328-0003, FAX:612-456-5850
MN Eitzen, Capacitor Assocs. 507-495-3306, FAX:507-495-3454
NJ Wyckoff, B & R Elctrns. 201-670-7200, FAX:201-670-6849
OH Chagrin Falls, Comm-Omni 216-247-7030, FAX:216-247-6199
PA Philadelphia, Shap Elctrns. Co., Inc. 215-969-3300, FAX:215-934-5539
TX Dallas, Comp. Dist., Inc. 214-644-0373, FAX:214-644-1115
WI Mequon, Taylor Elctrc. Co. 414-241-4321, FAX:414-241-4025
Can Gloucester, Ottowa, Elctrn. Whlsrs. 613-746-4413, FAX:613-746-6260
Can Montreal, Que., Elctrn. Whlsrs. 514-769-8851, FAX:514-769-9060
Can See-Foy, Que., Elctrn. Whlsrs. 418-657-5020, FAX:418-657-5234

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OLYMPIC WIRE & CABLE, 1 Madison Rd., Fairfield, NJ 07004, Tel: 201-227-7996, FAX: 201-227-1606; FSC No.: 63830; Empl.: 35; *Dist. Mgr.:* Robert T. Mello

OLYMPUS CORPORATION, Industrial Fiberoptics Division, 4 Nevada Dr., Lake Success, NY 11042-1179, Tel: 516-488-3880, FAX: 516-488-3973

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AZ Phoenix, Omni Switch USA, Inc. 602-582-0629
CA Irvine, Vale Elctrns. 714-551-4004
CA Santa Clara, Premier Tech. Sls. 408-736-2260
CO Westminster, Glenmar 303-423-1572
CT Darien, CW Assocs. 203-656-2339
GA Lilburn, Pinnacle Mktg. 404-410-9980
IL Itasca, LTD Technlgs. 708-773-2900
IN Indianapolis, C.C. Electro Sls. 317-921-5000
KS Lenexa, Midtec Assocs. 913-541-0505
MI Plymouth, C.C. Electro Sls. 313-455-0000
NM Albuquerque, Power Entprs. 505-271-9266
NY Eastchester, W.D. Sls. 914-779-8738
NC Raleigh, Pinnacle Mktg. 919-848-0404
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TX Dallas, Leon de Mexico 214-243-1089

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OMRON ELECTRONICS, INC., Control Components Division, 1 East Commerce Dr., Schaumburg, IL 60173, Tel: 708-843-7900, 1-800-626-6766, FAX: 708-843-7787; Empl.: 300; *Dist. Mgr.:* Mac Rowell

OMRON ELECTRONICS, INC., F A Systems Div., One E. Commerce Dr., Schaumburg, IL 60173, Tel: 708-843-7900, FAX: 708-843-7787; Empl.: 300; *Sls. Mgr.:* Sal Scalfi

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ONEAC CORPORATION, 27944 N. Bradley Rd., Libertyville, IL 60048, Tel: 708-816-6000,800-327-8801, TWX: 757024 ONEAC USA; Empl.: 150; *Sls. Mgr.:* Byron Brooks

ONSET COMPUTER CORP., 536 MacArthur Blvd., P.O. Box 3450, Pocasset, MA 02559-3450, Tel: 508-563-9000, FAX: 508-563-9477; Empl.: 12; *Sls. Mgr.:* Lon Hocker

ONSHORE TECHNOLOGY, 1917 W. 3rd St., Tempe, AZ 85281, Tel: 602-921-3000; Empl.: 200; *Sls. Mgr.:* R. Mandell; *Dist. Mgr.:* L. Anthole

ONTRACK DATA RECOVERY, INC., Ontrack Computer Systems, Inc., 6321 Bury Drive, Ste.15-19, Eden Prairie, MN 55346, Tel: 800-872-2599, FAX: 612-937-5750

OPAMP LABS, INC., 1033 N. Sycamore Ave., Los Angeles, CA 90038, Tel: 213-934-3566, FAX: 213-462-6490; FSC No.: 24699; Empl.: 18 ..... **D•1017**

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OPTELECOM, INC., 9300 Gaither Rd., Gaithersburg, MD 20877, Tel: 301-840-2121, FAX: 301-948-6357; FSC No.: 59338; Empl.: 50; *Sls. Mgr.:* Harish K. Jain ..... **B•1223-1227**

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OPTICAL ELECTRONICS, INC., P.O. Box 11140, Tucson, AZ 85734, Tel: 602-889-8811

OPTICS FOR RESEARCH, INC., P.O. Box 82, Caldwell, NJ 07006, Tel: 201-228-4480, TELEX: 497-4643, FAX: 201-228-0915; Empl.: 33; *Sls. Mgr.:* Diane M. Fiore

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CA Garden Grove, Elsco Elctrns., Inc. 714-891-4621
CA Santa Clara, Nova-Tronix 408-727-9530
FL Oviedo, Conley & Assocs., Inc. 407-365-3283
GA Tucker, Optima EPS 404-496-4000
IL Arlington Heights, Berndt Assocs., Inc. 708-632-0900
MA Milford, Selmark Assocs., Inc. 508-478-9088
MI Madison Hgts., DEM Electronic Sls., Inc. 313-583-1500
MO St. Louis, Rush & West Assocs., Inc. .. 314-965-3322
NJ Berkeley Heights, Cambridge Allen & Assocs. 908-464-0203
NY Manlius, Lamtec Sls. Corp. 315-682-4780
NC Chapel Hill, T.A. Barker Assocs. 919-968-7808
OH Cleveland, C.A. Robinson Co., Inc. 216-473-6044
TX Dallas, Kruvand Assocs., Inc. 214-437-3355
UT Salt Lake City, Sierra Technical Sales 801-566-9719
VA Sterling, Beacon North, Inc. 703-478-2480
WA Bellevue, El Tech 206-746-7780

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OPTIMUM APPLIED SYSTEMS, 145 Palisade St., Dobbs Ferry, NY 10522-1696, Tel: 914-693-9001, FAX: 914-693-8733; Empl.: 30; *Sls. Mgr.:* H. Joseph Braki

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AL Madison, E-Squared Mktg. 205-464-0392
AZ Paradise Valley, Techrep-Arizona 602-991-6646
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CO Franktown, MRC 303-660-8750

CT Canterbury, Deltech Sls. 203-546-6322
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FL Ft. Lauderdale, Tech-Rep Assoc. 305-791-2708
FL Merritt Island, Tech-Rep Assoc. 407-453-3313
GA Lawrenceville, E-Squared Mktg. 404-995-7206
IL Rolling Meadows, Eagle Tech. Sls. 708-991-0700
IN Ft. Wayne, Johnson GP. 219-471-7100
IA Cedar Rapids, C.H. Horn & Assoc. 319-393-8703
KS Wichita, DLE Elctrns. 316-683-6400
MD Annapolis, Elctrn. & Technlg. Sls. 410-974-9351
MA Littleton, Deltech Sls. 508-486-8294
MA Sharon, Cummings Assocs. 617-784-5600
MI Spring Lake, Johnson Gp. 616-842-7706
NY E. Rochester, Alan Lupton Assoc. 716-381-4800
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OH Cincinnati, Stegman Blaine Mktg. 513-521-0958
OH Cleveland, Stegman Blaine Mktg. 216-572-9797
OH Vandalia, Stegman Blaine Mktg. 513-890-7486
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TX Austin, Sunbelt Comps. 512-335-0499
TX Dallas, Sunbelt Comps. 214-248-8000
TX Missouri City, Sunbelt Comps. 713-499-4722
WA Bellevue, E2 206-637-0302

Local Distributors

CA Santa Ana, Norstan Elctrns. Inc. 714-NORSTAN
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TX Dallas, Assoctd. Aircraft Supp. Co., Inc. 214-331-4381

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OPTOELECTRONICS TEXTRON, 1309 Dynamic St, P.O. Box 750039, Petaluma, CA 94975-0039, Tel: 707-763-5900, FAX: 707-762-7383; Empl.: 100

OPTO PLUS ò INC., 23382 Madero, Unit A, Mission Viejo, California, CA 92691, Tel: 714-380-8654, 800-554-6786, FAX: 714-380-0761; Empl.: 7

OPTO TECHNOLOGY, INC., 562 Chaddick Dr., Wheeling, IL 60090, Tel: 708-537-4277, FAX: 708-537-4785; Empl.: 25; *Sls. Mgr.:* Thomas W. Hegberg, Sls. Mgr.

OPTOTEK LIMITED, 62 Steacie Dr., Kanata, Ont., Canada K2K 2A9, Tel: 613-591-0336, FAX: 613-591-0584; FSC No.: 38183; Empl.: 30

OPTO 22, 43044 Business Park Dr., Temecula, CA 92590, Tel: 714-695-9299, FAX: 714-695-2712

OPTREX, Asahi Glass, 23399 Commerce B-8, Farmington Hills, MI 48335, Tel: 313-471-6220; Empl.: 25

FAX: 310-214-1721

OPTREX/SATORI, 3830 Del Amo Blvd. Ste. 101, Torrance, CA 90503, Tel: 310-214-1791; Empl.: 12; *Sls. Mgr.:* David Liu; *Dist. Mgr.:* Dave Liu ..... **B•1102-1103**

Local Sales Offices & Reps

AZ Scottsdale, JKA Associates 602-990-8804
CA Santa Clara, Nova-Tronix 408-727-9530
CA Torrance, Satori Elec. 213-378-9478
CO Denver, Aki Entprs. 303-388-4488
CO Denver, AKI Entprs. 303-388-4488
GA Atlanta, Satori Elec. 404-320-8482
OR Portland, Venture Elctrns. 503-624-0617
OR Portland, Venture Elex 503-624-0617
WA Seattle, Venture Elctrns. 206-454-4594
TX Dallas, Satori Elec. 214-518-1946
WA Bellevue, Venture Elex. 206-454-4594
WA Bellvue, Venture Elex 206-454-4594

Local Distributors

CA Buena Park, Cypress Elctrns. 213-744-0355
CA San Diego, Cypress Elctrns. 619-535-0011
CA San Jose, Sierra West 408-435-7477
CA Santa Clara, Cypress Elctrns. 408-980-2500
CO Englewood, Cypress Elctrns. 303-792-5829
OR Beaverton, Cypress Elctrns. 503-641-2233
OR Beaverton, I E C 503-641-1690
OR Beaverton, IEC 503-641-1690
WA Bellevue, I.E.C. 206-455-2727
WA Bothell, Cypress Elctrns. 206-483-1144
WA Bothwell, Cypress Elctrns. 206-483-1144

OPTRONIC LABORATORIES, INC., 4470 35th St, Orlando, FL 32811, Tel: 407-422-3171, 800-899-3171, TELEX: 910-240-5263, FAX: 407-648-5412; FSC No.: 59938; Empl.: 36; *Sls. Mgr.:* William A. Schneider, VP of Sls. & Opers.

ORAM High Voltage

FAX: 409-258-5555

ORAM HIGH VOLTAGE, Klemp Road, P.O. Box 1176, Dayton, TX 77535, Tel: 409-258-5553; Empl.: 27; *Sls. Mgr.:* M. Su ..... **D•1852-1853**

ORBIT ADVANCED TECHNOLOGIES, 905 Sheehy Dr. Bldg., Horsham, PA 19044, Tel: 215-674-4220, FAX: 215-674-1102; Empl.: 140; *Sls. Mgr.:* Gerard Matyas

ORBIT INDUSTRIES, Countis Industries, 2670 Lockheed Way, Carson City, NV 89706, Tel: 702-882-6123; Empl.: 11; *Sls. Mgr.:* James T. Countis

ORBIT INSTRUMENT CORP., 80 Cabot Ct, Hauppauge, NY 11788, Tel: 516-435-8300, TWX: 510-221-2122, FAX: 516-435-8458; FSC No.: 11263; *Sls. Mgr.:* Jeanne Szabodas ..... **B•1849; D•1167**

Local Sales Offices & Reps

CA San Diego, D. Cary 619-222-8839
MA Tweksbury, Delcon Sls. 508-851-9911

ORBIT INSTRUMENT OF CAL., Orbit Instrument Corp., 5606 Corporate Ave., Cypress, CA 90630, Tel: 714-527-0561, FAX: 714-527-7552; FSC No.: 11263; *Sls. Mgr.:* Graham Vernon ..... **B•1849; D•1167**

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Local Distributors

AZ Scottsdale, Tusar 602-998-3688
CA Garden Grove, Avcom EDA 714-897-0319
CA San Diego, Insight Elctrns. 619-587-1100
CA Sunnyvale, Avcom EDA 408-733-5000
FL W. Melbourne, Trilogic Sunforce 407-722-1324
MA Wilmington, Trilogic Inc. 508-658-3800
MI Bloomfield Hills, MacKellar Assocs. 313-335-4440
NJ Freehold, Beta Lambda, Inc. 908-294-9500
NC Raleigh, Trilogic Sunforce 919-755-1700
OK Tulsa, Abcor, Inc. 918-299-1468
TX Dallas, Abcor, Inc. 214-739-3158
TX Houston, Abcor, Inc. 713-486-9251
WA Kirkland, Avcom EDA 206-828-2725

ORCUS, Box 16022, Kansas City, MO 64112, Tel: 913-897-5128, TELEX: 4994037, FAX: 913-897-5468; *Sls. Mgr.:* Manford Eaton

OREGON MICRO SYSTEMS, INC., 1800 N.W. 169th Pl, C100, Beaverton, OR 97006, Tel: 503-644-4999, 503-629-8081, FAX: 503-629-0688; Empl.: 12; *Sls. Mgr.:* Wayne Hunter

ORIEL CORP., 250 Long Beach Blvd., Stratford, CT 06497-0872, Tel: 203-377-8282, FAX: 203-378-2457; Empl.: 120; *Sls. Mgr.:* Thom. Connolly

ORIENTAL MOTOR USA CORP., 2580 W. 237th Street, Torrance, CA 90505-5217, Tel: 310-515-2264, FAX: 310-515-2879; Empl.: 60; *Sls. Mgr.:* 4; *Dist. Mgr.:* Greg Johnston

ORIGINAL ELECTRIC MFG. CO., INC., 123 Lincoln Blvd., Middlesex, NJ 08846, Tel: 908-271-5770, FAX: 908-271-5774

ORION DEVELOPMENT CORP., P.O. Box 2323, Merrifield, VA 22116-2323, Tel: 703-698-8126, 800-992-8170, FAX: 703-698-0857; Empl.: 2; *Sls. Mgr.:* Richard A. Long

ORION INSTRUMENTS, INC., 180 Independence Dr., Menlo Park, CA 94025, Tel: 415-327-8800, 800-767-4666, TELEX: 530942, FAX: 415-327-9881; *Sls. Mgr.:* Eric Mudama

ORLANDO DEVELOPMENT CENTER, Micro Energy Inc., 745 W. State Rd. 434, Longwood, FL 32750-4909, Tel: 407-831-2000, FAX: 407-831-1100; Empl.: 250; *Sls. Mgr.:* Bill Maxwell

ORMEC SYSTEMS CORP., 19 Linden Park, Rochester, NY 14625, Tel: 716-385-3520, FAX: 716-385-5999; Empl.: 50; *Sls. Mgr.:* Gregory Woods

ORTEL CORP., 2015 W. Chestnut St., Alhambra, CA 91803, Tel: 818-281-3636, TELEX: 752434, FAX: 818-281-8231; Empl.: 130; *Sls. Mgr.:* Bill Moore, V.P. of Sls.

OSCILLATEK
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FAX: 913-829-3505

OSCILLATEK, A Dover Technologies Company, 620 North Lindenwood Dr., Olathe, KS 66062, Tel: 913-829-1777; FSC No.: 57693; Empl.: 80; *Sls. Mgr.:* William J. Beck ..... **A•1442-1448**

Local Sales Offices & Reps

AZ Tempe, Cain Technlg. 602-966-4322
CA Fahmer-Miller 408-727-9800
CA Santa Clara, Fahmer Miller Assoc. 916-677-5838
CA Van Nuys, Cain Technlg. 818-904-9392
CO Englewood, Cain Technlg. 303-220-8118
CT Adelco 617-444-4754
FL Clearwater, Beacon Elctrns. 813-796-2378
GA Atlanta, Beacon Elctrns. 404-449-8464
IL RK Elctrns. 708-695-8552
IA Cedar Rapids, Midwest Tech. Sls. 319-377-1688
KS Gooddard, Midwest Tech. Sls. 316-794-8565
KS Lenexa, Midwest Tech. Sls. 913-888-5100
MA Needham, Addelco Corp. 617-444-4754
MN Chanhassen, Barnes Sls. 612-934-2907
MO MTS 314-298-8787
NJ Spectrum 914-472-8600
NY Advanced 315-437-6700
NY Advanced 607-785-3191
NY Hartsdale, Spectrum Sls. 914-472-8600
NY Syracuse, Advanced Comps. Corp. 315-437-6700
OR Thorson NW 503-293-9001
OR Portland, Thorson Co. Northwest 503-293-9001
PA Southampton, Eastern Instrmn. of PA 215-355-7700
TX Rep-Tec 214-956-8700
TX Dallas, Rep-Tec 214-956-8700
VA Alexandria, Mid States Mktg. 703-370-2600
WA Thorson NW 206-455-9180
WA Bellevue, Thorson Co. Northwest 206-455-9180
Can Mississauga, BBD 416-821-7800

OSCILLOQUARTZ, B & J Marketing, 17074 Dearborn St., Northridge, CA 91325, Tel: 818-993-0048, TELEX: 650 2068183, FAX: 818-993-5758; Empl.: 125; *Sls. Mgr.:* Alain Jendly

Oshino Lamps

FAX: 03-3450-3939

OSHINO LAMPS LIMITED, 5-2, Minami-Shinagawa 2-chome, Shinagawa-Ku, Tokyo, Japan 140, Tel: 03-3471-8548, TELEX: 0242-2117; Empl.: 300; *Sls. Mgr.:* T. Koyama ..... **B•1176-1177**

OSLO CONTROLS

FAX: 203-272-3492

OSLO CONTROLS, 328 Industrial Ave., Cheshire, CT 06410-1511, Tel: 203-272-2794; *Sls. Mgr.:* J. J. Martinez ..... **B•1797**

Local Sales Offices & Reps

AZ	Scottsdale, Vikeland Sls.	602-948-7921
AZ	Tempe, Vikeland Sls.	602-839-9370
CA	Mountain View, Frauman Assoc.	415-964-9464
CA	Trabuco Canyon, Interconn	714-589-4655
CO	Englewood, CompuTech Mktg.	303-773-3981
CT	Glastonbury, Pace Assocs.	203-659-2266
FL	Maitland, Hawkins-Frederickson	407-831-2474
GA	Atlanta, Overton Assoc.	404-497-0166
IL	Lisle, W-G Controls	708-963-5954
IA	Cedar Rapids, W-G Controls	319-373-1009
MN	St. Paul, Vikeland Sls.	612-645-4647
MO	Creve Coeur, Hill & Co.	314-432-1136
NJ	Englewood, Gray Assocs.	201-894-0894
NJ	Kenvil, Gray Assoc.	201-927-6662
NY	Syracuse, Canavan-Scanlon Assocs., Inc.	315-437-1271
NY	Yaphank, Gray Assoc.	516-924-2471
OH	Cincinnati, O. H. Bromberg & Assocs.	513-771-9333
OR	Lake Oswego, Luscombe Engr.	503-636-6664
PA	Pittsburgh, Catalyst Sls.	412-733-5450
PA	West Chester, All Tech. Mktg.	215-344-0134
TN	New Tazewell, Overton Assoc.	615-626-6009
TX	Dallas, Glidden Electro Equip.	214-341-0610
WA	Bellevue, Luscombe Engr.	206-223-1541
Can	Scarborough, Ont., Banke Elctrns.	416-292-5152

Local Distributors

AZ	Phoenix, Beswitched	602-275-4805
AZ	Tempe, LComp., Inc.	602-730-1633
CA	Anaheim, Deco Elctrns., Inc.	714-630-8252
CA	Gardena, California Switch & Signal	1-800-421-2471
CA	Los Angeles, Master Distrs.	213-452-1229
CA	Redwood City, HdB	415-368-1388
CA	San Diego, Deco Elctrns., Inc.	619-693-1595
CA	San Jose, Spectra Elctrns.	408-452-1590
CA	Tustin, Western Switches & Controls, Inc.	714-259-8144
CA	Van Nuys, Wes Garde Components	213-873-4802
CO	Aurora, Jet Elctrn. Supp., Co., Inc.	303-364-1000
CT	West Hartford, Wes Garde Components	203-527-7705
FL	Lakeland, A A Elec.	800-237-8274
FL	Lakeland, Wes Garde Components	813-644-7564
IL	Addison, LComp., Inc.	312-628-1400
IL	Carol Stream, Wes Garde Components	1-800-323-9431
IL	Crystal Lake, Sub Sem	815-459-4139
IN	Indianapolis, Mar Elctrns., Inc.	317-633-6699
IA	Cedar Rapids, Dee Elctrns.	319-365-7551
KS	Overland Park, Wes-Garde	913-262-2718
KS	Wichita, LComp.,Inc.	316-265-5100
MD	Kensington, Marine Air Supp.	301-949-9560
MA	Walpole, Richey Impact	508-668-8200
MI	St. Clair Shores, SPEMCO, Inc.	313-771-2700
MN	Minneapolis, Dot Elctrns.	612-926-9505
MN	Minneapolis, Elctrn. Center, Inc.	612-371-5200
MO	Maryland Hgts., LCOMP, Inc.	800-325-1393

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NJ	Mt. Laurel, Wes Garde Components	609-778-8190
NJ	Oakland, Relay Specialties, Inc.	201-337-1000
NY	Johnson City, Help Elctrns.	607-729-3528
NY	Woodside, Switches Unltd., Inc.	718-478-5000
OH	Shandon, Cartessa Corp.	513-738-4477
OH	Westerville, Wes Garde Components	614-885-0319
OR	Wilsonville, Wes Garde Comp.	503-682-1333
PA	Exton, USH Elctrns.	215-363-2250
PA	McKean, Advacom	814-476-7774
TX	Dallas, GEECO Sls. Co.	214-341-0610
TX	Dallas, Wes Garde Components	214-357-1768
WI	Grafton, Lakeview Elctrns.	414-377-8250
Can	Downsview, Ont., Westburne Elctrns.	416-635-2950

OSRAM SYLVANIA, 275 West Main St., Hillsboro, NH 03244, Tel: 603-464-5533, 603-464-5538 ..... **B•1190-1194**

OSTBY-BARTON TEST PROBES, 487 Jefferson Blvd., Warwick, RI 02886, Tel: 401-739-7310, TELEX: 927573, TWX: 401-732-4937; Empl.: 75; *Sls. Mgr.:* Joe Burns

OTTO CONTROLS

FAX: 708-428-1956

OTTO CONTROLS, Otto Engineering, 2 E. Main St., Carpentersville, IL 60110, Tel: 708-428-7171; FSC No.: 21649; Empl.: 160; *Sls. Mgr.:* R. E. Sparks ..... **B•1798-1799**

Local Sales Offices & Reps

AZ	Scottsdale, Advent Comps. Corp.	602-481-0044, FAX:602-481-0072
CA	Anaheim, Gabriel & Assocs.	714-666-0660, FAX:714-666-0753
CA	San Jose, Westron Assocs.	408-264-4070, FAX:408-264-1808
CO	Denver, Advent Comps. Corp.	303-455-1985, FAX:303-455-0900
FL	Orlando, S. Atlantic Comp. Sls.	407-857-3650, FAX:407-857-3298
GA	Alpharetta, Pinnacle Marketing Inc.	404-410-9980, FAX:404-410-9981
IL	Itasca, LTD Technlgs., Inc.	708-773-2900, FAX:708-773-0358
IN	Ft. Wayne, Menze Sls., Inc.	219-747-5616, FAX:219-747-3561
KS	Prairie Vlg., Spectrum Sls.	913-648-6811, FAX:913-648-6823
MD	Gaithersburg, Naudain Assocs. Southern, Inc.	301-258-5040,FAX:301-258-5146
MA	Norwell, Norris & Assocs.	617-659-7988, FAX:617-659-8172
MI	Royal Oak, Hilltronics Inc.	313-435-0920, FAX:313-435-3215
MN	Minneapolis, Josco Melius Inc.	612-861-3343, FAX:612-861-3046
MO	Florissant, Spectrum Sls.	314-921-1313, FAX:314-921-0701
NJ	Hackensack, Coakley, Boyd & Abbett	201-440-4114,FAX:201-440-4623
NJ	Marlton, Naudain Assocs., Inc.	609-983-5300, FAX:609-596-5367
NY	Skaneateles, Empire Technical Assocs.	315-685-5703,FAX:315-685-5979
NC	Raleigh, Pinnacle Mktg., Inc.	919-848-0404, FAX:919-848-0101
OH	Beavercreek, Electro Com (U.S. Gov't. Sls)	513-427-2696,FAX:513-427-2697
TX	Dallas, Control Comps. Corp.	214-458-8877, FAX:214-788-1259
WA	Kirkland, James Findlay Co.	206-822-1510, FAX:206-822-0359
WI	Mequon, Badgerep, Inc.	414-241-9200, FAX:414-241-8300
Can	Etobicoke, Ont., Millennium Mktg.	416-798-3044

Local Distributors

AZ	Phoenix, Beswitched	602-275-4805, FAX:602-275-4807
AZ	Tempe, LCOMP	602-730-1633,FAX:602-831-8757
AZ	Tuscon, Beswitched	602-792-2554
CA	Cupertino, Cal Switch	408-973-7800, FAX:408-725-8885
CA	Gardena, Cal Switch	310-770-2330, FAX:310-327-2741
CA	Hayward, TPS Aviation	510-475-1010, FAX:510-475-8817
CA	Los Angeles, Electric Switches, Inc.	213-660-1310, FAX:213-660-5130
CA	Santa Ana, Norstan Elctrns.	714-540-4165, FAX:714-250-0135
CO	Aurora, Jet Elctrn. Supply Co., Inc.	303-364-1000, FAX:303-364-0800
CT	Wallingford, Sager Elctrl. Supp.	203-265-4600
FL	Lakeland, Wes-Garde Comps.	813-644-7564, FAX:813-644-1722
FL	Orlando, Sager Elctrns.	407-354-1130, FAX:407-354-1137
FL	Pompano Beach, Peerless Radio Corp.	305-973-4141,FAX:305-977-4273
GA	Atlanta, Peerless Radio	404-612-9090, FAX:404-612-0242
GA	Norcross, Sager Elctrns.	404-446-0085
IL	Addison, LCOMP	708-628-1400, FAX:708-628-1400
IL	Carol Stream, Wes-Garde Comps. Grp.	708-653-1460,FAX:708-653-1491
KS	Wichita, Airtechnics, Inc.	316-267-2849, FAX:316-267-1482
MD	Columbia, Peerless Radio Corp.	800-225-0709
MD	Columbia, Sager Elctrns.	301-995-4900, FAX:301-381-9380
MD	Kensington, Marine Air Supp.	301-949-9560, FAX:301-942-1536
MD	Owings Mills, Miltech Elctrns.	410-356-3200, FAX:410-356-0967
MA	Hingham, Sager Elec. Supp.	617-749-6700, FAX:617-749-3842
MI	Grand Rapids, RM Elctrns.	616-531-9300, FAX:616-531-2990
MI	St. Clair Shores, Spemco	313-771-2700, FAX:313-771-3491
MO	Kansas City, LCOMP	816-241-0111, FAX:816-241-7373
MO	Maryland Heights, LCOMP	314-291-6200, FAX:314-298-7231
NH	Salem, Sager Electrl. Supply	603-898-1348
NY	Hauppauge, Sager Elctrns.	516-348-1300, FAX:516-348-1006
NY	Lynbrook, Peerless Radio Corp.	516-593-2121, FAX:516-593-2179
NY	Rockville Centre, Advantage Elctrns.	516-678-6956,FAX:516-678-7966
NC	Raleigh, Sager Elctrns.	919-850-9550
OH	Dayton, Stotts Friedman/Sager	513-298-5555, FAX:513-298-3046
PA	Mars, Sager Elctrns.	412-772-2233
PA	Philadelphia, Sager Elctrns.	215-464-4336, FAX:215-464-4079
TX	Dallas, Associated Aircraft Supp.	214-331-4381, FAX:214-339-9840
WI	Milwaukee, Progressive Image Inc.	414-321-4722, FAX:414-321-4665
Can	St. Laurent, Que., Ferrotronic Comps. Inc.	514-333-7288,FAX:514-333-2881

OTTOTEK DIVISION OF IMC

FAX: 602-790-2808

OTTOTEK, IMC, 4016 E. Tennessee St., Tucson, AZ 85714, Tel: 602-748-7900; *Sls. Mgr.:* Otto H. Fest, Jr. ..... **D•1364-1367**

Local Sales Offices & Reps

AZ	Tucson, IMC-OTTOTEK	602-748-7900
MA	Wilbraham, NEDT	413-596-8823
MI	Warren, Burcaw Co.	313-573-4605
MI	Wyoming, Burcaw Co.	616-532-2756
EXP	Tucson, AZ, OTTOTEK, Div. of IMC	602-748-7900

Local Distributors

AL	Birmingham, Brownell Electro, Inc.	205-332-3375
AL	Mobile, Brownell Electro, Inc.	205-479-5406
CO	Aurora, R&R Instrmn.	303-340-8728
CO	Denver, Brownell Electro, Inc.	303-333-3541
FL	Miami, Brownell Electro, Inc.	305-884-3197
FL	Orlando, Brownell Electro, Inc.	407-843-6771
GA	Forest Pk., Brownell Electro, Inc.	404-362-9009
IL	Chicago, Data Elctrns.	312-283-0674
IL	Wood Dale, Brownell Electro, Inc.	708-616-8770
MA	Woburn, Brownell Electro, Inc.	617-935-7820
MN	Edina, Brownell Electro, Inc.	612-942-8172
MO	Manchester, Universal Precision Instrs.	314-394-4693
NJ	Edison, Brownell Electro, Inc.	908-287-2030
NY	New York, Brownell Electro, Inc.	212-924-6000
NY	Rochester, Masline Elctrns.	716-546-5373
NC	Charlotte, Brownell Electro, Inc.	704-597-1270
NC	Raleigh, Brownell Electro, Inc.	919-876-6524

OR Portland, Brownell Electro, Inc. 503-226-3286
PA Bridgeville, Brownell Electro, Inc. 412-221-0075
PA Trevose, Brownell Electro, Inc. 215-364-1401
SC Columbia, Brownell Electro, Inc. 803-772-6111
TN Knoxville, Brownell Electro, Inc. 615-966-3441
TN Nashville, Brownell Electro, Inc. 615-885-1302
TX Grand Prairie, Brownell Electro, Inc. ... 214-988-0821
TX Lubbock, Brownell Electro, Inc. 806-747-0211
UT Salt Lake City, Brownell Electro, Inc. .. 801-262-8498
VA Bluefield, Brownell Electro, Inc. 703-322-3402
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EXP Tucson, AZ, OTTOTEK Div. of IMC ... 602-748-7900
Can Brampton, Ont., Mod-Tronic Inst. Ltd. .. 416-457-6322
Can Burlington, Ont., Tempotech Controls 416-336-3400
Can Langley, B.C., Vaiax Ltd. 604-530-3189
Can Scarborough, Ont., Banke Elctrns. 416-292-5152

OUPIIN AMERICA, INC., 65 W. Easy Street 201, Simi Valley, CA 93065, Tel: 805-520-0862, FAX: 805-520-0864; *Sls. Mgr.:* Randy Ryan

OUTLAND TECHNOLOGY INC., 1808-B Faith Pl, Gretna, LA 70056, Tel: 504-367-0104, FAX: 504-367-6754; Empl.: 4; *Sls. Mgr.:* George J. Mayfield; *Dist. Mgr.:* George J. Mayfield

OVENAIRE-AUDIO-CARPENTER, Oak Crystal Inc., 706 Forrest St., Charlottesville, VA 22901, Tel: 804-977-8050, TWX: 910-997-8053, FAX: 804-295-7265; FSC No.: 12020; Empl.: 190; *Sls. Mgr.:* Robert J. Mete

OVEN INDUSTRIES, 207 Hempt Rd., P.O. Box 290, Mechanicsburg, PA 17055, Tel: 717-766-0721, FAX: 717-766-4786; FSC No.: 21302; Empl.: 48; *Sls. Mgr.:* T. M. Nolan

OXLEY INC., 25 Business Pk. Dr., P.O. Box 814, Branford, CT 06405, Tel: 203-488-1033, FAX: 203-481-6971; FSC No.: 3R006; *Sls. Mgr.:* Carol Carr

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MA Needham, Com Sls. 617-444-8071

Local Distributors
CT Danbury, Pilgrim 203-792-7274
FL Melbourne, T. C. Pridmore 305-727-2491
IL Hillside, Schuten Elctrns. 312-449-5430
IL Rosemont, Advent Elctrns. 312-297-6200
IL Wood Dale, NEP Elctrns. 708-595-8500
IN Indianapolis, Advent Elctrns. 317-872-4910
IN Indianapolis, M.A.R. Elctrns. 317-633-6699
IA Cedar Rapids, Advent Elctrns. 319-363-0221
MI Farmington Hills, Advent Elctrns. 313-477-1650
NH Atkinson, Astrum Elctrns. 603-898-3399
NH Salem, Diamond Elctrns. 603-894-4420
TX Richardson, CTC 214-437-2211
WI Neguon, Lakeview 414-377-8250
WA Redmond, Priebe Elctrns. 800-426-9911

PACE, INC., 9893 Brewers Ct., Laurel, MD 20723-1990, Tel: 301-490-9860, TELEX: 198296, FAX: 301-498-3252; *Sls. Mgr.:* James K. Bausell

PACER INDUSTRIES, INC., 1450 First Ave., Chippewa Falls, WI 54729, Tel: 715-723-1141, FAX: 715-723-7890; FSC No.: 60162; Empl.: 7; *Sls. Mgr.:* Patrick Brennan; *Dist. Mgr.:* Patrick Brennan

PACER SYSTEMS, INC., 900 Technology Park Dr., Billercia, MA 01821, Tel: 508-667-8800, FAX: 508-663-5155; Empl.: 325; *Sls. Mgr.:* E. Childress

PACIFIC ATLANTIC ELCTRNS., Patronix, Inc., Box 754, El Cerrito, CA 94530, Tel: 510-237-5837, FAX: 510-524-9267; Empl.: 4; *Sls. Mgr.:* P. Yen; *Dist. Mgr.:* P. Yen

PACIFIC COAST CIRCUITS, INC., 189 Granada Dr., San Luis Obispo, CA 93401, Tel: 805-544-4881, FAX: 805-544-6475; FSC No.: 66107; Empl.: 18; *Sls. Mgr.:* Chris Cofer

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PACIFIC ELECTRO DYNAMICS, INC., 11465 Willows Rd. N.E., Redmond, WA 98073-9745, Tel: 206-881-1700, TWX: 910-449-2977; Empl.: 420

PACIFIC INDUSTRIAL COMPONENTS CORP., See Altair Exchange Corp.

PACIFIC INDUSTRIAL COMPONENTS CORP., 24907 Avenue Tibbets Unit-C, Valencia, CA 91355, Tel: 805-257-7901, FAX: 805-257-6490; *Sls. Mgr.:* Ray Pross ..... **B•1104**

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PACIFIC INSTRUMENTS INC., 215 Mason Circle, Concord, CA 94520, Tel: 510-827-9010, FAX: 510-827-9023; Empl.: 30

PACIFIC MICROCOMPUTERS, Fairway Optical Data Sys., Inc., 2440 Grand Ave. Ste. C, Vista, CA 92083, Tel: 619-727-9494, FAX: 619-727-9499; Empl.: 15; *Sls. Mgr.:* Guy Halac

PACIFIC MICROTRONICS CORP., 435 E. 79th St., New York, NY 10021, Tel: 212-517-5622, FAX: 212-517-5516; *Sls. Mgr.:* S. Miliziano; *Dist. Mgr.:* E. Dietz

PACIFIC POWER SOURCE CORP., 15122 Bolsa Chica St., Huntington Bch., CA 92649, Tel: 714-898-2691, 800-854-2433, FAX: 714-891-1928; FSC No.: 57148; Empl.: 50; *Sls. Mgr.:* Russ Engle ..... **D•2286-2290**

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CA Santa Clara, Amasco Corp. 408-987-7760
CA Torrance, Amasco Corp. 310-781-9494
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CT Mt. Carmel, Sci. Dvcs. 203-248-9361
FL Melbourne, W.A. Brown Instrs. 407-723-0766
FL Orlando, W.A. Brown Instrs. 407-648-9660
GA Norcross, W.A. Brown Instrs. 404-449-7160
ID East, Zeus Elctrns., Inc. 800-528-4512
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IL Elmhurst (N), Sector Eng. Sls. Inc. 708-530-7850
IN Indianapolis, Sector Eng. Sls., Inc 317-253-9221
KS Merriam, TecRep Corp. 913-262-9500
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MI Plymouth, EQS Sys. 313-455-7920
MN Minnetonka, Elctrn. Instrs. 612-933-7793
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NY Liverpool, Northern Tech. Sls. Assocs., Inc. 315-451-1091
NY Wantagh, Bytec Reps. 516-781-7400
NC Cary, W.A. Brown Instrs. 919-460-1120
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PA Wexford, EQS Sys. 412-935-0455
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TX Round Rock, Beacon Microwave 512-244-6675
UT Salt Lake City, Zeus Elctrns. Inc. 801-534-0500
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CA San Jose, Corntech Mktg. 408-294-5448

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IL Bolingbrook, John Nelson 708-852-9908
MA South Easton, Maurice Raymond 508-238-9283
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OH Perrysburg, Bruce Brown 419-874-1110
PA Philadelphia, Jim Bowdler 215-365-8400
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CA Milpitas, Zack Elctrns. 408-942-5432
CA San Jose, Quement Elctrns. 408-998-5355
CA San Jose, Rose Elctrns. 408-943-0200
CA Santa Clara, Force Elctrns. 408-748-1342
CA Sunnyvale, Fry's Elctrns. 408-733-1770
CO Aurora, Jet Elctrns. 303-364-1000
CO Littleton, Display's Plus 303-730-7333
CT Wallingford, Midstate Elctrns. 203-265-9900
CT Wallingford, Sager Elec. Supp. 203-265-6865
FL Largo, Electronic Precepts of FL. 800-367-4649
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MA Hingham, Sager Elec. Supp. 617-749-6700
MA Westborough, In-Stock Products Co. .. 800-225-3018
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MI Livonia, RS Elctrns. 313-525-1155
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MN Roseville, Parts I 612-633-8079
MO Kansas City, Walters Indl. Elctrns. 816-531-7015
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NE Lincoln, Scott Elctrns. 402-466-8221
NH Salem, Sager Elctrl. Supp. 603-898-1348
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NY Rochester, Summit Distr. 716-334-8110
NC Raleigh, Sager Elec. Supp. 919-850-9550
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TX	Ft. Worth, Allied Elctrns.	800-433-5700
TX	Ft. Worth, Tandy Natl. Pts.	800-322-3690
TX	Richardson, Off-the-Shelf Comps.	214-238-0808
TX	Richardson, Off-the-Shelf Comps.	214-247-0052
TX	Tomball, Wofford Elctrns.	713-351-2255
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VA	Charlottesville, Virginia Elctrn. Comps.	804-296-4184
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Can	Pointe Claire, Que., Future Elctrns.	514-694-7710
Can	Vancouver, BC, Future Elctrns.	604-294-1166

PADS SOFTWARE, INC., 119 Russell St., Littleton, MA 01460, Tel: 508-486-9521, FAX: 508-486-8217; Empl.: 46; *Sls. Mgr.:* Donna Andersson, Telesls. Mgr.; *Dist. Mgr.:* Sandra Jarry, Dir. of Sls., N.A.

PAINE CORPORATION, 2401 S. Bayview St., Seattle, WA 98144, Tel: 206-329-8600, 800-426-0366, FAX: 206-329-1615; FSC No.: 13624; Empl.: 96; *Sls. Mgr.:* John Sagvold, Steve Evans

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PALOMAR ENGINEERS, Box 462222, Escondido, CA 92046, Tel: 619-747-3343, FAX: 619-747-3346; Empl.: 9

PAMRAN INC., 1900 Williams St., Young Ind. Pk., Racine, WI 53404, Tel: 414-637-7999, FAX: 414-637-2303; FSC No.: K 8-67203; Empl.: 28; *Sls. Mgr.:* R. C. Pfeil

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Panasonic Industrial Company

FAX: 201-392-4782

PANASONIC INDUSTRIAL CO., Battery Sales GP, Box 1511, Secaucus, NJ 07096-1511, Tel: 201-348-5266; Empl.: 25 ..... **D•1457**

Local Sales Offices & Reps

CA	Glendale, Halbar Assocs. Inc.	818-906-3941
CA	San Diego, Tauber & Assocs.	619-274-7242
MN	Eden Prairie, Electro Mark Inc.	612-944-5850
OH	Beachwood, Elctrn. Salesmasters inc.	216-831-9555

Local Distributors

AL	Huntsville, Resistacap Inc.	205-883-4270
AZ	Scottsdale, Electro Mktg.	602-991-0110
CA	San Diego, Tauber Elctrns. Inc.	619-274-7242
CA	San Jose, Rose Elec. Distrbg. Co.	408-943-0440
CA	Santa Clara, Cypress Elctrns. Inc.	408-980-2500
CA	Van Nuys, NESCO	818-781-0505
CO	Littleton, AVT	303-798-1958
FL	St. Petersburg, Micro Precision	813-854-2861
GA	Norcross, Applied Power, Inc.	404-263-0421
IL	Morton Grove, Power Pak Inc.	708-966-6000
IL	Palatine, Ohm Elctrns.	708-359-5500
MD	Beltsville, Mark Elctrns.	301-792-0072
MA	Canton, Impact Sls. Co. Inc.	508-668-8200
MI	Danvers, Generation Elctrns. Inc.	508-683-1177
MA	Sutton, Engrd. Assemblies, Inc.	508-865-0722
MI	Brighton, Applied Power Inc.	313-227-3604
MN	Thief River Falls, Digi-Key	800-344-4539
MN	Minneapolis, Stark Elctrns. Supp. Inc.	612-332-1325
NJ	Clifton, Engineered Assem.	201-288-4477
NC	Raleigh, Engrd. Assemblies Inc.	919-790-9700
OH	Columbus, Hughes-Peters	614-294-5351
OH	Columbus, Promark Elctrns. Inc.	614-351-2191
OR	Beaverton, Micro Power	503-626-7086
PA	McKean, Advacom, Inc.	814-476-7774
TX	Dallas, Computer Comps. Corp.	214-239-0271
TX	Dallas, Norvell Elctrns. Inc.	214-233-0020
TX	Fort Worth, Allied Elctrns.	817-595-3500
WI	Fond Du Lac, Fedco Elctrns., Inc.	414-922-6490
WI	Mequon, Taylor Elec. Co.	414-241-4321

PANASONIC INDUSTRIAL COMPANY, Custom Peripheral Dept., Two Panasonic Way, Secaucus, NJ 07094, Tel: 201-392-6313, FAX: 201-348-7849; *Dist. Mgr.:* Edmund Silvia Jr., Prod. Mgr.

PANASONIC INDUSTRIAL CO., 1616 McCandless Dr., Milpitas, CA 95035, Tel: 408-946-7200, FAX: 408-946-3753

PANASONIC INDL. CO. STANDARD COMPS. SECTOR, Matsushita Elec. Corp. of America, Two Panasonic Way Panazip: 7H-4, Secaucus, NJ 07094, Tel: 201-392-4818, FAX: 201-392-6263; FSC No.: 54473; Empl.: 60; *Sls. Mgr.:* Hank Miyai; *Dist. Mgr.:* Dick Robert

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PANEL COMPONENTS CORP., 100 Interpower Ave., Oskaloosa, IA 52577, Tel: 515-673-0097; Empl.: 30 ..... **A•2443; B•1376-1377; C•1426-1438, 1793-1801; D•2291**

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CA	Santa Clara, Ross Mktg. Assoc.	408-988-8111
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FL	Altamonte Springs, DHR Mktg. Inc.	407-331-1199
GA	Duluth, DHR Mktg., Inc.	404-564-0529
IL	Northbrook, Raines & Assocs.	708-498-0890
IN	Indianapolis, Rockford Controls	317-846-7415
IA	Marion, M-S-B Assocs., Inc.	319-377-6261
KS	Roeland Park, M-S-B Assocs., Inc.	913-432-2131
MD	Frederick, Glasscock Assoc.	301-694-5048
MA	Scituate, Olsen Tech. Sls.	617-545-5101
MN	St. Paul, Arkco Sls.	612-777-7454
MO	St. Louis, M-S-B Assocs., Inc.	314-946-5577
NJ	Kenvil, CFE/Gray	201-927-6662
NM	Albuquerque, C.T. Carlberg & Assoc.	505-899-2155
NY	Victor, Net Sls.	716-924-1844
NC	Raleigh, DHR Mktg., Inc.	919-829-1970
OH	Medina, Rockford Controls	216-725-3705
OR	McMinnville, Electro-Design	503-472-0481
PA	Philadelphia, Eastern Sci. Mktg.	215-368-4570
PA	Pittsburg, Rockford Controls Ohio	412-331-0306
SC	Greenville, DHR Mktg. Inc.	803-235-3594
TN	Nashville, DHR Mktg.	615-331-2745
TX	Lewisville, Jim Hughes Co.	214-221-1536
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PANELTEC, 3307 Edward Ave., Santa Clara, CA 95054, Tel: 408-496-1175, FAX: 408-970-1277; Empl.: 105; *Sls. Mgr.:* Daniel Johnston

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CA Dana Point, Papst Mechatronic Corp. 714-661-1447
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CA Montrose, Luscombe Engrg. Co. of So. Calif. 818-249-9000
CA Mountain View, Papst Mechatronic Corp. 415-903-9311
CA San Diego, Luscombe Engrg. Co. of So. Calif. 619-689-0018
CO Englewood, Quorum 3 303-799-8100
CT Meriden, Delta Conn 203-634-8558
FL Altamonte Springs, Over & Over, Inc. 407-332-1222
GA Norcross, Over & Over, Inc. 404-449-6205
IL Arlington Heights, Brainard-Nielsen Mktg. 708-437-2700
IL Arlington Heights, Papst Mechatronic Corp. 708-981-1404
IL Arlington Hgts., Brainard-Nielsen Mktg. 708-437-2700
IA Marion, MSB Assocs. Inc. 319-377-6261
KS Shawnee Mission, MSB Assocs., Inc. 913-432-2131
MA Framingham, Papst Mechatronic Corp. 508-875-8986
MA Needham, Sturgeon Tech. Sls. 617-444-6603
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NJ Cherry Hill, Trinkle Sls., Inc. 609-795-4200
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NY Syracuse, Leonard D. Allen, Inc. 315-437-8387
NY Yaphank, C.F.E. Gray Assocs., Inc. 516-924-2471
NC Charlotte, Over & Over, Inc. 704-542-9111
OH Beachwood, Elctrn. Salesmasters, Inc. 216-831-9555
OR Portland, Venture Elctrns. 503-624-0617
PA Knoxville, Trinkle Sls., Inc. 215-922-2080
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WA Bellevue, Venture Elctrns. 206-454-4594
WI Manitowoc, Brainard-Nielsen Mktg. 414-682-1201

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PARA-LINE TRANSFORMER CO., INC., 511 South Palm Ave., Alhambra, CA 91803, Tel: 818-281-0222, FAX: 818-281-5867; FSC No.: 59465 ..... **A•2444**

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PARKER HANNIFIN CORP, Parflex Div., 1300 N. Freedom Street, Ravenna, OH 44266, Tel: 216-296-2871, FAX: 216-296-8433

PARKER HANNIFIN CORP., Pneumatic Division, 8676 E M-89, Richland, MI 49083, Tel: 616-629-5000, FAX: 616-629-5385

PARKER HANNIFIN CORP., Refrigerating Specialties Division, 2445 South 25th Ave., Broadview, IL 60153, Tel: 708-681-6300, FAX: 708-681-6306

PARKER HANNIFIN CORPORATION, Rotary Actuator Division, 135 Quadral Dr., Wadsworth, OH 44281-0450, Tel: 216-336-3511, TELEX: 216-334-3335

PARKER HANNIFIN CORP., Schrader Bellows Division, 257 Huddleston Avenue, Cuyahoga Falls, OH 44221, Tel: 216-923-5202, FAX: 1-800-426-3259

PARKER HANNIFIN CORPORATION, Seal Grp., 18321 Jamboree Rd., Irvine, CA 92715, Tel: 714-833-3000, FAX: 714-851-2127

PARKER HANNIFIN CORP., Tube Fittings, 3885 Gateway Blvd., Columbus, OH 43228, Tel: 614-279-7070, FAX: 614-279-7685

PARLEX CORPORATION, 145 Milk St., Methuen, MA 01844, Tel: 508-685-4341, FAX: 508-685-8809; FSC No.: 18377; Empl.: 375; *Sls. Mgr.:* Robert D. Cyr

SINCE 1922

FAX: 718-774-0583

PAR METAL PRODUCTS, INC., Par Industrial Complex, 1246 Atlantic Ave., Brooklyn, NY 11216, Tel: 718-774-5900, TELEX: 424 823 SNDS UI ATTN:PAR; FSC No.: 3449;3469; Empl.: 100; *Sls. Mgr.:* J. Troiano ..... **C•1069**

PARSONS MANUFACTURING, 1055 O'Brien Dr., Menlo Park, CA 94025-1476, Tel: 415-324-4726, FAX: 415-324-3051; Empl.: 45; *Sls. Mgr.:* S. Wurzer

PARSYTEC INC., Bldg. 9, Unit60, 245 W. Roosevelt Rd., West Chicago, IL 60185, Tel: 708-293-9500, FAX: 708-293-9525; Empl.: 7; *Sls. Mgr.:* Reinhard Rinn

PARVEX SERVO SYSTEMS, GEC Alsthom International, Inc., 4 Skyline Dr., Hawthorne, NY 10532, Tel: 914-345-5150, FAX: 914-345-5295

PASO SOUND PRODUCTS, 14 First St, Pelham, NY 10803, Tel: 914-738-4800, FAX: 914-738-3954; Empl.: 18; *Sls. Mgr.:* Ken O'Brien

PASS & SEYMOUR CANADA, INC., Legrand, 448 North Rivermede Rd., Concord, Ont L4K 3M9, Tel: 416-738-9195, FAX: 416-738-9721; Empl.: 40; *Sls. Mgr.:* Dennis Conard

PASS & SEYMOUR/LEGRAND, Pass & Seymour/Inc., P.O. Box 4822, Syracuse, NY 13221, Tel: 315-468-6211, TELEX: 93-7232, FAX: 315-468-6305; Empl.: 1700; *Sls. Mgr.:* Sergio Palluci, Sls. Mgr./Kristin Northrop, Prod. Mgr.

PASTERNACK ENTERPRISES, P.O. Box 16759, Irvine, CA 92713, Tel: 714-261-1920, FAX: 714-261-7451; FSC No.: 53919; *Sls. Mgr.:* Elayne Wilson

PATTON-MACGUYER INC., 17 Virginia Ave., Providence, RI 02905, Tel: 401-941-6000, FAX: 401-941-5290; FSC No.: 77147; Empl.: 45; *Sls. Mgr.:* F. Spunzo

PAVE TECHNOLOGY CO., INC., 2751 Thunderhawk Ct., Dayton, OH 45414-3445, Tel: 513-890-1100, FAX: 513-890-5165; Empl.: 35

PAYNE ENGINEERING, Box 70, Scott Depot, WV 25560, Tel: 304-757-7353, TELEX: 88-5452, FAX: 304-757-7305; Empl.: 40; *Sls. Mgr.:* R. B. Vogelbach

PCA ELECTRONICS, 16799 Schoenborn St., Sepulveda, CA 91343, Tel: 818-892-0761, TWX: 910-496-1525, FAX: 818-894-5791; FSC No.: 97722; Empl.: 45; *Sls. Mgr.:* Nand Aggarwal ..... **A•1572-1575, 1668-1671; D•1854-1856**

Local Sales Offices & Reps

AL Huntsville, Southeast Tech. Grp. 205-534-2376
AZ Phoenix, Toward Engrg. Assocs. 602-955-3193
CA Mission Viejo, Ramsey & Assocs. 714-380-7757
CA San Diego, Ramsey & Assocs. 619-451-8865
CA San Jose, Arnold Techn. Sls. 408-954-0400
FL Clearwater, Sunland Assocs. 813-536-2955
FL Goldenrod, Sunland Assocs. 305-365-9533
FL Lauderhill, Sunland Assoc. 305-561-1303
GA Lawrenceville, Southeast Tech. Grp. 404-979-2055
IL Elk Grove, W.G. Brouillette 708-290-1313
MA Sudbury, KSA of New England 508-443-5881
MN Bloomington, Bill Deming and Assocs. 612-888-5000
MS Meridan, Southeast Tech. Grp. 601-485-7055
NC Zebulon, Southeast Tech. Grp. 919-269-5589
OH Beavercreek, Electro-Com 513-427-2696
OH Mansfield, Electro-Com 419-756-5846
OR Beaverton, Elctrn. Comp. Sls. 503-245-2342
PA Exton, Linear Sls. 215-524-8080
TX Richardson, Blackburn Assocs. 214-238-8181
UT Salt Lake City, Luscombe Engrg. 801-268-3434
WA Mercer Island, Elctrn. Comp. Sls. 206-232-9301

Local Distributors

CA San Jose, Spectra Elctrns. 408-452-1590
CA Sherman Oaks, DLDI-Delay Lines Distrs. 818-986-9455
MA Sudbury, ASK Elctrns. 508-443-5881
PA Exton, VSH Elctrns. 215-363-2250

P.C. BOARDS, INC., 210 West Main, Chanute, KS 66720, Tel: 316-431-0406, FAX: 316-431-2013; Empl.: 73; *Sls. Mgr.:* Greg Bilyeu

PCB PIEZOTRONICS, 3425 Walden Ave., Depew, NY 14043-2495, Tel: 716-684-0001, TWX: 710-263-1371, FAX: 716-684-0987; Empl.: 210

PCD, 2 Technology Dr., Peabody, MA 01960, Tel: 508-532-8800, FAX: 508-532-6800; FSC No.: 58982; *Sls. Mgr.:* A. Arcisz

Local Sales Offices & Reps

AL Huntsville, REP, Inc. 205-881-9270
AZ Tempe, Elctrn. Dev. & Sls. 602-438-1547
CA San Diego, Qualtronics, Inc. 619-695-0118
CA San Jose, Kottmeier Assocs., Inc. 408-371-8700
CA Woodland Hills, Precision Connector Designs, Inc. 818-884-7171
FL Tampa, APM Assocs. 813-886-2457
GA Tucker, REP, Inc. 404-938-4358
IL Elk Grove Vlg., Control Sls. 708-595-2110
MA Sharon, S & Y Elctrns., Inc. 617-784-6437
MN Minneapolis, Electro-Tech Assocs., Inc. 612-853-0242
MO St. Louis, Harris Hanson 314-432-3611
NC Morrisville, REP, Inc. 919-469-9997
OH Miamisburg, Elctrn. Comps., Inc. 513-866-3340
PA Harrisburg, All-Tech Mktg., Inc. 717-540-1204
PA West Chester, All-Tech Mktg., Inc. 215-344-0134
TN Jefferson City, REP, Inc. 615-475-9012
TX Irving, AID Elctrns. 214-790-4761
WI Brookfield, Control Sls. 414-797-9500

P C EXPRESS, INC., 15103 U.S. Hwy. 19, Hudson, FL 34667, Tel: 813-863-6114; Empl.: 15

PCI LTD., 1530 Parkmoor Ave.-Ste. A, San Jose, CA 95128, Tel: 408-282-0200, FAX: 408-282-0216; Empl.: 2500; *Sls. Mgr.:* Mike Clarke; *Dist. Mgr.:* Jane Campbell

PCK ELASTOMERICS, INC., See Elastomeric Technologies, Inc.

PC TRANSFORMER CORP., 64 D Nancy St., West Babylon, NY 11704, Tel: 516-491-3300, FAX: 516-491-3689; FSC No.: 62281; Empl.: 15; *Sls. Mgr.:* Stanley L. Goldstein ..... **A•2445-2453**

PDS TECHNOLOGIES, See Power-Pac

PEARL TECHNOLOGY, 2988-A Scott Blvd., Santa Clara, CA 95054, Tel: 408-996-9823, FAX: 408-253-2287

PEARSON ELECTRONICS, INC., 1860 Embarcadero Rd., Palo Alto, CA 94303, Tel: 415-494-6444, TELEX: 171-412, FAX: 415-494-6716; FSC No.: 05280; Empl.: 16; *Sls. Mgr.:* Stacey Evensen ..... **A•2454**

PECA, INC., 592 Winks Lane, Bensalem, PA 19020, Tel: 215-245-1550, FAX: 215-639-3545; Empl.: 30; *Sls. Mgr.:* Joanne Fields

THE PEDRO COMPANIES, 104 E. 10th St., St. Paul, MN 55101, Tel: 612-224-9491, FAX: 612-224-8674; Empl.: 100; *Sls. Mgr.:* Douglas Bieniek

PENBERTHY, INC., 320 Locust St., Prophetstown, IL 61277, Tel: 815-537-2311, TWX: 257-339 PMCO PRWN, FAX: 815-537-5764; Empl.: 160

PENN ENGINEERING & MANUFACTURING CORP., 5190 Old Easton Rd. PO Box 1000, Danboro, PA 18916, Tel: 215-766-8853, 800-237-4736, FAX: 215-766-0143; FSC No.: CAGE 46384; Empl.: 950; *Sls. Mgr.:* John E. O'Brien; *Dist. Mgr.:* Ed Soorikian

PENN KEYSTONE CORP., 30 N. Plains Ind. Ste.13, Wallingford, CT 06492, Tel: 203-294-0537, FAX: 203-294-0361; FSC No.: 03034; *Sls. Mgr.:* Robert Ginter

PENN-TRAN CORP.,SUB. OF SPECTRUM ELCTRNS. INC., Box 1321, Rte. 144N, Wingate, PA 16880, Tel: 814-355-1521, FAX: 814-355-1524; FSC No.: 50783; Empl.: 80; *Sls. Mgr.:* Jeffrey Krauss ..... **A•1260-1261; D•1857**

Local Sales Offices & Reps

CA	Los Altos, Cain-White & Co.	415-948-6533
CA	Pasadena, A-F Sls. Engrg., Inc.	909-599-4412
MA	Medfield, Nortech	508-359-6063
MN	Minneapolis, International Sls. Co.	612-831-8423
NC	Raleigh, Arthur Harris	919-460-8660
OR	Portland, Intertech Sls.	503-775-7885
PA	Glenside, Koebert Assocs., Inc.	215-887-2310
TX	Dallas, Seaton Corp.	214-980-9860

PENNY & GILES, 1640 Fifth Street, Suite 224, Santa Monica, CA 90401, Tel: 310-393-1497, FAX: 310-393-6040; *Dist. Mgr.:* Rose Riedel Prod. Mgr.

Penny+Giles

FAX: 508-226-5208

PENNY & GILES CONTROLS, INC., 163 Pleasant St., Attleboro, MA 02703, Tel: 508-226-3008; Empl.: 10; *Sls. Mgr.:* Dean T. Bushy ..... **A•2115**

PENNY & GILES DATA SYSTEMS, INC., 1250 Northmeadow Pkwy., Ste. 114, Roswell, GA 30076, Tel: 404-740-0415, FAX: 404-740-0420

PENNY TECHNOLOGIES, INC., 78 Kingsland Ave., Greenpoint, NY 11222, Tel: 718-782-4149, FAX: 718-963-2930; Empl.: 54; *Sls. Mgr.:* Jack Russell

PENRIL DATACOMM NETWORKS, 1300 Quince Orchard Blvd., Gaithersburg, MD 20878, Tel: 301-921-8600, FAX: 301-921-8376; Empl.: 240

PENSTOCK ENGINEERING LABS., Penstock, Inc., 520 Mercury Dr., Sunnyvale, CA 94086-4018, Tel: 408-730-0300, 800-PENSTOCK, FAX: 408-730-4782; Empl.: 60; *Sls. Mgr.:* Ken Wadors; *Dist. Mgr.:* Ken Wadors

Local Distributors

CA	Penstock Southern CA	1-800-PENSTOCK
CA	Sunnyvale, Penstock, Inc.	408-730-0300
CO	Penstock Rocky Mtn. Desert States	1-800-PENSTOCK
DE	Penstock Mid-Atlantic	1-800-PENSTOCK
FL	Penstock Florida	1-800-PENSTOCK
GA	Penstock South	1-800-PENSTOCK
IL	Penstock Midwest	1-800-PENSTOCK
MA	Penstock New England	1-800-PENSTOCK
NJ	Penstock East	1-800-PENSTOCK
TX	Penstock Texas	1-800-PENSTOCK
WA	Penstock Northwest	1-800-PENSTOCK
Can	Penstock Canada	1-800-736-7862

PENTA LABORATORIES, INC., 21113 Superior St., Chatsworth, CA 91311, Tel: 818-882-3872, 800-421-4213, TELEX: 95-4295 798, FAX: 818-882-3368; Empl.: 50; *Sls. Mgr.:* Richard Sanett

PENTICA SYSTEMS, INC., 19A Crosby Dr., Bedford, MA 01730, Tel: 617-275-4419, FAX: 617-275-6514; FSC No.: 04-2978461; Empl.: 6; *Sls. Mgr.:* Pete Kurpis

PERCON, INC., 1720 Willow Creek Circle, Ste. 530, Eugene, OR 97402-9153, Tel: 1-800-8-PERCON, 503-344-1189, FAX: 503-344-1399; Empl.: 32; *Sls. Mgr.:* Sls. Dept.; *Dist. Mgr.:* Doug Wilson, Dir. Mktg./Sls.

PERFECT GEAR & INSTRUMENT, Designatronics, Inc., 2101 Jericho Tpke, Box 5416, New Hyde Park, NY 11042-5416, Tel: 516-328-3300, TWX: 510-223-0642, FAX: 516-326-8827; Empl.: 210; *Sls. Mgr.:* Murray Ores

PERFECTION MICA CO., See Magnetic Shield Corp.

PERFORMANCE CONTROLS, INC., 433 Caredean Drive, Horsham, PA 19044, Tel: 215-675-6500, TELEX: 88-1478, FAX: 215-674-8714; FSC No.: 61773; Empl.: 40

PERFORMANCE ELECTRONIC PACKAGING SERVICES, 6354-B Corte Del Abeto, Carlsbad, CA 92009, Tel: 619-931-7824

PERFORMANCE MOTION DEVICES, 11 Carriage Dr., Chelmsford, MA 01824, Tel: 508-256-1913, FAX: 508-256-0206; Empl.: 6; *Sls. Mgr.:* Erik Valeur; *Dist. Mgr.:* Erik Valeur

PERFORMANCE SEMICONDUTOR CORP., 610 E. Weddell Dr., Sunnyvale, CA 94089, Tel: 408-734-8200

PERIPHERAL RESOURCES, 9911 W. Pico Blvd., Ste. B-215, Los Angeles, CA 90035, Tel: 310-552-3888, 800-533-2297, FAX: 310-552-2806; Empl.: 11; *Sls. Mgr.:* Bil Dwyer

PERIPHERALS, 1363 Logan Ave., Costa Mesa, CA 92626, Tel: 714-540-4925, 800-468-6888, FAX: 714-540-2026; Empl.: 20; *Sls. Mgr.:* Sandra Weller

PERMALUSTER, INC., 1844 N. Keystone St., Burbank, CA 91504, Tel: 213-849-4543, 213-849-6454, FAX: 818-566-4232; Empl.: 6; *Sls. Mgr.:* J. Ross

PERMA POWER ELCTRNS., 5601 W. Howard Ave., Niles, IL 60714, Tel: 312-763-0763, FAX: 312-763-8330; Empl.: 80/100; *Sls. Mgr.:* Michael Shatz; *Dist. Mgr.:* Michael Shatz

PERRY AMPLIFIER, 138 Fuller St., Brookline, MA 02146, Tel: 617-734-0844, FAX: 617-734-0844; Empl.: 14; *Sls. Mgr.:* N. Geskos

PERX,INC., 525 Tamal Plaza, Corte Madera, CA 94925, Tel: 415-927-0155, FAX: 415-927-0159; Empl.: 5

PETER PARTS & ASSOCS., 82 E. Main St., Webster, NY 14580, Tel: 716-265-2540, FAX: 716-265-2542; *Sls. Mgr.:* Peter Parts

PFC, See Southern Elctrns. Co. Inc.

P.G. ELECTRONICS LTD., 800 Arrow Rd., 8, Weston, Ont., Canada M9M2Z8, Tel: 416-741-7682, FAX: 416-741-9927; FSC No.: 38243

PHASETRONICS INC./MOTORTRONICS INC., 13214-38th St. North, Clearwater, FL 34622, Tel: 813-573-1900, FAX: 813-573-1803; Empl.: 400; *Sls. Mgr.:* Karen Alberts

PHELPS DODGE MAGNET WIRE, P.O. Box 600, Ft. Wayne, IN 46801, Tel: 219-458-4444, 800-255-CLIC (2542), FAX: 219-422-1667; Empl.: 1,000; *Sls. Mgr.:* D.R. Disque, Mktg. VP

PHENIX TECHNOLOGIES, Central Garrett Ind'l. Pk., Accident, MD 21520, Tel: 301-746-8118, FAX: 301-895-5570; Empl.: 45; *Sls. Mgr.:* Bill Robeson

PHILADELPHIA INSULATED WIRE CO. INC., General Cable Corporation, 4 Tesseneer Drive., Highland Heights, KY 40176, Tel: 606-572-8306, 800-257-8357, FAX: 800-547-8249; Empl.: 140; *Sls. Mgr.:* Michael F. Wells

PHILIPS AUDIO VIDEO SYS. CORP., See AKG Acoustics

PHILIPS CIRCUIT ASSEMBLIES, 3602 W. Waters Avenue, Tampa, FL 33614-2797, Tel: 813-933-5113, TELEX: 3727509, FAX: 813-932-1373; *Sls. Mgr.:* Keith Weil

Philips Components
Discrete Products Division
A North American Philips Company

FAX: 407-881-3300

PHILIPS COMPONENTS DISCRETE PRODUCTS DIVISION, A North American Philips Company, 2001 W. Blue Heron Blvd., Riviera Beach, FL 33404, Tel: 407-881-3200, TELEX: 136461, TWX: 810-848-0228; *Dist. Mgr.:* Jess Hall ..... **A•1144-1148, 2010-2012, 2150-2170; B•1015, 1336-1338, 1888-1889; D•1403**

Local Sales Offices & Reps

AL	Huntsville, Over & Over Inc.	205-837-7105
AZ	Tempe, Philips Comps.	602-820-2225
CA	Santa Clara, Technlg. Sls. Inc.	408-727-7200
CA	Signal Hill, Harper & Strong, Inc.	310-424-3030
CA	Sunnyvale, Philips Comps.	408-991-2294
CO	Englewood, Philips Comps.	303-779-9696
FL	Altamonte Springs, Over & Over, Inc.	407-339-5073
FL	Ft. Lauderdale, Over & Over, Inc.	305-485-0115
GA	Norcross, Over & Over, Inc.	404-449-6205
GA	Roswell, Philips Comps.	404-992-0150
IL	Libertyville, GMR Sls., Inc.	708-367-8440
IL	Rolling Meadows, Philips Comps.	708-670-9494
IN	Fort Wayne, Corrao Marsh, Inc.	219-482-2725
IN	Green Field, Corrao Marsh, Inc.	317-462-4446
IN	Kokomo, Philips Comps.	317-456-1615
IA	Cedar Rapids, Lorenz Sls., Inc.	319-377-4666
KS	Overland Pk., Lorenz Sls. Inc.	913-469-1312
KS	Wichita, Lorenz Sls., Inc.	316-721-0500
MA	Woburn, Philips Comps.	617-932-4748
MI	Farmington Hills, Philips Comps.	313-553-6010
MN	Minneapolis, Electric Comp. Sls., Inc.	612-933-2594
MO	St. Louis, Lorenz Sls., Inc.	314-997-4558
NE	Lincoln, Lorenz Sls., Inc.	402-475-4660
NJ	Englewood Cliffs, ED Glass Assocs.	201-592-0200
NJ	Parsippany, Philips Comps.	201-455-1507
NY	East Rochester, Empire Tech. Assoc., Inc.	716-381-8500
NY	Edwell, Empire Tech. Assocs., Inc.	607-754-8756
NY	Skaneateles, Empire Tech. Assoc., Inc.	315-685-5703
NC	Charlotte, Over & Over, Inc.	704-542-9111
NC	Raleigh, Over & Over, Inc.	919-876-7338
NC	Raleigh, Philips Comps.	919-782-3334
OH	Dayton, Philips Comps.	513-436-0066
OH	Wickliffe, Philips Comps.	216-731-7721
OR	Beaverton, Eclipse Mktg. Grp.	503-642-1661
PA	Willow Grove, Philips Comps.	215-659-6096
TN	Greenville, Philips Comps.	615-639-0251
TX	Austin, Philips Comps.	512-331-8828
TX	Houston, Philips Comps.	713-272-8086
TX	Richardson, Philips Comps.	214-231-8274
WA	Redmond, Eclipse Mktg. Grp.	206-885-6991
WA	Spokane, Eclipse Mktg. Grp.	509-922-3972
WI	New Berlin, Philips Comps.	414-785-6509
PR	Caparra Hgts., M. Anderson Co. Inc.	809-793-6544
Can	Scarborough, Ont., Philips Comps.	416-292-5161

PHILIPS COMPONENTS DISCRETE PRODUCTS DIV., A North American Philips Co., 1033 Kings Hwy., Saugerties, NY 12477, Tel: 914-246-2811, TWX: 510-247-5410, FAX: 914-247-0486,914-246-0487; FSC No.: 02114; *Sls. Mgr.:* B. Grindle

PHILIPS COMPONENTS DISCRETE PRODUCTS DIV., A North American Philips Co., 1440 W. Indiantown Rd., Jupiter, FL 33458, Tel: 407-744-4200, FAX: 407-863-1811; *Sls. Mgr.:* Bill Winther ..... **A•1144, 1147-1148; B•1015**

PHILIPS COMPONENTS DISCRETE PRODUCTS DIV., A North American Philips Co., 6071 St. Andrews Rd., Columbia, SC 29212-3198, Tel: 803-772-2500, TELEX: 805024, FAX: 803-772-2445; *Sls. Mgr.:* Bill Cvirko ..... **A•1145-1146**

DC Aluminum Electrolytic Capacitors(Computer Grade, Radial)Indl. & Consumer AC Motor Starts, Film Capacitors (Film/Foil, Metallized) Tantalum Capacitors (Foil) Film Trimmer Capacitors

PHILIPS COMPONENTS DISCRETE PRODUCTS DIVISION, Airport Road, P.O. Box 760, Mineral Wells, TX 76067, Tel: 817-325-7871, FAX: 817-325-1052; *Sls. Mgr.:* Richard Swingen ..... **A•2010-2012; B•1888-1889**

PHILIPS COMPONENTS DISCRETE PRODUCTS DIV., Professional Components Grp., 100 Providence Pike, Slatersville, RI 02876, Tel: 401-762-3800, FAX: 401-767-4493; FSC No.: 73445; *Dist. Mgr.:* Jeff Brooke-Stewart ..... **A•2150-2170**

PHILIPS COMPONENTS DISCRETE PRODUCTS DIV,, Discrete Semiconductor Group, 100 Providence Pike, Slatersville, RI 02876-2078, Tel: 401-762-3800, FAX: 401-767-4493 ..... **A•2150-2170; B•1336-1338**

PhilipsECG

A North American Philips Company

FAX: 717-323-4691

PHILIPS ECG, North American Philips Co., 1025 Westminster Dr., Williamsport, PA 17701, Tel: 717-323-4691; *Sls. Mgr.:* L.R. Brophy, Gen. Mgr. Mktg.; *Dist. Mgr.:* E. H. Frost ..... **A•2172-2173**

Local Sales Offices & Reps

CA	Byron, Philips ECG	510-634-9879
CA	Gardena, Bidwell Schwartz Assoc.	213-770-0300
FL	Ft. Lauderdale, Hawkins Frederickson Assoc.	305-321-6702

FL Maitland, Hawkins Frederickson Assoc. 407-831-2474
GA Atlanta, Millar Elctrns. 404-634-3350
MA Woburn, Philips ECG 617-932-4748
MI Farmington Hills, R.C. Merchant & Co. 313-476-4600
MO Kansas City, Philips ECG 816-741-4019
NY Seneca Falls, Philips ECG 315-568-5875
NC Raleigh, Millar Elec., Inc. 919-828-8840
OH Dayton, Philips ECG 513-436-0066
PA Emporium, JSH Sls. Co. 814-486-1311
TX Richardson, Philips ECG 214-231-8274
Can Dorval, Que., ECG Canada Inc. 514-685-5800

PHILIPS SEMICONDUCTORS, Philips Electroincs, 811 E. Arques Ave., P.O. Box 3409, Sunnyvale, CA 94088-3409, Tel: 408-991-2000, FAX: 408-991-2311; FSC No.: 1CH66; Empl.: 20,000; *Sls. Mgr.:* Jim Feijoo; *Dist. Mgr.:* Vinnie Bonanno

Philips Technologies
A Philips Electronics North America Company

PHILIPS

FAX: 203-271-6522

PHILIPS TECHNOLOGIES, North American Philips Corporation, 7 McKee Place, Cheshire, CT 06410, Tel: 203-271-6525; Empl.: 4000; *Sls. Mgr.:* R.F. Kamm

PHILIPS TECHNOLOGIES, Airpax Mechatronics Group, 604 West Johnson Ave., Cheshire, CT 06410, Tel: 203-271-6000, FAX: 203-271-6400; Empl.: 350; *Sls. Mgr.:* Ron Barbieri

PHILIPS TECHNOLOGIES, Airpax Protector Group, 807 Woods Road, Cambridge, MD 21613, Tel: 410-228-4600, FAX: 410-228-8910; FSC No.: 81541; Empl.: 1100; *Sls. Mgr.:* S. Monagham (CBS)/C. Tinley (MCPS) ..... **B•1378**

Local Sales Offices & Reps
AL Huntsville, BCI 205-539-4411
AZ Tempe, Westrep 602-820-9932
CA Anaheim, Westrep 714-527-2822
CA San Diego, Westrep 619-566-6580
CA San Jose, Philips Technlgs. 408-453-5129
CO Littleton, Lange Sls. 303-795-3600
GA Lawrenceville, BCI 404-962-6826
ID Boise, Lange Sls., Inc. 208-323-0713
IL Lake Zurich, Somers-Stanton, Inc. 708-438-2999
IN Indianapolis, Philips Technlgs. 317-573-9911
IA Cedar Rapids, Rep Assocs. 319-373-0152
MA Westborough, Philips Technlgs. 508-366-7313
MI Farmington Hills, Philips Technlgs. 313-553-6030
MN Eagan, Philips Technlgs. 612-683-9007
NY Rochester, Philips Technlgs. 716-654-7470
NY Syosset, Philips Technlgs. 516-364-1217
OH Dayton, Baehr, Greenleaf 513-439-0724
OH Westlake, Baehr, Greenleaf 216-892-1770
OR Beaverton, Philips Technlgs. 503-641-6130
PA Pittsburgh, Russell F. Clark 412-242-9500
TX Dallas, Philips Technlgs. 214-851-7433
UT Salt Lake City, Lange Sls. 801-487-0843
WI Wauwatosa, Larson Assocs. 414-258-0529

PHILIPS TECHNOLOGIES, Airpax Protector Group, Husky Park, Frederick, MD 21701, Tel: 301-663-5141, FAX: 301-698-0624; Empl.: 600; *Sls. Mgr.:* Fred Dietzel ..... **B•1891**

Local Sales Offices & Reps
AL Huntsville, B.C.I. 205-539-4411
AZ Tempe, Westrep 602-820-9932
CA Anaheim, Westrep 714-527-2822
CA San Diego, Westrep 619-566-6580
CA San Jose, Philips Technlgs. 408-453-5129
CO Littleton, Lange Sls. 303-795-3600
GA Lawrenceville, B.C.I. 404-962-6826
ID Boise, Lange Sls., Inc. 208-323-0713
IL Lake Zurich, Somers-Stanton Inc. 708-438-2999
IN Indianapolis, Philips Technlgs. 317-573-9911
IA Cedar Rapids, Rep Assocs., Inc. 319-373-0152
MA Westborough, Philips Technlgs. 508-366-7313
MI Farmington Hills, Philips Technlgs. 313-553-6030
MN Eagan, Philips Technlgs. 612-683-9007
NY Rochester, Philips Technlgs. 716-654-7470
NY Syosset, Philips Technlgs. 516-364-1217
OH Dayton, Baehr, Greenleaf & Assocs. 513-439-0724
OH Westlake, Baehr, Greenleaf & Assocs. 216-892-1770
OR Beaverton, Philips Technlgs. 503-641-6130
PA Pittsburgh, Russell F. Clark Co. 412-242-9500
TX Dallas, Philips Technlgs. 214-851-7433
UT Salt Lake City, Lange Sls. 801-487-0843
WI Wauwatosa, Larson Assocs. 414-258-0529

PHILIPS TECHNOLOGIES, Airpax Instruments, 150 Knotter Drive, Cheshire, CT 06410, Tel: 203-271-6000, TELEX: 962421, TWX: 710-455-4048, FAX: 203-271-6100; Empl.: 200; *Sls. Mgr.:* Ron Cimino ..... **D•1168**

Local Sales Offices & Reps
AZ Tempe, Westrep 602-820-9932
CA Anaheim, Westrep 714-527-2822
CA San Diego, Westrep 619-566-6580
CA San Jose, Philips Technlgs. 408-453-5129
CO Littleton, Lange Sls., Inc. 303-795-3600
ID Boise, Lange Sls, Inc. 208-323-0713
IL Lake Zurich, Somers-Stanton Inc. 708-438-2999
IN Indianapolis, Philips Technlgs. 317-573-9911
IA Cedar Rapids, Rep Assocs. 319-373-0152
MA Westborough, Philips Technlgs. 508-366-7313
MI Farmington Hills, Philips Technlgs. 313-553-6030
MN Eagan, Philips Technlgs. 612-683-9007
NY Rochester, Philips Technlgs. 716-654-7470
NY Syosset, Philips Technlgs. 516-364-1217
OH Dayton, Baehr, Greenleaf & Assocs. 513-439-0724
OH Westlake, Baehr, Greenleaf, & Assocs. 216-892-1770
OR Beaverton, Philips Technlgs. 503-641-6130
PA Warrendale, Baehr, Greenleaf & Assocs. 412-934-3088
TX Dallas, Philips Technlgs. 214-851-7433
UT Salt Lake City, Lange Sls. 801-487-0843
WI Wauwatosa, Larsen Assocs. 414-258-0529

Local Distributors
AL Birmingham, Dwight D. Prouty 205-988-8110
AL Mobile, Dwight D. Prouty 205-476-5056
CA Costa Mesa, FLW Inc. 714-751-7512
CA Santa Clara, MANCO 408-496-6611
CO Denver, Q.E.D., Inc. 303-825-5011
CT Milford, Motors & Drives, Inc. 203-877-6509
FL Ft. Lauderdale, Indl. Instrs. 305-971-0209
FL Tampa, Wacco Inc. 813-621-6441
GA Marietta, Control Equip. Co. 404-427-8776
ID Boise, Radar Elec. Co., Inc. 208-336-2227
IL Countryside, Chicago Chain & Transmission 708-482-9000
IN Mishawaka, Power Comps. of Midwest 219-256-6630
IA Cedar Rapids, Van Meter Co. 319-366-5301
IA Des Moines, Kim Controls 515-274-9194
KY Louisville, Automatic Controls 502-426-4666
LA Baton Rouge, D & W Sys. Sls. 504-753-0992
LA Kenner, D & W. Sys. Sls. 504-466-1692
MA Hingham, Hingham Bay Corp. 617-740-1900
MI Detroit, Automatic Controls 315-533-8890
MN Minneapolis, Kim Controls 612-780-2991
MO Fenton, Hi-Tech Elec. 314-343-6060
NH Manchester, Industrial Control Sys. 603-625-2900
NY Amherst, N.E. Controls of Buffalo 716-691-0081
NY Clifton Park, N.E. Controls of Buffalo 518-371-4413
NY New Hyde Park, I/O Corp. 516-355-0130
NY Thompson Ridge, Vespo Mktg. 914-361-2800
NC Charlotte, McGuire & Crawford 704-366-3454
OH Brunswick, Automatic Controls 216-273-1117
OH Cleves, ATR Distrs. 513-353-1800
OR Portland, Radar Elec. Co., Inc. 503-232-3404
PA Ft. Washington, I/O Corp. 215-641-1870
PA Pittsburgh, Friday Engrg. 412-341-1444
PA Pittsburgh, Gilson Engrg. Sls. 412-369-0100
TX Dallas, Automatic Sys. 214-688-1810
TX Houston, The Haltom Co. 713-782-5625
VA Richmond, Process Specialties 804-794-2511
VA Salem, Process Specialties 703-563-0707
WA Richland, Radar Elec, Co., Inc. 509-943-8336
WA Seattle, Radar Elec, Co., Inc. 206-282-2511
WA Spokane, Radar Elec, Co., Inc. 509-747-3053
WV Charleston, Gilson Engrg Sls. 304-342-0012
WI New Berlin, Electric Sales & Engrg. 414-782-2400
Can Ontario, Leonard Elec., Ltd. 416-829-1200
Can Vancouver, Southwell Controls, Ltd. 604-980-3688

PHILIPS TECHNOLOGIES, Automotive Electronics Group, Cheshire Indl. Pk., Box E, Cheshire, CT 06410, Tel: 203-271-6000, TWX: 710-455-4048, FAX: 203-271-6100; Empl.: 800; *Sls. Mgr.:* Jim Richford

PHILIPS TECHNOLOGIES, Philips Key Modules Group, 2001 Gateway Place, Ste. 650 West, San Jose, CA 95110, Tel: 408-453-7373, FAX: 408-453 6444; Empl.: 10; *Sls. Mgr.:* Arend Verweij

PHILMORE MANUFACTURING, 2240 15th St. P.O. Box 6386, Rockford, IL 61125-1386, Tel: 815-229-7773, FAX: 815-229-7785; Empl.: 18

PHI TECHNOLOGIES, INC., 4605 North Stiles, Oklahoma City, OK 73105, Tel: 405-521-9000, TWX: 910-831-3286, FAX: 405-524-4254; Empl.: 40; *Sls. Mgr.:* Robert P. Gelernter

PHOENIX CONTACT INC., P.O. Box 4100, Harrisburg, PA 17111, Tel: 717-944-1300, FAX: 717-944-1625; *Sls. Mgr.:* Howard C. Minnick, Jr.; *Dist. Mgr.:* Mark F. Gilliford

PHOENIX MICROSYSTEMS, 991 Discovery Dr., Huntsville, AL 35806, Tel: 205-922-1200, TELEX: 752592, FAX: 205-837-1256; Empl.: 100

PHOENIX MICROWAVE, 100 Emlen Way, Telford, PA 18969, Tel: 215-723-6011, FAX: 215-723-6015; Empl.: 53; *Sls. Mgr.:* Joseph Diesso, VP Sls. & Mktg.

PHOENIX WIRE, INC., 100 Teflon Ave., S. Hero, VT 05486, Tel: 802-372-4561; Empl.: 25; *Sls. Mgr.:* Ohmer Corbin; *Dist. Mgr.:* Ohmer Corbin ..... **C•1802**

PHONON CORPORATION, 7 Herman Drive, P.O. Box 549, Simsbury, CT 06070, Tel: 203-651-0211, TELEX: 294705, FAX: 203-651-8618; FSC No.: 6Y858; Empl.: 20

PHOTON, INC., 1115 Space Park Dr., Santa Clara, CA 95054-3432, Tel: 408-492-9449, FAX: 408-492-9659; *Sls. Mgr.:* J. M. Darchuk

PHOTO RESEARCH:KOLLMORGEN, 9330 DeSoto Ave./PO Box 2192, Chatsworth, CA 91313-2192, Tel: 818-341-5151, FAX: 818-341-7070; FSC No.: 92434; Empl.: 66; *Sls. Mgr.:* M. L. Woolsey

PHYSICS INTERNATIONAL CO., Olin Defense Systems Grp., 2700 Merced St., San Leandro, CA 94577, Tel: 415-577-7236, TWX: 910-366-7033; Empl.: 360

PIC DESIGN, Remington Technologies, Inc., P.O. Box 1004, Middlebury, CT 06762, Tel: 203-758-8272, TWX: 910-997-0989, FAX: 203-758-8271; FSC No.: 00141; Empl.: 100; *Sls. Mgr.:* Gary Hampton

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FAX: 914-699-5565

PICO ELECTRONICS, INC., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, Tel: 914-699-5514, 800-431-1064; FSC No.: 31669; *Sls. Mgr.:* Joe Sweeney .. **A•1263-1273, 2455-2505; D•1859-1873, 2137-2185**

Local Sales Offices & Reps

CA Santa Clara, Fisher Assocs. 408-733-7350
IN Ft. Wayne, Denton Mktg., Inc. ... 219-486-0665/1264
WA Seattle, W. Spaulding Co. 206-282-9173

PICONICS, INCORPORATED, 26 Cummings Road, Tyngsboro, MA 01879, Tel: 508-649-7501, FAX: 508-649-9643; FSC No.: 26618; Empl.: 48; *Sls. Mgr.:* Virgilius Di Biase ..... **A•1274-1275, 2013**

Local Sales Offices & Reps

AL Huntsville, Murcota Corp. 205-539-8476
AZ Tempe, Semper-Fi Sls. 602-730-9553
CA Cupertino, Alpha Inds., Inc. 408-446-5333
CA N. Hollywood, Jewett Co. 818-789-8103
CA North, Alpha Ind., Inc. 408-446-5628
CO Parker, Mikro Sls. Co. 303-841-4131
FL Lighthouse Point, R.C. Simon & Co. ... 305-941-2757
IL No. IL.& WI, R.H.I. Sls. 708-888-0099
IN Huntington, Rixan Assoc. 513-278-1233
MD Kensington, Koebert Assocs. 301-493-8924
MA Chelmsford, Advanced Tech. Mktg. ... 508-458-0200
MN Minneapolis, Peterson Sls. Assocs. ... 612-835-5281
MO Grandview, Harris-Hanson Co. 816-763-6200
MO St. Louis, Harris-Hanson Co. 314-432-3611
NY Rochester, J.G. Welch 716-244-1100
NC Winston-Salem, Murcota Corp. 919-722-9445
OH Cincinnati, Rixan Assoc. 513-278-1233
OH Dayton, Rixan 513-222-0011
OK Bethany, El-Tec Sls. 405-789-5911
PA Bedford, NJ Koebert Assocs. 215-576-1329
PA Glenside, Koebert Assocs. Inc. 215-887-2310
TX Ft. Worth, El-Tec Sls. 817-268-2896
VA Alexandria, Koebert 703-461-3655

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[310] 538-9830
[213] 770-2330
[714] 525-6606
[415] 621-7386
[408] 279-8848
[510] 452-1009
[916] 448-6370
[209] 441-1725
[800] CAL-SWCH

WA Belleview, Call Factory 508-649-7501
WV Inwood, Koebert & Assocs., Inc. 304-229-8401

PICOSECOND ATE INC., P.O. Box 1080, Beaverton, OR 97075, Tel: 503-641-3295, FAX: 503-646-3778; Empl.: 2

Local Sales Offices & Reps

OR Beaverton, picosecond ATE Inc. 503-641-3295

PICOSECOND PULSE LABS, INC., P.O. Box 44, Boulder, CO 80306, Tel: 303-443-1249, FAX: 303-447-2236; Empl.: 7; *Sls. Mgr.:* J.R. Andrews; *Dist. Mgr.:* J.R. Andrews

PIEZO CRYSTAL CO., 100 K St., Box 619 , Carlisle, PA 17013, Tel: 717-249-2151, FAX: 717-249-7861; FSC No.: 74306; Empl.: 250; *Sls. Mgr.:* Glenn R. Kurzenknabe

PIEZO ELECTRIC PRODUCTS, INC., 212 Durham Ave., Metuchen, NJ 08840, Tel: 908-548-2800, FAX: 908-548-3625; Empl.: 75; *Sls. Mgr.:* M.R. Scarillo

PIEZO KINETICS INC., P.O. Box 756, Pine and Mill Streets, Bellefonte, PA 16823, Tel: 814-355-1593, FAX: 814-355-4342; FSC No.: 5Y690; Empl.: 28; *Sls. Mgr.:* Harry D. Shirey

PIEZO TECHNOLOGY INC., 2525 Shader Rd., Orlando, FL 32804, Tel: 407-298-2000, FAX: 407-293-2979; FSC No.: 25120; *Sls. Mgr.:* Paul Dechen

PIHER INTERNATIONAL CORP., NACESA, 903 Feehanville Dr., Mt. Prospect, IL 60056, Tel: 708-390-6680, 800-323-6693, FAX: 708-390-9866; FSC No.: 54869; Empl.: 13; *Sls. Mgr.:* Kimberly Mack, Sls. Supp. Mgr.

PILLAR INDUSTRIES

FAX: 818-358-0398

PILLAR INDUSTRIES, INC., 1780 Evergreen Street, Duarte, CA 91010, Tel: 818-358-1337; Empl.: 3 ..... **D•1874-1877**

Local Sales Offices & Reps

CA Los Angeles, Power Partner, Inc. 310-215-0800
CA Oxnard, Power Partner 805-659-5356
CA Santa Clara, Foresight 408-980-9700
WA Lynnwood, Blair Hirsh 206-775-8151

PIND TESTERS INC., 13805 Alton Parkway, Ste. B, Irvine, CA 92718, Tel: 714-457-1090, FAX: 714-457-1378; FSC No.: 66; Empl.: 15; *Sls. Mgr.:* C. Ditgen

PINE INSTRUMENT CO., 101 Industrial Dr., Grove City, PA 16127, Tel: 412-458-6391, FAX: 412-458-4648; Empl.: 60

PIONEER COMPONENTS, 2352 E. 66th St., Brooklyn, NY 11234, Tel: 718-444-3880; Empl.: 3; *Sls. Mgr.:* Michael R. Verter; *Dist. Mgr.:* Michael R. Verter

PIONEER MAGNETICS, 1745 Berkeley St., Santa Monica, CA 90404, Tel: 310-829-6751, FAX: 310-453-3929; FSC No.: 08676; Empl.: 310; *Sls. Mgr.:* Michael B. MacKrell ..... **D•1879-1881**

Local Sales Offices & Reps

AL Huntsville, Pen-Tech Assocs. 205-881-9298
AZ Scottsdale, Williams Assocs. 602-947-4297
CA Signal Hill, Thorson Co. 310-595-0361
CO Commerce City, Williams Assocs. 303-289-5647
FL West Palm Beach, Pen-Tech Assocs. 407-640-0800
GA Roswell, Pen-Tech Assocs. 404-642-4110
IL Arlington Hgts., Hill Sales 708-255-4400
MD Columbia, Stein Instrmn. 301-596-3748
MN St. Paul, Cahill, Schmitz & Cahill 612-646-7217
MO Lee's Summit, Omni Tech. Sls. 816-578-4221
NJ Glen Gardner, Daner-Hayes Inc. 201-537-4534
NM Albuquerque, Williams Assocs. 505-255-1368
NY Vestal, D. H. Technlgs. 716-359-4652
NC Greensboro, Pen-Tech Assocs. 919-852-6000
OH Dublin, KRW Sls. Inc. 614-885-2598
OH Westlake, KRW Sales 216-871-7521
PA Cheltenham, Stein Instrm. 215-379-1990
TX Dallas, Kruvand 214-437-3355
UT Salt Lake City, Williams Assocs. 801-485-6511
WA Redmond, Halbar-RTS 206-882-0990

PIONEER RESEARCH, INC., 1745 Berkeley St., Santa Monica, CA 90404, Tel: 310-829-6751, FAX: 310-453-3929; Empl.: 450; *Sls. Mgr.:* F. Heath

PIRELLI CABLE CORP., See Specialty Cable Corp.

PITTMAN®

FAX: 215-256-1338

PITTMAN, Penn Engrg. & Mfg. Corp., 343 Godshall Dr., Harleysville, PA 19438, Tel: 215-256-6601; FSC No.: 98938; Empl.: 180 ..... **B•1304-1305**

Local Sales Offices & Reps

AZ Fountain Hills, Halbar Assocs. 602-837-2464
CA Leucadia, Halbar Assocs. 619-942-4075
CA San Mateo, Halbar North, Inc. 415-349-4700
CA Van Nuys, Halbar Assocs. 818-906-3941
CO Englewood, Integrated Motion Sys. 303-792-5516
CT Bristol, M. L. Assocs., Inc. 203-589-2856
FL Fort Lauderdale, Motion Controls, Inc. 305-434-4197
GA Suwanee, Overton Assocs. Inc. 404-497-0166
IL Mount Prospect, K-W Assocs. 708-253-6680
IN Elkhart, Shaum Mfg., Inc. 219-264-0771
MA Wayland, M. L. Assocs. 508-358-5540
NY Glen Head, Marcus Sls. Assocs., Inc. ... 516-671-6820
NY Rochester, Application Spec. 716-586-6226
NC Raleigh, Overton Assocs. Inc. 919-469-5190
OH Cleveland, Servo-Mark 216-871-2353
OK Edmond, Motion Reps, Inc. 405-340-8100
OR Tigard, Halbar-RTS, Inc. 503-624-5741
PA Exton, Kiley Elect. Co., Inc. 215-363-8550
SC Walhalla, Overton Assocs. Inc. 803-638-7101
TN New Tazewell, Overton Assocs. Inc. .. 615-626-6009
TX Austin, Motion Reps, Inc. 512-288-5758
TX Carrollton, Motion Reps Inc. 214-492-0106
TX Denton, Motion Reps, Inc. 817-382-4159
TX Houston, Motion Reps, Inc. 713-981-8700
WA Redmond, Halbar-RTS, Inc. 206-882-0990
Can Woodbridge, Ont., Electromate Indl. Sls. Ltd. 416-850-7447

PIXELOGIC INC., 1200 N.E. Keyes Rd., Vancouver, WA 98684, Tel: 206-253-5033, FAX: 206-253-5033; Empl.: 5

PIXELWORKS, INC., 7 Park Ave., Hudson, NH 03051, Tel: 603-880-1322, FAX: 603-880-6558; Empl.: 15; *Sls. Mgr.:* Michael Jannery; *Dist. Mgr.:* A. Straume

PLAINVIEW BATTERIES, INC., 23 Newtown Rd., Plainview, NY 11803, Tel: 800-642-2354, FAX: 516-249-2876; *Sls. Mgr.:* B. Erde ..... **D•1459-1461**

PLAINVIEW ELECTRONICS, See Plainview Battieries, Inc.

PLANAR SYSTEMS, INC., 1400 N.W. Compton Dr., Beaverton, OR 97006-1992, Tel: 503-690-1100, FAX: 503-690-1244; FSC No.: 5Z179; Empl.: 121; *Sls. Mgr.:* Gary Baughn

PLANT SPECIALTIES, INC., P.O. Box 110537, Carrollton, TX 75011-0537, Tel: 214-245-9673, FAX: 214-245-9673; *Sls. Mgr.:* J. E. Bryer

PLASTIC CAPACITORS, INC., 2623 N. Pulaski Rd., Chicago, IL 60639, Tel: 312-489-2229, FAX: 312-489-0496; FSC No.: 99120; Empl.: 60; *Sls. Mgr.:* Thomas J. Brown; *Dist. Mgr.:* Thomas J. Brown

PLASTICORP, 24105 S. Frampton Ave., Harbor City, CA 90710, Tel: 310-539-9530, FAX: 310-539-8325; Empl.: 120; *Sls. Mgr.:* Thomas Salken

PLASTIC SYSTEMS INC., 261 Cedar Hill St., Marlboro, MA 01752-3004, Tel: 508-485-7390, FAX: 508-480-0257; *Sls. Mgr.:* Jim Novak; *Dist. Mgr.:* Jim Novak

PLASTIMATIC, INC., 11 Danco Rd., Putnam, CT 06260, Tel: 203-928-7911, FAX: 201-575-8748; Empl.: 85; *Sls. Mgr.:* Christopher Brooks

PLASTRON CORP., 429 S. Evergreen St., Bensenville, IL 60106, Tel: 708-595-2212, FAX: 708-595-2599; Empl.: 245; *Sls. Mgr.:* Ian Graham

PLATO PRODUCTS, INC., 18731 Railroad St., Industry, CA 91748, Tel: 818-965-8044, 800-423-4510, FAX: 818-965-8960; FSC No.: 32399; Empl.: 75; *Sls. Mgr.:* Walter Schaub

Local Distributors

AL Muscle Shoals, Jones Elctrns. 205-383-1241
AZ Phoenix, Scottsdale Tool & Supply ... 602-273-7376

CA Fullerton, Bertech 714-526-3700
CA Poway, Wassco 619-679-8787
CA Sunnyvale, COM-KYL 408-734-9660
CO Denver, Solder Tec 303-623-5000
FL Clearwater, Your Production Cupb'd 813-447-2581
FL Winter Pk., Deanco, Inc. 407-671-5100
GA Marietta, Deanco 404-429-0126
IL Chicago, E M F 312-889-8323
MD Gaithersburg, Deanco 301-948-5444
MA N. Andover, Contact East 508-682-2000
MI Bloomfield Hills, Murray Percival Co. 313-333-1700
MN Minneapolis, Warner Indl. Supp. 612-378-7300
NJ Fairfield, Deanco, Inc. 201-575-7960
NY Ithaca, Deanco, Inc. 607-257-4444
NY W. Babylon, Irv Morse Sls. 516-491-7800
NC Raleigh, Cameron & Barkley 919-834-6010
OR Portland, Gen. Tool & Supp. 503-226-3411
TX Dallas, Briggs-Weaver 214-631-3600
TX McAllen, McAllen Bolt & Screw, Inc. 512-687-8596
TX Pflugerville, Briggs-Weaver 512-244-3343
UT Salt Lake City, Techn. Devices 801-972-5935
WA Seattle, Gen. Tool & Supp. 206-762-1500
PR E.M.F. 800-621-0080
Can Edmonton, Alb., Cardinal Indl. Elctrns. 403-483-6266
Can Montreal, Que., Adtool Corp. 514-482-2548

PLESSEY ELECTRIC SYSTEMS CORP., See GEC-Marconi

PLETRONICS, INC., 19015 36th Ave. West, Ste. H, Lynnwood, WA 98036, Tel: 206-776-1880, FAX: 206-776-2760; Empl.: 11; *Sls. Mgr.:* Les Podgorny; *Dist. Mgr.:* Les Podgorny ..... **A•1449-1455**

Local Sales Offices & Reps
AL Huntsville, Strategic Mktg. 205-464-0490
AZ Phoenix, Sanford Sls. Assocs. 602-957-3570
CA Mission Viejo, Jay Mktg. Assocs. 714-768-7519
CA Pleasanton, Moulthrop Sls. 415-463-0450
CT N. Haven, Radix 203-239-3611
FL St. Petersburg, QXI 813-894-4556
IL Downers Grove, Golten Assocs. 708-512-0093
MA Randolph, Bengal 617-961-4120
MI Farmington, Bergin Assoc. 313-471-7940
MN St. Paul, Countryman 612-645-9151
NJ Springfield, Radix 201-467-4970
NY Skaneateles, Empire Tech. Assocs. 315-685-5703
NC Raleigh, Strategic Mktg. 919-847-7972
OH Centerville, Omega 513-434-5507
OH Cleveland, Omega Sls. 216-360-9400
OR Oregon City, Halbar PNW, Inc. 503-656-3714
TN Nashville, Strategic Mktg. 615-883-7882
TX Austin, Sage Mktg. 512-335-0300
TX Dallas, Sage Mktg. 512-335-0300
WA Redmond, Halbar 206-882-0990
Can Mississauga, Ont., Intellatech 416-629-0082

Local Distributors
AZ Phoenix, Arizona Comps 602-269-5655
AZ Scottsdale, Kent 602-998-0399
CA El Segundo, Force 213-772-1324
CA Milpitas, Kent 408-262-5300
CA San Diego, Kent Elctrns. 619-453-7133
CA Santa Clara, Force 408-748-1324
CA Sunnyvale, Capsco 408-734-3020
CA Sunnyvale, Target 408-733-0384
CA Torrance, All American 800-831-8300
CA Torrance, Kent Elctrns. 310-320-2700
CA Yoriba Linda, Target Elctrns. 714-692-1630
CT Norwalk, Cobra Comps. 203-847-6442
FL Largo, Kent 813-545-0057
GA Norcross, Century Elctrns. 404-729-2522
FL Sunrise, All American 800-432-6838
IL Woodridge, Golten Assocs. 708-985-5100
MD Beltsville, PSI 301-937-4960
MD Columbia, Kent 301-720-6200
MD Gaithersburg, Axis Elctrns. 301-840-9640
MA Chelmsford, Kent 508-250-9666
MA Norwood, Gerber Elctrns. 617-769-6000
MA Wakefield, All American 617-246-2300
MA Wilmington, North Star 508-657-5155
MA Worcester, Coghlin 508-791-7861
MN Eden Prairie, All American 612-944-2151
MN Fridley, Voyager 612-571-7766
MN St. Paul, Kent 612-642-2868
NJ Edison, Dove Elctrns. 908-738-0321
NY East Setauket, Dove Elctrns. 516-689-7733
NY Mt. Vernon, All American 800-926-6668
NY Rome, Rome Elctrns. 315-337-5400
NC Raleigh, Century Elctrns. 919-596-2220
OH Cincinnati, Schuster Elctrns. 513-489-1400
OH Twinsburg, Schuster Elctrns. 216-425-8134
PA Norristown, Century Elctrns. 215-631-5404
TX Austin, Kent Elctrns. 512-834-1900
TX Carrollton, North Star 800-882-6418
TX Houston, Kent Elctrns. 713-780-7770
TX Richardson, All American 214-231-5300
TX Richardson, Kent Elctrns. 214-669-2600
WA Redmond, Capsco 206-869-7400
WA Redmond, Kent Elctrns. 206-883-7200
WA Redmond, Priebe 206-881-2363
Can Mississauga, Ont., Intellatech 416-629-0082

PLITRON MANUFACTURING, INC., 250 Wildcat Rd., Downsview, Ont., CAN M3J 2N5, Tel: 416-667-9914, FAX: 416-667-8928; Empl.: 42; *Sls. Mgr.:* Brad Jolly ..... **A•2506-2507**

Local Sales Offices & Reps
AZ Phoenix, Saguaro Sls. 602-870-9242
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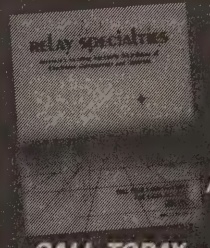

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MN Bloomington, Elect. Sls. Agency 612-884-8291
NH Nashua, Bell Controls, Inc. (Industrial) 603-882-6984
NH Nashua, Shain Assocs., Inc. (Military) 603-881-4881
NJ Mt. Laurel, S-J Assocs., Inc. 609-866-1234
NY Canandaigua, S-J Assocs., Inc. 716-394-3281
NY Yonkers, Sonkin Assocs. 914-968-8282
NC Charlotte, Elctrn. Mfr's Agts. 704-365-0547
OH Columbus, S-J Assocs., Inc. 614-885-6700
TX Garland, Carey, McMahill & Assocs., Inc. 214-681-1414
VA Falls Church, S-J Assocs., Inc. 703-533-2233
WI Butler, Richmar Elctrns. Corp. 414-781-1730
Can Toronto, Ont., Norgay Entprs. 416-234-8966

POWER DESIGNS, INC., 1700 Shames Dr., Westbury, NY 11590, Tel: 516-333-6200, TWX: 510-222-6561, FAX: 516-333-6512; Empl.: 48; *Sls. Mgr.:* Mary Loop

POWER DEVICES INC., 27071 Cabot Rd., Bldg. 114, Laguna Hills, CA 92653, Tel: 714-582-6712, FAX: 714-582-6722; Empl.: 10; *Sls. Mgr.:* G. E. Flynn

POWER DYNAMICS INC., 59 Lakeside Ave., P.O. Box 539, West Orange, NJ 07052, Tel: 201-736-5722, FAX: 201-736-8930; FSC No.: 60046; *Sls. Mgr.:* James Papianni; *Dist. Mgr.:* Lyle Scott

POWER ELECTRONIC COMPONENTS, INC., PEC, Inc, 6333 Old Lagrange Rd., Crestwood, KY 40014, Tel: 502-241-5970,800-245-0193, FAX: 502-241-5970; Empl.: 4; *Dist. Mgr.:* Carl Cloud

POWEREX

FAX: 412-925-4393

POWEREX, INC., 200 Hillis St., Youngwood, PA 15697-1800, Tel: 412-925-7272, TWX: 510-468-2840; Empl.: 400; *Dist. Mgr.:* Kathy Cullen ..... **A•2175**

Local Sales Offices & Reps

AZ Scottsdale, Lindberg Co. 602-998-2944
CA Laguna Hills, Westpower Co. 714-582-6716
CA Santa Clara, Engineering Assocs. Corp. 408-988-5001
CO Denver, Lindberg Co. 303-758-9033
CT Southington, The Orion Grp. 203-621-8371
FL Maitland, EIR, Inc. 407-660-9600
GA Alpharetta, Southeast Power Comps. 404-587-4851
GA Alpharetta, Southeast Power Comps. 404-664-5460
GA Norcross, Southeast Power Comps. ... 404-448-2458
IL Chicago, L&W Power Corp. 708-416-8838
IN Carmel, Giesting & Assocs. 317-844-5222
IA Cedar Rapids, Dy-Tronix, Inc. 319-377-8275
KS Leawood, Dy-Tronix, Inc. 913-339-6333
KS Wichita, Dy-Tronix, Inc. 316-838-0884
KY Lexington, Giesting & Assocs. 606-873-2330
MA Peabody, The Orion Grp. 508-532-6266
MI Detroit, L&W Power Corp. 313-451-1150
MN Bloomington, PSI Co. 612-944-8545
MO Bridgeton, Dy-Tronix, Inc. 314-291-4777
NM Albuquerque, Lindberg Co. 505-881-1006
NY Ithaca, Bob Dean, Inc. 607-257-1111
NY Smithtown, J&L Sls. Assocs., Inc. 516-864-1701
NY Wappinger Falls, Bob Dean, Inc. 914-297-6406
NC Charlotte, Southeast Power Comps. .. 704-846-8532
NC Greensboro, Southeast Power Comps. 919-854-9410
NC Henderson, Southeast Power Comps. 919-438-4450
OH Cincinnati, Giesting & Assocs. 513-385-1105
OH Cleveland, Giesting & Assocs. 216-261-9705
OH Columbus, Giesting & Assocs. 614-459-4800
OK Tulsa, NOVA Mktg. 918-660-5105
OR Tigard, Vantage Corp. 503-620-3280
PA Hatboro, Delta Tech. Sls., Inc. 215-957-0600
PA Pittsburgh, Bear Mktg. 412-492-1150
TX Austin, NOVA Mktg., Inc. 512-343-2321
TX Dallas, NOVA Mktg., Inc. 214-750-6082
TX Houston, NOVA Mktg., Inc. 713-988-6082
UT Salt Lake City, Lindberg Co. 801-484-8689
WA Bellevue, Vantage Corp. 206-455-3460
WI Milwaukee, L&W Power Corp. 414-782-0799
Can Burnaby, B.C., Blakewood Elec. Sys., Inc. 604-444-3344
Can Montreal, Que., GMA Assocs. 514-335-9572
Can Ottawa, Ont., GMA Assocs. 613-820-3822
Can Toronto, Ont., GMA Assocs 416-671-8111

Local Distributors

AL Birmingham, Industrial Elec. Supp. Co. 205-951-4601
AL Huntsville, Time Elctrns. 205-721-1133
AZ Tempe, Bell Inds. 602-966-7800
AZ Tempe, Time Elctrns. 602-967-2000
CA Agoura Hills, Bell Inds. 818-879-9494
CA Agoura Hills, Time Elctrns. 818-707-2890
CA Cypress, Bell Inds. 714-895-7801
CA Los Angeles, Bell Inds. 310-826-6778
CA Rocklin, Bell Inds. 916-652-0414
CA San Diego, All American 619-458-5850
CA San Diego, Bell Inds. 619-268-1277
CA San Diego, Time Elctrns. 619-674-2800
CA San Jose, All American 408-943-1200
CA Sunnyvale, Bell Inds. 408-734-8570
CA Sunnyvale, Time Elctrns. 408-734-9888
CA Torrance, All American 310-320-0240
CA Torrance, Time Elctrns. 310-320-0880
CA Tustin, Time Elctrns. 714-669-0100
CA Walnut, ACI Elctrns. 714-594-1731
CA West Lake Village, Semtex, Inc. 805-373-6850
CA Woodland Hills, Time Elctrns. 818-998-7200
CO Denver, Bell Inds. 303-691-9270
CO Englewood, Time Elctrns. 303-721-8882
CT Southbury, Time Elctrns. 203-271-3200
CT Wallingford, GRS Midan Elctrns. 203-265-2077
FL Ft. Lauderdale, Time Elctrns. 305-484-7778
FL Miami, All American 305-621-8282

FL Orlando, Time Elctrns. 407-841-6565
FL Sunrise, All American 305-572-7999
GA Norcross, Time Elctrns. 404-448-4448
IL Chicago, Newark Elctrns. 312-784-5100
IL Elmhurst, Semiconductor Specialists 708-279-1000
IL La Fox, Richardson Elctrns. Ltd. 800-348-5580
IL Schaumberg, Time Elctrns. 708-308-3000
IL Schaumburg, QPS Elctrns., Inc. 708-884-6620
IL Schaumburg, Time Elctrns. 708-303-3000
IN Indianapolis, Bell Inds. 317-875-8200
IN Indianapolis, Time Elctrns. 800-331-5114
IA Cedar Rapids, Time Elctrns. 800-325-9085
KS Lenexa, Time Elctrns. 800-325-9085
KY Lexington, Time Elctrns. 800-331-5114
MD Columbia, GRS Elctrns. 301-995-6744
MD Columbia, Time Elctrns. 410-964-3090
MA Norwood, Gerber Elctrns. 617-769-6000
MA Peabody, Time Elctrns. 508-532-9900
MA Woburn, ACI Elctrns. 617-935-7230
MI Madison Heights, Gaico Elctrns. 313-542-9090
MI Novi, Time Elctrns. 800-331-5114
MN Edina, Time Elctrns. 612-835-1250
MO Manchester, Time Elctrns. 314-391-6444
NJ Camden, GRS Elctrns. 609-964-8560
NJ East Hanover, Delburn Elctrns., Inc. 201-884-0800
NJ Marlton, Time Elctrns. 609-596-6700
NJ Wayne, Time Elctrns. 201-882-4611
NM Albuquerque, Bell Inds. 505-292-2700
NM Albuquerque, Harrison Equip. Co. 505-291-9951
NY Freeport, Semtex, Inc. 516-223-0200
NY Hauppauge, Time Elctrns. 516-273-0100
NY Plainview, ACI Elctrns. 516-293-6630
NY Rochester, Time Elctrns. 716-383-8853
NY Rome, Rome Elctrns. 315-337-5400
NC Asheville, Cameron & Barkley 800-222-3517
NC Charlotte, Cameron & Barkley 800-532-0331
NC Charlotte, Electronics Mktg. Corp. 704-394-6195
NC Charlotte, Time Elctrns. 800-638-1812
NC Fayetteville, Cameron & Barkley 800-346-0632
NC Greensboro, Cameron & Barkley 800-632-1303
NC Greenville, Cameron & Barkley 800-331-4620
NC Raleigh, Cameron & Barkley 800-662-7654
NC Wilmington, Cameron & Barkley 800-672-0435
OH Cincinnati, Hughes Peters 513-351-2000
OH Cleveland, CAM/RPC Elctrns. 216-461-4700
OH Cleveland, Darrah Elec. 216-631-0912
OH Columbus, Electronics Mktg. Corp. 614-299-4161
OH Columbus, Hughes Peters 614-294-5351
OH Columbus, Time Elctrns. 800-331-5114
OH Dayton, Electronics Mktg.Corp. 513-439-4711
OH Highland Heights, Electronics Mktg.Corp. 216-442-3441
OK Tulsa, Altair Co. 918-252-5781
OR Lake Oswego, Bell Inds. 503-635-6500
OR Portland, Dunn Elctrns. 503-285-0214
OR Portland, Time Elctrns. 503-684-3780
PA Philadelphia, Time Elctrns. 215-337-0900
PA Pittsburgh, CAM/RPC Elctrns. 412-782-3770
PA Pittsburgh, Time Elctrns. 800-331-5114
TN Columbia, Cameron & Barkley 615-381-8000
TX Austin, Harrison Equip. Co. 512-258-1320
TX Austin, Time Elctrns. 512-339-3051
TX Brownsville, Harrison Equip. Co. 512-548-2376
TX Dallas, Harrison Equip. Co. 214-239-2750
TX Houston, Altair Co. 713-462-3029
TX Houston, Time Elctrns. 713-530-0800
TX Richardson, Altair Co. 214-231-5166
TX Richardson, Time Elctrns. 214-644-4644
TX Stafford, Harrison Equip. Co. 713-879-2750
UT Midvale, Bell Inds. 801-255-9611
UT West Valley, Time Elctrns. 801-973-8181
VA Charlottesville, Virginia Elec. Comps. 804-296-4184
WA Bothell, Dunn Elctrns. 206-382-0379
WA Redmond, Bell Inds. 206-867-5410
WA Redmond, Time Elctrns. 206-882-1525
WI Milwaukee, Marsh Elctrns. 414-475-6000
WI Milwaukee, Time Elctrns. 800-331-5114
WY Gillette, WESCO 307-687-0014
Can Brampton, Ont., Richardson Elctrns., Ltd. 416-458-5333
Can Calgary, Alberta, Electro Sonic, Inc. 403-255-9550
Can Mississauga, Ont., Time Elctrns. 416-601-4368
Can Ottawa, Ont., Electro Sonic, Inc. 613-728-8333
Can Richmond, BC, Electro Sonic, Inc. 604-273-2911
Can Stoney Creek, Ont., Westinghouse Canada, Inc. 416-528-8811
Can Willowdale, Ont., Electro Sonic, Inc. 416-494-1666
Can Winnepeg, Manitoba, Electro Sonic, Inc. 204-783-3105

POWER FUNCTIONS ENGINEERING, 3831 Cavalier Dr., Garland, TX 75042, Tel: 214-278-0996; Empl.: 9

POWER GENERAL, Nidec Corp., 152 Will Dr., Canton, MA 02021, Tel: 617-828-6216, FAX: 617-828-3215; Empl.: 300; *Sls. Mgr.:* E.V. Lauria, VP-Sls. & Mktg.; *Dist. Mgr.:* Richard Bagg, Distbn. Sls. Mgr.

POWER INTEGRITY CORP., 1834 Pembroke Rd., Greensboro, NC 27408, Tel: 910-379-9773, 800-237-6260, FAX: 910-379-1301; *Sls. Mgr.:* James T. Fesmire

POWERLINE, INC., 1360 S. Clarkon St., Denver, CO 80210, Tel: 303-698-7883, FAX: 303-777-7573; Empl.: 9; *Sls. Mgr.:* Matt Breneman

POWER MAGNE-TECH CORPORATION, 441 High Street, Perth Amboy, NJ 08861, Tel: 908-826-4700, FAX: 908-826-4706; Empl.: 65; *Sls. Mgr.:* Arthur Zuckerman; *Dist. Mgr.:* Arthur Zuckerman

POWERMARK, See Square D Co. Power Protection Sys.

POWER/MATE CORPORATION, 2727 Kurtz St., San Diego, CA 92110, Tel: 800-843-8544, 619-299-3800, FAX: 619-296-8039 (sls); Empl.: 175

POWER MEASUREMENT LTD., 6703 Rajpur Place, Victoria, BC, Canada V8X 3X1, Tel: 604-652-5118, FAX: 604-652-0411; Empl.: 50; *Sls. Mgr.:* Bradford Forth, Mktg. Mgr.

POWERNETICS LTD., Clarence St. Loughborough, Leics, ENG LE11 1DX, Tel: 0509 214153, TELEX: 34306, FAX: 0509 262460; Empl.: 66; *Sls. Mgr.:* Margaret A. Foggon, Export Sls. Mgr.

Power-One
D.C. POWER SUPPLIES

FAX: 805-388-0476

POWER-ONE, INC., 740 Calle Plano, Camarillo, CA 93012, Tel: 805-987-8741; FSC No.: 54407; Empl.: 320; *Dist. Mgr.:* Julius Hirsch,V.P. Sls. ..... **D•1886-1895**

Local Sales Offices & Reps

AL Huntsville, M-Squared, Inc. 205-830-0498
AZ MESA, Sys. Sls. of AZ 602-464-9989
CA Escondido, Eagle Tech. Sls. 619-743-6550
CA Santa Clara, Nova-Tronix, Inc. 408-727-9530
CA Woodland Hills, Varigon, Inc. 818-594-5080
CO Englewood, Quorum 3 303-799-8100
CT Hamden, Datcom 203-288-7005
FL Boca Raton, Electrocraft 407-394-9686
FL Largo, Electrocraft 813-544-1766
FL Longwood, Electrocraft 407-682-7832
GA Norcross, M-Squared,Inc. 404-447-6124
IL Chicago, M. Gottlieb & Assocs. 312-775-1151
IN Indianapolis, Rathsburg Assoc. Inc. 313-489-1500
IA Cedar Rapids, Midwest Tech. Sls. 319-377-1688
KS Goddard, Midwest Tech. Sls. 316-794-8565
KS Lenexa, Midwest Tech. Sls. 913-888-5100
MD Baltimore, Eastern Comps. Sls. 410-788-7050
MA Waltham, Datcom, Inc. 617-891-4600
MI Farmington Hills, Rathsburg Assocs., Inc. 313-489-1500
MN Edina, G.P. Sls., Inc. 613-831-2362
MO Earth City, Midwest Tech. Sls. 314-298-8787
NM Albuquerque, Sys. Sls. of AZ 505-889-2901
NY E.Syracuse, Nycom, Inc. 315-437-8343
NY Fairport, Nycom, Inc. 716-425-5120
NY Great Neck, Trionic Assocs. 516-466-2300
NC Cary, M-Squared, Inc. 919-467-6319
NC Raleigh, M-Squared, Inc. 919-851-0010
OH Columbus, Rathsburg Assocs. Inc. 614-457-2242
OR Beaverton, Pacific Mktg. Specialist 503-641-9373
PA Norristown, Eastern Comp. Sls. 215-270-9530
VA Redmond, Pacific Mktg. Specialist 206-882-3144
WI Milwaukee, M. Gottlieb & Assocs. 414-546-4466

Local Distributors

AL Huntsville, Pioneer Elctrns.-Tech. 205-837-9300
AL Huntsville, RS Elctrns. 205-721-9999
AZ Phoenix, Sterling Elctrns. 602-437-5565
AZ Tempe, Bell Inds. 602-966-7800
AR Ft. Smith, Carlton-Bates 501-646-8201
AR Little Rock, Carlton-Bates 501-562-9100
AR Pine Bluff, Carlton-Bates 501-535-1354
AR Springdale, Carlton-Bates 501-756-5012
CA Agoura, Bell Inds. 818-879-9494
CA Carlsbad, FLW 619-434-5251
CA Costa Mesa, FLW 714-751-7512
CA Cypress, Bell Inds. 714-895-7801
CA Del Mar, Compumech Elctrns. 619-792-7800
CA Milpitas, Compumech Elctrns. 408-945-9395, 1-800-553-8558
CA Oxnard, FLW 805-984-0167
CA Rocklin, Bell Inds. 916-652-0418
CA San Diego, Bell Inds. 619-268-1277
CA San Diego, Sterling Elctrn. 619-560-8948
CA San Jose, Capstone Elctrns. 408-453-9804
CA Sunnyvale, Bell Inds. 408-734-8875
CA Tustin, Capstone Elctrns. 714-587-0638
CO Aurora, Capstone Elctrns. 303-375-1300
CO Denver, Bell Inds. 303-691-2460
CO Englewood, Sterling Elctrns. 303-792-3939
CT Shelton, Pioneer Elctrns.-Stand. 203-929-5600
CT Wallingford, Bell Inds. 203-269-6801
CT Wallingford, Greene-Shaw Co. 203-265-3333
CT Wallingford, Sterling Elctrns. 203-265-9535
FL Altamonte Springs, Bell Inds. 407-339-0078
FL Altamonte Springs, Pioneer Elctrns.-Tech. 407-834-9090
FL Deerfield Bch, Pioneer Elctrns.-Tech. 305-428-8877
FL Maintland, Elctrn. Equip. 407-539-0888
FL Maitland/Pompano Bch., Elctrn. Equip. 305-960-1200
FL Miami, Elctrn. Equip. Co. 305-526-6000
FL Tampa, Elctrn. Equip. 813-988-0810
GA Duluth, Pioneer Elctrns.-Tech. 404-623-1003
GA Norcross, Bell Inds. 404-446-7167
GA Norcross, RS Elctrns. 404-242-0520
ID Boise, Pioneer Elctrns.-Tech. 208-336-2227
IL Addison, Pioneer Elctrns. 312-495-9680
IL Arlington Hts., C.W. Elctrns. 708-439-9880
IL Bensonville, Voyager Elctrns. 312-860-1300
IL Elk Grove Village, Bell Inds. 312-640-1910
IL Itasca, Capstone Elctrns. 708-250-0300
IL Northbrook, Classic Comps. 708-272-9650
IL Schaumburg, Sterling 708-303-9900
IN Ft. Wayne, Bell Inds. 219-422-4300
IN Indianapolis, Bell Inds. 317-875-8200
IN Indianapolis, Pioneer Elctrns. 317-573-0880
IN Indianapolis, RS Elctrns. 317-253-9065
IA Cedar Rapids, Dee Elctrns. 319-365-7551
KS Lenexa, RS Elctrns. 913-362-1923
KS Lenexa, Sterling Elctrns. 913-492-5406
LA Shreveport, Carlton-Bates 318-636-9975
LA Westwego, Sterling Elctrns. 504-436-1481
MD Columbia, Bell Inds. 410-290-5100
MD Columbia, Sterling Elctrns. 301-290-3800
MD Gaithersburg, Pioneer Elctrns.-Tech. 301-921-0660
MA Andover, Bell Inds. 508-474-8880
MA Binghamton, Pioneer Elctrns. 617-748-8211
MA Lexington, Pioneer Elctrns. 617-861-9200
MA Newton, Greene-Shaw Co. 617-969-8900
MA Wilmington, Capstone Elctrns. 508-657-5874
MA Woburn, Sterling Elctrns. 617-938-6200
MI Grand Rapids, Pioneer 616-698-1800
MI Grand Rapids, RS Elctrns. 616-241-3483
MI Livonia, Pioneer Elctrns. 313-525-1800
MI Livonia, RS Elect. 313-525-1155
MN Eden Priarie, Pioneer 612-944-3355
MN Fridley, Voyager 612-571-7766
MN Minneapolis, Sterling 612-831-2666
MO Maryland Heights, RS Elctrns. 314-997-7709
MO Springfield, Carlton-Bates 417-862-1699
MO St. Louis, Pioneer 314-432-4350
NE Lincoln, Scott Elctrns. 402-466-8221
NE Omaha, Scott Elctrns. 402-734-6750
NJ Edison, Sterling Elctrns. 908-417-1000
NJ Fairfield, Bell Inds. 201-227-6060
NJ Fairfield, Pioneer Elctrns. 201-575-3510
NJ Marlton, Capstone Elctrns. 609-596-7500
NM Albuquerque, Bell Inds. 505-292-2700
NM Albuquerque, Sterling Elctrns. 505-884-1900
NY Binghamton, Pioneer Elctrns. 607-722-9300
NY Buffalo, Zeller Elctrns. 716-873-1300
NY Fairport, Pioneer Elctrns. 716-381-7070
NY Hauppauge, RS Elctrns. 516-231-6372
NY Rochester, CAM/RPC Elctrns., Inc. 716-427-9999
NY Rochester, Zeller Elctrns. 716-254-8840
NY Woodbury, Pioneer Elctrns. 516-921-8700
NC Morrisville, Pioneer Elctrns.-Tech. 919-460-1530
NC Raleigh, Capstone Elctrns. 919-954-0600
NC Raleigh, Sterling Elctrns. 919-790-8634
OH Cleveland, CAM/RPC Elctrns. 216-461-4700
OH Cleveland, Pioneer Elctrns. 216-587-3600
OH Dayton, Bell Inds. 513-435-5922
OH Dayton, Bell Inds. (Military) 513-434-8231
OH Dayton, Pioneer Elctrns. 513-236-9900
OH Maumee, RS Elctrns. 419-893-0721
OH Solon, CAM/RPC/First Connection 216-248-6181
OH Solon, Sterling Elctrns. 216-248-1122
OK Oklahoma City, Carlton-Bates 405-681-4446
OK Tulsa, Carlton-Bates 918-250-1626
OK Tulsa, Sterling Elctrns. 918-663-2410
OR Beaverton, Bell Inds. 503-644-3444
OR Portland, Radar Elec. 503-232-3404
PA Horsham, Pioneer Elctrns.-Tech. 215-674-4000
PA Pittsburgh, CAM/RPC Elctrns. 412-963-6202
PA Pittsburgh, Pioneer Elctrns. 412-782-2300
PA Trevose, Bell Inds. 215-953-2899
TN Jackson, Carlton-Bates 901-664-2714
TN Memphis, Carlton-Bates 901-365-3539
TN Nashville, Carlton-Bates 615-885-3232

TX Austin, Carlton-Bates ... 512-837-9098
TX Austin, Norcom, Inc. ... 512-451-2757
TX Austin, Pioneer Elctrns. ... 512-835-4000
TX Austin, Sterling ... 512-836-1341
TX Carrollton, Capstone Elctrns. ... 214-380-9049, 1-800-388-6757
TX Carrollton, Sterling Elctrns. ... 214-243-1600
TX Dallas, Norcom, Inc. ... 214-386-4888
TX Dallas, Pioneer Elctrns. ... 214-386-7300
TX Ft. Worth, Carlton-Bates ... 817-293-5588
TX Houston, Norcom, Inc. ... 713-778-0392
TX Houston, Pioneer Elctrns. ... 713-495-4700
TX Houston, Sterling Elctrns. ... 713-623-6600
TX Richardson, Bell Inds. ... 214-690-0468
TX San Antonio, Carlton-Bates ... 512-805-8300
TX Texarkana, Carlton-Bates ... 214-792-6923
UT Midvale, Bell Inds. ... 801-561-9691
UT Salt Lake City, Sterling Elctrns. ... 801-972-5444
VA Richmond, Sterling Elctrns. ... 804-226-2190
WA Redmond, Bell Inds. ... 206-881-2140
WA Richardson, Radar Elec. ... 509-747-3053
WA Richland, Radar Elec. ... 509-943-8836
WA Seattle, Radar Electric ... 206-282-2511
WA Spokane, Radar Elec. ... 509-747-3053
WI Brookfield, Pioneer Elctrns. ... 414-784-3480
WI New Berlin, Classic Comps. ... 414-786-5300
WI Waukesha, Bell Inds. ... 414-547-8879
EXP CA, Los Angeles, Hanex, Inc. ... 213-556-3807

POWER-PAK, INC., 6216 Oakton St., Morton Grove, IL 60053, Tel: 708-966-6000, FAX: 708-966-6009; Empl.: 35; *Sls. Mgr.:* Robert Villari

POWER PRODUCTS DIV., COMPUTER PRODS./POWER PRODS., See Computer Prods. Inc., Fremont, CA.

POWER SOLUTIONS INC., 4699 N. Federal Hwy., Pompano Bch., FL 33064, Tel: 305-943-4110, FAX: 305-943-6068

POWER-SONIC, Box 5242, 3106 Spring St., Redwood City, CA 94063, Tel: 415-364-5001, FAX: 415-366-3662; Empl.: 50; *Sls. Mgr.:* Carl E. Fischetti; *Dist. Mgr.:* Carl E. Fischetti ... **D•1464**

Local Sales Offices & Reps

CA Redwood City, Andrew Ryan ... 415-364-5001
CO Denver, Richard Moody ... 303-893-3771
FL Tampa, SRT Mktg. ... 813-884-4805
IL Chicago, Rendell Sls. Co. ... 312-539-1820
KY Lexington, Donald Keil ... 606-272-6960
MA Norwood, Assocd. Power Prods. ... 617-769-7516
MI Chelsea, Sean T Sls. ... 313-475-2021
MS Jackson, Doby Assocs. ... 601-981-1138
NJ Northvale, John Hart ... 201-767-9654
MN Bloomington, J.L.K. Tech. Sls. ... 612-884-0009
OH Willoughby, Nationwide Comps. ... 216-946-3226
TX Dallas, The Power Connection ... 214-401-3490

Local Distributors

AL Birmingham, Forbes Distrbg. ... 205-251-4104
AK Anchorage, Frigid North ... 907-561-4633
AZ Phoenix, Lynntronics ... 602-841-3900
AR Little Rock, Carlton Bates ... 501-562-9100
CA Costa Mesa, Battery Specialties ... 800-352-3706
CO Denver, Cargo Battery ... 303-296-8763
CT Waterbury, Jasco Batteries ... 203-597-9220
DE National Distr., Allied Elctrns. ... 800-433-5700
FL Altamonte Springs, TNR Tech. ... 800-346-0601
GA Decatur, Emergency Lighting Srvc. ... 404-981-2288
HI Honolulu, I.C. Supp. ... 808-839-1966
ID Boise, Kimball Elctrns. ... 208-232-2201
IL National Distr., Allied Elctrns. ... 800-433-5700
IN Evansville, Hutch & Sons ... 812-425-7201
IA Des Moines, Radio Trade Supp. ... 515-288-7237
KS Kansas City, North Supply ... 913-791-7000
KY Louisville, P.I. Burks ... 502-589-3960
LA New Orleans, Southern Radio Supp. ... 800-447-0444
ME National Distr., Allied Elctrns. ... 800-433-5700
MD Aberdeen, Harco Elctrns. ... 301-838-7990
MA Billerica, Mayer Elctrns. ... 401-724-7100
MI Livonia, R.S. Elctrns. ... 313-525-1155
MN Minneapolis, Burns Sls. ... 800-728-4761
MO Kansas City, Elctrn. Supp. ... 816-931-3383
NE National Distr., Allied Elctrns. ... 800-433-5700
NV Las Vegas, Kiesub ... 702-733-0024
NH National Distr., Allied Elctrns. ... 800-433-5700
NJ Randolph, Mouser Elctrns. ... 201-328-3322
NM Albuquerque, Betatron ... 505-821-1122
NY Ridgewood, J.A. McDermott Corp. ... 718-456-3606
NC Winston Salem, Kirkman Elctrns. ... 919-722-9131
ND National Distr., Allied Elctrns. ... 800-433-5700
OH Millbury, Dynalite ... 419-837-6837
OK Oklahoma City, Radio Supp. ... 405-232-6127
OR Beaverton, Micro Power ... 503-626-7086
PA National Distr., Allied Elctrns. ... 800-433-5700
SC Charleston, Wholesale Indl. Elctrns. ... 803-722-2634
TN Memphis, Carlton Bates ... 901-365-3539
TX Ft. Worth, Allied Elctrns. ... 800-433-5700
VA Cheseapeake, Battery Outlet ... 804-545-4442
WA Redmond, Energy Sls. ... 206-883-2343
Can Fort Erie, The Battery Co. ... 800-695-9482

POWER STAR, INC., P.O. Box 18701, Irvine, CA 92713, Tel: 714-261-5377, 800-854-9420, FAX: 714-261-5381; Empl.: 11

POWER SUPPLY CONCEPTS INC., 840 Jupiter Park Dr., Units 103-104, Jupiter, FL 33458-8947, Tel: 407-746-1800, FAX: 407-746-1805 ... **D•1896-1897**

power SWITCH Corp.

FAX: 201-478-8201

POWER SWITCH CORPORATION, 17 Vreeland St., Lodi, NJ 07644, Tel: 201-478-5788; Empl.: 33; *Sls. Mgr.:* Ken Schnitzer ... **D•1899-1905**

Local Sales Offices & Reps

AL Madison, Benchmark Tech. Sls. ... 205-464-9909
AZ Tempe, Gassner & Clack ... 602-968-9037
CA Camarillo, The Tricamo Co. ... 805-388-0039
CO Franktown, MRC ... 303-660-8750
FL Palm Bay, VM2 Mktg. ... 407-984-1918
GA Atlanta, Benchmark Tech. Sls. ... 404-446-1711
IL Wood Dale, BNI ... 708-595-9210
IN Indianapolis, Wilson Tech Sls. Inc. ... 317-872-2513
IA Cedar Rapids, Midtec Assoc., Inc. ... 319-395-0028
KS Lenexa, Midtec Assoc., Inc. ... 913-541-0505
MA Tyngsboro, CompTech ... 508-649-3030
MI Clarkson, Bradcor Elctrns. ... 313-625-7644
MN Minneapolis, Electro-Serv ... 612-338-3475
MO St. Louis, Midtec Assoc., Inc. ... 314-275-8666
NJ Haddonfield, M & S Assoc. ... 609-429-7055
NY Endwell, Micheal Foldes, Inc. ... 607-786-4962
NC Raleigh, Benchmark Tech. Sls. ... 919-850-0633
OH Cleveland, Bradcor Elctrns. ... 216-671-1200
OH Dayton, Bradcor Elctrns. ... 216-671-1200
TX Dallas, Tycom ... 214-960-7368
WA Edmonds, Power Sources Unltd. ... 206-743-6641
WI Brookville, BNI ... 414-781-4775
Can Mississauga, Andy Baumen Assoc.,Ltd. ... 416-828-2600

POWER SYSTEMS, INC., 45 Griffin Rd., South, Bloomfield, CT 06002, Tel: 203-726-1300, FAX: 203-726-1495; FSC No.: 50463; Empl.: 310; *Sls. Mgr.:* Kerry D. Smith

POWER SYSTEMS & CONTROLS, INC., 3206 Lanvale Ave., Richmond, VA 23230, Tel: 804-355-2803, FAX: 804-358-0498; Empl.: 55

POWER SYS. GRP., Rantec Div., Emerson Elec. Co., 9401 Oso Ave., Chatsworth, CA 91311, Tel: 818-885-8223, TWX: 910-493-1247; FSC No.: 04971; Empl.: 265; *Sls. Mgr.:* Fred Silver

POWERTEC INDUSTRIAL CORP., 3958 Airway Drive, Rock Hill, SC 29732, Tel: 803-328-1888, FAX: 803-328-1870; Empl.: 110; *Sls. Mgr.:* Ed Lee; *Dist. Mgr.:* Dale Norman

POWERTEC POWER SUPPLIES, INC., DIV. OF ASTEC AMERICA, See Astec America

POWERTECH, INC., Fair Lawn Ave., Fair Lawn, NJ 07410, Tel: 201-791-5050, TELEX: 353970; FSC No.: 32953; Empl.: 49

POWER TECHNOLOGY, INC., P.O. Box 191117, Little Rock, AR 72219-1117, Tel: 501-568-1995, FAX: 501-568-1994; Empl.: 85; *Sls. Mgr.:* John Webb

POWER TEN, INC., 486 Mercury Dr., Sunnyvale, CA 94086, Tel: 408-738-5959, FAX: 408-738-4326; FSC No.: 61987; *Sls. Mgr.:* Vince Mutascio ... **D•1907**

Local Sales Offices & Reps

AL Huntsville, TEQSPEC ... 205-883-6699
AZ Phoenix, Jayson Co., Inc. ... 602-867-1964
CA Los Alamitos, Power Specialists ... 213-594-9418
CA San Diego, Power Specialists ... 619-726-4799
CO Louisville, SDW ... 303-665-8089
CT Guilford, HG Assocs. ... 203-453-5424
FL Palm Harbor, TEQSPEC ... 813-942-6006
GA Snellville, TEQSPEC ... 404-972-7955
IL Arlington Hgts., Comtel Midwest Co. ... 708-392-4040
IN Indianapolis, Comtel Midwest Co. ... 317-253-1681
KS Shawnee Mission, Comtel Midwest Co. ... 913-268-0762
MA Stow, HG Assocs. ... 508-897-3190
MI Framington Hill, Carter, McCormic & Pierce ... 313-477-7700
MN Wayzata, Comtel Midwest Co. ... 612-476-1551
MO Manchester, Comtel Midwest Co. ... 314-227-7220
NM Albuquerque, SDW ... 505-883-3668
NY Great Neck, RTI ... 516-829-3770
NC Winston-Salem, TEQSPEC ... 919-765-5553
OH Parma, Carter, McCormic & Pierce ... 216-398-0400
OK Tulsa, Acudata ... 918-743-1875
PA Pittsburgh, Carter, McCormic & Pierce ... 412-826-3800
TX Austin, Acudata ... 512-478-1018
TX Houston, Acudata ... 713-580-2451
TX Plano, Acudata ... 214-424-3567
VT Graniteville, HG Assocs. ... 802-476-4223
VA Fairfax, SCI-REP ... 703-385-0600
WA Bellevue, A. J. Smith Co. ... 206-746-6770
WI New Berlin, Comtel Midwest Co. ... 414-544-6042
Can N. Vancouver, BC, Jerome & Francis ... 604-986-1286
Can Rexdale, Ont., Interfax ... 416-674-8970

POWERTREND, INC., 515 E. Pershing Blvd., Ste. 1001, Cheyenne, WY 82001, Tel: 307-635-9221, FAX: 307-635-8116; *Sls. Mgr.:* W. Rumsey

POWER TRENDS, INC., 1101 N. Raddant Rd., Batavia, IL 60510, Tel: 708-406-0900, FAX: 708-406-0901; Empl.: 45; *Sls. Mgr.:* Don Matthiesen

All Locations call Hamilton/Avnet 800-442-6458

Powertron

FAX: 516-883-7155

POWERTRON CORPORATION, Industrial Test Equipment Co., Inc., 21 Yennicock Ave., Port Wash., NY 11050, Tel: 516-883-1700; Empl.: 6; *Sls. Mgr.:* Barbara Assa ... **D•1012, 2268-2271**

POWERTRON, Contraves Goerz Corp., 3821 Barranger Dr., Charlotte, NC 28210, Tel: 704-525-8962, TELEX: 572-444

POWERTRONIX

FAX: 415-345-7240

POWERTRONIX CORP., 703 Cayman Ln., Foster City, CA 94404, Tel: 415-345-6800; Empl.: 94; *Sls. Mgr.:* Carl A. Svensson ... **A•2509-2511**

Local Sales Offices & Reps

AZ Phoenix, Chaparral Elctrns. ... 602-996-5909
AR Little Rock, Doby Assocs. ... 501-221-0326
CA Foster City, Powertronix Corp. ... 415-345-6800
CA Mission Viejo, Champa Assocs. ... 714-581-3459
CA Sherman Oaks, Champa Assocs. ... 818-769-9456
CO Littleton, Taylor Mktg. ... 303-850-0207
FL Delray Beach, Phelps Assocs. ... 407-276-7591
IL Arlington Hgts., MJ Petersen & Assocs. ... 708-577-8200
MD Baltimore, Chesapeake Indl. ... 410-653-0476
MA Bellingham, OEM Mktg. & Sls. ... 508-528-4983
NV Las Vegas, Chaparral Nevada ... 702-433-5486
NH Salem, OEM Mktg. & Sls. ... 603-893-0009
NJ Wayne, Apogee Mktg. ... 201-305-3735
NM Albuquerque, Chaparral Elctrns. ... 505-271-2266
NY Hauppauge, Sticom ... 516-366-4221
NY Rochester, H.C. Johnson Agencies ... 716-586-0777
OH Mainville, G.A. Barnett and Co. ... 513-677-0922
PA Glenshaw, Hollern Sls. Inc. ... 412-487-1246
PA Plymouth Meeting, CMS Sls. & Mktg. ... 215-834-6840
TN Collierville, Doby Assocs. ... 901-854-5482
TX Richardson, Jim D. Gray & Assocs. ... 214-699-9976
UT Ogden, Taylor Mktg. ... 801-546-9590

POWERVAR
THE ELECTRONIC SYSTEM POWER SPECIALISTS

FAX: 708-816-8988

POWERVAR, INC., 28457 N. Ballard Dr., Ste. C, Lake Forest, IL 60045, Tel: 708-816-8585, 800-369-7179; *Sls. Mgr.:* Tom Gornick; *Dist. Mgr.:* Tom Gornick ..... **D•2297-2299**

Local Sales Offices & Reps

AZ Glendale, Desert Canyon Sls. 602-938-1804, FAX:602-938-5026
CA Concord, Competent Tech. Scvs. 510-827-9501, FAX:510-676-2904
CA Inglewood, Ezra Mintz Assocs., Inc. 310-677-6790, FAX:310-677-7160
CA Los Alamitos, Power Dynamics Co., Inc. 714-527-6567,FAX:714-827-7832
CA Redondo Bch., Intelligent Power Solution 310-798-1946,FAX:310-379-1077
CA Santa Ana, Powervar West 714-544-9940
CA Santa Barbara, Powercom 805-963-4864, FAX:805-962-0104
CA Woodside, Radical Two 415-363-0267, FAX:415-364-9504
CO Boulder, Carebase Technlgs., Inc. 303-444-9399, FAX:303-444-6467
FL Boca Raton, Business Svc. Mgt., Inc. 407-750-6802,FAX:407-750-9823
HI Waipahu, Computer Power Specialists, Inc. 808-676-3700,FAX:808-676-5700
IL Barrington, Integrated Power Solutions 708-991-9424,FAX:708-991-9425
IN Zionsville, Elctrl. Powwer Protection Specs. 317-873-5027,FAX:317-873-4047
IA Honeycreek, Integrated Elctrl. Svcs. 712-545-9394, FAX:712-545-3572
IA Urbandale, Precision Power Sys. 515-276-4312, FAX:515-276-5058
MN Edina, Dytec 612-831-7169,FAX:612-831-5114
MN Lakeville, MESA Distbn. 612-469-1991, FAX:612-469-2273
MN Minneapolis, T.G. Power Sys. 612-781-2722, FAX:612-781-7545
NY N. Syracuse, Lachut Elctrl. Sls. 315-458-6486, FAX:315-458-6147
PA Feasterville, Spectrum Power Prods. 215-357-6562,FAX:215-357-5871
TX Dickinson, Power Unltd. 713-337-6804, FAX:713-337-5504
WA Redmond, AC Power Technlg. 206-868-3632, FAX:206-868-3730
WA Seattle, Quality Power Sys. 206-524-7016, FAX:206-524-7016
Can Bedford, NS, Powervar Canada 902-835-0497, FAX:902-835-4530
Can Vancouver, BC, Fisher Power Corp. 604-684-7383, FAX:604-684-0401

POWR-UPS CORP., Brookhaven R&D Plaza, 1 Roned Rd., Shirley, NY 11967, Tel: 516-345-5700, 1-800-333-POWR, FAX: 516-345-3106; Empl.: 50; *Sls. Mgr.:* Veronica Harney

PPC PRODUCTS CORPORATION, 7516 Central Industrial Dr., Riviera Beach, FL 33404, Tel: 407-848-9606, TWX: 510-952-7611; FSC No.: 33178; Empl.: 75; *Sls. Mgr.:* Kathy Anderson

PPD

FAX: 919-781-4980

PPD, INC., 6001 Resco Ct., Raleigh, NC 27613, Tel: 919-781-3955; Empl.: 25 ..... **A•1150-1155; B•1383**

Local Sales Offices & Reps

NC Raleigh, Godwin Assocs. 919-878-8000

PPM, INC., 23500 Mercantile Rd., Unit I, Cleveland, OH 44122, Tel: 1-800-899-4776; FSC No.: 29504; Empl.: 20; *Sls. Mgr.:* A. L. Bletcher ..... **D•1315**

Local Sales Offices & Reps

AL Huntsville, Jim Springer, Inc. 205-883-4163
AZ Phoenix, J. Smith & Assocs. 602-267-0981
CA Camarillo, Brevco 805-491-2943
CO Colorado Springs, J. Smith & Assocs. 719-597-5343
MI Ferndale, Tiby Co. 313-547-3550
NM Albuquerque, J. Smith & Assocs. 505-345-6501
OH Cleveland, Tiby Co. 216-371-5335
OH Dayton, Tiby Co. 513-277-3822

PRACTICAL AUTOMATION, INC., 2 Research Dr., Shelton, CT 06484, Tel: 203-929-5381, FAX: 203-929-9941; Empl.: 150; *Sls. Mgr.:* R. M. Banzaca

PRECICONTACT, INC., 835 Wheeler Way, Langhorne, PA 19047, Tel: 215-757-1202, FAX: 215-757-8025; FSC No.: 60197; Empl.: 50; *Sls. Mgr.:* Paul F. Ruo

PRECI-DIP, See Mill-Max Mfg. Corp.

PRECISE SENSORS, INC., 235 West Chestnut Ave., Monrovia, CA 91016, Tel: 818-358-4578, FAX: 818-358-3546; Empl.: 35

PRECISION COMPONENTS, INC., 400 W. Davy Ln., Wilmington, IL 60481, Tel: 708-543-6448, FAX: 708-543-6484

PRECISION CONTROL MANUFACTURING, INC., 1509-B Queen Anne Ave. N., Seattle, WA 98109, Tel: 206-281-9380; FSC No.: 64782; Empl.: 5; *Sls. Mgr.:* Steve L. Deters ..... **A•2116**

Local Sales Offices & Reps

WA Seattle, Precision Control Mfg., Inc. 206-281-9380

Local Distributors

CA Granada Hills, Lion Elctrn., Inc. 818-363-0993

PRECISION DIGITAL CORP., 15 Mercer Road, Natick, MA 01760, Tel: 508-655-7300, FAX: 508-655-8990; *Sls. Mgr.:* Jeffrey Peters

PRECISION ELECTRONIC HARDWARE, INC., 987 Woodtick Road, Waterbury, CT 01703, Tel: 203-754-0779, FAX: 203-755-7996; Empl.: 25; *Sls. Mgr.:* Jeffrey A. Balko

PRECISION ELECTRONICS, 9101 King Ave., Franklin Park, IL 60131, Tel: 708-678-5350, FAX: 708-678-0511; Empl.: 25; *Sls. Mgr.:* Jeff Franzen

PRECISION ELECTRONICS INC., One DiFornas Ct., Copiague, NY 11726, Tel: 516-842-4900, FAX: 516-842-4904 ..... **A•2526**

PRECISION ELECTRO-OPTICS, INC., 30 Commerce St., Box 1039, Chatham, NJ 07928, Tel: 201-635-8811, FAX: 201-635-0437; FSC No.: OG1WB-Cage Code; Empl.: 8; *Sls. Mgr.:* Jim Ingram

PRECISION EXTRUSIONS, INC., Box 120, Bensenville, IL 60106, Tel: 708-766-0340, FAX: 708-766-0495; Empl.: 135; *Sls. Mgr.:* Richard Ziehm

PFT

FAX: 219-253-6570

PRECISION FABRICATION TECHNOLOGIES, INC., State Road 16 W., Monon, IN 47959, Tel: 1-800-558-7297, 219-253-6666; Empl.: 100; *Sls. Mgr.:* Joseph Rogers; *Dist. Mgr.:* Duane Nagel ..... **C•1073-1079**

Local Sales Offices & Reps

AL Mobile, Allied Elctrns. 800-433-5700
AZ Phoenix, Allied Elctrns. 800-433-5700
AZ Phoenix, TeQni-Rep. Assoc. 602-242-9449
CA Saratoga, Edward King & Assocs. 408-741-0434
CA Sun Valley, TeQni-Rep. Assoc. 818-768-4223
CO Englewood, Techtel Mktg. 303-721-9626
CT Old Saybrook, FJS Assocs. 203-388-5374
FL Orlando, Aurora-Schmitt Assoc. 800-232-9005
IL Cary, Bob Burns & Assocs. 708-516-3322
IL Monee, C.R. Co. 708-534-7940
MA Burlington, FJS Assocs. 617-273-5959
MI Livonia, Amtech Rep. 313-474-8300
NJ Medford, Champion Elctrn. Sls. 609-983-0932
NY Hauppauge, Schmitt Mktg. Corp. 516-434-1313
OH Rocky Hill, Oak Hill Mktg., Inc. 216-333-0000
OR Portland, Caruso & Co. 503-246-5439
TX Austin, S.W. Mktg. Assoc. 512-255-8010
TX Dallas, S.W. Mktg. Assocs. 214-341-8631
TX Houston, S.W. Mktg. Assocs. 713-537-8166
WA Bellevue, Caruso & Co. 206-455-8811
WI Colgate, Rep One & Assocs. 414-628-4016
WI Madison, Rep One & Assoc. 608-246-8889

Local Distributors

AL Birmingham, ACK Radio Supply 205-322-0588
AL Huntsville, Allied Elctrns. 800-433-5700
AL Huntsville, Marshall Inds. 205-881-9235
AL Mobile, Allied Elctrns. 800-433-5700
AZ Phoenix, Allied Elctrns. 800-433-5700
AZ Phoenix, Marshall Inds. 602-496-0290
AZ Tucson, Elctrn. City 602-622-1173
CA Calabasas, Marshall Inds. 818-878-7021
CA Canoga Park, Sandy's Elctrns. 818-346-0510
CA Chatsworth, Allied Elctrns. 800-433-5700
CA Chatsworth, ITC Elctrns. 818-700-0900
CA Costa Mesa, Marvac Elctrns. 714-540-3280
CA El Toro, R-Vac Elctrns. 714-586-1210
CA Fremont, Allied Elctrns. 800-433-5700
CA Goleta, DOW Elctrns. 805-968-7272
CA Hawaiian Gardens, Dow Radio 213-421-3781
CA Irvine, Allied Elctrns. 800-433-5700
CA Irvine, Marshall Inds. 714-458-5394
CA Los Angeles, ITC Elctrns. 213-388-0621
CA Los Angeles, Pacific Radio 213-462-1393
CA Milpitas, Marshall Inds. 408-942-4700
CA Milpitas, Zack Elctrns. 408-942-5432
CA North Hollywood, Sandy's Elctrns. 818-983-2550
CA Oxnard, Dow Radio 805-486-6353
CA Oxnard, ITC Elctrns. 805-983-4115
CA Pamona, DOW-Radio 818-966-8461
CA Pasadena, DOW-Radio 818-793-1195
CA Rancho Cordova, Marshall Inds. 916-635-9700
CA Rocklin, Allied Elctrns. 800-433-5700
CA Sacramento, Allied Elctrns. 800-433-5700
CA Sacramento, Zack Elctrns. 916-369-1786
CA San Diego, Allied Elctrns. 800-433-5700
CA San Diego, Marshall Inds. 619-578-9600
CA San Jose, Quement Elctrns. 408-998-5900
CA San Jose, Rose Elctrns. 408-943-0255
CA San Rafael, Elctrns. Plus 415-457-0466
CA Santa Clara, Context Engrg. 408-748-8676
CA South San Francisco, Allied Elctrns. 800-433-5700
CA Thousand Oaks, Pace Elctrns. 805-379-9631
CO Denver, Gateway Elctrns. 303-458-5444
CO Englewood, Allied Elctrns. 800-433-5700
CO Thornton, Marshall Inds. 303-451-8444
CT Bridgeport, Park Dists. 203-366-7200
CT Cheshire, Allied Elctrns. 800-433-5700
CT Wallingford, Marshall Inds. 203-265-3822
FL Altamonte Springs, Marshall Inds. 407-767-8585
FL Casselbery, Allied Elctrns. 800-433-5700
FL Fort Lauderdale, Marshall Inds. 305-977-4880
FL Jacksonville, Allied Elctrns. 800-433-5700
FL Largo, Allied Elctrns. 800-433-5700
FL Miami Lakes, Allied Elctrns. 800-433-5700
FL Pompano Beach, Allied Elctrns. 800-433-5700
FL St. Petersburg, Marshall Inds. 813-573-1399
GA Atlanta, Allied Elctrns. 800-433-5700
GA Atlanta, ACK Radio 404-351-6340
GA Duluth, Allied Elctrns. 800-433-5700
GA Norcross, Marshall Inds. 404-923-5750
ID Boise, Radar Elc. 208-336-2227
IL Berwin, B-B & W Inc. 708-749-1710
IL Champaign, Klaus Radio 217-356-1896
IL LaSalle, Klaus Radio 815-223-7400
IL Libertyville, Allied Elctrns. 800-433-5700
IL Mt. Prospect, Tri-State Elctrns. 708-255-0600
IL Niles, Joseph Elctrns. 708-297-4240
IL Oak Forest, Allied Elctrns. 800-433-5700
IL Peoria, Klaus Radio 309-691-4840
IL Quincy, Klaus Radio 217-223-7560
IL Schaumburg, Marshall Inds. 708-490-0755
IL Wood Dale, Allied Elctrns. 800-433-5700
IL Wood Dale, NEP Elctrns. 708-595-8500
IN Evansville, Ohio Valley Sound 812-425-6173
IN Fort Wayne, Bell Inds. 219-423-3422
IN Indianapolis, Allied Elctrns. 800-433-5700
IN Indianapolis, Bell Inds. 317-634-8202
IN Indianapolis, Marshall Inds. 317-297-0483
IN Indianapolis, PEI-Genesis 317-879-0700
IN Terre Haute, Ohio Valley Sound 812-235-6025
IA Des Moines, Allied Elctrns. 800-433-5700
KS Lenexa, Allied Elctrns. 800-433-5700
KS Lenexa, Marshall Inds. 913-492-3121
KY Louisville, Allied Elctrns. 800-433-5700
KY Owensboro, Ohio Valley Sound 502-683-6727
LA Metairie, Allied Elctrns. 800-433-5700
MD Beltsville, Mark Elctrns. 301-595-5040
MD Columbia, Allied Elctrns. 800-433-5700
MD Gaithersburg, Capitol Radio 301-840-5700
MD Silver Spring, Marshall Inds. 301-622-1411
MA Billerica, Allied Elctrns. 800-433-5700
MA Northboro, Papi Supp. 508-393-8564
MA Norwood, Allied Elctrns. 800-433-5700
MA Wilmington, Marshall Inds. 508-658-0810
MI Grand Rapids, Allied Elctrns. 800-433-5700
MI Grand Rapids, S F Elctrn. Supp. 616-459-0216
MI Livonia, LWC Distributors 313-464-7700
MI Livonia, Marshall Inds. 313-525-5850
MI Plymouth, Allied Elctrns. 800-433-5700
MN Bloomington, Allied Elctrns. 800-433-5700

MN	Minneapolis, Tortec Corp.	612-866-3662
MN	Plymouth, Marshall Inds.	612-559-2255
MO	Bridgeton, Marshall Inds.	314-291-4650
MO	Earth City, Allied Elctrns.	800-433-5700
NE	Omaha, Allied Elctrns.	800-433-5700
NH	Nashua, Allied Elctrns.	800-433-5700
NJ	Edison, Allied Elctrns.	800-433-5700
NJ	Fairfield, Marshall Inds.	201-882-0320
NJ	Lodi, Nidisco	201-773-1771
NJ	Moorestown, Allied Elctrns.	800-433-5700
NJ	Mount Laurel, Marshall Inds.	609-234-9100
NJ	Parsippany, Allied Elctrns.	800-433-5700
NJ	Pine Brook, Allied Elctrns.	800-433-5700
NM	Albuquerque, Bestech	505-298-0034
NM	Albuquerque, TMA, Inc.	505-345-8921
NY	Endicott, Marshall Inds.	607-785-2345
NY	Fairport, Allied Elctrns.	800-433-5700
NY	Hauppauge, Broadline Elctrns.	516-273-2695
NY	Hauppauge, Marshall Inds.	516-273-1515
NY	Lagrangeville, Allied Elctrns.	800-433-5700
NY	Liverpool, WEI Inc.	315-652-8111
NY	Mineola, Allied Elctrns.	800-433-5700
NY	New York City, Audiotechniques	212-586-5989
NY	Rochester, Marshall Inds.	716-235-7620
NY	Syracuse, Allied Elctrns.	800-433-5700
NC	Charlotte, United Elctrn. Supp.	704-372-2650
NC	Raleigh, Allied Elctrns.	800-433-5700
NC	Raleigh, Marshall Inds.	919-878-9882
OH	Beachwood, Allied Elctrns.	800-433-5700
OH	Cincinnati, Allied Elctrns.	800-433-5700
OH	Columbus, Marshall Inds.	614-891-7580
OH	Dayton, Bell Inds.	513-435-8660
OH	Dayton, Consolidated Elctrns.	513-435-5662
OH	Dayton, Marshall Inds.	513-898-4480
OH	Solon, Marshall Inds.	216-248-1788
OH	Worthington, Allied Elctrns.	800-433-5700
OK	Tulsa, Allied Elctrns.	800-433-5700
OR	Beaverton, Marshall Inds.	503-644-5050
OR	Portland, Allied Elctrns.	800-433-5700
OR	Portland, Radar Elec.	503-232-8353
PA	Bethlehem, P.A. Peters	215-861-4850
PA	Camp Hill, Allied Elctrns.	800-433-5700
PA	Pittsburgh, Allied Elctrns.	800-433-5700
PA	Pittsburgh, Marshall Inds.	412-788-0441
RI	Cranston, Jabbour Elctrns.	401-944-2570
RI	Pawtucket, Jabbour Elctrns.	401-728-4600
SC	Greenville, Allied Elctrns.	800-433-5700
TN	Memphis, Allied Elctrns.	800-433-5700
TX	Austin, Allied Elctrns.	800-433-5700
TX	Austin, Altex Elctrns.	512-832-9131
TX	Austin, Marshall Inds.	512-837-1991
TX	Brownsville, Marshall Inds.	512-542-4589
TX	Carrollton, Marshall Inds.	214-233-5200
TX	Dallas, Allied Elctrns.	800-433-5700
TX	El Paso, Allied Elctrns.	800-433-5700
TX	El Paso, Marshall Inds.	915-593-0706
TX	Fort Worth, Allied Elctrns.	800-433-5700
TX	Houston, Allied Elctrns.	800-433-5700
TX	Houston, Marshall Inds.	713-467-1666
TX	Humble, Allied Ectrns.	800-433-5700
TX	Midland, GDL Elctrns.	915-687-3876
TX	San Antonio, Altex Elctrns.	512-828-0503
UT	Salt Lake City, Allied Elctrns.	800-433-5700
UT	Salt Lake City, Marshall Inds.	801-973-2288
VA	Alexandria, Arcade Elctrns.	703-256-4610
VA	Richmond, Norfolk Wire	804-355-1100
VA	Springfield, Allied Elctrns.	800-433-5700
VA	Virginia Beach, Allied Elctrns.	800-433-5700
VA	Virginia Beach, Norfolk Wire	804-449-1100
WA	Bothell, Marshall Inds.	206-486-5747
WA	Richland, Radar Elec.	509-943-8336
WA	Seattle, Allied Elctrns.	800-433-5700
WA	Seattle, Radar Elec.	206-282-2511
WA	Spokane, Radar Elec.	509-747-3053
WA	Tacoma, Allied Elctrns.	800-433-5700
WI	Madison, Satterfield Elctrns.	608-222-3400
WI	Milwaukee, Ind. Elctrns.	414-276-1212
WI	Milwaukee, Marsh Elctrns.	414-475-6000
WI	New Berlin, Allied Elctrns.	800-433-5700
WI	New Berlin, NEP Elctrns.	414-785-9100
WI	Waukesha, Marshall Inds.	414-797-8400
Can	Ontario, Marshall Inds.	416-458-8046
Can	Quebec, Marshall Ind.	514-694-8142

PRECISION FILTERS, INC.
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FAX: 607-277-4466

PRECISION FILTERS, INC., 240 Cherry St., Ithaca, NY 14850, Tel: 607-277-3550, TELEX: 646846; FSC No.: 66-II-F & 66-II-I; Empl.: 80; *Sls. Mgr.:* D. F. Chandler ..... **A•1616, 1673-1675; D•1018, 1200-1202**

Local Sales Offices & Reps

AZ	Tempe, Hannah-Hill	602-431-1772
CA	Chatsworth, Technologies West	818-700-6426
IL	Matteson, Instrumentation Sls. Inc.	708-720-0705
CA	San Jose, Dugan Technlgs.	408-268-1766
CO	Denver, Hannah-Hill, Inc.	303-252-1154
FL	Orlando, Microspec	407-898-3504
GA	Lilburn, Microspec	404-921-3840
IL	Matteson, Instrumentation Sales. Inc.	708-720-0705
KS	Merriam, TECREP Corp.	913-262-9500
IN	Indianapolis, RDP Corp.	317-243-8788
MD	W. Friendship, Gans & Pugh Assocs.	410-442-2189
MA	Boston, Ellis Assocs.	617-585-6750
MI	St. Louis, TECREP Corp.	314-454-9110
MI	Farmington Hills, RDP Corp.	313-471-0685
NH	Manchester, Ellis Assocs.	603-623-0185
NM	Albequerque, Hannah-Hill, Inc.	505-268-0950
NY	Amherst, Reliable Measurement	716-862-9484
NY	Port Chester, Radiation Elctrns.	914-937-2300
OH	Dayton, RDP Corp.	513-253-6175
OH	Richfield, RDP Corp.	216-659-3138
OK	Tulsa, Abcor, Inc.	918-279-1468
PA	North Wales, Gans & Pugh Associates, Inc.	215-699-6655
PA	Pittsburg, RDP Corp.	412-487-2217
SC	Rock Hill, Microspec	803-366-3015
TN	Nashville, Microspec	615-383-4064
TX	Houston, ABCOR, Inc.	713-486-9251
UT	Salt Lake City, Hannah-Hill, Inc.	801-943-9918
VA	Herndon, Gans & Pugh Assocs.	703-709-0305
WA	Bellevue, Syntek	206-462-7700

PRECISION GRAPHICS INC., 59 La Grange St., Raritan, NJ 08869, Tel: 908-707-8880, FAX: 908-707-8884; Empl.: 39; *Sls. Mgr.:* David K. Weissman

Local Sales Offices & Reps

NJ	West Orange, Rizzo Assocs.	201-731-0974
OH	Twinsburg, Protocol Sls.	216-425-2569
PA	New Hope & Norristown, Intek, Inc.	215-723-0433

PRECISION IMAGE CORPORATION, 501 Chesapeake Dr., Redwood City, CA 94063, Tel: 415-366-8900, 1-800-338-3377, FAX: 415-366-2149; Empl.: 70; *Sls. Mgr.:* Mr. Rene Carillo; *Dist. Mgr.:* Mr. Rene Carillo

PRECISION INTERCONNECT, Subsidiary of AMP Incorporated, 16640 SW 72nd Ave., Portland, OR 97224, Tel: 503-620-9400; FSC No.: 60381; Empl.: 500; *Sls. Mgr.:* Alex Guletsky

PRECISION LAMP, INC., 720 Portal St., Cotati, CA 94931, Tel: 707-792-0333, FAX: 707-792-2738; FSC No.: FSCM 58451; Empl.: 80

PRECISION MECHANISMS, 50 Bond St., Westbury, NY 11590, Tel: 516-ED3-5955, FAX: 516-333-5956; FSC No.: 08127; Empl.: 19; *Sls. Mgr.:* Leon N. Canick

PRECISION METAL PRODUCTS CO., Centennial Indl. Pk., Peabody, MA 01960, Tel: 508-532-5500, FAX: 508-532-9403; FSC No.: 86577; Empl.: 54; *Sls. Mgr.:* Robert A. Degnan

PRECISION MICROCONTROL, 8122 Engineer Rd., San Diego, CA 92111, Tel: 619-565-1500, FAX: 619-565-1511; *Sls. Mgr.:* Ian M. Clark

PRECISION PAPER TUBE CO., 1033 South Noel Ave, Wheeling, IL 60090, Tel: 708-537-4250, FAX: 708-537-5777; Empl.: 250

PRECISION PRODUCTS GROUP, INC., 4903 E. State St., Rockford, IL 61108, Tel: 815-395-2155, FAX: 815-395-2151; Empl.: 500; *Sls. Mgr.:* Douglas W. Franklin

PRECISION PROTOTYPES, INC., 255 Midland Ave., Garfield, NJ 07026, Tel: 201-546-6737, FAX: 201-546-8872; *Sls. Mgr.:* Rick Caporino

FAX: 319-394-9280

PRECISION RESISTIVE PRODUCTS, INC., P.O. Box 189, Highway 61 South, Mediapolis, IA 52637, Tel: 319-394-9131; Empl.: 65; *Sls. Mgr.:* Oscar Cline; *Dist. Mgr.:* Oscar Cline ..... **A•2014-2015**

Local Sales Offices & Reps

AZ	Tempe, Advanced Comp. S/S AZ	602-731-9711
CA	Mountain View, Frauman Assoc.	415-964-9464
CA	Seal Beach, Texel	310-596-9411
CO	Grand Junction, Krebill Comp. Sls.	303-243-8220
FL	Melbourne, Phoenix Comps.	407-723-4414
GA	Duluth, Dixie Tech. Mktg.	404-381-5592
IL	Arlington Heights, Russell Elctrn. Sale	708-394-5560
IN	Greenwood, Valentine & Associates	317-888-2260
KS	Prairie Village, Crosslink Elctrns.	913-649-7100
MD	Baltimore, Advanced Tech. Sls.	301-323-3140
MA	Lexington, Jesco, Inc.	617-863-1598
MN	Minneapolis, Intl. Sls. Co.	612-831-8423
NJ	Ridgewood, Ballou Inc.	201-444-6990
OH	Kettering, K.B. Smith Inc.	513-299-0033
TX	Dallas, Kay Todd Assocs.	214-458-8833
WA	Edmonds, ACDC	206-745-5445

PRC

FAX: 813-546-9515

PRECISION RESISTOR CO., INC., 10601 75 St. N., Largo, FL 34647-1421, Tel: 813-541-5771, TELEX: 821788; FSC No.: 48615; Empl.: 45; *Sls. Mgr.:* Arleen Reid ..... **A•2016-2017**

PRECISION SPECIALTIES, INC., 8740 Shirley Ave., Northridge, CA 91324, Tel: 818-349-9774, FAX: 818-349-4367; FSC No.: 66785; Empl.: 10

PRECISION TECH. SEWING, 921 E. Charleston Rd., Palo Alto, CA 94303, Tel: 415-856-2128, FAX: 415-856-1638

PRECISION THIN METAL (LP), 112 Mary Ann Road, Beaver Dam, WI 53916, Tel: 414-885-9000, FAX: 414-885-5078; Empl.: 12; *Sls. Mgr.:* Philip F. Lauf

PRECISION TUBE, 287 Wissahickon Ave., N. Wales, PA 19454, Tel: 215-699-5801, FAX: 215-699-0761; FSC No.: 82413; Empl.: 240; *Sls. Mgr.:* William J. McNeil

PRECISION TUBE CO., Coaxitube Div., 245 Naylor Mill Rd., Salisbury, MD 21801, Tel: 410-546-3911, FAX: 410-546-3913; FSC No.: OBV02; Empl.: 18; *Sls. Mgr.:* Douglas McNeil

PREFERRED ELECTRONICS, INC., Main Line Dr., P.O. Box 248, Westfield, MA 01086, Tel: 413-568-2301, 1-800-553-6374, FAX: 413-562-7275; Empl.: 160; *Sls. Mgr.:* Andree Buscemi

PREH ELECTRONIC INDUSTRIES, INC., 470 E. Main St., Lake Zurich, IL 60047-2578, Tel: 708-438-4000, FAX: 708-438-5522; FSC No.: 36-3193682; Empl.: 10; *Sls. Mgr.:* Pat Jones; *Dist. Mgr.:* Bob Van Orden

PREMA PRECISION ELECTRONICS, INC., 4650 Arrow Hwy. Suite E-5, Montclair, CA 91763, Tel: 714-621-7292, FAX: 714-625-2098

Premier Magnetics Inc.

FAX: 714-362-4212

PREMIER MAGNETICS INC., 27111 Aliso Creek Rd., Ste. 175, Aliso Viejo, CA 92656, Tel: 714-362-4211; Empl.: 10; *Sls. Mgr.:* Jim Earley ..... **A•2508**

Local Sales Offices & Reps

CA	Northern CA, Silicon Valley Sls.	408-432-1967
FL	Tampa, APM Assocs.	813-886-2457
GA	B.T. Funderburk, Inc.	404-963-9495
MD	Artco Assocs.	410-638-1134
MA	Advanced Comp. Grp.	508-845-2023
NJ	Unirep	908-940-1851
NJ	W. Milford, Dynamic Sls. Assoc.	201-728-1044
NJ	West Milford, Dynamic Sls. Assoc.	201-728-1044
NC	B.T. Funderburk, Inc.	919-846-2373
OR	Northwest Comp. Sls.	503-620-3285
WA	Kirkland, Northwest Comp. Sls.	206-828-2104

PREMIER METAL PRODS. CO., 381 Canal Pl., Bronx, NY 10451, Tel: 718-993-9200, FAX: 718-993-9211; Empl.: 75; *Sls. Mgr.:* Anthony E. Bozza ..... **C•1080**

Local Sales Offices & Reps

CA	Campbell, Shur Sls.	408-374-5577
CA	Fontana, Premier Metal	714-829-3089
CO	Denver, AKI Enterprises	303-338-4488
CT	East Haven, Eagle Assocs.	203-467-6542
GA	Marietta, Adams & Assocs.	404-973-0853
IL	Carmél, Current Elctrns.	317-844-1770
IL	St. Charles, May Assocs.	708-293-0062
KS	Kansas City, Delltron Co.	816-436-6445
MD	Burtonsville, Eastern Instrmn.	301-384-8500
MA	Needham, Eagle Assocs.	617-444-3446
MI	Brighton, Electronic Sources	313-227-3598
MN	Anoka, Tech. Solutions	612-785-9303
MO	Florissant, Delltron Co.	314-839-0033
NY	New Hyde Park, Harris & Aldrich Sls.	516-488-2622
NY	Rochester, MicroTech Mktg.	716-426-0806
NY	Yonkers, Sonkin Assocs.	914-968-8282
NC	Greenboro, Adams & Assocs.	919-272-6838
OH	Dayton, Thompson & Assocs.	513-435-7733
PA	Penndel, Delta Mktg.	215-353-6639
TX	Richardson, Spectra Sls. Corp.	214-234-3600
WA	Redmond, Scientific Dvcs	206-885-0004
EXP	FL, Ft. Lauderdale, GM Intl.	305-434-6617

Local Distributors

AZ	Phoenix, Dalis Elctrns.	602-275-2885
CA	San Diego, Sigma Elctrns.	619-565-2000
CA	San Jose, Quement Elctrns.	408-998-5900
CA	San Jose, Rose Elctrns.	408-943-0255
ID	Boise, Radar Elec.	208-336-2227
IL	Skokie, Anixter	708-677-2600
LA	Baton Rouge, Menard Elctms.	504-355-0323
MI	Ann Arbor, Purchase Radio Supp.	313-668-8696
MO	St. Louis, Gateway Elctrn. Supp.	314-427-6116
NJ	Cranford, Garden State Indl. Elec.	201-272-6400
NJ	Englewood, Datanet	201-569-2353
NY	Buffalo, Summit Distrs.	716-884-3450
NY	Great Neck, Avon Datacom	516-466-1690
NY	Hauppauge, Broadline Elec. Dist.	516-231-4100
NY	LIC, H. L. Dalis Inc.	212-361-1100
NY	New York, Audio Techniques	212-586-5989
NY	Portchester, Wise Comps.	914-939-8600
NY	Rochester, Simcona Elctrn. Corp.	716-328-3230
NY	Rochester, Summit Elctrns.	716-334-8110
NC	Raleigh, Southeastern Radio	919-828-2311
OH	Warren, Rem Elctrns.	216-248-1636
OR	Portland, Radar Elec.	503-232-3404
PA	Horsham, Toner Cable Equip.	215-675-2053
PA	West Chester, West Chester Elec. Supp.	215-696-7500
SC	Charleston, Wholesale Indl. Elec.	803-722-2634
TN	Clarksville, Randolph Hale & Matthews	615-647-2325
TN	Cookeville, Randolph & Parks	615-526-6184
TN	Nashville, Randolph & Rice	615-255-5601
TN	Tullahoma, Randolph Rice & Williams	615-455-4531
TX	Ft. Worth, Swieco Inc.	817-335-6521
TX	Houston, Lenert Co.	713-225-1465
VA	Arlington, Arlington Elctrns.	703-524-2412
WA	Richland, Radar Elec.	509-943-8336
WA	Seattle, Radar Elec. Co.	206-282-2511

PREMIER MICROWAVE, 35 New Broad St., Port Chester, NY 10573, Tel: 914-939-8900, FAX: 914-939-9239; FSC No.: 15870; Empl.: 43; *Sls. Mgr.:* Mel Radner

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FAX: 815-385-8578

PREM MAGNETICS, INC., 3521 N. Chapel Hill Rd, McHenry, IL 60050, Tel: 815-385-2700; FSC No.: 20462; Empl.: 180; *Sls. Mgr.:* D. Hertel ..... **A•1277-1281, 2512-2525**

PRES-AIR-TROL CORP., 1009 Boston Post Rd, Mamaroneck, NY 10543, Tel: 914-698-2026, 800-431-2625, FAX: 914-698-9456; Empl.: 25; *Sls. Mgr.:* Gilbert Bassin ..... **B•1800**

PRESCO, INC., 8 Lunar Drive, Woodbridge, CT 06525, Tel: 203-397-8722, FAX: 203-389-1129; Empl.: 8

PRESIDIO COMPONENTS, INC., 7169 Construction Ct., San Diego, CA 92121, Tel: 619-578-9390, FAX: 619-578-6225; FSC No.: 60212

PRESS-ON PRODUCTS, 21 Factory Rd., Addison, IL 60101, Tel: 708-628-2255, FAX: 708-628-8025; Empl.: 25; *Sls. Mgr.:* T. Cummins

PRESSURE CONTROLS, INC., 406 Cortlandt St., Belleville, NJ 07109, Tel: 201-751-5002, FAX: 201-751-9653; FSC No.: 52193; Empl.: 15; *Sls. Mgr.:* P. Emmarco

PRESSURE SYSTEMS, INC., 34 Research Dr., Hampton, VA 23666, Tel: 804-865-1243, TELEX: 901406, FAX: 804-766-2644; Empl.: 98; *Sls. Mgr.:* J. S. Yakshe

PRIMELINE, Soltec Corporation, P. O. Box 670, San Fernando, CA 91341-0670, Tel: 818-365-0101, TELEX: 494-3094 SOLTEC UI, FAX: 818-365-7839; *Sls. Mgr.:* Byron McIntire

PRIME TECHNOLOGY

FAX: 203-481-8937

PRIME TECHNOLOGY, INC., Twin Lakes Rd., P.O. Box 185, N. Branford, CT 06471, Tel: 203-481-5721, TWX: 710-452-3092; Empl.: 60; *Sls. Mgr.:* James L. Jamieson, Mktg. VP

PRIMO COMPANY LIMITED, 25-1, 6-Chome, Mure, Mitakashi, Tokyo, Japan 181, Tel: 0422-43-3121; FSC No.: 0422 49 8865; Empl.: 391; *Sls. Mgr.:* H. Ikoma; *Dist. Mgr.:* S. Mizutani

PRINCETON CASE CO., INC., 667 Lehigh Ave., Union, NJ 07083, Tel: 908-687-1750, FAX: 908-687-1755; Empl.: 60; *Sls. Mgr.:* S. E. Parker

PRINCETON ELECTRONIC PRODUCTS, 2549 U.S. Highway 1, North Brunswick, NJ 08902, Tel: 908-297-4448, FAX: 908-297-5641; Empl.: 29; *Sls. Mgr.:* H.R. Center; *Dist. Mgr.:* H.R. Center

PRINCO INSTRUMENTS, INC., 1020 Industrial Hwy., Southampton, PA 18966, Tel: 215-355-1500, FAX: 215-355-7766; FSC No.: 48620; Empl.: 70; *Sls. Mgr.:* G. G. Pfaff

PRINTER PRODUCTS, 25 Denby Road, Boston, MA 02134, Tel: 617-254-1200, FAX: 617-254-6848; Empl.: 100; *Sls. Mgr.:* Joe Grimaldi; *Dist. Mgr.:* Bruce Burgess

PRINT PRODUCTS INTL., 8931 Brookville Rd., Silver Spring, MD 20910, Tel: 301-587-7824, 800-638-2020, FAX: 800-545-0058; Empl.: 6; *Sls. Mgr.:* Scott MacDonald; *Dist. Mgr.:* Scott MacDonald

PBS PRO BATTERY SPECIALISTS

FAX: 404-449-5457

PRO BATTERY, INC., 3941 Oakcliff Indl. Ct., Atlanta, GA 30340, Tel: 800-451-7171; Empl.: 35; *Sls. Mgr.:* Neal A. Zucker ..... **B•1178; D•1465**

PROBE MASTER, INC., 4898 Ronson Ct., San Diego, CA 92111, Tel: 619-560-9676, 800-772-1519, FAX: 619-560-7354; *Sls. Mgr.:* Dick Press

PROBE-RITE, INC., P.O. Box 242, Santa Clara, CA 95052, Tel: 408-727-0100, FAX: 408-496-0117; *Sls. Mgr.:* Frank J. Ardezzone

PROCESS & ANALYTICAL INSTRUMENTS DIV., A Subsidiary of Ametek Inc., 150 Freeport Rd., Pittsburgh, PA 15238, Tel: 412-828-9040, FAX: 412-828-0399; Empl.: 110; *Sls. Mgr.:* Jerry Barth

PRO-COMM, INC., 1105 Industrial Pkwy., Brick, NJ 08724, Tel: 908-206-0660, FAX: 908-458-1919; FSC No.: OUTX6; Empl.: 10; *Sls. Mgr.:* Robert L. Sepulveda

PRO COM TECHNOLOGY INC., 29 Newton Rd., Plainview, NY 11803, Tel: 516-293-4443, 800-762-3785, FAX: 516-293-4456; FSC No.: 0K887; Empl.: 11; *Sls. Mgr.:* Alan Spiegel

PRODELIN CORPORATION, P.O. Box 368, Conover, NC 28613, Tel: 704-464-4141, FAX: 704-464-5725; Empl.: 130; *Sls. Mgr.:* Dan Johnson

PRODIGIT ELECTRONICS, 69 Moreland Rd., Simi Valley, CA 93065, Tel: 805-527-0888; Empl.: 100; *Sls. Mgr.:* Daniel Erb

PRODUCTION AUTOMATION, INC., 2558 Seaboard Ave., San Jose, CA 95131-1026, Tel: 408-894-9064, FAX: 408-894-9083; Empl.: 4; *Sls. Mgr.:* Bill Minnick; *Dist. Mgr.:* Bill Minnick

PRODUCTRONICS INC., 7616 Disalle Blvd., Fort Wayne, IN 46825, Tel: 219-489-8201, FAX: 219-489-6573; Empl.: 4; *Sls. Mgr.:* Bernard James

PRODUCTS ENGRG. CORP., 503 S. Vincent Ave., Azusa, CA 91702-5131, Tel: 818-969-5879, TELEX: 910-587-1559, FAX: 818-969-9381; FSC No.: CAGE 3S621; Empl.: 30; *Sls. Mgr.:* Richard Mitchell

PRODUCTS FOR RESEARCH, 88 Holten St., Danvers, MA 01923, Tel: 508-774-3250, FAX: 617-245-1628; Empl.: 16

PRODUCT TECHNOLOGY, INC., 2811-B McGaw Avenue, Irvine, CA 92714, Tel: 714-474-8998, FAX: 714-474-1340; FSC No.: 1Z295; Empl.: 85; *Sls. Mgr.:* Diane Weston ..... **C•1673**

PROFESSIONAL ENGINEERING SYSTEMS, 425 Parkway Dr., Erie, PA 16511-1051, Tel: 814-453-5452

PROGRAMMABLE DEVICES, INC., 205 Main St., North Reading, MA 01864, Tel: 508-664-6447, FAX: 508-664-9977; Empl.: 10

PTS FREQUENCY SYNTHESIZERS

FAX: 508-486-4495

PROGRAMMED TEST SOURCES, 9 Beaver Brook Road, P.O. Box 517, Littleton, MA 01460, Tel: 508-486-3008; FSC No.: 66381; Empl.: 30 ..... **D•1316**

PROJECTIONS UNLIMITED, 14831 Myford Rd., Tustin, CA 92680, Tel: 714-544-2700, FAX: 714-544-8711; *Sls. Mgr.:* Robert C. Gau

PROJECTOR RECORDER BELT CORP., Route 3 Highway 59 P.O. Box 176, Whitewater, WI 53190, Tel: 1-800-533-9654, FAX: 1-800-635-8101; Empl.: 30; *Sls. Mgr.:* Ed Wetzel; *Dist. Mgr.:* Nancy Smith

PROJECT PRO, 1710 Enterprise Pkwy., Twinsburg, OH 44087, Tel: 216-425-8888

PROJECT RESOURCES INC., 16 Kendrick Rd, Wareham, MA 02571, Tel: 508-295-7444, FAX: 508-295-7497; FSC No.: OEF11; Empl.: 18; *Sls. Mgr.:* T.R.Egan

PROJECTS UNLIMITED, 3680 Wyse Rd., Dayton, OH 45414, Tel: 513-890-1918, FAX: 513-890-4911; Empl.: 61; *Sls. Mgr.:* Greg Kimpton ..... **D•1057**

Local Sales Offices & Reps

AZ	Scottsdale, Williams Assocs.	602-494-0790
CA	Irvine, Cal Rep Inc.	
CA	San Jose, Comtech Mktg.	408-249-3330
CO	Commerce City, Williams Assocs.	303-289-5647
CT	Seymour, Sturdy Corp.	203-888-1480
FL	Lakeland, Munday Sls. Co.	813-858-5606
GA	Alpharetta, R.A. Sls.	404-442-6749
IL	Woodridge, Golten Assocs. Inc.	708-985-5100
IN	Indianapolis, The J. C. Hofstetter Co.	317-897-7914
IA	Cedar Rapids, Thomas Dowell	319-393-7920
KS	Overland Park, Thomas L. Dowell	913-722-4242
MA	Westwood, Sturdy Corp.	617-326-8300
MN	Edina, G.P. Sls.	612-831-2362
MO	St. Louis, Thomas L. Dowell	314-849-4234
NH	Derry, Sturdy Corp.	603-434-8440
NM	Albuquerque, Williams Assocs.	505-255-1638
NY	Bohemia, Optimum Metro Sls., Inc.	516-244-5744
NY	Penn Yan, Ecco New York	315-536-5033
NC	New Bern, R A Sales	919-244-2672
OH	Dayton, J.C. Hofstetter Co.	513-296-1010
OH	Medina, J. C. Hofstetter Co.	216-241-4880
OR	Hillsboro, Doran Sls., Assoc.	503-640-4500
PA	Hickory, J. C. Hofstetter Co.	412-356-2305
PA	Valley Forge, Providence Mktg.	215-935-3300
SC	Easley, R A Sales	803-859-1859
TN	Rutherford, R.A. Sls.	901-665-6301
TX	Austin, Kruvand Assocs. Inc	512-219-9443
TX	Dallas, Kruvand Assoc.	214-437-3355

WA Bothell, Doran Sls. Assocs., Inc. 206-488-1200
Can Islington, Ont., D.T. Shaw Co., Ltd. 416-231-3494
Can Montreal, Que., D.T. Shaw Co. Ltd. 514-332-1163

Local Distributors

AR Ft. Smith, Carlton Bates 501-646-8201
AR Little Rock, Carlton Bates 501-562-9100
AR Pine Bluff, Carlton Bates 501-535-1354
AR Springdale, Carlton Bates 501-756-5012
CA Milpitas, Kent Elctrns. 408-262-5300
CA San Jose, Speakers Unlimited 408-453-5698
CA Torrance, Kent Elctrns. 310-320-2700
CO Commerce City, Waco Elctrns. 303-289-4743
CT Newtown, Target Elctrns. 203-426-4403
FL Clearwater, Atlantic Elctrns. 813-531-5900
FL Lakeland, A-A Elec. 813-665-6941
FL Lakeland, Atlantic Elctrns. 813-687-0200
FL West Palm Beach, Atlantic Elctrns. 407-686-8553
GA Lawrenceville, A-A Elec. 404-822-4960
IL Bensenville, Voyager Elctrns. Corp. 708-860-1300
IA Cedar Rapids, Dee Elctrns. 319-365-7551
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NJ Mt. Laurel, S-J Assocs. 609-866-1234
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IN	Fort Wayne, Technlg. Mktg.	219-432-5553
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KS	Olathe, G.M. Brown & Assoc.	913-829-3086
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OH	Akron, Aesco Elctrns.	216-762-8811
PA	Exton, VSH Elctrns.	215-363-2250
PA	McKean, Advacom	814-476-7774
TX	Ft. Worth, Allied Elctrns.	800-433-5700
WI	New Berlin, NEP	414-785-9100

R. C. ELECTRONICS INC., 6464 Hollister Ave, Goleta, CA 93117, Tel: 805-685-7770, FAX: 805-685-5853; Empl.: 20; *Sls. Mgr.:* Chao-Sun Pang; *Dist. Mgr.:* Chao-Sun Pang

RC ELECTRONICS, 43002 Christy St., Fremont, CA 94538-3164, Tel: 510-656-8490, FAX: 510-656-4759; *Sls. Mgr.:* Joe Butler

R-COLUMBIA PRODS. CO., INC., 2008 St. Johns Ave., Highland Park, IL 60035, Tel: 708-432-7915, FAX: 708-432-9181; Empl.: 20

RDF CORPORATION, 23 Elm Ave., P.O. Box 490, Hudson, NH 03051-0490, Tel: 603-882-5195,800-445-8367, FAX: 603-882-6925; FSC No.: 02009; Empl.: 97; *Sls. Mgr.:* Randal A. Gauthier; *Dist. Mgr.:* Irwin Bluestein

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FAX: 914-777-7070

RDI ELCTRNS., INC., 147 Palmer Ave., Mamaroneck, NY 10543, Tel: 914-777-7000; Empl.: 9; *Sls. Mgr.:* Barry Miller **A•2117; B•1801; C•1440-1441, 1803; D•1060-1062**

Local Sales Offices & Reps

AL	Madison, E-Squared Mktg.	205-464-0392
CA	Newport Bch., SPA Elctrn. Sls.	714-863-1193
CA	San Jose, Comtech Mktg.	408-249-3330
FL	Longwood, M & H Assocs.	407-332-7912
GA	Marietta, E-Squared Mktg.	404-565-2088
MD	Germantown, Bresson Assocs.	301-540-0110
MN	Minneapolis, OEM Elctrl. Sls., Inc.	612-884-7509
NY	Hicksville, J. Square Mktg., Inc.	516-935-3200
OH	Dayton, John Stephenson Assoc.	513-435-0745
OK	Tulsa, Nova Mktg.	918-660-5105
PA	Narberth, Bresson Assocs.	215-664-6460
TX	Austin, Nova Mktg.	512-343-2321
TX	Dallas, Nova Mktg.	214-265-4600
TX	Houston, Nova Mktg.	713-988-6082
UT	Salt Lake City, Comp. Sls., Inc.	801-561-5099
WA	Redmond, Elctrnc. Mktg. Grp., Inc.	206-882-0962

REACTEL, INC., 687-K Lofstrand Ln., Rockville, MD 20850, Tel: 301-279-5535, FAX: 301-340-7304; FSC No.: 60458; Empl.: 30; *Sls. Mgr.:* Manny Assurian

READE ADVANCED MATERIALS, A Reade Intl. business unit, P.O. Drawer 15039, Riverside, RI 02915-0039, Tel: 401-433-7000, FAX: 401-433-7001; FSC No.: OA9E1; Empl.: 25; *Sls. Mgr.:* Charles Reade Jr.; *Dist. Mgr.:* J.W. Mearz

RE AMERICA, 31029 Center Ridge Rd., Westlake, OH 44145, Tel: 216-871-7617, FAX: 216-871-4303; Empl.: 25; *Sls. Mgr.:* P. A. Bosworth

RE-AN U.S.A, INC., Re-An Ltd. (UK), 16 Passait Ave., Fairfield, NJ 07004, Tel: 1-800-828-7266, FAX: 201-808-6517; *Sls. Mgr.:* Frank Riordan

Local Distributors
Can All of Canada, Cabletek 604-942-1001

RECOGNITION CONCEPTS,INC., 5200 Convair Drive, Carson City, NV 89706, Tel: 702-831-0473, 1-800-243-8724, TELEX: 753168, FAX: 702-831-8035; Empl.: 24; *Sls. Mgr.:* Joe Frankie

THE RECORDER COMPANY, P.O. Box 8, San Marcos, TX 78667, Tel: 210-629-1400, FAX: 512-353-5333; Empl.: 11; *Sls. Mgr.:* Floyd Mackenzie; *Dist. Mgr.:* Floyd Mackenzie

RECORDER SYS. DIV., See Gulton Graphic Instruments Div.

RECORTEC, INC., 1290 Lawrence Station Road, Sunnyvale, CA 94089, Tel: 800-729-7654, FAX: 408-734-2140; *Sls. Mgr.:* S. Giacomo

RECOTON CORP., 46-23 Crane St., Long Island City, NY 11101, Tel: 718-392-6442, TELEX: 236047 RCTN, FAX: 718-784-1080; Empl.: 300; *Sls. Mgr.:* Peter Dayton, VP, Sls.

RECTRON, 13252 E. Temple Ave., Industry, CA 91746, Tel: 818-333-3802, FAX: 818-330-6296

REDINGTON COUNTERS, 130 Addison Rd., Windsor, CT 06095, Tel: 203-688-6205, FAX: 203-688-1591; *Sls. Mgr.:* John P. Boyle, Jr.

REDLAKE CORP., 15005 Concord Circle, Morgan Hill, CA 95037, Tel: 408-779-6464, FAX: 408-778-6256; Empl.: 22; *Sls. Mgr.:* J. Stephen Wood

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RED SQUARE COMPANY, 2098 S. Grand Ave. Ste. H, Santa Ana, CA 92705, Tel: 714-751-1373; *Sls. Mgr.:* Ed Burg

REED SWITCH DEVELOPMENTS, INC., 1405-16th St., Racine, WI 53403, Tel: 414-637-8848, FAX: 414-637-8861; *Sls. Mgr.:* C. Carpenter ..... **B•2006**

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DIVISION DYNAMICS CORPORATION OF AMERICA

FAX: 717-243-0079

REEVES-HOFFMAN DIV., Dynamics Corporation of America, 400 W. North St., Carlisle, PA 17013-2248, Tel: 717-243-5929; Empl.: 340; *Sls. Mgr.:* Walt Sener ..... **A•1464-1469, 1716**

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AZ	Phoenix, Chaparral Elctrns.	602-996-5909
CA	Mountain View, Carleton Assocs.	415-961-0565
CA	Newbury Park, Westaironics	805-499-9844
CO	Denver, DMG, Inc.	303-231-6039
IL	Des Plaines, ESCO Assocs.	708-298-5310
MA	Wakefield, H. Jappe Co.	617-245-9359
MN	Minneapolis, Intl. Elctrns.	612-571-0000
NJ	Flanders, K&R Engrg. Corp.	201-584-5235
NC	Greensboro, Adams & Assocs.	919-272-6838
OH	Cincinnati, Tri-State Mktg.	513-761-7993
TX	Irving, Kite Elctrns. Sls.	214-986-0321
EXP	Jerusalem, Israel, Ben-R-Tek Elctrns.	972-2-380656
EXP	London, England, Reeves-Hoffman U.K.	44-844-275929
Can	Rexdale, Ont., Myelco, Inc.	416-790-8297

REGDON SOLENOID INC., See Magnet Schultz of America

REGENT CONTROLS, INC., 39 Fanny St., P.O. Box 767, Shelton, CT 06484-0767, Tel: 203-924-2924, FAX: 203-924-2928; Empl.: 20; *Sls. Mgr.:* Lora C. Murphy

REGULUS SYSTEMS, 11901 Forest View Dr., Nevada City, CA 95959, Tel: 415-593-4197

REICH ASSOCIATES, INC., Rt. 4, Box 4620, Lakehills, TX 78063, Tel: 210-751-3220, FAX: 210-751-3054; FSC No.: 55916; Empl.: 20; *Sls. Mgr.:* W. Reich

REKCO, INC., See LEM U.S.A. Inc.

RELAY SERVICE CO., 1300 N. Pulaski Rd., Chicago, IL 60651, Tel: 312-252-2700, FAX: 312-252-0300; Empl.: 25; *Sls. Mgr.:* Chas. H. Badger

RELAY SPECIALTIES, 17 Raritan Rd., Oakland, NJ 07436, Tel: 201-337-1000, TELEX: 642751, FAX: 201-337-1862; Empl.: 48; *Sls. Mgr.:* S. R. Gershberg

RELCO PRODUCTS, 5594 E. Jefferson Ave., Denver, CO 80237, Tel: 303-756-1143; FSC No.: 14454; Empl.: 7

RELCO/RITZ ELECTRONICS, 196 Queen St. N., New Dundee, Ont., Canada N0B 2E0, Tel: 519-696-2616 ..... **C•1081; D•1913**

RELIABLE CAPACITORS/HI-REL CAPACITORS, 12931 E. Sunnyside Place, Sante Fe Springs, CA 90690, Tel: 310-946-8577, FAX: 310-944-7494; FSC No.: 54795-Hi-Rel;18489-Reliable Capacitors; Empl.: 32; *Sls. Mgr.:* Bas Lim; *Dist. Mgr.:* Shelley Spain ..... **A•1156**

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CA	Fremont, C.B. King Assocs.	510-770-9188
MA	Framingham, Stone Comp. Sls.	508-875-3266
MN	Oakdale, Complete Sls.	612-731-2923
NY	New York, Radian Elctrns.	212-725-2860
OH	Alpha, Poliquin & Co., Inc.	513-426-8055
TX	Farmers Branch, Keats & Assocs.	214-243-5905

Local Distributors

NY	Hauppauge, Vargas Elctrns., Inc	516-273-1111
NY	Port Chester, Zeus Comp., Inc.	914-937-7400

RELIABLE ELECTRONIC MFG., Wyvern Technologies, 1205 E. Warner Ave., Santa Ana, CA 92705, Tel: 714-966-0710, FAX: 714-556-7014; FSC No.: 0FNJ8; *Sls. Mgr.:* Dave Hail

RELIABILITY INCORPORATED, P. O. Box 218370, Houston, TX 77218, Tel: 713-492-0550, FAX: 713-492-0615; *Sls. Mgr.:* Len Moscovitz; *Dist. Mgr.:* Mike Tenore

RELIANCE COMM/TEC, Reliance Electric, P.O. Box 17438, Cleveland, OH 44117, Tel: 800-245-4501

RELIANCE ELECTRIC CO., P.O. Box 17438, Cleveland, OH 44117, Tel: 800-245-4501

RELIANCE MOTION CONTROL, Reliance Electric, 6950 Washington Ave. So., Eden Prairie, MN 55344, Tel: 612-942-3600, FAX: 612-942-3636; *Sls. Mgr.:* Harry Webber; *Dist. Mgr.:* Brad Nelson

RELIANCE PLASTICS & PACKAGING, 217 Brook Ave., Passaic, NJ 07055, Tel: 201-473-7200, FAX: 201-473-1023; Empl.: 60; *Sls. Mgr.:* Hale Smith

RELM COMMUNICATIONS, INC., Adage, Inc., 7707 Records Street, Indianapolis, IN 46226, Tel: 317-545-4281, FAX: 317-545-2170; Empl.: 300; *Sls. Mgr.:* John Biljan

REMEE PRODUCTS CORP., 186 North Main Street, Florida, NY 10921, Tel: 914-651-4431, FAX: 914-651-4160; FSC No.: 4R362; Empl.: 135; *Sls. Mgr.:* Ken Pimental; *Dist. Mgr.:* Ken Pimental

RENARD MANUFACTURING COMPANY, INC., 3305 N.W. 79th Ave., Miami, FL 33122-1015, Tel: 305-592-1500, TELEX: 989326, ESYLNK: 62929141, FAX: 305-593-9990; Empl.: 250; *Sls. Mgr.:* S. Simerly

RENATA, 990 N. Bowser, Ste. 900, Richardson, TX 75081, Tel: 214-234-8091, FAX: 214-699-3900

RENCO ENCODERS INC., 26 Coromar Dr., Goleta, CA 93117-3094, Tel: 805-968-1525, FAX: 805-685-7965; FSC No.: 34479; Empl.: 100; *Sls. Mgr.:* Dan Baxter; *Dist. Mgr.:* Edward Burk

RENCO ELECTRONICS, INC.

FAX: 516-586-5562

RENCO ELECTRONICS, INC., 60 Jefryn Blvd., East, Deer Pk., NY 11729, Tel: 516-586-5566, 1-800-645-5828; FSC No.: 14778; Empl.: 275; *Sls. Mgr.:* Edward W. Rensing; *Dist. Mgr.:* Rhonda Rizzo ... **A•1283-1289, 2527-2531**
Toll-Free Engineering Hot Line 800-645-5828, in NY State 516-586-5566

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AL	Huntsville, Solutions Mfrs. Reps.	205-539-3152
AZ	Tempe, Border States Tech. Svc.	602-839-0248
AR	Arlington Heights, Russell Elctrn. Sls.	708-394-5560
CO	Wheat Ridge, Wescom Mktg. Inc.	303-422-8957
CT	East Hampton, Apex Assocs.	203-268-8401
GA	Marietta, Solutions Mfrs. Reps.	404-951-5683
IN	Indianapolis, Schark Mktg. Inc.	317-842-6204
MA	Needham, Apex Assocs.	617-444-8070
MS	Meridian, Solutions Mfrs. Reps.	601-482-4647
MO	St. Louis, Rush & West Assoc.	314-965-3322
NJ	Marlton, BGR Assocs.	609-983-1020
NM	Albuquerque, Border States Tech. Svc.	505-884-9100
NY	Skaneateles, NRM Mktg. Grp. Inc.	315-685-8991
NC	Raleigh, Solutions Mfrs. Reps.	919-790-7606
UT	Sandy, Moss Mktg.	801-562-9000
FL	Indian Harbor Bch., Solutions Inc.	407-777-0994
IA	Davenport, Rush & West Assocs.	319-388-9494
KS	Olathe, Rush & West Assocs.	913-764-2700
MD	Mt. Airy, Eltron Sls. Ltd.	410-875-0362
MI	Grosse Point Pk., Greiner Assocs.	313-499-0188
OH	Rocky River, Oak Hill Mktg. Inc.	216-333-0000
OR	Hillsboro, Temco Northwest	503-645-2030
TX	Dallas, Electra Reps	214-248-3852
VA	Front Royal, Eltron Sls. Ltd.	703-635-7201
WA	Bothell, Temco Nortwest	206-481-6150
WI	Brookfield, Bert Wartchow Assocs.	414-821-2993
Can	Montreal, Que, Eli Manis, Inc.	514-484-2923

REPRODUCTION TECHNOLOGIES INC., P.O. Box 790, Bristol, IN 46507-0790, Tel: 219-848-5233; Empl.: 10; *Sls. Mgr.:* Michael Stoll

REPUBLIC ELECTRONICS CO., Esterline Technologies, 200 Wireless Blvd., Hauppauge, NY 11788, Tel: 516-273-9800, FAX: 516-273-9820; FSC No.: 95750; Empl.: 145; *Sls. Mgr.:* Sy Newman, Mktg. Mgr.

RESEARCH DEVICES, INC., 121 Ethel Rd. West, Piscataway, NJ 08854, Tel: 908-572-4800, TELEX: 467058, FAX: 908-572-4808; Empl.: 30; *Sls. Mgr.:* Michael Schneider

RESEARCH INC., P.O. Box 24064, Minneapolis, MN 55424, Tel: 612-941-3300, TELEX: 29-0502, FAX: 612-941-3628; Empl.: 140; *Sls. Mgr.:* JD Strand, Al Day, Marianne Walmsley

RESEARCH SPECIALISTS, 1816 Settlers Oval, Cleveland, OH 44145, Tel: 216-871-8909; Empl.: 10; *Sls. Mgr.:* Tim Howard

RESISTANCE TECHNOLOGY INC., 1260 Red Fox Rd., St. Paul, MN 55112, Tel: 612-636-9770, FAX: 612-636-8944; *Sls. Mgr.:* Roger H. Falde, Dir. Sls.

RESISTORS, INC., 5226 W. 26th St., Chicago, IL 60650, Tel: 708-652-7555, FAX: 708-863-4272; Empl.: 35; *Sls. Mgr.:* Theresa McGraw

FAX: 408-441-7224

RESONANT POWER TECHNOLOGY, 1926 Junction Ave., San Jose, CA 95131-2102, Tel: 408-441-0800; FSC No.: 0BZ13; Empl.: 10; *Sls. Mgr.:* Dan H. Burgoon ..... **D•1914-1915**

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RFI CORPORATION, 100 E. Pine Aire Dr., Bay Shore, NY 11706, Tel: 516-231-6400, FAX: 516-231-6465; FSC No.: 13619; Empl.: 140; *Sls. Mgr.:* Dave Radford ..... **A•1157-1158, 1601, 1676, 2315, 2532**

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FL Clearwater, Tech-Rep Assocs. 813-572-9900
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FL Merritt Island, Tech-Rep Assocs. 407-453-3313
FL Winter Springs, Tech-Rep Assocs. 407-699-4010
IL Compucon West 708-513-7706
IN Ft. Wayne, Naunas Sls. Co. 219-432-4792
MD Kensington, Koebert Assoc. 301-493-8924
MO Ballwin, Gillam Entrprs., Inc. 314-458-1896
MA Burlington, Tritek, Inc. 617-272-4550
NM Albuquerque, M.G. Elctrns. 505-255-1638
NY Buffalo, Foster & Wager, Inc. 716-385-7744
NY Great Neck, Trionic Assocs. 516-466-2319
NY Ronkonkoma, Compucon Distrs., Inc. 516-981-8810
NC Winston-Salem, Murcota Corp. 919-722-9445
PA Glenside, Koebert Assocs.,Inc. 215-887-2310
TX Garland, McBride Sci. Sls. 214-494-5000
VA Alexandria, koebert Assocs. 703-461-3655
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RF INDUSTRIES LTD. (NUELINK), 7620 Miramar Rd., San Diego, CA 92126, Tel: 619-549-6340, 800-233-1728, FAX: 619-549-6340; Empl.: 25; *Sls. Mgr.:* Les Perlman

RFL ELECTRONICS INC., Powerville Rd., Boonton, NJ 07005-0239, Tel: 201-334-3100, FAX: 201-334-3863; FSC No.: 49673; Empl.: 300

RF MONOLITHICS, INC., 4441 Sigma Rd., Dallas, TX 75244, Tel: 214-233-2903, FAX: 214-387-8148; FSC No.: 2U874; Empl.: 200; *Sls. Mgr.:* C. Baker

R.F. POWER LABS., INC., Kalmus Engineering Inc., 21820 -87th S.E., Woodinville, WA 98072, Tel: 206-481-8833, FAX: 206-486-1002; FSC No.: 057143; Empl.: 17; *Sls. Mgr.:* Jeannie Olson

RGB SPECTRUM, 950 Marina Village Parkway, Alameda, CA 94501, Tel: 510-814-7000, FAX: 510-814-7026; Empl.: 30; *Sls. Mgr.:* Lucien E. Long; *Dist. Mgr.:* Lucien E. Long

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RHG ELECTRONICS LABORATORY, INC., 161 E. Industry Ct., Deer Park, NY 11729, Tel: 516-242-1100, FAX: 516-242-1222; Empl.: 205; *Sls. Mgr.:* David E. Krautheimer

RHINO ROBOTS, INC., P.O. Box 4010, Champaign, IL 61824, Tel: 217-352-8485, FAX: 217-356-7699; Empl.: 18; *Sls. Mgr.:* H.S. Sandhu

RHOMBUS INDUSTRIES, 15801 Chemical Ln., Huntington Bch., CA 92649-1595, Tel: 714-898-0960, FAX: 714-896-0971; FSC No.: 16714; Empl.: 60; *Sls. Mgr.:* Mary Manandik; *Dist. Mgr.:* Sheryl Lane ..... **A•1579, 2533**

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CO Parker, A-5 Co. 303-841-3651
CT Canterbury, Deltech Sls. 203-546-6322
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FL Boca Raton, Electramark 305-424-2872
FL Tampa, Electramark 813-962-1882
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TX Dallas, Component Technlg. 214-783-8831
TX Houston, Component Technlg. 713-690-3011
VT S. Burlington, Deltech Sls. 802-865-4454
WA Redmond, Joe Blanchard Sls. 206-778-9622

Local Distributors

CA Costa Mesa, Eric Elctrns. 714-751-1185
CA Manhattan Bch., Prime Electro Prods. 310-379-3642
CA San Jose, Eric Elctrns. 408-432-1111
MA Wakefield, Nu Horizons Elctrns. Corp. 617-246-4442
NH Atkinson, Astrum Elctrns. 603-898-3399
NJ Pine Brook, Nu Horizons Elctrns. Corp. 201-882-8300
NY Amityville, Nu Horizons Elctrns. Corp. 516-226-6000
NY E. Rochester, Nu Horizons Elctrns. Corp. 716-292-0777
WI McQuon, Taylor Elec. Co. 414-241-4321

RIA electronic

FAX: 908-389-9066

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PA Allison Park, Electro Mktg. Grp., Inc. ... 800-338-6856
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IN Indianapolis, Advent Elctrns. 317-872-4910
IN Indianapolis, Control Des. Supp. 317-788-4559
IA Cedar Rapids, Advent Elctrns., Inc. 319-363-0221
IA Marion, Control Des. Supp. 319-373-2923
KS Kansas City, Control Des. Supp. 913-362-4248
MA Walpole, Richey-Impact Elctrns. 508-668-8200
MA Woburn, Control Des. Supp. 617-932-9404
MI Farmington Hills, Control Des. Supp. .. 313-473-0220
MI Rose Mount, Advent Elctrns., Inc. 708-297-6200
MN Minneapolis, Control Des. Supp. 612-721-1628
MO Kansas City, Barr-Thorp Elec. Co. 816-531-8840
MO Maryland Heights, Control Design Supp. 314-432-1116
NH Goffstown, Key Comps. 603-626-1717
NJ Bellmawr, Mid Atlantic Comps. 609-931-5303
NJ Union, Lectron Inds. 908-687-2626
NY Bohemia, EBL Svcs., Inc. 516-567-7577
NY Ronkonkoma, Spectrum Comps. 516-737-6900
NC Charlotte, Control Des. Supp. 704-588-4410
NC Winston-Salem, Kirkman Elctrns., Inc. 919-722-9131
OH Akron, Aesco Elctrns., Inc. 216-762-8818
OH Cincinnati, Hughes Peters 513-351-2000
OH Cleveland, Roberts Elctrns. 216-230-1711
OH Columbus, Aesco Elctrns., Inc. 614-882-6762
OH Dayton, Related Comps. 513-253-6116
OR Portland, Tek-Elec. Control, Inc. 503-246-5451
PA Malvern, Control Des. Supp. 215-296-0150
PA Pittsburgh, Aesco Elctrns. 412-344-1550
TX Dallas, Control Des. Supp. 713-868-4018
TX Houston, Control Des. Supp. 713-868-4018
UT Nephi, Control Des. Supp. 801-623-2908
WA Kent, Control Des. Supp. 206-251-6323
WA Seattle, Tek-Electric Control 206-243-6007
WI Milwaukee, Marsh Elctrns., Inc. 414-475-6000
WI New Berlin, Control Des. Supp. 414-784-1015
Can Markham, Ont., Birde Mktg., Inc. 416-477-7722

RICHARD HIRSCHMANN OF AMERICAN, See Hirschmann

RICHARDS, ARKLAY S., CO., INC., 72 Winchester St., Newton Highlands, MA 02161-1796, Tel: 617-527-4385, FAX: 617-964-3746; *Sls. Mgr.:* L. K. Richards

RICHARDSON ELECTRONICS, LTD., 40W267 Keslinger Rd., LaFox, IL 60147, Tel: 708-208-2200, 800-348-5500, FAX: 708-208-2550; FSC No.: 5L804; Empl.: 625; *Sls. Mgr.:* Robert L. Prince; *Dist. Mgr.:* Robert L. Prince

RICHCO PLASTIC CO., P.O. Box 804238, Chicago, IL 60680, Tel: 312-539-4060, FAX: 312-539-6770; FSC No.: 06915; Empl.: 400; *Sls. Mgr.:* Ted E. Pavoris; *Dist. Mgr.:* Ted Pavoris

RIDGE TOOL CO., Sub. Emerson Elec. Co., 400 Clark St., Elyria, OH 44036, Tel: 216-323-5581, TELEX: 0243420, FAX: 216-323-5204; *Dist. Mgr.:* John Drew

RIFOCS CORP., 474 Constitution Ave., Camarillo, CA 93012, Tel: 805-389-9800, FAX: 805-389-9808; Empl.: 12; *Sls. Mgr.:* Dennis N. Horwitz

RITTAL CORP., One Rittal Place, Springfield, OH 45504-9807, Tel: 800-477-4000, TELEX: 513-390-5599; Empl.: 270

RITTER COIL, INC., 720 Sheridan Dr., P.O. Box 3130, Easton, PA 18043-3130, Tel: 215-258-6780, FAX: 215-258-6783; Empl.: 20; *Sls. Mgr.:* Jackie Berhel

RITZ ELECTRONICS/RELCO, 196 Queen St. N., New Dundee, Ont., Canada NOB 2EO, Tel: 519-696-2616, FAX: 519-696-2670; Empl.: 30; *Sls. Mgr.:* Gary Ritz; *Dist. Mgr.:* Leonard Snow ..... **C•1081; D•1913**

Local Sales Offices & Reps

CA Torrance, U.S. Power Converting Co. 213-316-9984
KS Wichita, US Power/Relco Midwest 316-722-6440
Can New Dundee, Ont., Ritz Electronics Ltd. 519-696-2616

Local Distributors

CA	Torrance, Leonard Snow & Assocs./U.S. Power	213-316-9984
KS	Wichita, US Power/Relco Midwest	316-722-6440
Can	New Dundee, Ont., Ritz Electronics Ltd.	519-696-2616

RIVERHEAD CIRCUITS, AMP ò AKZO Corporation, P.O. Box 700, West La., Aquebogue, NY 11931, Tel: 516-722-4100, FAX: 516-284-2352; Empl.: 500; *Sls. Mgr.:* Dennis Marek

RJF INTERANTIONAL CORP., 3875 Embassy Pkwy., Fairlawn, OH 44333, Tel: 216-668-7689, FAX: 216-668-7701

R-K ELECTRONICS, 11560 Goldcoast Dr., Cincinnati, OH 45249, Tel: 513-489-4060; Empl.: 25

RLC ELECTRONICS, INC., 83 Radio Cir., Mt. Kisco, NY 10549, Tel: 914-241-1334, FAX: 914-241-1753; FSC No.: 12598; Empl.: 56; *Sls. Mgr.:* Walter Crofut; *Dist. Mgr.:* Walter Crofut

RME FILTERS, INC., PO Box 838, Amherst, NH 03031, Tel: 603-595-4573, FAX: 603-881-7649; FSC No.: 0S2B1

RMF PRODUCTS, INC., 1275 Paramount Pkwy., P.O. Box 520, Batavia, IL 60510, Tel: 708-879-0020, FAX: 708-879-6749; Empl.: 11; *Sls. Mgr.:* R. Frieders ..... **C•1533**

RMS, Electrical Connector Division, 8600 Evergreen Blvd., Minneapolis, MN 55433, Tel: 612-786-1520, FAX: 612-786-1771; Empl.: 50; *Sls. Mgr.:* Connie Laurneyer

RMS INSTRUMENTS, 1415-2 Bonhill Rd., Mississauga, Ont., Can L5T 1R2, Tel: 416-564-5533, FAX: 416-670-0053; Empl.: 15; *Sls. Mgr.:* Edward A. McGovern

RMS TECHN., 11833 Canon Blvd., Ste 100, Newport News, VA 23606, Tel: 804-873-0100, FAX: 804-873-1512; FSC No.: 59606; Empl.: 42

ROANWELL, 180 Varick St., New York, NY 10014, Tel: 212-989-1090, FAX: 212-989-3285; FSC No.: 82872; Empl.: 80; *Sls. Mgr.:* Ray Lefebvre; *Dist. Mgr.:* Ray Lefebvre

RO ASSOCIATES

FAX: 408-744-1521

RO ASSOCIATES, INC., 246 Caspian Dr., Box 61419, Sunnyvale, CA 94088, Tel: 408-744-1450; FSC No.: 24230; Empl.: 60; *Sls. Mgr.:* R. D. Okada ..... **D•1916-1917, 2202-2205**

Local Sales Offices & Reps

AL	Huntsville, JSI, Inc.	205-883-4163
AZ	Phoenix, Chaparral Elctrns.	602-996-5909
CA	Los Angeles, West Coast Reps.	310-690-9960
CA	San Diego, W. Coast Rep	619-581-2406
CA	San Jose, P & M Elctrns.	408-287-0402
CO	Denver, F.G. Mktg.	303-795-9176
CT	Redding, Power Factor	203-938-7013
DC	Washington, Gans & Pugh	703-709-0305
FL	Ft. Lauderdale, Panamtech	305-587-3769
FL	Orlando, Panamtech	407-679-5506
IL	Chicago, Mar-con Assocs. Inc.	708-675-6450
KS	Kansas City, Midtec	913-541-0505
MD	Baltimore, Gans & Pugh	410-442-2189
MA	Boston, Power Factor	508-234-6415
MN	Minneapolis, R J Inc.	612-866-3661
MO	St. Louis, Midtec	314-275-8666
NV	Henderson, Chaparral	702-433-5486
NM	Albuquerque, Chaparral	505-292-0007
NY	Buffalo, NRM Mktg.	716-634-4300
NY	Great Neck, M.O.S. Mktg.	516-487-3966
NY	Rochester, NRM Mktg.	716-352-9166
NY	Syracuse, NRM Mktg.	315-685-8991
OH	Centerville, Omega Sls., Inc.	513-434-5507
OR	Beaverton, Pacific Mktg.	503-641-9373
PA	Philadelphia, Gans & Pugh	215-699-6655
TX	Houston, Barry Sls.	713-784-5860
TX	Richardson, Barry Sls.	214-234-0255
WA	Redmond, Pacific Mktg.	206-882-3144

ROBINSON NUGENT, INC., 800 East 8th St., New Albany, IN 47150, Tel: 812-948-0564, FAX: 812-945-0804; Empl.: 400; *Sls. Mgr.:* Bill Gruhn; *Dist. Mgr.:* Carl Pearcy

ROBISON ELECTRONICS, P.O. Box 8121, San Luis Obispo, CA 93403-8121, Tel: 805-544-8000, FAX: 805-544-8091; FSC No.: 19080; Empl.: 65

ROCKLAND INSULATED WIRE & CABLE, 87 Broadway, Haverstraw, NY 10927, Tel: 914-429-3103, FAX: 914-947-1712; FSC No.: 12111

ROCKLAND SCIENTIFIC CORPORATION, P.O. Box 3135, Princeton, NJ 08543, Tel: 609-844-0800, FAX: 609-895-9726; Empl.: 15; *Sls. Mgr.:* S.N. Thanos

ROCKWELL INTERNATIONAL, 2990 Airway Ave., Costa Mesa, CA 92626, Tel: 714-641-5311, TELEX: 685532 COLLINS CSMA, FAX: 714-641-5320; Empl.: 60; *Sls. Mgr.:* Robert A. Johnson

ROCKWELL INT'L:SEMICONDUCTOR PRODUCTS DIVISION, 4311 Jamboree Rd., Newport Beach, CA 92660, Tel: 714-833-4600, TWX: 910-591-1698; FSC No.: 34576; Empl.: 1995; *Sls. Mgr.:* Ernie Raper, Dir. of Sls.; *Dist. Mgr.:* K. Reutemann

ROCOM CORPORATION, 5957 Engineer Dr., Huntington Beach, CA 92649, Tel: 1-800-952-3539, 714-891-9922, FAX: 714-891-2121; FSC No.: 67361; Empl.: 21; *Sls. Mgr.:* Robert Jewell; *Dist. Mgr.:* Robert Jewell

RODALE Technical Sales Inc.

FAX: 516-277-8375

RODALE TECHNICAL SALES INC., 577 Main Street, Islip, NY 11751, Tel: 516-277-5454, TELEX: 5106007812, ESYLNK: T8003254112; Empl.: 10; *Sls. Mgr.:* Gene Lipman ..... **C•1640-1641, 1804-1805; D•1063**

Local Sales Offices & Reps

CA	Yorba Linda, Rodale Tech. Sls., Inc.	714-283-3140
IL	Bensenville, Connecting Technlg.	708-238-0509
IN	Carmel, Current Elctrns. Mktg.	317-844-1770
KS	Prairie Village, Crosslink Elctrl./Elctrns.	913-432-6100
NY	Islip, Rodale Tech. Sls., Inc.	516-277-5454
OH	Bedford Hgts., P.H.P.	515-472-5984

Local Distributors

AZ	Phoenix, Storm Prods.	602-269-3485
CA	Inglewood, Storm Prods.	213-776-8141
CA	Sacramento, AVAC Sunset	1-800-AVAC-DIV
CO	Broomfield, Storm Prods.	303-466-1991
MN	Bloomington, KL Tannehill	612-881-6700
MN	St. Paul, AVAC Mid-America	1-800-AVAC-DIV
NJ	Edison, AVAC National	1-800-AVAC-DIV
TN	Nashville, AVAC Pioneer Tenn.	1-800-AVAC-DIV
TX	Dallas, Storm Prods.	214-330-1381
UT	Salt Lake City, Standard Supp.	801-486-3371
WA	Woodinville, Storm Prods.	206-488-7400

RODANN ELECTRONICS MFG. CO., 3100 Airway Ave. 128, Costa Mesa, CA 92626, Tel: 714-662-3232, 800-366-7010, FAX: 714-662-3171; *Sls. Mgr.:* Alex Skarbek

RODELCO ELECTRONICS CORP., 111 Haynes Ct., Ronkonkoma, NY 11779, Tel: 516-981-0900, FAX: 516-981-1792; Empl.: 44

ROD-L ELECTRONICS, INC.

FAX: 415-326-1993

ROD-L ELECTRONICS, INC., 923 Hamilton Ave., Menlo Park, CA 94025, Tel: 415-322-0711, 1-800-548-6305, TWX: 296210; *Sls. Mgr.:* Tom Cooke .... **D•1320-1321**

Local Sales Offices & Reps

AZ	Mesa, Scientific Dvcs. W.	602-839-6628
CA	Menlo Park, ROD-L (factory)	415-322-0711
CO	Louisville, Scientific Dvcs. W.	303-665-8089
FL	Boca Raton, Electromark	407-852-2259
GA	Helen, Electromark Sys.	706-865-3120
IL	Elk Grove, Loren Green Assocs.	312-593-0282
KS	Merriam, Tec Rep	913-262-9500
MN	Minneapolis, Hei-Lite Sls	612-861-6051
MN	Plymouth, Hei-Lite	612-550-0506
MO	St. Louis, Tec Rep	314-454-9100
NJ	Laurel Springs, Donald Williams	609-346-2876
NY	Liverpool, Northern Tech. Sls.	314-451-1091
NC	Winston-Salem, Nelson Assocs.	919-765-5520
OH	N. Olmsted, AM Sls.	216-779-5033
OK	Tulsa, Spectra Sls	918-665-8899
OR	Aloha, Core II Mktg.	503-649-0871
OR	Beaverton, Core II Mktg	503-641-0877
RI	Narragansett, Pat Assocs.	401-783-9598
TX	Houston, Spectra Sls.	713-270-8212
TX	Richardson, Spectra Sls.	214-234-3600
VA	Alexandria, Dyna Rep	703-354-1222
Can	Scarborough, MultiTest Elctrns.	416-609-8399

Local Distributors

CA	Menlo Park, Rod-L (Factory)	415-322-0711
Can	Scarborough, MultiTest Elctrns.	416-609-8396

ROEDERSTEIN ELECTRONICS, INC., Vishay Electronic Components, 2100 W. Front St., Statesville, NC 28677, Tel: 704-872-8101, FAX: 704-872-8023; Empl.: 98; *Dist. Mgr.:* Teresa Alexander

ROGAN, 3455 Woodhead Dr., Northbrook, IL 60062, Tel: 708-498-2300, FAX: 708-498-2334; FSC No.: 86797; Empl.: 100; *Sls. Mgr.:* D. Pelletier; *Dist. Mgr.:* D. Pelletier

ROGERS CORPORATION, Circuit Components Div., 2400 S. Roosevelt St., Tempe, AZ 85282, Tel: 602-967-0624, FAX: 602-967-9385

ROGERS CORPORATION, Circuit Materials Div., Box 4000, Chandler, AZ 85244, Tel: 602-963-4584, FAX: 602-732-9381

ROGERS CORPORATION, Flexible Interconnections Div., Box 700, Chandler, AZ 85244, Tel: 602-963-4584, TELEX: 140-223, TWX: 910-950-1961, FAX: 602-786-8490; *Sls. Mgr.:* Darrel Brasch

ROGERS CORPORATION, Microwave & Circuit Matls. Div., 100 S. Roosevelt Ave., Chandler, AZ 85226, Tel: 602-961-1382, FAX: 602-961-4533

ROGERS CORPORATION, Molding Materials Div., P.O. Box 550, Manchester, CT 06040, Tel: 203-646-5500, FAX: 203-646-5503

ROGERS CORPORATION, Power Distribution Div., 5750 E. McKellips Rd., Mesa, AZ 85205, Tel: 602-830-3370, FAX: 602-396-6401

ROGERS CORP., One Technology Dr., Rogers, CT 06263, Tel: 203-774-9605, TWX: 710-448-0047; Empl.: 2500

ROH, Portland Instrument, 6120 San Fernando Rd., Glendale, CA 91201, Tel: 818-500-0137, FAX: 818-240-1828; Empl.: 10; *Sls. Mgr.:* Dick Herbert

ROHDE & SCHWARZ, INC., 4425 Nicole Drive, Lanham, MD 20706, Tel: 301-459-8800, FAX: 301-459-2810; FSC No.: 82199; Empl.: 65

ROHM CORPORATION, Rohm Electronics Division, 3034 Owen Drive, Antioch, TN 37013, Tel: 615-641-2020, FAX: 615-641-2022; Empl.: 115; *Sls. Mgr.:* Mike DelGrippo; *Dist. Mgr.:* Steve Bishop

ROLLS BATTERY ENGINEERING, 8 Proctor St., Salem, MA 01970, Tel: 508-745-3333, FAX: 508-741-8956; FSC No.: 6140 6135; Empl.: 4-5; *Dist. Mgr.:* John J. Surrette

ROLYN OPTICS CO., 706 Arrowgrand Circle, Covina, CA 91722-2199, Tel: 818-915-5707/5717, TELEX: 67-0380, FAX: 818-915-1379

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ROSE ENCLOSURES SYS., INC., 7330 Executive Way, Frederick, MD 21701-8353, Tel: 301-696-9800, FAX: 301-696-9494; FSC No.: 4Y520/C0242; Empl.: 45; *Sls. Mgr.:* Warren Hudacek

ROSEMONT-NASHVILLE, INC., See Chromalox Instrs. & Controls

ROSEMOUNT ANALYTICAL INC., 89 Commerce Rd., Cedar Grove, NJ 07009, Tel: 800-222-2600 ext. 400, FAX: 201-857-9403

ROSS ENGINEERING CORP.

FAX: 408-377-5182

ROSS ENGINEERING CORP., 540 Westchester Dr., Campbell, CA 95008, Tel: 408-377-4621; FSC No.: 23598; Empl.: 45; *Sls. Mgr.:* Jim Ross; *Dist. Mgr.:* Jim Ross ..... **B•1228, 1592-1594, 1802; D•1319**

ROTEK INSTRUMENT CORP., 390 Main St., Waltham, MA 02254, Tel: 617-899-4611, FAX: 617-894-7273; FSC No.: 06678; *Sls. Mgr.:* Paul Lualdi

Local Sales Offices & Reps

AL	Huntsville, Kemp Instrs.	205-837-4304
FL	Palm Harbor, Teqspec	813-942-6006
MA	Randolph, EML Assocs.	617-341-0781
MN	Minneapolis, Hei-Lite Sls.	612-550-0506
NC	Winston-Salem, Teqspec	919-765-5553
PA	Lansdale, Techn. Instr. Sls.	215-361-7850
PA	Pittsburgh, Meas. Instr. East	412-459-8090
TX	Dallas, Kemp Instrs.	214-931-7100
VA	Dumfries, Electra-Tech Inc.	703-670-6962
WA	Seattle, Branom Instr. Co.	206-762-6050

ROTORK CONTROLS, INC., 19 Jetview Drive, Rochester, NY 14624, Tel: 716-328-1550, FAX: 716-328-5848; Empl.: 75; *Sls. Mgr.:* Chris Warnett; *Dist. Mgr.:* Chris Warnett

ROWE INDUSTRIES, INC. | Talley Industries

FAX: 419-729-1794

ROWE INDUSTRIES, INC., 6225 Benore Rd., P.O. Box 6877, Toledo, OH 43612, Tel: 419-729-9761; FSC No.: 82878; Empl.: 89 ..... **C•1807**

Local Sales Offices & Reps

AL	Huntsville, Giestings & Assoc.	205-830-4550
AZ	Scottsdale, Pinnacle Comps. Sls.	602-994-0441
CA	Laguna Hills, Rowe Inds.	714-643-2675
CA	Tustin, R.T.S. Assocs.	714-730-9561
CO	Denver, Spectrum	303-480-9991
CT	New England, R.F. Assocs.	203-458-3674
FL	Clearwater, R.F. Assocs., Inc.	813-442-8500
FL	Longwood, R.F. Assocs., Inc.	407-657-7332
GA	Duluth, Giestings & Assocs.	404-476-0025
IL	Naperville, Connect Plus	708-355-6363
IL	Rolling Meadows, Rowe Inds.	708-670-0913
IN	Carmel, Giestings & Assoc.	317-844-5222
MD	Kensington, Koebert Assocs.	301-493-8924
MA	Topsfield, R.F. Assocs., Inc.	508-887-9762
MI	Livonia, Giestings & Assoc.	313-478-8106
MN	Stillwater, Kits Co.	612-439-8088
NY	Pittsford, Franklin Sls.	716-248-8251
NY	Smithtown, Koebert Assocs.	516-979-6683
OH	Cinicinnati, Makin Assocs.	513-871-2424
OH	Toledo, Rowe Inds.	419-729-9761
RI	Cranston, Rowe Inds., Inc.	401-946-0210
TX	Austin, Kruvand Assocs., Inc.	512-219-9441
TX	Dallas, Kruvand Assocs., Inc.	214-437-3355
UT	Ogden, Spectrum	801-972-8552
VA	Alexandria, Koebert Assocs.	703-461-3655
WA	Bellevue, Advanced Power Comp.	206-747-9127
WA	Vancouver, Advanced Power Comp.	206-896-4239
WI	Hartland, Connect-Plus	414-367-2094
Can	Barnaby, B.C., Cartwright	416-528-0294
Can	Burnaby, B.C., Advanced Power Comp.	604-299-7330

Local Distributors

PA	Glenside, Mark Elctrns.	215-887-2310
TX	Ft. Worth, Ft. Worth Wire & Cable	817-232-4100

ROYAL ENTERPRISES CO., 4260 Valley Fair St., Simi Valley, CA 93063, Tel: 805-522-8730, 818-998-2455, FAX: 805-522-9055; Empl.: 5; *Sls. Mgr.:* Robert E. Burks

MILTON ROY CO, Process & Environ., 1238 W. Grove Ave., Orange, CA 92665-4134, Tel: 714-974-5560, FAX: 714-921-2531; Empl.: 60; *Sls. Mgr.:* Harold Peper

ROYONIC INC., 25345 Ave. Stanford, Ste. 201, Valencia, CA 91355, Tel: 805-257-0303, TELEX: 315672, ESYLNK: 62840158, FAX: 805-257-0802; Empl.: 7; *Sls. Mgr.:* Terry Josselyn

R-THETA INC.

FAX: 1-800-567-7115

R-THETA INC., 290 Larkin St., P.O. Box 1089, Buffalo, NY 14220-8089, Tel: 1-800-388-5428; Empl.: 75; *Sls. Mgr.:* Barry Butwell; *Dist. Mgr.:* Mike Taverner ..... **C•1643**

Local Sales Offices & Reps

CA	Granada Hills, Timberlake Grp.	818-368-1782
MA	Brookline, Harman Assocs., Inc.	617-232-6687
MN	Eden Prairie, Hanna Lind Ltd.	612-942-8554
OH	Cleveland, Staffco	216-331-5100

Local Distributors

NJ	Darien, C.W. Assocs.	203-656-2339
NY	Syracuse, Leonard D. Allen Inc.	315-437-8387

RTRON CORP., 8151 N. Ridgeway, Skokie, IL 60076, Tel: 708-679-7180, FAX: 708-675-3709; FSC No.: 19130; *Sls. Mgr.:* R. McLean

RTS SYSTEMS, TELEX COMMUNICATIONS, INC., 1100 W. Chestnut St., Burbank, CA 91506, Tel: 818-566-6700, TELEX: 194855, FAX: 818-843-7953; FSC No.: 60572; Empl.: 45; *Sls. Mgr.:* Shelley Brown Harrison; *Dist. Mgr.:* Shelley Brown Harrison

RUSSTECH ENGINEERING COMPANY, INC., 23322 (D) Madero Road, Mission Viejo, CA 92691, Tel: 714-472-0880, FAX: 714-472-1081; FSC No.: 01EG24; *Sls. Mgr.:* David Zoscak

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FAX: 401-884-4872

RUSTRAK INSTRUMENTS, Mark IV Industries, Rte. 2 & Middle Rd., E. Greenwich, RI 02818, Tel: 401-884-6800, 800-332-3202, TWX: 710-387-1500; Empl.: 250; *Sls. Mgr.:* John Olobri; *Dist. Mgr.:* John Olobri ..... **D•1416**

Local Distributors

AZ	Tempe, CMI Metermaster	602-431-0015
CA	Fullerton, Rustrak	714-879-6384
CA	Hayward, Coast Inst.	510-786-9300
CA	San Marcos, Mitchell Inst.	619-744-2690
CO	Commerce City, WACO Elctrns.	303-289-4743
FL	Palm Bay, EIL Instrs.	407-725-8300
GA	Forest Park, Brownell Electro	404-362-9009
MD	Hunt Valley, EIL Instrs.	410-584-7400
MA	Burlington, EIL Instrs.	617-272-9450
MI	Grand Rapids, Smith Inst.	616-245-1195
MI	Royal Oak, George Inst.	313-280-1111
MO	St. Louis, Indl. Svc. Labs	314-423-3141
NJ	Newark, Norman Bragar Prods.	201-344-1100
NC	Charlotte, Inotek Corp.	704-527-5000
OH	Cincinnati, Schlemmer Assocs.	513-522-8340
OH	Cleveland, M.A. Blankenberg	216-251-7010
PA	Philadelphia, Sunshine Scientific	215-673-5600
RI	E. Greenwich, Rustrak	800-332-3202
TX	Dallas, Inotek Corp.	214-243-8370
TX	Houston, American Analog	713-941-7265
WA	Seattle, Branom Inst.	206-762-6050
WI	Waukesha, Wisconsin Control Corp.	414-542-1588

RUTHERFORD RESEARCH, Box 249, Rutherford, NJ 07070, Tel: 201-933-2091; Empl.: 4; *Sls. Mgr.:* Dr. A. Blanck; *Dist. Mgr.:* Dr. A. Blanck

R X D INC., Relm Communications, 806 Custer Ave., Norfolk, NE 68701, Tel: 402-379-0112, 800-228-8108, FAX: 402-379-3074 ..... **A•1470-1473**

Local Sales Offices & Reps

AL	Huntsville, BITS, Inc.	205-881-2900
AZ	Scottsdale, Jackson Mktg.	602-998-0831
CA	Cupertino, Prism Tech. Sls.	408-435-7377
CA	Huntington Beach, Solutech, Inc.	714-374-0130
CA	San Diego, Solutech, Inc.	619-581-2741
GA	Norcross, BITS, Inc.	404-564-5599
IL	Hoffman Estates, Astrotech Elctrns.	708-934-1538
IN	Indianapolis, Mohrfield Mktg.	317-546-6969
IN	Leo, Mohrfield Mktg.	219-627-5355
MN	Oakland, Complete Sls.	612-731-2923
NJ	Mt. Laurel, S-J Assocs.	609-866-1234
NJ	Tenafly, Michel Assocs.	201-894-8964
NY	Canandaigua, S-J Assocs.	716-394-3281
NY	Rockville Centre, S-J Assocs.	516-536-4242
NY	Roslyn Heights, Michel Assocs.	516-621-6378
NC	Raleigh, BITS, Inc.	919-676-1880
OH	Columbus, S-J Assocs.	614-885-6700
UT	Salt Lake City, Wind River Mktg., Inc.	801-972-1151
VA	Falls Church, S-J Assocs.	703-533-2233
WI	Watertown, Astrotech	414-261-7600
Can	Mississauga, Source Elctrns.	416-676-0830
Can	Mont. Gabriel, Source Elctrns.	514-369-0321
Can	Orleans, Source Elctrns.	613-837-0220

Local Distributors

AL	Huntsville, Resistacap, Inc.	205-883-4270
AZ	Phoenix, Arizona Comps.	602-269-5655
AZ	Scottsdale, Added Value Elec. Dist.	602-951-9788
CA	Chatsworth, E/W Elctrns.	818-718-2500
CA	Garden Grove, Ewing Elctrns.	714-891-9163
CA	Milpitas, California Capacitor	408-262-6000
CA	San Diego, Added Value Elec. Dist.	619-558-8890
CA	San Jose, Compass Comps.	408-432-7575
CA	San Jose, Inductive Comps.	408-971-0688
CA	Stanton, Inductive Comps.	714-828-3420
CA	Tustin, Added Value Elec. Dist.	714-259-8258
CA	Visalia, Added Value Elec. Dist.	209-734-8861
CO	Wheat Ridge, Added Value Elec. Dist.	303-422-1701
IN	Indianapolis, Custom Svc.	317-879-9119
MA	Methuen, AVED Elctrns., Inc.	508-688-3800
MN	Roseville, Parts 1	612-633-8079
MO	St. Louis, RIC-Tronics	314-997-4707
NH	Merrimack, Brevan Elctrns.	603-429-1900
NH	Salem, Diamond Elctrns.	603-894-4420
NC	Charlotte, E.M.C. (Elec. Mktg. Corp.)	704-394-6195
OH	Columbus, E.M.C. (Elec. Mktg. Corp.)	614-299-4161
OH	Highland Height, E.M.C. (Elec. Mktg. Corp.)	216-442-3441
TX	Austin, LCD Elctrns.	512-388-0900
TX	Carrollton, LCD Elctrns.	214-245-0600
TX	Richardson, Ewing Elctrns. Inc.	214-231-6725
UT	West Valley, Added Value Elec. Dist.	801-975-9500

RYE INDUSTRIES, INC., 3337 Air Park Rd., Fuquay-Varina, NC 27526, Tel: 919-557-0511, 800-626-1511, FAX: 919-557-0510; Empl.: 5

SABRE COMMUNICATIONS CORP., 3400 Hwy 75 N., P.O. Box 536, Sioux City, IA 51102, Tel: 712-258-6690, FAX: 712-258-8250; FSC No.: 60348; *Sls. Mgr.:* James D. Mack; *Dist. Mgr.:* Dick Fry

SABRITEC, 1733 Kaiser Ave., Irvine, CA 92714, Tel: 714-250-1244, FAX: 714-250-1009; FSC No.: 58795; Empl.: 49

SACO CONTROLS INC., 9700 Trans Canada Hwy., Montreal,Qc., Canada H4S 1V9, Tel: 514-745-0310, TELEX: 055-62171, FAX: 514-745-0315; Empl.: 36; *Sls. Mgr.:* Pat Argento

SAE POWER, INC., 282 Brokaw Rd., Santa Clara, CA 95050, Tel: 408-988-0700, FAX: 408-986-8529; *Sls. Mgr.:* Nick Markoff; *Dist. Mgr.:* Debbie Thomas

SAFT AMERICA INC., Power Sources Div., 711 Industrial Blvd., Valdosta, GA 31601, Tel: 912-247-2331, FAX: 912-247-6680; Empl.: 200; *Sls. Mgr.:* Syd Reames ..... **D•1418, 1467-1471**

Local Distributors

CT	Stamford, AeroQuality Sls.	203-351-8500
TN	Nashville, Ryder Aviall	615-754-7700

SAFT AMERICA INC., Research & Development Center, 109 Beaver Ct., Cockeysville, MD 21030, Tel: 410-771-3200, FAX: 410-771-1144 ..... **D•1418, 1467-1471**

SAFT AMERICA INC., Lithium Battery Div., 313 Crescent St., Valdese, NC 28690, Tel: 704-874-4111, FAX: 704-874-2431; Empl.: 150; *Sls. Mgr.:* Glen Bowling ..... **D•1418, 1467-1471**

SAFT

FAX: 912-247-6680

SAFT AMERICA, INC., Portable Battery Division, 711 Industrial Blvd., Valdosta, GA 31601, Tel: 912-247-2331, TELEX: 547-620; Empl.: 600; *Sls. Mgr.:* Michael Marcoux; *Dist. Mgr.:* George Lupul ..... **D•1418, 1467-1471**

Local Sales Offices & Reps

CA	Camarillo, SAFT America, Inc.	805-491-2821
CA	Redwood City, SAFT America, Inc.	415-365-4539
GA	Marietta, SAFT America, Inc.	404-992-6950
IL	Oak Forest, SAFT America, Inc.	708-687-6690
IN	Indianapolis, SAFT America, Inc.	317-594-0443
TX	Dallas, SAFT America, Inc.	214-239-3935
MN	Inver Grove Hgts., SAFT America, Inc.	612-552-0121
NY	Plainview, SAFT America, Inc.	516-931-5902
NY	Stoney Point, SAFT America, Inc.	914-786-0213
PA	Bensalem, SAFT America, Inc.	215-744-8044

Local Distributors

AK	Fairbanks, Cold Spot	907-457-8555
AZ	Phoenix, Lynntronics	602-841-3900
CA	Chatsworth, Mill Comm. Distrs., Inc.	818-998-3111
CA	Huntington Beach, House of Batteries	800-432-3385
CA	Mountain View, Energy Sls.	415-969-0800
CA	San Diego, Tauber Elctrns.	619-274-7242
CO	Littleton, AVT	303-798-1958
FL	Altamonte Springs, TNR Tech.	407-682-4311
FL	Hialeah, Pro Battery	305-884-4040
GA	Decatur, ELS Prods.	800-334-5066
HI	Honolulu, Battery Factory	808-537-6797
IL	Downers Grove, TDI	708-971-3460
IL	Lisle, Jabro Batteries	708-964-9358
IL	Rosemont, Advent Elctrns.	708-297-6200
IN	Indianapolis, Advent Elctrns.	317-872-4910
IA	Cedar Rapids, Advent Elctrns.	319-363-0221
MA	Andover, Generation Elctrns.	508-683-1177
MA	Middleboro, Glynn Elctrns.	508-947-4262
MI	Farmington Hills, Advent Elctrns.	313-477-1650
MN	St. Paul, D. C. Battery Prods. Inc.	612-646-7478
NY	Pen Yan, Advacom	315-536-2221
NY	Plainview, Plainview Batteries	516-249-2873
PA	Bensalem, Avex Elctrns. Corp.	215-638-3300
PA	McKean, Advacom	814-476-7774
TN	Mt. Juliet, Batteries Unlimited	615-754-8179
TX	Houston, Kent Elctrns.	713-783-2288
TX	Houston, Lone Star Mktg.	713-589-0853
TX	Spring, Jabro Batteries, S.W.	713-367-9393
UT	Salt Lake City, Standard Supp. Co.	801-486-3371
WA	Redmond, Energy Sls.	206-883-2343
Can	Brampton, Ont., Innovative	416-791-2132
Can	Burnaby, B.C., Polar	604-294-1891
Can	Edmonton, D.C. Solutions	403-486-3636
Can	Mississauga, Ont., Advance	416-670-7159
Can	Mississauga, Ont., Alexander	416-568-9877
Can	Montreal, Que., Universal	514-722-3311
Can	Pointe-Claire, A.R. Grey	514-694-6378
Can	Regina, Regina	306-522-2221

SAGE LABORATORIES, INC., 11 Huron Dr., Natick, MA 01760, Tel: 508-653-0844, FAX: 508-653-5671; FSC No.: 07180; Empl.: 43; *Sls. Mgr.:* Tony Cieri

SAINT SWITCH, INC., 103 N. 11th Ave.,Box 604, St. Charles, IL 60174, Tel: 708-377-3779, FAX: 708-377-7438; FSC No.: 60198; Empl.: 30

SAMARIUS PRECISION INSTRUMENTS, INC., 26 Beaver St., Ansonia, CT 06401, Tel: 203-736-9805, FAX: 203-736-9835; FSC No.: 18065; Empl.: 25; *Sls. Mgr.:* Joseph Mezei

SAMATIC WINDING MACHINE, Jenlor Ltd., 200 Highbridge St., Fayetteville, NY 13066, Tel: 315-637-9080, FAX: 315-637-9149; Empl.: 15; *Sls. Mgr.:* Jim Philips; *Dist. Mgr.:* Jim Phillips

SAMHWA U.S.A. INC., 9330 Eton Ave., Chatsworth, CA 91311, Tel: 818-727-0512, FAX: 818-727-0700/0800/0900; Empl.: 8; *Sls. Mgr.:* Joseph Buckle; *Dist. Mgr.:* Diane Lawrence

SAMSUNG ELECTRON DEVICES, See Samtron Displays, Inc.

SAMSUNG SEMICONDUCTOR, INC., 3655 North First Street, San Jose, CA 95134, Tel: 408-954-7000,1-800-423-7364, TELEX: 339544, FAX: 408-954-7883

samtec

FAX: 812-948-5047

SAMTEC, INC., P.O. Box 1147, New Albany, IN 47151-1147, Tel: 1-800-672-6832; FSC No.: 55322; Empl.: 200; *Sls. Mgr.:* Mike Hynes ..... **C•1548-1553**

Local Sales Offices & Reps

AZ	Tempe, Westrep/AZ	602-820-9932
CA	Anaheim, Westrep/CA	213-404-3881
CA	Fallbrook, Gary Chilcote Assocs.	619-728-7678
CA	San Jose, Kottmeier	408-371-8700
CO	Boulder, Front Range Mktg.	303-447-4780
FL	Margate, EPM Corp.	305-977-0331
IL	Lisle, W.G. Controls	312-963-5954
IN	Indianapolis, Needler Sls.	317-255-8056
IA	Cedar Rapids, W.G. Controls	319-373-1009
KS	Parker, S. W. Assocs.	913-898-6552
MD	Gaithersburg, Naudain Assocs.	301-258-5040
MI	Holland, Com-Tek Sls.	616-399-7273
MN	Shorewood, Frank Anthony Mktg.	612-474-2850
MO	St. Louis, S.W. Assoc./Saunders	800-821-6344
NJ	Hackensack, CBA/Metro	201-440-4114
NY	Rochester, Mullahy-Welch Sls.	716-244-1100
NC	Raleigh, B. T. Funderburk	919-846-2373
OH	Medina, J. C. Hofstetter	216-241-4880
PA	Huntington Valley, Inacker Sls.	215-947-5660
RI	Warwick, Schumacher & Yarrington	401-884-5671
TX	Plano, High Tech Sls.	214-612-0216
WA	Lynnwood, Quadra Sls.	206-743-2633
WI	Mequon, Badgerep	414-241-9200
PR	Caguas, K. D. Tronics	809-746-0275
Can	Oakville, Ont., Haltronics	416-844-2121
Can	Surrey, B.C., Cana Comm Mktg.	604-589-3822

Local Distributors

AL	Birmingham, Forbes	205-251-4104
AL	Huntsville, Hammond Elect.	205-830-4764
AZ	Tempe, Cypress	602-966-2256
CA	Agoura Hills, Cypress Elect.	818-597-9491
CA	Buena Pk., Cypress	714-521-5230
CA	Chatsworth, Milcomm	818-998-3111
CA	Manhattan Bch., Prime Electro	310-379-3642
CA	Milpitas, Sierra West	408-945-1050
CA	Riverside, Elec. Supp.	714-683-7300
CA	San Diego, Cypress	619-535-0011
CA	San Diego, Neumann Elect.	619-695-3005
CA	Santa Clara, Cypress	408-980-2500
CA	Sunnyvale, Abacus	408-732-2000
CO	Englewood, Cypress	303-792-5829
CO	Englewood, Indelco	303-694-9444
CT	East Haven, J.V. Elec.	203-469-2321
CT	Milford, Fleet Elect.	203-877-2577
CT	Yatesville, Schaal, Inc.	203-269-3779
FL	Ft. Lauderdale, KSM Elect.	800-327-8914
FL	Orlando, Hammond Elect.	407-841-1010
FL	Winter Park, Deanco	407-671-5100
GA	Marietta, Deanco	404-429-0126
GA	Norcross, Hammond Elect.	404-449-1996
IL	Addison, Belford Elec.	312-691-1100
IL	Wheaton, Mega/Deanco	708-665-6214
IN	Carmel, Altex	317-848-1323
IA	Cedar Rapids, Dee Elect.	319-365-7551
KS	Wichita, Mega/Deanco	316-636-5020
MD	Gaithersburg, Deanco	301-948-5444
MD	Gaithersburg, MS Elctrns.	301-921-0200
MD	Middletown, Current Comps.	301-473-5333
MA	Burlington, Schaal, Inc.	617-272-1506
MA	Walpole, Richey/Impact	508-668-8200
MA	Wilmington, North Star	508-657-5155
MI	Grand Rapids, Calder Elctrns.	616-698-7400
MI	Grand Rapids, RM Elect.	616-531-9300
MN	Eden Prairie, Cypress Elect.	612-934-2104
MN	New Brighton, Parts 1	612-633-8079
MN	St. Peters, Mega/Deanco	314-939-9129
MO	Kansas City, Elec. Supp.	800-669-3752
MO	St. Louis, Franklin Elec.	314-993-5333
NJ	Fairfield, Deanco	201-575-7960
NM	Albuquerque, Walker Elec.	505-883-2992
NY	Hauppauge, Broadline Elec.	516-231-4100
NY	Ithaca, Deanco	607-257-4444
NY	Penn Yan, Advacom Tech'y	315-536-2221
NC	Raleigh, Century Elec.	919-782-2116
NC	Raleigh, Deanco	919-851-2065
NC	Winston-Salem, Kirkman Elec.	919-722-9131
OH	Twinsburg, Schuster Elec.	216-425-8134
OR	Beaverton, Cypress	503-641-2233
OR	Tualatin, Moore	503-692-5333
PA	McKean, Advacom	814-476-7774
PA	Norristown, Century Elec.	215-631-5400
TX	Carrollton, North Star	214-980-2999
TX	Dallas, Cypress	214-869-1435
TX	Stafford, Southwest	713-240-4000
WA	Bothell, Cypress	206-483-1144
WA	Redmond, Priebe Elec.	800-426-9911
WA	Seattle, Radar Elect.	206-282-2511
WI	Milwaukee, Marsh	414-475-6000
Can	Burnaby, B.C., Intek	604-294-8100
Can	Calgary, Alberta, Intek	403-243-8035
Can	Dartmouth, Nova Scotia, Arcom	902-464-1600
Can	Gloucester, Ont., Elctrn. Whslr.	613-746-4413
Can	Mississauga, Ont., Rush Elect.	416-677-7280
Can	Montreal, Que., Elctrn. Whslr.	514-769-8851
Can	Montreal, Que., Ferro Technique Ltd.	514-341-3450
Can	Scarborough, Ont., UTech Elect.	416-609-2900
Can	Ste Foy, Que., Elctrn. Whslr.	418-657-5020
Can	Surrey, BC, Memco	604-590-1553
Can	Toronto, Ont., Carsten Elctrns. Ltd.	416-495-7705
Can	Victoria, B.C., Pacific Coast Elect.	604-385-5111

SAMTRON DISPLAYS, INC., SAMSUNG Display Devices, 14251 E. Firestone Bl. No. 101, La Mirada, CA 90638, Tel: 310-802-8425, TWX: 183423 SEDLA; *Sls. Mgr.:* Myung Bang ..... **B•1110-1111**

Local Sales Offices & Reps

AL	Madison, E-Squared Mktg.	205-464-0392
AZ	Phoenix, Moss Mktg.	602-433-9349
CA	Aliso Viejo, Pro Assocs.	714-588-2700
CO	Aurora, Moss Mktg.	303-340-8535
CT	Torrington, Phoenix Sls. Co.	203-934-7135
IL	Hoffman Estates, Astro/Tech. Elctrns.	708-934-1538
IN	Ft. Wayne, Gen II Mktg.	219-436-4485
IA	Marion, A.E.M., Inc.	319-377-1129
KS	Lenexa, A.E.M., Inc.	913-888-0022
KY	Louisville, Gen II Mktg.	502-491-5250
MA	Peabody, Orion Grp.	508-532-6266
MN	Eden Prairie, Comprehensive Tech. Sls.	612-941-7181
MO	Bridgeton, A.E.M., Inc.	314-298-9900
NJ	Allendale, Eastec Assocs.	201-934-7135
NM	Albuquerque, Moss Mktg.	505-292-7505
NC	Raleigh, Zucker Assocs.	919-782-8433
OH	Lyndhurst, Gallant III Elctrns.	216-291-1185
OK	Locust Grove, IMPAQ Sls. Co.	918-479-6493
OR	Beaverton, A.T.M.I., Inc.	503-643-8307
PA	Erdenheim, Omni Sls.	215-233-4600
TX	Irving, IMPAQ Sls. Co.	214-650-0000
UT	Salt Lake City, Moss Mktg.	801-363-5875
WA	Redmond, A.T.M.I., Inc.	206-869-7636
WI	Watertown, Deaken Tech. Sls. Co.	414-261-7600

Local Distributors

AZ	Scottsdale, Added Value	602-951-9788
CA	Laguna Hills, Jaco/Distel, Inc.	714-837-8966
CA	San Diego, Added Value	619-558-8890
CA	San Jose, JACO/DISTEL INC.	408-432-9290
CA	Sunnyvale, LCD Sys.	408-747-0277
CA	Tustin, Added Value	714-259-8258
CA	Visalia, Added Value	209-734-8861
CA	Westlake, JACO/DISTEL	805-495-9998
CA	Westlake Village, Added Value	818-889-2861
CO	Wheat Ridge, Added Value	303-422-1701
CT	Meriden, JACO Elctrns, Inc.	203-235-1422
FL	Tampa, JACO/Q.C.	813-628-4665
MA	Tewksbury, Jaco Elctrn. Inc.	508-640-0010
MI	Farmington Hills, Key Elctrns.	313-489-5455
NY	Hauppauge, Jaco Elctrns.,Inc.	516-273-5500
NC	Raleigh, Jaco/Q.C.	919-876-7767
OK	Tusla, Jaco/Q.C.	918-664-8515
OR	Beaverton, IEC	503-641-1690
TX	Addison, Jaco/Q.C.	214-733-4300
TX	Austin, Added Value	512-454-8845
TX	Austin, Jaco/Q.C.	512-835-0220
TX	Sugar Land, Jaco/Q.C.	713-240-2255

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SANDMAN ELECTRIC CO., INC., 530 West St., Braintree, MA 02184, Tel: 617-848-2111, FAX: 617-848-2129; Empl.: 30

S&S ASSOCIATES, INC.

FAX: 805-544-3109

S & S ASSOCIATES, INC., 863 Via Esteban, San Luis Obispo, CA 93401, Tel: 805-544-2500; *Sls. Mgr.:* Bob Priest; *Dist. Mgr.:* Bob Priest ..... **C•1082-1085, 1534**

SAN FERNANDO ELEC. MFG., See SFE Technlgs.

SANFORD-MILLER CORP., 1800 A Access Road, Oceanside, NY 11572, Tel: 516-763-0926, 800-645-5900, FAX: 516-678-1355; Empl.: 10

SANGAMO COMPONENTS DIV., See Cornell Dubilier Electronics

SANKEN ELECTRIC USA CORP., 2500 W. Higgins Rd. Ste. 730, Hoffman Estates, IL 60195, Tel: 708-519-1717, FAX: 708-884-1511; Empl.: 9; *Sls. Mgr.:* Lanny C. Anderson

SANLAR, INC. T/A, Harbison Industrial Products, 7205 Hibbs La., Levittown, PA 19057, Tel: 215-943-9000, FAX: 215-949-1518; Empl.: 40

SAN-O INDUSTRIAL CORP., 91-3 Colin Dr., Holbrook, NY 11741, Tel: 516-472-6666, FAX: 516-472-6777; Empl.: 50; *Sls. Mgr.:* N. Sato; *Dist. Mgr.:* P. Wernick

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SANWA COMPONENTS USA INC., 50 Brigham St., Marlboro, MA 01752, Tel: 508-480-9555, FAX: 508-481-2042; Empl.: 8; *Sls. Mgr.:* Mark Johnson

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FAX: 619-661-6743

SANYO ENERGY (U.S.A.) CORPORATION, 2001 Sanyo Avenue, San Diego, CA 92173, Tel: 619-661-6620; Empl.: 500; *Sls. Mgr.:* Joseph A. Carcone ..... **D•1472**

Local Sales Offices & Reps

AZ Phoenix, Lynntronics 602-841-3900
CA Mountain View, Energy Sls. 415-969-0800
CO Denver, Car-Go Battery 303-296-8763
NJ Teterboro, Engrd. Assemblies 201-288-4477
NY Farmingdale, Milgray Elctrns. 516-420-9800
NC Winston-Salem, Progressive Technqs. 919-368-1375
OR Aloha, Elctrn. Concepts 503-642-9715
TX Houston, K-Power 713-785-1300
WA Redmond, Energy Sls. 206-883-2343
WA Seattle, Rep West 206-283-8351

Local Distributors

CA Costa Mesa, Battery Specialties 714-755-0888
CA Escondido, Alexander Batteries 619-480-4445
CA Santa Clara, Cypress Elctrns. 408-980-8400
FL Altamonte Springs, TNR Tech. 800-346-0601
FL Tampa, Reptron Elctrns. (Lithium Only) 800-800-5441
MI Livonia, LWC Distrs. 313-464-7700
MN Eden Prairie, Imtron Corp. 612-942-8554
TX Stafford, Southwest Elctrns. 713-240-4000
UT Salt Lake City, Standard Supp. 801-486-3371

SANYO SEMICONDUCTOR CORPORATION, 453 Ravendale Dr., Ste. G, Mountain View, CA 94043, Tel: 415-960-8591, FAX: 415-960-8591

SANYO SEMICONDUCTOR CORP., 80 Commerce Dr., Allendale, NJ 07401, Tel: 201-825-8080, FAX: 201-825-0163; Empl.: 50; *Sls. Mgr.:* Yoshi Paulovich

SAPHIKON, INC., 33 Powers St., Milford, NH 03055, Tel: 603-673-5831, FAX: 603-673-1256; Empl.: 75; *Sls. Mgr.:* Linda Berthiaume

SaRonix

FAX: 415-856-4732

SARONIX, 151 Laura Lane, Palo Alto, CA 94303, Tel: 415-856-6900, TELEX: 348465; FSC No.: 61441; Empl.: 44; *Sls. Mgr.:* Mike Nusbaum; *Dist. Mgr.:* Mike Nusbaum ..... **A•1474-1479**

Local Sales Offices & Reps

AL Huntsville, Interep Assocs. Inc. 205-881-1096
CO Parker, Parker Webster Co. 303-841-4888
CT Torrington, Phoenix Sales 203-496-7709
FL Altamonte Springs, Sls. Engrg. Concepts 305-830-8444
FL Deerfield Beach, Sls. Engrg. Concepts 305-426-4601
GA Norcross, Interep 404-449-8680
IL Rolling Meadows, Phase II 708-806-1330
IN Indianapolis, EMCI 317-921-3450
MA Norwell, Norris Assocs. Inc. 617-659-7988
MI Jenisen, R. C. Nordstrom & Co. 616-457-5762
MI Southfield, R. C. Nordstrom & Co. 313-559-7373
MN St. Paul, Innovate 612-225-9772
NV Reno, Galena Technlg. Grp. 702-746-0642
NJ Kenvil, Harold Gray Assocs. 201-927-6662
NY Buffalo, Lynn Assocs. 716-631-0054
NC Raleigh, J & B Sls. 919-783-9440
OH Dayton, J. C. Hofstetter 513-296-1010
OH Medina, J. C. Hofstetter 216-241-4880
TN Greenville, Interep 615-639-3491
TX Austin, Strategic Mktg. 512-335-4535
UT Murray, Parker Webster Co. 801-266-9939
WI Wauwatosa, Phase II 414-771-9986
EXP CA, Palo Alto, SaRonix 415-856-6900

Local Distributors

CA Anaheim, Deco Elctrns. 714-630-8252
CA Manhattan Bch., Prime Electro Prods. 213-379-3642
CA Manhattan Beach, Prime Electro Prods. 213-379-3642
CA San Diego, Deco Elctrns. 619-693-1595
CA Sherman Oaks, Delay Line Dists., Inc. 818-986-9455
CA Sunnyvale, Target Elctrns. 408-733-0384
CO Englewood, Indelco 303-795-3431
FL Melbourne, Genl. Radio Supp. Co. 407-242-8151
FL Miami, All American 305-621-8282
IL Palantine, Technlg. Sls. Inc. 708-991-6600
MD Columbia, Genl. Radio Supp. 301-995-6744
MD Rockville, All American 301-251-1205
MA Wakefield, All American 617-246-2300
MA Wilmington, Northstar Elctrns. 508-657-5155
MN Eden Prairie, All American 612-944-2151
NJ Camden, General Radio Supp. Co. 609-621-8098
NY Mt. Vernon, All American 914-699-2224
NY Stonybrook, Dove Elctrn. Comps. 516-689-7733
OR Portland, Radar Elec. Co. 503-232-3404
TX Richardson, All American 214-231-5300
TX Richardson, Ewing Elctrns., Inc. 214-231-6725
WA Seattle, Radar Elec. Co. 206-282-2511
WI Milwaukee, Technlg. Sls. Inc. 414-964-5015

SAS INDUSTRIES INC., Wading River Manor Rd., Manorville, NY 11949, Tel: 516-727-1441, 1-800-544-5238, FAX: 516-727-1387; FSC No.: 4L975; Empl.: 35; *Sls. Mgr.:* Steve Steckis

SAVOY ELECTRONICS, INC., P.O. Box 5727, Ft. Lauderdale, FL 33310, Tel: 305-563-1333, 800-359-5400, FAX: 305-563-1378; FSC No.: 13075; Empl.: 20; *Sls. Mgr.:* June Harris

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SAYLOR ELECTRONICS INT'L, INC., 3680 Research Way, Carson City, NV 89706, Tel: 702-883-4184; Empl.: 7

SBE, INC., 4550 Norris Canyon Rd., San Ramon, CA 94583-1389, Tel: 510-355-2000, 800-925-2666, FAX: 510-355-2020; Empl.: 120; *Sls. Mgr.:* Bill Allen VP Sls.; *Dist. Mgr.:* Bill Allen VP Sls.

SB ELECTRONICS, INC., 131 South Main St., Barre, VT 05641, Tel: 802-476-4146, FAX: 802-476-4149; FSC No.: 49588; Empl.: 100; *Sls. Mgr.:* Mark Browning, Sr.

SCANBE, See Zero Enclosures, Zero Corp.

SCANNING DEVICES, INC., 108 Elm St., Waltham, MA 02154, Tel: 617-891-8991, FAX: 617-899-2235; Empl.: 16; *Sls. Mgr.:* David Chanoux

SCHAEFER, INC., Schaefer GmBH, 200 Butterfield Dr., Ashland, MA 01721, Tel: 508-879-8658, ESYLNK: 510-100-3630, FAX: 508-879-8669; Empl.: 60; *Sls. Mgr.:* Richard Sakakeeny

SCHAFFNER EMC, INC. COMPONENTS DIVISION, 9 Fadem Road, Springfield, NJ 07081, Tel: 201-379-7778, 800-367-5566, FAX: 201-379-1151; *Sls. Mgr.:* Steve Cogger, VP of Sls. ... **A•1602-1605; D•1322**

Local Sales Offices & Reps

AL Huntsville, SACS 205-533-4229
AZ Phoenix, C.T. Carlberg & Assoc. 602-468-0750
CA Auburn, Ewing-Foley, Inc. 916-885-6591
CA Fallbrook, Gary Chilcote Assoc. 619-728-7678
CA Irvine, Groh Assocs. 714-837-9871
CA Los Altos, Ewing-Foley, Inc. 415-941-4525
CO Englewood, Delltron Co. 303-741-2122
FL Ft. Lauderdale, Hawkins-Frederickson Assoc. Inc. 305-321-6702
FL Maitland, Hawkins-Frederickson Assoc. Inc. 407-831-2474
GA Norcross, SACS 404-447-6154
IL Arlington Heights, Brainard-Nielsen Mktg. 708-437-2700
IA Marion, A.E.M. Inc. 319-377-1129
KS Lenexa, A.E.M. Inc. 913-888-0022
MD Randallstown, Beacon North 703-478-2480
MI Livonia, Electro Mktg. Grp. 313-421-7590
MN Mendota Hgts., G-II Sls. 612-454-3086
MO St. Louis, A.E.M. Inc. 314-298-9900
NM Albuquerque, C.T. Carlberg 505-899-2155
NY Kings Park, Mil-Com Sls. 516-366-2156
NY Rochester, H. C. Johnson Agys. 716-586-0777
NC Raleigh, SACS 919-859-9970

OH Dayton, Electro Mktg. Grp. 513-890-8322
OH N. Royalton, Electro Mktg. Grp. 216-582-0075
OK Broken Arrow, D.J. Sls. 918-258-1445
OR Beaverton, Harry Levinson Co. 503-690-1312
PA Allison Park, Electro Mktg. Grp. 412-492-0688
SC Irmo, SACS 803-732-0816
TN Knoxville, Beacon Electronics 615-588-4168
TX Austin, D.J. Sls. 512-258-3002
TX Dallas, D.J. Sls. 214-783-8876
VA Sterling, Beacon North 703-478-2480
WA Seattle, Harry Levinson Co. 206-382-1300
WI Manitowa, Brainard-Nielsen Mktg. 414-682-1201
PR Bayamon, Selmark Assoc. 809-797-2096
Can Ontario, Avotronics Ltd. 416-475-2024
Can Quebec, Avontronics Ltd. 514-697-2135

Local Distributors

AL Huntsville, Comp. Distrs. 205-851-7800
AZ Mesa, Richey Impact Sls. 602-641-2313
AZ Tempe, Acacia/Deanco 602-894-2874
AZ Tempe, Cypress 602-966-2256
CA Agora Hills, Cypress 818-597-9491
CA Costa Mesa, Cypress 714-549-2424
CA Fremont, Acacia/Deanco 415-623-7500
CA Garden Grove, Richey Impact Sls. 714-895-0060
CA Gardena, Cal Switch 213-770-2330
CA Irvine, Acacia/Deanco 714-660-0834
CA Manhattan Bch., Prime Electro Prods. 310-379-3642
CA Riverside, Elctrn. Supp. 714-683-7300
CA San Diego, Acacia 619-597-0577
CA San Diego, Cypress Elctrns. 619-535-0011
CA San Diego, Richey Impact Sls. 619-271-4511
CA San Jose, Richey Impact Sls. 408-956-8010
CA San Jose, Rose Elctrns. 408-943-0255
CA Santa Clara, Cypress Elctrns. 408-980-2500
CA Sun Valley, Richey Impact Sls. 818-768-0403
CO Denver, IEC 303-292-6121
CO Englewood, Cypress 303-792-5829
CO Wheatridge, Acacia/Deanco 303-421-7004
CT Wallingford, Sager Elctrns. 203-265-4600
FL Orlando, Sager Elctrns. 407-240-3114
GA Norcross, Component Distrs. 404-441-3320
GA Norcross, Sager Elctrns. 404-446-0085
IL Hoffman Estates, IEC 708-843-2040
IL Schaumburg, QPS Elctrns. 708-884-6620
MD Columbia, D.K. Elctrns. 301-995-1950
MD Columbia, Sager Elctrns. 410-995-4900
MA Hingham, Sager Elctrns. 617-749-6700
MA Walpole, Richey Impact Sls. 508-668-8200
MI Farmington Hills, Key Elctrns. 313-489-5455
MN Eden Prairie, Cypress Elctrns. 612-934-2104
MN Roseville, Chris Elctrns. 612-631-2647
MO St. Charles, Finnigan Elctrns. 314-946-6201
MO St. Charles, Heartland 314-928-6010
NH Salem, Sager Electrns. 603-898-1348
NJ Moorestown, Marlac 609-234-4200
NY Hauppauge, Sager Elctrns. 516-348-1300
NY Rochester, Masline Elctrns. 716-546-5373
NC Raleigh, Sager Elctrns. 919-850-9550
OR Portland, Cypress 503-223-8900
PA Mars, Sager Elctrns. 412-772-2233
PA McKean, Advacom 814-476-7774
PA Philadelphia, Sager Elctrns. 215-464-4336
TX Dallas, Comp. Distrs. 214-644-0373
TX Irving, Cypress 214-255-0065
UT Salt Lake City, IEC 801-977-9750
WA Blaine, Memco 604-590-1553
WA Bothell, Cypress 206-483-1144
WA Redmond, Acacia/Deanco 206-881-5566
WA Seattle, Kam Elctrns. 206-382-1300
WA Seattle, Richey Impact Sls. 206-575-1910
WV McKean, Advacom 814-476-7774
Can Burlington, Ont., Sanbek Sls. 519-746-5801

SCHAFFNER EMC, INC. INSTR. DIV., 9 Fadem Rd., Springfield, NJ 07081, Tel: 201-379-7778, FAX: 201-379-1151; *Sls. Mgr.:* Michael O'Connor, VP Sls. ..... **D•1322**

Local Sales Offices & Reps

AL Huntsville, Southern Mktg. Assocs. 205-534-6020
AZ Phoenix, Tech. Mktg. Spec. 602-678-4940
CA Redondo Beach, Ward/Davis Assoc. 310-643-6977
CA San Diego, Ward/Davis Assoc. 619-292-1000
CA Santa Clara, Ward/Davis Assoc. 408-245-3700
CO Englewood, Tech. Mktg. Spec. 303-781-8819
FL Longwood, Southern Mktg. Assoc. 407-682-7317
FL Satelite Beach, Southern Mktg. Assoc. 407-777-3587
GA Alpharetta, Southern Mktg. Assoc. 404-664-9797
IL Willowbrook, PVA Corp. 708-655-3355
IN Fishers, Carter Technlg. 317-842-9277
KS Lenexa, Midtec 913-541-0505
MA Hopkinton, Eastern Sys. 508-435-2151
MI Farmington Hills, Carter Technlg. 313-477-7700
MN Apple Valley, Alliance Tech. Prod. 612-432-2111
MO St. Louis, Midtec 314-275-8666
NM Albuquerque, Tech. Mktg. Spec. 505-291-1363
NY Rochester, Eastern Sys. 716-292-1460
NC Greensboro, Southern Mktg. Assoc. 919-632-9370
OH Englewood, Carter Technlg. 513-836-0951
OH Parma, Carter Technlg. 216-398-0400
OR Wilsonville, Syntek 503-682-2750
PA Huntington Valley, Sci-Rep 215-322-6500
PA Pittsburgh, Carter Technlg. 412-826-3800
TX Austin, Barnhill Assocs. 512-472-2398
TX Houston, Barnhill Assocs. 713-266-2666
TX Richardson, Barnhill Assocs. 214-917-6777
VA Fairfax, Sci-Rep, Inc. 703-385-0600
WA Bellevue, Syntek 206-462-7700
WA Nine Mile Falls, Syntek 509-466-0451
Can St.Laurent, Que., Interfax Sys. 514-336-0392

SCHAFFNER EMC, INC., Intepro, 9 Fadem Rd., Springfield, NJ 07081, Tel: 201-379-7778; *Sls. Mgr.:* Mike O'Connor

SCHAUER MANUFACTURING, 4500 Alpine Ave., Cincinnati, OH 45242, Tel: 513-791-3030, FAX: 513-791-7192; Empl.: 195; *Sls. Mgr.:* Dave Blice, VP Mktg.; *Dist. Mgr.:* Dan Shaw

SCHELL INC., P.O. Box 12689, St. Petersburg, FL 33733, Tel: 813-822-2600, 800-237-2600, FAX: 813-822-8800; Empl.: 50; *Dist. Mgr.:* Steve Hahn

SCHENCK PEGASUS CORPORATION, 2890 John R Road, Troy, MI 48083, Tel: 313-689-9000, FAX: 313-689-8578; Empl.: 130; *Sls. Mgr.:* David Sallberg

SCHLEGEL CORP., P.O. Box 23197, Rochester, NY 14692, Tel: 800-828-6237, ext. 2126, TELEX: 6854121, FAX: 716-427-9993; Empl.: 500; *Sls. Mgr.:* Duncan Tyrrel

SCHLEICHER GMBH & CO., c/o Progressive Automation Controls Co., 8300 Parkview Rd., Greendale, WI 53129-2161, Tel: 414-421-4380, 1-800-803-0444, FAX: 414-421-5964; FSC No.: 39-174933; Empl.: 5; *Sls. Mgr.:* Robert J. Yoblin; *Dist. Mgr.:* Robert J. Yoblin

SCHLEUNIGER, INC., 150 Dow St. Tower Four, Manchester, NH 03101, Tel: 603-668-8117, FAX: 603-668-8119; Empl.: 20; *Sls. Mgr.:* Marc Amiet

SCHLUMBERGER INDUSTRIES, Tranducers Div., 11321 Richmond, M-102, Houston, TX 77082, Tel: 713-558-2587, TELEX: 791209, FAX: 713-558-8954; *Sls. Mgr.:* Mike Masso

SCHLUMBERGER INSTRUMENTS, Schlumberger Technlgs., 829 Middlesex Turnpike, Billerica, MA 01821, Tel: 508-671-9700, 1-800-225-5765, FAX: 508-671-9704; Empl.: 70

SCHNEIDER CORP. OF AMERICA, 400 Crossways Park Drive, Woodbury, NY 11797, Tel: 516-496-8500, FAX: 516-496-8524; Empl.: 13; *Sls. Mgr.:* Dwight Lindsey; *Dist. Mgr.:* Dwight Lindsey

SCHONSTEDT INSTRUMENT CO., 1775 Wiehle Ave., Reston, VA 22090, Tel: 703-471-1050, FAX: 703-471-1795; Empl.: 45; *Sls. Mgr.:* O. K. Davis

SCHOTT CORP., 1000 Parkers Lk. Rd., Wayzata, MN 55391, Tel: 612-475-1173, FAX: 612-475-1786; FSC No.: 80023; Empl.: 325; *Sls. Mgr.:* K. Nicholls

SCHOTT ELECTRONICS, 42 Silvermine Road, Seymour, CT 06483, Tel: 203-881-0102, TWX: 710-451-8911, FAX: 203-881-0098; Empl.: 150; *Sls. Mgr.:* Ross Wieringa

SCHOTT GLASS TECHNOLOGIES, INC., 400 York Ave., Duryea, PA 18642, Tel: 717-457-7485, TWX: 510-671-4535, FAX: 717-457-6960; FSC No.: 23-169-1403; Empl.: 500; *Sls. Mgr.:* J. Nimmerfroh

SCHOTT HIGH VOLTAGE, 1161 W. 2320 So., Salt Lake City, UT 84119, Tel: 801-972-3690, FAX: 801-972-3699; Empl.: 35; *Sls. Mgr.:* Jeff Dalebout

SCHRACK COMPONENTS, INC., 5305 NW 35th Terrace, Ft. Lauderdale, FL 33309, Tel: 305-733-3330, FAX: 305-733-7373; Empl.: 10; *Sls. Mgr.:* R. Biddle, T. DiLeonardo, C. Gilliland; *Dist. Mgr.:* Christopher Meza

Local Sales Offices & Reps

AL Huntsville, New Age Elctrns. 205-895-9400
AZ Phoenix/Scottsdale, Vikeland Sls. 602-948-7921
CA Montrose, Signal Entprs. 818-957-0640
CO Boulder, Stratford Grp. 303-530-3194
FL Longwood, M & H Assoc. 407-332-7912
IL Arlington Hgts., Thermek Inc. 708-577-6900
IN Mishawaka, Power Comps. 219-256-6630
MD Baltimore, Micro-Comp 410-644-5700
MA Swansea, Poisson 508-677-3655
MN Roseville, T.L.C. 612-483-2226
MO Bridgeton/St. Louis, Dy-Tronix 314-291-4777
NJ Lawrenceville, D.V.S. 609-896-1112
NJ Totowa, R.D.I. Sls. 201-812-9606
NY Buffalo, Lynn Assoc. 716-631-0054
OH Westlake, Baehr Greenleaf & Assoc. 216-892-1770
TX Dallas, Rem Comps. 214-234-1069
WA Seattle, Caruso & Camelleri Assoc. 206-455-8811
WI Wauwatosa, Larsen & Assoc. 414-258-0529

Local Distributors

AZ Mesa, Consolidated Elctrn. Distr. 602-962-9141
AZ Tempe, L Comp 602-730-1633
CA City of Industry, ITAL Elctrns. Sls. 818-968-8515
CA Irvine, Kelex Controls 714-863-1230
CA Martinez, GE Supp. Co. 513-229-6425
CA Sacramento, GE Supp. Co. 916-648-3144
CA San Jose, GE Supply Co. 408-534-0600
CA Tustin, Western Switches & Controls 714-259-8144
CO Denver, Control Des. Supp. 303-296-1922
CO Denver, CSID 303-292-9594
FL Coral Springs, G.R.E. 305-341-1103
FL Miami, All American 305-621-8282
GA Stone Mountain, Control Des. Supp. 404-979-3500
ID Boise, Bolen's Control House 208-362-5280
IL Addison, L Comp 708-628-1400
IL Carol Stream, Lectro Comps. 708-690-0520
IN Indianapolis, Control Des. Supp. 317-788-4559
KS Kansas City, Control Des. Supp. 913-362-4248
ME Gray, Longhill Electro. Tech. 207-657-2183
MD Gaithersburg, Axis Elec. 301-840-9640
MA Cambridge, Hi-Tek 617-491-0442
MA Methuen, Aved 508-688-3800
MA Norwood, Emtel 617-769-9500
MI Brighton, H.H. Barnum 313-229-2961
MN Minneapolis, Control Des. Supp. 612-721-1628
MN Plymouth, Leeds 612-557-1277
MN Roseville, Chris Elctrns. 612-631-2647
MO Kansas City, L Comp 816-241-0111
MO St. Louis, Elctrn. Controls Supp. 314-645-2400
MO St. Louis, L Comp 314-298-7231
NJ E. Rutherford, A.A. Elec. 201-777-5477
NJ Oakland, Relay Spec. 201-337-1000
NJ Pennsauken, I.M.S. 609-662-1770
NJ S. Hackensack, Nassor 201-641-3737
NY Newburgh, Electrol Control Supp. 914-561-5330
NY Orchard Park, Park Elctrn. 716-662-7070
NC Charlotte, Control Des. Supp. 704-588-4410
OH Cincinnati, Cincinnati Controls 513-530-0044
OR Portland, Dunn Elctrns. 503-285-0214
PA Malvern, Control Des. Supp. 215-296-0150
PA McKean, Advacom 814-476-7774
TX Houston, Wofford Elctrns. 713-351-2722
UT Nephi (Salt Lake City), Control Des. Supp. 801-623-2906
WA Spokane, Consolidated Elctrn. Distr. 509-535-8891
WI New Berlin, Control Des. Supp. 414-784-1015

SCHROFF, INC., 170 Commerce Dr., Warwick, RI 02886, Tel: 401-732-3770, FAX: 401-738-7988; Empl.: 120; *Sls. Mgr.:* William Bottis ..... **C•1088-1089**

Local Sales Offices & Reps

AL Huntsville, W.L.A. & Assoc. 205-721-1788
AZ Phoenix, JBS Assocs. 602-244-1212
CA Downey, Buffa Inc. 310-923-4618
CA Los Gatos, Luscombe Engrg. 408-370-2020
CO Longmont, Luscombe Engrg. 303-772-3342
FL Melbourne, R-Rep. Co. 407-722-1900
GA Lawrenceville, W.L.A. Assoc. 404-339-9443
IL Hillside, Cadre Tech. Rep. 708-449-3900
KS Olathe, Tech. Sls. Assoc. 913-829-2800
MD Baltimore, Leading Edge Sls. 301-644-0016
MI Troy, C. B. Jensen 313-643-0506
MN Minneapolis, D. A. Case Assoc. 612-831-6777
MO St. Louis, Tech. Sls. Assoc. 314-521-2044
NH Salem, Sales Engr. 603-893-5521
NJ Englewood, Sprung & Rea, Inc. 201-569-5666
NY E. Syracuse, Bastian Sls. 315-437-1482
NY Fairport, Bastian Sls. 716-223-0237
NC Raleigh, W.L.A. Assoc. 919-231-9939
OH Aurora, EMA 216-562-6104
OH Centerville, EMA 513-433-2800
TX Garland, C.M.A. 214-681-1414
TX Houston, C.M.A. 713-771-1500
UT Salt Lake City, Luscombe Eng. 801-268-3434
WA Woodinville, T.E.A.M. 206-485-1111
WI Brookfield, Mc Mahon Sls. Inc. 414-782-3335

Local Distributors

CT Wallingford, Sager 203-265-4600
FL Orlando, Sager 407-354-1130
GA Norcross, Sager 404-446-0085
IL Chicago, Leeds Elctrns. 312-625-3800
MD Columbia, Sager 410-995-4900
MA Hingham, Sager 617-749-6700
MI Madison Heights, Tracer Control Co. 313-545-7140

MN Minneapolis, Leeds Elctrns. 612-557-1277
NH Salem, Sager 603-898-1348
NJ Sager 201-585-0029
NY Hauppauge, Sager 516-348-1300
NC Raleigh, Sager 919-850-9550
PA Philadelphia, Sager 215-464-4336
WI Milwaukee, Leeds Elctrns. 414-789-6994

SCHUMACHER ELECT. CORP., 7474 N. Rogers Ave., Chicago, IL 60626, Tel: 312-973-1600, FAX: 312-973-7781; Empl.: 700; *Sls. Mgr.:* Norman Patinka

SCHURTER

FAX: 707-778-6401

SCHURTER, INC., 1016 Clegg Ct., Petaluma, CA 94954, Tel: 800-848-2600 ext.62; FSC No.: 61935; *Sls. Mgr.:* Janet Barrett ..... **A•1606-1608; B•1386-1388, 1803; C•1450-1455**

Local Sales Offices & Reps

AL Madison, Benchmark Tech. Sls. Inc. ... 205-464-0033
AZ Scottsdale, JK & Assos. 602-990-8804
AR Little Rock, Doby Assoc. 501-221-0326
CA Chatsworth, Cygnus Sls. Engrg. Corp. 818-727-0312
CA San Diego, Cygnus Sls. Engrg. Co. 619-268-7771
CA San Jose, Arnold Tech. Sls., Inc. 408-954-0400
CO Broomfield, Summit West Mktg., Inc. .. 303-460-9600
FL Pompano Bch., IMR, Inc. 305-942-2449
GA Norcross, Benchmark Tech. Sls. Inc. .. 404-446-1711
IL Arlington Hgts., MJ Petersen & Assoc., Ltd. 708-577-8200
IN Carmel, Current Elctrn. Mktg. 317-844-1770
KS Overland Park, Acorn Elctrns. 913-649-6402
MD Baltimore, Chesapeake Indl. Mktg. 410-653-0476
MN Shorewood, Frank Anthony Mktg. 612-474-2850
MS Jackson, Doby Assocs. 601-981-1138
MO St. Louis, Acorn Elctrns. Inc. 314-421-1751
NH Nashua, Bell Controls 603-882-6984
NJ Ho-Ho-Kus, D. J. Fisher Co. 201-652-0090
NJ Medford, Champion Elctrn. Sls. Co. 609-983-0932
NY Fairport, TAC Sls, Inc. 716-223-7610
NC Raleigh, Benchmark Tech. Sls. Inc. 919-850-0633
OH Beachwood, Electronic Salesmasters 216-831-9555
OR Hillsboro, Doran Sls. 503-640-4500
TX Dallas, Reese & Assocs. 214-224-1000
UT Salt Lake City, Luscombe Engrg. Co. .. 801-268-3434
WA Bothell, Doran Sls. 206-488-1200

Local Distributors

AZ Phoenix, BeSwitched 602-275-4805
AR Little Rock, Carlton-Bates 501-562-9100
CA Irvine, Kensington Elctrns., Inc. 714-588-0575
CA Livermore, Quail Elctrns. 510-373-6700
CO Aurora, Jet Elctrns. 303-364-1000
CT Wallingford, Sager Elctrns. 203-265-4600
FL Orlando, Sager 407-354-1130
GA Norcross, NRC Elctrns. 404-729-0411
ID Boise, Radar Elec. Co. 208-336-2227
IL Chicago, Leeds Electro Cmpnts. 312-625-3800
IL Elk Grove Village, Nu-Way Elctrn. Distrbs. Inc. 708-437-7120
IN Carmel, Altex Elctrns. 317-848-1323
IA Cedar Rapids, Dee Elctrns. 319-365-7551
MD Columbia, Sager Elctrns. 301-995-4900
MA Hingham, Sager Elctrns. 617-749-6700
MI Livonia, RS Elctrns. 313-525-1155
MN Plymouth, Leeds Electro Comps., Inc. 612-557-1277
NH Salem, Sager Elctrns. 603-898-1348
NY Hauppauge, Sager Elctrns. 516-348-1300
NY Rochester, Masline Elctrns. 716-546-5373
NC Raleigh, Sager Elctrns. 919-850-9550
OH Strongsville, Fuse World 216-238-1330
OR Portland, Radar Elctrns. Co. 503-232-3404
OR Tualatin, Moore Elctrns., Inc. 503-692-5333
PA Harrisburg, Ad-Tech Elctrns., Inc. 717-561-9905
PA Mars, Sager Elctrns. 412-772-2233
PA McKean, Advacom 814-476-7774
PA Philadelphia, Sager Elctrns. 215-464-4336
TX Dallas, Fuses Unlimited 214-907-8600
WA Kent, Moore Elctrns. 206-251-8090
WA Richland, Radar Elec. Co. 509-943-8336
WA Seattle, Radar Elec. Co. 206-282-2511
WA Spokane, Radar Elec. Co. 509-747-3053
WI Oconomowoc, GW Elctrns. Ltd. 414-567-9445
Can Markham, Ont., Birde Mktg. 416-477-7722

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SCHUSTER ELECTRONICS, 54 Cove Rd., Huntington, NY 11743, Tel: 516-271-0590; *Sls. Mgr.:* Norman Schuster

SCIENCE ACCESSORIES CORP., 200 Watson Blvd., Stratford, CT 06497, Tel: 203-386-9978, FAX: 203-381-9270; Empl.: 40; *Sls. Mgr.:* H. A. Cleveland

SCIENCE & ENGRG. CONSULTANTS, INC., 11800 Sunrise Valley Dr., Ste. A, Reston, VA 22091-5302, Tel: 703-471-1600, FAX: 703-620-1561; Empl.: 2; *Sls. Mgr.:* Mr. Kevin B. Deasy

SCIENCE/ELECTRONICS, P. O. Box 986, Dayton, OH 45401-0986, Tel: 513-859-5555, FAX: 513-859-7930; Empl.: 25; *Sls. Mgr.:* E. E. Pohl

SCIENTECH, INC., 5649 Arapahoe Ave., Boulder, CO 80303, Tel: 303-444-1361, 800-525-0522, TWX: 910-940-0994, FAX: 303-444-9229; Empl.: 35

SCIENTIFIC-ATLANTA, INC., See Optima Enclosures

Esterline SCIENTIFIC COLUMBUS

FAX: 614-272-2288

SCIENTIFIC COLUMBUS CO., 1900 Arlingate Lane, Columbus, OH 43228-4105, Tel: 614-274-0400; Empl.: 150 ..... **B•2007-2012**

Local Sales Offices & Reps

AL Birmingham, Spader & Assocs. 205-979-5500
NC Charlotte, Robert W. Chapman & Co. 704-525-2421
OH Grove City, Leidy Engrg. Sls. 614-875-1524
PA Collegeville, GEE Co., Inc. 215-489-8860
TN Chattanooga, Spader & Assocs. 615-899-3823
AZ Scottsdale, Young Power Equip. Co. .. 602-991-9191
AR Little Rock, BFCO, Inc. 501-753-9977
CA Glendale, Young & Co. 818-242-2171
CA San Francisco, Wrathall & Krusi, Inc. .. 415-777-0226
CO Littleton, The Beabout Co., Inc. 303-795-1000
FL Gainesville, RJC Assocs. 904-372-4635
FL Orlando, RJC Assocs. 407-894-7371
GA Decatur, Spader & Assocs. 404-296-3024
HI Honolulu, Berkley Engrg. & Equip. Co. 808-845-9377
IL Naperville, O'Conner, Serra & Assoc., Inc. 708-420-7812
IN Nobelsville, C.D. Arnold Co. 317-773-5821
IA Cedar Rapids, Harry Ferris Co. 319-377-1226
KS Kansas City, Power Equip. Sls. Co., Inc. 913-384-3848
LA Kenner, John J. Aertker Jr. Co., Inc. ... 504-469-0136
MA Quincy, Fantasia Assocs., Inc. 617-479-0800
MI Brighton, Dale P. Seyfried Co., Inc. 313-227-5353
MI Grand Rapids, Dale P. Seyfried Co., Inc. 616-453-8603
MN Minneapolis, Arjay Automation, Inc. ... 612-861-1749
MO Springfield, Power Equip. Sls. Co. Inc. 417-833-3056
MO St. Louis, Ken Way Co. 314-469-9998
NE Lincoln, Harry Ferris Co. 402-464-6148
NM Albuquerque, Young Power Equip. Co. 505-843-9450
NY Albany, Expert Industrial Sys., Inc. 518-869-3355
NY N. Tonawanda, Expert Industrial Sys. Inc. 716-694-3935
NY North Chili, Expert Industrial Sys. Inc. 716-594-5755
NY Syracuse, Expert Industrial Sys. Inc. ... 315-455-2469
NC Raleigh, Robert W. Chapman & Co. ... 919-782-2624
OH N. Canton, Leidy Engrg. Sls. 216-497-9585
OK Tulsa, C. B. Anderson Elec. Co. 918-836-4661
OR Portland, McLaren Inc. 503-627-0757
PA Pittsburgh, Russell F. Clark Co., Inc. ... 412-242-9500
SC Greenville, Robert W. Chapman & Co. 803-288-8821
SC W. Columbia, Robert W. Chapman & Co. 803-739-0220
TX Arlington, Ev Smith Sls. Co. 817-572-2911
TX Houston, Ev Smith Sls. Co. 713-931-0403
VA Alexandria, The Hildenbrand Co., Inc. 703-998-0445
VA Midlothian, Robert W. Chapman & Co. 804-323-6088
WA Kirkland, McLaren Inc. 206-827-9400
WI Milwaukee, Reynolds & Co. 414-351-1100
Can Calgary, Alb., Landel Controls Ltd. 403-254-8900
Can Mississauga, Ont., Sircon Controls, Ltd. 416-238-9505
Can Richmond, B.C., Landel Controls Ltd. .. 604-244-7331
Can St. Laurent, Que., Le Groupe Rotalec 514-341-3685

SCIENTIFIC CONVERSION, INC., 42 Truman Dr., Novato, CA 94947, Tel: 415-892-2323, FAX: 415-892-2321; Empl.: 15; *Sls. Mgr.:* Maura Vrydaghs

SCIENTIFIC INSTRUMENTS, 4400 W. Tiffany Dr., West Palm Beach, FL 33407, Tel: 407-881-8500, FAX: 407-881-8556; FSC No.: 591197614; Empl.: 52; *Sls. Mgr.:* Mike Capers; *Dist. Mgr.:* Mike Capers

SCIENTIFIC RESEARCH CORP., See TRAK Microwave Corp.

STI®

FAX: 510-471-9752

SCIENTIFIC TECHNOLOGIES INC., Control Components Div., 31069 Genstar Rd., Hayward, CA 94544-7831, Tel: 510-471-9717, 800-221-7060; FSC No.: 52797; Empl.: 25; *Sls. Mgr.:* Paul N. Dreiseszun ..... **B•1595-1596**

SCIENTIFIC TECHNOLOGIES INC., Optical Sensor Div., 31069 Genstar Rd., Hayward, CA 94544, Tel: 510-471-9717, FAX: 510-471-9752; Empl.: 120

SCI TECHNOLOGY, INC., PO Box 1000, 8600 So. Memorial Pkwy., Huntsville, AL 35807, Tel: 205-882-4569, FAX: 205-882-4659

SCITEQ ELECTRONICS, INC., 4775 Viewridge Ave., San Diego, CA 92123, Tel: 619-292-0500, FAX: 619-292-9120; FSC No.: 70561; Empl.: 40; *Sls. Mgr.:* Phil Feinberg

SCOPE INCORPORATED, 1860 Michael Faraday Dr., Reston, VA 22090, Tel: 703-471-5600, FAX: 703-471-6750; Empl.: 95; *Sls. Mgr.:* T. Titcomb

SCORPION SEMICONDUCTOR, 2360 Qume Dr., Ste. B, San Jose, CA 95131, Tel: 408-944-6270, FAX: 408-944-6272

SCOTT SPECIALTY GASES, INC., 6141 Easton Rd., P.O. Box 310, Plumsteadville, PA 18949-0130, Tel: 215-766-8861, FAX: 215-766-0320; FSC No.: SIC 2818; *Sls. Mgr.:* James Wallis

SC TECHNOLOGY, INC., 368 Earhart Way, Livermore, CA 94550, Tel: 510-373-9230, FAX: 510-373-9416; *Sls. Mgr.:* Susan L. Karl

SCREENPRINT DOW, See Dow Switch

SEABOARD ELECTRONICS, 70 Church St., New Rochelle, NY 10805, Tel: 914-235-8073, FAX: 914-235-8369; FSC No.: 63,58,Y,Z; Empl.: 30; *Sls. Mgr.:* Jerrold Hacker; *Dist. Mgr.:* Subhash Grandhi

SEACOR INC.

FAX: 201-664-8544

SEACOR, INC., 123 Woodland Ave, Westwood, NJ 07675, Tel: 201-666-5600; Empl.: 20; *Sls. Mgr.:* D. Calamaras ..... **A•1160-1162**

Local Sales Offices & Reps

AL Huntsville, Summit Mktg. 205-721-1701
AZ Tempe, FP Sls. 602-894-5303

CA Alhambra, James Gerry Co., Inc. 213-283-7694, FAX:818-282-3836
CA San Jose, H. W. Assocs. 408-996-9940, FAX:408-996-0885
CO Denver, English/Damco Sls. Co. 303-782-0683, FAX:303-782-0670
FL Palm Harbor, Francois & Assocs., Inc. 813-784-4812,FAX:813-784-4854
GA Norcross, Summit Mktg. Assoc. 404-498-4530
IN Indianapolis, Schank Elctrn. Mktg., Inc. 317-842-6204,FAX:317-842-6205
MD Bel Air, Freedman/Malta Assoc. 410-879-3148, FAX:410-838-0789
MA Sudbury, KSA of New England 508-443-5881, FAX:508-443-0483
MI Troy, Schank Elctrn. Mktg., Inc. 313-588-2040
MN Plymouth, Highland Elctrns. Sls. Co. 612-557-7002, FAX:612-557-7014
NJ Budd Lake, T & K Sls. 201-347-1856, FAX:201-691-1468
NM Albuquerque, FP Sls. 505-345-5553, FAX:505-345-5555
NY Skaneateles, NRM Mktg. Grp., Inc. 315-685-8991, FAX:315-685-6199
NY Smithtown, T & K Sls. 516-724-3456, FAX:516-724-3485
NC Chapel Hill, Summit Mktg. Assoc. 919-968-7808
OH Cincinnati, Bob Gilbert & Assocs. 513-574-1932, FAX:513-574-2854
OH Miamitown, Bob Gilbert & Assocs. 513-353-4889, FAX:513-353-4689
PA King of Prussia, Freedman-Malta Assocs. 215-337-9211,FAX:215-265-8764
TX Richardson, Barry Sls., Inc. 214-234-0255, FAX:214-235-0271
Can Markham, Ont., Kellock Sls. & Mktg. 416-471-0202, FAX:416-472-4519

Local Distributors

CT Bridgeport, Park Distrs. 203-366-7200
CT Wallingford, Mid-State Elctrns. 203-265-9900, FAX:203-269-2374
FL Boca Raton, NRC Elctrns. 407-241-8600, FAX:407-241-3328
FL Ft. Lauderdale, Brothers Elec. 305-561-6700, FAX:305-564-8080
GA Norcross, NRC Elctrns. 404-729-0411, FAX:404-448-2854
IN Carmel, Altex Elctrns. 800-783-2589, FAX:317-848-1323
MA Marlboro, NOW Elctrns. 508-460-0187, FAX:508-460-0467
MA Sudbury, ASK Elctrns. 508-443-5881, FAX:508-443-0483
MN Eitzen, Capacitor Assocs. 507-495-3306, FAX:507-495-3454
MN Fridley, Voyager Elctrns. 612-571-7766, FAX:612-571-9519
NJ E. Brunswick, Brothers Elctrns. 201-238-2200, FAX:201-238-2218
NJ Rockaway, Tonar Inds. 201-586-9000, FAX:201-586-2075
NY Ronkonkoma, Spectrum Comp. Supp. 516-737-6900,FAX:516-737-6642
WA Seattle, Vesco Elctrns. 206-575-3607

SEACOR PIEZO CERAMICS, 8 Huntington St. Ste. 300, Huntington, CT 06484, Tel: 203-925-1320, FAX: 203-925-1320

SEAFAB, INC., 14648 N.E. 95th St., Redmond, WA 98052, Tel: 206-881-2778, FAX: 206-882-0707; Empl.: 80; *Sls. Mgr.:* Bruce Murray

SEALING DEVICES, INC., 4400 Walden Ave., Lancaster, NY 14086, Tel: 716-684-7600, FAX: 716-684-0760; Empl.: 95; *Sls. Mgr.:* Wayne K. Carrig

SEALTRON, INC., 9705 Reading Road, Cincinnati, OH 45215, Tel: 513-733-8400, FAX: 513-733-0131; FSC No.: 3678; Empl.: 140; *Sls. Mgr.:* James Dawson

SEASTROM MANUFACTURING CO., INC., 701 Sonora Ave., Glendale, CA 91201, Tel: 800-634-2356, FAX: 818-246-6803; FSC No.: 86928; Empl.: 80; *Sls. Mgr.:* Dave Buddecke

secma inc.
A MEMBER OF SECME GROUP

FAX: 714-261-8390

SECMA, INC., Secme, 17752 Skypark Circle No. 200, Irvine, CA 92714, Tel: 714-261-0610; Empl.: 250 ..... **B•1804-1807, 1850-1851**

Local Sales Offices & Reps

AL Huntsville, Progressive Technlg. 205-551-7770
CA Alameda, Liaison, Inc. 510-769-1991
CA Chula Vista, PCA Mktg. & Sls. Eng. 714-493-3434
CA Dana Point, PCA Mktg. & Sls. Engrg. 714-493-9822
CO Grand Junction, Krebill Comp. Sls. 303-243-8220
IL Elk Grove Vlg., Tristar Grp. 708-593-0200
IL Elk Grove Vlge., Tristar Grp. 708-364-6507
IN Greenwood, Liberty Sls. 317-888-8396
IN Lafayette, Liberty Sls. 317-474-5058
MA Scituate, Olsen Tech. Sls. 617-545-5101
NY Bohemia, Optimum Metro Sls. 516-244-5744
OH Mentor, Sls. Plus 216-942-7811
OR Lake Oswego, SPS Elctrns. 503-697-7768
TX Lewisville, Elctrn. Prod. Rep. 817-467-0377
UT Sandy, Krebill Comp. Sls. 801-943-5311
WA Mountlake Perris, SPS Elctrns. 503-697-7768
Can Brossard, Que., D B Lectro 514-923-4525
Can Brossard, Que., DB Lectro 514-923-4525
Can Markham, Ont., Avotronics 416-475-1858
Can Ontario, Avotronics 416-475-2024

Local Distributors

CA Covina, SelectaSwitch 818-697-4119
MA Woburn, Control Des. Supp. 617-932-9404
Can Markham, Ont., ARMA 416-475-1858

SECTOR MICROWAVE IND. INC., 999 Grand Blvd., Deer Park, NY 11729, Tel: 516-242-2300, TELEX: 673-2151, TWX: 510-227-6075, FAX: 516-242-8158; Empl.: 45; *Sls. Mgr.:* Thomas Nelson

SECTOR SYSTEMS CO., INC., 416 Ocean Ave., Marblehead, MA 01945, Tel: 617-639-2625; Empl.: 10

SECURITY PLASTICS, INC., 14427 N.W. 60th Ave., Miami Lakes, FL 33014, Tel: 305-823-5440, FAX: 305-557-1431; Empl.: 400; *Sls. Mgr.:* Nelson Rodriguez

SEEQ TECHNOLOGY, 1849 Fortune Dr., San Jose, CA 95131, Tel: 408-432-7400, 1-800-333-7706, TELEX: 296609, TWX: 9103382313, FAX: 408-432-9549; Empl.: 370; *Sls. Mgr.:* Phil Ortiz, V.P Worldwide Sls.; *Dist. Mgr.:* Pat Bringuel

SII
Seiko Instruments

FAX: 310-517-7792

SEIKO INSTRUMENTS U.S.A., INC. ELECTRONIC COMPONENTS, 2990 W. Lomita Blvd., Torrance, CA 90505, Tel: 310-517-7770; *Sls. Mgr.:* A. Kishida; *Dist. Mgr.:* T. Touji ..... **A•1480; B•1113; D•1106, 1473**

Local Sales Offices & Reps

AL Huntsville, Cartwright & Bean, Inc. 205-830-1540
AZ Phoenix, C.T. Carlberg & Assocs. 602-468-0750
AZ Scottsdale, C.T. Carlberg & Assocs. 602-994-9388
AZ Tucson, C.T. Carlberg & Assocs. 602-299-1508
CA Irvine, Groh Assoc. 714-837-9871
CA Newbury Park, Groh Assocs. 805-498-8410
CA Poway, Groh Assocs. 619-673-4321
CA San Jose, H-Technical Sls. 408-453-2111
CO Aurora, Electrodyne 303-695-8903
CT Madison, Focus Elctrn. Sls. 203-245-4314
FL Plantation, Gallagher & Assocs. 305-473-2101
GA Norcross, Cartwright & Bean, Inc. 404-368-0160
IL Elk Grove Village, TriStar Grp., Inc. 708-593-0200
IN Ft. Wayne, Electro Rep Inc. 219-489-8205
IN Indianapolis, Electro Rep Inc. 317-842-7202
IA Cedar Rapids, J.R. Sls. Engrg., Inc. 319-393-2232
KS Overland Park, Electri-Rep 913-649-2168
MD Burtonsville, Chesapeake Technlg. 301-236-0530
MA Taunton, Focus Elctrns. Sls. 508-824-3840
MI Farmington Hills, Rathsburg Assoc., Inc. 313-489-1500
MN Bloomington, Matrix Mktg. Grp. 612-835-6977
MO St. Louis, Electri-Rep 314-993-4421
NJ E. Brunswick, Shepard & Assoc. 908-254-5757
NM Albuquerque, C.T. Carlberg & Assocs. 505-899-2155
NY E. Syracuse, Nycom, Inc. 315-437-8343
NC Charlotte, Cartwright & Bean, Inc. 704-536-0303
NC Raleigh, Cartwright & Bean, Inc. 919-876-4130
OH Brunswick, J. N. Bailey & Assocs. 216-273-3798
OH Columbus, J.N. Bailey & Assocs. 614-262-7274
OH New Lebanon, J. N. Bailey & Assocs. 513-687-1325
OR Tigard, Earl & Brown Co. Inc. 503-639-2100
PA Frazer, Industrial Comps., Inc. 215-889-0650
TN Knoxville, Cartwright & Bean, Inc. 615-693-7450
Can Markham, Ont., Birde Mktg. 416-477-7722
TX Austin, TI Mktg. Inc. 512-371-7272
TX Dallas, TL Mktg. Inc. 214-490-9300
TX Houston, TL Mktg. Inc. 713-587-8100
UT Salt Lake City, Electrodyne 801-264-8050
WA Redmond, Earl & Brown Co., Inc. 206-885-5064
WI Menomonee, TriStar Grp., Inc. 800-654-4105
Can Kanata, Ontario, Birde Mktg. 613-592-5411
Can St. Laurent, Quebec, Birde Mktg. 514-335-4050
Can Vancouver, B.C., Birde Mktg. 604-431-0426

Local Distributors

AZ Phoenix, Aerospace S.W. 602-582-2779
AZ Phoenix, Sterling Elctrns. 602-437-5565
AZ Tempe, Cypress Elctrns. 602-966-2256
CA Agoura Hills, Cypress Elctrns. 818-597-9491
CA Chatsworth, Sterling Elctrns. 818-407-8850
MD Columbia, Sterling Elctrns. 301-290-3800
CA Costa Mesa, Cypress Elctrns. 714-549-2424
CA San Diego, Cypress Elctrns. 619-535-0011
CA San Diego, Sterling Elctrns. 619-560-8097
CA San Jose, All American 408-943-1200
CA San Jose, Electro Alliance, Inc. 408-280-0221
CA San Jose, Sterling Elctrns. 408-435-0835
CA Santa Clara, Cypress Elctrns. 408-980-2500
FL Sunrise, All American 305-572-7999
CA Tustin, OBI 714-258-1411
CA Tustin, Sterling Elctrns. 714-259-0900
CO Englewood, Cypress Elctrns. 303-792-5829
CO Englewood, Sterling Elctrns. 303-792-3939
CT Wallingford, Sterling Elctrns. 203-265-9535
FL Miami, All American 305-621-8282
GA Norcross, Applied Power Inc. (printers only) 404-263-0421
IL Rosemont, Advent Elctrns., Inc.(printers only) 708-297-6200
IL Schaumburg, Marsh Elctrns. 708-240-9290
IL Schaumburg, Sterling Elctrns. 708-303-9900
IN Carmel, Altex Elctrns. 317-848-1323
IN Indianapolis, Advent Elctrns., Inc.(printers only) 317-872-4910
IA Cedar Rapids, Advent Elctrns., Inc.(printers only) 319-363-0221
IA Cedar Rapids, Dee Elctrns., Inc. (LCD only) 319-365-7551
KS Lenexa, Sterling Elctrns. 913-492-5406
MD Middletown, Current Comps. 301-473-5333
MD Raynham, Current Comps. 508-824-7900
MA Woburn, Sterling Elctrns. 617-938-6200
MI Farmington Hills, Advent Elctrns., Inc.(printers only) 313-477-1650
MN Eden Prairie, Cypress Elctrns. 612-934-2104
MN Minneapolis, Aerospace Computer Supps. 612-884-4725
MN Minneapolis, Sterling Elctrns. 612-831-2666
NJ Edison, Sterling Elctrns. 908-417-1000
NM Albuquerque, Sterling Elctrns. 505-884-1900
NC Raleigh, Century Elctrns. 919-782-2116
NY Ronkonkoma, All American 516-981-3935
NC Raleigh, Sterling Elctrns. 919-596-2220
OH Cincinnati, Schuster Elctrns. 513-489-1400
OH Solon, Sterling Elctrns. 216-248-1122
OK Tulsa, Sterling Elctrns. 918-663-2410
OR Tualatin, Moore Elctrns. 503-692-5333
OR Beaverton, Micropower (Batteries Only) 503-626-7086
PA Norristown, Century Elctrns. 215-631-5404
TX Austin, Sterling Elctrns. 512-836-1341
TX Dallas, Sterling Elctrns. 214-243-1600
TX Houston, Sterling Elctrns. 713-627-9800
TX Irving, Cypress Elctrns. 214-255-0065
UT Salt Lake City, Sterling Elctrns. 801-972-5444
VA Richmond, Sterling Elctrns. 804-323-5510
WA Bothell, Cypress Elctrns. 206-483-1144
WA Kent, Moore Elctrns., Inc. 206-251-8090
WI Milwaukee, Marsh Elctrns. 414-475-6000
Can Burnaby, B.C., Semad/DGW Elctrns. 604-420-9889
Can Calgary, Alb., Semad/DGW Elctrns. 403-252-5664
Can Markham, Ont., Carsten Elctrns. Ltd. 416-477-7705
Can Markham, Ont., Semad/DGW Elctrns. 416-475-8500
Can Ottawa, Ont., Semad/DGW Elctrns. 613-727-8325
Can Pointe Claire, Que., Semad/DGW Elctrns. 514-694-0860
Can St. Laurent, Que., Carsten Elctrns. Ltd. 514-334-8321

SEIKO INSTS. USA, INC., Graphic Devices & Systems Div., 1130 Ringwood Ct., San Jose, CA 95131, Tel: 408-922-5800, FAX: 408-922-5840; *Sls. Mgr.:* Steve Dodds; *Dist. Mgr.:* Ralph Kosoff

SEIKO INSTRUMENTS U.S.A., INC., Robotics/Automation Div., 2990 W. Lomita Blvd., Torrance, CA 90505, Tel: 213-517-7850, FAX: 213-517-7793; Empl.: 250; *Sls. Mgr.:* K. Curtis; *Dist. Mgr.:* P. Simpson

SEKAI ELECTRONICS OF AMERICA, INC., 14535H Valley View Ave., Santa Fe Springs, CA 90670-5234, Tel: 310-921-7775, FAX: 310-921-7875; FSC No.: 8V398; Empl.: 6; *Sls. Mgr.:* Larry Klementowski; *Dist. Mgr.:* Ron Burnett

selco

FAX: 714-739-1507

SELCO PRODUCTS CO., SEL Sales, Inc., 7580 Stage Rd., Buena Park, CA 90621, Tel: 714-521-8673; Empl.: 18; *Sls. Mgr.:* Ray Anton; *Dist. Mgr.:* Ray Anton ..... **B•1896-1897; C•1535; D•1368-1370**

Local Sales Offices & Reps

CA	Arcadia, HMC, Inc.	818-447-0958
CA	Mission Viejo, Summit Sls.	714-830-5545
CA	Sunnyvale, Pass Assocs.	408-735-9040
CO	Littleton, Summit Sls.	303-973-9681
FL	Sarasota, Rep-USA	813-923-2897
IL	Woodridge, Golten Assocs.	708-985-5100
IN	Indianapolis, S & M Sls. & Mktgs.	317-843-5519
MA	Andover, Crawford Assocs.	508-470-2122
NY	Hauppauge, Sticom	516-366-4221
OR	Beaverton, Luscombe Engrg.	503-636-6664
PA	Valley Forge, J.E. Cuesta & Co.	215-935-0400
TX	Dallas, H.H. & Assoc.	214-247-8308
WA	Bellevue, Luscombe Engrg.	206-223-1541

Local Distributors

CA	Arcadia, Parco	818-447-0958
IL	Wheeling, Hawk Elctrns.	312-459-4091
NY	Hauppauge, A J Elctrns.	516-361-9780

SELECO, INC., P.O. Box 68809, Indianapolis, IN 46268, Tel: 317-872-4148, FAX: 317-875-3276; Empl.: 30

SELECT CONTROLS INC., 350 I Central Ave., Bohemia, NY 11716, Tel: 516-467-8577, FAX: 516-567-9013; Empl.: 14

SEMICON COMPONENTS, INC., A Subsidiary of Semicon, Inc., 10 North Ave., Burlington, MA 01803, Tel: 617-272-9015, FAX: 617-272-9109

SEMICONDUCTOR CIRCUITS, INC., Astec America, Inc., 49 Range Rd., Windham, NH 03087, Tel: 603-893-2330, FAX: 603-893-6280; Empl.: 52; *Sls. Mgr.:* Douglas E. Hemingway, VP/Sls. ..... **D•2207-2209**

Local Sales Offices & Reps

AZ	Chandler, Technisource Corp.	602-497-0711
CA	Los Angeles, Wiley Co.	213-666-1611
CA	Los Gatos, Luscombe Engr. Co. of San Francisco	408-370-2020
CO	Lakewood, Frontier Mktg.	303-980-5888
IL	Berkeley, ESA Tech. Mktg.	708-544-0120
IN	Plainfield, Rathsburg Assoc.	317-838-0360
MD	Pasadena, Elctrn. Engr. & Sls., Inc.	410-255-9686
MI	Farmington Hills, Rathsburg Assocs.	313-489-1500
MN	Edina, Ohms Technlg., Inc.	612-932-2920
MO	Florissant, Delltron Co., Inc.	314-839-0033
NH	Nashua, Bennetron	603-880-7008
NJ	Morrestown, TAI Corp.	609-778-5353
NM	Albuquerque, Technisource Corp.	505-268-4232
NY	Melville, Parallax	516-351-1000
NY	Syracuse, L.D. Allen Co.	315-437-8387
OH	Columbus, Rathsburg Assocs.	614-457-2242
OR	Lake Oswego, Luscombe Engr. N/W	503-636-6664
TX	Richardson, R.F. Kimball Co., Inc.	214-231-3447
WA	Bellevue, Luscombe Engr. N/W	206-223-1541
Can	Ottawa, Ont., Cantec Reps., Inc.	613-725-3704

Local Distributors

CA	Santa Clara, Foresight Elctrns.	408-980-9700
CT	Seymore, Target Elctrns.	203-888-1480
GA	Norcross, Applied Power Inc.	404-263-0421
IN	Carmel, Altex Elctrns.	317-848-1323
MA	Wellsley Hills, Target Elctrns.	617-235-2545
MA	Westwood, Target Elctrns.	617-329-2700
MI	Brighton, Applied Power Inc.	313-227-3604
NH	Derry, Target Elctrns.	603-434-8440
NJ	Lodi, TRC Elctrns.	201-779-8282
TX	Stafford, Southwest Elctrns.	713-240-4000

SEMICONDUCTOR PACKAGING MATERIALS CO., 431 Fayette Ave., Mamaroneck, NY 10543, Tel: 914-698-5353, FAX: 914-698-5386; Empl.: 57; *Sls. Mgr.:* Dolores Bankose

Local Sales Offices & Reps

AZ	Chandler, Mission Mktg.	602-786-0804
CA	Anaheim, Chalman Technlgs.	714-632-1724
CA	San Ramon, California Tech. Svcs.	510-743-8544
CO	Fort Collins, Rep Sls., Inc.	303-226-1504
CT	Southington, Libby Assoc.	203-747-5601
CT	Southington, Libby Assocs.	203-747-5601
CT	Washington Depot, Gemair Inc.	203-868-1390
IL	Palatine, M & S Sls.	708-934-1200
MD	Walkerville, KH Sls.	301-898-0758
MN	Minneapolis, Ferrian Sls.	612-721-8915
PA	Franconia, Scharas Assocs.	215-582-0450
TX	Dallas, Dallas Indl. Sls.	214-669-2608
TX	Richardson, PSI	214-644-5090
WA	Bellevue, Mars	206-747-3292
WA	Redmond, Advanced Elec. Resources	206-881-5207

SEMICONDUCTOR TECHNOLOGY, INC., 3131 S.E. Jay St., Stuart, FL 34997, Tel: 407-283-4500, FAX: 407-286-8914; FSC No.: 50891; Empl.: 45

Local Sales Offices & Reps

AZ	Scottsdale, Fred Board Assocs.	602-994-9388
CA	Costa Mesa, Solid State Sls.	714-650-8414
CA	Pleasanton, Leddy Assocs.	510-417-1033
CO	Englewood, Component Sls.	303-779-8060
FL	Longwood, Delmac Sls.	407-831-0040
IL	Downers Grove, Frank Mendell Assoc.	708-719-0099
IN	Ft. Wayne, Scott Elctrns.	219-489-5690
IN	Indianapolis, Scott Elctrns.	317-841-0010
IA	Cedar Rapids, Lorenz Sls.	319-377-4666
KS	Overland Park, Lorenz Sls.	913-469-1312
MD	Towson, Arbotek	301-825-0775
MA	Burlington, Conti-Younger	617-273-1582
MN	Minneapolis, Bill Deming & Assocs.	612-888-5000
MO	St. Louis, Lorenz Sls.	314-997-4558
NE	Lincoln, Lorenz Sls.	402-474-7094
NJ	Hasbrouck Heights, Comp Tech Sls.	201-288-7400
NM	Albuquerque, Q.A. Elctrns.	505-888-1121
NY	New Hyde Park, Comp Tech Sls.	516-593-2628
NY	Rochester, Electra Sls.	716-427-7860
NY	Syracuse, Electra Sls.	315-463-1248
OH	Cincinnati, Scott Elctrns.	513-791-2513
OH	Cleveland, Scott Elctrns.	216-473-5050
OH	Dayton, Scott Elctrns.	513-294-0539
OH	Westerville, Scott Elctrns.	614-882-6100
OR	Beaverton, Westmark Elctrns.	503-641-8780
PA	Paoli, Stitzer Co. Inc.	215-644-5500
PA	Pittsburgh, Scott Elctrns.	412-963-6116
TX	Austin, M-Rep	512-250-0828
TX	Dallas, M-Rep	214-484-5711
UT	Midvale, Utah/CSI	801-561-5099
WA	Bellevue, Westmark Elctrns.	206-454-1944
Can	Montreal, Que., Solid State Engrg.	514-481-3313

SEMIKRON, INC., 11 Executive Dr., Hudson, NH 03051-0066, Tel: 603-883-8102, 1-800-258-1308, FAX: 603-883-8021; FSC No.: 58687; Empl.: 12; *Sls. Mgr.:* Arthur Connolly

SEMTECH CORPORATION

FAX: 805-498-3804

SEMTECH CORPORATION, 652 Mitchell Rd., Newbury Park, CA 91320, Tel: 805-498-2111; FSC No.: 14099; Empl.: 350; *Sls. Mgr.:* Jack Poe; *Dist. Mgr.:* Shawn O'Grady ..... **A•2180-2218; D•1845**

Local Sales Offices & Reps

AL	Huntsville, Giesting & Assocs.	205-830-4554
AZ	Scottsdale, Arcom Sls., Inc.	602-947-5745
CA	Anaheim, First Rep of S. CA.	805-373-0887
CA	La Jolla, Coastal Elctrns.	619-459-4148
CA	Newbury Pk., Semtech Western Reg. Sls.	805-498-2111
CA	Santa Clara, Quorum Tech. Sls.	408-980-0812
CA	Westlake Village, First Rep of S. CA.	805-373-0887
CO	Grand Junction, Krebill Comp. Sls.	303-243-8220
FL	Deerfield Beach, Delmac Sls., Inc.	305-427-7788
FL	Longwood, Delmac Sls., Inc.	407-831-0040
GA	Duluth, Giesting & Assocs.	404-476-0025
IL	Glendale Hgts., Synergistics Sls., Inc.	708-858-8686
IN	Carmel, Giesting & Assocs.	317-844-5222
KY	Versailles, Giesting & Assocs.	606-873-2330
MD	Glen Burnie, Logical Technlg., Inc.	410-766-7444
MA	Chelmsford, Semtech Eastern Reg. Sls.	508-256-0506
MA	Framingham, Stone Comp. Sls.	508-875-3266
MI	Comstock Park, Giesting & Assocs.	616-784-9437
MI	Livonia, Giesting & Assocs.	313-478-8106
MN	New Brighton, Design Technig. Comps., Inc.	612-631-3738
MO	Florissant, Central Tech. Sls.	314-831-4069
NJ	Fairfield, Metro Logic Corp.	201-575-5585
NY	Bellmore, Compar New York, Inc.	516-221-7300
NY	Rochester, Ontec Elctrn. Mktg.	716-464-8636
NY	Wappingers Falls, Ontec Elctrn. Mktg.	914-462-7188
OH	Cincinnati, Giesting & Assocs. (Home Off.)	513-385-1105
OH	Cleveland, Giesting & Assocs.	216-261-9705
OH	Dublin, Giesting & Assocs.	614-792-5900
OR	Beaverton, Quest Mktg.	503-641-7377
PA	Horsham, Nexus Technlg. Sls., Inc.	215-675-9600
PA	Pittsburgh, Giesting & Assocs.	412-828-3553
TX	Richardson, Semtech Central Reg. Sls.	214-783-9903
WA	Renton, Quest Mktg.	206-228-2660
WI	Brookfield, Synergistics Sls., Inc.	414-821-1516
EXP	Shijuku-Tokyo, Japan, Jepico-Shinjuku	03-348-0611
Can	Hamilton, Ont., Cartwright Southall Assoc., Inc.	416-528-0294

SEMTECH CORPUS CHRISTI, Semtech Corporation, 121 International Dr., Corpus Christi, TX 78410, Tel: 512-289-0403, FAX: 512-289-0472; Empl.: 200 ..... **A•2180-2218; D•1845**

SEMTRONICS CORP., 211 Prospect Pk., P.O. Box 2248, Peachtree City, GA 30269, Tel: 404-487-6681, FAX: 404-487-1128; Empl.: 30; *Sls. Mgr.:* Bradford Jubin

SENCORE, 3200 Sencore Dr., Sioux Falls, SD 57107, Tel: 1-800-736-2673, 605-339-0100, FAX: 605-339-0317; FSC No.: 33347; Empl.: 230; *Sls. Mgr.:* George Gonos

SENSIDYNE, INC., 16333 Bay Vista Drive, Clearwater, FL 34620, Tel: 813-530-3602, 1-800-451-9444; Empl.: 70; *Sls. Mgr.:* Bob Duff; *Dist. Mgr.:* John Lavezzorio

SENSITEK CORPORATION, See Biddle Instruments

SENSITIVE RESEARCH INSTRUMENTS, 25 Dock St., Mt. Vernon, NY 10550, Tel: 914-699-9717, FAX: 914-699-9410; FSC No.: 32590;16034A; Empl.: 35

SENSITRON SEMICONDUCTOR, RSM Electron Power Div., 221 W. Industry Ct., Deer Park, NY 11729, Tel: 516-586-7600, FAX: 516-242-9798; FSC No.: 13409; Empl.: 150; *Sls. Mgr.:* Bryan Rogers; *Dist. Mgr.:* Bryan Rogers

SENSORAY

FAX: 503-684-8164

SENSORAY, 15800 Upper Boones Ferry Rd., # 150, Lake Oswego, OR 97035, Tel: 503-684-8005

SENSOR CORP., 303 Scottdale Ave., Scottdale, PA 15683, Tel: 412-887-4080, FAX: 412-887-0383; Empl.: 6

SENSOR DEVELOPMENTS INC., PO Box 290, Lake Orion, MI 48361, Tel: 313-391-3000, FAX: 313-391-0107; Empl.: 80; *Sls. Mgr.:* Bill Wood

SENSOR PRODUCTS, INC., 171 Castle Ridge Park, E. Hanover, NJ 07936, Tel: 201-884-1755, FAX: 201-884-1699; Empl.: 5

SENSOR SCIENTIFIC, INC., 6 Kingsbridge Rd., Fairfield, NJ 07004, Tel: 201-227-7790, 800-524-1610, FAX: 201-227-8063; FSC No.: 0AES7; Empl.: 125; *Sls. Mgr.:* Robert Gliniecki ..... **B•1898-1901**

Local Sales Offices & Reps

CA	Irvine, Vale Elctrn. Assoc.	714-551-4004
CA	Van Nuys, Vale Elctrns.	818-705-0283
CO	Ft. Collins, Rep. Sls.	303-226-1504
MA	Lexington, Jodan Technig.	617-863-8898

SENSOR SYSTEMS, INC., 8929 Fullbright Ave., Chatsworth, CA 91311, Tel: 818-341-5366, TELEX: 69-1583, FAX: 818-341-9059; *Sls. Mgr.:* E. Schneider

SENSOTEC, INC., 1200 Chesapeake Ave., Columbus, OH 43212, Tel: 614-486-7723, TWX: 810-482-1188, FAX: 614-486-0506; FSC No.: 29927; *Sls. Mgr.:* Jack Feil

SENSYM, INC., 1255 Reamwood Ave., Sunnyvale, CA 94089, Tel: 408-744-1500, FAX: 408-734-0407; FSC No.: 5955; Empl.: 150; *Sls. Mgr.:* Fred Jones; *Dist. Mgr.:* Fred Jones

SENTECH, INC., 518 Ryers Ave., Cheltenham, PA 19012, Tel: 215-663-0422, FAX: 215-663-0461; Empl.: 5

SENTRY MANUFACTURING COMPANY, P.O. Box 250, Chickasha, OK 73023, Tel: 405-224-6780, FAX: 405-224-8808; FSC No.: 5955; Empl.: 26; *Sls. Mgr.:* Barbara Maberry

SERCO PRODUCTS DIVISION:SERCO MOLD, INC., 612 Commercial Ave., Covina, CA 91723, Tel: 818-331-0517, 800-843-8172(Calif.), FAX: 818-331-8584; Empl.: 70; *Sls. Mgr.:* Neil Reckon ..... **C•1090-1091**

Local Sales Offices & Reps

CA	Covina, Serco Prods.	818-331-0517
CA	Los Gatos, Shur Sls.	408-399-7487
CA	Valencia, Lessing & Assocs.	805-295-0225
GA	Atlanta, Beacon Elec.	404-256-9640
KY	Louiseville, O.H. Bromberg	502-456-1498
MA	Burlington, Gerber Sls. Corp.	617-229-1150
MN	S. IMinneapolis, R.J., Inc	612-866-3661
MO	Florissant, Delltron Co., Inc.	314-839-0033
NY	Latham, L-Tron Corp.	518-785-5032
NY	Pt. Washington, Ashtec, Inc.	516-767-0336
OR	Portland, Brown Co.	503-293-1683
PA	Ft. Washington, Simon Mktg. Consultants	215-628-3394
TX	Richardson, R. F. Kimball Co., Inc.	214-231-3447

Local Distributors

AL	Montgomery, Handey's Elctrn. Ctr. Inc.	205-262-4885
AZ	Phoenix, Capital Elctrns.	602-252-5897
AZ	Phoenix, Elctrn. Emporium Inc.	602-437-8633
AZ	Tucson, Electronic City	602-622-1173
CA	Canoga Park, Sandy's Elctrns.	818-346-0510
CA	Costa Mesa, Mar Vac Elctrns.	714-650-2001
CA	Cucamonga, Abletronics	714-944-4952
CA	Culver City, DOW Elctrns.	213-391-6763
CA	El Monte, Marshall Ind.	800-522-0084
CA	Fremont, Fry's Elctrns.	415-770-3797
CA	Goleta, DOW Elctrns.	805-968-7272
CA	Hawiian Gardens, DOW Elctrns.	213-421-3786
CA	Hollywood, Pacific Radio Exchange	213-462-1393
CA	Inglewood, Inglewood Elctrns.	213-674-2366
CA	Oxnard, DOW Elctrns.	805-486-6353
CA	Palo Alto, Fry's Elctrns.	415-496-6100
CA	Pasadena, DOW Elctrns.	818-793-1195
CA	Pomona, DOW Elctrns.	818-966-8461
CA	Sacramento, Mar Vac California Radio	916-922-6531
CA	San Jose, Quement Elctrns.	408-998-5900
CA	Santa Maria, Elctrn. Parts Supermart	805-925-8604
CA	Sunnyvale, Fry's Elctrns.	408-733-1770
CO	Aurora, Jet Elec. Supp.	303-364-1000
CT	Wallingford, Midstate Elctrns.	203-265-9900
FL	Tampa, Sunex Elctrn. Supp. Inc.	813-885-4074
FL	West Palm Beach, Dolphin Elctrn. Supp. Inc.	305-659-7166
MA	Burlington, Atlantic Comps.	617-270-0051
MA	Lynn, Land Elctrns. Inc.	617-592-2220
MN	S. Minneapolis, Tortec Corp.	612-866-3662
MN	Thief River Falls, Digi-Key	218-681-6674
NV	Las Vegas, Sandy's Elctrns.	702-383-8353
NJ	Lodi, Nidisco Inc.	201-773-1771
NJ	Rockaway, Tonar Ind.	201-586-9000
NY	Ronkonkoma, Jet Comps.	516-471-3124
NY	Woodside, Switches Unlimited	718-478-5000
NC	Durham, Southeastern Elctrns.	919-638-8204
NC	Raleigh, Southeastern Elctrns.	919-828-2311
OH	Hudson, Hamshire	216-425-8888
TN	Clarksville, Randolph, Hale & Matthews Inc.	615-647-2325
TX	Austin, Electrotex, Inc.	512-454-0318
TX	Dallas, Electrotex, Inc.	214-234-0433
TX	Ft. Worth, Allied Elctrns.	800-433-5700
TX	Houston, Electrotex, Inc.	713-526-3456
WI	Fond du Lac, Fedco Elctrns. Inc.	414-922-6490
WI	Milwaukee, Marsh Elctrns. Inc.	414-475-6000
Can	Kingston, Ont., Electronic Packaging Sys. Ltd.	613-384-1142
Can	Markham, Ont., Arma Elctrns.	416-475-1858
Can	Montreal, Future Elctrns.	800-388-8731

SERVOBYTE INC., P.O. Box 112, Millbury, MA 01527, Tel: 508-865-0225, FAX: 508-865-0295; Empl.: 5; *Sls. Mgr.:* C. Harris

SERVO CORPORATION OF AMERICA, 111 New South Rd., Hicksville, NY 11801-5259, Tel: 516-938-9700, FAX: 516-938-9644; FSC No.: 92110 & 05627; Empl.: 220

SERVOMEX COMPANY, INC., 90 Kerry Pl., Norwood, MA 02062, Tel: 617-769-7710, TELEX: 4430161, FAX: 617-769-2834; *Sls. Mgr.:* Michael Hammond

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FAX: 201-427-4249

SERVO-TEK PRODUCTS CO., 1086 Goffle Rd., Hawthorne, NJ 07506, Tel: 201-427-3100; Empl.: 47; *Sls. Mgr.:* T. J. Daly ..... **B•1306**

SESCOM, INC., 2100 Ward Dr., Henderson, NV 89015-4249, Tel: 702-565-3400, FAX: 702-565-4828; FSC No.: 7Z174; Empl.: 12; *Sls. Mgr.:* Franklin J. Miller ... **C•1093**

setra

FAX: 508-264-0292

SETRA SYSTEMS, INC., 45 Nagog Park, Acton, MA 01720, Tel: 508-263-1400, 1-800-25-SETRA, TELEX: 4430243; FSC No.: 53367; Empl.: 110 .... **B•2014-2015**

Local Sales Offices & Reps

AL	Huntsville, Burnette Techno Metrics	205-830-2832
AK	Anchorage, Unit Process	907-522-1010
CA	Concord, QCon, Inc.	510-682-2020
CA	Downey, Dynasales Co.	310-806-1400
CO	Westminster, RMS Sls.	303-429-1111
FL	Tampa, Quantum Measurements Corp.	813-933-8078
GA	Atlanta, Craft Assocs.	404-256-0420
IL	W. Dundee, Precision Meas. Prods.	708-426-4446
IN	Ft. Wayne, Domino, Inc.	219-456-5512
IN	Indianapolis, Domino, Inc.	317-841-6159
KY	Louisville, Domino, Inc.	502-425-2848
MD	Columbia, Stein Instrs.	301-596-3748
MA	Wilbraham, NEDT, Inc.	413-596-8853
MI	Hazel Park, Tiby Co.	313-547-3550
MN	Minneapolis, The Mark Co.	612-933-3026
MO	St. Louis, Adelphi, Inc.	314-821-1232
NJ	Little Falls, KLS Assocs.	201-785-4450
NY	Cazenovia, Ritec Entprs., Inc.	315-655-4158
NY	Rochester, Ritec Entprs., Inc.	716-271-3170
OH	Cleveland, Tiby Co.	216-371-5335
OH	Dayton, Tiby Co.	513-277-3822
OK	Tulsa, Inotek Corp.	918-627-1500
PA	Cheltenham, Stein Instrm.	215-379-1990
TX	Dallas, ADI Instrs.	214-340-3445
WA	Seattle, EMRA Controls, Inc.	206-244-4341
WI	Waukesha, Ray Knitter Assocs.	414-544-1976
Can	Ontario, Alpha Controls & Instr.	416-477-2133

SEVEN MOUNTAINS SCI. INC., P.O. Box 650, Boalsburg, PA 16827, Tel: 814-466-6559, FAX: 814-466-6559; Empl.: 4; *Sls. Mgr.:* Josephine Chesworth

SFE TECHNOLOGIES, 1501 1st St., San Fernando, CA 91340, Tel: 818-365-9411, TWX: 910-496-1535, FAX: 818-365-5117; FSC No.: 96733; Empl.: 800; *Sls. Mgr.:* Michael Rosenberg

SGS-THOMSON MICROELCTRONICS, INC., 1000 Bell Road, Phoenix, AZ 85022, Tel: 602-867-6100

SGS-THOMSON MICROELECTRONICS, INC., 1310 Electronics, Carrollton, TX 75006, Tel: 214-466-6000, FAX: 214-466-7602; FSC No.: 7X328; Empl.: 1700; *Sls. Mgr.:* Carlo Bozotti; *Dist. Mgr.:* Jack Dauber

SHALLCO, INC., Box 1089, Smithfield, NC 27577, Tel: 919-934-3135, 1-800-876-3135, FAX: 919-934-3298; Empl.: 30; *Sls. Mgr.:* M. D. Sutton .... **B•1808; D•1323**

SHALLTRONIX CORP., Preston St., P.O. Box 235, Selma, NC 27576, Tel: 919-965-6346, FAX: 919-965-6620; FSC No.: 58258; *Sls. Mgr.:* Joe Deans ..... **D•1324**

Local Sales Offices & Reps

TX	Arlington, Electronic Prod. Reps.	817-467-0377

SHAMROCK PLASTICS & RUBBER, INC., 5330 E. 25th St., Indianapolis, IN 46218, Tel: 317-543-3540, 800-382-4635, FAX: 317-543-3553; Empl.: 25; *Sls. Mgr.:* Bill Crispen

SHAPE ELECTRONICS, INC., The Wiremold Co., 901 DuPage Ave., Lombard, IL 60148, Tel: 708-620-8394, 1-800-367-5811, FAX: 708-620-0784; Empl.: 110; *Sls. Mgr.:* Jim Piantanida; *Dist. Mgr.:* Jim Piantanida

SHAPIRO SCIENTIFIC INST., 3500 E. Coast Hwy., Corona del Mar, CA 92625, Tel: 714-675-1024, FAX: 714-675-9063; Empl.: 7

SHARP ELECTRONICS CORP., Microelectronics Grp., 5700 NW Pacific Rim Blvd., M/S. 20, Camas, WA 98607, Tel: 206-834-2500, FAX: 206-834-8903; *Sls. Mgr.:* Doug Goodyear; *Dist. Mgr.:* George Campot

SHATTUCK INDUSTRIES, 117 Fern St., Santa Cruz, CA 95060, Tel: 408-427-3122, FAX: 408-427-3134; *Sls. Mgr.:* Bruce Shattuck; *Dist. Mgr.:* Julie Murray

SHELDAHL, INC., 1150 Sheldahl Rd., Northfield, MN 55057, Tel: 507-663-8000, TWX: 910-565-2180, FAX: 507-663-8545; Empl.: 1,257; *Sls. Mgr.:* Ed Lundstrom

SHELDON INSTRUMENTS, 1021 North University Ave., Ste. 204, Provo, UT 84604, Tel: 801-376-7861, FAX: 801-374-8022; Empl.: 6; *Sls. Mgr.:* Robert Gaurie

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Local Sales Offices & Reps

AZ	Mesa, Spectrum Assocs., S.W.	602-966-1788
CA	Pleasanton, Leddy Assocs., Inc.	510-417-1033
CA	San Diego, O'Donnell Assocs., Inc.	619-578-1645
CA	Torrance, O'Donnell Assocs., Inc.	310-781-2255
CO	Westminster, Wsetern Reg. Mktg.	303-428-8088
FL	Satellite Beach, Curtis Mktg.	407-779-3912
GA	Marietta, Intronics	404-973-6605
IL	Glen Ellyn, Lincoln Hoages, Inc.	708-469-6750
MN	Hopkins, Steve Forsythe & Assocs.	612-933-8267
MO	Grandview, R. R. Burton & Assocs.	816-763-5385
NJ	Pitman, Colrud Corp.	609-589-5866
NY	Port Washington, TMA	516-883-2432
RI	Lincoln, Global Tech. Sls.	401-334-3830
TX	Dallas, de Forest Sls. Co.	214-349-3290
UT	Salt Lake City, Western Reg. Mktg.	801-268-9768
WA	Bellevue, AIE	206-455-4697
Can	Scarborough, Ont., Banke Elctrns.	416-292-5152

Local Distributors

AR	Ft. Smith, Radio, Inc.	501-646-5200
CA	Anaheim, Bisco Inds. Inc.	714-635-0380
CA	San Jose, Bisco Inds. Inc.	408-435-8980
IL	Franklin Park, Bisco Inds. Inc.	708-451-1230
MA	Woburn, Bisco Inds.	617-938-8590
MO	Kansas City, Elctrns. Supp.	816-931-0250
NY	Elmsford, White Plains Elctrl.	914-592-9555
OH	Dayton, Advacom	513-272-5900
OH	Middleburg, Advacom	216-826-3300
OH	Strongsville, Roberts Elctrns. Co., Inc.	216-238-1711
OK	Tulsa, Radio, Inc.	918-587-9123
TX	Arlington, Bisco Inds.	817-640-7046
TX	Austin, Wofford Elctrns.	512-339-1131
TX	Dallas, Wofford Elctrns.	214-320-1294
TX	Houston, Wofford Elctrns.	713-351-2255
UT	Salt Lake City, Bisco	801-972-3525

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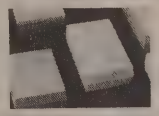

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Local Sales Offices & Reps

AL	Madison, Benchmark Sls.	205-464-0033
CA	Culver City, Shinano Kenshi Corp.	310-915-7300
CA	Cupertino, PEI Sls. Assoc.	408-253-1960
CO	Denver, Tech Rep Sls. Co.	303-758-7031
CO	Englewood, Tech. Rep. Sls.	303-799-8877
CT	Bloomfield, SIR/DSA Assocs.	203-243-9343
FL	Lighthouse Pt., Krutek & Assocs.	305-783-2501
GA	Norcross, Benchmark Sls.	404-446-1711
IN	Carmel, Current Elctrn. Mktg.	317-844-1770
MA	Westford, SIR/DSA Assocs.	508-692-2500
MI	Royal Oak, Elctrl. Sys. Co.	313-542-1747
MN	Minneapolis, HMR, Inc.	612-888-2122
NJ	Mt. Laurel, Paragon Sls.	609-778-1190
NY	Clark Mills, KLM Garner	315-853-6126
NY	Mineola, DOL Engrg.	516-747-3944
NY	Pittsford, KLM Garner	716-381-8350
NC	Raleigh, Benchmark Sls.	919-850-0633
OH	Dayton, Elctrl. Sys. Co.	513-545-9822
OH	Orville, Elctrl. Sys. Co.	216-682-5530
OR	Portland, Intertech Sls.	503-775-7885
PA	Blue Bell, Deltronics	215-641-9930
TX	Austin, Capitol Sls.	512-250-0201
TX	Dallas, Theodore Borek Assoc.	214-985-7702
WA	Redmond, Halbar	206-882-0990

Local Distributors

CA	Culver City, Digilog Devices Inc.	310-915-7346

Shindengen America, Inc.

FAX: 805-373-3710

SHINDENGEN AMERICA INC., 2985 E. Hillcrest Dr., Westlake Vl., CA 91362, Tel: 800-634-3654; Empl.: 10; *Sls. Mgr.:* Peter Gajewski; *Dist. Mgr.:* Peter Gajewski ..... **D•1918-1919, 2210-2211**

Local Sales Offices & Reps

AZ	Phoenix, Hartland Sls.	602-492-0012
CA	Murrieta, Mil-Com Sls., Inc.	714-677-2097
CA	San Diego, Power Assocs.	619-275-0641
CA	Santa Clara, Integrated Tech. Sls.	408-727-3408
CO	Bloomfield, Summitwest Mktg., Inc.	303-460-9600
FL	Land O' Lakes, A.J.'s Power Source, Inc.	813-996-2583
IL	Rolling Meadows, Eagle Tech. Sls., Inc.	312-991-0700
KS	Lenexa, Midtec Assocs.	913-541-0505
MD	Baltimore, Chesapeake Indl. Mktg.	301-653-0476
MI	Lathrup Vl., R. C. Nordstrom & Co.	313-559-7373
MN	Mancato, E. I. Sls.	507-345-5786
MO	St. Louis, Midtec Assocs.	314-275-8666
NH	Hampton, Primary Source	603-926-8044
NY	Hauppauge, Aurora-Schmitt	516-434-1313
NY	Pittsford, Franklin Sls. Corp.	716-248-8251
OR	Beaverton, Olsen Tech. Sls. Corp.	503-643-9488
PA	Blue Bell, Deltatronics Inc.	215-641-9930
TX	Richardson, Jim Gray & Assocs.	214-699-9976
TX	Richmond, Jim Gray & Assocs.	713-342-1710
UT	Midvale, Arrowhead/CSI	801-561-5688
WA	Bellevue, Olsen Tech. Sls. Corp.	206-883-7792
WI	Waukesha, Eagle Tech. Sls.	414-549-3622

Local Distributors

AZ	Phoenix, Dalis Elctrn. Supply	602-275-2626
AZ	Tucson, Dalis Elctrn Supply	602-294-2628
CO	Littleton, Displays Plus, Inc.	303-730-7333
CT	Danbury, Aved Elctrn. Dist., Inc.	203-744-7838
IL	Schaumburg, QPS Elctrns.	312-884-6620
MD	Gaithersburg, Axis Elctrns.	301-840-9640
MA	Andover, Aved Elctrn. Dist., Inc.	508-688-3800
MA	Tewksbury, Armor Elctrns.	508-640-1499
MI	St. Clair Shores, Spemco	313-771-2700
NJ	Pennsauken, Alta Elctrns.	609-488-1442
NM	Albuquerque, Summit Elec. Supp. Co.	505-884-4400
NM	Albuquerque, Walker Elctrn. Supply	505-883-2992
NY	Glen Head, Livera Polk Assocs.	516-759-9300
NY	Rochester, Masline ELctrns.	716-546-5373
OH	Cleveland, Major Elctrns.	216-442-6200
TX	Austin, Wofford Elctrns.	512-339-1131
TX	Dallas, Wofford Elctrns.	214-320-0294
TX	El Paso, Midland Wintronic Co.	915-779-8391
TX	Houston, Wofford Elctrns.	713-847-3583
TX	Stafford, Southwest Elctrns.	713-240-4000

SHIN-ETSU POLYMER AMERICA, INC., 34135 7th St., Union City, CA 94587, Tel: 510-475-9000, TWX: 910-338-2229, FAX: 510-475-0613; *Sls. Mgr.:* Doug Hall

Local Sales Offices & Reps

CA	Newbury Park, Interconn Tech. Mktg.	714-589-4655
IL	Crystal Lake, Mid America Reps.	815-455-5310
IN	Carmel, Technology Mktg. Corp.	317-844-8462
MA	Lexington, Jodan Technlg.	617-863-8898
MI	Farmington Hills, J.L.Montgomery	313-489-0099
TN	Greenville, Lamons Sls. Co.	615-639-8711
TX	Dallas, THT Sls.	214-783-1501

SHIPLEY COMPANY, INC., 2300 Washington St., Newton, MA 02162, Tel: 617-969-5500, FAX: 508-234-4055; *Sls. Mgr.:* Timothy S. Tubergen

SHOGYO

FAX: 516-466-0922

SHOGYO INTERNATIONAL CORP., 287 Northern Blvd., Great Neck, NY 11021-4799, Tel: 516-466-0911, TELEX: 4758024 ..... **A•2534; B•1180, 1809; C•1457-1459, 1808-1809; D•1064-1065, 1474, 1921**

SHOKAI

FAX: 914-736-3656

SHOKAI FAR EAST LTD., 9 Elena Court, Peekskill, NY 10566, Tel: 914-736-3500, TELEX: 224219; Empl.: 362; *Sls. Mgr.:* Shirlee Serber; *Dist. Mgr.:* Robert Craig ..... **A•2118; B•1181; C•1460; D•1067**

SHURE BROTHERS INC., 222 Hartrey Ave., Evanston, IL 60202-3696, Tel: 708-866-2200, TELEX: 4330191, FAX: 708-886-2279; *Sls. Mgr.:* A.G. Hershner, Dir. of Sls.

SHURITE METERS, A Prime Technology Co., P.O. Box 185, Twin Lakes Rd., North Branford, CT 06471, Tel: 203-481-5721, TWX: 710-452-3092, FAX: 203-481-8937; FSC No.: 82239; Empl.: 15; *Sls. Mgr.:* James L. Jamieson, Mktg. VP ..... **D•1371**

Local Sales Offices & Reps

AK	Please Consult Factory, Please Consult Factory	203-481-5721
CA	Burbank, Modco Co.	818-848-2215
CA	San Diego, Qualtronics	619-873-0118
CA	So. San Francisco, Carelli-EMA	415-873-3365
CO	Denver, Nelson Co. Inc.	303-295-1017
CT	Gilman, Adams McGregor Inc.	203-537-3033
FL	Lakeland, Munday Sls. Co.	813-858-5606
IL	Cary, Bob Burns Assocs.	708-516-3322
IN	Indianapolis, John Sukup Inc.	317-253-5501
IA	Des Moines, The Beams Co.	515-255-1148
KS	Lenexa, The Beams Co.	913-541-9197
MI	E. Detroit, Jack M. Thorpe Co.	313-779-6363
MO	St. Louis, The Beams Co.	314-434-8448
NJ	Franklin, D. F. Tobias & Co.	201-751-8680
NJ	Lawrenceville, DVS Co.	609-896-1112
NY	Rochester, D. F. Tobias	201-751-8680
NC	Raleigh, B.T. Funderburk Inc.	919-846-2373
OH	Cleveland, John Olsen Co.	216-838-0510
PA	Glenshaw, DVS Co.	609-896-1112
SC	Landrum, B.T. Funderburk Inc.	919-846-2373
TX	Dallas, The Crockett Sls. Co.	214-350-3377
Can	Thornhill, Ont., R. C. Kahnert Sls. Ltd.	416-764-2596
Can	Winnipeg, Manitoba, Smith-Patterson & Assocs.	204-885-1376

Local Distributors

AL	Birmingham, ACK Radio Supply	205-322-0588
AZ	Phoenix, Capital Elctrns. Supp.	602-252-5897
AR	Little Rock, Carlton-Bates	501-562-9100
CA	San Francisco, Zack Elctrns.	415-624-1444
CA	San Jose, Quements Elctrns.	408-998-5900
CA	San Rafael, Electronics Plus	415-457-0466
CO	Denver, Fistells Elec. Supp.	303-629-1312
CT	New Haven, Hatry Elctrns.	203-787-5921
IN	East Chicago, Acro Elctrns.	219-397-8681
IA	Des Moines, Radio Trade Supp.	515-288-7237
KY	Louisville, Peerless Elctrn.Eqpt.	502-637-7677
LA	Baton Rouge, Ralph's Elctrn. Supp.	504-344-3761
MO	Kansas City, Elctrn. Supp. Co.	816-931-0250
MO	Kansas City, Walters Indl. Elect. Inc.	1-800-821-5248
NM	Los Cruces, Elctrn. Parts Co.	505-523-4578
OH	Akron, Akron Elctrn. Supp.	216-762-8818
OH	Lima, Hutch & Sons	419-229-8751
OK	Tulsa, Radio Inc.	918-587-9123
PA	Reading, Barbey Elctrns. Corp.	215-376-7451
RI	Pawtucket, Jabbour Elctrns.	401-728-4600
TX	Fort Worth, Allied Elctrns.	1-800-433-5700
TX	Houston, City Elctrns. Supp.	713-621-1060
TX	Houston, Elctrn. Prts. Outlet	713-784-0140
WI	Milwaukee, E.M. Instrs. Inc.	414-272-7799
Can	Willowdale, Ontario, Electro Sonic Inc.	416-494-1666

SIEMENS-B C L MAGNETICS, Siemens Automotive Ltd., 5045 North Service Rd., Burlington, Ont., Canada L7L 5H6, Tel: 416-335-2530, FAX: 416-335-8474; Empl.: 180; *Sls. Mgr.:* Dave Dore

SIEMENS COMPONENTS, INC., 2191 Laurelwood Rd., Santa Clara, CA 95054, Tel: 408-980-4568, TELEX: 84-4491

SIEMENS COMPONENTS, INC., Optoelectronics Division, 19000 Homestead Rd., Cupertino, CA 95014, Tel: 408-257-7910, TELEX: 352084, TWX: 910-338-0022; FSC No.: 50579; Empl.: 1100; *Sls. Mgr.:* Chuck Berghoff; *Dist. Mgr.:* Regina Walls

SIEMENS COMPONENTS, INC., Special Products Div., 186 Wood Ave., South, Iselin, NJ 08830, Tel: 201-321-3400, TWX: 710-998-0588/0529, FAX: 201-321-3961; Empl.: 800; *Sls. Mgr.:* Curt Hozian; *Dist. Mgr.:* Dick Robert

SIENNA TECHNOLOGIES INC., 2535 Pilot Knob Road, St. Paul, MN 55120, Tel: 612-688-6106, FAX: 612-688-2417; Empl.: 18; *Sls. Mgr.:* Deborah L. Bernard; *Dist. Mgr.:* George Doerfler

SIERRA AUTOMATED SYSTEMS & ENGINEERING CORP., 2112 N. Glenoaks Blvd., Burbank, CA 91504, Tel: 818-840-6749, FAX: 818-840-6751; *Sls. Mgr.:* Al Salci

SIERRACIN/MAGNEDYNE, 2258 Rutherford Rd., Carlsbad, CA 92008, Tel: 619-438-3321, FAX: 619-438-4987; Empl.: 150

SIERRACIN POWER SYSTEMS, See Valor Electronics

SIERRA MONITOR CORP., 1991 Tarob Ct., Milpitas, CA 95035, Tel: 408-262-6611, TELEX: 17-1618; FSC No.: MSGSNDR; Empl.: 30; *Sls. Mgr.:* Stephen R. Ferree; *Dist. Mgr.:* Stephen R. Ferree

SIERRA POWER SYSTEMS, See Valor Electronics

SIERRA SEMICONDUCTOR CORP., 2075 N. Capitol Ave., San Jose, CA 95132, Tel: 408-263-9300, FAX: 408-263-3337

SIERRA WEST POWER SYSTEMS, 2615 Missouri Ave., Bldg. No. 5, Las Cruces, NM 88001, Tel: 505-522-8828, FAX: 505-522-8828; Empl.: 12

SIGMA ELECTRONICS INC., 10830 Kinghurst Dr., Houston, TX 77099, Tel: 713-933-4700, 800-874-7121, FAX: 713-933-9067; FSC No.: 60767; Empl.: 87; *Sls. Mgr.:* K. Johnson

SIGMA PLASTRONICS, INC., P.O. Box 649, Whitmore Lake, MI 48189, Tel: 810-231-2871, FAX: 810-231-2960; Empl.: 3

SIGMAPOWER, INC, FPBSM Industries, Inc., 19060 S. Dominguez Hills Dr., Rancho Dominguez, CA 90220-6404, Tel: 310-884-5200, FAX: 310-635-1956; FSC No.: 55196; Empl.: 150

SIGMA SYSTEMS CORP., 3163 Adams Ave., San Diego, CA 92116, Tel: 619-283-3193, FAX: 619-283-6526; Empl.: 21; *Sls. Mgr.:* David L. Russell ..... **D•1211**

Local Sales Offices & Reps

AZ	Scottsdale, Allen Sls. Assocs.	602-443-1820
CA	San Carlos, Electronic Engrg. Assoc.	415-593-2189
IL	Elgin, R.K. Elctrns., Inc.	312-695-8552
MA	Wilbraham, N.E.D.T.	413-596-8853
NJ	Parsippany, Creative Tech. Sls.	201-335-7881
EXP	Bristol, England, Wesser Elctrns.	272-571-404
Intl	Palaiseau, France, Salies S.A.	920-40-10

SIGNAL PROCESSING TECHNOLOGIES, 4755 Forge Rd., Colorado Springs, CO 80907, Tel: 719-528-2300, FAX: 719-528-2370; Empl.: 57; *Sls. Mgr.:* Rick Mintle; *Dist. Mgr.:* Sharon McDaniel

SIGNAL RESEARCH INC., River Road, P.O. Box 357, Titusville, NJ 08560, Tel: 609-737-1917

SIGNAL SWITCH COMPANY, 1791 Capital St., Ste. F, Corona, CA 91720, Tel: 909-736-5404, FAX: 909-736-5406; FSC No.: 58468; Empl.: 10; *Sls. Mgr.:* Stan Adams ..... **B•1479**

Local Sales Offices & Reps

CA Redlands, Esco Elctrns. 909-335-1444, FAX:909-335-2996
FL Orlando, E.G. Holmes & Assocs. 407-281-0067
IL Berkley, ESA Tech. Mktg. 708-544-0120, FAX:708-544-0266
MD Silver Springs, Instrucom Inc. 301-384-0700, FAX:301-984-6202
MA Holliston, E.S.I. 508-429-2493,FAX:508-881-4577
NM Albuquerque, C.T. Carlsberg & Assocs. 505-899-2155,FAX:505-899-2160
NY Kings Park, E Square Mktg. Assocs. ..... Voice, FAX:516-544-4788
OH Cleveland, Leading Edge Elctrn. Sls. ... 216-232-4946, FAX:216-232-9510
PA Holland, W.A. Drobile, Inc. 215-364-2501, FAX:215-364-2051
Can Halifax, N.S., Gates Engrg. Ltd. 902-457-0805

SIGNAL SYSTEMS INTERNATIONAL, P.O. Box 470, Lavalette, NJ 08735, Tel: 908-793-4668, FAX: 908-793-4679; Empl.: 7; *Sls. Mgr.:* W. Kinney

signal TRANSFORMER

FAX: 516-239-7208

SIGNAL TRANSFORMER CO., INC., Insilco Corporation, 500 Bayview Ave., Inwood, NY 11696, Tel: 516-239-5777; FSC No.: 08779; Empl.: 450; *Sls. Mgr.:* John Marino ..... **A•2536-2556**

Direct sales only. Inwood, NY 516-239-5777

Local Sales Offices & Reps

Can Toronto, Ont., Calbrooke Mktg. 416-346-2551

SIGNATRON, A Subsidiary of Meteor Communications Corp., 110 Hartwell Ave., Lexington, MA 02173, Tel: 617-861-1500, TELEX: 299551 (RCA GLOBCOM), FAX: 617-863-8039; FSC No.: 59371; Empl.: 25; *Sls. Mgr.:* Joseph T. McNamara

SIGNUM, INC., 80 Hovey Street, Watertown, MA 02172-3356, Tel: 617-926-3566, FAX: 617-926-0333; *Sls. Mgr.:* Thomas DiGennaro

SIGNUM SYSTEMS CORP., 171 E. Thousand Oaks Blvd. No. 202, Thousand Oaks, CA 91360, Tel: 805-371-4608, ESYLNK: ATTMAIL:SIGNUM, FAX: 805-371-4610; Empl.: 15; *Sls. Mgr.:* Don Mull; *Dist. Mgr.:* J. Pennese

SIKAMA INTERNATIONAL, INC., 301 B Donaldson Place, Santa Barbara, CA 93117, Tel: 805-683-6379, FAX: 805-683-6740; Empl.: 10; *Sls. Mgr.:* Len Cardoza; *Dist. Mgr.:* Len Cardoza

SILICONES UNLIMITED, INC., 3939 Roswell Rd., Ste. 250, Marietta, GA 30062, Tel: 404-578-1274, FAX: 404-578-8209

SILICON GENERAL, 11861 Western Ave., Garden Grove, CA 92641, Tel: 714-898-8121, TELEX: 692-411, TWX: 910-596-1804, FAX: 714-893-2570; FSC No.: 34333; Empl.: 250; *Sls. Mgr.:* Roger Holliday; *Dist. Mgr.:* Louise Toussaint

SILICON POWER CUBE, See Crydom Company

SILICON SENSORS, Old Hwy. 18 East, Dodgeville, WI 53533, Tel: 608-935-2707, TWX: 910-997-0072, FAX: 608-935-2775; FSC No.: 54822; Empl.: 30; *Sls. Mgr.:* Phil Lulewicz

SILICON SYSTEMS INC., 14351 Myford Rd., Tustin, CA 92680, Tel: 714-731-7110, TWX: 910-595-2809

SILICON TRANSISTOR CORP., Katrina Rd., Chelmsford, MA 01824, Tel: 508-256-3321, FAX: 508-250-1046; FSC No.: 07256; Empl.: 200; *Sls. Mgr.:* John J. Flynn; *Dist. Mgr.:* Fred Wheaton

SILONEX INC., 331 Cornelia St., Plattsburgh, NY 12901, Tel: 518-561-3160, FAX: 514-747-3906; Empl.: 110; *Sls. Mgr.:* Carol Larsen ..... **B•1339**

Local Sales Offices & Reps

FL Tampa, Standard Mktg. Inc. 813-933-5833
IL Crystal Lake, Komac Entprs. Inc. 815-459-7456
KS Lenexa, Midtec Assocs. Inc. 913-541-0505
MD Ellicott City, Nelson Elctrns. Inc. 410-747-7887
MA Topsfield, RFC-Elctrns. SLs., Inc. 508-887-8545
MI Livonia, Amtech Reps. 313-474-8300
NJ Denville, T. J. Sls., Inc. 201-361-5352
TX Lewisville, Silonex Inc. 214-317-7585

SILTRONICS LTD., P.O. Box 456, Dover, MA 02030, Tel: 617-329-4068, FAX: 508-785-2265; Empl.: 110; *Sls. Mgr.:* G. Urban

SIMCO

FAX: 305-233-1990

SIMCO, 21401 SW 127 Ave., Miami, FL 33177, Tel: 305-233-9900, 800-780-9090; Empl.: 15 ..... **C•1094-1096**

Local Sales Offices & Reps

CA San Diego, Qualtronics, Inc. 619-695-0118
CT Bethel, Instr. Dynamics 203-743-5045
GA Atlanta, Electro Sls. Inc. 404-394-1122
IL Cary, Bob Burns & Assocs. 708-516-3322
MD Baltimore, Muncy Sls. Assocs. 301-484-6376
MA Wakefield, Instr. Dynamics Inc. 617-245-5100
MN St. Paul, Heyda-Hanks Assoc. 612-484-8531
NY Great Neck, F & F Metro Inc. 516-482-4080
OR Beaverton, Luscombe Eng./NW 206-223-1541
TX Dallas, Southwest Elctrn. Ind. Inc. 214-690-9881
WA Bellevue, Luscombe Eng./NW 206-223-1541
WI Wauwatosa, Larsen Assocs. Inc. 414-258-0529
Can Markham, Ont., Avotronics Ltd. 416-475-2024

SIMCO CO., 2257 North Penn Rd., Hatfield, PA 19440, Tel: 215-822-2171, FAX: 215-822-3795; Empl.: 150; *Sls. Mgr.:* Bob Heacock

SIMMONDS PRECISION ENGINE SYSTEMS, BF Goodrich Aerospace, P.O. Box 310, Norwich, NY 13815, Tel: 607-335-5000, FAX: 607-335-5440; Empl.: 650; *Sls. Mgr.:* G. D. Cummings

SIMPSON ELECTRIC CO., 853 Dundee Ave., Elgin, IL 60120, Tel: 708-697-2260, FAX: 708-697-2272; Empl.: 550; *Sls. Mgr.:* Brian Gieler/Jack Femmel

SIMTEK CORP., 1465 Kelly Johnson Blvd., Colorado Springs, CO 80920, Tel: 719-531-9444, FAX: 719-531-9481; Empl.: 25; *Sls. Mgr.:* L.D. Hockaday; *Dist. Mgr.:* David Bowers

SIMULEX CORPORATION, 2832-C Walnut Avenue, Tustin, CA 92680, Tel: 714-730-1500, FAX: 714-730-7176; *Sls. Mgr.:* Dave Guss

SINCLAIR RADIO LABORATORIES LTD., 85 Mary St., Aurora, Ont., Canada L4G 3G9, Tel: 416-727-0165, FAX: 416-727-0861; Empl.: 130; *Sls. Mgr.:* J.C. Stratt

SINGER DATA PRODUCTS, INC., 790 Maple Lane, Bensenville, IL 60106, Tel: 708-860-6500, FAX: 708-860-3672; Empl.: 54; *Sls. Mgr.:* Shelly Kroan ..... **D•1107**

Local Sales Offices & Reps

NJ Haddonfield, Singer Data 609-429-6927

SINOTECH MADE IN CHINA, INC., Technology Communications Group, Inc., 23590 Stafford Hill Drive, West Linn, OR 97068, Tel: 503-638-1000, FAX: 503-638-1002; Empl.: 45; *Sls. Mgr.:* John Vezmar

SIPEX CORP., 22 Linnell Circle, Billerica, MA 01821, Tel: 508-667-8700, FAX: 508-667-8310; FSC No.: 33256; Empl.: 300; *Sls. Mgr.:* Emil Verano, Jack Worthen; *Dist. Mgr.:* Beth Tebbetts

SITCO ANTENNAS DIV.OF SIMPLICITY TOOL CORP., 10330 N.E. Marx St., Portland, OR 97220, Tel: 503-253-2000, FAX: 503-253-2009; Empl.: 18; *Sls. Mgr.:* M. Bureker

S.I. TECH, 901 N. Batavia Ave., Batavia, IL 60510, Tel: 708-232-8640, FAX: 708-232-8677; Empl.: 17; *Sls. Mgr.:* Ramesh Sheth; *Dist. Mgr.:* George Hain ..... **B•1229**

Local Sales Offices & Reps

AL Saraland, Coastal Computer Comm. .. 205-679-8657
FL Melbourne, Raynolds & Raynolds 407-259-7000
MA Holliston, Olson Mktg. 508-429-8066
MN Hibbing, Minntech Ec. 218-262-5228
NM Albuquerque, S & S Technlg. 505-298-7177
PA Canonsburg, Performance Metrics 412-942-3035
TN Memphis, Professional Technlg. 901-458-1228
WA Bellevue, Interconnect Tech. 206-462-9508

Local Distributors

AL Birmingham, Newark Ec. 205-942-4044
AK Anchorage, Potelcom Supp. 907-274-8525
AR Little Rock, Carlton Bates 817-293-5558
CA Los Angeles, Anixter 213-625-7828
CA San Francisco, Anixter 415-543-6070
CO Denver, Newark Ec. 303-373-4540
FL Miami, Newark Ec. 800-631-4608
IL Chicago, Newark 312-792-8233
IL Skokie, Anixter 800-243-8344
LA Baton Rouge, Anixter 504-922-7755
MA Boston, Anixter 508-682-8870
MI Detroit, Anixter 313-478-3900
MO St. Louis, Newark Ec. 314-821-7466
NY Hauppauge, Manchester Equip. Co. ... 516-294-5351
OH Columbus, Hughes-Peters 614-294-6215
PA Pittsburgh, South-Hills Ec. 800-245-6215
TN Chattanooga, Horizon Ec. 615-899-8585
TN Clarksville, Randolph, Hale, Matthews 615-647-2325
TX Houston, Anixter 713-460-9473
VA Chantilly, Newark Ec. 703-471-7447
WA Bellevue, Newark Ec. 206-641-9800
WI Milwaukee, Anixter 414-355-0222
Can London, Newark Ec. 519-685-4280
Can Toronto, Anixter 416-568-8999

SITRONIC GMBH, Weissenwolffstr.14, 4221 Steyregg, Steyregg, Austria, Tel: 732-640-591-0, FAX: 732-640-592-5; Empl.: 8; *Sls. Mgr.:* Ing. Franz Peter Kogl; *Dist. Mgr.:* Mrs. Michaela Eibl

SIVERS IMA AB, 11520 Jefferson Blvd., Culver City, CA 90230, Tel: 213-306-4248, FAX: 213-390-4350; Empl.: 300; *Sls. Mgr.:* Marshall Cleland

SJOBERG, C., & SON, INC., 415 Station St., P.O. Box 3583, Cranston, RI 02910, Tel: 401-461-8220, FAX: 401-467-5446; Empl.: 20

SKB COPORATION, 434 W. Levers Place, Orange, CA 92667, Tel: 714-637-1252, FAX: 714-637-0491; FSC No.: 61302; Empl.: 170; *Sls. Mgr.:* Allan Evavold

SKF CONDITION MONITORING, 4141 Ruffin Rd., San Diego, CA 92123-1841, Tel: 619-496-3400, FAX: 619-496-3546; Empl.: 150

SKO-DIE, INC., 8050 Austin Ave., Morton Grove, IL 60053, Tel: 708-965-1130, FAX: 708-966-0322; FSC No.: 7P145; Empl.: 50; *Sls. Mgr.:* Richard J. Steininger

SKY COMPUTERS, INC., Subsidiary of Analogic Corporation, 27 Industrial Ave., Chelmsford, MA 01824, Tel: 508-250-1920, TELEX: 499-1331, FAX: 508-250-0036; Empl.: 75

SKYDYNE DIV., AAR MFG., 21 River Rd., Port Jervis, NY 12771, Tel: 914-856-6655, 800-428-CASE, FAX: 914-856-8378; Empl.: 110; *Sls. Mgr.:* M. Timney

SKYWAY MAGNETICS, 35372 Hwy 79, Warner Springs, CA 92086-9714, Tel: 619-782-3342; FSC No.: 3612,5950,3677,7584,3670,3820; Empl.: 12; *Sls. Mgr.:* John Grudziadz

SLAUGHTER CO, R.E. Phelon Co., 801 Hailey St., Ardmore, OK 73401, Tel: 405-223-4773, TELEX: 697-5577, FAX: 405-226-5757; FSC No.: 05611; *Sls. Mgr.:* T. Medrick ..... **D•1325**

SL CORPORATION, 240 Tamal Vista Blvd. No. 110, Corte Madera, CA 94925, Tel: 415-927-1724, FAX: 415-927-2931; Empl.: 40; *Sls. Mgr.:* Christopher Wilson; *Dist. Mgr.:* Christopher Wilson

SLOAN™

FAX: 818-768-8326

SLOAN CO., 7704 San Fernando Rd., Sun Valley, CA 91353-0367, Tel: 213-875-1123, TWX: 910-498-2250; FSC No.: 08717; Empl.: 25 ..... **B•1182-1187**

Local Sales Offices & Reps

AL Huntsville, Remco 205-533-3763
CA Montrose, Signal Entprs. Inc. 818-957-0640
CA Mtn. View, Francisco & Assocs. 415-962-1717
RI Warwick, Schumacher & Yarrington ... 401-884-5671

IL	Wheaton, CS Tech Sls.	708-653-8126
MD	Glen Burnie, Macrotech Assoc.	301-766-1111
MN	Minneapolis, Loren Green Assoc. of Minn.	612-571-6666
MO	Shawnee Mission, Microtronics	913-262-1444
NJ	Cherry Hill, Quality Comps.	609-428-6226
NJ	Englewood Cliffs, E. Glass Assocs.	201-592-0200
NY	Rochester, Tech. Comps.	716-342-2406
OH	Cleveland, Allan Scraga	216-232-4946
TX	Dallas, IBL Engrg. & Sls.	214-363-2921
WA	Bellevue, Olson Tech Sls.	206-883-7792

Local Distributors

AL	Huntsville, Powell Elctrns.	205-529-2731
CA	Anaheim, Deco Elctrns.	714-630-8252
CA	Canoga Park, AMC Radio Hardware	818-998-2584
CA	Costa Mesa, Powell Elctrns.	714-754-1717
CA	San Diego, Deco Elctrns.	619-693-1595
CA	San Jose, Powell Elctrns.	408-943-9020
CT	W. Hartford, Signal Ctr. Inc.	203-236-6005
FL	Ft. Lauderdale, Peerless Radio Corp.	305-973-4141
FL	Ft. Lauderdale, Powell Elctrns.	305-979-5000
CA	Los Angeles, Trebor Elctrns.	213-641-8304
FL	Pompano Beach, Peerless Radio	305-973-4141

BRILL ELECTRONICS
(510) 834-5888
810 E. 10th. St., Oakland, CA 94606
A UNIT OF GENERAL SIGNAL
SOLA ELECTRIC
(310) 452-8002
1220 Olympic Bl., Santa Monica CA 90404

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Sorenson Lighted Controls, Inc.
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[213] 770-2330
[714] 525-6606
[415] 621-7386
[408] 279-8848
[510] 452-1009
[916] 448-6370
[209] 441-1725
[800] CAL-SWCH

KS	Wichita, Lee Prods.	316-264-2172
MD	Annapolis, Powell Elctrns.	301-880-3355
IL	Arlington, Mar'Lyn Elctrns.	312-364-7880
MA	Westborough, Powell Elctrns.	617-366-6100
NY	Lynbrook, Peerless Radio Corp.	516-593-2121
NJ	Englewood, Powell Elctrns.	201-568-5600
OH	Dayton, D & D Packaging Co., Inc.	513-233-8585
OH	Solon, Repco	216-248-8900
OK	Tulsa, Altair Co.	918-252-5781
PA	Philadelphia, Powell Elctrns.	215-365-1900
TN	Memphis, GFI Sls.	901-683-6252
TX	Austin, The Altair Co.	512-837-4490
NC	Cary, Powell Elctrns.	919-467-1212
TX	Houston, Altair Co.	713-462-3029
TX	Irving, Powell Elctrns.	214-258-6841
TX	Richardson, Altair Co.	214-231-5166

SLOAN TECHNOLOGY, 602 E. Montecito St., Santa Barbara, CA 93103, Tel: 805-963-4431, FAX: 805-965-0522; Empl.: 75; *Sls. Mgr.:* Drew Osterman

SL WABER, INC., 520 Fellowship Rd. Ste. 306, Mt. Laurel, NJ 08054, Tel: 609-866-8888, 800-257-8384, FAX: 609-866-1945; Empl.: 370; *Sls. Mgr.:* Edward Brown

SMART RELAY TECHNOLOGY, INC., 97 Gannet Dr., Commack, NY 11725, Tel: 516-543-7161, FAX: 516-543-7162; *Sls. Mgr.:* Ron Colino

H H SMITH, NT-T Inc., 632 Arch St., Meadville, PA 16335, Tel: 814-724-6440, FAX: 814-333-1912; Empl.: 300; *Sls. Mgr.:* Larry Zeiser; *Dist. Mgr.:* Larry Zeiser

SMK CORPORATION

FAX: 714-779-2790

SMK ELECTRONICS CORPORATION, U.S.A., 1901 Nancita Cir., Placentia, CA 92670, Tel: 714-996-0960; FSC No.: 637-7400; Empl.: 219; *Sls. Mgr.:* Gary Redman/T. Klymenko ..... **C•1461**

Local Sales Offices & Reps

AL	Huntsville, Electro-Mech	205-880-0592
CA	San Jose, Signet Tech. Sls.	408-453-0611
CO	Denver, Donohue Sls. Co.	303-455-1719
GA	Norcross, Electro-Mech.	404-447-6478
IL	Parkridge, Metcom Assocs.	708-696-1490
IN	Indianapolis, John H. Weaver Co.	317-849-1659
IN	Indianapolis, Lat-Tronics	317-846-5788
MI	Southfield, M. Gottlieb Assocs.	313-358-4151
MN	Eden Prairie, PWC Inc.	612-934-1409
NY	Dewitt, Interactive Comp. Sls.	315-445-9600
NC	Raleigh, Electro-Mech	919-790-9300
PA	Flourtown, C.G.M. Inc.	215-233-0333
RI	Warwick, Circuit-Pro, Inc.	401-738-7332
TX	Plano, Ram Elctrns.	214-578-5400
WA	Bothel, Quadra Sls. Corp.	206-489-3428
Can	Ottawa, Elctrn. Sls. Profs.	613-567-8547

Local Distributors

AZ	Phoenix, Aero-Space Southwest	602-582-2779
AZ	Tempe, Cypress Elctrns.	602-966-2256
CA	Agoura Hills, Cypress Elctrns.	818-597-9491
CA	Costa Mesa, Cypress Elctrns.	714-549-2424
CA	San Diego, Cypress Elctrns.	619-535-0011
CA	Santa Clara, Cypress Elctrns.	408-980-8400
CO	Englewood, Cypress Elctrns.	303-792-5829
CT	Danbury, Pilgrim Elctrns.	203-792-7274
FL	Ft. Lauderdale, Comp. Assocs.	305-733-4100
GA	Smyrna, ERC Parts, Inc.	404-984-0276
IN	Carmel, Altex Elctrns.	317-848-1323
MI	Grand Rapids, EC Elctrns.	616-530-0576
MN	Eden Prarie, Cypress Elctrns.	612-934-2104
MN	Minneapolis, Aero-Space Computer Supps. Inc.	612-884-4725
PA	Essington, Tri-Com, Inc.	215-259-7400
TX	Irving, Cypress Elctrns.	214-255-0065
WA	Bothel, Cypress Elctrns.	206-483-1144
Can	Markham, Ont., Carsten Elctrns.	416-477-7705
Can	St. Laurent, Que., Carsten Elctrns.	514-334-8321

S-MOS SYSTEMS, INC., 2460 North First St., San Jose, CA 95131, Tel: 408-922-0200, FAX: 408-922-0238

SMT EAST CORPORATION, 200 Foxborough Blvd., Foxborough, MA 02035, Tel: 800-888-SMT1, FAX: 508-543-3515; Empl.: 55; *Sls. Mgr.:* Steven E. Dutton; *Dist. Mgr.:* Kanan Technologies

SNAPTITE/ALLIED, 6424 W. Ridge Rd., Erie, PA 16506, Tel: 814-838-3190, FAX: 814-833-5439; Empl.: 75; *Sls. Mgr.:* Ed Kindlin

SOFTAID, INC., 8300 Guilford Rd., Columbia, MD 21046, Tel: 410-290-7760, FAX: 410-381-3253; Empl.: 9; *Sls. Mgr.:* Al Saxon

SOLA, 1717 Busse Rd., Elk Grove Village, IL 60007-5666, Tel: 708-439-2800, FAX: 800-626-6269; *Sls. Mgr.:* James Kimball; *Dist. Mgr.:* Brian Crowe

SOLAOYNE DIVISION, Rogers Corporation, 7447 Convoy Ct., San Diego, CA 92111, Tel: 619-279-7872, FAX: 619-277-9105; FSC No.: 55655; Empl.: 76; *Sls. Mgr.:* Dale Reed; *Dist. Mgr.:* Rick Jansen

SOLAR ELECTRONICS CO., A. T. Parker, Inc., 901 N. Highland, Hollywood, CA 90038, Tel: 800-952-5302, TWX: 910-997-1921, FAX: 213-462-3721; FSC No.: 13222; Empl.: 17; *Sls. Mgr.:* Roy Talley

SOLATRON ENTERPRISES, 421 E. Beach Ave., Inglewood, CA 90302, Tel: 213-678-4981, FAX: 213-678-0103; Empl.: 20

SOLDER ABSORBING TECHNOLOGY (SAT), A Spirig Co., 144 Oakland St., Springfield, MA 01108, Tel: 800-628-8862, FAX: 413-788-0490; Empl.: 3; *Sls. Mgr.:* Joyce White

SoLiCo/mec

Sorenson Lighted Controls, Inc

FAX: 1-800-275-7092

SOLICO/MEC, 75 Locust St., Hartford, CT 06114, Tel: 203-527-3092 ..... **B•1812**

Local Sales Offices & Reps

AZ	Scottsdale, Advent Comps.	602-481-0044
CA	Tustin, Schoenbachler-Dobson Co.	714-544-1888
CO	Denver, Advent Comps.	303-455-1985
IL	Shiller Park, WRB Inc.	708-678-7888
IN	Fort Wayne, Menze Sls.	219-747-5616
MD	Gaithersburg, Naudin Assoc., Southern, Inc.	301-258-5040
MA	Hopkinton, Berkshire Elctrns.	508-435-9356
MI	Dearborn, Pitcher-Poulin	313-582-5450
MN	Minneapolis, Technical Comps. Grp.	612-561-5556
NJ	Burlington, VDE Elctrns.	609-387-9331
NY	Great Neck, Pacent Engrg.	516-482-4678
NC	Siler City, Crossroads Elctrns.	919-742-2372
TX	Richardson, R.F. Kimball Co., Inc.	214-231-3447
WI	Mequon, WM Bolles Inc.	414-241-3320

Local Distributors

CA	Anaheim, Electro Comps. Distr.	213-628-2844
CA	Covina, Selecta-Switch Inc.	818-967-4123
CA	Freemont, Kea Elctrns.	415-651-2600
CA	Gardena, California Switch & Signal	213-538-9830
CA	Hayward, Electro Comps. Distr.	415-783-5800
CA	Los Angeles, Electric Switchs	213-660-1310
CA	Sunnyvale, Target Elctrncs.	408-733-0384
CA	Tustin, Western Switches & Controls	714-259-8144
CA	Van Nuys, Wes-Garde Compts.	818-786-3724
CT	Hartford, Wes-Garde Comps.	203-527-7705
FL	Lakeland, Wes-Garde Comps.	813-644-7564
GA	Tucker, CID Inc.	404-491-3143
IL	Carol Stream, Wes-Garde Comps.	708-653-1460
KS	Overland Park, Wes-Garde Comps.	913-262-2718
MA	Canton, Xenell	617-828-2948
MI	St. Clair Shores, Spemco Inc.	313-771-2700
MN	Minneapolis, Carl Berquist Co.	612-835-2322
MO	St. Louis, Wes-Garde Comps.	314-567-7776
NH	Nashua, Wes-Garde Comps.	603-880-1971
NJ	Mt. Laurel, Wes-Garde Comps.	609-778-8190
OH	Westerville, Wes-Garde Comps.	614-885-0319
OR	Wilsonville, Wes-Garde Comps.	503-682-1333
SC	Columbia, Dixie Elctrns. Inc.	803-779-5332
TX	Dallas, Wes-Garde Comps.	214-357-1768
WI	Grafton, Lakeview Elctrns.	414-377-8250
WI	Milwaukee, Progressive Image	414-321-4722

SOLID STATE, INC., 46 Farrand St., Bloomfield, NJ 07003-2596, Tel: 201-429-8700, FAX: 201-429-8683; Empl.: 110; *Sls. Mgr.:* Tom Smith, Gen. Sls. Mgr.

SOLID STATE DEVICES, 14849 Firestone Blvd., La Mirada, CA 90638, Tel: 714-670-7734; FSC No.: 30043; Empl.: 200; *Sls. Mgr.:* Sharon Pfifer

Local Sales Offices & Reps

AZ	Parker, Howard Assoc.	303-841-5755
IN	Ft. Wayne, M/S Sls. & Assoc., Inc.	219-436-3023
CA	Los Angeles, Varigon	818-594-5080
CO	Parker, Howard Assoc.	303-841-5755

FL St. Petersburg, Bolton Assoc., Inc. 813-864-2294
FL Pompano Bch, Bolton Assocs. 305-975-7245
IN Greenwood, M/S Sls. And Assocs., Inc. 317-881-0110
MN Bloomington, Bill Deming & Assoc. 612-888-5000
OH Dublin, M/S Sls. & Assoc., Inc. 201-288-7400
NJ Hasbrouck Heights, Comp. Tech. Sls. 201-288-7400
WA Seattle, J.J. Backer 206-285-1300
Can Oakville , Ont., Haltronics 800-387-7949

SOLID STATE ELECTRONICS CORP., 18646 Parthenia St., Northridge, CA 91324, Tel: 818-993-8257, FAX: 818-993-8259; FSC No.: 11911; Empl.: 15

Solid State Optronics, Inc.

FAX: 408-436-1392

SOLID STATE OPTRONICS, 2 North First St., San Jose, CA 95113-1201, Tel: 408-436-1390 ..... **B•1597-1601**

SOLID STATE RELAYS, 71 Regent, Oak Brook, IL 60521, Tel: 708-932-1660, FAX: 708-887-9522

SOLID STATE TESTING, INC., 56 Middlesex Tpke., Burlington, MA 01803, Tel: 617-272-0972, FAX: 617-273-4896; Empl.: 150; *Sls. Mgr.:* James Roberts; *Dist. Mgr.:* James DiGiacomo

SOLITRON DEVICES, INC., Semiconductor Group, 3301 Electronics Way, West Palm Beach, FL 33407-4697, Tel: 407-848-4311, FAX: 407-863-5946; FSC No.: 21845; Empl.: 275; *Sls. Mgr.:* Margaret McNutt; *Dist. Mgr.:* Joanne Crumbley ..... **A•2219**

SOLITRON/MICROWAVE, Solitron Devices, Inc., 3301 Electronics Way, West Palm Beach, FL 33407-4697, Tel: 407-848-4311, FAX: 407-848-4311, Ext.116; FSC No.: 95077; Empl.: 175; *Sls. Mgr.:* Brian Jackson; *Dist. Mgr.:* Brian Jackson ..... **A•2219**

Local Sales Offices & Reps
AZ Tempe, Piper Sls. Co. 602-949-0048
CO Longmount, Piper Sls. Co. 303-443-5337
CT Danbury, Phase One 203-791-9042
CT Washington, Tri-Com Assocs. 203-868-7027
IL Elgin, R.H.I. Sls. Corp. 708-888-0099
MA Burlington, Tri-Com Assocs. 617-272-8163
MN Edina, Gibb Tech. Sls. 612-835-3370
MO Grandview, R.R. Burton & Assocs., Inc. 816-763-5385
NJ Marlton, Solitron Dvs., Inc. 609-988-5470
NM Albuquerque, Piper Sls. Co. 505-828-1300
NY tappan, Solitron Dvs., Inc. 914-359-5050
NY Syracuse, PiTronics, Inc. 315-455-7346
OH Centerville, Solitron Dvs., Inc. 513-438-3308
OR Beaverton, Quest Mktg., Inc. 503-641-7377
TX Austin, Barry Sls., Inc. 512-837-3616
TX Houston, Barry Sls., Inc. 713-784-5860
TX Plano, Zeus Engnr. 214-423-2027
TX Richardson, Barry Sls., Inc. 214-234-0255
UT Salt Lake City, Piper Sls. Co. 801-466-9336
WA Renton, Quest Mktg., Inc. 206-228-2916
Can Montreal, Que., Cana-Rep Grp., Inc. 514-576-4477

Local Distributors
CA Burbank, Elmo Semicond. 818-768-7400
CA Centerville, Koehike Comps., Inc. 513-435-5435
CA San Jose, All American Semicond., Inc. 408-943-1200
CA Torrance, All American Semicond., Inc. 213-320-0240
CA Walnut, 3893004trns. Corp. 714-594-1731
CT Killingworth, ACI Elctrns. Corp. 203-663-3311
FL Miami, All American Semicond. 305-621-8282
FL Sunrise, All American Semicond., Inc. 305-572-7999
MD Rockville, All American Semicond., Inc. 301-251-1205
MA Wakefield, All American Semicond. 617-246-2300
MA Woburn, ACI Elctrns. Corp. 617-935-7230
MN Eden Prairie, All American Semicond., Inc. 612-944-2151
NJ Totowa, ACI Elctrns. Corp. 201-812-0507
NY Mt. Vernon, All American Semicond., Inc. 914-699-2224
NY Plainview, ACI Elctrns. Corp. 516-293-6630
NY Ronkonkoma, All American Semicond., Inc. 214-231-5300
TX Richardson, All American Semicond., Inc. 214-231-5300

SOLTEC CORP., 12977 Arroyo Street, San Fernando, CA 91340-1597, Tel: 818-365-0800, 800-423-2344, FAX: 818-365-7839; Empl.: 40; *Sls. Mgr.:* Byron G. McIntire

SONICALL, INC., 3288 E. Willow Street, Signal Hill, CA 90806, Tel: 213-490-2143, FAX: 213-490-2145; *Sls. Mgr.:* Frank Handler

SONICOR INSTRUMENT CORP., 100 Wartburg Ave., Copiague, NY 11726, Tel: 516-842-3344, TELEX: 649494, FAX: 516-842-3389; FSC No.: 31605; *Sls. Mgr.:* Arthur Liers; *Dist. Mgr.:* Arthur Liers

SONNENSCHEIN BATTERIES INC., See East Penn Manufacturing

SONOBOND ULTRASONICS INC., Inductotherm Industries, 887 S. Matlack St., West Chester, PA 19382, Tel: 610-696-4710, 800-323-1269, FAX: 610-692-0674; FSC No.: 15882; Empl.: 21; *Sls. Mgr.:* Thomas Walraven; *Dist. Mgr.:* Kyle Kimbro

SONY COMPONENT PRODUCTS CO, Semiconductor Division, 108333 Valley View St., Cypress, CA 90630, Tel: 714-229-4197, FAX: 714-229-4271; Empl.: 120; *Sls. Mgr.:* Chuck Schouw, V.P.; *Dist. Mgr.:* Mark Marrietta

SOPHIA SYSTEMS & TECHNOLOGY, 777 California Avenue, Palo Alto, CA 94304, Tel: 415-493-6700, 800-824-9294, FAX: 415-493-4648

SORENSEN COMPANY, 615 N. Railroad Ave., Paxton, IL 60957, Tel: 800-525-2024, FAX: 217-379-9216; Empl.: 115; *Sls. Mgr.:* Gerald J. Demirjian

SORENSON LIGHTED CONTROLS, 75 Locust St., Hartford, CT 06114, Tel: 203-527-3092, 1-800-275-7089, FAX: 1-800-275-7092; Empl.: 100; *Sls. Mgr.:* Ted Ogorzalek ..... **B•1812**

Local Sales Offices & Reps
CA Tustin, Schoenbachler-Dobson Co. 714-544-1888
AZ Scottsdale, Advent Comp. Corp. 602-481-0044
CA San Rafael, Wright Assocs. 415-457-9940
CO Denver, Advent Comps. 303-455-1985
FL Tampa, Florida Comp. Sls. 813-873-3622
IL Schiller Park, W.R.B. Inc. 708-678-7888
IN Fort Wayne, Menze Sls. 219-747-5616
KS Shawnee Mission, The Mertens Co. 913-432-9323
MD Gaithersburg, Naudian Assoc. Southern, Inc. 301-258-5040
MA Hopkinton, Berkshire Elctrns. 508-435-9356
MI Dearborn, Pitcher-Poulin, Inc. 313-582-5450
MN Minneapolis, Tech. Comps. Grp. 612-561-5556
MO Clayton, Mertens Co. 314-993-6600
NJ Burlington, VDE Elctrns. 609-387-9331
NJ Hazlet, Pacent Engrg. 908-264-2202
NY Great Neck, Pacent Eng. Co. 516-482-4678
NC Siler City, Crossroads Elctrns. 919-742-2372
TX Dallas, Glidden Electro Equip. 214-341-0610
WI Mequon, WM Bolles Assoc., Inc. 414-241-3320

Local Distributors
AZ Phoenix, Minarik Elec. Co. 602-233-3000
CA Anaheim, Electro Comps. Dist. 213-628-2844
CA Covina, Selecta Switch 818-967-4123
CA Freemont, KEA Elctrns. 510-651-2600
CA Gardena, California Switch & Signal 310-538-9830
CA Glendale, Minarik Elec. Co. 818-507-6445
CA Los Angeles, Electric Switches 213-660-1310
CA San Diego, Minarik Elec. Co. 619-560-6632
CA Santa Clara, Minarik Elec. Co. 408-727-0575
CA Tustin, Western Switches 714-259-8144
CA Van Nuys, Wes-Garde Comps. Grp. 818-786-3724
CO Commerce City, Minarik Elec. Co. 303-289-5800
CT Hartford, Wes-Garde Comp. Grp. 203-527-7705
FL Lakeland, Wes-Garde Comp. Grp. 813-644-7564
GA Tucker, CID, Inc. 404-491-3143
IL Carol Stream, Wes-Garde Comp. Grp. 708-653-1460
KS Overland Pk., Wes-Garde Comps. 913-262-2718
MA Canton, Xenell 617-828-2948
MI St. Clair Shores, Specialities Mfg. 313-771-2700
MN Minneapolis, Carl Bergquist 612-835-2322
MO St. Louis, Wes-Garde Comp. Grp. 314-567-7776
NH Nashua, Wes-Garde Comp. Grp. 603-880-1971
NJ Mt. Laurel, Wes-Garde Comp. Grp. 609-778-8190
NY Woodside, Switches Unltd. 718-478-5000
OH Valley City, Roberts Elctrns. 216-225-4646
OH Westerville, Wes-Garde Comps. Grp. 614-885-0319
OR Portland, Minarik Elec. 503-253-3402
SC Columbia, Dixie Elctrns. 803-779-5332
TX Dallas, Wes-Garde Comp. Grp. 214-357-1768
TX San Antonio, Minarik Elec. 512-822-7097
WI Grafton, Lake-View Elctrns. 414-377-8250
WI Milwaukee, Progressive Image 414-321-4722
Can Edmonton, Deskin Sls. 403-466-2106
Can Montreal, Deskin Sls. 514-331-2860
Can Ottawa, Deskin Sls. 613-228-1201
Can Toronto, Deskin Sls. 416-475-1412
Can Vancouver, Deskin Sls. 604-324-8343
Can Winnipeg, Deskin Sls. 403-466-2106

SOR, INC., 14685 W. 105th St., Lenexa, KS 66215, Tel: 913-888-2630, TELEX: 4992783, FAX: 913-888-0767; Empl.: 200; *Sls. Mgr.:* Steve Highberger

SOSHIN ELECTRIC CO., LTD., No. 18-18, 1-Chome Nakamagome, Ota-Ku, Tokyo, Japan, Tel: (03) 3775-9119, TELEX: 246-6377, FAX: (03) 3775-7092; Empl.: 1150; *Sls. Mgr.:* M. Chiba, Overseas Dept.

SOUNDCOAT CO., INC., 1 Burt Dr., Deer Park, NY 11729-5701, Tel: 516-242-2200, FAX: 516-242-2246; Empl.: 100; *Sls. Mgr.:* Anthony Fischetti

SOUTH AMERICAN DEVELOPMENT CORP., 29 Noxon Rd., Poughkeepsie, NY 12590, Tel: 914-452-1305, FAX: 914-452-2526; Empl.: 80; *Sls. Mgr.:* C. Healy

SOUTHCO, INC., 210 N. Brinton Lake Rd., Concordville, PA 19331, Tel: 215-459-4000, FAX: 215-459-4012; *Sls. Mgr.:* R. W. Dougherty

SOUTHERN COMPUTER CORP., 141 W. Wieuca Rd., Ste. 300-B, Atlanta, GA 30342, Tel: 404-252-3340, FAX: 404-252-8929; *Sls. Mgr.:* Ray Manley

SOUTHERN ELECTRONIC, F-Dyne, 726 So. Flower St., Burbank, CA 91502, Tel: 818-845-2458, FAX: 818-845-6348; Empl.: 50; *Sls. Mgr.:* John Levyssohn

SOUTHTRONICS, INC., 1265 Kennestone Circle, Marietta, GA 30066-6029, Tel: 404-429-1000, FAX: 404-424-2000; *Sls. Mgr.:* David Coleman

SOUTHWALL TECHNOLOGIES INC., 1029 Corporation Way, Palo Alto, CA 94303, Tel: 415-962-9111, FAX: 415-967-8713; FSC No.: 9U775; Empl.: 8; *Sls. Mgr.:* Terri Harris, Prod. Mgr.

SOUTHWESTERN NAMEPLATE & MFG. CO., INC., P.O. Box 35, Fourth St., Anna, TX 75003, Tel: 214-231-6663, 214-924-3289, 1-800-331-6600, FAX: 214-924-3090; Empl.: 14

SPACE ELECTRONICS, INC., 81 Fuller Way, Berlin, CT 06037, Tel: 203-829-0001, FAX: 203-829-0005; Empl.: 26; *Sls. Mgr.:* Richard Boynton

SPECIAL ELECTRIC CO., INC., 3628 W. Pierce St., Milwaukee, WI 53215, Tel: 414-383-6370, TELEX: 910-262-3106, FAX: 414-383-6725; Empl.: 40; *Sls. Mgr.:* F. James Heider

SPECIALIZED PRODUCTS COMPANY, 3131 Premier Dr., Irving, TX 75063, Tel: 214-550-1923, TELEX: 732764, FAX: 214-550-1386; Empl.: 39; *Sls. Mgr.:* Paul Jones

SPECIALTY CABLE CORPORATION, P.O. Box 50, Wallingford, CT 06492, Tel: 800-456-SPEC, FAX: 203-269-5293; Empl.: 72

SPECIALTY COATING SYSTEMS, INC., 5707 W. Minnesota St., Indianapolis, IN 46241, Tel: 317-244-1200, FAX: 317-240-2073; Empl.: 135; *Sls. Mgr.:* Bill Yager

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SPECIALITY ELECTRONICS, INC., 19200 Asheville Hwy., Landrum, SC 29356, Tel: 803-457-3824; Empl.: 80; *Sls. Mgr.:* Tim Smith; *Dist. Mgr.:* Frank Pellatt ..... **C•1462-1467; D•1475**

Local Sales Offices & Reps

PA Lewisberry, Specialty Elctrns., Inc. 717-938-6171, FAX:717-938-5910

SPECO DIV., Components Specialties, Inc., 1172 Rte. 109, P.O. Box 624, Lindenhurst, NY 11757-0624, Tel: 516-957-8700, 800-645-5516, FAX: 516-957-9142; FSC No.: 516-957-9142; Empl.: 29; *Sls. Mgr.:* Eric Forman/Angela Carolan; *Dist. Mgr.:* Mel Hulkower

SPECTRACOM CORPORATION, 101 Despatch Drive, East Rochester, NY 14445-1484, Tel: 716-381-4827, TELEX: 9103509587, FAX: 716-381-4998; *Sls. Mgr.:* Edward F. O'Connor

SPECTRAL INNOVATIONS, 4633 Old Ironsides Dr., Ste. 401, Santa Clara, CA 95054-1807, Tel: 408-727-1314, FAX: 408-727-1423

SPECTRA LUX CORP., 11825 120th Ave. NE, Kirkland, WA 98034, Tel: 206-823-6857, FAX: 206-821-3193; FSC No.: 51896; Empl.: 120; *Sls. Mgr.:* Woody Hertzog

SPECTRAN CORP., 50 Hall Road, Sturbridge, MA 01566, Tel: 508-347-2261, FAX: 508-347-1211; FSC No.: 6V569; Empl.: 150

SPECTRA-PHYSICS LASERS INC., 1330 Terra Bella Ave.,P.O. Box 7013, Mountain View, CA 94039-7013, Tel: 415-961-2550, 800-456-2552, TELEX: 348-488, FAX: 415-969-4084; *Sls. Mgr.:* Bob Turcotte

SPECTRASCAN, INC., 1110A Elkton Drive, Colorado Springs, CO 80907, Tel: 719-599-9254, FAX: 719-599-0815; Empl.: 15; *Sls. Mgr.:* Don Trutwin

SPECTRA SONICS, 3750 Airport Rd., Ogden, UT 84405, Tel: 801-392-7531; Empl.: 35

SPECTRA-STRIP, See Amphenol Products

Spectrol®

FAX: 909-923-6765

SPECTROL ELECTRONICS CORP., 4051 Greystone Dr., Ontario, CA 91761, Tel: 909-923-3313; FSC No.: 02111; Empl.: 200; *Sls. Mgr.:* Rob Taflinger; *Dist. Mgr.:* Rob Taflinger ..... **A•2119-2121; B•2016-2017**

Local Sales Offices & Reps

AL	Huntsville, DHR Mktg.	205-536-9775
AZ	Scottsdale, JK Assocs.	602-990-8804
CA	Huntington Beach, West Elctrns. Sls.	714-375-5500
CA	San Diego, Hadden & Assoc.	619-565-9444
CA	San Jose, Silicon Valley	408-432-1967
CO	Denver, West, Inc.	303-477-8180
CT	North Haven, Kitchen & Kutchin	203-239-0212
FL	Altamonte Springs, DHR Mktg.	407-331-1199
IL	Naperville, Lancastle Sls.	708-527-1142
IA	Cedar Rapids, Lowell-Kangas	319-362-9290
KS	Shawnee Mission, Lowell-Kangas	913-631-3515
GA	Duluth, DHR Mktg.	404-564-0529
MA	Burlington, Kitchen & Kutchin	617-229-2660
MI	Farmington Hills, Luebbe Sls.	313-489-8828
MN	Bloomington, Murnco	612-854-4161
MO	St. Louis, Lowell-Kangas	314-821-4050
NJ	Haddonfield, Sunday-O'Brien	609-429-4013
NM	Scottsdale, AZ, J.K. Assocs.	602-990-8804
NY	Commack, E.R.A.	516-543-0510
NY	Victor, Net Sls.	716-924-1844
NC	Raleigh, DHR Mktg.	919-829-1970
OH	Cincinnati, Luebbe Sls.	513-530-0600
OH	Dayton, Luebbe Sls.	513-438-0490
OH	Westlake, Luebbe Sls.	216-899-0071
OR	Beaverton, Westmark Elctrn., Inc.	503-641-8780
PA	Pittsburgh, Luebbe Sls.	412-364-0490
TN	Nashville, DHR Mktg.	205-722-0440
TX	Richardson, Pro Comp. Sls. Co.	214-669-1500
VA	Sterling, Beacon North	703-478-2480
WA	Bellevue, Westmark Elctrns.	206-454-1944
WI	Lancastle, Lancastle	414-569-9084
Can	Markham, Deskin Sls.	416-475-1412

Local Distributors

AL	Mobile, Newark Elctrns.	205-471-6500
AZ	Phoenix, Newark Elctrs.	602-864-9905
AZ	Phoenix, Sterling Elctrns.	602-437-5565
AZ	Scottsdale, Kent/Shelley-Ragon	602-998-0399
CA	Costa Mesa, Cypress Elctrns.	714-549-2424
CA	Fountain Valley, Component Center	714-979-0433
CA	Orange, Newark Elctrs.	714-634-8224
CA	Santa Clara, Cypress Elctrns.	408-980-2500
CA	Sunnyvale, Abacus Elctrns.	408-732-2000
CO	Denver, Newark Elctrns.	303-757-3351
CO	Englewood, Kent/Shelley-Ragon	303-762-0670
CO	Englewood, Sterling Elctrns.	303-792-3939
CT	Wallingford, Cronin Elctrns.	203-265-3134
FL	Largo, Kent/Shelley-Ragon	813-545-0057
GA	Norcross, Newark Elctrns.	404-448-8500
ID	Boise, Newark Elctrns.	208-342-4311
IL	Bensenville, Voyager	312-860-1300
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Rosemont, Advent	708-297-6200
IN	Ft. Wayne, Newark Elctrns.	219-484-0766
IN	Indianapolis, Olive Elctrns.	317-253-9065
IA	Cedar Rapids, Advent Elctrns.	319-363-0221
KS	Lenexa, Sterling Elctrns.	913-492-5406
MD	Columbia, Newark Elctrns.	301-964-4482
MA	Needham, Cronin Elctrns.	617-449-5000
MA	Norwood, Gerber Elctrns.	617-769-6000
MA	Tewksbury, Armor Elctrns.	508-640-1499
MA	Waltham, Newark Elctrns.	617-894-8050
MA	Woburn, Sterling Elctrns.	617-938-6200
MI	Farmington Hills, Advent Elctrns.	313-477-1650
MI	Livonia, RS Elctrns.	313-525-1155
MI	Oakpark, Newark Elctrns.	313-967-0600
MN	Bloomington, Sterling Elctrns.	612-831-2666
MN	Fridley, Voyager	612-571-7766
MN	Minneapolis, Newark Elctrns.	612-331-6350
MN	St. Paul, Kent/Shelley-Ragon	612-642-2828
MN	St.Paul, Gopher Elctrns.	612-483-3322
MO	Independence, Kent/Shelley-Ragon	816-254-3410
MO	Maryland Heights, Olive Elctrns.	314-997-7709
NJ	Randolph, Mouser Elctrns.	201-328-3322
NJ	Union, Newark Elctrns	908-851-2290
NM	Albuquerque, Sterling Elctrns.	505-884-1900
NY	Buffalo, Summit Distrs.	716-887-2800
NY	Medford, Kent/Shelley-Ragon	516-447-2000
NC	Charlotte, Newark Elctrns.	704-535-5650
OH	Akron, Akron Elctrns. Supp.	216-762-8818
OH	Cincinnati, Newark Elctrns.	513-722-8181
OH	Columbus, Electronics Mktg.	614-299-4161
OH	Dayton, Stotts-Friedman	513-298-5555
OK	Tulsa, Altair	918-252-5781
OR	Portland, Radar Elec.	503-232-3401
OR	Tualatin, Moore Elctrns.	503-692-5333
PA	N. Versailles, CMD	412-678-6020
PA	Philadelphia, Shap Elctrns.	215-969-3300
SC	Columbia, Dixie Elctrns.	803-779-5332
TN	Knoxville, Newark Elctrns.	615-588-6493
TN	Nashville, Randolph & Rice	615-255-5601
TX	Dallas, Sterling Elctrns.	214-243-1600
TX	Houston, Kent/Shelley-Ragon	713-780-7770
TX	Houston, Sterling Elctrns.	713-623-3900
TX	Mansfield, Mouser Elctrns.	817-483-0165
TX	Richardson, Altair	214-231-5166
UT	Salt Lake City, Sterling Elctrns.	801-972-5444
VA	Richmond, Sterling Elctrns.	804-226-2190
WA	Bellevue, Newark Elctrns.	206-641-9800
WA	Redmond, Kent/Shelley-Ragon	206-883-7200
WA	Seattle, Radar Electrns.	206-282-2511
WV	Charleston, Newark Elctrns.	304-744-9022
WI	Milwaukee, Newark Elctrns.	414-453-9100

SPECTRON ENGINEERING INC., 255 Yuma Ct., Denver, CO 80223, Tel: 303-733-1060, FAX: 303-733-2432; Empl.: 9; *Sls. Mgr.:* Zdzislav Krzystek

SPECTRON GLASS & ELECTRONICS, INC., 595 Old Willets Path, P.O. Box 13368, Hauppauge, NY 11788, Tel: 516-582-5600, TELEX: 968296; FSC No.: 57349; Empl.: 70; *Sls. Mgr.:* Bob Marshall

SPECTRONICS CORP., 956 Brush Hollow Rd., Westbury, NY 11590, Tel: 516-333-4840/1-800-274-8888, TWX: 510-222-5877, FAX: 516-333-4859; Empl.: 150; *Sls. Mgr.:* David Ross

SPECTRUM CONTROL, INC.

FAX: 814-835-9000

SPECTRUM CONTROL, INC., 6000 West Ridge Rd., Erie, PA 16506, Tel: 814-835-4000; FSC No.: 33095;5733; Empl.: 604; *Sls. Mgr.:* D. Reynolds; *Dist. Mgr.:* D. Zaday ..... **A•1677-1679; C•1468**

Local Sales Offices & Reps

AL	Huntsville, EMA, Inc.	205-880-8050
AZ	Tempe, Westrep	602-820-9932
CA	Huntington Bch., West Elctrn. Sls.	714-375-6500
CA	Mountain View, RF Assocs. North	415-694-4972
CO	Denver, Lindberg Co.	303-758-9033
CT	North Haven, Kitchen & Kutchin	203-239-0212
FL	Margate, EPM Corp.	305-977-0331
GA	Atlanta, EMA, Inc.	404-448-1215
IL	Crystal Lake, Spectrum Control, Inc.	815-477-2600
IA	Cedar Rapids, T. L. Dowell & Assoc.	319-393-7920
KS	Overland Park, T. L. Dowell & Assoc.	913-722-4242
MD	Centerville, EMC Technlgsts.	410-758-3510
MA	Burlington, Kitchen & Kutchin	617-229-2660
MN	Bloomington, Murnco	612-854-4161
MO	St. Louis, T. L. Dowell & Assoc.	314-849-4234
NJ	Brielle, EMC Technlgsts.	908-223-6699
NY	Victor, EMC Technlgsts.	716-924-1844
NC	Raleigh, EMA, Inc.	919-847-8800
OH	Beachwood, Elctrn. Salesmasters, Inc.	216-831-9555
TX	Dallas, J.Y. Schoonmaker Co.	214-349-1650
UT	Salt Lake City, Lindberg Co.	801-484-8689
VA	Sterling, EMC Technlgsts.	703-450-7988
WA	Redmond, EMG, Inc.	206-882-0962
Can	Oakville, Ont., Haltronics, Ltd.	416-844-2121

SPECTRUM CORP., 10048 Easthaven, Houston, TX 77075, Tel: 713-944-6200, 1-800-392-5050(Sls), FAX: 713-944-1290; Empl.: 35; *Sls. Mgr.:* Gary W. Liddell; *Dist. Mgr.:* Jim B. Bishop

SPECTRUM DEVICES, P.O. Box 1586, Sugar Land, TX 77487-1586, Tel: 713-242-6417, FAX: 713-242-6415; FSC No.: 0RNT4; Empl.: 7; *Sls. Mgr.:* Sajid Rafique

SPECTRUM SIGNAL PROC., 250 H st., P.O. Box 8110-25, Blaine, WA 98231-0025, Tel: 1-800-663-8986 (US), 604-421-5422, FAX: 604-421-1764; Empl.: 48; *Sls. Mgr.:* Brian Lowe; *Dist. Mgr.:* Rod Jensen

Local Sales Offices & Reps

CA	Mountain View, Spectrum Signal Processing	415-903-7355
MA	Westborough, Spectrum Signal Processing	800-323-1842,508-366-7355
Can	Burnaby, B.C., Spectrum Signal Processing	800-663-8986,604-421-5422

Local Distributors

CA	Mountainview, Thorson West	415-964-9300

SPECTRUM TECHNOLOGY, INC., DATUM, Incorporated, 749 Ward Drive, Santa Barbara, CA 93111, Tel: 805-964-7791, TWX: 910-334-1163, FAX: 805-683-3481; FSC No.: 32464; Empl.: 70; *Sls. Mgr.:* R.L. Waguespack

SPEEDY CIRCUITS, PJC Technologies, Inc., 5332 Commerical Dr., Huntington Bch., CA 92649, Tel: 714-898-4901, FAX: 714-891-0607; Empl.: 36; *Sls. Mgr.:* Jon P. Herkins

Spellman
High Voltage Electronics Corp

FAX: 516-349-8699

SPELLMAN HIGH VOLTAGE ELCTRNS. CORP., 7 Fairchild Ave., Plainview, NY 11803, Tel: 516-349-8686, TWX: 510-221-2155; Empl.: 180; *Sls. Mgr.:* Eric Marko; *Dist. Mgr.:* Eric Marko ..... **D•1922-1935**

Local Sales Offices & Reps

Can British Columbia, Broman Engrg. 604-254-6311

SPEMCO SWITCHES, 23425 Harper, Box 386, St. Clair Shores, MI 48080, Tel: 800-482-2828, FAX: 313-771-3491; Empl.: 12; *Sls. Mgr.:* Andrew Richardson

SPERRY, A. W. INSTRUMENTS, P.O. Box 9300, Smithtown, NY 11787, Tel: 516-231-7050, 800-645-5398, TELEX: 645104, FAX: 516-434-3128; Empl.: 50; *Sls. Mgr.:* Dennis W. Carroll

SPIRA MANUFACTURING CORP., 12721 Saticoy Street South, North Hollywood, CA 91605, Tel: 818-764-8222, FAX: 818-764-9880; FSC No.: 60050; Empl.: 18; *Sls. Mgr.:* Lisa A Panzich

SPIRICON, INC., 2600 North Main, Logan, UT 84321, Tel: 801-753-3729, TELEX: 296-465 SPIR UR, FAX: 801-735-5231; Empl.: 15; *Sls. Mgr.:* Ed Danahy

SPRAGUE, 70 Pembroke Rd., Concord, NH 03301, Tel: 603-224-1961, FAX: 603-224-1430 ..... **A•1166-1167**

SPRAGUE, Solid Tantalum Capacitors, 678 Main Street, Sanford, ME 04073-0231, Tel: 207-324-4140, FAX: 207-324-7223; *Sls. Mgr.:* Bob Marlowe ... **A•1166-1167**

SPRAGUE, Wet & Foil Tantalum Capacitors, 1600 Curran Hwy., North Adams, MA 01247-3987, Tel: 413-664-4431, FAX: 413-663-5079; *Sls. Mgr.:* Mike Duffy ..... **A•1166-1167**

SPRAGUE, 267 Lowell Rd., Hudson, NH 03051, Tel: 603-881-7200, 603-883-9774 (Mktg), FAX: 603-880-1910; *Sls. Mgr.:* Phil Brucato

SPRAGUE GOODMAN

FAX: 516-746-1396

SPRAGUE-GOODMAN ELCTRNS., INC., 134 Fulton Ave., Garden City Pk., NY 11040, Tel: 516-746-1385; FSC No.: 52769; Empl.: 80; *Sls. Mgr.:* Martin D. Markson ..... **A•1164-1165**

Local Sales Offices & Reps

AL	Huntsville, TMA	205-883-7893
AZ	Mesa, System Sls. of Arizona	602-464-9989
CA	Cupertino, Dura Elctrn. Sls.	408-255-2084
CA	Dana Point, Quattro Sls. Assocs.	714-493-1720
CA	Hermosa Bch., Quattro Sls. Assocs.	310-372-4221
CA	Moorpark, Quattro Sls. Assocs.	805-523-2978
CA	San Diego, Quattro Sls. Assocs.	619-581-3093
CO	Englewood, Cain Technlg.	303-220-8118
CT	KSA Connecticut	203-524-5849
FL	Deerfield, TMA	305-427-1090
FL	Largo, TMA	813-531-4405
FL	Winter Park, TMA	407-671-2245
GA	Norcross, TMA	404-446-3565
IL	Wood Dale, B.N.I. Elctrns.	708-595-9210
IN	Ft. Wayne, Denton Mktg., Inc.	219-486-0665
IA	Marion, M.S.B. Assocs.	319-377-6261
KS	Roeland Park, M.S.B. Assocs.	913-432-2131
MD	Manchester, Imagitron Sls.	410-374-5600
MA	Sudbury, KSA of New England	508-443-5881
MI	Brighton, A.P. Assocs.	313-229-6550
MN	Eden Prairie, Electro Mark Inc.	612-944-5850
MO	St. Charles, M.S.B. Assocs.	314-946-5577
NJ	Imagitron Sls. Co., Inc.	800-638-3592
NM	Albuquerque, SSA of New Mexico	505-889-2901
NY	Buffalo, Upstate Engrg. Sls.	716-632-0011
NY	Johnson City, Upstate Engrg. Sls.	607-729-0827
NY	Melville, R F Elctrns. Sls. Co. Inc.	516-420-8890
NY	Rochester, Upstate Engrg. Sls.	716-225-2383
NC	Raleigh, TMA	919-872-5104
OH	Cincinnati, Stegman Blaine Mktg.	513-729-1969
OH	Cleveland, Stegman Blaine Mktg.	216-582-0003
OH	Stow, Stegman Blaine Mktg.	216-688-6421
OH	Vandalia, Stegman Blaine Mktg.	513-890-7975
OK	Tulsa, Delta Comps.	918-592-7711
OR	Beaverton, Harry Levinson Co.	503-690-1312
TX	Seagoville, Delta Comps.	214-287-6333
WA	Seattle, Harry Levinson Co.	206-382-1300
WI	Waukesha, BNI Elctrns.	414-784-3544
PR	Caroline, Elctrn. Sls. Assocs.	809-762-6459
Can	Halifax, Norgay Entprs.	902-864-4321
Can	Montreal, Norgay Entprs.	514-932-3233
Can	Ottawa, Norgay Entprs.	613-745-4051
Can	Toronto, Ont., Norgay Entprs.	416-234-8966
Can	Vancouver, Norgay Entprs.	604-940-8988

Local Distributors

AZ	Phoenix, Arizona Comps.	602-269-5655
AZ	Tempe, TTI, Inc.	602-431-1191
CA	Garden Grove, Natl. Elctrns.	714-892-7749
CA	Milpitas, Projections Unltd.	408-942-1717
CA	Milpitas, TTI, Inc.	408-946-5577
CA	Mission Hills, TTI, Inc.	818-891-8885
CA	San Diego, Neumann Elctrns.	619-695-3005
CA	San Diego, Projections Unltd.	619-453-7900
CA	San Diego, TTI, Inc.	619-748-2025
CA	Santa Ana, TTI, Inc.	714-641-9393
CA	Tustin, Projections Unltd.	714-544-2700
CO	Denver, TTI, Inc.	303-429-6806
CT	Wallingford, TTI, Inc.	203-284-7474
FL	Ft. Lauderdale, Bros. Elctrns. of FL	305-561-6700
FL	Melbourne, New Yorker Elctrns.	407-727-0955
FL	Orlando, TTI, Inc.	407-859-1000
GA	Norcross, TTI, Inc.	404-662-0911
IL	Schaumberg, TTI Inc.	708-884-6500
IN	Indianapolis, Meunier Elctrns., Supp.	317-635-3511
MD	Columbia, TTI, Inc.	301-995-1331
MA	Wilmington, TTI, Inc.	508-658-4700
MN	Minnetonka, TTI, Inc.	612-933-8555
NJ	Fairfield, Tri Start Elctrns.	201-227-3500
NJ	Mt. Laurel, TTI, Inc.	609-234-6400
NY	Mamaroneck, New Yorker Elctrns.	914-698-7600
NY	Ronkonkoma, Tri-Start Elctrns.	516-737-2200
NY	Ronkonkoma, TTI, Inc.	516-737-2000
OH	Dayton, TTI Inc.	513-898-8330
OH	Independence, TTI Inc.	216-328-9755
TX	Ft. Worth, TTI, Inc.	817-595-3100
TX	Garland, J & S Elctrns. Inc.	214-487-8808
WA	Redmond, TTI, Inc.	206-882-0291
WA	Seattle, Kam Elctrns.	206-382-1300
Can	Toronto, Ont., Norgay Entprs. Ltd.	416-234-8966

S-PRODUCTS INC., 35 Kings Highway East, Fairfield, CT 06430, Tel: 203-331-9546, FAX: 203-335-2723; Empl.: 4

SQUARE D CO., Executive Plaza, Palatine, IL 60067, Tel: 708-397-2600, FAX: 708-397-8814; Empl.: 17,000; *Sls. Mgr.:* D. Pugh, Sls. VP; *Dist. Mgr.:* K. Fairleigh, Distbn. Mktg. & Sls. VP

SQUARE D COMPANY, 1700 Sunshine Drive, Clearwater, FL 34625, Tel: 813-447-2511, FAX: 813-447-4662; Empl.: 175; *Sls. Mgr.:* Nick Powers

SQUARE D. COMPANY, Control Products, Hwy 64 East, Knightdale, NC 27545, Tel: 919-266-3671, FAX: 919-266-8393; Empl.: 900

SR ENGINEERING, BW/IP International, Inc., 13961 Nautilus Dr., Dept. E, Garden Grove, CA 92643, Tel: 714-554-4200, TELEX: 364412INTR-871, FAX: 714-265-0856; FSC No.: 21441

SRT ELECTRO-OPTICS, INC., 756 Tom Martin Drive, Birmingham, AL 35211, Tel: 205-916-2929, FAX: 205-916-2903; Empl.: 35

SSAC INCORPORATED, P.O. Box 1000, Baldwinsville, NY 13027, Tel: 315-638-1300, FAX: 315-638-0333; Empl.: 250; *Sls. Mgr.:* D. Carroll

S SQUARED ELECTRONICS, formerly ComTech Systems, Inc., 10 Halyard Rd., Valley Stream, NY 11581-2813, Tel: 516-791-1175; Empl.: 10

STACKBIN CORP., 29 Powder Hill Rd., PO Box 397, Lincoln, RI 02865, Tel: 401-333-1600, 800-333-1603, FAX: 401-333-1952; Empl.: 50; *Sls. Mgr.:* Lisa Porazzo; *Dist. Mgr.:* Timothy J. O'Leary

STACKPOLE COMPONENTS CO., See Ark-les Special Products Grp., Div. of Stackpole Switches

STACKPOLE, MAGNET DIV., 700 Elk Ave., Kane, PA 16735, Tel: 814-837-0272, FAX: 814-837-0277; *Sls. Mgr.:* G.A. Olson, Mgr. Sls. & Mktg.

STACO, INC., See Staco Transpower Components Corp. of America

STACO ENERGY PRODUCTS CO.

FAX: 513-253-1723

STACO ENERGY PRODUCTS CO., 301 Gaddis Blvd., Dayton, OH 45403, Tel: 513-253-1191; FSC No.: 83008; Empl.: 146; *Sls. Mgr.:* Don Ruther .... **A•2535; D•1936**

Local Sales Offices & Reps

CA	Mtn. View, Westech	415-961-1422
CO	Denver, EDS	303-871-8865
FL	Maitland, Hawkins Frederickson	407-831-2474
GA	Atlanta, Millar	404-634-3350
IL	Chicago, Saffro	708-299-7680
MA	Lexington, Hathaway	617-861-7010
MI	Detroit, R.C. Nordstrom	313-559-7373
MO	St. Louis, Dowell	314-849-4234
NY	Clarence, R.W. Mitscher	716-759-2350
NY	Northport, LSC	516-266-5020
NC	Raleigh, Millar	919-828-8840
OH	Cleveland, Depco	216-442-6200
OR	Hillsboro, Turn-A-Round	503-640-4661
PA	Philadelphia, ECSC	215-825-8610
Can	Scarborough, Decade	416-439-9921

Local Distributors

AL	Birmingham, JLS	205-322-2486
CA	San Francisco, Stevens Engrg.	415-588-9200
CO	Arvada, Denver Beta Wintronic	303-431-7161
CT	Wallingford, Sager Elctrn. Supp.	203-265-4600
FL	Miami, Elctrn. Equip.	305-526-6060
FL	Tampa, EMSCO	813-253-2684
GA	Atlanta, Cleveland Elec.	404-696-4550
HI	Honolulu, Victor Kim	808-841-6266
IL	Chicago, Newark Elctrns.	312-792-8233
IL	Palatine, Ohm Elctrns.	312-359-5500
IN	Indianapolis, Bell Inds.	317-875-8200
KY	Louisville, Peerless	502-637-7674
LA	Lafayette, Ralph's	318-234-4507
MA	Norwood, Gerber Elctrns.	617-769-6000
MA	Somerville, Electro Sls.	617-666-0500
MI	Madison Hgts., Galco	313-542-9090
MN	Minneapolis, Elctrn. Center	612-378-2442
MS	Jackson, Ellington Elctrns.	601-355-0561
MO	St. Louis, Van Sickle Ind.	314-621-5000
NJ	Kenilworth, Federated Purchaser	201-272-0505
NY	Hauppauge, Broadline Elctrns.	516-231-4100
NC	Winston-Salem, Kirkman Elctrns.	919-722-9131
OH	Cincinnati, Hughes-Peters, Inc.	513-351-2000
OH	Dayton, Stotts Friedman Elctrns.	513-298-5555
PA	Drexel Hill, Kass Elctrns.	215-449-2300
SC	Charleston, Wholesale Elctrns.	803-722-2634
TN	Knoxville, Indl. Elctrns.	615-573-7135
TN	Nashville, Randolph & Rice	615-255-5602
TX	Ft. Worth, Allied Elctrns.	817-595-3500
TX	San Antonio, Sherman Elctrns.	210-224-1001
VA	Charlottesville, VA Elctrns.	804-296-4184
WA	Seattle, Radar Elec.	206-282-2511
WI	Milwaukee, Marsh Elctrns.	414-475-6000
Can	Scarborough, Decade Elctrns.	416-439-9921

STACOSWITCH, 1139 Baker St., Costa Mesa, CA 92626, Tel: 714-549-3041, FAX: 714-549-0930; FSC No.: 12522;Multiple; Empl.: 80; *Sls. Mgr.:* D. Sugg

STACO TRANSPOWER, Components Corp. of America, 610 W. 6th St., Mt. Carmel, IL 62863, Tel: 618-262-5555, FAX: 618-263-3150; FSC No.: 83008; Empl.: 75; *Sls. Mgr.:* Lori Jeffries

STAFFALL INC., 1468 Elmwood Ave., Cranston, RI 02910, Tel: 401-461-5554, TWX: 710-381-6964; Empl.: 25

STAG MICROSYSTEMS INC., 1600 Wyatt Drive, Santa Clara, CA 95054, Tel: 408-988-1118, 1-800-227-8836, FAX: 408-988-1232; Empl.: 120; *Sls. Mgr.:* Bob Herriford; *Dist. Mgr.:* Bob Herriford

STAINLESS, INC., 210 S. 3rd St., N. Wales, PA 19454, Tel: 215-699-4871, TWX: 510-661-8097, FAX: 215-699-9597; Empl.: 80; *Sls. Mgr.:* Owen F. Ulmer

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STANCOR, White-Rodgers, 131 Godfrey St., Logansport, IN 46947, Tel: 219-722-2244; FSC No.: 80089; Empl.: 400; *Sls. Mgr.:* Richard K. Noel; *Dist. Mgr.:* Judi Carpenter, Prod. Mgr. ..... **A•2558-2564; B•1602-1604; D•1937**

Local Sales Offices & Reps

AL	Athens, E.M.F.	205-233-2947
AZ	Scottsdale, Suntech Sls.	602-860-8262
CA	Irvine, Groh Assocs.	714-837-9871
CA	Los Gatos, Shur Sls.	408-399-7487
CO	Denver, West, Inc.	303-477-8180
CT	Waterbury, Cannon Assocs.	203-597-0240
FL	Tampa, Uni-Rep	813-681-3477
GA	Atlanta, E.M.F.	404-948-6023
IL	Chicago, Joel Wasserman Assocs.	708-256-3566
IN	Indianapolis, Century Tech. Sls.	219-329-0447
IA	Cedar Rapids, Lowell Kangas	319-362-9290
KS	Shawnee, Lowell Kangas	913-631-3515
MD	Sykesville, D.J.C.	301-795-7020
MN	Bloomington, Murnco	612-854-4161
MO	St. Louis, Lowell Kangas	314-821-4050
NH	Nashua, Cannon Assoc.	603-598-4766
NM	Albuquerque, Marino Elec.	505-292-0007
NY	Rochester, Senntec	716-425-3954
NC	Lillington, E.M.F.	919-867-6221
OH	Beachwood, Elctrn. SalesMasters	216-831-9555
OR	Beaverton, Temper Tech.	503-292-8201
PA	Philadelphia, D.J.C.	215-334-4533
RI	Barrington, Cannon Assocs.	401-245-0850
TX	Richardson, Pro-Comp Sls.	214-669-1500

STANDARD CONDENSER CORP., 8151 N. Ridgeway, Skokie, IL 60076, Tel: 708-675-3133, FAX: 708-675-3709; FSC No.: 97419; *Sls. Mgr.:* B. P. McLean

STANDARD CRYSTAL CORPORATION, 9940 E. Baldwin Pl., El Monte, CA 91731, Tel: 818-443-2121, FAX: 818-443-9049; FSC No.: 30149; Empl.: 45; *Sls. Mgr.:* Kathy Allee; *Dist. Mgr.:* Kathy Allee ..... **A•1481**

Local Sales Offices & Reps

AZ	Phoenix, Suntech	602-860-8262
CA	Fallbrook, Chilcote Assoc.	619-728-7678
CA	Huntington Beach, Force 1 Sls.	714-963-3949
CA	Sunnyvale, ESCO Assoc.	408-745-1410
FL	Winter Pk., HHP Assoc.	407-740-0320
IN	Ft. Wayne, M/S Sls.	219-436-3023
MI	Grand Rapids, R.P. Urban & Assocs.	616-245-0511
MN	Afton, Real Elctrns.	612-436-1950

Local Distributors

AL	Huntsville, Resistacap	205-883-4270
CA	Carlsbad, Aegis Elctrn. Grp.	619-729-2026
CA	Irvine, Kelex Elctrns.	714-863-1230
CA	Milpitas, Sierra West	408-945-1050
FL	Boca Raton, NRC Elctrns.	407-241-8600
FL	Largo, Elctrn. Precepts of Fl.	813-544-3636
FL	Melbourne, Dove Elctrns.	407-242-6916
GA	Norcross, NRC Elctrns.	404-729-0411
IN	Indianapolis, Mar	317-633-6699
MA	Woburn, First Frequency	617-935-3885
MI	Wyoming, EC Elctrns.	616-530-0576
NV	Las Vegas, Kiesub Elctrns.	702-733-0024
NJ	Edison, Dove Elctrns.	908-738-0321
NJ	Fairfield, Tri Start	201-229-3500
NY	E. Setauket, Dove Elctrns.	800-232-9825
NY	Ronkonkoma, TRI Start	516-737-2200
TX	Richardson, Ewing Elctrns.	214-231-6725
VA	Vienna, Dove Elctrns.	703-893-1821

STANDARD ENVIRONMENTAL SYSTEMS, INC., 383 Minnisink Rd., Totowa, NJ 07512, Tel: 201-256-2200, FAX: 201-256-2820; Empl.: 26

STANDARD GRIGSBY, INC., FLINT INDUSTRIES, See OakGrigsby, Inc.

STANDARD GRIGSBY INC., W. Gunther GMBH, Virnsberger Strasse 51, D 8500 Nurnberg 82, West Germany, Tel: 0911-65521, TELEX: 622351, FAX: 0911/6552-239

STANDARD INSERT CO., Penn Engrg. & Mfg. Corp., 5190 Old Easton Rd., Danboro, PA 18916, Tel: 215-766-0960, FAX: 215-766-0962; Empl.: 7; *Sls. Mgr.:* Ed Soorikian

STANDARD MAGNETIC CORP., 7231 Garden Grove Blvd., Ste. D, Garden Grove, CA 92641, Tel: 714-379-5671, FAX: 714-379-5673; FSC No.: 51103; Empl.: 20; *Sls. Mgr.:* Satish Jain

STANDARD MICROSYSTEMS, 80 Arkay Dr., Hauppauge, NY 11788, Tel: 516-273-3100, FAX: 516-273-3123; FSC No.: 53848; Empl.: 500

STANDARD REFERENCE LABS, INC., See Koep Precision Standards, Inc.

STANDARD WIRE & CABLE CO., 1959 E. Cashdan St., Rancho Dominguez, CA 90220, Tel: 310-609-1811, 800-326-0006, TELEX: 65-3423, ESYLNK: 62931655, FAX: 310-609-1862; Empl.: 50; *Sls. Mgr.:* Dan Varvais; *Dist. Mgr.:* Jerry Gaither

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STANDEX ELECTRONICS, Standex International, 4538 Camberwell Rd., Cincinnati, OH 45209, Tel: 513-871-3777; FSC No.: 56402; Empl.: 450; *Sls. Mgr.:* Charles C. Johnson, VP Sls. .... **A•1290-1295; B•1605, 1810-1811**

Local Sales Offices & Reps

AL	Huntsville, R. W. Mitscher Co.	205-464-0745
AZ	Tempe, Gassner & Clark	602-968-9037
CA	Granada Hills, C & W Comp. Sls.	818-368-4032
FL	Lutz, R.W. Mitscher Co.	813-948-2351
FL	Tequesta, R.W. Mitscher Co.	407-575-4485
GA	Lawrenceville, R. W. Mitscher Co.	404-923-3239
IL	Arlington Hgts., Brainard-Nielson Mktg.	312-437-2700
IN	Granger, Gregory Sls. Co.	219-272-9626
KS	Olathe, G.M. Brown & Assoc.	913-829-3086
MD	Laurel, R. W. Mitscher Co., Inc.	301-498-6090
MA	Sudbury, KSA of New England	617-443-5881
MI	Detroit, R.P. Urban & Assoc.	313-535-2355
MI	Grand Rapids, R.P. Urban & Assoc.	616-245-0511
MN	Bloomington, Jay Borman Sls. Co.	612-922-7909
MO	Florissant, G.M. Brown & Assoc.	314-839-3600
NJ	Woodbridge, Jade Mktg.	201-750-2998
NY	Binghamton, R.W. Mitscher Co., Inc.	607-724-6561
NY	Clarence, R. W. Mitscher Co., Inc.	716-759-2350
NY	Rochester, R. W. Mitscher Co., Inc.	716-227-0839
NC	Davidson, R.W. Mitscher Co., Inc.	704-896-7434
NC	Raleigh, R. W. Mitscher Co., Inc.	919-848-0941
OH	Dayton, J. C. Hofstetter Co.	513-296-1010
OH	Medina, J. C. Hofstetter Co.	216-241-4880
OR	Portland, Components Technlg.	503-292-1518
PA	Wynnewood, Metz-Jade Assocs., Inc.	215-896-7300
TN	Johnson City, R. W. Mitscher Co., Inc.	615-929-7258
TX	Plano, B & R Elctrn. Sls. Corp.	214-985-0028
VA	Richmond, R. W. Mitscher Co., Inc.	804-222-5425
WI	Manitowoc, Brainard-Wilson Mktg.	414-682-1201

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Division of Standish Industries, Inc.

FAX: 414-648-1001

STANDISH INDUSTRIES, Standish LCD Div., W7514 Hwy V, Lake Mills, WI 53551, Tel: 414-648-1000; FSC No.: OS145; Empl.: 250; *Sls. Mgr.:* Richard D. Barbieri ..... **B•1118**

Local Sales Offices & Reps

CA	Anaheim, Gabriel & Assocs.	714-666-0660
CA	Mountain View, Straube Assocs.	415-969-6060
CO	Boulder, Design Technlg. Sls.	303-440-5121
CT	Branford, Coakley, Boyd & Abbett, Inc.	203-481-2218
FL	Tampa, Bob Dean, Inc.	813-969-2875
GA	Atlanta, Wallace Elctrn. Sls.	404-634-3159
IL	Skokie, Indl. Rep.	708-967-8430
IN	Carmel, TMC	317-844-8462
IN	Ft. Wayne, TMC	219-432-5553
IA	Davenport, Rush & West	319-388-9494
KS	Olathe, Rush & West	913-764-2700
KY	Louisville, TMC	502-245-7411
MD	Gaithersburg, Naudain Assocs. Southern, Inc.	301-258-5040
MA	Framingham, Coakley, Boyd & Abbett, Inc.	508-820-0800
MI	Farmington Hills, J.L. Montgomery Assocs.	313-489-0099
MN	Minneapolis, R-J, Inc.	612-866-3661
MO	St. Louis, Rush & West	314-965-3322
NJ	Hackensack, Coakley, Boyd, Abbett, Metro	201-440-4114
NJ	Marlton, Naudain Assoc.	609-983-5300
NY	Ithaca, Bob Dean, Inc.	607-257-1111
NC	Kernersville, Wallace Elctrn. Sls.	919-996-2742
OH	Centerville, Bear Mktg.	513-436-2061
OH	Richfield, Bear Mktg.	216-659-3131
TX	Austin, Procomp Sls. Co.	512-331-0800
TX	Hurst, Procomp Sls. Co.	817-589-0336
TX	Richardson, Procomp Sls. Co.	214-669-1500
WI	Brookfield, Indl. Rep.	414-789-9393
Can	Oakville, Ont., Haltronics Ltd.	416-844-2121

Local Distributors

AZ	Phoenix, Force Elctrns.	602-437-1060
AZ	Tempe, Cypress Elctrns.	602-966-2256
CA	Milpitas, Zack Elctrns.	408-942-5432
CA	San Diego, Cypress Elctrns.	619-535-0011
CA	Santa Clara, Cypress Elctrns.	408-980-2500
CO	Littleton, Displays Plus	303-730-7333
CT	Danbury, Heilind Elctrns.	203-797-8600
IL	Palatine, Ohm Elctrns.	708-359-5500
IN	Ft. Wayne, Bell Inds.	219-423-3422
IN	Indianapolis, Bell Inds.	317-875-8200
MA	Hingham, Sager Elec. Supp.	617-749-6700
MA	Wilmington, Heilind Elctrns.	508-657-4870
MI	Grand Rapids, Calder Elctrns.	616-698-7400
MI	Saginaw, Shand Elctrns.	517-753-9900
MN	Minneapolis, Voyager Elctrns.	612-571-7766
NJ	W. Berlin, General Comps., Inc.	609-768-6767
NM	Albuquerque, Bell Inds.	505-292-2700
NY	Buffalo, Summit Distr.	716-887-2800
NY	Rome, Rome Elctrns.	315-337-5400
OH	Dayton, Bell Inds.	513-435-8660
OH	Solon, Repco	216-248-8900
OK	Tulsa, Radio, Inc.	918-587-9123
OR	Portland, Radar Elec.	503-232-3404
PA	McKean, Advacom	814-476-7774
TX	Dallas, Harrison Equip. Co.	214-239-2750
TX	Ft. Worth, Allied Elctrns.	817-595-3500
TX	Stafford, Harrison Equip.	713-879-2700
TX	Stafford, Southwest Elctrns.	713-240-4000
WA	Seattle, Radar Elec. Co.	206-282-2511
WI	Mequon, Taylor Elec.	414-241-4321
Can	Markham, Ont., Semad Elctrns.	416-475-8500
Can	Ottawa, Ont., Semad Elctrns.	613-727-8325
WA	Bellevue, Testco, Inc.	206-454-7422

STANFORD RESCH. SYS., INC., 1290 D. Reamwood Ave., Sunnyvale, CA 94089, Tel: 408-744-9040, FAX: 408-744-9049; *Sls. Mgr.:* Daniel R. Melick

STANFORD TELECOMMUNICATIONS, INC., 2421 Mission College Blvd., Santa Clara, CA 95056, Tel: 408-748-1010, TWX: 910-339-9531, FAX: 408-980-1066; FSC No.: 61362; Empl.: 900; *Sls. Mgr.:* Chuck Frank

STANGENES INDUSTRIES, INC., 1052 East Meadow Circle, Palo Alto, CA 94303, Tel: 415-493-0814, FAX: 415-855-9926; FSC No.: 62709; Empl.: 61; *Sls. Mgr.:* Magne Stangenes

STANLEY ELECTRONICS DIV., 250 E. Sandford Blvd., Mt. Vernon, NY 10550, Tel: 914-699-2000; FSC No.: 61544; Empl.: 12

STANLEY

FAX: 714-222-0555

I I STANLEY CO., INC., 2660 Barranca Pkwy., Irvine, CA 92714, Tel: 1-800-LED-LCD1; Empl.: 450; *Sls. Mgr.:* Bill Roth ..... **B•1130, 1188-1189**

Local Sales Offices & Reps

AZ	Scottsdale, B.S.E.	602-483-0373
CA	Irvine, Gravley & Assoc., Inc.	714-852-9994
CA	San Jose, Signet	408-453-0611
CO	Boulder, Stratford Grp.	303-530-3194
FL	Lighthouse Pt., Jack Krutek Assoc.	305-783-2501
IL	Berkeley, ESA Tech. Mktg.	708-544-0120
IN	Indianapolis, EMCI	317-921-3450
KS	Overland Park, Mink Assoc.	913-341-8309
MD	Highland, Penn Star Elctrns.	301-854-2308
MA	N. Reading, Alpha-Omega Sls.	508-664-1118
MO	Bridgeton, Mink Assoc.	314-291-5454
NJ	Long Valley, Paul Sweeney Co., Inc.	908-852-1434
NY	N. Syracuse, Entec Grp. Inc.	315-458-7936
NC	Greensboro, Arthur, Harris & Assoc., Inc.	919-275-3030
OH	Lexington, EMCI	414-884-3639
PA	Penn Star Elctrns.	301-854-2308

TX	Dallas, Norcom	214-386-4888
UT	Sandy, First Source	801-943-6894

Local Distributors

AL	Huntsville, Future Elctrns.	205-830-2322
AZ	Tempe, Cypress Elctrns.	602-966-2256
CA	Santa Clara, Cypress Elctrns.	408-980-2500
CO	Littleton, Indelco, Inc.	303-795-3431
CT	Hartford, Wesgarde Comps. Grp.	203-527-7705
FL	Lakeland, Wesgarde Comps. Grp.	813-644-7564
GA	Norcross, Milgray Elctrns.	404-446-9777
IL	Woodale, NEP Elctrns.	708-595-8500
IN	Carmel, Altex	317-848-1323
IA	Cedar Rapids, DEE Elctrns. Inc.	319-365-7551
KS	Overland Park, Milgray Elctrns.	913-236-8800
MD	Columbia, Future Elctrns.	410-290-0600
MA	Bolton, Future Elctrns.	508-779-3000
MI	Livonia, Future Elctrns.	313-261-5270
MN	Roseville, Chris Elctrns.	612-631-2647
MO	St. Louis, Wesgarde Comps. Grp.	314-567-7776
NH	Nashua, Wesgarde Comps. Grp.	603-880-1971
NJ	Mt. Laurel, Wesgarde Comps. Grp.	609-778-8190
NY	Farmingdale, Milgray Elctrns.	516-391-3000
NC	Concord, Future	704-455-9030
OH	Westerville, Wes Garde Comps.	614-885-0319
OR	Portland, Cypress Elctrns.	503-223-8900
PA	N. Versailles, CMD Elctrns.	412-678-6020
TX	Houston, Kent Elctrns.	713-789-7770
UT	Murray, Milgray Elctrns.	801-261-2999
WA	Redmond, Priebe Elctrns.	206-881-2363
WI	Waukesha, Future Elctrns.	414-786-1884

STANLEY-VIDMAR, Stanley Works, 11 Grammes Rd., Allentown, PA 18103, Tel: 215-797-6600, TELEX: 847-345; Empl.: 500ö; *Sls. Mgr.:* Ernie Gitlin, Vic Joliat; *Dist. Mgr.:* Frank Casey

STANPAT PRODS., 100 Goldstein Drive, Woonsocket, RI 02895, Tel: 401-766-8400, FAX: 401-767-0244; Empl.: 35; *Sls. Mgr.:* John Howley

STANTON MAGNETICS, INC., 101 Sunnyside Blvd., Plainview, NY 11803-1511, Tel: 516-349-0235, FAX: 516-349-0230; Empl.: 300; *Sls. Mgr.:* Ed Maidel; *Dist. Mgr.:* Ed Maidel

STAR CASE MANUFACTURING CO., INC., 648 Superior Avenue, Munster, IN 46321, Tel: 219-922-4440, 800-822-STAR (outside IN), 800-782-CASE (inside IN), FAX: 219-922-4442; Empl.: 75; *Sls. Mgr.:* Veronica Stadden

FAX: 908-572-5095

STAR MICRONICS, INC., OEM Division, 70-D Ethel Rd. W., Piscataway, NJ 08854, Tel: 908-572-9512; Empl.: 120; *Sls. Mgr.:* Georgia Lombardi; *Dist. Mgr.:* Chris Duffy ..... **D•1068-1071, 1108-1111**

Local Sales Offices & Reps

CA	Burbank, Star Micronics	818-972-1877
IL	Arlington Hgts., Star Micronics	708-670-7222

Local Distributors

CA	Los Angeles, Elec. Switches, Inc.	213-660-1310
CA	Pasadena, MS Cash Drawer	818-792-2111
CA	San Diego, Tauber Elctrns.	619-274-7242
CA	Sunnyvale, Penstock Inc.	408-730-0300
CA	Tustin, OBI Dists.	714-258-1411
CO	Englewood, NEP Elctrns.	303-799-9898
FL	Oldsmar, Applied Power	813-854-4004
GA	Norcross, Applied Power Inc.	404-263-0421
IL	Wood Dale, NEP Elctrns.	708-595-8500
IL	Wheeling, Hawk Elctrns. Inc.	708-459-4030
KY	Florence, U R I Elctrns. Inc.	606-371-4423
MD	Middletown, Current Comps.	301-473-5333
MA	Mansfield, Current Comps. Inc.	508-824-7900
MI	Brighton, Applied Power	313-227-3604
MI	Grand Rapids, S. F. Elec. Supp., Inc.	616-459-0216
NJ	Sparta, Instrument & Equip. Co.	201-579-0009
OH	Cincinnati, U R I Elctrns.	513-723-8800
OH	Columbus, Applied Power	614-882-1110
TX	Channelview, R. T. Henry Elctrns.	713-452-4451
TX	Dallas, Foxfire Inc.	214-353-9543
WA	Bellevue, Penstock Inc.	206-454-2371
WI	New Berlin, NEP Elctrns. Inc.	414-785-9100
WI	Waukesha, Hawk Elctrns. Inc.	414-547-4457
EXP	Markham, Ont., Birde Mktg. Inc.	416-477-7722
EXP	Vancouver, B.C., Birde Mktg. Inc.	604-431-0426

STAR SEMICONDUCTOR CORP., 25 Independence Blvd., Warren, NJ 07059, Tel: 908-647-9400, FAX: 908-647-4755; *Sls. Mgr.:* Jim Magos, VP Sls.

STAR SEMICONDUCTOR CORP., 25 Independence Blvd., Warren, NJ 07059, Tel: 908-647-9400, FAX: 908-647-4755; *Sls. Mgr.:* Jim Magos, VP Sls.

STAR-TRON CORPORATION, 58 Curtis St., Providence, RI 02909, Tel: 401-274-5090, FAX: 401-274-3936; Empl.: 27; *Sls. Mgr.:* Joyce D'Orsi

FAX: 714-997-1256

STATEK CORP., 512 N. Main St., Orange, CA 92668, Tel: 714-639-7810, TELEX: 67-8394; FSC No.: 51791; Empl.: 130; *Sls. Mgr.:* Suzanne Ray; *Dist. Mgr.:* Suzanne Ray ..... **A•1482-1483**

Local Sales Offices & Reps

AL	Huntsville, L & D	205-837-1469
AZ	Phoenix, Eltron	602-266-2164
CA	Long Beach, RD & D Sls.	310-988-1116
CA	Mtn. View, Disman-Bakner	415-969-3010
CO	Englewood, Comp. Sls.	303-779-8060
FL	Palm Habor, Sigma Tech	813-789-5522
GA	Atlanta, L & D	404-395-7079
IL	Rolling Meadows, Eagle Tech. Sls.	708-991-0700
IN	Kokomo, Skyline Sls.	317-452-6500
IA	Des Moines, SPS Assocs.	515-225-0607
KS	Olathe, SPS Assocs.	913-764-4460
MA	Woburn, Radian Assocs.	617-933-7386
MI	Brighton, AP Assoc.	313-229-6550
MN	Bloomington, Murnco Inc.	612-854-4161
MO	Earth City, SPS Assocs.	314-291-0520
NJ	Bellmawr, TAI Corp.	609-778-5353
NY	Endwel, Reagan/Compar	607-754-2171
NY	Rye Brook, Tekmar	914-632-2828
NC	Charlotte, Prime Comps.	704-522-1150
NC	Raleigh, Prime Comps.	919-850-9866
OH	Centerville, Omega Sls. Inc.	513-434-5507
OH	Cleveland, Omega Sls. Inc.	216-360-9400
OR	Oregon City, Halbar Assoc.	503-656-3714
TX	Austin, Norcom	512-451-2757
TX	Dallas, Norcom	214-386-4888
TX	Houston, Norcom	713-778-0392
UT	Midvale, Comp. Sls.	801-561-5099
WA	Redmond, Halbar Assocs.	206-882-0990

Local Distributors

AL	Huntsville, Reptron Elect.	205-722-9500
CA	Orange, Western Micro	714-637-0200
CA	San Diego, Western Micro	619-453-8430
CA	Sunnyvale, Target Elctrns.	408-733-0384
CA	Yorba Linda, Target Elctrns.	714-692-1630
CO	Littleton, Indelco	303-795-3431
FL	Ft. Lauderdale, Reptron Elctrns.	305-735-1112
FL	Miami, All American	305-621-8232
FL	Tampa, Reptron Elctrns.	813-855-4656
GA	Norcross, Reptron Elctrns.	404-446-1300
IL	Palatine, OHM Elctrns.	708-359-5500
IL	Schaumberg, Reptron Elctrns.	708-882-1700
IN	Indianapolis, Mar Elctrns., Inc.	317-633-6699
MA	Woburn, First Frequency	617-935-3885
MI	Livonia, Reptron Elctrns.	313-525-2700
MN	Minnetonka, Reptron Elctrns.	612-938-0000
MO	Maryland Hgts., RS Elctrns.	314-997-7709
NY	Buffalo, Summit Distrs.	716-887-2800
NY	E. Setauket, Dove Elctrns.	516-689-7733
NY	Mt. Vernon, All American	914-699-2224
OH	Solon, Reptron Elctrns.	216-349-1415
TX	Richardson, Ewing Elctrns., Inc.	214-231-6725
WA	Redmond, Kent Elect	206-883-7200

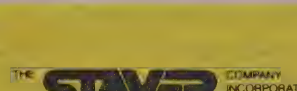
STATE OF THE ART, INC., 2470 Fox Hill Rd., State College, PA 16803-1797, Tel: 814-355-8004, FAX: 814-355-2714; Empl.: 100; *Sls. Mgr.:* Thomas S. Hufnagel ..... **A•2020-2027**

Local Sales Offices & Reps

AZ	Phoenix, Eltron, Inc.	602-266-2164
CA	La Miranda, Select Elctrns.	714-739-8891
CA	Saratoga, EMS	408-446-3833
CT	New Haven, Masten-Wright, Inc.	203-288-1638
FL	Melbourne, Graham Assoc., Inc.	407-773-6631
FL	Palm Bch. Gdns., Graham Assoc., Inc.	407-662-4049
IL	Glenview, Crimson Engrg. Sls., Inc.	312-470-0024
IN	Indianapolis, Hi-Tek Sls.	317-887-2564
MA	Newton, NormellAssocs.,Inc.	617-969-5478
MN	Minneapolis, Peterson Sls. & Assocs.	612-835-5281
NY	Bellmore, Compar NY, Inc.	516-221-7300
NY	Lewiston, Watmet, Inc.	716-285-3595
PA	Lansdale, E.L. Assocs.	215-368-8000
TX	Dallas, Merino Sls. Co.	214-233-6002
WA	Bellevue, Mars	206-747-3292
Can	Niagara Falls, Waters Metal Prods., Ltd.	416-374-3050

Local Distributors

CA	Los Alamitos, Semi Dice, Inc.	213-594-4631
MD	Baltimore, RESCO	410-931-8200
NJ	Fairfield, Micross Comps.	201-227-8007
NJ	Red Bank, CHIPS, Inc.	908-758-1200
NY	Hauppauge, Jaco Elctrns.	516-273-5500
NY	Port Chester, Zeus Comps.	914-937-7400



FAX: 516-666-8039

STAVER CO., INC., 41 Saxon Ave./P.O. Box 220M, Bay Shore, NY 11706-9998, Tel: 516-666-8000; Empl.: 80; *Sls. Mgr.:* Pat Sullivan ..... **B•1119-1123**

Local Sales Offices & Reps

CA	Cathedral City, R D Sls. Corp.	619-324-5044
IL	Wheaton, RMP McBride Corp.	708-462-2500
IN	Sugar Grove, The Manx Co.	708-466-4200
MN	St. Paul, Proud Inds.	612-646-9428
NH	Hancock, Eisenbeis Sls.	603-525-4417
NY	East Northport, Levison Sls. Co.	516-266-5020
NC	New Hill, Tom G. Santel	919-362-4091
OR	Beaverton, Quest Mkgt.	503-641-7377
PA	Montgomeryville, Eastern Scientific Mktg.	215-368-4570
SC	Mauldin, Carl Hart Assocs.	803-288-2323
TX	Dallas, Innovative Tech. Sls.	214-669-3485
TX	Houston, Innovative Tech. Sls.	713-443-0331
WA	Renton, Quest Mkgt.	206-228-2660
WI	Colgate, RMP McBride Sls. Corp.	414-628-4016

STEINEL AMERICA, INC., 15317 Minnetonka Ind. Rd., Minnetonka, MN 55345, Tel: 800-852-4343, FAX: 612-931-3026; *Sls. Mgr.:* Nat Reidel; *Dist. Mgr.:* Jim Stangl

Local Distributors

IL	Addison, Len's Ace Hardware	708-543-8882
MA	N. Andover, Contact East	508-682-9844
MN	Bloomington, K.L. Tannehill, Inc.	612-881-6700
ND	Grand Forks, Acme Elctrc.	701-746-6481
OH	Akron, Philcap Elctrns.	216-253-2109
TX	Ft. Worth, Connector Micro Tooling	817-283-4882
WA	Seattle, Radar Elctrc.	206-282-2511

STEINWALL, INC., 7895 Ranchers Rd. NE, Minneapolis, MN 55432, Tel: 612-571-8202, FAX: 612-572-2031; Empl.: 61; *Sls. Mgr.:* Maureen Steinwall

STENNING INSTRUMENTS, INC., 604 Via Del Oerro, Camarillo, CA 93010, Tel: 805-484-4996, FAX: 805-484-5337; *Sls. Mgr.:* Charles Stenning

STEP ENGINEERING, P.O. Box 3166, Sunnyvale, CA 94088, Tel: 408-733-7837, TWX: 910-339-9506, FAX: 408-773-1073; Empl.: 50; *Sls. Mgr.:* Darrell Wilburn

STEPHENS ANALYTICAL, INC., 2750 Brabant-Marineau, Montreal, Que., CA H4S 1L1, Tel: 514-332-1230, FAX: 514-335-6566; Empl.: 12; *Sls. Mgr.:* Mr. Alan Lee

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Local Sales Offices & Reps

AZ	Phoenix, Silver Mountain Des.	602-266-7671
CA	Chatsworth, Western Component Sls.	818-882-6226
CA	San Carlos, Western Comp. Sls.-N.	415-594-1222
CO	Denver, Manufacturers Marketing Corp.	303-985-2008
FL	Clearwater, Tech-Rep Assoc., Inc.	813-572-9900
IL	Downers Grove, Rockford Controls Co.	708-960-2046
MD	Upperco, Imagitron Sales Co.	301-374-5600
MA	Lowell, Underwood Sales	508-256-8191
MI	Southfield, R.C. Nordstrom & Co.	313-559-7373
MN	St. Paul, Northstar Motion & Control	612-770-5311
NY	Clark Mills, KLM-Garner, Inc.	315-853-6126
NY	New Hyde Park, (Metropolitan) Sterling	516-328-3300
OH	Medina, Rockford Controls Ohio, Inc.	216-725-3705
TX	Richardson, Zonk & Associates	214-238-7651
WA	Seattle, Northmar Inc.	208-524-5170

STETCO, INC., 3344 Schierhorn Ct., Franklin Pk., IL 60131, Tel: 708-671-4208, FAX: 708-671-5270; FSC No.: 52763; Empl.: 45; *Sls. Mgr.:* Saul A. Gusaras

STETRON INTERNATIONAL, INC., 90 Broadway, Buffalo, NY 14203, Tel: 716-854-3443, FAX: 716-854-3448; Empl.: 70

STEVENS PRODUCTS, INC., 128 N. Park St., E. Orange, NJ 07019, Tel: 201-672-2140, FAX: 201-672-2837; Empl.: 50; *Sls. Mgr.:* Robert Cantilina

STEWARD, INC., E 36th st., P.O. Box 510, Chattanooga, TN 37401, Tel: 615-867-4100, FAX: 615-867-4102; Empl.: 250; *Sls. Mgr.:* Don Lepard; *Dist. Mgr.:* Steve Woods

STEWART CONNECTOR SYS., INC., R.D. No. 2 Box 2020, Glen Rock, PA 17327, Tel: 717-235-7512, TELEX: 4977105, FAX: 717-235-7954; Empl.: 196; *Dist. Mgr.:* T. Meighen, Dir. Mktg.(USA) A. McDonald, Dir. Mktg.(Europe) **C•1469**

Local Sales Offices & Reps

AL	Huntsville, Comps. Mktg. Svc.	205-881-6699
CA	Dana-Point, PCA	714-493-9822
CA	Santa Clara, Nova-Tronix	408-727-9530
CO	Boulder, Component Prod. Sls. Co., Inc.	303-530-2800
IL	Prospect Hgts., Comms. Equip.	708-506-9000
IL	St. Charles, XYZ Mktg.	708-584-3001
IN	Carmel, Valentine Assocs.	317-846-0008
KS	Parker, S.W. Assocs., Inc.	913-898-6552
MA	Tauton, Focus	508-824-3840
MI	Southfield, Carl H. Schmidt	313-353-6000
MN	Brooklin Center, Combined Sls.	612-566-2724
NJ	Franklin Lakes, Atlantic Tech. Comps., Inc.	201-337-2477
NY	Syracuse, Leonard D. Allen, Inc.	315-437-8387
NC	Charlotte, D.P. Riggins	704-375-7550
OH	Dayton, J.C. Hofstetter Co.	513-296-1010
OH	Medina, J.C. Hofstetter	216-725-6422
PA	Boswell, B.E. Gibson	814-629-6772
PA	Glen Rock, SCS	717-235-7512
TX	Dallas, JYSCO	214-349-1650
VA	Ashland, Glassock Assocs.	804-798-2125
WA	Issquah, Elctrns. Northwest, Inc.	206-557-0851
Can	Campden, Ont., Magden	416-563-5408

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CA	San Jose, Spectra Elctrns.	408-452-1590
IL	Lisle, Comps., Inc.	708-852-7707
MA	Ashland, Quality Comps.	508-881-6504
NH	Atkinson, AEI Astrum	603-898-3399

Stimpson Co. Inc.

FAX: 516-472-2425

STIMPSON COMPANY, INC., 900 Sylvan Ave., Bayport, NY 11705-1097, Tel: 516-472-2000; Empl.: 800; *Sls. Mgr.:* Edward J. Dewalters **C•1555**

Local Sales Offices & Reps

NY	Bayport, Stimpson Co., Inc.	516-472-2000
RI	Cranston, Stimpson Co., Inc.	401-461-7720

Local Distributors

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RI	Cranston, Stimpson Co.,Inc.	401-461-7720

ST KELTEC CORP., Subsidiary of Signal Technology Corp., 84 Hill Ave., Ft. Walton Beach, FL 32548, Tel: 904-244-0043, FAX: 904-664-0546; FSC No.: 09062; Empl.: 410; *Sls. Mgr.:* Alex Coronis

ST MICROSONICS CORP., Subsidiary of Signal Technology Corporation, 60 Winter St., Weymouth, MA 02188, Tel: 617-337-4200, FAX: 617-337-4208; FSC No.: 11869; Empl.: 80; *Sls. Mgr.:* Ken Lambert

ST MICROWAVE CORP., Sub. of Signal Technlg. Corp., 955 Benecia Ave., Sunnyvale, CA 94086, Tel: 408-730-6300, FAX: 408-245-3396,408-733-0254; FSC No.: 27338; Empl.: 208; *Sls. Mgr.:* Paul Thesing

STN INTERNATIONAL C/O CHEMICAL ABSTRACTS SERVICE, 2540 Olentangy River Road, Columbus, OH 43202-1505, Tel: 614-447-3600, TELEX: 810-482-1608, ESYLNK: 614-447-3713; Empl.: 1500; *Sls. Mgr.:* Tom Gornick

STOCK DRIVE PRODUCTS, a DSG Company, 2101 Jericho Tpke. Box 5416, New Hyde Pk., NY 11042-5416, Tel: 516-328-0200, 328-3300, TWX: 510-223-0642, FAX: 516-326-8827; Empl.: 228; *Sls. Mgr.:* Murray Ores

Local Sales Offices & Reps

AZ	Phoenix, Silver Mountain Des.	602-266-7071
CA	Chatsworth, Western Comp. Sls.	818-882-6226
CA	San Carlos, Western Comp. Sls. N.	415-594-1222
CO	Denver, Manufacturer's Mktg.	303-985-2008
FL	Clearwater, Tech-Rep Assoc., Inc.	813-572-9900
IL	Downers Grove, Rockford Controls Co.	708-960-2046
MD	Upperco, Imagitron Sls. Co.	301-374-5600
MA	Lowell, Underwood Sls.	508-256-8191
MI	Southfield, R.C. Nordstrom & Co.	313-559-7373
MN	St. Paul, Northstar Motion & Control	612-770-5311
NY	Clark Mills, KLM-Garner, Inc.	315-853-6126
NY	New Hyde Park, SDP	516-328-3300
OH	Medina, Rockford Controls Ohio	216-725-3705
TX	Richardson, Zonk & Associates	214-238-7651
WA	Seattle, Northmar Inc.	206-524-5170

STOCK MODEL PARTS, a DSG Company, 2101 Jericho Tpke. Box 5416, New Hyde Pk., NY 11042-5416, Tel: 516-328-3300, FAX: 516-326-8827

STOCKO CONNECTORS, Stocko Corporation, 495 Industrial Road, Carlstadt, NJ 07072, Tel: 201-933-4452, FAX: 201-933-4522; Empl.: 34; *Sls. Mgr.:* Rudolf Schindler **C•1470-1471**

Local Sales Offices & Reps

AL	Huntsville, E-Squared Mktg.	205-430-3000
CA	San Diego, Cetinske Sls. Co.	619-487-3335, FAX:619-673-0612
CA	Santa Clara, Nova-Tronix	408-729-9530
GA	Lawrenceville, E-Squared Mktg.	404-995-7206
GA	Marietta, E-Squared Mktg.	404-565-2088
KS	Olathe, G.M. Brown & Assocs.	913-829-3086, FAX:913-829-3274
MA	Norwood, Comp. Mktg. Svcs.	617-762-4339, FAX:617-769-8662
MI	Grand Rapids, J.M.J. & Assocs., Inc.	616-285-8887, FAX:616-285-7633
MO	Florissant, G.M. Brown & Assocs.	314-839-3600, FAX:314-839-3601
PA	Pittsburgh, KT Mktg.	412-367-1011, FAX:412-367-2153
TX	Burleson, Bounty Elctrns., Inc.	817-447-9775, FAX:817-447-9706

Local Distributors

MI	Wyoming, EC Elctrns.	616-530-0576, FAX:616-530-8598
MO	St. Charles, Heartland Elctrns.	314-928-6010, FAX:314-447-3416
NJ	Carlstadt, Stocko Connectors	201-933-4452, FAX:201-933-4522
OR	Beaverton, Murphy Elctrns.	503-642-2001
WA	Redmond, Murphy Elctrns.	206-881-1234

ST OLEKTRON CORPORATION, Subsidiary of Signal Technology Corp., 28 Tozer Rd., Beverly, MA 01915, Tel: 508-922-0019, FAX: 508-927-9328; FSC No.: ON8W8; Empl.: 105; *Sls. Mgr.:* Chuck Davis

All Locations for Compucon Distrs. Call 800-426-7746

ST OLEKTRON SYSTEMS, Signal Technology Corp., 61 Sutton Road, Webster, MA 01570, Tel: 508-943-7440, FAX: 508-949-1804; FSC No.: 32252; Empl.: 35; *Sls. Mgr.:* Bill Uffelman

STOLZBERG RESEARCH, INC., 3 Seabrook Court, Stony Brook, NY 11790-3305, Tel: 516-751-4277, 800-568-4634, FAX: 516-689-6671; Empl.: 4; *Sls. Mgr.:* Bruce Davis; *Dist. Mgr.:* Bruce Davis

STORM PRODUCTS CO., 116 Shore Drive, Hinsdale, IL 60521, Tel: 708-323-9121, FAX: 708-323-9398; FSC No.: 57500; Empl.: 72; *Sls. Mgr.:* Brian J. Holland

STRATOS PRODUCT DEVELOPMENT GROUP, 2025 First Ave., Ste PH-B, Seattle, WA 98121, Tel: 206-448-1388, FAX: 206-448-7830; Empl.: 28

STRAWBERRY TREE, INC., 160 S. Wolfe Rd., Sunnyvale, CA 94086, Tel: 408-736-8800, TELEX: 650 3172834 MCI, FAX: 408-736-1041; Empl.: 25

STRONGBOX, P.O. Box 2726, Culver City, CA 90231-2726, Tel: 310-305-8288, FAX: 310-305-1905; FSC No.: 2T043; Empl.: 5; *Sls. Mgr.:* Larry Martinek **C•1098-1099**

STRUTHERS-DUNN, INC. AND HI-G CO., INC., Lambs Rd., Pitman, NJ 08071-0901, Tel: 609-589-7500, ESYLNK: 622-87939, FAX: 609-589-2619,609-589-2094; FSC No.: 78290; Empl.: 467; *Sls. Mgr.:* Bruce E. Armstrong, V.P. **B•1606-1614**

Local Sales Offices & Reps

AZ	Scottsdale, BSE, Inc.	602-483-0373
CA	Los Angeles, RD&D	213-666-1611
CA	San Jose, Ruppert Sls. & Engrg.	408-998-8717
CO	W. Parker, W. Howard Assoc., Inc.	303-841-5755
CT	Bloomfield, Friedman	203-242-7781
FL	Orlando, Comp. Design Mktg.	407-352-5480
GA	E. Norcross, Advanced Comps. Mktg.	404-448-7025
IL	Downers Grove, Bob Burns & Assoc.	312-960-2046
IN	Ft. Wayne, TX Sls.	219-423-3422
IA	Cedar Rapids, Advanced Tech. Sls.	319-393-8280
KS	Olathe, Advanced Tech. Sls.	913-782-8702
LA	Lafayette, Fralia	318-269-9452
MD	Monkton, Imagitron Sls.	410-374-5600
MI	Southfield, TX Sls.	313-353-8210
MN	Minneapolis, Jay Borman	612-888-2122
MO	St. Louis, Advanced Tech. Sls.	314-878-2921
NJ	West Caldwell, Grimm, Siegel Assocs.	201-575-9300
NM	Albuquerque, B.S.E.	505-293-2582
NY	Buffalo, Tri-Tech	716-877-3677
OH	Cincinnati, Elctrn Comps.	513-729-1969
OH	Miamisburg, Elctrn. Comps.	513-866-3340
TX	Euless, W. Pat Fralia Co.	817-354-1144
WA	Bellevue, Eltech, Inc.	206-643-4330

Local Distributors

CA	Santa Ana, Norstan Elctrns., Inc.	714-540-4165
MO	Maryland Hgts., L Comp. Inc.	314-291-6200
NJ	Oakland, Relay Specialties, Inc.	201-337-1000
NY	Plainview, A.C.I. Elctrns.	516-293-6630
PA	Philadelphia, PEI/Genesis	215-673-0400
TX	Dallas, Associated Aircraft	214-331-4381

ST-SEMICONDUCTORS OF INDIANA, INC., 415 N. College Ave., P.O. Box 609, Bloomington, IN 47402-0609, Tel: 812-332-1435, FAX: 812-331-8706; Empl.: 100; *Sls. Mgr.:* Jim Davis; *Dist. Mgr.:* Jim Davis

SUBMARINE SIGNAL DIVISION, Raytheon Company, 1847 W. Main Road, Portsmouth, RI 02871, Tel: 401-847-8000, TELEX: 71-6817111, FAX: 401-847-2364; Empl.: 2,300

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Local Sales Offices & Reps

AZ	Phoenix, TM Entprs.	602-759-9650
AL	Athens, Effective Mktg. Force	205-233-2947
CA	Lacanada, KCP	818-790-1365
CA	Newport Beach, Qual Conn	714-851-6465
CA	Santa Clara, Nova-Tronix, Inc.	408-727-9530
CO	Wheatridge, Cluff & Assocs.	303-425-6604
FL	Palm Harbor, Bob Dean, Inc.	813-789-1233
GA	Lithia Springs, Effective Mktg. Force	404-948-6023
IL	Mt. Prospect, Dombrow Co.	708-253-3326
IN	Indianapolis, M & L Elctrn. Sls.	317-359-4742
IA	Marion, M-S-B Assocs.	319-377-6261
KS	Shawnee Mission, M-S-B Assoc.	913-432-2131
MD	Randallstown, Chesapeake Inds. Mktg.	410-653-0476
MA	Harvard, Cycle Sls.	508-456-6868
MN	Minneapolis, RK Sls. Assocs., Inc.	612-571-1001
MO	St. Louis, M-S-B Assocs., Inc.	314-772-2166
NY	Peconic, HLJ Comp-Tech	516-734-7784
NC	Lillington, Effective Mktg. Force	919-867-6221
OH	Dublin, Sls. Plus	216-942-7811
PA	Ft. Washington, SMC Inc.	215-628-3394
TX	Richardson, Comp. Partners	214-644-1288
WA	Camas, Elctrn. Mktg. Grp.	206-834-6548
WA	Redmond, Elctrn. Mktg. Grp.	206-882-0962
WI	Oconomowoc, Artmor Ltd.	414-367-8789

Local Distributors

AL	Birmingham, American Elctrn. Supp.	205-942-4656
AZ	Phoenix, Arizona Comps.	602-269-5655
AZ	Tempe, Cypress Elctrns.	602-966-2256
CA	Burbank, Atwater Elctrns.	818-841-9050
CA	City of Industry, Ital Elect Sls. Inc.	818-968-8515
CA	Costa Mesa, Cypress Elctrns.	714-549-2424
CA	Pasadena, Empire Elctrns.	213-681-2711
CA	San Diego, Cypress/RPS Elect.	619-535-0011
CA	San Jose, Sierra W. Elctrns.	408-945-1050
CA	Santa Clara, Cypress Elctrns.	408-980-2500
CA	Simi Valley, Lee Johnson Sls.	818-346-5412
CA	Woodland Hills, Cypress Elctrns.	818-710-7780
CO	Arvada, Denver Beta Wintronic	303-431-7161
CO	Engelwood, Cypress Elctrns.	303-792-5829
CO	Littleton, Indelco Inc.	303-795-3431
CT	Bridgeport, Millenium Elctrn. Sls.	203-372-2037
FL	Davie, Arco Distrs., Inc.	305-473-2550
FL	Miami, Electronic Equip. Co.	305-871-3500
FL	Winter Park, Deanco	407-671-5100
GA	Marietta, Deanco	404-429-0126
IL	Addison, Belford Elctrns.	708-691-1100
IL	Carol Stream, Lectro Comps.	708-690-0520
IL	Wheeling, Hawk Elctrns.	708-459-4030
IL	Wood Dale, NEP Elctrns.	708-595-8500
IN	Indianapolis, Advent Elctrns.	317-872-4910
IN	Indianapolis, Mar Elctrns., Inc.	317-633-6699
IA	Cedar Rapids, DEE Electrns.	319-365-7551
MD	Beltsville, Petricko Sls.	301-937-4960
MD	Gaithersburg, Axis Elctrns., Inc.	301-840-9640
MD	Gaithersburg, Deanco	301-948-5444
MD	Timonium, M X 4 Elctrns., Inc.	301-252-1192
MA	Canton, Richey/Impact Elect.	508-668-8200
MI	Farmington Hills, Advent Elctrns.	313-477-1650
MI	St. Claire Shore, Spemco	313-771-2700
MN	Bloomington, Bergquist Co.	612-835-2322
MN	Eden Prarie, Cypress Elctrns.	612-934-2104
MN	St. Paul, Kent/Shelley Ragon, Inc.	612-642-2828
MN	Thief River Fls., Digi-Key Corp.	218-681-6674
MO	Independence, Shelley-Ragon, Inc.	816-254-3410
NH	Atkinson, Astrum Elctrns.	603-898-3399
NJ	Bellmawr, Mid-Atlantic Elect.	609-931-5303
NJ	Fairfield, Deanco	201-575-7960
NM	Albuquerque, Electronic Parts	505-293-6161
NM	Las Cruces, Electronic Parts	505-523-4578
NY	Ithaca, Deanco	607-257-4444
NY	Peconic, Forejay Assocs.	516-734-7760
NY	Penn Yan, Advacom Technlg., Inc.	315-536-2221
NC	Fayetteville, Southeastern Elctrns.	704-523-1122
NC	Hickory, Southeastern Elctrns., Inc.	919-828-2311
OH	Cincinnati, Schuster Elec. Co.	513-489-1400
OH	Twinsburg, Schuster Elec. Co.	216-425-8134
OR	Portland, Dunn Elctrns.	503-285-0214
PA	McKean, Advacom	814-476-7774
PA	Wayne, Peak Elctrns.	215-293-9000
RI	Warwick, Cal-Greg Comps., Inc.	401-738-6170
TN	Knoxville, Indl. Elctrns., Inc.	615-573-7135
TN	Nashville, Randolph & Rice	615-255-5601
TX	Dallas, Off The Shelf	214-247-0052
TX	Dallas, Tactic Elctrns.	214-702-6111
TX	Garland, J & S Elctrns.	214-487-8808
TX	Houston, Kent/Shelley-Ragon	713-780-7770
TX	Irving, Cypress Elctrns.	214-255-0065
TX	Pflugerville, RSI	512-251-1161
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VA	Annandale, Arcade Elect. Inc.	703-256-4610
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WA	Seattle, Radar Elec.	206-282-2611
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SUMMAGRAPHICS CORP., 60 Silvermine Rd., Seymour, CT 06483, Tel: 203-881-5400, TELEX: 964348, FAX: 203-881-5367; Empl.: 185; *Sls. Mgr.:* Jim Whitney; *Dist. Mgr.:* George Poland

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SUNBANK ELECTRONICS, 1740 Commerce Way, Paso Robles, CA 93446, Tel: 805-238-2840, FAX: 805-238-0241; FSC No.: 07418; Empl.: 260; *Sls. Mgr.:* Patrick Banakis

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SUNRISE ELECTRONICS, INC., 524 S. Vermont Ave., Glendora, CA 91740, Tel: 818-914-1926, FAX: 818-914-1583; FSC No.: 64908; Empl.: 10; *Sls. Mgr.:* Joseph F. Petralia; *Dist. Mgr.:* Joseph F. Petralia

SUNSHINE INSTRUMENTS, 1810 Grant Ave., Philadelphia, PA 19115, Tel: 215-673-5600, 800-343-1199, FAX: 215-673-5609; Empl.: 30; *Sls. Mgr.:* M.L. Norton

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SUPERCOMIX INC., 261 Fifth St. East, St. Paul, MN 55101, Tel: 612-222-0046, FAX: 612-222-0049; Empl.: 15; *Sls. Mgr.:* C. Gallo; *Dist. Mgr.:* C. Gallo

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SUPERIOR ELECTRIC, Warner Electric, 383 Middle St., Bristol, CT 06010, Tel: 203-582-9561, FAX: 203-584-1483; FSC No.: 58474; Empl.: 500; *Sls. Mgr.:* John Hegel/James Hayden; *Dist. Mgr.:* Michael Miga/Michael Bonney ..... **A•2557; B•1308-1309; C•1475**

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SUPPORT SYSTEMS INTL. CORP., 150 South Second St., Richmond, CA 94804, Tel: 510-234-9090, TWX: 910-382-8130, FAX: 510-233-8888; Empl.: 30; *Sls. Mgr.:* Nola Sanders; *Dist. Mgr.:* Nola Sanders

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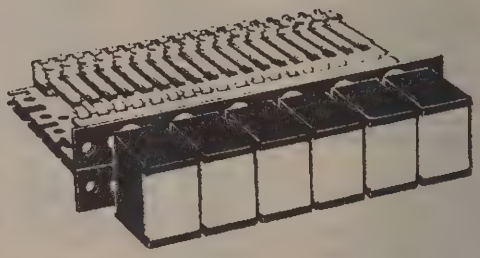

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SWITCHING SYSTEMS INTERNATIONAL, 500 Porter Way, Placentia, CA 92670, Tel: 714-996-0909, 800-992-7740; Empl.: 85; *Sls. Mgr.:* Guy Lacerte ..... **D•1938-1941**

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NY Rochester, Power Conversion Assocs. 716-426-3598
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SYLVANIA AUTOMOTIVE AND MINIATURE LIGHTING, Osram Sylvania, 275 W. Main St, Hillsboro, NH 03244, Tel: 603-464-5533, FAX: 603-464-0259; FSC No.: 88204; Empl.: 850; *Dist. Mgr.:* Tom Izbicki, Sls. Mgr. ..... **B•1190-1194**

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IL Skokie; I.R.I 708-967-8430
IN Ft. Wayne, R.O. Whitesell & Assocs. 219-432-5591
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IN Kokomo, R. O. Whitesell 317-457-9127
IA Cedar Rapids, R. W. Kunz 319-396-5386
KS Prairie Village, R.W. Kunz 913-648-3535
KY Versailles, R.O. Whitesell & Assocs. 606-873-1182
LA Covington, Cartwright & Bean 504-892-1780
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MI Grand Rapids, R.O. Whitesell & Assocs. 616-942-5420
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OH Cincinnati, R.O. Whitesell & Assocs. 513-528-5644
OH Cleveland, R.O. Whitesell & Assocs. 216-447-9020
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WA Bellevue, Electronic Sources Inc. 206-451-3500
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SYNERGY SEMICONDUCTOR CORPORATION, 3450 Central Expressway, Santa Clara, CA 95051, Tel: 408-730-1313, FAX: 408-737-0831

SYNETCOM DIGITAL INCORPORATED, 1426 Aviation Blvd. Ste. 101, Redondo Bch., CA 90278, Tel: 310-379-2000; Empl.: 5; *Sls. Mgr.:* Donald Laufer

SYNOPTICS, LTD., Paragon Towers, 233 Needham St, Newton, MA 02164, Tel: 617-527-4461, FAX: 617-527-4084; Empl.: 25; *Sls. Mgr.:* Barbara Finer; *Dist. Mgr.:* Barbara Finer

SYNTEST CORP., 40 Locke Dr., Marlboro, MA 01752-9973, Tel: 508-481-7827, FAX: 508-481-5769; Empl.: 26; *Sls. Mgr.:* Mitchell Corrigan ..... **D•1112**

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CA Murrieta, Mil-Com Sales, Inc. 714-677-2097, Fx:714-677-2096
CA San Diego, Mil-Com Sales, Inc. 619-275-0641, Fx:619-275-0641
FL Winter Pk., Carter Assocs. 407-678-5133, Fx:407-678-5251
IL Arlington Hgts., Coombs Assocs., Inc. 708-439-9810,Fx:708-593-1746
NJ Butler, General Technlgs. 201-492-1292, Fx:201-492-0051
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OH Centerville, EMA, Inc. 513-433-2800, Fx:513-433-3147
OH Cleveland, EMA Inc. 216-562-7498
TX Missouri City, C & L Assocs. 713-499-5541, Fx:713-499-5473
WI Milwaukee, Coombs Assocs. 414-351-6123, Fx:414-351-6154

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SYSTEC, INC., 3816 Chandler Dr., Minneapolis, MN 55421, Tel: 612-788-9701, FAX: 612-788-9502; Empl.: 15; *Sls. Mgr.:* Tom Thielen

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NH Merrimack, Wilson/Reilly Assoc. 603-673-9504
PA Philadelphia, Austek 215-924-6228
TX Denton, System General Corp. 817-565-9944

SYSTEMS ALTERNATIVES, 1705 Indian Wood Circle, Maumee, OH 43537, Tel: 419-891-1100, FAX: 419-891-1045; *Sls. Mgr.:* Mark Weihs

SYSTEMS DATA, INC., 2830 Copley Road, P.O. Box 4297, Akron, OH 44321, Tel: 216-666-0085, FAX: 216-666-7183; Empl.: 12; *Sls. Mgr.:* John C. Hall

SYSTEMS RESEARCH LABOROTORIES, Arvin/Calspan, 2800 Indian Ripple Rd., Dayton, OH 45440, Tel: 513-426-6000, FAX: 513-426-1984; FSC No.: 14590; Empl.: 1000; *Sls. Mgr.:* Frank Balogh, Jr.

SYSTEMS TESTING, INC., PO Box 242, Santa Clara, CA 95052, Tel: 408-727-0100, FAX: 408-496-0117; Empl.: 4; *Sls. Mgr.:* Frank J. Ardezzone

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SYSTRON-DONNER INERTIAL DIV., A BEI Electronics Company, 2700 Systron Dr., Concord, CA 94518, Tel: 510-671-6400, TWX: 910-481-9478, FAX: 510-671-6590; Empl.: 370

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TABER INDUSTRIES, 455 Bryant St., N. Tonawanda, NY 14120, Tel: 716-694-4000, 800-333-5300, FAX: 716-694-1450; Empl.: 100; *Sls. Mgr.:* Bernie W. Daube

3-D VISIONS, 2780 Skypark Dr., Torrance, CA 90505, Tel: 310-325-1339, FAX: 310-325-1505; Empl.: 8

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TACC INTERNATIONAL CORPORATION, Formulated Resins Grp., Air Station Inds. Pk., Rockland, MA 02370, Tel: 617-878-7015, TELEX: 952123, ESYLNK: 5106015650(TACC INTL CORP), FAX: 617-871-6727; Empl.: 70; *Sls. Mgr.:* Norman G. Harrington

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CA	Santa Ana, Technlg. Solutions	714-558-9562
CT	Bloomfield, Friedman Sls. Inc.	203-243-3122
CT	Farmington, SBX Sls. (FSI)	203-676-1880
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IL	Palatine, Technology Sls.	708-991-6600
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CA	Palo Alto, Power Source	415-856-0700
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FL	Altamonte Springs, TNR Tech.	800-346-0601
FL	Hialeah, Pro Battery Specs.	305-884-4040
FL	Jacksonville, Sunn Battery	904-353-6452
FL	Tampa, Micro Precision, Inc.	813-854-2816
GA	Decatur, ELS	800-334-5066
GA	Marietta, Synergistics	404-973-2200
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IL	Downers Grove, Telecomm. Dvcs.	708-971-3460
IL	Lisle, Jabro House of Batteries	708-964-9358
LA	Lafayette, Mark Avant Sls.	301-232-6609
MD	Gaithersburg, Pioneer Technlgs.(Corporate Ofc.)	301-921-0660
MA	Andover, Generation Elctrns.	508-683-1177
MA	Methuen, Generation Elctrns.	508-683-1177
MI	Grand Rapids, North Coast Comps.	616-452-0800
MI	Livonia, LWC Distrs.	313-464-7700
MN	Minneapolis, Unipower Corp.	612-884-2933
MN	St. Paul, D C Battery Prods.	612-646-7478
MN	St. Paul, Shelly Ragon(Corporate Ofc.)	612-642-2820
NY	Bohemia, Battery Assemblers	516-567-8855
NY	Commack, Bren-Tronics	516-499-5155
NY	Lynbrook, Dantona Inds., Inc.	800-326-8662
NY	Plainview, Micro Connections	516-993-1400
NY	Staten Island, Yakar Sys.	800-783-8181
NC	Pilot Mountain, Progressive Tech., Inc.	919-368-1375
NC	Winston Salem, Progressive Technlgs.	919-761-1375
OH	Cleveland, Pioneer Standard(Corporate Ofc.)	216-587-3600
OH	Columbus, Promark Elctrns.	614-351-2191
OR	Beaverton, Micro Power	503-626-7086
PA	Levittown, Aim Elctrns.	215-785-3500
PA	Richboro, Power Comps.	800-628-7029
TX	Ft. Worth, Tandy Consumer Mail	817-390-8273
TX	Houston, Bar-Tec	713-957-4717
TX	Houston, Kent Elctrns.	713-780-7770
TX	Richardson, Elect-A-Van	214-231-5351
TX	Spring, Jabro	713-367-9393
UT	Salt Lake City, Standard Supp. Co.	801-486-3371
Can	Alberta, Edmonton, Cardinal Elec., Ltd.	403-484-8926
Can	Burnaby, BC, Enercell	604-435-3666
Can	Calgary, AB, Cardinal Elctrns., Ltd.	403-259-6817
Can	Markham, Ont., Sernad	416-475-8500
Can	Richmond, BC, Enermax Batteries	604-270-0812
Can	Surrey, BC, Excell Battery Co.	604-591-6588

TA ENGINEERING CO., INC., 1605 School St., Moraga, CA 94556, Tel: 415-376-8500, FAX: 415-376-4977; Empl.: 12

TAIYO YUDEN (USA) INC., 714 W. Algonquin Rd., Arlington Heights, IL 60005-4493, Tel: 708-364-6104, FAX: 708-870-7828; Empl.: 63; *Sls. Mgr.:* Ken Keim

talema

FAX: 314-265-3350

TALEMA ELECTRONIC, INC., P.O. Box 306, Saint James, MO 65559, Tel: 314-265-5500; Empl.: 44; *Sls. Mgr.:* Jeff Goff **A•2566-2570**

Local Sales Offices & Reps

AL	Huntsville, Progressive Technlg.	205-551-7770
CA	Campbell, King-Way Assocs. Inc.	408-866-5010
CA	Tarzana, King-Way Assocs., Inc.	818-609-1974
CO	Grand Junction, Krebill Comp. Sls.	303-293-8220
IL	Wheaton, EMTronics, Inc.	312-665-6222
KS	Shawnee, Buckman & Assocs.	913-268-6917
MN	Minneapolis, RK Sls. Assocs., Inc.	612-571-1001
MO	St. Charles, Buckman & Assocs.	314-946-6201
NH	Hampton, Primary Source	603-926-8044
NY	Commack, R.C. Engrg. Sls.	516-543-3325
OR	Beaverton, Luscombe Engrg.	503-636-6664
RI	Warwick, Circuit-Pro, Inc.	401-738-7332
TX	Lewisville, Elctrn. Prod. Reps.	214-436-4772
WA	Bellevue, Luscombe Engrg.	206-643-1463
Can	Markham, Ont., Avotronics Ltd.	416-475-2024

TALIQ CORP., 1277 Reamwood Ave., Sunnyvale, CA 94089, Tel: 408-745-0750, FAX: 408-745-1820; Empl.: 100; *Sls. Mgr.:* Bob Simpson

TALTRONICS, Dimetrics, Inc., 404 Armour St., P.O. Box 339, Davidson, NC 28036, Tel: 704-892-8872, FAX: 704-892-4713; Empl.: 3000; *Sls. Mgr.:* Gene Sokolowski; *Dist. Mgr.:* Gene Sokolowski **D•1942-1943, 2313**

Local Sales Offices & Reps

CA	Sunnyvale, Peartech Ind.	408-732-1500
FL	Largo, Electrocraft	813-544-1766
NH	Nashua, Bennetron	603-880-7008
NJ	Medford, The McCoy Grp.	609-953-0770
NY	Jericho, J Squared Mktg.	516-935-3200
NC	Raleigh, Pinnacle Mktg.	919-848-0404
OK	Tulsa, Advance Tech. Sls.	918-664-0482
TX	Dallas, Advance Tech. Sls.	214-340-1300

TAMA ELECTRIC CO., LTD., See Raltron Electronics Corp.

tamura

FAX: 909-676-9482

TAMURA CORPORATION OF AMERICA, 43352 Business Park Dr., P.O. Box 892230, Temecula, CA 92589-2230, Tel: 909-699-1270; Empl.: 6000; *Sls. Mgr.:* Steve Fisher; *Dist. Mgr.:* Steve Fisher **A•1297-1299, 1610-1611, 2571-2579; D•1479, 1945-1955**

Local Sales Offices & Reps

AL	Huntsville, Electronic Mktg. Assoc.	205-880-8050
AZ	Scottsdale, Avtec/Earl & Assoc.	602-994-3813
CA	Marina Del Rey, Macro Rep Inc.	310-827-5120
CA	San Diego, Varigon San Diego, Inc.	619-576-0100
CA	Santa Clara, Technlg. Sls.	408-727-7200
CO	Golden, J. F. Hurlbut Co.	303-279-7796
CT	Marlborough, Precision Sls., Inc.	203-295-0580
FL	Deerfield Bch., Micro-Elec. Comps. Corp.	305-426-8944
FL	Largo, Micro-Elec. Comps. Corp.	813-393-5011
FL	Winter Springs, Micro-Elctrn. Comps.	407-366-1379
GA	Atlanta, Electronic Mktg. Assoc.	404-448-1215
IL	Park Ridge, Metcom Assoc., Corp.	708-696-1490
IN	Huntington, Elctrn. Reps Inc.	219-356-3513
IN	Indianapolis, Elctrn. Reps Inc.	317-894-1414
IA	Davenport, Rush & West	319-388-9494
KS	Olathe, Rush & West	913-764-2700
KY	Lexington, Elctrn. Reps Inc.	606-277-0436
MI	Livonia, Lowell-Wendt Mktg. Co.	313-464-2722
MI	Wyoming, Lowell-Wendt Mktg. Co.	616-791-7370
MN	Edina, Grayden & Flemmer	612-941-1120
MO	St. Louis, Rush & West	314-965-3322
NJ	Lodi, TRC Elctrns.	201-779-8282
NC	Raleigh, Elctrn. Mktg. Assoc.	919-847-8800
OH	Dayton, Dolfuss-Root & Co.	513-433-6776
OH	Westlake, Dolfuss-Root & Co.	216-899-9370
OH	Worthington, Dolfuss-Root & Co.	614-885-4844
PA	Allentown, TRC Elctrns.	215-264-4995
TX	Dallas, Marathon Assocs.	214-234-5686
TX	Freeport, Marathon Assocs.	409-233-7026
TX	Houston, Marathon Assocs.	713-495-6495
WA	Redmond, S.E.A. (Sls. & Engrg. Assoc.)	206-883-4999
WA	Vancouver, S.E.A. (Sls. & Engrg. Assoc.)	206-573-5161
WI	West Allis, Metcom Assocs. Corp.	414-476-1300
Can	Pointe Claire, Que., A.R. Gray & Assocs.	514-694-6378

Local Distributors

AL	Birmingham, American Elctrn. Supply	205-942-4656
CA	Manhattan Beach, Prime Electro Prods. Co.	213-379-3642
CA	Santa Clara, Foresight Elctrns.	408-980-9700
CA	Yorba Linda, Target Elctrns., Inc.	714-733-0384
CO	Littleton, Deltex, Inc.	303-779-1611
CO	Littleton, Displays Plus, Inc.	303-730-7333
FL	Palm Bay, Comp. Distrs., Inc.	407-724-9910
GA	Norcross, Applied Power Inc.	404-263-0421
IL	Glendale Hgts., Mac Gregor & Co., Inc.	708-469-4080
IL	Grove Vlg., Nu-Way Elctrns., Inc.	708-437-7120
IN	Indianapolis, Meunier Elctrns.	317-635-3511
LA	Houma, Control Genl.	504-872-9002
MD	Burtonsville, U.S. Elctrns., Inc.	301-384-3300
MD	Columbia, Vantage Comps.	410-720-5100
MI	Livonia, LWC Distrs.	313-464-7700
MN	Minneapolis, Acme Elctrns.	612-338-1016
MN	Minneapolis, Bergquist Co.	612-835-2322
MN	Minneapolis, Tortec Corp.	612-866-3662
MN	St. Paul, Power Mation	612-645-0781
MN	St. Paul, Power Motion	612-645-0781
MS	Jackson, Ellington Elctrn. Supp., Inc.	601-355-0561
NJ	Lodi, TRC Elctrns.	201-779-8282
NM	Albuquerque, Elctrn. Parts Co.	505-293-6161
NY	Syracuse, ADR Technlgs. Inc.	315-437-7087
OH	Centerville, Indl. Prods. Distbg., Inc.	513-435-2086
OH	Cincinnati, Schuster Elctrns., Inc.	513-489-1400
TX	Richardson, The Altair Co.	214-231-5166
TX	Stafford, Southwest Elctrns.	713-240-4000
TX	Tomball, Wofford Elctrns.	713-351-2255
WA	Redmond, Priebe Elctrns.	206-881-2363
WI	Mequon, Taylor Elec. Co.	414-241-4321
WI	Milwaukee, Progressive Image, Inc.	414-321-4722

T&W SYSTEMS, INC., See Versacad Computervision Personal CAD/CAM

TANE ALARM PRODUCTS, 247-40 Jericho Tpke., Flora Park, NY 11001, Tel: 516-328-3351, FAX: 516-326-9125 Empl.: 10; *Sls. Mgr.:* Tab Hauser; *Dist. Mgr.:* Sam Lurie

K.L. TANNEHILL INC., 1210 W. 96th St., Bloomington, MN 55431, Tel: 612-881-6700, FAX: 612-881-0743; Empl.: 21 *Sls. Mgr.:* James Falcone

TANSITOR ELECTRONICS, West Rd., P.O. Box 230 Bennington, VT 05201, Tel: 802-442-5473, TELEX 954007, FAX: 802-447-1297; FSC No.: 030266626; Empl.: 183; *Sls. Mgr.:* David Latchum; *Dist. Mgr.:* 225

TAPECON, INC., 10 Latta Rd., Rochester, NY 14612, Tel 716-621-8400; Empl.: 120; *Sls. Mgr.:* Joseph C. Pallone

TAPESWITCH CORP. OF AMERICA, 100 Schmitt Blvd Farmingdale, NY 11735, Tel: 516-694-6312, FAX: 516 694-6304; Empl.: 100; *Sls. Mgr.:* Ed Duhon

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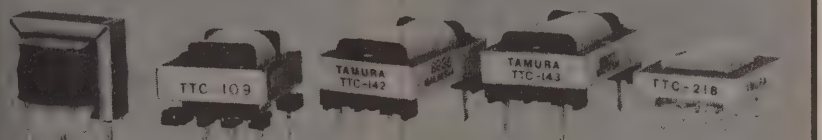
DELIVERS AC PRODUCTS FROM STOCK



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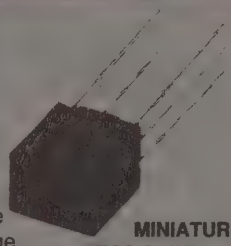
TELECOMMUNICATIONS TRANSFORMERS MEET FCC PART 68



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MINIATURE AUDIO & FCC PART 68 COUPLING

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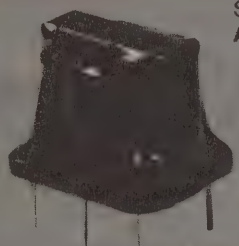
A•1610

COMMON MODE COILS



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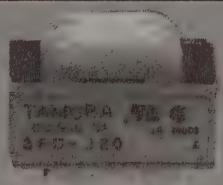
SCR/TRIAC TRIGGER TRANSFORMERS



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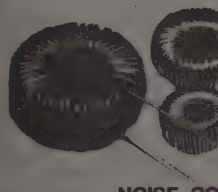
OEM PC BOARD POWER TRANSFORMERS



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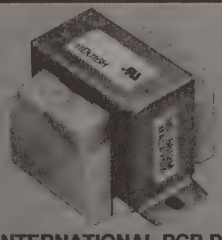
NOISE, COMMON MODE & POWER COILS



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LOW PROFILE PCB POWER TRANSFORMERS

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TELCOM CENTRAL OFFICE/PBX

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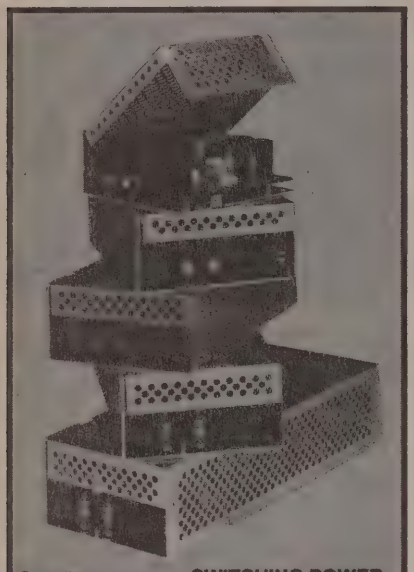
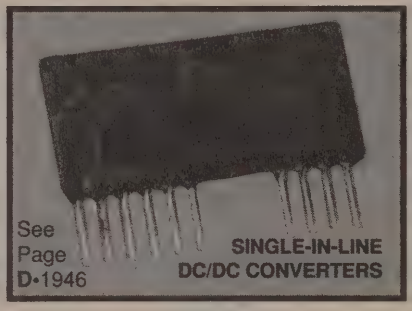
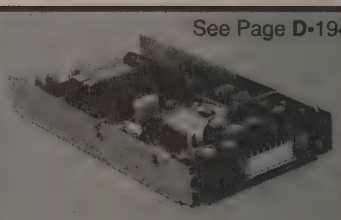


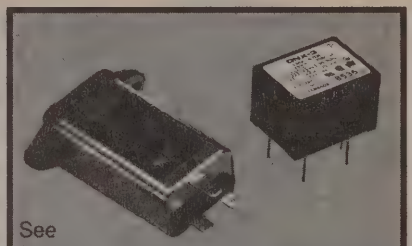
See Page D•1948
SWITCHING POWER SUPPLIES TO 400W



See Page D•1946
SINGLE-IN-LINE DC/DC CONVERTERS



See Page D•1949
1" HIGH, 85-264VAC, 50W SWITCHING POWER SUPPLIES



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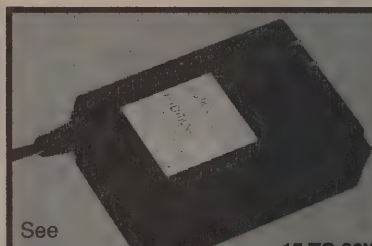
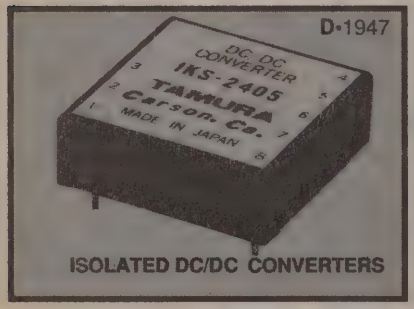
EMI/RFI LINE FILTERS



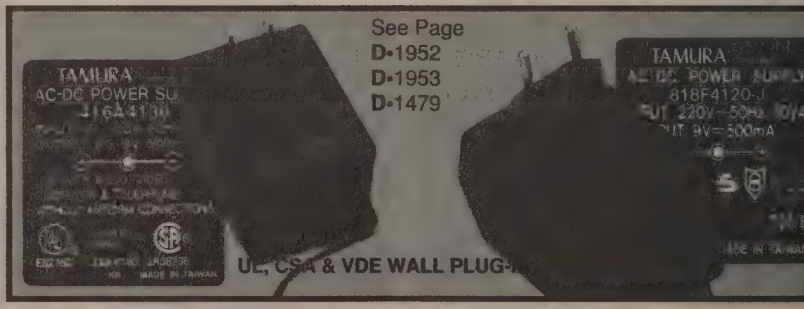
See Page D•1954
15 TO 30W SWITCH-MODE POWER

See Page D•1950, D•1951
SINGLE & MULTI-OUTPUT LINEAR POWER SUPPLIES

See Page D•1954
40 TO 60W TABLE TOP POWER SUPPLIES



D•1947
ISOLATED DC/DC CONVERTERS



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TARSAN ENG. INC., 1290 Old Bayshore Hwy., Burlingame, CA 94010, Tel: 415-348-8666, 800-284-8666, FAX: 415-348-2821; Empl.: 8; *Sls. Mgr.:* Arthur Lin

TATUM LABS INC., 1287 N. Silo Ridge, Ann Arbor, MI 48108, Tel: 313-663-8810, FAX: 313-663-3640; Empl.: 11

TAUBER

FAX: 619-274-2220

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Local Sales Offices & Reps

AL	Huntsville, Macro-Mktg.	205-883-9630
CA	Fullerton, Tauber Elctrns.	1-800-927-0004
CA	San Diego, Irv Korson-Mike Dione	619-274-7242
CA	Santa Ana, Carlos Gonzalez	1-800-927-0004
FL	Land-O-Lakes, AJ'S Power Source	813-996-2583
GA	Norcross, Marco Mktg.	404-662-5580
IL	Wheeling, Ed Joyner & Co.	708-520-1200
IA	Des Moines, Beams Co.	515-255-1148
KS	Shawnee Mission, Beams Co.	913-631-0300
MD	Laurel, Penn Star Elctrns.	301-854-2308

TAURUS CORPORATION, See Signal Research Inc.

TAURUS ELECTRONICS, INC., One Tupperware Dr., Ste. 13, N. Smithfield, RI 02895, Tel: 401-769-2625, FAX: 401-765-8455; Empl.: 10; *Sls. Mgr.:* Richard E. Schaffer

TAYLOR ELECTRONICS, INC., 401 West Orion, Tempe, AZ 85283, Tel: 602-838-4523, FAX: 602-838-7456; Empl.: 25; *Sls. Mgr.:* Sharon F. Hansen

TAYLOR INDUSTRIAL SOFTWARE, 10045 111 St., Ste. 1002, Edmonton, Alberta, Canada T5K 2M5, Tel: 403-482-7547, FAX: 403-488-8032; Empl.: 75; *Dist. Mgr.:* Carl Cooke, VP Sls. & Mktg.

T-BAR DATA SWITCH CORP., 12 Carcade Blvd., Orange, CT 06477, Tel: 203-795-0739, 800-726-8227, FAX: 203-795-8870; FSC No.: 14195; Empl.: 140; *Sls. Mgr.:* Gerard F. Ryan ..... **B•1814**

Local Sales Offices & Reps

AZ	Tempe, Cantec Sls., Inc.	602-345-1276
CA	Arcadia, Van Gott & Assocs.	818-445-9728
FL	Clearwater, Tech-Rep Assocs.	813-577-9370
MD	Gaithersburg, Carwithen Assocs.	301-921-9545
NY	E. Setauket, Eastern Metro Assoc.	516-928-2726
TX	Richardson, McCoy Assocs. Co.	214-864-1838
WA	Seattle, Datacom Assocs.	206-285-2525

Local Distributors

IL	Chicago, Newark Elctrns.	312-784-5100

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TDK CORPORATION OF AMERICA, Electronic Components & Material, 1600 Feehanville Drive, Mount Prospect, IL 60056, Tel: 708-803-6100, FAX: 708-803-6296; Empl.: 7,800; *Sls. Mgr.:* Tadashi Enami; *Dist. Mgr.:* Tadashi Enami (TDK Corp. of America)

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TEAM SYSTEMS, 2934 Corvin Dr., Santa Clara, CA 95051, Tel: 408-720-8877, FAX: 408-720-9643; Empl.: 6; *Sls. Mgr.:* Bill Nicklin

TEAM VISIONICS CORPORATION, 3071 De La Cruz Blvd., Ste. 108, Santa Clara, CA 95054, Tel: 408-562-0123, FAX: 408-492-1380; Empl.: 15

TEAPO ELECTRONIC CORP. OF AMERICA, 5550 Peachtree Inds. Blvd., Norcross, GA 30071, Tel: 404-449-6220, FAX: 404-447-1109,404-448-8584; Empl.: 1000; *Sls. Mgr.:* Michael Lin

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FAX: 312-342-0191

TECA, THERMOELECTRIC COOLING AMERICA CORP., 4048 W. Schubert Ave., Chicago, IL 60639, Tel: 312-342-4900; Empl.: 50 ..... **C•1644-1645**

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TECCOR ELECTRONICS, INC., 1801 Hurd Dr., Irving, TX 75038, Tel: 214-580-1515, TELEX: 79-1600; Empl.: 1250; *Sls. Mgr.:* Gerry Wiley, Sls. Mgr. VP ..... **A•2220-2223**

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AL	Huntsville, Interep Assocs.	205-881-1096
AZ	Mesa, System Sls. of Az.(SSA)	602-464-9989
CA	Meadow Vista, O'Donnell North	916-878-9087
CA	San Diego, O'Donnell Assocs.	619-578-1645
CA	San Jose, O'Donnell North	408-456-2950
CA	Torrance, O'Donnell Assocs.	310-781-2255
CO	Littleton, Harthun Assocs.	303-795-5545
CT	Guilford, S-J Connecticut	203-458-7558
FL	Boca Raton, Perrott Assocs. Inc.	407-362-0191
FL	Casselberry, Perrott Assocs. Inc.	407-830-0094
FL	Melbourne, Perrott Assocs. Inc.	407-676-0305
FL	Tampa, Perrott Assocs. Inc.	813-985-1900
GA	Norcross, Interep Assocs. Inc.	404-449-8680
IL	Itasca, Micro Sls.(MSI)	708-285-1000
IN	Huntington, Elctrn. Rep, Inc.	219-356-3513
IN	Indianapolis, Elctrn. Rep, Inc.	317-894-1414
IA	West Des Moines, SPS Assocs. Ltd.	515-225-0607
KS	Olathe, SPS Assocs. Ltd.	913-764-4460
KY	Lexington, Elctrn. REP, Inc.	606-277-0436
MA	Medfield, JEF Components	508-359-5501
MA	Still River, JEF Comps.	508-456-3369
MA	Wenham, S-J New England (Boston)	508-468-5057
MA	Worcester, S-J Assocs. Inc.	508-799-5409
MI	Farmington Hills, Rathsburg Assocs.	313-489-1500
MN	Minneapolis, ECS (Electric Comp. Sls.)	612-933-2594
MO	Earth City, SPS Assocs. Ltd.	314-291-0520
NJ	Mt. Laurel, S-J Mid Atlantic Inc.	609-866-1234
NM	Albuquerque, Sys. Sls. of NM (SSA)	505-889-2901
NY	Canandaigua, Bensman/Upstate Assocs.	716-396-2498
NY	Lewiston, Bensman/Upstate Assocs.	716-754-9155
NY	Rockville Centre, S-J Assocs. Inc.	516-536-4242
NC	Charlotte, Godwin Assocs.	704-549-8500
NC	Raleigh, Godwin Assocs.	919-878-8000
OH	Columbus, Rathsburg Assoc.	614-457-2242
OH	Independence, Rathsburg Assoc.	216-447-8825
OH	Miamisburg, Rathsburg Assocs.	513-434-1026
TN	Greenville, Interep Assocs. Inc.	615-639-3491
TX	Irving, Amir Jabin	214-580-1515
VA	Falls Church, S-J Chesapeake	703-533-2233
WA	Bothel, Quadra Sls.	206-489-3428
WI	Wauwatosa, Larsen Assocs.	414-258-0529
Can	Concord, Ont., Astec Comps.	416-669-4022

Local Distributors

AL	Huntsville, Hammond Elctrns.	205-830-4764
AZ	Phoenix, Arizona Comp. Co.	602-269-5655
CA	Hayward, Electro Comp. Distrs.	510-783-5800
CA	Santee, Mouser Elctrns.	619-449-2220
CA	Tustin, Added Value Elect. Distr. Inc.	714-259-8258
CT	Milford, Fleet Elctrns. Inc.	203-877-2577
CT	Wallingford, Greene-Shaw	203-265-3333
FL	Ft. Lauderdale, Hammond Elctrns.	305-973-7103
FL	Orlando, Hammond Elctrns.	407-849-6060
GA	Norcross, Hammond Elctrns.	404-449-1996
CO	Wheat Ridge, Added Value Rcky. Mtns.	303-422-1701
IL	Rosemont, Advent Elctrns. Inc.	708-298-4210
IN	Indianapolis, Advent Elctrns. Inc.	317-872-4910
IA	Cedar Rapids, Advent Elctrns. Inc.	319-363-0221
MD	Savage, Pyttronic Ind. Inc.	301-953-9650
MA	Newton, Greene-Shaw	617-969-8900
MI	Farmington Hills, Advent Elctrns. Inc.	313-477-1650
MN	Minneapolis, Stark Elctrns. Supp. Co.	612-332-1325
MN	St. Paul, Gopher Elctrns.	612-490-4907
MN	Thief River Falls, Digi-Key	800-344-4539
MO	St. Charles, Finnegan Elctrns.	314-946-6201
NE	Lincoln, Scott Elctrn. Supp.	402-466-8221
NJ	Bloomfield, Solid State Inc.	201-429-8700
NJ	Randolph, Mouser Elctrns.	201-328-3322
NM	Albuquerque, Bell Inds. of NM	505-292-2700
NY	Buffalo, Summit Elctrns.	716-887-2800
NY	Penn Yan, Advacom Inc.	315-536-2221
NC	Greensboro, Hammond Elctrns.	919-275-6391
OR	Portland, Radar Elec.	503-232-3404
PA	Export, Advacom Inc.	412-325-7551
PA	McKean, Advacom Inc.	814-476-7774
PA	Montgomeryville, Pyttronic Ind. Inc.	215-643-2850
SC	Greenville, Hammond Elctrns.	803-233-4121
TX	Carrollton, Omni Pro Intl. Inc.	214-713-9000
TX	Houston, Omni Pro Elctrns.	713-270-1700
TX	Mansfield, Mouser Elctrns.	817-483-4422
UT	West Valley City, Added Value (AVED)	801-975-9500
WA	Richland, Radar Elec. Co., Inc.	509-943-8336
WA	Seattle, Radar Elec. Co. Inc.	206-282-2511
WA	Spokane, Radar Elec.	509-747-3053
WI	Milwaukee, Marsh Elctrns. Inc.	414-475-6000
WI	Mukwonago, Advent Elctrns.	414-363-3249
Can	Calgary, Alberta, Cardinal Ind Elctrns.	403-259-6817
Can	Edmonton, Alberta, Cardinal IND Elctrns.	403-483-6266
Can	Montreal, Que, Electronic Wholesalers	514-769-8861
Can	Richmond, B C, Electro Sonic Inc.	604-273-2911
Can	Saskatoon, Sask., Cardinal Ind. Elctrns.	306-934-3443
Can	Willowdale, Ont., Electro Sonic Inc.	416-494-1666

TECH-ETCH, INC., 45 Aldrin Rd., Plymouth, MA 02360, Tel: 508-747-0300, TELEX: 989997, FAX: 508-746-9639; Empl.: 280; *Sls. Mgr.:* P. A. Thomas

TECH LABORATORIES INC., 500 10th St., Palisades Pk., NJ 07650, Tel: 201-944-2221, FAX: 201-944-1653; FSC No.: 83332; Empl.: 25; *Sls. Mgr.:* Nino M. Vlacich ..... **B•1815**

Local Sales Offices & Reps

CA	Canoga Park, C & W Compents Sls.	818-700-2684
CA	Mtn. View, Bridge Mktg.	415-965-8045
IL	Glenview, Crimson Engrg. Co.	312-470-0024
KS	Lenexa, Midtec Assocs.	913-541-0505
MI	Jackson, N. Scroggs Co.	517-750-1170
MO	St. Louis, Midtec Assocs.	314-275-8666
NJ	Whippany, Ken L. Love Assocs.	201-540-0204
NY	Hempstead, Ken L. Love Assocs.	516-681-3155
OH	Cincinnati, Patco	513-931-3311
SC	Myrtle Beach, Candor Co. Inc.	803-448-8361
TX	Dallas, Southwest Elctrns.	214-690-9881
TX	Houston, Southwest Elctrns.	713-729-1670

FAX: 310-827-2572

TECHMAR CORP., 4150-A Glencoe Ave., Marina Del Rey, CA 90292, Tel: 310-827-8897; FSC No.: 32597; Empl.: 8; *Sls. Mgr.:* Jeff Wilson ..... **C•1102-1104**

TECHMATION, INC., 2730 South Hardy, Ste. 5, Tempe, AZ 85282, Tel: 602-968-9946, FAX: 602-968-1849

TECHNAR, INC., See TRW Technar, Inc.

TECHNETICS CORPORATION, 6408 Castleplace Dr., Indianapolis, IN 46250, Tel: 317-842-5377, 800-467-8324; Empl.: 120; *Sls. Mgr.:* Michael L. Scherer

TECHNIC, INC., Box 9650, Providence, RI 02940-9650, Tel: 401-781-6100, TELEX: 927514, FAX: 401-781-2890; Empl.: 225; *Sls. Mgr.:* Andrew T. Ferris

TECHNICAL DEVICES, 560 Alaska Ave., Torrance, CA 90503, Tel: 310-618-8437, FAX: 310-618-1543; FSC No.: 04772; Empl.: 45; *Sls. Mgr.:* D. Murrin; *Dist. Mgr.:* D. Murrin

TECHNICAL DEVICES, 9181 N. Dixie Dr., Dayton, OH 45414, Tel: 513-890-7881, FAX: 513-890-5136; Empl.: 12 ..... **C•1813; D•1956-1957**

Local Sales Offices & Reps

AL	Huntsville, CMS	205-881-6699
AZ	Scottsdale, Western Region Mktg.	602-661-0093
CO	Westminister, Western Region Mktg.	303-428-8088
FL	Longwood, Larry Wood Sls. Agy. Inc.	407-774-2554
GA	Newman, CMS	404-304-0814
IL	Western Springs, Corlinear Reps.	708-784-1100
MI	Grand Rapids, J.M.J. & Assocs.	616-285-8887
MN	New Hope, Customer First	612-533-5604
NC	Durham, CMS	919-383-9448
OH	Cleveland, Tech. Dvcs.	216-975-1985
OH	Dayton, Tech. Dvcs.	513-890-6811
TX	Austin, Component Technlg.	512-288-7382
TX	Dallas, Component Technlg.	214-783-8831
TX	Houston, Component Technlg.	713-690-3011
UT	Salt Lake City, Western Reg. Mktg.	801-268-9768

TECHNICAL HEATERS, INC./THERMOLAB, 710 Jessie St., San Fernando, CA 91340, Tel: 818-365-9435, FAX: 818-361-2788; FSC No.: 09152

TECHNICAL MARKING SYS., See Autoroll Machine Corp.

TECHNICAL PANELS, INC., 1600 W. Acoma Blvd., 60, Lake Havasu City, AZ 86403, Tel: 602-680-9191, FAX: 602-680-9101; Empl.: 14

TECHNICAL RESEARCH & MFG., INC., See TRM, Inc.

TECHNICAL SERVICES FOR ELECTRONICS, INC., 108 5th Ave. N.W., P.O. Box 616, Arlington, MN 55307, Tel: 612-964-2237, FAX: 612-964-2465; Empl.: 300

TECHNICAL SERVICES LABORATORY INC., 95 Ready Ave., Ft. Walton Beach, FL 32548, Tel: 904-243-3722, FAX: 904-244-6653; FSC No.: 51283; Empl.: 12; *Sls. Mgr.:* Andrew J. Corbin

TECHNICAL WITTS, INC., 6319 W. Villa Theresa Dr., Glendale, AZ 85308, Tel: 602-439-1833, FAX: 602-439-1833; Empl.: 2; *Sls. Mgr.:* Ernest H. Wittenbreder

TECHNIPOWER

A SUBSIDIARY OF Penril DATACOMM NETWORKS inc

FAX: 203-797-9285

TECHNIPOWER, A PENRIL CO., P.O. Box 222, Commerce Pk., Danbury, CT 06813, Tel: 203-748-7001; FSC No.: 13850; Empl.: 85; *Sls. Mgr.:* Jack Schramm ..... **A•2565; D•1958-1959**

Local Sales Offices & Reps

AL	Huntsville, Rakes Engrg. & Mktg.	205-533-3763
CA	La Habra, Cygnus Sls. Engrg. Corp.	213-691-2993
CO	Parker, Technlg. Mktg. Assoc.	303-841-3435
MD	Owings Mills, Neal Deoul Assocs.	301-363-4311
MN	Minneapolis, Intertec Assocs.	612-921-8443
MO	St. Louis, AEM Inc.	314-298-9900
NJ	Flanders, K & R Engrg. Sls. Corp.	201-584-5235
PA	Pipersville, Yax Assocs.	215-766-2100
TX	Irving, Kite Elctrn.	214-986-0321
WA	Kirkland, NorthWest Comp. Sls.	206-828-2104
Can	Guelph, Ont., Victrix, Ltd.	518-836-1480
Can	Ontario, Cana Rep. Grp. Inc.	416-250-6683

Local Distributors

CA	Los Angeles, Cal-State Elctrns.	213-933-8187
CA	Oakland, N. A. D'Arcy	415-638-7773
CT	Bristol, M.L. Assocs., Inc.	203-589-2856
GA	Atlanta, Motion Elctrns.	404-455-8262
IL	Des Plaines, Delta Tech.Prods.	708-803-6070
IN	South Bend, PEI/Genesis	800-523-0727
MD	Baltimore, PEI/Genesis	301-529-2200
MA	Woburn, Abbott Elctrns. Co.	617-935-2040
MI	Dearborn, Industrial Temp. & Control	313-278-2210
MN	St. Paul, Gopher Elctrns. Co.	612-494-4900
NY	Albany, Adirondack Elctrns., Inc.	518-456-0203
NC	Charlotte, Jenkins Elec. Co.	704-392-7371
OH	Dayton, Wright Source	513-293-1341
OK	Tulsa, Inotek Corp.	918-627-1500
PA	Philadelphia, PEI/Genesis	215-673-0400
TX	Dallas, Inotek Corp.	214-243-7000
TX	Houston, Inotek Corp.	713-688-4494
Can	Guelph, Ont., Victrix Ltd.	519-836-1480

TECHNIQUES, INC., 235 Jackson St., Englewood, NJ 07631, Tel: 201-569-5900, FAX: 201-569-5615; Empl.: 60

TECHNI-TOOL, 5 Apollo Rd., Box 368, Plymouth Meeting, PA 19462, Tel: 215-825-4990, TELEX: 834-763, FAX: 215-828-5623; FSC No.: 30239; Empl.: 80; *Sls. Mgr.:* W. Bezar

Local Sales Offices & Reps

AZ	Mesa, Techni-Tool West	602-345-2700
CA	W. Covina, Electra-Tec	818-964-9772
FL	Ft. Pierce, Hyber-Sem	305-464-0461
NJ	Butler, Genl. Techn.	201-492-1292

TECHNITROL, 1952 E. Allegheny Ave., Philadelphia, PA 19134, Tel: 215-426-9105, FAX: 215-426-2836; FSC No.: 90095; Empl.: 900; *Sls. Mgr.:* G. Shilling ... **A•1580-1583**

Local Sales Offices & Reps

CA	Livermore, United Techn. Mktg.	415-449-7644
AZ	Phoenix, Detomasi & Grupp	602-947-3724
CA	Mission Hills, Detomasi & Grupp	818-365-8285
CA	Torrance, Detomasi & Grupp, Inc.	213-618-8898
CO	Grand Juction, Krebill Comp. Sls.	303-243-8220
AL	Huntsville, Advanced Comps. Mktg.	205-881-5493
GA	Norcross, Advanced Comps.Mktg.	404-448-7025
IL	Wauconda, Cudahy Sls.	708-526-2484
KS	Parker, S.W. Assocs.	913-898-6552
MD	Baltimore, Callas Elctrns.	301-744-7711
MO	St. Louis, S.W. Assocs., Inc.	314-576-4650
NM	Albuquerque, Quatra Assocs., Inc.	505-296-6781
NY	Jericho, J. Square Mktg.	516-935-3200
NY	Mendon, Tech-Mark, Inc.	716-624-3840
OH	Dayton, The Lyons Corp.	513-278-0714
FL	Seminole, Q-Rep	813-397-8431
OR	Tigard, Vantage Corp.	503-684-0422
PA	Easton, The Kendon Co.	215-253-3100
TX	Dallas, M-Rep	214-484-5711
UT	Sandy, Krebill Comp. Sls.	801-943-5311
WA	Bellevue, Vantage Corp.	206-455-3460

TECHNO DIVISION, DALE ELECTRONICS, 7803 Lemona Avenue, Van Nuys, CA 91405-1139, Tel: 818-781-1642, FAX: 818-781-8647; FSC No.: 69274; Empl.: 140; *Sls. Mgr.:* Pete Huber; *Dist. Mgr.:* Jon Trabert ..... **A•1916, 1925**

TECHNO-ISEL USA DIVISION, Designatronics, 2101 Jericho Tpke. - Box 5416, New Hyde Park, NY 11042-5416, Tel: 516-328-3970, TWX: 510-223-0642, FAX: 516-326-8827; Empl.: 85; *Sls. Mgr.:* Dr. George Klein; *Dist. Mgr.:* Dr. George Klein

TECHNOLOGY DESIGN INC., 10838 Main St., Bellevue, WA 98006, Tel: 206-455-9822, FAX: 206-455-3449; Empl.: 16; *Sls. Mgr.:* Larry Stapleton

TECHNOLOGY DYNAMICS inc.

FAX: 201-385-0702

TECHNOLOGY DYNAMICS INC., 100 School St., Bergenfield, NJ 07621, Tel: 201-385-0500; Empl.: 70; *Sls. Mgr.:* Mark S.Jacobus ..... **D•1574-1578, 2056-2057, 2070**

Local Sales Offices & Reps

AL	Huntsville, BCI	205-539-4411
CA	San Diego, Cirolia Elctrns. Sls.	619-743-3015
CA	Santa Clara, W. J. Elect Sls.	408-982-9222
FL	Clearwater, Tech-Rep Assoc.	813-872-9900
GA	Lawrenceville, BCI	404-962-6826
IL	Arlington Heights, Greenslade	708-593-3450
MD	Columbia, Delta III Assoc.	410-730-4700
MA	Topsfield, Whitehead Assoc.	508-887-8050
MN	Minneapolis, Tec Teams Sls.	612-854-6616
NM	Albuquerque, IMEC	505-275-0936
NY	Elmont, Crane & Egert	516-872-0800
NY	Fayetteville, Tri-Tech	315-446-2881
OH	Chagrin, J. J. Bair	216-543-8617
TX	Dallas, Tesco	214-553-1200
UT	Midvale, Christee	801-566-3694
WI	Wauwatosa, Greenslade Sls.	414-258-2727

TECHNOLOGY 80, INC., 658 Mendelssohn Ave. N., Minneapolis, MN 55427, Tel: 612-542-9545, FAX: 612-542-9785; Empl.: 25; *Sls. Mgr.:* Dennis Sherwood

TECHNO SCIENTIFIC INC., 60 Caster Ave., Woodbridge, Ont., Canada L4L 5Y9, Tel: 905-851-9958, FAX: 905-851-6314; FSC No.: 6635; Empl.: 20; *Sls. Mgr.:* Victoria McDonald

TECHRAND CORP. OF AMERICA, 6520 Schamber Dr., Muskegon, MI 49444, Tel: 616-798-2930, FAX: 616-798-2934; Empl.: 40; *Sls. Mgr.:* James Arter

TECHRON

FAX: 1-219-294-8329

TECHRON DIV., Crown Intl., Inc., 1718 W. Mishawaka Rd., Elkhart, IN 46517, Tel: 219-294-8300, TWX: 810-294-2160; FSC No.: 06306; Empl.: 600 ..... **D•1019-1021**

Local Sales Offices & Reps

CA	Laguna Hills, Elotek Sys., Inc.	714-830-4856
CA	Pleasanton, IFM Inc.	510-846-0762
CO	Commerce City, Williams Assocs.	303-289-5647
CT	Woodbridge, Electronic Marketing Assoc.	203-397-1461
FL	Melbourne, Reynolds & Assocs., Inc.	407-259-7000
IL	Arlington Hgts., Berndt Assocs., Inc.	708-632-0900
MI	Livonia, Lowell-Wendt Mktg. Co.	313-464-2722
NY	Syracuse, Labtronics Inc.	315-455-7314
OH	Brecksville, Audio Mktg. Assoc.	216-526-2426
PA	Montgomeryville, Eastern Sci-Mktg.	215-368-4570

TECH SPRAY, INC., Box 949, Amarillo, TX 79105, Tel: 806-372-8523, TELEX: 738450, FAX: 806-372-8750; Empl.: 70; *Sls. Mgr.:* Gerald Winters

TECHTROL CYCLONETICS, INC., 815 Market St., New Cumberland, PA 17070, Tel: 717-774-2746, FAX: 717-774-6799; FSC No.: 58792; Empl.: 15; *Sls. Mgr.:* James M. Griffith

TECKNIT, 129 Dermody St., Cranford, NJ 07016, Tel: 908-272-5500, TELEX: 6853079 TCKNT, FAX: 908-272-2741; FSC No.: 07700; Empl.: 225; *Sls. Mgr.:* Joseph Barbuto

TECLAB, Kalamazoo Technical Furniture, P.O. Box 1165, Kalamazoo, MI 49005, Tel: 616-372-6000, 800-832-5227, FAX: 616-372-6116; Empl.: 35; *Sls. Mgr.:* B. Smith ..... **C•1105**

TECNETICS, See Computer Products, Inc.

TECNETICS INC., 6287 Arapahoe Ave., Boulder, CO 80303, Tel: 303-442-3837, FAX: 303-444-9437; Empl.: 120; *Sls. Mgr.:* Paula Guadiana

Refer to Tecnetics Inc. 6287 Arapaho Ave. Boulder, CO 80303

TECO CORP., Bay Rd., P. O. Box A, Winnisquam, NH 03289, Tel: 603-524-1998, FAX: 603-524-1899; Empl.: 30; *Sls. Mgr.:* Sandra Murphy

TECTROL INC
SWITCHING POWER PRODUCTS

FAX: 416-638-0553

TECTROL, INC., 39 Kodiak Cres., Downsview, Ontario, Canada M3J 3E5, Tel: 416-630-8108; Empl.: 450; *Sls. Mgr.:* Paul Carroll ..... **D•1960-1964**

Local Sales Offices & Reps

CA	Granada Hills, Plustronics	818-995-8908
CA	Newport Beach, Plustronics	714-476-8009
CA	San Diego, Mesa Comps.	619-278-8021
CO	Denver, Seale & Assoc., Inc.	303-695-1980
CA	Cupertino, PEI Sls. Assoc.	408-253-1960
IN	Columbus, High-Tech Assocs.	812-378-4835
CT	Bloomfield, Zaslow Sls.	203-242-7781
MA	Natick, Zaslow Sls.	508-393-8150
MN	S.St. Paul, Northport Engrg., Inc.	612-457-8000

NY Albany, Lynn Assocs. 518-459-1239
NY Buffalo, Lynn Assocs. 716-631-0054
NY Ronkonkoma, PMR 516-467-8200
NC Raleigh, VMI 919-870-7123
OH Dayton, Tech. Dvcs. 513-890-6811
OK Tulsa, Tectrol Inc. 918-234-2440
OR Tigard, Rep-West 503-639-0325
PA Pittsburgh, Lynn Assocs. 412-443-3670
TX Arlington, T-Tech Sls. 817-274-0505
WA Seattle, Rep-West 206-283-8351
Can Downsview, Ont., Tectrol Inc. 416-630-8108

Local Distributors

CA Santa Clara, Foresight Elctrns. 408-980-9700

TEGAM, INC., 7230 North Ridge Rd., Madison, OH 44057, Tel: 800-666-1010, FAX: 216-428-1068; Empl.: 50; *Sls. Mgr.:* Terry Gambill

TEKA an Interplex Industries company

FAX: 401-461-2310

TEKA INTERCONNECTION SYSTEMS, Interplex Industries, 45 Salem Dr., Providence, RI 02907, Tel: 401-785-4110; Empl.: 89; *Sls. Mgr.:* Barry Manchester; *Dist. Mgr.:* Barry Manchester ..... **C•1484-1489**

Local Sales Offices & Reps

AZ Tempe, Spectrum Assocs. S.W. Inc. ... 602-966-1788
CA Downey, Management Mktg. & Sls. ... 213-560-5584
CA Fullerton, Kent Elctrns. 714-773-0781
CA Pleasanton, Leddy Assocs., Inc. 510-417-1033
CA San Diego, Kent Elctrns. 619-271-5404
CA San Diego, Qualtronics 619-695-0118
CO Boulder, R.G. Entprs., Inc. 303-447-9211
FL Orlando, Werndli & Assocs. 407-851-1923
GA Marietta, Quality Mktg. 404-565-5578
IL Barrington, Bill Walthall & Assocs. 708-381-3177
MN Wayzata, Cardinal Sls. 612-475-0041
NY Hauppauge, Sticom Sls. & Mktg. 516-366-4221
NJ Mt. Laurel, WYCK Mktg. 609-727-1070
OH Cincinnati, Century Tech. Sls. 513-677-5088
OR Beaverton, Norwest Inteconnect Sys. 503-690-7120
RI Lincoln, Global Technical Sls. Inc. 401-334-3830
TX Austin, Mil-Rep Assocs. 512-346-6331
TX Houston, Mil-Rep Assocs. 713-444-2557
TX Richardson, Mil-Rep Assocs. 214-644-6731
EXP Huntington Beach, Intercation Inc. 714-636-3722
Can St. Laurent, Que., HHR Electro 514-739-7054

Local Distributors

CA Hayward, KEA Elctrns. 415-887-2900
CA Irvine, Mann Southwest 714-380-4170
CA San Diego, Deco 619-693-1595
CA San Jose, Compass Comp. 408-432-7575
CA San Jose, Spectra Elec. 1-800-252-1590
CA San Jose, Turbo Elctrns. 408-441-6616
CA Santa Ana, Norstan Elctrns. 714-540-4165
CA Santa Clara, Kent Elec. 408-727-9810
CA Sunnyvale, PSC Elctrns. 408-737-1333
FL Largo, Elctrn. Precepts of FL. 1-800-367-4649, 813-544-3636
MA Methuen, Aved Elctrns. 508-688-3800
MI Fraser, Madison Elctrns. 313-294-8300
MN St. Paul, Kent Elctrns. 612-642-2844
NJ Cherry Hill, Jetta Corp. 609-663-7272
NJ Whippany, American Distrs. Inc. 201-428-0510
NY Farmingdale, Pride Elctrns. 516-293-4020
NY Ronkonkoma, Conco Elctrns. 516-467-8200
NC Raleigh, Resco Raleigh 919-781-5700
OH Centerville, I.P.D., Inc. 513-435-2086
RI Warwick, Cal-Greg-Comps. 401-738-6170
TX Allen, Prime Distbn. 214-231-0170
WA Redmond, Kent Elctrns. 206-241-1980
Can Burlington, Ont., Alternate Source Comp. 416-335-6385

TEKNATIONAL INDS., INC., 430 S. Clinton Ave., Rochester, NY 14620-1103, Tel: 716-232-1291, FAX: 716-232-1295; FSC No.: 24227; Empl.: 15; *Sls. Mgr.:* J. D. Hochheimer

TEKNOR MICROSYSTEMS INC., 31 Blvd. de la Seigneurie Est., Ste. 107, Blainville, Que., CAN J7G 4G6, Tel: 514-437-5682, 800-387-4222, FAX: 514-437-8053; Empl.: 32; *Sls. Mgr.:* Pierre McMaster

TEKTONE SOUND & SIGNAL, 1331 S. Killian Dr., Lake Park, FL 33403, Tel: 407-844-2383, FAX: 407-845-1587; FSC No.: 59-1500771; Empl.: 70; *Sls. Mgr.:* David Duelfer; *Dist. Mgr.:* David Duelfer

TEKTRONIX, INC., P.O. Box 1000, Wilsonville, OR 97070, Tel: 800-835-9433, TWX: 910-467-8708; FSC No.: 80009; Empl.: 12,500

TEKTRONIX, INC., Display Products, P.O. Box 500 M/S 46-943, Beaverton, OR 97077, Tel: 503-627-5000, FAX: 503-627-1070

TEKTRONIX-SIGNAL ANALYSIS UNIT, 3003 Bunker Hill Ln, PO Box 58086, Santa Clara, CA 95052-8086, Tel: 408-496-0960, FAX: 408-496-6108

TELCO INTERCONTINENTAL CORPORATION

FAX: 713-859-8825

TELCO INTERCONTINENTAL CORP., TECO, 9812 Whithorn Dr., Houston, TX 77095, Tel: 713-855-2218; Empl.: 13; *Sls. Mgr.:* Ruth Haber ..... **B•1311; C•1490-1491**

Local Sales Offices & Reps

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CA Mountain View, Bridge Mktg. 415-965-8045
CA San Jose, Mc Farland Assoc. 408-993-0200, FAX:408-993-0123
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IL Chicago, Rendell Sls. 312-539-1820
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MA Northborough, Easterly Sls. 508-393-7399
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NJ Sussex, Carbone Assoc. 201-875-1882, FAX:201-875-2685
NY Glen Cove, DynoRep 516-676-1598
OH Worthington, R J Mktg. 614-888-7638
PA Willow Grove, Tech Sls. Assocs. 215-784-0170
TX Austin, Sunbelt Comps. 512-335-0499, FAX:512-331-1351
TX Burleson, Bounty Elctrns. 817-447-9775
TX Dallas, Sunbelt Comps. 214-248-8000, FAX:214-248-8100

TELEBYTE TECHNOLOGY, INC., 270 East Pulaski Road, Greenlawn, NY 11740, Tel: 516-423-3232, 800-835-3298, FAX: 516-385-8184; Empl.: 48; *Sls. Mgr.:* J. Kramer; *Dist. Mgr.:* R. Nazario

TELECOMMUNICATIONS TECHNIQUES CORP., 20410 Observation Drive, Germantown, MD 20876, Tel: 301-353-1550, FAX: 301-353-0734

TELECTRO SYSTEMS CORP., 96-18 43rd Ave., Corona, NY 11368, Tel: 718-651-8900, TWX: 510-601-8607 TELECTRO, FAX: 718-651-4103; FSC No.: 30040; Empl.: 50; *Sls. Mgr.:* Harry Sussman

TELE-DENKEN RESOURCES, INC., 7702 FM 1960 East, Humble, TX 77346, Tel: 713-852-5366, TELEX: 4949653, FAX: 713-852-3869; *Sls. Mgr.:* Gary Killian; *Dist. Mgr.:* Gary Killian

TELEDYNE COMPONENTS, 1300 Terra Bella Ave., PO Box 7267, Mountain View, CA 94039-7267, Tel: 415-968-9241, FAX: 415-967-1590; FSC No.: 15818; Empl.: 200; *Sls. Mgr.:* Robbie Izat; *Dist. Mgr.:* Nancye R. Beck, Worldwide Distr. Sls. Mgr.

TELEDYNE GURLEY, 514 Fulton St., P.O. Box 88, Troy, NY 12181, Tel: 518-272-6300, 800-759-1844, TWX: 710-443-8156, FAX: 518-274-3660; *Sls. Mgr.:* G. S. Gordon

TELEDYNE KINETICS, Div. of Teledyne, Inc., 8650 Balboa Ave., San Diego, CA 92123-1502, Tel: 619-576-1005, FAX: 619-576-0607; FSC No.: 06928; Empl.: 100; *Sls. Mgr.:* Peter Kurbikoff

TELEDYNE MICROELECTRONICS, 12964 Panama St., Los Angeles, CA 90066, Tel: 310-822-8229, 310-305-0248, TWX: 910-343-7436, FAX: 213-305-0248; FSC No.: 16170; Empl.: 912; *Sls. Mgr.:* W. Kennedy

TELEDYNE MICROWAVE, 1290 Terra Bella Ave., Mountain View, CA 94043, Tel: 415-968-2211, FAX: 415-966-1521; FSC No.: 24022; Empl.: 200; *Sls. Mgr.:* M. Lee

TELEDYNE PENN-UNION, Solderless Connector Div., One Riverside Dr., Ansonia, CT 06401, Tel: 203-732-7025, TELEX: 963408, ESYLNK: 62877180, FAX: 203-732-0831; FSC No.: 19724; *Sls. Mgr.:* Bob O'Keefe

TELEDYNE PENN-UNION, 229 Waterford St., Edinboro, PA 16412, Tel: 814-734-1631 Ext. 382, FAX: 814-734-4946; *Sls. Mgr.:* Chuck Malay

TELEDYNE RELAYS

FAX: 213-779-9161

TELEDYNE RELAYS, Teledyne, Inc., 12525 Daphne Ave., Hawthorne, CA 90250, Tel: 213-777-0077; FSC No.: 11532; *Sls. Mgr.:* Tom Garland ..... **B•1616-1623**

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CA San Diego, Westrep 619-674-1880, FAX:619-674-1878
CA San Jose, Meridian-West 408-927-6377, FAX:408-927-6378
CO Englewood, Thorson Rocky Mtn., Inc. 303-773-6300,FAX:303-773-6302
CT Stratford, VISTAssociates, Inc. 203-375-5456, FAX:203-375-6907
FL Longwood, Teledyne Relays 407-682-9044, FAX:407-682-7644
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GA Norcross, Elcom ... 404-447-8200,FAX:404-447-8340
IL Bloomingdale, Teledyne Relays 708-529-1060, FAX:708-529-1120
IN Indianapolis, Leslie M. Devoe Co. 317-842-3245, FAX:317-845-8440
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KS Olathe, C-Tron 913-780-3796,FAX:913-780-3007
MD Towson, Arbotek Assocs., Inc. 410-825-0775, FAX:410-337-2781
MA Marlborough, VISTAssociates, Inc. 508-481-9277, FAX:508-460-1869
MN Eden Prairie, Stan Clothier Co. 612-944-3456, FAX:612-944-6904
MO St. Louis, Rothkopf & Assocs., Inc. 314-961-4485, FAX:314-961-4736
NJ Cherry Hill, Vantage Sls. 609-424-6777, FAX:609-424-8909
NJ Montville, Teledyne Relays 201-299-7667, FAX:201-299-6998
NM Albuquerque, Reptronix 505-292-1718, FAX:505-299-1611
NY Mount Vernon, Friedman-Smith Elctrns. 914-664-4866,FAX:914-664-4928
NY Syracuse, Hotze & Murcan Assocs. 315-455-8807, FAX:315-455-8810
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OH Dayton, J.C. Hofstetter Co. 513-296-1010, FAX:513-296-1274
OH Medina, J.C. Hofstetter Co. 216-241-4880, FAX:216-725-4471
OR Beaverton, Tekrep Inc. 503-626-3759, FAX:503-626-3759
PA Hickory, J. C. Hofstetter Co. 412-356-2305, FAX:412-356-7303
TX Austin, Kruvand Assocs., Inc. 512-219-9441, FAX:512-219-1932
TX Dallas, Kruvand Assocs., Inc. 214-437-3355, FAX:214-680-8854
UT Salt Lake City, Thorson Rocky Mtn. 801-942-1683, FAX:801-942-1694
VA Hawthorne, Teledyne Relays 213-777-0077, FAX:213-779-9161
WA Gig Harbor, Tekrep, Inc. 206-884-5050, FAX:206-884-3170
Can Mississauga, Ont., G.M.A. 416-671-8111, FAX:416-671-2422

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CA San Jose, Milgray/San Jose 408-456-0900, FAX:408-456-0300
CA Sunnyvale, Time Elctrns. 408-734-9888, FAX:408-734-1719
CA Tustin, Time Elctrns. 714-669-0100, FAX:714-544-2526
CA Woodland Hills, Time Elctrns. 818-593-8400, FAX:818-593-8484
CO Englewood, Time Elctrns. 303-721-8882, FAX:303-796-0324
CT Milford, Milgray/Conn. 203-878-5538, FAX:203-878-6970
CT Norwalk, Pioneer/Connecticut 203-853-1515, FAX:203-838-9901
FL Altamonte Springs, Pioneer/Altamonte Spgs. 407-834-9090,FAX:407-834-0865
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FL Deerfield Beach, Pioneer/Deerfield Beach 305-428-8877,FAX:305-481-2950
FL Ft. Lauderdale, Time Elctrns. 305-484-7778, FAX:305-484-7880
FL Orlando, Time Elctrns. 407-841-6565, FAX:407-648-0814
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GA Norcross, Time Elctrns. 404-368-0969, FAX:404-368-0970
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MI Grand Rapids, Pioneer Western Mich. 616-698-1800,FAX:616-698-1831
MI Livonia, Pioneer/Mich. 313-525-1800, FAX:313-427-3720
MN Eden Prairie, Pioneer/Twin Cities 612-944-3355, FAX:612-944-3794
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MO Manchester, Time Elctrns. 314-230-7500, FAX:314-391-8603
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PA Horsham, Pioneer/Horsham 215-674-4000, FAX:215-674-3107
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WI Brookfield, Pioneer/Wisconsin 414-784-3480, FAX:414-784-8207
Can Mississauga, Ont., Milgray/Toronto 416-678-0958, FAX:416-678-1213
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Can Pointe Claire, Milgray/Montreal 514-426-5900, FAX:514-426-5836

TELEDYNE ROTOLITE, P.O. Box 398, Owen, WI 54460, Tel: 800-524-0105, FAX: 715-229-2124; *Sls. Mgr.:* Harry Brebaugh

TELEDYNE RYAN ELECTRONICS, 8650 Balboa Ave., San Diego, CA 92123, Tel: 619-560-6400, TELEX: 695-028, TWX: 910-335-1174, FAX: 619-560-1147; Empl.: 250; *Sls. Mgr.:* J.E. Wallin

TELEDYNE SOLID STATE

FAX: 213-779-9161

TELEDYNE SOLID STATE, 12525 Daphne Ave., Hawthorne, CA 90250, Tel: 213-777-0077; FSC No.: 63745; *Sls. Mgr.:* Tom Garland ..... **B•1616-1623**

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CA Tustin, Time Elctrns. 714-669-0100, FAX:714-544-2526
CA Woodland Hills, Time Electronics 818-593-8400, FAX:818-593-8484
CO Englewood, Time Elctrns. 303-721-8882, FAX:303-796-0324
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CT Norwalk, Pioneer/CT 203-853-1515, FAX:203-838-9901
FL Altamonte Spgs., Pioneer/Altamonte Spgs. 407-834-9090,FAX:407-834-0865
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MD Columbia, Time Elctrns. 301-964-3090, FAX:301-964-9274
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MO Manchester, Time Elctrns. 314-230-7500, FAX:314-391-8603
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NJ Fairfield, Pioneer/New Jersey 201-575-3510, FAX:201-575-3454
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NJ Marlton, Time Elctrns. 609-596-6700, FAX:609-596-4555
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NY Farmingdale, Milgray/New York 516-391-3000, FAX:516-420-0685
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NY Pittsford, Milgray/Upstate New York 716-381-9700,FAX:716-381-9495
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UT West Valley, Time Elctrns. 801-973-8494, FAX:801-973-7418
WA Kirkland, Time Elctrns. 206-820-1525, FAX:206-820-1088
WI Brookfield, Pioneer/Wisconsin 414-784-3480, FAX:414-784-8207

Can Mississauga, Ont., Milgray/Toronto 416-678-0958, FAX:416-678-1213
Can Mississauga, Ont., Time Elctrns. 416-672-5300, FAX:416-672-5304
Can Pointe Claire, Que., Milgray/Montreal 514-426-5900,FAX:514-426-5836

TELEDYNE THERMATICS, Teledyne Inds., Inc., P O Box 909, Elm City, NC 27822, Tel: 919-236-4311, ESYLNK: 62877220, FAX: 919-236-3613; FSC No.: 12515; Empl.: 400; *Sls. Mgr.:* Harry Helmer; *Dist. Mgr.:* Ed Rattie

TELEFUNKEN, See AEG Corp.

TELEGENIX/GRIM AN INDUCTOTHERM COMPANY

FAX: 609-424-2022

TELEGENIX/GRIM CORP., P.O. Box 5550, Cherry Hill, NJ 08034, Tel: 609-424-5220; Empl.: 125; *Dist. Mgr.:* Ray Madonna ..... **D•1074-1075**

Local Sales Offices & Reps
VA Fairfax, GRIM Corp., Govt. Sls. 703-934-4615

Local Distributors
NJ Cherry Hill, Telegenix/GRIM Corp. 800-933-4746

TELEMET, Geotel, Inc., 25 Davids Dr., Hauppauge, NY 11788, Tel: 516-436-7260, TWX: 510-227-9850, FAX: 516-436-7257; Empl.: 35; *Sls. Mgr.:* Paul H. Paulson III

TELENEX CORPORATION, A Unit of General Signal Corp., 13000 Midlantic Dr., Mt. Laurel, NJ 08054, Tel: 609-234-7900, FAX: 609-778-8700; Empl.: 400; *Sls. Mgr.:* Kirby Holmes, EVP-Mktg. & Sls.

TELEPHONICS CORPORATION/PRD INSTRUMENTS, 770 Park Avenue, Huntington, NY 11743, Tel: 516-549-6415/6428, TELEX: 510-222-4494, FAX: 516-549-6100; FSC No.: 78711, 9N770; Empl.: 22; *Sls. Mgr.:* Jacob Levy

TELEPLEX, INC., Alford Division, 32 Sixth Rd., Woburn, MA 01801, Tel: 617-935-8610, FAX: 617-933-4512; FSC No.: OL1H4; Empl.: 20; *Sls. Mgr.:* Lois Clark, V.P.

TELE QUARZ, USA, 2427 Twilight Rd., P.O. Box 240392, Charlotte, NC 28224-0392, Tel: 704-553-0300, FAX: 704-552-6044

TELEQUARZ-GMBH, See Raltron Electronics Corp.

TELESIS MARKING SYSTEMS, INC., Box 5000, Chillocothe, OH 45601, Tel: 614-642-3200, FAX: 614-642-2037; Empl.: 75; *Sls. Mgr.:* Larry Holt; *Dist. Mgr.:* Larry Holt

TELE-TECH CORPORATION, P.O. Box 790, Bozeman, MT 59715, Tel: 406-586-0291, FAX: 406-587-0653; FSC No.: 62759; Empl.: 75; *Sls. Mgr.:* Al Zoller

TELETERMINAL CORP., Greenland, NH 03840, Tel: 603-431-1200; Empl.: 13

TELEVISION EQUIPMENT ASSOCS., Box 393, So. Salem, NY 10590-0393, Tel: 914-763-8893, FAX: 914-763-9158; Empl.: 10

TELLUREX CORP., 1248 Hastings, Traverse City, MI 49684, Tel: 616-947-0110, FAX: 616-947-5821; Empl.: 16; *Sls. Mgr.:* Gregg Smith

TELONIC/BERKELEY, Berkeley Inds. Inc., P.O. Box 277, Laguna Beach, CA 92652, Tel: 714-494-9401, FAX: 714-497-7331; FSC No.: 04423; Empl.: 50; *Sls. Mgr.:* Richard Aaron

TELPAR, INC., 4137 Billy Mitchell Rd., Box 796, Addison, TX 75001, Tel: 214-233-6631, TELEX: 73-2561, FAX: 214-233-8947; Empl.: 28; *Sls. Mgr.:* Bob Reynolds ..... **D•1113-1115**

TELTEC, INC., 7890 12th Ave. S., Minneapolis, MN 55425, Tel: 612-854-9177, FAX: 612-854-8601; FSC No.: 57856; Empl.: 7; *Sls. Mgr.:* Victor Vachhani; *Dist. Mgr.:* Victor Vachhani

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TEMESCAL/AIRCO COATING TECHNOLOGY, The BOC Group, Inc., 2700 Maxwell Way, PO Box 2529, Fairfield, CA 94533-0252, Tel: 707-423-2100, FAX: 707-425-1706; *Sls. Mgr.:* Brian Kaemmer

TEMP-FLEX CABLE, INC., 11 Depot Street, S. Grafton, MA 01560, Tel: 508-839-5987, FAX: 508-839-4128; FSC No.: 0CGL7; Empl.: 48; *Sls. Mgr.:* Warren Persak

TEMPIL DIV., Big Three Inds., Hamilton Blvd., S. Plainfield, NJ 07080, Tel: 908-757-8300, TELEX: 138-662, FAX: 908-757-9273; Empl.: 38; *Sls. Mgr.:* A. P. Jeanguenin

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TEMPOSONICS SENSORS DIVISION, MTS Sys. Corp., PO Box 13218, Research Triangle Park, NC 27709, Tel: 919-677-0100, FAX: 919-677-0200; *Sls. Mgr.:* David Miller

TEMPTRONIC CORPORATION, 55 Chapel St., Newton, MA 02158, Tel: 617-969-2501, FAX: 617-969-2475; Empl.: 75ò; *Sls. Mgr.:* R. Himmel, R. DiFilippo, E. Lowerre

TEMPUSTECH, INC., 295 Airport Rd., Naples, FL 33942, Tel: 813-643-2424, FAX: 813-643-4981; Empl.: 13 ..... **D•1144**

TENNEY ENGINEERING, 109 Springfield Rd., Union, NJ 07083, Tel: 908-686-7870, TWX: 710-985-4725, FAX: 908-686-7971; Empl.: 175; *Sls. Mgr.:* Jerome A. Perlstein, Mgr. Application Engr.

TENOR CONTROLS COMP, 17020 W. Rogers Dr., New Berlin, WI 53151, Tel: 414-782-3800, FAX: 414-782-0005; Empl.: 30; *Sls. Mgr.:* Ted James

TENSOLITE COMPANY, Subsidiary of Carlisle Corp., 100 Tensolite Drive, St. Augustine, FL 32092, Tel: 904-829-5600, FAX: 904-829-3447; Empl.: 210; *Sls. Mgr.:* William Dungan; *Dist. Mgr.:* John Berlin

TENSOR, Box 14843, Austin, TX 78761, Tel: 512-251-4131, TELEX: ITT 4940124, FAX: 512-251-5798; Empl.: 36

TEN-TEC, INC., Industrial Park, Sevierville, TN 37862, Tel: 615-453-7172, FAX: 615-428-4483; Empl.: 100

TEPRO OF FLORIDA, 2608 Enterprise Rd., Clearwater, FL 34623, Tel: 813-796-1044, FAX: 813-791-7425; FSC No.: 15915; Empl.: 97; *Sls. Mgr.:* Pat Tesi ..... **A•2028-2035**

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CA Bridge Mktg. 415-965-8045
FL APM Assocs. 813-886-2457
MA Berkshire Elctrns. 508-435-9356
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TX Miles J. Cooley Co. 214-262-5893
VA Absco 804-674-8939

Local Distributors
FL NRC 407-241-8600
NY Sherburn Elctrns. 516-231-4300
NY Tri-Start Elctrns. 516-737-2200

TERADYNE CONNECTION SYS., Teradyne, Inc., 44 Simon St., Nashua, NH 03060, Tel: 603-889-5156, FAX: 603-889-2128; FSC No.: 31413; Empl.: 1000; *Sls. Mgr.:* D. Murphy

Local Sales Offices & Reps
CA Irvine, Teradyne Connection Sys. 714-757-2600
CA Sunnyvale, Teradyne Connection Sys. 408-732-8770
CO Longmont, Teradyne Connection Sys. 303-651-3737
CT Cromwell, Teradyne Connection Sys. 203-635-3360
FL Altamonte Springs, Teradyne Connection Sys. 407-332-6555
NC Raleigh, Teradyne Connection Sys. 919-872-0392
MD Columbia, Teradyne Connection Sys. 410-290-9189
MN Columbia Heights, Teradyne Connection Sys. 612-636-1770
NH Nashua, Teradyne Connection Sys. 603-889-5156
PA Trevose, Teradyne Connection Sys. .. 215-638-2829
TX Richardson, Teradyne Connection Sys. 214-231-5384

Can Mississauga, Ont., Teradyne Canada, Ltd. 416-602-6999

TERADYNE INC., Assembly Test Group, 2625 Shadelands Dr., Walnut Creek, CA 94598, Tel: 510-932-6900, FAX: 510-934-0540; Empl.: 350; *Sls. Mgr.:* David Bernstein

TERMINAL DATA CORP., 15733 Crabbs Branch Way, Rockville, MD 20855, Tel: 301-921-8282, FAX: 301-921-8353; Empl.: 18; *Sls. Mgr.:* Mark Teitelbaum

TERRA TECHNLG. CORP., 3854 148th Ave. N.E., Redmond, WA 98052, Tel: 206-883-7300, FAX: 206-882-1412; *Sls. Mgr.:* Greg Hoyle, Sls. Mgr.

THE TEST CONNECTION, INC., 130 Lakefront Dr., Hunt Valley, MD 21030, Tel: 410-584-2500, FAX: 410-584-9556; Empl.: 15; *Sls. Mgr.:* Ronnie Ronnenburg; *Dist. Mgr.:* Steve Sowa

THE TEST GRP., INC., 4025 Sorrento Valley Blvd., San Diego, CA 92121, Tel: 619-452-4160, FAX: 619-450-9639; Empl.: 15; *Sls. Mgr.:* D. Sorlie

TESTONE INC., Rt. 113 & Mensch Rd., P.O. Box 1589, Skippack, PA 19474-1589, Tel: 215-584-9658, FAX: 215-584-9166; Empl.: 36; *Sls. Mgr.:* Harold Schweriner; *Dist. Mgr.:* Harold Schweriner

TEST PROBES, INC., 9178 Brown Deer Rd., San Diego, CA 92121, Tel: 619-552-2090, FAX: 619-535-1260; FSC No.: FK95-3136706; *Sls. Mgr.:* Hal Wardein

TESTRONICS, 1320 Millwood Rd., McKinney, TX 75069, Tel: 214-542-3111, FAX: 214-542-2131; FSC No.: 62236; Empl.: 30

TEST SYSTEMS, INC., 217 W. Palmaire, Phoenix, AZ 85021, Tel: 602-861-1010; FSC No.: 6625; *Sls. Mgr.:* Mike Milburn

TEXAS INSTRUMENTS

FAX: 508-699-5200

TEXAS INSTRUMENTS, Connector Systems, 34 Forest St., MS 14-01, Attleboro, MA 02703, Tel: 508-699-5269, 508-699-3450, TELEX: 92-7708, TWX: 710-346-0566; FSC No.: 59350; *Sls. Mgr.:* Dom Archino, Sls. Mgr.-; *Dist. Mgr.:* Dom Archino, Distr. Sls. Mgr. ... **C•1493-1498**

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CT	Hamden, Wray Johnson	203-269-0074
IL	Arlington Heights, Chuck Young	708-640-3185
IL	Arlington Heights, Gerald Rosenthal	708-640-2976
MD	Baltimore, Rick Gesue	301-964-2003
MA	Attleboro, Jim Palombo	508-699-5206
NC	Charlotte, Don King	704-522-5485
OH	Beachwood, Eric Schriver	216-765-7257
PA	Blue Bell, Jay Burnett	215-941-7577
TX	Dallas, Bob Anderson	214-917-7549
TX	Dallas, Kay Houston	214-917-7548

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TEXAS INSTRUMENTS, Data/Image Sensing (Opto), 13532 N. Central Expressway M/S 93, Dallas, TX 75265, Tel: 214-995-6611, TWX: 910-867-4702; Empl.: 80,000 Worldwide

TEXAS INSTRUMENTS, INC., SEMICONDUCTOR GROUP, P.O. Box 655303, Dallas, TX 75265, Tel: 214-995-2011, TWX: 910-867-4702

TEXAS OPTOELECTRONICS, INC., 714 Shepherd Dr., Garland, TX 75042, Tel: 214-487-0085, FAX: 214-276-8059; FSC No.: 63034; Empl.: 102; *Sls. Mgr.:* Jim Thompson

TEXAS TRANSFORMER CORP., PO Box 860220, Plano, TX 75086, Tel: 214-424-1581, FAX: 214-424-1586; FSC No.: 1181; Empl.: 70; *Sls. Mgr.:* Felix Smith

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(USA Toll Free)

TEXMATE, INC., 995 Park Center Dr., Vista, CA 92083-8397, Tel: 619-598-9899; Empl.: 36; *Sls. Mgr.:* Earl Chafin ..... **D•1145, 1204-1205, 1372-1387, 1965**

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Intl	Bangkok, Thailand, Texmate(Thailand Branch)	(662) 391-5990
Intl	Brighton, UK, Texmate/Amplicon Live Line	(0273)-570220
Intl	Taiwan/Taipei, Texmate (Taiwan Branch)	886-2-591-7865

Local Distributors

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CO	R & R Instrmn.	303-340-8728
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IN	Fishers, Couchman-Conant	317-849-9890
LA	New Orleans, Currier & Roser Inc.	504-734-1147
MI	Highland Park, Marsh Instrs.	313-869-9200
MN	New Brighton, J & W Instrs.	612-784-5708
MT	Billings, Kirst Engrg.	406-656-9570
NJ	Landing, PC & S	201-398-5843
NJ	Marmora, Brooks Tech., Inc.	609-390-2380
NY	East Syracuse, Liberty Elctrns.	315-437-8100
NC	Statesville, Statesville Process Instr.	704-873-1835
OR	Portland, HIS Elctrns.	503-643-5648
PA	Bridgeville, Norton Equip.	412-221-3131
PA	Wayne, Mainline Instrs.	215-687-5307
TN	Knoxville, Southeastern Automation	615-675-3080
TX	Houston, Talon Tech. Sls.	713-999-8588
TX	Houston, The Meter Shop of Texas	713-957-8586
TX	Lewisville, KSE-Texas	800-594-2121
TX	Odessa, Whitlock Instrs.	915-337-3412
UT	Sandy, Indl. Instrs.	801-566-2980
WA	Belleville, Eustis Corp.	206-451-0700
WI	Milwaukee, Gordon Hatch Co.	414-671-6550
EXP	San Juan, PR, Tomas Cuerda, Inc.	809-758-7830
Intl	Australia, Braemac Pty. Ltd.	858-5966
Intl	New Zealand, Auckland, Metermaster NZ Ltd.	(649) 579-5120
Intl	Sweden, Amerikanska Teleprod	87 100620/109950
Can	Montreal, R. H. Nichols Co. Ltd.	514-337-0425
Can	Ottawa, R.H.Nichols Co. Ltd.	613-727-3974
Can	Toronto, R. H. Nichols Co. Ltd.	416-851-8871

TEX-TECHS CONNECTROS, See Norwesco Interconnect Devices

TFD INC. (DBA THIN FILM DEVICES INC.), 1180 N. Tustin Ave., Anaheim, CA 92807, Tel: 714-630-7127, FAX: 714-630-7119; FSC No.: OHWH8; Empl.: 27; *Sls. Mgr.:* Denise Beeson

THALER CORP., 10940 N. Stallard Pl., Tucson, AZ 85737, Tel: 602-742-5572, FAX: 602-742-9826; FSC No.: 70770; Empl.: 6; *Sls. Mgr.:* Leslie Ehney

TH ELECTRONICS, Tong Hsing Electronic Ind., Ltd., 2155 N. Forbes Blvd., 106, Tucson, AZ 85745-1443, Tel: 602-791-7825, FAX: 602-791-7938; *Sls. Mgr.:* Frederick R. Hyatt ..... **B•1624**

THERMACORE INC., 780 Eden Road, Lancaster, PA 17601, Tel: 717-569-6551, FAX: 717-569-4797; Empl.: 52; *Sls. Mgr.:* George Meyer

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FL	Maitland, EIR, Inc.	407-660-9600
GA	Norcross, Montgomery Mktg., Inc.	404-447-6124
IL	Elk Grove Village, Oasis Sls. Corp.	708-640-1850
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KY	Versailles, R.O. Whitesell & Assocs.	606-873-1182
MI	Grand Blanc, R.O Whitesell & Assocs.	313-695-0770
MI	Grand Rapids, R.O. Whitesell & Assocs.	616-942-5420
MI	Southfield, R.O. Whitesell & Assocs.	313-352-5454
MI	St. Joseph, R.O. Whitesell & Assocs.	616-983-7337
MN	Minneapolis, Comstrand, Inc.	612-574-9480
MO	Florissant, Spectrum Sls.	314-921-1313
NH	Salem, Sales Engrg. Co., Inc.	603-893-5521
NJ	Cherry Hill, Trinkle Sls., Inc.	609-795-4200
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NY	Ithaca, Bob Dean, Inc.	607-257-1111
NY	Ronkonkoma, Comtronic Assocs.	516-737-2400
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OR	Beaverton, UniComp, Inc.	503-643-1645
PA	Pittsburgh, R.O. Whitesell & Assocs.	412-963-6161
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UT	Salt Lake City, Lindberg Co.	801-484-8689
WA	Snohomish, UniComp, Inc.	206-568-0511
WA	Spokane, UniComp, Inc.	509-922-4883
WI	Brookfield, Oasis Sls. Corp.	414-782-6660
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Can	St. Laurent, Tech-Trek, Ltd.	514-337-7540

THERMAX WIRE CORP., 32-02 Linden Pl., Flushing, NY 11354-2897, Tel: 718-939-8300, TELEX: 645587, TWX: 710-582-2551, FAX: 718-886-3704; FSC No.: 12814; Empl.: 220; *Sls. Mgr.:* Joseph A. Cardello

THERMIK CORP., Thermik Sensor Technics, GmbH, 100 Industrial Drive, New Bern, NC 28562, Tel: 919-636-5720, FAX: 919-636-5737; Empl.: 13

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FAX: 419-525-8344

THERM-O-DISC, INC., Sub. Emerson Elec. Co., 1320 South Main St., P. O. Box 3538, Mansfield, OH 44907-0538, Tel: 419-525-8500, TELEX: 987455; FSC No.: 81439; *Sls. Mgr.:* L.R. Clark ..... **B•1389, 1903**

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MI	Wayland, Therm-O-Disc	616-795-9958
MO	Lake St. Louis, Therm-O-Disc	314-625-3632
NY	Youngstown, Therm-O-Disc	716-745-3550
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TN	Nashville, Therm-O-Disc	615-646-6542
TX	The Colony, Therm-O-Disc	214-370-2744

Local Distributors

CA	Saratoga, Testco	408-253-1900
MA	Burlington, Atcom	800-433-6600
OH	Mansfield, Therm-O-Disc	419-525-8500

THERM-O-DISC, INC., Midwest Components Product Grp., 1320 S. Main St. P.O. Box 3538, Mansfield, OH 44907-0538, Tel: 419-525-8450, FAX: 419-525-8344; FSC No.: 50157; Empl.: 5000; *Sls. Mgr.:* Lanny Clark ..... **B•1904-1907**

Local Sales Offices & Reps

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CA	San Diego, Hadden Assocs.	619-565-9444
CA	Saratoga, Testo, Inc.	408-253-1900
CO	Wheat Ridge, Trembly Assocs.	303-279-3019
CT	Middletown, Gerber Sls.	800-843-7377
CT	Shelton, Therm-O-Disc	203-929-4268
FL	Sanford, Glen White Assoc.	407-322-4875
GA	Norcross, Glen White Assoc.	404-441-1447
IL	Arlington Heights, Therm-O-Disc	708-394-8858
IL	Chicago, Dolin Sales Co.	312-498-6770
IN	Floyd Knobs, Therm-O-Disc	812-923-5974
IN	Indianapolis, Wilson Tech. Sls.	317-872-2513
MA	Waltham, Gerber Sls.	800-843-7377
MI	Grand Rapids, William Moses	616-795-9958
MI	Wayland, Therm-O-Disc	616-795-9958
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MO	Lake Saint Louis, Therm-O-Disc	314-625-3632
MO	St. Louis, Smith-Bollinger & Co.	314-343-2221
NV	Las Vegas, Trembly Assocs.	702-739-9770
NJ	W. Caldwell, Grimm, Siegel Assocs.	201-575-9300
NM	Albuquerque, Trembly Assocs.	505-266-8616
NY	Pittsford, James E. Zimmerman Sls.	716-381-3186
NY	Youngstown, Therm-O-Disc	716-745-3513
NC	Charlotte, Therm-O-Disc	704-875-3994
NC	Huntersville, Glen White Assocs.	704-875-3737

OH	Dayton, Jay Engrg.	513-253-2151
OH	Mansfield, Therm-O-Disc	419-525-8315
TN	Gray, Glen White Assocs.	615-477-8850
TN	Nashville, Therm-O-Disc	615-646-6542
TX	Dallas, Norcom	214-386-4888
TX	The Colony, Therm-O-Disc	214-370-2744
UT	Salt Lake City, Trembly Assocs.	801-295-4703
VA	Lynchburg, Glen White Assoc.	804-385-6110
WI	Milwaukee, D. Dolin Sls.	414-482-1111
Can	Mississauga, Ont., Gidden-Morton Assoc.	416-671-8111

Local Distributors

CA	Saratoga, Testco	408-253-1900
MA	Burlington, Atlantic Comps.	617-270-0051

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THERMODYNE INTERNATIONAL LTD., 20850 S. Alameda St., Long Beach, CA 90810, Tel: 310-603-1976, FAX: 310-603-1929; FSC No.: 29724; Empl.: 100-120; *Sls. Mgr.:* Gary S. Ackerman

THERMO ELECTRIC, 109 Fifth St., Saddle Brook, NJ 07662, Tel: 201-843-5800, TELEX: 178127 THERMO2SARC , FAX: 201-843-7144; Empl.: 250

THERMOELECTRICS, See TECA

THERMOMETRICS, INC., 808 U.S. Hwy. #1, Edison, NJ 08817-4695, Tel: 908-287-2870, FAX: 908-287-8847; FSC No.: FSCM 58090; Empl.: 150; *Sls. Mgr.:* Dan Lippman

THERMONICS, INC., 3350 Scott Blvd., Bldg. 32, Santa Clara, CA 95054, Tel: 408-496-6838, FAX: 408-496-6918

THERMOSEN, INC., Allied Controls, Inc., 150 E. Aurora St., Waterbury, CT 06708, Tel: 203-757-4200, FAX: 203-757-4202; FSC No.: 00428; Empl.: 10

THERMOSET PLASTICS INC., 5101 East 65th St., Indianapolis, IN 46220, Tel: 317-259-4161, TELEX: 910-250-5447, ESYLNK: 62045624, FAX: 317-252-8402; Empl.: 65; *Sls. Mgr.:* Bob Meyer

THERMOTRON INDS., 291 Kollen Park Dr., Holland, MI 49423, Tel: 616-392-1491, FAX: 616-392-5643; Empl.: 500; *Sls. Mgr.:* Lynn Ternan

THHC LIGHTING, 17870 Castleton St., Ste. 246, City of Ind., CA 91748, Tel: 818-965-6088, FAX: 818-810-4746; Empl.: 5; *Sls. Mgr.:* Clint N.W. Ling; *Dist. Mgr.:* Clint N.W. Ling

THIRD DOMAIN, INC., P.O. Box 17568, Tucson, AZ 85731-7568, Tel: 602-290-1820, TELEX: 602-885-1189; Empl.: 9; *Sls. Mgr.:* Sharon Raban

THOMAS & BETTS CORPORATION, ELECTRONICS DIVISION, 200 Executive Center Dr., P.O.Box 24901, Greenville, SC 29616-2401, Tel: 803-676-2900, FAX: 803-676-2994; FSC No.: 59730; Empl.: 4,700; *Sls. Mgr.:* Rich Kampf; *Dist. Mgr.:* Dennis Martin, Dir. of Mktg.

THOMAS ELECTRONICS, INC., 100 Riverview Dr., Wayne, NJ 07470, Tel: 201-696-5200, FAX: 201-696-8298; FSC No.: ;01852; Empl.: 380; *Sls. Mgr.:* Bruce Piaget, VP Sls.

THOMSON COMPONENTS & TUBES CORP., Thomson CSF, 40 G Commerce, Totowa, NJ 07511, Tel: 201-812-9000, FAX: 201-812-9050; Empl.: 20; *Sls. Mgr.:* Victor Pastore

THOMSON PASSIVE COMPONENTS CORP., 6203 Variel Ave., Unit A, Woodland Hills, CA 91367, Tel: 818-887-1010, TELEX: 408067, FAX: 818-702-0831; Empl.: 25; *Sls. Mgr.:* Steve Chegwin

THORDARSON MEISSNER, Components Corp. of Amer., 628 Belmont St., Mt. Carmel, IL 62863, Tel: 618-262-5121, FAX: 618-263-3150; FSC No.: 96256; Empl.: 75; *Sls. Mgr.:* Lori L. Jeffries; *Dist. Mgr.:* Pat Hoh

THORN AUTOMATED SYSTEMS, INC, THORN EMI, 835 Sharon Dr., Westlake, Ohio 44145, Tel: 216-871-9900, FAX: 216-871-8320; Empl.: 440; *Sls. Mgr.:* Michael Collins, VP Mktg.

THORN EMI ELECTRON TUBES INC., 23 Madison Rd., Fairfield, NJ 07006, Tel: 201-575-5586, TELEX: RCA 221236 TEGI, FAX: 201-575-8717; Empl.: 25; *Sls. Mgr.:* Michael R. Avery

THORSON ENGINEERING CO., 6225-76th St. S.E., Snohomish, WA 98290, Tel: 206-334-4214

THREE-FIVE SYS., INC., 10230 S. 50th Pl., Phoenix, AZ 85044, Tel: 602-496-0035, FAX: 602-496-0168; FSC No.: 70365; Empl.: 300; *Dist. Mgr.:* Julie Scarboro ..... **B•1124-1125**

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3M CO., see listing under letter "M"

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TII INDUSTRIES INC., 1385 Akron St., Copiague, NY 11726, Tel: 516-789-5000, TELEX: 144631, FAX: 516-789-5063; *Sls. Mgr.:* Jim Roach, VP Sls.

TIL-TEK LIMITED, 500 Van Buren St., P.O. Box 550, Kemptville, Ontario, Canada K0G 1J0, Tel: 613-258-5928, FAX: 613-258-7418; *Sls. Mgr.:* Hector Boudreau

TIMBER-TOP, Hopkins Rd., Box 517E, Watertown, CT 06795, Tel: 203-274-6706, FAX: 203-274-8041; FSC No.: 06773; Empl.: 5; *Sls. Mgr.:* W. E. Fischer

TIME AND FREQUENCY LTD., 2315 NW 107 Ave., Miami, FL 33172, Tel: 305-593-8000, FAX: 305-593-8002; Empl.: 110; *Sls. Mgr.:* Sandy Cohen

TIMECO, INC., 1035 - 26th St., P.O. Box 8038, Huntington, WV 25705, Tel: 304-523-5149; Empl.: 7; *Sls. Mgr.:* James E. Myers

TIME MARK CORP., 11440 E. Pine St., Tulsa, OK 74116, Tel: 918-438-1220, FAX: 918-437-7584; Empl.: 60; *Sls. Mgr.:* Steve Purple; *Dist. Mgr.:* Steve Purple

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TITCHENER, E. H., & CO., 1 Titchener Pl., Binghamton, NY 13902-1706, Tel: 607-772-1161, FAX: 607-771-0264; Empl.: 235; *Sls. Mgr.:* Donald E. Young, VP-Mktg. Sls.

TIW SYSTEMS, INC., 1284 Geneva Drive, Sunnyvale, CA 94089, Tel: 408-734-3900, TELEX: 346352, FAX: 408-734-9012; Empl.: 100; *Sls. Mgr.:* Debora Holt-Thompson (Amplifiers)

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TMC SYSTEMS (ARIZ.) INC., See Dale Electronics, Inc.

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CA San Clemente, A.T.A. Assocs. 714-661-9700

TNR TECHNICAL INC., 279 Douglas Ave. No.1112, Altamonte Springs, FL 32714, Tel: 407-682-4311, FAX: 407-682-4469; Empl.: 9; *Sls. Mgr.:* Jerrold Lazarus

TOBE DEUTSCHMANN LABS., INC., 550 Turnpike St., Canton, MA 02021, Tel: 617-828-3366, FAX: 617-828-3048; FSC No.: 21966; Empl.: 25; *Sls. Mgr.:* T. Deutschmann, Jr.

TOCOS AMERICA, INC., Tokyo Cosmos Electric Co., Ltd., 1177 E. Tower Road, Schaumburg, IL 60173, Tel: 708-884-6664, FAX: 708-884-6665; Empl.: 2,000; *Sls. Mgr.:* Robert W. Kruse ..... **A•2122-2123**

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CO Denver, English-Damco Sls. Co. 303-782-0683, FAX:303-782-0670
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FL Boca Raton, TSS, Inc. 407-391-3718
FL Clearwater, TSS, Inc. 813-530-5739
GA Lawrenceville, WLA & Assocs. 404-339-9443, FAX:404-513-9148
IL Deerfield, Mid-Tek Mktg. Co. 708-808-8822, FAX:708-808-8869
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IN Fishers, AE Sls. 317-578-2121,FAX:317-842-7703
IN Leesburg, AE Sls. 219-834-1232, FAX:219-834-1234
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MI Kentwood, Miltimore Sls., Inc. 616-554-9292, FAX:616-554-9210
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MN Roseville, Vector Comp. Sls. 612-631-1334, FAX:612-631-1329
NM Albuquerque, Zia Tech. Sls. 505-296-4255, FAX:505-296-4255
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CA San Jose, Passive Comps. 408-441-1441
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NY Ronkonkoma, Baldwin Comps. Ctr. Inc. 800-645-5608,FAX:516-588-5441
NY Syracuse, A.D.R. Technlgs. 315-437-7087, FAX:315-437-7794
PA Wayne, Peak Elctrns. 215-293-9000, FAX:215-687-4579
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TX Dallas, Off the Shelf Comps. 214-247-0052, FAX:214-247-2332
TX Richardson, All American 214-231-5300
TX Richardson, Comp. Technlg. Corp. 214-437-2211, FAX:214-437-2265
TX Richardson, Off the Shelf Comps. 214-238-0808, FAX:214-669-0560
WA Seattle, KAM 206-382-1300
WI Brookfield, Leeds 414-789-6995, FAX:414-789-6994
Can Burlington, Alternate Source Comp. 800-661-9536
Can Calgary,Alb., Memco 403-258-3399, FAX:403-259-3459
Can Surrey, B.C., Memco 604-590-1553, FAX:604-590-5008

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TODD PRODUCTS CORP., 50 Emjay Blvd., Brentwood, NY 11717, Tel: 516-231-3366; Empl.: 250 ..... **D•1488, 1967-1996**

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FL Baco Raton, Glen White Assocs. 407-393-0776
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IL Hoffman Estates, Todd Prods. Corp. .. 708-882-3325
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NC Raleigh, Glen White Assocs. 919-848-1931
OH Dayton, Electro Mktg. 513-890-8322
OH No. Royalton, Electro Mktg. 215-582-0075
OR Bothell, Temco Northwest 206-481-6150
PA Allison Park, Electro Mktg. 412-492-0688
PA Glenside, Koebert Assocs. 215-887-2310
TN Gray, Glen White Assocs. 615-477-8850
TX Houston, AID Elctrns. Inc. 713-575-7959
TX Irving, AID Elctrs. Inc. 214-790-4761
UT Salt Lake City, Thorson Rocky Mtn. Inc. 801-942-1683
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WA Bothell, Temco Northwest 206-481-6150

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FL Miami Bch., B. Frank Inc. 305-861-8227
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IL Aurora, Bwy. Appliance 708-897-8688
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MA Boston, Astro Int. 617-323-6993
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NJ Newark, Pinto Trading 201-344-7748
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VA Fairfax, Atlantic Export 703-573-8383
WA Seattle, ForeigN Elctrns. 206-682-2761
WA Seattle, Pearl Elctrns. 206-622-6200
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TOKIN AMERICA, INC., 155 Nicholson Ln., San Jose, CA 95134, Tel: 408-432-8020, FAX: 408-434-0375; Empl.: 20; *Sls. Mgr.:* William English; *Dist. Mgr.:* William English

TOKO AMERICA, INC., 1250 Feehanville Dr., Mt. Prospect, IL 60056, Tel: 708-297-0070, FAX: 708-699-7864; Empl.: 75; *Sls. Mgr.:* Frank Migliarese; *Dist. Mgr.:* Tom Quinlan

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CA	San Diego, Centaur Corp.	619-278-4950
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KS	Olathe, C-Tron Inc.	913-780-3796
MA	Boston, Mac Allister & Assoc.	617-631-7556
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MN	Minneapolis, Technical Comps.	612-561-5556
NJ	Lodi, TRC Elctrns.	201-779-8282
OH	Dayton, J.C. Hofstetter	513-296-1010
OH	Medina, J.C. Hofstetter	216-725-4477
OR	Portland, Power Factor	503-233-6969
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TX	Austin, Kruvano Assoc.	512-219-9441
TX	Dallas, Kruvand Assoc.	512-219-9441
TX	Dallas, Kruvano Assoc.	214-437-3355
WI	Milwaukee, Heartland Tech.	414-789-6860

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CO	Englewood, Comp. Distrs.	303-770-6214, 800-551-7357
CO	Littleton, Displays Plus	713-240-4000,800-231-3612
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FL	Palm Bay, Comp. Distrs.	407-724-9910, 800-558-2351
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NJ	Lodi, TRC Elctrns.	201-779-8282
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TX	Houston, Southwest Elctrns.	713-240-4000, 800-231-3612

TORAD COIL CO., INC., 283 Linden Rd., Wayne, NJ 07470, Tel: 201-835-6195; *Sls. Mgr.:* Dan Gupta

TORELCO, INC., 14 Paine Ave., P. O. Box 560, Irvington, NJ 07111, Tel: 201-374-8641, 800-867-3526, FAX: 201-374-7611; Empl.: 20; *Sls. Mgr.:* Harold Tischler ..... **A•2581**

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CA	Seal Beach, Texel	213-596-9411
CA	Simi Valley, Texel	805-582-1223
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GA	Atlanta, Overton Assocs.	404-497-0166
IL	Wheeling, Ed Joyner & Co.	708-520-1200
MD	Salisbury, Toroid Corp. of Maryland	410-860-0300
MA	Southboro, Sullivan Tech. Sls.	508-881-2215
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NY	Pittsford, KLM Garner	716-381-8350
NY	Smithtown, T & K Sales.	516-724-3456
NC	Raleigh, Overton Assocs.	919-469-5190
OH	Vandalia, Whit-Com Sls.	513-898-5433
OR	Beaverton, Harry Levinson Co.	503-690-1312
PA	Huntingdon Valley, Ed Leiby & Assoc.	215-659-8938
SC	Walhalla, Overton Assocs.	803-638-7101
TN	New Tazewell, Overton Assocs.	615-626-6009
VT	Ludlow, Verro & Assoc.	802-228-5240
VA	Alexandria, Ed Leiby & Assocs.	703-360-9039
WA	Seattle, Harry Levinson Co.	206-382-1300

TOROID TECHNOLOGIES, INC., 8-70 Hanlan Rd., Woodbridge, Ont., Can L4L 3P6, Tel: 905-850-5122, FAX: 905-850-5129; Empl.: 11; *Sls. Mgr.:* Saverio Panetta; *Dist. Mgr.:* Saverio Panetta

TOROTEL PRODUCTS INCORPORATED

FAX: 816-763-2278

TOROTEL PRODS. INC., 13402 S. 71 Hwy., Grandview, MO 64030-3199, Tel: 816-761-6314; Empl.: 250; *Sls. Mgr.:* H. Norem ..... **A•1301-1307, 2594-2596**

Local Sales Offices & Reps

AZ	Tempe, Gassner & Clark Co.	602-968-9037
CA	San Jose, Tech Rep Inc.	408-261-8287
CA	Santa Ana, California Elctrn. Mktg.	714-835-2702
FL	Altamonte Springs, Semtronics Inc.	407-831-8233
KS	Overland Pk., QDC Inds.	913-642-2214
MD	Baltimore, Dickison Sls. Co.	301-823-0923
MA	Lowell, Underwood Sls.	508-256-8191
MI	Livonia, Electro-Mktg. Inc.	313-421-7590
NY	Northport, R. P. Luce & Co., Inc.	516-754-5064
NY	Pittsford, James E. Zimmerman Sls., Inc.	716-381-3186
OH	Dayton, Electro-Mktg. Inc.	513-890-8322
PA	Langhorne, R.P. Luce & Co.	215-757-3518
WA	Bellevue, Olson Tech. Sls. Corp.	206-883-7792

TOROTRON CORP., 519 South Fifth Ave., Mt. Vernon, NY 10550, Tel: 914-664-2050; Empl.: 14; *Sls. Mgr.:* Miriam Zanger ..... **D•1326**

TORQ CORP., 32 W. Monroe St., Bedford, OH 44146, Tel: 216-232-4100, FAX: 216-232-4104; Empl.: 50; *Sls. Mgr.:* Lee Seabeck

TORTRAN INC., 915 Pembroke St., Bridgeport, CT 06608, Tel: 203-367-5188, FAX: 203-384-8120; Empl.: 6 ..... **A•2593**

TORWICO ELCTRNS. INC., 410 Oberlin Ave. South, Lakewood, NJ 08701, Tel: 908-364-1800, FAX: 908-363-6234; Empl.: 200

TOSHIBA AMERICA ELECTRONIC COMPONENTS, INC., 9775 Toledo Way, Irvine, CA 92718, Tel: 714-455-2000, FAX: 714-859-3963

TOSHIBA INSTRUMENTATION DIV., Toshiba Intl. Corp., 5354 S. 129th E. Ave., Tulsa, OK 74134, Tel: 918-252-3548, FAX: 918-250-9023; Empl.: 20; *Sls. Mgr.:* Lewis E. Smith

TOSHIN KOGYO CO., R.G. Allen Co., 7267 Coldwater Canyon, N. Hollywood, CA 91605, Tel: 818-765-8300

TOTAL CONCEPT SALES, 501 W. Glenoaks Blvd., Ste 343, Glendale, CA 91202-2896, Tel: 818-547-9476, FAX: 818-547-9473; Empl.: 3; *Sls. Mgr.:* Robert J. Cunningham; *Dist. Mgr.:* Robert J. Cunningham

TOTAL POWER INTERNATIONAL, INC., 418 Bridge St., Lowell, MA 01850, Tel: 508-453-7272, FAX: 508-453-7395; Empl.: 15; *Sls. Mgr.:* Patrick Letendre .... **D•2002**

All states not listed call T.P.I. direct 508-453-7272

Local Sales Offices & Reps

AZ	Tempe, Trembly	602-431-9417
CA	San Diego, Amasco	619-292-7666
CA	San Jose, Amasco	408-262-1500
CA	Torrance, Amasco	310-781-9494
CT	Weston, Paquette Elctrns.	203-544-8424
CO	Golden, Trembly Assoc.	303-279-3019
IL	Palatine, Vine Sls., Inc.	708-934-5476
IN	Carmel, Giesting & Assoc.	317-844-5222
KY	Versailles, Giesting & Assoc.	606-873-2330
MD	Ellicott City, Technology Sls.	301-461-7802
MA	Marlboro, JDS Reps.	508-460-0187
MI	Livonia, Giesting & Assoc.	313-478-8106
MN	Oakdale, Complete Sls.	612-731-2923
NV	Las Vegas, Trembly Assoc.	702-739-9770
NM	Albuquerque, Trembly Assoc.	505-266-8616
NY	Buffalo, Lynn Assocs.	716-631-0054
OH	Cincinnati, Giesting & Assoc.	513-385-1105
OR	Portland, Index, Inc.	503-297-3364
PA	Gibsonia, Lynn Assocs.	412-443-3670
PA	Horsham, Jacobsen Assoc.	215-674-2937
PA	Pittsburg, Giesting & Assoc.	412-828-6160
TX	Dallas, Rem Components	214-234-1069
UT	N. Salt Lake City, Trembly Assoc.	801-295-4703
WA	Bellevue, Inex, Inc.	206-271-2979
WI	Genoa City, Vine Sls. Inc.	414-279-3871

Local Distributors

AL	Huntsville, Resistacap	205-883-4270
CA	San Jose, Power and Data	408-629-3550
MA	Marlboro, Now Electronics	508-460-0187
MN	Roseville, Parts 1	612-633-8079
TX	Houston, Wofford	713-847-3583

TOTAL TEMPERATURE INSTRUMENTATION, INC., PO Box 1073, 30 Krupp Dr., Williston, VT 05495, Tel: 802-863-0085, FAX: 802-863-1193; Empl.: 10; *Sls. Mgr.:* Bob Berman; *Dist. Mgr.:* Bob Berman

TOUCH TECHNOLOGY, 5524 Bee Caves Rd. Building L, Austin, TX 78746, Tel: 512-328-9284, FAX: 512-328-9285; Empl.: 65; *Sls. Mgr.:* Sue Ellen Smith

TOWER ELECTRONICS, INC., 281 S. Commerce Circle, Fridley, MN 55432, Tel: 612-571-3737, FAX: 612-571-5605; Empl.: 75; *Sls. Mgr.:* Gary Schmitz

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TOYOCOM U.S.A., INC.

FAX: 708-593-5678

TOYOCOM USA INC., 617 E. Golf Rd., Ste. 112, Arlington Heights, IL 60005, Tel: 708-593-8780/1-800-TOYOCOM; Empl.: 16; *Sls. Mgr.:* Dennis Reifel ..... **A•1484-1495**

Local Sales Offices & Reps

AL	Huntsville, Electramark	205-830-4400
AZ	Tempe, Cantec Sls.	602-968-9021
CA	El Toro (Southern), English/Damco	714-753-1950
CA	Santa Clara, Pinnacle Sls.	408-249-7400
CO	Colorado Spgs., Pinnacle Rocky Mtn.	719-570-0180
FL	Maitland, EIR	407-660-9600
GA	Norcross, Electramark	404-446-7915
IL	Arlington Hgts., Toyocom U.S.A., (Corp. Hdqtrs.)	708-593-8785
IN	Carmel, Giesting & Assocs.	317-844-5222
IA	Cedar Rapids, ATS	319-393-8280
MD	Rockville, Cetech	301-590-0111
MD	Timonium, Cetech	410-666-0315

MA	Randolph, Hatch Assocs.	617-963-3306
MI	Colorna, Giesting & Assocs.	616-468-4200
MI	Livonia, Giesting & Assocs.	313-478-8106
MN	Minneapolis, Scott Elctrns.	612-929-2985
NJ	Mountainside, Henry G. Richter	908-233-4615
NY	Fairport, Henry G. Richter	716-223-6010
NC	Raleigh, C-Tech Sls.	919-954-7000
OH	Cincinnati, Giesting & Assocs.	513-385-1105
OH	Cleveland, Giesting & Assocs.	216-261-9705
OR	Beaverton, Quest Mktg.	503-641-7377
PA	Phoenixville (E.PA), Henry G. Richter	215-495-6176
PA	Pittsburgh (W.PA), Giesting & Assocs.	412-828-3553
TX	Ft. Worth (xtal), Rice Entpr.	214-436-6062
UT	Salt Lake City, Pinnacle Rocky Mtn.	801-264-8366
WA	Renton, Quest Mktg.	206-228-2660
Intl	San German, Digit-Tech Sls.	809-892-4317
Can	Kanata, Ont. (East), C.M.T.	613-591-9555
Can	Mississauga, Ont. (East), C.M.T.	416-612-0900

TRACER ELECTRONICS, INC., 200 Broadacres Drive, Bloomfield, NJ 07003, Tel: 201-338-1234, FAX: 201-338-1125; Empl.: 10

TRACEWELL ENCLOSURES, INC., 567 Enterprise Dr., Westerville, OH 43081, Tel: 614-846-6175, 800-848-4525, FAX: 614-846-4450; Empl.: 50; *Sls. Mgr.:* Fred Meyer **C•1106-1113**

TRA-CON, INC., 55 North St., Medford, MA 02155, Tel: 617-391-5550; Empl.: 55; *Sls. Mgr.:* Dan Romanow

FAX: 813-886-2794

TRAK MICROWAVE CORP., 4726 Eisenhower Blvd., Dept. E-2, Tampa, FL 33634, Tel: 813-884-1411, TELEX: 52-827, TWX: 810-876-9140; FSC No.: 12855; *Sls. Mgr.:* Thomas L. Roberts; *Dist. Mgr.:* Sharon Altimari **A•1852-1857; D•1077, 1207**

Local Sales Offices & Reps

AZ	Scottsdale, Thorson Desert States, Inc.	602-998-2444
CA	Dana Point, S&S Technlgy., Inc.	714-661-4619
CA	Folsom, Disman-Bakner	916-983-1029
CA	Granada Hills, S & S Technlg., Inc.	818-366-2866
CA	Mountain View, Disman Bakner	415-969-3010
CA	San Diego, S & S Technlg. Inc.	619-484-2996
CO	Parker, Howard Assocs.	303-841-5755
FL	Harbour Bch, M. Lader Co.	800-442-3177
FL	Melbourne, Jerry Williams, Inc.	407-259-7700
FL	Tampa, M. Lader Co.	813-264-1444
GA	Stockbridge, M. Lader Co.	800-442-3177
GA	Warner Robbins, JC Coefield	912-922-5555
IL	Northbrook, CJ Sls.	708-559-0660
IN	Ft. Wayne, TX Sls. Indiana	219-489-4447
IA	Cedar Rapids, J.R. Sls. Engrg.	319-393-2232
MD	Columbia, M. Lader Co.	410-381-1550
MO	Florissant, Central Tech. Sls.	314-831-4069
NH	Amherst, TMR Assocs.	603-672-9336
NJ	Clarksboro, M Lader Co.	609-423-4213
NJ	Denville, Ascor Elctrns., Inc.	201-627-1863
NM	Albuquerque, Thorson Desert States, Inc.	505-883-4343
NY	Liverpool, R&D Assocs.	315-457-0100
NY	New Rochelle, Ascor Elctrns.	914-235-8838
NY	Seaford, Ascor Elctrns., Inc.	516-826-7204
NC	Greensboro, M. Lader Co.	919-674-8970
PA	Conshohocken, M. Lader Co.	215-825-3177
PA	East Greenville, M Lader Co.	215-679-8485
TX	Austin, Thorson Co.	512-467-2737
TX	Dallas, Thorson Co.	214-233-5744
TX	Houston, Thorson Co.	713-558-8205
VA	Strasburg, M. Lader Co.	703-465-9180
Can	Burnaby, B.C., Giga-Tron	604-299-4244
Can	Ottawa, Giga Tron Assocs. Ltd.	613-225-4090

Local Distributors

AZ	Scottsdale, Spirit Elctrns.	602-998-2444
CA	Mtn. View, Comstock Distrs., Inc.	415-969-3010
NY	Ronkonkoma, Compucon Distr., Inc.	516-981-8810
PA	Conshohocken, MLC Distrs., Ltd.	215-825-3177

TRAK MICROWAVE LTD., TRAK Microwave Corp., 3/4 Lindsay Court, Dundee Technlg. Pk., Dundee, Scotland DD2 1TY, Tel: 44-382-561509, FAX: 44-382-562643; Empl.: 30

FAX: 813-886-2794

TRAK SYSTEMS, Div. TRAK Microwave Corp., 4722 Eisenhower Blvd., Dept. E-2, Tampa, FL 33634-6391, Tel: 813-884-1411, TELEX: 52-827, TWX: 810-876-9140; FSC No.: 11165; *Sls. Mgr.:* Thomas L. Roberts **D•1077, 1207**

Local Sales Offices & Reps

AL	Huntsville, Saber Assocs., Inc.	205-776-9481
AZ	Phoenix, J. Smith Assocs.	602-267-0981
CA	Laguna Hills, Elotek Sys.	714-830-4856
CA	Mountain View, Disman Bakner	415-969-3010
CO	Parker, Howard Assocs.	303-841-5755
FL	Ft. Walton Bch., Mktg. & Consulting	904-863-3017
FL	Melbourne, Saber Assocs.	407-724-0920
GA	Lawrenceville, Saber Assocs., Inc.	404-962-8740
IN	Ft. Wayne, TX Sls. Indiana	219-489-4447
MA	Andover, Saret Assocs.	508-475-9332
MO	Maryland Hgts., KJS Mktg., Inc.	314-770-1412
NM	Albuquerque, J. Smith Assocs.	505-345-6501
NC	Clayton, Saber Assocs., Inc.	919-553-5009
PA	Philadelphia, Rabal Assocs.	215-922-6914
TX	Austin, Thorson	512-467-2737
TX	Dallas, Thorson	214-233-5744
TX	Houston, Thorson	713-558-8205
Can	Burnaby, B.C., Giga-Tron	604-299-4244
Can	Ottawa, Giga-Tron Assocs., Ltd.	613-225-4090

TRANSAMERICA DELAVAL, INC., See CEC Instruments, IMO Inds. Inc.

TRANSAMERICA DELAVAL, See Gems Sensors, IMO Inds. Inc.

Trans American Transformer, Inc.

FAX: 516-928-0852

TRANS AMERICAN TRANSFORMER, 26 Hulse Rd., E. Setauket, NY 11733, Tel: 516-928-0762; FSC No.: 61619; Empl.: 30 **A•2597**

TRANSCHEM, Jetronics Industries, Inc., P.O. Box 667, 1521 Pomona Rd., Corona, CA 91718, Tel: 909-371-5751, FAX: 909-371-9602; FSC No.: 03526; Empl.: 60; *Sls. Mgr.:* Ernie Aiu, Genl. Mgr.

TRANSCO PRODUCTS, INC., Subsidiary of Datron Systems Inc., Vard Newport, Camarillo, CA 93012, Tel: 805-987-8007, TELEX: 857579, FAX: 805-484-0830; FSC No.: 82152; Empl.: 300; *Sls. Mgr.:* Larry Neeley, Sls. Mgr.

TRANSDUCERS & SYSTEMS, A Prime Technology Company, Twin Lakes Rd., P.O. Box 185, N. Branford, CT 06471, Tel: 203-481-5721, TWX: 710-452-3092, FAX: 203-481-8937; Empl.: 60; *Sls. Mgr.:* J.L. Jamieson, Mktg. VP

All states not listed consult factory, N. Branford, CT

TRANSDUKTOR, INC., See Ulveco, Inc.

TRANSENE, Rte. 1, Rowley, MA 01969, Tel: 508-948-2501, FAX: 508-948-2206; Empl.: 21; *Sls. Mgr.:* H. Femino

TRANSFORMER DESIGN , MTE Corporation, W147 N9525 Held Drive, Menomonee Falls, WI 53051, Tel: 414-253-8200, FAX: 414-253-8222; Empl.: 120; *Sls. Mgr.:* John A. Houdek

TRANSFORMER ENGINEERING CORPORATION, 2550 Brookpark Rd., Cleveland, OH 44134, Tel: 216-741-5282, FAX: 216-741-4860; Empl.: 85; *Sls. Mgr.:* William M. Dick

TRANSFORMER TECHNOLOGIES, INC., 402 Locust St., Mt. Vernon, NY 10552, Tel: 914-668-1600, FAX: 914-668-4794; Empl.: 15; *Sls. Mgr.:* Thomas Quaglieri **A•2598**

Local Sales Offices & Reps

IL	Highland Pk., Mid-Tek Mktg.	708-831-1130
VA	Ashland, Glasscock Assocs.	804-798-2125

TRANSICOIL INC, Eagle-Picher Inc., 2560 General Armistead Blvd., Trooper, PA 19403, Tel: 215-539-4400, FAX: 215-539-3400; FSC No.: 82686; Empl.: 215; *Sls. Mgr.:* John Stalber; *Dist. Mgr.:* Fran Mashintonio

TRANSISTOR DEVICES, INC., 274 S. Salem St., Randolph, NJ 07869, Tel: 201-361-6622, FAX: 201-361-7665; FSC No.: 09004; Empl.: 650; *Sls. Mgr.:* Martin M. O'Donnell **D•2003**

Local Sales Offices & Reps

AL	Huntsville, Reynolds & Assocs., Inc.	205-539-1485
AZ	Phoenix, Trembley Assocs.	602-431-9417
AZ	Tucson, Trembley Assoc.	602-790-9945
CA	Bakersfield, FLW, Inc.	805-398-0720
CA	Campbell, SMA	408-370-6900
CA	Carlsbad, FLW, Inc.	619-434-5251
CA	Costa Mesa, FLW Inc.	714-751-7512
CO	Colorado Springs, Trembley Assocs.	719-475-0072
CO	Denver, Trembley Assocs.	303-279-3019
CT	Scientific Dvcs., Inc.	203-248-9361
FL	Melbourne, Reynolds Assocs., Inc.	407-259-7000
GA	Duluth, Reynolds Assocs., Inc.	404-476-4992
IL	Wheeling, Ed Joyner & Co.	312-520-1200
IA	Cedar Rapids, Midwest Tech. Sls.	319-377-1688
KS	Goddard, Midwest Tech. Sls.	316-794-8565
KS	Lenexa, Midwest Tech. Sls.	913-888-5100
MA	Lexington, E. F. Delfino, Inc.	617-862-1118
MI	Ann Arbor, Ashby Assocs., Inc.	313-995-4082
MN	Anoka, Tech. Solutions, Inc.	612-785-9303
MO	Earth City, Midwest Tech. Sls. Inc.	314-298-8787
NV	Las Vegas, Trembley Assocs., Inc.	702-739-9770
NJ	Comp-Tech Sls.	201-935-2152
NJ	Hasbrouck Hgts., Comp-Tech Sls.	201-288-7400
NM	Alburquerque, Trembley Assocs. Inc.	505-266-8616
NM	Las Cruces, Trembley Assocs. Inc.	505-526-1615
NY	Commack, Comp-Tech Sls.	516-499-9189
NY	New Hyde Park, Comp-Tech Sls.	516-488-4520
NC	Raleigh, Reynolds & Assocs., Inc.	919-876-0282
OH	Arcanum, Ashby Assocs., Inc.	513-692-8713
OH	Cleveland, Ashby Assocs., Inc.	216-461-0826
PA	Southampton, Campbell Assoc.	215-322-6630
TX	Austin, Jim Hughes Co.	512-467-8896
TX	Lewisville, Jim Hughes Co.	214-221-1536
UT	N. Salt Lake City, Trembley	801-295-4703
VA	Alexandria, Dyna-Rep Co.	703-354-1222
Can	Weston Ont., Duncan Instrs. Canada Ltd.	416-742-4448

TRANSMAGNETICS, 210 Adams Blvd., Farmingdale, NY 11735, Tel: 516-293-3100, FAX: 516-293-3793; FSC No.: 17755; Empl.: 44; *Sls. Mgr.:* Fred Haber ... **D•1208-1210**

Local Sales Offices & Reps

NY	Saugerties, Beckrep	914-246-3031
OR	Beaverton, Seltech Elctrns. Mfg. Rep. Inc.	503-629-9254
TX	Richardson, Scientific Sls. Co.	214-231-6541
WA	Bellevue, Seltech Elctrns. Mfg. Rep. Inc.	206-746-7970
Can	St. Laurent, Que., Testforce Sys. Inc.	514-856-0970

TRANS METRICS, INC., 5325 Naiman Pkwy Ste.E , Solon, OH 44139, Tel: 216-248-2229, FAX: 216-248-7780; FSC No.: 6685; Empl.: 20; *Sls. Mgr.:* James N. Dietrich

TRANSONIC SYSTEMS INC., 34 Dutch Mill Rd., Ithaca, NY 14850, Tel: 607-257-5300, TELEX: 413523, ESYLNK: 62050974; Empl.: 40

TRANSPARENT DEVICES, INC., 853 Lawrence Drive, Newbury Park, CA 91320, Tel: 805-499-5000, FAX: 805-499-5888; Empl.: 26; *Sls. Mgr.:* C. Estiandan ... **B•1126**

Local Sales Offices & Reps

CA	Irvine, Cal Rep, Inc.	714-509-7707
CO	Aurora, Electrodyne	303-695-8903
GA	Acworth, EAB, Inc.	404-975-3660
IL	Glendale Heights, Synergistic Sls.	708-858-8686
IA	Cedar Rapids, Spectrum Sls.	319-366-0576
KS	Overland Park, Spectrum Sls.	913-648-6811
MD	Towson, ATS, Inc.	410-296-9360
MN	Minneapolis, Electro-Serv	612-338-3475
MO	Florissant, Spectrum Sls.	314-921-1313
NJ	E. Brunswick, Shepard Assocs.	908-254-5757
NY	E. Syracuse, Nycom, Inc.	315-437-8343
OH	Solon, Five Star Elctrns.	216-349-1611
OK	Tulsa, Delta Comps., Inc.	918-592-7711
PA	Frazer, Indl. Comps.	215-889-0650
PA	Pittsburgh, Marktech	412-367-2327
TX	Seagoville, Delta Comps., Inc.	214-287-6333
UT	Salt Lake City, Electrodyne	801-264-8050
WA	Seattle, J.J. Assocs.	206-246-6619

WI Brookfield, Synergistic Sls. 414-821-1516
MA Westford, Elctrn. Microtech Assoc. 508-692-0070

TRANSTECHNOLOGY ELECTRONICS, Transtechnology Corporation, 8800 Allen Rd., Peoria, IL 61615-1584, Tel: 309-693-3300, TWX: 510-390-3691, FAX: 309-693-3308; FSC No.: 30463; Empl.: 105; *Sls. Mgr.:* Ignas Budrys; *Dist. Mgr.:* Ignas Budrys

TRANSTECTOR SYSTEMS, INC., P.O. Box 300, Hayden Lake, ID 83835, Tel: 800-829-2901, TELEX: 150-077TRANSTECPFLS, FAX: 208-772-9016; FSC No.: 30992; Empl.: 150; *Sls. Mgr.:* Mary Mohr

TRAN-TEC CORP., Box 1044, Columbus, NE 68601, Tel: 402-564-2748, FAX: 402-564-4946; Empl.: 46; *Sls. Mgr.:* Cliff Schroeder

TRATEC OF CALIFORNIA, INC., 3648 Main St., Chula Vista, CA 91911, Tel: 619-476-1155, ESYLNK: 619-476-1176; Empl.: 250; *Sls. Mgr.:* Dale Fox

TREE TECHNOLOGIES CORPORATION, Baird Research Pk., 1576 Sweet Home Rd., Buffalo, NY 14228, Tel: 716-688-4640, FAX: 716-636-3630; Empl.: 8; *Sls. Mgr.:* Victor Demjanenko, PH.D.

TREK, INCORPORATED, 3932 Salt Works Road, Medina, NY 14103-0728, Tel: 716-798-3140, FAX: 716-798-3106; Empl.: 119; *Sls. Mgr.:* Donald L. Pritchard; *Dist. Mgr.:* Donald L. Pritchard

TREND CIRCUITS, 44358 Old Warm Springs Blvd., Fremont, CA 94538-6148, Tel: 510-651-1150, FAX: 510-651-5763; Empl.: 142; *Sls. Mgr.:* Colleen Frisz

TREND DLC, INC., 3D Great Meadow Lane, East Hanover, NJ 07936, Tel: 201-515-4935, FAX: 201-515-4938; Empl.: 20; *Sls. Mgr.:* Joseph R. La Manna

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TRICONEX CORP., 15091 Bake Parkway, Irvine, CA 92718, Tel: 714-768-3709, 800-325-2128 (outside Ca), FAX: 714-768-6601; Empl.: 115; *Sls. Mgr.:* Paul Hamilton; *Dist. Mgr.:* Paul Hamilton

TRICON INDUSTRIES, INC., Brazing Alloys & Chemical Products Div., 5000 Chase St., Downers Grove, IL 60515-4012, Tel: 708-963-0220, FAX: 708-963-0269; Empl.: 19; *Sls. Mgr.:* T. R. Boedeker

TRICON INDUSTRIES, INC., Electromechanical Division, 2325 Wisconsin Avenue, Downers Grove, IL 60515-4076, Tel: 708-964-2330, FAX: 708-964-5179; Empl.: 289; *Sls. Mgr.:* Robert Stevens

TRIDAK, 1120 Federal Rd., Brookfield, CT 06804, Tel: 203-775-1287, FAX: 203-775-4376; Empl.: 20; *Sls. Mgr.:* Frank Barbera

TRIDYNE PROCESS SYSTEMS, DBI Industries, 80 Allen Rd., So. Burlington, VT 05403, Tel: 802-863-6873, FAX: 800-325-2654; Empl.: 35; *Sls. Mgr.:* Charlie Goetz

TRIGON/ADCOTECH, Dynatech, 100 S. Milpitas Blvd., Milpitas, CA 95035, Tel: 408-946-4300, FAX: 408-263-9217; Empl.: 50

TRILITHIC, INC., 9202 E. 33rd St., Indianapolis, IN 46236, Tel: 800-344-2412, FAX: 317-895-3613; FSC No.: 23042; Empl.: 120; *Sls. Mgr.:* D. Distler

TRI-MAG, Inc.

FAX: 209-651-0188

TRI-MAG, INC., 1601 N. Clancy Ct., Visalia, CA 93291, Tel: 209-651-2222, TELEX: (ITT) 4994462; FSC No.: 64771; Empl.: 80 ..... **A•1612-1614; D•2004-2006, 2212-2214**

Local Sales Offices & Reps

AL	Huntsville, Stelmack Comps.	404-441-7927
CA	Burlingame, William J. Purdy Co.	415-347-7701
CA	Dana Point, Electro-Venture	714-496-5225
FL	Land O'Lakes, AJ's Power Source, Inc.	813-996-2583
IL	Arlington Hgts., Coombs Assocs., Inc.	708-439-9810
KS	Kansas City, EPI, Inc.	816-523-8911
MD	Ambler, W.R. Hartmaier Assoc., Inc.	215-643-6691
MA	Ashland, Sullivan Tech. Sls.	508-881-2215
MO	St. Louis, EPI, Inc.	314-962-1411
NJ	Ridgewood, Ballou, Inc.	201-444-6990
NY	Rochester, R.M. Scanlon & Assoc., Inc.	716-359-0773
NY	Syracuse, R.M. Scanlon & Assoc., Inc.	315-463-7682
OH	Mentor, Sales Plus, Inc.	216-942-7811
OK	Tulsa, Innovative Tech. Sls.	214-699-3485
OR	Beaverton, Pacific Mktg. Spec.	503-641-9373
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PA	Ambler, W.R. Hartmaier Assocs., Inc.	215-643-6691
TX	Austin, Innovative Tech. Sls.	512-255-1510
TX	Dallas, Innovative Tech. Sls.	214-699-3485
TX	Houston, Innovative Tech. Sls.	214-699-3485
WA	Redmond, Pacific Mktg. Spec.	206-882-3144
WI	Milwaukee, Coombs Assocs., Inc.	414-351-6123

Local Distributors

CA	Santa Ana, El-Com/Cabletek	714-432-6630
MA	Needman, Power Electro Supp. Co.	718-767-1447

TRIMM INC., 400 W. Lake St., Box 489, Libertyville, IL 60048, Tel: 708-362-3700, FAX: 708-680-3888; FSC No.: 81812; Empl.: 50; *Sls. Mgr.:* Richard Neidl

TRIM-TRONICS, INC., 2763 Route 20 East, Cazenovia, NY 13035, Tel: 315-655-9528, FAX: 315-655-2149; Empl.: 20; *Sls. Mgr.:* James E. Dowd

TRINETICS INC., 55807 Currant Rd., Mishawaka, IN 46545-4899, Tel: 219-259-8535, FAX: 219-259-8552; FSC No.: 3677; Empl.: 50; *Sls. Mgr.:* AJ Reinke

TRIONICS, INC., P.O. Box 225, St. Charles, IL 60174, Tel: 708-365-6570, FAX: 708-365-6575; Empl.: 80

TRIO-TECH INTERNATIONAL, 355 Parkside Dr., San Fernando, CA 91340, Tel: 818-365-9200, TELEX: 194811(TTI INTL SFDO), FAX: 818-365-8210; Empl.: 266; *Sls. Mgr.:* Jon Easterson

TRIPLE I, See PHI Technologies, Inc.

TRIPLETT CORPORATION, One Triplett Dr., Bluffton, OH 45817-9987, Tel: 419-358-5015, FAX: 419-358-7956; *Sls. Mgr.:* Joel Weldy; *Dist. Mgr.:* Tony Augsburger

TRIPP LITE, 500 No. Orleans, Chicago, IL 60610-4188, Tel: 312-329-1777, FAX: 312-644-6505; Empl.: 200; *Sls. Mgr.:* Ray Foster

TRI QUINT SEMICONDUCTOR, 3625 S.W. Murray Blvd., Beaverton, OR 97005, Tel: 503-644-3535, FAX: 503-644-3198

TRIRIDGE

FAX: 412-899-2284

TRIRIDGE CORP., P.O. Box 12420, Pittsburgh, PA 15231, Tel: 412-899-2288, 800-537-3529; FSC No.: 31951; Empl.: 48; *Sls. Mgr.:* Michael Minich ..... **B•1625**

Local Sales Offices & Reps

CA	Seal Beach, Texel	213-596-9411
MA	Chelmsford, Interstate Sls. Assocs.	508-256-2287
MN	Stillwater, Kits Co.	612-439-8088
NY	Manhasset, Win-Cor Elctrn.Sls.	516-627-9474
PA	Horsham, Jacobsen Assoc.	215-674-2937

Local Distributors

CA	Los Angeles, Masters Distrs.	213-452-1229
OH	Warren, Rem Elctrn. Supp. Co.	216-373-1300
PA	McKean, Advacom Inc.	814-476-7774

TRI-SOURCE INC., 415 Howe Ave., Shelton, CT 06484, Tel: 203-924-7030, FAX: 203-924-7045; Empl.: 45; *Sls. Mgr.:* Lloyd Schiller ..... **D•2008-2011**

Local Sales Offices & Reps

CT	Hartford, E.M.I.	800-443-4506
FL	Ft. Lauderdale, CBC Elctrns.	305-755-1111
FL	Orlando, CBC Elctrns.	407-831-5380
FL	Tampa, CBC Elctrns.	813-969-1901
MA	Marlborough, E.M.I.	800-424-4506
NJ	Mt. Laurel, Power Square	609-424-0064
NY	Great Neck, Mos Assocs.	516-487-3966
TX	Dallas, MT Associates	214-380-9090

Local Distributors

MA	Marlboro, E.M.I.	1-800-443-4506

TRI-STAR ELCTRNS., 11020 Audelia Rd., Dallas, TX 75243, Tel: 214-553-8011, FAX: 214-553-8009

TRI-TECH ELECTRONICS, INC., 9480 E. Colonial Dr., Orlando, FL 32817, Tel: 407-277-2131, FAX: 407-282-1202; Empl.: 115

TRM, INC., 280 S. River Rd., Manchester, NH 03110, Tel: 603-627-6000, FAX: 603-627-6025; Empl.: 40; *Sls. Mgr.:* D. Crocker

TROMPETER ELECTRONICS, INC., 31186 La Baya Dr., P.O. Box 5069, Westlake Village, CA 91362-4047, Tel: 818-707-2020, FAX: 818-706-1040; FSC No.: 14949; Empl.: 180; *Sls. Mgr.:* Dick Coleman; *Dist. Mgr.:* Raymond Calvin ..... **C•1499-1505**

Local Sales Offices & Reps

AL	Huntsville, CP&F (Dixie)	205-536-1506
AZ	Tempe, Aztec Entprs.	602-649-9155
CA	Los Angeles, Knight Co.	310-670-2833
CA	Santa Clara, Interconnect Sls. Grp.	408-980-1166
CA	Temecula, Knight Co.	714-699-2495
CO	Denver, Aztec Entprs.	303-779-5285
CT	Wethersfield, Underwood Sls.	203-563-3046
FL	Orlando, CP&F Florida, Inc.	407-855-0843
FL	Tampa, CP&F Florida, Inc.	813-854-5116
FL	W.Melbourne, CP&F Florida, Inc.	407-724-6795
GA	Duluth, CP&F (Dixie)	404-497-9404
IL	Arlington Heights, Berndt Assocs.	708-632-0900
IN	Carmel, Berndt Assocs.	317-844-0114
KS	Overland Pk., BAKA Corp.-Kansas City	913-432-5252
KS	Wichita, BAKA Corp.-Wichita	316-682-8411
MD	Landover, Sel-Tronics, Inc.	301-341-2700
MA	Lowell, Underwood Sls.	508-256-8191
MI	Rochester Hills, Geotronix	313-373-4334

MN Minneapolis, Engrg. Prods. Assoc., Inc. 612-835-9002
MO St. Johns, BAKA Corp. 314-429-2252
NJ Elmwood Park, L & M Assoc. 800-722-0441
NM Albuquerque, Aztec Entprs. 505-262-1688
NY Clifton Park, TAE REP Inc. 518-371-3117
NY Rochester, TAE REP Inc. 716-586-8710
NY Waverly, TAE REP Inc. 607-565-3485
NY Whitney Point, TAE REP Inc. 607-692-3705
NC Charlotte, CPF Atlantic, Inc. 704-846-1702
NC Greensboro, CP&F Atlantic, Inc. 919-218-0800
OH Cincinnati, Geisting & Assoc. 513-385-1105
OH Richfield, Geotronix 216-659-6100
OH Trotwood, Geotronix 513-854-5939
OR Portland, Evergreen Mktg. Grp. 503-598-7667
PA Allison Park, Geotronix 412-487-1770
PA Southampton, WA Drobile, Inc. 215-364-2501
TX Arlington, Ion Assocs. 817-695-8000
TX Austin, Ion Assocs. 512-794-9006
TX Houston, ION Assocs. 713-537-7717
UT Salt Lake City, Aztec Entprs. 801-467-4675
WA Edmonds, Evergreen Mktg. 206-771-3593
WI Milwaukee, Berndt Assocs. 414-545-8400
Can Burlington, Ont., Promark Elctrns. 416-332-1145
Can St. Laurent, PQ, Promark Elctrns. (Canada) 800-363-8855

TRONTECH, INC., 38 Industrial Way E., Eatontown, NJ 07724, Tel: 908-542-1133; Empl.: 70; *Sls. Mgr.:* Albert E. Arbuckle

TRU

FAX: 508-531-6993

TRU-CONNECTOR CORP., 245 Lynnfield St., Peabody, MA 01960, Tel: 508-532-0775, 1-800-262-9787, 1-800-COAXTRU; FSC No.: 92180; Empl.: 46; *Sls. Mgr.:* Robert F. Hoff ..... **C•1507**

Local Sales Offices & Reps
CA Irvine, Calrep 714-509-7707,FAX:714-509-7708
FL Clearwater, Brennan Assocs. 813-446-5006, FAX:813-443-6035
MD Rockville, KMA Sls. 301-460-8876, FAX:301-460-9530
MA Lexington, O'Sullivan & Murphy 617-862-6570, FAX:617-862-7252
NY East Syracuse, R.D. Sherman Corp. 315-433-1165, FAX:315-437-8283
OH Wilmington, R.N. Smith Co. 513-382-4048
PA Fawn Grove, Chesapeake Tech. Sls. 717-382-4944,FAX:717-382-4149
Intl Israel, Tel Aviv, STG Intl. Ltd. 011-972-3-265231
Can Oakville, Ont., Paltronics Ltd. 416-844-2233, FAX:416-844-0129

TRUETIME, INC., 3243 Santa Rose Ave, Santa Rosa, CA 95407, Tel: 707-528-1230, TELEX: 176687(TRUETIME SARO), FAX: 707-527-6640; Empl.: 50; *Sls. Mgr.:* Rick Dielman

TRUEVISION, 7340 Shadeland Station, Indpls., IN 46256, Tel: 317-841-0332, FAX: 317-576-7700; Empl.: 103; *Sls. Mgr.:* Brian Donahue

TRULINE CORPORATION, 909 W. Visalia Rd., Farmersville, CA 93223, Tel: 209-747-1261, FAX: 209-747-0280; Empl.: 85; *Sls. Mgr.:* R. W. Aubery

TRUMETER COMPANY, INC., 38 West 32nd St., New York, NY 10001, Tel: 212-564-0666, 800-537-2261, FAX: 212-268-0432; Empl.: 9; *Sls. Mgr.:* Rene Jacobus

TRW MICROWAVE, See FEI Microwave

TRW RESISTIVE PRODUCTS DIV., See International Resistive Co.

TRW TECHNAR, INC., TRW, Inc., 5462 Irwindale Ave., Irwindale, CA 91706, Tel: 818-334-0250, FAX: 818-969-4781; Empl.: 750; *Sls. Mgr.:* George R. Downs

TSCHUDIN & HEID, INC, Tschudin & Heid AG, 2 North Plains Industrial Rd., Wallingford, CT 06492, Tel: 203-269-3337, FAX: 203-269-4448; Empl.: 6; *Sls. Mgr.:* Thomas M. D'Allesantro; *Dist. Mgr.:* Michael E. Losi

TS PRODUCTS, INC., 12455 Branford St., Bldg. 22, Arleta, CA 91331-3429, Tel: 818-896-6676, FAX: 818-896-2816; Empl.: 5; *Sls. Mgr.:* James T. Thomasson; *Dist. Mgr.:* James T. Thomasson ..... **D•2317**

Local Sales Offices & Reps
CA Corona Del Mar, Motion Control, Inc. .. 714-675-0211
CA Los Angeles, TS Products, Inc. 818-896-6676
CA Montebello, TUCUL Engrg. 818-791-1364

TSSI, 8205 S.W. Creekside Place, Beaverton, OR 97005, Tel: 503-643-9281, FAX: 503-646-4954; Empl.: 65; *Sls. Mgr.:* Dean Turnbaugh, V.P., N.A. Sls.; *Dist. Mgr.:* David Flaningam, V.P., Intl. Sls.

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FAX: 516-589-7793

TTE FREQUENCY DEVICES, LTD., 351 Knickerbocker Ave., Bohemia, NY 11716, Tel: 516-589-7789; Empl.: 800 (Worldwide); *Sls. Mgr.:* Paul Huron; *Dist. Mgr.:* Lloyd Kittlesen ..... **A•1496-1501**

Local Sales Offices & Reps
CA Irvine, Balzerwolf Assoc. 714-261-6977
IL Arlington Hgt., Davix 708-577-4475
MI Grand Rapid, JMJ Assoc. 616-774-9480
NY Bohemia, High Energy Prods. 516-589-7789
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T T I TESTRON INC., 41 Century Drive, Woonsocket, RI 02895, Tel: 401-766-9100, FAX: 401-766-9017; Empl.: 250; *Sls. Mgr.:* Barry Ross

TUCKER ELECTRONICS, Box 551419, Dallas, TX 75355-1419, Tel: 214-348-8800, 800-527-4642, FAX: 214-348-0367; Empl.: 65; *Sls. Mgr.:* Bill Chapman

TUMBLER CORP. CABLE DIV., 175 Kootenai Drive, Fremont, CA 94539, Tel: 510-657-3002, FAX: 510-770-1933; Empl.: 86; *Sls. Mgr.:* Vincent P. Lin

TUMBLER TECHNOLOGIES, 1340 Fulton Place, Fremont, CA 94539, Tel: 510-651-7724, FAX: 510-651-7840; Empl.: 5 Local/120 Overseas; *Sls. Mgr.:* Alex T. Hung

TUNGSTONE BATTERIES, INC., 18 Billings St., Sharon, MA 02067, Tel: 617-784-2000, FAX: 617-784-5563; Empl.: 23; *Sls. Mgr.:* William O'Connell

TURCK INC., 3000 Campus Drive, Minneapolis, MN 55441-2656, Tel: 612-553-9224, 1-800-328-0580, FAX: 612-553-0708; FSC No.: SIC 3625; Empl.: 98; *Sls. Mgr.:* Jeffrey C. Ursell, Dir. of Sls.; *Dist. Mgr.:* B. Nielson (West)/ R. Black (East)

TURTLE MOUNTAIN CORPORATION, 1st St. So., Dunseith, ND 58329, Tel: 701-244-5242, FAX: 701-244-5582; Empl.: 190; *Sls. Mgr.:* Van Barkus

TUS ELECTRONICS

FAX: 714-458-1166

TUS ELECTRONICS, 22612 Albares, Mission Viejo, CA 92691, Tel: 714-458-1155 ..... **C•1649-1651**

TUSONIX

FAX: 602-744-6155

TUSONIX, INC., 7741 N. Business Park Drive, P. O. Box 37144, Tucson, AZ 85740-7144, Tel: 602-744-0400, TELEX: 102-299640, TWX: 310-299640; FSC No.: 59660; Empl.: 800; *Sls. Mgr.:* Robert H. Jones; *Dist. Mgr.:* Patrick K. Gougeon ..... **A•1168-1169, 1684-1685**

Local Sales Offices & Reps
AZ Tucson, Tusonix, Inc. 602-744-0400
CA San Diego, DJM Elctrns. 619-488-9166
CA San Fransisco, Tusonix, Inc. 510-793-3785
CA Valencia, DJM Elctrns. 805-254-2677
NY Webster, Tusonix, Inc. 716-671-7870
NC Greensboro, Tusonix, Inc. 919-292-4286
TX Dallas, Tusonix, Inc. 214-985-9335

Local Distributors
AZ Tempe, TTI 602-431-1191
CA Agoura Hills, Penstock 818-879-8374
CA Milpitas, TTI 408-946-5577
CA Mission Hills, TTI 818-891-8885
CA San Diego, Penstock 619-535-3015
CA San Diego, TTI 619-748-2025
CA Santa Ana, TTI 714-641-9393
CA Sunnyvale, Penstock, Inc. 408-730-0300
CA Westwood, Penstock 310-208-2877
CO Denver, TTI 303-429-6806
CO Englewood, Penstock, Inc. 303-421-7161
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IN	Richmound, Penstock	317-935-0141
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MD	Columbia, Penstock	410-290-3746
MD	Columbia, TTI	301-995-1331
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NY	Ronkonkoma, TTI	516-737-2000
OH	Dayton, TTI	513-898-8330
OH	Independence, TTI	216-328-9755
PA	Coatesville, Penstock	215-383-9536
TX	Dallas, TTI	214-701-9555
TX	Fort Worth, TTI	817-595-3100
WA	Bellevue, Penstock, Inc.	206-454-2371
WA	Redmond, TTI	206-882-0291

TUSTIN ELECTRONICS CO., 1580 N. Kellogg Drive, Anaheim, CA 92807, Tel: 714-777-5800, FAX: 714-777-5814; FSC No.: 7025-0010; *Sls. Mgr.:* Saul Tunkelrott

2M SALES COMPANY, 1601 E. Hwy. 13, Ste. 202, Burnsville, MN 55337, Tel: 612-890-7774, FAX: 612-894-9352

TWO TECHNOLOGIES,INC., 419 Sargon Way, Horsham, PA 19044, Tel: 215-441-5305, FAX: 215-441-0423; Empl.: 13; *Sls. Mgr.:* Joan Rickards

TWP, INC., 2133 4th St., Berkeley, CA 94710, Tel: 510-548-4434, FAX: 510-548-3073; Empl.: 10; *Sls. Mgr.:* Colleen Heffley

TYCO INSTR. DIV., See Data Instrs.

TYCOR INTERNATIONAL INC., 6107-6 Street S.E., Calgary, Alberta, Canada T2H 1L9, Tel: 403-259-3200, FAX: 403-253-0663; Empl.: 32

TYTON CORP., Box 23055, 7930 N. Faulkner Rd., Milwaukee, WI 53223, Tel: 414-355-1130, 800-535-5552, TWX: 910-262-3094, FAX: 414-355-7341; *Sls. Mgr.:* Jim Campion, VP Sls.; *Dist. Mgr.:* Terry Tuttle

UCE, INC., 35 Rockland Rd., Norwalk, CT 06854, Tel: 203-838-7509, FAX: 203-838-2566; Empl.: 20; *Sls. Mgr.:* C. Rob Wilcox; *Dist. Mgr.:* Greg Borstelmann

UDS/MOTOROLA, INC., Motorola Information Systems Group, 5000 Bradford Dr., Huntsville, AL 35805-1993, Tel: 205-430-8000, TELEX: 752602 UDS HTV, FAX: 205-830-5657; Empl.: 1000; *Sls. Mgr.:* Tony Zalenski

U. E. SYSTEMS, INC., 12 West Main St., Elmsford, NY 10523, Tel: 914-592-1220, 800-223-1325, TELEX: 229676, FAX: 914-347-2181; Empl.: 20

ULTRAN LABORATORIES, 1020 East Boal Ave., Boalsburg, PA 16827, Tel: 814-466-6200, FAX: 814-466-6847; FSC No.: 6635,AJ14,H266,5999; Empl.: 13; *Sls. Mgr.:* Julie L. Rhodes

ULTRAVOLT, INC., CS9002, Ronkonkoma, NY 11779, Tel: 800-876-POWER, FAX: 516-363-2423; Empl.: 15; *Sls. Mgr.:* Jim Morrison ..... **D•2013-2015**

ULVAC NORTH AMERICA CORPORATION, P.O. Box 799, 105 York Street, Kennebunk, ME 04043, Tel: 207-985-2973, TELEX: 46-9045, FAX: 207-985-4459; Empl.: 50; *Sls. Mgr.:* Susan Zilaro; *Dist. Mgr.:* Harold Baum

Ulveco

FAX: 713-977-5031

ULVECO, INC., 10401 West Office Dr., Houston, TX 77042, Tel: 1-800-527-7042; Empl.: 50; *Sls. Mgr.:* Dave Snelling ..... **A•2600-2601**

Local Sales Offices & Reps

AZ	Chandler, Techni-Source Corp.	602-497-0711
AR	Van Buren, Hightower Indl. Sls.	501-471-8116
CA	Arcadia, Van Gott & Assocs.	818-445-9728
CA	Murrieta, Van Gott & Assocs.	909-698-7774
CA	San Jose, Carmen Elctrns.	408-275-3775
CO	Franktown, MRC	303-660-8750
CT	Avon, Tom Maguire Assocs.	203-673-3019
FL	Maitland, E I R, Inc.	407-660-9600
GA	Duluth, PCI	404-623-8604
IL	Arlington Heights, Hill Sales Corp.	708-255-4400
MA	Norwood, Tom Maguire Assocs.	617-551-0500
MI	Ann Arbor, Lintott Assocs., Inc.	313-665-8457
MN	Minneapolis, Electro-Serv Co.	612-338-3475
NH	Windham, Tom Maguire Assocs.	603-437-1245
NM	Albuquerque, Techni-Source Corp.	505-268-4232
OH	Lexington, North Central Mktg.	419-884-9804
PA	Exton, Linear Sls.	215-524-8080

UNADILLA ANTENNA MFG. CO., Ballardvale Station, P.O. Box 4215, Andover, MA 01810, Tel: 508-475-7831, FAX: 508-474-8949; Empl.: 6; *Sls. Mgr.:* P. Jannini

UNDERWATER KINETICS, 1020 Linda Vista Dr., San Marcos, CA 92069, Tel: 619-744-7560, FAX: 619-744-7320; Empl.: 85; *Sls. Mgr.:* Greg Sippel

UNDERWOOD INDUSTRIES OF N.Y., INC., d/b/a Viking Products, 456 Broad St., P.O. Box 269, Waverly, NY 14892, Tel: 607-565-4551, FAX: 607-565-9650; Empl.: 7; *Sls. Mgr.:* Robert Pichette

UNGAR, Rubbermaid Office Products Group, 5620 Knott Ave., Buena Park, CA 90621, Tel: 714-994-2510, TELEX: 4720750 Eldon, FAX: 714-523-7790; FSC No.: 78976; Empl.: 140; *Sls. Mgr.:* Richard Shivers; *Dist. Mgr.:* Dianna Paul

UNHOLTZ-DICKIE CORP., 6 Brookside Dr., Wallingford, CT 06492, Tel: 203-265-3929, FAX: 203-265-2690; Empl.: 45

UNICORP, 291 Cleveland St., Orange, NJ 07050, Tel: 201-674-1700, 800-526-1389, FAX: 201-674-3803; FSC No.: 04729; Empl.: 82; *Sls. Mgr.:* Steven Mercadante

UNIMAX, A Divison of C & K, Ives Rd., P.O. Box 152, Wallingford, CT 06492, Tel: 203-269-8701, FAX: 203-265-5398; FSC No.: 80207; Empl.: 250; *Sls. Mgr.:* B. D'Amico

UNIMEASURE, INC., 7055 N.W. Grandview Dr., Corvallis, OR 97330, Tel: 503-757-3158, FAX: 503-757-0858

UNION CARBIDE CHEMICALS & PLASTICS COMPANY INC., Industrial Chemicals Div., Crystal, 9320 Chesapeake Dr., Ste. 216, San Diego, CA 92123, Tel: 619-279-4500, FAX: 619-565-8926; Empl.: 125; *Sls. Mgr.:* L. R. Rothrock

UNIPLEX CORP., 2905 Country Dr., St. Paul, MN 55117, Tel: 612-490-1936, FAX: 612-490-0495; Empl.: 8; *Sls. Mgr.:* M. Bryan

UNIpower CORPORATION

FAX: 305-971-1837

UNIPOWER CORPORATION, 2981 Gateway Dr., Pompano Bch., FL 33069-4803, Tel: 305-974-2442; FSC No.: 62125; Empl.: 260; *Sls. Mgr.:* Warren Peters, Mgr. Tech. Sls. ..... **D•2016-2035**

Local Sales Offices & Reps

AL	Huntsville, Marco Mktg.	205-883-9630
AZ	Phoenix, Comp. Sls.	602-263-6022
CA	Los Angeles, Wiley Co.	213-666-1611
CA	San Diego, Wiley Co.	619-453-9018
CA	San Jose, The JSYS Grp.	408-928-1411
CO	Denver, AKI Enterprises	303-756-0700
FL	Margate, EPM Corp.	305-977-0331
FL	Orlando, EPM Corp.	407-425-6149
IL	Itasca, Beta Technlgy.	708-250-9586
MD	Gaithersburg, Deltatronics	301-253-0615
MA	Bellingham, OEM Mktg. & Sls.	508-528-4983
MI	Livonia, Lowell-Wendt Mktg.	313-464-2722
MI	Wyoming, Lowell-Wendt Mktg.	616-791-7370
MN	Minneapolis, Scott Elctrn. Sls.	612-929-2985
NH	Salem, OEM Mktg. & Sls.	603-893-0009
NY	Great Neck, F & F Metro	516-482-4080
NY	Rochester, Elcom Sls. Inc.	716-385-1400
NY	Skaneateles, Elcom Sls. Inc.	315-685-8967
OH	Columbus, McFadden Sls.	614-761-3177
OR	Tigard, Northwest Comp. Sls.	503-620-3285
PA	Blue Bell, Deltatronics	215-641-9930
TX	Richardson, Jim D. Gray Assocs.	214-699-9976
VA	Alexandria, Deltatronics	703-971-1733
WA	Kirkland, Northwest Comp. Sls.	206-828-2104
WI	Milwaukee, Beta Technlg.	414-543-6609
Can	Mississauga, Andy Bauman Assocs.	416-828-2600
Can	W. Vancouver, Leister Blake Entprs.	604-926-6127

Local Distributors

CA	N. Hollywood, B.J. Wolfe	213-877-5518
CA	San Jose, B.J. Wolfe	408-371-3443
CA	San Jose, ForeSight Elctrns.	408-980-9700
CA	Santa Ana, ForeSight Elctrns.	714-833-2134
FL	Land-O-Lakes, AJ'S Power Source	813-996-2583
IL	Roselle, ForeSight Elctrns.	708-980-9890
NH	Salem, Diamond Elctrns.	603-894-4420
TX	Austin, Wofford Elctrns.	512-339-1131
TX	Dallas, Wofford Elctrns.	214-340-8555
TX	Houston, Wofford Elctrns.	713-351-2255

UNI-POWER HYBRIDS INTERNATIONAL, See Hybrids Intl. Ltd.

UNIT DESIGN, 1811 N. Case St., Orange, CA 92665, Tel: 714-282-8100, FAX: 714-282-8188; Empl.: 20; *Sls. Mgr.:* Nanette Janes

UNITED CHEMI CON

FAX: 708-640-6341

UNITED CHEMI-CON INC., 9801 W. Higgins Rd., Rosemont, IL 60018, Tel: 708-696-2000; Empl.: 65 ..... **A•1171-1173**

Local Sales Offices & Reps

AL	Huntsville, R. O. Whitesell	205-883-5110
CA	Los Altos, Recht Assoc.	415-964-6321
CA	Santa Ana, Jones & McGeoy Sls., Inc.	714-547-6466
CO	Englewood, Purdy & Assocs.	303-790-2211
GA	Norcross, R. O. Whitesell	404-449-9190
IL	Chicago, M. Gottlieb Assocs.	312-775-1151
IN	Indianapolis, R. O. Whitesell	317-876-9000
IA	Cedar Rapids, J.R. Sls., Inc.	319-393-2232
KS	Overland Pk., Spectrum Sls.	913-648-6811
KY	Versailles, R. O. Whitesell	606-873-1182
MI	Grand Rapids, R. O. Whitesell	616-942-5420
MI	Southfield, R. O. Whitesell	313-559-5454
MI	St. Joseph, R. O. Whitesell	616-983-7337
MN	Plymouth, Twist Co.	612-550-0922
NY	Hauppauge, Aurora Mktg.	516-434-1313
NY	Pittsford, Franklin Sls. Corp.	716-248-8251
NC	Raleigh, Vantage Mktg.	919-870-7123
OH	Cleveland, R. O. Whitesell	216-447-9020
OH	Dayton, R. O. Whitesell	513-298-9546
OR	Beaverton, Elctrn. Source, Inc.	503-627-0838
PA	Ambler, W.R. Hartmaier	215-643-6691
PA	Pittsburgh, R. O. Whitesell	412-963-6161
PA	Spring House, Hartmaier, Assoc.	215-643-6691
TN	Knoxville, R. O. Whitesell	615-694-9476
TX	Austin, RAM Elctrn Sls.	512-250-5082
TX	Houston, RAM Elctrn. Sls.	713-580-7394
TX	Plano, RAM Elctrn. Sls.	214-578-5400
Can	Scarborough, Ont., JRL/Franklin	416-756-9862

Local Distributors

AL	Huntsville, Hammond Elctrns	205-830-4764
AZ	Phoenix, Arizona Comps.	602-269-5655
AZ	Tempe, Time Elctrns.	602-967-2000
CA	Agoura Hills, Bell Inds.	818-706-2608
CA	Agoura Hills, Time Elctrns.	818-707-2890
CA	Anaheim, Time Elctrns.	714-937-0911
CA	Camarillo, Milgray Elctrns.	800-635-7812, 805-484-4055
CA	Chatsworth, Passive Comps.	818-700-8838
CA	El Monte, Marshall Inds.	818-307-6000
CA	Irvine, Kelex Elctrns.	714-863-1230
CA	Irvine, Milgray Elctrns.	714-753-1282
CA	San Jose, Capstone Elctrns.	408-453-9804
CA	Tustin, Capstone Elctrns.	713-730-0349
CA	Tustin, Projections Unltd.	714-544-2700
CA	Tustin, Time Elctrns.	714-669-0100
CO	Denver, Capstone Elctrns.	303-375-1300
CO	Englewood, Time Elctrns.	303-799-8851
CT	Cheshire, Time Elctrns.	203-271-3200
CT	Milford, Milgray	800-922-6911
FL	Ft. Lauderdale, Hammond Elctrns.	305-973-7103
FL	Ft. Lauderdale, Time Elctrns.	305-974-4800
FL	Melbourne, New Yorker Elctrns.	407-727-0955
FL	Winter Pk., Milgray Elctrns.	800-241-5523
GA	Atlanta, Time Elctrns.	404-984-0923
GA	Norcross, Hammond Elctrns.	404-449-1996
GA	Norcross, Milgray Elctrns.	800-241-5523
IL	Chicago, Newark Elctrns.	312-907-5211

IL	Itasca, Capstone Elctrns.	708-250-0300
IL	Palatine, Milgray Elctrns.	800-322-6271
IL	Schaumburg, Time Elctrns.	708-303-3000
IL	Wood Dale, Nep Elctrns.	708-595-8500
KS	Overland Pk, Milgray Elctrns.	800-255-6576, 913-236-8800
MD	Columbia, Milgray Elctrns.	800-638-6656
MD	Columbia, Time Elctrns.	301-964-3090
MA	Hopkinton, Interface Elctrns.	508-435-6858
MA	Peabody, Time Elctrns.	508-532-9756
MA	Wilmington, Capstone Elctrns.	508-657-5874
MA	Wilmington, Milgray Elctrns.	800-334-6941
MA	Wilmington, North Star Elctrns.	508-657-5155
MO	St. Louis, Time Elctrns.	314-391-6444
NJ	Marlton, Capstone Elctrns.	609-727-7800
NJ	Marlton, Milgray Elctrns.	800-257-7111
NJ	Parsippany, Milgray Elctrns.	800-622-0291
NJ	Rockaway, Tonar Inds.	201-586-9000
NJ	Teterboro, EAC	201-288-4477
NY	Farmingdale, Milgray Elctrns.	800-645-4729
NY	Hauppauge, Time Elctrns.	516-273-0100
NY	Mamaroneck, New Yorker Elctrns.	914-698-7600
NY	Ronkonkoma, Tri-Start Elctrns.	516-737-2200
NC	Charlotte, Time Elctrns.	704-522-7600
NC	Greensboro, Hammond Elctrns.	919-275-6391
NC	Raleigh, Capstone Elctrns.	919-954-0600
NC	Raleigh, Milgray Elctrns.	800-562-3118
OH	Cleveland, Milgray Elctrns.	800-321-0006
OH	Dublin, Time Elctrns.	614-761-1100
OR	Beaverton, Future Elctrns.	503-645-9454
PA	King of Prussia, Time Elctrns.	215-337-0900
PA	Malvern, Interface Elctrns.	215-889-2060
SC	Greensville, Hammond Elctrns.	803-233-4121
TX	Carrollton, Capstone Elctrns.	214-380-9049
TX	Dallas, Milgray Elctrns.	800-637-7227
TX	Fort Worth, TTI, Inc.	817-740-9000
TX	Houston, Time Elctrns.	713-530-0800
UT	Salt Lake City, Milgray Elctrns.	800-537-9739
UT	W. Valley, Time Elctrns.	801-973-8181
WA	Bothell, Projections Unltd.	206-485-2147
WA	Redmond, Time Elctrns.	206-882-1600
WI	Milwaukee, Marsh Electronics	414-786-5300
WI	New Berlin, Nep Elctrns.	414-785-9100
Can	Mississauga, Ont., Capstone	416-495-7705
Can	Mississauga, Ont., Time Elctrns.	416-672-5300
Can	Ottawa, Ont., Future Elctrns.	613-820-8313
Can	Richmond, B.C., Electrosonics, Inc.	604-273-2911
Can	Vancouver, B.C., Future	604-438-5545
Can	Willowdale, Ont., Electronics	416-494-1666
Can	Willowdale, Ont., Milgray Elctrns.	800-268-3315, 416-756-4481
Can	Winnipeg, Sas., Zentronics	204-694-1957

(UEC) UNITED ELECTRIC CONTROLS, P. O. Box 9143, Watertown, MA 02272-9143, Tel: 617-926-1000, TELEX: 92 2445, FAX: 617-926-2568; Empl.: 420; *Sls. Mgr.:* Dave Williams; *Dist. Mgr.:* George Miller

UNITED FOAM PLASTICS, 172-Q E. Main St., Georgetown, MA 01833, Tel: 508-352-2200, FAX: 508-352-7169; FSC No.: 55900; Empl.: 200; *Sls. Mgr.:* R.L. Bailly

UNITED MOTION TECHNOLOGY, 2954 Scott Blvd., Santa Clara, CA 95054, Tel: 408-970-9742, 1-800-424-STEP, FAX: 408-986-8009; Empl.: 4

Local Sales Offices & Reps

CA	Milpitas, Maxim Elctrn. Sls.	408-946-6001
CT	Essex, Winslow Elec. Co.	203-767-8229
FL	Pampano Bch., Motion Prods.	305-783-9003
NY	Cazenovia, Delen Assocs.	315-655-8602
PA	Pittsburgh, Precision Dvcs.	412-941-7662
Can	Ottawa, Graham Dewar & Assoc.	613-744-8463

UNITED PRICING REPORTS, 645 Stewart Ave., Garden City, NY 11530, Tel: 516-227-1300, FAX: 516-227-1901

UNITED SOLDER WRAP INC., See Vector Elctrns. Co., Inc.

UNITED STATES CRYSTAL CORP., 3605 McCart St., Fort Worth, TX 76110, Tel: 817-921-3014, 800-433-7140, TWX: 910-893-4084, FAX: 817-923-0424; FSC No.: 52847; Empl.: 75; *Sls. Mgr.:* Jan Henderson

UNITED STATES ELECTRONICS, 60 Brown Ave., Springfield, NJ 07081, Tel: 201-912-0111, FAX: 201-912-0015; Empl.: 20

UNITED SUPERTEK, INC., 118 Charcot Ave., San Jose, CA 95131-1101, Tel: 408-922-0730, FAX: 408-922-0534; Empl.: 55; *Sls. Mgr.:* Roger Meade

UNITED SWITCH COMPANY, 3214 W. McGraw, Seattle, WA 98199, Tel: 206-282-8823, FAX: 206-282-9173; Empl.: 3; *Sls. Mgr.:* John Spaulding

UNITED TECHNICAL PRODUCTS, 6 Headley Pl, Fallsington, PA 19054, Tel: 800-553-5300, FAX: 215-736-8515; Empl.: 50; *Sls. Mgr.:* Bob Harbison, Jr.

UNITED TECHNOLOGIES MICROELECTRONICS CENTER, United Technologies Corp., 1575 Garden of The Gods Rd., Colorado Springs, CO 80907, Tel: 719-594-8000, 1-800-MIL-UTMC, FAX: 719-594-8032; Empl.: 308; *Sls. Mgr.:* Dwight Deem

UNITED WIRE & CABLE CORP., 425 Shrewsbury St., Worcester, MA 01604, Tel: 508-757-3872, FAX: 508-753-2173; FSC No.: 51348; Empl.: 10; *Sls. Mgr.:* T. P. Andrews

UNIT INDUSTRIES, 1140 E. Valencia Dr., Fullerton, CA 92631, Tel: 714-871-4161, FAX: 714-871-4164; FSC No.: 0AMM9; Empl.: 40; *Sls. Mgr.:* D. Molby

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FAX: 302-424-5055

UNITRACK INDUSTRIES, INC., 967 E. Masten Cir., Milford, DE 19963, Tel: 302-424-5050; Empl.: 40; *Sls. Mgr.:* Anna Orcutt ..... **C•1114-1115**

Local Sales Offices & Reps

AZ	Paradise Valley, Techrep-Arizona	602-991-6646
CA	Santa Ana, El-Com, Inc.	714-432-6630
CA	Santa Clara, Cindel/Penmark	408-988-8331
CO	Highlands Ranch, Valcomp Elctrns., Inc.	303-791-0330
FL	Clearwater, Brennan Assocs.	813-446-5006
IA	Des Moines, The Beams Co.	515-255-1148
IL	Glen Ellyn, Lincoln, Hodges & Assocs.	708-469-6750
IN	Ft. Wayne, Outman Sls.	219-489-7699
MD	Ellicott City, Callas Elctrns., Inc.	410-465-0044
MA	Northboro, Easterly Sls. Assocs.	508-393-7399
MI	Chelsea, Sean T. Sls.	313-475-2021
MN	St. Paul, Countryman Assocs.	612-645-9151
NJ	Hampton, Churchill Assocs.	908-735-6626
NY	Larchmont, Hingston Walsh Assocs., Inc.	914-834-5781
NY	Rochester, Nortek	716-387-0640
NC	Greensboro, Loki Data Prods., Inc.	919-234-5066
OH	Akron, Augnat Assocs.	216-239-2499
PA	Souderton, Intek, Inc.	215-723-0433
TX	Richardson, Barry Sls.	214-234-0255

Local Distributors

CA	Milpitas, M.S. Inserts & Fasteners	408-946-6565
CA	Santa Ana, El-Com, Inc.	714-432-6630
CA	Santa Clara, Context Engrg.	408-748-8676
CO	Denver, Integrated Elctrns., Inc.	303-393-6121
CT	Wallingford, Midstate Elctrns.	203-265-9900
FL	Coral Springs, HAI Elctrns., Inc.	305-752-7520
GA	Norcross, Applied Power, Inc.	404-263-0421
MA	Billerica, M.S. Inserts & Fasteners	508-670-5600
MA	Northboro, Papi Supp. Co.	508-393-3127
MA	Winchester, Webb Distbn.	617-729-5800
MI	Grand Rapids, S-F Elctrns. Supp. Co.	616-459-0216
NC	Winston-Salem, Kirkman Elctrns.	919-722-9131
OH	Warren, Rem Elctrns. Supp. Co., Inc.	216-373-1300
TX	Houston, Tristar Elctrns.	713-667-7200
TX	Wylie, Air Quip/Robleyco	214-442-3573

UNITREK CORPORATION, 3000 Lewis & Clark Hwy., Ste.2, Vancouver, WA 98661, Tel: 206-699-7277, FAX: 206-694-9230; Empl.: 80; *Sls. Mgr.:* John Sailer

UNITRODE CORP., 580 Pleasant St., Watertown, MA 02172, Tel: 617-926-0404, FAX: 617-924-1235; Empl.: 2,000; *Sls. Mgr.:* Leslie Wallace; *Dist. Mgr.:* Ron Myers

UNITRODE INTEGRATED CIRCUITS CORP., 7 Continental Blvd., Merrimack, NH 03054-0399, Tel: 603-424-2410, TWX: 95-3040

UNIVERSAL AD-YU/D-F INC., 2517 E. Norwich St., St. Francis, WI 53235, Tel: 414-482-4100; FSC No.: 90101; Empl.: 10; *Sls. Mgr.:* Ronald Tessmer

UNIVERSAL INSTRS. CORP., MECHANIZED ELCTRN. ASSEMBLY (MEA) DIV., See Mechanized Elctrn. Assembly Div., Universa

UNIVERSAL SEMICONDUCTOR INC., 1925 Zanker Rd., San Jose, CA 95112, Tel: 408-436-1906, FAX: 408-436-1125; FSC No.: 62305; Empl.: 30; *Sls. Mgr.:* Uday B. Koppikar

Universal Voltronics

FAX: 914-241-3129

UNIVERSAL VOLTRONICS DIV., Thermo Voltek Corp., 27 Radio Circle Dr., Mt. Kisco, NY 10549, Tel: 914-241-1300, TWX: 710-571-2142; FSC No.: 14225; Empl.: 85 ..... **D•2037-2039**

Local Sales Offices & Reps

AZ	Tempe, Trembly Assocs.	602-967-2058
CA	Los Alamitos, Tritek Sci. Dvcs.	714-362-3592
CO	Wheat Ridge, Trembly Assocs.	303-921-8900
IN	Ossian, Science Sls. Inc.	219-622-7383
NV	Las Vegas, Trembly Assoc., Inc.	702-739-9770
NJ	Roseland, Tech. Mktg. Assoc.	201-228-7800
NM	Albuquerque, Trembly Assoc., Inc.	505-266-8616
PA	Audubon, Holmes Assocs., Inc.	215-666-0637
TX	El Paso, Trembly Assoc.	915-533-9380
UT	No. Salt Lake City, Trembly Assocs., Inc.	801-295-4703
WA	Bellevue, The Western Rep.	206-637-0947
Can	Nepean, Ont., Datacomp Elctrns.	613-723-8825
Can	Toronto, Ont., Datacomp Elctrns.	416-533-4076

Local Distributors

AZ	Phoenix, Trembly Assoc. Inc.	602-967-2058
CO	Wheat Ridge, Trembly Assoc. Inc.	303-421-8900
NV	Las Vegas, Trembly Assoc. Inc.	702-739-9770
NM	Albuquerque, Trembly Assoc. Inc.	505-266-8616
UT	North Salt Lake, Trembly Assoc. Inc.	801-295-4703
Can	Toronto, Ont., Datacomp Elctrns.	416-533-4076

UNIVERSITY SOUND, INC., Mark IV Industries, 13278 Ralston, Sylmar, CA 91342, Tel: 818-362-9516, FAX: 818-367-5292; Empl.: 72; *Sls. Mgr.:* Greg McLagan

URBAN ELECTRONICS, P. O. Box 456, Dover, MA 02030, Tel: 617-329-4068, FAX: 508-785-2265; Empl.: 50; *Sls. Mgr.:* G. Urban

U.RD

United Research and Development

FAX: 714-831-6371

U.R.D. AMERICA, P.O. Box 6006, Laguna Nigel, CA 92607, Tel: 714-831-0111; *Sls. Mgr.:* Lawrence Sultan ..... **D•1169**

Local Sales Offices & Reps

CA	Canoga Pk., C & W Comp. Sls.	818-700-2684
IL	Lena, BB & J Sls., Inc.	815-369-2066
MA	Brookline, Reliable Sls.	617-738-8305
NY	Franklin Sq., Cooper Simon Emtec	516-489-0404

USAPEX CORP., 2378 Walsh Ave., Ste B, Santa Clara, CA 95051, Tel: 408-982-9063, FAX: 408-982-0223; FSC No.: 77-0326422; Empl.: 15

USAR SYSTEMS, INC., 568 Broadway Ste. 405, New York, NY 10012, Tel: 212-226-2042, FAX: 212-226-3215; Empl.: Less than 10; *Sls. Mgr.:* Tony D'Amato

US DIGITAL

FAX: 206-260-7452

U. S. DIGITAL CORP., 17401 N.E. Stoney Meadows Dr., Vancouver, WA 98682, Tel: 206-260-7451; *Sls. Mgr.:* David Madore ..... **B•2019-2023; D•1327**

Local Sales Offices & Reps

VA	Roanoke, Engrg. & Mktg. Corp. of VA	703-562-0726

Local Distributors

VA	Roanoke, Engrg. & Mktg. Corp. of VA	703-562-0726

USD PRODUCTS , Div. of Bussmann, 7300 W. Wilson Ave., Chicago, IL 60656, Tel: 708-867-4600, FAX: 708-867-2211; Empl.: 200; *Sls. Mgr.:* Mr. Chris Osmun

USECO DIV., Litton Inds, 13536 Saticoy St, Van Nuys, CA 91409, Tel: 818-786-6381, FAX: 818-786-9162; FSC No.: 88245; Empl.: 100; *Sls. Mgr.:* Ed Wallen

U.S. ELCO, INC., See Cosel USA Inc.(Formerly US Elco)

U. S. LASER CORP., 825 Windham Court North, Wyckoff, NJ 07481, Tel: 201-848-9200, FAX: 201-848-9006; Empl.: 25; *Sls. Mgr.:* James F. Golden

U.S. POWER/RELCO MIDWEST, U.S. Power Converting Co., 8830 West 61st North, Wichita, KS 67205, Tel: 316-722-6440; Empl.: 12; *Dist. Mgr.:* Jonathan P. Snow ..... **C•1081; D•1913**

U.S. POWER CONVERTING COMPANY/RELCO, Leonard V. Snow & Assocs., 21517 Ocean, Torrance, CA 90503, Tel: 310-316-9984, FAX: 310-316-9050; Empl.: 8; *Sls. Mgr.:* Van Snow; *Dist. Mgr.:* Tom Clark ..... **C•1081; D•1913**

Local Sales Offices & Reps

KS	Wichita, U.S. Power Converting/Relco	316-722-6440
Can	New Dundee, Ont., Ritz Elctrns.	519-696-2616
Can	Torrance, U.S. Power Conv. Co.	310-316-9984

Local Distributors

CA	Torrance, U.S. Power Converting/L. Snow & Assocs.	310-316-9984
KS	Witchita, U.S. Power Converting/Relco	316-722-6440
Can	New Dundee, Ont., Ritz Elctrns.	519-696-2616

U.S. RESISTOR, INC., P.O. Box 1059, St. Marys, PA 15857-1059, Tel: 814-781-7679, FAX: 814-834-9201

U.S. SENSOR CORP., 1832 W. Collins Ave., Orange, CA 92667, Tel: 714-639-1000, FAX: 714-639-1220; Empl.: 25

U.S. SENSOR CORP., 1832 W. Collins Ave., Orange, CA 92667, Tel: 714-639-1000, FAX: 714-639-1220; Empl.: 25

U.S. TERMINALS INC., 7502 Camargo Rd., Cincinnati, OH 45243, Tel: 513-561-8145, FAX: 513-561-8755; FSC No.: 12615; Empl.: 45; *Sls. Mgr.:* George L.Stepp

FAX: 818-287-7350

U.S. TOYO FAN CORP., 4915 Walnut Grove Ave., San Gabriel, CA 91776, Tel: 818-287-5297; Empl.: 20; *Sls. Mgr.:* Bill Jacobs; *Dist. Mgr.:* Bill Jacobs ..... **C•1652-1653**

Local Sales Offices & Reps

AL	Huntsville, DHR Mktg., Inc.	205-536-9775
AZ	Scottsdale, Western High Tech. Mktg.	602-860-2702
CA	Oceanside, Noo Rep Tech Sls.	619-941-0558
CA	San Gabriel, U.S. Toyo Fan Corp.	818-287-5297
CA	Sunnyvale, U.S. Toyo Fan Corp.	408-737-0123
CO	Boulder, Comp. Prod. Sls.	303-530-2800
FL	Oviedo, Sunland Assocs.	407-365-9533
GA	Duluth, DHR Mktg., Inc.	404-564-0529
IL	Woodridge, Golten Assoc.	708-985-5100
IA	Blue Grass, Rothkopf & Assocs.	319-381-4396

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OAKLAND, CA 94606

KS	Olathe, Rothkopf & Assocs.	913-829-8897
MD	Towson, Dalbrook Corp.	410-296-3165
MA	Norwood, Tom Maguire Assocs.	617-551-0500
MI	Brighton, W. R. Hummon	313-486-5333
MN	New Brighton, Boerger & Assoc.	612-636-4339
MO	St. Louis, Rothkopf & Assocs.	314-961-4485
NJ	Fort Lee, Nepture Elec.	201-461-2789
NY	E. Syracuse, Fountain, Young & Co.	315-437-7733
NY	Plainview, Neptune Elec.	516-349-1600
NC	Raleigh, DHR Mktg., Inc.	919-829-1970
OH	Richfield, Geotronix	216-659-6100
OR	Beaverton, Unicomp, Inc.	503-643-1645
PA	Allison Pk., Geotronix Inc.	412-487-1770
PA	Lansdale, Dalbrook Corp.	215-362-8033
SC	Greenville, DHR Mktg., Inc.	803-235-3594
TN	Nashville, DHR Mktg., Inc.	615-331-2745
TX	Richardson, Zonk & Assoc.	214-238-7651
VA	Fredericksburg, Dalbrook Corp.	703-786-1873
WA	Snohomish, Unicomp, Inc.	206-568-0511
PR	Santruce, SISCO	809-726-3137
Can	Montreal, Dynatech Elctrns.	514-276-4477

Local Distributors

AZ	Scottsdale, Added Value Elctrns.	602-951-9788
CA	Fremont, Connex Elctrns.	510-656-7722
CA	San Jose, Rose Elctrns.	408-263-9700
CA	Tustin, Added Value Elctrns. Distr.	714-259-8258
CO	Wheatridge, Added Value Elctrns.	303-422-2529
CT	Hamden, Astrex, Inc.	203-288-0044
UT	Salt Lake City, Added Value Elect.	801-975-9500
IL	Elk Grove, Martec Assocs.	708-956-8090
MD	Beltsville, Petricko Sls.	301-937-4960
MA	Haverhill, Cord Elctrns.	617-374-0100
MA	W. Springfield, Astrex, Inc.	413-788-7341
MN	Fridley, Voyager Elec.	612-571-9519
MN	Minneapolis, Aerospace Computer Supp.	612-884-4725
NY	Elmsford, Multimeterics	914-347-3666
NY	Endwell, Astrex, Inc.	607-754-3823
OR	Beaverton, Comp. Resources, Inc.	503-641-8488
PA	Willow Grove, Astrex, Inc.	215-784-9934
TX	Richardson, Zec Sls.	214-669-0895
Can	Mississauga, Ont., Rush Elex. Ltd.	416-677-7280
Can	Surrey, B.C., MEMCO	604-590-1553

U.S. TRANSFORMER AND INDUCTOR, 1400 E. College Dr., Cheyenne, WY 82007, Tel: 800-584-9339, FAX: 307-637-4883; Empl.: 11; *Sls. Mgr.:* Carl Le Jamdre

UTE MICROWAVE, 3500 Sunset Ave., Asbury Park, NJ 07712, Tel: 908-922-1009, FAX: 908-922-1848; FSC No.: 23261; Empl.: 35

UTICOR TECHNOLOGY, 4140 Utica Ridge Rd., Bettendorf, IA 52722, Tel: 319-359-7501, FAX: 319-359-9094; Empl.: 110; *Sls. Mgr.:* Tom Howard

UTI INSTRUMENTS CO., 2030-C Fortune Dr., San Jose, CA 95131, Tel: 408-428-9400, FAX: 408-428-0823; Empl.: 80; *Sls. Mgr.:* Tom Strahl

UVP, INC., 5100 Walnut Grove Ave., San Gabriel, CA 91776, Tel: 818-285-3123, 800-452-6788, FAX: 818-285-2940; Empl.: 100; *Sls. Mgr.:* Phil Spillane

VAIL SILICON TOOLS, 692 A S. Military Trail, Deerfield Beach, FL 33442, Tel: 305-570-5580, FAX: 305-428-1811; Empl.: 4; *Sls. Mgr.:* Jim Prince; *Dist. Mgr.:* Doug Beard

FAX: 619-457-0127

VALHALLA SCIENTIFIC, 9955 Mesa Rim Rd., San Diego, CA 92121, Tel: 619-457-5576; Empl.: 75; *Sls. Mgr.:* Kerry Clark ..... **D•1328-1331**

Local Sales Offices & Reps

AL	Huntsville, Currie, Peak & Frazier	205-536-1506
CA	Costa Mesa, Cutlass Elctrns.	714-549-9358
CA	San Diego, Amasco	619-292-7666
CA	San Jose, ARC Tech. Resources	408-263-6486
CA	Sunnyvale, ARC Technical Resources	408-773-8871
CA	Torrance, Cutlass Elctrns.	213-324-7360
FL	Orlando, Currie, Peak & Frazier	407-855-0843
FL	Pace, Currie, Peak & Frazier	904-994-0599
FL	Tampa, Currie, Peak & Frazier	813-854-5116
FL	W. Melbourne, Currie, Peak & Frazier	407-724-6795
GA	Duluth, Currie, Peak & Frazier	404-497-9404
IL	Arlington Hgts., Comtel Midwest Co.	708-392-4040
IN	Indianapolis, Comtel Midwest Co.	317-253-1681
KS	Shawnee Mission, Comtel Midwest	913-268-0762
KS	Shawnee Mission, Comtel Midwest Co.	913-268-0762
MD	Landover, Sel-Tronics	301-341-2700
MA	Hopkinton, Eastern Sys.	508-435-2151
MI	Farmington Hills, Carter, McCormic & Peirce (CMP)	313-477-7700
MN	Wayzata, Comtel Midwest Co.	612-476-1551
MO	Kansas City, Comtel Midwest	913-268-0762
NY	Rochester, Eastern Systems	716-292-1460
NC	Charlotte, Currie, Peak & Frazier	704-846-1702
NC	Greensboro, Currie, Peak & Frazier	919-373-0380
OH	Englewood, Carter, McCormic & Peirce (CMP)	513-836-0951
OH	Parma, Carter, McCormic & Peirce (CMP)	216-398-0400
OR	Portland, Westcon, Inc.	503-283-0132
PA	Philadelphia, Robert Meyers Assocs.	215-224-1663
PA	Pittsburg, Carter, McCormic & Peirce (CMP)	412-826-3800
TX	Dallas, Entest	214-980-9876
TX	Houston, Entest	713-686-7306
VA	Hampton, Sel-Tronics	804-827-6308
WI	New Berlin, Comtel Midwest Co.	414-544-6042

VALIDYNE ENGINEERING CORPORATION, 8626 Wilbur Ave., Northridge, CA 91324, Tel: 818-886-2057, TELEX: 65-1303, FAX: 818-886-6512; Empl.: 200

VALLEY ELECTROMAGNETICS, ECM Motor Co., 1099 Proctor Dr., Elkhorn, WI 53121, Tel: 414-723-6400, FAX: 414-723-7373; Empl.: 100; *Sls. Mgr.:* R. Forschler

VALOR ELECTRONICS, 9715 Business Park Avenue, San Diego, CA 92131-1642, Tel: 619-537-2500, TELEX: 653406 VALORSD, FAX: 619-458-0875; FSC No.: 15003; Empl.: 5000; *Sls. Mgr.:* Brad Rogers ..... **A•1686-1687, 2602-2603; D•2215**

Local Sales Offices & Reps

AL	Madison, Benchmark Tech.	205-464-0033, FAX:205-464-9909
AZ	Scottsdale, American Mktg., Inc.	602-948-2778, FAX:602-860-4455
CA	Garden Grove, Elsco Elctrns.	714-891-4621, FAX:714-891-1251
CA	San Diego, Elsco Elctrns., Inc.	619-292-1771
CA	Santa Clara, Fahrner-Miller Assocs.	408-727-9800, FAX:408-496-6952
CO	Englewood, Comp. Sls., Inc.	303-779-8060, FAX:303-779-8357
FL	Boca Raton, So. Atlantic Comp. Sls.	417-391-1034
FL	Orlando, So. Atlantic Comp., Sls.	407-857-3650, FAX:407-857-3298
FL	Seminole, So. Atlantic Comp., Sls.	813-595-6397, FAX:813-595-6397
GA	Norcross, Benchmark Technlg.	404-446-1711, FAX:404-448-2854
ID	Meridian, Utah CSI	208-888-3554
IL	Arlington Hgts., KMA Sls., Co.	708-398-5300, FAX:708-398-5708
IN	Carmel, Valentine Assoc., Inc.	317-846-0008
MA	Topsfield, Whitehead Assocs. Inc.	508-887-8050, FAX:508-887-5434
MI	Canton, Techrep Inc.	313-981-1950, FAX:313-981-2006
MN	Minneapolis, DeBeck-Hays Assocs. Inc.	612-835-3610,FAX:612-835-0515
NJ	Marlton, BGR Assocs.	609-983-1020, FAX:609-983-1879
NJ	Matawan, Ashtec, Inc.	908-583-6903, FAX:908-583-0379
NY	Apalachin, T-Squared Elctrns. Co.	607-625-3983
NY	Cicero, T-Squared Elctrns. Co.	315-699-1559
NY	Port Washington, Ashtec Inc.	516-767-0336, FAX:516-767-0981
NY	Victor, T-Squared Elctrns. Co.	716-924-9101
NC	Raleigh, Benchmark Technlg.	919-850-0633, FAX:919-850-0725
OH	Dayton, KW Elctrn. Sls.	513-890-2150, FAX:513-890-5408
OH	Shaker Heights, KW Elctrn. Sls.	216-491-9177, FAX:216-491-9102
PA	Pittsburgh, KW Elctrn. Sls.	412-492-0777, FAX:412-492-0780
TX	Austin, Kruvand	512-219-9441,FAX:512-219-1932
TX	Dallas, Kruvand	214-437-3355,FAX:214-680-8854
UT	Midvale, Utah CSI	801-561-5099
WA	Seattle, Northmar Inc.	206-524-5170, FAX:206-524-0402
WI	Milwaukee, KMA Sls. Co.	414-259-1771, FAX:414-259-0246
PR	Rio Piedras, D.K. Marketing	809-765-5380, FAX:809-758-5380
Can	Rexdale,Ont., Electro-Source, Inc.	416-675-4490

Local Distributors

AL	Huntsville, Hall-Mark Elctrns. Corp.	205-837-8700
AZ	Phoenix, Hall-Mark Elctrns. Corp.	602-437-1200

CA Chatsworth, Hall-Mark Elctrns. Corp. .: 818-773-4560
CA Irvine, Hall-Mark Elctrns. Corp. 714-727-6000
CA Milpitas, Sierra West 408-945-1050
CA Riverside, Electronic Supply 714-683-7300
CA Rocklin, Hall-Mark Elctrns. Corp. 916-624-9781
CA San Diego, Elctrn. Supp. 619-693-8222
CA San Diego, Hall-Mark Elctrns. Corp. ... 619-268-1201
CA San Jose, Elctrn. Supp. 408-453-3770
CA San Jose, Hall-Mark Elctrns. Corp. 408-432-4000
CO Englewood, Hall-Mark Elctrns. Corp. .. 303-790-1662
CT Cheshire, Hall-Mark Elctrns. Corp. 203-271-2844
CT Wallingford, Cronin Elctrns. 203-265-3134
FL Casselberry, Hall-Mark Elctrns. Corp. 407-830-5855
FL Largo, Hall-Mark Elctrns. Corp. 813-541-7440
FL Pompano Bch., Hall-Mark Elctrns. Corp. 305-971-9280
GA Duluth, Hall-Mark Elctrns. Corp. 404-623-4400
IL Wood Dale, Hall-Mark Elctrns. Corp. .. 708-860-3800
IN Indianapolis, Hall-Mark Elctrns. Corp. 317-872-8875
KS Lenexa, Hall-Mark Elctrns. Corp. 913-888-4747
MD Columbia, Hall-Mark Elctrns. Corp. 301-988-9800
MA Billerica, Hall-Mark Elctrns. Corp. 508-667-0902
MA Needham, Cronin Elctrns. 617-449-5000
MI Plymouth, Hall-Mark Elctrns. Corp. 313-416-5800
MN Bloomington, Hall-Mark Elctrns. Corp. 612-881-2600
MO Earth City, Hall-Mark Elctrns. Corp. 314-291-5350
NH Manchester, Cronin Elctrns. 603-624-0105
NJ Moorsetown, Hall-Mark Elctrns. Corp. 609-235-1900
NJ Parsippany, Hall-Mark Elctrns. Corp. .. 201-515-3000
NJ Rockaway, Tonar Inds. Inc. 201-586-9000
NY Fairport, Hall-Mark Elctrns. Corp. 716-425-3300
NY Ronkonkoma, Hall-Mark Elctrns. Corp. 516-737-0600
NC Raleigh, Hall-Mark Elctrns. Corp. 919-872-0712
OH Solon, Hall-Mark Elctrns. Corp. 216-349-4632
OH Worthington, Hall-Mark Elctrns. Corp. 614-888-3313
OK Tulsa, Hall-Mark Elctrns. Corp. 918-254-6110
TX Austin, Hall-Mark Elctrns. Corp. 512-258-8848
TX Dallas, Hall-Mark Elctrns. Corp. 214-343-5822
TX Houston, Hall-Mark Elctrns. Corp. 713-781-6100
UT Salt Lake City, Hall-Mark Elctrns., Inc. 801-269-0416
WA Seattle, Hall-Mark Elctrns. Corp. 206-547-0415
WI New Berlin, Hall-Mark Elctrns. Corp. .. 414-797-7844
Can Pointe Claire, Tonar Inds., Inc. 514-694-3057

VALPEY-FISHER:MATEC CORP, 75 South St, Hopkinton, MA 01748, Tel: 508-435-6831, FAX: 508-435-5289; FSC No.: 5955; Empl.: 120; *Sls. Mgr.:* Mark Freyermuth, Mktg. Mgr.; *Dist. Mgr.:* John Pimentel

VALPEY-OPT COMPANY, Valpey-Fisher Corp./Opt Inds., 75 South St., Hopkinton, MA 01748, Tel: 508-435-6831, FAX: 508-435-5289; Empl.: 7; *Sls. Mgr.:* Wim Van Den Akker

VAMISTOR CORP., 144 River Bend Drive, Sevierville, TN 37862, Tel: 615-453-0001, FAX: 615-453-0003; FSC No.: 56856, OEBU2; Empl.: 53; *Sls. Mgr.:* Pat Healy; *Dist. Mgr.:* Pat Healy

VANGUARD ELECTRONICS CO., 1480 W. 178th St., Gardena, CA 90248, Tel: 310-323-4100, FAX: 310-329-8427; FSC No.: 03550; Empl.: 250; *Sls. Mgr.:* Kenneth R. Finley (Intl.); *Dist. Mgr.:* John Hoenig (Domestic)

VANN INSTRUMENTS, 1046 Vassar N.E., Albuquerque, NM 87106, Tel: 505-265-2498, FAX: 505-268-9722; *Sls. Mgr.:* Michael E. Vann

VAN WATERS & ROGERS INC., Univar Corp., PO Box 64004, St. Paul, MN 55164-0004, Tel: 612-774-9400, FAX: 612-774-0850; Empl.: 30000; *Sls. Mgr.:* George Coyle

VARIAN ASSOCIATES, Electron Device Business, 3100 Hansen Way, Palo Alto, CA 94304, Tel: 415-493-4000, 800-544-4636, TELEX: 34 8476, FAX: 415-424-6276; FSC No.: 02845; Empl.: 10,700; *Sls. Mgr.:* John Beighley

VARIAN MICROWAVE EQUIPMENT PRODUCTS, Varian Assocs., Inc., 3200 Patrick Henry, Santa Clara, CA 95054, Tel: 408-496-6273, TELEX: 510-601-5674 MEDSC, TWX: 348476, FAX: 408-496-6235; FSC No.: 59782; Empl.: 300; *Sls. Mgr.:* Don Crumm

VARITRONIX, See VL Electronics

VARTA BATTERIES, INC., 300 Executive Blvd., Elmsford, NY 10523, Tel: 914-592-2500, 800-431-2154, FAX: 914-592-2667; Empl.: 33

VASAK INDS., INC., 211 Eucalyptus Drive, El Segundo, CA 90245, Tel: 1-800-67-VASAK; Empl.: 10; *Sls. Mgr.:* John Vasak

VA-TRAN SYSTEMS INC., 677 Anita St. Ste. A , Chula Vista, CA 91911, Tel: 619-423-4555, FAX: 619-423-4604; Empl.: 10; *Sls. Mgr.:* J.E. Sloan

VEAM, Litton Systems, 100 New Wood Rd., Watertown, CT 06795, Tel: 203-274-9681, TELEX: 710-477-0039, FAX: 203-274-4963; FSC No.: 55561; Empl.: 80; *Sls. Mgr.:* Maryellen Myers

VECTOR ELECTRONIC COMPANY

FAX: 818-365-5718

VECTOR ELECTRONIC CO., INC., 12460 Gladstone Ave., Sylmar, CA 91342, Tel: 818-365-9661, 800-423-5659; FSC No.: 82893; Empl.: 95; *Dist. Mgr.:* J. Forman ..... **C•1025, 1674-1675, 1678-1681**

For Vector Elctrns.' sales offices and reps. in all other states- 800-423-5659.

Local Sales Offices & Reps

CA Carlsbad, QPI Sls. 714-431-8859
CA Santa Ana, Mike Roth 714-647-0606
FL Melbourne, Saber Assocs. 407-724-0920
IL Inverness, Carvel Eng. 708-934-9600
MA Needham Hgts., Todino 617-444-7925
NJ Newark, Rical Assocs. 201-643-0880
NM Albuquerque, Odyssey1 505-345-9695
OH Solon, Five Star 216-349-1161
OR Beaverton, Luscombe, Eng. 503-636-6664
PA King of Prussia, KSI, Inc. 215-783-6400
TX Dallas, Technlg. Reps. 214-713-9027
VA Alexandria, Dyna-Rep 703-354-1222

National Distributors

Local Distributors

IL Chicago, Newark Elctrns. 312-784-5100
MD Gaithersburg, Pioneer Technlgs. 301-921-0660
MN Thief River Falls, Digi-Key 800-344-4539
OH Cleveland, Pioneer Stand. Elec. 216-587-3600
PA Philadelphia, Powell Elctrns. 215-365-1900
TX Ft. Worth, Allied 800-433-5700
TX Ft. Worth, Allied Elctrns. 800-433-5700

THE VECTOR GROUP, INC., 189 Horsham Rd., Horsham, PA 19044, Tel: 1-800-523-3696, FAX: 215-672-3411; Empl.: 10; *Sls. Mgr.:* Frank Menichello

VECTRONICS MICROWAVE CORP., 113 Lincoln Blvd., Middlesex, NJ 08846, Tel: 908-356-2377, FAX: 908-356-6782; FSC No.: 32846; Empl.: 30; *Sls. Mgr.:* John G. Vogler

VECTRON LABORATORIES, INC., 166 Glover Ave., P.O. Box 5160, Norwalk, CT 06856-5160, Tel: 203-853-4433, TWX: 710-468-3796, FAX: 203-849-1423; FSC No.: 27802; Empl.: 340; *Sls. Mgr.:* Larry Jawitz ..... **A•1502-1509**

Local Sales Offices & Reps

AL Huntsville, Saber Assocs. 800-327-0853
AZ Phoenix, J. Smith & Assoc. 602-267-0981
CA Mountain View, Schoenduve Corp. 415-962-8330
CA San Diego, Midwin & Olifson, Inc. 800-275-8765
CA Tarzana, Midwin & Olifson, Inc. 800-275-8765
CO Parker, Techn. Mktg. Assocs. 303-841-3435
CT Watertown, May Tech. 203-274-3777
FL Melbourne, Saber Assocs. 800-432-6288
GA Lawrenceville, Saber Assocs. 800-327-0853
IL Libertyville, GMR Sls., Inc. 708-367-8440
IN Greenwood, Valentine & Assocs. 317-888-2260
IN Kokomo, Valentine & Assocs. 317-453-3799
IN South Bend, Valentine & Assocs. 219-288-7070
MO St. Louis, Rush & West Assocs. 314-965-3322
KS Olathe, Rush & West Assocs. 913-764-2700
MD Burtonsville, Eastern Instrumentation 301-384-8500
MA Reading, May Tech. 617-942-7135
MI Grand Rapids, R. P. Urban Assocs. 616-245-0511
MN Burnsville, Allied Comp. Reps. 612-435-7876
NY Great Neck, F & F Metro 516-482-4080
NM Albuquerque, J. Smith & Assocs. 505-345-6501
NY Rochester, T—Squared Elctrns. 716-924-9101
NC Clayton, Saber Assocs. 800-327-0853
OH Englewood, A. Nace Co. 513-836-0931
OH Hudson, A. Nace Co. 216-656-3273
PA Havertown, SWR Tech., Inc. 215-353-6639
TX Dallas, Texas Avionics 214-437-5677
UT Salt Lake City, Techn. Mktg. Assocs. .. 801-483-1009

WA Seattle, Datacom 206-285-2525
Can Quebec, Microvolt Elctrns. 514-421-4164

VEECO INSTRUMENTS INC., Terminal Dr., Plainview, NY 11803, Tel: 516-349-8300, FAX: 516-349-8321; *Sls. Mgr.:* Gary DiBiase

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VEETRONIX, INC., Box 480, Lexington, NE 68850, Tel: 308-324-4600; Empl.: 25; *Sls. Mgr.:* Eddie Howerter ..... **B•1816-1817**

VEGA PRECISION LABS., 800 Follin La., Vienna, VA 22180, Tel: 703-938-6300, FAX: 703-938-6311; FSC No.: 23115; Empl.: 160; *Sls. Mgr.:* Joe E. Bennett

VEKTREX ELECTRONIC SYSTEMS, INC., 8675 Miralani Dr., Ste. 150, San Diego, CA 92126, Tel: 619-578-6787; FSC No.: 0BV42; Empl.: 5

VELMEX, INC., P. O. Box 38, East Bloomfield, NY 14443, Tel: 716-657-6151, 800-642-6446, FAX: 716-657-6153; Empl.: 30; *Sls. Mgr.:* R. Yurick

VELONEX, 560 Robert Ave., Santa Clara, CA 95050, Tel: 408-727-7370, FAX: 408-727-0389; Empl.: 25; *Sls. Mgr.:* Sam Link ..... **D•1388**

VEMALINE PRODUCTS DIV., See Handles Unlimited

VENABLE INDUSTRIES, INC., 2120-M Braker Ln., Austin, TX 78758, Tel: 512-837-2888,800-262-2522, TELEX: 752421, FAX: 512-837-3209; Empl.: 20; *Sls. Mgr.:* Shelley Kelly

VENT RAK, See General Devices

VERDURE INDUSTRIES INC., PO Box 24886, Omaha, NE 68124, Tel: 402-691-8300, FAX: 402-691-8400; Empl.: 7; *Sls. Mgr.:* Larry Johnson

VERMONT PRECISION RESISTOR, Codeco Corp. of Vermont, P.O. Box 1207, Stowe, VT 05672-1207, Tel: 802-253-8567, 802-253-7649, FAX: 802-253-8019; Empl.: 8 ..... **A•2036-2037**

Local Sales Offices & Reps

MA Framingham, Gallagher Assosc. 508-626-2346
VT Burlington, Twin State Sls. 802-658-7868

VERMONT RESEARCH CORP., Precision Pk., N. Springfield, VT 05150, Tel: 802-886-2256, FAX: 802-886-2682; Empl.: 50; *Sls. Mgr.:* John Dimitruk

VERNITECH:VERNITRON CORP., 300 Marcus Blvd., Deer Pk., NY 11729, Tel: 516-586-5100, TWX: 510-227-6079; FSC No.: 30223; Empl.: 170

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Local Sales Offices & Reps

AL	Huntsville, South Tech. Sls.	205-880-8200
AK	Factory Direct	813-347-2181
AZ	Phoenix, Shefler-Kahn	602-257-9015
AR	Little Rock, Doby Assoc.	501-221-0326
CA	Los Angeles, Factory Direct	813-347-2181
CA	Santa Clara, West Rep	408-988-3188
CO	Denver, J.F. Hurlbut Co.	303-279-7796
NH	Amherst, D.A. Crowley & Assoc.	603-673-7050
FL	Largo, Electrocraft	813-544-1766
IL	Downers Grove, Golten Assocs.	708-985-5100
IN	Indianpolis, Elctms. Reps.	317-894-1414
KS	Lenexa, MTS	913-888-5100
MD	Manchester, Imagitron Sls.	410-374-5600
MI	Farmington Hills, R.C. Merchant & Co.	313-476-4600
MI	St. Joseph, R.C. Merchant & Co.	616-983-7378
MN	Minneapolis, PSI	612-944-8545
MS	Jackson, Doby Assocs.	601-981-1138
NM	Albuquerque, Shefler-Kahn	505-345-3591
NY	Great Neck, Mos Assocs.	516-487-3966
NY	Syracuse, Pi'tronics	315-435-7346
OH	Cleveland, Baehr Greenleaf	216-892-1770
OH	Dayton, Baehr Greenleaf	513-439-0724
PA	Warrendale, Baehr Greenleaf	412-934-3088
TX	Dallas, Erickson Sls.	214-739-5833
Can	Scarbourough, Ont., JRL Assocs.	416-756-9862
Can	W. Vancouver, Leister Blake	604-926-6127

Local Distributors

AZ	Phoenix, Future	602-968-7410
AZ	Scottsdale, Kent	602-998-0399
AZ	Tempe, TTI	602-431-1191
CA	Agoura Hills, Zeus	818-889-3838
CA	Los Angeles, Bell	310-826-3975
CA	Los Angeles, TTI	818-891-8885
CA	San Diego, Kent	619-453-7133
CA	San Diego, TTI	619-748-2025
CA	San Jose, Future	408-434-1122
CA	San Jose, TTI	408-946-5577
CA	San Jose, Zeus	408-629-4789
CA	Santa Ana, TTI	714-641-9393
CA	Santa Clara, Kent	408-727-9830
CA	Torrance, Kent	310-320-2700
CO	Denver, TTI	303-429-6806
CT	Bethel, Future	203-743-9594
CT	Wallingford, TTI	203-284-7474
FL	Baco Raton, Jaco	407-241-7943
FL	Clearwater, Future	813-530-1222
FL	Orlando, TTI Inc.	407-849-1000
GA	Norcross, Jaco	404-449-9508
GA	Norcross, RS	404-242-0520
GA	Norcross, TTI	404-662-0911
IL	Elk Grove, Kent	708-364-1300
MA	Wilmington, TTI Inc.	508-658-4700
MD	Columbia, TTI	410-995-1331
MD	Columbia, Zeus	410-997-1118
MA	Bolton, Future	508-779-3000
MA	Lexington, Zeus	617-246-8200
MA	Tewksbury, JACO	508-640-0010
MN	Eden Prarie, TTI	612-933-8555
MN	St. Pauls, Kent	612-642-2828
MO	St. Louis, Olive	314-997-7709
MD	Columbia, Jaco	301-995-6620
NJ	Marlton, Future	609-596-4080
NJ	Mt. Carmel, TTI	609-234-6400
NY	Hauppauge, Fairmont Elec. Sls.	516-231-3313
NY	Hauppauge, Jaco Elctms.	516-273-5500
NY	Liverpool, Future	315-451-2371
NY	Mamaronneck, New Yorker	914-698-7800
NY	Port Chester, Zeus	914-937-7400
NY	Port Jefferson Station, Unique	516-474-4320
NY	Ronkonkoma, TTI Inc.	516-737-2000
OH	Columbus, Elctms. Mktg.	614-299-4161
OH	Dayton, Bell Micro-Mil	513-434-8231
OH	Dayton, Zeus	513-293-6162
OH	Independence, TTI	216-328-9755
PA	Philadelphia, P.E.I. Genisus	215-673-0400
TX	Addison, JACO	214-733-4300
TX	Ft. Worth, Allied	817-595-3500
TX	Ft. Worth, TTI Inc.	817-595-3100
TX	Richardson, Zeus	214-783-7010
UT	Salt Lake City, Future	801-972-8489
WA	Bothell, Future	206-489-3400
WA	Redmond, TTI	206-882-0291
WI	Milwaukee, Marsh Elctms.	414-475-6000
Can	Pointe Claire, Que., Future Elctms.	514-694-7710

VERNITRON ELEC. COMPS., See Beau Prods. Div.

VERN KIEBLER ELECTRONICS, INC., 201 N. Gables, Wheaton, IL 60187, Tel: 708-668-5407, FAX: 708-462-7590; Empl.: 150; *Sls. Mgr.:* Vern Kiebler

VERSALOGIC CORP., 3888 Stewart Rd., Eugene, OR 97402, Tel: 800-824-3163, FAX: 503-485-5712

VERTEK INTL. INC., 9465 Customhouse Plaza, Ste. D, San Diego, CA 92173, Tel: 619-661-6868, FAX: 706-686-3444(Mexico); Empl.: 150

VERTEX INDUSTRIES, INC., P. O. Box 996, 23 Carol St., Clifton, NJ 07014, Tel: 201-472-1331, FAX: 201-472-0814; Empl.: 85; *Sls. Mgr.:* Carlo Pastore

VERTOX CO., 10022 Imperial Ave. E , Garden Grove, CA 92643, Tel: 714-530-4541, FAX: 714-530-0143; FSC No.: 53688; Empl.: 12; *Sls. Mgr.:* Steve Hacker; *Dist. Mgr.:* Steve Hacker

VESTA TECHNOLOGY, INC., 7100 W. 44th Ave. Ste 101, Wheat Ridge, CO 80033, Tel: 303-422-8088, FAX: 303-422-9800; Empl.: 12; *Sls. Mgr.:* Cyndi Reish

VETRA SYSTEMS CORP., 27 Newtown Rd., Plainview, NY 11803, Tel: 516-454-6469, FAX: 516-454-1648; Empl.: 10; *Sls. Mgr.:* Jim Del Rossi ..... **B•1852**

VG CONTROLS, INC., 34 Jenkins Road, Hewitt, NJ 07421, Tel: 201-853-4600, TELEX: 201-853-7913; Empl.: 3 ..... **B•1855**

VGI, INC., Vikay Industrial Pte. Ltd., 1800 Vernon St., Roseville, CA 95661, Tel: 916-783-7878, FAX: 916-783-7845; Empl.: 14; *Sls. Mgr.:* Gary Johnson

VIABLE SYSTEMS INC., Box 369, Sherborn, MA 01770, Tel: 508-653-7665, TELEX: 922 495 VIABLEUS, FAX: 508-653-6645; Empl.: 30

VIATRAN CORPORATION, 300 Industrial Drive, Grand Island, New York 14072, Tel: 716-773-1700, TELEX: 710-260-1353, ESYLNK: 716-773-2488; Empl.: 110

VIA WEST INTERFACE, INC., 534 N. Stone Ave., Tucson, AZ 85705, Tel: 602-623-5716, 1-800-266-5716, FAX: 1-602-623-5718; Empl.: 4; *Sls. Mgr.:* Robert S. Bos

VIBRAC, 16 Columbia Dr., Amherst, NH 03031, Tel: 603-882-6777, TELEX: 312698 VIBRAC, FAX: 603-886-3857; Empl.: 50; *Sls. Mgr.:* R. Searle

Vibra-Metrics INC.

FAX: 203-288-4937

VIBRA-METRICS, INC., 1014 Sherman Ave., Hamden, CT 06514, Tel: 203-288-6158, 1-800-U-SENS-IT; Empl.: 25; *Sls. Mgr.:* William McClain ..... **B•2024**

Local Sales Offices & Reps

AZ	Tempe, Rusler Tech.	602-897-2877
CA	Huntington Bch., Transducer Sys. Co.	714-969-7690
CO	Longmont, Weaver & Assocs.	303-772-1999
GA	Tunnel Hill, Pump & Vibration Consits.	404-935-5851
MI	Troy, Satullo Assoc., Inc.	313-585-4811
LA	Greenwell Springs, Vibratronics	504-261-7580
MI	Troy, Satullo Assocs., Inc.	313-585-4811
NM	Albuquerque, Mesa Tech. Corp.	505-883-8833
NY	E. Berne, Northeast Rsch. Assoc.	518-872-2062
OH	Cleveland, Abitec	216-531-9122
OR	Portland, R & T Factors, Inc.	503-287-6114
PA	New Hope, NOVA Pennsylvania Inc.	215-297-0950
RI	Narragansett, Pat Assocs.	800-628-8860
SC	Spartanburg, Pat Assocs.	803-591-4284
TN	Chattanooga, Pump & Vibation Consits.	404-935-5851
TX	Friendswood, Parameter Meas.	713-482-8470
TX	Webster, Parameter Meas.	214-907-6300
UT	W. American Fork, Highland Tech. Mktg.	801-756-2634
VA	Powhatan, IHN Mntc & Eng. Svcs.	804-598-7625
WA	Issaquah, Avantech	206-392-4033
WI	Mequon, James L. Griffin Co. Inc.	414-241-4451
EXP	Hamden, CT, Vibra-Metrics, Inc.	203-288-6158
Can	Burnaby, BC, Machinery Condition Monitoring	506-738-8675
Can	Montreal, Que., Silentec, Ltd.	514-731-3397
Can	St. John, NB, Dynamic Signal Analysis Corp.	604-433-8515

Local Distributors

CT	Ledyard, Emprise Corp.	203-464-8555
MA	Action, Lindskog Balancing Co.	508-263-2040

VIBRO-METER CORP., P.O. Box 5058, Billerica, MA 01822-5058, Tel: 508-663-7322, TELEX: 948145, TWX: 710-320-1872, FAX: 508-667-1944; FSC No.: 62587; Empl.: 50; *Sls. Mgr.:* John Strich

VICOM SYSTEMS, INC., 46107 Landing Pkwy., Fremont, CA 94538, Tel: 415-498-3200, FAX: 415-498-3325; Empl.: 45; *Sls. Mgr.:* Michael Piltoff, Sls. VP

VICOR CORP., 23 Frontage Rd., Andover, MA 01810, Tel: 508-470-2900, TELEX: 910-380-5144, ESYLNK: 508-475-6715; Empl.: 400; *Sls. Mgr.:* D. Nesbitt; *Dist. Mgr.:* L. Cavanaugh

V.I. CORPORATION, 47 Pleasant St., Northampton, MA 01060, Tel: 413-586-4144, FAX: 413-586-3805; Empl.: 75; *Sls. Mgr.:* Paul Maguire, VP Nat. Sls.

VICTOREEN, INC., 6000 Cochran Rd., Solon, OH 44139-3395, Tel: 216-248-9300, 216-248-9043, FAX: 216-248-9301; Empl.: 350; *Sls. Mgr.:* Glenn Whiteley ..... **A•2038-2040**

VICTOR ELEC. WIRE & CABLE, 618 Main St., W. Warwick, RI 02893, Tel: 401-821-1700, SALES 401-821-7800, TELEX: 952122, TWX: 710-382-1534, FAX: 401-828-0441; Empl.: 500; *Sls. Mgr.:* E. M. Colasanto

VICTOR ENGINEERING, 1000 Calle Cordillera, San Clemente, CA 92673, Tel: 714-366-2931, FAX: 714-366-2385

VICTOR WIRE & CABLE CORP., 3601 Holdrege Ave., Los Angeles, CA 90016, Tel: 213-870-9933, FAX: 213-559-4167; Empl.: 30

VICTORY ENGINEERING CORP., Victory Rd., Springfield, NJ 07081, Tel: 201-379-5900, FAX: 201-379-5982; Empl.: 98

VIDCO, INC., 6175 S.W. 112th Ave., Beaverton, OR 97005, Tel: 503-641-1804, FAX: 503-641-1806; Empl.: 10; *Sls. Mgr.:* Bradley Cohen

VIDEO AUTOMATION SYSTEMS, 10 Upper Shad Rd., Pound Ridge, NY 10576, Tel: 914-764-4613, FAX: 914-764-4613; Empl.: 5

VIDEO DISPLAY CORP., 1868 Tucker Industrial Dr., Tucker, GA 30084, Tel: 404-938-2080,800241-5005, FAX: 404-493-3903; Empl.: 300; *Sls. Mgr.:* Robert (Bob) Liss; *Dist. Mgr.:* Randy Russell

VIDEO MONITORS, INC., Dotronix, Inc., 3833 N. White Ave., Eau Claire, WI 54703, Tel: 715-834-7785, TELEX: 510-100-1880, FAX: 715-834-5672; Empl.: 120; *Sls. Mgr.:* J. Jenson

VIKING CASES, 10480 Oak St. N.E., St. Petersburg, FL 33716, Tel: 813-577-1216, FAX: 813-577-2082; *Sls. Mgr.:* Bill Strickland

VIKING ELECTRONICS, INC., 1531 Ind. St. PO Box 448, Hudson, WI 54016, Tel: 715-386-8861, FAX: 715-386-7423; Empl.: 40; *Sls. Mgr.:* Roy Crist

VIKING ELECTRONICS, INC., 21001 Nordhoff St., P.O. Box 2379, Chatsworth, CA 91311, Tel: 818-341-4330, FAX: 818-882-5713; FSC No.: 05574; Empl.: 150; *Sls. Mgr.:* William Vockerath; *Dist. Mgr.:* William Vockerath

VIKING INDUSTRIAL PRODUCTS, 729 Farm Rd., Marlboro, MA 01752, Tel: 508-481-4600, FAX: 508-481-4602; Empl.: 25; *Sls. Mgr.:* Aubrey Elms

VIRGINA PANEL CORPORATION, 1400 New Hope Rd., Waynesboro, VA 22980, Tel: 703-949-8376, FAX: 703-942-2856; FSC No.: 18117; Empl.: 130; *Sls. Mgr.:* Norman D. Wood

FAX: 703-375-0135

VIRGINIA PLASTICS CO., P.O. Box 4577, Roanoke, VA 24015-0577, Tel: 703-375-0100; FSC No.: 59608; Empl.: 110; *Sls. Mgr.:* Barry D. Lee ..... **C•1508-1509, 1814-1817**

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AL Huntsville, Solutions, Inc. 205-539-3152
AZ Phoenix, Howe & Howe Sls. 602-264-7971
CA Arcadia, H M C Inc. 818-447-0958
CA San Diego, HMC, Inc. 619-484-8921
CA Santa Clara, Penmark Sls. Co. 408-980-1303
CO Denver, Lindberg Co. 303-758-9033
FL Apopka, Dan-Tech Sls. 407-884-0252
FL Clearwater, Dan-Tech Sls. 813-441-2609
FL Davie, Dan-Tech Sls. 305-581-2884
GA Marietta, Solutions, Inc. 404-951-5683
IL Wheaton, CS Tech. Sls., Inc. 708-653-8126
MD Gaithersburg, Carwithen Assocs. 301-921-9545
MA Norwood, MacInnis Co. 617-762-8090
MI Livonia, Engrg. & Mktg. Svcs. Co. 313-522-9465
MN Minneapolis, Elec. Comp. Sls. 612-933-2594
MS Meridian, Solutions, Inc. 601-482-4647
MO Lake St. Louis, Markline Technlgs. 314-625-6222
NJ Englewood, Sprung & Rea Inc. 201-569-5666
NM Albuquerque, Lindberg Co. 505-881-1006
NY Buffalo, Empire Tech. 716-381-8500
NY Skaneateles, Empire Tech. 315-685-5703
NC Raleigh, Solutions, Inc. 919-790-7606
OH Rocky River, Oak Hill Mktg. 216-333-0000
OH Westerville, Oak Hill Mktg. 614-890-5150
OR Lake Oswego, SPS Elctrns. 503-697-7768
PA Harrisburg, All-Tech. Mktg. 717-540-1204
PA West Chester, All-Tech Mktg., Inc. 215-344-0134
KS Overlook Pk., Markline Technlgs. 913-681-8880
TX Austin, M-Rep 512-250-0828
TX Dallas, M-Rep 214-484-5711
UT Salt Lake City, Lindberg Co. 801-484-8689
WA Mountlake Terrace, SPS Elctrns. 206-323-4140
Can Downsview, Ont., Tienkay, Inc. 416-736-1221
Can Montreal, Que., XLR8 Inc. 514-481-6566

Local Distributors

CA Canoga Park, Acort Inds. 818-700-2991
NH Manchester, Yankee Elctrn. Supp. Co. 800-365-9720
Can Downsview, Ont., P.S. Comps. 416-665-9546

VISHAY-MANN SYSTEM, See Vishay Resistive Systems

VISHAY RESISTORS, 63 Lincoln Hwy., Malvern, PA 19355, Tel: 215-644-1300, TWX: 510-668-5812; Empl: 500; *Sls. Mgr.:* William Brennan ... **A•2041-2048, 2127**

Local Sales Offices & Reps

AL Huntsville, JWL Assocs. 205-883-1712
CA Redwood City, James S. Heaton Co. 415-367-9000
CA San Diego, VEC 619-535-9080
CA Tustin, VEC 714-544-7024
CO Loveland, VEC 303-667-7500
GA Atlanta, JWL Assocs. 404-518-8500
IN Ft. Wayne, Scott Elctrns. 219-489-5690
IL Skokie, IRI-Illinois 708-967-8430
IN Indianapolis, Scott Elctrns. 317-841-0010
MI Plymouth, Jay Mktg. Assocs. 313-459-1200
MN Bloomington, IRI of Minnesota 612-854-8027
NJ Flanders, K & R Engrg. Sls. Co. 201-584-5235
NY Fairport, L-Mar Assocs. 716-425-9100
NC Charlotte, JWL Assocs. 704-541-5750
NC Raleigh, JWL Assocs. 919-787-4826
OH Cincinnati, Scott Elctrns. 513-791-2513
OH Cleveland, Scott Elctrns. 216-473-5050
OH Dayton, Scott Elctrns. 513-294-0539
OR Beaverton, Uni Comp, Inc. 503-643-1645
PA Horsham, TMI 215-441-4300
PA Malvern, Vishay Resistive Sys. Grp. 215-644-1300
TX Austin, BPA, Inc. 512-346-9186
TX Richardson, BPA, Inc. 214-234-8438
WA Snohomish, Uni Comp, Inc. 206-568-0511
WI Brookfield, IRI-Wisconsin 414-789-9393
Can Burnaby, B.C., Kaytronics, Inc. 604-294-2000
Can Calgary, Alberta, Kaytronics 403-275-7000
Can Kanata, Ont., Kaytronics, Inc. 613-564-0080
Can Mississauga, Ont., Kaytronics, Inc. 416-507-6400
Can Ville St. Laurent, Que., Kaytronics, Inc. 514-745-5800

Local Distributors

AZ Scottsdale, Kent Elec./Shelley-Ragon 602-998-0399
AZ Tempe, TTI, Inc. 602-431-1191
CA Chatsworth, Kent Elec./Shelley-Ragon 818-998-3333
CA Chatsworth, Passive Comps. Inc. 818-700-8838
CA Milpitas, Kent Elec./Shelley-Ragon 408-262-5300
CA Mission Hill, TTI, Inc. 818-891-8885
CA San Diego, Kent Elec./Shelley-Ragon 619-453-7133
CA San Diego, TTI, Inc. 619-748-2025
CA San Jose, Passive Comps. 408-441-1441
CA Santa Ana, TTI, Inc. 714-641-9393
CA Sunnyvale, TTI, Inc. 408-946-5577
CA Torrance, Kent/Shelley-Ragon 310-321-2700
CO Englewood, Kent Elec./Shelley-Ragon 303-762-0670
CO Westminister, TTI, Inc. 303-429-6806
CT Berlin, Kent Elec./Shelley-Ragon 203-829-2100
FL Largo, Kent Elec./Shelley-Ragon 813-545-0057
FL Orlando, TTI, Inc. 407-859-1000
FL St. Petersburg, MMG Elec./L&S 813-521-2966
CT Wallingford, TTI, Inc. 203-284-7474
GA Norcross, TTI, Inc. 404-662-0911
IL Elk Grove, Kent Elec./Shelley-Ragon 708-364-1300
IL Schaumburg, TTI, Inc. 708-884-6500
IA Cedar Rapids, Kent Elec./Shelley-Ragon 319-373-0525
KS Overland, Kent Elec./Shelley-Ragon 816-254-3410
MD Baltimore, RESCO/Baltimore 410-931-8200
MD Beltsville, RESCO/Washington 301-937-9100
MA Chelmsford, Kent Elec./Shelley-Ragon 508-250-9666
MA Tewksbury, TTI, Inc. 508-851-2000
MN Minnetonka, TTI, Inc. 612-933-8555
MN St. Paul, Kent Elec./Shelley-Ragon 612-642-2828
MS Columbia, TTI, Inc. 410-995-1331
MO Hazlewood, Kent Elec./Shelley-Ragon 314-895-1515
MO Independence, Kent Elec./Shelley-Ragon 816-254-3410
NJ Denville, Kent Elec./Shelley-Ragon 201-625-5500
NJ Mt. Laurel, TTI Inc. 609-234-6400
NY Farmingdale, Command Elctrns. Corp. 516-293-1212
NY Ronkonkoma, Mast Distrs., Inc. 516-471-4422
NY Ronkonkoma, TTI, Inc. 516-737-2000
NY Valley Stream, L & S Elctrns. 516-561-2474
NC Charlotte, TTI, Inc. 704-522-0277
SC Charleston, L & S 803-720-4242
OH Dayton, Micro Mil Div. 513-434-8231
OH Dayton, TTI, Inc. 513-898-8330
OH Independence, TTI, Inc. 216-328-9755
OR Beaverton, Kent Elec./Shelley-Ragon 503-626-8300
PA Malvern, Vishay Resistive Sys. Grp. 215-644-1300
TX Austin, Kent Elec./Shelley-Ragon 512-834-1900
TX Fort Worth, TTI, Inc. 817-595-3100
TX Ft. Worth, TTI, Inc. 817-740-9000
TX Houston, Kent Elec./Shelley-Ragon 713-780-7770
TX Houston, Texas Comp. Corp. 713-468-3882
TX Houston, TTI, Inc. 713-879-5800
TX Richardson, Kent Elec./Shelley-Ragon 214-669-2600
WA Redmond, Kent Elec./Shelley-Ragon 206-883-7200
WA Redmond, TTI, Inc. 206-882-0291
Can Burnaby, B.C., Kaytronics 604-294-2000
Can Kanata, Ont., Kaytronics 613-564-0080
Can Mississauga, Ont., Kaytronics 416-507-6400
Can Que., Kaytronics, Inc. 514-745-5800

VISIONARY ELECTRONICS, 141 Parker Avenue, San Francisco, CA 94118, Tel: 415-751-8811

VISION ENGINEERING, INC., 570 Danbury Rd., New Milford, CT 06776, Tel: 203-355-3776, FAX: 203-355-0712; Empl.: 15; *Sls. Mgr.:* Richard Jones

VISION ENGINEERING LABORATORIES, Amglo Kemlite Laboratories Inc., 8787 Enterprise Blvd., Largo, FL 34643, Tel: 813-539-0448, FAX: 813-539-8535

VISTA SYSTEMS, INC., 2 Centennial Drive, Peabody, MA 01960, Tel: 508-532-1971, FAX: 508-532-2068; Empl.: 4; *Sls. Mgr.:* Jim Atwood

VISUAL COMMUNICATIONS CO., INC., 7920 Arjons Dr., Ste. G, San Diego, CA 92126, Tel: 619-549-6900, FAX: 619-549-3520; Empl.: 9; *Sls. Mgr.:* P. Loudon ..... **B•1196-1199**

Local Sales Offices & Reps

CT Litchfield, Intrade 203-567-5901

Local Distributors

AL Huntsville, Component Dist. Inc. 800-888-0331
CA Costa Mesa, Orange County Comp. 714-979-3597
CA Los Angeles, Electric Switch Inc. 213-660-1310
CA San Diego, Orange County Comps. 619-549-2511
CA San Jose, Spectra Elctrns. 408-452-1590
CA Sunnyvale, PSC Elctrns. 408-737-1333
CO Englewood, Component Dist. Inc. 800-551-7357
FL Clearwater, Component Distrs. 800-558-2351
FL Ft. Lauderdale, Component Distrs. 813-796-0466
FL Palm Bay, Component Dist. Inc. 407-724-9910
GA Norcross, Component Dist. Inc. 404-441-3320
IL Palatine, OHM Elctrns. 800-624-8490
MA Lynn, Land Elctrns. 617-581-9060
MI Grand Rapids, S F Elctrn. Supp. 616-459-0216
MN New Brighton, Chris Elctrns. 612-631-2647
NJ Bellmawr, Mid Atlantic 609-931-5303
OH Aurora, Industrial Prods. 216-562-8113
OH Centerville, Industrial Prod. Dist. 513-435-2086
OH Columbus, Spectra Elctrns. 614-265-2250
TX Dallas, Component Dist. Inc. 800-848-4234

VISUAL INFORMATION TECHNOLOGIES, INC.(UITEC), 3460 Lotus Dr., Plano, TX 75075, Tel: 214-596-5600, 800-325-6467, FAX: 214-867-4489; Empl.: 40; *Sls. Mgr.:* Ken Hilton, VP Sls., Mktg.; *Dist. Mgr.:* Winston Guillory

VITEC ELECTRONICS CORP., 8530 W. Roosevelt Ave., Visalia, CA 93291, Tel: 209-651-1535, FAX: 209-651-1538; *Sls. Mgr.:* Ed Green

VITEC, INC., 236000 Mercantile Rd., Cleveland, OH 44122, Tel: 1-800-321-6384, FAX: 216-464-5324; Empl.: 300; *Dist. Mgr.:* Ernie Hopp

VITEQ CORP., 1000 Aerospace Rd., Lanham, MD 20706, Tel: 301-731-0400, FAX: 301-731-5995; Empl.: 120; *Sls. Mgr.:* Edward Bone

VITREK CORPORATION, 7576 Trade Street, San Diego, CA 92121, Tel: 619-586-1695, FAX: 619-586-0802; Empl.: 42; *Sls. Mgr.:* Kevin Clark ..... **D•1333**

VIZ METEOROLOGICAL INSTRUMENTS, 335 E. Price St., Philadelphia, PA 19144-5782, Tel: 215-844-2626, TWX: 710-670-2626; FSC No.: 41226; Empl.: 325; *Sls. Mgr.:* Tom Curran; *Dist. Mgr.:* Tom Curran

VL ELECTRONICS, INC., 3250 Wilshire Blvd., Ste. 1301, Los Angeles, CA 90010-1603, Tel: 213-738-8700, FAX: 213-738-5340; FSC No.: 95-3896380; Empl.: 10; *Sls. Mgr.:* C. Kreslake; *Dist. Mgr.:* C. Kreslake ..... **B•1127**

Local Sales Offices & Reps

AL Huntsville, Giesting & Assocs. 205-830-4554
CA San Diego, Varitronix 213-738-8700
CO Denver, MRC 303-660-8750
DC D.C./Baltimore, Eastern Elctrns. 919-876-7591
GA Norcross, Giesting & Assocs. 404-242-9320
IL Des Plaines, ESCO Assocs. 708-298-5310
IN Indianapolis, J. C. Hofstetter Co. 317-897-7914
IA Marion, A.E.M. Assocs. 319-377-1129
KS Olathe, A.E.M. Assocs. 913-888-0022
MA Canton, New England Elctrn. Sls. 617-828-4835
MO St. Louis, A.E.M. Assocs. 314-298-9900
NY E. Chester, WD Sales 914-779-8738

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TX Dallas, Altech 214-418-0850
MN St. Paul, Proud Inds. 612-646-9428
WI Colgate, Rep One 414-628-4016
WI Madison, Rep 1 & Assocs. 608-835-7365
Can Toronto, Ont., Norgay Entprs., Ltd. 416-234-8966
Can Vancouver, Norgay Ltd. 604-275-1121

Local Distributors

CA Los Angeles, VL Elctrns Inc. 213-738-8700
MN Minnesota, Digi Key 800-344-4539
NC Raleigh, Eastern Elctrns. 919-876-7591

VLSI TECHNOLOGY, INC., 1109 McKay Dr., San Jose, CA 95131, Tel: 408-434-3000, FAX: 408-434-7926; Empl.: 2000; *Dist. Mgr.:* John Levers

VME MICROSYSTEMS INTL CORP., 12090 South Memorial Pkwy., Huntsville, AL 35803-3308, Tel: 205-880-0444, FAX: 205-882-0859; FSC No.: OBPH5; Empl.: 137; *Sls. Mgr.:* Al Casteleyn

VMETRO, INC., VMETRO as, 16010 Barker's Point Ln., Ste. 575, Houston, TX 77079, Tel: 713-584-0728, FAX: 713-584-9034; Empl.: 6; *Sls. Mgr.:* Jennifer Kaufmann

VOICE CONNEXION, 17835 Skypark Circle, Ste. C, Irvine, CA 92714, Tel: 714-261-2366, FAX: 714-261-8563; *Sls. Mgr.:* Shirley Dworak

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IL	Palatine, Vine Sls., Inc.	708-934-5476
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MA	Lowell, Underwood Sls. Corp.	508-256-8191
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WIREBENDERS, INC., 2440 W. Mission Ln., Ste. 9,10, Phoenix, AZ 85021-2824, Tel: 602-861-1856, FAX: 602-870-9242; FSC No.: 5950;FSCS/CAGE 1DA26; Empl.: 22

WIRE GRAPHICS, INC., 95 Sherwood Ave., Farmingdale, NY 11735, Tel: 516-293-1525, FAX: 516-293-1607; Empl.: 23; *Sls. Mgr.:* Nat Stettin

THE WIREMOLD COMPANY, 60 Woodlawn Street, W. Hartford, CT 06110, Tel: 203-233-6251, FAX: 203-232-2062; Empl.: 900; *Sls. Mgr.:* Scott Bartosch

WIRE-PRO, INC., 23 Front Street, Salem, NJ 08079, Tel: 609-935-7601, 609-935-7651, TWX: 510-680-4750, FAX: 609-935-0102; FSC No.: FSCN 50738; Empl.: 225; *Sls. Mgr.:* Russell Morgan, Sls. & Svc. Mgr.; *Dist. Mgr.:* Phil Negrin, Mktg. Mgr.

WOLFRAM RESEARCH, INC., 100 Trade Center Drive, Champaign, IL 61820-7237, Tel: 217-398-0700, FAX: 217-398-0747; Empl.: 1000; *Sls. Mgr.:* Zoe Miolier; *Dist. Mgr.:* Roy Chumko

WONDERWARE, 16 Technology, Ste 154, Irvine, CA 92718, Tel: 714-727-3200; Empl.: 45; *Sls. Mgr.:* Jerry Brooks; *Dist. Mgr.:* Rick Mellor

WONTRONICS, 3048 N. Coolidge Ave., Los Angeles, CA 90039, Tel: 213-660-6230, FAX: 213-913-2299; *Sls. Mgr.:* Frank Phillips

WORLD PRODUCTS INC., 19654 8th St. East, Sonoma, CA 95476, Tel: 707-996-5201, TELEX: Worldpro snom 171715, FAX: 707-996-3380; FSC No.: 410966309; Empl.: 445; *Sls. Mgr.:* Mark Beynon
.. **A•1177, 2050-2051, 2224-2225; B•1128-1129, 1399**

Local Sales Offices & Reps

AZ Scottsdale, American Mktg. 602-948-2778, FAX:602-860-4455
AZ Tempe, Spectrum Assocs., Inc. 602-966-1788, FAX:602-966-1726
CA Anaheim (North), Jay Mktg. Assocs. 714-768-7519, FAX:714-581-1211
CA Anaheim (South), Jay Mktg. Assocs. 714-974-7182, FAX:714-283-2915
CA Fullerton, Jay Mktg. Assocs. 714-870-9573, FAX:714-870-1448
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CA Northridge, Jay Mktg. Assocs. 818-363-6308, FAX:818-363-6790
CA San Jose (NEC only), Signet Tech. Sls. 408-453-0611,FAX:408-453-0633
CO Englewood, Purdy Co. Assocs. 303-790-2211, FAX:303-790-2230
CT Bloomfield, Zaslow Sls. Co., Inc. 203-242-7781, FAX:203-243-9442
FL Boca Raton, Aurora-Schmitt Assocs. 407-392-9497,FAX:407-392-9497
FL Orlando, Aurora-Schmitt Assocs. 407-297-6039, FAX:407-297-6039
GA Alpharetta, Pinnacle Mktg. 404-410-9980, FAX:404-410-9980
IL Arlington Hgts., Davix Intl. Ltd. 708-259-5300, FAX:708-259-5428
IN Indianapolis, Elctrn. Sls. & Engrg. 317-849-4260, FAX:317-841-0231
IA Marion, Associated Elctrn. Mktg., Inc. 319-377-1129,FAX:319-377-1539
MD Towson, Arbotek Assocs., Inc. 410-825-0775, FAX:410-337-2781
MI Livonia, Lowell-Wendt Mktg. Co. 313-464-2722, FAX:313-464-3123
MN Minneapolis, Tecteam Sls. Inc. 612-854-6616, FAX:612-854-8031
MO St. Louis, AEM, Inc. 314-298-9900, FAX:314-298-8660
NJ Marlton, BGR Assocs. 609-983-1020, FAX:609-983-1879
NM Albuquerque, Syntech 505-266-7951, FAX:505-292-4411
NY Hauppauge, Aurora-Schmitt Assocs. 516-434-1313,FAX:516-434-1572
NY New Hartford, Franklin Sls. 315-793-3161, FAX:315-793-3139
NY Pittsford, Franklin Sls. 716-248-8251, FAX:716-248-3866
NC Raleigh, Pinnacle Mktg. 919-848-0404, FAX:919-848-0101
NC Wilmington, Pinnacle Mktg. 919-686-4696, FAX:919-686-4697
OH Dayton, Baehr Greenleaf & Assocs. (BGA) 513-439-0724,FAX:513-439-0387
OH Dayton, John Stephenson & Assoc. 513-435-0745, FAX:513-435-7902
OH Westlake, Baehr Greenleaf & Assoc. 216-892-1770,FAX:216-892-1771
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PA Pittsburgh, Baehr Greenleaf & Assoc. 412-934-3088,FAX:412-934-3990
TX Austin, Comp. Technlg. 512-288-7328, FAX:512-288-7372
TX Dallas, Comp. Technlg. 214-783-8831, FAX:214-783-4801
TX Houston, Comp. Technlg. 713-690-3011, FAX:713-462-9906
WA Bellevue, Luscombe Engrg. 206-643-1463, FAX:206-649-9120
WI Menomonee Falls, Davix Intl. Ltd. 414-255-1600, FAX:414-255-1863

Local Distributors

AL Huntsville, All American 205-837-1555, FAX:205-837-7732
AL Huntsville, Reptron Elctrns. Inc. 205-722-9500, FAX:205-722-9565
CA Corona, Compumech Elctrns. 714-278-4761, FAX:714-278-4761
CA Milpitas, Compumech Elctrns. 408-945-9100, FAX:408-945-9395
CA San Diego, All American 619-458-5850
CA San Diego, All American 619-458-5850, FAX:619-458-5866
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CA San Jose, All American Semiconductor Inc. 408-943-1200,FAX:408-943-1393
CA Santa Clara, Trinity Elctrns. 408-980-9011, FAX:408-980-9014
CA Sunnyvale, Target Elctrns. 408-733-0384, FAX:408-733-0397
CA Thousand Oaks, Compumech Elctrns. 805-492-6299,FAX:805-492-8429
CA Torrance, All American Semiconductor Inc. 310-320-0240,FAX:310-320-7207
CA Yorba Linda, Target Elctrns. 714-692-1630, FAX:714-692-1547
CO Aurora, QPS 303-373-2766,FAX:303-373-4029
FL Ft. Lauderdale, Reptron Elctrns. 305-735-1112, FAX:305-735-1121
FL Melbourne, Pridmore 407-727-2491, FAX:407-723-1213
FL Miami, All American Semiconductor Inc. 305-621-8282,FAX:305-620-7831
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FL Tampa, Reptron Elctrns. 813-854-2351, FAX:813-855-0942
GA Athens, Resource Elctrns. 706-613-7755, FAX:706-613-7856
GA Norcross, Reptron Elctrns. 404-446-1300, FAX:404-446-2991
ID Boise, Radar Elctrn. 208-337-2227, FAX:208-337-2322
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IL Lisle, Components Inc. 708-852-7707, FAX:708-852-0263
IL Schaumburg, QPS Elctrns., Inc. 708-884-6620, FAX:708-884-7573
IL Schaumburg, Reptron Elctrns. 708-882-1700, FAX:708-882-8904
IL Wheeling, All American 708-970-8976, FAX:708-537-5631
IA Des Moines, Midstate 515-244-7231, FAX:515-244-0828
MD Rockville, All American Semiconductor Inc. 800-426-0420,FAX:301-251-8574
MA Norwood, Emtel 617-769-9500,FAX:617-769-8329
MA Wakefield, All American Semiconductor Inc. 617-246-2300,FAX:617-246-2305
MI Livonia, Reptron Elctrns. 313-525-2700, FAX:313-525-3209
MN Eden Prairie, All American Semiconductor Inc. 612-944-2151,FAX:612-944-9803
MN Minnetonka, Reptron Elctrns. 612-938-0000, FAX:612-938-3995
MO Fenton, Beckwith Elctrns. 314-343-6463, FAX:314-343-7026
MO St. Charles, Finnigan Elctrns. 314-946-6201, FAX:314-724-8956
NE Omaha, Mid-State Distbn. Co. 402-592-5965, FAX:402-331-7382
NE Omaha, Midstate 402-592-5965
NJ West Berlin, GCI ... 609-768-6767,FAX:609-768-3649
NM Albuquerque, Betatron 505-821-1122, FAX:505-828-0450
NY Penn Yan, Advacom 315-536-2221
NY Ronkonkoma, All American Semiconductor 516-981-3935,FAX:516-981-3947
NC Charlotte, Resource Elctrns. 704-521-8682, FAX:704-558-4696
NC Hickory, Resource Elctrns. 704-328-1130, FAX:704-328-8318
NC Raleigh, Reptron Elctrns. 919-870-5189, FAX:919-870-5210
NC Raleigh, Resource Elctrns. 919-829-0704, FAX:919-527-9647
NC Winston-Salem, Resource Elctrns. 919-724-5961, FAX:919-723-7024
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OH Middleburg, Advacom, Inc. 216-826-3300, FAX:216-826-1669
OH Solon, Reptron Elctrns. 216-349-1415, FAX:216-349-1634
OR Portland, Radar Elctrns. 503-232-3404, FAX:503-235-0428
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PA McKean, Advacom Inc. 814-476-7774, FAX:814-476-7724
PA York, Advacom, Inc. 717-741-9277, FAX:717-741-9462
SC Columbia, Resource Elctrns. 803-779-5332, FAX:803-765-9276
SC Greensville, Resource Elctrns. 803-297-1430, FAX:803-297-1439

SC No. Charleston, Resource Elctrns. 803-552-2671, FAX:803-552-2676
TN Gray, Resource Elctrns. 615-477-2131, FAX:615-477-4407
TN Oakridge, Resource Elctrns. 615-481-3393, FAX:615-481-3397
TX Austin, Omni Pro Elctrns. 512-794-9200, FAX:512-338-9576
TX Carrollton, Omni Pro Elctrns. 214-713-9000, FAX:214-732-8743
TX Houston, Omni Pro Elctrns. 713-270-1700, FAX:713-270-8020
TX Richardson, All American Semiconductor 214-231-5300,FAX:214-437-0353
UT Salt Lake City, All American 801-682-8313, FAX:801-261-3885
VA Charlottesville, Virginia Elctrn. Comp. 804-296-4184,FAX:804-971-8411
WA Edmonds, Oman & Assocs. 206-774-1887, FAX:206-771-2296
WA Richland, Radar Elctrns. 509-943-8336, FAX:509-943-6790
WA Seattle, Radar Elctrns. 206-282-2511, FAX:206-282-1598
WA Spokane, Radar Elctrns. 509-747-3053, FAX:509-456-8069
WI Lisle, Comps. Inc. 414-529-4106, FAX:708-852-0263
WI Milwaukee, QPS Elctrns. 414-789-7577, FAX:708-884-7573
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Can Ontario, Utech 416-609-2900,FAX:416-609-2588
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Can St. Laurent, Que., Versatech Elctrns. ... 514-335-3833, FAX:514-355-0307
Can Surrey, B.C., Memco 604-590-1553, FAX:604-590-5008
KS Lenexa, Associated Elctrn. Mktg., Inc. 913-888-0022,FAX:913-888-4848

WORLD PRODUCTS INC.

FAX: 707-996-3380

WORLD PRODUCTS INC., Systems Devices Grp., 19654 8th St. E., Sonoma 95476, Tel: 707-996-5201; Empl.: 50 ..... **A•1177, 2050-2051, 2224-2225; B•1128-1129, 1399**

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AZ Tempe, Spectrum Assocs. 602-966-1788
CA Los Angeles, SPA Elctrn. Sls. 714-863-1193
CA San Jose, Signet Tech. Sls. 408-453-0611
CO Denver, Donohue Sls., Co. 303-455-1719
FL Melbourne, R-Rep Co., Inc. 407-242-9800
IL Arlington, KMA Sls. Co. 312-398-5300
IN Fort Wayne, Berberich Assoc. 219-486-0673
MN Minneapolis, Holmgren Assocs. 612-786-7641
NJ Livingston, Avemark Tech. Mktg. 201-992-5331
OH Dayton, Berberich Assocs. Inc. 513-433-0342
OR Beaverton, Luscombe Engrg./N.W. 503-636-6664
PA Hatboro, AQS Electro 215-674-4421
TX Dallas, Southwestern Tech. Sls. 214-369-0977
VA Herndon, Stinson Assocs. 703-620-1332
WA Bellevue, Luscombe Engrg./N.E. 206-643-1463
WI Milwaukee, KMA Sls. Co. 414-259-1771
Can Montreal, ELI Manis Inc. 514-484-2923

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AL Huntsville, Reptron Elctrns. Inc. 205-722-9500, FAX:205-722-9565
CA Anaheim, Compumech Elctrns. 714-939-9100, FAX:714-939-9113
CA Milpitas, Compumech Elctrns. 408-945-9100, FAX:408-945-9395
CA San Diego, All American 619-458-5850
CA San Diego, Neumann 619-695-3005, FAX:619-695-0935
CA San Jose, All American Semiconductor 408-943-1200,FAX:408-943-1393
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CA Sunnyvale, Target Elctrns. 408-733-0384, FAX:408-733-0391
CA Torrance, All American Semiconductor 800-831-8300,FAX:310-320-7207
CA Yorba Linda, Target Elctrns. 714-692-1630, FAX:714-692-1547
CT Yalesville, Schaal 203-269-3779, FAX:203-284-2159
FL Ft. Lauderdale, Reptron Elctrns. 305-735-1112, FAX:305-735-1121
FL Melbourne, Pridmore 407-727-2491, FAX:407-723-1213
FL Miami, All American Semiconductor 305-621-8282, FAX:305-620-7831
FL Sunrise, All American Semiconductor 305-572-7999,FAX:305-749-9229
FL Tampa, Reptron Elctrns. 813-854-2351, FAX:813-855-0942
FL Winter Park, Deanco 407-671-5100, FAX:407-679-0361
GA Augusta, Dixie Elctrns. 404-722-2055, FAX:404-722-0388
GA Marietta, Deanco 404-429-0126, FAX:404-429-0333
GA Norcross, Reptron Elctrns. 404-446-1300, FAX:404-446-2991
ID Boise, Radar Elctrns. 208-336-2227, FAX:208-336-2322
IL Lisle, Components Inc. 708-852-7707, FAX:708-852-0263
IL Schaumburg, Reptron Elctrns. 708-882-1700, FAX:708-882-8904
IA Cedar Rapids, Mid-State Distbg. Co. ... 800-798-9411, FAX:319-365-9411
IA Des Moines, Mid-State Distbrg. Co. 515-244-7231, FAX:515-244-0828
IA Mason City, Mid-State Distbg. Co. 800-798-8012, FAX:515-423-8012
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MD Gaithersburg, Deanco 301-948-5444, FAX:301-963-6469
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MA Norwood, Emtel ... 617-769-9500,FAX:617-769-8329
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NE Omaha, Mid-State Distbg. Co. 402-592-5965, FAX:402-331-7382
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NY Penn Yan, Advacom Technlg. 315-536-2221, FAX:315-536-0828
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NC Raleigh, Reptron Elctrns. 919-870-5189, FAX:919-870-5210
NC Winston-Salem, Dixie Elctrns. 919-724-5961, FAX:919-723-7024
OH Cleveland, Advacom, Inc. 216-826-3300, FAX:216-688-5914
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OH Worthington, Reptron Elctrns. 614-436-6675, FAX:614-436-4285
OR Portland, Radar Elctrns. 503-232-3404, FAX:503-235-0428
PA Harrisburg, Cumberland Elctrns. 717-232-5999, FAX:717-238-5379
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TN Gray, Dixie Elctrns. 615-477-3838, FAX:615-477-4407
TN Oakridge, Dixie Elctrns. 615-481-3393, FAX:615-938-4133
TX Austin, Omni Pro Elctrns. 512-794-9200, FAX:512-338-9576
TX Dallas, Omni Pro Elctrns. 214-233-0500, FAX:214-385-7508
TX Houston, Omni Pro Elctrns. 713-270-1700, FAX:713-270-8020
TX Richardson, All American Semiconductor 214-231-5300,FAX:214-437-0353
VA Charlottesville, Virginia Elctrns. Comps. 804-296-4184,FAX:804-971-8411
VA Virginia Beach, Deanco 804-499-3322, FAX:804-499-1038
WA Richland, Radar Elctrns. 509-943-8336, FAX:509-943-6790
WA Seattle, Radar Elctrns. 206-282-2511, FAX:206-282-1598
WA Spokane, Radar Elctrns. 509-747-3053, FAX:509-456-8069
Can Nepean, Ont., Zanin Elctrns. 613-596-2911, FAX:613-596-2915
Can St. Foy, Que., Zanin Elctrns. 418-681-1262, FAX:418-681-1264
Can St. Laurent, Que., Zanin Elctrns. 514-342-6211, FAX:514-342-4071
Can Toronto, Ont., Zanin Elctrns. 416-674-7220, FAX:416-674-7836

'WORLD' TEST SYSTEMS, INC., P. O. Drawer 1428, Waynesboro, VA 22980, Tel: 703-949-6753, FAX: 703-943-3826; *Sls. Mgr.:* Buford H. Baber

WOVEN ELECTRONICS, Woven Electronics Corporation, 1001 Old Stage Rd., Simpsonville, SC 29681, Tel: 803-963-5131, TWX: 810-963-5131, FAX: 803-963-1761; Empl.: 400; *Sls. Mgr.:* Tommy Little

WPI GROUP, INC., 18 Mill St., Warner, NH 03278, Tel: 603-456-3111, FAX: 603-456-2498; Empl.: 115; *Sls. Mgr.:* Paul D. Iverson

WSI, 47280 Kato Rd., Fremont, CA 94538, Tel: 510-656-5400, 800-451-5970 (USA), FAX: 510-657-5916; Empl.: 150; *Sls. Mgr.:* Bob Hoard; *Dist. Mgr.:* Mike Speckman

WYLE LABS, See Electronic Enclosures

XANTREX TECHNOLOGY INC., 3873 Airport Way, Bellingham, WA 98227-9754, Tel: 206-671-2966, FAX: 206-671-3095; *Sls. Mgr.:* Michael Rodger; *Dist. Mgr.:* Michael Rodger

XCEL CORPORATION, See Digitran and Computron Display Sys. Divs.

XCEL CONTROLS, INC., 1600 W. 6th St., Mishawaka, IN 46544, Tel: 219-259-7804, FAX: 219-259-5769; Empl.: 40; *Sls. Mgr.:* Bruce Shepard

XCP, INC., 40 Elm St., P.O. Box 819, Dryden, NY 13053, Tel: 607-844-9143; *Sls. Mgr.:* Diane Rademacher

XEDAR CORP., 2500 Central Ave., Boulder, CO 80301, Tel: 303-443-6441, FAX: 303-443-6444; *Sls. Mgr.:* Andy Zeidler

XELTEK, 757 N. Pastoria Ave., Sunnyvale, CA 94086, Tel: 408-524-1935, FAX: 408-245-7084; Empl.: 19; *Sls. Mgr.:* Andrew Rao; *Dist. Mgr.:* Brian Lee

XENON CORP., 20 Commerce Way, Woburn, MA 01801, Tel: 617-938-3594, FAX: 617-933-8804; Empl.: 45; *Sls. Mgr.:* Louis R. Panico

XENOTRONIX INC., 26074 Ave., Hall No. 10, Valencia, CA 91355, Tel: 805-257-4793, FAX: 805-257-1093; *Dist. Mgr.:* L. Geery, T. Dos Santos, M. Mitchner

Xentek

FAX: 619-471-4021

XENTEK, INC., Taiyo Yuden USA, Inc., 1770 La Costa Meadows Dr., San Marcos, CA 92069, Tel: 619-471-4001; FSC No.: 53279; Empl.: 220; *Sls. Mgr.:* Chuck Henry ..... **D•2042-2047, 2308-2309**

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FL Ft. Lauderdale, Post Mktg. 305-989-2931
FL Indian Harbor Bch., Post Mktg. 407-777-0994
GA Norcross, Lamons Sls. Co. 404-242-2610
IL Itasca, LTD Technlgs., Inc. 708-773-2900
IA Cedar Rapids, Midtec Assocs. 319-395-0028
KS Lenexa, Midtec Assoc. 913-541-0505
MA Chelmsford, Waterstate Sls. 508-256-2287

MI Farmington Hills, Carter, McCormic & Pierce 313-477-7700
NJ Medford, Mech-Elec. Sls. 609-654-8209
MN Richfield, Clay Rep Co. 612-861-2191
MO St. Louis, Midtec Assocs. 314-275-8666
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NC Raleigh, Lamons Sls. Co. 919-846-1652
NJ Fairfield, Astrorep 201-808-0025
NY Babylon, Astrorep 516-422-2500
NY Dewitt, ICS 315-445-9600
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TX Richardson, Pro Comp 214-669-1500
VA Richmond, Mech-Elec Sls. 804-231-4006
WA Bellevue, E-Square 206-637-0302
WI Milwaukee, LTD Technigs. 414-774-1000

XERCON, INC., P.O. Box 554, Portland, OR 97207, Tel: 503-292-8682, FAX: 503-292-8697; Empl.: 6; *Sls. Mgr.:* G. Osgood

XEROX CORPORATION, United States Customer Operations, Xerox Square, 0-5, Rochester, NY 14644, Tel: 800-832-6979; Empl.: 100,900

XETEL CORPORATION, 2525 Brockton Dr., Austin, TX 78758, Tel: 512-834-2266, FAX: 512-834-9250; Empl.: 395; *Sls. Mgr.:* Mark Trutna

XICO, INC., 9737 Eton Ave., Chatsworth, CA 91311, Tel: 818-709-4403, FAX: 818-709-5235; Empl.: 21; *Sls. Mgr.:* Robert Browning

XICON CAPACITORS, P.O. Box 170537, Arlington, TX 76003, Tel: 800-628-0544, FAX: 817-473-1808; *Sls. Mgr.:* Drey Hayford; *Dist. Mgr.:* Buck Johnson

XICOR, INC., 851 Buckeye Court, Milpitas, CA 95035, Tel: 408-432-8888, TWX: 910-379-0033, FAX: 408-432-0640; FSC No.: 60395; Empl.: 1010; *Sls. Mgr.:* Bruce Mattern,VP Sls.; *Dist. Mgr.:* Bruce Mattern

XILINX CORP., 2100 Logic Drive, San Jose, CA 95124, Tel: 408-559-7778, FAX: 408-559-7114

XITRON TECHNOLOGIES

FAX: 619-458-9213

XITRON TECHNOLOGIES, 10225 Barnes Canyon Rd., San Diego, CA 92121, Tel: 619-458-9852; Empl.: 10; *Sls. Mgr.:* Stephen Merrill ..... **D•1335**

XKD CORPORATION, Dynatech, 101 Cooper Court, Los Gatos, CA 95030, Tel: 408-395-3700, FAX: 408-354-2606; *Sls. Mgr.:* Skip McLaughlin

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AL Huntsville, Murcota Corp. 205-539-8476
AZ Phoenix, Western High Tech. Mktg. 602-266-2070
CA Los Altos, Kolm Mktg. Assoc. 415-948-2635
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EXP NY, Great Neck, Techcomp Intl. 516-466-2167
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XYZ ELECTRONICS, 4700 N. 600 W, McCordsville, IN 46055, Tel: 317-335-2128, FAX: 317-335-2128; Empl.: 5

YAMAICHI ELECTRONICS, INC., Yamaichi Electronics Co., Ltd., 1420 Koll Circle, Ste.B, San Jose, CA 95112, Tel: 408-452-0797, FAX: 408-452-0799; Empl.: 24; *Sls. Mgr.:* Bob Million; *Dist. Mgr.:* Jim Bennett

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NJ Scotch Plains, RJM Sls. 908-322-7880
NY Syracuse, Labtronics 315-455-7314
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PA Chadds Ford, RJM Sls. 215-358-4014
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NJ Scotch Plains, RJM Sls. 201-322-7880
OH Dayton, RDP Corp. 513-253-6175
Can Scarborough, Ont., Finnan Engrd. 416-438-6070

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FAX: 215-378-0345

YUASA-EXIDE, INC., 645 Penn St., Reading, PA 19601, Tel: 215-378-0333; Empl.: 2000; *Sls. Mgr.:* Ronn Alonso, Francis Taylor, Bill McKenty; *Dist. Mgr.:* Greg Rapp ..... **D•1485**

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AZ Tempe, Westrep 602-820-9932
CA Huntington Beach, West Elctrns. 310-493-5569
CA San Diego, West Elctrns. 619-233-0236
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CO Denver, Lindberg Co. 303-758-9033
CT North Haven, Kitchen & Kutchin 203-239-0212
FL Altamonte Springs, Over & Over 407-332-1222
FL Coral Springs, Over & Over 305-753-7050
FL Tampa, Over & Over 813-626-9100
GA Norcross, Over & Over 404-449-6205
IL Arlington Heights, Brainard-Nielsen 708-437-2700
IA Cedar Rapids, R.W. Kunz & Assocs. 319-396-5386
KS Prairie Vlg., R.W. Kunz & Assocs. 913-648-3535
KS Wichita, R. W. Kunz & Assocs. 316-686-3436
MD Hunt Valley, Samual K. MacDonald 410-584-8631
MA Burlington, Kitchen & Kutchen 617-229-2660
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MO St. Louis, R.W. Kunz & Assocs. 314-966-4799
NJ Berkeley Hgts., Cambridge Allen & Assocs. 908-464-0203
NC Charlotte, Over & Over 704-542-9111
NC Raleigh, Over & Over 919-876-7338
OH Columbus, McFadden Sls. 614-761-3177
OR Beaverton, Westmark Elctrns. 503-641-8780
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Can St. Laurent, Que, Tech-Trek Ltd. 514-337-7540

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HI Honolulu, Elctrl. Equip. 808-533-3881
IL Downers Grove, Jarbo Battery 312-964-9358
MD Beltsville, Mark Elctrns. 301-595-5040
MA Middleboro, Glynn Elctrns. 617-947-4262
MI Brighton, Applied Power 313-229-6550
MN Minneapolis, Bergquist Co. 612-835-2322
NH Salem, Cronin Elctrns. 603-898-4440
NJ Clifton, Engrd. Assemblies 201-340-0600
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EXP National & Canada, Newark Elctrns. 800-367-3573
Can Brampton, Ont., Zentronics 416-451-8445

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ZAMBRE CO., INC., 2134 Old Middlefield Way, Mountain View, CA 94043, Tel: 415-968-9176, FAX: 415-968-4851; FSC No.: 58758; 5950; Empl.: 20 Average

ZAXTEK, 42 Corporate Pk. Ste. 100, Irvine, CA 92714, Tel: 714-474-1170, 800-421-0982, FAX: 714-474-0159; Empl.: 15; *Sls. Mgr.:* Robert J. Parente, Dir. of Sls. & Mktg.

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ZEBRA TECHNOLOGIES CORPORATION, 333 Corporate Woods Pkwy., Vernon Hills, IL 60061-3109, Tel: 708-634-6700, TELEX: 206230, FAX: 708-913-8766; *Sls. Mgr.:* Kevin O'Donnell

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ZENDEX CORP., 6780 Sierra Court, Ste. A, Dublin, CA 94568, Tel: 510-828-3000, TWX: 910-389-4009, FAX: 510-828-1574; Empl.: 20; *Sls. Mgr.:* Russ Gamble

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CO Denver, Tech Rep Sls. 303-758-7031
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CT Franklin, OEM Mktg. & Sls. 313-572-0516
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VA Alexandria, Mid-States Mktg., Inc. 703-370-2600

ZERCOM CORPORATION, P.O. Box 84, Zercom Drive, Merrifield, MN 56465-0084, Tel: 218-765-3151, FAX: 218-765-3900; Empl.: 160; *Sls. Mgr.:* Jeff Zernov

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NH Hudson, Benoit & Co. 603-598-3291
NM Albuquerque, S & S Technlgs. 505-298-7177
NY Commack, MTR Inc. 516-462-9580
NY New Hyde Pk., MTR Inc. 516-326-8138
NY Syracuse, Fountain, Young & Co., Inc. 315-437-7733
OH Cincinnati, KCH Co. 513-931-1686
OR Tigar, Halbar-R.T.S. Inc. 503-624-5741
PA Boswell, B.E. Gibson, Co. 814-629-6772
PA Southampton, Campbell Assocs. 215-322-6630
TX Houston, Barry Sls. 713-784-5860
TX Richardson, Barry Sls. 214-234-0255
UT Salt Lake City, Effective Sls. 801-266-9617
VA Martinsville, Engrg. Reps Assocs. 703-632-2365
WA Redmond, Halbar-R.T.S. Inc. 206-882-0990
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WI Milwaukee, Carlson Elctrn. Sls. 414-476-2790

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CO Golden, J.F. Hurlburt 303-279-7796, FAX:303-278-0092
FL Indian Rocks Bch., P & M Tech. Sls. .. 813-593-3248
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MA Monson, Zero East (House Acct.) 413-267-5561
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MN Bloomington, Elctrn. Sls. Agency 612-884-8291
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NM Albuquerque, S & S Technlgs. 505-298-7177
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TX Richardson, Barry Sls., Inc. 214-234-0255
UT Salt Lake City, Effective Sls. 801-266-9617
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WA Vashon, Halbar-RTS, Inc. 206-285-1363, FAX:206-463-2009
Can Montreal, Jelco 514-522-6038

ZERO ENCLOSURES, Zero Corp., 200 North 500 West, North Salt Lake, Utah 84054-0310, Tel: 801-298-5900, FAX: 801-292-9450; Empl.: 285; *Sls. Mgr.:* Doug Griffith, V.P.

ZERO CORP., Zero East Div., 288 Main St., Monson, MA 01057-0128, Tel: 413-267-5561, FAX: 413-267-5569; FSC No.: 19178; Empl.: 380; *Sls. Mgr.:* Roger St. Martin

ZERO PLASTICS, Zero Corp., 288 Main St., Monson, MA 01092, Tel: 413-267-5561, FAX: 413-267-3179; FSC No.: 03663; Empl.: 110; *Sls. Mgr.:* Kathy Odiorne

ZETA GRAPHICS CORP., 737 E. Arnold Dr., Martinez, CA 94553, Tel: 510-313-5900, FAX: 510-372-7431; Empl.: 70; *Sls. Mgr.:* Gary Hasenfus, VP Sls. Mktg.

ZETEX

FAX: 516-864-7630

ZETEX, INC., Zetex plc., 87 Modular Avenue, Commack, NY 11725, Tel: 516-543-7100; *Sls. Mgr.:* Joseph M. DeBlasio ..... **A•2227**

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FL West Palm Beach, American Micro Sls. 407-689-3860
GA Norcross, ACM,Inc. 404-448-7025
IL Park Ridge, Metcom Assocs. 708-696-1490
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MA Framingham, Stone Comp. Sls., Inc. ... 508-875-3266
MI Grand Rapids, Urban Assocs., Inc. 616-245-0511
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MN Eden Prairie, Electro Mark Inc. 612-944-5850
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Can Vancouver, GMA 604-439-3383

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CA San Jose, Jaco 408-432-9290
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CA Westlake, Jaco 805-495-9998
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FL Miami, All American 305-621-8282
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ID Boise, Radar Elec. 208-336-2227
IL Rosemont, Advent 708-297-6200
IN Indianapolis, Advent 317-872-4910
IA Cedar Rapids, Advent 319-363-0221
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MA Wakefield, All American 617-246-2300
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NY Ronkonkoma, Mast Distrs. 516-471-4422
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OH Cleveland, Schuster 216-425-8134
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UT Salt Lake City, All American Semiconductor 801-261-4210
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WI West Allis, Advent Elctrns. 414-475-6860
Can Surrey, BC, Martin Elctrn. Mktg. Corp. 604-590-1553

ZEUS INDL. PRODS. INC., P.O. Box 2167, Orangeburg, SC 29116, Tel: 803-531-2174, 800-526-3842, FAX: 803-533-5694; FSC No.: 32039; Empl.: 350; *Sls. Mgr.:* Jamie McLean, OEM Sls. Mgr.; *Dist. Mgr.:* Heather Bernardo, Distr. Sls. Mgr.

ZEVATECH, INC., 2700 Gateway Centre Blvd., Morrisville, NC 27560, Tel: 919-460-0111, FAX: 919-469-0480; Empl.: 29; *Dist. Mgr.:* Bob Black

ZEXCO, 5526 Murietta Ave., Van Nuys, CA 91401, Tel: 818-997-7895

ZIATECH, 3433 Roberto Ct., San Luis Obispo, CA 93401, Tel: 805-541-0488, FAX: 805-541-5088; Empl.: 65; *Sls. Mgr.:* Ron Giovannelli

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ZIPPERTUBING CO., Box 61129, Los Angeles, CA 90061, Tel: 310-527-0488, FAX: 310-767-1714; Empl.: 60; *Sls. Mgr.:* Mike Sullivan

ZI-TECH INSTRUMENT CORP., P.O Box 51845, Palo Alto, CA 94303-0725, Tel: (415) 326-2151, FAX: 415-325-1276; Empl.: 7; *Sls. Mgr.:* J. Ziman

ZITEL CORPORATION, 630 Alder Drive, Milpitas, CA 95035, Tel: 408-321-9600, 800-622-5020, FAX: 408-321-9696; Empl.: 160; *Sls. Mgr.:* Don Olker; *Dist. Mgr.:* Don Olker

Z-LINE POWER CONTROLLERS, See Pulizzi Engineering, Inc.

ZMAN MAGNETICS, 7633 South 180th, Kent, WA 98032, Tel: 206-251-8064, FAX: 206-251-6264; Empl.: 40; *Sls. Mgr.:* Mark Mennella ..... **A•1315, 2606**

Local Sales Offices & Reps

CA Mountain View, Bridge Mktg. 415-965-9045
OR Beaverton, Eclipse Mktg. Grp. 503-642-1661
WA Redmond, Eclipse Mktg. Grp. 206-885-6991

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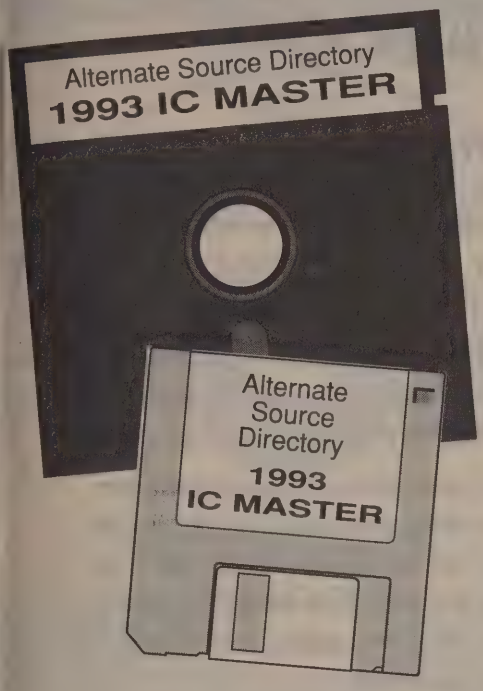

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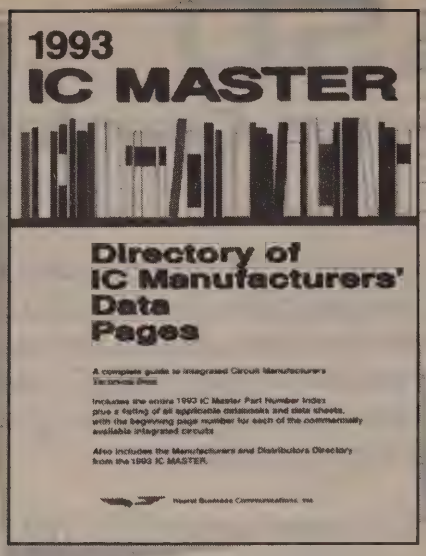

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CHARACTERISTICS OF BATTERIES AND FUEL CELLS

System	Anode	Cathode	Theoretical battery		Practical battery		
			Voltage, V	Capacity, Ah/kg	Typical voltage, V	Capacity[a]	
						Wh/kg	Wh/dm³
Primary:							
Leclanche	Zn	MnO_2	1.6	230	1.2	65	175
Magnesium	Mg	MnO_2	2.0	270	1.5	100	195
Organic cathode	Mg	*m*-DNB	1.8	1,400	1.15	130	180
Alkaline MnO_2	Zn	MnO_2	1.5	230	1.15	65	200
Mercury	Zn	HgO	1.34	185	1.2	80	370
Mercad	Cd	HgO	0.9	165	0.85	45	175
Silver oxide	Zn	AgO	1.85	285	1.5	130	310
Zinc-air	Zn	Air (O_2)	1.6	815	1.1	200	190
Li-organic electrolyte	Li	[b]	2.1-5.4	130-660	1.8-3.2	250	400
Secondary:							
Lead-acid	Pb	PbO_2	2.1	55	2.0	37	70
Edison	Fe	Ni oxides	1.5	195	1.2	29	65
Nickel-cadmium	Cd	Ni oxides	1.35	165	1.2	33	60
Silver-zinc	Zn	AgO	1.85	285	1.5	100	170
Silver-cadmium	Cd	AgO	1.4	230	1.05	55	120
Zinc-nickel oxide	Zn	Ni oxides	1.75	185	1.6	55	110
Zinc-air[c]	Zn	Air (O_2)	1.6	815	1.1	150	155
Cadmium-air[c]	Cd	Air (O_2)	1.2	475	0.8	90	90
Zinc-O_2	Zn	O_2	1.6	610	1.1	130	120
H_2-O_2	H_2	O_2	1.23	3,000	0.8	45	65
Reserve:							
Cuprous chloride	Mg	CuCl	1.5	240	1.4	45	65[d]
Silver-chloride	Mg	AgCl	1.6	170	1.5	60	95[d]
Zinc-silver oxide	Zn	AgO	1.85	285	1.5	30	75[e]
Thermal	Ca	[b]	2.8	240	2.6	10	20[f]
Ammonia-activated	Mg	*m*-DNB	2.2	1,400	1.7	22	60[g]
High-	NA	S	2.1	685	1.8	200	[h]
temperature	Li	S	2.2	1,150	1.8	200	[i]
Solid electrolyte	Ag	Polyiodide	0.66	. . .	0.6	180	75[j]
Fuel cell:							
Hydrogen[c]	H_2	Air	1.23	26,000	0.7		[k]
Hydrazine[c]	N_2H_4	Air	1.5	2,100	0.7	800[b]	[l]
Methanol[c]	CH_2OH	Air	1.3	1,400	0.9	175[b]	185[m]

a Delivered capacity when discharged at normal temperatures (20°C) at normal discharge rates.
b Based on fuel consumption only.
c Weight of air not considered in computation of watt hours.
d Water-activated
e Automatically activated; high rate discharge; 2- to 10-min rate.
f Fused salt; heat-activated; high rate discharge; 2- to 10-min rate.
g Four-minute discharge rate.
h β-alumina electrolyte, 300°C operation.
i Fused salt; 350°C operation.
j Solid $RbAg_4I_5$ electrolyte.
k Several different cathode materials used.
l Fuel consumption is based on source of H_2.
m Based on methanol battery-fuel supply in situ.

MINIGLOSSARY CAPACITORS

Anode: One of two plates or conductors. In polarized capacitors, the anode should be connected to the positive conductor in the circuit.

Capacitive Reactance: The opposition (in ohms) of capacitance to the flow of alternating current, equal to the reciprocal of the product of the angular frequency (2π times frequency in Hertz) of the current times the capacitance in farads.

Cathode: One of two plates or conductors. In electrostatic capacitors the cathode is metallic. In electrolytic capacitors the cathode is a liquid, gel or other conductive material which is in intimate contact with a metallic cathodic connection.

Dielectric Constant: The ratio of the capacitance of a capacitor with some material other than air between the capacitor plates to the capacitance of the same capacitor with air between the plates. For example, the dielectric constants of air, Teflon®, polystyrene and ruby mica are 1, 2.1, 2.6 and 5.4, respectively.

Electrolytic: A capacitor with one metallic conductor (generally the anode) and with a liquid or semiconductor cathode. Nonpolarized electrolytic capacitors generally have two equal anodes as well as the liquid cathode. These anodes operate alternately as anode and cathodic connection as alternating current is applied.

Electrostatic: One of two general classes of capacitors in which two or more discrete metallic conductors are present and separated by an insulating dielectric material. Examples include: mica, ceramic, film, and paper types.

Farad: The basic unit of measure in capacitors. A capacitor charged to one volt with a charge of one coulomb (one ampere flowing for one second) has a capacitance of one farad. Capacitors are generally rated at portions of a farad (microfarads or picofarads).

1 farad (F) = 1,000,000 microfarads (μF) 1 microfarad (μF) = 1,000,000 picofarads (pF)

Impedance: All capacitors exhibit impedance. It is a function of capacitor type and internal construction. This can be particularly important in certain applications such as filters for switching power supplies. Capacitors used in these applications often have special multiple tab construction to shorten current paths and to reduce internal resistance.

Leakage Current: Expressed as dcl for electrolytic capacitors, a measure of the intrinsic losses in a charged capacitor. Generally speaking, the lower the dcl, the higher quality the capacitor.

Power Factor: A measure of the overall efficiency of a capacitor. Power factor ratings take all internal losses into consideration in a complex formula. This parameter of certain capacitors is often very important in AC applications such as motor-start and/or motor-run capacitors

Rated Voltage: The rated working voltage of a capacitor. Generally expressed in DC Volts (Vdcw). This is the voltage at which a capacitor may be safely operated at 25°C continuously within its overall parameters.

Ripple Current: The total amount of alternating and direct current that may be applied to an electrolytic capacitor under stated conditions. In general, the higher the ripple current applied, the shorter the operating life of the capacitor will be. Application of significantly higher than rated ripple currents can shorten the capacitor life dramatically and may even cause catastrophic failure (explosion).

Surge Voltage: The momentary surge voltage which may be applied for a stated length of time without doing permanent damage to the unit.

Temperature: Capacitors are generally rated at 25°C at sea level under specific humidity conditions. Operating temperature ranges are also given, along with derating (reliability) curves for operation at temperatures other than 25°C.

Temperature Coefficient: Expressed as TC in ppm (parts per million) or in percent (%) from the norm of 25°C. This is seldom a straight line and may vary widely for certain types. Most capacitors have positive TC in that the capacitance increases as temperature increases. Some types, however, have negative TC in that the capacitance decreases as temperature increases.

Ceramic Capacitor Codes
(Capacitance Given In pF)

Color	Digit	Multiplier	Tolerance			Temperature Coefficient ppm°C	Significant Figure	Multiplier
			Class 1		Class 2			
			10pF or less	Over 10pF				
Black	0	1	±2.0pF	±20%	±20%	0	0.0	–1
Brown	1	10	±0.1pF	±1%		–33		–10
Red	2	100		±2%		–75	1.0	–100
Orange	3	1000		±3%		–150	1.5	–1000
Yellow	4	10000			+100% –0%	–220	2.0	–10000
Green	5		±0.5pF	±5%	±5%	–330	3.3	+1
Blue	6					–470	4.7	+10
Violet	7					–750	7.5	+100
Gray	8	0.01	±0.25pF		+80% –20%	+150 to –1500		+1000
White	9	0.1	±1.0pF	±10%	±10%	+100 to –750		+10000
Silver								
Gold								

MINIGLOSSARY
BASIC CAPACITOR FORMULAS

I. Capacitance (farads)

English: $C = \frac{.224\ K\ A}{t_D}$

Metric: $C = \frac{.0884\ K\ A}{t_D}$

II. Energy stored in capacitors (Joules, watt-sec)

$E = \frac{1}{2}\ CV^2$

III. Linear charge of a capacitor (Amperes)

$I = C\frac{dV}{dt}$

IV. Total Impedance of a capacitor (ohms)

$Z = \sqrt{R_s^2 + (X_C - X_L)^2}$

Where Rs = ESR

V. Capacitive Reactance (ohms)

$X_C = \frac{1}{2\pi fC}$

VI. Inductive Reactance (ohms)

$X_L = 2\pi fL$

VII. Phase Angles:

Ideal Capacitors: Current leads voltage 90°
Ideal Inductors: Current lags voltage 90°
Ideal Resistors: Current in phase with voltage

VIII. Dissipation Factor

$DF = \tan\delta\ (\text{loss angle}) = \frac{ESR}{X_c} = (2\pi fC)\ (ESR)$

IX. Power Factor

PF = Sine δ (loss angle) = Cos φ (phase angle)
PF = DF (when less than 10%)

X. Quality Factor (dimensionless)

$Q = \text{Cotan}\ \delta\ (\text{loss angle}) = \frac{1}{DF}$

XI. Equivalent Series Resistance (ohms)

$ESR = (DF)\ (Xc) = (DF)\ (\frac{1}{2}\pi fC)$

XII. Power Loss (watts)

Power loss $= (2\pi fCV^2)\ (DF)$

XIII. KVA (Kilowatts)

$KVA = 2\pi fCV^2 \times 10^{-3}$

XIV. Temperature Characteristic (ppm/°C)

$TC = \frac{Ct - C_{25}}{C_{25}\ (T_t - 25)} \times 10^6$

XV. Cap Drift (%)

$C.D. = \frac{C_1 - C_2}{C_1} \times 100$

XVI. Reliability of Ceramic Capacitors

$\frac{L_O}{L_t} = \left(\frac{V_t}{V_o}\right)^x \left(\frac{T_t}{T_o}\right)^\tau$

XVII. Capacitors in Series (current the same)

Any number: $\frac{1}{C_T} = \frac{1}{C_1} + \frac{1}{C_2} \cdots + \frac{1}{C_N}$

Two: $C_T = \frac{C_1\ C_2}{C_1 + C_2}$

XVIII. Capacitors in Parallel (voltage the same)

$C_T = C_1 + C_2 \cdots + C_N$

XIX. Aging Rate

A.R. = % Δ C/decade of time

XX. Decibels

$db = 20 \log \frac{V_1}{V_2}$

Metric prefixes:

Pico	X 10^{-12}
Nano	X 10^{-9}
Micro	X 10^{-6}
Milli	X 10^{-3}
Deci	X 10^{-1}
Deca	X 10
Kilo	X 10^3
Mega	X 10^6
Giga	X 10^9
Tera	X 10^{12}

Symbols:

K	=	Dielectric Constant
A	=	Area of electrode overlap
t_D	=	Dielectric thickness
V	=	Voltage (volts)
t	=	time (hours)
R_S	=	Series Resistance (ohms)
f	=	frequency (Hertz)
L	=	Inductance (henries)
δ	=	Loss angle
ø	=	Phase angle
x+y	=	Exponent effect of voltage and temperature
L_O	=	Operating life (hours)
L_t	=	Test life (hours)
V_t	=	Test voltage (volts)
V_o	=	Operating voltage (volts)
T_t	=	Test temperature (°C)
T_o	=	Operating temperature (°C)

eem

MINIGLOSSARY CONNECTORS

Connector terminology is often quite confusing. This confusion starts with the very names of connectors. The name of a connector may derive from its shape, application, type of conductor or even method of termination.

Shape—Circular, cylindrical, and rectangular.

Electrical application—High voltage, RF, microwave, input/output, etc.

Mechanical application—Printed circuit, rack & panel, cable, etc.

Conductor type—Coaxial, flat cable, ribbon cable, flex circuit, etc.

Termination method—Wirewrap, soldercup, solderless, etc.

Hardware such as clamps, hoods, and adapters are frequently used to convert cable connectors to rack and panel types. This adds to the name confusion. A very common telephone connector, for example (the "C" type) got its name from the model number of the original maker.

Contact: The part(s) of the connector that actually provides circuit continuity between its two sections—the parts which are normally mated. The back end of the connector should properly be called the *termination.* This is the point where the wires or PC board is attached to the connector.

Contact alignments: Often called *contact float.* Describes the amount of allowable contact movement within the connector body. Permits self-alignment.

Male vs. female: In the U.S. this describes the contact construction. In Europe this term is more often used to describe the outer shell mating action which may be the reverse of the contacts.

Closed entry: A female contact which prevents entry of a male contact larger than a specific size.

Open entry: A female contact designed for a specific size of male contact but which will allow entry of larger male contacts by spring action.

Hermaphrodite: Contacts or connector bodies which are the same configuration. Male/female designations do not apply. Bodies usually have some mechanical means for maintaining polarity.

Hermetic seal: Glass-to-metal seals at terminations. Often used improperly to describe vacuum-tight seals.

Waterproof seal: May or may not be truly *waterproof.* May prevent easy entrance of casual water by means of a rubber or other boot.

Printed circuit connector: Connectors which are used in conjunction with printed circuit boards. There are two distinctly different styles.

Edgeboard. May be called *edge* or *card.* The printed circuit (PC) board edge enters the connector.

Two-piece: One part of the connecting pair is physically attached to the PC board itself. The other part is attached to something else such as a cable or a motherboard.

Readout: Describes the arrangement at the terminating edge of a PC board. May be single or double. A double readout PC board has termination strips on each side not usually interconnected.

Ribbon connectors: A type of connector which allows flat "ribbon" cable to be attached to a round or rectangular connector but also used interchangeably for flat connectors to flat cable.

Ribbon contact connector: Describes the contacts in a rectangular connector which have a self-wiping mating action. Not the same as ribbon connector.

Solderless terminal: Any style of termination which does not require solder for a permanent connection. See *crimp* and *insulation displacement.*

Crimp termination: A stripped wire is inserted into a barrel or trough which is then crimped to the conductor with a suitable tool.

Insulation displacement: Unstripped insulated wire is fitted into a channel containing metal teeth which are forced through the insulation to make contact with the conductor.

Service rating: The maximum rated voltage and/or current which may be applied continuously. May be called *working voltage.* Can be confused with the term used to describe how many times a connector may be mated and separated.

Withstanding voltage: Also called *test voltage.* The voltage a connector must withstand for one minute without breakdown. Applied between connectors and between connectors and shell and any grounding devices of the connector.

MAXIMUM CURRENT CAPACITY— CONDUCTORS

Size, AWG	MIL-W-5088				National Electrical Code	Underwriters Laboratory		American Insurance Association	500 c mils/A
	Copper		Aluminum						
	Single-wire	Wire-bundled	Single-wire	Wire-bundled		60°C	80°C		
30	...	...	...	...	...	0.2	0.4	...	0.20
28	...	...	...	...	...	0.4	0.6	...	0.32
26	...	...	...	...	...	0.6	1.0	...	0.51
24	...	...	...	...	...	1.0	1.6	...	0.81
22	9	5	...	...	...	1.6	2.5	...	1.28
20	11	7.5	...	...	...	2.5	4.0	3	2.04
18	16	10	...	...	6	4.0	6.0	5	3.24
16	22	13	...	...	10	6.0	10.0	7	5.16
14	32	17	...	...	20	10.0	16.0	15	8.22
12	41	23	...	...	30	16.0	26.0	20	13.05
10	55	33	...	...	35	...	...	25	20.8
8	73	46	58	36	50	...	...	35	33.0
6	101	60	86	51	70	...	...	50	52.6
4	135	80	108	64	90	...	...	70	83.4
2	181	100	149	82	125	...	...	90	132.8
1	211	125	177	105	150	...	...	100	167.5
0	245	150	204	125	200	...	...	125	212.0
00	283	175	237	146	225	...	...	150	266.0
000	328	200	...	...	275	...	...	175	336.0
0000	380	225	...	...	325	...	...	225	424.0

MINIGLOSSARY
BASIC
EBCDIC CODE

Bit Positions 4, 5, 6, 7	Second Hexadecimal Digit	Digit Punches	00				01				10				11				Bit Positions 0, 1
			00	01	10	11	00	01	10	11	00	01	10	11	00	01	10	11	Bit Positions 2, 3
			0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	First Hexadecimal Digit
			12				12	12		12	12	12		12	12				Zone Punches
				11				11	11	11		11	11	11		11			
					0		0		0	0	0		0	0			0		
			9	9	9	9	9	9	9	9									Digit Punches
			①	②	③	④	⑤	⑥	⑦	⑧					⑨	⑩	⑪	⑫	
0000	0	8-1	NUL	DLE	DS		SP	&	-									0	8-1
0001	1	1	SOH	DC1	SOS				⑬		a	j			A	J	⑭	1	1
0010	2	2	STX	DC2	FS	SYN					b	k	s		B	K	S	2	2
0011	3	3	ETX	TM							c	l	t		C	L	T	3	3
0100	4	4	PF	RES	BYP	PN					d	m	u		D	M	U	4	4
0101	5	5	HT	NL	LF	RS					e	n	v		E	N	V	5	5
0110	6	6	LC	BS	ETB	UC					f	o	w		F	O	W	6	6
0111	7	7	DEL	IL	ESC	EOT					g	p	x		G	P	X	7	7
1000	8	8		CAN							h	q	y		H	Q	Y	8	8
1001	9	8-1		EM							;	r	z	`	I	R	Z	9	9
1010	A	8-2	SMM	CC	SM		¢	!	⑮	:									8-2
1011	B	8-3	VT	CU1	CU2	CU3	.	$	,	#									8-3
1100	C	8-4	FF	IFS		DC4	<	*	%	@									8-4
1101	D	8-5	CR	IGS	ENQ	NAK	(	)	_	'									8-5
1110	E	8-6	SO	IRS	ACK		+	;	>	=									8-6
1111	F	8-7	SI	IUS	BEL	SUB	I	¬	?	"									8-7
			12				12				12	12		12	12	12		12	Zone Punches
				11				11				11	11	11		11	11	11	
					0				0		0		0	0	0		0	0	
			9	9	9	9									9	9	9	9	

Card Hole Patterns

①	12-0-9-8-1	⑤	No-Punches	⑨	12-0	⑬	0-1
②	12-11-9-8-1	⑥	12	⑩	11-0	⑭	11-0-9-1
③	11-0-9-8-1	⑦	11	⑪	0-8-2	⑮	12-11
④	12-11-0-9-8-1	⑧	12-11-0	⑫	0		

Control Character Representations

ACK	Acknowledge	EOT	End of Transmission	PF	Punch Off
BEL	Bell	ESC	Escape	PN	Punch On
BS	Backspace	ETB	End of Transmission Block	RES	Restore
BYP	Bypass	ETX	End of Text	RS	Reader Stop
CAN	Cancel	FF	Form Feed	SI	Shift In
CC	Cursar Control	FS	Field Separator	SM	Set Mode
CR	Carriage Return	HT	Horizontal Tab	SMM	Start of Manual Message
CU1	Customer Use 1	IFS	Interchange File Separator	SO	Shift Out
CU2	Customer Use 2	IGS	Interchange Group Separator	SOH	Start of Heading
CU3	Customer Use 3	IL	Idle	SOS	Start of Significance
DC1	Device Control 1	IRS	Interchange Record Separator	SP	Space
DC2	Device Control 2	IUS	Interchange Unit Separator	STX	Start of Text
DC4	Device Control 4	LC	Lower Case	SUB	Substitute
DEL	Delete	LF	Line Feed	SYN	Synchronous Idle
DLE	Data Link Escape	NAK	Negative Acknowledge	TM	Tape Mark
DS	Digit Select	NL	New Line	UC	Upper Case
EM	End of Medium	NUL	Null	VT	Vertical Tab
ENQ	Enquiry				

Special Graphic Characters

¢	Cent Sign
.	Period, Decimal Point
<	Less-than Sign
(	Left Parenthesis
+	Plus Sign
!	Logical OR
&	Ampersand
!	Exclamation Point
$	Dollar Sign
*	Asterisk
)	Right Parenthesis
;	Semicolon
¬	Logical NOT
-	Minus Sign, Hyphen
/	Slash
,	Comma
%	Percent
_	Underscore
>	Greater-than Sign
?	Question Mark
:	Colon
#	Number Sign
@	At Sign
'	Prime, Apostrophe
=	Equal Sign
"	Quotation Mark

eem MINIGLOSSARY ENCAPSULATION

MATERIALS/HANDLING

Catalyst: A substance which changes the *rate* of chemical reaction. Very small quantities can cause fast change.

Conformal coating Sprayed or dipped. A thin conformal jacket which protects an assembly from moisture or other degrading environments.

Curing agent: See catalyst.

Hardener: See catalyst.

Hermetic: A permanent gas-tight seal.

RTV: Room Temperature Vulcanizing. Associated with silicone rubber sealants which vulcanize at room temperature.

Thermoplastic: Plastic materials which can be made to flow *repeatedly* with the application of heat.

Thermosetting: Plastics which once cured cannot be made to flow again.

Thixotropy: The property of a coating compound which has low viscosity when agitated, but which thickens when the agitation ceases.

Viscosity: Measured in units of *poise* or *centipoise*. The property of a liquid which resists internal flow. Low viscosity equates with thin and vice-versa.

PROCESSING

Casting: Parts or assemblies are placed in a mold. Encapsulating material is added and cured. Part is then removed from the mold.

Dip coating: Part or assembly is dipped into the encapsulating material. Final thickness is determined by number of dips, viscosity, rate of withdrawal, and temperature.

Embedding: Wherein an encapsulant substantially fills all voids in and about an assembly.

Impregnation: A process of encapsulation involving evacuating all air and then allowing the encapsulating material to flow in and fill all voids.

Molding: Similar to casting except this process usually implies multicavity molds and costly machines.

Potting: Wherein the part or assembly is immersed in an encapsulating material contained in a shell which becomes a permanent outer surface after curing.

DIELECTRIC

Arc resistance: An encapsulant's resistance to the formation of a conductive path or track. Measured in time.

Breakdown voltage: The voltage at which an encapsulant fails electrically.

Capacitance: The property of conductors and dielectrics which allows the storage of an electrical charge when the voltage is applied.

Corona: A luminous discharge of electricity due to air ionization when a certain voltage is reached. Can be internal or external. The formation of ozone can cause rapid deterioration of certain materials.

Dielectric: Insulator (Nonconductor.)

Dielectric constant: The property of a material that determines its ability to store electrostatic energy.

Dielectric strength: The ratio of dielectric breakdown to the thickness of insulating material.

Dissipation factor: The ratio of a dielectric material's energy losses.

Flashover: Point at which an electric discharge occurs around an edge or across a surface. Can result in a carbon track and permanent degradation.

Insulation resistance: (IR) An insulating material's total DC leakage.

Surface resistivity: The resistance of the surface of an insulating material to the flow of direct current.

Voltage endurance: Sometimes called corona resistance. The ability of a material to withstand the application of sustained high voltage.

Volume resistivity: The resistance of a material to direct current flow as a measure of volume. Expressed as ohm centimeters.

MINIGLOSSARY OPTO SEMICONDUCTORS

Avalanche Photodiode: A photodiode that takes advantage of avalanche multiplication of photocurrent. It is particularly suited to low noise and/or high speed applications.

Contrast: A noticeable difference in color, brightness, or other characteristics in a side-by-side comparison.

Chrominance Contrast: The color contrast between two adjacent surfaces of identical area, shape, texture, and luminance. The human eye is more sensitive to differences in color than it is to differences in brightness.

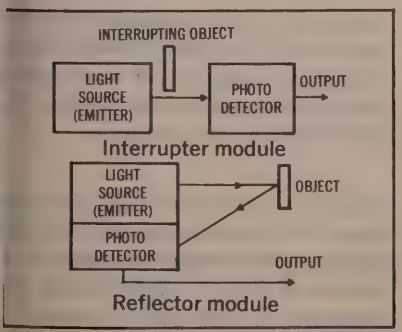
Current Transfer Ratio: The ratio of an optocoupler's output current to input current at a specified bias.

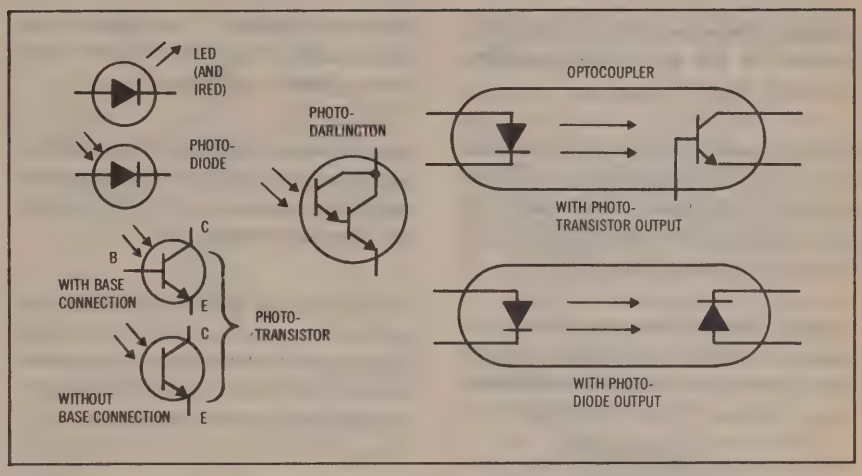
Dark Current: The leakage current of a photodetector with no incident light.

Dominant Wavelength: The wavelength that is a quantitative measure of apparent color of light as perceived by the human eye.

Infrared Radiation: The electromagnetic wavelength region between approximately 0.75 and 100 micrometers longer than the wavelength of visible light.

Interrupter (module): A device that produces an electrical output signal when an object breaks the light (visible or invisible) between a light source and a photodetector.





IRED: An infrared-emitting diode. See light-emitting diode.

Light Current: The current that flows through a photodetector when it is exposed to radiant energy.

Light-Emitting Diode (LED): A semiconductor diode that emits incoherent light at its PN junction when forward biased. The light can be in the visible or invisible (infrared) wavelength region.

Luminance Contrast: The observed brightness of a light-emitting element compared to the brightness of the "surround," an integral part of the device and inseparable from it.

Optocoupler: A device that transmits electrical signals, without electrical connection, between a light source (input) and the receiver (output). The input is generally an LED; the output might be a photodiode, phototransistor, a photo–Darlington, etc. Sometimes referred to as optoisolator.

Peak Wavelength: The wavelength at the peak of the radiated spectrum of an emitter.

Photo–Darlington: A light-sensitive Darlington-connected transistor pair. The photo–Darlington has a very high sensitivity to illumination or radiation.

Photodetector: A device that provides an electrical output signal when subjected to radiation in the visible, infrared, or ultraviolet regions of the electromagnetic spectrum. Photodiodes, phototransistors, and photo–Darlingtons are the most common type of photodetectors.

Photodiode: A junction diode that is responsive to radiant energy. Photodiodes have a high degree of linearity between the input radiation and the output current, and faster switching speeds than phototransistors.

Photothyristor: A thyristor whose switching action is controlled by light applied to the thyristor gate.

Phototransistor: A light-sensitive transister that delivers an electrical output proportional to the light intensity at its input. The low-level photocurrent that is generated is amplified by the current gain of the transistor. The base region (or gate in a FET) may or may not be brought out as an external terminal.

Point Source: A source with a maximum dimension less than one-tenth the distance between sources and detector.

Reflector (module): A device containing a light source and a photodetector that detects any object that reflects light produced by the source back to the detector.

eem MINIGLOSSARY POWER SUPPLIES

Ambient reference: Refers to the temperature of the still air surrounding the power supply

Case reference: One of the specs that make up the nominal rating. The temperature of the case with the temperature of the surrounding still air at a stated temperature (usually 25°C).

Crowbar circuit: Protects the load. A protective circuit that applies a short circuit across the output immediately upon overload. (See overvoltage).

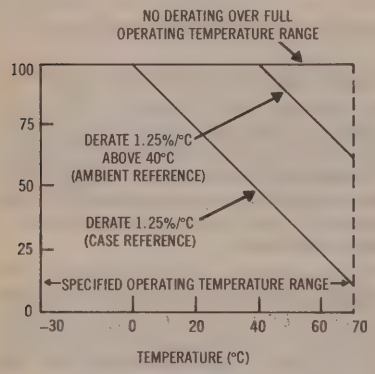


Fig. 1. Power output derating can be referred to ambient or case.

Derating: The degree output is reduced as temperature increases. Usually referenced to ambient case temperature and shown on a graph.

Efficiency: Ratio of the output power to the required input power. Usually expressed as a percentage given nominal environmental temperature.

EMI/RFI: Interference electronic circuitry caused by energy from electromechanical or radio frequency power supplies.

Foldback: Built-in protective circuits that automatically reduce the output voltage and/or current to very low levels in the event of an overload.

Holdover (Holdup): The interval that rated output will continue after input ceases. Usually milliseconds.

Input reflected current: The peak-to-peak alternating current generated by switching transients in DC/DC converters. Should not exceed 1%.

Inrush current limiting: Built-in circuits that monitor high currents through the rectifiers to the capacitors at turn ON. Circuit is usually inhibited as capacitors attain full charge.

Nominal rating: The spec value of the supply at stated conditions of input, output, and temperature.

Overshoot: A transient voltage change occurring during turn ON or OFF or during an abrupt load change.

Overvoltage (Overload) protection: Built-in circuits that protect the load or the supply by shutting it down or providing foldback.

Recovery: The time interval between the termination of an overload and restoration to normal operations.

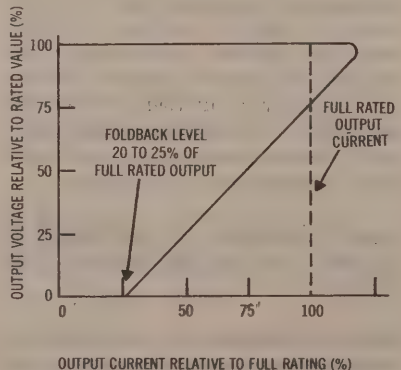


Fig. 2. Current foldback limiting self-resets with removal of fault.

Response: The time interval between a stated step change in input voltage or load current and return of output to normal operating conditions.

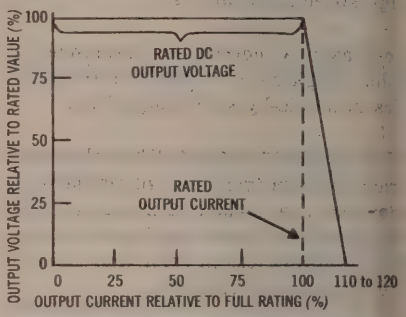


Fig. 3. Current limiting restrictions output current to a valve somewhat greater than full rated output; it resets when fault is removed.

Sensing: Regulation techniques that monitor output voltage and/or current. *Local sensing* refers to the output terminals. *Remote sensing* allows a feedback from the load circuit to the power supply.

Soft start: Allows the supply to start from zero current and/or voltage over a stated period of time during start up to prevent voltage overshoots and current imbalances.

Switchers: Power supplies using switching techniques to achieve high efficiency regulation. These techniques can have attendant EMI/RFI problems.

Tracking: The maintaining of fixed ratios between multiple outlets despite variations in line, load or temperature. Particularly important in supplies with symetrical (+)(−) outputs.

Transient protection: Circuitry designed to protect the supply from high amplitude line transients. Generally expressed in terms of peak voltage and maximum transient time duration.

eem MINIGLOSSARY ELECTROMECHANICAL RELAYS

RELAYS

Hybrid: Isolated input and output either with a solid-state input and an electromechanical output or vice versa. Typically a reed switch is used to trigger a solid-state output or a solid-state amplifier is used to trigger an electromechanical relay.

Differential: Have multiple windings to function when voltage, current and/or power difference reaches a specific level or value.

Close-differential: The dropout value is specified close to the pickup value.

Frequency sensitive: Operates at a set frequency or within specific frequency bands. A resonant reed, for example.

Hermetically sealed: Totally sealed by glass-to-metal or metal-to-metal seals to ensure very low rates of gas leakage over long time periods.

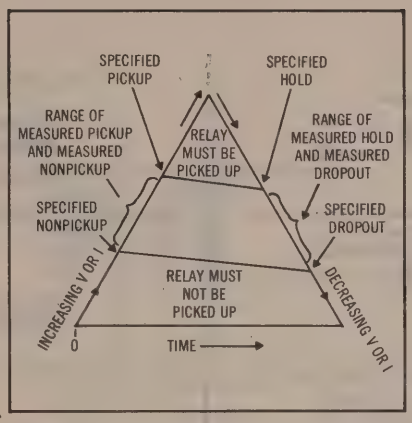
Encapsulated: Imbedded in a suitable potting compound.

Sealed: Enclosed in a relatively air-tight cover. (Not the same as hermetically sealed.)

Covered: Unsealed metal or plastic enclosure or housing.

CONTACTS

Dry circuit: contacts that carry current but do not open or close during energizing of the load circuit. Often wrongly used in reference to low level contacts.



Low Level: Contacts controlling relatively low voltages and low currents. Generally below 5 Vdc and 10mA.

OPERATING CHARACTERISTICS

Measured dropout: The value at which all contacts restore to their unoperated position as current or voltage decreases.

Specified dropout: The value at or *above* which all contacts *must* restore to their unoperated position as voltage or current is decreased.

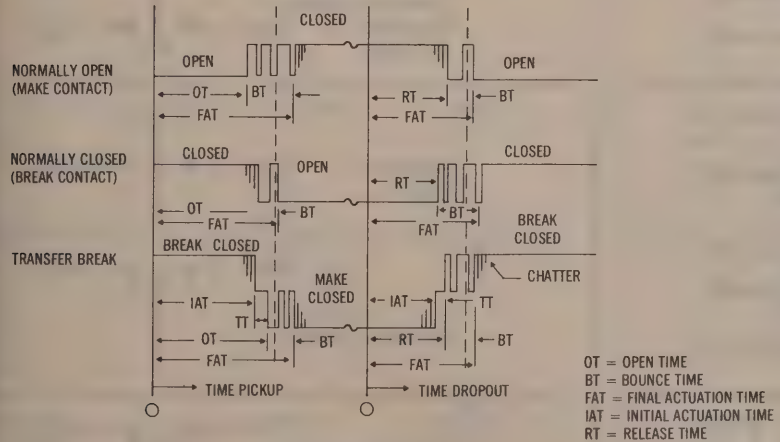


Fig. 2. Typical time vs. current (non-inductive load)

Specified hold: The value that *must* be reached before any contact change occurs as voltage or current is decreased on an operated relay.

Specified nonpickup: The value that *must* be reached before any contact change occurs as voltage or current decreases on an unoperated relay.

Measured pickup: The value at which all contacts function as voltage or current increases on an unoperated relay.

Specified pickup. The value at or *below* which all contacts *must* function as voltage or current increases on an unoperated relay.

Sensitivity: Specified pickup expressed in watts.

Normal bridging: The make-before-break action between adjacent contacts on relays designed for this purpose.

Abnormal bridging: The undesired closing of contacts caused by a metal bridge or protrusion developed by arcing.

Magnetic freezing: Sticking of the armature to the core as a result of residual magnetism.

TIME

Actuation: The interval from coil energization or de-energization to the functioning of a specified contact.

Initial actuation: The interval from coil energization or de-energization to the *first* closing or opening of a previously open or closed contact.

Final actuation: Sum of initial actuation *and* bounce intervals following an actuation.

Contact bounce: The interval from close or opening of a contact to the end of the bounce of "chatter."

Chatter: See bounce.

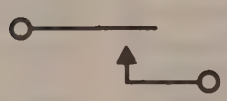
Operate: Normally taken as the interval between energization and the opening or closing of the last contact to function not including bounce.

Release: Normally taken as the interval between de-energization and the opening or closing of the last contact to function excluding bounce.

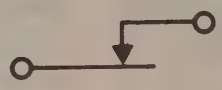
Transfer: The interval between opening a closed contact and closing an open contact of a break-before-make relay.

MINIGLOSSARY
RELAY CONTACT FORMS

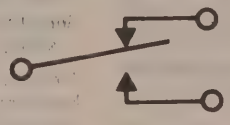
A
Make
SPST-NO



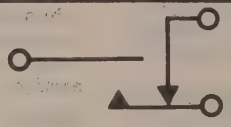
B
Break
SPST-NC



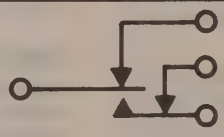
C
Break, Make
(Transfer)
SPDT



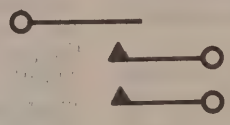
D
Make, Break
(Continuity
Transfer)



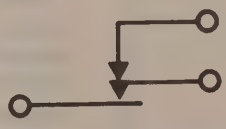
E
Break,
Make,
Break



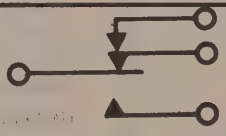
F
Make,
Make



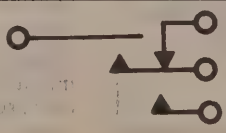
G
Break,
Make



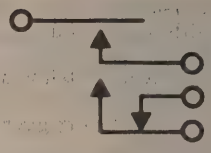
H
Break,
Break,
Make



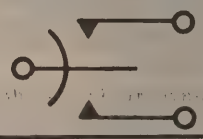
I
Make,
Break,
Make



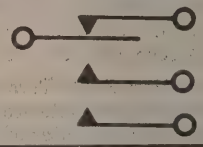
J
Make,
Make,
Break



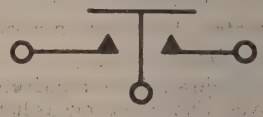
K
Center off
SPDT



L
Break,
Make,
Make

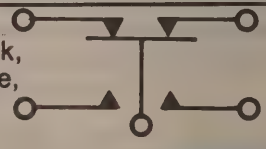


U
Double
make
Contact
on arm



V
Double break
Contact on arm

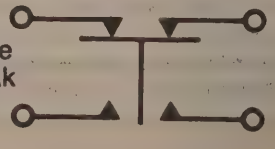
W
Double break,
Double make,
Contact
on arm



X
Double
make

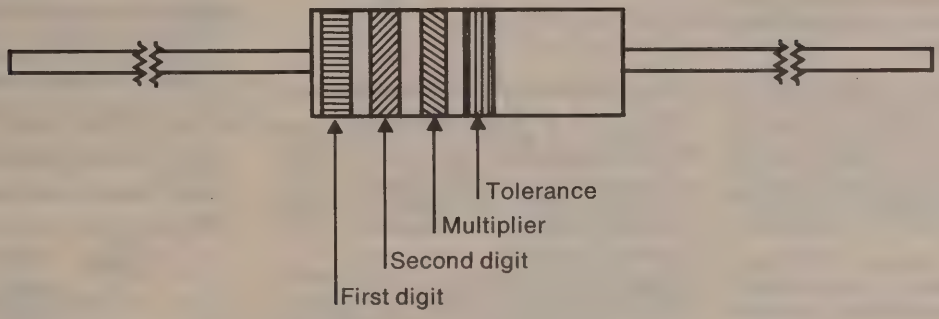
Y
Double break

Z
Double make
Double break
SPDT-DB

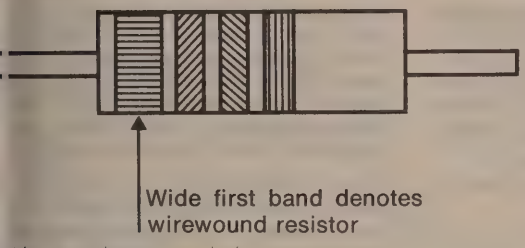


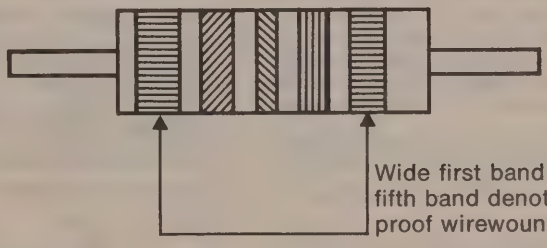
MINIGLOSSARY
RESISTOR COLOR CODES

IA/MIL Resistor Color Codes



olor code for general-purpose industrial resistors

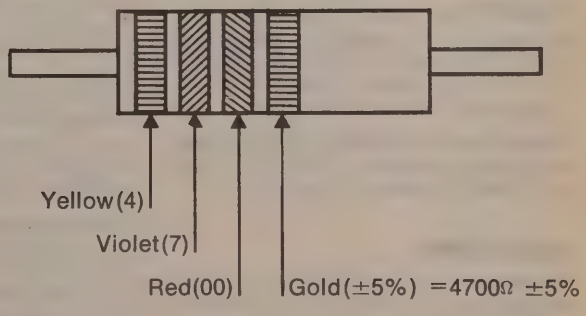




lor code for general-purpose wirewound resistors

olor	Significant digit	Multiplier	Tolerance
lack	0	1	—
rown	1	10	± 1%
ed	2	100	± 2%
range	3	1000	± 3%
ellow	4	10,000	± 4%
reen	5	100,000	—
lue	6	1,000,000	—
iolet	7	10,000,000	—
ray	8	—	—
White	9	—	—
old	—	0.1	± 5%
ilver	—	0.01	±10%
lo color	—	—	±20%

Example:



MINIGLOSSARY SERVO COMPONENTS

SPECIFICATIONS

Excitation: The input voltage and frequency.

Transformation Ratio: The ratio of the output voltage, at maximum coupling, to the input voltage.

Phase Shift: The lead or lag of the output voltage with respect to the input voltage. For most synchros and resolvers, the phase shift can be approximated by the angle whose tangent is the ratio of the primary winding's DC resistance to its reactive component.

Impedance: Specified as R + jX, where R is the AC resistive component and X is the reactive component. Important impedances are: (a) Z_{po} (or Z_{ro} for rotor primary units), which is the impedance of the primary winding with the secondary open; (b) Z_{so}, which is the impedance of the secondary winding with the primary open; and (c) Z_{ss}, which is the impedance of the secondary with the primry shorted (essentially when driven by a low impedance).

Null Voltage: The voltage remaining when the unit is at electrical zero or in the minimum coupling position.

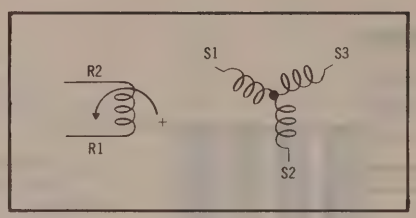
Accuracy: The error of the position of the rotor with respect to the electrical angle. It is defined as the output voltage driven by the "speed" (pole pairs) of the unit, referenced to the starting point of the calibration (usually the electrical zero position). Error is commonly expressed in minutes of arc (1/60 of a degree) or in seconds of arc.

Loads: For a transmitting unit, the impedance that the output voltage signal faces. This can be a receiver, a differential with its load, a control transformer, an A/D converter, etc.

Operation Temperature: The ambient temperature range over which the unit performs its primary function.

FUNCTIONS

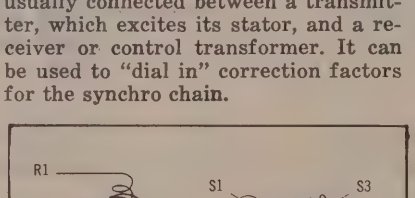
Transmitter: A unit with a Y-connected stator that outputs a signal proportional to the position of its single-phase excited rotor. High power units, called "torque transmitters," are used to drive one or more receivers. Low power transmitters are used to drive control transformers.



Receiver: A unit with a three-phase stator excited by the input, usually from a torque transmitter, and a single-phase rotor that follows the resulting stator field. Usually used to drive a position pointer.

Control Transformer: A unit with a three-phase stator excited by the input from a transmitter and a single-phase rotor mechanically driven to the null position by an external motor or other device.

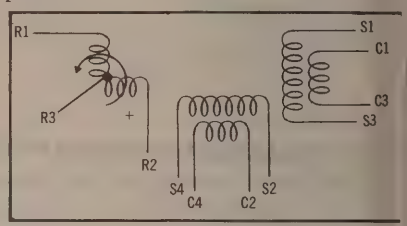
Differential: A unit with a three-phase stator and a three-phase rotor. It is usually connected between a transmitter, which excites its stator, and a receiver or control transformer. It can be used to "dial in" correction factors for the synchro chain.



Transolver: A unit with a three-phase stator and a two-phase rotor that can be used either as a control transmitter (with one rotor phase excited and the other shorted), or as a control transformer with the signal obtained from one phase of the rotor—making sure the other phase is equally loaded to prevent unbalances.

Differential Resolver: A unit with a two-phase stator and a three-phase rotor that is used as a transolver with the advantage that when connected as a control transformer, the signal does not travel through slip rings.

Resolver: A unit with a two-phase rotor and a two-phase stator that is used to create or receive SIN-COS signals such as vector resolutions for solving inertial platform coordinate transformations, unknowns of right triangles, etc. Resolvers can also be used as transmitting, differential, or receiving elements by proper choice of impedances. It is also possible to use resolvers as phase shifters where, in one mode, one rotor phase is excited and the two stator windings are feeding an appropriate RC network and indicating a phase shift, referred to the input, that corresponds to the rotor position.



Compensated Resolver: A unit with a "2×2" phase stator and a two-phase rotor used as a resolver with the added benefit of feedback windings in parallel with the stator windings that increase the useful accuracy over a wide range of environmental operating conditions.

Linear Transformer: A unit with a single-phase stator and single-phase rotor designed to provide a linear output voltage that is directly proportional to the rotor input angle. It operates over a range of less than ±90°, and is analogous to a potentiometer providing infinite resolution, but without contact between the elements. It can be used only with AC voltages.

Brushless Synchro: Available in two types—hairspring and bobbin. Hairspring synchros use spiral wound conductor springs to pick off the rotor signal, and are generally limited to a ±165° rotation. Most have mechanical stops to prevent damage due to over-rotation. Bobbin synchros pick off the rotor signal with rotary transformers inside the unit, allowing the rotor unlimited motion.

Pancake Unit: A name derived from the physical dimensions of the unit which has a diameter that exceeds axial length. Sizes range from under 1" to 20" or more. The unit is frequently used as a gimbal pickoff element and is designed to fit a particular application envelope. It can be supplied as a rotor and stator only.

PRODUCT SELECTION GUIDES

TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 93/94 EDITION OF EEM

AC Power Supplies, Product Selection Guide D•2221
Batteries, Product Selection Guide D•1419
Cabinets, Enclosures, Racks & Chassis, Product Selection Guide C•1003
Capacitors, Product Selection Guide A•1003
Coils, Chokes, Inductors, Product Selection Guide A•1179
Connectors, Terminals & Sockets, Product Selection Guide C•1139
Cores, Magnets & Ferrites A•1317
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide A•1326
DC-DC Converters D•2049
DC Power Supplies, Product Selection Guide D•1488
Delay Lines, Product Selection Guide A•1513
Discrete Semiconductors, Product Selection Guide A•2130
Displays, Readouts, & CRTs, Product Selection Guide B•1017
Fans, Blowers, Cooling Equipment, & Heat Exchangers, Product Selection Guide C•1557
Fiber Optics, Product Selection Guide B•1200
Filters, Power, Product Selection Guide A•1584
Filters, Signal, Product Selection Guide A•1617
Instruments, Test & Measuring, Product Selection Guide D•1215
Interconnection Systems, Product Selection Guide C•1670
Keyboards & Keypads, Product Selection Guide B•1818
Lamps, Lights, & Indicators, Product Selection Guide B•1131
Microwave Components, Product Selection Guide A•1719
Military Qualified Products List B•1002
Motors, Drives, & Rotating Components, Product Selection Guide B•1231
Oscilloscopes, Product Selection Guide D•1402
Panel Hardware, Product Selection Guide C•1522
Panel Meters, Analog & Digital, Product Selection Guide D•1336
Potentiometers, Trimmers, Controls, & Rheostats, Product Selection Guide A•2053
Power Supplies, AC, Product Selection Guide D•2221
Power Supplies, DC, Product Selection Guide D•1488
Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide B•1341
Relays, Product Selection Guide B•1401
Resistors, Product Selection Guide A•1859
Solenoids, Product Selection Guide B•1626
Switches, Product Selection Guide B•1658
Thermal Components, Product Selection Guide B•1857
Transducers & Encoders, Product Selection Guide B•1911
Transformers, Product Selection Guide A•2229
Wire & Cable, Product Selection Guide C•1701

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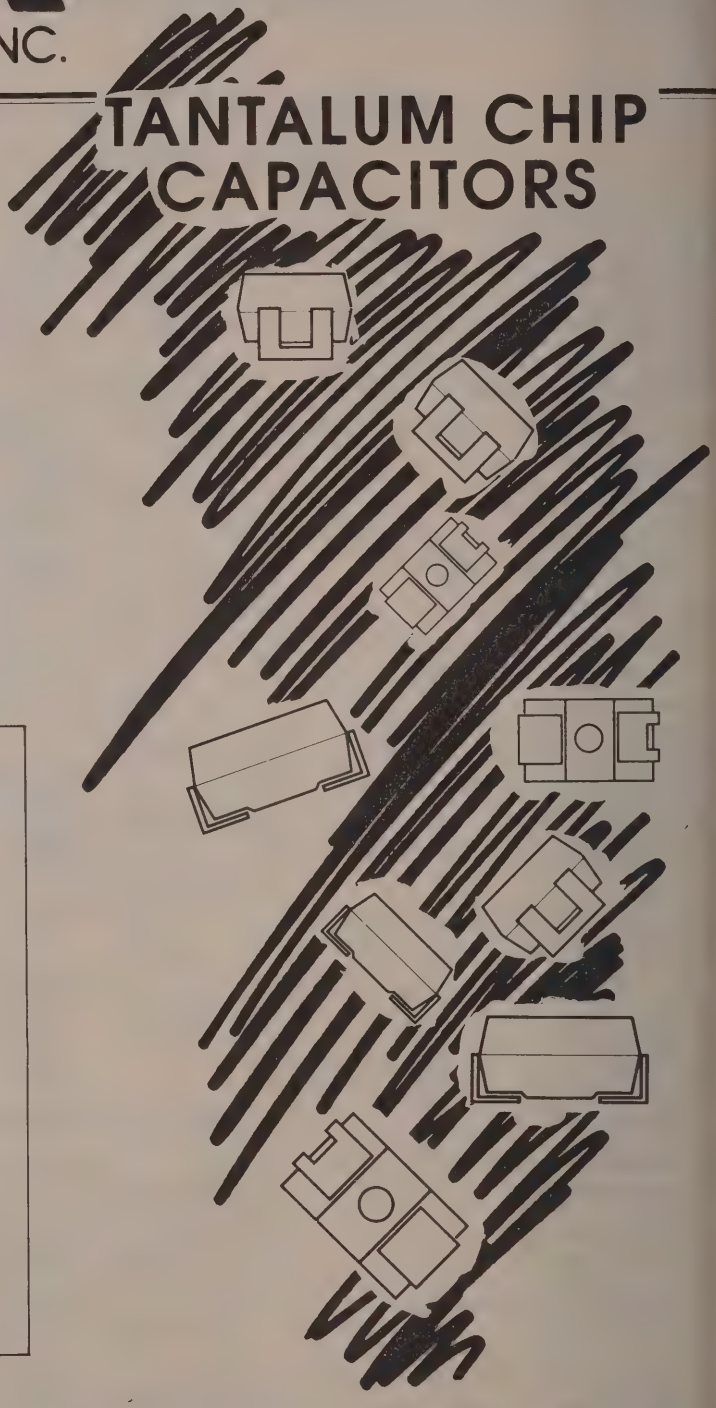

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*For additional information or application data see us in Section 1500 page **A**•1081 and Section 1800 page **A**•1216 or contact:*

KOA Speer Electronics Application Engineering.

Other KOA Speer Products:

See our Data Sheets in Section 4700
Pages **A**•1931 - **A**•1944

SMT - Resistors (General Purpose & Precision)
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P.O. Box 547
Bradford, PA 16701

Telephone General Office (814) 362-5536
Sales Order (814) 362-8810
FAX 814-362-8883

CAPACITORS, FIXED, ELECTROLYTIC

ALUMINUM

Manufacturer	Starting EEM Page No.	Subminiature Tubular				Standard Tubular				Small Can		Large Can Storage	Plastic Cases	AC Motor Start
		Axial Leads		Single End		Axial Leads		Single End		Single Section	Multi-Section			
		Polar	Nonpol.	Polar	Nonpol.	Polar	Nonpol.	Polar	Nonpol.					
Aerovox	A•1008	√				√				√	√	√		√
Robert G. Allen Co.	A•1010	√	√	√	√	√	√	√	√					
Cornell Dubilier	A•1062	√	√	√	√	√	√	√	√	√	√	√		√
Illinois Capacitors	A•1082	√	√	√	√	√	√	√	√	√		√		
KCK America	A•1091	√	√	√	√	√	√	√	√					
Mallory Controls	A•1099							√		√		√		
Metuchen Capacitors	A•1106	√		√										
North American Capacitor Co.	A•1130	√		√		√		√		√		√		
PACCOM Electronics	A•1142			√§	√	√	√	√	√					
Philips Components/ Discrete Products Div.	A•1144							√				√		√
United Chemi-Con Inc.	A•1171	√	√	√	√	√	√	√	√	√	√	√		

MIL Spec. § Surface Mount.

TANTALUM

Manufacturer	Starting EEM Page No.	Solid Electrolyte						Wet Slug		Foil	
		Dipped Radial	Molded Axial	Molded Radial	DIP	Chip	Metal Case	Tubular Case	Large Case	Polar	Nonpolar
Robert G. Allen	A•1010	√				√					
AVX	A•1024	√	√	√	√	√		√			
Kemet Electronics Corp.	A•1092	√	√	√	√	√	√				
KOA Speer	A•1095					√					
Mallory/North American Capacitor Co.	A•1130	√	√	√		√	√	√	√	√	√
Matsuo Electronics	A•1100	√		√	√	√	√	√			
Metuchen Capacitors	A•1106						√	√		√	
NEC Electronics	A•1122					√					
PACCOM Electronics	A•1142	√				√					
Philips Components/ Discrete Products Div.	A•1144		√	√		√		√		√	√
Sprague (VEC)	A•1166	√	√	√	√	√	√	√	√	√	√

MIL Spec. § Surface Mount.

CAPACITORS, FIXED, ELECTROSTATIC

CERAMIC

Manufacturer	Starting EEM Page No.	General Purpose (Z5U)		Special Purpose (CDG etc.)				Monolithic						
										Encapsulated				
		Axial	Disc/ Radial	Axial	Disc/ Radial	DIP	Chip	Chip	DIP	Axial	Dipped Radial	Molded Radial	Feed Thru	High Voltage Power
Robert G. Allen	A•1010	√	√	√	√	√	√	√	√	√	√			
Arm Bar Industries	A•1015							√						
AVX	A•1024	√	√			√	√						√	
Illinois Capacitors Inc.	A•1082				√									
ISKRA Electronics	A•1085				√						√			
Johanson Dielectrics	A•1089						√	√						
KCK America, Inc.	A•1091				√		√							
Kemet Electronics Corp.	A•1092	√	√	√	√	√	√	√	√	√	√	√		
Maida Development	A•1096		√		√									√
Mallory/North American Capacitor Co.	A•1130	√	√	√	√	√	√	√					√	
Metuchen Capacitors Inc.	A•1106	√	√	√	√	√	√	√	√	√	√	√	√	√
Murata Erie North America	A•1117	√	√	√	√		√	√		√	√			√
NEC Electronics	A•1122							√						-
Okaya Electric America	A•1140		√		√						√			√
PACCOM Electronics	A•1142	√	√	√	√			√	√	√	√			
Philips Components/ Discrete Products Div.	A•1144	√	√	√	√	√		√						
Sprague (VEC)	A•1166	√	√	√	√	√	√	√	√	√	√	√	√	√
Tusonix	A•1168	√	√	√	√	√	√	√	√	√	√	√	√	

* MIL Spec. § Surface Mount.

CAPACITORS, FIXED, ELECTROSTATIC

FILM/FOIL (NONMETALLIZED)

Manufacturer	Starting EEM Page No.	Polyester		Polystyrene		Polycarbonate		Polypropylene		Teflon Axial	Paralene		Combi-nations
		Axial	Radial	Axial	Radial	Axial	Radial	Axial	Radial		Axial	Radial	
Aerovox	A•1008	√	√	√	√			√	√				
Robert G. Allen	A•1010	√	√	√	√			√	√				
ASC Capacitors	A•1016	√	√	√	√	√	√	√	√				
Chicago Condenser Corp.	A•1029	√	√			√	√	√	√	√			
Component Research Co. Inc.	A•1030	√	√	√	√	√	√	√	√	√		√	
Condenser Products	A•1058	√	√					√	√	√			
Cornell Dubilier	A•1062	√	√			√	√	√	√				
CSI Capacitors	A•1066	√						√					
Electronic Concepts Inc.	A•1068	√	√	√	√	√	√	√	√	√			
Electronic Film Capacitor	A•1075	√	√	√	√	√	√	√	√				
Elpac Components	A•1076	√	√										
Illinois Capacitors Inc.	A•1082		√										
Inter-Technical Group	A•1084		√				√		√				
ITW Paktron	A•1087							√	√				

* MIL Spec. § Surface Mount.

CAPACITORS, FIXED, ELECTROSTATIC

FILM/FOIL (NONMETALLIZED) (cont'd)

Manufacturer	Starting EEM Page No.	Polyester		Polystyrene		Polycarbonate		Polypropylene		Teflon	Paralene		Combinations
		Axial	Radial	Axial	Radial	Axial	Radial	Axial	Radial	Axial	Axial	Radial	
KCK America, Inc.	A•1091	√	√	√	√	√	√	√	√				
Matsuo Electronics	A•1100	√	√	√	√	√			√				
Metuchen Capacitors	A•1106	√	√			√	√						
NWL Capacitors; NWL Transformers	A•1136	√	√			√	√				√		
PACCOM Electronics	A•1142	√	√	√	√			√	√				
Philips Components/ Discrete Products Div.	A•1144	√		√	√			√		√			
PPD, Inc.	A•1150							√	√				
Reliable Capacitors Inc.	A•1156	√	√	√		√	√	√	√	√			
RFI (Del Electronics)	A•1157	√	√					√	√		√	√	
Seacor Inc.	A•1160	√	√	√	√	√	√	√	√				
World Products	A•1177		√										

' MIL Spec. § Surface Mount.

METALLIZED FILM

Manufacturer	Starting EEM Page No.	Polyester		Polysulfone		Polycarbonate			Polypropylene		AC & Motor Run	Teflon Axial	Combinations
		Axial	Radial	Axial	Radial	Axial	Radial	Chip	Axial	Radial			
Aerovox	A•1008	√	√						√	√	√		
Robert G. Allen Co. Inc.	A•1010	√	√						√	√			
ASC Capacitors	A•1016	√	√			√	√		√	√	√		√
Chicago Condenser Corp.	A•1029	√	√			√	√						√
Component Research Co. Inc.	A•1030	√	√	√	√	√	√		√	√	√	√	√
Comell Dubilier	A•1062	√	√			√	√		√	√	√		
CSI Capacitors	A•1066	√							√		√		
Electrocube	A•1067	√	√	√	√	√	√		√	√			
Electronic Concepts Inc.	A•1068	√	√	√	√	√	√		√	√	√	√	√
Electronic Film Capacitor	A•1075	√	√			√	√		√	√	√		
Elpac Components	A•1076	√	√			√	√		√	√			
Illinois Capacitors Inc.	A•1082	√	√			√			√	√			
Inter-Technical Group	A•1084		√		√		√			√			
ISKRA Electronics	A•1085		√							√	√		
ITW Paktron	A•1087		√§										
KCK America, Inc.	A•1091	√	√			√	√		√	√			
Mallory/North American Capacitor Co.	A•1130	√	√						√	√			
Matsuo Electronics	A•1100	√		√	√		√		√	√			√
Metuchen Capacitors	A•1106	√	√	√	√	√	√	√	√	√	√	√	
Motor Capacitors	A•1116	√	√						√	√	√		
NWL Capacitors; NWL Transformers	A•1136	√	√			√	√		√	√			
Okaya Electric America	A•1140		√							√			
PACCOM Electronics	A•1142	√§	√						√	√			
Philips Components/ Discrete Products Div.	A•1144	√				√	√			√			√
PPD, Inc.	A•1150	√	√						√	√	√		
Reliable Capacitors Inc.	A•1156	√	√			√	√		√	√		√	
Seacor Inc.	A•1160	√	√			√	√		√	√	√		√
Wesco Electrical Co.	A•1174	√	√			√			√				
World Products	A•1177		√										

' MIL Spec. § Surface Mount.

CAPACITORS, FIXED, ELECTROSTATIC

MICA

Manufacturer	Starting EEM Page No.	Dipped	Chip	Button	Transmitting	Reconstituted
Robert G. Allen Co. Inc.	A•1010	√				
Cornell Dubilier	A•1062	√§*	√§		√	√
Metuchen Capacitors	A•1106	√	√			
NWL Capacitors; NWL Transformers	A•1136				√	√
RFI (Del Electronics)	A•1157					√

* MIL Spec. § Surface Mount.

PAPER & PAPER/FILM

Manufacturer	Starting EEM Page No.	Paper Foil (Dry)			Paper Foil (Impregnated)		Metallized Paper			Paper/ Film (Axial)
		Axial	Single End	Herm. Sealed	Energy Store	Motor Run	Axial	Single Ended	Herm. Sealed	
Chicago Condenser Corp.	A•1029				√					√
Cornell Dubilier	A•1062	√	√		√	√	√	√		
CSI Capacitors	A•1066				√				√	√
Inter-Technical Group	A•1084								√	
NWL Capacitors; NWL Transformers	A•1136				√			√	√	√
RFI (Del Electronics)	A•1157	√	√	√	√					
Seacor Inc.	A•1160		√		√	√		√		√

* MIL Spec. § Surface Mount.

CAPACITORS, VARIABLE

Manufacturer	Starting EEM Page No.	Air				Ceramic		Gas Filled	Glass		Mica	Plastic		Sapphire	Vacuum
		Single Turn	Multi-Turn	Ball Bearing	Ganged	Tubular	Disk		Piston	Non-magnetic		Single Turn	Multi turn		
Illinois Capacitors Inc.	A•1082						√								
Johanson Manufacturing Corp.	A•1088	√	√				√							√	
Joslyn Jennings Corp.	A•1090							√*							√*
Metuchen Capacitors	A•1106					√	√				√	√	√		
Murata Erie North America	A•1117	√					√							√	
Sprague-Goodman Inc.	A•1164	√	√				√		√	√	√	√	√	√	

* MIL Spec. § Surface Mount.

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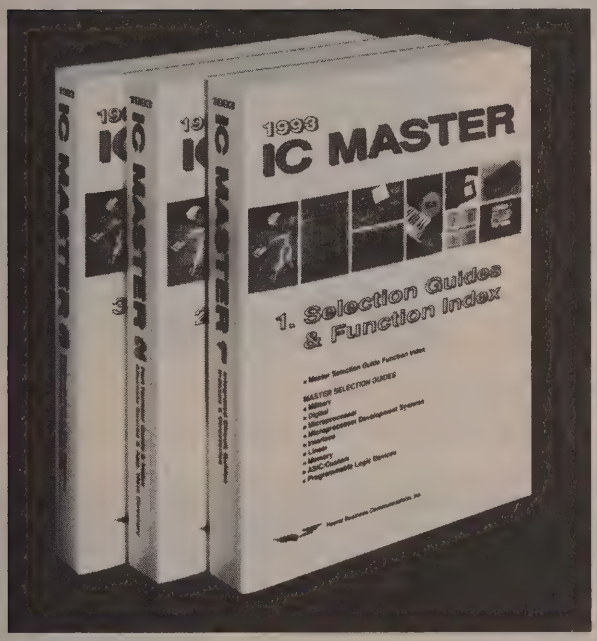

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Applications: Flash lamps, laser equipment, defibrillators, power supplies, welding equipment, particle accelerators and fusion power applications, high energy X-rays, Loran guidance systems.

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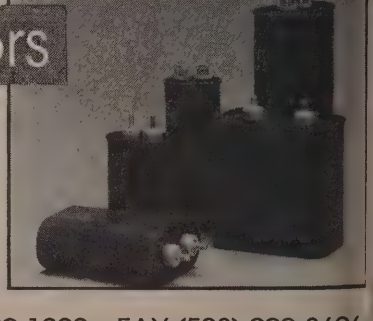
SCRs and snubbers
Application: Power supplies



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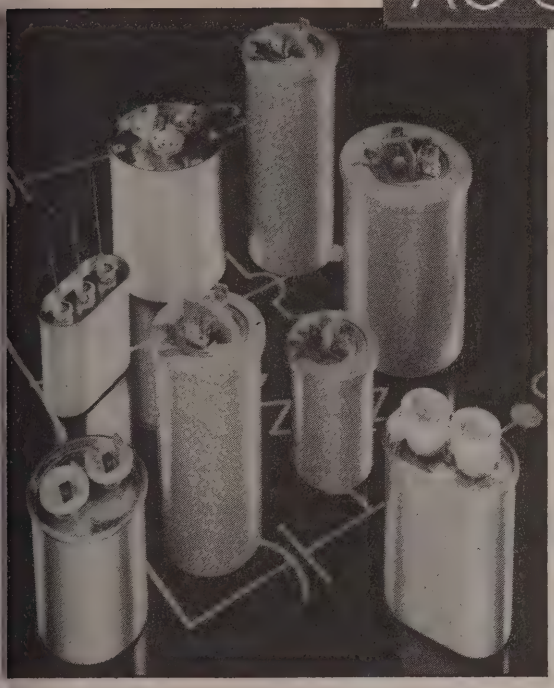

Metallized Polypropylene (Oil Filled)
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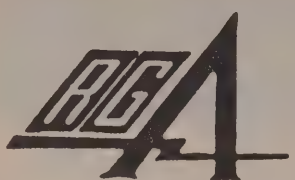

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ALUMINUM ELECTROLYTIC CAPACITORS

- Axial—General Purpose, Miniature Size
- Axial—High Voltage
- Axial—Wide Temperature
- Axial—Low Leakage
- Axial—Non-Polarized
- Radial—General Purpose
- Radial—Low Profile
- Radial—High Voltage
- Radial—Wide Temperature
- Radial—Low Profile (5mm Height Max)
- Radial—Low Leakage
- Radial—Low Leakage, Wide Temperature
- Radial—Super Subminiature, Low Leakage, Tantalum Replacement
- Radial—Non-Polarized
- Radial—Low ESR for Switching Regulators
- Snap-in Terminal
- Snap-in Terminal, Low Profile
- Snap-in Terminal, Wide Temperature
- Snap-in Terminal, Low Profile, Wide Temperature

TANTALUM CAPACITORS

- Radial—Resin Dipped
- Chip type, Surface Mounted

FILM CAPACITORS

- Radial, Inductive Dipped Polyester
- Radial, Non-Inductive Dipped Polyester
- Axial, Wrap and Fill Polyester, Non-Inductive
- Radial, Metalized Polyester, Dipped
- Axial, Metalized Polyester, Wrap and Fill, Flat Oval
- Axial, Metalized Polyester, Wrap and Fill, Tubular
- Radial Metalized Polypropylene, Dipped
- Axial Metalized Polypropylene, Wrap and Fill, Flat Oval
- Axial Metalized Polypropylene, Wrap and Fill, Tubular
- Radial Polypropylene
- Axial Polypropylene
- Axial Polystyrene, Film Foil

CERAMIC CAPACITORS

- Radial Disc, HI-K Type
  Y5F, Y5P, Z5U, Z5V
- Radial Disc, Temperature Compensating Type
  NPO, SL, N750, N1500
- Radial Disc, Semi-Conductive Type
  Y5S, Y5T, Y5V
- Radial, Multi-Layer, Epoxy Dip
  NPO, X7R, Z5U
- Chip Type Multi-Layer
  NPO, X7R, Y5V, Z5U
- Axial Single Layer

CAPACITOR PRODUCTS

Electrolytics	Ceramics	Tantalum	Film
General Purpose	*Chip (SMD)*	*Dipped Type*	*Polyester (Mylar)*
Low Leakage	*Ceramic Disks*	*Molded Types*	*Metallized Polyester*
Subminiature		*Solid*	*Polystyrene*
High Voltage		*Wet Slug*	*Polypropylene*
Low ESR		*Chip (SMD)*	*Polycarbonate*
Snap in Terminals			*Polysulfonate*
High Temperature			*UL, CSA, VDE Approved*
Chip (SMD)			*Chip (SMD)*

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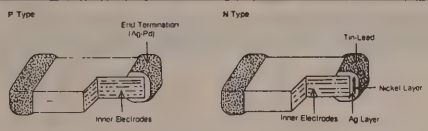
SURFACE MOUNT CAPACITORS

SMD CERAMIC

CHIP CAPACITOR

Construction

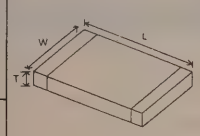


COG/NPO
Ultra Stable class I dielectric,with negligible dependance of electrical properties on temperature, voltage, frequency or time. Used in circuits requiring stable performance.

X7R
Stable class II dielectric, with predictable change of properties with temperature, voltage, frequency and time. Used as blocking, coupling, by-pass and frequency discriminating elements. This dielectric is ferroelectric and offers higher capacitance ranges than class I.

Y5V (Z5U)
General purpose class II dielectric with higher dielectric constant and greater variation of properties with temperature and test conditions. Very high capacitance per unit volume is attainable for general purpose applications.

SIZE & CAPACITANCE VALUE RANGE

SIZE	CONSTRUCTION	DIMENSION L	W	T
0805		2.0±0.15	1.25±0.15	$0.7\pm^{0.}_{0.2}$
				$1.0\pm^{0.}_{0.4}$
				$1.25\pm^{0.}_{0.4}$
1206		3.2±0.15	1.6±0.15	$0.7\pm^{0.}_{0.2}$
				$1.0\pm^{0.}_{0.4}$
				$1.25\pm^{0.}_{0.4}$

CAPACITANCE VALUE RANGE OBTAINABLE FOR EACH SIZE

SIZE	THICKNESS (mm)	COG (pF)	X7R (pF) 50V	X7R (pF) 25V	Y5V (Z5U) (pF) 50V	Y5V (Z5U) (pF) 25V
0805	$0.7\pm^{0.}_{0.2}$	10-330	470-8200	10000-12000	1000-2200	33000-68000
	$1.0\pm^{0.}_{0.4}$	360-510	10000-15000	15000-22000	33000-47000	100000
	$1.25\pm^{0.}_{0.4}$	560-820	18000-27000	27000-39000	68000	-
1206	$0.7\pm^{0.}_{0.2}$	20-750	1000-15000	39000-47000	1000-47000	68000-100000
	$1.0\pm^{0.}_{0.4}$	820-1000	18000-27000	56000-100000	8000	150000
	$1.25\pm^{0.}_{0.4}$	1100-2200	33000-68000		100000	220000

SMD FILM/ALUMINUM ELECTROLYTIC SPECIFICATIONS AVAILABLE UPON REQUEST.

Your Prime Source
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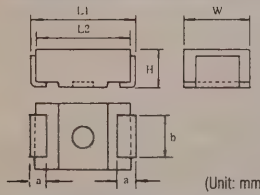
Miniaturization of electronics products requires less space for components. TCM Series Molded Chip Tantalum Capacitors are designed for use in thick film hybrid circuits and for direct mounting on printed on circuit boards. Fully-molded construction has good resistance to mechanical stress and moisture. They are supplied on Carrier Tape for automatic assembly.

SPECIFICATIONS

Operating Temperature Range		−55°C – +125°C
Maximum Operating Temperature at Rated Voltage		+85°C
Capacitance Range		0.047µF – 100µF
Rated Voltage Range		4.0V – 35V DC
Capacitance Tolerance		±20% (at 20°C, 120Hz)
Leakage Current		0.01CV or 0.5µA max.
Dissipation Factor at 20°C and 120Hz		Cap. ≦1.0 .umF less than 4% Cap. ≧1.5µF less than 6%
Humidity Test	Test Condition	Temp.: 60°C, humidity: 90 – 95% RH, duration: 500 hrs.
	Capacitance Change	Within 5% of the value before test
	Leakage Current	Not to exceed the value specified above
	Dissipation Factor	Not to exceed 125% of the value specified above
High Temp. Load Test	Test Condition	Temp.: 85°C at rated voltage duration: 1,000 hrs.
	Capacitance Change	Within 10% of the value before test
	Leakage Current	Not to exceed 125% of the value specified above
	Dissipation Factor	Not to exceed 125% of the value specified above
Reliability		Failure rate: Less than 1%/1,000 hours (60% CL)

DIMENSIONS



(Unit: mm)

	L1±0.2	L2±0.2	W±0.2	H±0.2	a±0.2	b±0.2
Case A	3.2	2.9	1.6	1.7	0.8	1.2
Case B	5.1	4.8	3.2	1.8	0.8	2.0
Case B1	3.4	3.1	2.8	1.9	0.8	1.8
Case C	6.7	6.4	4.8	1.8	1.2	2.5
Case C1	5.8	5.5	3.2	2.5	1.2	2.0
Case D	6.7	6.4	4.8	2.5	1.2	2.5
Case D1	5.8	5.5	4.6	3.2	1.3	2.4
Case E	7.3	7.0	4.3	2.9	1.3	2.4

STANDARD RATINGS AND CASE CODES

W.V. / Cap. (µF)	4.0	6.3	10	16	20	25	35
0.047							A
0.068							A
0.1							A
0.15							A
0.22							A
0.33							A
0.47						A	B, B1
0.68					A		B, B1
1.0				A			B, B1
1.5			A			B, B1	C, C1
2.2		A			B, B1	C, C1	C, C1
3.3	A			B, B1	C, C1	C, C1	C, C1
4.7	A		B, B1	C, C1	C, C1	C, C1	D, D1, E
6.8		B, B1	C, C1	C, C1	C, C1	D, D1, E	D, D1, E
10	B, B1	C, C1	C, C1	C, C1	D, D1, E	D, D1, E	E
15	C, C1	C, C1	C, C1	D, D1, E	D, D1, E		
22	C, C1	C, C1	D, D1, E	D, D1, E			
33	C, C1	D, D1, E	D, D1, E				
47	D, D1, E	D, D1, E	D, D1, E				
68	D, D1, E	D, D1, E					
100	D, D1, E						

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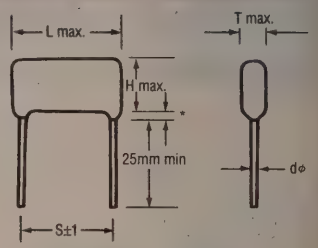
FILM CAPACITORS

MEF SERIES METALLIZED POLYESTER FILM

- Flame retardant
- Non-inductive
- Small size
- Self-healing
- Epoxy resin coating for superior heat, moisture & solvent resistance



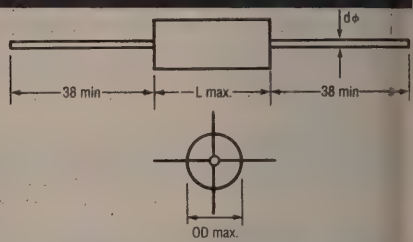
*2mm max. for L <20mm
*1.5mm max for L ≤20mm

SPECIFICATIONS

Operating Temperature	−40°C to +85°C
Rated Voltage	DC100V, 250V, 400V, 630V
Capacitance Range	0.01 to 10 MFD
Capacitance Tolerance	+5%, +10%, +20%
Insulation Resistance	C<0.33 MFD, R≥15,000 MEGOHM C≥0.33 MFD, RC≥5,000 MEGOHM × MFD
Dissipation Factor	≤0.01 (at 1KHz)

MET SERIES METALLIZED POLYESTER FILM

- Non-inductive
- Small size
- High reliability
- Self-healing
- Exterior sealed by polyester adhesive tape & epoxy resin at both ends
- Tape & reel available
- Flame retardant



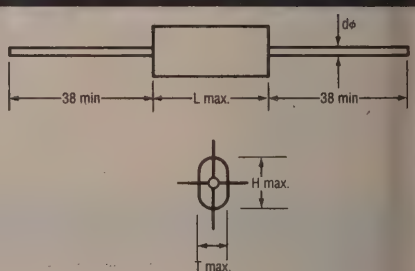
OD	dφ
up to 8.0mm	0.6mm
over 8.0mm	0.8mm

SPECIFICATIONS

Operating Temperature	−40°C to +85°C
Rated Voltage	DC100V, 250V, 400V, 630V
Capacitance Range	0.01 to 10 MFD
Capacitance Tolerance	+5%, +10%, +20%
Insulation Resistance	C<0.33 MFD, R≥15,000 MEGOHM C≥0.33 MFD, RC≥5,000 MEGOHM × MFD
Dissipation Factor	≤0.01 (at 1KHz)

MEA SERIES METALLIZED POLYESTER FILM

- Non-inductive
- High reliability
- High capacitance
- Moisture resistant
- Excellent electrical characteristics
- Exterior sealed by polyester adhesive tape & epoxy resin
- Flame retardant
- Used in filtering, DC blocking, communication equipment



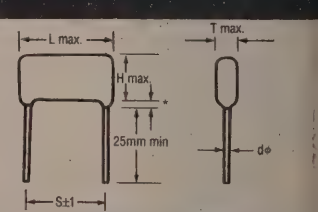
L	14.0	19.0	27.0	32.0	47.0
dφ	0.6	0.6	0.8	0.8	1.0

SPECIFICATIONS

Operating Temperature	−40°C to +85°C
Rated Voltage	DC100V, 250V, 400V, 630V
Capacitance Range	0.01 to 10 MFD
Capacitance Tolerance	+5%, +10%, +20%
Insulation Resistance	C<0.33 MFD, R≥15,000 MEGOHM C≥0.33 MFD, RC≥5,000 MEGOHM × MFD
Dissipation Factor	≤0.01 (at 1KHz)

PPN SERIES POLYPROPYLENE FILM CAPACITORS

- Non-inductive
- Extended foil construction
- Welded leads
- Low dissipation factor
- Flame retardent
- Used in high frequency coupling & decoupling circuits, filtering, timing



*2mm max. for L <20mm
*1.5mm max for L ≤20mm

L	13.0	19.0	24.0
S	10.0	15.0	20.0
dφ	0.6	0.8	0.8

SPECIFICATIONS

Operating Temperature	−40°C to +85°C
Rated Voltage	DC100V, 250V, 400V, 630V
Capacitance Range	0.001 to 2.2 MFD
Capacitance Tolerance	+5%, +10%, +20%
Insulation Resistance	50,000 MEGOHM MIN
Dissipation Factor	≤0.001 (at 1KHz) ≤0.002 (at 100KHz) for C≤0.01 MFD ≤0.003 (at 100KHz) for 0.01≤0.1 MFD

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MONOLITHIC MULTILAYER CERAMIC CAPACITORS

EPOXY COATED RADIAL TYPE R SERIES

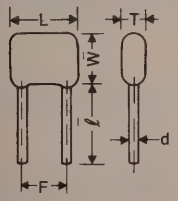
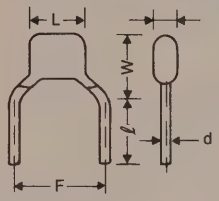
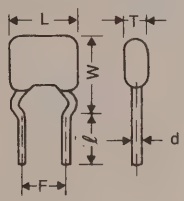
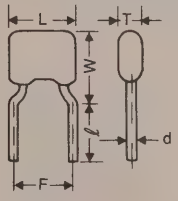
Small Size, Big Capacitance Epoxy Coated Radial Leaded Monolithic Multilayer Ceramic Capacitor R Series

FEATURES

1. Small size, big capacitance from 10pF up to 10uF with no polarity, suitable for taking place of aluminum electrolytic capacitors if only the smaller installation space is available.
2. The internal electrodes are built inside dielectric then sealed with resin, this structure makes the capacitors highly reliable in quality.
3. Due to ceramic intrinsic excellent frequency characteristic, it can serve for high frequency application.
4. As the epoxy powder is applied for coating, these products show excellent resistance to humidity, and no change in the appearance of capacitor surface during soldering or solvent cleaning.

DIMENSIONS

1. LEAD STYLE:

L	A	Y	H
			

2. LEAD SPACE (F):

CODE	LEAD SPACE	REMARK
2	2.5mm ± 1mm	0.1" Pitch
5	5.0mm ± 1mm	0.2"
7	7.5mm ± 1mm	0.3"

3. LEAD LENGTH (ℓ)

CODE	LEAD LENGTH	REMARK
6	6mm ± 1mm	Standard
4	4mm ± 1mm	
9	9mm ± 1mm	
L	25mm (min)	

BODY SIZE and its dimension as follows:

SIZE CODE	LEAD STYLE AVAILABLE	CAPACITANCE RANGE (pF)				DIMENSIONS (mm)					
		NP0	X7R	Z5U	Y5V	L max.	W max.	T max.	ℓ ± 1	d ± 0.05	F ± 1
R15	L	10~	470~	10,000~	10,000~	3.8	3.8	2.5	6	0.5	2.5
	A, H	1,500	33,000	150,000	150,000	3.8	5.5	2.5	6	0.5	5.0
R20	Y	1,000~	39,000~	150,000~	150,000~	5.0	6.0	3.0	6	0.5	2.5
	A, H	6,800	330,000	1,500,000	1,000,000	5.0	6.0	3.0	6	0.5	5.0
R25	L	–	180,000~ 680,000	820,000~ 3,300,000	820,000~ 1,000,000	6.3	6.5	3.0	6	0.5	5.0
R30	Y	–	100,000~(1) 220,000	2,200,000~ 10,000,000	–	7.6	7.6	3.5	6	0.5	5.0

Note: (1) For High voltage capacitors.

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COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A
A/D acrylonitrile butadiene-styrene
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AFC audio frequency control
AFT automatic filter test
ALGOL algorithmic language
AM a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
ASIC application specific IC
ATE automatic test equipment
ATG automatic test generation
AWG American wire gauge

B
BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility syste

C
CAD computer-aided design
CAE computer-aided engineering
CAM computer-aided manufacture
CAMAC computer-automated measurement and control
CAPP computer-aided process planning
CAT computer-aided test
CATV cable television or community antenna television
CCC (leaded) ceramic chip carriers
CCD computer-controlled display
CERMET ceramic metal element
CIE computer-integrated engineering
CIM computer-integrated manufacturing
CLCC ceramic leadless chip carriers
CMOS complementary metal-oxide semiconductor
Comm. communications
CPS characters per second
CPU central processing unit

D
D/A digital to analog
DAC digital to analog converter
DBMS data base management system
DC direct current
DFT design for testability
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DRAM dynamic RAM
DTL diode transistor logic

E
EDA electronic design automation
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EIA Electronic Industries Association
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM erasable programmable ROM
ESR equivalent series resistance

F
FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G
GaAsFET gallium arsenide FET
CMIP commn management information protocol
GPIB general purpose interface bus
GPS global positioning system

H
HF high frequency (3 to 30 MHz)
HIPOT test, measurement, and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I
IAB Internet Activities Board
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared
ISDN integrated services digital network
ISO International Standards Organization

J
JEDEC Joint Electronic Device Engineering Council
JFET junction FET
JMOS junction MOS

K
kHz kilohertz (10^3 hertz)
KSR keyboard send /receive

L
LAN local area network
LC (filters) inductance/capacitance
LCC leaded chip carrier
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M
MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
µF microfarad
MHz megahertz
MIC microwave IC
MIPS million instructions per second
MIB microcomputer interface board
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor FET
MOSIGT metal oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N
NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM national instrumentation module
NOR not OR
NTC negative temperature coefficient

O
OCR optical character reader
OEM original equipment manufacturer
OR a logical operator
OSI open systems interconnection

P
PAL programmable array logic
PC printed circuit
PCB printed circuit board
PCM pulse code modulation
PCS plastic clad silica
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLCC plastic leaded chip carrier
PLL phased lock loop
PPI plan position indicator
PROM programmable ROM
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q
QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R
RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S
SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon-controlled switch
SDA source & detector assemblies
SGMP simple gateway monitoring protocol
SIDAC bidirectional voltage-triggered switch
SIMM single in-line memory module
SIP single in-line package
SMD surface mount device
SMT surface mount technology
SNMP simpole network management protocol
SO small outline
SOIC small outline IC
SOT small outline transistor
SSI small scale integration
SSR solid-state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T
TC temperature coefficient
TCE thermal coefficient of expansion
TXCO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U
UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

V
VAC volts (of) alternating current
VAN value-added network
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency (30 kHz to 300 MHz)
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W
WPS word processing software

Y
YIG yttrium iron garnet

Z
ZIF zero insertion force

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FAX 908/679-3222

CERAMIC CHIP CAPACITORS FOR SURFACE MOUNTED TECHNOLOGY

CHIP PACKAGING INFORMATION—CERAMIC

CoPS (Component Placement System) Reeling

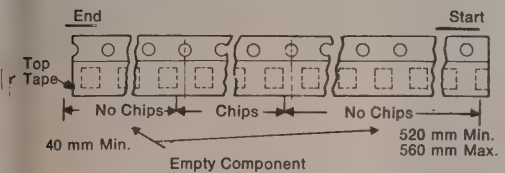
Armbar Industries is offering KEMET's CoPS (Component Placement System), Multilayer Ceramic Chip Capacitors in carrier tape form for automatic placement on printed circuit boards. They are available in nine sizes.

KEMET CoPS capacitors conform to the Electronic Industries Association specification RS-481A for Automated Compoennt Processing and insertion.

FIGURE 1
KEMET CoPS Capacitors are wound on a standard 178.0 mm (7.00") or 330.0 mm (13.0") diameter 8 mm reel. Seven-inch diameter reels contain 4,000 chips and for 13.0" diameter reels, 12,500 chips.

FIGURE 2
Figure 2 shows carrier leader and ending amounts of KEMET Multilayer Ceramic Chips on CoPS reels.

Figure 2 — CoPS Carrier Chips



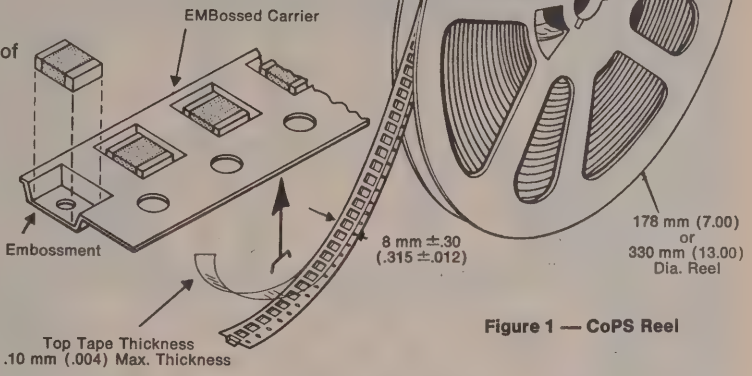


Figure 1 — CoPS Reel

Armbar stocks the following chip sizes and values on reel for immediate shipping.
Additional sizes and value will be made available on reels — consult Armbar for delivery.

NPO DIELECTRIC

CAP pF	SIZE C0805
1.0	C0805C109D5GAC
1.5	C0805C159D5GAC
2.2	C0805C229D5GAC
3.3	C0805C339D5GAC
4.7	C0805C479D5GAC
6.8	C0805C689D5GAC
10.0	C0805C100J5GAC
15.0	C0805C150J5GAC
22.0	C0805C220J5GAC
33.0	C0805C330J5GAC
47.0	C0805C470J5GAC
68.0	C0805C680J5GAC
100.0	C0805C101J5GAC
150.0	C0805C151J5GAC
220.0	C0805C221J5GAC
330.0	C0805C331J5GAC

C1206C

CAP pF	SIZE C1206
1.0	C1206C109D5GAC
4.7	C1206C479D5GAC
10.0	C1206C100J5GAC
15.0	C1206C150J5GAC
22.0	C1206C220J5GAC

C1206C (Cont.)

CAP pF	SIZE C1206
33.0	C1206C330J5GAC
47.0	C1206C470J5GAC
68.0	C1206C680J5GAC
100.0	C1206C101J5GAC
150.0	C1206C151J5GAC
220.0	C1206C221J5GAC
330.0	C1206C331J5GAC
470.0	C1206C471J5GAC
680.0	C1206C681J5GAC
1,000.0	C1206C102J5GAC
1,500.0	C1206C152J5GAC

X7R DIELECTRIC

CAP pF	SIZE C0805
470	C0805C471K5RAC
680	C0805C681K5RAC
1,000	C0805C102K5RAC
1,500	C0805C152K5RAC
2,200	C0805C222K5RAC
3,300	C0805C332K5RAC
4,700	C0805C472K5RAC
6,800	C0805C682K5RAC
10,000	C0805C103K5RAC
15,000	C0805C153K5RAC

C1206

Cap pF	SIZE C1206
1,000	C1206C102K5RAC
2,200	C1206C222K5RAC
3,300	C1206C332K5RAC
4,700	C1206C472K5RAC
6,800	C1206C682K5RAC
10,000	C1206C103K5RAC
15,000	C1206C153K5RAC
22,000	C1206C223K5RAC
33,000	C1206C333K5RAC
47,000	C1206C473K5RAC
68,000	C1206C683K5RAC
100,000	C1206C104K5RAC

Z5U

CAP pF	SIZE C1206
100,000	C1206C104M5UAC
150,000	C1206C154M5UAC

Chip Size	Capacitance Range			Chip Quantities Per Reel*		
	NPO	X7R	Z5U	178 mm Dia. (7 inches)	330 mm Dia. (13 inches)	Tape Width (mm)
C0805	1 — 470 PF	470 — .015 MF	.6800 — .033 MF	2,500	12,500	8
C1005	1 — 1000 PF	680 — 39,000 PF	.018 — .082 MF	2,500	12,500	8
C1206	1 — 2,200 PF	1000 — .1 MF	.033 — .15 MF	2,500	12,500	8
C1210	1000 — 4700 PF	.01 — .15 MF	.047 — .27 MF	2,500	12,500	8
C1805	470 — 2700 PF	.0033 — .1 MF	.033 — .15 MF	2,500	12,500	12
C1808	470 — 4700 PF	.0056 — .18 MF	.068 — .33 MF	2,500	12,500	12
C1812	470 — 10,000 PF	.01 — .33 MF	.082 — .68 MF	1,300	7,500	12
C1825	5600 — 10,000 PF	.12 — .68 MF	.18 — 1.5 MF	1,300	7,500	12
C2225	2200 — 27,000 PF	.27 — .015 MF	.33 — 2.2 MF	1,300	7,500	12

* Minimum shipping quantity is quantity contained on one reel.

ARMBAR INDUSTRIES INCORPORATED
139 WHITE OAK LANE, P.O. BOX 339, OLD BRIDGE, NJ 08857
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For your convenience we welcome credit card purchases (min. $35.00).

A Minority Owned Business!

ASC® CAPACITORS FILM CAPACITORS

ASC is AGRESSIVELY focused on providing the electronics market with:

- reliable, high quality capacitors —
- at a competitive price —
- in a timely manner.

Our corporate goals are built around business partnerships. This philosophy of customer service and partnerships is supported by everyone at ASC, from upper management to night maintenance. That's the only way it works — otherwise, it's just talk.

Evidence of our PARTNERSHIP ORIENTED, SINGLE GOAL focus is found in ASC's implementation of a manufacturing procedure policy supporting CONTINUOUS FLOW MANUFACTURING and rapid-pace improvements.

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ASC® CAPACITORS

FILM CAPACITORS

STRONG MANUFACTURING CAPABILITIES.
Since its acquisition of the TRW Capacitor Division in 1987, ASC has emerged as the fastest growing film capacitor company in the U.S.A.

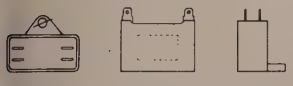
Ogallala, Nebraska, America's new "film capital", is the site of ASC's 170,000 square foot manufacturing facility. This is just one of our state-of-the-art facilities, where ASC manufactures one of the most complete lines of high quality film capacitors in the world.

ASC's broad range of product offerings, combined with strong engineering know-how and a total commitment to customer service means you now have a single domestic source for all your film capacitor requirements.

Ogallala, Nebraska, Engineering and Production Facility.

AC CAPACITORS

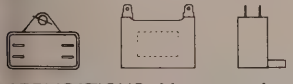
METALLIZED POLYESTER (Dry type)



VDE approved
UL810 listed styles available

APPLICATIONS: Motor run, fans/appliances/pumps/business machines, electric tools.

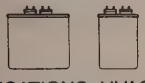
METALLIZED POLYPROPYLENE (Dry type)



UL810 listed styles available

APPLICATIONS: Motor run, fans/appliances, electric tools, lighting ballasts.

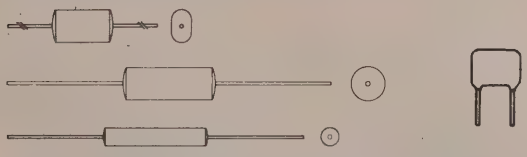
METALLIZED POLYPROPYLENE (Oil filled)



UL810 listed styles available

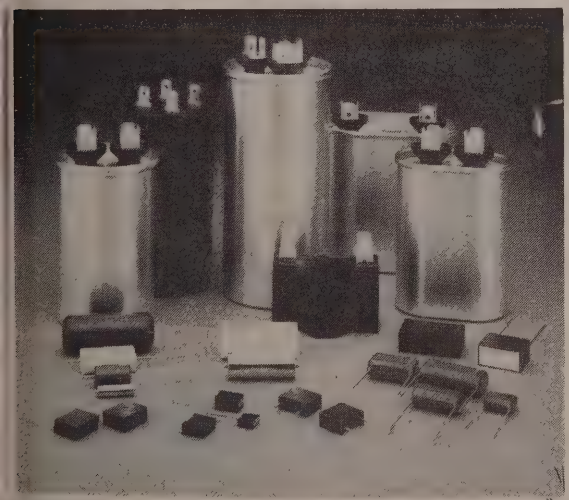
APPLICATIONS: HVAC, HID lighting, power factor correction, UPS.

METALLIZED POLYESTER
(Wrap and fill, conformal coated)



APPLICATIONS: Fans/ventilators/air conditioners/business machines, electric tools, power factor correction, small motors, noise filtering.

CUSTOM CONFIGURATIONS
ASSEMBLIES
FILTERS
RC NETWORKS



AC & DC CAPACITORS.
ASC is unique in its ability to manufacture and deliver a full range of film capacitor products, for both AC and DC applications. ASC has the experience and production capacity to satisfy the demands of nearly every market–medical or test instrumentation, computer products, switch mode power supplies, heating and air-conditioning, lighting, automotive sensors and controls or appliances.

ASC's sizeable Engineering Staff stands ready to assist you in making the proper capacitor selection for your application and answer any technical questions you might have.

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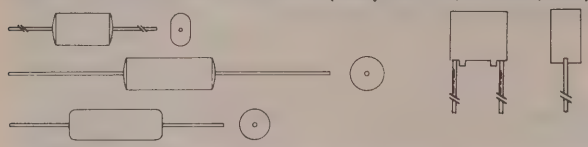
CUSTOM & MILITARY EXPERTISE.
With over 45 years of engineering experience, ASC has all the resources necessary to serve the Aerospace and Military markets with quality capacitors and RC networks.

It is the kind of experience you can rely on for custom solutions to a wide range of application specific problems. These include critical electrical parameters, unusually high voltage or low E.S.R. applications, all sizes and types of packages, tape wraps, hermetically sealed enclosures, potted boxes, multi-pin DIP packages and surface mount devices. The film capacitors shown represent only a small sampling of our overall custom and Hi-Rel capabilities.

ASC's facilities include a NASA approved test laboratory, a Hi-Rel production room and a Mil.Q-9858A Approved quality system.

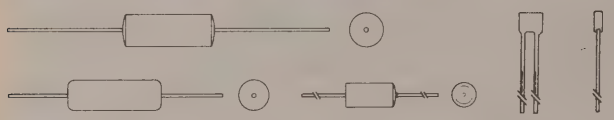
DC CAPACITORS

METALLIZED POLYESTER (Wrap and fill, molded, box)



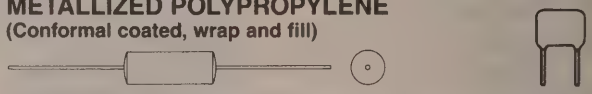
APPLICATIONS: Military, airborne, instruments, power supplies, auto-insertion, analog and digital circuitry, decoupling, high volume applications in consumer, automotive and industrial markets.

METALLIZED POLYCARBONATE
(Wrap and fill, molded, box, hermetically sealed)



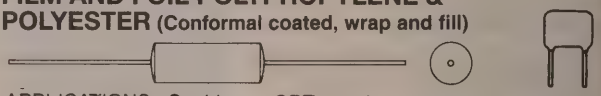
APPLICATIONS: Military and space, high volume applications in consumer, automotive and industrial markets.

METALLIZED POLYPROPYLENE
(Conformal coated, wrap and fill)



APPLICATIONS: Instrumentation, switching power supplies, AC/DC/RMS current applications.

FILM AND FOIL POLYPROPYLENE & POLYESTER (Conformal coated, wrap and fill)



APPLICATIONS: Snubbers, CRT monitors, power supplies, RF generators, test equipment, pulse forming, deflection.

ALSO FEATURING THE FOLLOWING FOR YOUR SPECIFIC APPLICATIONS REQUIRING:

X & Y FUNCTION: AC types for appliances and DC types for power supplies. UL, CSA, VDE, SEV & TUV approvals.

HERMETICALLY SEALED: Available in metallized dielectrics, metallized polyester, and film/foil for applications in instrumentation and high reliability.

SMT: Surface mount capacitors for hybrid and chip-on-board applications (in development; consult factory).

ASC's COMPETITIVE POLYESTER BOX CAPACITORS - TYPE X678

In our X678 series you will find direct replacements for the Mallory/Westlake 160/167 series and the Thomson MC series of metallized polyester box capacitors. These components are price competitive and are available from stock to eight weeks A.R.O. Call for information and samples today.

X678

- .300" & up lead space
- 100 to 630 Vdc
- Values up to 10 MFD

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ASC® CAPACITORS FILM CAPACITORS

TYPE X335 - SUPERIOR TO OTHER DIELECTRICS FOR SOME VERY POWERFUL REASONS
SWITCH-MODE POWER SUPPLY CAPACITORS

SUPERIOR TO OTHER DIELECTRICS FOR SOME VERY POWERFUL REASONS

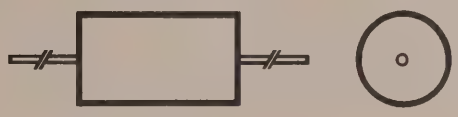
- Low Dielectric Absorbtion
- Long Term Stability
- Good Retrace
- High Insulation Resistance

ASC's X335 series (formerly TRW-35) is among the most recognized, and most respected, series of film capacitors designed specifically for the power supply industry. The metallized polypropylene capacitors are designed and manufactured to achieve the optimum characteristics for high current and low ESR applications.

The X335 and X335L series outperform electrolytic capacitors, as well as capacitors utilizing other film dielectrics. ASC capacitors are second to none. Let us prove it to you.

X335 "L"

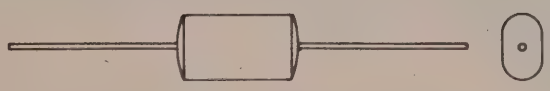
X335



TYPE X661 - METALLIZED POLYESTER CAPACITORS
SWITCH-MODE POWER SUPPLY CAPACITORS

- Designed for 20-60KHz Usage
- High Current—Up to 4 A rms
- Special High Current Termination
- Low ESR Values
- Capacitance Tolerances to ±5%

X661



100% tested for ESR

PERFORMANCE

The X661 is designed specifically for switching power supply applications where current and low ESR values are important. The metallized polyester X661 shows negligible shift in capacitance under long exposure to humidity, operating life and temperature cycling. Insulation resistance, dielectric absorption and dissipation factor properties are all superior to those of electrolytic capacitors presently used by switching power supply manufacturers.

These features, plus size and weight savings in SPS designs, make the X661 the logical capacitor for performance and design of switching power supplies.

Operating Temperature	-55° to +85°C at full rated voltage
Rated Voltage	250 and 400 Vdc
Dielectric Strength	200% of rated voltage for one minute
Capacitance Range	1.0 - 4.7 MFD
Standard Capacitance Tolerance	±5%, ±10% and ±20%

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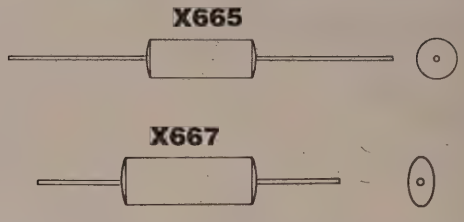
ASC® CAPACITORS FILM CAPACITORS

TYPE X665 - X667 - METALLIZED POLYESTER

NEW

- Miniature Size & Weight
- Cost Effective
- Distributor Item
- Self-Healing

Applications:
Used in circuits for coupling, bypass or line isolation applications requiring surge protection. Lightweight and small size make it ideally suited for small portable equipment applications.



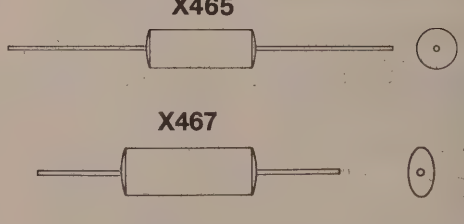
The X665-X667 Series features axial wrap & fill construction. Lead are solder coated on tinned solid wire.

Operating Temperature	
Rated Voltage	63, 100, 250 & 400 Vdc
Dielectric Strength	160% at rated voltage for one minute
Capacitance Range	.01-10.0 MFD
Standard Tolerances	5%, 10% & 20%

TYPE X465 - X467 METALLIZED POLYCARBONATE

NEW WHITE WRAPPER SERIES

- Miniaturized Sizes
- Cost Effective
- Stocked Locally



The X465 - X467 series features axial wrap and fill construction. Leads are solder coated or tinned solid wire.

DESIGN FEATURES
Non-inductive wound metallized polycarbonate.
Polyester tape wrap & epoxy filled case.
Capable of withstanding a five (5) pound pull force on lead axis.

APPLICATIONS
Military
Temperature Compensating Circuits
Precision Testing Equipment
Telecommunications

Operating Temperature	-55° to +125° C at full rated voltage
Rated Voltage	50, 100, 200 & 400 Vdc
Dielectric Strength	200% of rated voltage for one minute
Capacitance Range	.001-10 MFD
Standard Capacitance Tolerance	±1%(F), ±2%(G), ±5%(J), ±10% (K)

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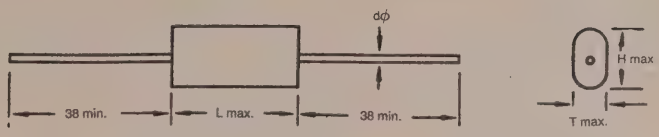
ASC® CAPACITORS FILM CAPACITORS

TYPE X637 - DESIGNED FOR 220-250 VAC APPLICATIONS

- Flame Retardant Encapsulation
- 400Vdc-500 Vdc Dielectric Strength
- High Durability
- Unimpregnated

X637



APPLICATIONS:

The X637 series of metallized polyester capacitors combine high capacitance and small size, making it ideal for use in motors, fans, appliances, pumps, business machines, electric tools and other general purpose AC applications. The proven durability and self-healing characteristics of the X637 make it an excellent alternative to other AC rated capacitors.

Custom Terminations: Special terminations such as stranded insulated leads or quick disconnects are available for the X640 on a customized basis. Consult the factory for details.

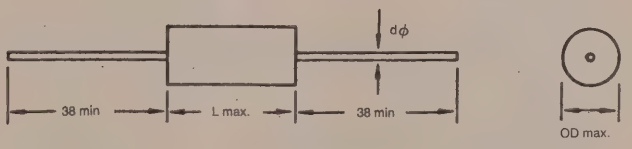
X637 Provides Corona-Free Performance

Operating Temperature	– 55° to + 85° at full rated voltage
Rated Voltage	220 Vac 50/60 Hz 250 Vac 50/60 Hz
Capacitance Range	.50 - 25.0 MFD
Standard Capacitance Tolerance	± 20%, ± 10%, ± 5%

TYPE X640 - DESIGNED FOR CORONA-FREE PERFORMANCE

- Flame Retardant Encapsulation
- 900Vdc-2100Vdc Dielectric Strength
- High Durability
- Unimpregnated and Self-Healing
- Metallized Polyester Dielectric

X640



Small Motor Applications:

The X640's impedance and physical characteristics make it a superior alternative to other passive or active devices for motor start, motor run or speed control applications with small motors. It eliminates the heat generation problems of resistance controls. It is an effective impedance device for various commercial and household electrical products; motors, fans and blowers; computer peripherals, such as terminals, printers and disc drives; and other small motor applications.

Custom Terminations: Special terminations such as stranded insulated leads or quick disconnects are available for the X640 on a customized basis. Consult the factory for details.

330-460VAC

Operating Temperature	– 55 to + 85° at full rated voltage
Rated Voltages	330, 370 and 460 Vac 50/60 Hz
Capacitance Range	.010 - 2.0 MFD
Standard Capacitance Tolerance	± 20%, ± 10%, ± 5%

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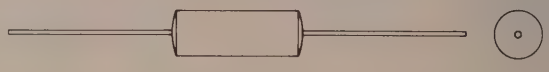
ASC® CAPACITORS FILM CAPACITORS

TYPE X675 - FOR HIGH VOLTAGE APPLICATIONS

- Small Size, Lightweight
- Self Healing
- Long Life
- Fully Rated to 65°C
- VDC to 16 KV
- Capacitance Tolerances to ±5%

X675



PERFORMANCE

The X675 capacitor is a high voltage capacitor designed to meet the needs of voltage multipliers and high voltage filters required in today's high density, high voltage power supplies. Uses are found in CRT displays of all types, copiers, laboratory instruments and power supplies.

In keeping with the state of the art in construction of silicon high voltage rectifiers, the physical design of the X675 lends itself to this demanding application. The dry winding and skin tight polyester case offer considerable size and weight reductions from former high voltage designs.

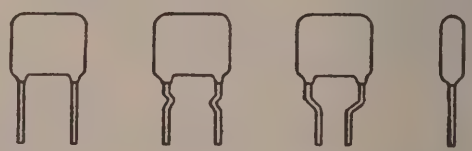
A long term matrix testing program shows that when applications are within the X675 ratings, a high standard of reliability is maintained.

Operating Temperature	-55° to +65°C at full rated voltage, to 85°C with 25% derating
Rated Voltage	2000 Vdc to 16000 Vdc
Capacitance Range	.001-.68 MFD
Standard Capacitance Tolerance	±5%, ±10% and ±20%

TYPE 315 - POLYPROPYLENE & FOIL CAPACITORS TO 1600 VDC

- Polypropylene film and aluminum foil construction
- Low DF losses
- Stable characteristics
- Ideal for high frequency and pulse applications
- Low ESR

315



Straight STYLE A | Hairpin STYLE B | Hockey STYLE C

APPLICATIONS:

Instrumentation: Excellent stability plus outstanding electrical properties make the 315 ideal for use in timing and integrating circuitry.

Close Tolerance: Where close tolerance capacitors are required, this series is ideal because of inherent stability with service conditions and life.

Pulse and High Frequency: Low DF and ESR make the 315 ideal for these applications.

Operating Temperature	– 40° to + 85°C.
Rated Voltage	1000, 1250, 1600 VDC
Capacitance Range	.001-.47 uF
Standard Capacitance Tolerance	± 2%, ± 5%, ± 10%, and ± 20%

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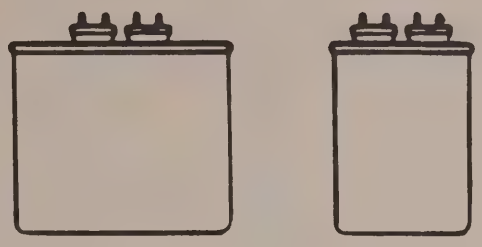
ASC® CAPACITORS FILM CAPACITORS

TYPES X386, X387, X388, and X389 - METALLIZED POLYPROPYLENE OIL FILLED/METAL ENCASED

- 50% Size and Weight Reduction over Conventional Designs
- Extremely Low Losses and Heat Dissipation
- Non-PCB SPEARINOL III™ Oil Filled
- Self-Healing Ability for Enhanced Reliability and Life
- Round Aluminum or Oval Terne-Plated Steel Cases
- −40°C to +70°C Operating Temperature Range (to +90°C for types X388-X389 only)
- UL Approved Internal Protective Device
- Mounting Brackets and Terminal Caps Available
- 2, 3, or 4 Tine Terminal Configurations
- Painted or Unpainted Cases
- Exceeds EIA 456 Standards
- 240 VAC to 440 VAC Ratings
- Types X386/X387: CSA approved File No. LR68147 and LR68148. Types X388/X389: CSA pending

ROUND STYLE OVAL STYLE



INTERNAL PROTECTIVE DEVICE:
Type X386/7 capacitors have an internal protective device designed to prevent case rupturing. This unique patented device is recognized by Underwriter's Laboratories under file number E83671. A minimum of 1/2″ additional space is required above the terminals for proper operation of this protector.

TYPES X345, X347, X349, X647 & CME-D—CAPACITORS FOR MOTOR RUN APPLICATIONS

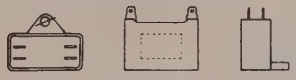
- Self-Healing Dielectric
- Plastic Case, Flame Retardant to UL 94V-O
- Mounting Brackets
- Dry Construction
- X345 and X349 UL Recognized File No. E83671 to 10,000 Amp Fault Current
- CME-D approved to VDE 0560-8

APPLICATIONS:

Ideal for Use in Motors, Fans, Appliances, Pumps, Business Machines, & Electric Tools Requiring High Capacitance & Small Size.

AC CAPACITORS

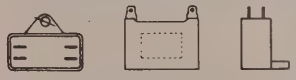
METALLIZED POLYESTER (Dry type)



VDE approved CME-D
UL810 listed styles available

APPLICATIONS: Motor run, fans/appliances/pumps/business machines, electric tools.

METALLIZED POLYPROPYLENE (Dry type)



UL810 listed styles available

APPLICATIONS: Motor run, fans/appliances, electric tools, lighting ballasts.

Rated Voltage	200-500 VAC
Capacitance Range	Up to 25 MFD in lower voltages
Terminals or stranded wire leads available.	
Standard Tolerances	±5%, ±10%, +10%/−5%

ASC® CAPACITORS

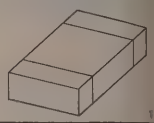
ASC ▪ 301 WEST "O" STREET ▪ OGALLALA ▪ NE 69153 ▪ PHONE (308) 284-3611 ▪ FAX (308) 284-8324

AVX CORPORATION
A KYOCERA GROUP COMPANY

Part Numbering System:

AVX Chip MLC: Example: 08055A101JATMA

0805	5	A	101	J	A	T	M	A
Chip Size (L x W) 0805 etc.	**Voltage** 4 = 16V 3 = 25V 5 = 50V 1 = 100V	**Dielectric** A = NPO C = X7R E = Z5U G = 45V	**Capacitance Code** (2 significant digits + no. of zeros)	**Capacitance Tolerance** J = ±5% K = ±10% M = ±20% Z = $^{+80}/_{-20}$%	**Failure Rate** A = Std.	**Terminations** T = Plated Ni/ Solder Plated	**Packaging**	**Special Code** A = STD



MLC Chip Capacitor (dimensions in inches)

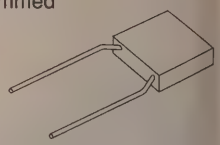
Size		0603	0805	1206	1210	1812
Length		0.0 63 ±0.006	0.0 79 ±0.008	0.120 ±0.008	0.126 ±0.008	0.177 ±0.012
Width		0.0 32 ±0.006	0.0 49 ±0.008	0.063 ±0.008	0.098 ±0.008	0.126 ±0.008
Thickness		0.0 40	0.0 50	0.050	0.060	0.060
Terminal		0.0 20 ±0.010	0.0 20 ±0.010	0.025 ±0.010	0.025 ±0.010	0.025 ±0.010
Capacitance Range pf or mfd if 10,000 pf or greater						
NPO	100V	0.5 - 220pF	0.5 - 470pF	0.5 - 1800pF	100 - 2700pF	100 - 4700pF
	50V	0.5 - 270pF	0.5 - 1000pF	0.5 - 3300pF	100 - 4700pF	100 - 10,000pF
X7R	100V	100 - 3300pF	330 - 12,000pF	0.001 - 0.039µF	0.001 - 0.1µF	0.001 - 0.15µF
	50V	100 - 10,000pF	330 - 47,000pF	0.001 - 0.15µF	0.001- 0.22µF	0.001 - 1µF
	25V	100 - 15,000pF	330 - 100,000pF	0.001 - 0.22µF	0.001 - 0.47µF	0.001 - 1µF
Z5U	50V	0.0 1 - 0.022µF	0.0 1 - 0.1µF	0.01 - 0.27µF	0.01 - 0.47µF	0.01 - 1µF
	25V	0.0 1 - 0.068µF	0.0 1 - 0.12µF	0.01 - 0.33µF	0.01 - 0.68µF	0.01 - 1µF
Y5V	50V	0.0 1 - 0.033µF	0.0 1 - 0.1µF	0.01 - 0.33µF	0.1 - 0.47µF	0.15 - 1µF
	25V	0.0 1 - 0.1µF	0.0 1- 0.27µF	0.01 - 1µF	0.1 - 1.5µF	0.15 - 1.2µF
	16V	0.0 1 - 0.1µF	0.0 1 - 0.47µF	0.01 - 3.3µF	0.1 - 4.7µF	0.15 - 1.2µF

NOTE: For 0504, 1005, 0907, 1505, 1808, 2321, 2224 contact factory.

Part Numbering System:

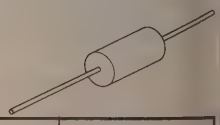
Leaded MLCs: Example: MR055A561FAA

MRO5	5	A	561	F	A	A
AVX Style SR.. = Dipped Radials MR.. = Molded Radials MA.. = Molded Axials MD.. = 2–pin Dips	**Voltage** 5 = 50V 1 = 100V 2 = 200V	**Temperature Coefficient** A = NPO C = X7R E = Z5U	**Capacitance Code** (2 significant digits + no. of zeros)	**Capacitance Tolerance** C = ±25pf D = ±5pf E = ±.5% F = ±1% G = ±2%	**Failure Rate** A = Std.	**Leads** A = Standard T = Trimmed



Molded Radial Leaded Capacitors MR Series (dimensions in inches)

AVX		MR04	MR05	MR06	MR07	MR08
Length		0.190 ± 0.010	0.190 ± 0.010	0.290 ± 0.010	0.490 ± 0.010	0.490 ± 0.010
Width		0.190 ± 0.010	0.190 ± 0.010	0.290 ± 0.010	0.490 ± 0.010	0.490 ± 0.010
Thickness		0.090 ± 0.010	0.090 ± 0.010	0.090 ± 0.010	0.140 ± 0.010	0.240 ± 0.010
Lead Spacing		0.100 ± 0.010	0.200 ± 0.010	0.200 ± 0.010	0.400 ± 0.010	0.400 ± 0.010
Lead Diameter		0.025 ± 0.002	0.025 ± 0.002	0.025 ± 0.002	0.025 ± 0.002	0.025 ± 0.002
Tolerances ± 0.010 in. Lead Diameter ± 0.002 in. Capacitance Range pf or mfd if 10,000pf or greater						
NPO	200	1 - 1000	1 - 1200	1500 - 3900	2200 - 0.015	3900 - 0.027
	100	1 - 4700	1 - 4700	5600 - 0.015	2200 - 0.068	3900 - 0.12
	150	1 - 8200	1 - 8200	0.010 - 0.18	2200 - 0.10	3900 - 0.27
X7R	200	100 - 0.015	100 - 0.015	0.018 - 0.039	5600 - 0.18	0.01 - 0.33
	100	100 - 0.056	100 - 0.056	0.068 - 0.15	5600 - 0.47	0.01 - 4.7
	50	100 - 0.12	100 - 0.12	0.15 - 1.0	5600 - 3.3	0.01 - 5.6
Z5U	100	0.010 - 0.22	0.10 - 0.22	0.27 - 0.68	0.1 - 2.7	0.18 - 4.7
	50	0.010 - 0.39	0.010 - 0.39	0.47 - 1.0	0.1 - 4.7	0.18 - 10.0



Molded Axial Leaded MLC MA Series (dimensions in inches)

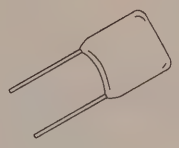
AVX		MA10	MA20	MA30	MA40	MA50	MA60
Length		0.160±0.010	0.250±0.010	0.240±0.010	0.390±0.010	0.500±0.020	0.690±0.020
Diameter		0.090±0.010	0.090±0.010	0.130±0.010	0.140±0.010	0.250±0.015	0.350±0.015
Lead Diameter		0.019±0.002	0.019±0.002	0.019±0.002	0.025±0.002	0.025±0.002	0.025±0.002
Capacitance Range pf or mfd if 10,000pf or greater							
		MA10	MA20	MA30	MA40	MA50	MA60
NPO	200	1.0-180	82-330	120-1200	180-1800	1000-8200	3300-0.033
	100	1.0-820	82-1500	120-4700	180-6800	1000-0.033	3300-0.10
	50	1.0-1000	82-1800	120-5600	180-0.012	1000-0.056	3300-0.15

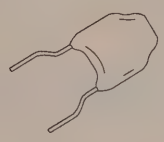
Part Numbering System:
Leaded MLCs: Example: SR205A561FAA

AVX CORPORATION
A KYOCERA GROUP COMPANY

SR20	5	A	561	F	A	A
AVX Style	**Voltage**	**Temperature Coefficient**	**Capacitance Code**	**Capacitance Tolerance**	**Failure Rate**	**Leads**
SR.. = Dipped Radials	5 = 50V	A = NPO	561 = 560pf	C = ±.25pf	A = Std.	A = Standard
MR.. = Molded Radials	1 = 100V	C = X7R	56 = Sig. fig. of cap.	D = ±.5pf		T = Trimmed
MA.. = Molded Axials	2 = 200V	E = Z5U	1 = Additional number of zeros	E = ±.5%		
MD.. = 2–pin Dips				F = ±1%		
				G = ±2%		

Conformally Coated Radial Leaded MLC
SkyCap SR Series





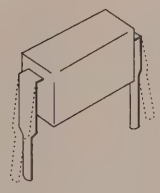
Size and Capacitance Specifications (dimensions in inches)

AVX	SR15	SR20	SR21	SR22	SR27	SR30	SR40	SR50
Length	0.150	0.200	0.200	0.200	0.260	0.300	0.400	0.500
Width	0.150	0.200	0.200	0.200	0.250	0.300	0.400	0.500
Thickness	0.100	0.125	0.125	0.125	0.160	0.150	0.150	0.200
Lead Spacing	0.100	0.100	0.200	0.250	0.300	0.200	0.200	0.400
Lead Diameter	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.025

Capacitance Range pf or mfd if 10,000pf or greater

EIA/TC	WVDC	SR15	SR20	SR21	SR22	SR27	SR30	SR40	SR50
NPO	100	1.0 - 680	1000 - 6800	1000 - 6800	1000 - 6800	1000 - 6800	8200 - 0.022	0.033 - 0.047	0.01 - 0.068
	50	1.0 - 1000	1500 - 8200	1500 - 8200	1500 - 8200	1500 - 8200	0.01 - 0.033	0.047 - 0.068	0.01 - 0.1
X7R	100	470 - 0.01	0.012 - 8200	0.012 - 8200	0.012 - 8200	0.012 - 8200	0.15 - 0.47	0.82 - 1.0	0.33 - 2.2
	50	470 - 0.022	0.033 - 0.22	0.033 - 0.22	0.033 - 0.22	0.033 - 0.22	0.33 - 1.0	1.5 - 2.7	1.0 - 4.7
Z5U	100	0.01	0.047 - 0.22	0.047 - 0.22	0.047 - 0.22	0.047 - 0.22	0.33 - 1.0	1.5 - 2.2	1.0 - 2.7
	50	0.01 - 0.068	0.1 - 0.47	0.1 - 0.47	0.1 - 0.47	0.1 - 0.47	0.82 - 3.5	4.7	1.0 - 4.7

Molded Dual–In–Line MLC
DipGuard MD Series



Size Specifications

AVX	MD01	MD02	MD03
Length	0.260	0.260	0.260
Height	0.135 max	0.165 max	0.290 max
Width	0.165 max	0.195 max	0.320 max
Thickness	0.098 max	0.098 max	0.098 max

Capacitance Range pf or mfd if 10,000pf or greater

EIA/TC	WVDC	MD01	MD02	MD03
NPO	100	10 - 150	—	—
	50	220 - 3300	4700 - 0.01	—
X7R	100	220 - 0.01	—	—
	50	0.15 - 0.1	0.15 - 0.22	0.33 - 1.0
Z5U	100	—	—	—
	50	0.01 - 0.33	0.47	0.68 - 1.0

Conformally Coated
Axial Leaded MLC
SpinGuard SA Series

Size Specifications

AVX	SA10	SA20	SA30	SA40
Length	0.170	0.260	0.290	0.400
Diameter	0.100	0.100	0.150	0.150
Lead Diameter	0.019	0.019	0.019	0.019

Capacitance Range pf or mfd if 10,000pf or greater

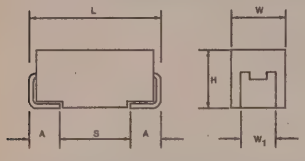
	WVDC	SA10	SA11	SA20	SA30	SA40
NPO	200	1.0 - 120	—	—	—	—
	100	150-820	1000-2700	1000-1800	1800-3900	4700-8200
	50	1000-1200	1800-3900	1800-3300	4700-5600	8200-12,000
X7R	200	220-0.01	—	—	—	—
	100	560-0.015	0.018-0.039	0.018-0.033	0.022-0.1	0.12-0.18
	50	0.01-0.047	0.047-0.1	0.027-0.1	0.056-0.33	0.33-0.47
Z5U	100	0.01-0.047	0.1-0.15	0.033-0.047	0.068-0.33	0.1-0.47
	50	0.01-0.22	0.22-0.47	0.47-0.22	0.15-1.0	—

Part Numbering System:

AVX CORPORATION
A KYOCERA GROUP COMPANY

TAJ	B	335	M	016	R
Type TAJ – Solid Ta Chip TPS – Low ESR Ta Chip TAZ – Molded Ta Chip	**Case Size**	**Capacitance Code** 1st two digits represent sig. figures. 3rd digit represents multiplier (no. of zeros)	**Capacitance Tolerance** M = ±20% K = ±10% J = ± 5%	**Rated DC Voltage Code**	**Tape & Reel Suffix** R = 7" S = 13"

Solid Tantalum Chip Capacitors TAJ Series



Case Dimensions inches (mm)

Code	EIA Code	L±0.008(0.2)	W+0.008(0.2) -0.004(0.1)	H+0.008(0.2) -0.004(0.1)	W1±0.008(0.2)	A+0.012(0.3) -0.008(0.2)	S min.
A	3216	0.126 (3.2)	0.063 (1.6)	0.063 (1.6)	0.047 (1.2)	0.031 (0.8)	0.043 (1.1)
B	3528	0.138 (3.5)	0.110 (2.8)	0.075 (1.9)	0.087 (2.2)	0.031 (0.8)	0.055 (1.4)
C	6032	0.236 (6.0)	0.126 (3.2)	0.102 (2.6)	0.087 (2.2)	0.051 (1.3)	0.114 (2.9)
D	7343	0.287 (7.3)	0.169 (4.3)	0.114 (2.9)	0.094 (2.4)	0.051 (1.2)	0.173 (4.4)
E	7343H	0.287 (7.3)	0.169 (4.3)	0.162 (4.1)	0.094 (2.4)	0.051 (1.3)	0.173 (4.4)

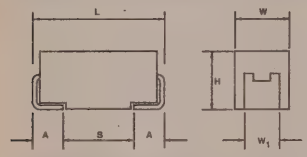
W_1 dimension applies to the termination width for A dimensional area only.

Capacitance and Voltage Range
(letter denotes case code)

Capacitance µF	Code	Rated Voltage DC (Vr) at 85°C 4V	6.3V	10V	16V	20V	25V	35V	50V
0.1	104							A	A
0.15	154							A	B
0.22	224							A	B
0.33	334							A	B
0.47	474						A	B	C
0.68	684					A		B	C
1.0	105				A	A		B	C
1.5	155			A	A		B	C	D
2.2	225		A	A	B	B		C	D
3.3	335	A	A		B	B	C	C	D
4.7	475	A		B	B	C	C	D	D
6.8	685		B	B	C	C	D	D	
10	106	B	B		C		D	D	
15	156	B	C	C		D	D	D	
22	226	C	C	C	D	D	D	E	
33	336	C	C	D	D	D	E		
47	476		D	D	D	E			
68	686	D	D	D	E				
100	107	D	D	D	E				
150	157				E				
220	227		E	E					

Contact AVX for extended range values not listed

Low Profile Solid Ta Chip Capacitors TAJ Series



Case Dimensions inches (mm)

Code	EIA Code	L±0.008 (0.2)	W+0.008 (0.2) -0.004 (0.1)	H Max.	W1±0.004 (0.1)	A+0.012 (0.3) -0.004 (0.1)	S Min.
0805 Equivalent							
R	2012	0.08 (2.05)	0.05 (1.3)	0.047 (1.2)	0.047 (1.2)	0.020 (0.5)	0.033 (0.85)
Low Profile versions of A and B Case							
S	3216L	0.12 (3.2)	0.06 (1.6)	0.047 (1.2)	0.047 (1.2)	0.031 (0.8)	0.043 (1.1)
T	3528L	0.14 (3.5)	0.11 (2.8)	0.047 (1.2)	0.087 (2.2)	0.031 (0.8)	0.055 (1.4)

W_1 dimension applies to the termination width for A dimensional area only.
Pad Stand–off is 0.1 ±0.1

Capacitance and Voltage Range
(letter denotes case code)

Capacitance µF	Code	Rated Voltage DC (Vr) at 85°C 2V	4V	6.3V	10V	16V	20V
0.1	104						R/S
0.15	154						R/S
0.22	224						R/S
0.33	334						R/S
0.47	474						R/S
0.68	684					R/S	S/T
1.0	105				R/S	R/S	S/T
1.5	155			R/S	S	S	T
2.2	225		R/S	R/S	S	T	T
3.3	335		R/S	S	T	T	
4.7	475	R	S	T	T		
6.8	685	R	T	T			
10	106		T				

Molded Ta Chip Capacitors TAZ Series

Case Dimensions inches (mm)

Case Code	Length L±0.015(.38)	Width W±0.015(.38)	Height H±0.015(.38)	Term. Width W1±0.005(.13)	Term. Length A±0.005(.13)	S Min.
"Regular"						
A	0.100(2.54)	0.050(1.27)	0.050(1.27)	0.050(1.27)	0.030(.76)	0.015(.38)
B	0.150(3.81)	0.050(1.27)	0.050(1.27)	0.050(1.27)	0.030(.76)	0.065(1.65)
C	0.200(5.08)	0.050(1.27)	0.050(1.27)	0.050(1.27)	0.030(.76)	0.115(2.92)
D	0.150(3.81)	0.100(2.54)	0.050(1.27)	0.095(2.41)	0.030(.76)	0.065(1.65)
E	0.200(5.08)	0.100(2.54)	0.050(1.27)	0.095(2.41)	0.030(.76)	0.115(2.92)
F	0.220(5.59)	0.135(3.43)	0.070(1.78)	0.130(3.30)	0.030(.76)	0.135(3.43)
G	0.265(6.73)	0.110(2.79)	0.110(2.79)	0.105(2.67)	0.050(1.27)	0.140(3.56)
H	0.285(7.24)	0.150(3.81)	0.110(2.79)	0.145(3.68)	0.050(1.27)	0.160(4.06)
"Special"						
R	0.087 Max (2.2)	0.057 Max (1.5)	0.047 Max (1.2)	0.047(1.2)	0.016(0.4)	0.043(1.1)
X	0.285 Max (7.2)	0.220 Max (6.1)	0.115 Max (2.8)	0.120(3.05)	0.050(1.27)	N/A

NOTE: For solder coated terminations add 0.015 (0.38) max. to length and height dimensions.

Capacitance and Voltage Range
(letter denotes case code)

Capacitance µF	Code	Rated Voltage DC (Vr) at 85°C 4V	6V	10V	15V	20V	25V	35V	50V
0.10	104								A
0.15	154								A
0.22	224							A	B
0.33	334						A		B
0.47	474					A		B	C
0.68	684				A	B	B	C	D
1.00	105			A		B	C	D	E
1.50	155		A		B	C	D	E	F
2.20	225	A		B	C	D	E		F
3.30	335		B	C	D	E		F	G
4.70	475	B	C	D	E		F	G	H
6.80	685	C	D	E		F	G	H	
10	106	D	E		F		G		
15	156	E		F		G	H		
22	226		F		G	H			
33	336	F		G	H				
47	476		G	H					
68	686	G	H						
100	107	H							

NOTE: TAZ Standard Range ratings are also available as CWR09 Military parts.

Low ESR Power Supply Ta Chip Capacitors TPS Series

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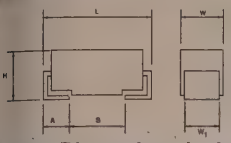


Case Dimensions inches (mm)

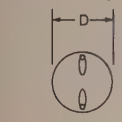
Inches							
Code	EIA Code	L ±0.008	W +0.008 -0.004	H +0.008 -0.004	W1 ±0.008	A +0.012 -0.008	S Min.
D	7343	0.287	0.169	0.114	0.094	0.051	0.173
E	7343A	0.287	0.169	0.162	0.094	0.051	0.173
Millimeters							
Code	EIA Code	L ±0.2	W +0.2 -0.1	H +0.2 -0.1	W1 ±0.2	A +0.3 -0.2	S Min.
D	7343	7.3	4.3	2.9	2.4	1.3	4.4
E	7343H	7.3	4.3	4.1	2.4	1.3	4.4

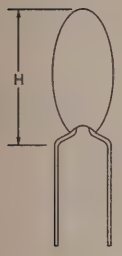
W_1 dimension applies to the termination width for A dimensional area only.
Pad Stand–off is 0.1 ±0.1

Capacitance and Voltage Range (letter denotes case code)

Capacitance		Rated Voltage DC (Vr) at 85°C					
µF	Code	6.3V	10V	16V	20V	25V	35V
4.7							
6.8							
10							D
15							
22						D	E
33					D	E	
47				D	E		
68							
100			D	E			
150							
220			E				
330		E					

Solid Ta Resin Dipped Capacitors TAP Series





Available in .100" and .200" leadspace.
Taped or Bulk.

*H1 refers to H dimension on S wire form.

Part Numbering System:

TAP	475	M	035	SCS
Type	**Capacitance Code:**	**Capacitance Tol.**	**Rated DC Voltage Code**	**Wire Form and Packaging Suffix**
TAP	1st two digits represent	J = ±5%		R = Radial
TAL	significant figure. 3rd digit	K = ±10%		A = Axial
TAV	represents multiplier (no. of zeros)	M = ±20%		

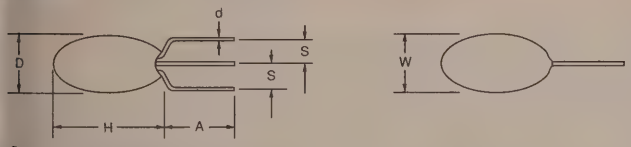
Case Dimensions inches (mm)

Case	H	*H1	D
A	0.33(8.5)	0.28(7.0)	0.18(4.5)
B	0.35(9.0)	0.30(7.5)	0.18(4.5)
C	0.39(10.0)	0.33(8.5)	0.20(5.0)
D	0.41(10.5)	0.35(9.0)	0.20(5.0)
E	0.41(10.5)	0.35(9.0)	0.22(5.5)
F	0.45(11.5)	0.39(10.0)	0.24(6.0)
G	0.45(11.5)	0.39(10.0)	0.26(6.5)
H	0.47(12.0)	0.41(10.5)	0.28(7.0)
J	0.51(13.0)		0.31(8.0)
K	0.55(14.0)		0.33(8.5)
L	0.55(14.0)		0.35(9.0)
M	0.57(14.5)		0.35(9.0)
N	0.63(16.0)		0.35(9.0)
P	0.67(17.0)		0.39(10.0)
R	0.73(18.5)		0.39(10.0)

Capacitance and Voltage Range** (letter denotes case code)

Capacitance	Rated Voltage DC (VR)						
µF	6.3V	10V	16V	20V	25V	35V	50V
0.1						A	A
0.15						A	A
0.22						A	A
0.33						A	A
0.47						A	A
0.68						A	B
1.0				A	A	A	C
1.5			A	A	A	A	D
2.2		A	A	A	A	B	E
3.3	A	A	A	B	B	C	F
4.7	A	A	B	C	C	E	G
6.8	A	B	C	D	D	F	H
10	B	C	D	E	E	F	J
15	C	D	E	F	F	H	K
22	D	E	F	H	H	K	L
33	E	F	F	J	J	M	
47	F	G	J	K	M	N	
68	G	H	L	N	N		
100	H	K	N	N			
150	K	N	N				
220	M	P	R				
330	P	R					

Three–Leaded Solid Ta Resin Dipped Capacitors TAL Series



Case Dimensions inches (mm)

Code	H Max.	W Max.	*A ±0.020 (0.5)	*S1/S2 ±0.010 (0.25)
A	0.354 (9.0)	0.197(5.0)	0.120 (3.0)	0.104 (2.65)
B	0.362 (9.2)	0.236(6.0)	0.120 (3.0)	0.104 (2.65)
C	0.425 (10.8)	0.256(6.5)	0.120 (3.0)	0.104 (2.65)
D	0.461 (11.7)	0.295(7.5)	0.120 (3.0)	0.104 (2.65)

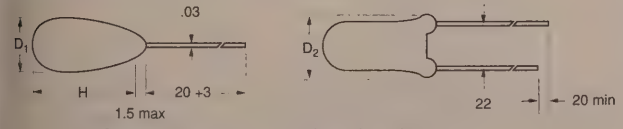
*Refers to loose products. D = 0.300 (7.6) max. d = 0.020 (0.5) ±0.0002 (0.005)

Capacitance and Voltage Range** (letter denotes case code)

Capacitance	Rated Voltage DC (Vr)						
µF	6.3V	10V	16V	20V	25V	35V	50V
0.1						A	A
0.15						A	A
0.22						A	A
0.33						A	A
0.47						A	A
0.68						A	B
1.0					A	A	B
1.5				A	A	A	B
2.2			A	A	A	B	C
3.3		A	A	B	B	B	C
4.7	A	A	B	B	B	C	D
6.8	A	B	B	C	C	D	D
10	B	B	C	C	C	D	
15	B	C	C	D	D		
22	C	C	D	D	D		
33	C	D	D	D			
47	D	D	D				
68	D	D					
100	D						
150	D						

**Values outside this std. range may be available on request without appropriate release or qualification. AVX reserves the right to supply capacitors to a tighter spec. than that ordered.

Subminiature Solid Ta Resin Dipped Capacitors TAV Series



Case Dimensions inches (mm)

Case Size	D1 Max.	D2 Max.	H Max.
A	0.100 (2.5)	0.126 (3.2)	0.180 (4.5)
B	0.110 (2.8)	0.126 (3.2)	0.220 (5.5)

NOTE: The tabulated dimensions are for non-insulated capacitors. Insulated capacitors are standard. Dimension L_1 will increase by 0.8mm max, and dimension D by 0.2mm max.

Capacitance and Voltage Range (letter denotes case code)

Capacitance	Cap	Rated Voltage DC					
µF	Code	4V	6.3V	10V	16V	25V	35V
0.010	103						A
0.015	153						A
0.022	223						A
0.033	333						A
0.047	473						A
0.068	683						A
0.10	104						A
0.15	154						A
0.22	224						A
0.33	334						A
0.47	474					A	B
0.68	684					A	B
1.0	105				A	B	
1.5	155		A		B		
2.2	225	A		B			
3.3	335	A	B				
4.7	475	B					
6.8	685	B					

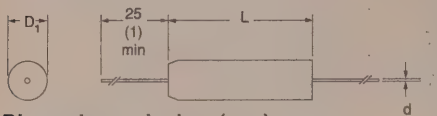
Tantalum Capacitors (Cont.)

AVX CORPORATION
A KYOCERA GROUP COMPANY

Part Numbering System: TAR B 335 M 016 A

Type	Case Code	Capacitance Code:	Capacitance Tol.	Rated DC Voltage Code	Lead Configuration
TAR		1st two digits represent	J = ±5%		R = Radial
TMH		significant fig. 3rd.digit	K = ±10%		A = Axial
TMN		represents multiplier	M = ±20%		
TMM		(number of zeros)			

Solid Ta Molded Axial Capacitors TAR Series



Dimensions – inches (mm)

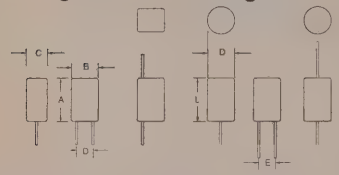
Case Size	L ±0.01 (0.25)	D1 ±0.01 (0.25)	d ±0.02 (0.05)	Typical Weight g
Q	0.25 (6.35)	0.085 (2.16)	0.02 (0.5)	0.20
R	0.29 (7.4)	0.10 (2.5)	0.02 (0.5)	0.25
S	0.34 (8.6)	0.17 (4.3)	0.02 (0.5)	0.52
W	0.41 (10.4)	0.17 (4.3)	0.02 (0.5)	0.53

Capacitance µF	Rated Voltage DC (Vr) 4V	6.3V	10V	15V	20V	25V	35V	50V
0.1							Q	Q
0.15							Q	Q
0.22							Q	Q
0.33							Q	R
0.47						Q	Q	R
0.68						Q	R	R
1.0					Q	Q	R	R
1.5				Q	Q	R	R	S
2.2			Q	Q	R	R	S	S
3.3		Q	Q	R	R	R	S	W
4.7	Q	Q	R	R	R	S	S	W
6.8	Q	R	R	R	S	S	W	
10	R	R	R	S	S	S	W	
15	R	R	S	S	W	W		
22	R	S	S	W	W			
33	S	S	W	W				
47	S	W	W					
68	W	W						

Values outside this std. range may be available on request without appropriate release or qualification. AVX reserves the right to supply capacitors to a tighter spec.than that ordered.

Minitan® Capacitors TMH Series

Figure 1 Figure 2



Leads - Leads are solder coated pure nickel wire suitable for soldering or welding. Tested in accordance with MIL-STD-202 Method 211. 0.010 diameter leads withstand a 1-lb. pull and 0.007 diameter leads a 8-oz. pull. All lead diameters withstand 5 rotation twist.

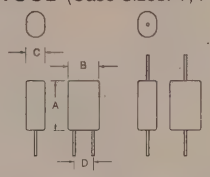
Case Size	Applicable Drawing	A Max	B Max	C Max	E
X	Figure 1	0.075 (1.9)	0.050 (1.3)	0.040 (1.1)	0.030 ±0 015 (0.8 ±0.1)
W	Figure 1	0.100 (2.5)	0.050 (1.3)	0.040 (1.1)	0.030 ±0.015 (0.8 ±0.1)
U	Figure 1	0.125 (3.2)	0.070 (1.8)	0.040 (1.1)	0.050 ±0.015 (1.3 ±0.4)

Case Size	Applicable Drawing	A Max	D Max	E
Q	Figure 2	0.110 (2.8)	0.067 (1.7)	0.050 ±0.015 (1.3 ±0.4)
Y	Figure 2	0.125 (3.2)	0.067 (1.7)	0.050 ±0.015 (1.3 ±0.4)
Z	Figure 2	0.145 (3.7)	0.067 (1.7)	0.050 ±0.015 (1.3 ±0.4)
P	Figure 2	0.160 (4.1)	0.070 (1.8)	0.050 ±0.015 (1.3 ±0.4)
K	Figure 2	0.160 (4.1)	0.077 (2.0)	0.050 ±0.015 (1.3 ±0.4)
B	Figure 2	0.190 (4.8)	0.077 (2.0)	0.050 ±0.015 (1.3 ±0.4)
V	Figure 2	0.200 (5.1)	0.080 (2.1)	0.050 ±0.015 (1.3 ±0.4)
A	Figure 2	0.215 (5.5)	0.098 (2.5)	0.070 ±0.020 (1.8 ±0.5)
G	Figure 2	0.250 (6.3)	0.150 (3.8)	0.120 ±0.025 (3.0 ±0.6)

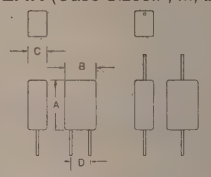
Capacitance Range:	0.001µF to 22µF
Capacitance Tolerance:	+40/-20%, ±20%; ±10%; ±5%
Rated Voltage DC (Vr) ≤ +85°C:	2 3 4 6 10 15 20
Surge Voltage (Vs) ≤ +85°C:	2.6 4 5.2 8 13 19 26
Temperature Range:	-55°C to +85°C
Reverse Voltage Max:	0.15 Vr @ 20°C 0.15 Vr @ 55°C 0.05 Vr @ 85°C (or 1 volt, whichever is less)
Life Test:	After 2000 hrs. @ 85°C with Vr applied. ΔCAP = ± 15% max. ΔDF, DCL = initial limit

Minitan® Capacitors TMN Series

CORDWOOD (Case Sizes: Y, P, B, A, G)



MODULAR (Case Sizes:F, M, L, S)



Case Dimensions – inches (mm)

Case Size	A Max (Axial)	A Max (Radial)	B Max	C Max	D Max
Y	.175 (4.45)	.135 (3.43)	.120 (3.05)	.070 (1.78)	.100 ±.020 (2.54 ±.51)
P	.210 (5.33)	.160 (4.06)	.120 (3.05)	.070 (1.78)	.100 ±.020 (2.54 ±.51)
B	.240 (6.10)	.200 (5.08)	.140 (3.56)	.080 (2.03)	.100 ±.020 (2.54 ±.51)
A	.275 (6.99)	.235 (5.97)	.190 (4.83)	.105 (2.67)	.125 ±.020 (3.18 ±.51)
G	.310 (7.87)	.270 (6.86)	.290 (7.37)	.155 (3.94)	.200 ±.025 (5.08 ±.64)
F	.220 (5.59)	.180 (4.57)	.125 (3.18)	.125 (3.18)	.100 ±.020 (2.54 ±.51)
M	.280 (7.11)	.240 (6.10)	.140 (3.56)	.180 (4.57)	.100 ±.020 (2.54 ±.51)
L	.370 (9.40)	.315 (8.00)	.180 (4.57)	.220 (5.59)	.150 ±.025 (3.81 ±.64)
S	.390 (9.91)	.335 (8.51)	.230 (5.84)	.230 (5.84)	.200 ±.025 (5.08 ±.64)

Leads - Leads are solder coated pure nickel wire suitable for soldering or welding. Tested in accordance with Mil-C-49137 .010 dia. leads withstand a 1-lb. pull and .016 diameter leads a 3-lb. pull. All lead diameters withstand 5 rotation twist.

Leads - G, L and S leads are 26 AWG, 0.016 ±.002 (.41 ±.051) dia. All others are 30 AWG, .010 ±.002 (.25 ±.051) dia. All leads are1.625 ±.125 (41.3 ±3.18) long.

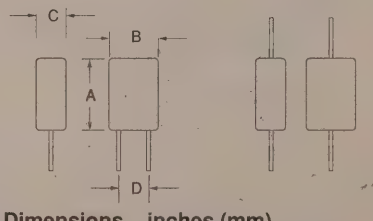
Capacitance Range:	0.001µF to 33µF
Capacitance Tol.:	±10%; ±20%; ±5% in above 0.01µF
Rated DC Voltage (Vr) ≤ +85°C:	2 3 4 6 10 15 20 25 35 50
Category Voltage (Vc) ≤ +125°C:	1.3 2 2.6 4 6.7 10 13 16 23 33
Surge Voltage (Vs) ≤ +85°C:	2.6 4 5.2 8 13 19 26 32 46 65
≤ +125°C:	1.7 2.6 3.4 5.2 8.7 13 16 20 28 40
Temperature Range:	-55°C to +125°C
Life Test:	After 2000 hrs. @ 85°C with Vr applied ΔCAP=±10% Max ΔDF, DCL approx. = initial limits

Minitan® Capacitors TMM Series

Leads - Leads are solder coated pure nickel wire suitable for soldering or welding. Tested in accordance with Mil-C-49137. 0.010 diameter leads withstand a 1-lb. pull and .016 diameter leads a 3-lb. pull. All lead diameters withstand 5 rotation twist.
All sizes are qualified to Mil-C-49137 and are shown on the part number table. Military parts are only rated from -55°C to +85°C.

Leads - F, M leads are 30 AWG, 0.010 ±.002 (0.25 ±.051) diameter. L, S, J leads are 26 AWG, 0.016 ±.002 (.41±.051) diameter All anode leads are 1.625 ±.125 (41.3 ±3.18) long. All cathode leads are 1.375 ±0.125 (34.9 ±3.18) long.

RADIAL AXIAL



Case Dimensions – inches (mm)

Case Size	A Max	B Max	C Max	D
F	.165 (4.19)	.120 (3.05)	.070 (1.78)	.100 ±.020 (2.54 ±.51)
M	.225 (5.72)	.185 (4.70)	.075 (1.91)	.150 ±.020 (3.81 ±.51)
L	.290 (7.37)	.220 (5.59)	.110 (2.79)	.180 ±.025 (4.57 ±.64)
S	.310 (7.87)	.230 (5.84)	.130 (3.30)	.200 ±.025 (5.08 ±.64)
J	.475 (12.07)	.375 (9.53)	.150 (3.81)	.300 ±.025 (7.62 ±.64)

Capacitance Range:	0.0047µF to 270µF
Capacitance Tolerance:	±10%; ±20%, ±5%
Rated Volt DC (Vr) ≤ +85°C:	2 3 4 6 10 15 20 25 35 50
Category Volt (Vc) ≤ +125°C:	1.3 2 2.6 4 6.7 10 13 16 23 33
Surge Voltage (Vs) ≤ +85°C:	2.6 4 5.2 8 13 19 26 33 46 65
≤ +125°C:	1.7 2.6 3.4 5.2 8.7 13 16 20 28 40
Temperature Range:	-55°C to +125°C (-55°C to +85°C for military)
Reverse Volt Max:	0.15Vr @ 20°C 0.10Vr @ 55°C 0.05Vr @ 85°C 0.01Vc @ 125°C (or 1V, whichever is less)
Life Test:	After 2000 hrs @ 85°C with Vr applied ΔCAP = ±10% max ΔDF, DCL = initial limit

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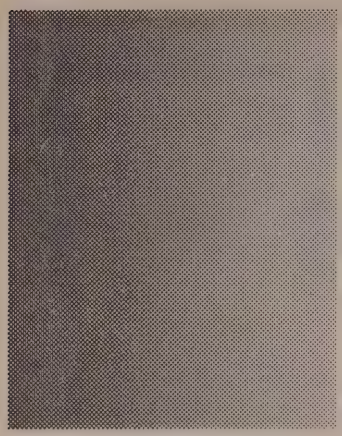

Component Research

High Reliability Film Capacitors

Component Research Company is recognized as the leader in hermetically sealed high reliability plastic film capacitors. These capacitors see large usage in military, aerospace, space, medical and oil well logging industries.

Established in 1958, Component Research Company has gained industry wide recognition for outstanding technical expertise, unsurpassed quality and excellent service.
Since the early sixties, Component Research Company capacitors have been used in every U.S. space program. Many of the innovations developed and produced by Component Research have resulted in new military specifications such as MIL-C-83421, MIL-C-39022/9 and MIL-C-87217.

Quality is assured by the strictest adherence to all specification requirements and state-of-the-art manufacturing and testing methods. To this end, Component Research maintains a complete military approved environmental testing laboratory with capabilities for vibration, shock, acceleration, thermal shock, burn-in, moisture resistance, and resistance to solvents, hermeticity and radiographic testing.This quality system is approved to MIL-Q-9858 and MIL-STD-790. A calibration laboratory complying to MIL-STD-45662 is also maintained.

In addition to the standard line of hermetically sealed film capacitors, Component Research Company designs and manufactures capacitors networks, high current capacitors, feedthrough capacitors and other custom capacitors.

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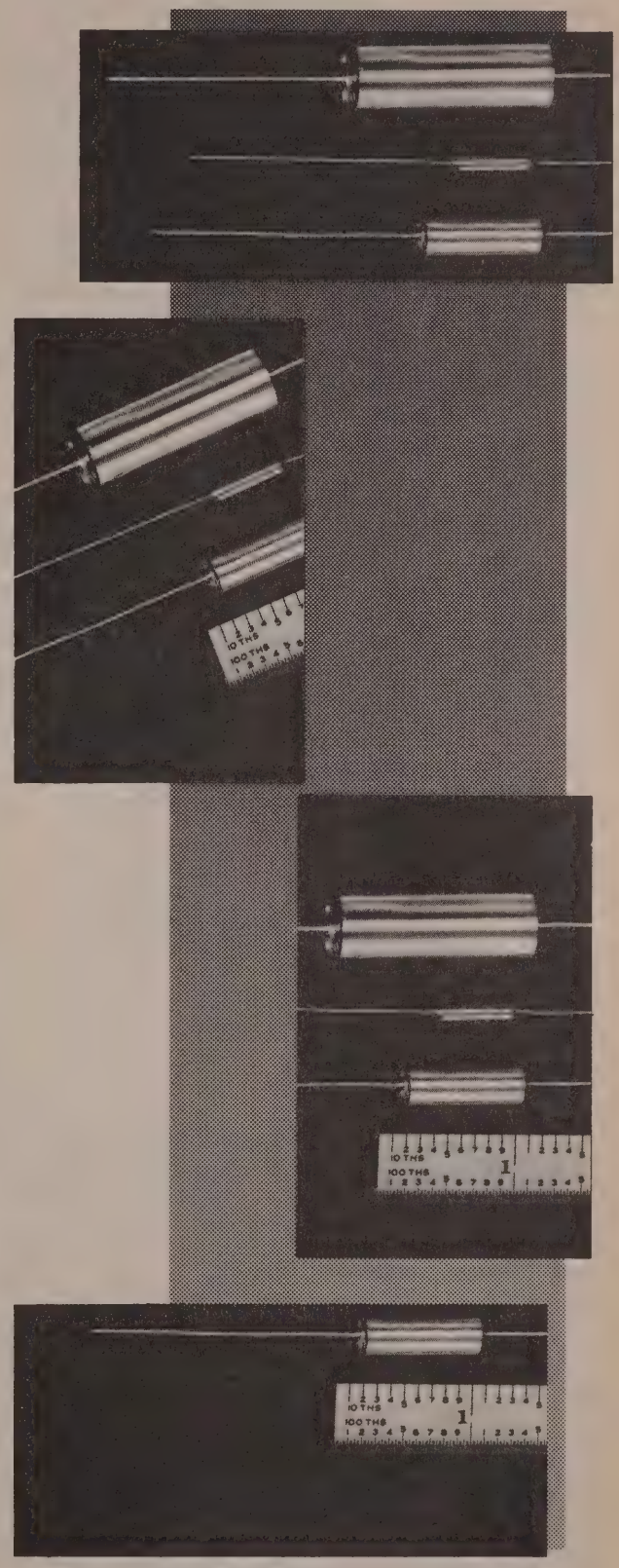
Component Research

Ordering Information

Custom Capacitors

Component Research designs and manufactures thousands of custom capacitors for special applications. These custom designs include:

- **Capacitor Networks**
- **Capacitor Standards**
- **Feedthrough capacitors**
- **Matched Sets**
- **Special Temperature Coefficient Capacitors**
- **High Temperature Capacitors**
- **Special Hermetic Packages for High Vibration**
- **High Current Capacitors Tested at High Frequencies**



Military Approvals

Component Research is qualified to the following Military specifications:

- MIL-C-83421/1
- MIL-C-83421/2
- MIL-C-39022/7
- MIL-C-39022/9
- MIL-C-39022/10
- MIL-C-87217/1
- MIL-C-19978/1
- MIL-C-19978/9
- MIL-C-19978/10

Patent Information

Component Research capacitors are exclusively manufactured under one or more of the following patents: 3,238,428; 3,260,906; 3,920,063; 3,506,895; 3,539,886; 3,603,849; 4,587,144. Additional patents pending.

Applications Assistance

Our applications engineers are recognized as the most knowledgeable in the industry. Please call our applications department for any requirement that is not covered in our catalog.

Sales Information

Standard products listed in the catalog may be ordered by contacting our sales office.

Phone: (310) 829-3615
Telefax: (310) 829-9584
Mail: 1655 26th Street
Santa Monica
CA 90404-4090
Attention: Sales

Terms

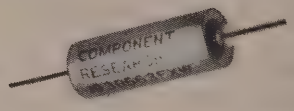
Net 30 upon approval by our credit dept. Minimum order is $40, $20 per line item, All shipments are FOB Santa-Monica.

Component Research

Metallized Polycarbonate Capacitor - A12

Product Features

- **Qualified** to Mil-C-83421/01 failure rate S.
- **Hermetically Sealed** high reliability screened for critical aerospace applications.
- **AC Rated** from 22 Vrms to 240 Vrms at frequencies from 0 to 400 Hz. Ratings to 40 Khz at lower voltage ratings, -65°C to +100°C with derated operation at 125°C, DC rated 30Vdc to 400 Vdc.
- **100% Reliability Screening,** Includes burn-in, temperature cycling, fine leak tests, and AC square wave tests.
- **Low Loss,** Rugged internal terminations qualified for all Hi-Rel programs (CRC patented construction).



1.0 µF 30VDC Actual size capacitor

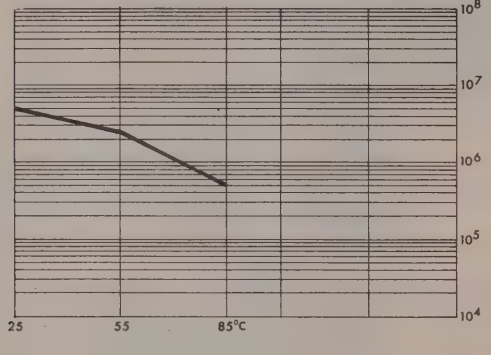
- **Capacitors** have been thermal shock tested for 1000 cycles from -65°C to +125°C, air to air and liquid to liquid.
- **Capacitors** of same design and construction have been life tested to 40,000 hours, see 40,000 hour life test data page.
- **Available in Standard Tolerances:** 0.25%, 0.5%, 1%, 2%, 5%, 10%. Other tolerances available on request.

Typical Applications

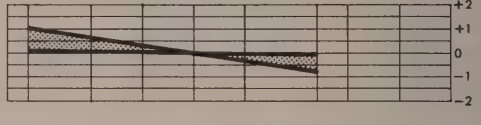
- Critical Timing Circuits
- Fixed Tuning Circuits
- Filtering
- Temperature Compensation
- Coupling and Decoupling
- Feedback Circuits
- Power Supply Filtering
- Gyro Circuits
- Pulse Forming Networks
- Integrating Circuits

Typical Curves

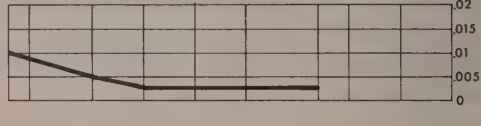
Insulation Resistance with Temperature in Megohms (0.1 F or less)



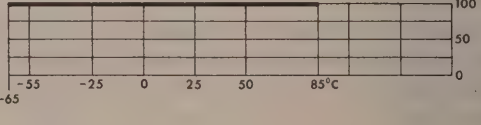
% Capacitance Change with Temperature



% Dissipation Factor with Temperature



% Voltage Rating with Temperature



Life Test Data CRC Test Report # 77TR116

List of Capacitors Submitted to Life Test			Insulation Resistance In Megohms at 25°C			%Capacitance Change with Life			%Dissipation Factor at 25°C with Life		
CRC Type	µ F Value	Q'ty Tested	Post Test Limits (min. I.R.)	Test Results		Post Test Limits (Max. C)	Test Results		Post Test Limits Max. D.F.)	Test Results	
				Low	High		Low	High		Low	High
A12A	.1	20	$1x10^6$	$3x10^6$	$4x10^6$	±2.0	0.00	+.40	.25	.07	08
A12A	.001	20	$1x10^6$	$1x10^7$	$30x10^6$	±2.0	-3.8	+.06	.25	.05	.05
A12B	1.0	20	$1x10^5$	$8x10^5$	$1x10^6$	±2.0	-.03	+.18	.25	.04	.05
A12B	.018	20	$1x10^6$	$1.2x10^7$	$2.5x10^7$	±2.0	-.33	-.16	.25	.07	.08
A12C	4.7	20	$2x10^4$	$1.1x10^5$	$5x10^5$	±2.0	-.13	-.06	.25	.04	.05
A12C	.039	20	$1x10^6$	$1.4x10^7$	$2x10^7$	±2.0	-.07	+.05	.25	.08	.08
A12D	.56	30	$1.8x10^5$	$1.6x10^6$	$1.8x10^6$	±2.0	-.03	+.05	.25	.05	.06
A12E	.01	30	$1x10^6$	$4x10^7$	$6.6x10^7$	±2.0	+.02	-.16	.25	.07	.07

Test results for series A12 capacitors life tested for 2000 hours at 100°C at 140% of rated DC voltage.
There were no failures for this test.

Component Research

Metallized Polycarbonate Capacitor - A12

Specifications

Construction: Metallized polycarbonate dielectric, hermetically sealed, extended metal film electrodes, axial leads isolated from case.

Environmental: Capacitors meet all environmental requirements and are qualified to MIL-C-83421/1.

Operating Temperature: -65°C to +100°C
At full rated voltage, derate linearly to 50% of rated voltage at 125°C.

Dielectric Absorption: 0.1% maximum
At 25°C when measured per MIL-C-83421.

Dissipation Factor: 0.15% maximum
At 25°C when measured per MIL-C-83421.

AC Square Wave: 100 Hz, 60 seconds
At 25°C at a peak to peak voltage of 3 times rated DC voltage, terminal to terminal per MIl-C-83421.

Dielectric Strength: 200% rated DC voltage
At 25°C from terminal to terminal to case for 60 seconds minimum.

Temperature Coefficient: (In % Capacitance) -1.0% to 1.2%; From +25°C to +125°C
-0% to -2.5%; From -55°C to 25°C

Capacitance Stability: (In % Capacitance) ±0.2.5%
When measured at any two corresponding temperature points taken in five successive temperature cycles from -65°C to +125°C.

Hermetic Seal: $1x10^{-6}$ atm/cm^3/sec.
Maximum leak rate

Insulation Resistance: See Insulation Resistance Table
Measured from terminal to terminal at rated DC voltage and 5 minutes charge time. Values greater than 1 µF, allow an additional minute / µF charge time.

Minimum Insulation Resistance At Rated DC Voltage

For values over 0.1 µf divide limit shown by µF to obtain minimum I.R.

Example: A 0.5 µF series A12 capacitor at 25°C is 300,000 ÷ 0.5 = 600,000 megohms

Range	Style	25°C	55°C	85°C	100°C	125°C
.001 to 0.1 F	A12	3,000,000 Megohms	2,000,000 Megohms	1,000,000 Megohms	3000,000 Megohms	20000 Megohms
Greater Than 0.1µ F	A12	300,000 Megohms- µF	200,00 Megohms- µF	100,00 Megohms- µF	30,000 Megohms-µF	2,000 Megohms- µF

Quality Conformance Inspection

Test No.	Test	Test Conditions	Test Meth. MIL-C-83421	Test Limit	Quality Level A12
1	Burn-In	48 Hrs. minimum at 125°C, at 140% rated DC voltage	4.7.2	No physical damage	100% Test
2	Thermal Aging	10 cycles minimum from -65°C to +125°C	4.7.3	No physical damage	100% Test
3	Seal Test (Fine Leak)	Helium bomb 45 PSi for 1 hr. minimum, check for helium leak	4.7.5	$1x10^{-6}$ atm/cm^3/sec. max.	100% Test
4	Sel Test (Gross Leak)	Per MIL-C-83421	4.7.5	No continuous bubble stream	100% Test
5	AC square wave	Apply 100 Hz at a peak to peak voltage of 3 times DC rated voltage for 60 seconds minimum'	4.7.6	No shorts	100% Test
6	DC Hi-Pot (Terminal to Terminal and Terminals to case)	Apply 200% of rated DC voltage for 60 seconds minimum. Do not exceed 800 volts peak to peak.	4.7.6	No shorts	100% Test
7	Insulation Resistance (Terminal to Terminal)	At 25°C at rated DC voltage	4.7.7	Per I.R. Table	100% Test
8	% Capacitance Tolerance	At 25°C at 1 KHz	4.7.8	Per Part Number	100% Test
9	% Dissipation Factor	At 25°C at 1 KHZ, values above 1 µF measure at 0.1 Khz	4.7.6	0.15% max.	100% Test
10	Visual and Mechanical Inspection	For marking dimensions, and workmanship	4.7.1	Per specification	1.0% AQL

1. Capacitors are packaged and shipped with Certification of Conformance. **2.** Traceability to production and test records by permanent marking of parts with date code lot. **3.** Process and inspection date is maintained on file per NHB 5300.4 (1C), MIL-Q-9858 and MIL-STD-790.

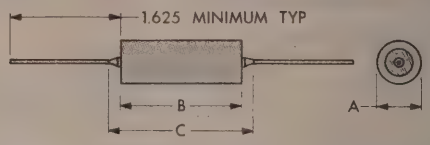
Component Research • 1655 26th St., Santa Monica, CA 90404 • (310) 829-3615 Fax (310) 829-9584

Component Research

Metallized Polycarbonate Capacitor - A12

Case Dimensions:
"A" Diameter
"B" Case Length
"C" Bead to Bead Max. Length

Tolerance Limits (inches)
±0.10 Without Sleeving;+0.02 / -0.00 With Mylar Sleeving
±0.03 With or Without Sleeving
The lengths shown in table are maximum and include solder beads. CRC "C" dimensions for A12 and K12 capacitors is 0.1" less than MIL-C-83421/1 requires.



Case Dimensions

For special values and tolerances please contact our application department

	30VDC			50VDC			100VDC			200VDC			400VDC		
µF	Diam. A	Length B	Length C	Diam. A	Length B	Length C	Diam. A	Length B	Length C	Diam. A	Length B	Length C	Diam. A	Length B	Length C
.001	.170	.500	.600	.170	.500	.600	.170	.500	.600	.170	.562	.662	.193	.562	.662
.0012	.170	.500	.600	.170	.500	.600	.170	.500	.600	.170	.562	.662	.193	.562	.662
.0015	.170	.500	.600	.170	.500	.600	.170	.500	.600	.170	.562	.662	.193	.562	.662
.0018	.170	.500	.600	.170	.500	.600	.170	.500	.600	.170	.562	.662	.193	.562	.662
.002	.170	.500	.600	.170	.500	.600	.170	.500	.600	.170	.562	.662	.193	.562	.662
.0022	.170	.500	.600	.170	.500	.600	.170	.500	.600	.170	.562	.662	.193	.562	.662
.0027	.170	.500	.600	.170	.500	.600	.170	.500	.600	.170	.562	.662	.235	.562	.662
.0033	.170	.500	.600	.170	.500	.600	.170	.500	.600	.170	.562	.662	.235	.562	.662
.0039	.170	.500	.600	.170	.500	.600	.170	.500	.600	.170	.562	.662	.170	.562	.662
.0047	.170	.500	.600	.170	.500	.600	.170	.500	.600	.170	.562	.662	.235	.562	.662
.005	.170	.500	.600	.170	.500	.600	.170	.500	.600	.170	.562	.662	.235	.562	.662
.0056	.170	.500	.600	.170	.500	.600	.170	.500	.600	.170	.562	.662	.235	.562	.662
.0068	.170	.500	.600	.170	.500	.600	.170	.562	.662	.170	.562	.662	.235	.687	.787
.0075	.170	.500	.600	.170	.562	.662	.170	.562	.662	.193	.562	.662	.235	.687	.787
.0082	.170	.500	.600	.170	.562	.662	.170	.562	.662	.193	.562	.662	.235	.687	.787
.01	.170	.500	.600	.170	.562	.662	.170	.687	.787	.193	.562	.662	.235	.687	.787
.012	.170	.500	.600	.170	.562	.662	.170	.687	.787	.193	.562	.662	.235	.687	.787
.015	.170	.500	.600	.170	.562	.662	.170	.687	.787	.235	.562	.662	.235	.813	.913
.018	.170	.500	.600	.193	.562	.662	.193	.687	.787	.235	.687	.787	.312	.813	.913
.02	.170	.500	.600	.193	.562	.662	.193	.687	.787	.235	.687	.787	.312	.813	.913
.022	.170	.500	.600	.193	.562	.662	.193	.687	.787	.235	.687	.787	.312	.813	.913
.027	.170	.562	.662	.193	.562	.662	.193	.687	.787	.312	.687	.787	.312	.813	.913
.033	.170	.562	.662	.193	.562	.662	.193	.687	.787	.312	.687	.787	.312	.813	.913
.039	.170	.562	.662	.170	.687	.787	.235	.687	.787	.312	.687	.787	.312	.813	.913
.047	.170	.562	.662	.170	.687	.787	.235	.687	.787	.312	.687	.787	.400	.813	.913
.05	.170	.562	.662	.170	.687	.787	.235	.687	.787	.312	.687	.787	.400	.813	.913
.056	.170	.562	.662	.193	.687	.787	.235	.687	.787	.312	.813	.913	.400	.813	.913
.068	.170	.687	.787	.193	.687	.787	.235	.813	.913	.312	.813	.913	.400	.813	.913
.075	.170	.687	.787	.193	.813	.913	.312	.687	.787	.312	.813	.913	.400	1.063	1.163
.082	.170	.687	.787	.193	.813	.913	.312	.687	.787	.312	.813	.913	.400	1.063	1.163
.1	.193	.687	.787	.193	.813	.913	.312	.687	.787	.312	.813	.913	.400	1.063	1.163
.12	.193	.687	.787	.235	.687	.787	.312	.687	.787	.312	.813	.913	.400	1.063	1.163
.15	.235	.562	.662	.235	.687	.787	.312	.813	.913	.400	1.063	1.163	.400	1.375	1.475
.18	.235	.687	.787	.235	.813	.913	.312	.813	.913	.400	1.375	1.475	.500	1.375	1.475
.2	.235	.687	.787	.235	.813	.913	.312	.813	.913	.400	1.375	1.475	.500	1.375	1.475
.22	.235	.687	.787	.235	.813	.913	.312	.813	.913	.400	1.375	1.475	.500	1.375	1.475
.27	.235	.687	.787	.312	.687	.787	.312	1.063	1.163	.500	1.375	1.475	.562	1.375	1.475
.33	.235	.687	.787	.312	.687	.787	.312	1.063	1.163	.500	1.375	1.475	.562	1.375	1.475
.39	.235	.687	.787	.312	.813	.913	.400	1.063	1.163	.500	1.375	1.475	.562	1.875	1.975
.47	.312	.687	.787	.312	.813	.913	.400	1.063	1.163	.500	1.375	1.475	.562	1.875	1.975
.5	.312	.687	.787	.312	.813	.913	.400	1.063	1.163	.500	1.375	1.475	.562	1.875	1.975
.56	.312	.687	.787	.400	.813	.913	.400	1.063	1.163	.500	1.375	1.475	.562	1.875	1.975
.68	.312	.687	.787	.400	.813	.913	.500	1.125	1.225	.562	1.376	1.475	.750	1.875	1.975
.75	.312	.813	.913	.400	1.063	1.163	.500	1.125	1.225	.562	1.875	1.975	.750	1.875	1.975
.82	.312	.813	.913	.400	1.063	1.163	.500	1.125	1.225	.561	1.875	1.975	.750	1.875	1.975
1.0	.312	.813	.913	.400	1.063	1.163	.562	1.125	1.225	.562	1.875	1.975	.750	1.875	1.975
1.2	.312	.813	.913	.400	1.063	1.163	.562	1.125	1.225	.562	1.875	1.975	1.000	1.875	1.975
1.5	.400	.813	.913	.400	1.063	1.163	.562	1.375	1.475	.670	1.875	1.975	1.000	2.375	2.475
1.8	.400	.813	.913	.400	1.063	1.163	.670	1.375	1.475	.750	1.875	1.975	1.000	2.375	2.475
2.0	.400	.813	.913	.500	1.125	1.225	.670	1.375	1.475	.750	1.875	1.975	1.000	2.375	2.475
2.2	.400	.813	.913	.500	1.125	1.225	.670	1.375	1.475	.750	1.875	1.975	1.000	2.375	2.475
2.5	.400	1.063	1.163	.500	1.375	1.475	.670	1.875	1.975	.750	1.875	1.975			
2.7	.400	1.063	1.163	.500	1.375	1.475	.670	1.875	1.975	.750	1.875	1.975			
3.0	.400	1.063	1.163	.500	1.375	1.475	.670	1.875	1.975	1.000	1.875	1.975			
3.3	.400	1.063	1.163	.500	1.375	1.475	.670	1.875	1.975	1.000	1.875	1.975			
3.9	.400	1.375	1.475	.562	1.375	1.475	.750	1.875	1.975	1.000	2.375	2.475			
4.7	.500	1.375	1.475	.670	1.375	1.475	.750	1.875	1.975	1.000	2.375	2.475			
5.0	.500	1.375	1.475	.670	1.375	1.475	.750	1.875	1.975	1.000	2.375	2.475			
5.6	.500	1.375	1.474	.670	1.375	1.475	.750	1.875	1.975	1.000	2.375	2.475			
6.8	.562	1.375	1.475	.670	1.875	1.975	1.000	2.375	2.475						
7.5	.562	1.375	1.474	.670	1.875	1.975	1.00	2.375	2.475						
8.2	.562	1.375	1.475	.670	1.875	1.975	1.000	2.375	2.475						
10.0	.562	1.375	1.475	.670	1.875	1.975	1.000	2.375	2.475						
12.0	.562	1.875	1.975	.750	1.875	1.975	1.000	2.375	2.475						
15.0	.562	1.875	1.975	.750	1.875	1.975									
18.0	.670	1.875	1.975	1.000	1.875	1.975									
20.0	.670	1.875	1.975	1.000	1.875	1.975									
22.0	.670	1.875	1.975	1.000	1.875	1.975									
25.0	.750	1.875	1.975	1.000	2.375	2.475									
27.0	.750	1.875	1.975	1.000	2.375	2.475									

A12 - A - 104 - J - S - W

Style

Voltage
A= 30VDC
B=50VDC
C=100VDC
D=200VDC
E=400VDC

Picofarad Code: First two digits represent significant figures, Last digit represents number of zeros to follow. Example: 104= 100,000 picofarads

Capacitance Tolerance
K=10% F=1% B=1/4%
J=5% D=1/2% A=.1%
G=2%

Sleeving Code
S=Mylar Sleeve
X=No Sleeve

Lead Code
W = Tinned copper clad steel: #22 (.025") for .312" case dia. & smaller; #20(.032"0 for .400" & .500" case dia.
C = Tinned oxygen-free copper:#18(.040") for .562" case dia. & larger

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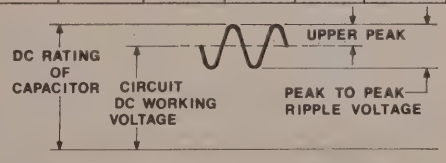
Component Research

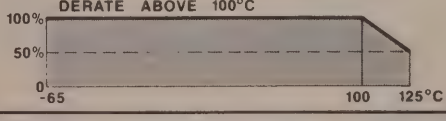
Metallized Polycarbonate Capacitor - A12

AC Ratings

µF	30VDC RMS Volts 400Hz	30VDC RMS Volts 40KHz	30VDC Max. RMS Amps	50VDC RMS Volts 400Hz	50VDC RMS Volts 40KHz	50VDC Max. RMS Amps	100VDC RMS Volts 400Hz	100VDC RMS Volts 40KHz	100VDC Max. RMS Amps	200VDC RMS RMS 400Hz	200VDC RMS Volts 40KHz	200VDC Max. RMS Amps	400VDC RMS Volts 400Hz	400VDC RMS Volts 40KHz	400VDC Max. RMS Amps
0.0010	22.00	22.00	0.0060	36.00	36.00	0.0090	60.00	60.00	0.0150	120.00	80.00	0.020	240.00	100.00	0.025
0.0012	22.00	22.00	0.0070	36.00	36.00	0.0110	60.00	60.00	0.0180	120.00	80.00	0.024	240.00	100.00	0.030
0.0015	22.00	22.00	0.0080	36.00	36.00	0.0130	60.00	60.00	0.0220	120.00	80.00	0.030	240.00	98.67	0.037
0.0018	22.00	22.00	0.0100	36.00	36.00	0.0160	60.00	60.00	0.0270	120.00	80.00	0.036	240.00	100.00	0.045
0.0020	22.00	22.00	0.0110	36.00	36.00	0.0180	60.00	60.00	0.0300	120.00	80.00	0.040	240.00	100.00	0.050
0.0022	22.00	22.00	0.0120	36.00	36.00	0.0200	60.00	60.00	0.0330	120.00	80.00	0.044	240.00	100.00	0.055
0.0027	22.00	22.00	0.0150	36.00	36.00	0.0240	60.00	60.00	0.0410	120.00	80.00	0.054	240.00	100.74	0.068
0.0033	22.00	22.00	0.0180	36.00	36.00	0.0300	60.00	60.00	0.0500	120.00	80.00	0.066	240.00	100.61	0.083
0.0039	22.00	22.00	0.0210	36.00	36.00	0.0350	60.00	60.00	0.0580	120.00	80.00	0.078	240.00	99.49	0.097
0.0047	22.00	22.00	0.0260	36.00	36.00	0.0420	60.00	60.00	0.0710	120.00	80.00	0.094	240.00	102.13	0.120
0.0050	22.00	22.00	0.0280	36.00	36.00	0.0450	60.00	60.00	0.0750	120.00	80.00	0.100	240.00	104.00	0.130
0.0056	22.00	22.00	0.0310	36.00	36.00	0.0500	60.00	60.00	0.0840	120.00	78.57	0.110	240.00	100.00	0.140
0.0068	22.00	22.00	0.0370	36.00	36.00	0.0610	60.00	60.00	0.1000	120.00	82.35	0.140	240.00	100.00	0.170
0.0075	22.00	22.00	0.0370	36.00	36.00	0.0610	60.00	60.00	0.1000	120.00	74.67	0.140	240.00	90.67	0.170
0.0082	22.00	22.00	0.0450	36.00	36.00	0.0740	60.00	60.00	0.1200	120.00	78.05	0.160	240.00	102.44	0.210
0.0100	22.00	22.00	0.0550	36.00	36.00	0.0900	60.00	60.00	0.1500	120.00	80.00	0.200	240.00	100.00	0.250
0.0120	22.00	22.00	0.0660	36.00	36.00	0.1100	60.00	60.00	0.1800	120.00	76.67	0.230	240.00	100.00	0.300
0.0150	22.00	22.00	0.0820	36.00	36.00	0.1400	60.00	58.67	0.2200	120.00	77.33	0.290	240.00	93.33	0.350
0.0180	22.00	22.00	0.1000	36.00	36.00	0.1600	60.00	57.78	0.2600	120.00	77.33	0.330	240.00	91.11	0.410
0.0200	22.00	22.00	0.1100	36.00	36.00	0.1800	60.00	56.00	0.2800	120.00	72.00	0.360	240.00	88.00	0.440
0.0220	22.00	22.00	0.1200	36.00	36.00	0.2000	60.00	52.73	0.2900	120.00	67.27	0.370	240.00	85.45	0.470
0.0270	22.00	22.00	0.1500	36.00	36.00	0.2400	60.00	50.37	0.3400	120.00	65.19	0.440	240.00	81.48	0.550
0.0330	22.00	22.00	0.1800	36.00	36.00	0.3000	60.00	49.70	0.4100	120.00	61.82	0.510	240.00	78.79	0.650
0.0390	22.00	22.00	0.2200	36.00	36.00	0.3500	60.00	48.21	0.4700	120.00	60.51	0.590	240.00	74.87	0.730
0.0470	22.00	22.00	0.2600	36.00	36.00	0.4200	60.00	46.81	0.5500	120.00	57.02	0.670	240.00	70.64	0.830
0.0500	22.00	22.00	0.2800	36.00	36.00	0.4500	60.00	46.40	0.5800	120.00	56.00	0.700	240.00	70.40	0.880
0.0560	22.00	22.00	0.3100	36.00	36.00	0.5000	60.00	45.71	0.6400	120.00	55.71	0.780	240.00	67.86	0.950
0.0680	22.00	22.00	0.3700	36.00	34.12	0.5800	60.00	41.76	0.7100	120.00	50.00	0.850	240.00	60.00	1.020
0.0750	22.00	22.00	0.3700	36.00	30.93	0.5800	60.00	37.87	0.7100	120.00	45.33	0.850	240.00	54.40	1.020
0.0820	22.00	22.00	0.4500	36.00	32.20	0.6600	60.00	38.05	0.7800	120.00	43.90	0.900	240.00	50.24	1.030
0.1000	22.00	22.00	0.5500	36.00	30.00	0.7500	60.00	36.00	0.9000	120.00	44.00	1.100	240.00	48.00	1.200
0.1200	22.00	22.00	0.6600	36.00	30.00	0.9000	60.00	35.00	1.0500	120.00	40.00	1.200	240.00	44.67	1.340
0.1500	22.00	22.00	0.8300	36.00	26.13	0.9800	60.00	33.07	1.2400	120.00	35.73	1.340	240.00	40.00	1.500
0.1800	22.00	22.00	1.0000	36.00	25.11	1.1300	60.00	31.11	1.4000	120.00	34.22	1.540	240.00	37.78	1.700
0.2000	22.00	20.00	1.0000	36.00	24.00	1.2000	60.00	30.00	1.5000	120.00	33.00	1.650	240.00	37.00	1.850
0.2200	22.00	18.55	1.0200	36.00	23.09	1.2700	60.00	27.27	1.5000	120.00	32.00	1.760	240.00	35.09	1.930
0.2700	22.00	17.04	1.1500	36.00	18.96	1.2800	60.00	24.00	1.6200	120.00	29.04	1.960	240.00	33.19	2.240
0.3300	22.00	16.00	1.3200	36.00	17.94	1.4800	60.00	23.03	1.9000	120.00	28.00	2.310	240.00	32.12	2.650
0.3900	22.00	14.97	1.4600	36.00	17.03	1.6600	60.00	22.05	2.1500	120.00	26.97	2.630	240.00	32.21	3.140
0.4700	22.00	14.04	1.6500	36.00	15.74	1.8500	60.00	21.02	2.4700	120.00	26.04	3.060	240.00	30.98	3.640
0.5000	22.00	13.52	1.6900	36.00	15.20	1.9000	60.00	20.00	2.5000	120.00	25.04	3.130	240.00	30.00	3.750
0.5600	22.00	12.93	1.8100	36.00	14.36	2.0100	60.00	18.86	2.6400	120.00	22.64	3.170	240.00	28.93	4.050
0.6800	22.00	12.00	2.0400	36.00	14.00	2.3800	60.00	16.00	2.7200	120.00	20.00	3.400	240.00	26.47	4.500
0.7500	22.00	10.88	2.0400	36.00	12.69	2.3800	60.00	14.51	2.7200	120.00	18.13	3.400	240.00	24.00	4.500
0.8200	22.00	10.00	2.0500	36.00	12.00	2.4600	60.00	14.00	2.8700	120.00	18.05	3.700	240.00	23.41	4.800
1.0000	22.00	8.40	2.1000	36.00	10.00	2.5000	60.00	12.00	3.000	120.00	15.00	3.750	240.00	20.80	5.200
1.2000	22.00	7.17	2.1500	36.00	9.10	2.7300	60.00	10.83	3.2500	120.00	13.50	4.050	240.00	18.33	5.500
1.5000	22.00	5.79	2.1700	36.00	7.73	2.9000	60.00	10.00	3.7500	120.00	12.00	4.500	240.00	16.00	6.000
1.8000	22.00	4.89	2.2000	36.00	6.67	3.0000	60.00	8.33	3.7500	120.00	11.11	5.000	240.00	15.11	6.800
2.0000	22.00	4.40	2.2000	36.00	6.20	3.1000	60.00	8.20	4.1000	120.00	10.00	5.000	240.00	14.00	7.000
2.2000	22.00	4.00	2.2000	36.00	5.82	3.2000	60.00	7.49	4.1200	120.00	9.09	5.000	240.00	12.73	7.000
2.5000	22.00	3.52	2.2000	36.00	5.34	3.3400	60.00	7.04	4.4000	120.00	8.00	5.000			
2.7000	22.00	3.26	2.2000	36.00	4.95	3.3400	60.00	6.52	4.4000	120.00	7.70	5.200			
3.0000	22.00	2.93	2.2000	36.00	4.53	3.4000	60.00	6.01	4.5100	120.00	7.03	5.270			
3.3000	22.00	2.67	2.2000	36.00	4.24	3.5000	60.00	5.52	4.5500	120.00	6.50	5.360			
3.9000	22.00	2.26	2.2000	36.00	3.69	3.6000	60.00	5.03	4.9000	120.00	5.54	5.400			
4.7000	22.00	1.87	2.2000	36.00	3.06	3.6000	60.00	4.26	5.0000	120.00	4.60	5.400			
5.0000	22.00	1.76	2.2000	36.00	2.88	3.6000	60.00	4.00	5.0000	120.00	4.32	5.400			
5.6000	22.00	1.57	2.2000	36.00	2.57	3.6000	60.00	3.57	5.0000	120.00	3.86	5.400			
6.8000	22.00	1.29	2.2000	36.00	2.12	3.6000	60.00	2.94	5.0000						
7.5000	22.00	1.17	2.2000	36.00	1.92	3.6000	60.00	2.67	5.0000						
8.2000	22.00	1.07	2.2000	36.00	1.76	3.6000	60.00	2.44	5.0000						
10.0000	22.00	0.88	2.2000	36.00	1.44	3.6000	60.00	2.00	5.0000						
12.0000	22.00	0.73	2.2000	36.00	1.20	3.6000	60.00	1.67	5.0000						
15.0000	22.00	0.59	2.2000	36.00	0.96	3.6000									
18.0000	22.00	0.49	2.2000	36.00	0.80	3.6000									
20.0000	22.00	0.44	2.2000	36.00	0.72	3.6000									
22.0000	22.00	0.40	2.2000	36.00	0.65	3.6000									
25.0000	22.00	0.35	2.2000	36.00	0.58	3.6000									
27.0000	22.00	0.33	2.2000	36.00	0.53	3.6000									

1. The combined DC and AC voltages should not exceed the DC ratings, see figure.
2. Capacitors may be operated at higher frequencies, at reduced RMS voltage such that max. AC current ratings are not exceeded.
3. Capacitors can handle pulse currents up to 100 times greater than the peak currents calculated from the rated RMS rating (provided slow repetition rates are used). If there is any doubt, a sketch of the voltage and current wave forms with time base should be sent to CRC for analysis.





Component Research

Metallized Polycarbonate Capacitor - G12

Specifications

Construction: Metallized polycarbonate dielectric, hermetically sealed, extended metal film electrodes, axial leads isolated from case.

Environmental: Capacitors meet all environmental requirements and are qualified to MIL-C-83421.

Operating Temperature: -65°C to +100°C
At full rated voltage, derate linearly to 50% of rated voltage at 125°C.

Dielectric Absorption: 0.1% maximum
At 25°C when measured per MIL-C-83421.

Dissipation Factor: 0.15% maximum
At 25°C when measured per MIL-C-83421.

AC Square Wave: 100 Hz, 60 seconds minimum
At 25°C at a peak to peak voltage of 2 times rated DC voltage, terminal to terminal per MIl-C-83421.

Dielectric Strength: 200% rated DC voltage
At 25°C from terminal to terminal to case for 60 seconds minimum.

Temperature Coefficient: ±2% ; From +25°C to +125°C
–0% to –2%; From 25°C to –55°C

Capacitance Stability: ±0.2.5%
When measured at any two corresponding temperature points taken in five successive temperature cycles from -65°C to +125°C.

Hermetic Seal: $1x10^{-6}$ atm/cm^3/sec.
Maximum leak rate

Insulation Resistance: See Insulation Resistance Table
Measured from terminal to terminal at rated DC voltage and 5 minutes charge time. Values greater than 1 µF, allow an additional minute / µF charge time.

Minimum Insulation Resistance At Rated DC Voltage

For values over 0.1 µf divide limit shown by µF to obtain minimum I.R.

Example: A 0.18 µF capacitor at 25°C is 100,000 ÷ 0.18 = 555,555 megohms

Range	25°C	85°C	100°C	125°C
.001 to 0.1 F	1,000,000 Megohms	60,000 Megohms	30,000 Megohms	10,000 Megohms
Greater Than 0.1µ F	100,000 Megohms- µF	6,000 Megohms- µF	3,000 Megohms- µF	1,000 Megohms-µF

Quality Conformance Inspection

Test No.	Test	Test Conditions	Test Meth. MIL-C-83421	Test Limit	Quality Level
1	Burn-In	48 Hrs. minimum at 125°C, at 140% rated DC voltage	4.7.2	No physical damage	100% Test
2	Thermal Aging	10 cycles minimum from -65°C to +125°C	4.7.3	No physical damage	100% Test
3	Seal Test (Fine Leak)	Helium bomb 45 PSi for 1 hr. minimum, check for helium leak	4.7.5	1x10-6 atm/cm3/sec. max.	100% Test
4	Seal Test (Gross Leak)	Per MIL-C-83421	4.7.5	No continuous bubble stream	100% Test
5	AC square wave (Terminal To Terminal)	Apply 100 Hz at a peak to peak voltage of 2 times DC rated voltage for 60 seconds minimum'	4.7.6	No shorts	100% Test
6	DC Hi-Pot (Terminal to Terminal and Terminals to Case)	Apply 200% of rated DC voltage for 60 seconds minimum.	4.7.6	No shorts	100% Test
7	Insulation Resistance (Terminal to Terminal)	At 25°C at rated DC voltage	4.7.7	100,000 megohm-uF, need not exceed 1,000,000 meohms	100% Test
8	% Capacitance Tolerance	At 25°C at 1 KHz	4.7.8	Per Part Number	100% Test
9	% Dissipation Factor	At 25°C at 1 KHZ, values above 1 µF measure at 0.1 Khz	4.7.9	0.15% max.	100% Test
10	Visual and Mechanical Inspection	For marking dimensions, and workmanship	4.7.1	Per specification	1.0% AQL

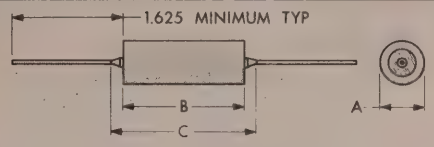
1. Capacitors are packaged and shipped with Certification of Conformance. **2.** Traceability to production and test records by permanent marking of parts with date code lot. **3.** Process and inspection date is maintained on file per NHB 5300.4 (1C), MIL-Q-9858 and MIL-STD-790.

Component Research

Metallized Polycarbonate Capacitor - G12

Case Dimensions:
"A" Diameter
"B" Case Length
"C" Bead to Bead Max. Length

Tolerance Limits (inches)
±0.10Without Sleeving; +0.02 / -0.00 With Mylar Sleeving
±0.03 With or Without Sleeving
The lengths shown in table are maximum and include solder beads.



Case Dimensions

For special values and tolerances please contact our application department

	30VDC				50VDC				100VDC				200VDC			
µF	Basic P/N	Diam. A	Length B	Length C	Basic P/N	Diam. A	Length B	Length C	Basic P/N	Diam. A	Length B	Length C	Basic P/N	Diam. A	Length B	Length C
.001	G12A102	.170	.500	.600	G12B102	.170	.500	.600	G12C102	.170	.500	.600	G12D102	.170	.500	.600
.0012	G12A122	.170	.500	.600	G12B122	.170	.500	.600	G12C122	.170	.500	.600	G12D122	.170	.500	.600
.0015	G12A152	.170	.500	.600	G12B152	.170	.500	.600	G12C152	.170	.500	.600	G12D152	.170	.500	.600
.0018	G12A182	.170	.500	.600	G12B182	.170	.500	.600	G12C182	.170	.500	.600	G12D182	.170	.500	.600
.002	G12A202	.170	.500	.600	G12B202	.170	.500	.600	G12C202	.170	.500	.600	G12D202	.170	.500	.600
.0022	G12A222	.170	.500	.600	G12B222	.170	.500	.600	G12C222	.170	.500	.600	G12D222	.170	.500	.600
.0027	G12A272	.170	.500	.600	G12B272	.170	.500	.600	G12C272	.170	.500	.600	G12D272	.170	.500	.600
.0033	G12A332	.170	.500	.600	G12B332	.170	.500	.600	G12C332	.170	.500	.600	G12D332	.170	.500	.600
.0039	G12A392	.170	.500	.600	G12B392	.170	.500	.600	G12C392	.170	.500	.600	G12D392	.170	.500	.600
.0047	G12A472	.170	.500	.600	G12B472	.170	.500	.600	G12C472	.170	.500	.600	G12D472	.170	.500	.600
.005	G12A502	.170	.500	.600	G12B502	.170	.500	.600	G12C502	.170	.500	.600	G12D502	.170	.500	.600
.0056	G12A562	.170	.500	.600	G12B562	.170	.500	.600	G12C562	.170	.500	.600	G12D562	.170	.500	.600
.0068	G12A682	.170	.500	.600	G12B682	.170	.500	.600	G12C682	.170	.500	.600	G12D682	.170	.500	.600
.0075	G12A752	.170	.500	.600	G12B752	.170	.500	.600	G12C752	.170	.500	.600	G12D752	.170	.562	.662
.0082	G12A822	.170	.500	.600	G12B822	.170	.500	.600	G12C822	.170	.500	.600	G12D822	.170	.562	.662
.01	G12A103	.170	.500	.600	G12B103	.170	.500	.600	G12C103	.170	.500	.600	G12D103	.170	.687	.787
.012	G12A123	.170	.500	.600	G12B123	.170	.500	.600	G12C123	.170	.500	.600	G12D123	.170	.687	.787
.015	G12A153	.170	.500	.600	G12B153	.170	.500	.600	G12C153	.170	.500	.600	G12D153	.170	.687	.787
.018	G12A183	.170	.500	.600	G12B183	.170	.500	.600	G12C183	.170	.562	.662	G12D183	.193	.687	.787
.02	G12A203	.170	.500	.600	G12B203	.170	.500	.600	G12C203	.170	.562	.662	G12D203	.193	.687	.787
.022	G12A223	.170	.500	.600	G12B223	.170	.500	.600	G12C223	.170	.562	.662	G12D223	.193	.687	.787
.027	G12A273	.170	.500	.600	G12B273	.170	.500	.600	G12C273	.170	.562	.662	G12D273	.193	.687	.787
.033	G12A333	.170	.500	.600	G12B333	.170	.500	.600	G12C333	.170	.562	.662	G12D333	.193	.687	.787
.039	G12A393	.170	.500	.600	G12B393	.170	.500	.600	G12C393	.170	.562	.662	G12D393	.235	.687	.787
.047	G12A473	.170	.500	.600	G12B473	.170	.500	.600	G12C473	.193	.562	.662	G12D473	.235	.687	.787
.05	G12A503	.170	.500	.600	G12B503	.170	.500	.600	G12C503	.193	.562	.662	G12D503	.235	.687	.787
.056	G12A563	.170	.500	.600	G12B563	.170	.500	.600	G12C563	.193	.562	.662	G12D563	.235	.687	.787
.068	G12A683	.170	.500	.600	G12B683	.170	.562	.662	G12C683	.235	.562	.662	G12D683	.312	.687	.787
.075	G12A753	.170	.500	.600	G12B753	.170	.562	.662	G12C753	.235	.562	.662	G12D753	.312	.687	.787
.082	G12A823	.170	.562	.662	G12B823	.170	.562	.662	G12C823	.235	.562	.662	G12D823	.312	.687	.787
.1	G12A104	.193	.562	.662	G12B104	.193	.562	.662	G12C104	.235	.687	.787	G12D104	.312	.687	.787
.12	G12A124	.193	.562	.662	G12B124	.193	.562	.662	G12C124	.235	.687	.787	G12D124	.312	.687	.913
.15	G12A154	.193	.562	.662	G12B154	.193	.562	.662	G12C154	.235	.687	.787	G12D154	.312	.813	.913
.18	G12A184	.235	.562	.662	G12B184	.235	.562	.662	G12C184	.235	.687	.787	G12D184	.312	.813	.913
.20	G12A204	.235	.562	.662	G12B204	.235	.562	.662	G12C204	.235	.687	.787	G12D204	.312	.813	.913
.22	G12A224	.235	.562	.662	G12B224	.235	.562	.662	G12C224	.235	.687	.787	G12D224	.312	.813	1.163
.27	G12A274	.235	.562	.662	G12B274	.235	.687	.787	G12C274	.312	.687	.787	G12D274	.312	1.063	1.163
.33	G12A334	.235	.562	.662	G12B334	.235	.687	.787	G12C334	.312	.813	.913	G12D334	.312	1.063	1.163
.39	G12A394	.235	.687	.787	G12B394	.235	.687	.787	G12C394	.312	.813	.913	G12D394	.400	1.063	1.163
.47	G12A474	.235	.687	.787	G12B474	.312	.687	.787	G12C474	.400	.687	.787	G12D474	.400	1.063	1.163
.50	G12A504	.235	.687	.787	G12B504	.312	.687	.787	G12C504	.400	.687	.787	G12D504	.400	1.063	1.163
.56	G12A564	.235	.687	.787	G12B564	.312	.687	.787	G12C564	.400	.687	.787	G12D564	.400	1.063	1.163
.68	G12A684	.235	.813	.913	G12B684	.312	.687	.787	G12C684	.400	.813	.913	G12D684	.500	1.125	1.225
.75	G12A754	.235	.813	.913	G12B754	.312	.687	.787	G12C754	.400	.813	.913	G12D754	.500	1.125	1.225
.82	G12A824	.235	.813	.913	G12B824	.312	.687	.787	G12C824	.400	.813	.913	G12D824	.500	1.375	1.425
1.0	G12A105	.235	.813	.913	G12B105	.312	.813	.913	G12C105	.400	1.063	1.163	G12D105	.500	1.375	1.475
1.2	G12A125	.312	.813	.913	G12B125	.312	.813	.913	G12C155	.400	1.063	1.163	G12D125	.500	1.375	1.475
1.5	G12A155	.312	.813	.913	G12B155	.400	.813	.913	G12C185	.400	1.375	1.475				
1.8	G12A185	.312	.813	.913	G12B185	.400	.813	.913	G12C205	.400	1.375	1.475				
2.0	G12A205	.312	.813	.913	G12B205	.400	.813	.913	G12C225	.500	1.375	1.475				
2.2	G12A225	.312	.813	.913	G12B225	.400	.813	.913	G12C255	.500	1.375	1.475				
2.5	G12A255	.312	1.063	1.163	G12B255	.400	.813	.913	G12C275	.500	1.375	1.475				
2.7	G12A275	.312	1.063	1.163	G12B275	.400	1.063	1.163	G12C305	.500	1.375	1.475				
3.0	G12A305	.312	1.063	1.163	G12B305	.400	1.063	1.163	G12C335	.500	1.375	1.475				
3.3	G12A335	.312	1.063	1.163	G12B335	.400	1.063	1.163								
3.9	G12A395	.400	1.063	1.163	G12B395	.400	1.375	1.475								
4.7	G12A475	.400	1.063	1.163	G12B475	.500	1.375	1.475								
5.0	G12A505	.400	1.063	1.163	G12B505	.500	1.375	1.475								
5.6	G12A565	.400	1.063	1.163	G12B565	.500	1.375	1.475								
6.8	G12A685	.400	1.375	1.475	G12B685	.500	1.375	1.475								
7.5	G12A755	.400	1.375	1.475	G12B755	.500	1.375	1.475								
8.2	G12A825	.400	1.375	1.475	G12B825	.500	1.375	1.475								
10.0	G12A106	.500	1.375	1.475												

G12 - A - 104 - J - S - W

Style

Voltage
A= 30VDC
B=50VDC
C=100VDC
D=200VDC

Picofarad Code: First two digits represent significant figures, Last digit represents number of zeros to follow. Example: 104= 100,000 picofarads

Capacitance Tolerance
K=10% F=1% B=1/4%
J=5% D=1/2% A=.1%
G=2%

Sleeving Code
S=Mylar Sleeve
X=No Sleeve

Lead Code
W = Tinned copper clad steel: #22 (.025") for .312" case dia. & smaller; #20(.032"0 for .400" & .500" case dia.

Component Research • 1655 26th St., Santa Monica, CA 90404 • (310) 829-3615 Fax (310) 829-9584

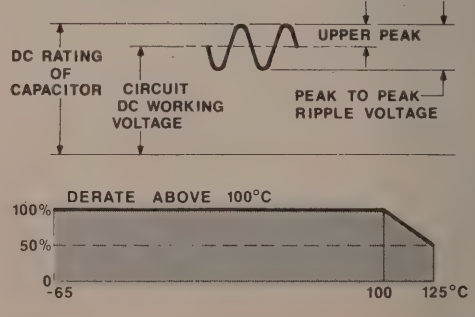
Component Research

Metallized Polycarbonate Capacitor - G12

AC Ratings

uF	30VDC RMS Volts 400Hz	30VDC RMS Volts 40KHz	30VDC Max. RMS Amps	50VDC RMS Volts 400Hz	50VDC RMS Volts 40KHz	50VDC Max. RMS Amps	100VDC RMS Volts 400Jz	100VDC RMS Volts 40KHz	100VDC Max. RMS Amps	200VDC RMS Volts 400Hz	200VDC RMS Volts 40KHz	200VDC Max. RMS Amps
0.0010	22.00	22.00	.0055	36.00	36.00	.0090	60.00	60.0	.0150	120.00	120.0	.030
0.0012	22.00	22.00	.0066	36.00	36.00	.0108	60.00	60.0	.0180	120.00	120.0	.036
0.0015	22.00	22.00	.0083	36.00	36.00	.0135	60.00	60.0	.0225	120.00	120.0	.045
0.0018	22.00	22.00	.0099	36.00	36.00	.0162	60.00	60.0	.0270	120.00	120.0	.054
0.0020	22.00	22.00	.0110	36.00	36.00	.0180	60.00	60.0	.0300	120.00	120.0	.060
0.0022	22.00	22.00	.0121	36.00	36.00	.0198	60.00	60.0	.0330	120.00	120.0	.066
0.0027	22.00	22.00	.0149	36.00	36.00	.0243	60.00	60.0	.0405	120.00	120.0	.081
0.0033	22.00	22.00	.0182	36.00	36.00	.0297	60.00	60.0	.0495	120.00	120.0	.099
0.0039	22.00	22.00	.0215	36.00	36.00	.0351	60.00	60.0	.0585	120.00	120.0	.117
0.0047	22.00	22.00	.0259	36.00	36.00	.0423	60.00	60.0	.0705	120.00	120.0	.141
0.0050	22.00	22.00	.0275	36.00	36.00	.0450	60.00	60.0	.0750	120.00	120.0	.150
0.0056	22.00	22.00	.0308	36.00	36.00	.0504	60.00	60.0	.0840	120.00	120.0	.168
0.0068	22.00	22.00	.0374	36.00	36.00	.0612	60.00	60.0	.1020	120.00	120.0	.204
0.0075	22.00	22.00	.0413	36.00	36.00	.0675	60.00	60.0	.1125	120.00	120.0	.225
0.0082	22.00	22.00	.0451	36.00	36.00	.0738	60.00	60.0	.123	120.00	120.0	.246
.010	22.00	22.00	.0550	36.00	36.00	.090	60.00	60.0	.150	120.00	120.0	.30
.012	22.00	22.00	.0660	36.00	36.00	.108	60.00	60.0	.180	120.00	120.0	.36
.015	22.00	22.00	.0825	36.00	36.00	.135	60.00	60.0	.225	120.00	120.0	.45
.018	22.00	22.00	.0990	36.00	36.00	.162	60.00	60.0	.27	120.00	120.0	.54
.020	22.00	22.00	.1100	36.00	26.00	.180	60.00	60.0	.30	120.00	120.0	.60
.022	22.00	22.00	.1210	36.00	36.00	.198	60.00	60.0	.33	120.00	120.0	.66
.027	22.00	22.00	.1485	36.00	36.00	.243	60.00	60.0	.405	120.00	120.0	.81
.033	22.00	22.00	.1815	36.00	36.00	.297	60.00	54.54	.45	120.00	103.03	.85
.039	22.00	22.00	.2145	36.00	31.79	.31	60.00	46.15	.45	120.00	120.0	1.17
.047	22.00	22.00	.2585	36.00	26.38	.31	60.00	60.00	.705	120.00	120.0	1.41
.050	22.00	22.00	.275	36.00	24.80	.31	60.00	60.00	.75	120.00	120.0	1.50
.056	22.00	22.00	.308	36.00	22.14	.31	60.00	60.00	.84	120.00	107.14	1.50
.068	22.00	18.23	.31	36.00	26.47	.45	60.00	60.00	1.02	120.00	120.0	2.04
.075	22.00	16.53	.31	36.00	24.00	.45	60.00	58.66	1.10	120.00	109.33	2.05
.082	22.00	21.95	.45	36.00	21.95	.45	60.00	53.65	1.10	120.00	100.00	2.05
.100	22.00	18.00	.45	36.00	34.00	.85	60.00	60.00	1.50	120.00	82.00	2.05
.12	22.00	15.00	.45	36.00	28.33	.85	60.00	50.00	1.50	120.00	68.33	2.05
.15	22.00	12.00	.45	36.00	22.66	.85	60.00	40.00	1.50	120.00	57.33	2.15
.18	22.00	18.88	.85	36.00	24.44	1.10	60.00	33.33	1.50	120.00	47.77	2.15
.20	22.00	17.00	.85	36.00	22.00	1.10	60.00	30.00	1.50	120.00	43.00	2.15
.22	22.00	15.45	.85	36.00	20.00	1.10	60.00	27.27	1.50	120.00	39.09	2.15
.27	22.00	16.29	1.10	36.00	22.22	1.50	60.00	30.37	2.05	120.00	33.33	2.25
.33	22.00	13.33	1.10	36.00	18.18	1.50	60.00	26.06	2.15	120.00	27.27	2.25
.39	22.00	15.38	1.50	36.00	15.38	1.50	60.00	22.05	2.15	120.00	30.76	3.00
.47	22.00	12.76	1.50	36.00	17.44	2.05	60.00	19.14	2.25	120.00	25.53	3.00
.50	22.00	12.00	1.50	36.00	16.40	2.05	60.00	18.00	2.25	120.00	24.00	3.00
.56	22.00	10.71	1.50	36.00	14.64	2.05	60.00	16.07	2.25	120.00	21.42	3.00
.68	22.00	10.11	1.72	36.00	12.05	2.05	60.00	14.70	2.50	120.00	19.41	3.30
.75	22.00	9.17	1.72	36.00	10.93	2.05	60.00	13.33	2.50	120.00	17.60	3.30
.82	22.00	8.39	1.72	36.00	10.00	2.05	60.00	12.19	2.50	120.00	17.07	3.50
1.0	22.00	6.88	1.72	36.00	8.60	2.15	60.00	12.00	3.00	120.00	14.00	3.50
1.2	22.00	7.16	2.15	36.00	7.16	2.15	60.00	9.99	3.00	120.00	11.66	3.50
1.5	22.00	5.73	2.15	36.00	6.66	2.50	60.00	8.80	3.30			
1.8	22.00	4.77	2.15	36.00	5.55	2.50	60.00	7.33	3.30			
2.0	22.00	4.30	2.15	36.00	5.00	2.50	60.00	7.00	3.50			
2.2	22.00	3.90	2.15	36.00	4.54	2.50	60.00	6.36	3.50			
2.5	22.00	3.60	2.25	36.00	4.00	2.50	60.00	5.60	3.50			
2.7	22.00	3.33	2.25	36.00	4.44	3.00	60.00	5.18	3.50			
3.0	22.00	2.99	2.24	36.00	3.99	3.00	60.00	4.66	3.50			
3.3	22.00	2.72	2.24	36.00	3.63	3.00	60.00	4.24	3.50			
3.9	22.00	3.09	3.01	36.00	3.38	3.30						
4.7	22.00	2.55	3.00	36.00	2.97	3.50						
5.0	22.00	2.40	3.00	36.00	2.80	3.50						
5.6	22.00	2.14	3.00	36.00	2.50	3.50						
6.8	22.00	1.94	3.30	36.00	2.05	3.50						
7.5	22.00	1.76	3.30	36.00	1.86	3.50						
8.2	22.00	1.71	3.50	36.00	1.70	3.50						
10.0	22.00	1.40	3.50	36.00								

1. The combined DC and AC voltages should not exceed the DC ratings, see figure.
2. Capacitors may be operated at higher frequencies, at reduced RMS voltage such that max. AC current ratings are not exceeded.
3. Capacitors can handle pulse currents up to 100 times greater than the peak currents calculated from the rated RMS rating (provided slow repetition rates are used). If there is any doubt, a sketch of the voltage and current wave forms with time base should be sent to CRC for analysis.



CRC Component Research

Metallized Polycarbonate Capacitor - P12

Specifications

Construction: Metallized polycarbonate dielectric, hermetically sealed, extended metal film electrodes, axial leads isolated from case.

Environmental: Capacitors meet all environmental requirements and are qualified to MIL-C-83421/1.

Operating Temperature: -65°C to +100°C
At full rated voltage, derate linearly to 50% of rated voltage at 125°C.

Dielectric Absorption: 0.1% maximum
At 25°C when measured per MIL-C-83421.

Dissipation Factor: 0.15% maximum
At 25°C when measured per MIL-C-83421

AC Square Wave: 100 Hz, 60 seconds
At 25°C at a peak to peak voltage of 2 times rated DC voltage, terminal to terminal per MIl-C-83421.

Dielectric Strength: 150% rated DC voltage
At 25°C from terminal to terminal to case for 60 seconds minimum.

Temperature Coefficient: +1.5% to –1.0%; From +25°C to +125°C
–0.5% to –1.5%; From –55°C to –55°C

Capacitance Stability: ±0.2.5%
When measured at any two corresponding temperature points taken in five successive temperature cycles from –65°C to +125°C.

Hermetic Seal: $1x10^{-6}$ atm/cm^3/sec.
Maximum leak rate

Insulation Resistance: See Insulation Resistance Table
Measured from terminal to terminal at rated DC voltage and 5 minutes charge time. Values greater than 1 µF, allow an additional minute / µF charge time.

Minimum Insulation Resistance At Rated DC Voltage

For values over 0.5 µf divide limit shown by µF to obtain minimum I.R.

Example: A 0.68 µF capacitor at 25°C is 200,000 ÷ 0.68 = 294,000 megohms

Range	25°C	85°C	100°C	125°C
.001 to 0.5 F	4,000,000 Megohms	2,000,000 Megohms	30,000 Megohms	2,500 Megohms
Greater Than 0.5µ F	200,000 Megohms- µF	100,00 Megohms- µF	15,000 Megohms- µF	15,000 Megohms-µF

Quality Conformance Inspection

Test No.	Test	Test Conditions	Test Meth. MIL-C-83421	Test Limit	Quality Level
1	Burn-In	48 Hrs. minimum at 100°C, at 120% rated AC voltage at 400Hz	4.7.2	No physical damage	100% Test
2	Thermal Aging	10 cycles minimum from –65°C to +125°C	4.7.3	No physical damage	100% Test
3	Seal Test (Fine Leak)	Helium bomb 45 PSi for 1 hr. minimum, check for helium leak	4.7.5	$1x10^{-6}$ atm/cm^3/sec. max.	100% Test
4	Sel Test (Gross Leak)	Per MIL-C-83421	4.7.5	No continuous bubble stream	100% Test
5	AC square wave (Terminal to Terminal)	Apply 100 Hz at a peak to peak voltage of 2 times DC rated voltage for 60 seconds minimum'	4.7.6	No shorts	100% Test
6	DC Hi-Pot (Terminal to Terminal and Terminals to case)	Apply 150% of rated DC voltage for 60 seconds minimum.	4.7.6	No shorts	100% Test
7	Insulation Resistance (Terminal to Terminal)	At 25°C at rated DC voltage	4.7.7	20,000 megohm-uF need not exceed 400,000 megohms	100% Test
8	% Capacitance Tolerance	At 25°C at 1 KHz	4.7.8	Per Part Number	100% Test
9	% Dissipation Factor	At 25°C at 1 KHZ, values above 1 µF measure at 0.1 Khz	4.7.6	0.15% max.	100% Test
10	Visual and Mechanical Inspection	For marking dimensions, and workmanship	4.7.1	Per specification	1.0% AQL

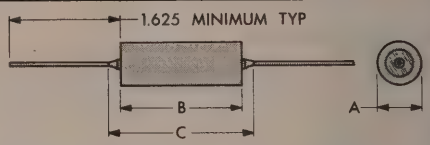
. Capacitors are packaged and shipped with Certification of Conformance. **2** .Traceability to production and test records by permanent marking of parts with date code lot. **3.** Process and inspection date is maintained on file per NHB 5300.4 (1C), MIL-Q-9858 and MIL-STD-790.

Component Research

Metallized Polycarbonate Capacitor - P12

Case Dimensions:
"A" Diameter
"B" Case Length
"C" Bead to Bead Max. Length

Tolerance Limits (inches)
±0.10 Without Sleeving; +0.02 / -0.00 With Mylar Sleeving
±0.03 With or Without Sleeving
The lengths shown in table are maximum and include solder beads.



Case Dimensions

For special values and tolerances please contact our application department

µF	50VDC Diam. A	50VDC Length B	50VDC Length C	100VDC Diam. A	100VDC Length B	100VDC Length C	200VDC Diam. A	200VDC Length B	200VDC Length C	400VDC Diam. A	400VDC Length B	400VDC Length C
.001	.170	.500	.600	.170	.500	.600	.170	.562	.662	.193	.562	.662
.0012	.170	.500	.600	.170	.500	.600	.170	.562	.662	.193	.562	.662
.0015	.170	.500	.600	.170	.500	.600	.170	.562	.662	.193	.562	.662
.0018	.170	.500	.600	.170	.500	.600	.170	.562	.662	.193	.562	.662
.002	.170	.500	.600	.170	.500	.600	.170	.662	.662	.193	.562	.662
.0022	.170	.500	.600	.170	.500	.600	.170	.562	.662	.193	.562	.662
.0027	.170	.500	.600	.170	.500	.600	.170	.562	.662	.193	.687	.787
.0033	.170	.500	.600	.170	.500	.600	.170	.562	.662	.193	.687	.787
.0039	.170	.500	.600	.170	.500	.600	.170	.562	.662	.193	.687	.787
.0047	.170	.500	.600	.170	.500	.600	.170	.562	.662	.193	.687	.787
.005	.170	.500	.600	.170	.500	.600	.170	.562	.662	.193	.687	.787
.0056	.170	.500	.600	.170	.500	.600	.170	.562	.662	.193	.687	.787
.0068	.170	.500	.600	.170	.500	.600	.193	.562	.662	.235	.687	.787
.0075	.170	.500	.600	.170	.500	.600	.193	.562	.662	.235	.687	.787
.0082	.170	.500	.600	.170	.500	.600	.193	.562	.662	.235	.687	.787
.01	.170	.500	.600	.170	.562	.662	.193	.687	.787	.312	.687	.787
.012	.170	.500	.600	.170	.562	.662	.193	.687	.787	.312	.687	.787
.015	.170	.500	.600	.170	.562	.662	.193	.687	.787	.312	.687	.787
.018	.170	.562	.662	.193	.562	.662	.235	.687	.787	.312	.813	.913
.02	.170	.562	.662	.193	.562	.662	.235	.687	.787	.312	.813	.913
.022	.170	.562	.662	.193	.562	.662	.235	.687	.787	.312	.813	.913
.027	.170	.562	.662	.193	.562	.662	.235	.687	.787	.312	.813	.913
.033	.170	.562	.662	.193	.562	.662	.235	.687	.787	.312	.813	.913
.039	.170	.562	.662	.193	.562	.662	.235	.687	.787	.312	.813	.913
.047	.193	.562	.662	.193	.687	.787	.312	.687	.787	.400	.813	.913
.05	.193	.562	.662	.193	.687	.787	.312	.687	.787	.400	.813	.913
.056	.193	.562	.662	.193	.687	.787	.312	.687	.787	.400	.813	.913
.068	.193	.562	.662	.193	.687	.787	.312	.687	.787	.400	.813	.913
.075	.193	.687	.787	.235	.687	.787	.312	.813	.913	.400	1.063	1.163
.082	.193	.687	.787	.235	.687	.787	.312	.813	.913	.400	1.063	1.163
.1	.193	.687	.787	.235	.687	.787	.312	.813	.913	.400	1.063	1.163
.12	.193	.687	.787	.235	.687	.787	.312	.813	.913	.400	1.063	1.163
.15	.235	.687	.787	.312	.687	.787	.312	.813	.913	.500	1.125	1.225
.18	.235	.687	.787	.312	.687	.787	.400	.813	.913	.500	1.125	1.225
.20	.235	.687	.787	.312	.687	.787	.400	.813	.913	.500	1.125	1.225
.22	.235	.687	.787	.312	.687	.787	.400	.813	.913	.500	1.125	1.225
.27	.312	.687	.787	.312	.813	.913	.400	1.063	1.163	.562	1.375	1.475
.33	.312	.687	.787	.312	.813	.913	.400	1.063	1.163	.562	1.375	1.475
.39	.312	.687	.787	.312	.813	.913	.400	1.063	1.163	.562	1.375	1.475
.47	.312	.813	.913	.400	.813	.913	.500	1.125	1.225	.670	1.375	1.475
.50	.312	.813	.913	.400	.813	.913	.500	1.125	1.225	.670	1.375	1.475
.56	.312	.813	.913	.400	.813	.913	.500	1.125	1.225	.670	1.375	1.475
.68	.400	.813	.913	.400	1.063	1.163	.562	1.375	1.475	.670	1.375	1.475
.75	.400	.813	.913	.400	1.063	1.163	.562	1.375	1.475	.670	1.375	1.475
.82	.400	.813	.913	.400	1.063	1.163	.562	1.375	1.475	.670	1.375	1.475
1.0	.400	.813	.913	.400	1.063	1.163	.562	1.375	1.475	.750	1.875	1.975
1.2	.400	1.063	1.163	.500	1.125	1.225	.670	1.375	1.475	.750	1.875	1.975
1.5	.400	1.063	1.163	.500	1.125	1.225	.670	1.375	1.475	.750	1.875	1.975
1.8	.500	1.125	1.225	.500	1.375	1.475	.670	1.875	1.975	1.000	1.875	1.975
2.0	.500	1.125	1.225	.500	1.375	1.475	.670	1.875	1.975	1.000	1.875	1.975
2.2	.500	1.125	1.225	.500	1.375	1.475	.670	1.875	1.975	1.000	1.875	1.975
2.5	.562	1.375	1.475	.670	1.375	1.475	.750	1.875	1.975	1.000	2.375	2.475
2.7	.562	1.375	1.475	.670	1.375	1.475	.750	1.875	1.975	1.000	2.375	2.475
3.0	.562	1.375	1.475	.670	1.375	1.475	.750	1.875	1.975	1.000	2.375	2.475
3.3	.562	1.375	1.475	.670	1.375	1.475	.750	1.875	1.975	1.000	2.375	2.475
3.9	.562	1.375	1.475	.670	1.375	1.475	.750	1.875	1.975			
4.7	.670	1.375	1.475	.670	1.875	1.975	1.000	1.875	1.975			
5.0	.670	1.375	1.475	.670	1.875	1.975	1.000	1.875	1.975			
5.6	.670	1.375	1.475	.670	1.875	1.975	1.000	1.875	1.975			
6.8	.670	1.375	1.475	.670	1.875	1.975	1.000	2.375	2.475			
7.5	.670	1.875	1.975	.750	1.875	1.975	1.000	2.375	2.475			
8.2	.670	1.875	1.975	.750	1.875	1.975	1.000	2.375	2.475			
10.0	.670	1.875	1.975	.750	1.875	1.975	1.000	2.375	2.475			
12.0	.750	1.875	1.975	1.000	1.875	1.975						
15.0	.750	1.875	1.975	1.000	1.875	1.975						
18.0	1.000	1.875	1.975	1.000	2.375	2.475						
20.0	1.000	1.875	1.975	1.000	2.375	2.475						
22.0	1.000	1.875	1.975	1.000	2.375	2.475						
25.0	1.000	2.375	2.475									
27.0	1.000	2.375	2.475									

P12 - B - 104 - J - S - W

Style

Voltage
B=50VDC
C=100VDC
D=200VDC
E=400VDC

Picofarad Code: First two digits represent significant figures, Last digit represents number of zeros to follow. Example: 104= 100,000 picofarads

Capacitance Tolerance
K=10% F=1% B=1/4%
J=5% D=1/2% G=2%

Sleeving Code
S=Mylar Sleeve
X=No Sleeve

Lead Code
W = Tinned copper clad steel: #22 (.025") for .312" case dia. & smaller; #20(.032" for .400" & .500" case dia.
C = Tinned oxygen-free copper:#18(.040") for .562" case dia & larger

Component Research • 1655 26th St., Santa Monica, CA 90404 • (310) 829-3615 Fax (310) 829-9584

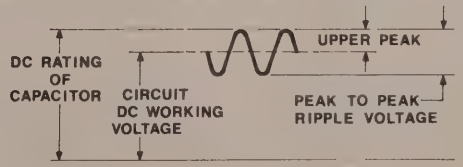
Component Research

Metallized Polycarbonate Capacitor - P12

AC Ratings

CAP µF	50VDC Volts RMS	50VDC Freq. In KHz	50VDC Amps RMS	100VDC Volts RMS	100VDC Freq. In KHz	100VDC Amps RMS	200VDC Volts RMS	200VDC Freq. In KHz	200VDC Amps RMS	400VDC Volts RMS	400VDC Freq. In KHz	400VDC Amps RMS
.001	36.0	40.00	.14	60.0	40.00	.14	120.0	40.00	.25	240.0	40.0	.4
.0012	36.0	40.00	.14	60.0	40.00	.14	120.0	40.00	.25	240.0	40.0	.4
.0015	36.0	40.00	.14	60.0	40.00	.14	120.0	40.00	.25	240.0	40.0	.4
.0018	36.0	40.00	.14	60.0	40.00	.14	120.0	40.00	.25	240.0	40.0	.4
.002	36.0	40.00	.14	60.0	40.00	.14	120.0	40.00	.25	240.0	40.0	.4
.0022	36.0	40.00	.14	60.0	40.00	.14	120.0	40.00	.25	240.0	40.0	.4
.0027	36.0	40.00	.14	60.0	40.00	.14	120.0	40.00	.25	240.0	40.0	.6
.0033	36.0	40.00	.14	60.0	40.00	.14	120.0	40.00	.25	240.0	40.0	.6
.0039	36.0	40.00	.14	60.0	40.00	.14	120.0	40.00	.25	240.0	40.0	.6
.0047	36.0	40.00	.14	60.0	40.00	.14	120.0	40.00	.25	240.0	40.0	.6
.005	36.0	40.00	.14	60.0	40.00	.14	120.0	40.00	.25	240.0	40.0	.6
.0056	36.0	40.00	.14	60.0	40.00	.14	120.0	40.00	.25	240.0	40.0	.6
.0068	36.0	40.00	.14	60.0	40.00	.14	120.0	40.00	.40	240.0	40.0	1.0
.0075	36.0	40.00	.14	60.0	40.00	.14	120.0	40.00	.40	240.0	40.0	1.0
.0082	36.0	40.00	.14	60.0	40.00	.14	120.0	40.00	.40	240.0	40.0	1.0
.01	36.0	40.00	.14	60.0	40.00	.25	120.0	40.00	.60	240.0	40.0	1.4
.012	36.0	40.00	.14	60.0	40.00	.25	120.0	40.00	.60	240.0	40.0	1.4
.015	36.0	40.00	.14	60.0	40.00	.25	120.0	40.00	.60	240.0	40.0	1.4
.018	36.0	40.00	.25	60.0	40.00	.40	120.0	40.00	1.00	240.0	40.0	1.6
.02	36.0	40.00	.25	60.0	40.00	.40	120.0	40.00	1.00	240.0	40.0	1.6
.022	36.0	40.00	.25	60.0	40.00	.40	120.0	40.00	1.00	240.0	40.0	1.6
.027	36.0	40.00	.25	60.0	40.00	.40	120.0	40.00	1.00	240.0	40.0	1.6
.033	36.0	40.00	.25	60.0	32.00	.40	120.0	40.00	1.00	240.0	32.3	1.6
.039	36.0	32.00	.28	60.0	29.00	.42	120.0	40.00	1.20	240.0	27.4	1.6
.047	36.0	32.00	.34	60.0	28.00	.50	120.0	39.70	1.40	240.0	25.5	1.8
.05	36.0	32.00	.36	60.0	28.00	.53	120.0	37.30	1.40	240.0	24.0	1.8
.056	36.0	31.70	.40	60.0	27.50	.58	120.0	33.30	1.40	240.0	21.4	1.8
.068	36.0	29.00	.45	60.0	27.40	.70	120.0	27.40	1.40	240.0	17.0	1.8
.075	36.0	29.00	.50	60.0	25.00	.70	120.0	27.00	1.50	240.0	17.0	2.0
.082	36.0	28.00	.53	60.0	25.00	.78	120.0	26.00	1.60	240.0	16.3	2.0
.1	36.0	26.60	.60	60.0	25.00	.94	120.0	21.30	1.60	240.0	13.3	2.0
.12	36.0	26.00	.70	60.0	25.00	1.10	120.0	17.80	1.60	240.0	11.1	2.0
.15	36.0	25.00	.85	60.0	24.80	1.40	120.0	16.00	1.80	240.0	11.0	2.4
.18	36.0	24.60	1.00	60.0	20.70	1.40	120.0	13.30	1.80	240.0	11.0	3.0
.20	36.0	22.20	1.00	60.0	18.70	1.40	120.0	12.00	1.80	240.0	10.0	3.0
.22	36.0	20.00	1.00	60.0	16.90	1.40	120.0	11.00	1.80	240.0	10.0	3.0
.27	36.0	20.00	1.20	60.0	15.80	1.60	120.0	10.00	2.00	240.0	10.0	4.2
.33	36.0	16.00	1.20	60.0	13.00	1.60	120.0	8.80	2.20	240.0	8.7	4.3
.39	36.0	14.00	1.20	60.0	11.00	1.60	120.0	8.20	2.40	240.0	7.3	4.3
.47	36.0	14.00	1.50	60.0	10.20	1.80	120.0	8.00	2.80	240.0	6.4	4.5
.50	36.0	13.30	1.50	60.0	9.60	1.80	120.0	8.00	3.00	240.0	6.0	4.5
.56	36.0	11.90	1.50	60.0	8.60	1.80	120.0	7.60	3.20	240.0	5.4	4.5
.68	36.0	11.90	1.80	60.0	7.80	2.00	120.0	7.40	3.80	240.0	5.0	5.0
.75	36.0	10.60	1.80	60.0	7.10	2.00	120.0	7.40	4.20	240.0	4.4	5.0
.82	36.0	9.75	1.80	60.0	6.50	2.00	120.0	7.00	4.30	240.0	4.1	5.0
1.0	36.0	8.00	1.80	60.0	5.80	2.20	120.0	5.70	4.30	240.0	3.3	5.0
1.2	36.0	7.40	2.00	60.0	5.70	2.60	120.0	5.00	4.50	240.0	3.3	6.0
1.5	36.0	5.90	2.00	60.0	5.30	3.00	120.0	4.00	4.50	240.0	2.7	6.0
1.8	36.0	5.70	2.30	60.0	5.10	3.50	120.0	3.70	5.00	240.0	2.4	6.4
2.0	36.0	5.10	2.30	60.0	4.70	3.50	120.0	3.30	5.00	240.0	2.1	6.4
2.2	36.0	4.50	2.60	60.0	4.20	3.50	120.0	3.00	5.00	240.0	2.0	6.4
2.5	36.0	4.60	2.60	60.0	4.80	4.50	120.0	3.20	6.00	240.0	1.9	7.0
2.7	36.0	4.30	2.60	60.0	4.40	4.50	120.0	3.00	6.00	240.0	1.7	7.0
3.0	36.0	3.90	2.60	60.0	4.00	4.50	120.0	2.70	6.00	240.0	1.6	7.0
3.3	36.0	3.50	2.60	60.0	3.60	4.50	120.0	2.40	6.00	240.0	1.4	7.0
3.9	36.0	3.00	2.60	60.0	3.10	4.50	120.0	2.10	6.00			
4.7	36.0	2.80	3.00	60.0	2.80	5.00	120.0	1.80	6.40			
5.0	36.0	2.60	3.00	60.0	2.70	5.00	120.0	1.70	6.40			
5.6	36.0	2.40	3.00	60.0	2.40	5.00	120.0	1.50	6.40			
6.8	36.0	2.00	3.00	60.0	2.00	5.00	120.0	1.30	6.40			
7.5	36.0	2.00	3.50	60.0	2.00	6.00	120.0	1.20	7.00			
8.2	36.0	1.90	3.50	60.0	1.95	6.00	120.0	1.14	7.00			
10.0	36.0	1.60	3.50	60.0	1.60	6.00	120.0	.93	7.00			
12.0	36.0	1.50	4.00	60.0	1.42	6.40						
15.0	36.0	1.20	4.00	60.0	1.14	6.40						
18.0	36.0	1.18	4.80	60.0	.98	6.60						
20.0	36.0	1.10	4.80	60.0	.88	6.60						
22.0	36.0	.97	4.80	60.0	.80	6.60						
25.0	36.0	.96	5.40									
27.0	36.0	.88	5.40									

1. The combined DC and AC voltages should not exceed the DC ratings, see figure.
2. Capacitors may be operated at higher frequencies, at reduced RMS voltage such that max. AC current ratings are not exceeded.
3. Capacitors can handle pulse currents up to 100 times greater than the peak currents calculated from the rated RMS rating (provided slow repetition rates are used). If there is any doubt, a sketch of the voltage and current wave forms with time base should be sent to CRC for analysis.



Component Research

Metallized Polypropylene Capacitor - C15

Specifications

Construction: Metallized polypropylene dielectric, hermetically sealed, extended metal film electrodes, axial leads isolated from case.

Operating Temperature: -55°C to +105°C
At voltage and current shown in table.

Dielectric Absorption: 0.2% maximum
At 25°C when measured per MIL-C-83421.

Dissipation Factor: 0.07% maximum
At 25°C when measured per MIL-C-83421 at 1KHz.

AC Square Wave: 1000 Hz, 60 seconds minimum
At 25°C at a peak to peak voltage of 3 times rated DC voltage, terminal to terminal. Do not exceed 800V P/P.

Dielectric Strength: 200% rated DC voltage
At 25°C from terminal to terminal and terminals to case for 60 seconds minimum.

Dielectric Strength: 200% rated DC voltage
At 25°C from terminal to terminal and terminals to case for 60 seconds minimum.

Temperature Coefficient: 0 to -4% max; From 25°C to +105°C
0 to +3% max; From 25°C to -55°C

Capacitance Stability: ±0.25% max.
When measured at any two corresponding temperature points taken in five successive temperature cycles from -55°C to +105°C.

Hermetic Seal: $1x10^{-6}$ atm/cm^3/sec.
Maximum leak rate

Insulation Resistance: See Insulation Resistance Table
Measured from terminal to terminal at rated DC voltage and 5 minutes charge time. Values greater than 1 µF, allow an additional minute / µF charge time.

Equivalent Series Resistance: Per Table
At 25°C at 100KHz.

Minimum Insulation Resistance At Rated DC Voltage

For values over 0.1 µf divide limit shown by µF to obtain minimum I.R.

Example: A 0.18 µF capacitor at 25°C is 300,000 ÷ 0.18 = 1,666,666 megohms

Range	25°C	85°C	105°C
.001 to 0.1 uF	3,000,000 Megohms	150,000 Megohms	20,000 Megohms
Greater Than 0.1µ F	300,000 Megohms- µF	15,00 Megohms- µF	2,000 Megohms- µF

Quality Conformance Inspection

Test No.	Test	Test Conditions	Test Meth. MIL-C-83421	Test Limit	Quality Level A12
1	Burn-In	24 Hrs. minimum at 85°C, at rated current at 40KHz	4.7.2	No physical damage	100% Test
2	Thermal Aging	10 cycles minimum from -65°C to +105°C	4.7.3	No physical damage	100% Test
3	Seal Test (Fine Leak)	Helium bomb 45 PSi for 1 hr. minimum, check for helium leak	4.7.5	$1x10^{-6}$ atm/cm^3/sec. max.	100% Test
4	Sel Test (Gross Leak)	Per MIL-C-83421	4.7.5	No continuous bubble stream	100% Test
5	AC square wave (Terminal to Terminal)	Apply 100 Hz at a peak to peak voltage of 3 times DC rated voltage for 60 seconds minimum'	4.7.6	No shorts	100% Test
6	DC Hi-Pot (Terminal to Terminal and Terminals to case)	Apply 200% of rated DC voltage for 60 seconds minimum.	4.7.6	No shorts	100% Test
7	Insulation Resistance (Terminal to Terminal)	At 25°C at rated DC voltage	4.7.7	300,000 megohms-uF need not exceed 3,000,000 megohms	100% Test
8	% Capacitance Tolerance	At 25°C at 1 KHz	4.7.8	0.07% max.	100% Test
9	% Dissipation Factor	At 25°C at 100KHz 1 µF measure at 0.1 Khz	4.7.9	Per table.	100% Test
10	Equivalent Series Resistance	At 25° at 100KHz	TBD	Per table.	100% Test
11	Visual & Mechanical Inspection	For marking, dimensions, & workmanship	4.7.1	Per specification	1.0% AQL

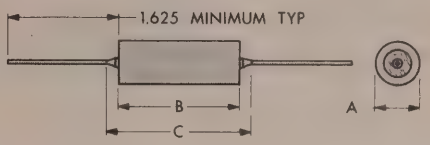
1. Capacitors are packaged and shipped with Certification of Conformance. **2.** Traceability to production and test records by permanent marking of parts with date code lot. **3.** Process and inspection date is maintained on file per NHB 5300.4(1C), MIL-Q-9858 and MIL-STD-790.

Component Research

Metallized Polypropylene Capacitor - C15

Case Dimensions:
A" Diameter
B" Case Length
C" Bead to Bead Max. Length

Tolerance Limits (inches)
±0.10Without Sleeving; =0.02 / -0.00 With Mylar Sleeving
±0.03 / -.09 With or Without Sleeving
"C" dimension is 0.2" maximum more than "B" dimensions in table



Case Dimensions • AC Ratings

For special values and tolerances please contact our application department

* Part No.	uF	Rated VDC	Diam. A	E. S. R. Length B	E. S. R. (Ohms) Max. @ 100kHz	E. S. R. Rated VRMS @ 400Hz	25°C Max. ARMS	35°C Max. ARMS	45°C Max. ARMS	55°C Max. ARMS	65°C Max. ARMS	75°C Max. ARMS	85°C Max. ARMS	95°C Max. ARMS	105°C Max. ARMS
C15C474-SC	0.470	100	0.400	0.875	0.025	60	5.3	4.9	4.6	4.2	3.7	3.2	2.6	1.9	0.8
C15C564-SC	0.560	100	0.500	0.875	0.024	60	6.0	5.6	5.2	4.8	4.3	3.7	3.0	2.1	1.0
C15C684-SC	0.680	100	0.500	0.875	0.023	60	6.2	5.8	5.4	4.9	4.4	3.8	3.1	2.2	1.0
C15C824-SC	0.820	100	0.500	0.875	0.022	60	6.3	5.9	5.5	5.0	4.5	3.9	3.2	2.2	1.0
C15C105-SC	1.000	100	0.562	0.906	0.017	60	7.7	7.2	6.7	6.1	5.4	4.7	3.9	2.7	1.2
C15C205-SC	2.000	100	0.670	1.094	0.014	60	10.3	9.7	8.9	8.2	7.3	6.3	5.2	3.7	1.6
C15C305-SC	3.000	100	0.750	1.094	0.013	60	11.4	10.7	9.9	9.0	8.1	7.0	5.7	4.0	1.8
C15C505-SC	5.000	100	0.750	1.406	0.012	60	13.6	12.7	11.8	10.7	9.6	8.3	6.8	4.8	2.1
C15C106-SC	10.000	100	1.000	1.687	0.010	60	15.0	15.0	15.0	14.3	12.8	11.1	9.1	6.4	2.9
C15C206-SC	20.000	100	1.000	2.437	0.009	60	15.0	15.0	15.0	15.0	15.0	14.1	11.5	8.2	3.6
C15C256-SC	25.000	100	1.000	2.437	0.008	60	15.0	15.0	15.0	15.0	15.0	14.4	11.7	8.3	3.7
C15D184-SC	0.180	200	0.400	0.875	0.031	120	4.8	4.5	4.0	3.8	3.4	2.9	2.4	1.7	0.8
C15D224-SC	0.220	200	0.500	0.875	0.030	120	5.4	5.1	4.7	4.3	3.8	3.3	2.7	1.9	0.9
C15D274-SC	0.270	200	0.500	0.875	0.029	120	5.5	5.2	4.8	4.4	3.9	3.4	2.8	2.0	0.9
C15D334-SC	0.330	200	0.500	0.875	0.028	120	5.6	5.3	4.9	4.5	4.0	3.5	2.8	2.0	0.9
C15D394-SC	0.390	200	0.562	0.906	0.026	120	6.2	5.8	5.4	4.9	4.4	3.8	3.1	2.2	1.0
C15D474-SC	0.470	200	0.562	1.094	0.025	120	7.0	6.5	6.1	5.5	4.9	4.3	3.5	2.5	1.1
C15D564-SC	0.560	200	0.562	1.094	0.024	120	7.2	6.7	6.2	5.7	5.1	4.4	3.6	2.5	1.1
C15D684-SC	0.680	200	0.670	1.094	0.023	120	8.0	7.5	6.9	6.3	5.7	4.9	4.0	2.8	1.3
C15D824-SC	0.820	200	0.670	1.094	0.022	120	8.2	7.7	7.1	6.5	5.8	5.0	4.1	2.9	1.3
C15D105-SC	1.000	200	0.670	1.094	0.021	120	8.4	7.9	7.3	6.7	6.0	5.2	4.2	3.0	1.3
C15D205-SC	2.000	200	0.750	1.406	0.017	120	11.1	10.4	9.6	8.8	7.8	6.8	5.5	3.9	1.8
C15D305-SC	3.000	200	1.000	1.437	0.015	120	13.9	13.0	12.0	11.0	9.8	8.5	7.0	4.9	2.2
C15D505-SC	5.000	200	1.000	1.687	0.013	120	15.0	15.0	14.2	12.9	11.6	10.0	8.2	5.8	2.6
C15E102-SW	0.0010	400	0.235	0.562	1.000	240	0.49	0.46	0.42	0.39	0.35	0.30	0.25	0.17	0.08
C15E122-SW	0.0012	400	0.235	0.562	0.950	240	0.50	0.47	0.44	0.40	0.36	0.31	0.25	0.18	0.08
C15E152-SW	0.0015	400	0.235	0.562	0.900	240	0.52	0.48	0.45	0.41	0.37	0.32	0.26	0.18	0.08
C15E182-SW	0.0018	400	0.235	0.562	0.850	240	0.53	0.50	0.46	0.42	0.38	0.33	0.27	0.19	0.08
C15E202-SW	0.0020	400	0.235	0.562	0.750	240	0.57	0.53	0.49	0.45	0.40	0.35	0.28	0.20	0.09
C15E222-SW	0.0022	400	0.235	0.562	0.700	240	0.59	0.55	0.51	0.46	0.41	0.36	0.29	0.21	0.09
C15E272-SW	0.0027	400	0.235	0.562	0.650	240	0.61	0.57	0.53	0.48	0.43	0.37	0.30	0.22	0.10
C15E332-SW	0.0033	400	0.235	0.562	0.600	240	0.63	0.59	0.55	0.50	0.45	0.39	0.32	0.22	0.10
C15E392-SW	0.0039	400	0.235	0.562	0.550	240	0.66	0.62	0.57	0.52	0.47	0.41	0.33	0.23	0.10
C15E472-SW	0.0047	400	0.235	0.562	0.500	240	0.69	0.65	0.60	0.55	0.49	0.42	0.35	0.25	0.11
C15E562-SW	0.0056	400	0.235	0.687	0.450	240	0.80	0.74	0.69	0.63	0.56	0.49	0.40	0.28	0.13
C15E682-SW	0.0068	400	0.235	0.687	0.350	240	0.90	0.84	0.78	0.71	0.64	0.55	0.45	0.32	0.14
C15E822-SW	0.0082	400	0.235	0.687	0.300	240	0.97	0.91	0.84	0.77	0.69	0.60	0.49	0.34	0.15
C15E103-SW	0.0100	400	0.235	0.687	0.260	240	1.05	0.98	0.91	0.83	0.74	0.64	0.52	0.37	0.17
C15E123-SW	0.0120	400	0.235	0.687	0.200	240	1.19	1.12	1.03	0.94	0.84	0.73	0.60	0.42	0.19
C15E153-SW	0.0150	400	0.312	0.813	0.120	240	1.95	1.82	1.69	1.54	1.38	1.19	0.97	0.69	0.31
C15E183-SW	0.0180	400	0.312	0.813	0.110	240	2.04	1.90	1.76	1.61	1.44	1.25	1.02	0.72	0.32
C15E203-SW	0.0200	400	0.312	0.813	0.100	240	2.14	2.00	1.85	1.69	1.51	1.31	1.07	0.75	0.34
C15E223-SW	0.0220	400	0.312	0.813	0.090	240	2.25	2.11	1.95	1.78	1.59	1.38	1.13	0.80	0.36
C15E273-SW	0.0270	400	0.312	0.813	0.090	240	2.32	2.17	2.01	1.83	1.64	1.42	1.16	0.82	0.37
C15E333-SC	0.0330	400	0.400	0.875	0.080	240	1.85	2.66	2.47	2.25	2.01	1.74	1.42	1.01	0.45
C15E393-SC	0.0390	400	0.400	0.875	0.070	240	3.04	2.85	2.64	2.41	2.15	1.86	1.52	1.08	0.48
C15E473-SC	0.0470	400	0.400	0.875	0.060	240	3.29	3.08	2.85	2.60	2.32	2.01	1.64	1.16	0.52
C15E563-SC	0.056	400	0.400	0.875	0.058	240	3.5	3.3	3.0	2.8	2.5	2.1	1.7	1.2	0.6
C15E683-SC	0.068	400	0.500	0.875	0.046	240	4.4	4.1	3.8	3.5	3.1	2.7	2.2	1.5	0.7
C15E823-SC	0.082	400	0.500	0.875	0.039	240	4.7	4.4	4.1	3.7	3.4	2.9	2.4	1.7	0.7
C15E104-SC	0.100	400	0.500	0.875	0.035	240	5.0	4.7	4.4	4.0	3.6	3.1	2.5	1.8	0.8
C15E124-SC	0.120	400	0.562	0.906	0.033	240	5.5	5.2	4.8	4.4	3.9	3.4	2.8	2.2	0.9
C15E154-SC	0.150	400	0.670	0.906	0.032	240	6.2	5.8	5.3	4.9	4.4	3.8	3.1	2.2	1.0
C15E184-SC	0.180	400	0.670	0.906	0.031	240	6.3	5.9	5.4	5.0	4.4	3.8	3.1	2.2	1.0
C15E224-SC	0.220	400	0.670	1.094	0.030	240	7.0	6.6	6.1	5.6	5.0	4.3	3.5	2.5	1.1
C15E274-SC	0.270	400	0.670	1.094	0.029	240	7.2	6.7	6.2	5.7	5.1	4.4	3.6	2.5	1.1
C15E334-SC	0.330	400	0.670	1.094	0.028	240	7.3	6.8	6.3	5.8	5.2	4.5	3.7	2.6	1.2
C15E394-SC	0.390	400	0.750	1.094	0.026	240	7.9	7.4	6.8	6.2	5.6	4.8	3.9	2.8	1.2
C15E474-SC	0.470	400	0.750	1.094	0.025	240	8.1	7.6	7.0	6.4	5.7	4.9	4.0	2.9	1.3
C15E564-SC	0.560	400	0.750	1.406	0.025	240	9.2	8.6	7.9	7.2	6.5	5.6	4.6	3.2	1.4
C15E684-SC	0.680	400	0.750	1.406	0.024	240	9.4	8.8	8.1	7.4	6.6	5.7	4.7	3.3	1.5
C15E824-SC	0.820	400	0.750	1.656	0.023	240	10.4	9.7	9.0	8.2	7.4	6.4	5.2	3.7	1.6
C15E105-SC	1.000	400	0.750	1.656	0.022	240	10.7	10.0	9.3	8.5	7.6	6.5	5.3	3.8	1.7
C15E205-SC	2.000	400	1.000	1.938	0.017	240	15.0	14.1	13.0	11.9	10.6	9.2	7.5	5.3	2.4

To complete Part Number, select capacitance-tolerance letter from list below, and insert as 8th character.

K = 10%
J = 5%
G = 2%
F = 1%
D = 1/2%
B = 1/4%
A = 1/10%

If insulated sleeving is not desired then replace the ninth character "S" with and "X".

Component Research

Metallized Teflon Capacitor - J11

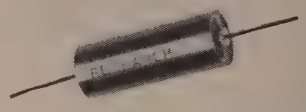
Product Features

High Insulation Resistance: 10,000,000 megohms Minimum. (For J11 Series, All Values Up To 0.1uF).

Low Dielectric Absorption: 0.01% maximum voltage recovery.

Long Term Stability: Less than 0.5% capacitance drift after 2000 hrs. at 125°C at rated volts.

Series 11 Capacitors have been qualified for use in space and missile systems where maximum reliability and low dielectric loss are essential.



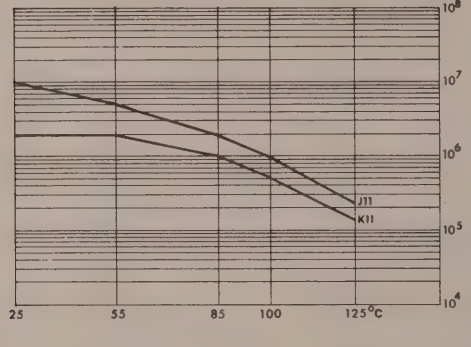
.068 µF 50VDC Actual size capacitor

Typical Applications

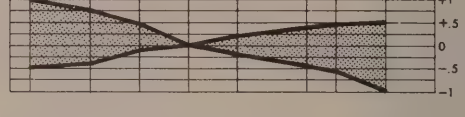
- Critical Timing Circuits
- Fixed Tuning Circuits
- Temperature Compensation
- Coupling and Decoupling
- Feedback Circuits
- Gyro Circuits
- Integrating Circuits

Typical Curves

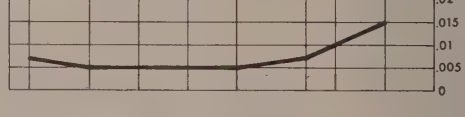
Insulation Resistance with Temperature in Megohms (0.1 µF or less)



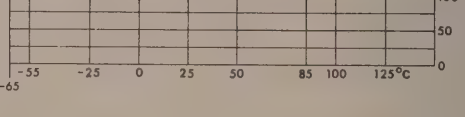
% Capacitance Change with Temperature



% Dissipation Factor with Temperature



% Voltage Rating with Temperature



Life Test Data CRC Test Report

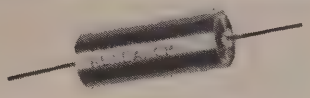
List of Capacitors Submitted to Life Test			Insulation Resistance In Megohms at 25°C			%Capacitance Change with Life			%Dissipation Factor at 25°C with Life		
CRC Type	µF Value	Q'ty Tested	Post Test Limits (min. I.R.)	Test Results Low	Test Results High	Post Test Limits (Max. C)	Test Results Low	Test Results High	Post Test Limits Max. D.F.)	Test Results Low	Test Results High
D11B	0.1	12	$5x10^5$	$3.9x10^6$	$5x10^7$	±1	-.035	-.35	.2	.01	.065
D11B	0.22	32	$5x10^5$	$2x10^6$	$2.5x10^7$	±1	-.01	+.85	.2	.005	.075
D11B	0.47	11	$5x10^5$	$1x10^6$	$1x10^6$	±1	-.005	+.58	.2	.01	.10
D11B	1.0	6	$2.5x10^5$	$5.2x10^5$	$3.8x10^6$	±1	-.005	+.24	.2	.01	.12
D11B	0.5	20	$5x10^5$	$3.8x10^6$	$5x10^7$	±1	-.02	+.48	.2	.01	.02

Test results for 80 Series D11B Capacitors life tested for 2000 hours at 125°C at 140% of rated DC voltage. There were no failures for this test. D11B capacitors are the same construction and design as J11 Series.

CRC Component Research

Metallized Teflon Capacitor - J11

Specifications



Construction: Metallized teflon dielectric, hermetically sealed, extended metal film electrodes, axial leads isolated from case.

Environmental: Capacitors meet all environmental requirements of MIL-C-83421, except vibration at 20g & shock at 50g.

Operating Temperature: -65°C to +125°C
At full rated voltage.

Dielectric Absorption: 0.01% maximum
At 25°C when measured per MIL-C-83421.

Dissipation Factor: 0.05% maximum
At 25°C when measured per MIL-C-83421

Dielectric Strength: 200% rated DC voltage
At 25°C from terminal to terminal and terminals to case for 60 seconds minimum.

Temperature Coefficient: Referenced to 25°C
-55°C; From -0.5°C to +1.0°C

Temperature Coefficient (cont.): -25°C; From -0.35% to +0.75%
0°C; From -0.1% to +0.45%
50°C; From -0.2% to +0.2%
85°C; From -0.45% to +0.4%
100°C; From -0.65% to +0.45%
125°C; From -1.0% to +0.5%

Capacitance Stability: ±0.10%
When measured at any two corresponding temperature points taken in five successive temperature cycles from -65°C to +125°C.

Hermetic Seal: $1x10^{-6}$ atm/cm^3/sec.
Maximum leak rate

Insulation Resistance: See Insulation Resistance Table
Measured from terminal to terminal at rated DC voltage and 5 minutes charge time. Values greater than 1 µF, allow an additional minute/ µF charge time.

Minimum Insulation Resistance At Rated DC Voltage

For values over 0.1 µf divide limit shown by µF to obtain minimum I.R.

Example: A 0.68 µF capacitor at 25°C is 1,000,000/0.68 = 1,475,000 megohms.

Range	25°C	55°C	85°C	100°C	125°C
.001 to 0.1 F	10,000,000 Megohms	5,000,000 Megohms	2,000,000 Megohms	1,000,000 Megohms	250,000 Megohms
Greater Than 0.1µ F	1,000,000 Megohms- µF	500,000 Megohms- µF	200,000 Megohms- µF	100,000 Megohms-µF	25,000 Megohms- µF

Quality Conformance Inspection

Test No.	Test	Test Conditions	Test Meth. MIL-C-83421	Test Limit	Quality Level A12
1	Burn-In	48 Hrs. minimum at 125°C, at 140% rated DC voltage	4.7.2	No physical damage	100% Test
2	Thermal Aging	10 cycles minimum from -65°C to +125°C	4.7.3	No physical damage	100% Test
3	Seal Test (Fine Leak)	Helium bomb 45 PSi for 1 hr. minimum, check for helium leak	4.7.5	$1x10^{-6}$ atm/cm^3/sec. max.	100% Test
4	Seal Test (Gross Leak)	Per MIL-C-83421	4.7.5	No continuous bubble stream	100% Test
5	DC Hi-Pot	Apply 200% of rated DC voltage for 60 seconds minimum	4.7.6	No shorts	100% Test
6	Insulation Resistance (Terminal to Terminal)	At 25°C at rated DC voltage	4.7.7	Per I.R. Table	100% Test
7	% Capacitance Tolerance	At 25°C at 1 KHz	4.7.8	Per Part Number	100% Test
8	% Dissipation Factor	At 25°C at 1 KHZ, values above 1 µF measure at 0.1 Khz	4.7.9	0.05% max.	100% Test
9	Visual and Mechanical Inspection	For marking dimensions, and workmanship	4.7.1	Per specification	1.0% AQL

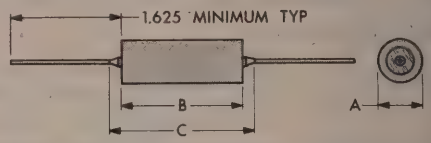
. Capacitors are packaged and shipped with Certification of Conformance. **2.**Traceability to production and test records by permanent marking of parts with date code lot. **3.** Process and inspection date is maintained on file per NHB 5300.4 (1C), MIL-Q-9858 and MIL-STD-790.

Component Research

Metallized Teflon Capacitor - J11

Case Dimensions:
"A" Diameter
"B" Case Length
"C" Bead to Bead Max. Length

Tolerance Limits (inches)
±0.010 Without Sleeving; +0.02 /-0.00 With Mylar Sleeving
±0.03 With or Without Sleeving
The lengths shown in table are maximum and include solder beads.



Case Dimensions

For special values and tolerances please contact our application department

	50 VDC				100 VDC				200 VDC			
UF	J11	Diam. A	Length B	Length C	J11	Diam. A	Length B	Length C	J11	Diam. A	Length B	Length C
.001	J11B102	.235	.687	.887	J11C102	.235	.687	.887	J11D102	.235	.687	.887
.0012	J11B122	.235	.687	.887	J11C122	.235	.687	.887	J11D122	.235	.687	.887
.0015	J11B152	.235	.687	.887	J11C152	.235	.687	.887	J11D152	.235	.687	.887
.0018	J11B182	.235	.687	.887	J11C182	.235	.687	.887	J11D182	.235	.687	.887
.002	J11B202	.235	.687	.887	J11C202	.235	.687	.887	J11D202	.235	.687	.887
.0022	J11B222	.235	.687	.887	J11C222	.235	.687	.887	J11D222	.235	.687	.887
.0027	J11B272	.235	.687	.887	J11C272	.235	.687	.887	J11D272	.235	.687	.887
.0033	J11B332	.235	.687	.887	J11C332	.235	.687	.887	J11D332	.235	.687	.887
.0039	J11B392	.235	.687	.887	J11C392	.235	.687	.887	J11D392	.235	.687	.887
.0047	J11B472	.235	.687	.887	J11C472	.235	.687	.887	J11D472	.235	.687	.887
.005	J11B502	.235	.687	.887	J11C502	.235	.687	.887	J11D502	.235	.687	.887
.0056	J11B562	.235	.687	.887	J11C562	.235	.687	.887	J11D562	.235	.687	.887
.0068	J11B682	.235	.687	.887	J11C682	.235	.687	.887	J11D682	.235	.687	.887
.0082	J11B822	.235	.687	.887	J11C822	.235	.687	.887	J11D822	.235	.687	.887
.01	J11B103	.235	.687	.887	J11C103	.235	.687	.887	J11D103	.235	.687	.887
.012	J11B123	.235	.687	.887	J11C123	.235	.687	.887	J11D123	.235	.687	.887
.015	J11B153	.312	.687	.887	J11C153	.312	.687	.887	J11D153	.312	.687	.887
.018	J11B183	.312	.687	.887	J11C183	.312	.687	.887	J11D183	.312	.813	1.013
.02	J11B203	.312	.687	.887	J11C203	.312	.687	.887	J11D203	.312	.813	1.013
.022	J11B223	.312	.687	.887	J11C223	.312	.687	.887	J11D223	.312	.813	1.013
.027	J11B273	.312	.687	.887	J11C273	.312	.813	1.013	J11D273	.312	.813	1.013
.033	J11B333	.312	.687	.887	J11C333	.312	.813	1.013	J11D333	.400	.813	1.013
.039	J11B393	.312	.687	.887	J11C393	.400	.813	1.013	J11D393	.400	1.063	1.263
.047	J11B473	.312	.687	.887	J11C473	.400	.813	1.013	J11D473	.400	1.063	1.263
.05	J11B503	.312	.687	.887	J11C503	.400	.813	1.013	J11D503	.400	1.063	1.263
.056	J11B563	.312	.813	1.013	J11C563	.400	.813	1.013	J11D563	.400	1.063	1.263
.068	J11B683	.312	.813	1.013	J11C683	.400	.813	1.013	J11D683	.400	1.063	1.263
.082	J11B823	.312	.937	1.137	J11C823	.400	1.063	1.263	J11D823	.500	1.125	1.325
.1	J11B104	.312	.937	1.137	J11C104	.400	1.063	1.263	J11D104	.500	1.125	1.325
.12	J11B124	.312	1.063	1.263	J11C124	.500	1.125	1.325	J11D124	.500	1.375	1.575
.15	J11B154	.312	1.063	1.263	J11C154	.500	1.125	1.325	J11D154	.562	1.375	1.575
.18	J11B184	.400	1.063	1.263	J11C184	.500	1.125	1.325	J11D184	.562	1.375	1.575
.20	J11B204	.400	1.063	1.263	J11C204	.562	1.125	1.325	J11D204	.562	1.375	1.575
.22	J11B224	.400	1.063	1.263	J11C224	.562	1.125	1.325	J11D224	.562	1.375	1.575
.27	J11B274	.400	1.063	1.263	J11C274	.562	1.125	1.325	J11D274	.670	1.375	1.575
.33	J11B334	.500	1.125	1.325	J11C334	.562	1.125	1.325	J11D334	.670	1.375	1.575
.39	J11B394	.500	1.125	1.325	J11C394	.562	1.375	1.575	J11D394	.562	1.875	2.075
.47	J11B474	.562	1.125	1.325	J11C474	.670	1.375	1.575	J11D474	.670	1.875	2.075
.50	J11B504	.562	1.125	1.325	J11C504	.670	1.375	1.575	J11D504	.670	1.875	2.075
.56	J11B564	.562	1.125	1.325	J11C564	.670	1.375	1.575	J11D564	.670	1.875	2.075
.68	J11B684	.562	1.125	1.325	J11C684	.670	1.875	2.075	J11D684	.750	1.875	2.075
.82	J11B824	.562	1.375	1.575	J11C824	.670	1.875	2.075	J11D824	.750	1.875	2.075
1.0	J11B105	.670	1.375	1.575	J11C105	.670	1.875	2.075	J11D105	.750	1.875	2.075
1.5	J11B155	.670	1.875	2.075	J11C155	.750	1.875	2.075	J11D155	1.00	1.875	2.075
2.0	J11B205	.670	1.875	2.075	J11C205	1.00	1.875	2.075	J11D205	1.00	2.375	2.575

J11 - B - 104 - J - S - A

Style

Voltage
B=50VDC
C=100VDC
D=200VDC

Picofarad Code: First two digits represent significant figures, Last digit represents number of zeros to follow. Example: 104= 100,000 picofarads

Capacitance Tolerance
K=10% D = 1/2%
J=5% B = 1/4%
G=2% A = .1%
F=1%

Sleeving Code
S=Mylar Sleeve
X=No Sleeve

Lead Code
W=Tinned copper clad steel: #22 (.025") for .312" case dia. & smaller; #20(.032") for .400" case dia. & larger.

CRC Component Research

High Temperature Metallized Teflon Capacitor - H11

Specifications

Construction: Metallized teflon dielectric, hermetically sealed, extended metal film electrodes, axial leads isolated from case.

Environmental: Capacitors meet all environmental requirements of MIL-C-83421, except vibration at 20g & shock at 50g.

Operating Temperature: -65°C to +200°C
At full rated voltage.

Dielectric Absorption: 0.01% maximum
At 25°C when measured per MIL-C-83421.

Dissipation Factor: 0.05% maximum
At 25°C when measured per MIL-C-83421

Dielectric Strength: 200% rated DC voltage
At 25°C from terminal to terminal & terminals to case for 60 seconds minimum.

Temperature Coefficient: -65%; From ±2.0% max.
+125°C; From ±3.0% max.
+200°C; From ±3.5% max.

Capacitance Stability: ±0.10%
When measured at any two corresponding temperature points taken in five successive temperature cycles from -65°C to +125°C.

Hermetic Seal: $1x10^{-6}$ atm/cm^3/sec.
Maximum leak rate

Insulation Resistance: See Insulation Resistance Table
Measured from terminal to terminal at rated DC voltage and 5 minutes charge time. Values greater than 1 µF, allow an additional minute / µF charge time.

Minimum Insulation Resistance At Rated DC Voltage

For values over 0.1 µf divide limit shown by µF to obtain minimum I.R.

Example: A 0.68 µF capacitor at 25°C is 1,000,000/0.68 = 1,475,000 megohms.

Range	25°C	55°C	85°C	100°C	125°C
.001 to 0.1 F	10,000,000 Megohms	5,000,000 Megohms	2,000,000 Megohms	1,000,000 Megohms	250,000 Megohms
Greater Than 0.1µ F	1,000,000 Megohms- µF	500,000 Megohms- µF	200,000 Megohms- µF	100,000 Megohms-µF	25,000 Megohms- µF

Quality Conformance Inspection

Test No.	Test	Test Conditions	Test Meth. MIL-C-83421	Test Limit	Quality Level A12
1	Burn-In	48 Hrs. minimum at 125°C, at 140% rated DC voltage	4.7.2	No physical damage	100% Test
2	Thermal Aging	10 cycles minimum from -65°C to +125°C	4.7.3	No physical damage	100% Test
3	Seal Test (Fine Leak)	Helium bomb 45 PSi for 1 hr. minimum, check for helium leak	4.7.5	$1x10^{-6}$ atm/cm^3/sec. max.	100% Test
4	Seal Test (Gross Leak)	Per MIL-C-83421	4.7.5	No continuous bubble stream	100% Test
5	DC Hi-Pot (Terminal to Terminal and Terminals to case)	Apply 200% of rated DC voltage for 60 seconds minimum.	4.7.6	No shorts	100% Test
6	Insulation Resistance (Terminal to Terminal)	At 25°C at rated DC voltage	4.7.7	Per I.R. Table	100% Test
7	% Capacitance Tolerance	At 25°C at 1 KHz	4.7.8	Per Part Number	100% Test
8	% Dissipation Factor	At 25°C at 1 KHZ, values above 1 µF measure at 0.1 Khz	4.7.9	0.5% max.	100% Test
9	Visual and Mechanical Inspection	For marking dimensions, and workmanship	4.7.1	Per specification	1.0% AQL

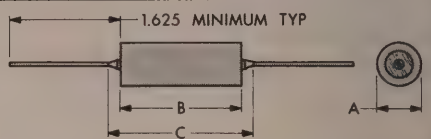
Capacitors are packaged and shipped with Certification of Conformance. **2.** Traceability to production and test records by permanent marking of parts with date code lot. **3.** Process and inspection date is maintained on file per NHB 5300.4 (1C), MIL-Q-9858 and MIL-STD-790.

Component Research

High Temperature Metallized Teflon Capacitor - H11

Case Dimensions:
"A" Diameter
"B" Case Length
"C" Bead to Bead Max. Length

Tolerance Limits (inches)
±0.10Without Sleeving; +0.02 / -0.00 With Mylar Sleeving
±0.03
The lengths shown in table are maximum and include solder beads.



Case Dimensions

For special values and tolerances please contact our application departme

	50 VDC				100 VDC				200 VDC			
UF	H11	Diam. A	Length B	Length C	H11	Diam. A	Length B	Length C	H11	Diam. A	Length B	Length C
.001	11B102	.235	.687	.887	11C102	.235	.687	.887	11D102	.235	.687	.887
.0012	11B122	.235	.687	.887	11C122	.235	.687	.887	11D122	.235	.687	.887
.0015	11B152	.235	.687	.887	11C152	.235	.687	.887	11D152	.235	.687	.887
.0018	11B182	.235	.687	.887	11C182	.235	.687	.887	11D182	.235	.687	.887
.002	11B202	.235	.687	.887	11C202	.235	.687	.887	11D202	.235	.687	.887
.0022	11B222	.235	.687	.887	11C222	.235	.687	.887	11D222	.235	.687	.887
.0027	11B272	.235	.687	.887	11C272	.235	.687	.887	11D272	.235	.687	.887
.0033	11B332	.235	.687	.887	11C332	.235	.687	.887	11D332	.235	.687	.887
.0039	11B392	.235	.687	.887	11C392	.235	.687	.887	11D392	.235	.687	.887
.0047	11B472	.235	.687	.887	11C472	.235	.687	.887	11D472	.235	.687	.887
.005	11B502	.235	.687	.887	11C502	.235	.687	.887	11D502	.235	.687	.887
.0056	11B562	.235	.687	.887	11C562	.235	.687	.887	11D562	.235	.687	.887
.0068	11B682	.235	.687	.887	11C682	.235	.687	.887	11D682	.235	.687	.887
.0082	11B822	.235	.687	.887	11C822	.235	.687	.887	11D822	.235	.687	.887
.01	11B103	.235	.687	.887	11C103	.235	.687	.887	11D103	.235	.687	.887
.012	11B123	.235	.687	.887	11C123	.235	.687	.887	11D123	.235	.687	.887
.015	11B153	.312	.687	.887	11C153	.312	.687	.887	11D153	.312	.687	.887
.018	11B183	.312	.687	.887	11C183	.312	.687	.887	11D183	.312	.813	1.013
.02	11B203	.312	.687	.887	11C203	.312	.687	.887	11D203	.312	.813	1.013
.022	11B223	.312	.687	.887	11C223	.312	.687	.887	11D223	.312	.813	1.013
.027	11B273	.312	.687	.887	11C273	.312	.813	1.013	11D273	.312	.813	1.013
.033	11B333	.312	.687	.887	11C333	.312	.813	1.013	11D333	.400	.813	1.013
.039	11B393	.312	.687	.887	11C393	.400	.813	1.013	11D393	.400	1.063	1.263
.047	11B473	.312	.687	.887	11C473	.400	.813	1.013	11D473	.400	1.063	1.263
.05	11B503	.312	.687	.887	11C503	.400	.813	1.013	11D503	.400	1.063	1.263
.056	11B563	.312	.813	1.013	11C563	.400	.813	1.013	11D563	.400	1.063	1.263
.068	11B683	.312	.813	1.013	11C683	.400	.813	1.013	11D683	.400	1.063	1.263
.082	11B823	.312	.937	1.137	11C823	.400	1.063	1.263	11D823	.500	1.125	1.325
.1	11B104	.312	.937	1.137	11C104	.400	1.063	1.263	11D104	.500	1.125	1.325
.12	11B124	.312	1.063	1.263	11C124	.500	1.125	1.325	11D124	.500	1.375	1.575
.15	11B154	.312	1.063	1.263	11C154	.500	1.125	1.325	11D154	.562	1.375	1.575
.18	11B184	.400	1.063	1.263	11C184	.500	1.125	1.325	11D184	.562	1.375	1.575
.20	11B204	.400	1.063	1.263	11C204	.562	1.125	1.325	11D204	.562	1.375	1.575
.22	11B224	.400	1.063	1.263	11C224	.562	1.125	1.325	11D224	.562	1.375	1.575
.27	11B274	.400	1.063	1.263	11C274	.562	1.125	1.325	11D274	.670	1.375	1.575
.33	11B334	.500	1.125	1.325	11C334	.562	1.125	1.325	11D334	.670	1.375	1.575
.39	11B394	.500	1.125	1.325	11C394	.562	1.375	1.575	11D394	.562	1.875	2.075
.47	11B474	.562	1.125	1.325	11C474	.670	1.375	1.575	11D474	.670	1.875	2.075
.50	11B504	.562	1.125	1.325	11C504	.670	1.375	1.575	11D504	.670	1.875	2.075
.56	11B564	.562	1.125	1.325	11C564	.670	1.375	1.575	11D564	.670	1.875	2.075
.68	11B684	.562	1.125	1.325	11C684	.670	1.875	2.075	11D684	.750	1.875	2.075
.82	11B824	.562	1.375	1.575	11C824	.670	1.875	2.075	11D824	.750	1.875	2.075
1.0	11B105	.670	1.375	1.575	11C105	.670	1.875	2.075	11D105	.750	1.875	2.075
1.5	11B155	.670	1.875	2.075	11C155	.750	1.875	2.075	11D155	1.00	1.875	2.075
2.0	11B205	.670	1.875	2.075	11C205	1.00	1.875	2.075	11D205	1.00	2.375	2.575

H11 - B - 104 - J - X - A

Style

Voltage
B=50VDC
C=100VDC
D=200VDC

Picofarad Code: First two digits represent significant figures, Last digit represents number of zeros to follow. Example: 104= 100,000 picofarads

Capacitance Tolerance
K=10% F=1%
J=5%
G=2%

Sleeving Code
X=No Sleeve

Lead Code
W=Tinned copper clad steel: #2 (.025") for .312" case dia. & smaller; #20(.032") for .400" & .400" case dia. & larger.

Component Research • 1655 26th St., Santa Monica, CA 90404 • (310) 829-3615 Fax (310) 829-9584

CRC Component Research

Polystyrene Capacitor - J93

Product Features

5,000,000 Megohms Min. insulation resistance for values 0.1uF and less.

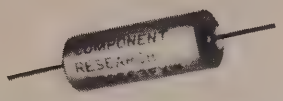
0.02% Maximum dielectric absorption.

0.1% Maximum shelf drift for 10 years (or in nomal use.)

Utilizes CRC unique patented, rugged, low loss lead terminations, qualified for all Hi-Rel programs.

Hermetically Sealed, high reliability screened for critical aerospace programs.

100% Reliability Screening, includes temperature cycling, fine leak test, AC square wave test.



.056 µF 50VDC Actual size capacitor

Similar Generic Parts have been qualified for Trident program.

Avaiable in ±0.1% to ±10% capacitance tolerance from 50VDC to 400VDC.

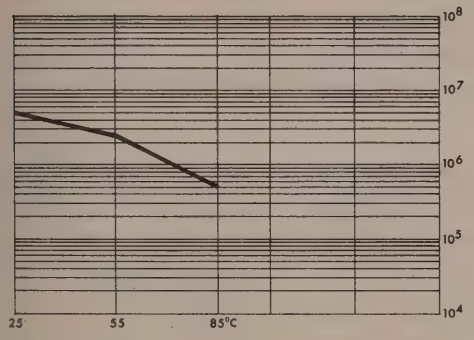
AC and DC Rated.

Typical Applications

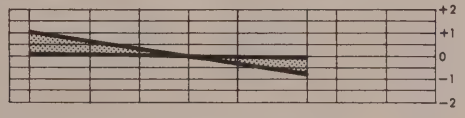
- Critical Timing Circuits
- Fixed Tuning Circuits
- Filtering
- Temperature Compensation
- Coupling and Decoupling
- Feedback Circuits
- Power Supply Filtering
- Gyro Circuits
- Pulse Forming Networks
- Integrating Circuits

Typical Curves

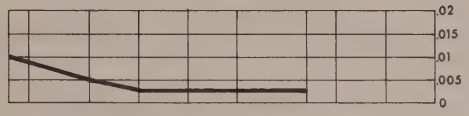
nsulation Resistance with Temperature
n Megohms (0.1 F or less)



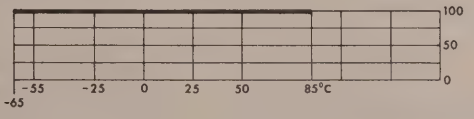
% Capacitance Change with Temperature



% Dissipation Factor with Temperature



% Voltage Rating with Temperature



Life Test Data CRC Test Report # XT1304

List of Capacitors Submitted to Life Test			Insulation Resistance In Megohms at 25°C			%Capacitance Change with Life			%Dissipation Factor at 25°C with Life		
CRC Type	µ F Value	Q'ty Tested	Post Test Limits (min. I.R.)	Test Results Low	Test Results High	Post Test Limits (Max. ΔC)	Test Results Low	Test Results High	Post Test Limits Max. D.F.)	Test Results Low	Test Results High
N53B	.012	20	$5x10^5$	$2x10^7$	$5x10^7$	0.5	0.00	+.26	.05.	.01	01
N53B	.1	20	$5x10^5$	$1x10^7$	$5x10^7$	0.5	-.03	+.29	.05	.01	.01
N53B	.82	15	$5x10^5$	$5x10^6$	$4x10^7$	0.5	-.02	+.18	.05	.01	.01
N53C	.02	5	$5x10^5$	$3.3x10^7$	$5x10^7$	0.5	-.025	+.245	.05	.01	.01
N53C	.039	5	$5x10^5$	$5.5x10^6$	$1x10^8$	0.5	-.01	+.30	.05	.01	.01
N53C	.068	20	$5x10^5$	$1x10^7$	$2x10^7$	0.5	-.06	+.22	.05	.01	.01

est results for 75 Series N53 Capacitors life tested for 2000 ours at +85°C at 140% of rated DC voltage. There were no failures for this test. N53 capacitors are the same construction and design as J93 Series Capacitors.

Component Research

Polystyrene Capacitor - J93

Specifications

Operating Temperature: -65°C to +85°C
At full rated voltage.

Dielectric Absorption: 0.02% maximum
At 25°C when measured per MIL-C-83421.

Dissipation Factor: 0.02% maximum
At 25°C when measured per MIL-C-83421

Dielectric Strength: 200% rated DC voltage
At 25°C from terminal to terminal & terminals to case for 60 seconds minimum.

Temperature Coefficient: -80 ±50 PPM/°C; For values 0.001uF to 0.0082uF; -60 ±50 PPM/°C; For values 0.01uF to 2.7uF
Special polystrene capacitors can be supplied with a temperature coefficient of -

Temperature Coefficient (cont.): 20 to -100 PPM/°C that is linear to ± 30 PPM/°C & ±10 PPM/°C. A wide selection is available of large uF values in bethtub & custom cases.

Capacitance Stability: ±0.03%
With five cycles from -25°C to +85°C

Hermetic Seal: $1x10^{-6}$ atm/cm^3/sec.
Maximum leak rate

Insulation Resistance: See Insulation Resistance Table
Measured from terminal to terminal at rated DC voltage and 5 minutes charge time. Values greater than 1 µF, allow an additional minute / µF charge time.

Minimum Insulation Resistance At Rated DC Voltage

For values over 0.1 µf divide limit shown by µF to obtain minimum I.R.

Example: A 2.0 µF capacitors at 25°C is 1,000,000/2 = 500,000 megohms.

Range	25°C	55°C	85°C
.001 to 0.1 F	10,000,000 Megohms	5,000,000 Megohms	1,000,000 Megohms
Greater Than 0.1µ F	1,000,000 Megohms- µF	500,000 Megohms- µF	100,000 Megohms- µF

Quality Conformance Inspection

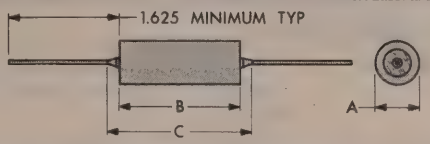
Test No.	Test	Test Conditions	Test Meth. MIL-C-83421	Test Limit	Quality Level A12
1	Burn-In	48 Hrs. minimum at 85°C, at 140% rated DC voltage	4.7.2	There shall be no physical damage	100% Test
2	Thermal Aging	5 cycles minimum from -65°C to +85°C	4.7.3	There shall be no physical damage	100% Test
3	Seal Test (Fine Leak)	Helium bomb 45 PSi for 1 hr. minimum, check for helium leak	4.7.5	$1x10^{-6}$ atm/cm^3/sec. max.	100% Test
4	Seal Test (Gross Leak)	Place in 85°C hot water for 60 seconds minimum & observe for bubbles	4.7.5	No continuous bubble stream	100% Test
5	AC square wave (Terminal to Terminal)	Apply 100 Hz at a peak to peak voltage of 3 times DC rated voltage for 60 seconds minimum. Do not exceed 800 volts peak to peak.	4.7.6	No shorts	100% Test
6	DC Hi-Pot (Terminal to Terminal and Terminals to case)	Apply 200% of rated DC voltage for 60 seconds minimum.	4.7.6	No shorts	100% Test
7	Insulation Resistance (Terminal to Terminal)	At 25°C at rated DC voltage	4.7.7	Per I.R. Table	100% Test
8	% Capacitance Tolerance	At 25°C at 1 KHz	4.7.8	Per Part Number	100% Test
9	% Dissipation Factor	At 25°C at 1 KHZ, values above 1 µF measure at 0.1 Khz	4.7.6	0.02% max.	100% Test
10	Visual and Mechanical Inspection	For marking dimensions, and workmanship	4.7.1	Per specification	1.0% AQL

Component Research

Polystyrene Capacitor - J93

Case Dimensions:
"A" Diameter
"B" Case Length
"C" Bead to Bead Max. Length

Tolerance Limits (inches)
±0.010 Without Sleeving; +0.02 / -0.00 With Mylar Sleeving
±0.03 With or Without Sleeving
The lengths shown in table are maximum and include solder beads.



Case Dimensions

For special values and tolerances please contact our application department

	50VDC				100VDC				200VDC				400VDC			
µF	Basic P/N	Diam. A	Length B	Length C	Basic P/N	Diam. A	Length B	Length C	Basic P/N	Diam. A	Length B	Length C	Basic P/N	Diam. A	Length B	Length C
.001	93B102	.193	.562	.662	93C102	.193	.687	.787	93D102	.235	.687	.787	93E102	.312	.687	.787
.0012	93B122	.193	.562	.662	93C122	.193	.687	.787	93D122	.235	.687	.787	93E122	.312	.687	.787
.0015	93B152	.193	.562	.662	93C152	.193	.687	.787	93D152	.235	.687	.787	93E152	.312	.687	.787
.0018	93B182	.193	.562	.662	93C182	.193	.687	.787	93D182	.235	.687	.787	93E182	.312	.687	.787
.002	93B202	.193	.562	.662	93C202	.193	.687	.787	93D202	.235	.687	.787	93E202	.312	.687	.787
.0022	93B222	.193	.562	.662	93C222	.193	.687	.787	93D222	.235	.687	.787	93E222	.312	.687	.787
.0027	93B272	.193	.562	.662	93C272	.193	.687	.787	93D272	.235	.687	.787	93E272	.312	.687	.787
.0033	93B332	.193	.562	.662	93C332	.193	.687	.787	93D332	.235	.687	.787	93E332	.312	.687	.787
.0039	93B392	.193	.562	.662	93C392	.193	.687	.787	93D392	.235	.687	.787	93E392	.312	.687	.787
.0047	93B472	.193	.562	.662	93C472	.193	.687	.787	93D472	.235	.687	.787	93E472	.312	.687	.787
.005	93B502	.193	.562	.662	93C502	.193	.687	.787	93D502	.235	.687	.787	93E502	.312	.687	.787
.0056	93B562	.193	.562	.662	93C562	.193	.687	.787	93D562	.235	.687	.787	93E562	.312	.687	.787
.0068	93B682	.193	.562	.662	93C682	.193	.687	.787	93D682	.235	.687	.787	93E682	.312	.687	.787
.0075	93B752	.193	.687	.787	93C752	.193	.813	.913	93D752	.235	.813	.913	93E752	.312	.813	.913
.0082	93B822	.193	.687	.787	93C822	.193	.813	.913	93D822	.235	.813	.913	93E822	.312	.813	.913
.01	93B103	.193	.687	.787	93C103	.193	.813	.913	93D103	.235	.813	.913	93E103	.312	.813	.913
.012	93B123	.193	.687	.787	93C123	.193	.813	.913	93D123	.235	.813	.913	93E123	.312	.813	.913
.015	93B153	.235	.687	.787	93C153	.235	.813	.913	93D153	.312	.813	.913	93E153	.400	.813	.913
.018	93B183	.235	.813	.913	93C183	.312	.813	.913	93D183	.400	.813	.913	93E183	.400	1.063	1.163
.02	93B203	.235	.813	.913	93C203	.312	.813	.913	93D203	.400	.813	.913	93E203	.400	1.063	1.163
.022	93B223	.235	.813	.913	93C223	.312	.813	.913	93D223	.400	.813	.913	93E223	.400	1.063	1.163
.027	93B273	.235	.813	.913	93C273	.312	.813	.913	93D273	.400	.813	.913	93E273	.400	1.063	1.163
.033	93B333	.235	.813	.913	93C333	.312	.813	.913	93D333	.400	.813	.913	93E333	.400	1.063	1.163
.039	93B393	.312	.813	.913	93C393	.400	.813	.913	93D393	.400	1.063	1.163	93E393	.500	1.125	1.225
.047	93B473	.312	.813	.913	93C473	.400	.813	.913	93D473	.400	1.063	1.163	93E473	.500	1.125	1.225
.05	93B503	.312	.813	.913	93C503	.400	.813	.913	93D503	.400	1.063	1.163	93E503	.500	1.125	1.225
.056	93B563	.312	.813	.913	93C563	.400	.813	.913	93D563	.400	1.063	1.163	93E563	.500	1.125	1.225
.068	93B683	.400	.813	.913	93C683	.400	1.063	1.163	93D683	.500	1.125	1.225	93E683	.500	1.375	1.475
.075	93B753	.400	.813	.913	93C753	.400	1.063	1.163	93D753	.500	1.125	1.225	93E753	.500	1.375	1.475
.082	93B823	.400	.813	.913	93C823	.400	1.063	1.163	93D823	.500	1.125	1.225	93E823	.500	1.375	1.475
.1	93B104	.400	.813	.913	93C104	.400	1.063	1.163	93D104	.500	1.125	1.225	93E104	.500	1.375	1.475
.12	93B124	.400	.813	.913	93C124	.400	1.063	1.163	93D124	.500	1.125	1.225	93E124	.500	1.375	1.475
.15	93B154	.400	1.063	1.163	93C154	.500	1.125	1.125	93D154	.500	1.375	1.475	93E154	.562	1.375	1.475
.18	93B184	.400	1.063	1.163	93C184	.500	1.125	1.125	93D184	.500	1.375	1.475	93E184	.562	1.375	1.475
.20	93B204	.400	1.063	1.163	93C204	.500	1.125	1.125	93D204	.500	1.375	1.475	93E204	.562	1.375	1.475
.22	93B224	.400	1.063	1.163	93C224	.500	1.125	1.125	93D224	.500	1.375	1.475	93E224	.562	1.375	1.475
.27	93B274	.500	1.125	1.225	93C274	.500	1.375	1.475	93D274	.562	1.375	1.475	93E274	.670	1.375	1.475
.33	93B334	.500	1.125	1.225	93C334	.500	1.375	1.475	93D334	.562	1.375	1.475	93E334	.670	1.375	1.475
.39	93B394	.500	1.375	1.475	93C394	.562	1.375	1.475	93D394	.670	1.375	1.475	93E394	.670	1.875	1.975
.47	93B474	.562	1.375	1.475	93C474	.670	1.375	1.475	93D474	.670	1.875	1.975	93E474	.750	1.875	1.975
.50	93B504	.562	1.375	1.475	93C504	.670	1.375	1.475	93D504	.670	1.875	1.975	93E504	.750	1.875	1.975
.56	93B564	.562	1.375	1.475	93C564	.670	1.375	1.475	93D564	.670	1.875	1.975	93E564	.750	1.875	1.975
.68	93B684	.670	1.375	1.475	93C684	.670	1.875	1.975	93D684	.750	1.875	1.975	93E684	1.000	1.875	1.975
.75	93B754	.670	1.875	1.975	93C754	.750	1.875	1.975	93D754	1.000	1.875	1.975	93E754	1.000	2.375	2.475
.82	93B824	.670	1.875	1.975	93C824	.750	1.875	1.975	93D824	1.000	1.875	1.975	93E824	1.000	2.375	2.475
.0	93B105	.670	1.875	1.975	93C105	.750	1.875	1.975	93D105	1.000	1.875	1.975	93E105	1.000	2.375	2.475
.2	93B125	.750	1.875	1.975	93C125	1.000	1.875	1.975								
.5	93B155	.750	1.875	1.975	93C155	1.000	1.875	1.975								
.8	93B185	1.000	1.875	1.975	93C185	1.000	2.375	2.475								
.0	93B205	1.000	1.875	1.975	93C205	1.000	2.375	2.475								
.2	93B225	1.000	1.875	1.975												
.5	93B255	1.000	2.375	2.225												
.7	93B275	1.000	2.375	2.225												

J93 - B - 104 - J - S - W

Style

Voltage
E =50VDC
C =100VDC
D =200VDC
F =400VDC

Picofarad Code: First two digits represent significant figures, Last digit represents number of zeros to follow. Example: 104= 100,000 picofarads

Capacitance Tolerance
K=10% F=1% B=1/4%
J=5% D=1/2% A=.1%
G=2%

Sleeving Code
S=Mylar Sleeve
X=No Sleeve

Lead Code
W=Tinned copper clad steel: #22 (.025") for .312" case dia. & smaller; #20(.032") for .400" & .500" case dia.

Component Research • 1655 26th St., Santa Monica, CA 90404 • (310) 829-3615 Fax (310) 829-9584

Component Research

Foil Polycarbonate Capacitor - A52

Specifications

Construction: Polycarbonate dielectric, extended foil electrodes, hermetically sealed, leads isolated from case.

Environmental: Capacitors meet all environmental requirements of MIL-C-8321 except vibration & shock. Vibration is at 20g's & shock at 50G's.

Operating Temperature: -65°C to +100°C
At full rated voltage, derate linearly to 50% of rated voltage at 125°C.

Dielectric Absorption: 0.1% maximum
At 25°C when measured per MIL-C-83421.

Dissipation Factor: 0.15% maximum
At 25°C when measured per MIL-C-83421

AC Square Wave: 100 Hz, 60 seconds minimum
At 25°C at a peak to peak voltage of 3 times rated DC voltage, terminal to terminal per MII-C-83421.

Dielectric Strength: 200% rated DC voltage
At 25°C from terminal to terminal to case for 60 seconds minimum.

Temperature Coefficient: ±2% maximum capacitance change; From -55°C to +125°C

Capacitance Stability: ±0.2.5%
When measured at any two corresponding temperature points taken in five successive temperature cycles from -65°C to +125°C.

Hermetic Seal: $1x10^{-6}$ atm/cm^3/sec. Maximum leak rate

Insulation Resistance: See Insulation Resistance Table
Measured from terminal to terminal at rated DC voltage and 5 minutes charge time. Values greater than 1 µF, allow an additional minute / µF charge time.

Minimum Insulation Resistance At Rated DC Voltage

For values over 0.1 µf divide limit shown by µF to obtain minimum I.R.

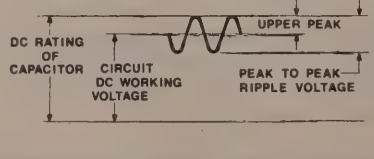
Example: A 0.18 µF capacitance at 25°C is 100,000/0.18 = 555,000 megohms

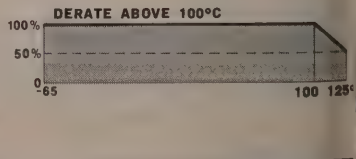
Range	25°C	85°C	125°C
.001 to 0.1 F	1,000,000 Megohms	500,000 Megohms	30,000 Megohms
Greater Than 0.1µ F	100,000 Megohms- µF	50,000 Megohms- µF	3,000 Megohms- µF

Quality Conformance Inspection

Test No.	Test	Test Conditions	Test Meth. MIL-C-83421	Test Limit	Quality Level A12
1	Burn-In	48 Hrs. minimum at 100°C, at 120% rated DC voltage at 400Hz not to exceed 240VRMS	4.7.2	No physical damage	100% Test
2	Thermal Aging	10 cycles minimum from -65°C to +125°C	4.7.3	No physical damage	100% Test
3	Sel Test (Gross Leak)	Per MIL-C-83421	4.7.5	No continuous bubble stream	100% Test
4	AC square wave	Apply 100 Hz at a peak to peak voltage of 3 times DC rated voltage for 60 seconds minimum. Do not exceed 800 volts peak to peak.	4.7.6	No shorts	100% Test
5	DC Hi-Pot (Terminal to Terminal and Terminals to case)	Apply 200% of rated DC voltage for 60 seconds minimum.	4.7.6	No shorts	100% Test
6	Insulation Resistance (Terminal to Terminal)	At 25°C at rated DC voltage	4.7.7	100,000 megohms-uF, need not exceed 1,000,000 megohms	100% Test
7	% Capacitance Tolerance	At 25°C at 1 KHz	4.7.8	Per Part Number	100% Test
8	% Dissipation Factor	At 25°C at 10 KHZ	4.7.9	25% max.	100% Test
9	Visual and Mechanical Inspection	For marking dimensions, and workmanship	4.7.1	Per specification	1.0% AQL

1. The combined DC & AC voltages should not exceed the DC ratings, see figure.
2. Capacitors may be operated at higher frequencies, at reduced RMS voltage such that max. AC current ratings are not exceeded.
3. Type A52 capacitors can handle much higher pulse repetition rates than metallized capacitors.



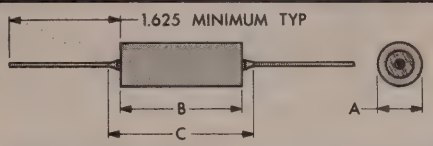


Component Research

Foil Polycarbonate Capacitor - A52

ase Dimensions:
A" Diameter
B" Case Length
C" Bead to Bead Max. Length

Tolerance Limits (inches)
±0.10 Without Sleeving; +0.02 / -0.00 With Mylar Sleeving
±0.03 With or Without Sleeving
"C" Dimensions is 0.2" maximum more than "B" dimension in table



Case Dimensions - AC Ratings

For special values and tolerances please contact our application department

	Type A52C 100 VDC					Type A52D 200 VDC					Type A52V 300 VDC					Type A52E 400 VDC				
			AC Ratings					AC Ratings					AC Ratings					AC Ratings		
uF	Dia. A	Length B	Max. RMS Volts 20 KHz	Max. RMS Volts 100 KHz	Max. RMS Amps	Dia. A	Length B	Max. RMS Volts 20 KHz	Max. RMS Volts 100 KHz	Max. RMS Amps	Dia. A	Length B	Max. RMS Volts 20 KHz	Max. RMS Volts 100 KHz	Max. RMS Amps	Dia. A	Length B	Max. RMS Volts 20 KHz	Max. RMS Volts 100 KHz	Max. RMS Amps
.001	.193	.562	60	60	.038	.193	.562	120	120	.075	.193	.562	180	180	.113	.193	.687	240	240	.15
.0012	.193	.562	60	60	.045	.193	.562	120	120	.090	.193	.562	180	180	.135	.193	.687	240	240	.18
.0015	.193	.562	60	60	.056	.193	.562	120	120	.112	.193	.562	180	180	.169	.193	.687	240	240	.22
.0018	.193	.562	60	60	.067	.193	.562	120	120	.135	.193	.562	180	180	.202	.193	.687	240	240	.27
.002	.193	.562	60	60	.075	.193	.562	120	120	.150	.193	.562	180	180	.225	.193	.687	240	240	.30
.0022	.193	.562	60	60	.083	.193	.562	120	120	.165	.193	.562	180	180	.248	.193	.687	240	240	.33
.0027	.193	.562	60	60	.101	.193	.562	120	120	.202	.193	.687	180	180	.304	.193	.687	240	240	.4
.0033	.193	.562	60	60	.124	.193	.562	120	120	.247	.193	.687	180	180	.371	.193	.687	240	240	.5
.0039	.193	.562	60	60	.146	.193	.562	120	120	.293	.193	.687	180	180	.439	.193	.687	240	240	.6
.0047	.193	.562	60	60	.176	.193	.687	120	120	.353	.193	.687	180	180	.529	.235	.687	240	240	.7
.005	.193	.562	60	60	.188	.193	.687	120	120	.375	.193	.687	180	180	.562	.235	.687	240	240	.75
.0056	.193	.562	60	60	.210	.193	.687	120	120	.420	.193	.687	180	180	.623	.235	.687	240	240	.85
.0068	.193	.687	60	60	.255	.193	.687	120	120	.511	.235	.687	180	180	.766	.312	.687	240	240	1.0
.0075	.193	.687	60	60	.282	.235	.687	120	120	.563	.235	.687	180	180	.845	.312	.687	240	240	1.13
.0082	.193	.687	60	60	.308	.235	.687	120	120	.615	.235	.687	180	180	.923	.312	.687	240	240	1.23
.01	.235	.687	60	60	.375	.235	.687	120	120	.750	.312	.687	180	180	1.13	.312	.687	240	224	1.4
.012	.235	.687	60	60	.451	.235	.687	120	120	.902	.312	.687	180	172	1.3	.312	.687	240	200	1.5
.015	.235	.687	60	60	.561	.312	.687	120	120	1.12	.312	.687	180	150	1.4	.312	.813	240	190	1.8
.018	.312	.687	60	60	.674	.312	.687	120	120	1.35	.312	.687	180	134	1.5	.312	.813	240	178	2.0
.02	.312	.687	60	60	.750	.312	.687	120	112	1.4	.312	.813	180	132	1.65	.400	.813	240	168	2.1
.022	.312	.687	60	60	.822	.312	.687	120	110	1.5	.312	.813	180	130	1.8	.400	.813	240	158	2.2
.027	.312	.687	60	60	1.02	.312	.813	120	106	1.8	.312	.813	180	118	2.0	.400	.813	240	148	2.5
.033	.312	.687	60	60	1.22	.312	.813	120	98	2.0	.400	.813	180	108	2.2	.400	1.063	240	130	2.7
.039	.312	.813	60	60	1.46	.400	.813	120	90	2.2	.400	.813	180	98	2.4	.400	1.063	240	117	2.9
.047	.312	.813	60	60	1.76	.400	.813	120	82	2.4	.400	.813	180	85	2.5	.400	1.063	240	102	3.0
.05	.400	.813	60	60	1.88	.400	.813	120	80	2.5	.400	1.063	180	83.2	2.6	.500	1.125	240	102	3.2
.056	.400	.813	60	60	2.07	.400	.813	120	73	2.5	.400	1.063	180	78	2.7	.500	1.125	240	100	3.5
.068	.400	.813	60	53	2.2	.400	1.063	120	65	2.7	.400	1.063	180	67	2.8	.500	1.125	240	96	4.0
.075	.400	.813	60	50	2.4	.400	1.063	120	61	2.9	.400	1.063	180	63	3.0	.500	1.375	240	97	4.6
.082	.400	.813	60	49	2.5	.400	1.063	120	59	3.0	.500	1.125	180	61	3.15	.500	1.375	240	98	5.0
.1	.400	1.063	60	44	2.7	.500	1.125	120	55	3.4	.500	1.125	180	56	3.50	.562	1.375	240	85	5.3
.12	.400	1.063	60	37	2.8	.500	1.125	120	48	3.6	.500	1.125	180	53	4.00	.562	1.375	240	75	5.6
.15	.400	1.063	60	37	2.9	.500	1.125	120	43	4.00	.500	1.375	180	48	4.50	.562	1.375	240	53	6.0
.18	.400	1.063	60	27	3.0	.500	1.375	120	40	4.50	.500	1.375	180	45	5.00					
.20	.500	1.125	60	26	3.3	.500	1.375	120	38	4.75	.562	1.375	180	45	5.63					
.22	.500	1.125	60	25	3.4	.500	1.375	120	37	5.00	.562	1.375	180	45	6.00					
.27	.500	1.125	60	22	3.8	.562	1.375	120	33	5.50										
.33	.500	1.125	60	20	4.13	.562	1.375	120	29	6.00										
.39	.500	1.375	60	20	5.00															
.47	.562	1.375	60	20	6.00															

A52 - C - 104 - J - S - W

tyle

oltage
=100VDC
=200VDC
=300VDC
=400VDC

Picofarad Code: First two digits represent significant figures, Last digit represents number of zeros to follow. Example: 104= 100,000 picofarads

Capacitance Tolerance
K=10% G=2%
J=5% F=1%

Sleeving Code
S=Mylar Sleeve
X=No Sleeve

Lead Code
W=Tinned copper clad steel: #22 (.025") for .312" case dia. & smaller; #20(.032") for .400" & .500" case dia.
C=Tinned oxygen-free copper: #18 (.040") for .562" case dia. & larger.

Component Research • 1655 26th St., Santa Monica, CA 90404 • (310) 829-3615 Fax (310) 829-9584

Component Research

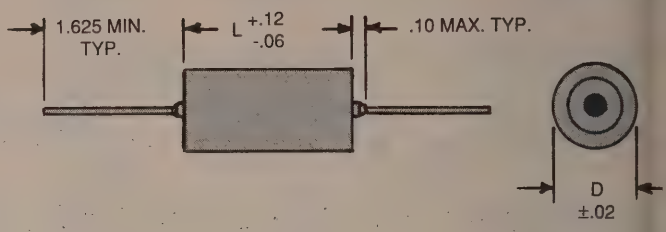
Foil Polycarbonate Capacitor - B52

Technical Information

High Current AC Power Capacitors rated to 40 Khz
400 VAC (600 VDC), 600 VAC (800 VDC) -65 to +100°C
100% A.C. Burn-in @ 400 Hz @ 100°C
Snubber and pulse applications

Construction: Polycarbonate film/foil, hermetically sealed, leads isolated from case. Metal case insulated with mylar shrink sleeving.

Part Dimensions and Tolerances



Ordering Information

Part numbers listed in the table have a capacitance tolerance of ±10% (other tolerances are available on special order).

Lead Size
.041 ±.003 (#18AWG) Tinned copper for case diameter .400 and larger

Dimensions & AC Ratings

Type B52F 400 VRMS Rated								Type B52P 600 VRMS Rated							
	600VDC Rated or 600 Volts Peak (AC Plus DC Volts)			Max. AC Rating -65°C to 100°C				800VDC Rate or 840 Volts Peak (AC PLus DC Volts)			Max. AC Rating -65°C to 100°C			
mF	Part No.	D	L	RMS Volts at 400Hz	RMS Volts at 4Khz	RMS Volts at 40Khz	Max. RMS Amps	Part No.	D	L	RMS Volts at 400Hz	RMS Volts at 4KHz	RMS Volts at 40Khz	Max. RMS Amps
.033	B52F333KSC	.400	1.063	400	400	360	3.0	B52P333KSC	.500	1.375	600	600	600	5.0
.039	B52F393KSC	.400	1.063	400	400	308	3.0	B52P393KSC	.500	1.375	600	600	513	5.0
.047	B52F473KSC	.500	1.125	400	400	306	3.6	B52P473KSC	.500	1.375	600	600	426	5.0
.056	B52F563KSC	.500	1.125	400	400	255	3.6	B52P563KSC	.500	1.375	600	600	357	5.0
.068	B52F683KSC	.500	1.125	400	400	235	4.0	B52P683KSC	.562	1.375	600	600	353	6.0
.075	B52F753KSC	.500	1.375	400	400	235	4.4	B52P753KSC	.562	1.375	600	600	320	6.0
.082	B52F823KSC	.500	1.375	400	400	235	4.8	B52P823KSC	.562	1.375	600	600	293	6.0
.092	B52F923KSC	.562	1.375	400	400	230	5.3	B52P923KSC	.670	1.375	600	600	305	7.0
.1	B52F104KSC	.562	1.375	400	400	220	5.5	B52P104KSC	.670	1.375	600	600	280	7.0
.12	B52F124KSC	.562	1.375	400	400	200	6.0	B52P124KSC	.670	1.375	600	600	233	7.0
.15	B52F154KSC	.562	1.375	400	400	160	6.0	B52P154KSC	.670	1.875	600	600	214	8.0
.18	B52F184KSC	.670	1.375	400	400	155	7.0	B52P184KSC	.670	1.875	600	600	178	8.0
.22	B52F224KSC	.670	1.375	400	400	127	7.0	B52P224KSC	.670	1.875	600	600	146	8.0
.27	B52F274KSC	.670	1.875	400	400	118	8.0	B52P274KSC	.750	1.875	600	600	133	9.0
.33	B52F334KSC	.670	1.875	400	400	97	8.0	B52P334KSC	.750	1.875	600	600	109	9.0
.39	B52P394KSC	.670	1.875	400	400	82	8.0	B52P394KSC	.750	2.375	600	600	103	10.0
.47	B52F474KSC	.750	1.875	400	400	77	9.0	B52P474KSC	.750	2.375	600	600	85.1	10.0
.56	B52F564KSC	.750	1.875	400	400	64	9.0							
.68	B52F684KSC	.750	2.375	400	400	53	9.0							
.75	B52F754KSC	.750	2.375	400	400	53	10.0							
.82	B52F824KSC	.750	2.375	400	400	49	10.0							

Quality Conformance Inspection

Test No.	Test	Test Conditions	Test Method	Test Limit	Inspection Level
1	Burn-In	16 hrs. minimum at 120% rated AC voltage at 400 Hz at 100°C	4.7.2 MIL-C-83421	No physical damage	100% Test
2	Thermal Aging	5 cycles minimum from -65°C to +125°C	4.7.3	No physical damage	100% Test
3	Seal Test	Gross leak Meth. 112 MIL-STD-202 Cond. B		No continuous bubble stream or oil leaks as required	100% Test
4	Insulation Resistance (Terminal to Terminal)	At 25°C at rated DC voltage or at 600 VDC, whichever is less	4.7.7	100,000 megohms-uF, need not exceed 1,000,000 megohms	100% Test
5	% Capacitance Tolerance	At 25°C at 1KHz	4.7.8	Per part number	100% Test
6	% Dissipation Factor	At 25°C at 10KHz	4.7.9	0.25% maximum	100% Test
7	Visual and Mechanical Inspection	For marking, dimensions and workmanship	4.7.1	Per specification	1.0% AQL

Component Research

Metallized Polycarbonate Capacitor - B12

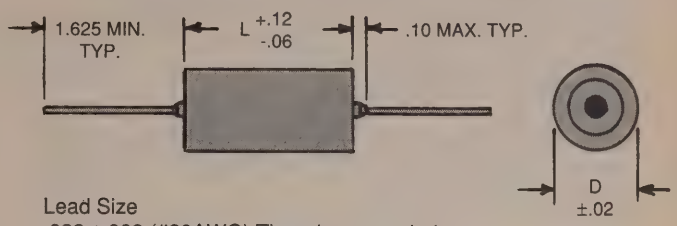
Technical Information

High Current AC Power Capacitors rated to 40 Khz
.00 VAC (600 VDC), 600 VAC (800 VDC) -65 to +100°C
00% A.C. Burn-in @ 400 Hz @ 100°C
tesonant power applications
Construction: Metallized Polycarbonate, hermetically sealed, eads isolated from case. Metal case insulated with mylar shrink leeving.

Ordering Information

art numbers listed in the table have a capacitance tolerance of 10% (other tolerances are available on special order).

Part Dimensions and Tolerances



Lead Size
.032 ±.003 (#20AWG) Tinned copper-clad steel for case diameter .312
.041 ± .003 (#18AWG) tinned copper for case diameter .400 and larger

Dimensions & AC Ratings

	Type B12F 400 VRMS Rated							Type B12P 600 VRMS Rated						
	600VDC Rated or 600 Volts Peak (AC Plus DC Volts)			Max. AC Rating -65°C to 100°C				800VDC Rate or 840 Volts Peak (AC PLus DC Volts)			Max. AC Rating -65°C to 100°C			
uF	Part No.	D	L	RMS Volts at 400Hz	RMS Volts at 4KHz	RMS Volts at 40KHz	Max. RMS Amps	Part No.	D	L	RMS Volts at 400Hz	RMS Volts at 4KHz	RMS Volts at 40KHz	Max. RMS Amps
.01	B12F103KSW	.312	.813	400	400	400	1.0	B12P103KSC	.400	1.063	600	600	600	1.5
.012	B12F123KSW	.312	.813	400	400	400	1.2	B12P123KSC	.400	1.063	600	600	600	1.8
.015	B12F153KSW	.312	.813	400	400	400	1.5	B12P153KSC	.400	1.063	600	600	600	2.3
.018	B12F183KSW	.312	.813	400	400	355	1.6	B12P183KSC	.400	1.063	600	600	600	2.7
.022	B12F223KSC	.400	.813	400	400	309	1.7	B12P223KSC	.400	1.063	600	600	509	2.8
.027	B12F273KSC	.400	.813	400	400	252	1.7	B12P273KSC	.400	1.063	600	600	414	2.8
.033	B12F333KSC	.400	.813	400	400	218	1.8	B12P333KSC	.400	1.063	600	600	339	2.8
.039	B12F393KSC	.400	.813	400	400	205	2.0	B12P393KSC	.500	1.063	600	600	287	2.8
.047	B12F473KSC	.400	1.063	400	400	187	2.2	B12P473KSC	.500	1.125	600	600	272	3.2
.056	B12F563KSC	.400	1.063	400	400	164	2.3	B12P563KSC	.500	1.125	600	600	236	3.3
.068	B12F683KSC	.400	1.063	400	400	159	2.7	B12P683KSC	.500	1.125	600	600	200	3.4
.075	B12F753KSC	.400	1.063	400	400	149	2.8	B12P753KSC	.500	1.375	600	600	200	3.75
.082	B12F823KSC	.500	1.125	400	400	146	3.0	B12P823KSC	.500	1.375	600	600	195	4.0
.092	B12F923KSC	.500	1.125	400	400	140	3.2	B12P923KSC	.562	1.375	600	600	191	4.4
.1	B12F104KSC	.500	1.125	400	400	128	3.2	B12P104KSC	.562	1.375	600	600	180	4.5
.12	B12F124KSC	.500	1.375	400	400	110	3.3	B12P124KSC	.562	1.375	600	600	160	4.8
.15	B12F154KSC	.500	1.375	400	400	110	4.1	B12P154KSC	.562	1.375	600	600	134	5.0
.18	B12F184KSC	.562	1.375	400	400	95	4.3	B12P184KSC	.670	1.375	600	600	120	5.4
.22	B12F224KSC	.562	1.375	400	400	91	5.0	B12P224KSC	.670	1.375	600	600	102	5.6
.27	B12F274KSC	.562	1.375	400	400	74	5.0	B12P274KSC	.670	1.875	600	600	101	6.8
.33	B12F334KSC	.670	1.375	400	400	67	5.5	B12P334KSC	.670	1.875	600	600	82	6.8
.39	B12F394KSC	.670	1.375	400	400	57	5.5	B12P394KSC	.670	1.875	600	600	70	6.8
.47	B12F474KSC	.670	1.875	400	400	47	5.5	B12P474KSC	.750	1.875	600	600	61	7.2
.56	B12F564KSC	.670	1.875	400	400	42	5.9	B12P564KSC	.750	1.875	600	535	53.5	7.5
.68	B12F684KSC	.670	1.875	400	400	40	6.8	B12P684KSC	.750	1.875	600	470	47	8.0
.75	B12F754KSC	.750	1.875	400	400	40	7.5	B12P754KSC	.750	2.375	600	533	53.3	10.0
.82	B12F824KSC	.750	1.875	400	366	36	7.5	B12P824KSC	1.0	2.375	600	488	48.8	11.0
.92	B12F924KSC	.750	2.375	400	370	37	8.5							
1.0	B12F105KSC	.750	2.375	400	340	34	8.5							
1.2	B12F125KSC	.750	2.375	400	333	33.3	10.0							

Quality Conformance Inspection

Test No.	Test	Test Conditions	Test Method	Test Limit	Inspection Level
1	Burn-In	16 hrs. minimum at 120% rated AC voltage at 400 Hz at 100°C	4.7.2 MIL-C-83421	No physical damage	100% Test
2	Thermal Aging	5 cycles minimum from -65°C to +125°C	4.7.3	No physical damage	100% Test
3	Seal Test	Gross leak Meth. 112 MIL-STD-202 Cond. B		No continuous bubble stream or oil leaks as required	100% Test
	Insulation Resistance (Terminal to Terminal)	At 25°C at rated DC voltage or at 600 VDC, whichever is less	4.7.7	100,000 megohms-uF, need not exceed 1,000,000 megohms	100% Test
5	% Capacitance Tolerance	At 25° at 1KHz	4.7.8	Per part number	100% Test
6	% Dissipation Factor	At 25°C at 10KHz	4.7.9	0.5% maximum	100% Test
7	Visual and Mechanical Inspection	For marking, dimensions and workmanship	4.7.1	Per specification	1.0% AGL

Component Research

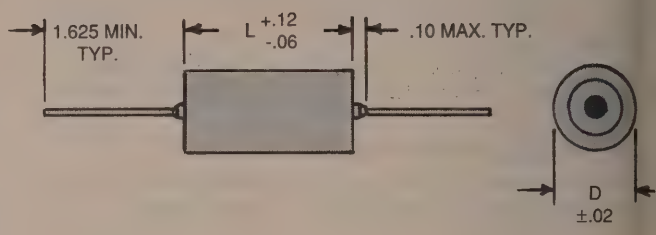
Foil Polypropylene Capacitor - B55

Technical Information

High Current AC Power Capacitors rated to 40 Khz
400 VAC (600 VDC), 600 VAC (800 VDC) -65 to +85°C
100% A.C. Burn-in @ 400 Hz @ 85°C
Snubber and pulse applications

Construction: Polypropylene film/foil, hermetically sealed, leads isolated from case. Metal case insulated with mylar shrink sleeving.

Part Dimensions and Tolerances



Lead Size
.041 ±.003 (#18AWG) Tinned copper for case diameter .400 and larger

Ordering Information

Part numbers listed in the table have a capacitance tolerance of ±10% (other tolerances are available on special order).

Dimensions & AC Ratings

Type B55F 400 VRMS Rated								Type B55P 600 VRMS Rated							
	600VDC Rated or 600 Volts Peak (AC Plus DC Volts)			Max. AC Rating -55°C to 85°C				800VDC Rate or 840 Volts Peak (AC PLus DC Volts)			Max. AC Rating -55°C to 85°C			
uF	Part No.	D	L	RMS Volts at 400Hz	RMS Volts at 4KHz	RMS Volts at 40KHz	Max. RMS Amps	Part No.	D	L	RMS Volts at 400Hz	RMS Volts at 4KHz	RMS Volts at 40KHz	Max. RMS Amps
.033	B55F333KSC	.400	1.063	400	400	400	4	B55P333KSC	.500	1.375	600	600	600	6
.039	B55F393KSC	.400	1.063	400	400	400	4	B55P393KSC	.500	1.375	600	600	600	6
.047	B55F473KSC	.500	1.125	400	400	400	5	B55P473KSC	.500	1.375	600	600	511	6
.056	B55F563KSC	.500	1.125	400	400	357	5	B55P563KSC	.500	1.375	600	600	428	6
.068	B55F683KSC	.500	1.125	400	400	294	5	B55P683KSC	.562	1.375	600	600	412	7
.075	B55F753KSC	.500	1.375	400	400	320	6	B55P753KSC	.562	1.375	600	600	373	7
.082	B55F823KSC	.500	1.375	400	400	293	6	B55P823KSC	.562	1.375	600	600	342	7
.092	B55F923KSC	.562	1.375	400	400	305	7	B55P923KSC	.670	1.375	600	600	348	8
.1	B55F104KSC	.562	1.375	400	400	280	7	B55P104KSC	.670	1.375	600	600	360	8
.12	B55F124KSC	.562	1.375	400	400	233	7	B55P124KSC	.670	1.375	600	600	266	8
.15	B55F154KSC	.562	1.375	400	400	187	7	B55P154KSC	.670	1.875	600	600	214	8
.18	B55F184KSC	.670	1.375	400	400	178	8	B55P184KSC	.670	1.875	600	600	200	9
.22	B55F224KSC	.670	1.375	400	400	146	8	B55P224KSC	.670	1.875	600	600	164	9
.27	B55F274KSC	.670	1.875	400	400	133	9	B55P274KSC	.750	1.875	600	600	178	12
.33	B55F334KSC	.670	1.875	400	400	109	9	B55P334KSC	.750	1.875	600	600	145	12
.39	B55P394KSC	.670	1.875	400	400	92.7	9	B55P394KSC	.750	2.375	600	600	144	14
.47	B55F474KSC	.750	1.875	400	400	102.0	12	B55P474KSC	.750	2.375	600	600	119	14
.56	B55F564KSC	.750	1.875	400	400	85.7	12							
.68	B55F684KSC	.750	2.375	400	400	70.6	12							
.75	B55F754KSC	.750	2.375	400	400	74.6	14							
.82	B55F824KSC	.750	2.375	400	400	68.3	14							

Quality Conformance Inspection

Test No.	Test	Test Conditions	Test Method	Test Limit	Inspection Level
1	Burn-In	16 Hrs. minimum at 120% rated AC voltage at 400 Hz at 85°C	4.7.2 MIL-C-83421	No physical damage	100% Test
2	Thermal Aging	5 cycles minimum from -55°C to +85°C	4.7.3	No physical damage	100% Test
3	Seal Test	Gross leak Meth. 112 MIL-STD-202 Cond. B		No continuous bubble stream or oil leaks as required	100% Test
4	Insulation Resistance (Terminal to Terminal)	At 25°C at rated DC voltage, or at 600 VDC, whichever is less	4.7.7	100,000 megohms-uF, need not exceed 1,000,000 megohms	100% Test
5	% Capacitance Tolerance	At 25° at 1KHz	4.7.8	Per part number	100% Test
6	% Dissipation Factor	At 25°C at 10KHz	4.7.9	.05% maximum	100% Test
7	Visual and Mechanical Inspection	For marking, dimensions and workmanship	4.7.1	Per specification	1.0% AQL

Component Research

Metallized Polypropylene Capacitor - B15

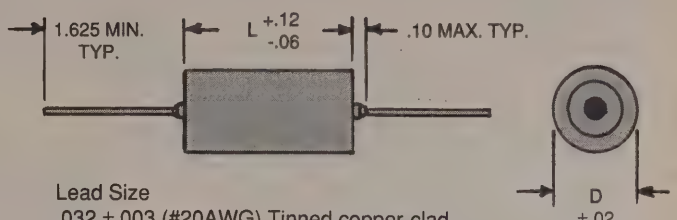
Technical Information

High Current AC Power Capacitors rated to 40 Khz
400 VAC (600 VDC), 600 VAC (800 VDC) -65 to +85°C
100% A.C. Burn-in @ 400 Hz @ 85°C
Resonant power applications
Construction: Metallized Polypropylene, hermetically sealed, leads isolated from case. Metal case insulated with mylar shrink sleeving.

Ordering Information

Part numbers listed in the table have a capacitance tolerance of ±10% (other tolerances are available on special order).

Part Dimensions and Tolerances



Lead Size
.032 ±.003 (#20AWG) Tinned copper-clad steel for case diameter .312
.041 ± .003 (#18AWG) tinned copper for case diameter .400 and larger

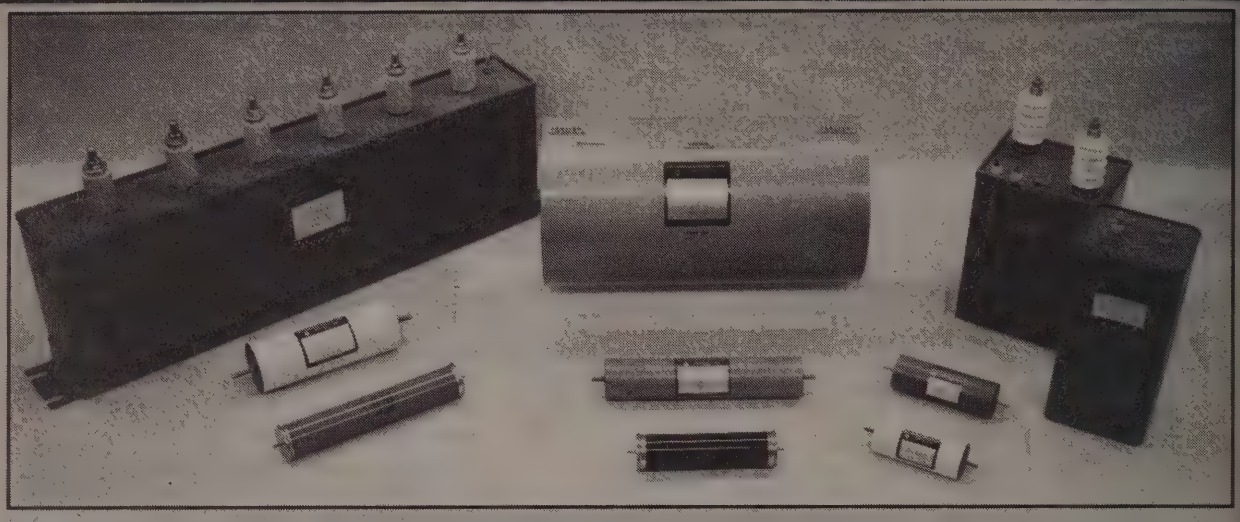
Dimensions & AC Ratings

	Type B15F 400 VRMS Rated							Type B15P 600 VRMS Rated						
	600VDC Rated or 600 Volts Peak (AC Plus DC Volts)			Max. AC Rating -65°C to 100°C				800VDC Rate or 840 Volts Peak (AC PLus DC Volts)			Max. AC Rating -65°C to 100°C			
uF	Part No.	D	L	RMS Volts at 400Hz	RMS Volts at 4KHz	RMS Volts at 40KHz	Max. RMS Amps	Part No.	D	L	RMS Volts at 400Hz	RMS Volts at 4KHz	RMS Volts at 40KHz	Max. RMS Amps
.01	B15F103KSW	.312	.813	400	400	400	2.5	B15P103KSC	.400	1.063	600	600	600	3.5
.012	B15F123KSW	.312	.813	400	400	400	2.5	B15P123KSC	.400	1.063	600	600	600	3.5
.015	B15F153KSW	.312	.813	400	400	400	2.5	B15P153KSC	.400	1.063	600	600	600	3.5
.018	B15F183KSW	.312	.813	400	400	400	2.5	B15P183KSC	.400	1.063	600	600	600	3.5
.022	B15F223KSC	.400	.813	400	400	400	3.0	B15P223KSC	.400	1.063	600	600	600	3.5
.027	B15F273KSC	.400	.813	400	400	400	3.0	B15P273KSC	.400	1.063	600	600	518	3.5
.033	B15F333KSC	.400	.813	400	400	364	3.0	B15P333KSC	.400	1.063	600	600	424	3.5
.039	B15F393KSC	.400	.813	400	400	308	3.0	B15P393KSC	.400	1.063	600	600	369	3.5
.047	B15F473KSC	.400	1.063	400	400	298	3.5	B15P473KSC	.500	1.125	600	600	340	4
.056	B15F563KSC	.400	1.063	400	400	250	3.5	B15P563KSC	.500	1.125	600	600	286	4
.068	B15F683KSC	.400	1.063	400	400	206	3.5	B15P683KSC	.500	1.125	600	600	235	4
.075	B15F753KSC	.400	1.063	400	400	187	3.5	B15P753KSC	.500	1.375	600	600	267	5
.082	B15F823KSC	.500	1.125	400	400	195	4	B15P823KSC	.500	1.375	600	600	244	5
.092	B15F923KSC	.500	1.125	400	400	174	4	B15P923KSC	.562	1.375	600	600	261	6
.1	B15F104KSC	.500	1.125	400	400	160	4	B15P104KSC	.562	1.375	600	600	240	6
.12	B15F124KSC	.500	1.375	400	400	167	5	B15P124KSC	.562	1.375	600	600	200	6
.15	B15F154KSC	.500	1.375	400	400	134	5	B15P154KSC	.562	1.375	600	600	160	6
.18	B15F184KSC	.562	1.375	400	400	133	6	B15P184KSC	.670	1.375	600	600	155	7
.22	B15F224KSC	.562	1.375	400	400	109	6	B15P224KSC	.670	1.375	600	600	127	7
.27	B15F274KSC	.562	1.375	400	400	88.8	6	B15P274KSC	.670	1.875	600	600	118	8
.33	B15F334KSC	.670	1.375	400	400	84.7	7	B15P334KSC	.670	1.875	600	600	96.8	8
.39	B15F394KSC	.670	1.375	400	400	72.1	7	B15P394KSC	.670	1.875	600	600	82.4	8
.47	B15F474KSC	.670	1.875	400	400	68.1	8	B15P474KSC	.750	1.875	600	600	93.6	11
.56	B15F564KSC	.670	1.875	400	400	57	8	B15P564KSC	.750	1.875	600	600	78.5	11
.68	B15F684KSC	.670	1.875	400	400	47	8	B15P684KSC	.750	1.875	600	600	64.7	11
.75	B15F754KSC	.750	1.875	400	400	58.6	11	B15P754KSC	.750	2.375	600	600	69.3	13
.82	B15F824KSC	.750	1.875	400	366	53.7	11	B15P824KSC	1.0	2.375	600	600	63.4	15
.92	B15F924KSC	.750	2.375	400	370	56.6	13							
1.0	B15F105KSC	.750	2.375	400	340	52	13							
1.2	B15F125KSC	.750	2.375	400	333	43.3	13							

Quality Conformance Inspection

Test No.	Test	Test Conditions	Test Method	Test Limit	Inspection Level
1	Burn-In	16 hrs. minimum at 120% rated AC voltage at 400 Hz at 85°C	4.7.2 MIL-C-83421	No physical damage	100% Test
2	Thermal Aging	5 cycles minimum from -55°C to +85°C	4.7.3	No physical damage	100% Test
3	Seal Test	Gross leak Meth. 112 MIL-STD-202 Cond. B		No continuous bubble stream or oil leaks as required	100% Test
4	Insulation Resistance (Terminal to Terminal)	At 25°C at rated DC voltage or at 600 VDC, whichever is less	4.7.7	100,000 megohms-uF, need not exceed 1,000,000 megohms	100% Test
5	% Capacitance Tolerance	At 25°C at 1KHz	4.7.8	Per part number	100% Test
6	% Dissipation Factor	At 25°C at 10KHz	4.7.9	0.05% maximum	100% Test
7	Visual and Mechanical Inspection	For marking, dimensions and workmanship	4.7.1	Per specification	1.0% AQL

High Voltage, Oil Filled Capacitors



Our Capacitors & Their Applications

KM & CPO Series	Composite dielectric of kraft tissue &polyester film with a mineral oil impregnant. A proven standard for the industry, with DC filter, limited AC, and pulse discharge applications.
KN Series	Composite dielectric of kraft tissue & polypropylene film. An economical unit for DC filter, limited AC, and pulse applications.
NS & TS Series	Polypropylene film & teflon film respectively, with a silicone fluid impregnant. Extremely low loss & excellent high frequency characteristics allow for very high rep. rate discharge service and high frequency operation into the megahertz band.
NX Series	Ideally suited for pulse and AC applications. Low loss characteristics allow operation in both pulse discharge and AC applications up to 10 kilohertz (when operated in accordance with the applicable derating graphs for both maximum operating voltage and temperature).
MO Series	Very efficient performer for low voltage and high capacitance applications – i.e., pulse discharge, induction heating, flash photolysis, DC filter. More compact for low voltage applications compared to other standard rated capacitors.

Our Capacitor Specifications

SERIES	CONTAINER	CAPACITANCE MAXIMUM	VOLTAGE MAXIMUM	TEMPERATURE	DIELECTRIC SYSTEM
					KM/CPO
KMOC	CAN	500 mfd.	150KV	-40°C to +85°C	Kraft/Mylar
KMOB	PHENOLIC TUBE	150 mfd.	250 KV	-55°C to +85°C	Kraft/Mylar
KMOP	THERMO PLASTIC TUBE	150 mfd.	250KV	-40°C to +65°C	Kraft/Mylar
KMOG	GLASS	2 mfd.	100 KV	-40°C to +85°C	Kraft/Mylar
CPOC	CAN	500 mfd.	150 KV	-40°C to +85°C	Kraft/Mylar
					KN
KNOC	CAN	300 mfd.	150 KV	-40°C to +65°C *	Kraft/Polypropylene
KNOB	PHENOLIC TUBE	150 mfd.	250 KV	-40°C to +65°C *	Kraft/Polypropylene
KNOP	THERMO PLASTIC TUBE	150 mfd.	250 KV	-40°C to +65°C	Kraft/Polypropylene
KNOG	GLASS	2 mfd.	100 KV	-40°C to +65°C *	Kraft/Polypropylene
					N
NSC	CAN	50 mfd.	50 KV	-40°C to +65°C *	Polypropylene
NSB	PHENOLIC TUBE	60 mfd.	100 KV	-40°C to +65°C *	Polypropylene
NSG	GLASS	1 mfd.	60 KV	-40°C to +65°C *	Polypropylene
					T
TSC	CAN	5 mfd.	50 KV	-55°C to +125°C	Teflon
TSB	PHENOLIC TUBE	1.5 mfd.	100 KV	-55°C to +125°C	Teflon
TSG	GLASS	.04 mfd.	60 KV	-55°C to +125°C	Teflon
					N
NXC	CAN	200 mfd.	3,000 VAC	-40°C to +65°C *	Polypropylene
NXB	PHENOLIC TUBE	60 mfd.	70,000 VAC	-40°C to +65°C *	Polypropylene
NXG	GLASS	3 mfd.	30,000 VAC	-40°C to +65°C *	Polypropylene
					M
MOC	CAN	250 mfd.	3,000 V/Peak	-55°C to +85°C	Mylar

* Derated to 85°C

Condenser Products
2131 Broad St., Brooksville, FL 34609
Phone (904) 796-3561 • Fax (904) 799-0221

1-800-382-6874

Product Application - InfoFAX

Please provide the following information concerning your product application and fax to (904) 799-0221. If you have any questions concerning your capacitor requirements, please call our Engineering or Sales Department.

Name _____ Title _____

Company & Division _____

Company Address _____

City _____ State _____ Zip _____

Telephone Number _____ Extension _____ Date _____

GENERAL CAPACITOR INFORMATION

1. Application _____
2. Capacitance & Tolerance _____
3. Max or Peak Working Voltage _____
4. DC _____ AC _____ Pulse _____
5. Peak Current _____ AMPS _____
6. Operating Life Hours _____ Discharges _____
7. Ambient Operating Temperature _____
8. Maximum Size _____
9. Quantities: Proto Types _____ First Production _____
10. Price Range You Anticipate for First Production _____
11. Desired Delivery _____

	ENERGY STORAGE OR PULSE DISCHARGE	AC OR HIGH FREQUENCY COMMUTATION
Pulse Width	_____	_____
Rep Rate/Freq.	_____	_____
RMS Current	_____	_____
RMS Voltage	_____	_____
Discharge	_____	
Full	_____	
Partial From	_____ To _____	
Percent Voltage Reversal	_____	
Ringing Frequency	_____	

DC FILTER

Ripple Voltage PK to PK _____ Frequency _____

Load Current _____ Pulse Width _____

Load Current Rep Rate _____

Maximum Voltage Drop _____

Condenser Products
2131 Broad St., Brooksville, FL 34609
Phone (904) 796-3561 • Fax (904) 799-0221

1-800-382-6874

Condenser Products

A Component Products Inc. Company
2131 Broad Street, Brooksville,, FL 34609
Phone (904) 796-3561 • Fax (904) 799-0221

Typical Values and Related Sizes

Cap. Value MFD	KMOB/P OD x L**	KNOB/P OD x L**	KMOC W x L x H*	KNOC W x L x H*	KMOG/KNOG OD x L**
			5KV		
.01	1 1/4 x 22	1 1/4 x 2	1 1/4 x 2 3/16 x 2 3/8	1 1/4 x 2 3/16 x 2 3/8	3/4 x 1 3/4
.05	1 1/4 x 2 1/2	1 1/4 x 3	1 1/4 x 2 3/16 x 2 3/8	1 1/4 x 2 3/16 x 2 3/8	29/32 x 2 1/4
.1	1 1/4 x 3	1 1/4 x 3 1/2	1 1/4 x 2 3/16 x 2 3/8	1 1/4 x 2 3/16 x 2 3/8	1 3/8 x 2 1/4
.5	1 5/8 x 5	1 5/8 x 6	1 1/4 x 2 3/16 x 4	1 1/4 x 2 3/16 x 4 1/2	1 5/8 x 5 1/4
1	1 5/8 x 7 1/4	2 1/4 x 5	2 x 3.7 x 3 1/2	2 x 3.7 x 4 1/2	1 5/8 x 6 1/2
5	3 1/2 x 6 1/4	4 x 7 1/2	3 3/4 x 4 9/16 x 4 1/2	3 3/4 x 4 9/16 x 5	
10	3 1/2 x 11 1/2	4 x 11 1/2	3 3/4 x 4 9/16 x 7 1/2	3 3/4 x 4 9/16 x 7 1/2	
25	5 1/2 x 11 1/2	6 1/2 x 11 1/2	4 x 8 x 12	4 1/4 x 13 1/2 x 7	
50	8 x 10 1/2	8 x 14	5 1/4 x 13 1/2 x 11	6 x 15 x 8	
			10KV		
.01	1 1/4 x 3 1/4	1 1/4 x 3 1/4	2 x 3.7 x 3 1/2	2 x 3.7 x 3 1/2	29/32 x 2 3/4
.05	1 1/4 x 5 1/4	1 1/4 x 6 1/4	2 x 3.7 x 3 1/2	2 x 3.7 x 3 1/2	1 5/8 x 2 3/4
.1	1 1/4 x 7 1/4	1 5/8 x 6 1/4	2 x 3.7 x 3 1/2	2 x 3.7 x 3 1/2	1 5/8 x 4 1/4
.5	2 1/4 x 7 1/4	3 x 7 1/4	2 x 3.7 x 5 1/2	2 x 3.7 x 5 1/2	
1	3 x 7 1/4	3 1/2 x 7 1/2	3 3/4 x 4 9/16 x 4 1/2	3 3/4 x 4 9/16 x 5 1/2	
5	4 1/2 x 14	5 1/2 x 14	4 1/4 x 13 1/2 x 7	5 1/4 x 13 1/2 x 7	
10	6 1/2 x 11 1/2	8 x 11 1/2	4 1/4 x 13 1/2 x 11	6 x 15 x 8	
15	8 x 11 1/2	8 x 17 1/2	4 1/4 x 13 1/2 x 15	6 x 18 x 15	
25	8 x 15 1/4	8 x 26	6 x 15 x 15	6 x 15 x 15	
			20KV		
.001	1 x 5 1/2	1 x 5 1/2	2 x 3.7 x 3 1/2	2 x 3.7 x 3 1/2	3/4 x 5 3/8
.005	1 1/4 x 5 1/2	1 5/8 x 5 1/2	2 x 3.7 x 3 1/2	2 x 3.7 x 3 1/2	1 3/8 x 5 3/8
.01	1 5/8 x 5 1/2	1 7/8 x 5 1/2	2 x 3.7 x 3 1/2	2 x 3.7 x 4	1 5/8 x 6 1/2
.05	2 1/2 x 5 1/2	2 1/2 x 7 1/2	2 x 3.7 x 3 1/2	2 x 3.7 x 6	1 5/8 x 12 1/2
.1	2 1/2 x 7 1/2	3 x 7 1/2	2 x 3.7 x 4 1/2	3 3/4 x 4 9/16 x 6	
.5	4 x 9 3/4	4 x 11 3/4	3 3/4 x 4 9/16 x 8	3 3/4 x 4 9/16 x 10 1/2	
1	5 1/2 x 9 3/4	5 1/2 x 11 3/4	4 x 8 x 9	4 x 8 x 10	
5	8 x 16 3/4	8 x 21 3/4	6 x 15 x 12	6 x 21 x 11	
10			6 x 15 x 22	6 x 18 x 19	
			30KV		
.001	1 1/4 x 7 3/4	1 1/4 x 7 3/4	3 3/4 x 4 9/16 x 4	3 3/4 x 4 9/16 x 4	3/4 x 4 3/8
.005	1 5/8 x 7 3/4	1 5/8 x 7 3/4	3 3/4 x 4 9/16 x 4	3 3/4 x 4 9/16 x 4	1 3/8 x 4 3/8
.01	1 3/8 x 7 3/4	2 1/4 x 7 3/4	3 3/4 x 4 9/16 x 4	3 3/4 x 4 9/16 x 4	1 5/8 x 4 3/8
.05	3 1/2 x 8	3 1/2 x 8	3 3/4 x 4 9/16 x 5 1/2	3 3/4 x 4 9/16 x 5	1 5/8 x 9 1/2
.1	3 x 10 3/4	3 1/2 x 11	3 3/4 x 4 9/16 x 6 1/2	3 3/4 x 4 9/16 x 7	1 5/8 x 12 7/8
.5	6 1/2 x 11	6 1/2 x 14	3 3/4 x 4 9/16 x 10 1/2	4 x 8 x 11	
1	8 x 11	8 x 14	4 1/4 x 13 1/2 x 11	5 1/4 x 13 1/2 x 11	
4	8 x 29	8 x 33 1/4	6 x 18 x 19	6 x 18 x 20	

*Plus terminal height **Plus stud length
Sizes may vary slightly from dimensions shown–check with factory for actual sizes. All dimensions are in inches.

For higher voltage and other capacitance values available, **consult factory**.

1-800-382-6874

eem

MINIGLOSSARY CAPACITORS

Anode: One of two plates or conductors. In polarized capacitors, the anode should be connected to the positive conductor in the circuit.

Capacitive Reactance: The opposition (in ohms) of capacitance to the flow of alternating current, equal to the reciprocal of the product of the angular frequency (2π times frequency in Hertz) of the current times the capacitance in farads.

Cathode: One of two plates or conductors. In electrostatic capacitors the cathode is metallic. In electrolytic capacitors the cathode is a liquid, gel or other conductive material which is in intimate contact with a metallic cathodic connection.

Dielectric Constant: The ratio of the capacitance of a capacitor with some material other than air between the capacitor plates to the capacitance of the same capacitor with air between the plates. For example, the dielectric constants of air, Teflon®, polystyrene and ruby mica are 1, 2.1, 2.6 and 5.4, respectively.

Electrolytic: A capacitor with one metallic conductor (generally the anode) and with a liquid or semiconductor cathode. Nonpolarized electrolytic capacitors generally have two equal anodes as well as the liquid cathode. These anodes operate alternately as anode and cathodic connection as alternating current is applied.

Electrostatic: One of two general classes of capacitors in which two or more discrete metallic conductors are present and separated by an insulating dielectric material. Examples include: mica, ceramic, film, and paper types.

Farad: The basic unit of measure in capacitors. A capacitor charged to one volt with a charge of one coulomb (one ampere flowing for one second) has a capacitance of one farad. Capacitors are generally rated at portions of a farad (microfarads or picofarads).

1 farad (F) = 1,000,000 microfarads (μF) 1 microfarad (μF) = 1,000,000 picofarads (pF)

Impedance: All capacitors exhibit impedance. It is a function of capacitor type and internal construction. This can be particularly important in certain applications such as filters for switching power supplies. Capacitors used in these applications often have special multiple tab construction to shorten current paths and to reduce internal resistance.

Leakage Current: Expressed as dcl for electrolytic capacitors, a measure of the intrinsic losses in a charged capacitor. Generally speaking, the lower the dcl, the higher quality the capacitor.

Power Factor: A measure of the overall efficiency of a capacitor. Power factor ratings take all internal losses into consideration in a complex formula. This parameter of certain capacitors is often very important in AC applications such as motor-start and/or motor-run capacitors

Rated Voltage: The rated working voltage of a capacitor. Generally expressed in DC Volts (Vdcw). This is the voltage at which a capacitor may be safely operated at 25°C continuously within its overall parameters.

Ripple Current: The total amount of alternating and direct current that may be applied to an electrolytic capacitor under stated conditions. In general, the higher the ripple current applied, the shorter the operating life of the capacitor will be. Application of significantly higher than rated ripple currents can shorten the capacitor life dramatically and may even cause catastrophic failure (explosion).

Surge Voltage: The momentary surge voltage which may be applied for a stated length of time without doing permanent damage to the unit.

Temperature: Capacitors are generally rated at 25°C at sea level under specific humidity conditions. Operating temperature ranges are also given, along with derating (reliability) curves for operation at temperatures other than 25°C.

Temperature Coefficient: Expressed as TC in ppm (parts per million) or in percent (%) from the norm of 25°C. This is seldom a straight line and may vary widely for certain types. Most capacitors have positive TC in that the capacitance increases as temperature increases. Some types, however, have negative TC in that the capacitance decreases as temperature increases.

Ceramic Capacitor Codes
(Capacitance Given In pF)

Color	Digit	Multiplier	Tolerance			Temperature Coefficient ppm°C	Significant Figure	Multiplier
			Class 1		Class 2			
			10pF or less	Over 10pF				
Black	0	1	±2.0pF	±20%	±20%	0	0.0	–1
Brown	1	10	±0.1pF	±1%		–33		–10
Red	2	100		±2%		–75	1.0	–100
Orange	3	1000		±3%		–150	1.5	–1000
Yellow	4	10000			+100% –0%	–220	2.0	–10000
Green	5		±0.5pF	±5%	±5%	–330	3.3	+1
Blue	6					–470	4.7	+10
Violet	7					–750	7.5	+100
Gray	8	0.01	±0.25pF		+80% –20%	+150 to –1500		+1000
White	9	0.1	±1.0pF	±10%	±10%	+100 to –750		+10000
Silver								
Gold								

CDE CORNELL DUBILIER
538 Sangamo Rd., P.O. Box 128 • Pickens, SC 29671
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ALUMINUM CAPACITORS*

Axial Leaded Capacitors

Type	Applications	Product Strengths	Life Test	Temp. Range C	Max CV Range	Nominal Size DXL Inches
201	Automotive, Commercial & Industrial Electronics	Subminiature + 105 C	1000 hrs at + 105 C	–40 +105	10,000µF - 100µF 6.3V 250V	0.197 x 0.492 to 0.703 x 1.575
557/ UHL	Data & Mobile Communications Military	Commercial Equivalent to 39018/01, Extra High Temperature	2000 hrs +125 C	–55 + 125	1000µF-27µF 5V - 200V	0.380 x 1.062 to 0.380 x 2.812

Radial Leaded Capacitors

Type	Applications	Product Strengths	Life Test	Temp. Range C	Max CV Range	Nominal Size DXL Inches
226 227	Automotive, Commercial & Industrial Electronics	Subminiature + 105 C (226) Subminiature +85 C (227)	1000 hrs +100 C 1000 hrs +85 C	–40 + 105 –40 + 85	10,000µF - 100µF 6.3V - 250V	0.197 x 0.433 to 0.709 x 1.575
228 229	Compact Office and Consumer Electronics	Ultra Subminiature, all 7mm Lengths, Low Leakage	1000 hrs +85 C	–40 + 85	100µF-10µF 6.3V - 50V	0.157 x 0.276 to 0.250 x 0.276
300 301 300R 301R	Switching Power Supply Input and Output Filters	Low ESR, Low 100 kHz Z, Strong Welded Leads Lower ESR-Higher Ripple (300R/301R)	2000 hrs with ripple +105 C	–55 + 105	18000-2200µF 6.3V - 250V	1/2 x 1 to 1 x 3 5/8
350	Very High Frequency Switching Power	Very Low Z beyond 100 kHz Welded Lead, Low ESL	2000 hrs with ripple +105 C	–55 +105	15500-620µF 3V - 100V	3/4 x 1 1/2 to 1 x 2 5/8

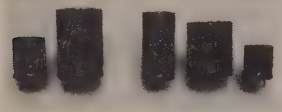
Computer Grade, Screw Terminal Capacitors

Type	Applications	Product Strengths	Life Test	Temp. Range C	Max CV Range	Nominal Size DXL Inches
DCM DCMX	Power Supply Filters, Welders, Power Hold Up, Industrial	Lowest Cost, High Cap Values Wide Voltage Range	1000 hrs at +85C or 100 hrs +85 C with Ripple	–40 + 85	0.74F - 5000µF 6.3V 450V	1 3/8 x 1 5/8 to 3 x 8 5/8
500 500X 500R	High-Ripple Power Supply Filters, Main Frame Computers, Long Life Industrial Applications	Increased Reliability with Increased Temp., Wide Voltage Range Lower ESR and Higher Ripple (500R)	2000 hrs +95 C or 1500 hrs +85 C with Ripple	–40 +95	0.78F - 7400µF 6.3V - 450V	1 3/8 x 1 5/8 to 3 x 8 5/8
550	Motor Control & High Ripple/High Voltage	Ultra-high ripple capability	1000 hrs + 105 C	–40 +105	19000 - 7600µF 200V - 450V	1 3/8 x 1 5/8 to 3 x 8 5/8
101 101X	Wide Temperature Military Power Supply Filters	Commercial Version of MIL-C-39018/04, 06, 10	2000 hrs + 105 C 2000 hrs +85 C with Ripple	–55 +105	0.63F - 8900µF 6.3V - 250V	1 3/8 x 1 5/8 to 3 x 5 7/8

* For complete line of CDE aluminum capacitors, request the aluminum capacitor catalog.

NEW! TYPES 380LX, 381LX SNAPMOUNT CAPACITORS

New low-profile 20 mm height, new high density 20 mm diameter, 105C capability through. 450 Vdc, ripple capability to beyond 10 amps — these high-value, aluminum capacitors are it for power supply input and output capacitors.



POPULAR STOCK RATINGS: TYPE 380LX, 85C

Voltage	Cap µF	ESR (ohms) max @ 120 Hz	Ripple Amps max @ 85C 120 Hz	Nom. Size D x L (mm)	Catalog Number
16	4700	0.141	1.6	22 x 20	380LX472M016H202
16	22000	0.030	6.1	25 x 35	380LX223M016J032
16	33000	0.020	6.8	30 x 40	380LX333M016K042
16	68000	0.010	9.1	35 x 50	380LX683M016A052
25	4700	0.113	1.8	25 x 20	380LX472M025J202
25	6800	0.078	3.5	22 x 30	380LX682M025H022
25	10000	0.053	3.8	22 x 35	380LX103M025H032
25	22000	0.024	6.1	25 x 50	380LX223M025J052
25	33000	0.016	6.8	30 x 50	380LX333M025K052
25	47000	0.011	8.0	35 x 50	380LX473M025A052
35	2200	0.211	1.4	22 x 20	380LX222M035H202
35	3300	0.141	2.7	20 x 25	380LX332M035G012
35	4700	0.099	3.3	25 x 25	380LX472M035J012
35	6800	0.068	2.4	35 x 20	380LX682M035A202
35	10000	0.046	4.4	30 x 30	380LX103M035K022
35	15000	0.031	5.6	25 x 50	380LX153M035J052
35	22000	0.021	6.1	35 x 40	380LX223M035A042
35	33000	0.008	7.2	35 x 50	380LX333M035A052
50	2200	0.181	1.4	25 x 20	380LX222M050J202
50	3300	0.121	1.7	30 x 20	380LX332M050K202
50	4700	0.085	3.0	25 x 30	380LX472M050J022
50	6800	0.059	3.9	30 x 30	380LX682M050K022
50	10000	0.040	5.0	30 X40	380LX103M050K042
50	15000	0.027	6.4	35 x 40	380LX153M050A042
50	22000	0.012	7.6	35 x 50	380LX223M050A052
63	1000	0.332	1.2	22 x 20	380LX102M063H202
63	2200	0.151	2.5	22 x 30	380LX222M063H022
63	3300	0.100	4.1	25 x 30	380LX332M063J022
63	4700	0.071	4.9	30 x 30	380LX472M063K022
63	6800	0.049	5.8	30 x 40	380LX682M063K042
63	10000	0.033	6.5	35 x 40	380LX103M063A042
100	470	0.564	1.0	22 x 20	380LX471M100H202
100	680	0.390	1.1	25 x 20	380LX681M100J202
100	1000	0.265	2.0	22 x 30	380LX102M100H022
100	2200	0.121	3.1	30 x 30	380LX222M100K022
100	3300	0.080	4.1	30 x 40	380LX332M100K042
100	4700	0.056	5.1	35 x 40	380LX472M100A042
100	6800	0.039	6.6	35 x 50	380LX682M100A052

POPULAR STOCK RATINGS: TYPE 380LX, 85C

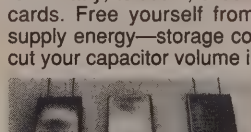
Voltage	Cap µF	ESR (ohms) max @ 120 Hz	Ripple Amps max @ 85C 120 Hz	Nom. Size D x L (mm)	Catalog Number
200	220	0.904	0.9	25 x 20	380LX221M200J202
200	330	0.603	1.6	25 x 25	380LX331M200J012
200	470	0.423	1.9	25 x 30	380LX471M200J022
200	680	0.293	2.7	25 x 35	380LX681M200J032
200	1000	0.199	3.3	35 x 30	380LX102M200A022
200	1200	0.166	3.5	30 x 45	380LX122M200K452
200	1500	0.133	3.9	30 x 50	380LX152M200K052
200	2200	0.090	4.9	35 x 50	380LX222M200A052
250	220	0.904	1.2	22 x 30	380LX221M250H022
250	330	0.603	1.1	35 x 20	380LX331M250A202
250	470	0.423	2.1	25 x 40	380LX471M250J042
250	680	0.293	2.5	35 x 30	380LX681M250A022
250	1000	0.199	3.3	35 x 40	380LX102M250A042
250	1500	0.133	4.0	35 x 50	380LX152M250A052
400	47	4.233	0.3	22 x 20	380LX470M400H202
400	68	2.926	0.8	22 x 25	380LX680M400H012
400	100	1.989	0.5	30 x 20	380LX101M400K202
400	220	0.904	1.5	30 x 30	380LX221M400K022
400	330	0.603	1.9	30 x 40	380LX331M400K042
400	470	0.423	2.4	35 x 45	380LX471M400A452
450	33	6.029	0.2	22 x 20	380LX330M450H202
450	47	4.233	0.3	25 x 20	380LX470M450J202
450	68	2.926	0.4	30 x 20	380LX680M450K202
450	100	1.989	0.5	35 x 20	380LX101M450A202
450	330	0.603	2.0	35 x 40	380LX331M450A04
450	470	0.423	2.5	35 x 50	380LX471M450A052

POPULAR STOCK RATINGS: TYPE 381LX, 105C

Voltage	Cap µF	ESR (ohms) max @ 120 Hz	Ripple Amps max @ 105C 120 Hz	Nom. Size D x L (mm)	Catalog Number
10	33000	0.022	3.4	30 x 35	381LX333M010K032
16	6800	0.088	2.2	22 x 25	381LX682M016H012
16	10000	0.060	2.6	22 x 30	381LX103M016H022
16	22000	0.027	3.8	30 x 35	381LX223M016K032
16	33000	0.018	4.7	35 x 35	381LX333M016A032
25	4700	0.099	2.0	22 x 25	381LX472M025H012
25	6800	0.068	2.4	25 x 25	381LX682M025J012
25	10000	0.046	3.0	25 x 35	381LX103M025J032
25	22000	0.021	4.3	35 x 35	381LX223M025A032
35	2200	0.181	1.4	25 x 20	381LX222M035J202
35	3300	0.121	1.9	22 x 25	381LX332M035H012
35	4700	0.085	2.2	25 x 25	381LX472M035J012
35	6800	0.059	2.6	30 x 30	381LX682M035K022
35	10000	0.040	3.2	30 x 35	381LX103M035K032
50	2200	0.151	1.7	22 x 30	381LX222M050H022
50	3300	0.100	1.7	35 x 20	381LX332M050A202
50	4700	0.071	2.5	30 x 30	381LX472M050K022
50	6800	0.049	3.3	35 x 30	381LX682M050A022
50	10000	0.033	4.0	30 x 50	381LX103M050K052
50	15000	0.022	4.8	35 x 50	381LX153M050A052
200	100	1.989	0.5	22 x 20	381LX101M200H202
200	220	0.904	1.0	22 x 25	381LX221M200H012
200	330	0.603	1.2	25 x 25	381LX331M200J012
200	470	0.282	1.4	35 x 30	381L471M200A022
200	1200	0.166	2.3	35 x 40	381LX122M200A042
450	33	8.038	0.4	22 x 25	381LX330M450H012
450	47	5.644	0.4	25 x 25	381LX470M450J012
450	68	3.901	0.5	25 x 30	381LX680M450J022
450	100	2.653	0.6	25 x 30	381LX101M450J022
450	220	1.206	0.9	35 x 40	381LX221M450A042
450	330	0.804	1.4	30 x 50	381LX331M450K052
450	470	0.564	1.7	35 x 50	381LX471M450A052

TYPE MLP FLATPACK ALUMINUM INPUT CAPACITORS

for military, telecom, & computer power supply modules and circui cards. Free yourself from height problems. Replace the powe supply energy—storage computer grade with an MLP flatpack, an cut your capacitor volume in half and height to less than ½ inch.



Performance Highlights

Height less than ½ inch. 47,000µF/7.5V t 820µF/250V. Operates -55°C to 85°C and t 125°C if potted. Voltages from 5 to 45 Vdc. Case 0.47" x 1.75" x 3".

Cap µF	ESR max. Ω 120Hz	20kHz	Ripple Amps 120Hz	20kHz	Catalog Number
7.5 Vdc — 10 Vdc Surge					
47,000	0.037	0.030	8.6	9.5	MLP473M7R5EB0A
75 Vdc — 100 Vdc Surge					
4,700	0.042	0.033	8.1	9.1	MLP472M7R5EB0A
200 Vdc — 250 Vdc Surge					
1,000	0.140	0.060	4.4	6.7	MLP102M200EB0A
250 Vdc — 300 Vdc Surge					
820	0.160	0.067	4.1	6.4	MLP821M250EB0A

CDE CORNELL DUBILIER
1605 East Rodney French Blvd. • New Bedford, MA 02744
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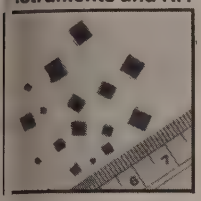
TYPE MC MICA CAPACITOR CHIP

High Frequency, high stability CHIP Mica Capacitors for Instruments and RF.



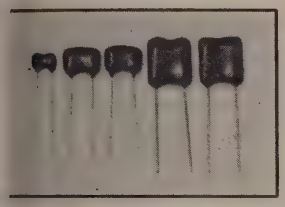
Performance Highlights

Great for High Frequency Applications Like CATV and Flight Radio
Available in Tight Tolerance Exact Values

- Temperature range −55° to 125°C
- Low impedance to beyond 1 GHz
- Near zero capacitance change, all environments
- Handles pulses with dV/dt 20,000
- Rock Stable Through Severe Environments
- Easy to Attach to Printed Circuit Boards
- Capacitance values 1 to 2000 pF ±0.25% to ±5%
- Voltages 100 and 500 WVdc
- Case Sizes 0805, 1210, 1812 and 2220

SNUBBER MIKES

The mica capacitor for snubbers and resonant Power Supplies



Performance Highlights

- Capacitance values from 100pF to 0.01µF

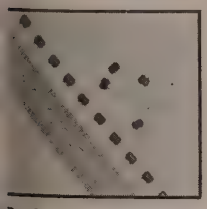
- Up to 8.7 amperes continuous current ratings
- Up to 1500 Vdc voltage ratings
- 20,000 V/µs dV/dt capability minimum
- Quiet - No piezoelectric-effect buzzing
- Zero Capacitance change with voltage
- Near zero capacitance change with frequency and temperature
- 0.0005 typical dissipation factor
- −55°C to +125°C at rated voltage

Popular Snubber Mike Ratings

Volts Vdc	Cap pF	Dimensions, inches L	W	T	S	Type Designation
500	100	0.46	0.36	0.18	0.23	CD15FA101J03
500	220	0.46	0.38	0.20	0.23	CD15FA221J03
500	330	0.47	0.39	0.21	0.23	CD15FC331J03
500	470	0.47	0.40	0.22	0.23	CD15FC471J03
500	680	0.65	0.51	0.21	0.34	CD19FD681J03
500	1000	0.65	0.52	0.22	0.34	CD19FD102J03
500	2200	0.67	0.53	0.25	0.34	CD19FD222J03
500	3300	0.68	0.55	0.29	0.34	CD19FD332J03
500	4700	0.70	0.58	0.35	0.34	CD19FD472J03
500	6800	0.78	0.87	0.29	0.43	CD30FD682J03
500	10000	0.80	0.89	0.34	0.43	CD30FD102J03
1000	100	0.64	0.50	0.19	0.34	CDV19FA101J03
1000	220	0.64	0.50	0.19	0.34	CDV19FA221J03
1000	330	0.65	0.51	0.20	0.34	CDV19FC331J03
1000	470	0.65	0.51	0.20	0.34	CDV19FC471J03
1000	1000	0.66	0.52	0.22	0.34	CDV19FD102J03
1000	2200	0.69	0.56	0.31	0.34	CDV19FD222J03
1000	3300	0.72	0.63	0.46	0.34	CDV19FD332J03
1000	4700	0.76	0.63	0.46	0.34	CDV19FD472J03
1000	6800	0.80	0.89	0.36	0.44	CDV30FD682J03
1000	10000	0.82	0.91	0.42	0.44	CDV30FD102J03

CD4 RF CAPACITOR

The mica capacitor for high frequency and instrumentation



Performance Highlights

- Low impedance to beyond 1 GHz
- The value you need - Up to 1500 pF in 5% steps

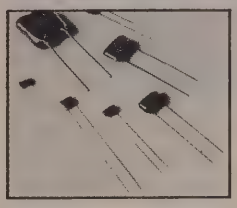
- Replaces other 0.1" lead-spacing capacitors
- Cool operation - Typical Qs > 2000
- Shockproof and delamination free
- Near zero capacitance change with frequency
- Near zero capacitance change with temperature
- Zero capacitance change with voltage
- 0.0005 typical dissipation factor
- 20,000 V/µs dV/dt capability minimum
- −55°C to +125°C at rated voltage

Popular CD4 Ratings

Volts Vdc	Cap pF	Length L in.	Width W in.	Thick T in.	Type Designation
500	10	0.28	0.22	0.11	CD4FD100J03
500	22	0.28	0.22	0.11	CD4FD220J03
500	33	0.28	0.22	0.11	CD4FD330J03
500	47	0.28	0.22	0.11	CD4FD470J03
500	68	0.28	0.22	0.11	CD4FD680J03
500	100	0.28	0.24	0.11	CD4FD101J03
500	220	0.34	0.31	0.16	CD4FD221J03
500	330	0.34	0.31	0.16	CD4FD331J03
500	470	0.34	0.31	0.16	CD4FD471J03
300	680	0.34	0.31	0.16	CD4FC681J03
100	1000	0.34	0.31	0.17	CD4FA102J03
100	1500	0.34	0.31	0.18	CD4FA152J03

FULL-LINE MICA CAPACITORS

The broadest line of dipped mica capacitors



Performance Highlights

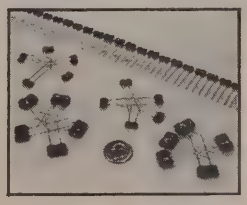
- More stable than other types
- Capacitance values 1 pF to 0.082 µF
- Rated voltage 50 to 2500 Vdc
- Choice of MIL-C-5 or hi rel MIL-C-39001
- Tight tolerance ±½ pF and ±½% available
- Standard tolerance ±5%

CDE CATALOG Designation		CD 6	CD 7	CD 4	CD 5	CD 10	D 10	CD 15	CDA 15	CD 19	CD 30	CD 42
Mil-C-5 Style		—	—	—	—	CM 04	—	CM 05	—	CM 06	CM 07	CM 08
Max., Capacitance pF @ indicated VDCW	100VDCW	120	1500	1500	200	400	1500	1500	1500	8200	40,000	82,000
	300VDCW	120	300	820	120	300	820	820	820	6800	30,000	68,000
	500VDCW	75	180	510		250	510	510	510	5100	20,000	51,000
	1000VDCW									4700	13,000	
	1500VDCW										8,200	
	2000VDCW										4,300	
	2500VDCW										3,000	

MIL-C-39001		CMR 03	CMR 04	CMR 05	CMR 06	CMR 07	CMR 08
	50VDCW	400					
	100VDCW	200	390				82,000
	300VDCW	120	300				68,000
	500VDCW		240	390	4700	20,000	51,000

NEW! TYPE CD17 & CD18 RF CAPACITORS

The mica capacitors for CATV and RF



Performance Highlights

- 1 to 8200pF, 1% to 5%
- 100 to 500 Vdc
- Low impedance to beyond 1 GHz
- Flat insertion loss ±0.20 dB from 200 kHz to 1.2 GHz.
- Replaces Types CD15 & CD17
- -55°C to 125°C at rated volts
- Lead spacing CD17 .234"
  CD18 .344"

Popular CD17 & CD18 Ratings

Volt Vdc	Cap. pF	Length L in.	Width W in.	Thick T in.	Type Designation
500	10	0.45	0.36	0.17	CD17CD100J03
500	22	0.45	0.36	0.17	CD17ED220J03
500	33	0.45	0.36	0.17	CD17ED330J03
500	47	0.45	0.36	0.17	CD17ED470J03
500	68	0.45	0.36	0.18	CD17FD680J03
500	100	0.46	0.36	0.18	CD17FD101J03
500	220	0.46	0.38	0.20	CD17FD221J03
500	330	0.47	0.39	0.21	CD17FD301J03
500	470	0.47	0.40	0.32	CD17FD471J03
500	680	0.65	0.51	0.21	CD18FD681J03
500	1000	0.65	0.52	0.22	CD18FD102J03
500	2200	0.67	0.53	0.25	CD18FD222J03
500	3300	0.68	0.55	0.29	CD18FD332J03
500	4700	0.70	0.58	0.35	CD18FD472J03
300	6800	0.69	0.57	0.33	CD18FC682J03

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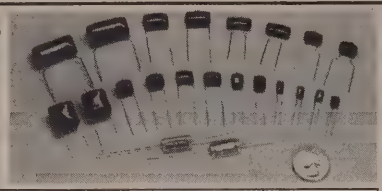
FILM CAPACTIORS

25 Axial and Radial leaded types perform great in AC & Pulse applications.



CONSTRUCTION	TYPE	CAP. RANGE µF	VOLTAGE RANGE	PRODUCT STRENGTHS	APPLICATIONS
POLYESTYER CAPACITORS					
Axial Film/Foil	WMF	.001 - 5	50-600 Vdc (35-220 Vac)	Wide Range of Cap. and Voltage	Commercial Industrial
Axial Film/Foil	WMC	.00047 - .47	80-400 Vdc (50-200 Vac)	Miniature Size	Modules General Purpose
Axial Film/Foil	MFP	.01 - 5	50-600 Vdc (35-250 Vac)	Low Profile	Circuit Cards General Purpose
Axial Metallized	MMA	.01 - 5	125-480 Vac (250-1000 Vdc)	Hi Vac Capability Self Healing	AC Applications
Axial Metallized	MMP	.01 - 10	100-630 Vdc (63-220 Vac)	Low Profile Self Healing	Circuit Cards General Purpose
Axial Metallized	MTE	.047 - 50	60-150 Vdc (40-95 Vac)	Sub-Miniature Self Healing	Modules General Purpose
Axial Metallized	MMWA	.01 - 10	50-1000 Vdc (35-300 Vac)	Wide Range C & V Self Healing	General Purpose
Radial Film/Foil	DLR	.001 - .68	100 Vdc (63 Vac)	Compact Size Auto Insertable	General Purpose Inductive Style
Radial Film/Foil	DLM	.001 - .47	100 Vdc (63 Vac)	Small Footprint Miniature Size	General Purpose Inductive Style
Radial Film/Foil	DMT	.001 - 1.0	100-600 Vdc (65-250 Vac)	Wide Range of Cap. and Voltage	General Purpose
Radial Metallized	DMM	.01 - 10	100-630 Vdc (65-250 Vac)	Optional Lead Space Self Healing	DC Applications General Purpose
Radial Metallized	DMMA	.01 - 5	125-480 Vac (250-1000 Vdc)	Hi Vac Capability Self Healing	AC Applications
POLYPROPYLENE CAPACITORS					
Axial Film/Foil	WPP	.001 - 3	100-1000 Vdc (70-250 Vac)	Close Tolerances High Stability	High Frequency Precise Values
Axial Metallized	930	.022 - 10	100-630 Vdc (70-275 Vac)	Wide Range of Cap. High Stability	Hi Voltage/Freq.
Axial Metallized	935	1 - 30	100-400 Vdc (63-250 Vac)	Low ESR U.L. Approved	Power Supplies Hi Curr Circuits
Axial Metallized	950	5 - 65	250 Vac	Low ESR	Motor Run
Radial Film/Foil	DPP	.001 - .47	100-630 Vdc (63-220 Vac)	W/stands Soldering	Hi Frequency Precise Values
Radial Film/Foil	DPPS	.001 - .033	1000-2000 Vdc (450-500 Vac)	High Voltage High Peak Current	High-Current Snubbers
Radial Film/Foil	DPFF	.001 - .47	200-1600 Vdc (155-500 Vac)	High Voltage High Peak Current	High-Current Snubbers
Radial Film/Foil	DPPM	.001 - .047	1000-2000 Vdc (450-500 Vac)	High Voltage Self-Healing	High Cap Snubbers
Radial Film/Foil	DPMF	.001 - 1	200-1600 Vdc (155-500 Vac)	High Voltage Self-Healing	High Cap Snubbers
Radial Metallized	DPM	.01 - 6.8	250-630 Vdc (160-250 Vac)	Low ESR Optional Lead Space	High Current General Purpose
POLYCARBONATE CAPACITORS					
Axial Film/Foil	WCR	.001 - 2	50-200 Vdc (35-125 Vac)	High Temperature High Stability	Military Precise Values
Axial Metallized	MCR	.01 - 5	100-600 Vdc (70-250 Vac)	Compact Size High Temperature	Military Precise Values
Axial Metallized	MTC	.047 - 30	50-150 Vdc (35-95 Vac)	Sub-Miniature High Temperature	Modules Precise Values

POPULAR STOCK RATINGS

Type DPPM— Metallized Radial Leads Snubber Applications

Cap. µF	Catalog Number	Thickness Inches (mm)	Height Inches (mm)	Length Inches (mm)	Lead Space Inches (mm)
1000 Vdc (450 Vac)					
.001	DPPM10D1K	.256 (6.5)	.452 (11.5)	.984 (25.0)	.826 (21.0)
.0022	DPPM10D22K	.256 (6.5)	.452 (11.5)	.984 (25.0)	.826 (21.0)
.0047	DPPM10D47K	.295 (7.5)	.531 (13.5)	.984 (25.0)	.826 (21.0)
.01	DPPM10S1K	.374 (9.5)	.649 (16.5)	.984 (25.0)	.826 (21.0)
.022	DPPM10S22K	.433 (11.0)	.728 (18.5)	1.220 (31.0)	1.043 (26.5)
.033	DPPM10S33K	.511 (13.0)	.807 (20.5)	1.220 (31.0)	1.043 (26.5)
.047	DPPM10S47K	.590 (15.0)	.885 (22.5)	1.220 (31.0)	1.043 (26.5)
1200 Vdc (475 Vac)					
.001	DPPM12D1K	.256 (6.5)	.452 (11.5)	.984 (25.0)	.826 (21.0)
.0033	DPPM12D33K	.295 (7.5)	.511 (13.0)	.984 (25.0)	.826 (21.0)
.0047	DPPM12D47K	.314 (8.0)	.551 (14.0)	.984 (25.0)	.826 (21.0)
.01	DPPM12S1K	.354 (9.0)	.629 (16.0)	1.220 (31.0)	1.043 (26.5)
.022	DPPM12S12K	.472 (12.0)	.787 (20.0)	1.220 (31.0)	1.043 (26.5)
.033	DPPM12S33K	.551 (14.0)	.866 (22.0)	1.220 (31.0)	1.043 (26.5)
1600 Vdc (500 Vac)					
.001	DPPM16D1K	.256 (6.5)	.452 (11.5)	.984 (25.0)	.826 (21.0)
.0022	DPPM16D22K	.314 (8.0)	.590 (15.0)	.984 (25.0)	.826 (21.0)
.0033	DPPM16D33K	.374 (9.5)	.649 (16.5)	.984 (25.0)	.826 (21.0)
.0047	DPPM16D47K	.413 (10.5)	.748 (19.0)	.984 (25.0)	.826 (21.0)
.01	DPPM16S1K	.472 (12.0)	.866 (22.0)	1.220 (31.0)	1.043 (26.5)
.022	DPPM16S22K	.708 (18.0)	1.082 (27.5)	1.220 (31.0)	1.043 (26.5)
2000 Vdc (500 Vac)					
.001	DPPM20D1K	.275 (7.0)	.492 (12.5)	.984 (25.0)	.826 (21.0)
.0033	DPPM20D33K	.413 (10.5)	.688 (17.5)	.984 (25.0)	.826 (21.0)
.0047	DPPM20D47K	.393 (10.0)	.748 (19.0)	1.220 (31.0)	1.043 (26.5)
.01	DPPM20S1K	.551 (14.0)	.866 (22.0)	1.220 (31.0)	1.043 (26.5)
.015	DPPM20S15K	.629 (16.0)	.964 (24.5)	1.220 (31.0)	1.043 (26.5)

Type WMC— Film/Foil Axial Leads Miniature Size

Cap. µF	Catalog Number	Diameter Inches (mm)	Length Inches (mm)	Lead Diameter Inches (mm)
80 Vdc (50 Vac)				
.001	WMC8D1K	.153 (3.9)	.406 (10.3)	.020 (.5)
.0022	WMC08D22K	.153 (3.9)	.406 (10.3)	.020 (.5)
.01	WMC08DS1K	.185 (4.7)	.406 (10.3)	.020 (.5)
.022	WMC08S22K	.185 (4.7)	.531 (13.5)	.020 (.5)
.1	WMC08P1K	.315 (8.0)	.531 (13.5)	.024 (.6)
200/250 Vdc (125 Vac)				
.0022	WMC2D22K	.185 (4.7)	.406 (10.3)	.020 (.5)
.0033	WMC2D33K	.185 (4.7)	.468 (11.9)	.020 (.5)
.0047	WMC2D47K	.185 (4.7)	.468 (11.9)	.020 (.5)
.01	WMC2DS1K	.185 (4.7)	.531 (13.5)	.020 (.5)
.015	WMC2S15K	.229 (5.8)	.468 (11.9)	.020 (.5)
.022	WMC2S22K	.229 (5.8)	.656 (16.7)	.020 (.5)
.033	WMC2S33K	.250 (6.4)	.656 (16.7)	.020 (.5)
.1	WMC2P1K	.343 (8.7)	.656 (16.7)	.024 (.6)
.22	WMC2P22K	.343 (8.7)	1.218 (30.9)	.024 (.6)
400 Vdc (200 Vac)				
.001	WMC4D1K	.185 (4.7)	.468 (11.9)	.020 (.5)
.0022	WMC4D22K	.185 (4.7)	.531 (13.5)	.020 (.5)
.0033	WMC4D33K	.229 (5.8)	.531 (13.5)	.020 (.5)
.0047	WMC4D47K	.229 (5.8)	.531 (13.5)	.020 (.5)
.01	WMC4DS1K	.250 (6.4)	.656 (16.7)	.020 (.5)
.022	WMC4S22K	.315 (8.0)	.718 (18.2)	.024 (.6)
.033	WMC4S33K	.343 (8.7)	.718 (18.2)	.024 (.6)
.047	WMC4S47K	.343 (8.7)	.906 (23.0)	.024 (.6)

Type DMM— Metallized Radial Leads DC Applications

Cap. µF	Catalog Number	Thickness Inches (mm)	Height Inches (mm)	Length Inches (mm)	Lead Space Inches (mm)
250 Vdc (160 Vac)					
.1	DMM2P1K	.280 (7.0)	.390 (10.0)	.550 (14.0)	.390 (10.0)
.22	DMM2P22K	.280 (7.0)	.470 (12.0)	.710 (18.0)	.590 (15.0)
.33	DMM2P33K	.280 (7.0)	.510 (13.0)	.710 (18.0)	.590 (15.0)
.47	DMM2P47K	.310 (8.0)	.590 (15.0)	.710 (18.0)	.790 (20.0)
1	DMM2W1K	.390 (10.0)	.670 (17.0)	.940 (24.0)	.790 (20.0)
2.2	DMM2W2P2K	.510 (13.0)	.870 (22.0)	1.220 (31.0)	1.080 (27.5)
4.7	DMM2W4P7K	.590 (15.0)	.910 (23.0)	1.380 (35.0)	1.080 (27.5)
400 Vdc (200 Vac)					
.047	DMM4S47K	.310 (8.0)	.430 (11.0)	.550 (14.0)	.390 (10.0)
.1	DMM4P1K	.240 (6.0)	.510 (13.0)	.710 (18.0)	.590 (15.0)
.22	DMM4P22K	.310 (8.0)	.630 (16.0)	.710 (18.0)	.790 (20.0)
.47	DMM4P47K	.390 (10.0)	.710 (18.0)	.940 (24.0)	.790 (20.0)
1	DMM4W1K	.470 (12.0)	.870 (22.0)	1.180 (30.0)	1.080 (27.5)
630 Vdc (250 Vac)					
.01	DMM6S1K	.240 (6.0)	.390 (10.0)	.550 (14.0)	.390 (10.0)
.047	DMM6S47K	.300 (7.5)	.490 (12.5)	.710 (18.0)	.590 (15.0)
.1	DMM6P1K	.350 (9.0)	.610 (15.5)	.710 (18.0)	.590 (15.0)
.47	DMM6P47K	.510 (13.0)	.870 (22.0)	1.180 (30.0)	1.080 (27.5)
1	DMM6W1K	.670 (17.0)	1.180 (30.0)	1.380 (35.0)	1.080 (27.5)

Type 930— Metallized Axial Leads Switching Power Supplies

Cap. µF	Catalog Number	Diameter Maximum Inches (mm)	Length Inches (mm)	ESR (milliohms) 20-100 kHz
100 Vdc (70 Vac)				
.47	930C1P47K	.376 (9.6)	.750 (19.1)	37
1	930C1W1K	.421 (10.7)	1.000 (25.4)	26
250 Vdc (175 Vac)				
.1	930C2P1K	.279 (7.1)	.750 (19.1)	—
.22	930C2P22K	.306 (7.8)	1.000 (25.4)	—
.33	930C2P33K	.362 (9.2)	1.000 (25.4)	—
.47	930C2P47K	.422 (10.7)	1.000 (25.4)	35
1	930C2W1K	.513 (13.0)	1.250 (31.8)	28
2	930C2W2K	.700 (17.8)	1.250 (31.8)	21
400 Vdc (275 Vac)				
.1	930C4P1K	.348 (8.8)	.750 (19.1)	—
.15	930C4P15K	.328 (8.3)	1.000 (25.4)	—
.22	930C4P22K	.385 (9.8)	1.000 (25.4)	—
.47	930C4P47K	.545 (13.8)	1.000 (25.4)	32
1	930C4W1K	.655 (16.6)	1.250 (31.8)	27
2	930C4W2K	.752 (19.1)	1.750 (44.5)	21
3	930C4W3K	.909 (23.1)	1.750 (44.5)	17
630 Vdc (275 Vac)				
.022	930C6S22K	.283 (7.2)	.750 (19.1)	—
.047	930C6S47K	.388 (9.9)	.750 (19.1)	—
1	930C6W1K	.794 (20.2)	1.750 (44.5)	18

Type 935— Metallized Axial Leads Power Supplies

Cap. µF	Catalog Number	Diameter Inches (mm)	Diameter ± Inches (mm)	Length Inches (mm)	Max ESR (milliohms) 20-100 kHz
With Wire Leads		**100 Vdc (70 Vac)**			
1	935C1W1K	.469 (11.9)	.062 (1.6)	.750 (19.1)	15
5	935C1W5K	.640 (16.3)	.093 (2.4)	1.250 (31.8)	10
10	935C1W10K	.805 (20.4)	.093 (2.4)	1.500 (38.1)	9
With Wire Leads		**200 Vdc (140 Vac)**			
1	935C2W1K	.450 (11.4)	.062 (1.6)	1.250 (31.8)	20
3	935C2W3K	.654 (16.6)	.093 (2.4)	1.500 (38.1)	13
10	935C2W10K	.905 (23.0)	.125 (3.2)	2.250 (57.2)	9
20	935C2W20K	1.315 (33.4)	.125 (3.2)	2.250 (57.2)	6
With Wire Leads		**400 Vdc (275 Vac)**			
1	935C4W1K	.620 (15.7)	.093 (2.4)	1.500 (38.1)	19
3	935C4W3K	.961 (24.4)	.125 (3.2)	1.750 (44.5)	12
5	935C4W5K	1.067 (27.1)	.125 (3.2)	2.250 (57.2)	10

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Phone: (508) 996-8564 ext 3360 • Fax: (508) 996-3830

Type MMWA— Metallized Axial Leads High Cap/Voltage

Cap. µF	Catalog Number	Diameter Inches (mm)	Length Inches (mm)	Lead Diameter Inches (mm)
		50 Vdc (35 Vac)		
.1	MMWA05P1K	.220 (5.6)	.562 (14.3)	.020 (.5)
.15	MMWA05P15K	.210 (5.3)	.687 (17.4)	.020 (.5)
.22	MMWA05P22K	.240 (6.1)	.687 (17.4)	.020 (.5)
.33	MMWA05P33K	.280 (7.1)	.687 (17.4)	.024 (.6)
.47	MMWA05P47K	.320 (8.1)	.687 (17.4)	.024 (.6)
1	MMWA05W1K	.335 (8.5)	1.000 (25.4)	.024 (.6)
2	MMWA05W2K	.400 (10.2)	1.250 (31.8)	.024 (.6)
		100 Vdc (65 Vac)		
.01	MMWA1S1K	.170 (4.3)	.562 (14.3)	.020 (.5)
.022	MMWA1S22K	.185 (4.7)	.562 (14.3)	.020 (.5)
.033	MMWA1S33K	.190 (4.8)	.562 (14.3)	.020 (.5)
.047	MMWA1S47K	.200 (5.1)	.562 (14.3)	.020 (.5)
.1	MMWA1P1K	.220 (5.6)	.562 (14.3)	.020 (.5)
.22	MMWA1P22K	.240 (6.1)	.687 (17.4)	.020 (.5)
.33	MMWA1P33K	.280 (7.1)	.687 (17.4)	.024 (.6)
.47	MMWA1P47K	.320 (8.1)	.687 (17.4)	.024 (.6)
1	MMWA1W1K	.335 (8.5)	1.000 (25.4)	.024 (.6)
2	MMWA1W2K	.400 (10.2)	1.250 (31.8)	.024 (.6)
3	MMWA1W3K	.475 (12.1)	1.250 (31.8)	.024 (.6)
10	MMWA1W10K	.670 (17.0)	1.750 (44.5)	.040 (1.0)
		200/250 Vdc (125 Vac)		
.01	MMWA2S1K	.170 (4.3)	.562 (14.3)	.020 (.5)
047	MMWA2S47K	.210 (5.3)	.562 (14.3)	.020 (.5)
.1	MMWA2P1K	.240 (6.1)	.687 (17.4)	.020 (.5)
.22	MMWA2P22K	.310 (7.9)	.687 (17.4)	.024 (.6)
.33	MMWA2P33K	.365 (9.3)	.687 (17.4)	.024 (.6)
.47	MMWA2P47K	.320 (8.1)	1.000 (25.4)	.024 (.6)
1	MMWA2W1K	.430 (10.9)	1.062 (27.0)	.024 (.6)
2	MMWA2W2K	.525 (13.3)	1.250 (31.8)	.032 (.8)
5	MMWA2W5K	.650 (16.5)	1.750 (44.5)	.040 (1.0)
		400 Vdc (200 Vac)		
.01	MMWA4S1K	.170 (4.3)	.562 (14.3)	.020 (.5)
.047	MMWA4S47K	.245 (6.2)	.687 (17.4)	.020 (.5)
.1	MMWA4P1K	.320 (8.1)	.687 (17.4)	.024 (.6)
.22	MMWA4P22K	.335 (8.5)	1.000 (25.4)	.024 (.6)
.33	MMWA4P33K	.360 (9.1)	1.187 (30.1)	.024 (.6)
.47	MMWA4P47K	.415 (10.5)	1.187 (30.1)	.024 (.6)
1	MMWA4W1K	.470 (11.9)	1.750 (44.5)	.024 (.6)
2	MMWA4W2K	.650 (16.5)	1.750 (44.5)	.040 (1.0)
		600/630 Vdc (200 Vac)		
.01	MMWA6S1K	.185 (4.7)	.687 (17.4)	.020 (.5)
.047	MMWA6S47K	.305 (7.7)	.750 (19.1)	.024 (.6)
.1	MMWA6P1K	.340 (8.6)	1.000 (25.4)	.024 (.6)
.47	MMWA6P47K	.470 (11.9)	1.750 (44.5)	.024 (.6)
1	MMWA6W1K	.685 (17.4)	1.750 (44.5)	.040 (1.0)

Type DPFF— Film/Foil Radial Leads AC & Pulse Applications

Cap. µF	Catalog Number	Diameter Inches (mm)	Length Inches (mm)	Lead Space Inches (mm)
		200/250 Vdc (155 Vac)		
.015	DPFF2S15K	.370 (9.4)	.750 (19.1)	.370 (9.4)
.022	DPFF2S22K	.370 (9.4)	.750 (19.1)	.370 (9.4)
.033	DPFF2S33K	.420 (10.7)	.750 (19.1)	.370 (9.4)
.047	DPFF2S47K	.400 (10.2)	.950 (24.1)	.370 (9.4)
.068	DPFF2S68K	.450 (11.4)	.950 (24.1)	.370 (9.4)
.1	DPFF2P1K	.450 (11.4)	1.300 (33.0)	.719 (18.3)
.15	DPFF2P15K	.550 (14.0)	1.300 (33.0)	.719 (18.3)
.22	DPFF2P22K	.620 (15.7)	1.300 (33.0)	.719 (18.3)
.33	DPFF2P33K	.650 (16.5)	1.700 (43.2)	1.094 (27.8)
.47	DPFF2P47K	.750 (19.1)	1.700 (43.2)	1.094 (27.8)
		400 Vdc (200 Vac)		
.01	DPFF4S1K	.400 (10.2)	.750 (19.1)	.375 (9.5)
.033	DPFF4S33K	.500 (12.7)	.950 (24.1)	.375 (9.5)
.15	DPFF4P15K	.650 (16.5)	1.300 (33.0)	.719 (18.3)
.22	DPFF4P22K	.700 (17.8)	1.700 (43.2)	1.094 (27.8)
.33	DPFF4P33K	.800 (20.3)	1.700 (43.2)	1.094 (27.8)
.47	DPFF4P47K	.900 (22.9)	1.700 (43.2)	1.094 (27.8)
		600/630 Vdc (200 Vac)		
.001	DPFF6D1K	.400 (10.2)	.750 (19.1)	.375 (9.5)
.0047	DPFF6D47K	.450 (11.4)	.750 (19.1)	.375 (9.5)
.01	DPFF6S1K	.450 (11.4)	.950 (24.1)	.375 (9.5)
.022	DPFF6S22K	.550 (14.0)	.950 (24.1)	.375 (9.5)
.033	DPFF6S33K	.550 (14.0)	1.300 (33.0)	.719 (18.3)
.047	DPFF6S47K	.600 (15.2)	1.300 (33.0)	.719 (18.3)
.1	DPFF6P1K	.750 (19.1)	1.300 (33.0)	.719 (18.3)
.22	DPFF6P22K	.850 (21.6)	1.700 (43.2)	1.094 (27.8)
		800 Vdc (500 Vac)		
.015	DPFF8S15K	.550 (14.0)	1.300 (33.0)	.719 (18.3)
.022	DPFF8S22K	.600 (15.2)	1.300 (33.0)	.719 (18.3)
.033	DPFF8S33K	.700 (17.8)	1.300 (33.0)	.719 (18.3)
.1	DPFF8P1K	.900 (22.9)	1.700 (43.2)	1.094 (27.8)
		1200 Vdc (500 Vac)		
.015	DPFF12S15K	.650 (16.5)	1.300 (33.0)	.719 (18.3)
.047	DPFF12S47K	.850 (21.6)	1.700 (43.2)	1.094 (27.8)
		1600 Vdc (500 Vac)		
.0022	DPFF16D22K	.500 (12.7)	1.300 (33.0)	.719 (18.3)
.0033	DPFF16D33K	.550 (14.0)	1.300 (33.0)	.719 (18.3)
.0047	DPFF16D47K	.600 (15.2)	1.300 (33.0)	.719 (18.3)
.0068	DPFF16D68K	.650 (16.5)	1.300 (33.0)	.719 (18.3)
.01	DPFF16S1K	.700 (17.8)	1.300 (33.0)	.719 (18.3)
.015	DPFF16S15K	.750 (19.1)	1.700 (43.2)	1.094 (27.8)
.022	DPFF16S22K	.850 (21.6)	1.700 (43.2)	1.094 (27.8)
.033	DPFF16S33K	.950 (24.1)	1.700 (43.2)	1.094 (27.8)

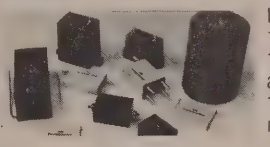
AC/DC HIGH VOLTAGE CAPACITORS

AC and DC High Voltage Capacitors perform great in a wide range of applications including motor run, high-intensity lighting, high-energy pulse discharge, and heart difibrillation.

	AC Motor Run Capacitors	AC Motor Start Capacitors	DC Rated Capacitors	Commutating Capacitors
Type	SM, PF, AP, MP, AF	ETW	OT, T, TMK	SCRN
Voltage Ratings	240 to 660 Vac	110 to 330 Vac	5 to 10 kVdc	200 to 2000 Peak Volts
Capacitance	0.5 - 75 µF	12 - 1200 µF	0.1 - 35 µF	0.25 - 70 µF
Capacitance Tolerance	±10% Standard	±10% Standard	±10% Standard	±10% Standard
Rated Temperature	–40°C to 70°C	–40°C to 65°C	–40°C to 85°C	–40°C to 65°C
Dissipation Factor (Max)	0.10 - 0.6%	N/A	< 1% (OT) ≤ 1% (T) 0.5% (TMK)	.2% to .3%

TYPE KV^X HIGH VOLTAGE AND PULSE CAPACITORS

Spanning voltages up to 150 kV, peak currents up to 10,000 amps and temperatures from -65 to 250°C. Type KV^X Capacitors meet and exceed military and commercial requirements for applications like pulse ignition, corona-free signal coupling, high-voltage energy storage and high-AC-voltage voltage division.



Performance Highlights
1 pF to 10 µF, ±0.5 to ±20%, 500 Vdc, to 150 kVdc, 90 kVac maximum. Corona Free available to 50 kVac or kVdc. -55°C to 125°C, -65°C to 300°C. Wrap and Fill, molded & fiberglass tube units.

Typical Ratings—Wrap & Fill Units

V Volt kVdc	C Cap. µF	Max 1pk A, ½ V & 120pps	L Length in.	W Width in.	H Height in.	Type Designation
1	0.47	430	1.81	1.02	0.14	KVX01B473K0T
1	0.1	440	1.81	1.47	0.17	KVX01B104K0T
1	0.22	420	2.06	1.74	0.24	KVX01B224K0T
1	0.47	610	3.06	1.98	0.24	KVX01B474K0T
1	0.68	840	3.56	2.04	0.27	KVX01B105K0T
1	1	1500	3.81	2.19	0.35	KVX01B105K0T
1	2.2	3100	4.56	3.04	0.41	KVX01B225K0T
1	3.3	3800	4.56	3.29	0.55	KVX01B335K0T
1	4.7	4900	4.56	3.09	0.84	KVX01B475K0T
1	6.8	5500	3.06	3.07	1.93	KVX01B685K0T
2	0.033	440	1.56	1.07	0.18	KVX02B333K0T
2	0.68	580	3.56	1.96	0.40	KVX02B105K0T
2	1	1400	3.81	2.41	0.47	KVX02B105K0T
2	3.3	1900	4.56	2.79	0.91	KVX02B335K0T
2	4.7	2400	3.56	2.37	2.06	KVX02B475K0T
5	0.0047	450	1.81	1.24	0.14	KVX05B472K0T
5	0.01	560	2.06	1.26	0.17	KVX05B103K0T
5	0.068	1700	3.56	1.82	0.25	KVX05B683K0T
5	0.1	2700	2.06	1.78	0.65	KVX05B104K0T
5	1	2900	4.56	2.84	1.27	KVX05B105K0T
10	0.001	220	1.81	1.48	0.13	KVX10B102K0T
10	0.0022	540	2.81	1.46	0.13	KVX10B222K0T
10	0.01	1000	3.56	1.69	0.19	KVX10B103K0T
10	0.047	1400	4.56	2.84	0.28	KVX10B473K0T
10	0.33	1400	4.56	2.88	1.64	KVX10B334K0T
15	.00047	300	2.06	1.81	0.14	KVX15B471K0T
15	.00068	280	2.06	1.25	0.17	KVX15B681K0T
15	0.001	400	3.06	1.64	0.15	KVX15B102K0T
15	0.01	1000	4.31	2.10	0.26	KVX15B103K0T
15	0.22	2600	4.56	3.76	2.15	KVX15B224K0T
20	.00033	240	1.81	1.60	0.18	KVX20B331K0T
20	0.001	420	3.06	1.66	0.19	KVX20B102K0T
20	0.01	2900	3.81	2.25	0.50	KVX20B103K0T
20	0.047	2400	4.31	2.86	1.02	KVX20B473K0T
25	0.0001	220	2.06	1.16	0.17	KVX25B101K0T
25	.00022	230	2.06	1.23	0.25	KVX25B221K0T
25	.00047	320	3.06	1.24	0.27	KVX30B471K0T
25	0.001	680	3.06	2.29	0.20	KVX30B102K0T
25	0.0022	1100	3.06	1.59	0.45	KVX30B222K0T
25	0.0033	1100	3.06	2.02	0.49	KVX30B332K0T
25	0.0047	1700	3.06	2.45	0.53	KVX30B472K0T
25	0.01	2300	4.06	2.35	0.55	KVX30B103K0T
25	0.033	3100	4.56	2.49	1.29	KVX30B333K0T
30	0.0001	310	2.06	1.58	0.22	KVX30B101K0T
30	0.0010	640	3.06	1.70	0.30	KVX30B102K0T
30	0.01	2600	4.81	2.78	0.55	KVX30B103K0T
30	0.022	3000	4.81	2.89	1.11	KVX30B223K0T

Capacitors

a division of
CSI Technologies, Inc.

Over 20 years experience in the design and production of high voltage capacitors up to 250 KV.

PRODUCT CATALOG MAILED ON REQUEST

Medical:	Lasers, X-ray Equipment, Defibrillators
Industrial:	Lasers, Discharge Lighting, High Voltage Power Supplies
Military:	Radar, Communications, HV Power Supplies
Scientific:	Particle Accelerators, Fusion Research, Pulse Power
Communications:	Radio & TV Transmitters

PRODUCT SUMMARY

SERIES	TYPE/ FEATURES	VOLTAGE RANGE (KILOVOLTS) 0.6 1 3 6 10 30 60 100 200	APPLICATIONS
WM	GENERAL PURPOSE PULSE	50nF to 100µF	LASERS PHOTOFLASH
ES	LARGE ENERGY STORAGE	0.5µF to 650µF	ACCELERATORS LASERS PULSE POWER
WPC	PLASTIC CASE LOW INDUCTANCE	10nF to 1µF	LASERS PULSE POWER RESEARCH
AE	VERY LOW INDUCTANCE	5nF to 0.25µF	LOW ENERGY LASERS
CX	COAXIAL CASE LOW INDUCTANCE	50nF to 20µF	PHOTOFLASH LASERS PULSE POWER
MED	SMALL SIZE HIGH DENSITY	← 16 to 50µF	CARDIAC DEFIBRILLATORS
M	GENERAL PURPOSE DC FILTER	0.02 to 50µF	RF TRANSMITTERS POWER SUPPLIES
FT	CYLINDRICAL CASE DC FILTER	2 to 400nF	X RAY VOLTAGE DIVIDERS POWER SUPPLIES
CWF	AXIAL LEADS DC FILTER	1nF to 0.5µF	VOLTAGE MULTIPLIERS DC BLOCKING
SCR	HIGH RMS CURRENT LOW D.F.	1 to 50µF	POWER SEMICONDUCTORS CIRCUITS
AC	50/60 HZ AC LOW D.F.	0.5 to 10µF	LIGHTING BALLASTS STROBE LIGHTING FERRORES. PS
MIL	ALL METAL CASED CAPACITORS	CAPACITORS TO MEET THE REQUIREMENTS OF MIL-C-19978	
CUSTOM		CSI SPECIALIZES IN CUSTOM CAPACITOR DESIGN. WHETHER IT IS A NEW DESIGN OR A RETROFIT OF AN EXISTING DESIGN THAT REQUIRES A SECOND SOURCE, CSI WILL BE PLEASED TO PROVIDE THE PARTS REQUIRED.	

CSI Capacitors, 810 Rancheros Drive, San Marcos, California 92069-3009, U.S.A.
telephone: 619-747-4000 telefax: 619-743-5094 telex: WUI 697832

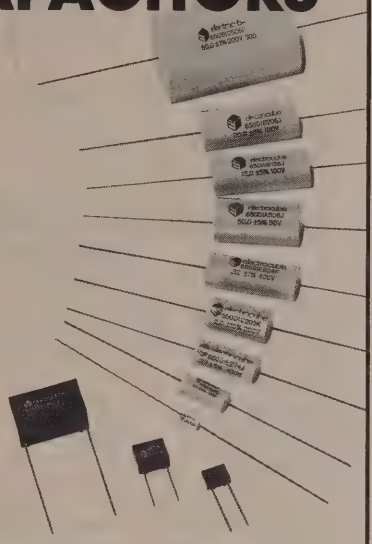
electrocube

FILM CAPACITORS

Precision wrap and fill, oval, round and flat, as well as epoxy case and hermetic sealed capacitors.

A wide variety of styles and performance characteristics to meet virtually any system requirement. Units are rated from 0.0010 to 200 mfd., 50 to 1,000 VDC/67 to 660 VAC volts, with temperature ranges of −55°C to +125°C.

A range of materials is offered for any application—Metallized Polyester, Polystyrene/Foil, Metallized Polycarbonate, Polyester/Foil, Metallized Polypropylene, Polypropylene/Foil and Metallized Combination Film Capacitors.

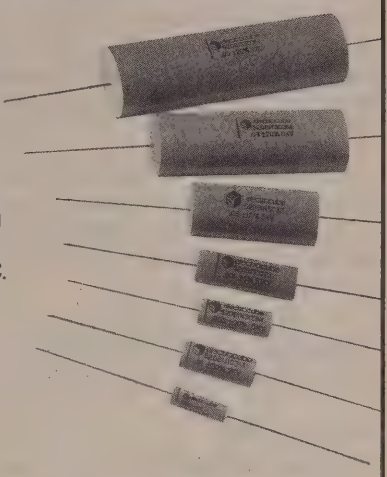


HIGH VOLTAGE CAPACITORS

Miniature wrap and fill capacitors, high performance and long life.

A unique miniature capacitor series for applications requiring voltage ratings from 1,000 to 10,000 VDC. Higher voltages are available on special order. The dielectric materials used are Polyester and Kraft Paper.

All units feature extended foil construction, and tin-coated copper-clad steel leads. Other lead materials are also available.

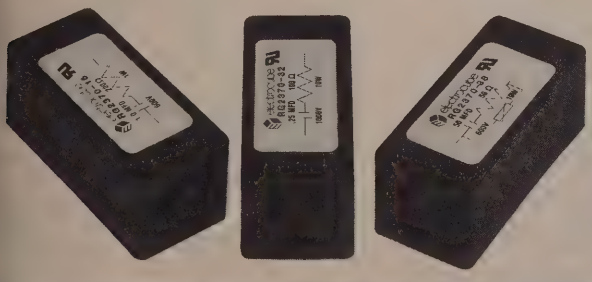


RC NETWORKS

More than 400 precision UL-Recognized RC Networks—many available off-the-shelf.

A series of encapsulated networks developed for such industrial and commercial applications as machine tools, switchgear, motor controls, computers, telephone and automated equipment.

Units may cover the range from 1 to as many as 40 networks in an enclosure, for single or 3-phase operation. Many feature unusual case configurations—metal can or epoxy case—with a variety of leads; networks may also be provided on printed circuit boards.

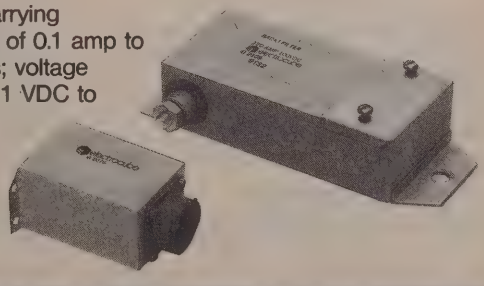


EMI FILTERS

To resolve EMI problems in commercial and aerospace installations.

Electrocube EMI Filters have been designed for the Apollo LEM, Saturn S1VB and Patriot missiles, the C-5A, C-17, F-16 and other current aircraft, as well as for computers and UL Listed commercial equipment.

These filters have current carrying capacities of 0.1 amp to 500 amps; voltage ratings of 1 VDC to 5,000 VDC and up to 660 VAC; frequencies to 1,000 Hz; for intermittent and continuous duty. Single and multicircuit configurations including L, Pi, Pi with feed through capacitors, and T circuits are employed.



electrocube
1307 So. Myrtle Avenue, Monrovia, CA 91016; TEL: (818) 301-0122 ■ FAX: (818) 357-8099

ELECTRONIC CONCEPTS INC.

TYPE 5MP SWITCH-MODE POWER SUPPLY CAPACITORS METALLIZED POLYPROPYLENE

Type 5MP capacitors have been developed by Electronic Concepts for use in switching power supplies. These metallized polypropylene capacitors are manufactured by using special techniques in order to achieve the optimum characteristics for high current, high capacitance, low ESR applications.

For filter designs where capacitance of 50 mfd or less is suitable for the circuit, type 5MP affords the opportunity to improve general system design. These unique capacitors also exhibit none of the "roll-off" of capacitance with frequency often associated with electrolytics.

In addition to the features which make type 5MP particularly suitable for switching applications, they are also characterized by low losses. Other advantages of polypropylene are long-term stability, retrace, low dielectric absorbtion, and high insulation resistance.

INTERNAL CONSTRUCTION

Extended foil winding (non-inductive)

ENCLOSURE

Mylar tape outerwrap

ENVIRONMENTAL

These capacitors shall meet or exceed the requirements of MIL-C-55514 for all the following:

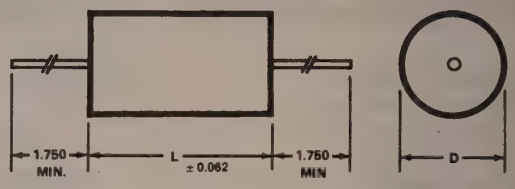
Vibration	(Para. 3.16)
Immersion	(Para. 3.21)
Shock	(Para. 3.17)
Moisture Resistance	(Para. 3.22)
Life	(Para. 3.23)

Electronic Concepts, Inc. is qualified as a supplier for the MIL versions CFR13 and CFR14 capacitors. These capacitors are manufactured to meet the requirements of MIL-C-55514/9. MIL designations are shown in the table above. The last two characters of the MIL designations (CFR13ALB106 - -) specify capacitance tolerance and failure rate respectively (CFR13ALB-106KM).

Capacitance tolerance: M = 20%, K = 10% and J = 5%.

Failure rate level: M, P, R or S

EC Type 5MP12 Military Style CFR13



All dimensions are in inches.

CATALOG NUMBERING SYSTEM

5MP 12 D 106 K

TYPE

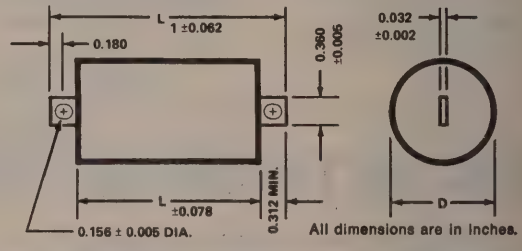
STYLE
Wrap and fill axial leads

VOLTAGE
D = 100 VDC
F = 200 VDC
J = 400 VDC

CAPACITANCE
Expressed in Picofarads, the first two digits are significant figures. The third is the number of zeroes (e.g., 106 equals 10,000,000 pF).

TOLERANCE
M-20% K-10% J-5%
Closer tolerances upon request

EC Type 5MP16 Military Style CFR14



All dimensions are in inches.

CATALOG NUMBERING SYSTEM

5MP 16 D 106 K

TYPE

STYLE
Wrap and fill lug termination

VOLTAGE
D = 100 VDC
F = 200 VDC
J = 400 VDC

CAPACITANCE
Expressed in Picofarads, the first two digits are significant figures. The third is the number of zeroes (e.g., 106 equals 10,000,000 pF).

TOLERANCE
M-20% K-10% J-5%
Closer tolerances upon request

OPERATING TEMPERATURE RANGE

−55°C to +105°C without derating.

CAPACITANCE TOLERANCE

Standard tolerance is ±10%. Tolerances of ±20% and ±5% are available.
NOTE: *Capacitance shall be measured at 25°C, and at or referred to a frequency of 1 KHz for all values.*

DIELECTRIC STRENGTH

Capacitors shall withstand a DC potential of twice rated voltage for one minute through a limiting resistance of 100 ohms/volt without damage or breakdown.

DISSIPATION FACTOR

When measured at the frequency specified for capacitance measurement, the dissipation factor shall not exceed 0.1%.

INSULATION RESISTANCE

When measured at the applicable test temperature, and rated voltage, after 2 minutes electrification, the insulation resistance shall equal or exceed the following values:

Megohm X	+25°C	+85°C	+105°C
Microfarads	300,000	30,000	3,000
Except the insulation resistance in megohms need not exceed	500,000	50,000	5,000

CAPACITANCE CHANGE

Temperature coefficient −200 ±50 PPM/°C from 25°C to −55°C. −350 ±50 PPM/°C from 25°C to 105°C.

ELECTRONIC CONCEPTS INC.

TYPE 5MP SWITCH-MODE POWER SUPPLY CAPACITORS METALLIZED POLYPROPYLENE

EC Type 5MP12 Military Style CFR13

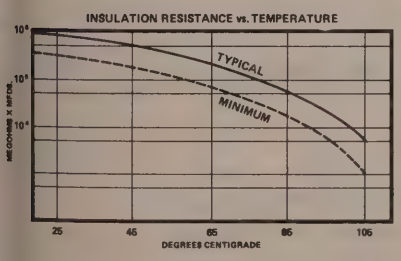
Commercial EC Part Number	Equivalent Military Designation	Capacitance Nominal in MFD	D Diameter	L Length	Lead Dia.	ESR Ohms 20-100 kHz Max	Maximum Ripple Current (AMP RMS) 20-100 kHz Case Temperature +25°C	+35°C	+45°C	+55°C	+65°C	+75°C	+85°C	Resonant Frequency in kHz	I Peak	DVDT
100 VDC																
5MP12D105-	CFR13ALB105--	1.0	.469 ±.062	.750	.032	.015	9.2	8.5	7.8	7.0	6.0	4.9	4.5	1065	407	407
5MP12D205-	CFR13ALB205--	2.0	.534 ±.062	.938	.032	.012	10.8	10.0	9.1	8.2	7.0	5.8	5.3	703	528	264
5MP12D305-	CFR13ALB305--	3.0	.624 ±.093	.938	.040	.011	12.1	11.2	10.3	9.2	8.0	6.5	5.9	574	790	263
5MP12D505-	CFR13ALB505--	5.0	.640 ±.093	1.250	.040	.010	13.8	12.7	11.6	10.4	9.0	7.4	6.7	385	828	166
5MP12D106-	CFR13ALB106--	10.0	.805 ±.093	1.500	.040	.009	15.0	15.0	14.2	12.7	11.0	9.0	8.2	248	1280	128
5MP12D206-	CFR13ALB206--	20.0	.875 ±.125	2.250	.040	.008	15.0	15.0	15.0	15.0	13.6	11.1	10.0	141	1517	76
5MP12D306-	CFR13ALB306--	30.0	1.075 ±.125	2.250	.040	.006	15.0	15.0	15.0	15.0	15.0	12.4	11.4	115	2277	76
5MP12D506-	(Not Available)	50.0	1.375 ±.125	2.250	.040	.004	15.0	15.0	15.0	15.0	15.0	13.6	12.4	89	3795	76
200 VDC																
5MP12F105-	CFR13ALC105--	1.0	.450 ±.062	1.250	.032	.020	7.3	7.3	7.3	7.3	7.2	5.9	5.4	861	250	250
5MP12F205-	CFR13ALC205--	2.0	.605 ±.093	1.250	.032	.015	12.0	12.0	11.3	10.1	8.7	7.1	6.5	609	498	249
5MP12F305-	CFR13ALC305--	3.0	.654 ±.093	1.500	.040	.013	15.0	13.8	12.6	11.3	9.8	8.0	7.3	452	576	192
5MP12F505-	CFR13ALC505--	5.0	.769 ±.093	1.750	.040	.011	15.0	15.0	14.7	13.1	11.4	9.3	8.5	323	782	156
5MP12F106-	CFR13ALC106--	10.0	.905 ±.125	2.250	.040	.009	15.0	15.0	15.0	15.0	13.8	11.3	10.3	200	1139	114
5MP12F206-	CFR13ALC206--	20.0	1.315 ±.125	2.250	.040	.006	15.0	15.0	15.0	15.0	15.0	14.1	12.8	141	2277	114
400 VDC																
5MP12J105-	CFR13ALE105--	1.0	.620 ±.093	1.500	.040	.019	9.5	9.5	9.5	9.5	9.5	7.8	7.1	784	319	319
5MP12J205-	CFR13ALE205--	2.0	.802 ±.093	1.750	.040	.015	15.0	15.0	15.0	13.4	11.6	9.5	8.7	511	521	260
5MP12J305-	CFR13ALE305--	3.0	.961 ±.125	1.750	.040	.012	15.0	15.0	15.0	15.0	13.1	10.7	9.8	417	781	260
5MP12J505-	CFR13ALE505--	5.0	1.067 ±.125	2.250	.040	.010	15.0	15.0	15.0	15.0	15.0	12.5	11.4	283	950	190
5MP12J106-	CFR13ALE106--	10.0	1.543 ±.125	2.250	.040	.006	15.0	15.0	15.0	15.0	15.0	15.0	14.1	200	1898	190

EC Type 5MP16 Military Style CFR14

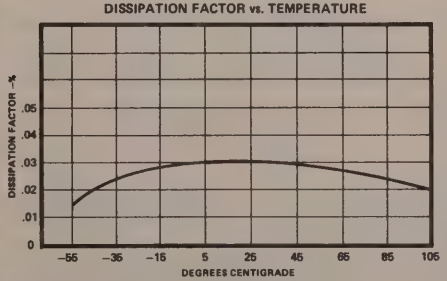
Commercial EC Part Number	Equivalent Military Designation	Capacitance Nominal in MFD	D Diameter	L Length	L_1	ESR Ohms 20-100 kHz Max	Maximum Ripple Current (AMP RMS) 20-100 kHz Case Temperature +25°C	+35°C	+45°C	+55°C	+65°C	+75°C	+85°C	Resonant Frequency in kHz	I Peak	DVDT
100 VDC																
5MP16D105-	CFR14LLB105--	1.0	.469 ±.062	.922	1.640	.015	10.3	9.5	8.7	7.8	6.7	5.5	5.0	949	407	407
5MP16D205-	CFR14LLB205--	2.0	.534 ±.062	1.110	1.828	.012	12.0	11.0	10.0	8.9	7.8	6.3	5.8	617	528	264
5MP16D305-	CFR14LLB305--	3.0	.624 ±.093	1.110	1.828	.011	13.3	12.3	11.2	10.0	8.7	7.1	6.5	504	790	263
5MP16D505-	CFR14LLB505--	5.0	.640 ±.093	1.422	2.140	.010	14.8	13.7	12.5	11.2	9.7	7.9	7.2	347	828	166
5MP16D106-	CFR14LLB106--	10.0	.805 ±.093	1.672	2.390	.009	17.8	16.5	15.0	13.5	11.7	9.5	8.7	227	1280	128
5MP16D206-	CFR14LLB206--	20.0	.875 ±.125	2.422	3.140	.008	21.6	20.0	18.3	16.4	14.2	11.6	10.6	133	1517	76
5MP16D306-	CFR14LLB306--	30.0	1.075 ±.125	2.422	3.140	.006	24.3	22.5	20.5	18.4	15.9	13.0	11.9	108	2277	76
5MP16D506-	(Not Available)	50.0	1.375 ±.125	2.422	3.140	.004	29.6	27.3	25.5	23.6	20.6	20.0	19.7	84	3795	76
200 VDC																
5MP16F105-	CFR14LLC105--	1.0	.450 ±.062	1.422	2.140	.020	7.3	7.3	7.3	7.3	7.3	6.4	5.8	776	250	250
5MP16F205-	CFR14LLC205--	2.0	.605 ±.093	1.422	2.140	.015	14.3	13.3	12.1	10.8	9.4	7.7	7.0	548	498	249
5MP16F305-	CFR14LLC305--	3.0	.654 ±.093	1.672	2.390	.013	15.9	14.7	13.5	12.0	10.4	8.5	7.8	414	576	192
5MP16F505-	CFR14LLC505--	5.0	.769 ±.093	1.922	2.640	.011	18.3	17.0	15.5	13.9	12.0	9.8	8.9	299	782	156
5MP16F106-	CRF14LLC106--	10.0	.905 ±.125	2.422	3.140	.009	22.4	20.7	18.9	16.9	14.6	12.0	10.9	188	1139	114
5MP16F206-	CFR14LLC206--	20.0	1.315 ±.125	2.422	3.140	.006	27.4	25.4	23.2	20.7	17.9	14.7	13.4	133	2277	114
400 VDC																
5MP16J105-	CFR14LLE105--	1.0	.620 ±.093	1.672	2.390	.019	9.5	9.5	9.5	9.5	9.5	8.3	7.5	716	319	319
5MP16J205-	CFR14LLE205--	2.0	.802 ±.093	1.922	2.640	.015	15.0	15.0	15.0	14.2	12.3	10.0	9.1	472	521	260
5MP16J305-	CFR14LLE305--	3.0	.961 ±.125	1.922	2.640	.012	21.1	19.5	17.8	15.9	13.8	11.3	10.3	386	781	260
5MP16J505-	CFR14LLE505--	5.0	1.067 ±.125	2.422	3.140	.010	24.4	22.6	20.6	18.5	16.0	13.1	11.9	265	950	190
5MP16J106-	CFR14LLE106--	10.0	1.543 ±.125	2.422	3.140	.006	30.0	27.8	25.4	22.7	19.7	16.1	14.7	188	1898	190

ELECTRICAL CHARACTERISTICS vs. TEMPERATURE

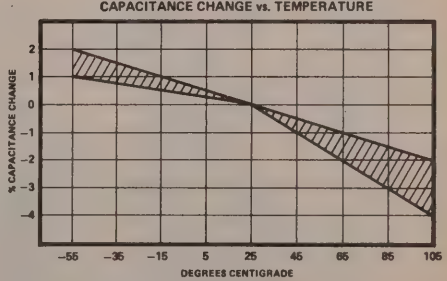
INSULATION RESISTANCE vs. TEMPERATURE



DISSIPATION FACTOR vs. TEMPERATURE



CAPACITANCE CHANGE vs. TEMPERATURE



ELECTRONIC CONCEPTS INC.

TYPE 5MC SWITCH-MODE POWER SUPPLY CAPACITORS METALLIZED POLYCARBONATE

A new innovation pioneered by Electronic Concepts, Inc. leads the way to a new era of miniature metallized polycarbonate film capacitors physically designed to minimize circuit board real estate in switch mode power converters while maintaining a low ESR, excellent ripple capability and high resonant frequency. Electronic Concepts offers, in addition to conventional axial leaded termination, a flat tinned copper tab termination for increased current carrying capability and higher resonant frequency.

To aid the best layout potential, the copper tab terminated version is offered in both high and low profiles for each capacitance/voltage rating.

Excellent electrical characteristics and super miniaturization are offered to switch mode power supply designers with his requirements in mind.

5MC26 and 5MC27 type capacitors are qualified to MIL-c-55514/11, styles CFR26 and CFR27.

5MC29 type capacitors are qualified to MIL-C-55514/12, style CFR29.

CAPACITANCE In MFD	AXIAL LEADS 5MC22			LOW PROFILE 5MC26			HIGH PROFILE 5MC27			TYPE 5MC29			ESR Milliohms 100 KHz	Ripple Current Max @ 25°	Resonant Frequency KHz (5MC22, 5MC26, 5MC27	Resonant Frequency KHz 5MC29
	T	H	L	T	H	L	T	H	L	T	W	H				
50 VDC																
1.0	.250	.343	.687										18	7.8	1106	
3.0	.406	.593	.687										15	9.8	638	
5.0	.406	.593	.812										13	10.6	460	
10.0	.562	.812	.812	.812	.562	.750	.562	.812	.750	.562	.862	.750	11	12.6	325	390
20.0	.718	.968	.937	.968	.718	.875	.718	.968	.875	.718	.968	.875	10	14.8	215	258
50.0	1.000	1.375	1.062	1.375	1.000	1.000	1.000	1.375	1.000	1.000	1.375	1.000	6	23.5	128	154
75 VDC																
1.0	.281	.375	.812										19	7.9	1028	
3.0	.468	.718	.812							.468	.718	.750	15	10.3	593	712
5.0	.500	.750	.937				.500	.750	.875	.500	.750	.875	13	11.6	431	517
10.0	.718	1.031	.937	1.031	.718	.875	.718	1.031	.875	.718	1.031	.875	12	13.5	305	366
20.0	.937	1.312	1.062	1.312	.937	1.000	.937	1.312	1.000	.937	1.312	1.000	11	16.5	203	244
50.0	1.312	1.687	1.312	1.687	1.312	1.250	1.312	1.687	1.250	1.312	1.687	1.250	6	24.2	116	139
100 VDC																
1.0	.281	.375	.937										20	8.0	963	
3.0	.437	.750	.937							.437	.750	.875	15	10.6	556	667
5.0	.593	.906	.937	.906	.593	.875	.593	.906	.875	.593	.906	.875	13	12.4	431	517
10.0	.781	1.093	1.062	1.093	.781	1.000	.781	1.093	1.000	.781	1.093	1.000	12	14.6	287	344
20.0	.906	1.281	1.312	1.281	.906	1.250	.906	1.281	1.250	.906	1.281	1.250	11	17.1	183	220
50.0	1.437	1.812	1.437	1.812	1.437	1.375	1.437	1.812	1.375	1.437	1.812	1.375	6	23.6	111	133

SPECIFICATIONS

Operating Temperature Range: −55°C to +125°C.

Dissipation Factor: When measured at the frequency specified for capacitance measurements, the dissipation factor shall not exceed 0.3%.

Insulation Resistance: When measured at the applicable test temperature, and rated voltage, the insulation resistance shall equal or exceed the following values:

	25°C	85°C	125°C
Megohm x Microfarads	100,000	7,000	700
Except the insulation resistance in megohms need not exceed	200,000	70,000	7,000

Capacitance Change: The Capacitance change vs. temperature for these capacitors shall not exceed the following:

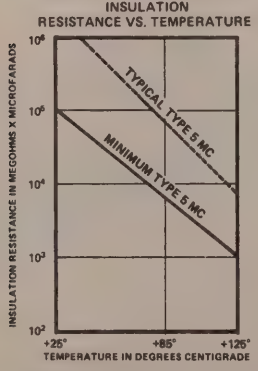
Temperature Degrees C.	−55	+25	+85	+125
Percent Change	−2.5	0	±1.0	±2.0

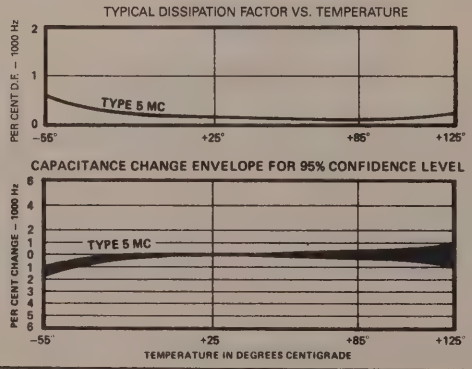
The measurement at each temperature shall be recorded when two successive readings taken at 5-minute intervals indicate no change in capacitance.

Capacitance Tolerance: Standard Tolerance is ±10%. Tolerances of ±20%, ±5%, ±2% and ±1% are available.

Note: Capacitance shall be measured at 25°C, and at or referred to a frequency of 1 KHz.

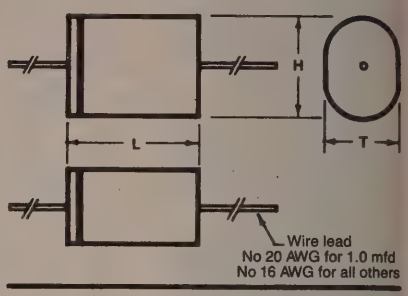
ELECTRICAL CHARACTERISTICS VS TEMPERATURE



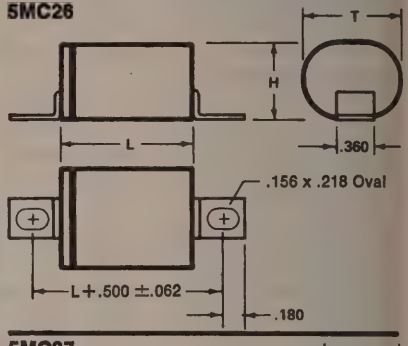


DIMENSIONAL DATA

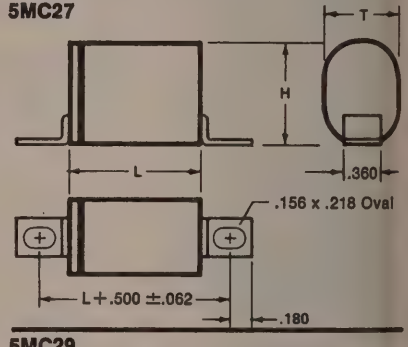
5MC22



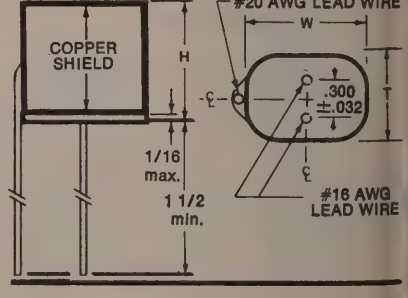
5MC26



5MC27

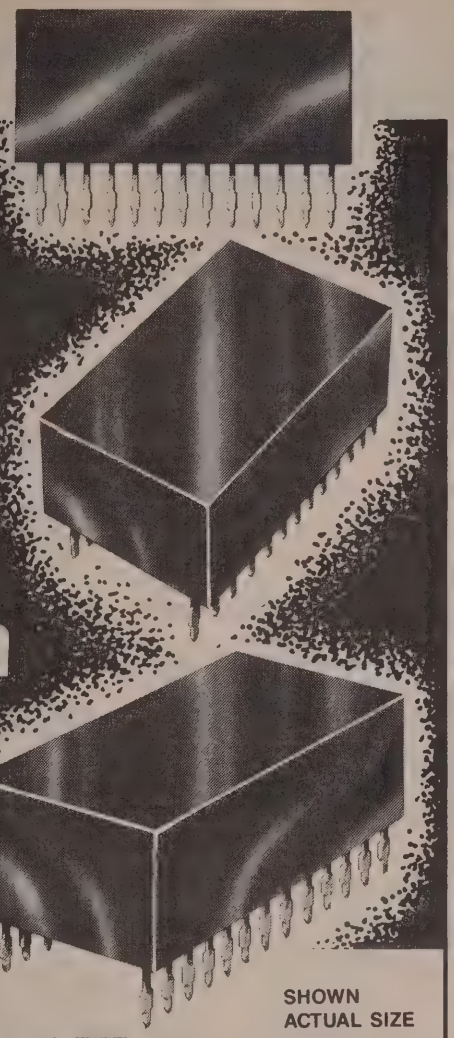


5MC29



L: + 3/32, − 1/16
T & H & W: .291 thru .500 : + .062, − .156
.501 and greater : + .093, − .187

the first polycarbonate capacitor with dual inline leads that out perform the ceramics:



SHOWN
ACTUAL SIZE

our new TYPE 5MC47 metallized polycarbonate

The 5MC47 not only offers the performance and configuration of ceramic capacitors, but also overcomes such negative characteristics as cracking, instability and excess weight. In addition, the 5MC47 generates less heat to eliminate overheating problems. With lower ESR and ESL, a highly protective plastic encapsulation, and a "similar to ceramics" form factor.

***Now* — a better alternative for high frequency AC application!**

WRITE FOR LITERATURE

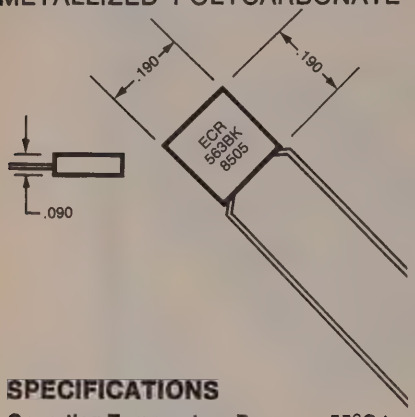
electronic concepts inc.

P.O. Box 1278, EATONTOWN, NJ 07724 ■ (908) 542-7880 ■ FAX (908) 542-0524

SW-514

ELECTRONIC CONCEPTS INC. AVIONICAPS®

METALLIZED POLYCARBONATE



TYPE ECR

- NO PIEZOELECTRIC EFFECT
- NOT FREQUENCY SENSITIVE
- NOT VOLTAGE SENSITIVE
- QUALIFIED TO MIL-C-55514/8, STYLES CFR12 AND CFR16

A new innovation pioneered by Electronic Concepts leads the way to a new era of smaller metallized film capacitors. Now a combination of excellent electrical characteristics and compactness is offered the equipment designer in a size equal to a ceramic CK05 capacitor.

Besides the superior electrical characteristics Type ECR are self-healing, as is the case with all metallized capacitors.

Additionally, these capacitors do not exhibit any of the drawbacks inherent in all ceramic capacitors.

SPECIFICATIONS

Operating Temperature Range: −55°C to +125°C.

Dissipation Factor: When measured at the frequency specified for capacitance measurements, the dissipation factor shall not exceed 0.3%.

Insulation Resistance: When measured at the applicable test temperature, and rated voltage, the insulation resistance shall equal or exceed the following values:

	25°C	85°C	125°C
Megohm x Microfarads	100,000	7,000	700
Except the insulation resistance in megohms need not exceed	200,000	70,000	7,000

Capacitance Change: The Capacitance change vs. temperature for these capacitors shall not exceed the following:

Temperature Degrees C.	−55	+25	+85	+125
Percent Change	−2.5	0	±1.0	±2.0

The measurement at each temperature shall be recorded when two successive readings taken at 5-minute intervals indicate no change in capacitance.

Capacitance Tolerance: Standard Tolerance is ±10%. Tolerances of ±20%, ±5%, ±2% and ±1% are available.

Note: Capacitance shall be measured at 25°C, and at or referred to a frequency of 1KHz.

VALUE IN MFD	VDC	PHYSICAL SIZE T	H	L	LEAD SPACING LS	SEE FIGURE
.0010	250	.090	.190	.190	.200	1
.0012	250	.090	.190	.190	.200	1
.0015	250	.090	.190	.190	.200	1
.0018	250	.090	.190	.190	.200	1
.0022	250	.090	.190	.190	.200	1
.0027	250	.090	.190	.190	.200	1
.0033	250	.090	.190	.190	.200	1
.0039	200	.090	.190	.190	.200	1
.0047	200	.090	.190	.190	.200	1
.0056	200	.090	.190	.190	.200	1
.0068	150	.090	.190	.190	.200	1
.0082	150	.090	.190	.190	.200	1
.010	100	.090	.190	.190	.200	1
.012	100	.090	.190	.190	.200	1
.015	100	.090	.190	.190	.200	1
.018	100	.090	.190	.190	.200	1
.022	75	.090	.190	.190	.200	1
.027	75	.090	.190	.190	.200	1
.033	50	.090	.190	.190	.200	1
.039	50	.090	.190	.190	.200	1
.047	50	.090	.190	.190	.200	1
.056	50	.090	.190	.190	.200	1
.068	50	.095	.245	.295	.200	2
.082	50	.095	.245	.295	.200	2
.10	50	.095	.245	.295	.200	2
.12	50	.095	.295	.295	.200	2
.15	50	.095	.295	.295	.200	2
.18	50	.095	.295	.295	.200	2
.22	50	.095	.395	.395	.300	2
.27	50	.095	.395	.395	.300	2
.33	50	.095	.395	.395	.300	2
.39	50	.095	.395	.395	.300	2
.47	50	.145	.395	.395	.300	2
.56	50	.145	.395	.395	.300	2
.68	50	.195	.395	.395	.300	2
.82	50	.195	.395	.395	.300	2
1.0	50	.195	.395	.395	.300	2

DIMENSIONAL DATA

Figure 1

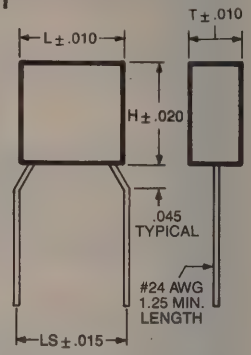
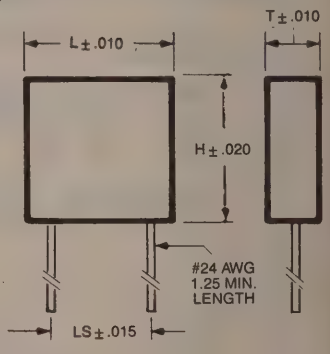
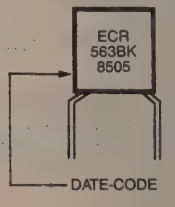


Figure 2

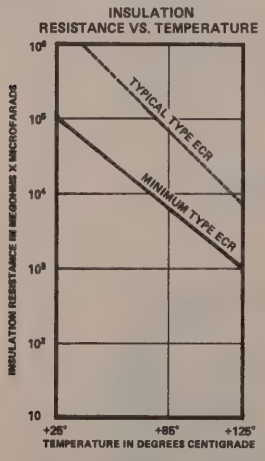


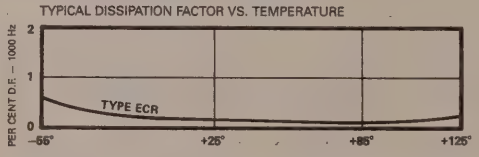
Part Marking

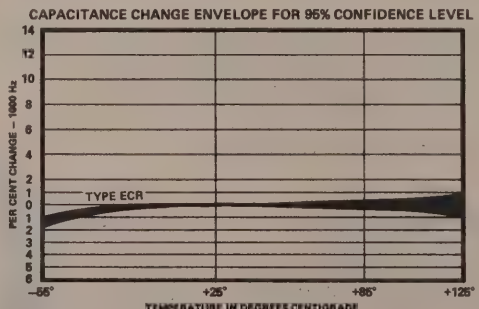


The first two digits represent the year, th second two digits represent the week ie. 8452 is the 52nd week of 1984, 8512 i the 12th week of 1985.

ELECTRICAL CHARACTERISTICS VS TEMPERATURE



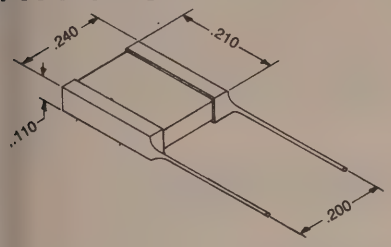




ELECTRONIC CONCEPTS INC.

MINIATURE HERMETICALLY SEALED POLYCARBONATE

TYPE HECR



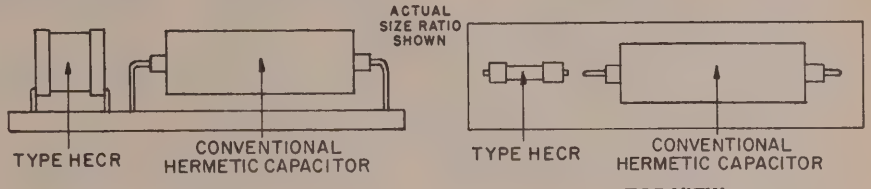
THE FIRST POLYCARBONATE TO OFFER SUBMINIATURE SIZE AND HERMETICITY

The Avionicap® HECR represents a major improvement in capacitor design that will advance the trend toward miniaturization. This improvement is made possible by a new, patented manufacturing process that enables us to maximize density and actually compress the capacitance of a conventional hermetic capacitor into a subminiature package. Type HECR is the smallest hermetically sealed polycarbonate capacitor on the market today, measuring as compact as .100″ × .200″ × .230″, which is 3.5 times smaller in volume than conventional hermetic polycarbonate capacitors. The HECR represents a competitive edge to the user, because it is the first time both subminiature size and hermeticity are available in a polycarbonate capacitor.

Now qualified to MIL-C-39022/11, style CHR20 through CHR25
Also available with insulating plastic sleeves.

OFFERS GREATER DESIGN LATITUDE WITHOUT COMPROMISE

It is no longer necessary for the designer to compromise because of lack of availability. Before the introduction of the HECR, the choice was between using either a larger than ideal hermetic or a non-hermetic in a small enough size. But now the designer can have both miniature size and hermetics — and as a result, he can miniaturize without compromising performance, reliability or environmental protection requirements.



NO LOSS IN ELECTRICAL CHARACTERISTICS AS COMPARED TO CONVENTIONAL HERMETICS

Even though the size of the HECR has been reduced, performance has not been. The HECR still offers excellent stability retrace and insulation resistance, long term capacitance stability, and capacitance as high as 1.0 MFD. There is full hermeticity in accordance with MIL-C-202, method 112. And it meets the environmental and performance standards of MIL-C-83421, as well as other military and commercial standards.

LENDS ITSELF TO END PRODUCT MINIATURIZATION — WITH GREATER PCB DENSITY

Because of its subminiature size the HECR will save valuable printed circuit board surface area and volume, thus allowing for a smaller pc board, and therefore more boards packaged in a specified area. In addition, this capacitor has a rectangular rather than a tubular shape, and is radially rather than axially mounted. As a result the surface area requirement is even further reduced.

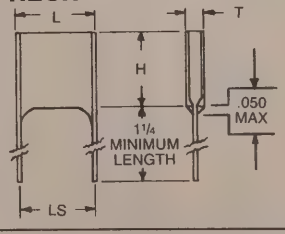
The HECR facilitates miniaturization of the component package and the end product, to reduce system weight and production costs.

NUMERALS INDICATE CASE NUMBERS. SEE ADJACENT TABLE FOR CASE DIMENSIONS

VALUE IN MFD	VDC 30	50	100	150	200	300	VALUE IN MFD	VDC 30	50	100	150	200	300	VALUE IN MFD	VDC 30	50	100	150	200	300
.0010						1	.010		1	2			3	.10		3	5	6		
.0012						1	.012		1	2		3	4	.12		3	5			
.0015						1	.015		1	2		3	4	.15		3	6			
.0018						1	.018		1			3	5	.18	3	4	6			
.0022					1	2	.022		1		3	4	5	.22	3	4	6			
.0027					1	2	.027		1		3	4	5	.27	3	4				
.0033				1	2	3	.033	1	2	3	4	5	6	.33	4	5				
.0039				1	2	3	.039	1	2	3	4	5	6	.39	4	5				
.0047				1	2	3	.047	1	2	3		5		.47	5	6				
.0056			1	2		3	.056	2		3	5	6		.56	5	6				
.0068			1	2		3	.068	2	3	4	5	6		.68	5	6				
.0082			1			3	.082	2	3	4	6			.82	6					
														1.00	6					

CASE NO.	T +.030 −.010	H +.030 −.010	L +.030 −.020	LS ±.015
1	.110	.210	.240	.200
2	.170	.270	.240	.200
3	.170	.270	.340	.300
4	.190	.380	.340	.300
5	.190	.380	.450	.400
6	.220	.500	.450	.400

DIMENSIONAL DATA TYPE HECR



ALL DIMENSIONS SHOWN IN INCHES

ELECTRONIC CONCEPTS INC.
P.O. BOX 1278 EATONTOWN, NEW JERSEY 07724 • (908) 542-7880

MINIGLOSSARY
BASIC
CAPACITOR FORMULAS

I. Capacitance (farads)

English: $C = \frac{.224\,K\,A}{t_D}$

Metric: $C = \frac{.0884\,K\,A}{t_D}$

II. Energy stored in capacitors (Joules, watt-sec)

$E = \frac{1}{2}\,CV^2$

III. Linear charge of a capacitor (Amperes)

$I = C\frac{dV}{dt}$

IV. Total Impedance of a capacitor (ohms)

$Z = \sqrt{R_s^2 + (X_C - X_L)^2}$

Where Rs = ESR

V. Capacitive Reactance (ohms)

$X_C = \frac{1}{2\pi fC}$

VI. Inductive Reactance (ohms)

$X_L = 2\pi fL$

VII. Phase Angles:

Ideal Capacitors: Current leads voltage 90°
Ideal Inductors: Current lags voltage 90°
Ideal Resistors: Current in phase with voltage

VIII. Dissipation Factor

$DF = \tan\delta \text{ (loss angle)} = \frac{ESR}{X_c} = (2\pi fC)\,(ESR)$

IX. Power Factor

PF = Sine δ (loss angle) = Cos ϕ (phase angle)
PF = DF (when less than 10%)

X. Quality Factor (dimensionless)

$Q = \text{Cotan } \delta \text{ (loss angle)} = \frac{1}{DF}$

XI. Equivalent Series Resistance (ohms)

$ESR = (DF)\,(Xc) = (DF)\,(\frac{1}{2}\pi fC)$

XII. Power Loss (watts)

Power loss $= (2\pi fCV^2)\,(DF)$

XIII. KVA (Kilowatts)

$KVA = 2\pi fCV^2 \times 10^{-3}$

XIV. Temperature Characteristic (ppm/°C)

$TC = \frac{Ct - C_{25}}{C_{25}\,(T_t - 25)} \times 10^6$

XV. Cap Drift (%)

$C.D. = \frac{C_1 - C_2}{C_1} \times 100$

XVI. Reliability of Ceramic Capacitors

$\frac{L_O}{L_t} = \left(\frac{V_t}{V_O}\right)^x \left(\frac{T_t}{T_O}\right)^\tau$

XVII. Capacitors in Series (current the same)

Any number: $\frac{1}{C_T} = \frac{1}{C_1} + \frac{1}{C_2} \cdots + \frac{1}{C_N}$

Two: $C_T = \frac{C_1\,C_2}{C_1 + C_2}$

XVIII. Capacitors in Parallel (voltage the same)

$C_T = C_1 + C_2 \cdots + C_N$

XIX. Aging Rate

A.R. = % Δ C/decade of time

XX. Decibels

$db = 20 \log \frac{V_1}{V_2}$

Metric prefixes:

Pico	X 10^{-12}
Nano	X 10^{-9}
Micro	X 10^{-6}
Milli	X 10^{-3}
Deci	X 10^{-1}
Deca	X 10
Kilo	X 10^3
Mega	X 10^6
Giga	X 10^9
Tera	X 10^{12}

Symbols:

K	=	Dielectric Constant
A	=	Area of electrode overlap
t_D	=	Dielectric thickness
V	=	Voltage (volts)
t	=	time (hours)
R_S	=	Series Resistance (ohms)
f	=	frequency (Hertz)
L	=	Inductance (henries)
δ	=	Loss angle
ø	=	Phase angle
x+y	=	Exponent effect of voltage and temperature
L_O	=	Operating life (hours)
L_t	=	Test life (hours)
V_t	=	Test voltage (volts)
V_o	=	Operating voltage (volts)
T_t	=	Test temperature (°C)
T_o	=	Operating temperature (°C)

ELECTRONIC FILM CAPACITORS, INC.

Reidville Industrial Park, 41 Interstate Lane, Waterbury, CT 06705 • Tel: (203) 755-5629 • Fax: (203) 755-0659

E.F.C., although a young company, was founded by a management team with a combined experience of over 50 years in the film capacitor business. We are dedicated to being the most responsible and reliable source for a complete line of precision tight tolerance film capacitors. We offer all metallized varieties of Polyester (Mylar*), Polypropylene, Polycarbonate, as well as foil versions of the above, including high quality Polystyrene with excellent capacitance stability.

METALLIZED POLYPROPYLENE

SP1213 are metallized polypropylene capacitors in a wrap and fill construction. Special metallization and HIGH-TECH terminations allow these capacitors to operate at up to 30 amps ripple current at frequencies up to 100KHZ. **SP1213** exhibit little or no capacitance rolloff, when compared to electrolytics, at these high frequencies.

Operating Temperature:
-55°C to 105°C at full voltage ratings

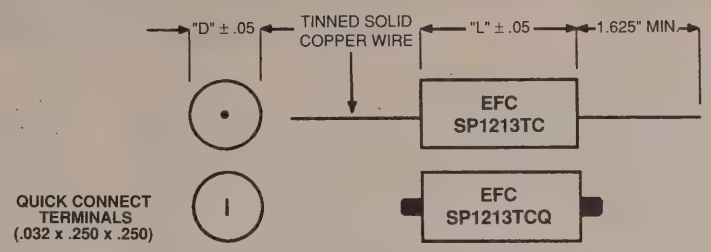
Capacitance Tolerances:
±1%, 2%, 5%, 10% & 20%

Dissipation Factor (1KHZ):
.1% maximum when measured at 25°C

Insulation Resistance:
150,000 megohm-microfarads (need not exceed 300,000 megohms) when measured at rated voltage at 25°C

ESR: see size chart

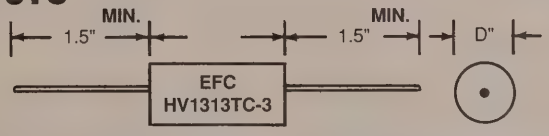
SP1213TC



Dimensional and Current Specifications					
Cap (UF)	D" x L"	Lead Dia.	ESR @ 100 KHZ (Milli Ohms)	Solid Wire Max Ripple Current (Amps)	Quick Connect @ 100 KHZ (25°)
100 VDC					
1.0	.580 x .781	.032	15	9.0	10
2.0	.630 x .906	.032	12	11.0	12
3.0	.750 x .906	.040	11	12.0	13
5.0	.780 x 1.250	.040	9	14.0	15
10.0	.940 x 1,531	.040	8	15.0	18
20.0	1.050 x 2,250	.040	7	15.0	22
30.0	1,250 x 2,250	.040	6	15.0	24
200 VDC					
1.0	.520 x 1.250	.032	20	7.5	8
2.0	.700 x 1,250	.032	15	12.0	14.5
3.0	.750 x 1,531	.040	13	15.0	16
5.0	.870 x 1,781	.040	11	15.0	18.5
10.0	1.030 x 2,250	.040	9	15.0	22.5
20.0	1,450 x 2,250	.040	6	15.0	27.5
400 VDC					
1.0	.720 x 1,531	.032	19	9.5	10.0
2.0	.900 x 1,781	.040	15	15.0	15.0
3.0	1.090 x 1,781	.040	12	15.0	21.0
5.0	1,190 x 2,250	.040	10	15.0	24.5
10.0	1,700 x 2,250	.040	7	15.0	30.0

HV1313TC

Notes: E.F.C. Series HV1313TC capacitors are designed for use with high voltage rectifiers, power supplies for electrostatic copiers and televisions. Operating Temperature: +85C D.F.: 1.0% Maximum at 1KHZ Dimensional Tolerances: ±.05



	2000 VDC		3000 VDC		4000 VDC		5000 VDC		6000 VDC		8000 VDC		10000 VDC		15000 VDC	
Capacitance	D	L	D	L	D	L	D	L	D	L	D	L	D	L	D	L
.001											.250	1.812	.281	2.00	.453	2.375
.0012									.250	1.312	.265	1.812	.312	2.00	.468	2.375
.0015									.265	1.312	.281	1.812	.328	2.00	.531	2.375
.0018									.296	1.312	.296	1.812	.359	2.00	.578	2.375
.0022							.250	1.312	.312	1.312	.328	1.812	.387	2.00	.656	2.375
.0027					.250	1.25	.281	1.312	.343	1.312	.375	1.812	.437	2.00	.703	2.375
.0033					.265	1.25	.296	1.312	.375	1.312	.390	1.812	.468	2.00	.562	3.00
.0039					.281	1.25	.312	1.312	.406	1.312	.437	1.812	.515	2.00	.609	3.00
.0047					.312	1.25	.343	1.312	.343	1.687	.468	1.812	.562	2.00	.656	3.00
.0056					.328	1.25	.375	1.312	.375	1.687	.500	1.812	.609	2.00	.718	3.00
.0068			.250	1.25	.359	1.25	.406	1.312	.406	1.687	.546	1.812	.671	2.00	.781	3.00
.0087			.265	1.25	.375	1.25	.343	1.687	.437	1.687	.484	2.312	.734	2.00	.859	3.00
.01	.218	1.25	.286	1.25	.409	1.25	.375	1.687	.484	1.687	.531	2.312	.796	2.00	.937	3.00
.012	.234	1.25	.317	1.25	.445	1.25	.406	1.687	.531	1.687	.562	2.312	.875	2.00	1.031	3.00
.015	.250	1.25	.343	1.25	.375	1.75	.437	1.687	.578	1.687	.625	2.312	.750	2.625	1.156	3.00
.018	.265	1.25	.375	1.25	.406	1.75	.500	1.687	.531	2.062	.687	2.312	.796	2.625		
.022	.296	1.25	.406	1.25	.428	1.75	.531	1.687	.578	2.062	.750	2.312	.875	2.625		
.027	.312	1.25	.359	1.75	.484	1.75	.578	1.687	.640	2.062	.875	2.312	.968	2.625		
.033	.343	1.25	.375	1.75	.531	1.75	.531	2.062	.703	2.062	.906	2.312	1.062	2.625		
.039	.375	1.25	.437	1.75	.562	1.75	.593	2.062	.796	2.062	.843	2.812				
.047	.359	1.50	.453	1.75	.515	2.25	.625	2.062	.828	2.062	.921	2.812				
.056	.375	1.50	.468	1.75	.562	2.25	.687	2.062	.906	2.062	1.000	2.812				
.068	.406	1.50	.453	2.25	.609	2.25	.750	2.062	.875	2.437	1.125	2.812				
.087	.453	1.50	.484	2.25	.671	2.25	.734	2.437	.953	2.437	1.250	2.812				
.10	.500	1.50	.531	2.25	.734	2.25	.875	2.437	1.062	2.437	1.375	2.812				

ELPAC COMPONENTS

OVER 30 YEARS OF EXCELLENCE

FILM CAPACITORS MADE EASY

Elpac's film capacitors offer high quality at competitive prices. They are typically available from 0.001 to 25 microfarads at voltages from 50 to 1,000VDC with temperatures up to 125°C (teflon is good up to 200°C). Film capacitors are non-polarized and are noted for their low leakage and capacitance stability over variations in voltage, frequency, and temperature. They also provide excellent volumetric efficiency at higher voltage ratings (over 100 volts), and are applicable to high energy filter applications because of their extremely low DF and exceptionally low ESR (the lowest of all capacitor dielectrics). Film capacitors are typically utilized in test and measurement instruments, telecommunication equipment, industrial control systems, and computers or computer peripherals.
...Available in 5 primary series.
Each with multiple packaging options.

FILM CAPACITOR PRODUCT GUIDE

Applications	Z Polyester Metallized	MD Polyester Film-Foil	PM Polypropylene Metallized	C Polycarbonate Metallized	PD Polystyrene Film-Foil
Coupling	Yes	Yes	Yes	Yes	
Bypass	Yes	Yes	Yes	Yes	
Filtering	Yes	Yes	Yes	Yes	
Timing			Yes	Yes	Yes
Pulse Discharge		Yes			No
Arc Suppression	Yes	Yes			No
Ripple Suppression	No	Yes			
Tuning		No	Yes	Yes	Yes

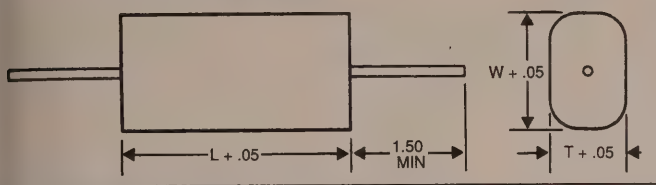
Ratings

Cap Range .001 to	25uf	5uf	10uf	12uf	1.5uf
Temp Range –55°C to	+125°C	+125°C	+105°C	+125°C	+85°C
Tempco in ppm	960	960	300	120	90
DF @ 25°C 1Khz	0.8%	0.8%	0.1%	0.25%	0.1%
DA @ 25°C	0.5%	0.25%	0.1%	0.2%	.05%
IR (Meg x Mfd)	10K	50K	100K	25K	100K
Stability/Yr.	0.2%	0.2%	0.2%	0.3%	0.1%

ELPAC COMPONENTS
A DIVISION OF ELPAC ELECTRONICS, INC.
1562 REYNOLDS, IRVINE, CA 92714
TEL. (714) 476-6070 • FAX (714) 476-6085

Z SERIES Polyester Oval Metallized Wrap and Fill

- ☐ Excellent General Purpose Capacitor
- ☐ Best Volumetric Efficiency
- ☐ Lowest Cost
- ☐ Excellent Dielectric Strength



LEAD SIZE		
CASE LENGTH	A.W.G.	LEAD DIA.
.40 THRU .65	NO. 24	.020
.78 THRU .90	NO. 22	.025
1.17 THRU 1.90	NO. 20	.032

	50 VDC				100 VDC				200 VDC				400 VDC				600 VDC			
MFD	T	W	L	PART NO.	T	W	L	PART NO.	T	W	L	PART NO.	T	W	L	PART NO.	T	W	L	PART NO.
.001	.09	.18	.40	Z5A102	.09	.18	.40	Z1A102	.09	.18	.40	Z2A102	.09	.18	.40	Z4A102	.09	.18	.40	Z6A102
.0012	.09	.18	.40	Z5A122	.09	.18	.40	Z1A122	.09	.18	.40	Z2A122	.09	.18	.40	Z4A122	.09	.18	.40	Z6A122
.0015	.09	.18	.40	Z5A152	.09	.18	.40	Z1A152	.09	.18	.40	Z2A152	.09	.18	.40	Z4A152	.09	.18	.40	Z6A152
.0018	.09	.18	.40	Z5A182	.09	.18	.40	Z1A182	.09	.18	.40	Z2A182	.09	.18	.40	Z4A182	.09	.18	.40	Z6A182
.0022	.09	.18	.40	Z5A222	.09	.18	.40	Z1A222	.09	.18	.40	Z2A222	.09	.18	.40	Z4A222	.09	.18	.40	Z6A222
.0027	.09	.18	.40	Z5A272	.09	.18	.40	Z1A272	.09	.18	.40	Z2A272	.09	.18	.40	Z4A272	.09	.18	.40	Z6A272
.0033	.09	.18	.40	Z5A332	.09	.18	.40	Z1A332	.09	.18	.40	Z2A332	.09	.18	.40	Z4A332	.09	.18	.40	Z6A332
.0039	.09	.18	.40	Z5A392	.09	.18	.40	Z1A392	.09	.18	.40	Z2A392	.09	.18	.40	Z4A392	.09	.18	.40	Z6A392
.0047	.09	.18	.40	Z5A472	.09	.18	.40	Z1A472	.09	.18	.40	Z2A472	.09	.18	.40	Z4A472	.09	.18	.40	Z6A472
.0056	.09	.18	.40	Z5A562	.09	.18	.40	Z1A562	.09	.18	.40	Z2A562	.09	.18	.40	Z4A562	.09	.18	.53	Z6A562
.0068	.09	.18	.40	Z5A682	.09	.18	.40	Z1A682	.09	.18	.40	Z2A682	.09	.18	.40	Z4A682	.09	.18	.53	Z6A682
.0082	.09	.20	.40	Z5A822	.09	.18	.40	Z1A822	.09	.18	.40	Z2A822	.09	.18	.40	Z4A822	.09	.18	.53	Z6A822
.01	.09	.18	.40	Z5A103	.09	.18	.40	Z1A103	.09	.18	.40	Z2A103	.09	.18	.40	Z4A103	.09	.18	.53	Z6A103
.012	.09	.18	.40	Z5A123	.09	.18	.40	Z1A123	.09	.18	.40	Z2A123	.09	.18	.53	Z4A123	.11	.20	.53	Z6A123
.015	.09	.18	.40	Z5A153	.09	.18	.40	Z1A153	.09	.18	.40	Z2A153	.09	.18	.53	Z4A153	.12	.22	.53	Z6A153
.018	.09	.18	.40	Z5A183	.09	.18	.40	Z1A183	.09	.18	.40	Z2A183	.09	.18	.53	Z4A183	.14	.23	.53	Z6A183
.022	.09	.18	.40	Z5A223	.09	.18	.40	Z1A223	.09	.18	.53	Z2A223	.09	.18	.53	Z4A223	.15	.25	.53	Z6A223
.027	.09	.18	.40	Z5A273	.09	.18	.40	Z1A273	.09	.18	.53	Z2A273	.11	.21	.53	Z4A273	.18	.27	.53	Z6A273
.033	.09	.18	.40	Z5A333	.11	.19	.40	Z1A333	.09	.18	.53	Z2A333	.12	.22	.53	Z4A333	.18	.29	.53	Z6A333
.039	.09	.18	.40	Z5A393	.12	.20	.40	Z1A393	.09	.18	.53	Z2A393	.14	.24	.53	Z4A393	.18	.27	.65	Z6A393
.047	.09	.18	.40	Z5A473	.12	.22	.40	Z1A473	.09	.18	.53	Z2A473	.15	.25	.53	Z4A473	.20	.29	.65	Z6A473
.056	.09	.18	.40	Z5A563	.12	.25	.40	Z1A563	.11	.20	.53	Z2A563	.17	.27	.53	Z4A563	.22	.32	.65	Z6A563
.068	.09	.18	.40	Z5A683	.12	.28	.40	Z1A683	.12	.22	.53	Z2A683	.20	.30	.53	Z4A683	.23	.34	.65	Z6A683
.082	.10	.20	.40	Z5A823	.10	.20	.53	Z1A823	.14	.23	.53	Z2A823	.16	.28	.68	Z4A823	.25	.35	.65	Z6A823
.1	.12	.22	.40	Z5A104	.12	.21	.53	Z1A104	.16	.25	.53	Z2A104	.18	.20	.65	Z4A104	.25	.35	.78	Z6A104
.12	.13	.23	.40	Z5A124	.13	.22	.53	Z1A124	.17	.27	.53	Z2A124	.20	.32	.65	Z4A124	.28	.37	.78	Z6A124
.15	.15	.25	.40	Z5A154	.15	.23	.53	Z1A154	.20	.29	.53	Z2A154	.23	.36	.65	Z4A154	.27	.39	.90	Z6A154
.18	.10	.20	.53	Z5A184	.17	.25	.53	Z1A184	.22	.32	.53	Z2A184	.21	.34	.78	Z4A184	.31	.44	.90	Z6A184
.22	.12	.22	.53	Z5A224	.19	.27	.53	Z1A224	.18	.31	.65	Z2A224	.24	.37	.78	Z4A224	.27	.39	1.17	Z6A224
.27	.13	.23	.53	Z5A274	.15	.27	.65	Z1A274	.21	.33	.65	Z2A274	.27	.40	.78	Z4A274	.31	.44	1.17	Z6A274
.33	.15	.25	.53	Z5A334	.17	.24	.65	Z1A334	.24	.36	.65	Z2A334	.27	.40	.90	Z4A334	.35	.48	1.17	Z6A334
.39	.17	.27	.53	Z5A394	.15	.27	.78	Z1A394	.22	.34	.78	Z2A394	.30	.42	.90	Z4A394	.39	.53	1.17	Z6A394
.47	.19	.29	.53	Z5A474	.17	.27	.78	Z1A474	.24	.37	.78	Z2A474	.33	.46	.90	Z4A474	.44	.57	1.17	Z6A474
.56	.16	.28	.65	Z5A564	.19	.31	.78	Z1A564	.27	.40	.78	Z2A564	.29	.44	1.17	Z4A564	.48	.60	1.17	Z6A564
.68	.17	.30	.65	Z5A684	.22	.33	.78	Z1A684	.31	.43	.78	Z2A684	.33	.48	1.17	Z4A684	.39	.57	1.70	Z6A684
.82	.19	.32	.65	Z5A824	.23	.33	.78	Z1A824	.34	.47	.78	Z2A824	.37	.52	1.17	Z4A824	.44	.60	1.70	Z6A824
1.0	.22	.35	.65	Z5A105	.23	.34	.90	Z1A105	.33	.46	.90	Z2A105	.41	.56	1.17	Z4A105	.50	.65	1.70	Z6A105
1.2	.21	.33	.78	Z5A125	.25	.38	.90	Z1A125	.29	.42	1.17	Z2A125	.40	.55	1.40	Z4A125	.54	.74	1.70	Z6A125
1.5	.24	.36	.78	Z5A155	.29	.39	.90	Z1A155	.34	.48	1.17	Z2A155	.45	.60	1.40	Z4A155	.64	.78	1.70	Z6A155
1.8	.26	.39	.78	Z5A185	.32	.45	.90	Z1A185	.38	.52	1.17	Z2A185	.42	.62	1.70	Z4A185	.68	.88	1.70	Z6A185
2.0	.28	.41	.78	Z5A205	.34	.45	.90	Z1A205	.40	.55	1.17	Z2A205	.45	.65	1.70	Z4A205	.73	.93	1.70	Z6A205
3.0	.31	.44	.90	Z5A305	.35	.45	1.17	Z1A305	.52	.64	1.17	Z2A305	.47	.77	1.98	Z4A305	.80	1.05	1.98	Z6A305
4.0	.29	.44	1.17	Z5A405	.35	.46	1.40	Z1A405	.52	.66	1.40	Z2A405	.52	.82	2.20	Z4A405	.95	1.20	1.98	Z6A405
5.0	.34	.48	1.17	Z5A505	.40	.55	1.70	Z1A505	.50	.69	1.70	Z2A505	.60	.90	2.20	Z4A505	1.00	1.25	2.25	Z6A505
6.0	.37	.52	1.17	Z5A605	.40	.57	1.70	Z1A605	.58	.73	1.70	Z2A605								
8.0	.44	.59	1.17	Z5A805	.40	.63	1.98	Z1A805	.55	.84	1.98	Z2A805								
10.0	.44	.58	1.40	Z5A106	.40	.80	1.98	Z1A106	.57	.87	2.20	Z2A106								
12.0	.41	.60	1.70	Z5A126	.40	.92	1.98	Z1A126	.64	.94	2.20	Z2A126								
15.0	.46	.66	1.70	Z5A156	.40	1.20	1.98	Z1A156	.73	1.03	2.20	Z2A156								
18.0	.52	.72	1.70	Z5A186																
20.0	.45	.75	1.98	Z5A206																
25.0	.52	.82	1.98	Z5A256																

*Round Wrap and Fill, Molded-Box and Hermetic Styles are available.

How to Order (Add tolerance code to part number shown above)

Z 5 A* 104 K –1

- **Series** Z
- **Voltage** 5 = 50v 1 = 100v 2 = 200v 4 = 400v 6 = 600v
- **Style** (Wrap and Fill, Oval, Axial) A*
- **Cap Code** 104
- **Tolerance Code** F = 1% G = 2% H = 3% J = 5% K = 10% M = 20%
- **Options** -1 = Add Clear Sleeve /R = Tape and Reel

ELPAC COMPONENTS
A DIVISION OF ELPAC ELECTRONICS, INC.
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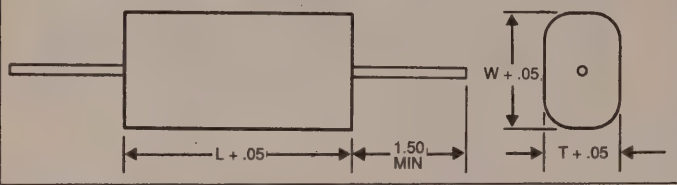
MD SERIES Polyester Film – Foil Oval

- ☐ Excellent for High Current/ High Frequency
- ☐ Ideal for Pulse Circuits
- ☐ Low Cost



LEAD SIZE		
CASE LENGTH	A.W.G.	LEAD DIA.
.58 THRU .71	NO. 24	.020
.84 THRU 1.25	NO. 22	.025
1.50 THRU 2.25	NO. 20	.032

	50 VDC				100 VDC				200 VDC				400 VDC				600 VDC			
MFD	T	W	L	PART NO.	T	W	L	PART NO.	T	W	L	PART NO.	T	W	L	PART NO.	T	W	L	PART NO.
.001	.10	.20	.58	MD5A102	.10	.20	.58	MD1A102	.10	.20	.58	MD2A102	.10	.20	.58	MD4A102	.10	.20	.58	MD6A102
.0012	.10	.20	.58	MD5A122	.10	.20	.58	MD1A122	.10	.20	.58	MD2A122	.10	.20	.58	MD4A122	.10	.20	.58	MD6A122
.0015	.10	.20	.58	MD5A152	.10	.20	.58	MD1A152	.10	.20	.58	MD2A152	.10	.20	.58	MD4A152	.10	.20	.58	MD6A152
.0018	.10	.20	.58	MD5A182	.10	.20	.58	MD1A182	.10	.20	.58	MD2A182	.10	.20	.58	MD4A182	.10	.20	.58	MD6A182
.0022	.10	.20	.58	MD5A222	.10	.20	.58	MD1A222	.10	.20	.58	MD2A222	.10	.20	.58	MD4A222	.10	.20	.58	MD6A222
.0027	.10	.20	.58	MD5A272	.10	.20	.58	MD1A272	.10	.20	.58	MD2A272	.10	.20	.58	MD4A272	.10	.20	.58	MD6A272
.0033	.10	.20	.58	MD5A332	.10	.20	.58	MD1A332	.10	.20	.58	MD2A332	.10	.20	.58	MD4A332	.13	.23	.58	MD6A332
.0039	.10	.20	.58	MD5A392	.10	.20	.58	MD1A392	.10	.20	.58	MD2A392	.10	.20	.58	MD4A392	.14	.23	.58	MD6A392
.0047	.10	.20	.58	MD5A472	.10	.20	.58	MD1A472	.10	.20	.58	MD2A472	.12	.21	.58	MD4A472	.15	.24	.58	MD6A472
.0056	.10	.20	.58	MD5A562	.10	.20	.58	MD1A562	.10	.20	.58	MD2A562	.14	.23	.58	MD4A562	.13	.23	.71	MD6A562
.0068	.10	.20	.58	MD5A682	.10	.20	.58	MD1A682	.10	.20	.58	MD2A682	.15	.24	.58	MD4A682	.14	.24	.71	MD6A682
.0082	.10	.20	.58	MD5A822	.10	.20	.58	MD1A822	.12	.21	.58	MD2A822	.11	.20	.71	MD4A822	.16	.26	.71	MD6A822
.01	.10	.20	.58	MD5A103	.10	.20	.58	MD1A103	.13	.23	.58	MD2A103	.13	.21	.71	MD4A103	.18	.28	.71	MD6A103
.012	.10	.20	.58	MD5A123	.10	.20	.58	MD1A123	.15	.24	.58	MD2A123	.15	.23	.71	MD4A123	.20	.30	.71	MD6A123
.015	.12	.21	.58	MD5A153	.12	.21	.58	MD1A153	.12	.20	.71	MD2A153	.16	.26	.71	MD4A153	.23	.33	.71	MD6A153
.018	.15	.23	.58	MD5A183	.15	.23	.58	MD1A183	.13	.21	.71	MD2A183	.18	.28	.71	MD4A183	.21	.31	.84	MD6A183
.022	.11	.21	.71	MD5A223	.11	.21	.71	MD1A223	.15	.23	.71	MD2A223	.20	.30	.71	MD4A223	.24	.33	.84	MD6A223
.027	.12	.22	.71	MD5A273	.12	.22	.71	MD1A273	.17	.25	.71	MD2A273	.23	.33	.71	MD4A273	.26	.35	.84	MD6A273
.033	.14	.22	.71	MD5A333	.14	.22	.71	MD1A333	.19	.28	.71	MD2A333	.26	.36	.71	MD4A333	.23	.37	.98	MD6A333
.039	.14	.26	.71	MD5A393	.14	.26	.71	MD1A393	.20	.30	.71	MD2A393	.22	.33	.84	MD4A393	.25	.38	.98	MD6A393
.047	.16	.28	.71	MD5A473	.16	.28	.71	MD1A473	.22	.33	.71	MD2A473	.25	.36	.84	MD4A473	.28	.42	.98	MD6A473
.056	.18	.30	.71	MD5A563	.18	.30	.71	MD1A563	.25	.36	.71	MD2A563	.23	.33	.98	MD4A563	.32	.47	.98	MD6A563
.068	.20	.33	.71	MD5A683	.20	.33	.71	MD1A683	.22	.33	.84	MD2A683	.27	.36	.98	MD4A683	.35	.48	.98	MD6A683
.082	.23	.35	.71	MD5A823	.23	.35	.71	MD1A823	.25	.36	.84	MD2A823	.29	.40	.98	MD4A823	.32	.45	1.25	MD6A823
.1	.26	.36	.71	MD5A104	.26	.36	.71	MD1A104	.24	.33	.98	MD2A104	.33	.46	.98	MD4A104	.35	.48	1.25	MD6A104
.12	.23	.36	.84	MD5A124	.23	.36	.84	MD1A124	.27	.36	.98	MD2A124	.29	.40	1.25	MD4A124	.31	.47	1.50	MD6A124
.15	.26	.36	.84	MD5A154	.15	.26	.36	MD1A154	.30	.43	.98	MD2A154	.33	.46	1.25	MD4A154	.35	.52	1.50	MD6A154
.18	.25	.35	.98	MD5A184	.18	.25	.35	MD1A184	.33	.46	.98	MD2A184	.30	.43	1.50	MD4A184	.39	.56	1.50	MD6A184
.22	.27	.46	.98	MD5A224	.27	.46	.98	MD1A224	.30	.43	1.25	MD2A224	.34	.46	1.50	MD4A224	.44	.63	1.50	MD6A224
.27	.31	.43	.98	MD5A274	.31	.43	.98	MD1A274	.34	.46	1.25	MD2A274	.39	.50	1.50	MD4A274	.44	.63	1.75	MD6A274
.33	.28	.41	1.25	MD5A334	.28	.41	1.25	MD1A334	.32	.45	1.50	MD2A334	.43	.56	1.50	MD4A334	.50	.69	1.75	MD6A334
.39	.31	.43	1.25	MD5A394	.31	.43	1.25	MD1A394	.34	.46	1.50	MD2A394	.48	.60	1.50	MD4A394	.47	.69	2.00	MD6A394
.47	.34	.46	1.25	MD5A474	.34	.46	1.25	MD1A474	.31	.51	1.50	MD2A474	.47	.60	1.75	MD4A474	.52	.75	2.00	MD6A474
.56	.30	.43	1.50	MD5A564	.30	.43	1.50	MD1A564	.41	.53	1.50	MD2A564	.52	.63	1.75	MD4A564	.55	.74	2.25	MD6A564
.68	.34	.46	1.50	MD5A684	.34	.46	1.50	MD1A684	.47	.60	1.50	MD2A684	.54	.65	1.75	MD4A684	.62	.80	2.25	MD6A684
.82	.38	.50	1.50	MD5A824	.38	.50	1.50	MD1A824	.46	.58	1.75	MD2A824	.60	.86	1.75	MD4A824	.65	.84	2.25	MD6A824
1.0	.43	.53	1.50	MD5A105	.43	.53	1.50	MD1A105	.51	.63	1.75	MD2A105	.60	1.05	1.75	MD4A105	.77	.94	2.25	MD6A105
1.5	.48	.60	1.75	MD5A155	.48	.60	1.75	MD1A155	.51	.75	2.00	MD2A155	.76	.92	2.00	MD4A155				
2.0	.56	.70	1.75	MD5A205	.56	.70	1.75	MD1A205	.61	.90	2.00	MD2A205	.89	1.05	2.00	MD4A205				
3.0	.66	.82	1.75	MD5A305	.66	.82	1.75	MD1A305	.77	1.05	2.00	MD2A305								
4.0	.82	1.05	1.75	MD5A405	.82	1.05	1.75	MD1A405												
5.0	.80	1.00	2.00	MD5A505	.80	1.00	2.00	MD1A505												

*Round Wrap and Fill, Molded-Box and Hermetic Styles are available.

How to Order (Add tolerance code to part number shown above)

Series: MD

Voltage: 5 = 50v, 1 = 100v, 2 = 200v, 4 = 400v, 6 = 600v

Style (Wrap and Fill, Oval, Axial): A*

Cap Code: 104

Tolerance Code: K (F = 1%, G = 2%, H = 3%, J = 5%, K = 10%, M = 20%)

Options: –1 = Add Clear Sleeve, /R = Tape and Reel

ELPAC COMPONENTS
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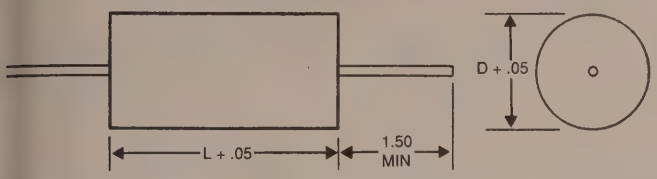
- ☐ Excellent Dissipation Factor
- ☐ Low E.S.R.
- ☐ Outstanding Temperature Stability



LEAD SIZE		
CASE LENGTH	A.W.G.	LEAD DIA.
.40 THRU .65	NO. 24	.020
.78 THRU .90	NO. 22	.025
1.17 THRU 1.90	NO. 20	.032

	50 VDC			100 VDC			200 VDC			400 VDC			600 VDC		
MFD	D	L	PART NO.	D	L	PART NO.	D	L	PART NO.	D	L	PART NO.	D	L	PART NO.
.0011													.13	.40	PM6B102
.0012													.13	.40	PM6B122
.0015													.13	.40	PM6B152
.0018													.13	.40	PM6B182
.0022													.14	.40	PM6B222
.0027													.15	.40	PM6B272
.0033													.16	.40	PM6B332
.0039													.17	.40	PM6B392
.0047										.14	.40	PM4B472	.19	.40	PM6B472
.0056										.15	.40	PM4B562	.20	.40	PM6B562
.0068										.16	.40	PM4B682	.22	.40	PM6B682
.0082							.13	.40	PM2B822	.17	.40	PM4B822	.17	.53	PM6B822
.01							.15	.40	PM2B103	.18	.40	PM4B103	.19	.53	PM6B103
.012							.16	.40	PM2B123	.20	.53	PM4B123	.20	.53	PM6B123
.015							.17	.40	PM2B153	.22	.53	PM4B153	.23	.53	PM6B153
.018	.13	.40	PM5B183	.13	.40	PM1B183	.19	.40	PM2B183	.17	.53	PM4B183	.25	.53	PM6B183
.022	.14	.40	PM5B223	.14	.40	PM1B223	.20	.40	PM2B223	.19	.53	PM4B223	.27	.53	PM6B223
.027	.16	.40	PM5B273	.16	.40	PM1B273	.22	.40	PM2B273	.20	.53	PM4B273	.30	.53	PM6B273
.033	.17	.40	PM5B333	.17	.40	PM1B333	.17	.53	PM2B333	.22	.53	PM4B333	.27	.65	PM6B333
.039	.18	.40	PM5B393	.18	.40	PM1B393	.19	.53	PM2B393	.24	.53	PM4B393	.29	.65	PM6B393
.047	.20	.40	PM5B473	.20	.40	PM1B473	.20	.53	PM2B473	.26	.53	PM4B473	.32	.65	PM6B473
.056	.21	.40	PM5B563	.21	.40	PM1B563	.22	.53	PM2B563	.29	.53	PM4B563	.34	.65	PM6B563
.068	.23	.40	PM5B683	.23	.40	PM1B683	.24	.53	PM2B683	.26	.65	PM4B683	.33	.78	PM6B683
.082	.18	.53	PM5B823	.18	.53	PM1B823	.26	.53	PM2B823	.28	.65	PM4B823	.36	.78	PM6B823
.1	.20	.53	PM5B104	.20	.53	PM1B104	.29	.53	PM2B104	.31	.65	PM4B104	.40	.78	PM6B104
.12	.21	.53	PM5B124	.21	.53	PM1B124	.29	.65	PM2B124	.34	.65	PM4B124	.39	.90	PM6B124
.15	.24	.53	PM5B154	.24	.53	PM1B154	.28	.65	PM2B154	.33	.78	PM4B154	.43	.90	PM6B154
.18	.26	.53	PM5B184	.25	.53	PM1B184	.31	.65	PM2B184	.36	.78	PM4B184	.47	.90	PM6B184
.22	.28	.53	PM5B224	.28	.53	PM1B224	.34	.65	PM2B224	.39	.78	PM4B224	.44	1.17	PM6B224
.27	.26	.65	PM5B274	.26	.65	PM1B274	.33	.78	PM2B274	.39	.90	PM4B274	.49	1.17	PM6B274
.33	.28	.65	PM5B334	.28	.65	PM1B334	.36	.78	PM2B334	.43	.90	PM4B334	.54	1.17	PM6B334
.39	.31	.65	PM5B394	.31	.65	PM1B394	.39	.78	PM2B394	.47	.90	PM4B394	.58	1.17	PM6B394
.47	.33	.65	PM5B474	.33	.65	PM1B474	.39	.90	PM2B474	.43	1.17	PM4B474	.64	1.17	PM6B474
.56	.32	.78	PM5B564	.32	.78	PM1B564	.42	.90	PM2B564	.47	1.17	PM4B564	.70	1.17	PM6B564
.68	.35	.78	PM5B684	.35	.78	PM1B684	.46	.90	PM2B684	.52	1.17	PM4B684	.77	1.17	PM6B684
.82	.38	.78	PM5B824	.38	.78	PM1B824	.43	1.17	PM2B824	.56	1.17	PM4B824	.84	1.17	PM6B824
1.0	.42	.78	PM5B105	.42	.78	PM1B105	.47	1.17	PM2B105	.62	1.17	PM4B105	.82	1.40	PM6B105
1.2	.41	.90	PM5B125	.41	.90	PM1B125	.51	1.17	PM2B125	.68	1.17	PM4B125	.90	1.40	PM6B125
1.5	.46	.90	PM5B155	.46	.90	PM1B155	.57	1.17	PM2B155	.76	1.17	PM4B155	.91	1.68	PM6B155
1.8	.42	1.17	PM5B185	.42	1.17	PM1B185	.63	1.17	PM2B185	.83	1.17	PM4B185	.92	1.95	PM6B185
2.0	.44	1.17	PM5B205	.44	1.17	PM1B205	.66	1.17	PM2B205	.77	1.40	PM4B205	.96	1.95	PM6B205
2.5	.50	1.17	PM5B255	.50	1.17	PM1B255	.74	1.17	PM2B255	.86	1.40	PM4B255	1.00	2.25	PM6B255
3.0	.54	1.17	PM5B305	.54	1.17	PM1B305	.81	1.17	PM2B305	.85	1.68	PM4B305	1.10	2.25	PM6B305
3.5	.58	1.17	PM5B355	.58	1.17	PM1B355	.77	1.40	PM2B355	.92	1.68	PM4B355	1.18	2.25	PM6B355
4.0	.62	1.17	PM5B405	.62	1.17	PM1B405	.82	1.40	PM2B405	.91	1.95	PM4B405			
4.5	.66	1.17	PM5B455	.66	1.17	PM1B455	.87	1.40	PM2B455	.96	1.95	PM4B455			
5.0	.69	1.17	PM5B505	.69	1.17	PM1B505	.83	1.68	PM2B505	.95	2.25	PM4B505			
6.0	.76	1.17	PM5B605	.76	1.17	PM1B605	.92	1.68	PM2B605	1.04	2.25	PM4B605			
							.97	1.95	PM2B805	1.19	2.25	PM4B805			
							1.00	2.25	PM2B106						

*Oval Wrap and Fill, Molded-Box and Hermetic Styles are available.

How to Order (Add tolerance code to part number shown above)

PM 5 B* 104 K –1

- **Series**
- **Voltage** 5 = 50v 1 = 100v 2 = 200v 4 = 400v 6 = 600v
- **Style** (Wrap and Fill, Round, Axial)
- **Cap Code**
- **Tolerance Code** F = 1% G = 2% H = 3% J = 5% K = 10% M = 20%
- **Options** -1 = Add Clear Sleeve /R = Tape and Reel

ELPAC COMPONENTS
A DIVISION OF ELPAC ELECTRONICS, INC.
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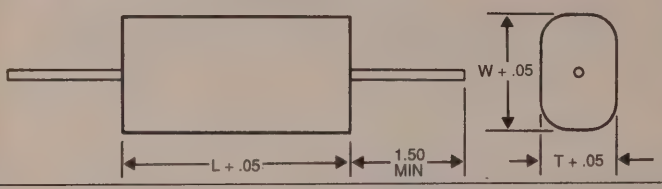
C Polycarbonate Oval SERIES

Metallized Wrap and Fill

- ☐ +125°C Operation Without Derating
- ☐ Excellent Temp. Stability, especially 0°C to 50°C
- ☐ Excellent Volumetric Efficiency



LEAD SIZE		
CASE LENGTH	A.W.G.	LEAD DIA.
.40 THRU .65	NO. 24	.020
.78 THRU .90	NO. 22	.025
1.17 THRU 1.90	NO. 20	.032

	50 VDC				100 VDC				200 VDC				400 VDC				600 VDC			
MFD	T	W	L	PART NO.	T	W	L	PART NO.	T	W	L	PART NO.	T	W	L	PART NO.	T	W	L	PART NO.
.001	.09	.18	.40	C5A102	.09	.18	.40	C1A102	.09	.18	.40	C2A102	.09	.18	.40	C4A102	.09	.18	.40	C6A102
.0012	.09	.18	.40	C5A122	.09	.18	.40	C1A122	.09	.18	.40	C2A122	.09	.18	.40	C4A122	.10	.20	.40	C6A122
.0015	.09	.18	.40	C5A152	.09	.18	.40	C1A152	.09	.18	.40	C2A152	.09	.18	.40	C4A152	.12	.22	.40	C6A152
.0018	.09	.18	.40	C5A182	.09	.18	.40	C1A182	.09	.18	.40	C2A182	.09	.18	.40	C4A182	.12	.23	.40	C6A182
.0022	.09	.18	.40	C5A222	.09	.18	.40	C1A222	.09	.18	.40	C2A222	.09	.18	.40	C4A222	.13	.23	.40	C6A222
.0027	.09	.18	.40	C5A272	.09	.18	.40	C1A272	.09	.18	.40	C2A272	.09	.18	.40	C4A272	.14	.24	.40	C6A272
.0033	.09	.18	.40	C5A332	.09	.18	.40	C1A332	.09	.18	.40	C2A332	.09	.18	.40	C4A332	.12	.22	.53	C6A332
.0039	.09	.18	.40	C5A392	.09	.18	.40	C1A392	.09	.18	.40	C2A392	.11	.21	.40	C4A392	.15	.25	.53	C6A392
.0047	.09	.18	.40	C5A472	.09	.18	.40	C1A472	.09	.18	.40	C2A472	.14	.24	.40	C4A472	.18	.28	.53	C6A472
.0056	.09	.18	.40	C5A562	.09	.18	.40	C1A562	.09	.18	.40	C2A562	.15	.25	.40	C4A562	.20	.30	.53	C6A562
.0068	.09	.18	.40	C5A682	.09	.18	.40	C1A682	.09	.18	.40	C2A682	.14	.24	.53	C4A682	.22	.32	.53	C6A682
.0082	.09	.18	.40	C5A822	.09	.18	.40	C1A822	.09	.18	.40	C2A822	.15	.25	.53	C4A822	.24	.34	.53	C6A822
.01	.09	.18	.40	C5A103	.09	.18	.40	C1A103	.09	.18	.40	C2A103	.16	.26	.53	C4A103	.25	.35	.53	C6A103
.012	.09	.18	.40	C5A123	.09	.18	.40	C1A123	.12	.21	.40	C2A123	.18	.28	.53	C4A123	.28	.38	.53	C6A123
.015	.09	.18	.40	C5A153	.09	.18	.40	C1A153	.14	.24	.40	C2A153	.20	.30	.53	C4A153	.25	.35	.68	C6A153
.018	.09	.18	.40	C5A183	.09	.18	.40	C1A183	.15	.25	.40	C2A183	.23	.33	.53	C4A183	.29	.39	.68	C6A183
.022	.09	.18	.40	C5A223	.09	.18	.40	C1A223	.16	.26	.40	C2A223	.25	.35	.53	C4A223	.30	.40	.68	C6A223
.027	.09	.18	.40	C5A273	.10	.20	.40	C1A273	.17	.27	.40	C2A273	.28	.38	.53	C4A273	.33	.43	.68	C6A273
.033	.09	.18	.40	C5A333	.10	.21	.40	C1A333	.12	.22	.53	C2A333	.25	.35	.68	C4A333	.35	.45	.68	C6A333
.039	.09	.18	.40	C5A393	.11	.23	.40	C1A393	.13	.23	.53	C2A393	.28	.38	.68	C4A393	.35	.45	.78	C6A393
.047	.09	.18	.40	C5A473	.11	.24	.40	C1A473	.14	.24	.53	C2A473	.30	.40	.68	C4A473	.35	.45	.90	C6A473
.056	.09	.18	.40	C5A563	.13	.26	.40	C1A563	.16	.26	.53	C2A563	.33	.43	.68	C4A563	.38	.48	.90	C6A563
.068	.09	.18	.40	C5A683	.14	.27	.40	C1A683	.18	.28	.53	C2A683	.35	.45	.68	C4A683	.40	.50	.90	C6A683
.082	.10	.20	.40	C5A823	.09	.22	.53	C1A823	.22	.32	.53	C2A823	.35	.45	.78	C4A823	.43	.53	.90	C6A823
.1	.12	.21	.40	C5A104	.11	.24	.53	C1A104	.25	.35	.53	C2A104	.35	.45	.90	C4A104	.45	.55	.90	C6A104
.12	.13	.22	.40	C5A124	.13	.26	.53	C1A124	.25	.35	.53	C2A124	.38	.48	.90	C4A124	.48	.66	.90	C6A124
.15	.15	.25	.40	C5A154	.14	.27	.53	C1A154	.25	.35	.68	C2A154	.40	.50	.90	C4A154	.45	.63	1.17	C6A154
.18	.10	.19	.53	C5A184	.16	.29	.53	C1A184	.28	.38	.68	C2A184	.43	.53	.90	C4A184	.48	.66	1.17	C6A184
.22	.11	.21	.53	C5A224	.18	.30	.53	C1A224	.30	.40	.68	C2A224	.45	.55	.90	C4A224	.50	.68	1.17	C6A224
.27	.12	.22	.53	C5A274	.20	.32	.53	C1A274	.31	.41	.68	C2A274	.40	.55	1.17	C4A274	.50	.68	1.45	C6A274
.33	.15	.25	.53	C5A334	.17	.30	.68	C1A334	.25	.35	.90	C2A334	.45	.60	1.17	C4A334	.51	.68	1.70	C6A334
.39	.16	.26	.53	C5A394	.19	.32	.68	C1A394	.29	.39	.90	C2A394	.50	.64	1.17	C4A394	.57	.74	1.70	C6A394
.47	.18	.28	.53	C5A474	.18	.27	.78	C1A474	.24	.37	.90	C2A474	.55	.67	1.17	C4A474	.63	.80	1.70	C6A474
.56	.20	.29	.53	C5A564	.20	.31	.78	C1A564	.27	.40	.90	C2A564	.49	.67	1.45	C4A564	.69	.87	1.70	C6A564
.68	.23	.32	.53	C5A684	.22	.33	.78	C1A684	.31	.43	.90	C2A684	.50	.68	1.70	C4A684	.75	.93	1.70	C6A684
.82	.26	.35	.53	C5A824	.26	.33	.78	C1A824	.34	.47	.90	C2A824	.55	.73	1.70	C4A824	.83	1.01	1.70	C6A824
1.0	.22	.31	.68	C5A105	.26	.34	.90	C1A105	.33	.46	1.17	C2A105	.60	.78	1.70	C4A105	.90	1.08	1.70	C6A105
1.2	.24	.34	.68	C5A125	.28	.38	.90	C1A125	.29	.42	1.17	C2A125	.68	.91	1.70	C4A125				
1.5	.23	.33	.78	C5A155	.30	.39	.90	C1A155	.34	.48	1.17	C2A155	.76	.94	1.70	C4A155				
1.8	.26	.35	.78	C5A185	.32	.45	.90	C1A185	.38	.52	1.45	C2A185	.83	1.01	1.70	C4A185				
2.0	.27	.37	.78	C5A205	.33	.45	.90	C1A205	.40	.55	1.45	C2A205	.90	1.08	1.70	C4A205				
3.0	.35	.44	.78	C5A305	.35	.45	1.17	C1A305	.52	.64	1.70	C2A305								
6.0	.34	.44	1.17	C5A605	.45	.57	1.70	C1A605	.58	.73	1.70	C2A605								
8.0	.37	.53	1.17	C5A805	.50	.63	1.98	C1A805	.55	.84	1.70	C2A805								
10.0	.42	.59	1.17	C5A106	.60	.80	1.98	C1A106	.57	.87	1.90	C2A106								
12.0	.47	.63	1.17	C5A126																

*Round Wrap and Fill, Molded-Box and Hermetic Styles are available.

How to Order (Add tolerance code to part number shown above)

C 5 A* 104 K –1

- **Series** C
- **Voltage** 5 = 50v 1 = 100v 2 = 200v 4 = 400v 6 = 600v
- **Style** (Wrap and Fill, Oval, Axial) A*
- **Cap Code** 104
- **Tolerance Code** F = 1% G = 2% H = 3% J = 5% K = 10% M = 20%
- **Options** -1 = Add Clear Sleeve /R = Tape and Reel

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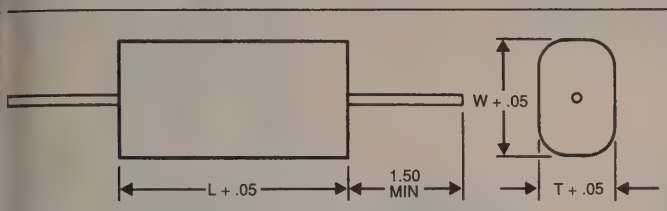
- ☐ Superior Dielectric Absorption
- ☐ Film-Foil for High Current



LEAD SIZE		
CASE LENGTH	A.W.G.	LEAD DIA.
.58 THRU .71	NO. 24	.020
.84 THRU 1.25	NO. 22	.025
1.50 THRU 2.00	NO. 20	.032

	50 VDC				100 VDC				200 VDC				400 VDC			
MFD	T	W	L	PART NO.	T	W	L	PART NO.	T	W	L	PART NO.	T	W	L	PART NO.
.001	.12	.20	.58	PD5A102	.12	.20	.58	PD1A102	.12	.20	.58	PD2A102	.12	.20	.58	PD4A102
.0012	.12	.20	.58	PD5A122	.12	.20	.58	PD1A122	.12	.20	.58	PD2A122	.12	.20	.58	PD4A122
.0015	.12	.20	.58	PD5A152	.12	.20	.58	PD1A152	.12	.20	.58	PD2A152	.12	.20	.58	PD4A152
.0018	.12	.20	.58	PD5A182	.12	.20	.58	PD1A182	.12	.20	.58	PD2A182	.13	.21	.58	PD4A182
.0022	.12	.20	.58	PD5A222	.12	.20	.58	PD1A222	.12	.20	.58	PD2A222	.14	.23	.58	PD4A222
.0027	.12	.20	.58	PD5A272	.12	.20	.58	PD1A272	.12	.20	.58	PD2A272	.16	.24	.58	PD4A272
.0033	.12	.20	.58	PD5A332	.12	.20	.58	PD1A332	.14	.23	.58	PD2A332	.13	.24	.71	PD4A332
.0039	.12	.20	.58	PD5A392	.12	.20	.58	PD1A392	.16	.25	.58	PD2A392	.14	.25	.71	PD4A392
.0047	.12	.20	.58	PD5A472	.12	.20	.58	PD1A472	.18	.27	.58	PD2A472	.16	.27	.71	PD4A472
.0056	.12	.20	.58	PD5A562	.12	.20	.58	PD1A562	.19	.29	.58	PD2A562	.18	.29	.71	PD4A562
.0068	.12	.20	.58	PD5A682	.13	.21	.58	PD1A682	.14	.25	.71	PD2A682	.20	.32	.71	PD4A682
.0082	.12	.20	.58	PD5A822	.17	.25	.58	PD1A822	.16	.27	.71	PD2A822	.22	.35	.71	PD4A822
.01	.12	.21	.58	PD5A103	.18	.27	.58	PD1A103	.19	.29	.71	PD2A103	.25	.38	.71	PD4A103
.012	.15	.23	.58	PD5A123	.15	.24	.71	PD1A123	.21	.32	.71	PD2A123	.22	.35	.84	PD4A123
.015	.17	.25	.58	PD5A153	.16	.29	.71	PD1A153	.23	.35	.71	PD2A153	.25	.36	.84	PD4A153
.018	.18	.27	.58	PD5A183	.19	.32	.71	PD1A183	.21	.34	.84	PD2A183	.23	.37	.98	PD4A183
.022	.15	.28	.71	PD5A223	.20	.34	.71	PD1A223	.23	.37	.84	PD2A223	.26	.39	.98	PD4A223
.027	.16	.29	.71	PD5A273	.23	.36	.71	PD1A273	.23	.35	.98	PD2A273	.29	.43	.98	PD4A273
.033	.19	.32	.71	PD5A333	.25	.38	.71	PD1A333	.25	.38	.98	PD2A333	.33	.46	.98	PD4A333
.039	.16	.28	.84	PD5A393	.22	.34	.84	PD1A393	.27	.40	.98	PD2A393	.29	.43	1.25	PD4A393
.047	.17	.30	.84	PD5A473	.24	.36	.84	PD1A473	.32	.45	.98	PD2A473	.32	.46	1.25	PD4A473
.056	.19	.31	.84	PD5A563	.24	.34	.98	PD1A563	.34	.49	.98	PD2A563	.35	.49	1.25	PD4A563
.068	.22	.34	.84	PD5A683	.25	.38	.98	PD1A683	.30	.44	1.25	PD2A683	.39	.53	1.25	PD4A683
.082	.24	.35	.84	PD5A823	.28	.40	.98	PD1A823	.34	.47	1.25	PD2A823	.44	.57	1.25	PD4A823
.1	.27	.39	.84	PD5A104	.31	.43	.98	PD1A104	.37	.50	1.25	PD2A104	.43	.53	1.50	PD4A104
.12	.30	.38	.84	PD5A124	.29	.42	1.25	PD1A124	.41	.54	1.25	PD2A124	.48	.58	1.50	PD4A124
.15	.34	.46	.84	PD5A154	.33	.44	1.25	PD1A154	.47	.59	1.25	PD2A154	.46	.58	1.75	PD4A154
.18	.35	.47	.98	PD5A184	.36	.47	1.25	PD1A184	.45	.58	1.50	PD2A184	.49	.63	1.75	PD4A184
.22	.37	.54	.98	PD5A224	.40	.51	1.25	PD1A224	.50	.64	1.50	PD2A224	.56	.65	1.75	PD4A224
.27	.42	.58	.98	PD5A274	.46	.59	1.25	PD1A274	.48	.59	1.75	PD2A274	.63	.76	1.75	PD4A274
.33	.46	.61	.98	PD5A334	.51	.64	1.25	PD1A334	.52	.64	1.75	PD2A334	.66	.79	1.75	PD4A334
.39	.38	.55	1.25	PD5A394	.47	.59	1.50	PD1A394	.57	.70	1.75	PD2A394				
.47	.43	.58	1.25	PD5A474	.44	.57	1.75	PD1A474	.64	.76	1.75	PD2A474				
.56	.47	.60	1.75	PD5A564	.47	.60	1.75	PD1A564	.68	.82	1.75	PD2A564				
.68	.56	.69	1.75	PD5A684	.56	.69	1.75	PD1A684	.76	.88	1.75	PD2A684				
.82	.62	.72	1.75	PD5A824	.62	.72	1.75	PD1A824								
1.0	.70	.81	1.75	PD5A105	.70	.81	1.75	PD1A105								
1.5	.70	.85	2.00	PD5A155	.70	.85	2.00	PD1A155								

*Round Wrap and Fill, Molded-Box and Hermetic Styles are available.

How to Order (Add tolerance code to part number shown above)

PD 5 A* 104 K –1

- **Series** PD
- **Voltage** 5 = 50v 1 = 100v 2 = 200v 4 = 400v 6 = 600v
- **Style** A* (Wrap and Fill, Oval, Axial)
- **Cap Code** 104
- **Tolerance Code** J = 5% K = 10% M = 20%
  1%, 2% Tolerance Available on .12 Mfd and Higher Only.
- **Options** -1 = Add Clear Sleeve /R = Tape and Reel

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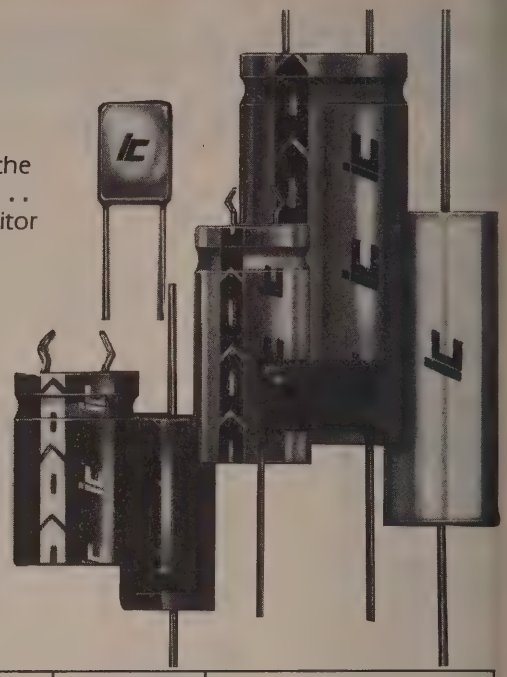

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ILLINOIS CAPACITOR, INC.
3757 W. Touhy Ave., Lincolnwood, Illinois 60645
(708) 675-1760 • Fax (708) 673-2850

Aluminum Electrolytic Capacitors

PRODUCT SELECTOR

IC SERIES	DESCRIPTION	TYPE	CAPACITANCE MFD.	WVDC	TEMP RANGE	STANDARD TOLERANCE	FEATURES
CKR	Sub-Miniature	Radial	0.1 to 15,000	6.3 to 250	−40°C to +85°C	+20% Std. (+10% Opt.)	Small Size Low Std. Leakage Current
CKS	Sub-Miniature	Radial	.33 to 15,000	6.3 to 50	−40°C to +85°C	+20% Std. (+10% Opt.)	New Very Small Size
CKH	High Temperature Sub-Miniature	Radial	0.1 to 15,000	6.3 to 250	−40°C to +105°C	+20% Std. (+10% Opt.)	New Smaller Size Extended Temperature (+105°C)
RMR	High Temperature Sub-Minature	Radial	.47 to 10,000	6.3 to 450	−40°C to +105°C	+20% Std. (+10% Opt.)	Extended Temperature (+105°C) Small Size Low Leakage Current
RSC	Sub-Subminiature/ Low Profile	Radial	10 to 6,800	6.3 to 50	−40°C to +85°C	+20% Std.	New Small Size – Low Profile
RSS	Sub-Subminiature/ Low Profile	Radial	.1 to 3,300	6.3 to 50	−40°C to +85°C	+20% Std. (+10% Opt.)	Extremely Small Size Tantalum Alternative
RLR	Low Leakage	Radial	.1 to 2,200	6.3 to 50	−40°C to +85°C	+20% Std. (+10% Opt.)	Timing Circuits Tantalum Alternative
RLS	Low Leakage	Radial	.1 to 1,000	6.3 to 50	−40°C to +85°C	+20% Std. (+10% Opt.)	New Smaller Size Timing Circuits Tantalum Alternative
RZM	High Frequency/ High Temperature	Radial	.47 to 15,000	6.3 to 50	−55°C to +105°C	+20% Std. (+10% Opt.)	New Small Size High Frequency (100 KHz)
RZS	High Frequency/ High Temperature	Radial	22 to 2,200	6.3 to 63	−55°C to +105°C	+20% Std. (+10% Opt.)	High Frequency (100 KHz) Low ESR, Low ESL High Ripple Current
BPS	Non-Polarized	Radial	.47 to 1,000	10 to 100	−40°C to +85°C	+20% Std. (+10% Opt.)	Smaller Size Polarity Reversing Low Power AC
TTA	Miniature	Axial	.47 to 22,000	6.3 to 450	−40°C to +85°C	+20% Std. (+10% Opt.)	Low Std. Leakage Current
TLS	Low Leakage	Axial	.1 to 100	10 to 50	−40°C to +85°C	+20% Std. (+10% Opt.)	New Smaller Size Timing Circuits Tantalum Alternative
BPA	Non-Polarized	Axial	.47 to 1,000	16 to 100	−40°C to +85°C	+20% Std. (+10% Opt.)	Polarity Reversing Low Power AC
LBA	Snap-Mount	Snap-Mount	47 to 47,000	16 to 450	−40°C to +85°C	+20% Std. (+10% Opt.)	High Ripple Current Power Supplies
LMU	Snap-Mount	Snap-Mount	330 to 1,500	200 to 400	−40°C to +105°C	+20% Std. (+10% Opt.)	High Ripple Current Power Supplies

Film Capacitors

PRODUCT SELECTOR

ILLINOIS CAPACITOR, INC.
3757 W. Touhy Ave.,
Lincolnwood, Illinois 60645
(708) 675-1760
Fax (708) 673-2850

IC SERIES	DESCRIPTION	TYPE	CAPACITANCE (MFD.) TOLERANCE ± 10%	WVDC	TEMP. RANGE	APPLICATION
MSR	Metalized Polyester	Radial, Epoxy Resin Dipped	.01 to 10	100 to 1,000	−55°C to +125°C	Telecommunications Tuned Circuits Audio, Digital Pulse Discharge
MSS	Miniature/ Metallized Polyester	Radial, Epoxy Resin Dipped	.01 to .47	63 to 100	−55°C to +100°C	Telecommunications Tuned Circuits Audio, Digital Pulse Discharge
FFR	Polyester Film/Foil	Radial, Epoxy Resin Dipped	.001 to .22	100	−55°C to +125°C	Telecommunications Audio, Bypass Coupling
UMR	Polyester Film/Foil	Radial, Epoxy Resin Dipped	.001 to .47	100	−40°C to +85°C	Audio Bypass Coupling
MPR	Metallized Polypropylene	Radial, Epoxy Resin Dipped	.01 to 2.2	250 to 630	−55°C to +105°C	Telecommunications Tuned Circuits Audio, Digital Pulse Discharge AC Circuits
MWF	Metallized Polyester	Flat Wrap & Filled	0.1 to 18	100 to 630	−55°C to +125°C	Telecommunications Tuned Circuits Audio, Digital Pulse Discharge
MWR	Metallized Polyester	Axial Wrap & Filled	.001 to 22	63 to 1,000	−55°C to +125°C	Telecommunications Tuned Circuits Audio, Digital Pulse Discharge
MWM	Metallized Polyester	Axial Wrap & Filled	.22 to 10	50	−55°C to +125°C	
MPH/ MPL	High Frequency High Current/ Metallized Polypropylene	Axial Wrap & Filled Flame Retardant Lug Terminal (MPL)	1.0 to 30	100, 200, 400	−55°C to +105°C	High Frequency AC Circuits High Current Power Supplies
MPW	Metallized Polypropylene	Axial Wrap & Filled	.001 to 10	160 to 630	−55°C to +105°C	Telecommunications Tuned Circuits Audio, Digital Pulse Discharge AC Circuits
PWM	Double Metallized Polypropylene/ High Current	Axial Wrap & Filled	.047 to 1.5	850 to 2,000	−55°C to +85°C	Snubbers SMPS SCR
PWS	Film/Foil Polypropylene/ High dV/dt	Axial Wrap & Filled	.001 to .47	630 to 2,000	−55°C to +105°C	SMPS SCR TV Deflection Snubbers
MCW	Metallized Polycarbonate	Axial Wrap & Filled	.001 to 22	63 to 400	−55°C to +125°C	Telecommunications Tuned Circuits Audio, Digital Pulse Discharge

Ceramic Disc Selector Guide

IC TYPE	DESCRIPTION	CAPACITANCE	VOLTAGE	STANDARD TOLERANCE	TEMPERATURE CHARACTERISTICS	APPLICATION
BCR	Temperature Stable	1 pf to 680 pf	50 WVDC	±10%	Y5F	Tuned Circuits RF & Below
GCR	General Purpose	.001 MFD to .1 MFD	50 WVDC	±20%	Y5V, Z5V	Bypass & Coupling
				−20%, +80%	Z5V, Y5V	Bypass & Coupling
GMR	Miniature General Purpose	.01 MFD to .47 MFD	12 WVDC	±20%	Y5T	Bypass & Coupling
				−20%, +80%	Y5V	Bypass & Coupling
GQR	General Purpose	.001 MFD to .01 MFD	500 WVDC	−20% to +80%	Z5V	Bypass & Coupling

Miniature Specialty Film Capacitors

SMD—capacitors	Polyester film metallized		**WIMA MKS 01-SMD**
Miniature Type capacitors PCM 2.5 mm	Polyester film metallized	€	**WIMA MKS 02**
	Polyester film metallized		**WIMA MKS 022**
	Polycarbonate film metallized		**WIMA MKC 02**
	Polycarbonate film, film/foil		**WIMA FKC 02**
	Polpropylene film, film/foil		**WIMA FKP 02**
PCM 5 mm	Polyester film metallized	€	**WIMA MKS 2**
	Polyester film metallized for stringent requirements	€	**WIMA MKS 2-i**
	Polyester film metallized for high reliability applications		**WIMA MKS 2-HR**
	Polyester film metallized		**WIMA MKS 22**
	Polyester film with metal foil electrodes, for pulse duty	€	**WIMA MKS 20**
	Polycarbonate film metallized	€	**WIMA MKC 2**
	Polpropylene with metal foil electrodes, for pulse duty		**WIMA MKP 20**
	PPS film metallized		**WIMA MKI 2**
	Polyester film, film/foil	€	**WIMA FKS 2**
	Polycarbonate film, film/foil	€	**WIMA FKC 2**
	Polypropylene film, film/foil	€	**WIMA FKP 2**
	PPS film, film/foil		**WIMA FKI 2**
Semi-miniature capacitors PCM 7.5 mm	Polyester film metallized		**WIMA MKS 3**
	Polyester film metallized		**WIMA MKS 33**
	Polycarbonate film metallized		**WIMA MKC 3**
Capacitors for stringent requirements PCM 7.5—27.5 mm	Polyester film metallized	€	**WIMA MKS 4**
	Polycarbonate film metallized	€	**WIMA MKC 4**
	Polycarbonate film metallized		**WIMA MKC 4 SV 21**
	Polypropylene film metallized		**WIMA MKP 4**
Capacitors for high current ratings	Polyester film with metal foil electrodes		**WIMA MKS 10**
	Polycarbonate film with metal foil electrodes		**WIMA MKC 10**
	Polypropylene film with metal foil electrodes		**WIMA MKP 10**
	Polypropylene film/foil capacitors, internally series connected		**WIMA FKP 1**
Film capacitors with metal foil electrodes PCM 7.5—15 mm	Polyester film, film/foil	€	**WIMA FKS 3**
	Polycarbonate film, film/foil	€	**WIMA FKC 3**
	Polypropylene film, film/foil		**WIMA FKP 3**
Radio interference suppression capacitors	Polyester film metallized	Class X3 under preparation	**WIMA MKS 5-R**
	Capacitor paper metallized	Class Y	**WIMA MP 3-Y**
	Capacitor paper metallized	Class Y	**WIMA MP 30-Y**
	Capacitor paper metallized	Class X1	**WIMA MP 3-X1**
	Capacitor paper metallized	Class X2	**WIMA MP 3-X2**
	Capacitor paper metallized	Class X2	**WIMA MP 380**

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RADIO INTERFERENCE SUPPRESSION CAPACITORS

	CLASS Y		CLASS X1			CLASS X2	
Series	**KNB2520**	**KM1-Y**	**KNB1540**	**KNB1550**	**KM1-X1**	**KNB1530**	**KEB1520**
Rated Voltage	250VAC 275VAC	250VAC	250VAC	275VAC	250VAC	250VAC 275VAC	250VAC
Dielectric Material	Polypropylene Film Metallized	Ceramic Y5U/Z5U	Polypropylene Film Metallized	Polypropylene Film Metallized	Ceramic Y5U/Z5U	Polypropylene Film Metallized	Polyester Film Metallized
Features	- Molded Box - Radial Leads - Lead lengths up to 200mm - Leads available as tinned copper wire, with or without insulation, or stranded wire with insulation	- Epoxy Coated Disc - Radial Leads - Lead lengths up to 200mm - Tinned copper wire leads	- Molded Box - Radial Leads - Lead lengths up to 200mm - Leads available as tinned copper wire, with or without insulation, or stranded wire with insulation	- Molded Box - Radial Leads - Lead lengths up to 200mm - Leads available as tinned copper wire, with or without insulation, or stranded wire with insulation	- Epoxy Coated Disc - Radial Leads - Lead lengths up to 200mm - Tinned copper wire leads	- Molded Box - Radial Leads - Lead lengths up to 200mm - Leads available as tinned copper wire, with or without insulation, or stranded wire with insulation	- Molded Box - Radial Leads - Lead lengths up to 200mm - Leads available as tinned copper wire, with or without insulation, or stranded wire with insulation
.001	13x9.5x4.3x10	11x6x7.5			11x6x7.5		
.0015	13x9.5x4.3x10	15x6x7.5			11x6x7.5		
.0022	13x9.5x4.3x10	15x6x7.5	18x11x5.5x15		11x6x7.5		
.0027	13x9.5x4.3x10	15x6x7.5	18x11x5.5x15		11x6x7.5		
.0028	13x9.5x4.3x10	15x6x7.5	18x11x5.5x15		11x6x7.5		
.0033	13x10.5x5x10	15x6x7.5	18x11x5.5x15		15x6x7.5		
.0047	13x11.5x6x10	19x6x7.5	18x11x5.5x15		15x6x7.5		
.005	13x11.5x6x10	19x6x7.5	18x11x5.5x15		15x6x7.5		
.0068	18x11x5.5x15	19x6x7.5	18x11x5.5x15		15x6x7.5		
.0082	18x11x5.5x15	22x6x12.5	18x11x5.5x15		19x6x7.5		
.01	18x11x5.5x15	26x6x15	18x12x6x15	18x11x5x15	19x6x7.5	18x11x5.5x15	18x11x5.5x15
.015	18x12x6x15		18x13x7x15 ●	18x11x5x15	22x6x12.5	18x11x5.5x15	18x11x5.5x15
.022	18x13x7x15		18x14.5x8.5x15 ●	18x11x5x15		18x11x5.5x15	18x11x5.5x15
.033			27x15x6.5x22.5	18x11x5.5x15		18x11x5.5x15	18x11x5.5x15
.047			27x16.5x7x22.5	18x13x7x15		18x11x5.5x15	18x13x7x15
.068			27x18.5x8.5x22.5	18x13.5x7.5x15		18x12x6x15	18x13.5x7.5x15
.1			27x19x10.5x22.5 ●	18x16.5x8.5x15 ●		18x13x7x15 ●	18x14.5x9x15
.15			27x23x14x22.5 ●	27x16.5x7.5x22.5		27x15x6.5x22.5	27x18.5x8.5x22.5
.22			27x25x16x22.5 ●	27x18.5x9x22.5		27x16.5x7x22.5	27x19x10.5x22.5
.27			32x24.5x15x27.5	27x18.5x10x22.5		27x18.5x8.5x22.5	N/A
.33			32x28x18x27.5	27x20.5x11x22.5 ●		27x18.5x8.5x22.5	27x21x12x22.5 ●
.47			32x33x20x27.5	27x23x14x22.5 ●		27x19x10.5x22.5 ●	27x23x14x22.5 ●
.68				31.5x23.5x14x27.5		32x20x11x27.5	32x24.5x15x27.5
1.0				31.5x26.5x17x27.5		32x24.5x15x27.5	41.5x27x16x37.5
1.5						32x28x18x27.5 ●	41.5x31x18x37.5
2.2						41.5x31x18x37.5	

● These items available with alternate dimensions. Contact factory.

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MINIGLOSSARY
BASIC
EBCDIC CODE

Bit Positions 4, 5, 6, 7	Second Hexadecimal Digit	Digit Punches	00				01				10				11				Bit Positions 0, 1
			00	01	10	11	00	01	10	11	00	01	10	11	00	01	10	11	Bit Positions 2, 3
			0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	First Hexadecimal Digi
			12				12	12		12	12	12		12	12				Zone Punches
				11				11	11	11		11	11	11		11			
					0		0		0	0	0		0	0			0		
			9	9	9	9	9	9	9	9									Digit Punches
			①	②	③	④	⑤	⑥	⑦	⑧					⑨	⑩	⑪	⑫	
0000	0	8-1	NUL	DLE	DS		SP	&	-									0	8-1
0001	1	1	SOH	DC1	SOS				⑬		a	j			A	J	⑭	1	1
0010	2	2	STX	DC2	FS	SYN					b	k	s		B	K	S	2	2
0011	3	3	ETX	TM							c	l	t		C	L	T	3	3
0100	4	4	PF	RES	BYP	PN					d	m	u		D	M	U	4	4
0101	5	5	HT	NL	LF	RS					e	n	v		E	N	V	5	5
0110	6	6	LC	BS	ETB	UC					f	o	w		F	O	W	6	6
0111	7	7	DEL	IL	ESC	EOT					g	p	x		G	P	X	7	7
1000	8	8		CAN							h	q	y		H	Q	Y	8	8
1001	9	8-1		EM							;	r	z		I	R	Z	9	9
1010	A	8-2	SMM	CC	SM		¢	!	⑮	:									8-2
1011	B	8-3	VT	CU1	CU2	CU3	.	$	,	#									8-3
1100	C	8-4	FF	IFS		DC4	<	*	%	@									8-4
1101	D	8-5	CR	IGS	ENQ	NAK	(	)	_	'									8-5
1110	E	8-6	SO	IRS	ACK		+	;	>	=									8-6
1111	F	8-7	SI	IUS	BEL	SUB	I	¬	?	"									8-7
			12				12				12	12		12	12	12		12	
				11				11				11	11	11		11	11	11	Zone Punches
					0				0		0		0	0	0		0	0	
			9	9	9	9									9	9	9	9	

Card Hole Patterns

①	12-0-9-8-1	⑤	No-Punches	⑨	12-0	⑬	0-1
②	12-11-9-8-1	⑥	12	⑩	11-0	⑭	11-0-9-1
③	11-0-9-8-1	⑦	11	⑪	0-8-2	⑮	12-11
④	12-11-0-9-8-1	⑧	12-11-0	⑫	0		

Control Character Representations

ACK	Acknowledge	EOT	End of Transmission	PF	Punch Off
BEL	Bell	ESC	Escape	PN	Punch On
BS	Backspace	ETB	End of Transmission Block	RES	Restore
BYP	Bypass	ETX	End of Text	RS	Reader Stop
CAN	Cancel	FF	Form Feed	SI	Shift In
CC	Cursar Control	FS	Field Separator	SM	Set Mode
CR	Carriage Return	HT	Horizontal Tab	SMM	Start of Manual Message
CU1	Customer Use 1	IFS	Interchange File Separator	SO	Shift Out
CU2	Customer Use 2	IGS	Interchange Group Separator	SOH	Start of Heading
CU3	Customer Use 3	IL	Idle	SOS	Start of Significance
DC1	Device Control 1	IRS	Interchange Record Separator	SP	Space
DC2	Device Control 2	IUS	Interchange Unit Separator	STX	Start of Text
DC4	Device Control 4	LC	Lower Case	SUB	Substitute
DEL	Delete	LF	Line Feed	SYN	Synchronous Idle
DLE	Data Link Escape	NAK	Negative Acknowledge	TM	Tape Mark
DS	Digit Select	NL	New Line	UC	Upper Case
EM	End of Medium	NUL	Null	VT	Vertical Tab
ENQ	Enquiry				

Special Graphic Characters

¢	Cent Sign
.	Period, Decimal Point
<	Less-than Sign
(	Left Parenthesis
+	Plus Sign
I	Logical OR
&	Ampersand
!	Exclamation Point
$	Dollar Sign
*	Asterisk
)	Right Parenthesis
;	Semicolon
¬	Logical NOT
-	Minus Sign, Hyphen
/	Slash
,	Comma
%	Percent
_	Underscore
>	Greater-than Sign
?	Question Mark
:	Colon
#	Number Sign
@	At Sign
'	Prime, Apostrophe
=	Equal Sign
"	Quotation Mark

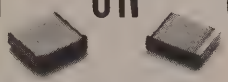
NOT JUST ANOTHER LINE...

It's ITW Paktron's complete line of film capacitors. Design us into your next product.

RA

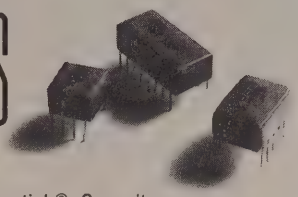
- Angstor® Capacitor
- Multilayer metallized polyester
- .0047 to 3.3 MFD
- ±5, 10, 20%
- 63 to 250 VDC
- Full voltage rating to 125°C
- 5, 7.5, 10, 15mm lead spacing
- Smallest film construction available

ST SN SS



- Surfilm® Capacitors
- Surface mount film
- Multilayer metallized PET, PPS and PEN
- Reflow solderable to 230°C—ST
- Reflow and wave solderable to 260°C—SS and SN
- 25 VDC—SS and SN
- 50 VDC—ST
- 1812, 2824, 3827 EIA sizes
- .01 to .47 MFD—SS and SN
- .01 to 2.2 MFD—ST

CS



- Capstick® Capacitor
- Multilayer metallized polyester
- High frequency ripple filter capacitor
- 4.7 to 25.0 MFD/100 VDC
- Compact footprint on 10mm lead spacing
- Ideal for frequencies 100 KHZ to 1 MHZ
- Very low ESR and ESL
- Low impedence per unit volume

PP

- Micromatic® Capacitor
- Polypropylene/foil
- 100 pf to .15 MFD
- ±1, 2, 2½, 5, 10%
- 100 to 600 VDC
- Sealed polypropylene case
- "The 1% solution"
- Tight T.C. applications

PA

- Polypropylene/foil
- .0033 to .47 MFD
- ±2, 5, 10, 20%
- 200 to 1600 VDC
- Flame retardant coating
- High pulse applications

Q

- Quencharc® Capacitor
- Metallized polyester R/C snubber network
- .1, .25, .50, 1.0 MFD
- 50 to 1600 VDC, 125 to 660 VAC
- ½, 1, 2 watt carbon comp. series resistor
- U.L. recognized version available
- Flame retardant coating
- Arc/transient suppression

- Location—Lynchburg, Virginia, USA
- Maturity—37 years in the film capacitor business
- Technical Leadership—Over 60 US patents related to capacitor construction
- Stability—A division of Illinois Tool Works Inc.
- Technical Expertise—Paktron's innovative Interleaf® Technology has been licensed to major companies in Europe and Japan
- Specialized Applications—DC to DC conversion, RFI/EMI filtering Solid state ignitions, Electronic ballast and lighting accessories, "S" correction circuits

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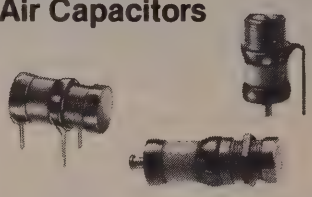


- ☐ Capacitance ranges: .8-10pf to 1-30pf
- ☐ Q's to > 10,000
- ☐ Excellent tuning stability and low dynamic noise
- ☐ Patented* self-locking constant torque adjustment mechanism
- ☐ Qualified to MIL-C-14409D, QPL approved
- ☐ Engineering prototype kit JK-500

*U.S. Patent No. Re. 30,406

Miniature Air Capacitors

- ☐ Capacitance ranges: .35-3.5pf to .8-10pf
- ☐ Q's to > 10,000
- ☐ Patented* self-locking constant torque adjustment mechanism
- ☐ Ideal for miniature microwave, VHF and UHF applications
- ☐ Engineering prototype kit JK-500

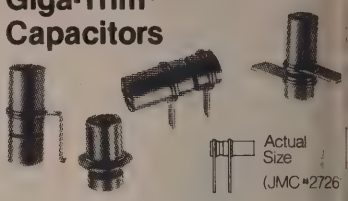
*U.S. Patent No. Re. 30,406

Thin-Trim® /Seal-Trim® Ceramic Capacitors

- ☐ Capacitance ranges: .2-.6pf to 20-100pf
- ☐ Q's to > 3000 at 100 MHz
- ☐ Ideal for sub-miniature hybrid circuit applications
- ☐ Seal-Trims impervious to all standard PCB cleaning solvents
- ☐ Conform to MIL-C-81 requirements
- ☐ Engineering prototype kits available

U.S. Patent No. 4,179,722

Giga-Trim® Capacitors



- ☐ Capacitance ranges: .3-1.2pf to .8-8pf
- ☐ Q's over 4000 at 250 MHz
- ☐ Ideal for microwave oscillators and filters
- ☐ Qualified to MIL-C-14409D, QPL approved
- ☐ New Zero TC verisons
- ☐ Engineering prototype kit JK-272

U.S. Patent No. Re. 30,406

Variable Ceramic Capacitors

- ☐ Low cost
- ☐ Broad tuning ranges: 1.7-6pf to 6.0-70pf
- ☐ Top, side and bottom tuning styles available
- ☐ Ideal for crystal oscillators, CATV amplifiers and all varieties of test and communication equipment
- ☐ Engineering prototype kit JK-930

Microwave Tuning Elements

- ☐ Provide a unique money-saving means of introducing a variable reactance into waveguides, cavities, and other microwave structures
- ☐ High resolution
- ☐ Patented* self-locking constant torque adjustment mechanism

*U.S. Patent No. Re. 30,406

The "First Word" in Ceramic Chip Capacitors

For over 25 years Johanson Dielectrics has provided an industry standard in high quality U.S. designed and manufactured ceramic multilayer chip capacitors.

Johanson Dielectrics' dedication to world class quality and on-time delivery makes them the choice of circuit designers worldwide.

JOHANSON DIELECTRICS

5191 Bledsoe Street, Sylmar, California 91342
TEL (818) 364 9800 FAX (818) 364 6100

Chip Capacitor Prototyping Kits

Designer chip capacitor kits for prototype circuit design and evaluation containing commonly used values in standard case sizes and dielectrics. Supplied in individual containers in a single vinyl note book for convenient storage and access.

Kits available:

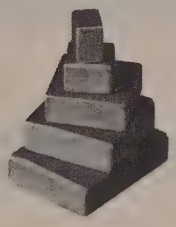
S-920	SMT Kit		
S-900	NPO Kit		
S-905	X7R/Z5U Kit	S-911	SLC Kit

From Johanson Dielectrics

Surface Mount Multilayer Ceramic Chip Capacitors

Feature nickel-barrier terminations in standard EIA case sizes: 0603, 0805, 1206, 1210, and 1812. Choice of plastic or paper tape on 7" or 13" reels. Compatibile with today's smt auto-placement systems & reflow processes.

High Voltage Surface Mount Chip Capacitors

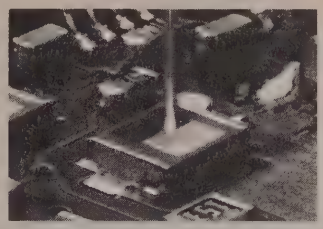


Offered in NPO and X7R dielectric with voltage ratings from 500 to 5,000 VDCW. Case sizes include 1206, 1210, 1808, 1812, 2221, and 2225. Typical applications are telecom line surge protection, and filtering, power supply decoupling, and voltage multiplier circuits.

MemoryGUARD® Decoupling Capacitors

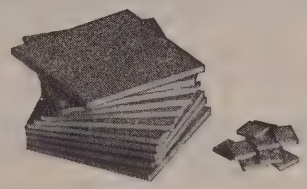
Advanced designs feature high capacitance values in two low profile configurations ideal for mounting beneath SOJ packaged DRAM's to minimize circuit inductance and increase circuit densities.

LASERtrim™ Surface Mount Tuning Capacitors



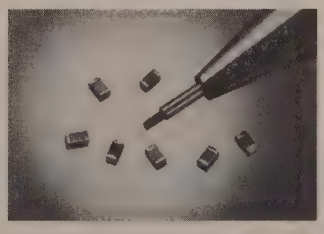
YAG laser adjustable MLC capacitors in 1206 and 1210 sizes for "in line" functional tuning of RF circuits. Applications include oscillator frequency and amplitude adjustment in pagers, radios, cell-phones, keyless entry and other RF products.

Single Layer (SLC) Microwave Capacitors



These units are used in microwave components, oscillators, MMIC's, multichip modules and other circuits requiring high frequency performance not possible with conventional MLC capacitors. Applications include bypass, decoupling and filter elements operating up to 50 GHz.

0402 Size SMT Chip Capacitors

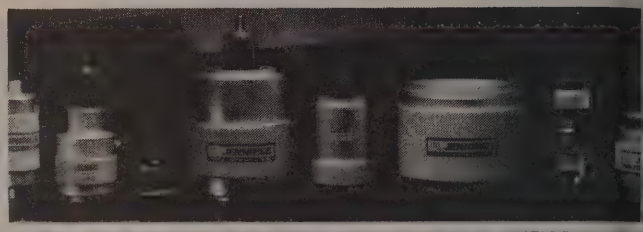


Ultra-compact chip capacitors in 0402 size for high density surface mount circuits. Capacitances of up to 220 pF in NPO dielectric, .01 µF (16v) in X7R dielectric, and .10 µF (16v) in Y5V dielectric.

JENNINGS VACUUM/GAS CAPACITORS

Jennings offers over 400 high voltage vacuum capacitors in various models, capacitance values, voltage and current ratings for radio frequency applications. Units are available in both glass and ceramic envelopes. Working voltage ratings are from 2 to 36 KV, at capacitance values to 5000 pfd, and with current ranges to 420 amps RMS (air-cooled) and 1,000 amps (water cooled) — depending upon capacity, frequency, and working voltage.

The examples described represent our most requested models. Please write or call for our comprehensive capacitor catalog that details our complete line.



VACUUM FIXED CAPACITORS

Peak Voltage Kilovolts			Capacity	Continuous RMS	Nominal Dimensions[3] (Inches)	
Test 60 Hz	RF Working[1] (Peak)	Type	pF	Amperes[2] (Max.)	Length	Diameter
12	7	CFDS	1000	95	4.6	3.6
15	9	CFDP	1500, 2000	200	3.3	5.6
15	9	CFED	5000	250	13.0	8.2
25	15	CFED	500, 750, 1000	180	3.8	4.6
30	18	CY	1, 2, 3, 5	12	3.3	0.8
30	20	CLF1	150, 200, 250	100	6.5	2.6
30	18	CFED	150, 300	140	3.6	3.4
30	18	CFFM	2500	400	5.8	8.2
35	25	CLF1	6, 12, 25, 50, 75, 100	85	6.5	2.3
35	21	CFFP	2000	360	5.8	8.2
50	30	CFHP	1000	350	6.2	7.2
55	33	CFHP	450	300	5.5	5.6
60	36	CFHD	12, 25, 50, 100, 200, 300	240	5.4	4.6

GAS FIXED CAPACITORS

Peak Voltage Kilovolts				Capacity	Continuous RMS	Nominal Dimensions[3] (Inches)	
Test 60 Hz	RF + DC	RF Working [1] Peak	Type	pF	Amperes[2] (Max.)	Length	Diameter
20	18	12	CGF1-1000	1000	215	3.5	4.8
35	30	20	CGF2-1000	1000	270	4.0	6.0
50	40	25	CGF2-500	500	240	5.5	5.7

VACUUM VARIABLE CAPACITORS

Peak Voltage Kilovolts			Capacity	Continuous RMS	Nominal Dimensions[3] (Inches)	
Test 60 Hz	RF Working[1] (Peak)	Type	pF	Amperes[2] (Max.)	Length	Diameter
5	3	CACA[4]	5-125	22	4.2	1.3
5	3	CSV1	5-500	45	5.8	2.4
5	5	CMV2	6-500	38	4.7	1.8
5	3	CVCJ	7-1000	70	7.6	3.1
3	3	CMV1	8-1000	40	4.3	1.8
5	3	CVCD	10-1500, 20-2000, 50-3000	100	8.3	4.6
5	5	CMV1	25-4000	70	6.6	3.2
15	9	CADD[4]	3-30	20	4.1	1.3
15	9	CVDD	6.5-50, 10-100	65	6.6	2.4
15	9	CVDD	10-300, 20-500	95	7.5	3.4
15	9	CSVF[4]	12-500	65	7.9	3.5
15	9	CVDD	25-750, 25-1000	150	8.0	4.6
15	9	CVDP	35-1500, 50-2300	160	9.8	5.6
15	9	CVEP	100-2000	200	10.2	7.2
15	9	CVED	100-5000	200	21.3	9.3
20	12	CVEP	25-500, 50-1000, 100-1500	210	10.2	7.2
30	18	CVFNP[5]	10-50	20	5.1	4.0
35	21	CVFP	100-1500, 100-2000	220	14.5	8.2
40	24	CVFP	15-250, 25-450	170	9.6	5.6
40	24	CVFP	20-750, 35-1000	225	11.7	7.2
40	24	CWV2	100-1600 (water cooled)	790	25.0	8.6
50	30	CWV2	25-450, 30-650 (water cooled)	840	17.9	7.6
50	30	CVHP	60-1000	250	14.5	8.0
50	30	CWV1	100-1000 (water cooled)	840	21.6	8.6
55	33	CVHP	10-250, 25-450, 30-650	240	11.9	7.2
60	36	CWV1	100-1600 (water cooled)	1000	23.0	12.6

GAS VARIABLE CAPACITORS

Peak Voltage Kilovolts			Capacity	Continuous RMS	Nominal Dimensions[3] (Inches)	
Test 60 Hz	RF Working[1]	Type	pF	Amperes[2] (Max.)	Length	Diameter
5	3	CHV1	1.5-45	18	3.5	0.9
15	9	CHV1	2.5-50	30	6.4	1.4

1 The maximum RF working voltage that can be applied over the 2-32 MHz frequency range while not exceeding the RF current rating.
2 RF current rating is dependent upon capacity, frequency and working voltage. Rating shown is largest unit in series. Write for complete applications data.
3 Dimensions of largest unit in a series. Available with metric thread mounting — on request.
4 Non-magnetic version available.
5 Neutralizing Capacitor.

JOSLYN JENNINGS CORPORATION
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KCK All the Suppliers You'll Ever Need

Leaded Components

Ceramic Disc Capacitors

Class 1

PO, N80, N150,N330,N470, N750, 1000, N1500, SL(P350-N1000)

	NPO		SL
0V	1pF-300	thru	100pF
00V	1pF-240	thru	820pF
00	1pF-430	thru	1000pF
KV	1pF-330	thru	430pF
KV	1pF-91	thru	300pF

Class 2

Y5E, Y5P,Y5T,Y5U,Y5V,

50V Y5E 100pF to Y5V .047uF

100V Y5E 100pF to Y5V .022uF

500V Y5E 100pF to Y5V .022uF

1KV Y5E 100pF to Y5V 0.22uF

2KV Y5P 100pF to Y5V .01uF

3KV Y5P 100pF to Y5V 6800pF

Class 3

Y5R, Y5U, Y5V

	Y5R	Y5U	Y5V
12V	-	.047-.22	-
16V	-	-	.022-.22
25V	.001-.1	.047-.22	.01-.22
50V	-	.01-.01	.01-.15

luminum Electrolytic Capacitors

adial Leaded

- 0.47uF to 10,000uF
- *Rated Voltage:* 6.3VDC to 350VDC
- -55°C to +105°C

Axial Leaded

- 0.47uF to 4700uF
- *Rated Voltage:* 6.3VDC to 350VDC
- -40°C to +85°C

Snap and Lock

- 100uF to 22,000uF
- *Rated Voltage:* 10VDC to 250VDC
- -40°C to +85°C

ilm Capacitors

poxy Dipped, Radial eaded

- Polyester Capacitor
- Metallized Polyester Capacitor
- Polypropylene Capacitor
- Metallized Polypropylene Capacitor
- Metallized Polycarbonate Capacitor

Tubular-Flat Axial Leaded

- Polyester Capacitor
- Metallized Polyester Capacitor
- Polypropylene Capacitor
- Metallized Polypropylene Capacitor
- Metallized Polycarbonate Capacitor

Box Radial Leaded

- Metallized Polyester Capacitor
- Metallized Polypropylene Capacitor
- 0.01uF to 4.7uF
- Rated Voltage: 50VDC to 630VDC

MD Components

hip Resistor

- Wattages: 1/8, 1/10, 1/8, 1/4, 1/2, and 1 W
- Values: 2.2 ohm to 10M ohm
- Dimensions: 1.6x .8 mm (for the1/16W) to 6.4 x 3.2 mm (for the 1W)
- Resistance Tolerance: .1%, .25%, .5%, 1%, 2%, 5% and 10%

vailable on tape, magazine or bulk packaging.

Ceramic Chip Capacitor

- Capacitance Range: 1pf to 3.3µF
- Temperature Characteristics: NPO to N750, SL, X7R, Z5U and Y5V
- Voltage Range: 25V to 630V
- Taping: 8mm is available on paper and plastic
- Sizes: 0603, 0805, 1206

Chip Thermistor

- Resistance Range: 1.5K ohm to 150K ohm
- Standard Tolerance: ±10% and ±15% (Tighter tolerances are available)
- B Value Range: 3450 to 4500
- Operating Temperature: –40 to +130°C

NF41 Series EMI Filter

- 3 Terminal, Multi-layer ceramic chip capacitor
- Compatible with all automatic PCB assemblies
- Due to its very low stray inductance, it is more effective than ordinary two terminal ceramic chip capacitors.

Chip Ferrite Beads

- Noise Suppression Range: 1MHz to 1GHz
- Size Ranges: 2mm x 1.2mm to 4.5mm x 3.2mm Ideal for common mode and differential mode line filtering. Prevent abnormal oscillation of high frequency amplifying circuits.

M X M Series

- *Package Sizes:* 12mm and 16mm tape and reel
- *Nominal Capacitance Range:* 1uF to 220uF
- *Standard Tolerance:* 20%

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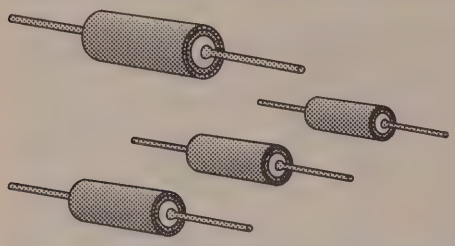
KEMET® *SOLID TANTALUM CAPACITORS*

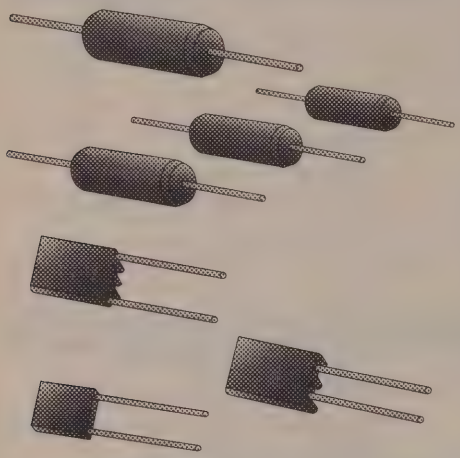
HERMETICALLY SEALED TANTALUM



AXIAL

T110, **T212** (CSR13), **T222** (CSR09), **T242** (CSR23), **T25** (CSR33), and **T262** (CSR21) per MIL-C-39003 also available Capacitance values from 0.0047 - 330µF; ±20% ±10%, and 5% tolerance; 6 - 125VDC. 4 Case sizes. Higher CV values available in **T140** series. Ultra miniature **T222** capacitance values fron 0.0047 - 22µF. Available on tape and reel.

MOLDED TANTALUM



AXIAL

Miniature molded gold color epoxy. Laser marked. Low impedanc at high frequencies. Capacitance values from 0.1 - 330µF; 2 50VDC. 6 Case sizes. **T323** (CX01 & CX05) per MIL-C-4913 available. Available on tape and reel.

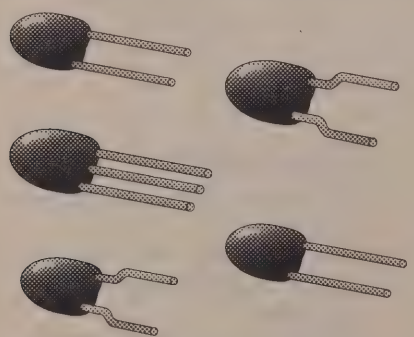
RADIAL

Precision molded gold color epoxy. Laser marked. Rectangula case, plus a radius on positive side of case. Capacitance value from 0.1 - 330µF; 6 - 50VDC. 6 Case sizes.

MICRONS

Complete line of microminiature solid tantalum capacitors. Micron consist of ultra small anode assemblies encapsulated in epoxy Capacitance values from 0.68 - 220µF; 3 - 35VDC.

DIPPED TANTALUM



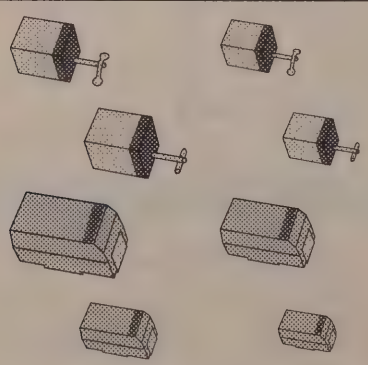
RADIAL

T35X "UltraDip II" miniature dipped solid tantalum capacitors. Gol color epoxy. Laser marked. Compact design plus low DC leakag and DF. Capacitance values from 0.1 - 680µF; 3 - 50VDC. 12 Cas sizes.

T36X MII-C-49137 radial dipped capacitors are available i capacitance values from 0.1µF - 330µF; 6 - 50 volts.

T396X "Ultra Dip III" Three-Leaded design with anode lead i middle for "fail-safe" insertion. Capacitance values from 0.1 680µF; 3 - 50 VDC. Gold color epoxy. Laser marked. 12 Cas sizes.

CHIPS TANTALUM



SOLID TANTALUM CHIP CAPACITORS

T411 and **T421** offer maximum volumetric efficiency and hig temperature capability. Economical price. Capacitance values fro 0.1 - 100µF; 4 - 50 VDC. 5 Case sizes.

T491, **T492** (CWR11) per MIL-C-55365 & **T496** Fail-Safe Fuse Chip. Molded tantalum chip capacitors mount directly to printe circuit boards. Same worldproven solid tantalum anode used i KEMET's leaded devices. Permanently attached to a solder coate lead frame. Assembly precision molded. Outstanding dimensiona consistancy. Beveled case denotes positive (+) polarity. Gold colo epoxy. Laser marked. Capacitance values from 0.1 - 150µF; 4 50VDC. Cap. tolerance ±20% and ±10%. Available on 8mm an 12mm tape on 7" and 13" reels. Bulk packaging available

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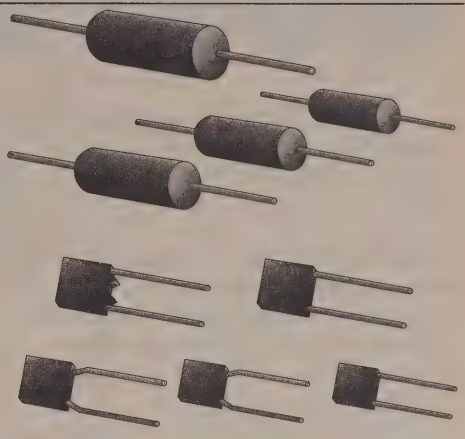
KEMET® MULTILAYER CERAMIC CAPACITORS

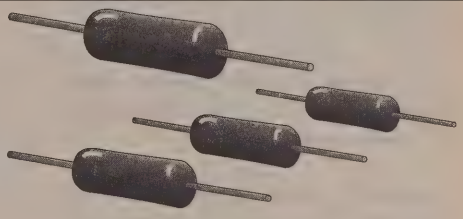
MOLDED MULTILAYER CERAMIC



AXIAL AND RADIAL

Molded gold color epoxy multilayer ceramic capacitors. Available in Ultrastable (C0G), Stable (X7R) (Military BX or BP) or General Purpose (Z5U) temperature characteristics. Military versions conform to MIL-C-39014, MIL-C-11015, MIL-C-123 and MIL-C-20 standards. Capacitance values from 10pF - 1μF; 50 100 and 200 volts.

CONFORMALLY COATED MULTILAYER CERAMIC

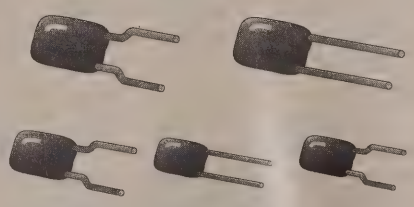


AXIAL

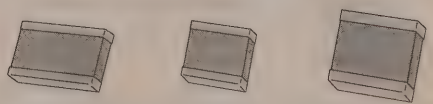
Maximax conformally coated multilayer ceramic capacitors. Available in C0G, X7R, and Z5U temperature characteristics. 5 Case sizes include over 138 CV values in capacitance range of 10 pF - 1.0μF; 50 And 100 volts. Gold color epoxy. Laser marked. Available on tape and reel.

RADIAL

Golden Max dipped multilayer ceramic capacitors. Reliable and economical. Available in C0G, X7R, or Z5U temperature characteristics. Gold color epoxy. Laser marked. Capacitance values from 1.0pF - 6.8μF; 100 and 200 volts. 6 Case sizes.



CHIPS CERAMIC



MULTILAYER CERAMIC CHIPS

Available in NPO, X7R, or Z5U temperature characteristics. MIL-C-55681 and MIL-C-123 approved. Capacitance values from 1pF - 1μF; 50, 100 and 200 volts. 9 Chips sizes. C0805 and C1206 sizes. Available in COPS (Component Placement System) 8mm or 12mm tape.

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eem

MINIGLOSSARY CAPACITORS

Anode: One of two plates or conductors. In polarized capacitors, the anode should be connected to the positive conductor in the circuit.

Capacitive Reactance: The opposition (in ohms) of capacitance to the flow of alternating current, equal to the reciprocal of the product of the angular frequency (2π times frequency in Hertz) of the current times the capacitance in farads.

Cathode: One of two plates or conductors. In electrostatic capacitors the cathode is metallic. In electrolytic capacitors the cathode is a liquid, gel or other conductive material which is in intimate contact with a metallic cathodic connection.

Dielectric Constant: The ratio of the capacitance of a capacitor with some material other than air between the capacitor plates to the capacitance of the same capacitor with air between the plates. For example, the dielectric constants of air, Teflon®, polystyrene and ruby mica are 1, 2.1, 2.6 and 5.4, respectively.

Electrolytic: A capacitor with one metallic conductor (generally the anode) and with a liquid or semiconductor cathode. Nonpolarized electrolytic capacitors generally have two equal anodes as well as the liquid cathode. These anodes operate alternately as anode and cathodic connection as alternating current is applied.

Electrostatic: One of two general classes of capacitors in which two or more discrete metallic conductors are present and separated by an insulating dielectric material. Examples include: mica, ceramic, film, and paper types.

Farad: The basic unit of measure in capacitors. A capacitor charged to one volt with a charge of one coulomb (one ampere flowing for one second) has a capacitance of one farad. Capacitors are generally rated at portions of a farad (microfarads or picofarads).

1 farad (F) = 1,000,000 microfarads (μF) 1 microfarad (μF) = 1,000,000 picofarads (pF)

Impedance: All capacitors exhibit impedance. It is a function of capacitor type and internal construction. This can be particularly important in certain applications such as filters for switching power supplies. Capacitors used in these applications often have special multiple tab construction to shorten current paths and to reduce internal resistance.

Leakage Current: Expressed as dcl for electrolytic capacitors, a measure of the intrinsic losses in a charged capacitor. Generally speaking, the lower the dcl, the higher quality the capacitor.

Power Factor: A measure of the overall efficiency of a capacitor. Power factor ratings take all internal losses into consideration in a complex formula. This parameter of certain capacitors is often very important in AC applications such as motor-start and/or motor-run capacitors

Rated Voltage: The rated working voltage of a capacitor. Generally expressed in DC Volts (Vdcw). This is the voltage at which a capacitor may be safely operated at 25°C continuously within its overall parameters.

Ripple Current: The total amount of alternating and direct current that may be applied to an electrolytic capacitor under stated conditions. In general, the higher the ripple current applied, the shorter the operating life of the capacitor will be. Application of significantly higher than rated ripple currents can shorten the capacitor life dramatically and may even cause catastrophic failure (explosion).

Surge Voltage: The momentary surge voltage which may be applied for a stated length of time without doing permanent damage to the unit.

Temperature: Capacitors are generally rated at 25°C at sea level under specific humidity conditions. Operating temperature ranges are also given, along with derating (reliability) curves for operation at temperatures other than 25°C.

Temperature Coefficient: Expressed as TC in ppm (parts per million) or in percent (%) from the norm of 25°C. This is seldom a straight line and may vary widely for certain types. Most capacitors have positive TC in that the capacitance increases as temperature increases. Some types, however, have negative TC in that the capacitance decreases as temperature increases.

Ceramic Capacitor Codes
(Capacitance Given In pF)

Color	Digit	Multiplier	Tolerance			Temperature Coefficient ppm°C	Significant Figure	Multiplier
			Class 1					
			10pF or less	Over 10pF	Class 2			
Black	0	1	±2.0pF	±20%	±20%	0	0.0	–1
Brown	1	10	±0.1pF	±1%		–33		–10
Red	2	100		±2%		–75	1.0	–100
Orange	3	1000		±3%		–150	1.5	–1000
Yellow	4	10000			+100% –0%	–220	2.0	–10000
Green	5		±0.5pF	±5%	±5%	–330	3.3	+1
Blue	6					–470	4.7	+10
Violet	7					–750	7.5	+100
Gray	8	0.01	±0.25pF		+80% –20%	+150 to –1500		+1000
White	9	0.1	±1.0pF	±10%	±10%	+100 to –750		+10000
Silver								
Gold								

TMC SERIES

TANTALUM CHIP CAPACITORS

KOA SPEER ELECTRONICS, INC.

TYPE TMC: *STANDARD CAPACITANCE RANGE*

STANDARD VALUES		VOLTAGE CODE	0G	0J	1A	1C	1D	1E	1V	1H
85°C	RATED VOLTAGE (VDC)		4	7	10	16	20	25	35	50
	SURGE VOLTAGE (VDC)		5	9	13	20	26	32	46	63
25°C	DERATED VOLTAGE (VDC)		2.5	4	6.3	10	13	16	23	32
CAPACITANCE (U F)		CAP CODE	–	–	–	–	–	–	–	–
0.1		104							A	A
0.15		154							A	B
0.22		224							A	B
0.33		334							A	B
0.47		474						A	B	C
0.68		684					A		B	C
1.0		105				A			B	C
1.5		155			A			B	C	D,E
2.2		255		A			B	C	C	D,E
3.3		335	A			B	C	C	C	
4.7		475			B	C	C	C	D,E	
6.8		685		B	C	C	C	D,E	D,E	
10		106	B	C	C	C,E	D,E	D,E		
15		156	C	C	C	D,E	D,E			
22		226	C	C	D,E	D,E				
33		336	C	D,E	D,E					
47		476	D,E	D,E						
68		686	D,E							

TYPE TMC-M: *EXTENDED CAPACITANCE RANGE*

STANDARD VALUES		VOLTAGE CODE	0G	0J	1A	1C	1D	1E	1V	1H
85°C	RATED VOLTAGE (VDC)		4	7	10	16	20	25	35	50
	SURGE VOLTAGE (VDC)		5	9	13	20	26	32	46	63
125°C	DERATED VOLTAGE (VDC)		2.5	4	6.3	10	13	16	23	32
CAPACITANCE (U F)		CAP CODE	–	–	–	–	–	–	–	–
0.1		104								
0.15		154								A
0.22		224								
0.33		334								
0.47		474							A	B
0.68		684						A	A	
1.0		105					A	A		
1.5		155				A	A		B	C
2.2		255			A	A	A	B	B	
3.3		335		A	A	A	B	B		D,E
4.7		475	A	A	A	B	B		C	E
6.8		685	A	A	A,B	B	B,C	C		
10		106	A	A,B	B	B,C	C		D,E	
15		156	A,B	B	B	C		E		
22		226	B	B	C		D,E			
33		336	B	B,C		D,E	D,E			
47		476	B,C	C	D,E	D,E				
68		686	C	D,E	D,E					
100		107	D,E	E						
150		157	D,E							

FEATURES

- EPOXY MOLDED BODY, UL 94 V-O FLAMMABILITY
- EIA – U.S. AND EIA – JAPAN COMPATIBLE SIZES
- 100% BURN-IN AND END OF LINE TESTING
- EXTENDED VALUES PER CASE SIZE
- EXCELLENT HUMIDITY AND SOLDER HEAT RESISTANCE

TMC Series of molded tantalum chip capacitors offers an extensive range of values in EIA–U.S. and EIA–Japan compatible sizes. By design, strict process control, and a commitment to provide the most reliable product in the industry, the TMC has passed our customers' most severe humidity/temperature/pressure induced life stress testing. For surface mount applications, the space saving, highly reliable TMC is the most ideal tantalum chip capacitor.

'orking Temperature Range: –55°C to 125°C
(derate voltage above 85°C: refer to Standard Rating Chart D.V.)

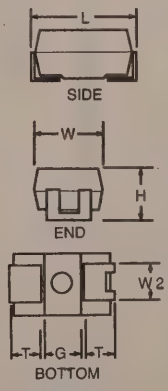
oltage Range (Vdc): 4V to 50V

olerance: ±20%, ±10%

issipation Factor: measured at 20°C, 120Hz

TMC
0.1 – 1.0µf less than 4.0%
1.5 – 68µf less than 6.0%

TMC-M
0.47 – 33µf less than 6%
47µf–150µf less than 8%



C. Leakage Current: at rated voltage after 5 minutes .01CV or 0.5µA whichever is greater C – capacitance, V – voltage

CASE DIMENSIONS

CASE KSE / EIA		L	W	H	T	G	W²
A/3216	mm	3.2±0.2	1.6±0.2	1.6±0.2	0.7±0.3	1.4±0.2	1.2±0.2
	in	.126 ±.008	.063 ±.008	.063 ±.008	.028 ±.012	.055 ±.008	.047 ±.008
B/3528	mm	3.4±0.2	2.6±0.2	1.9±0.2	0.8±0.3	1.4±0.2	1.8±0.2
	in	.134 ±.008	.102 ±.008	.073 ±.008	.031 ±.012	.055 ±.008	.071 ±.008
C/6032	mm	6.0±0.3	3.2±0.2	2.5±0.2	1.3±0.3	2.4±0.2	2.4±0.2
	in	.236 ±.012	.126 ±.008	.098 ±.008	.051 ±.012	.094 ±.008	.094 ±.008
D/----- (EIA-J)	mm	5.8±0.2	4.5±0.2	3.1±0.2	1.3±0.3	2.5±0.2	3.3±0.2
	in	.228 ±.012	.177 ±.008	.122 ±.008	.051 ±.012	.098 ±.008	.130 ±.008
E/7343 (EIA-D Size)	mm	7.3±0.3	4.3±0.3	2.8±0.2	1.3±0.3	3.8±0.2	2.4±0.2
	in	.287 ±.012	.169 ±.012	.110 ±.008	.051 ±.012	.150 ±.008	.094 ±.008

KOA SPEER ELECTRONICS, INC.

CERAMIC CAPACITORS & METAL OXIDE VARISTORS

MAIDA DEVELOPMENT COMPANY
"DOMESTIC MANUFACTURERS SINCE 1947"

90,000 square foot manufacturing facilities located in Hampton, Virginia

Maida

See our Metal Oxide Varistor Listings - Section 4700.

serving the electronics industry as partners in progress for more than forty-five years.

Maida Development Company is a domestically owned and operated manufacturer of a wide variety of electronic ceramic components. Since 1947, we have specialized in the custom design and fabrication of ceramic disc capacitors - from ceramic dielectric powder formulation through finished devices - to meet the specific requirements of our customers. Maida's major capacitor products include (1) Class I, Class II, and Class III high voltage disk capacitors, 1 KDVC thru 30 KDVC; (2) capacitors safety- recognized by UL, CSA, and VDE. for across-the-line, line-by-pass, and antenna-coupling applications; (3) close tolerance adjusted NPO disk capacitors; (4) low-inductance leadless disks; (5) slot-mountable "trapezoids" for printed circuits; (6) trimmer capacitors; (7) post insulators/capacitors; (8) radial tubular capacitors; (9) feedthrus and (10) sparkgaps.

Maida Development Company also produces a complete line of metal oxide varistors (MOV's) designed for transient voltage suppression and surge energy absorption. We are now the only U.S. manufacturer of these components, with ceramic formulation, powder preparation, fabrication and assembly facilities all located in this country. Maida's varistors are recognized by UL, CSA and VDE. Please contact Maida's Sales Department to request our full-line varistors catalog.

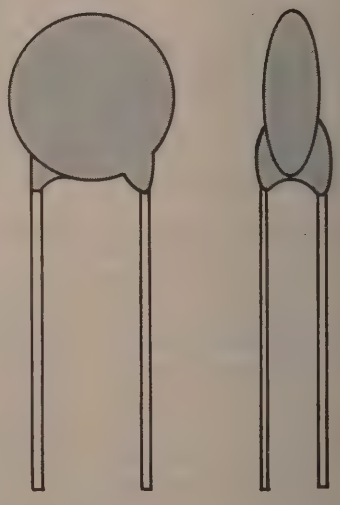
Delivery is both timely and reliable - with either bulk or tape and reel packaging.

Our sales representatives are strategically located throughout the USA and world. Maida welcomes the opportunity to discuss and bid on capacitor requirements not covered by this catalog. Please contact our Engineering Department.

CERAMIC DISC CAPACITORS — 500V THRU 6KV

CLASS	T.C.	Maximum Capacitance, *pF*						
		VDC 500V	VDC 1KV	VDC 2KV	VDC 3KV	VDC 4KV	VDC 5KV	VDC 6KV
1	P100	81	68	51	36	27	22	18
1	NP0	910	910	750	470	360	300	240
1	N033	910	910	750	470	360	300	240
1	N075	1000	1000	820	560	430	330	270
1	N150	560	560	430	300	200	180	150
1	N220	620	620	470	330	240	200	160
1	N330	750	750	560	360	270	220	190
1	N470	1300	1300	1100	750	560	470	390
1	N750	1500	1500	1300	820	620	510	430
1	N1500	2700	2700	2200	1500	1100	910	750
1	N2200	3900	3900	3300	2200	1600	1300	1100
1	N3300	6800	6800	5600	3600	3700	2200	1800
1	N4700	22000	22000	18000	12000	9100	7500	4700
1	N5600	8200	8200	6200	4300	3000	2400	2000
2	X5F	10000	10000	7500	5100	3900	3000	2700
2	Z5P	18000	18000	9100	6200	4700	3600	3000
2	X5P	15000	15000	12000	7500	5600	4700	3900
2	X7R	20000	20000	15000	10000	7500	6200	5100
2	X5R	27000	27000	20000	15000	10000	8200	6800
3	Z5U	62000	62000	47000	33000	24000	20000	16000
3	X5U	18000	18000	9100	6200	4700	3600	3000

APPLICATIONS:
CLASS 1. High-Q, temperature compensating, or stable capacitance requirements.
CLASS 2. Semi-Stable General Purpose.
CLASS 3. General Purpose, Line-by-pass, Coupling, etc.



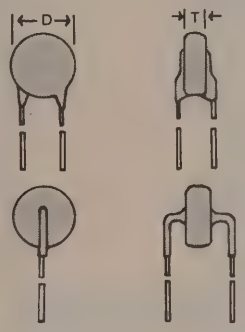
CERAMIC CAPACITORS

MAIDA DEVELOPMENT COMPANY
"DOMESTIC MANUFACTURERS SINCE 1947"

HIGH VOLTAGE DISCS

MAX NOM. CAP. ±20% pF	10KV "T" MAX. 0.360 X5R	10KV "T" MAX. 0.360 Z5U	12KV "T" MAX 0.400 X5R	12KV "T" MAX 0.400 Z5U	15KV "T" MAX 0.460 X5R	15KV "T" MAX 0.460 Z5U	20KV "T" MAX X5R	20KV "T" MAX Z5U
100	D68	—	D68	—	D689	—	D689	—
200	D68	—	D68	—	D619	—	D719	—
250	D68	—	D61	—	D719	—	D719	—
500	D71	D68	D63	D68	D699	D619	D649	D719
750	D69	D61	D64	D61	D639	D719	D679	D629
1000	D64	D71	D63	D71	D679	D699	D769	D699
1500	D67	D62	D65	D69	D669	D649	D709	D639
2200	D66	D64	D66	D63	D709	D679	—	D769
2500	D66	D63	D70	D67	—	D659	—	D669
3000	D70	D63	D70	D67	—	D769	—	D669
4300	D70	D76	—	D66	—	D669	—	D709
5600	—	D66	—	D70	—	D709	—	—
6800	—	D70	—	D70	—	—	—	—

STYLE	MAX. "D"
D68/D689	0.406
D61/D619	0.469
D71/D719	0.532
D62/D629	0.594
D69/D699	0.659
D64/D649	0.719
D63/D639	0.781
D67/D679	0.840
D65/D659	0.969
D66/D669	1.100
D70/D709	1.350

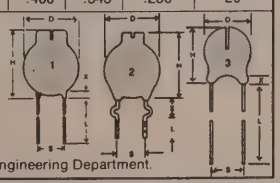


APPLICATIONS:
Voltage Multipliers, High Voltage Power Supplies

SPARK GAPS & CAPACITOR/SPARK GAPS

MDC STYLE	FIG. NO.	CAP. pF	TOL. CODE	GAP VOLTAGE RANGE, KVDC	MAX. DIAM. in.	MAX. HGHT. in.	LEAD SPACING in.	WIRE GAGE AWG
100	3	–	–	1.2-1.8	.440	.500	.200	22
100-1	3	–	–	1.2-1.8	.440	.500	.200	20
100-2	3	–	–	1.2-1.8	.440	.500	.250	22
100-3	3	–	–	1.2-1.8	.440	.500	.250	20
100-4	3	–	–	1.2-1.8	.440	.500	.200	22
100-5	3	–	–	2.0-3.0	.440	.500	.375	20
100H	3	–	–	3.0-4.5	.440	.500	.200	22
101	1	10000	Z	2.0-3.0	.750	1.000	.375	20
102	1	2700	Z	3.0-4.5	.875	1.125	.375	20
108	1	10000	M	2.0-3.0	.750	1.000	.375	20
109	1	4700	K	2.0-3.0	.532	.757	.375	20
111	1	4700	K	3.0-4.0	.656	.881	.375	20
112	1	2700	Z	3.5-5.0	.875	1.125	.375	20
117	1	10000	Z	1.8-2.6	.930	1.200	.375	20
117A	1	10000	Z	1.2-1.8	.750	1.000	.500	20
124	1	20000	P	1.0-2.0	1.000	1.175	.375	20
125	2	1000	Z	2.0-3.0	.437	.620	.375	20
126	1	1000	Z	1.0-2.0	.440	.750	.250	20
127	1	1000	M	1.0-2.0	.500	.675	.250	20
128	2	1000	Z	1.0-2.0	.440	.620	.250	20
130	1	10000	M	2.0-3.0	.875	1.000	.375	20
132	1	1000	P	2.0-3.0	.420	.570	.250	20
133	2	1000	P	2.0-3.0	.440	.620	.250	20
136	2	1000	Z	2.0-3.0	.440	.620	.250	20
137	1	9000	Z	1.0-2.2	.685	.900	.375	20
138	1	1000	M	2.0-3.0	.400	.545	.250	20

TOL. CODES:
K=+/-10%; M=+/-20%;
Z=+80%, -20%; P=+100%, -0%
WIRE DIAMS: 22 AWG=0.025 in.
20 AWG =0.032 in.

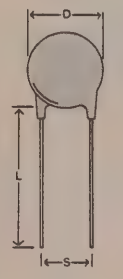


APPLICATIONS: Protection of low voltage circuits from high voltage surges.
For specific requirements, please contact our Engineering Department.

UL/CSA/VDE SAFETY-RECOGNIZED TYPE UW CAPACITORS

MDC STYLE	CAPACITANCE pF ± 20%	DIMENSIONS, in. DMAX	HMAX	L.S.	TEMP. COEFF. EIA	IEC	VDE 565-1 CLASS CODE
D68UW101M	100	.394	.512	.300	Z5U	2B4	X1/Y
D68UW121M	120	.394	.512	.300	Z5U	2B4	X1/Y
D68UW151M	150	.394	.512	.300	Z5U	2B4	X1/Y
D68UW181M	180	.394	.512	.300	Z5U	2B4	X1/Y
D68UW221M	220	.394	.512	.300	Z5U	2B4	X1/Y
D68UW271M	270	.394	.512	.300	Z5U	2B4	X1/Y
D68UW331M	330	.394	.512	.300	Z5U	2B4	X1/Y
D68UW391M	390	.394	.512	.300	Z5U	2B4	X1/Y
D61UW471M	470	.472	.590	.375	Z5U	2B4	X1/Y
D61UW561M	560	.472	.590	.375	Z5U	2E4	X1/Y
D61UW681M	680	.472	.590	.375	Z5U	2E4	X1/Y
D61UW821M	820	.472	.590	.375	Z5U	2E4	X1/Y
D61UW102M	1000	.472	.590	.375	Z5U	2E4	X1/Y
D61UW122M	1200	.472	.590	.375	Z5U	2E4	X1/Y
D61UW152M	1500	.472	.590	.375	Z5U	2E4	X1/Y
D61UW182M	1800	.472	.590	.375	Z5U	2E4	X1/Y
D61UW202M	2000	.472	.590	.375	Z5U	2E4	X1/Y
D62UW222M	2200	.590	.708	.375	Z5U	2E4	X1/Y
D62UW272M	2700	.590	.708	.375	Z5U	2E4	X1/Y
D62UW332M	3300	.590	.708	.375	Z5U	2E4	X1/Y
D62UW392M	3900	.590	.708	.375	Z5U	2E4	X1/Y
D64UW472M	4700	.748	.866	.375	Z5U	2E4	X1/Y
D64UW562M	5600	.748	.866	.375	Z5U	2E4	X1
D64UW622M	6200	.748	.866	.375	Z5U	2E4	X1
D63UW682M	6800	.787	.905	.375	Z5U	2E4	X1
D67UW822M	8200	.866	.984	.375	Z5U	2E4	X1
D65UW103M	10000	.905	1.02	.375	Z5U	2E4	X1

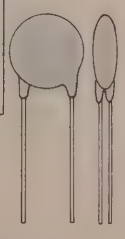
Voltage Ratings:
DC - 4 KVDC - all values
CSA C22.2 - 125 VAC - all values
UL1414 - 250 VAC - all values
VDE 565-1 - 250 VAC - all values
VDE 560-2 - 400VAC - 1000pF to 10000pF



APPLICATIONS:
Line-by-pass, antenna couplings, across-the-line

250 & 500 VOLT AC POWER LINE CAPACITORS

STYLE CODE	MAX. "D" INCHES	MAX CAPACITANCE pF 250VAC	MAX CAPACITANCE pF 500VAC
60	0.312	1200	680
68	0.375	2500	1200
61	0.470	3600	2000
71	0.530	4300	2200
62	0.590	6800	3600
64	0.720	10000	6200
63	0.780	13000	6800
67	0.840	15000	8200
65	0.970	22000	12000
66	1.10	30000	15000



APPLICATIONS:
AC line voltage applications where minimum currents - reactive and resistive - are required.

TOLERANCES AVAILABLE:
±20% or +80 - 20%

20 LIBBY STREET / P.O. BOX 3529—HAMPTON, VIRGINIA 23663 / (804) 723-0785 / FAX (804) 722-1194

LOW VOLTAGE DISC CAPACITORS

MAIDA DEVELOPMENT COMPANY

"DOMESTIC CAPACITOR MANUFACTURERS SINCE 1947"

TEMPERATURE COMPENSATING TYPE

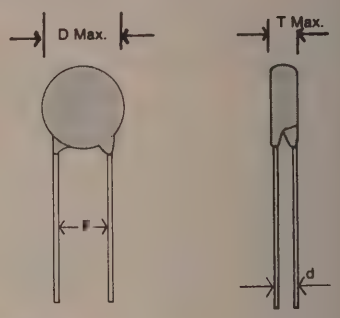
MAXIMUM CAPACITANCE VALUES BY TC TYPE

T.C. / W.V.	CAPACITANCE (pF) NPO	N80	N150	N220	N330	N470	N770	P350 - N1000	DIMENSIONS INCHES (mm) D	T	F	d
50V DC	22	18	16	30	20	22	39	110	.157 (4.0)	.157 (4.0)	.098 (2.5)	.020 (0.5)
	30	30	22	47	39	39	55	130	.197 (5.0)	.118 (3.0)	.098 (2.5)	.020 (0.5)
	56	47	47	91	62	56	100	240	.248 (6.3)	.118 (3.0)	.197 (5.0)	.020 (0.5)
	100	82	91	130	120	130	150	510	.315 (8.0)	.118 (3.0)	.197 (5.0)	.020 (0.5)
	200	130	130	250	200	200	240	680	.394 (10.0)	.118 (3.0)	.197 (5.0)	.020 (0.5)
	—	250	250	370	350	360	390	1000	.492 (12.5)	.118 (3.0)	.197 (5.0)	.020 (0.5)

GENERAL PURPOSE TYPE

MAX. CAPACITANCE VALUES BY TC TYPE

T.C. / W.V.	CAPACITANCE (pF) Y5P	Z5U	Z5V	DIMENSIONS INCHES (mm) D	T	F	d
50V DC	1200	1200	2200	.155 (4.0)	.157 (4.0)	.098 (2.5)	.020 (0.5)
	1800	1800	4700	.197 (5.0)	.118 (3.0)	.098 (2.5)	.020 (0.5)
	3300	3300	10000	.248 (6.3)	.118 (3.0)	.197 (5.0)	.020 (0.5)
	5600	5600	22000	.315 (8.0)	.118 (3.0)	.197 (5.0)	.020 (0.5)
	8200	8200	40000	.394 (10.0)	.118 (3.0)	.197 (5.0)	.020 (0.5)
	10000	10000	47000	.492 (12.5)	.118 (3.0)	.197 (5.0)	.020 (0.5)



SEMICONDUCTOR TYPE

MAX. CAPACITANCE VALUES BY TC TYPES

T.C. / W.V.	CAPACITANCE (pF) Y5P	Y5R	Y5T	Y5U	Y5V	DIMENSIONS INCHES (mm) D	T	F	d
12V DC	—	10000	22000	22000	47000	.197 (5.0)	.118 (3.0)	.098 (2.5)	.020 (0.5)
	—	22000	47000	47000	100000	.248 (6.3)	.157 (4.0)	.197 (5.0)	.020 (0.5)
	—	47000	100000	100000	—	.315 (8.0)	.157 (4.0)	.197 (5.0)	.020 (0.5)
	—	—	220000	220000	220000	.394 (10.0)	.157 (4.0)	.197 (5.0)	.020 (0.5)
	—	100000	330000	—	470000	.492 (12.5)	.157 (4.0)	.197 (5.0)	.020 (0.5)
	—	—	470000	—	—	.630 (16.0)	.157 (4.0)	.197 (5.0)	.020 (0.5)
25V DC	—	4700	10000	10000 20000	22000	.197 (5.0)	.157 (4.0)	.197 (5.0)	.020 (0.5)
	10000	15000	22000	—	47000	.248 (6.3)	.157 (4.0)	.197 (5.0)	.020 (0.5)
	—	22000	47000	100000	100000	.315 (8.0)	.157 (4.0)	.197 (5.0)	.020 (0.5)
	22000	47000	100000	—	22000	.394 (10.0)	.157 (4.0)	.197 (5.0)	.020 (0.5)
	47000	100000	—	220000	—	.492 (12.5)	.157 (4.0)	.197 (5.0)	.020 (0.5)
	100000	—	—	—	470000	.630 (16.0)	.157 (4.0)	.197 (5.0)	.020 (0.5)
50V DC	—	—	—	10000	22000	.197 (5.0)	.157 (4.0)	.197 (5.0)	.020 (0.5)
	10000	10000	1000	22000	47000	.248 (6.3)	.157 (4.0)	.197 (5.0)	.020 (0.5)
	15000	22000	22000	47000	100000	.315 (8.0)	.157 (4.0)	.197 (5.0)	.020 (0.5)
	22000	47000	47000	100000	—	.394 (10.0)	.157 (4.0)	.197 (5.0)	.020 (0.5)
	470000	—	100000	—	—	.492 (12.5)	.157 (4.0)	.197 (5.0)	.020 (0.5)
	100000	100000	—	—	—	.630 (16.0)	.157 (4.0)	.197 (5.0)	.020 (0.5)

Straight

Inside Kink

Outside Kink

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MALLORY *custom aluminum electrolytic capacitors*

eatures	Benefits
and-Selected Foils	• Eliminates traditional capacitor derating • Provides high voltage, ripple and temperature performance up to 500 V at 85°C with ripple current up to 50 amps (rms)
acuum-Impregnated	• Complete electrolyte penetration of cartridge • Guarantees superior performance and repeatability • High MTBF
ough Aging	• Aged at 85°C to full voltage • Customer receives preformed capacitor • Lower D.C. leakage • Lower E.S.R. • Longer shelf life

A capacitors are long-life aluminum electrolytic capaci- rs custom-designed for your extreme applications.

ith capacitance ratings up to 500,000 µF, voltage rat- gs up to 500 V, ripple currents up to 50 amps (rms) and mperature stability up to 85C, Mallory EA capacitors ovide superior performance across a wide range of plication requirements.

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TYPE 202
DIPPED TANTALUM CAPACITORS

Designed to take advantage of high purity tantalum powder resulting in smaller size units and minimum cost, with very low leakage current and excellent stability over both temperature and time, with a very limited distribution. Ideal for by-passing, coupling and timing applications.

SPECIFICATIONS

Capacitance Range: 0.1 to 330 μF
Rated Working Voltage: 3.15 to 50 VDC
Capacitance Tolerance: $\pm$10% (K)
Operating Temperature Range: $-$55°C to $+$85°C
DC Leakage Current (Rated Voltage, 5 min. 25°C): 0.01 CV (μA) or 0.5 μA, whichever is greater.
Conform to the test method of Capacitor Flame Test in UL 1414.

SURGE VOLTAGE

DC Rated Voltage at 85°C	3.15	6.3	10	16	20	25	35	50
DC Surge Voltage at 85°C	4.0	8.0	13	20	25	32	44	63

Capacitors shall withstand the surge voltage applied in series with a 1000 ohm resistor at the rate of ½ minute on, 5½ minutes off, for 1000 successive test cycles at 85°C. After test, capacitors shall meet the requirements in Table 1.

Table 1

Capacitance Change	Within 5% of initial value
Dissipation Factor	Within initial requirement specified
DC Leakage Current	Within initial requirement specified

ALLOWABLE REVERSE VOLTAGE

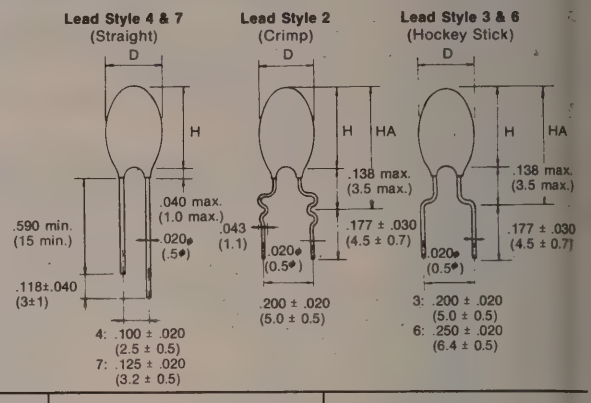
10% of rated voltage or 0.5 V, whichever is greater, at 25°C; 3% of rated voltage or 0.5 V, whichever is greater, at 85°C.

STANDARD RATINGS, SHOWING CASE SIZES

CAP (μF) \ RV (VDC)	3.15	6.3	10	16	20	25	35	50
.10							1	2
.15							1	2
.22							1	2
.33							1	2
.47							1	2
.68							1	2
1.0							1	3
1.5						1	2	4
2.2					1	2	3	5
3.3				1	2	3	4	6
4.7			1	2	3	4	5	
6.8		1	2	3	4	5	6	
10	1	2	3	4	5	6	7	
15	2	3	4	5	6	7	8	
22	3	4	5	6	7	8	9	
33	4	5	6	7	8	9	10	
47	5	6	7	8	9	10		
68	6	7	8	9	10			
100	7	8	9	10				
150	8	9	10					
220	9	10						
330	10							

NOTE: Intermediate non-standard values available. 1000 Pcs. Minimum.

DIMENSIONS: Inch (mm)



CASE SIZE	3.15 VDC — 35 VDC D MAX.	H MAX.	HA MAX.	50 VDC D MAX.	H MAX.	HA MAX.
1	.142(3.6)	.236(6.0)	.374(9.5)	-	-	-
2	.150(3.8)	.256(6.5)	.394(10.0)	.150(3.8)	.276(7.0)	.414(10.5)
3	.157(4.0)	.276(7.0)	.414(10.5)	.157(4.0)	.295(7.5)	.433(11.0)
4	.189(4.8)	.295(7.5)	.433(11.0)	.189(4.8)	.315(8.0)	.453(11.5)
5	.197(5.0)	.315(8.0)	.453(11.5)	.197(5.0)	.335(8.5)	.473(12.0)
6	.217(5.5)	.335(8.5)	.473(12.0)	.217(5.5)	.374(9.5)	.512(13.0)
7	.217(5.5)	.374(9.5)	.512(13.0)			
8	.256(6.5)	.453(11.5)	.591(15.0)			
9	.295(7.5)	.512(13.0)	.650(16.5)			
10	.315(8.0)	.551(14.0)	.689(17.5)			

ORDERING INFORMATION

202 L 3151 106 K 4

TYPE

FAILURE RATE
L: 2%/1000 Hrs.

VOLTAGE RATING

Code	Volts	Code	Volts	Code	Volts
3151	3.15	1602	16	2502	25
6301	6.3	2002	20	3502	35
1002	10			5002	50

CAPACITANCE IN PICOFARADS
First two digits are significant figures.
Third digit is the number of zeros following.

CAPACITANCE TOLERANCE
K = $\pm$10%

LEAD STYLE

Lead Style	Lead Space Inch	mm	Code	Lead Style	Lead Space Inch	mm	Code
Straight .100"	.100	2.5	4	Hocky Stick .250"	.250	6.4	6
Straight .125"	.125	3.2	7	Tape & Reel .200"	.200	5.0	C or F
Crimp .200"	.200	5.0	2	Tape & Reel .100"	.100	2.5	H or J
Hockey Stick .200"	.200	5.0	3	Tape & Ammo Pack .200"	.200	5.0	B
Straight .200"	.200	5.0	*3	Tape & Ammo Pack 100"	.100	2.5	G

*Case Sizes 8,9,10 only

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TYPE 204 (HIGH RELIABILITY) DIPPED TANTALUM CAPACITORS

MATSUO®

LUEDT® 204 Series is designed to maintain high reliability electrical erformance characteristics. These high reliability 204 Series capaci- rs offer small case sizes and are ideal for use in any "Hi-Rel" product ich as automotive electronics, telecommunications equipment, or y other industrial product where reliability is a must.

PECIFICATIONS

perating Temperature Range: −55°C to +125°C (For operation at 125°C derate voltage linearly to 67% of 85°C voltage rating.)
ated Voltage: 3.15, 6.3, 10, 16, 20, 25, 35, 50VDC
apacitance Range: 0.1 to 470µF
apacitance Tolerance: ±20%(M), ±10%(K), ±5%(J)
Leakage Current: 0.008 × CV or 0.4µA, whichever is greater (Rated voltage, 5 min, 25°C)
ssipation Factor: See Table 1 (at 120Hz)

urge Voltage

DC Rated Voltage at 85°C	3.15	6.3	10	16	20	25	35	50
DC Surge Voltage at 85°C	4.0	8.0	13	20	25	32	44	63

apacitors shall withstand the surge voltage applied in series with a 1000 ohm sistor at the rate of ½ minute on, 5½ minutes off, for 1000 successive test cles at 85°C. After test, capacitors shall meet the requirements in Table 1.

Table 1

Capacitance Change	Within 5% of initial value
Dissipation Factor	Within initial requirement specified
DC Leakage Current	Within initial requirement specified

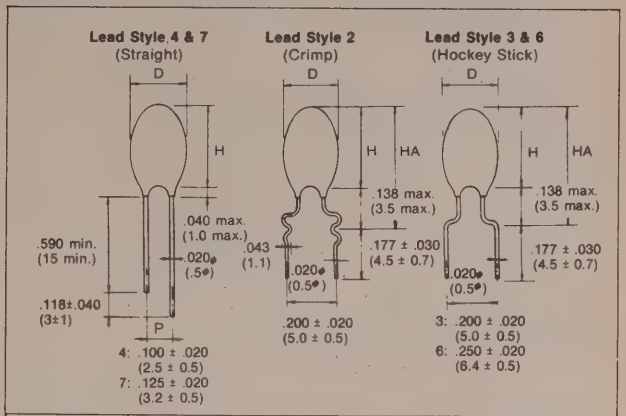
LLOWABLE REVERSE VOLTAGE

)% of rated voltage or 0.5 V, whichever is greater, at 25°C; 3% of rated ltage or 0.5 V, whichever is greater, at 85°C.

TANDARD RATINGS, SHOWING CASE SIZES

R.V. (VDC) / Cap. (µF)	3.15	6.3	10	16	20	25	35	50
0.1							1	2
0.15							1	2
0.22							1	2
0.33							1	2
0.47							1	2
0.68							1	2
1.0							1	3
1.5						1	2	4
2.2					1	2	3	5
3.3				1	2	3	4	6
4.7			1	2	3	4	5	7
6.8		1	2	3	4	5	6	8
10	1	2	3	4	5	6	7	9
15	2	3	4	5	6	7	8	10
22	3	4	5	6	7	8	9	11
33	4	5	6	7	8	9	10	
47	5	6	7	8	9	10	11	
68	6	7	8	9	10	11		
100	7	8	9	10	11			
150	8	9	10	11				
220	9	10	11					
330	10	11						
470	11							

DIMENSIONS: Inches (mm)



Case Code	D max.	H max.	*P ± .02 (.5)
1	.142 (3.6)	.256 (6.5)	.098 (2.5)
2	.150 (3.8)	.276 (7.0)	.098 (2.5)
3	.157 (4.0)	.296 (7.5)	.098 (2.5)
4	.189 (4.8)	.315 (8.0)	.098 (2.5)
5	.197 (5.0)	.335 (8.5)	.098 (2.5)
6	.217 (5.5)	.374 (9.5)	.098 (2.5)
7	.236 (6.0)	.394 (10.0)	.098 (2.5)
8	.256 (6.5)	.453 (11.5)	.125 (3.2)
9	.295 (7.5)	.512 (13.0)	.197 (5.0)
10	.315 (8.0)	.551 (14.0)	.197 (5.0)
	.335 (8.5)	.787 (20.0)	.197 (5.0)

*Style 4 only

Packaging Style (available up to Case 8)

Code	Lead Spacing	Polarity	Style
H	.100 ± .020 (2.5 ± 0.5)	⊕ proceeding	Reeled
J		⊖ proceeding	Reeled
G			Ammo
C	.200 ± .020 (5.0 ± 0.5)	⊕ proceeding	Reeled
F		⊖ proceeding	Reeled
B			Ammo

ORDERING INFORMATION

204 M 3151 106 M 3

TYPE 204

FAILURE RATE
M: 1%/1000Hr.
N: 0.5%/1000Hr.

VOLTAGE RATING

Code	Vol	Code	Vol	Code	Vol	Code	Vol
3151	3.15	1002	10	2002	20	3502	35
6301	6.3	1602	16	2502	25	5002	50

CAPACITANCE IN PICOFARADS
First two digits are significant figures.
Third digit is the number of zeros following.

CAPACITANCE TOLERANCE
M = ±20%
K = ±10%
J = ±5%

LEAD STYLE
SEE DIMENSIONS

TYPE 269 (BUILT-IN FUSE) TANTALUM CHIP CAPACITORS

MATSUO Type 269 is specially designed as a surface mount component for use in hybrid and low profile print circuit board applications.
Built-in fuse functions either as thermal fuse under small current or as electric fuse under larger currents.

SPECIFICATIONS

Operating Temperature Range: –55°C to +125°C (For operation at 125°C derate voltage linearly to 67% of 85°C voltage rating.)
Rated Voltage: 10, 16, 20, 25, 35, 50VDC
Capacitance Tolerance: ±20%(M), ±10%(K)
DC Leakage Current: 0.01 x CV or 0.5μA. Whichever is greater (Rated voltage, 5 minutes, 25°C)

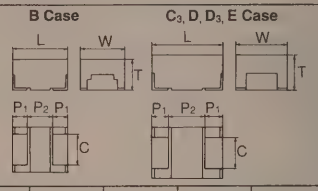
Failure Rate Level	M (1%/1000h)
Capacitance range:	1.0μF to 68μF
Dissipation Factor:	0.04 max. (1.0μF) 0.06 max. (1.5 – 68μF)

CATALOG NUMBERING SYSTEM

269 M 2502 105 M R

- TYPE
- FAILURE RATE LEVEL M:1%/1000Hrs.
- VOLTAGE RATING
- CAPACITANCE TOLERANCE K = ±10% M = ±20%
- CAPACITANCE IN PICOFARADS First two digits are significant figures. Third digit is the number of zeros following.
- LEAD STYLE

DIMENSIONS: Inches (mm)



Cap. (μF) \ R.V. (VDC)	10	16	20	25	35	50
1.0				B	B,C3	C3
1.5			B	B	C3	C3
2.2		B	B		C3	D3
3.3		B		C3	D,D3	D3
4.7	B		C3		D,D3	
6.8		C3	C3	D,D3	E	
10	C3	C3	D,D3		E	
15	C3	D,D3		E		
22		D,D3	E			
33	D,D3	E				
47		E				
68	E					

Case Code	EIA Code	L ±.008 (0.2)	W ±.008 (0.2)	T ±.008 (0.2)	P1 ±.008 (0.2)	P2 min.	C ±.00 (0.1)
B	3528	.138 (3.5)	.110 (2.8)	.075 (1.9)	.031 (0.8)	.059 (1.5)	.087 (2.2)
C3	6032	.236 (6.0)	.126 (3.2)	.098 (2.5)	.051 (1.3)	.118 (3.0)	.087 (2.2)
D		.220 (5.6)	.181 (4.6)	.126 (3.2)	.051 (1.3)	.110 (2.8)	.126 (3.2)
D3	7243	.287 (7.3)	.173 (4.4)	.110 (2.8)	.051 (1.3)	.157 (4.0)	.094 (2.4)
E	7257	.287 (7.3)	.228 (5.8)	.138 (3.5)	.051 (1.3)	.157 (4.0)	.138 (3.5)

TYPE 242 MOLDED TANTALUM CAPACITORS

For High Density Packaging

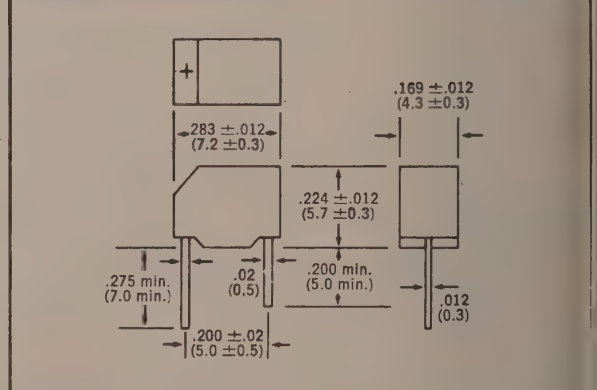
Impact resistant rectangular molded case. Uniform lead location for automatic insertion. Low impedance at high frequencies. Ideal for noise bypassing in high speed logical circuits. High capacitance in miniature case.

SPECIFICATIONS

Capacitance Range: 0.1 to 47 μF **Capacitance Tolerance:** ±20% (M)
Rated Working Voltage: 6.3, 10, 16, 20, 25, 35 & 50 VDC
Operating Temperature Range: –55°C to +125°C (For operation at 125°C derate voltage linearly to 67% of 85°C voltage rating.)
DC Leakage Current (Rated Voltage, 5 min. 20°C): 0.01 CV (μA) or 0.5 μA, whichever is greater: (85°): 0.5 CV 5.0 μA, whichever is greater.
Conforms to UL 1414.
Available on tape in ammo-pack or reel.

CAP. (μF) \ R.V. (VDC)	6.3	10	16	20	25	35	50
0.1						•	•
0.15						•	•
0.22						•	•
0.33						•	•
0.47						•	•
0.68						•	•
1.0						•	•
1.5						•	•
2.2						•	•
3.3			•			•	•
4.7					•	•	
6.8				•		•	
10			•		•		
15		•		•			
22	•		•				
33		•					
47	•						

DIMENSIONS: Inches (mm)



ORDERING INFORMATION

242 M 1602 106 M 2

- TYPE
- FAILURE RATE LEVEL M: 1%/1000 Hrs.
- VOLTAGE RATING
- CAPACITANCE IN PICOFARADS First two digits are significant figures. Third digit is the number of zeros following.
- CAPACITANCE TOLERANCE M = ±20%
- LEAD STYLE

Code	Volts	Code	Volts
6301	6.3	2502	25
1002	10	3502	35
1602	16	5002	50
2002	20		

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MATSUO® TYPE 244/245 MOLDED TANTALUM CAPACITORS

TYPE 244

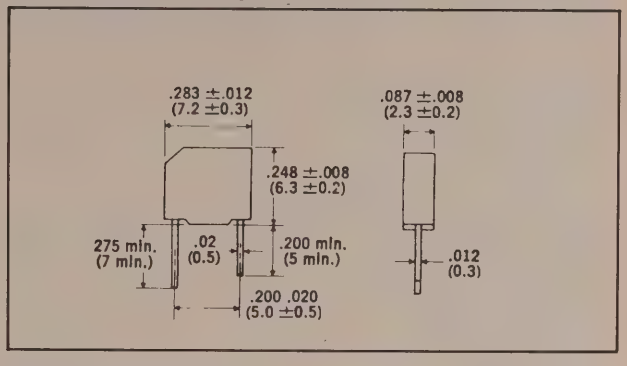
FOR NOISE BYPASSING

Impact resistant rectangular molded case. Eliminating the noise generated at the rise time of pulse in ultra-high speed logical circuits such as TTL and ECL.

SPECIFICATIONS

Operating Temperature Range: −55°C to +125°C (for temperature above 85°C, derate voltage to 67% of R.V.)
Failure Rate Level: M (1%/1000 Hrs.)
Rated Voltage: 16, 35, 50 VDC
Capacitance: 1, 3.3MFD
Capacitance Tolerance: ±20% (M)
DC Leakage Current (Rated Voltage, 5 min. 25°C): 0.01 CV (μA) or 0.5 μA, whichever is greater.
Conforms to UL 1414
Available on tape in ammo-pack or reel.

DIMENSIONS: Inches (mm)



STANDARD RATING

CATALOG NO.	DC RATED VOLTAGE (VDC)	CAPACITANCE (μF)
244M 1602-335M	16	3.3
244M 3502-105M	35	1.0
244M 5002-105M	50	1.0

TYPE 245

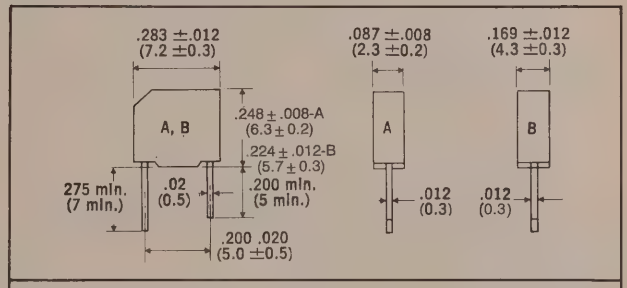
Hybrid Capacitor — Fuse

Eliminates the noise generated at rise time in ultra-high speed logical circuits such as TTL and ECL. Built-in fuse functions either as thermal fuse under small current or as electric fuse under larger currents.

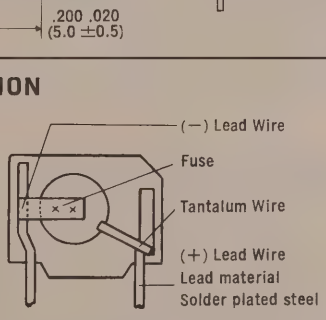
SPECIFICATIONS

Operating Temperature Range: −55°C to +125°C (For temperature above 85°C, derate voltage to 67% of R.V.)
Rated Voltage: 10 VDC to 50 VDC
Capacitance Range: 1.0 to 33 MFD
Capacitance Tolerance: ±20% (M)
DC Leakage Current: (Rated voltage, 5 minutes, 25°C) 0.01 CV (μA) or 0.5 μA whichever is greater.
Conforms to UL 1414.
Circuit Breaking Performance
Built-in fuse functions as a thermal fuse at current of less than 5 amperes. At current of more than 5 amperes, built-in fuse functions by the current flowing through fuse.
Available on tape in ammo-pack or reel.

DIMENSIONS: Inches (mm)



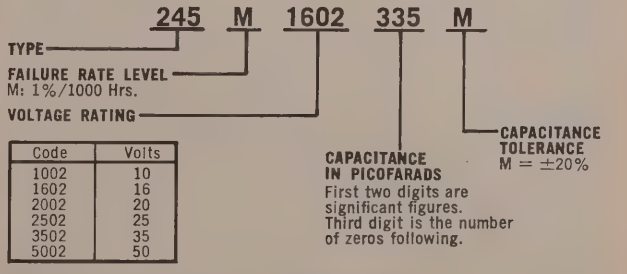
CONSTRUCTION



STANDARD RATINGS, SHOWING CASE SIZES

CAP. (μF) \ R.V. (VDC)	10	16	20	25	35	50
1.0					A	A
1.5						B
2.2					B	B
3.3		A			B	B
4.7				B	B	
6.8			B		B	
10		B		B		
15	B		B			
22		B				
33	B					

ORDERING INFORMATION



Code	Volts
1002	10
1602	16
2002	20
2502	25
3502	35
5002	50

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These specifications are subject to change without notice.

TYPE 267 TANTALUM CHIP CAPACITORS

MATSUO Type 267 is specially designed as a surface mount component for use in hybrid and low profile print circuit board applications. Fully-molded construction provides excellent mechanical protection, superior moisture resistance and high soldering heat resistance.

FEATURES:

- Ultra small dimensions (A case): 3.2 × 1.6mm.
- Dimensions are equivalent to EIA standards and IECQ. (Case A, B, C3 and D3).
- Flame retardant resin molded case.
- Precise dimensions allow for high density package.
- Reeled packaging is compatible with automatic mounting equipment per EIA-481.
- Failure rate: M(1%/1000Hr.).
- Symmetrical construction of positive and negative terminals provides "SELF-ALIGNMENT".
- Soldering: 260°C for 10 sec. by re-flow or dip.

SPECIFICATIONS

Operating Temperature Range: –55°C to +125°C (For operation at 125°C derate voltage linearly to 67% of 85°C voltage rating.)
Rated Voltage: 4, 6.3, 10, 16, 20, 25, 35, 50VDC
Capacitance Tolerance: ±20%(M), ±10%(K)
DC Leakage Current: 0.008 x CV or 0.4μA. Whichever is greater (Rated voltage, 5 minutes, 25°C)
Dissipation Factor: See Table 1 (at 120Hz)

Surge Voltage

DC Rated Voltage at 85°C	4	6.3	10	16	20	25	35	50
DC Surge Voltage at 85°C	5.0	8.0	13	20	25	32	44	63

Capacitor shall withstand the surge voltage applied in series with a 1000 ohm resistor at the rate of ½ minute on, 5½ minute off, for 1000 successive test cycles at 85°C.
After test, capacitors shall meet the requirements in Table 1.

Table 1

Capacitance Change	Within 5% of initial value
Dissipation Factor	Within initial requirement specified
DC Leakage Current	Within initial requirement specified

ALLOWABLE REVERSE VOLTAGE

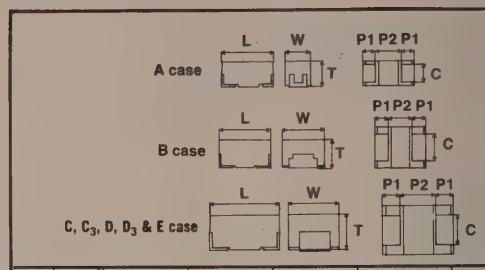
10% of rated voltage or 0.5 V, whichever is greater, at 25°C; 3% of rated voltage or 0.5 V, whichever is greater, at 85°C.
C,C3

STANDARD RATINGS, SHOWING CASE SIZES

R.V. (VDC) Cap. (μF)	4	6.3	10	16	20	25	35	50
0.1							A	A
0.15							A	(A),B
0.22							A	B
0.33							A	B
0.47						A	(A) B	(B),C,C3
0.68					A	(A)	B	C,C3
1.0				A	(A)		B	C,C3
1.5			A	(A)		B	(B) C,C3	(C,C3),D,D3
2.2		A	(A)		B	(B)	C,C3	D,D3
3.3	A	(A)		B	(B)	C3	C,D3	(D),(D3)
4.7	(A)		B	(B)	C3	C,C3	D,D3	
6.8		B	(B)	C3	C,C3	D3	D,D3	
10	B	(B)	C3	C,C3	(C)	D,D3	E	
15	(B)	C3	C	(C,C3)	D,D3		E	
22	C3	C	(C,C3)	D,D3	(D,D3)	E		
33	C,C3	(C,C3)	D,D3	(D,D3)	E			
47	(C,C3)	D,D3	(D,D3)	E				
68	D,D3	(D,D3)	E					
100	(D,D3)	E	(E)					
150	E	(E)						
220	(E)							

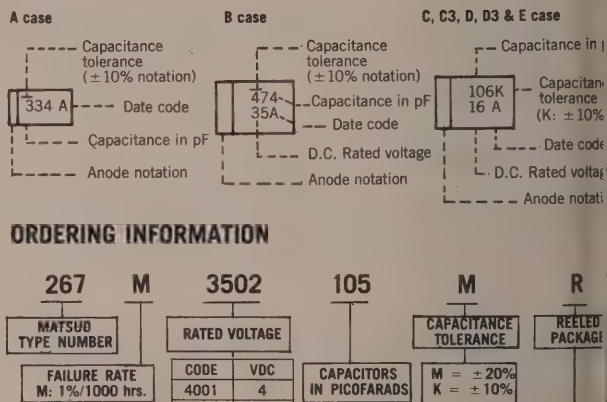
NOTE: ( ) = Designates Extended Range.

DIMENSIONS: Inches (mm)

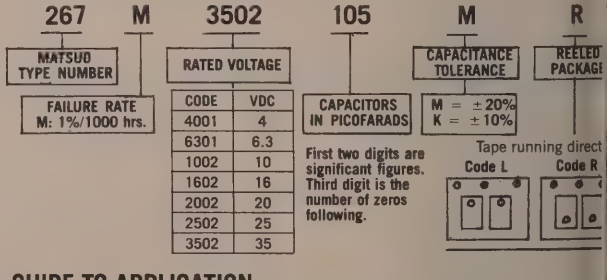


Case Code	EIA. Code	L ±.008 (0.2)	W ±.008 (0.2)	T ±.008 (0.2)	P_1 ±.008 (0.2)	P_2 min.	C ±.006 (0.15)
A	3216	.126 (3.2)	.063 (1.6)	.063 (1.6)	.030 (0.75)	.056 (1.4)	.047 (1.2
B	3528	.138 (3.5)	.110 (2.8)	.075 (1.9)	.031 (0.8)	.059(1.5)	.087 (2.2
C		.220 (5.6)	.130 (3.3)	.091 (2.3)	.051 (1.3)	.110 (2.8)	.087 (2.2
C_3	6032	.236 (6.0)	.126 (3.2)	.098 (2.5)	.051 (1.3)	.118 (3.0)	.087 (2.2
D		.220 (5.6)	.181 (4.6)	.126 (3.2)	.051 (1.3)	.110 (2.8)	.126 (3.2
D_3	7243	.287 (7.3)	.173 (4.4)	.110 (2.8)	.051 (1.3)	.157 (4.0)	.094 (2.4
E	7257	.287 (7.3)	.228 (5.8)	.138 (3.5)	.051 (1.3)	.157 (4.0)	.138 (3.5

Marking



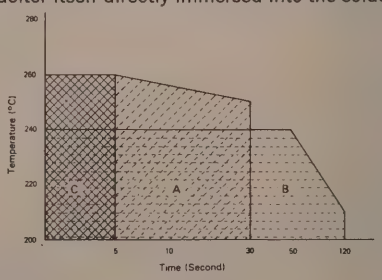
ORDERING INFORMATION



GUIDE TO APPLICATION

Soldering condition

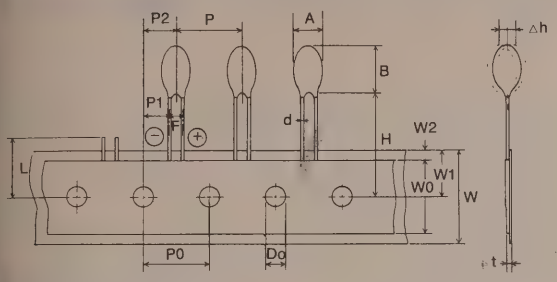
1. Pre-heating:
   Preheating at 130–160°C is recommended to avoid thermal shock in soldering.
2. Soldering:
   Temperature of capacitor body itself should not exceed 260°C.
   2–1 Direct heating (condition A)
   Substrate or PC board placed and floated on the solder bat
   Substrate or PC board placed on a hot plate.
   Substrate or PC board passed through on the solder bath.
   2–2 Heating in oven (condition B)
   By hot air.
   2–3 Immersion (dipping) (condition C)
   Capacitor itself directly immersed into the solder.



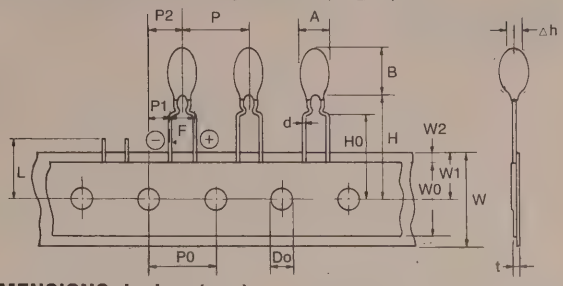
TYPE 202 & 204 (RADIAL LEAD)

PACKAGING FOR AUTOMATIC INSERTION and MOUNTING

Lead Spacing .100 ± .020 (2.5 ± 0.5)



Lead Spacing .200 ± .020 (5.0 ± 0.5)



IMENSIONS: Inches (mm)

Item	Symbol	Specification	
		Value	Tolerance
ody diameter	A	See Dimension Table	
ody height	B		
ead wire diameter	d	.020 (0.5)	.002 (0.05)
itch of component	P	.500 (12.7)	.039 (1.0)
ed hole pitch	Po	.500 (12.7)	.012 (0.3)
ed hole center to lead	P1	.200 (5.1)	.020 (0.5)
ole center to component center	P2	.250 (6.35)	.039 (1.0)
ead to lead distance	F	.098 (2.5)	+.031 (0.8) −.008 (0.2)
omponent alignment	h	0	.039 (1.0)
ape width	W	.709 (18.0)	.020 (0.5)
old down tape width	W0	.374 (9.5) minimum	
ole position	W1	.354 (9.0)	.020 (0.5)
old down tape position	W2	.098 (2.5) maximum	
eight of component from tape center	H	.787 (20.0)	.020 (0.5)
ed hole diameter	Do	.157 (4.0)	.008 (0.2)
tal tape thickness	t	.028 (0.7)	.008 (0.2)
ength of snipped lead	L	.433 (11.0) maximum	

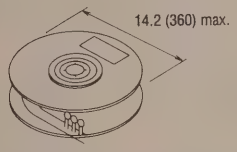
DIMENSIONS: Inches (mm)

Item	Symbol	Specification	
		Value	Tolerance
Body diameter	A	See Dimension Table	
Body height	B		
Lead wire diameter	d	.020 (0.5)	.002 (0.05)
Pitch of component	P	.500 (12.7)	.039 (1.0)
Feed hole pitch	Po	.500 (12.7)	.012 (0.3)
Feed hole center to lead	P1	.152 (3.85)	.020 (0.5)
Hole center to component center	P2	.250 (6.35)	.039 (1.0)
Lead to lead distance	F	.197 (5.0)	+.031 (0.8) −.008 (0.2)
Component alignment	h	0	.039 (1.0)
Tape width	W	.709 (18.0)	.020 (0.5)
Hold down tape width	W0	.374 (9.5) minimum	
Hole position	W1	.354 (9.0)	.020 (0.5)
Hold down tape position	W2	.098 (2.5) maximum	
Lead wire clinch height	Ho	.630 (16.0)	.020 (0.5)
Feed hole diameter	Do	.157 (4.0)	.008 (0.2)
Total tape thickness	t	.028 (0.7)	.008 (0.2)
Length of snipped lead	L	.433 (11.0) maximum	
(Height of component from tape center	(H)	.787 (20.0)	

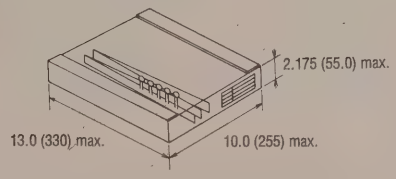
OUSING OF TAPED COMPONENT

ype 202, 204, 242, 244 & 245

Reeled Package



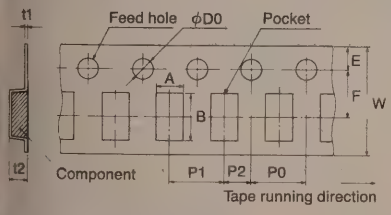
Ammo Package



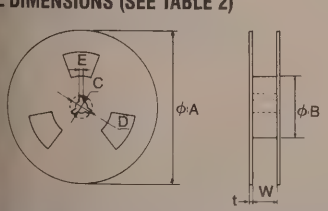
TYPE 267 (CHIP)

EELED PACKAGE

APE DIMENSIONS (SEE TABLE 1)



EEL DIMENSIONS (SEE TABLE 2)



DIMENSIONS: Inches (mm)

Table 1

Type	Case Code	A ±.004 (0.1)	B ±.004 (0.1)	W ±.012 (0.3)	F ±.002 (0.05)	E ±.004 (0.1)	P1 ±.004 (0.1)	P2 ±.002 (0.05)	P0 ±.004 (0.1)	∅D +.004 (0.1) −0	T1	T2
267	A	.075 (1.9)	.138 (3.5)	.315 (8.0)	.138 (3.5)	.069 (1.75)	.157 (4.0)	.079 (2.0)	.157 (4.0)	.059 (1.5)	.024 (0.6)	.079 Max. (2.0)
	B	.130 (3.3)	.150 (3.8)	.315 (8.0)	.138 (3.5)	.069 (1.75)	.157 (4.0)	.079 (2.0)	.157 (4.0)	.059 (1.5)	.024 (0.6)	.087 ±.004 (2.2 ±0.1)
	C	.142 (3.6)	.236 (6.0)	.472 (12.0)	.222 (5.65)	.059 (1.50)	.315 (8.0)	.079 (2.0)	.157 (4.0)	.059 (1.5)	.024 (0.6)	.098 ±.004 (2.5 ±0.1)
	C3	.146 (3.7)	.252 (6.4)	.472 (12.0)	.222 (5.65)	.069 (1.50)	.315 (8.0)	.079 (2.0)	.157 (4.0)	.059 (1.5)	.024 (0.6)	.118 ±.004 (3.0 ±0.1)
	D	.193 (4.9)	.236 (6.0)	.472 (12.0)	.222 (5.65)	.059 (1.50)	.315 (8.0)	.079 (2.0)	.157 (4.0)	.059 (1.5)	.024 (0.6)	.138 ±.004 (3.5 ±0.1)
	D3	.189 (4.8)	.303 (7.7)	.472 (12.0)	.222 (5.65)	.059 (1.50)	.315 (8.0)	.079 (2.0)	.157 (4.0)	.059 (1.5)	.024 (0.6)	.130 ±.004 (3.3 ±0.1)
	E	.240 (6.1)	.303 (7.7)	.472 (12.0)	.222 (5.65)	.059 (1.50)	.315 (8.0)	.079 (2.0)	.157 (4.0)	.059 (1.5)	.024 (0.6)	.150 ±.004 (3.8 ±0.1)

Table 2

Type	Case Code	∅A ±.079 (2)	∅B min.	∅C ±.031 (0.5)	∅D ±.031 (0.8)	E ±.020 (0.5)	W ±.059 (1.5)	t ±.020 (0.5)	Quantity/Reel pcs.
267	A,B	7 (178)	3.150 (80)	.512 (13.0)	.827 (21.0)	.079 (2.0)	.394 (10.0)	.079 (2.0)	2,000
	C,C_3,D, D_3,E	7 (178)	3.150 (80)	.512 (13.0)	.827 (21.0)	.079 (2.0)	.561 (14.0)	.079 (2.0)	500

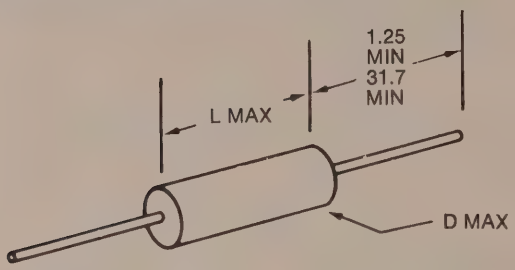
REEL Ø A : AVAILABLE 13 (330) UPON REQUEST.

ATSUO ELECTRONICS 2134 Main St., Ste. 200 / Huntington Beach, CA 92648 / Tel. (714) 969-2491 / FAX (714) 960-6492

These specifications are subject to change without notice.

METUCHEN CAPACITORS INC.
NPO, X7R, & Z5U Conformally Coated Axial-Leaded Ceramic Capacitors

RUGGED, RELIABLE, AND IDEAL FOR AUTOMATIC INSERTION



MECHANICAL SPECIFICATIONS

BODY CONSTRUCTION: Conformal coating

LEAD MATERIAL: .020 Dia. — Solderable tinned copper

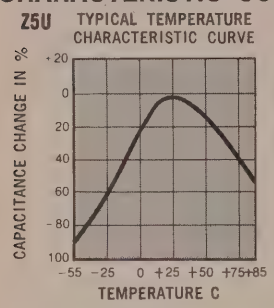
MARKING:

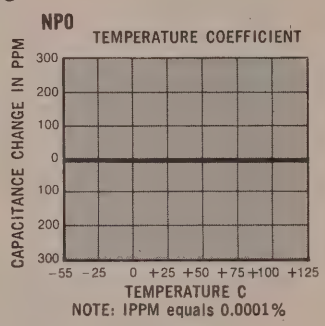
Parts will be marked with the following:

Trademark — Capacitance — Tolerance Letter Designation Voltage (size permitting)

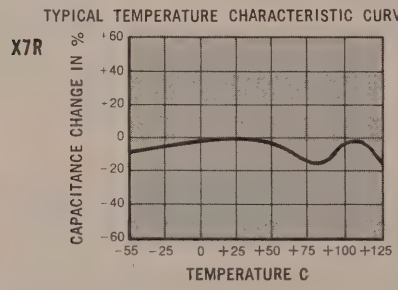
EIA specifications apply regarding Q, TC tol and CAP tol on all units of 10 pF or less

TYPICAL TEMPERATURE CHARACTERISTIC CURVES





NOTE: 1PPM equals 0.0001%



NPO (COG) CHARACTERISTICS

WORKING VOLTAGE: 50/100 VDC

TEMPERATURE COEFFICIENT: 0 ±30 PPM/°C, −55°C to +125°C (EIA Characteristic COG)

INSULATION RESISTANCE: 100 K megohms or 1000 megohm-microfarads, whichever is less at 25°C, at rated voltage

DIELECTRIC STRENGTH: 250% rated voltage with 50 mA maximum charging current

CAPACITANCE TOLERANCES AVAILABLE: ±1%, ±2%, ±5%, ±10%, ±20%

Meets or exceeds requirements of MIL-C-20

DISSIPATION FACTOR: Min. Q of 1000 at 1 MHz. Meets provisions of EIA standard for capacitance less than 30 pF and greater than 1000 pF

X7R & Z5U characteristics not shown. Please contact factory for sizes.

MCI PART NO.	GT07		GT10		GT14		Capacitance Characteristic EIA
	in.	mm	in.	mm	in.	mm	
L MAX	.170	4.32	.260	6.60	.400	10.16	
D MAX	.100	2.54	.100	2.54	.150	3.81	
Capacitance in pF	WVDC 100	50	WVDC 100	50	WVDC 100	50	
10							100
12							120
15							150
18							180
22							220
27							270
33							330
39							390
47							470
56							560
68							680
82							820
100							101
120							121
150							151
180							181
220							221
270							271
330							331
390							391
470							471
560							561
680							681
820							821
1000							102
1200							122
1500							152
1800							182
2200							222
2700							272
3300							332
3900							392
4700							472
5600							562
6800							682
8200							822
10,000							103

HOW TO ORDER

GT07 B CG 101 J

SIZE:

WVDC: (B = 50V)[1] (D = 100V)

CHARACTERISTIC: (CG = NPO) (BM = X7R) (BN = Z5U)

CAPACITANCE CODE:[2]

TOLERANCE:[3]

1. **WVDC AVAILABLE:** 50 VDC, 100 VDC
2. 101 = 100 pF i.e., the third digit signifies number of zeroes
3. **MINIMUM AVAILABLE CAPACITANCE TOLERANCES:**

B = ±.1 pF (10 pF and below)	J = ±5% (10 pF and above)
C = ±.25 pF (10 pF and below)	K = 10% (5.6 pF and above)
D = ±.5 pF (10 pF and below)	M = 20% (2.7 pF and above)
F = ±1% (10 pF and above)	Z = +80%, −20% (all values)
G = 2% (10 pF and above)	P = +100%, −0% (GMV — all values)

MasterCard VISA For your convenience we welcome credit card purchases (min. $35.00).

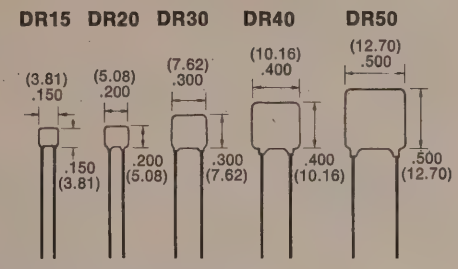
Metuchen Capacitors Inc./139 WHITE OAK LANE/P.O. BOX 499/OLD BRIDGE, N.J. 08857/908-679-3366/FAX 908-679-3222

METUCHEN CAPACITORS INC.

For your convenience we welcome credit card purchases (min. $35.00).

Epoxy Coated Sub-Miniature Radial-Leaded Ceramic Capacitors

MCI PART NUMBERS



MAXIMUM PHYSICAL DIMENSIONS

MCI PART NO.	DR15	DR20	DR30	DR40	DR50
S ±.030	.100 (2.54)	.100 (2.54)	.200 (5.08)	.200 (5.08)	.400 (10.16)
D +.004 −.001	.016 (.406)	.020 (.508)	.020 (.508)	.020 (.508)	.025 (.635)
T MAX	.100 (2.54)	.125 (3.18)	.150 (3.81)	.150 (3.81)	.200 (5.08)
AWG#	26	24	24	24	22

= Lead spacing D = Lead size T = Body thickness mm are in parentheses

MECHANICAL SPECIFICATIONS

BODY CONSTRUCTION: Dipped epoxy

LEAD MATERIAL: Solderable tinned copper

MARKING:

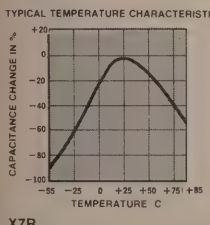
Parts will be marked with the following:

Trademark — Capacitance — Tolerance Letter Designation Voltage (size permitting)

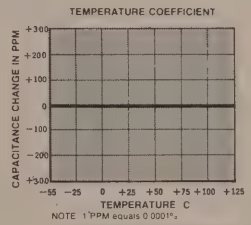
EIA specifications apply regarding Q. TC tol and CAP tol on all units 10 pF or less

TYPICAL TEMPERATURE CHARACTERISTIC CURVES

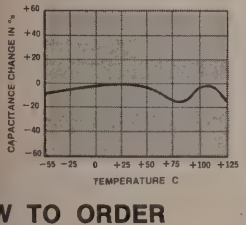
Z5U

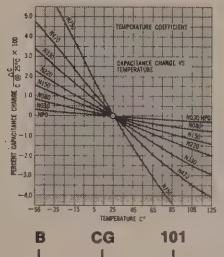


NP0



X7R





HOW TO ORDER

DR15 B CG 101 J

SIZE:

WVDC: (B = 50V)[1] (D = 100V)

CHARACTERISTIC: (CG = NPO) (BM = X7R) (BN = Z5U)

CAPACITANCE CODE:[2]

TOLERANCE:[3]

1. WVDC AVAILABLE: 50 VDC, 100 VDC, 200 VDC
2. 101 = 100pF i.e., the third digit signifies number of zeroes
3. MINIMUM AVAILABLE CAPACITANCE TOLERANCES:
   - B = ±.1 pF (10 pF and below)
   - C = ±.25 pF (10 pF and below)
   - D = ±.5 pF (10 pF and below)
   - F = ±1% (10 pF and above)
   - G = ±2% (10 pF and above)
   - J = ±5% (10 pF and above)
   - K = ±10% (5.6 pF and above)
   - M = ±20% (2.7 pF and above)
   - Z = +80%, −20% (all values)
   - P = +100%, −0% (GMV — all values)

Z5U CHARACTERISTICS

CAPACITANCE RANGE: .001 MFD to 4.7 MFD

WORKING VOLTAGE: 50/100/200 VDC
Higher voltages available on request

TEMPERATURE COEFFICIENT: +22%, −56% from +10°C to +85°C (EIA Characteristic Z5U)

DISSIPATION FACTOR: 3% maximum at 1 kHz, 25°C

INSULATION RESISTANCE: 100 K megohms or 500 megohm-microfarad, whichever is less at 25°C, at rated voltage

DIELECTRIC STRENGTH: 250% rated voltage with 50 mA maximum charging current

CAPACITANCE TOLERANCES AVAILABLE: ±20%, +80% −20%, or +100% −0%

MCI offers a complete range of temperature coefficients. Contact factory for sizes and ordering information.

MCI PART NO.	DR15		DR20		DR30		DR40		DR50		Capacitance Characteristic EIA
Capacitance in pF	WVDC 50	100	WVDC 50	100	WVDC 50	100	WVDC 50	100	WVDC 50	100	
1000											102
1200											122
1500											152
1800											182
2200											222
2700											272
3300											332
3900											392
4700											472
5600											562
6800											682
8200											822
10,000											103
12,000											123
15,000											153
18,000											183
22,000											223
27,000											273
33,000											333
39,000											393
47,000											473
56,000											563
68,000											683
82,000											823
100,000											104
120,000											124
150,000											154
180,000											184
220,000											224
270,000											274
330,000											334
390,000											394
470,000											474
560,000											564
680,000											684
820,000											824
1,000,000											105
1,200,000											125
1,500,000											155
1,800,000											185
2,200,000											225
2,700,000											275
3,300,000											335
3,900,000											395
4,700,000											475

Metuchen Capacitors Inc./139 WHITE OAK LANE/P.O. BOX 499/OLD BRIDGE, N.J. 08857/908-679-3366/FAX 908-679-3222

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Epoxy Coated Sub-Miniature Radial-Leaded Ceramic Capacitors

NPO (COG) CHARACTERISTICS

WORKING VOLTAGE: 50/100/200 VDC
Higher voltages available on request
TEMPERATURE COEFFICIENT: 0 ±30 PPM/°C, −55° to 125°C (EIA Characteristic COG)
DISSIPATION FACTOR: Min. Q of 1000 at 1 MHz. Meets provisions of EIA standard for capacitance less than 30 pF and greater than 1000 pF
INSULATION RESISTANCE: 100 K megohms or 1000 megohm-microfarads, whichever is less at 25°C, at rated voltage
DIELECTRIC STRENGTH: 250% rated voltage with 50 mA maximum charging current
CAPACITANCE TOLERANCES AVAILABLE: ±1%, ±2%, ±5%, ±10%, ±20%
Meets or exceeds requirements of MIL-C-20
MCI offers a complete range of temperature coefficients. Contact factory for sizes and ordering information.

MCI PART NO	DR15			DR20			DR30			DR40			DR50			Cap. Char. EIA
Cap. in pF	WVDC 50	100	200	WVDC 50	100	200	WVDC 50	100	200	WVDC 50	100	200	WVDC 50	100	200	
1.0																109
1.2																129
1.5																159
1.8																189
2.2																229
2.7																279
3.3																339
3.9																399
4.7																479
5.6																569
6.8																689
8.2																829
10																100
12																120
15																150
18																180
22																220
27																270
33																330
39																390
47																470
56																560
68																680
82																820
100																101
120																121
150																151
180																181
220																221
270																271
330																331
390																391
470																471
560																561
680																681
820																821
1000																102
1200																122
1500																152
1800																182
2200																222
2700																272
3300																332
3900																392
4700																472
5600																562
6800																682
8200																822
10,000																103
12,000																123
15,000																153
18,000																183
22,000																223
27,000																273
33,000																333
39,000																393
47,000																473
56,000																563
68,000																683
82,000																823
100,000																104

X7R CHARACTERISTICS

TEMPERATURE COEFFICIENT: ±15% from −55°C to +125°C (EIA Characteristic X7R)
DISSIPATION FACTOR: 2.5% maximum at 1 kHz, 25°C
CAPACITANCE TOLERANCES AVAILABLE: ±5%, ±10%, ±20%, +80% −20%, or +100% −0%
Meets or exceeds requirements of MIL-C-39014
Working Voltage, Insulation Resistance and Dielectric Strength same as NPO Radial
MCI offers a complete range of temperature coefficients. Contact factory for sizes and ordering information.

MCI PART NO.	DR15			DR20			DR30			DR40			DR50			Cap. Char. EIA
Cap. in pF	WVDC 50	100	200	WVDC 50	100	200	WVDC 50	100	200	WVDC 50	100	200	WVDC 50	100	200	
10																100
12																120
15																150
18																180
22																220
27																270
33																330
39																390
47																470
56																560
68																680
82																820
100																101
120																121
150																151
180																181
220																221
270																271
330																331
390																391
470																471
560																561
680																681
820																821
1000																102
1200																122
1500																152
1800																182
2200																222
2700																272
3300																332
3900																392
4700																472
5600																562
6800																682
8200																822
10,000																103
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27,000																273
33,000																333
39,000																393
47,000																473
56,000																563
68,000																683
82,000																823
100,000																104
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150,000																154
180,000																184
220,000																224
270,000																274
330,000																334
390,000																394
470,000																474
560,000																564
680,000																684
820,000																824
1,000,000																105
1,200,000																125
1,500,000																155
1,800,000																185
2,200,000																225
2,700,000																275
3,300,000																335
3,900,000																395
4,700,000																475

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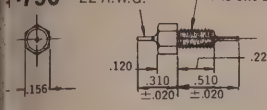
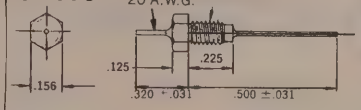
Feed-Thru Ceramic Capacitors RESIN SEAL

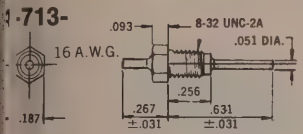
-790- 22 A.W.G. 4-40 UNC-2A



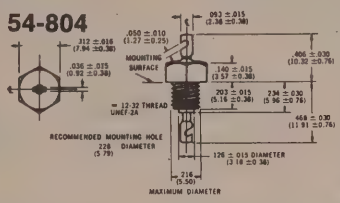
54-779- 20 A.W.G. 6-32 UNC-2A



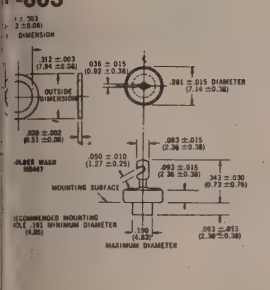
-713- 16 A.W.G. 8-32 UNC-2A



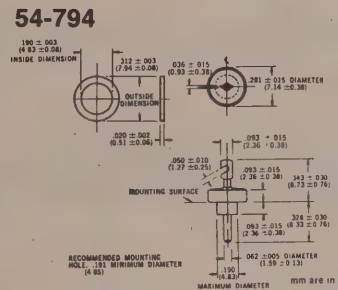
54-804



-803



54-794



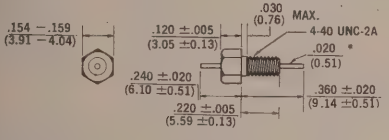
mm are in parentheses

Working Voltage +85°C	Working Voltage +125°C	Cap. pF	Ordering Number
200 WVDC	100 WVDC	10	54-713-001-100M
200 WVDC	100 WVDC	100	54-713-001-101M
200 WVDC	100 WVDC	1000	54-713-001-102Z
200 WVDC	100 WVDC	5000	54-713-001-502P
200 WVDC	100 WVDC	10	54-779-001-100M
200 WVDC	100 WVDC	100	54-779-001-101M
200 WVDC	100 WVDC	500	54-779-001-501P
200 WVDC	100 WVDC	1000	54-779-001-102P
200 WVDC	100 WVDC	22,000	54-779-001-223Z
200 WVDC	100 WVDC	10	54-790-001-100M
200 WVDC	100 WVDC	100	54-790-001-101M
200 WVDC	100 WVDC	500	54-790-001-501Z
200 WVDC	100 WVDC	1000	54-790-001-102P
200 WVDC	100 WVDC	22,000	54-790-001-223Z

Ordering Number	Type	Tolerance %	Capacitance pF
54-794-002-101M	54-794	20	100
54-794-002-471M		20	470
54-794-002-102P		GMV	1000
54-803-004-101M	54-803	20	100
54-803-004-471M		20	470
54-803-004-102P		GMV	1000
54-804-002-101M	54-804	20	100
54-804-002-471M		20	470
54-804-002-102P		GMV	1000

CI 910X/911X/912X

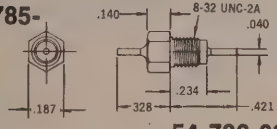
l or 24 gauge tinned copper leads, replace "X" with "0"; for 6 gauge tinned steel leads (.016 Dia.) replace "X" with "2." When steel lead is used, maximum DC current is 5 amps.



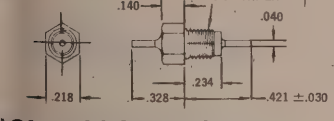
Series	SCI 910X	SC 911X	SCI 912X
VOLTAGE	50 WVDC	100 WVDC	200 WVDC 115 VAC 60 Hz
DC AMPS MAX	10	10	10
CAPACITANCE (GMV)	100 pF 1000 5000	100 pF 1000 5000	100 pF 1000 5000
	.01 µF .027 .05	.01 µF .027 .05	.01 µF

GH CAPACITY MULTI-LAYER FEED-THRU CAPACITORS

54-785-

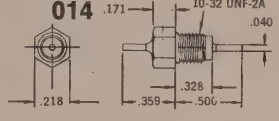


-786-013



54-786-021

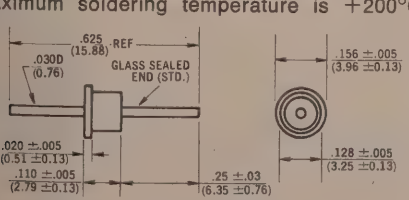
014



Working Voltage @ 125°C	Cap. µF	Ordering Number
100 WVDC	.05	54-785-005-503P
100 WVDC	.3	54-786-013-304Z
50 WVDC	.5	54-786-021-504Z
50 WVDC	1.0	54-786-014-105Z

CI 9900/9910/9920

units are hermetically sealed (glass to metal) on one end, ile the other end is epoxy sealed. These units are also avail- le reversed with the hermetic seal at the opposite end. To ler, add "R" to the end of the part number; e.g. 9900-502R. tallation: Series 9900 units are designed to be soldered in ice. Maximum soldering temperature is +200°C (400°F).



Ordering Number	Rated DC Current	Capacitance (GMV)	Working Voltage
SCI-9910-101	5 AMPS	100pF	100 WVDC
SCI-9910-501	5 AMPS	500pF	100 WVDC
SCI-9910-102	5 AMPS	1000pF	100 WVDC
SCI-9910-122	5 AMPS	1200pf	100 WVDC
SCI-9910-272	5 AMPS	2700pf	100 WVDC
SCI-9910-502	5 AMPS	5000pf	100 WVDC
SCI-9910-153	5 AMPS	.015µf	50 WVDC
SCI-9920-101	5 AMPS	100pf	200 WVDC/ 115 VAC 60 Hz
SCI-9920-501	5 AMPS	500pf	200 WVDC/ 115 VAC 60 Hz
SCI-9920-102	5 AMPS	1000pf	200 WVDC/ 115 VAC 60 Hz
SCI-9920-122	5 AMPS	1200pf	200 WVDC/ 115 VAC 60 Hz

All EMI Filtered D Subminiature Connectors stocked by MCI are manufactured in the U.S.A. by **Spectrum Control, Inc...**
The world's leading manufacture of Electro-Magnetic Components. Distributed for Spectrum Control, Inc.

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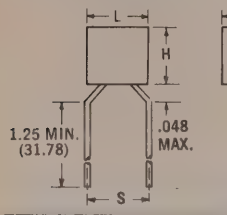
METUCHEN CAPACITORS INC.

NPO Ceramic Capacitors QUALIFIED TO MIL-C-20

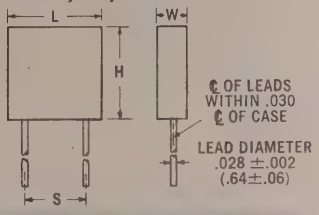
- 0 ±30 ppm/°C Per MIL-C-20
- .1 to 100,000 Pf −55°C +125°C
- Low Dissipation Factor
- Tight Tolerances

RADIAL LEAD CAPACITORS

CCR05



CCR06, 07, 08 & 09



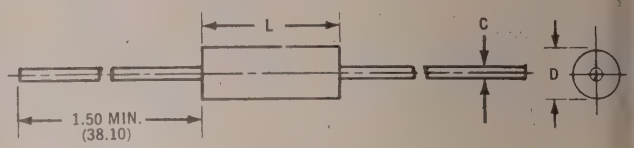
Mil. Equiv.	H & L	W	S
CCR05	.190 ±.010	.090 ±.010	.200 ±.015
CCR09	.190 ±.010	.090 ±.010	.100 ±.015
CCR06	.290 ±.010	.090 ±.010	.200 ±.015
CCR07	.480 ±.020	.140 ±.010	.400 ±.020
CCR08	.480 ±.020	.240 ±.010	.400 ±.020

ER	Slash Sheet	Volt	Cap. Range pF
CCR05 CCR09	35	200 100 50	1-330 360-1800 2200-3300
CCR06	36	200 100 50	360-1800 2000-4700 5100-18,000
CCR07	37	200 100 50	2200-4700 5600-12,000 15,000-100,000
CCR08	38	200 100 50	3900-4700 15,000-18,000 56,000-68,000

All dimensions shown in inches.

AXIAL LEAD CAPACITORS

CCR75, 76, 77, 78 & 79



Mil. Equiv.	L	D	Lead Size
CCR75	.160 ±.010	.090 ±.010	.016
CCR76	.250 ±.010	.090 ±.010	.016
CCR77	.390 ±.010	.140 ±.010	.025
CCR78	.500 ±.020	.250 ±.015	.025
CCR79	.690 ±.020	.350 ±.015	.025

ER	Slash Sheet	Volt	Cap. Range pF
CCR75	27	200 100 50	.1-75 82-240 270-680
CCR76	28	200 100 50	82-130 270-680 750-1000
CCR77	29	200 100 50	150-680 750-2200 2400-5600
CCR78	30	200 100 50	820-3300 3900-12,000 15,000-27,000
CCR79	31	200 100 50	3900-10,000 15,000-39,000 47,000-82,000

Fixed Capacitors, Ceramic Dielectric (Temperature Compensating), Established Reliability

ER **CCR05** **CG** (0±30ppm/°C) **102** **G** **R**

STYLE

05 = Radial .190x.190 75 = Axial .160x.090
09 = Radial .190x.190 76 = Axial .250x.090
06 = Radial .290x.290 77 = Axial .390x.140
07 = Radial .480x.480 78 = Axial .500x.250
08 = Radial .480x.480 79 = Axial .690x.350

CAPACITANCE

Nominal capacitance expressed in picofarads (uF) by three-digit number, first two digits represent significant figures, last digit specifies number of zeroes to follow. When the nominal value is less than 10 pF, the letter 'R' indicates the decimal point and the succeeding digit(s) represent significant figure(s). For example: IRO indicates 1.0 pF; R75 indicates 0.75 pF and OR5 indicates 0.5 pF.

FAILURE RATE LEVEL

M = 1.0%
P = 0.1%
R = 0.01%
S = 0.001%
Expressed in % per 1000 hours

CAPACITANCE TOLERANCE

C = ±.25 pF
D = ±.5 pF
F = ±1%
G = ±2%
J = ±5%
K = ±10%

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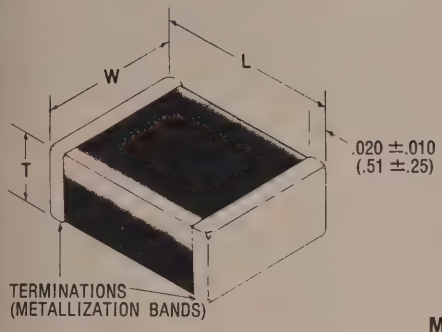
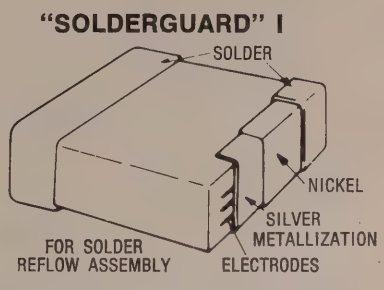
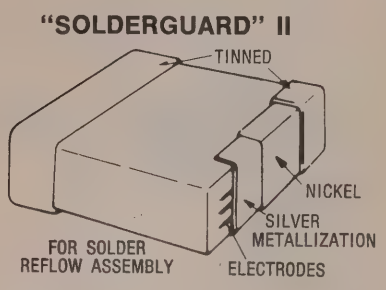
Ceramic Chip/MIL-C-55681
ESTABLISHED RELIABILITY

CAPACITOR OUTLINE DRAWINGS







MILITARY DESIGNATION "S" OR "U" **MILITARY DESIGNATION "W" OR "Y"**

DIMENSIONS—MILLIMETERS & (INCHES)

Style	Size Code	L	W	T	
				Min.	Max.
CDR01	C0805	2.03 ±.38 (.080 ±.015)	1.27 ±.38 (.050 ±.015)	.51 (.020)	1.40 (.055)
CDR02	C1805	4.57 ±.38 (.180 ±.015)	1.27 ±.38 (.050 ±.015)	.51 (.020)	1.40 (.055)
CDR03	C1808	4.57 ±.38 (.180 ±.015)	2.03 ±.38 (.080 ±.015)	.51 (.020)	2.03 (.080)
CDR04	C1812	4.57 ±.38 (.180 ±.015)	3.18 ±.38 (.125 ±.015)	.51 (.020)	2.03 (.080)
CDR05	C1825	4.57 +.51 −.38 (1.80 +.020 −.015)	6.35 +.51 −.38 (.250 +.020 −.015)	.51 (.020)	2.03 (.080)
CDR06	C2225	5.72 ±.51 (.225 ±.020)	6.35 ±.51 (.250 ±.020)	.51 (.020)	2.03 (.080)
CDR31	C0805	2.00 ±.20 (.078 ±008)	1.25 ±.20 (.049 ±.008)	.50 ±.20 (.020 ±.008)	1.30 ±.20 (.051 ±.008)
CDR32	C1206	3.20 ±.20 (.125 ±.008)	1.60 ±.20 (.062 ±.008)	.50 ±.20 (.020 ±.008)	1.30 ±.20 (.051 ±.008)
CDR33	C1210	3.20 ±.25 (.125 ±.010)	2.50 ±.25 (.098 ±.010)	.50 ±.25 (.020 ±.010)	1.50 ±.25 (.059 ±.010)
CDR34	C1812	4.50 ±.25 (.176 ±.010)	3.20 ±.25 (.125 ±.010)	.50 ±.25 (.020 ±.010)	1.50 ±.25 (.059 ±.010)
CDR35	C1825	4.50 ±.30 (.176 ±.012)	6.40 ±.30 (.250 ±.012)	.50 ±.30 (.020 ±.012)	1.50 ±.30 (.059 ±.012)

ORDERING INFORMATION

CDR01 B P 101 B K S M

STYLE & SIZE CODE
STYLE
C — Ceramic
D — Dielectric, Fixed Chip
R — Established Reliability

RATED TEMPERATURE
−55°C to +125°C

DIELECTRICS
P — 0 ±30 ppm/°C
X — ±15%

CAPACITANCE
Expressed in picofarads (pF)
First 2 digits represent significant figures and the last digit specifies the number of zeros to follow.
Example: 103 — 10,000 picofarads. When nominal value is less than 10 pF, the letter "R" is used to indicate the decimal point.
Example: 1R0 — 1.0 pF; R75 — 0.75 pF; 0R5 — 0.5 pF.

RATED VOLTAGE
A — 50; B — 100

CAPACITANCE TOLERANCE

B	C	D	F	J	K	M
±. 1pF	±.25 pF	±.5 pF	±1%	±5%	±10%	±20%

TERMINATION FINISH
S — Solder Coated, Final (SolderGuard I)
U — Base Metallization Barrier Metal— Solder Coated (SolderGuard I)
W — Base Metallization— Barrier Metal— Tinned (Tin or Tin/Lead Alloy) (SolderGuard II)
Y — Base Metallization Barrier Metal— 100% in coated (SolderGuard II)

FAILURE RATE LEVEL
M — 1.0 (%/1000 hrs.)
P — 0.1
R — 0.01
S — 0.001

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A world of top quality capacitors, built to KEMET® standards. Distributed for KEMET.

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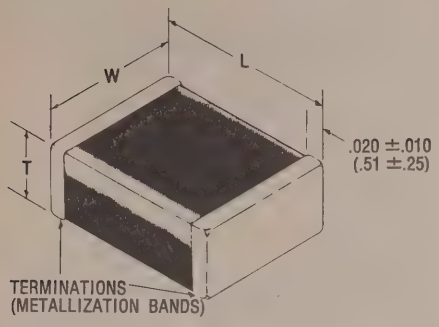
METUCHEN CAPACITORS INC.

High Voltage Ceramic Chip Capacitor

NPO



Size	1515	1812	1825	2020	3333	4040	5440	5550	6560
L	.150	.175	.175	.200	.330*	.400*	.540*	.550*	.650*
W	.150	.125	.250	.200	.330*	.400*	.400*	.500*	.600*
WVDC	Max Capacitance Values								
500v	3900	3900	.01µF	.01µF	.039µF	.056µF	.082µF	.1µF	..15µF
1kV	8200	1500	3300	2700	.01µF	.018µF	.022µF	.033µF	.047µF
2kV	330	560	1200	1000	3900	6800	8200	.012µF	.018µF
3kV	100	220	470	390	1500	2200	3900	4700	6800

*Denotes L & W tolerance of ±.025
NOTES: 1. Values are in pF unless otherwise specified.
2. Dimensions are in inches

GENERAL SPECIFICATIONS:

Capacitance Range: 10pF to .15µF
Dissipation Factor: .15% max.
(measured @ 25°C, @ 1.0 VRMS @ 1mHz for values through 100 pF and 1 kHz for all higher values)
Operating Temp. Range: −55°C to +125°C
Temperature Coefficient: 0 ± 30ppm/°C over Temp. Range
Dielectric Withstanding Voltage: 500V: 2.5 × Rated Voltage
1kV & over: 1.5 × Rated Voltage
Insulation Resistance: 1,000 Ohm-Farad or 100,000 megOhms min., whichever is less.

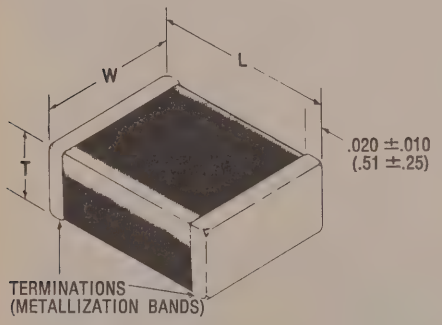
PART NUMBERING SYSTEM HIGH VOLTAGE LINE

202 C 1825 A 122 J

Voltage (3rd digit is No. of zeros)
Mfg Designation
Size
Dielectric Type (A = NPO; B = X7R)
Cap. in pF (3rd digit is No. of zeros)
Capacitance Tolerance (F ± 1%; G ± 2%; J ± 5%; K ± 10%; M ± 20%)
(min. tolerance ± .25pF)

Other sizes and configurations are available on request.

X7R



Size	1515	1812	1825	2020	3333	4040	5440	5550	6560
L	.150	.175	.175	.200	.330*	.400*	.540*	.550*	.650*
W	.150	.125	.250	.200	.330*	.400*	.400*	.500*	.600*
WVDC	Max Capacitance Values								
500v	.027µF	.033µF	.068µF	.056µF	.27µF	.33µF	.68µF	.82µF	1.0µF
1kV	.012µF	.018µF	.039µF	.033µF	.12µF	.22µF	.33µF	.39µF	.56µF
2kV	2700	4700	.01µF	8200	.033µF	.056µF	.068µF	.1µF	..15µF
3kV	1000	1800	3300	2700	.012µF	.022µF	.027µF	.039µF	.056µF

*Denotes L & W tolerance of ±.025
NOTES: 1. Values are in pF unless otherwise specified.
2. Dimensions are in inches

GENERAL SPECIFICATIONS:

Capacitance Range: 10pF to .15µF
Dissipation Factor: 2.5% max.
(measured @ 25°C, @ 1kHz @ 1.0 VRMS)
Operating Temp. Range: −55°C to +125°C
Temperature Coefficient: ±15% from −55°C to +125°C
Dielectric Withstanding Voltage: 500V: 2.5 × Rated Voltage
1000V: 1.5 × Rated Voltage
>1kV: 1.2 × Rated Voltage
Insulation Resistance: 1,000 Ohm-Farad or 100,000 megOhms min., whichever is less.

Other sizes and configurations are available on request.

PART NUMBERING SYSTEM HIGH VOLTAGE LINE

302 C 1825 B 332 K

Voltage (3rd digit is No. of zeros)
Mfg Designation
Size
Dielectric Type (A = NPO; B = X7R)
Cap. in pF (3rd digit is No. of zeros)
Capacitance Tolerance (J ± 5%; K ± 10%; M ± 20%; Z +80%-20%)

Other sizes and configurations are available on request.

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Ceramic Chip/MIL-C-55681
ESTABLISHED RELIABILITY
RATINGS & PART NUMBER REFERENCE

CAP. pF	CAP. TOL.	MIL-C-55681 CDR01-06 CAPACITORS
100 VOLT — C0805 SIZE (MILITARY CDR01)		
10	J,K	CDR01BP100B(2)W(3)
12	J	CDR01BP120BJW(3)
15	J,K	CDR01BP150B(2)W(3)
18	J	CDR01BP180BJW(3)
22	J,K	CDR01BP220B(2)W(3)
27	J	CDR01BP270BJW(3)
33	J,K	CDR01BP330B(2)W(3)
39	J	CDR01BP390BJW(3)
47	J,K	CDR01BP470B(2)W(3)
56	J	CDR01BP560BJW(3)
68	J,K	CDR01BP680B(2)W(3)
82	J	CDR01BP820BJW(3)
100	J,K	CDR01BP101B(2)W(3)
120	J,K	CDR01B(1)121B(2)W(3)
150	J,K	CDR01B(1)151B(2)W(3)
180	J,K	CDR01B(1)181B(2)W(3)
220	K,M	CDR01BX221B(4)W(3)
270	K	CDR01BX271BKW(3)
330	K,M	CDR01BX331B(4)W(3)
390	K	CDR01BX391BKW(3)
470	K,M	CDR01BX471B(4)W(3)
560	K	CDR01BX561BKW(3)
680	K,M	CDR01BX681B(4)W(3)
820	K	CDR01BX821BKW(3)
1,000	K,M	CDR01BX102B(4)W(3)
1,200	K	CDR01BX122BKW(3)
1,500	K,M	CDR01RX152B(4)W(3)
1,800	K	CDR01BX182BKW(3)
2,200	K	CDR01BX222BKW(3)
2,700	K	CDR01BX272BKW(3)
3,300	K	CDR01BX332BKW(3)
50 VOLT — C0805 SIZE (MILITARY CDR01)		
3,900	K	CDR01BX392AKW(3)
4,700	K,M	CDR01BX472A(4)W(3)
100 VOLT — C1805 SIZE (MILITARY CDR02)		
220	J,K	CDR02BP221B(2)W(3)
270	J	CDR02BP271BJW(3)
3,900	K	CDR02BX392BKW(3)
4,700	K,M	CDR02BX472B(4)W(3)
5,600	K	CDR02BX562BKW(3)
6,800	K,M	CDR02BX682B(4)W(3)
8,200	K	CDR02BX822BKW(3),
10,000	K,M	CDR02BX103B(4)W(3)
50 VOLT — C1805 SIZE (MILITARY CDR02)		
12,000	K	CDR02BX123AKW(3)
15,000	K,M	CDR02BX153A(4)W(3)
18,000	K	CDR02BX183AKW(3)
22,000	K,M	CDR02BX223A(4)W(3)
100 VOLT — C1808 SIZE (MILITARY CDR03)		
330	J,K	CDR03BP331B(2)W(3)
390	J	CDR03BP391BJW(3)
470	J,K	CDR03BP471B(2)W(3)
560	J	CDR03BP561BJW(3)
680	J,K	CDR03BP681B(2)W(3)
820	J	CDR03BP821BJW(4)
1,000	J,K	CDR03BP102B(2)W(3)
12,000	K	CDR03BX123BKW(3)
15,000	K,M	CDR03BX153B(4)W(3)
18,000	K	CDR03BX183BKW(3)
22,000	K,M	CDR03BX223B(4)W(3)
27,000	K	CDR03BX273BKW(3)
33,000	K,M	CDR03BX333B(4)W(3)
50 VOLT — C1808 SIZE (MILITARY CDR03)		
39,000	K	CDR03BX393AKW(3)
47,000	K,M	CDR03BX473A(4)W(3)
56,000	K	CDR03BX563AKW(3)
68,000	K,M	CDR03BX683A(4)W(3)

CAP. pF	CAP. TOL.	MIL-C-55681 CDR01-06 CAPACITORS
100 VOLT — C1812 SIZE (MILITARY CDR04)		
1,200	J	CDR04BP122BJW(3)
1,500	J,K	CDR04BP152B(2)W(3)
1,800	J	CDR04BP182BJW(3)
2,200	J,K	CDR04BP222B(2)W(3)
2,700	J	CDR04BP272BJW(3)
3,300	J,K	CDR04BP332B(2)W(3)
39,000	K	CDR03BX393BKW(3)
47,000	K,M	CDR04BX473B(4)W(3)
56,000	K	CDR04BX563BKW(3)
50 VOLT — C1812 SIZE (MILITARY CDR04)		
82,000	K	CDR04BX823AKW(3)
100,000	K,M	CDR04BX104A(4)W(3)
120,000	K	CDR04BX124AKW(3)
150,000	K,M	CDR04BX154A(4)W(3)
180,000	K	CDR04BX184AKW(3)
100 VOLT — C1825 SIZE (MILITARY CDR05)		
3,900	J,K	CDR05BP392B(2)S(3)
4,700	J,K	CDR05BP472B(2)W(3)
5,600	J,K	CDR05BP562B(2)W(3)
68,000	K,M	CDR05BX683B(4)W(3)
82,000	K	CDR05BX823BKW(3)
100,000	K,M	CDR05BX104B(4)W(3)
120,000	K	CDR05BX124BKW(3)
150,000	K,M	CDR05BX154B(4)W(3)
50 VOLT — C1825 SIZE (MILITARY CDR05)		
220,000	K,M	CDR05BX224A(4)W(3)
270,000	K	CDR05BX274AKW(3)
330,000	K,M	CDR02BX335A(4)W(3)
100 VOLT — C2225 SIZE (MILITARY CDR06)		
6,800	J,K	CDR06BP682B(2)W(3)
8,200	J,K	CDR06BP822B(2)W(3)
10,000	J,K	CDR06BP103B(2)W(3)
50 VOLT — C2225 SIZE (MILITARY CDR06)		
390,000	K	CDR06BX394AKW(2)
470,000	K,M	CDR06BX474A(4)W(3)

CAP. pF	CAP. TOL.	CDR31 CAPACITORS PER MIL-C-55681
100 VOLT — BP — C0805 SIZE (MILITARY CDR31)		
1.0	B,C	CDR31BP1R0B(5)W(3)
1.1	B,C	CDR31BP1R1B(5)W(3)
1.2	B,C	CDR31BP1R2B(5)W(3)
1.3	B,C	CDR31BP1R3B(5)W(3)
1.5	B,C	CDR31BP1R5B(5)W(3)
1.6	B,C	CDR31BP1R6B(5)W(3)
1.8	B,C	CDR31BP1R8B(5)W(3)
2.0	B,C	CDR31BP2R0B(5)W(3)
2.2	B,C	CDR31BP2R2B(5)W(3)
2.4	B,C	CDR31BP2R4B(5)W(3)
2.7	B,C,D	CDR31BP2R7B(6)W(3)
3.0	B,C,D	CDR31BP3R0B(6)W(3)
3.3	B,C,D	CDR31BP3R3B(6)W(3)
3.6	B,C,D	CDR31BP3R6B(6)W(3)
3.9	B,C,D	CDR31BP3R9B(6)W(3)
4.3	B,C,D	CDR31BP4R3B(6)W(3)
4.7	B,C,D	CDR31BP4R7B(6)W(3)
5.1	B,C,D	CDR31BP5R1B(6)W(3)
5.6	B,C,D	CDR31BP5R6B(6)W(3)
6.2	B,C,D	CDR31BP6R2B(6)W(3)
6.8	B,C,D	CDR31BP6R8B(6)W(3)
7.5	B,C,D	CDR31BP7R5B(6)W(3)
8.2	B,C,D	CDR31BP8R2B(6)W(3)
9.1	B,C,D	CDR31BP9R1B(6)W(3)
10	F,J,K	CDR31BP100B(7)W(3)
11	F,J,K	CDR31BP110B(7)W(3)
12	F,J,K	CDR31BP120B(7)W(3)
13	F,J,K	CDR31BP130B(7)W(3)

CAP. pF	CAP. TOL.	CDR31 CAPACITORS PER MIL-C-55681
100 VOLT — BP — CO805 SIZE (MILITARY CDR31) (Cont'd)		
15	F,J,K	CDR31BP150B(7)W(3)
16	F,J,K	CDR31BP160B(7)W(3)
18	F,J,K	CDR31BP180B(7)W(3)
20	F,J,K	CDR31BP200B(7)W(3)
22	F,J,K	CDR31BP220B(7)W(3)
24	F,J,K	CDR31BP240B(7)W(3)
27	F,J,K	CDR31BP270B(7)W(3)
30	F,J,K	CDR31BP300B(7)W(3)
33	F,J,K	CDR31BP330B(7)W(3)
36	F,J,K	CDR31BP360B(7)W(3)
39	F,J,K	CDR31BP390B(7)W(3)
43	F,J,K	CDR31BP430B(7)W(3)
47	F,J,K	CDR31BP470B(7)W(3)
51	F,J,K	CDR31BP510B(7)W(3)
56	F,J,K	CDR31BP560B(7)W(3)
62	F,J,K	CDR21BP620B(7)W(3)
68	F,J,K	CDR31BP680B(7)W(3)
75	F,J,K	CDR31BP750B(7)W(3)
82	F,J,K	CDR31BP820B(7)W(3)
91	F,J,K	CDR31BP910B(7)W(3)
100	F,J,K	CDR31BP101B(7)W(3)
110	F,J,K	CDR31BP111B(7)W(3)
120	F,J,K	CDR31BP121B(7)W(3)
130	F,J,K	CDR31BP131B(7)W(3)
150	F,J,K	CDR31BP151B(7)W(3)
160	F,J,K	CDR31BP161B(7)W(3)
180	F,J,K	CDR31BP181B(7)W(3)
200	F,J,K	CDR31BP201B(7)W(3)
220	F,J,K	CDR31BP221B(7)W(3)
240	F,J,K	CDR31BP241B(7)W(3)
270	F,J,K	CDR31BP271B(7)W(3)
300	F,J,K	CDR31BP301B(7)W(3)
330	F,J,K	CDR31BP331B(7)W(3)
360	F,J,K	CDR31BP361B(7)W(3)
390	F,J,K	CDR31BP391B(7)W(3)
430	F,J,K	CDR31BP431B(7)W(3)
470	F,J,K	CDR31BP471B(7)W(3)
50 VOLT — BP — C0805 SIZE (MILITARY CDR31)		
510	F,J,K	CDR31BP511A(7)W(3)
560	F,J,K	CDR31BP561A(7)W(3)
620	F,J,K	CDR31BP621A(7)W(3)
680	F,J,K	CDR31BP681A(7)W(3)
100 VOLT — BX — C0805 SIZE (MILITARY CDR31)		
470	K,M	CDR31BX471B(4)W(3)
560	K,M	CDR31BX561B(4)W(3)
680	K,M	CDR31BX681B(4)W(3)
820	K,M	CDR31BX821B(4)W(3)
1,000	K,M	CDR31BX102B(4)W(3)
1,200	K,M	CDR31BX122B(4)W(3)
1,500	K,M	CDR31BX152B(4)W(3)
1,800	K,M	CDR31BX182B(4)W(3)
2,200	K,M	CDR31BX222B(4)W(3)
2,700	K,M	CDR31BX272B(4)W(3)
3,300	K,M	CDR31BX332B(4)W(3)
3,900	K,M	CDR31BX392B(4)W(3)
4,700	K,M	CDR31BX472B(4)W(3)
50 VOLT — BX — C0805 SIZE (MILITARY CDR31)		
5,600	K,M	CDR31BX562A(4)W(3)
6,800	K,M	CDR31BX682A(4)W(3)
8,200	K,M	CDR31BX822A(4)W(3)
10,000	K,M	CDR31BX103A(4)W(3)
12,000	K,M	CDR31BX123A(4)W(3)
15,000	K,M	CDR31BX153A(4)W(3)
18,000	K,M	CDR31BX183A(4)W(3)

(1) To complete Part Number for Dielectric, insert P or X symbol — J tolerance is not available with the BX Dielectric.
(2) To complete Part Number, insert Capacitance Tolerance Symbol (when applicable): J—±5%; K—±10%.
(3) To complete Part Number, insert Failure Rate Symbol: M—1.0%, P—0.1%; R—0.01%; S—.001%.
(4) To complete Part Number, insert Capacitance Tolerance Symbol (when applicable): K—±10%, M—±20% only.
(5) To complete Part Number, insert Capacitance Tolerance Symbol (when applicable): B—±0.1 pF, C—±0.25 pF.
(6) To complete Part Number, insert Capacitance Tolerance Symbol (when applicable): B—±0.1 pF, C—±0.25 pF, D—±0.5 pF.
(7) To complete Part Number, insert Capacitance Tolerance Symbol (when applicable): F—±1%, J—±5%, K—±10%.

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Ceramic Chip/MIL-C-55681
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RATINGS & PART NUMBER REFERENCE

CAP. pF	CAP. TOL.	CDR32 CAPACITORS PER MIL-C-55681
1000 VOLT — BP — C1206 SIZE (MILITARY CDR32)		
1.0	B,C	CDR32BP1R0B/5)W(3)
1.1	B,C	CDR32BP1R1B(5)W(3)
1.2	B,C	CDR32BP1R2B/5)W(3)
1.3	B,C	CDR32BP1R3B(5)W(3)
1.5	B,C	CDR32BP1R5B(5)W(3)
1.6	B,C	CDR32BP1R6B(5)W(3)
1.8	B,C	CDR32BP1R8B(5)W(3)
2.0	B,C	CDR32BP2R0B(5)W(3)
2.2	B,C	CDR32BP2R2B(5)W(3)
2.4	B,C	CRD32BP2R4B(5)W(3)
2.7	B,C,D	CDR32BP2R7B(6)W(3)
3.0	B,C,D	CDR32BP3R0B(6)W(3)
3.3	B,C,D	CDR32BP3R3B(6)W(3)
3.6	B,C,D	CDR32BP3R6B(6)W(3)
3.9	B,C,D	CDR32BP3R9B(6)W(3)
4.3	B,C,D	CDR32BP4R3B(6)W(3)
4.7	B,C,D	CDR32BP4R7B(6)W(3)
5.1	B,C,D	CDR32BP5R1B(6)W(3)
5.6	B,C,D	CDR32BP5R6B(6)W(3)
6.2	B,C,D	CDR32BP6R2B(6)W(3)
6.8	B,C,D	CDR32BP6R8B(6)W(3)
7.5	B,C,D	CDR32BP7R5B(6)W(3)
8.2	B,C,D	CDR32BP8R2B(6)W(3)
9.1	B,C,D	CDR32BP9R1B(6)W(3)
10	F,J,K	CDR32BP100B(7)W(3)
11	F,J,K	CDR32BP110B(7)W(3)
12	F,J,K	CDR32BP120B(7)W(3)
13	F,J,K	CDR32BP130B(7)W(3)
15	F,J,K	CDR32BP150B 7)W(3)
16	F,J,K	CDR32BP160B(7)W(3)
18	F,J,K	CDR32BP180B(7)W(3)
20	F,J,K	CDR32BP200B(7)W(3)
22	F,J,K	CDR32BP220B 7)W(3)
24	F,J,K	CDR32BP240B(7)W(3)
27	F,J,K	CDR32BP270B(7)W(3)
30	F,J,K	CDR32BP300B(7)W(3)
33	F,J,K	CDR32BP330B(7)W(3)
36	F,J,K	CDR32BP360B(7)W(3)
39	F,J,K	CDR32BP390B(7)W(3)
43	F,J,K	CDR32BP430B(7)W(3)
47	F,J,K	CDR32BP470B(7)W(3)
51	F,J,K	CDR32BP510B(7)W(3)
56	F,J,K	CDR32BP560B(7)W(3)
62	F,J,K	CDR32BP620B(7)W(3)
68	F,J,K	CDR32BP680B(7)W(3)
75	F,J,K	CDR32BP750B(7)W(3)
82	F,J,K	CDR32BP820B(7)W(3)
91	F,J,K	CDR32BP910B(7)W(3)
100	F,J, K	CDR32BP101B(7)W(3)
100 VOLT — BP — C1206 SIZE (MILITARY CDR32)		
110	F,J,K	CDR32BP111B(7)W(3)
120	F,J,K	CDR32BP121B(7)W(3)
130	F,J,K	CDR32BP131B(7)W(3)
150	F,J,K	CDR32BP151B(7)W(3)
160	F,J,K	CDR32BP161B(7)W(3)
180	F,J,K	CDR32BP181B(7)W(3)
200	F,J,K	CDR32BP201B(7)W(3)
220	F,J,K	CDR32BP221B(7)W(3)
240	F,J,K	CDR32BP241B(7)W(3)
270	F,J,K	CDR32BP271B(7)W(3)
300	F,J,K	CDR32BP301B(7)W(3)
330	F,J,K	CDR32BP331B(7)W(3)
360	F,J,K	CDR32BP361B(7)W(3)
390	F,J,K	CDR32BP391B(7)W(3)
430	F,J,K	CDR32BP431B(7)W(3)
470	F,J,K	CDR32BP471B(7)W(3)
510	F,J,K	CDR32BP511B(7)W(3)
560	F,J,K	CDR32BP561B(7)W(3)
620	F,J,K	CDR32BP621B(7)W(3)
680	F,J,K	CDR32BP681B(7)W(3)
750	F,J,K	CDR32BP751B(7)W(3)

CAP. pF	CAP. TOL.	CDR32 CAPACITORS PER MIL-C-55681
100 VOLT — BP — C1206 SIZE (MILITARY CDR32) (Cont'd)		
820	F,J,K	CDR32BP821B(7)W(3)
910	F,J,K	CDR32BP911B(7)W(3)
1,000	F,J,K	CDR32BP102B(7)W(3)
50 VOLT — BP — C1206 SIZE (MILITARY CDR32)		
1.100	F,J,K	CDR32BP112A(7)W(3)
1,200	F,J,K	CDR32BP122A(7)W(3)
1,300	F,J,K	CDR32BP132A(7)W(3)
1,500	F,J,K	CDR32BP152A(7)W(3)
1,600	F,J,K	CDR32BP162A(7)W(3)
1,800	F,J,K	CDR32BP182A(7)W(3)
2,000	F,J,K	CDR32BP202A(7)W(3)
2,200	F,J,K	CDR32BP222A(7)W(3)
100 VOLT — BX — C1206 SIZE (MILITARY CDR32)		
4,700	K,M	CDR32BX472B(4)W(3)
5,600	K,M	CDR32BX562B(4)W(3)
6,800	K,M	CDR32BX682B(4)W(3)
8,200	K,M	CDR32BX822B(4)W(3)
10,000	K,M	CDR32BX103B(4)W(3)
12,000	K,M	CDR32BX123B(4)W(3)
15,000	K,M	CDR32BX153B(4)W(3)
50 VOLT — BX — C1206 SIZE (MILITARY CDR32)		
18,000	K,M	CDR32BX183A(4)W(3)
22,000	K,M	CDR32BX223A(4)W(3)
27,000	K,M	CDR32BX273A(4)W(3)
33,000	K,M	CDR32BX333A(4)W(3)
39,000	K,M	CDR32BX393A(4)W(3)

CAP. pF	CAP. TOL.	CDR33, 34, 35 CAPACITORS PER MIL-C-55681
100 VOLT — BP — C1210 SIZE (MILITARY CDR33)		
1,000	F,J,K	CDR33BP102B(7)W(3)
1,100	F,J,K	CDR33BP112B(7)W(3)
1,200	F,J,K	CDR33BP122B(7)W(3)
1,300	F,J,K	CDR33BP132B(7)W(3)
1,500	F,J,K	CDR33BP152B(7)W(3)
1,600	F,J,K	CDR33BP162B(7)W(3)
1,800	F,J,K	CDR33BP182B(7)W(3)
2,000	F,J,K	CDR33BP202B(7)W(3)
2,200	F,J,K	CDR33BP222B(7)W(3)
50 VOLT — BP — C1210 SIZE (MILITARY CDR33)		
2,400	F,J,K	CDR33BP242A(7)W(3)
2,700	F,J,K	CDR33BP272A(7)W(3)
3,000	F,J,K	CDR33BP302A(7)W(3)
3,300	F,J,K	CDR33BP332A(7)W(3)
100 VOLT — BX — C1210 SIZE (MILITARY CDR33)		
15,000	K,M	CDR33BX153B(4)W(3)
18,000	K,M	CDR33BX183B(4)W(3)
22,000	K,M	CDR33BX223B(4)W(3)
27,000	K,M	CDR33BX273B(4)W(3)
50 VOLT — BX — C1210 SIZE (MILITARY CDR33)		
39,000	K,M	CDR33BX393A(4)W(3)
47,000	K,M	CDR33BX473A(4)W(3)
56,000	K,M	CDR33BX563A(4)W(3)
68,000	K,M	CDR33BX683A(4)W(3)
82,000	K,M	CDR33BX823A(4)W(3)
100,000	K,M	CDR33BX104A(4)W(3)
100 VOLT — BP — C1812 SIZE (MILITARY CDR34)		
2,200	F,J,K	CDR34BP222B(7)W(3)
2,400	F,J,K	CDR34BP242B(7)W(3)

CAP. pF	TOL. CAP.	CDR33, 34, 35 CAPACITORS PER MIL-C-55681
100 VOLT — BP — C1812 SIZE (MILITARY CDR34) (Cont'd)		
2,700	F,J,K	CDR34BP272B(7)W(3)
3,000	F,J,K	CDR34BP302B(7)W(3)
3,300	F,J,K	CDR34BP332B(7)W(3)
3,600	F,J,K	CDR34BP362B(7)W(3)
3,900	F,J,K	CDR34BP392B(7)W(3)
4,300	F,J,K	CDR34BP432B(7)W(3)
4,700	F,J,K	CDR34BP472B(7)W(3)
50 VOLT — BP — C1812 SIZE (MILITARY CDR34)		
5,100	F,J,K	CDR34BP512A(7)W(3)
5,600	F,J,K	CDR34BP562A(7)W(3)
6,200	F,J,K	CDR34BP622A(7)W(3)
6,800	F,J,K	CDR34BP682A(7)W(3)
7,500	F,J,K	CDR34B752A(7)W(3)
8,200	F,J,K	CDR34BP822A(7)W(3)
9,100	F,J,K	CDR34BP812A(7)W(3)
10,000	F,J,K	CDR34BP103A(7)W(3)
100 VOLT — BX — C1812 SIZE (MILITARY CDR34)		
27,000	K,M	CDR34BX273B(4)W(3)
33,000	K,M	CDR34BX333B(4)W(3)
39,000	K,M	CDR34BX393B(4)W(3)
47,000	K,M	CDR34BX473B(4)W(3)
56,000	K,M	CDR34BX563B(4)W(3)
50 VOLT — BX — C1812 SIZE (MILITARY CDR34)		
100,000	K,M	CDR34BX104A(4)W(3)
120,000	K,M	CDR34BX124A(4)W(3)
150,000	K,M	CDR34BX154A(4)W(3)
180,000	K,M	CDR34BX184A(4)W(3)
100 VOLT — BP — C1825 SIZE (MILITARY CDR35)		
4,700	K,M	CDR35BP472B(7)W(3)
5,100	K,M	CDR35BP512B(7)W(3)
5,600	F,J,K	CDR35BP562B(7)W(3)
6,200	F,J,K	CDR35BP622B(7)W(3)
6,800	F,J,K	CDR35BP682B(7)W(3)
7,500	F,J,K	CDR35BP752B(7)W(3)
8,200	F,J,K	CDR35BP822B(7)W(3)
9,100	F,J,K	CDR35BP912B(7)W(3)
10,000	F,J,K	CDR35BP103B(7)W(3)
50 VOLT — BP — C1825 SIZE (MILITARY CDR35)		
11,000	F,J,K	CDR35BP113A(7)W(3)
12,000	F,J,K	CDR35BP123A(7)W(3)
13,000	F,J,K	CDR35BP133A(7)W(3)
15,000	F,J,K	CDR35BP153A(7)W(3)
16,000	F,J,K	CDR35BP163A(7)W(3)
18,000	F,J,K	CDR35BP183A(7)W(3)
20,000	F,J,K	CDR35BP203A(7)W(3)
22,000	F,J,K	CDR35BP223A(7)W(3)
100 VOLT — BX — C1812 SIZE (MILITARY CDR35)		
56,000	K,M	CDR35BX563B(4)W(3)
68,000	K,M	CDR35BX683B(4)W(3)
82,000	K,M	CDR35BX823B(4)W(3)
100,000	K,M	CDR35BX104B(4)W(3)
120,000	K,M	CDR35BX124B(4)W(3)
150,000	K,M	CDR35BX154B(4)W(3)
50 VOLT — BX — C1825 SIZE (MILITARY CDR35)		
180,000	K,M	CDR35BX184A(4)W(3)
220,000	K,M	CDR35BX224A(4)W(3)
270,000	K,M	CDR35BX274A(4)W(3)
330,000	K,M	CDR35BX334A(4)W(3)
390,000	K,M	CDR35BX394A(4)W(3)
470,000	K,M	CDR35BX474A(4)W(3)

(1) To complete Part Number for Dielectric, insert P or X symbol — J tolerance is not available with the BX Dielectric.
(2) To complete Part Number, insert Capacitance Tolerance Symbol (when applicable): J—±5%; K—±10%.
(3) To complete Part Number, insert Failure Rate Symbol: M—1.0%, P—0.1%; R—0.01%; S—.001%.
(4) To complete Part Number, insert Capacitance Tolerance Symbol (when applicable): K—±10%, M—±20% only.
(5) To complete Part Number, insert Capacitance Tolerance Symbol (when applicable): B—±0.1 pF, C—±0.25 pF.
(6) To complete Part Number, insert Capacitance Tolerance Symbol (when applicable): B—±0.1 pF, C—±0.25 pF, D—±0.5 pF.
(7) To complete Part Number, insert Capacitance Tolerance Symbol (when applicable): F—±1%, J—±5%, K—±10%.

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PRODUCT SELECTION GUIDES

TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 93/94 EDITION OF EEM

AC Power Supplies, Product Selection Guide D•2221
Batteries, Product Selection Guide D•1419
Cabinets, Enclosures, Racks & Chassis, Product Selection Guide C•1003
Capacitors, Product Selection Guide A•1003
Coils, Chokes, Inductors, Product Selection Guide A•1179
Connectors, Terminals & Sockets, Product Selection Guide C•1139
Cores, Magnets & Ferrites A•1317
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide A•1326
DC-DC Converters D•2049
DC Power Supplies, Product Selection Guide D•1488
Delay Lines, Product Selection Guide A•1513
Discrete Semiconductors, Product Selection Guide A•2130
Displays, Readouts, & CRTs, Product Selection Guide B•1017
Fans, Blowers, Cooling Equipment, & Heat Exchangers, Product Selection Guide C•1557
Fiber Optics, Product Selection Guide B•1200
Filters, Power, Product Selection Guide A•1584
Filters, Signal, Product Selection Guide A•1617
Instruments, Test & Measuring, Product Selection Guide D•1215
Interconnection Systems, Product Selection Guide C•1670
Keyboards & Keypads, Product Selection Guide B•1818
Lamps, Lights, & Indicators, Product Selection Guide B•1131
Microwave Components, Product Selection Guide A•1719
Military Qualified Products List B•1002
Motors, Drives, & Rotating Components, Product Selection Guide B•1231
Oscilloscopes, Product Selection Guide D•1402
Panel Hardware, Product Selection Guide C•1522
Panel Meters, Analog & Digital, Product Selection Guide D•1336
Potentiometers, Trimmers, Controls, & Rheostats, Product Selection Guide A•2053
Power Supplies, AC, Product Selection Guide D•2221
Power Supplies, DC, Product Selection Guide D•1488
Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide B•1341
Relays, Product Selection Guide B•1401
Resistors, Product Selection Guide A•1859
Solenoids, Product Selection Guide B•1626
Switches, Product Selection Guide B•1658
Thermal Components, Product Selection Guide B•1857
Transducers & Encoders, Product Selection Guide B•1911
Transformers, Product Selection Guide A•2229
Wire & Cable, Product Selection Guide C•1701

Motor Capacitors, Inc.

Type AD

Metallized Polyester/ Metallized Polypropylene Capacitors

• Motor Run • Fans • Lighting • Power Supplies • Appliances • Pumps • Tools

General Description

Dielectric: Metallized Polypropylene (AD-P) or Metallized Polyester (AD-M) Film. Metallized Film is self-healing in the event of a momentary over-voltage.

Winding: Non-inductive using a zinc alloy spray to contact the edges of the metallized film.

Enclosure: Molded rectangular case of black polyester-glass which is flame retardant per UL94V-0. The integral mounting ear allows mounting of the capacitor to the chassis by a single screw.

Encapsulant: The epoxy compound used to fill the enclosure and protect the capacitor is flame retardant per UL94V-0.

Marking: Each unit is stamped with the Capacitance, Tolerance, Voltage Rating and Series Code.

Terminals: .187 or .250 Brass Terminals may be selected from several Style combinations. Solderable Lugs and UL 1015 Stranded Wire Leads are also available.

Electrical Characteristics

	AD-M	AD-P
Capacitance: Values are available in 5% and 10% tolerances when measured at 1000 Hz. (25°C)	0.5-20µF.	0.5-16µF.
Voltage: The standard available operating AC Voltages	250,330,370,440,500	250,330,370,440
Temperature: Unit will operate continuously over this temperature range without derating.	-25 to +60°C	-26 to +85°C
Dissipation Factor: Max. percentage when measured at 60 Hz and 25°C.	less than 0.35%	less than 0.10%
Insulation Resistance: Min. measurement at 135 VDC (25°C.)		
Across the terminals.	1,000 MOhm X µF	1,000 MOhm X µF
Terminal to Case.	2,000 MOhm	2,000 MOhm

Test Specifications

Dielectric Strength: Capacitors shall withstand 175% of the rated AC voltage for a period of 60 seconds.

Case Test: Terminal to case shall withstand 200% of the rated AC voltage plus 1500 VAC for a period of 60 seconds.

Humidity Resistance: Units shall exceed the requirements of MIL-Std-202, Method 106.

Life Test: After 1000 hours at the maximum rated temperature with 120% of the rated voltage applied between the terminals:

	AD-M	AD-P
Max. Capacitance Shift:	+/- 7.0%	+/-4.0%
Max. Dissipation Factor:	0.45%	0.10%
Min. Insulation Res.:	100 MOhm X µF	100 MegOhm X µF

Case Size Required For a Given Capacitor

µF	250 VAC		330 VAC		370 VAC		440 VAC		500 VAC	
	ADM	ADP	ADM	ADP	ADM	ADP	ADM	ADP	ADM	ADP
0.5	A	A	A	E	A	E	C	E	E	J
1.0	A	A	A	E	A	E	E	J	G	
1.5	A	A	C	E	C	E	J	J	J	
2.0	A	A	E	J	C	J	J	L	J	
2.5	A	E	E	J	J	J	J	N	L	
3.0	A	E	J	J	J	J	J	N	L	
4.0	E	E	J	L	J	L	L	P		
5.0	E	L	L	N	L	N	N	R		
6.0	J	N	L	N	L	N	P			
7.0	J	N	N	P	N	P	R			
7.5	J	N	N	P	N	P	R			
8.0	J	P	N	R	N	R				
10.0	L	P	R	R	R	R				
12.0	N	R								
12.5	N	R								
15.0	P	R								
17.5	P									
20.0	R									
25.0	R									

Type AD Case Sizes

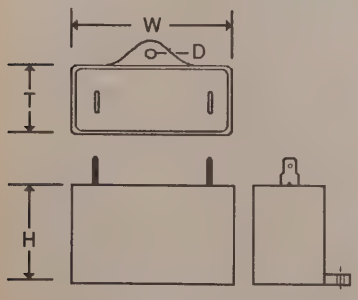
Case	Width (W)		Thickness (T)		Height (H)		Hole Dia (D)	
	in.	mm.	in.	mm.	in.	mm.	in.	mm.
A	1.28	32.5	0.51	13.0	0.87	22.0	.170	4.3
C	1.28	32.5	0.55	14.0	1.00	25.5	.170	4.3
D	1.46	37.0	0.51	13.0	0.94	24.0	.170	4.3
E	1.48	37.5	0.61	15.5	1.04	26.5	.170	4.3
G	1.52	38.5	0.61	15.5	1.18	30.0	.170	4.3
J	1.56	39.5	0.77	19.5	1.14	29.0	.170	4.3
L	1.54	39.0	0.87	22.0	1.30	33.0	.170	4.3
N	1.97	50.0	0.81	20.5	1.20	30.5	.170	4.3
P	2.05	52.0	0.89	22.5	1.40	35.5	.170	4.3
R	2.01	51.0	1.18	30.0	1.57	40.0	.170	4.3

Typical Part Number

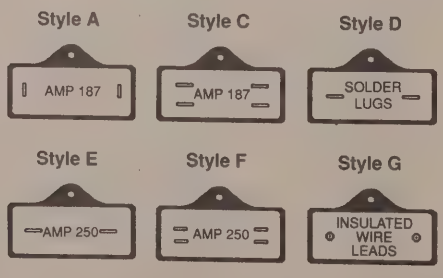
AD M 250 C 106 K (N)

- AD — Series
- M — Film
- 250 — Voltage
- C — Terminal
- 106 — Capacitance
- K — Tolerance
- (N) — No Mounting Ear

Dimensions



Terminal Configurations



Tolerance Code

J = +/- 5%
K = +/- 10%

Motor Capacitors, Inc., 6655 N. Avondale Ave., Chicago, IL 60631 • 312-631-0713 • FAX: 312-774-8778

disc ceramic capacitors

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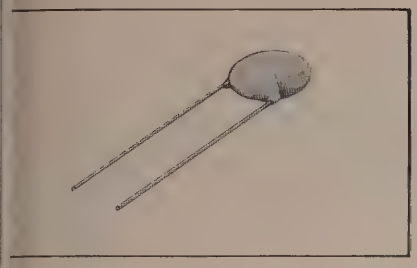
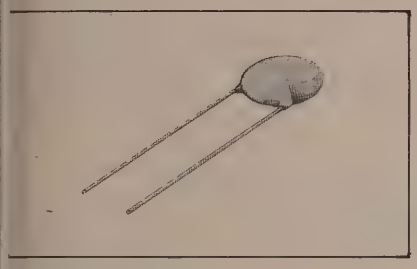


Low Voltage and Ultra Small

	DISC	ULTRA SMALL DISC
Capacitance Ranges:	.5pF to .47μF	1pF to .047μF
Voltage Ratings:	12 VDC to 1000 VDC	12, 16, 25 & 50V
Temperature Characteristics:	B, E, F CH, CJ, CK, 5L	B, CH, CJ, CK, F, SL
Dimensions:	.157″ to .690″ Dia.	.138 ± .020 Dia.

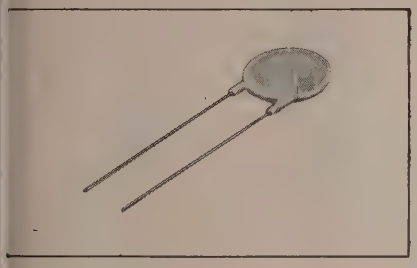
Standard packaging is tape & ammo. Bulk available upon request.



Medium Voltage

Capacitance Range:	10pF to .01μF
Voltage Ratings:	1,000; 2,000; 3,000; 6,000 VDC
Temperature Characteristics:	B, E, F SL
High Temperature Characteristics (+125°C):	R: (Less than 0.2% DF at 1 KHz) SL C: (Less than 0.2% DF at 1 KHz)
Dimensions:	.177″ to .669″

Available in standard packaging for auto-insertion



Safety Recognized UL, CSA, etc.

Capacitance Range:	100pF to .01μF
Voltage Ratings:	125, 250, 400 VAC
Temperature Characteristics:	B, F, FZ
Dimensions:	.394″ to .669″ Dia.
Approval Types:	UL, CSA, VDE, SEMKO, BS, SEV, EI, NEMKO, SAA

*Many items have multiple safety recognitions.
*Many items are double protection safety recognized.
Available in standard packaging for auto-insertion.

monolithic ceramic capacitors

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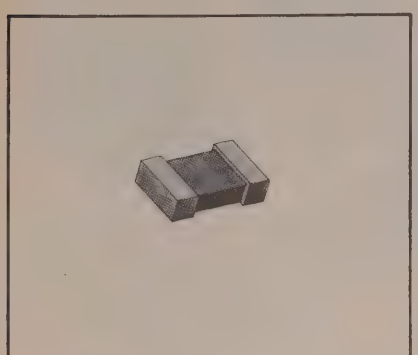
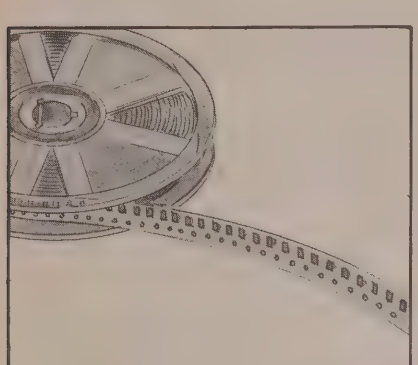


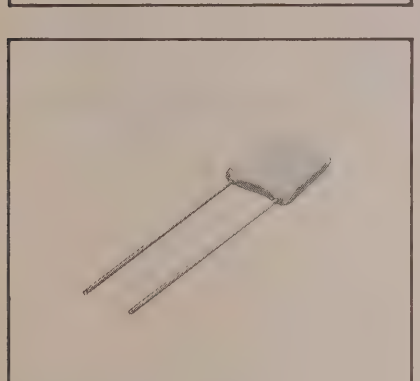
Chips

Capacitance Range:	1pF to 22µF
Voltage Ratings:	16, 25, 50, 100, 200, 500 and 1000 VDC
Temperature Characteristics:	COG, X7R, Z5U, Y5V
Dimensions:	.040" x .020" to .492" x .394"



Chips for Tape and Reel

Capacitance Range:	1pF to 3.3µF
Voltage Ratings:	16, 25, 50, 100, 200, 500 and 1000 VDC
Temperature Characteristics:	COG, X7R, Z5U, Y5V
Dimensions:	.060″ × .030″ to .220″ × .250″
Carrier Tape:	Standard 8 & 12 MM, 7″ or 13″ reels



Radial Leaded Conformal Epoxy Coated

Capacitance Range:	.5 pF to 100µF
Voltage Ratings:	25, 50, 100, 200 and 500 VDC
Temperature Characteristics:	COG, X7R, Z5U, Y5V
Dimensions:	.138" x .120" to 1.38" x .827"

Available taped and reeled for auto-insertion (most values)

TRIMMING CAPACITORS

MURATA ERIE NORTH AMERICA

TZO3 SERIES

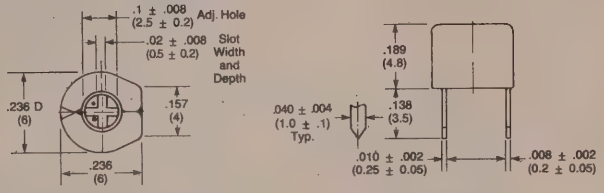
The TZ Series ceramic trimmer capacitors are built into and protected by a color coded plastic case. This unique, axle-less and solder-less construction protects the unit from damages during assembly and provides exceptionally linear temperature coefficient at low cost.

FEATURES
- **Excellent shock and vibration resistance**
- **Exceptionally linear TC**
- **Dust and flux resistant construction**
- **Plastic case meets UL94V-0**
- **Very adaptable to auto insertion**
- **Available as solvent washable unit utilizing a unique "O" ring seal.**

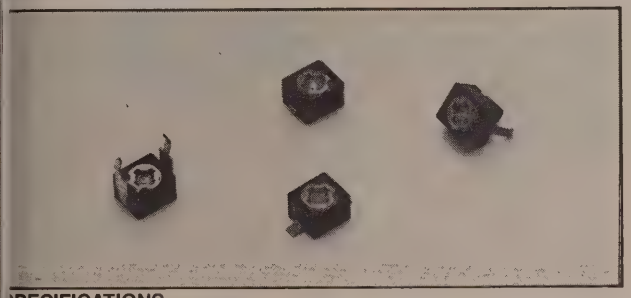
SPECIFICATIONS

Cap. Range: 1.25pF to 2.3pF thru 10pF to 120pF
Working Voltage: 100VDC or 50 VDC
Withstanding Voltage: 220 VDC (100V units) or 110VDC (50 V units)
Insulation Resistance: 10^4MΩ min. (50 VDC, C max.)
Operating Torque: .3 to 2 in.-oz.

TYPICAL DIMENSIONS



TZBX4 SERIES



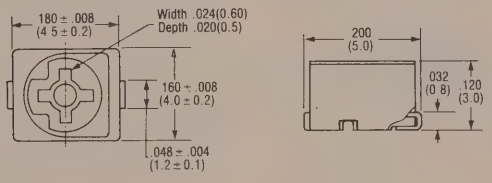
Murata Erie's new chip trimmer capacitors are specifically designed for automatic surface placement. The small size and outstanding performance over a wide frequency spectrum make them entirely compatible with other types of surface mounted components.

FEATURES
- **Miniature rectangular shape just 4.0 × 4.5 × 3.0 mm**
- **Specifically designed for auto surface placement. Designed to withstand solder bath (260°C, 5 sec.) and flux baths**
- **Impervious to solvent cleaners**
- **Can be reflow soldered**
- **Available (optionally) as totally sealed package**
- **Conventional snap-in configuration available**
- **Color coded**

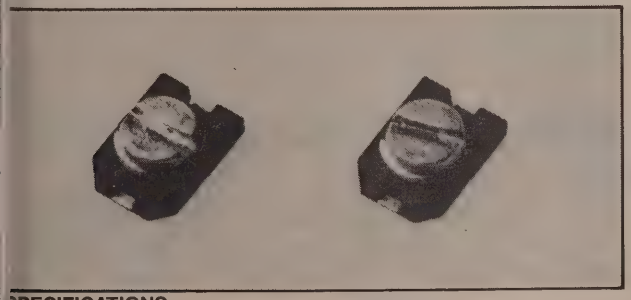
SPECIFICATIONS

Cap. Range: 1.4pF to 3.0pF thru 7.0pF to 50.0pF
Working Voltage: 100VDC or 50 VDC
Withstanding Voltage: 220 VDC
Insulation Resistance: 10^4MΩ min.
Operating Torque: 15 to 200g-cm

TYPICAL DIMENSIONS



TZCO3 SERIES



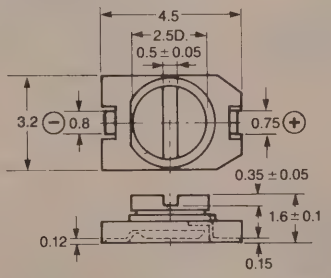
This new low profile chip trimming capacitor is specifically designed to meet the requirements of high density surface mount applications and automated placement equipment.

FEATURES
- **Extremely small size—just 3.2 mm × 4.5 mm × 1.6 mm**
- **Designed for auto-placement in surface mount applications**
- **Color-coded**
- **Heat-resistant resin withstands reflow soldering temperatures**
- **Can be adjusted with standard adjustment tools**

SPECIFICATIONS

Cap. Range: 1.0pF to 3.0pF thru 6.5pF to 30pF
Working Voltage: 100VDC
Withstanding Voltage: 220 VDC
Insulation Resistance: 10^4MΩ min.
Operating Torque: 15 to 200g-cm

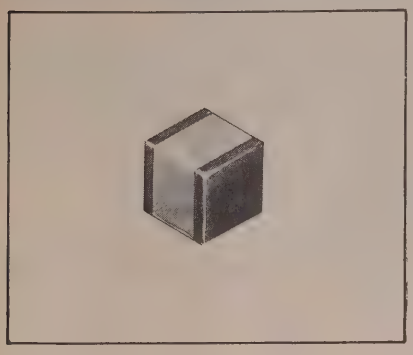
TYPICAL DIMENSIONS



MURATA ERIE NORTH AMERICA 220 Lake Park Dr., Smyrna, Georgia 30080 Tel: 1-800-831-9172 Telex: 26-1301 FAX: 1-404-684-1541

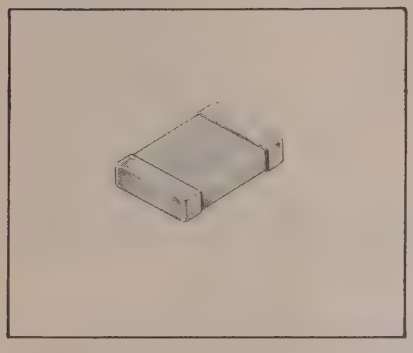
fixed ceramic capacitors for microwave applications

muRata ERIE®
MURATA ERIE NORTH AMERICA



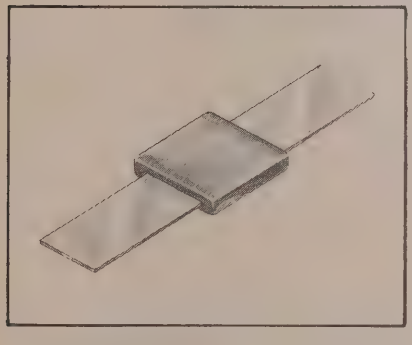
Monolithic Chips—MA Series

Capacitance Ranges:	0.3pF to .1mF
Voltage Ratings:	50, 100, 200, 300, 500 VDC
Tolerances:	B. ±0.1pF thru M, ±20%, thru Z +80 −20%
Q:	10.000@1 MHz (P90, C0G)
Dissipation Factor:	2.5% (X7R)
Temperature Characteristics:	P90, ±20ppm/°C, C0G, X7R
Size:	.055″ x .055″ to .110″ x .110″



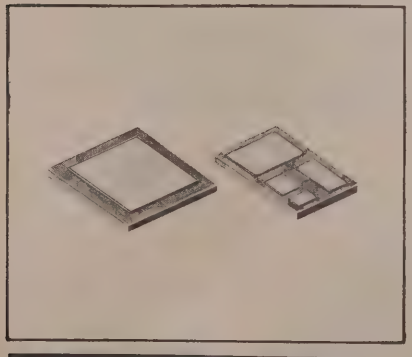
Monolithic Chips - GRH700

Capacitance Ranges:	1.0 to 1000pF
Voltage Ratings:	50 to 500 V
Q:	15,000 ÷ C (pF) @ 100 MHz
Case Size:	1210 and 0805
Temperature Characteristics:	C0G
Insulation Resistance:	1.0 to 470pF 10^6 Megohms over 470pF 10^5 Megohms



Glass Encapsulated Monolithic RF Power—UFP Series

Capacitance Ranges:	10pF to 3000pF
Voltage Ratings:	300 to 3,600 VDC
Q:	5000 @ 1 MHz
RF Current Ratings:	8 Amperes
Temperature Characteristics:	P90, ±20ppm/°C, C0G
Size:	.580″ x .547″



Parallel Plate Single Layer Ceramic Capacitors for MIC—CLA Series

	Single Electrode	Multi Electrodes
Capacitance Ranges:	1-130pF	.1-5.9pF/electrode
Voltage Ratings:	100 VDC	100 VDC
Number of Electrodes:	1	3-5
Q:	≥200	≥200
Temperature Characteristics:	C0G, N750, N220, ±500ppm/°C	
Size:	.010″ x .010″ to .035″ x .035″	.020″ x .020″ to .035″ x .035″

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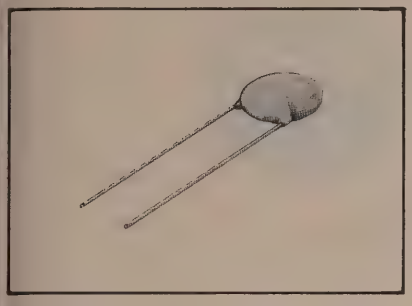
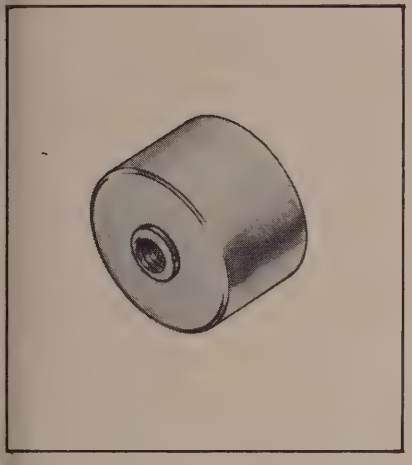
high voltage ceramic capacitors

MURATA ERIE NORTH AMERICA



High Voltage—DHR Series

Capacitance Range:	100pF to 2,200pF
Voltage Ratings:	7,500; 10,000; 15,000 VDC
Temperature Characteristics:	Y5P, Z5U, N4700
Dimensions:	.354″ to .870″ Dia.



10 to 40 KVDC, DHS Series

For AC and DC Pulse Applications

Capacitance Ranges:	190pF to 8000pF
Voltage Ratings:	10, 15, 20, 30, 40, 50 KVDC
Temperature Characteristics:	N4700
Size:	.63″ x .79″ Dia. to 1.42″ x 2.36″ Dia.

(Best Suited for Laser Applications)

For General Purpose Applications

Capacitance Ranges:	180pF to 9300pF
Voltage Ratings:	10, 15, 20, 30, 40 KVDC
Temperature Characteristics:	Z5V
Size:	.75″ x .79″ Dia. to 1.61″ x 2.36″ Dia.

High Voltage, High Current Ceramic Capacitors—DC Series

Operating Temperature Range:	−55°C to +85°C
Insulation Resistance:	10^4 megohms min. at 500 VDC
Capacitance Range:	3 to 1000pF
Capacitance Tolerance:	D thru M depending on Cap. Value
Rated Voltage:	5 to 20 KVDC
R.F. Current Rating (30 MHz):	1.4 to 35 Amp
Temperature Coefficient:	CH, UJ, F, YL

PLEASE CONTACT OUR FACTORY FOR SPECIAL REQUESTS

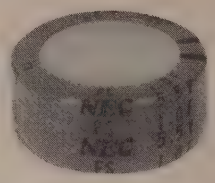
MURATA ERIE NORTH AMERICA 220 Lake Park Dr., Smyrna, Georgia 30080 Tel: 1-800-831-9172 Telex: 26-1301 FAX: 1-404-684-1541

NEC Electronics Inc.
475 Ellis St., Mountain View, CA 94039-7241
Telephone: 1-800-366-9782 FAX #: 1-800-729-9288

NEC SUPERCAP®—ELECTRIC DOUBLE LAYER CAPACITORS

SUPERCAP is a completely innovative type of capacitor providing a volumetric efficiency (capacitance per unit volume of a given voltage) of 10 to 50 times that of conventional aluminum electrolytic capacitors. The high capacitance (1 000 000 microfarads) and low leakage current makes the **SUPERCAP** an efficient, reliable, and cost effective energy storage device. **SUPERCAP** can be used as standby power sources for CMOS memories and microcomputers up to several weeks during power outages.

The **SUPERCAP** can be assembled on printed circuit boards by conventional soldering processes together with all other components. The **SUPERCAP** can be charged and discharged at both high and low current rates; i.e., microamps to amps.



Shown Actual Size

SUPERCAP Catalog Numbering System

F— 0H 105 Z

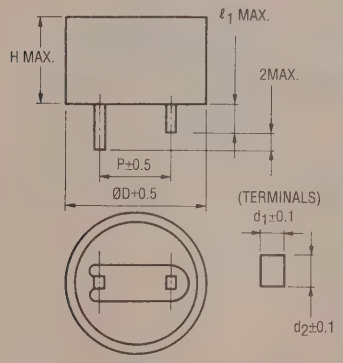
- Capacitance tolerance: $^{+80}_{-20}$%
- Capacitance; First two digits represent significant figures. 3rd digit specifies number of zeros to follow. Microfarad code.
- Max. DC working voltage
  OH: 5.5V
  1A: 11V
- Super capacitor
  FA: FA-Series
  FS: FS-Series
  FYH: FY-Series
  FYD: FY-Series
  FYL: FY-Series
  FR: FR-Series
  FE: FE-Series
  FM: FM Series

STANDARD PRODUCTS

FA SERIES

Catalog NBR	Cap. (Farad)	Max. W.V. (V.D.C.)	Max. ESR (Ω at 1 kHz)	Charging Max. I_3 (mA)	Max. I_2 (mA)	Dimensions (Unit)	D	H max.	P	d_1	d_2	l_1 max
FA0H473Z	0.047	5.5	20		0.071	mm (inch)	16.0 (0.630)	15.5 (0.610)	5 (0.197)	0.6 (0.024)	1.2 (0.047)	5.0 (0.197)
FA0H104Z	0.1	5.5	8		0.15	mm (inch)	21.5 (0.846)	15.5 (0.610)	7.5 (0.295)	0.6 (0.024)	1.2 (0.047)	5.5 (0.217)
FA0H224Z	0.22	5.5	5		0.33	mm (inch)	28.5 (1.122)	16.5 (0.650)	10 (0.394)	1.0 (0.039)	5.5 (0.055)	9.5 (0.374)
FA0H474Z	0.47	5.5	3.5		0.71	mm (inch)	36.5 (1.437)	16.5 (0.650)	15 (0.591)	0.6 (0.024)	1.7 (0.067)	9.5 (0.374)
FA0H105Z	1.0	5.5	2.5		1.5	mm (inch)	44.5 (1.752)	18.5 (0.728)	20 (0.787)	1.0 (0.039)	1.4 (0.055)	9.5 (0.374)
FA1A223Z	0.022	11	20		0.066	mm (inch)	16.0 (0.630)	25.0 (0.984)	5 (0.197)	0.6 (0.024)	1.2 (0.047)	5.0 (0.197)
FA1A104Z	0.1	11	8		0.3	mm (inch)	28.5 (1.122)	25.5 (1.004)	10 (0.394)	1.0 (0.039)	1.4 (0.055)	9.5 (0.374)
FA1A224Z	0.22	11	6		0.66	mm (inch)	36.5 (1.437)	27.5 (1.083)	15 (0.591)	1.0 (0.039)	1.4 (0.055)	9.5 (0.374)
FA1A474Z	0.47	11	4		1.41	mm (inch)	44.5 (1.752)	28.5 (1.122)	20 (0.787)	1.0 (0.039)	1.4 (0.055)	9.5 (0.374)

DIMENSIONS (UNIT: mm)



FS SERIES

FS0H223Z	0.022	5.5	60	0.033	mm (inch)	11.5 (0.453)	8.5 (0.335)	5.08 (0.200)	0.4 (0.016)	1.2 (0.047)	2.7 (0.106)
FS0H473Z	0.047	5.5	40	0.071	mm (inch)	13.0 (0.512)	8.5 (0.335)	5.08 (0.200)	0.4 (0.016)	1.2 (0.047)	2.2 (0.087)
FS0H104Z	0.1	5.5	25	0.15	mm (inch)	16.5 (0.650)	8.5 (0.335)	5.08 (0.200)	0.4 (0.016)	1.2 (0.047)	2.7 (0.106)
FS0H224Z	0.22	5.5	25	0.33	mm (inch)	16.5 (0.650)	13.0 (0.512)	5.08 (0.200)	0.4 (0.016)	1.2 (0.047)	2.7 (0.106)
FS0H474Z	0.47	5.5	13	0.71	mm (inch)	21.5 (0.846)	13.0 (0.512)	7.62 (0.300)	0.6 (0.024)	1.2 (0.047)	3.0 (0.118)
FS0H105Z	1.0	5.5	7	1.5	mm (inch)	28.5 (1.122)	14.0 (0.551)	10.16 (0.400)	0.6 (0.024)	1.4 (0.055)	6.1 (0.240)

See NECEL's other products in Sections 2450, 3700 and 4500.

These specifications are subject to change without notice.

NEC Electronics Inc.
475 Ellis St., Mountain View, CA 94039-7241
Telephone: 1-800-366-9782 FAX #: 1-800-729-9288

NEC SUPERCAP®—ELECTRIC DOUBLE LAYER CAPACITORS (Continued)

STANDARD PRODUCTS

FY SERIES • FYD Type: Small Diameter

Catalog NBR	Cap. (Farad)	Max. W.V. (V.D.C.)	Max. ESR (Ω at 1 kHz)	Max. I_a (mA)	SD* (V)	Dimensions (Unit)	D	H max.	P	d_1	d_2	ℓ_1 max.
FYD0H223Z	0.022	5.5	220	0.033	4.2	mm (inch)	11.5 (0.453)	8.5 (0.335)	5.08 (0.200)	0.4 (0.016)	1.2 (0.047)	2.7 (0.106)
FYD0H473Z	0.047	5.5	220	0.071	4.2	mm (inch)	11.5 (0.453)	8.5 (0.335)	5.08 (0.200)	0.4 (0.016)	1.2 (0.047)	2.7 (0.106)
FYD0H104Z	0.1	5.5	100	0.15	4.2	mm (inch)	13.0 (0.512)	8.5 (0.335)	5.08 (0.200)	0.4 (0.016)	1.2 (0.047)	2.2 (0.087)
FYD0H224Z	0.22	5.5	120	0.33	4.2	mm (inch)	14.5 (0.571)	15.0 (0.591)	5.08 (0.200)	0.4 (0.016)	1.2 (0.047)	2.4 (0.095)
FYD0H474Z	0.47	5.5	65	0.71	4.2	mm (inch)	16.5 (0.65)	15.0 (0.591)	5.08 (0.200)	0.4 (0.016)	1.2 (0.047)	2.7 (0.106)
FYD0H105Z	1.0	5.5	35	1.5	4.2	mm (inch)	21.5 (0.85)	16.0 (0.629)	7.62 (0.300)	0.6 (0.024)	1.2 (0.047)	3.0 (0.118)
FYD0H145Z	1.4	5.5	45	2.1	4.2	mm (inch)	21.5 (.85)	19.0 (0.748)	7.62 (0.300)	0.6 (0.024)	1.2 (0.047)	3.0 (0.118)
FYD0H225Z	2.2	5.5	35	3.3	4.2	mm (inch)	28.5 (1.122)	22.0 (0.866)	10.16 (0.400)	0.6 (0.024)	1.4 (0.055)	6.1 (0.240)

FY SERIES • FYH Type: Low Height

FYH0H223Z	0.022	5.5	200	0.033	4.2	mm (inch)	11.5 (0.453)	7.0 (0.276)	5.08 (0.200)	0.4 (0.016)	1.2 (0.047)	2.7 (0.106)
FYH0H473Z	0.047	5.5	100	0.071	4.2	mm (inch)	13.0 (0.512)	7.0 (0.276)	5.08 (0.200)	0.4 (0.016)	1.2 (0.047)	2.2 (0.087)
FYH0H104Z	0.1	5.5	50	0.15	4.2	mm (inch)	16.5 (0.65)	7.5 (0.295)	5.08 (0.200)	0.4 (0.016)	1.2 (0.047)	2.7 (0.106)
FYH0H224Z	0.22	5.5	60	0.33	4.2	mm (inch)	16.5 (0.65)	9.5 (0.374)	5.08 (0.200)	0.4 (0.016)	1.2 (0.047)	2.7 (0.106)
FYH0H474Z	0.47	5.5	35	0.71	4.2	mm (inch)	21.5 (0.85)	10.0 (0.394)	7.62 (0.300)	0.6 (0.024)	1.2 (0.047)	3.0 (0.118)
FYH0H105Z	1.0	5.5	20	1.5	4.2	mm (inch)	28.5 (1.122)	11.0 (0.433)	10.16 (0.400)	0.6 (0.024)	1.4 (0.055)	61 (0.240)

FY SERIES • FYL Type: Very Low Height

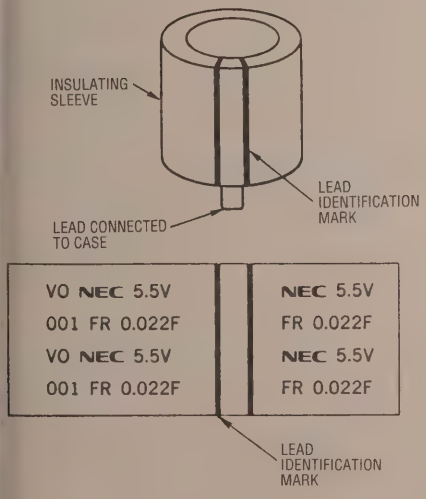
FYL0H103Z	0.01	5.5	300	0.015	4.2	mm (inch)	11.0 (0.43)	5.0 (0.197)	5.08 (0.200)	0.4 (0.016)	1.2 (0.047)	2.7 (0.106)
FYL0H223Z	0.022	5.5	200	0.033	4.2	mm (inch)	11.0 (0.43)	5.0 (0.197)	5.08 (0.200)	0.4 (0.016)	1.2 (0.047)	2.7 (0.106)
FYL0H473Z	0.047	5.5	200	0.071	4.2	mm (inch)	12.0 (0.47)	5.0 (0.197)	5.08 (0.200)	0.4 (0.016)	1.2 (0.047)	2.2 (0.087)

*SD: Voltage holding characteristic.

FR SERIES

Part Number	Cap. (Farads)	Max. W.V.	Max. ESR (Ω at 1 kHz)	Charging Current (at 30 Min.) (mA)	Voltage Holding Characteristics (V)	Dimensions φD	H	P	L	d_1	d_2
FR0H223Z	0.022	5.5	220	0.033	4.2	11.5	14.0	5.08	2.7	0.4	1.2
FR0H473Z	0.047	5.5	110	0.071	4.2	14.5	8.5	5.08	2.4	0.4	1.2
FR0H104Z	0.10	5.5	150	0.15	4.2	14.5	15.5	5.08	2.4	0.4	1.2
FR0H224Z	0.22	5.5	180	0.33	4.2	14.5	21.0	5.08	2.4	0.4	1.2
FR0H474Z	0.47	5.5	100	0.71	4.2	16.5	21.5	5.08	2.7	0.4	1.2
FR0H105Z	1.0	5.5	60	1.5	4.2	21.5	22.0	7.62	3.0	0.6	1.2

FR SERIES MARKINGS



See NECEL's other products in Sections 2450, 3700 and 4500.

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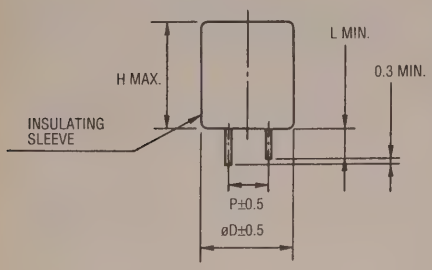
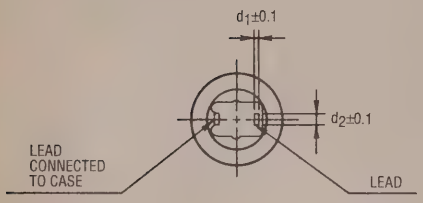
Telephone: 1-800-366-9782 FAX #: 1-800-729-9288

NEC SUPERCAP®—ELECTRIC DOUBLE LAYER CAPACITORS (Continued)

DIMENSIONS (UNIT: mm)



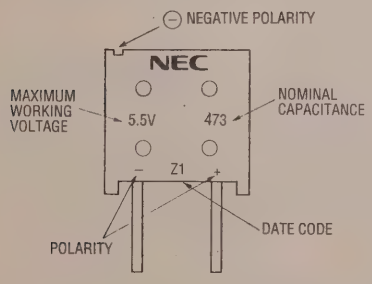


STANDARD PRODUCTS

FE SERIES

Part Number	Cap. (Farads)	Max. W.V.	Max. ESR (Ω at 1 kHz)	Charging Current (at 30 Min.) (mA)	Dimensions					
					φD	H	P	L	d_1	d_2
FE0H473Z	0.047	5.5	14.0	0.071	14.5	14.0	5.1	2.2	0.4	1.2
FE0H104Z	0.10	5.5	6.5	0.15	16.5	14.0	5.1	2.7	0.4	1.2
FE0H224Z	0.22	5.5	3.5	0.33	21.5	15.5	7.6	3.0	0.6	1.2
FE0H474Z	0.47	5.5	1.8	0.71	28.5	16.5	10.2	6.1	0.6	1.4
FE0H105Z	1.0	5.5	1.0	1.5	36.5	18.5	15.0	6.1	0.6	1.7
FE0H155Z	1.5	5.5	0.6	2.3	44.5	18.5	20.0	6.1	1.0	1.4

MARKINGS

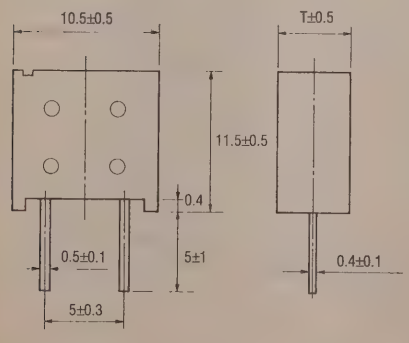


FM-Series

Part Number		Max. Working Voltage (V . DC)	Nominal Capacitance (F)	ESR (at 1 kHz) max. (Ω)	Charging Current (30 min) max. (mA)	Voltage Holding Characteristic min. (V)	T (mm)	Weight (g)
	Ammo pack							
FM0H103Z	FM0H103ZTP (*)	5.5	0.01	300	0.015	4.2	5.0	1.3
FM0H223Z	FM0H103ZTP (*)	5.5	0.022	200	0.033	4.2	5.0	1.3
FM0H473Z	FM0H473ZTP (*)	5.5	0.047	200	0.071	4.2	5.0	1.3
FM0H104Z	FM0H104ZTP (*)	5.5	0.10	100	0.15	4.2	6.5	1.6

* To complete part number, insert height of component from tape center; "16" for 16 mm or "18" for 18 mm

DIMENSIONS (UNIT: mm)



See NECEL's other products in Sections 2450, 3700 and 4500.

These specifications are subject to change without notice.

NEC Electronics Inc.
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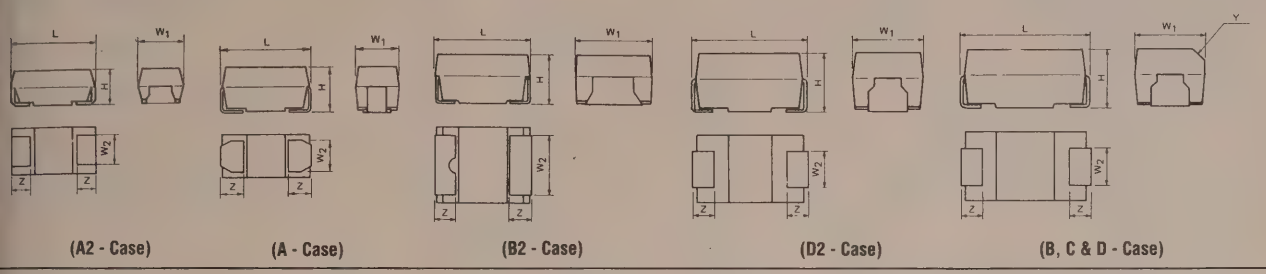
Telephone: 1-800-366-9782 FAX #: 1-800-729-9288

R-SERIES SOLID TANTALUM CAPACITORS

DIMENSIONS [mm]



(A2 - Case) (A - Case) (B2 - Case) (D2 - Case) (B, C & D - Case)

PERFORMANCE CHARACTERISTICS

- Operating temperature range −55 to +125°C with proper voltage derating as shown in following table.
- DC working voltage and surge voltage

Working	@ 85°C	2.5	4	6.3	10	16	20	25	35	V
	@ 125°C	1.6	2.5	4	6.3	10	13	16	22	V
Surge	@ 85°C	3.3	5.2	8	13	20	26	33	46	V

- Capacitance (at 25°C, 120 Hz)
  Range 0.01 μF to 100 μF
  Tolerance ±20%, ±10%
- Capacitance change with temperature
  −12% at −55°C,
  +12% at 85°C and +15% at 125°C.
- Dissipation factor (at 25°C, 120Hz)
  0.01 μF to 4.7 μF 4% max
  6.8 μF to 68 μF 6% max
  100 μF 8% max
- DC leakage current (at 25°C)
  0.01CVμA or 0.5μA whichever is greater
- Humidity (90 ~ 95% RH at 40°C, 500h)
  Capacitance change ±5% (±12% @ 2.5V)
  Dissipation factor 150% of initial requirements
  DC Leakage current initial requirements
- Load life (at 125°C, DC W.V., 1000h)
  Capacitance change ±10% (±12% @ 2.5V)
  Dissipation factor initial requirements
  DC Leakage current initial requirements
- Resistance to soldering heat (solder reflow @260°C, 10 sec. or solder dip @260°C, 5 sec.
  Capacitance change ±5% (±12% @ 2.5V)
  Leakage current initial requirements
  Dissipation factor initial requirements

NEC obtained IEC Qualification Approval on R-series tantalum capacitors, JP154-9, JP154-10 and JP154-11 on Sept. 29, 1987

Case Code	L	W_1	W_2	H	Z	Y
A	3.2±0.2	1.6±0.2	1.2±0.1	1.6±0.2	0.8±0.3	
A2	3.2±0.2	1.6±0.2	1.2±0.1	1.2 MAX.	0.8±0.3	
B2	3.5±0.2	2.8±0.2	2.3±0.1	1.9±0.2	0.8±0.3	
B	4.7±0.3	2.6±0.3	1.4±0.1	2.1±0.3	0.8±0.3	0.4C
C	6.0±0.3	3.2±0.3	1.8±0.1	2.5±0.3	1.3±0.3	0.4C
D2	5.8±0.3	4.6±0.3	2.4±0.1	3.2±0.3	1.3±0.3	
D	7.3±0.3	4.3±0.3	2.4±0.1	2.8±0.3	1.3±0.3	0.5C

VDC / μF	2.5	4	6.3	10	16	20	25	35	50
0.047								A	
0.068								A	
0.10						A2		A	A
0.15						A2		A	A
0.22						A2		A	B2
0.33						A2		A	B2
0.47						A2	A	A, B2, B	B2
0.68					A2	A, A2		A, B2, B	C
1.0				A2	A, A2	A2	A	A, B2, B	C
1.5			A2	A, A2	A, A2	A, A2	A, B2, B	A, B2, B, C	
2.2		A2	A, A2	A, A2	A, A2	A, B2, B	A, B2	A, B2, B, C	D
3.3		A, A2	A, A2	A, A2	A, B2, B	A, B2	B2, B, C	B2, C, D	
4.7	A2	A, A2	A, A2	A, B2, B	A, B2	B, B2, C	B2, C	C, D2, D	
6.8	A2	A, A2	A, B2, B	A, B2	B, B2, C	B2, C	C, D2, D	C, D2, D	
10	A2	A, B2, B	A, B2,	A, B, B2, C	B2, C	B2, C, D2, D	C, D2, D	D	
15	A	A, B2	A, B, B2, C	B2, C	C, D2, D	C, D2, D	D	D	
22	A	A, B, B2	B2, C	B2, C, D2, D	C, D2, D	C, D2, D	D		
33	A, B2	B2, C	B2, C, D2, D	C, D2, D	C, D2, D	D, D2			
47	B2	B2, C, D2, D	C, D2, D	C, D2, D	D, D2	D			
68	B2	C, D2, D	C, D2, D	D, D2	D				
100		C, D2, D	D, D2	D					
150		D, D2	D						
220		D							

See NECEL's other products in Sections 2450, 3700 and 4500.

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SVS - SERIES SOLID TANTALUM CAPACITORS (Ultra Miniaturized)

The SVS Series is a line-up of high performance ultra miniaturized tantalum chip capacitors. The case dimensions are 2.0 mm x 1.25 mm x 1.2 mm as shown below.

FEATURES

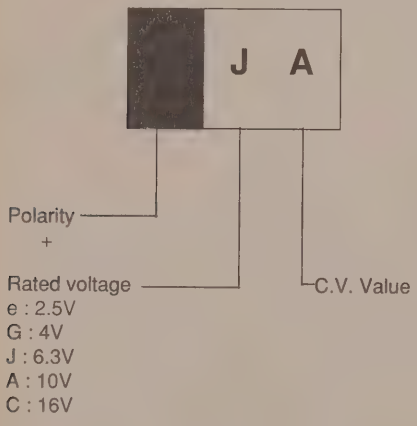
- The smallest molded chip tantalum capacitor
- Available up to 2.2 μF with case dimension of 2.0 mm x 1.25 mm x 1.2 mm (case code P)
- Case size of half as small as the EIA standard A case

APPLICATIONS

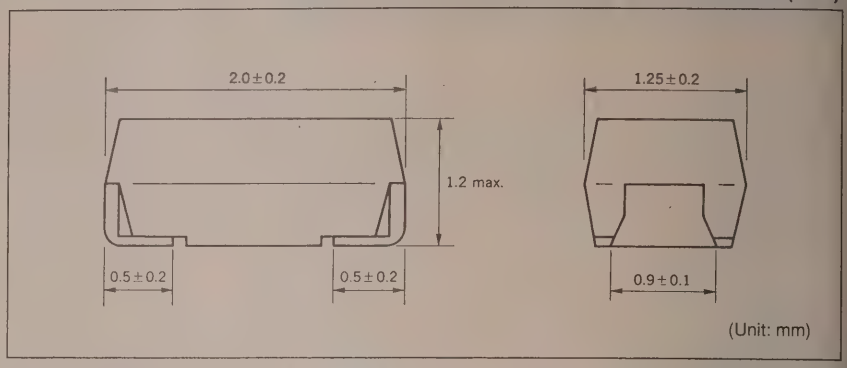
- Portable stereos
- VCR cameras
- Hearing aids

MARKING DETAIL

(ex: 6.3V/1μF)



DIMENSIONS (mm)



PRODUCT LINE-UP AND MARKING CODE

R.V. (V DC) / μF	2.5	4	6.3	10	16
0.33					CN
0.47					CS
0.68				AW	CW
1			JA	AA	
1.5		GE	JE		
2.2	eJ	Gj			
3.3	eN				

PART NUMBERING SYSTEM

[BULK]

SVS P OJ 105 M

- M: Capacitance tolerance ±20%
- 105: Capacitance code in pF. First two digits represent significant figures. Third digit specifies number of zeros to follow.
- OJ: Rated Voltage. OE: 2.5V, OG: 4V, OJ: 6.3V, 1A: 10V, 1C: 16V
- P: Case Code
- SVS: SVS Series

[TAPE & REEL]

TE SVSPOJ105M 8 R

- R: Packing orientation. R: Cathode on the side of sprocket hole; L: Anode on the side of sprocket hole
- 8: Tape width 8mm
- SVSPOJ105M: Part number of bulk (see left)
- TE: Tape and reel

See NECEL's other products in Sections 2450, 3700 and 4500.

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SVF-SERIES SOLID TANTALUM CAPACITORS (Fuse Built-In Type)

PERFORMANCE CHARACTERISTICS

- Operating temperature range −55 to +125°C with proper voltage derating as shown in following table.

- DC working voltage and surge voltage

Working	@ 85°C	10	16	20	25	35	50	V
	@125°C	6.3	10	13	16	22	33	V
Surge	@ 85°C	13	20	26	33	46	65	V

- Capacitance (at 25°C, 120 Hz)
  Range 1.0 µF to 33 µF
  Tolerance ±20%

- Capacitance change with temperature
  Not to exceed −12% at −55°C, +12% at 85°C and +15% at 125°C.

- Dissipation factor (at 25°C, 120Hz)
  1.0 µF to 4.7 µF less than 0.04
  6.8 µF to 33 µF less than 0.06

- DC leakage current (at 25°C)
  0.01CVµA or 0.5µA whichever is greater

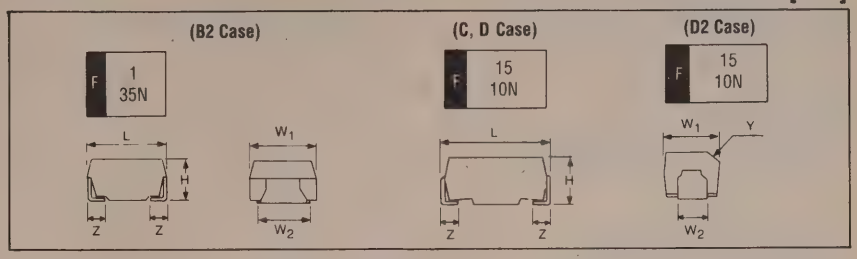
- Humidity (90 ~ 95% RH at 40°C, 500h)
  Capacitance change ±5%
  Dissipation factor 150% of initial requirements
  DC Leakage current initial requirements

- Load life (at 85°C, DC W.V., 1000h)
  Capacitance change ±10%
  Dissipation factor initial requirements
  DC Leakage current initial requirements

- Resistance to soldering heat or solder dip @260°C, 5 sec.
  Capacitance change ±5%
  Leakage current initial requirements
  Dissipation factor initial requirements

- Fuse blow-out characteristic
  Blow-out time:
  B2: 2A-5 sec Max.
  C: 2A-10 sec Max.
  D,D2: 2A-20 sec Max.

DIMENSIONS [mm]



Case Code	L	W_1	W_2	H	Z	Y
B2	3.5±0.2	2.8±0.2	2.3±0.1	1.9±0.2	0.8±0.3	—
C	6.0±0.3	3.2±0.3	1.8±0.1	2.5±0.3	1.3±0.3	0.4C
D2	5.8±0.3	4.6±0.3	2.4±0.1	3.2±0.3	1.3±0.3	—
D	7.3±0.3	4.3±0.3	2.4±0.1	2.8±0.3	1.3±0.3	0.5C

NOTE: For details regarding marking, part number, tape and reel request catalog.

STANDARD RATINGS

Part Number	Working Voltage (V DC)	Capacitance (F)	Dissipation Factor	Leakage Current (µA)	Case Code
TESVFB21A475M8R	10	4.7	0.04	0.5	B2
TESVFC1A156M12R		15	0.06	1.5	C
TESVFD21A156M12R		15	0.06	1.5	D2
TESVFD1A156M12R		15	0.06	1.5	D
TESVFD21A336M12R		33	0.06	3.3	D2
TESVFD1A336M12R		33	0.06	3.3	D
TESVFD1A476M12R		47	0.06	4.7	D
TESVFB21C335M8R	16	3.3	0.04	0.5	B2
TESVFC1C475M12R		4.7	0.04	0.7	C
TESVFC1C685M12R		6.8	0.06	1.0	C
TESVFC1C106M12R		10	0.06	1.6	C
TESVFD21C156M12R		15	0.06	2.4	D2
TESVFD21C226M12R		22	0.06	3.5	D2
TESVFD1C226M12R		22	0.06	3.5	D
TESVFD1C336M12R		33	0.06	5.2	D
TESVFB21D225M8R	20	2.2	0.04	0.5	B2
TESVFC1D475M12R		4.7	0.04	0.9	C
TESVFD21D106M12R		10	0.06	2.0	D2
TESVFD1D106M12R		10	0.06	2.0	D
TESVFD1D156M12R		15	0.06	3.0	D
TESVFD1D226M12R		22	0.06	4.4	D
TESVFB21E155M8R	25	1.5	0.04	0.5	B2
TESVFC1E335M12R		3.3	0.04	0.8	C
TESVFD21E685M12R		6.8	0.06	1.7	D2
TESVFD1E685M12R		6.8	0.06	1.7	D
TESVFD1E106M12R		10	0.06	2.5	D
TESVFB21V105M8R	35	1.0	0.04	0.5	B2
TESVFC1V225M12R		2.2	0.04	0.7	C
TESVFD21V475M12R		4.7	0.04	1.6	D2
TESVFD1V475M12R		4.7	0.04	1.6	D
TESVFD1V685M12R		6.8	0.06	2.3	D
TESVFC1H105M12R	50	1.0	0.04	0.5	C

DATE CODE

Year \ Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1991	a	b	c	d	e	f	g	h	j	k	l	m
1992	n	p	q	r	s	t	u	v	w	x	y	z
1993	A	B	C	D	E	F	G	H	J	K	L	M
1994	N	P	Q	R	S	T	U	V	W	X	Y	Z

See NECEL's other products in Sections 2450, 3700 and 4500.

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Y5U CHARACTERISTIC CHIP TYPE MULTILAYER CERAMIC CAPACITORS

PERFORMANCE CHARACTERISTICS

Operating temperature range
-55 to +125°C

DC rated voltage
25, 50, 100 V. DC

Capacitance (at 25°C, 1kHz)
Range 0.1 µF to 22 µF
Tolerance +80%, -20%

Temperature characteristic
+22%, -56% with no voltage applied
(EIA code Y5U)

Dissipation factor (at 25°C, 1 kHz)
0.07 MAX.

Dielectric strength
250% of DC rated voltage

Insulation resistance (at 25°C)
Over 1000Ω • F

Humidity (90 to 95% RH at 40°C, 500h)
Capacitance change ±15%
Dissipation factor 0.07 MAX.
Insulation resistance Over 200Ω • F

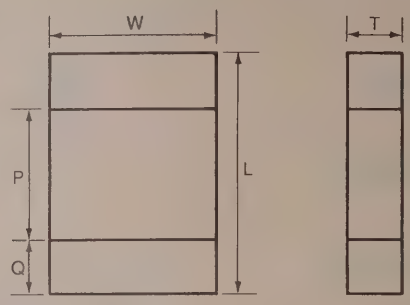
Load life (at 85°C, 200% of DC R.V., 1000h)
Capacitance change ±30%
Dissipation factor 0.07 MAX.
Insulation resistance Over 400Ω • F

CATALOG NUMBERING SYSTEM

C23 Y5U 1H 105 Z TE08

- TE08: Tape width 8 mm for TE08, 12 mm for TE12
- Z: Capacitance tolerance Z: +80%, -20%
- 105: Capacitance (pF)
- 1H: DC rated voltage 1E: 25V, 1H: 50V, 2A: 100V
- Y5U: Temperature characteristic
- C23: Size code

DIMENSIONS



STANDARD RATINGS

Catalog Number	DC Rated Voltage (V)	Capacitance (µF)	Case Code	Case Size (mm) L	W	P MIN.	Q MIN.	T MAX.	Taping K (±0.2)
C23Y5U1E225Z	25	2.2	C23	3.2±0.3	2.5±0.3	1.0	0.3	1.6	2.0
C23Y5U1E335Z		3.3	C23	3.2±0.3	2.5±0.3	1.0	0.3	2.0	2.2
C34Y5U1E475Z		4.7	C34	4.5±0.4	3.2±0.3	1.5	0.3	2.0	2.2
C34Y5U1E685Z		6.8	C34	4.5±0.4	3.2±0.3	1.5	0.3	2.0	2.2
C25Y5U1E106Z		10	C25	5.7±0.4	2.7±0.3	1.8	0.3	2.5	2.7
C55Y5U1E156Z		15	C55	5.7±0.4	5.0±0.4	1.8	0.3	2.0	3.2
C55Y5U1E186Z		18	C55	5.7±0.4	5.0±0.4	1.8	0.3	2.5	3.2
C55Y5U1E226Z		22	C55	5.7±0.4	2.7±0.3	1.8	0.3	3.0	3.2
C23Y5U1H105Z	50	1.0	C23	3.2±0.3	2.5±0.3	1.0	0.3	2.0	2.2
C23Y5U1H155Z		1.5	C23	3.2±0.3	2.5±0.3	1.0	0.3	2.5	2.7
C34Y5U1H225Z		2.2	C34	4.5±0.4	3.2±0.3	1.5	0.3	2.0	2.2
C34Y5U1H335Z		3.3	C34	4.5±0.4	3.2±0.3	1.5	0.3	2.5	2.7
C55Y5U1H475Z		4.7	C55	5.7±0.4	5.0±0.4	1.8	0.3	2.0	3.2
C55Y5U1H685Z		6.8	C55	5.7±0.4	5.0±0.4	1.8	0.3	2.5	3.2
C55Y5U1H106Z		10	C55	5.7±0.4	5.0±0.4	1.8	0.3	3.0	3.2
C13Y5U2A104Z	100	0.1	C13	3.2±0.2	1.6±0.2	1.0	0.3	1.2	1.4
C23Y5U2A224Z		0.22	C23	3.2±0.3	2.5±0.3	1.0	0.3	1.5	2.0
C23Y5U2A334Z		0.33	C23	3.2±0.3	2.5±0.3	1.0	0.3	1.5	2.0
C25Y5U2A334Z		0.33	C25	5.7±0.4	2.7±0.3	1.8	0.3	1.5	2.7
C25Y5U2A474Z		0.47	C25	5.7±0.4	2.7±0.3	1.8	0.3	1.5	2.7
C25Y5U2A684Z		0.68	C25	5.7±0.4	2.7±0.3	1.8	0.3	2.0	2.7
C25Y5U2A105Z		1.0	C25	5.7±0.4	2.7±0.3	1.8	0.3	2.5	2.7
C55Y5U2A155Z		1.5	C55	5.7±0.4	2.7±0.3	1.8	0.3	2.5	3.2
C55Y5U2A225Z		2.2	C55	5.7±0.4	2.7±0.3	1.8	0.3	3.0	3.2
C55Y5U2A335Z		3.3	C55	5.7±0.4	2.7±0.3	1.8	0.3	3.0	3.2

(Unit: mm)

Case Code	L	W	P MIN.	Q MIN.
C13	3.2±0.2	1.6±0.2	1.0	0.3
C23	3.2±0.3	2.5±0.3	1.0	0.3
C25	5.7±0.4	2.7±0.3	1.8	0.3
C34	4.5±0.4	3.2±0.3	1.5	0.3
C55	5.7±0.4	5.0±0.4	1.8	0.3

Case Code	Capacitance Range 25 DC R.V.	50 DC R.V.	100 DC R.V.
C13	—	—	0.1 µF
C23	2.2 to 3.3 µF	1.0 to 1.5 µF	0.22 to 0.33 µF
C34	4.7 to 6.8 µF	2.2 to 3.3 µF	—
C25	10 µF	—	0.33 to 1.0 µF
C55	15 to 22 µF	4.7 to 10 µF	1.5 to 3.3 µF

See NECEL's other products in Sections 2450, 3700 and 4500.

NEC Electronics Inc.
475 Ellis St., Mountain View, CA 94039-7241
Telephone: 1-800-366-9782 FAX #: 1-800-729-9288

Y5V CHARACTERISTIC CHIP TYPE MULTILAYER CERAMIC CAPACITORS

PERFORMANCE CHARACTERISTICS

Operating temperature range
-25 to +85°C

DC rated voltage
10, 16, 25, 50 DC R.V.

Capacitance (at 25°C, 1kHz)
Range 0.1 μF to 3.3 μF
Tolerance +80%, -20%

Temperature characteristic
+22%, -88% with no voltage applied
(EIA code Y5V)

Dissipation factor (at 25°C, 1 kHz)
0.05 MAX (25, 50 V. DC)
0.09 MAX (10,16 V. DC)

Dielectric strength
250% of DC rated voltage

Insulation resistance (at 25°C)
over 500Ω F

Humidity (90 to 95% RH at 40°C, 500h)
Capacitance change ±30%
Dissipation factor 0.075 MAX. (25, 50 V.DC) 0.1 MAX (10: 16 V. DC)
Insulation resistance Over 50ΩF

Load life (at 85°C, 200% of DC R.V., 1000h)
Capacitance change ±30%
Dissipation factor 0.075 MAX. (25, 50 V.DC) 0.1 MAX (10, 16 V. DC)
Insulation resistance Over 50Ω F

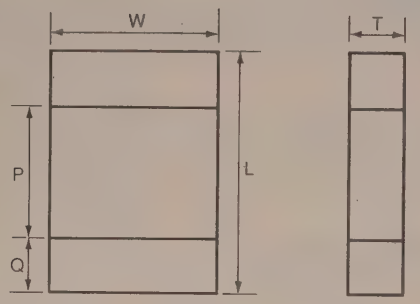
(Unit: mm)

Case Code	L	W	P MIN.	Q MIN.
C12	2.0±0.2	1.25±0.2	1.0	0.2
C13	3.2±0.2	1.6±0.2	1.0	0.3
C23	3.2±0.3	2.5±0.3	1.0	0.3
C34	4.5±0.4	3.2±0.3	1.5	0.3

Case Code	Capacitance Range		
	16 DC R.V.	25 DC R.V.	50 DC R.V.
C12	0.1 to 1.0μF	0.1 to 0.15μF	0.1μF
C13	0.22 to 4.7μF	0.22 to1.0μF	0.15 to 0.22μF
C23	—	0.68 to2.2μF	*0.33 to 0.47μF
C34	6.8 to 10μF	1.5 to 3.3μF	*0.47 to 1.0μF

* 50 DC R.V., C23-C34: Terminal Type is Ag only

DIMENSIONS



STANDARD RATINGS

Catalog Number	DC Rated Voltage (V. DC)	Case Code	Capacitance (μF)	T max. (mm)
C12Y5V1C104Z [ ]	16	C12	0.1	1.0
C12Y5V1C154Z [ ]			0.15	1.0
C12Y5V1C224Z [ ]			0.22	1.0
C12Y5V1C334Z [ ]			0.33	1.0
C12Y5V1C474Z [ ]			0.47	1.0
C12Y5V1C684Z [ ]			0.68	1.3
C12Y5V1C105Z [ ]			1.0	1.6
C13Y5V1C224Z [ ]		C13	0.22	1.0
C13Y5V1C334Z [ ]			0.33	1.0
C13Y5V1C474Z [ ]			0.47	1.0
C13Y5V1C684Z [ ]			0.68	1.0
C13Y5V1C105Z [ ]			1.0	1.0
C13Y5V1C155Z [ ]			1.5	1.0
C13Y5V1C225Z [ ]			2.2	1.3
C13Y5V1C335Z [ ]			3.3	1.8
C13Y5V1C475Z [ ]			4.7	1.8
C34Y5V1C685Z [ ]		C34	6.8	2.0
C34Y5V1C106Z [ ]			10.0	2.0
C12Y5V1E104Z [ ]	25	C12	0.1	1.3
C12Y5V1E154Z [ ]			0.15	1.3
C13Y5V1E224Z [ ]		C13	0.22	1.0
C13Y5V1E334Z [ ]			0.33	1.3
C13Y5V1E474Z [ ]			0.47	1.3
C13Y5V1E684Z [ ]			0.68	1.3
C13Y5V1E105Z [ ]			1.0	1.3
C23Y5V1E684Z [ ]		C23	0.68	1.3
C23Y5V1E105Z [ ]			1.0	1.6
C23Y5V1E155Z [ ]			1.5	2.0
C23Y5V1E225Z [ ]			2.2	2.0
C34Y5V1E155Z [ ]		C34	1.5	2.0
C34Y5V1E225Z [ ]			2.2	2.0
C34Y5V1E335Z [ ]			3.3	2.0
C12Y5V1H104Z [ ]	50	C12	0.1	1.3
C13Y5V1H154Z [ ]		C13	0.15	1.3
C13Y5V1H224Z [ ]			0.22	1.3
C23Y5V1H334Z		C23	0.33	1.6
C23Y5V1H474Z			0.47	1.6
C34Y5V1H474Z		C34	0.47	2.0
C34Y5V1H684Z			0.68	2.0
C34Y5V1H105Z			1.0	2.0

NOTE: In the [ ] "P" indicates the solder plating terminal. * Silver terminal only

CATALOG NUMBERING SYSTEM

C13 Y5V 1A 335 Z P TE08

- TE08 — Tape width 8 mm for TE08 ; 12 mm for TE12
- P — Terminal Type P: Solder plating for flow and reflow soldering non: Ag (For reflow soldering)
- Z — Capacitance tolerance Z: +80%, -20%
- 335 — Capacitance (pF)
- 1A — DC rated voltage 1A: 10V, 1C:16V, 1E: 25V, 1H: 50V
- Y5V — Temperature characteristics
- C13 — Size Code

See NECEL's other products in Sections 2450, 3700 and 4500.

MALLORY *sonalert® solid state signals*

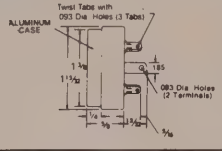
AUDIBLE ELECTRONIC SIGNALS

- Solid State
- No Mechanical Wear
- Salt Spray Resistant

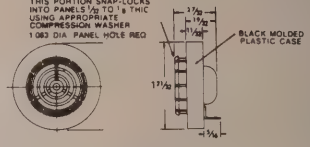
Electronically produces an audible tone when voltage is applied. Voltages from 1V to 250V may be used depending on the model. A piezoelectric transducer, operating substantially at resonance in a solid state oscillator, converts electrical power to sound, resulting in an efficient power conversion. Can be powered by many electrical sources, ranging from a single cell battery to industrial power lines. Because of low power requirement they can be turned on or off with a transistor, SCR, or integrated circuit. Temperature range: – 30°C to + 65°C. Some units will sound at voltages lower than minimum voltage specified.

OUTLINE DIMENSIONS

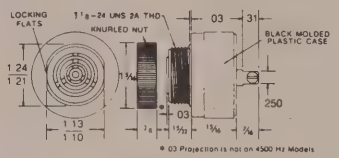
Case Style A



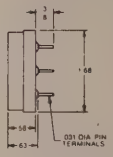
Case Style B


THIS PORTION SNAP-LOCKS INTO PANELS 1/32 TO 1/8 THIC USING APPROPRIATE COMPRESSION WASHER
1.063 DIA. PANEL HOLE REQ
BLACK MOLDED PLASTIC CASE

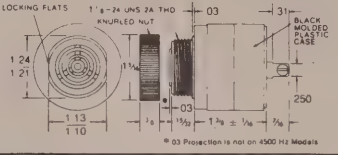
Case Style C



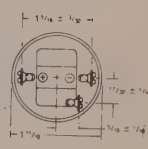
Case Style F



Case Style D



Case Style D-1



Case Style E

Case Style E has the same outline dimensions as Case Style D except length is $1\frac{15}{16}$" $\pm\frac{3}{32}$.

CONTINUOUS TONE

Type	Case Style	Loudness	Mounting Style	DC Voltage Min.	DC Voltage Max.	Typical Operating Current (mA)	Freq. ± 500 Hz	Sound Output @ 2 Feet (dB)
SC110E	D	Soft	Panel	30	120*	3 to 14	1900	55 to 65
SC628E	C	Soft	Panel	6	28	3 to 8	1900	55 to 68
SC250F	D	Soft	Panel	60	250*	1 to 4	2900	55 to 65
SC628AF	D	Soft	Panel	6	28*	1 to 4	2900	55 to 70
SC628F	C	Soft	Panel	6	28	0.5 to 3	2900	55 to 70
SC1.5	A	Soft	Twist Tab	1	4	4@1.5V	3500	60 @ 1.5V
SC6	A	Soft	Twist Tab	4	8	12@6V	3500	68 @ 6V
SC12	A	Soft	Twist Tab	8	15	14@12V	3500	70 @ 12V
SC24	A	Soft	Twist Tab	20	30	16@24V	3500	70 @ 24V
SBM2•	F	Medium	PC Board	1	5	3 to 16	2900	55 to 68
SBM428•	F	Medium	PC Board	4	28	3 to 16	2900	64 to 78
SC105	C	Medium	Panel	1	5	3 to 16	2900	60 to 75
SC110D•	D	Medium	Panel	30	120*	6 to 21	1900	60 to 75
SC250D	D	Medium	Panel	60	250*	4 to 16	1900	60 to 72
SC628AD	D	Medium	Panel	6	28*	4 to 16	1900	60 to 75
SC628D•	C	Medium	Panel	6	28	6 to 23	1900	60 to 75
SAC648AD•	D	Medium	Panel	10	48*	4 to 16	1900	60 to 75
SC648D	C	Medium	Panel	10	48	3 to 14	1900	60 to 75
SNP2	B	Medium	Snap-in Panel	1	5	2 to 12	2900	55 to 68
SNP428•	B	Medium	Snap-in Panel	4	28	3 to 18	2900	64 to 76
SC110•	D	Medium	Panel	30	120*	6 to 21	2900	68 to 80
SC250	D	Medium	Panel	60	250*	4 to 16	2900	68 to 80
SC628•	C	Medium	Panel	6	28	3 to 18	2900	68 to 80
SC628A•	D	Medium	Panel	6	28*	6 to 23	2900	68 to 80
SC648•	C	Medium	Panel	10	48	5 to 22	2900	68 to 80
SC648A	D	Medium	Panel	10	48*	4 to 16	2900	68 to 80
SC110H•	D	Medium	Panel	30	120*	6 to 21	4500	68 to 80
SC628AH	D	Medium	Panel	6	28*	4 to 16	4500	68 to 80
SC628H•	C	Medium	Panel	6	28	6 to 23	4500	68 to 80
SC648AH	D	Medium	Panel	10	48*	4 to 16	4500	68 to 80
SC648H	C	Medium	Panel	10	48	3 to 14	4500	68 to 80
SC628MN	C	Loud	Panel	6	28	4 to 16	2900	80 to 90
SC110N•	D	Loud	Panel	30	120*	8 to 28	2900	80 to 95
SC307N	C	Loud	Panel	3	7	3 to 8	2900	80 to 90
SC616N	C	Loud	Panel	6	16	4 to 16	2900	80 to 95
SC628AN	D	Loud	Panel	6	28*	8 to 28	2900	80 to 95

*AC/DC Non-polarized, all others DC only. •UL recognized, Guide UCST2, yellow cards S1290

SNP SERIES COMPRESSION WASHERS

Type	Panel Thickness (In.)
PW-1	.109 to .125 (11-12 Ga.)
PW-2	.056 to .093 (13-17 Ga.)
PW-3	.031 to .050 (18-22 Ga.)

Compression washers for panel mounting of type SNP Sonalerts. For panel holes 1.063 ± 0.005 in diameter. Mount from rear of panel.

NORTH AMERICAN CAPACITOR CO.
7545 Rockville Road, Indianapolis, IN 46214
Phone: (317) 273-0090, Fax: (317) 273-2400

MALLORY sonalert® solid state signals

INTERMITTENT TONE

FAST PULSE—Turns on and off @ 2 to 10 pps depending upon voltage @ 50% duty cycle.

Type	Case Style	Loudness	Mounting Style	DC Voltage Min.	DC Voltage Max.	Typical Operating Current (mA)	Freq. ± 500 Hz	Sound Output @ 2 Feet (dB)
SC110EP	E	Soft	Panel	30	120*	3 to 14	1900	55 to 65
SC110FP	E	Soft	Panel	30	120*	4 to 16	2900	55 to 65
SC628AEP	E	Soft	Panel	6	28*	3 to 14	1900	50 to 65
SC628ADP	E	Medium	Panel	6	28*	4 to 16	1900	60 to 75
SC648ADP	E	Medium	Panel	10	48*	4 to 16	1900	60 to 75
SC110P•	E	Medium	Panel	30	120*	6 to 21	2900	68 to 80
SC250P	E	Medium	Panel	60	250*	4 to 16	2900	68 to 78
SNP616P	B	Medium	Snap-in Panel	6	16	1 to 5	2900	65 to 75
SC628AP	E	Medium	Panel	6	28*	4 to 16	2900	68 to 80
SC628P•	D	Medium	Panel	6	28	6 to 22	2900	68 to 80
SC648AP	E	Medium	Panel	10	48*	4 to 16	2900	68 to 80
SBM616P	F	Medium	PC Board	6	16	1 to 4	2900	68 to 78
SC110HP	E	Medium	Panel	30	120*	4 to 16	4500	68 to 80
SC250HP	E	Medium	Panel	60	250*	4 to 16	4500	68 to 80
SC628AHP	E	Medium	Panel	6	28*	4 to 16	4500	68 to 80
SC628HP	D	Medium	Panel	6	28	3 to 14	4500	68 to 80
SC110NP	D	Loud	Panel	30	120*	8 to 28	2900	80 to 95
SC616NP	C	Loud	Panel	6	16	4 to 16	2900	80 to 95
SC628ANP	D	Loud	Panel	6	28*	8 to 28	2900	80 to 95

SLOW PULSE—Turns on and off @ .5 to 2 pps depending upon voltage @ 50% duty cycle.

SC110EJ	E	Soft	Panel	30	120*	3 to 14	1900	55 to 65
SC628EJ	D	Soft	Panel	6	28	3 to 8	1900	50 to 65
SC628FJ	D	Soft	Panel	6	28	3 to 14	2900	50 to 65
SC110DJ	E	Medium	Panel	30	120*	4 to 16	1900	60 to 75
SNP616J	B	Medium	Snap-in Panel	6	16	1 to 5	2900	65 to 75
SC648ADJ	E	Medium	Panel	10	48*	4 to 16	1900	60 to 75
SBM616J	F	Medium	PC Board	6	16	1 to 4	2900	68 to 78
SC110J•	E	Medium	Panel	30	120*	6 to 21	2900	68 to 80
SC250J	E	Medium	Panel	60	250*	4 to 16	2900	68 to 78
SC628AJ	E	Medium	Panel	6	28*	4 to 16	2900	68 to 80
SC628J•	D	Medium	Panel	6	28	6 to 22	2900	68 to 80
SC648AJ	E	Medium	Panel	10	48*	4 to 16	2900	68 to 80
SC110HJ	E	Medium	Panel	30	120*	4 to 16	4500	68 to 80
SC628ANJ	D	Loud	Panel	6	28	8 to 28	2900	80 to 95
SC110NJ	D	Loud	Panel	30	120*	8 to 28	2900	80 to 95
SC616NJ	C	Loud	Panel	6	16	4 to 16	2900	80 to 95

DUAL-MODE OPERATION—CONTINUOUS OR FAST PULSE

SC616PU	C-1	Medium	Panel	6	16	3 to 12	2900	68 to 78
SBM616PU	F	Medium	PC Board	6	16	3 to 12	2900	68 to 78
SC616NPU	D-1	Loud	Panel	6	16	4 to 16	2900	80 to 90

SHORT PULSE—Turns on and off @ .5 to 2 pps depending upon voltage @ 10% duty cycle.

SC110K •	E	Medium	Panel	30	120*	6 to 22	2900	68 to 80
SC628K	D	Medium	Panel	6	28	3 to 14	2900	68 to 80

FAST WARBLE—Produces two tones alternatively when used with additional continuous tone units.

SC628FW‡	D-1	Soft	Panel	6	28	3 to 14	2900	55 to 70
SC628W†	D-1	Medium	Panel	6	28	3 to 16	2900	68 to 80

SLOW WARBLE—Produces two tones alternatively when used with additional continuous tone units.

SC628FJW‡	D-1	Soft	Panel	6	28	3 to 14	2900	55 to 70
SC628JW†	D-1	Medium	Panel	6	28	3 to 16	2900	68 to 80

CHIME TONE—Chimes every one to two seconds as long as voltage is applied.

SC616CP	D	Medium	Panel	6	16	3 to 8	2900	68 to 78

CHIRP TONE—Pulse rate is 20–60 pps.

SC110Q**	C	Medium	Panel	30	120	6 to 22	2900	68 to 80
SC616Q	C-1	Medium	Panel	6	16	1 to 4	2900	68 to 78

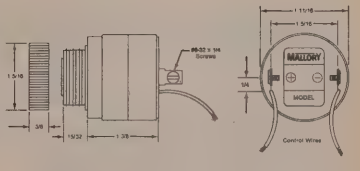
*AC/DC non-polarized; **AC only; †Use with SC628D; ‡Use with SC628E •UL recognized, Guide #UCST2, yellow cards S1290

MULTI-TONE SONALERTS

Type SC616WY tone patterns are pulsate-high-frequency, pulsate-low-frequency, and warble. Type SC616WXY has two additional tones, continuous high and low frequency. Operating modes determined by connection of two control wires. Both employ solid state circuitry.

Type	Voltage Min.	Voltage Max.	Typical Current (mA) @ Min. V	Typical Current (mA) @ Max. V	Tone Frequency ± 300Hz High	Tone Frequency ± 300Hz Low	Pulse Rate/Sec.*	Sound Pressure @ 2 Feet (dB)
SC616WY	6	16	2	18	3000	1750	0.5-1.2	60 to 72
SC616WXY	6	16	2	18	3000	1750	0.5-1.2	60 to 72

*50% duty cycle



COMPACT SONALERT II AUDIBLE SIGNALS

Miniature piezoelectric audible signal. Standard printed circuit mounting. Low power consumption. Suitable for fire alarm, call buzzer, car alarm, clocks, and cash register applications.

Type	Fig.	Frequency	Sound Pressure dB@ 2Ft.	Input DC Voltage	Current (mA) @ 12VDC
MSR320•	1	3.4 ± 0.5kHz	75dB Min. @ 12VDC	3-20VDC	16 mA Max.
MSO320*	2	3.4 ± 0.5kHz	75dB Min. @ 12VDC	3-20VDC	16 mA Max.

* Sealed for wave soldering on special order

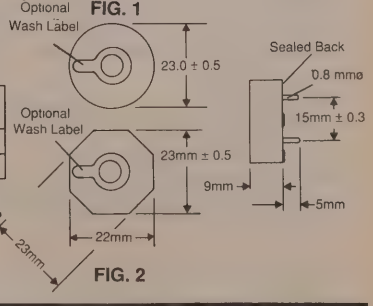


FIG. 1

FIG. 2

NORTH AMERICAN CAPACITOR CO.
7545 Rockville Road, Indianapolis, IN 46214
Phone: (317) 273-0090, Fax: (317) 273-2400

MALLORY *military and custom design*

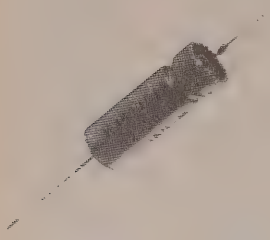
OVER 50 years application engineering experience serving Aerospace, Military and Oil Exploration Markets. From extreme temperatures of space to the rugged requirements of oil exploration, Mallory can supply Custom Designs for unique applications.

Readily available standard metal case designs in hermetic sealed cans available in 12 case sizes. Molded flat pack case in 1/2 inch thick × 2 inch square, or we can design around your specifications. Let the Mallory Design Group tackle your problem.

The wet Tantalum capacitors shown below can be configured into a custom module to meet the requirements of your specific application.

ESTABLISHED RELIABILITY, HERMETICALLY SEALED / WET SLUG TANTALUM CAPACITORS

MIL-C-39006/22 TANTALUM CASE / STYLE CLR 79



HIGHLIGHTS

Capacitance: 1.7 to 1200µF
Voltage: 6 to 125WVDC
Tolerance: ±5%, ±10%, ±20%
Temperature: −55°C to 85°C to 125°C with proper derating
Case Sizes: 4 sizes available .188″ x .453″ to .375″ x 1.062″

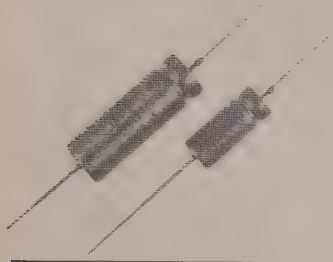
KEY FEATURES

Reverse Voltage Capability
Higher Ripple Current Capability
Tantalum Case
Hermetic Seal
Low ESR, Low DCL
Rugged Mechanical Construction

APPLICATIONS

Filtering, bypass, coupling, energy storage
Low source impedance circuits
High charging current circuits

MIL-C-39006/25 TANTALUM CASE (EXTENDED RANGE) / STYLE CLR 81



HIGHLIGHTS

Capacitance: 6.8 to 2200µF
Voltage: 6 to 125WVDC
Tolerance: ±10%, ±20%
Temperature: −55°C to 85°C (to 125°C with proper derating)
Case Sizes: 4 sizes available .188″ x .453″ to .375″ x 1.062″

KEY FEATURES

Reverse Voltage Capability
Higher Ripple Current Capability
Tantalum Case
Hermetic Seal
Low ESR, Low DCL
Rugged Mechanical Construction
Highest CV per Case Size

APPLICATIONS

Filtering, bypass, coupling, energy storage
Low source impedance circuits
High charging current circuits
Switching regulator supplies

THT TANTALUM CASE (TEMPERATURE RANGE TO +200°C)

HIGHLIGHTS

Capacitance: to 1200µF
Voltage: 6 to 125VDC @ 85°C
3.6 to 75 VDC @ 200°C
Tolerance: ±10%, ±20%
Temperature: −55°C to 200°C with voltage derating.
Case Sizes: 4 sizes available .188″ x .453″ to .375″ x 1.062″

KEY FEATURES

Operation to 200°C
All tantalum construction.
Hermetic Seal.
Reverse Voltage Capability.
Higher ripple current rating.
Low ESR, Low DCL

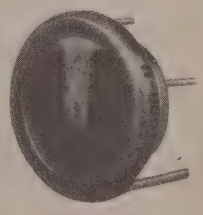
APPLICATIONS

Filtering, bypass, coupling, timing, circuits.
Low source impedance circuits
High charge current circuits

W13 SERIES ALL-TANTALUM BUTTON CAPACITOR

FEATURES

- **High AC and Surge Currents**
  No derating for frequency or wave shape
- **Reverse Voltage to +125°C**
  Fully oxidized tantalum cathode
- **Long Life Operation and Shelf**
  No metal migration or degradation of dielectric
- **Seal Integrity**
  Tested for over 300 thermal-shock cycles and vacuum life
- **100% Burn-In**
  Five thermal-shock cycles followed by 48 hrs., 85°C, rated VDC
- **Convenient Packaging Form**
  Mounting styles prevent reverse installation



RANGES

Style	Application	Capacitance Range µF	Voltage Range Volts	Temperature Range °C	Reverse Voltage Capacity Volts
CP/CS	STANDARD MIL-C-83500 RANGE	47 to 1200	125 to 6	−55 to +85/125	3
EP/ES	EXTENDED CAPACITANCE RANGE	82 to 1500	125 to 6	−55 to −85/125	3

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MALLORY wet slug tantalum electrolytic capacitors

MILITARY–ESTABLISHED RELIABILITY TYPE

		Style	Mil Spec	Type	Description	Features	Temp. Range (°C)	Voltage Range (WVDC)	Cap. Range (µF)	Standard Tolerance %
ALL TANTALUM / SILVER CASE AXIALS		CLR79	M39006/22 Failure Rates: M, P & R	TLT	All Tantalum Hermetic Seal Mylar Sleeve High Vibration	Reverse Voltage High Ripple No Silver Migration	–55 to +125	6 to 125	1.7 to 1200	±10, 20
		CLR81	M39006/25 Failure Rates: M, P & R	TXT	All Tantalum Hermetic Seal Mylar Sleeve High Vibration	Reverse Voltage High Ripple No Silver Migration Extended Cap. Range	–55 to +125	6 to 125	6.8 to 2200	±10, 20
		CLR65	M39006/09 Failure Rates: M, P & R	TLX	Hermetic Seal Mylar Sleeve Silver Case	Std. Cap. Range High CV/Case	–55 to +125	6 to 125	1.7 to 1200	±10,20
		CLR69	M39006/21 Failure Rates: M, P & R	TXX	Hermetic Seal Mylar Sleeve Silver Case	Ext. Cap. Range Highest CV/Case	–55 to +125	6 to 125	6.8 to 2200	±10, 20
MODULE		CLR10	Mil-C-39006/18 Failure Rates: L, M & P	XTM XTK	Metal Can Hermetic Seal Silver Case	Very High Temp. High Cap. & Voltage High Shock & Vibration	–55 to +200	8 to 360	2 to 140	–15 +50,75 ±20
		CLR14	Mil-C-39006/19 Failure Rates: L, M & P	XTH XTL	Metal Can Hermetic Seal Silver Case	Very High Temp. High Cap. & Voltage High Shock & Vibration	–55 to +200	20 to 360	3.5 to 200	–15 +50,75 ±20
		CLR17	Mil-C-39006/20 Failure Rates: L, M & P	XTV	Metal Can Hermetic Seal Silver Case	Very High Temp. High Cap. & Voltage High Shock & Vibration	–55 to +200	30 to 630	18 to 1300	–15 +50,75 ±20

MILITARY–NON-ESTABLISHED RELIABILITY TYPE

		Style	Mil Spec	Type	Description	Features	Temp. Range (°C)	Voltage Range (WVDC)	Cap. Range (µF)	Standard Tolerance %
AXIAL		CL64/65	Mil-C-3965	TLS	Silver Tubular Elastomer Seal	Low DCL High CV/Case	–55 to +125	6 to 125	1.7 to 1200	±10, 20
		CL66/67	Mil-C-3965	TLX	Silver Tubular Hermetic Seal	Low DCL High CV/Case Long Life	–55 to +125	6 to 125	1.7 to 1200	±10, 20
MOD.		CL55	Mil-C-3965	TL	Metal Case Glass to Metal Seal	Low DCL Wide Temp. Range	–55 to +125	15 to 150	70 to 2400	±10, 20
BUTTON		CRL01	Mil-C-83500	W13	Low Profile All Tantalum P.C. Mount	Reverse Voltage High Ripple Long Shelf & Operating Life	–55 to +125	6 to 125	47 to 1200	±10, 20
		CRL02	Mil-C-83500	W13	Low Profile All Tantalum Stud Mount	Reverse Voltage High Ripple High Shock & Vibration	–55 to +125	6 to 125	47 to 1200	±10, 20

INDUSTRIAL (NON-MILITARY) TYPE

		Type	Description	Features	Temp. Range (°C)	Voltage Range (WVDC)	Cap. Range (µF)	Standard Tolerance %
MINI. AXIAL		MTP	Silver Tubular Mylar Sleeve, Resin Enseal	High Capacitance	–55 to +85	6 to 60	3.3 to 470	±10, 20
		MTPH	Silver Tubular Mylar Sleeve, Resin Enseal	High Reliability	–55 to +85	6 to 60	4.7 to 470	±10, 20
ALL TANTALUM		TLW	Hermetic Seal Kapton Sleeve	High Capacitance High Temperature	–55 to +175	6 to 125	2.5 to 1200	±10, 20
		THT	All Tantalum Hermetic Seal Kapton Sleeve	Reverse Voltage High Temperature High Ripple	–55 to +200	6 to 125	1.7 to 1200	±10, 20
		THX	All Tantalum Hermetic Seal Kapton Sleeve	High Ripple Reverse Voltage Extended Capacitance	–55 to +175°	6 to 125	1.7 to 2200	±10, 20
		TMX	All Tantalum Subassembly Steel Outer Case Glass to Metal Terminals	Reverse Voltage High Ripple Extended Capacitance High Voltage	–55 to +125	6 to 250	25 to 39,600	±10, 20
		TLH	Silver Tubular Elastomer Seal	Low DCL Extended Capacitance	–55 to +125	6 to 75	1.7 to 2200	±10, 20
BUTTON		HP (W13)	Low Profile All Tantalum P.C. Mount	Reverse Voltage High Ripple Very High Temp.	–55 to +200	6 to 75	47 to 330	±10, 20
		HS (W13)	Low Profile All Tantalum Stud Mount	Reverse Voltage High Ripple Very High Temp. High Shock & Vib.	–55 to +200	6 to 75	47 to 330	±10, 20

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MALLORY solid tantalum electrolytic capacitors

MILITARY–ESTABLISHED RELIABILITY TYPE

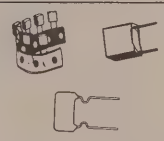
		Style	Mil Spec	Type	Features	Temp. Range (°C)	Voltage Range (WVDC)	Cap. Range (µF)	Standard Tolerance %
AXIAL LEAD		CSR13	Mil-C-39003/01 F.R.: M, P, R & S B, C, & D	TER	High Reliability	-55 to +125	6 to 100	.0047 to 330	±10, 20
		CSR23	Mil-C-39003/03 F.R.: M, P, R & S B, C, & D	TXE	High Reliability	-55 to +125	6 to 50	1.2 to 1000	±10, 20
		CSR21	Mil-C-39003/09 F.R.: M, P, R & S B, C & D	TFR	High Frequency High Ripple	-55 to +125	6 to 50	5.6 to 330	±10, 20

INDUSTRIAL (NON-MILITARY) TYPE

			Type	Features	Temp. Range (°C)	Voltage Range (WVDC)	Cap. Range (µF)	Standard Tolerance %
TUBULAR	AXIAL		TAS	Low Leakeage Temperature Stable	– 55 to + 125	6 to 100	.0047 to 330	± 10, 20
			TXA	Extended Capacitance Range	– 55 to + 125	6 to 50	1.2 to 1000	± 10, 20
			THF	High Frequency Low ESR	– 55 to + 125	6 to 50	5.6 to 330	± 10, 20
MOLDED	RAD.		TIM	High Density Mounting	– 40 to + 125	6 to 50	.10 to 220	± 10, 20
	AXIAL		TAC	High Shock & Vibration Auto-Insertable Tape & Reel Pack	– 40 to + 125	6 to 50	.10 to 330	± 10
EPOXY DIPPED	RADIAL		TDC	Low Cost Extended Capacitance Temperature Stable	– 55 to + 125	6 to 50	.10 to 330	± 10, 20
			TDL	Low Cost Low Profile	– 55 to + 125	6 to 50	.10 to 330	± 10, 20
SURFACE MOUNT			TSC	EIA 15-28 Sizes Lowest Profile Molded Package Tape & Reel Package	– 55 to 125°C	6 to 50	.1 to 150	± 10

MALLORY film capacitors/components

GENERAL PURPOSE

			Type	Description	Temp. Range (°C)	Voltage Range (WVDC)	Cap. Range	Standard Tolerance %
POLYESTER	AXIAL		150	Metallized Electrodes	-55 to +125	63 to 630	.001 to 10µF	±5,10, 20
	RADIAL		160	Metallized Electrodes	-55 to +125	63 to 1000	.001 to 10µF	±5,10, 20
			167/184	Metallized Electrodes	-55 to +125	63 to 630	.001 to 1µF	±5,10, 20
			168/185	Metallized Electrodes	-55 to +125	50 to 100	.001 to 1µF	±5,10, 20
			PVC	Metal Foil Polyester (to 600V) Polypropylene Foil (to 2000V)	-55 to +125 (100-1000VDC) -55 to +105 (1600-2000VDC)	100-2KV	.001 to .68µF	±10%
POLYPROPYLENE	AXIAL		170	Metallized Electrodes	-55 to +105	160 to 630	.001 to 4.7µF	±5,10, 20
	RADIAL		171	Metallized Electrodes	-55 to +105	160 to 630	.001 to 10µF	±5,10, 20
PRECISION CAPACITORS	AXIAL		SX	Metal Foil Electrodes Polystyrene Dielectric	-40 to +70°C	33-500	20pF to .1µF	±2.5, ±5
			148	Metallized Electrodes Polypropylene Dielectric	-55 to +105	160 to 250	.001 to 4.7µF	±1,1.25, 2,2.5
INTERFERENCE SUPPRESSOR	RADIAL		158X	Metallized Electrodes Polyester Dielectric	-40 to +100	250V-AC	.01 to 2.2µF	±20

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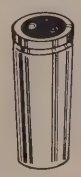
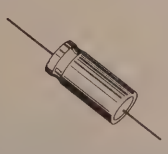
)C CAPACITORS

			Type	Description	Temp. Range (°C)	Voltage Range (WVDC)	Cap. Range	Standard Tolerance %
CERAMIC DISC			UN	X Type Filter	Z5U	125VAC	.001-.01	20%
			440L	Y Type Filter	Y5U, Z5U	250 VAC	.001-.01	20%
			AT, ASR, ATR	Spark Arrestor	Z5U	1-3 KVDC	.75pF and .01µF	-20% +80%
MULTILAYER CERAMIC	AXIAL		M	Epoxy Dipped	NPO, X7R, Z5U	50 to 200	1.0pF to 6.8µF	±5,10,20
	RADIAL		P	Epoxy Coated	NPO, X7R, Z5U	50 to 100	10pF to 1.0µF	±5,10,20
	CHIP		0402 to 5830	Chip Capacitor	NPO, X7R, Z5U	50 to 1000	1.0pF to 1.0µF	±5,10,20
MONOLOTHIC CERAMIC CAPACITORS	RADIAL		CK05	Mil-C-11015/18	X7R	50-200	10pF to .1µF	±10 ±20
			CKR05	Mil-C-39014/01 Failure Rate: M,P,R & S	X7R	50-200	10pF to .1µF	±10 ±20
			CK06	Mil-C-11015/19	X7R	50-200	1,200pF to 1.0µF	±10 ±20
			CKR06	Mil-C-39014/02 Failure Rate: M,P,R & S	X7R	50-200	1,200pF to 1.0µF	±10 ±20
	AXIAL		CKR11	Mil-C-39014/05 Failure Rate: M,P, R & S	X7R	50 & 100	10pF to .01µF	±10 ±20
			CK12	Mil-C-11015/20	X7R	50 & 100	10pF to .01µF	±10 ±20
			CKR12	Mil-C-39014/05 Failure Rate: M,P,R & S	X7R	50 & 100	5600pF to .047µF	±10 ±20
			CK13	Mil-C-11015/20	X7R	50 & 100	5600pF to .047µF	±10 ±20
			CK14	Mil-C-11015/20	X7R	50 & 100	.012µF to .27µF	±10 ±20
			CKR14	Mil-C-39014/05 Failure Rate: M, P, R & S	X7R	50 & 100	.012µF to .27µF	±10 ±20
			CK15	Mil-C-11015/20	X7R	50 & 100	.056µF to 1.0µF	±10 ±20
			CKR15	Mil-C-39014/05 Failure Rate: M,P,R & S	X7R	50 & 100	.056µF to 1.0µF	±10 ±20
			CK16	Mil-C-11015/20	X7R	50 & 100	.47µF to 3.3µF	±10 ±20
			CKR16	Mil-C-39014/05 Failure Rate:M,P, R & S	X7R	50 & 100	.47µF to 3.3µF	±10 ±20
ALUMINUM ELECTROLYTIC CAPACITORS	LARGE CAN		CGS	Computer Grade High Capacitance	-40 to +85	10 to 450	to 640,000µF	-10 +75 -10 +50
			CGH	Computer Grade-High Voltage Very High Capacitance	-40 to +85	250 to 450	620 to 22,000	-10 +50
			CGR	Computer Grade High Ripple Capability	-40 to +85	6.3 to 100	330 to 100,000	-10 +75 -10 +50
			CGO	Computer Grade Power Supply Output Filter	-55 to +95	5 to 55	2,800 to 45,000	-20 +20
			CG	Computer Grade High Reliability Long Life	-40 to +85	10 to 450	40 to 160,000	-10 +75 -10 +50
			HES	Storage Capacitor High Energy Discharge	-40 to +85	400 to 450	300 to 2,100	-0 +50
			LP, HPW	Low Profile-Snap In	-40 to +105	6.3 to 400	47 to 47,000	±20%
			LPX, LPW	Low Profile-Snap In High Capacitance	-40 to +85	10 to 450	56 to 22,000	-20 +20
			FP PFP	Twist Prong/PC Mount	-30 to +85	10 to 475	2 to 10,000 1-4 sections	-10 +50 -10 +100 -10 to +150
	TUBULAR RADIAL		WGR	Low Impedance for SMPS	-55 to +105	10 to 100	1 -4700	±20%
			TMR	Long Life, High Reliability	-40 to +105	6.3 - 400	1-4700	±20%
			UKR	Horizontal Deflection	-25 to +85	25-50	2.2-18	±20% ±10%
			FSR	For Photo Flash Applications	-25 to +55	330	100-200	-10 +20%
			VPR	High Performance Radial Leads	-55 to +105	6.3 to 100	130 to 12,000	-10 +100 -10 +75 -10 +50
			SKR	Miniature, Radial Leads	-40 to +85	6.3 to 450	.47 to 15,000	-20 +20
			TKR	Miniature, Radial Leads High Reliability	-40 to +105	6.3 to 400	.47 to 15,000	-20 +20
			SSR	Sub-Miniature 7mm Ht. Radial Leads	-40 to +85	6.3 to 63	.1 to 100	-20 +20
			NKR	Non-polar Radial Leads	-40 to +85	6.3 to 100	.47 to 2200	-10 +50
	AXIAL		TCG	Computer Grade, Long Life Axial Leads	-40 to +85	10 to 450	10 to 10,000	-10 +75 -10 +50
			TCX	Computer Grade High Performance, Axial Leads	-55 to +105	6 to 150	27 to 12,000	-10 +75 -10 +50
			SKA	Miniature, Decade Ratings Axial Leads	-40 to +85	6.3 to 450	.47 to 15,000	-20 +20
			TT	Miniature, Axial Leads	-40 to +85	6 to 250	1 to 2,400	-20 +20
			TC	Industrial Grade Axial Leads	-20 to +85	6 to 450	1 to 5,000	-10 +100 -10 +50

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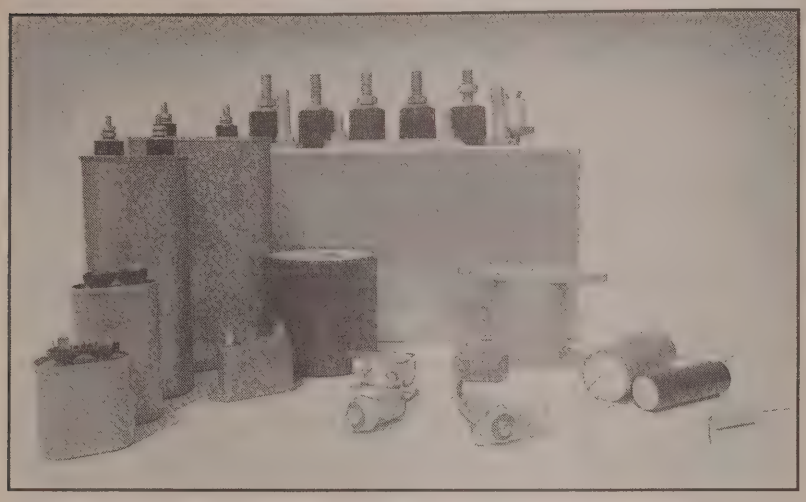
NWL ... the Source for Custom



A sampling of our diversified size and case capability.

NWL Capacitors . . .
Dedicated entirely to the design, production and marketing of high voltage custom oil-filled capacitors for the industrial community, NWL Capacitors has two facilities to serve your capacitor needs. Snow Hill, North Carolina, our newest facility and Riviera Beach, Florida. Either location you have the assurance of quality when you do business with NWL Capacitors because we are a division of NWL Transformers. In business for over 60 years, NWL employs over 300 people with an excellent reputation for manufacturing transformers, power supplies, reactors, chokes, and electronic controls.

All capacitors are 100% tested by a quality control inspector before shipping.

Engineering Excellence

NWL's engineering staff has over 60 years of cumulative engineering experience in the design and manufacture of industrial capacitors.

This experience tells us that for most applications a properly specified custom capacitor will perform better and provide long term cost savings when compared to "stock units".

Our engineers analyze every request and custom build each order to the customer's exact requirements.

Efficient computer-based design techniques plus a large and varied raw materials inventory, allows NWL to design capacitors specifically for your requirements, and deliver quickly.

Modern Equipment

NWL's production equipment is built to exacting specifications to support our engineer's design techniques. Multiple vacuum chambers allow all capacitors to be both dried and impregnated without being moved. We consistently achieve vacuum levels of less than 10 microns.

These techniques result in capacitors with superior mechanical form and higher corona inceptive voltages. All this means a longer, safer operating life.

Quality . . . Quality Assurance

Quality assurance personnel test each and every production capacitor according to customer requirements. This assures consistent high quality in every product shipped to the field.

NWL CAPACITORS

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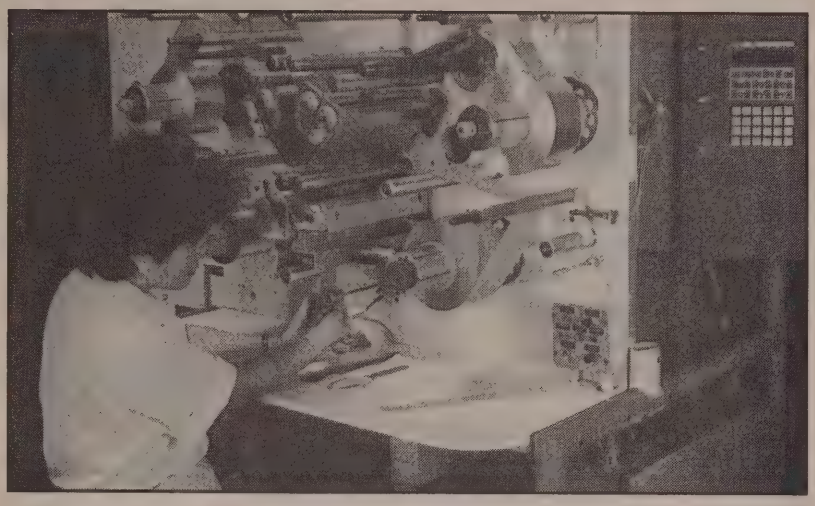
204 Carolina Drive, Snow Hill, P.O. Box 97, NC 28580, (919) 747-5943, FAX: (919) 747-8979

High Voltage Capacitors

Quick Delivery

NWL's deliveries are the best in the industry because:

- We maintain large inventories of foil and film in a wide variety of widths and thicknesses.
- Our custom-built high capacity film slitting machines means any film width we need is immediately available. Thus, our capacitor deliveries are not controlled by the lead times of our film suppliers.
- Sophisticated computer-based production control and material planning systems let us quickly and effectively review and adjust our schedules to meet customer requirements.



One of many winding machines that accept a wide variety of materials.

Specifications

Voltages: from 200 - 200,000
Currents: from .001 - 150,000A
Capacitance: from 50 Pico-farads to 2000 Microfarads
KVAR: up to 2000
Frequency: DC-15 Mhz

These industries and applications served, while representative of the diverse nature of NWL's design and manufacturing capabilities, are by no means all-inclusive. The NWL design engineering team will be happy to help solve your specific problems.

Products

- Wrap & Fill • Tublar Caps • Bathtubs
- Drawn Ovals • Drawn Rectangulars
- Welded Steel • Welded Aluminum
- PFN's • Water Cooled • Feedthru's
- Ignition Caps • Reconstituted MICA
- R-C Networks • Natural MICA

Products *(continued)*

- Flat Pac Capacitors
  High energy density low inductance for fast rise time applications.
- Military Spec Equipment
  All of our products can be built to military specifications.
- Power Factor Correction
  Custom paper-polypropylene low loss capacitors.

Applications

- DC Filter • Energy Storage • Laser
- Corona Free • Power Supplies
- Induction Heating • Pulse Power
- Transmitting • Noise Suppression
- Arc Suppression • Plate Blocking
- Dielectric Heating • Commutating
- Radar • Broadcast • Ion Beam
- Magnetizing • Ignition • Snubber
- Pulse Forming Networks

Vacuum chambers for fluid impregnation

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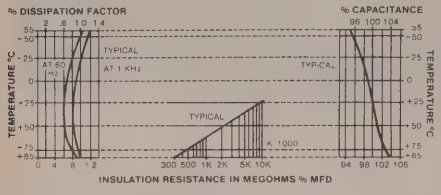
High Voltage Capacitors PERFORMANCE CHARACTERISTICS

DIELECTRIC:
A combination of plastic film and the finest grade of capacitor kraft tissue is used. Capacitors are impregnated and filled with the proper highly purified dielectric fluid. The closely controlled processing assures high reliability and prolonged life.

OPERATING TEMPERATURE
NWL High Voltage Capacitors are designed to operate over a temperature range of—55° to +85°C without derating.

CAPACITANCE
Measurements are made at a frequency of 1000 Hz. Standard tolerance for all capacitors in this catalog is ±20% at +25°C. Closer tolerances are available upon request. Capacitance change over the temperature range is shown graphically and does not exceed ±5%

DISSIPATION FACTOR
Dissipation factor is less than 1.0% at 1000 Hz +25 C (See graph)



INSULATION RESISTANCE
Terminal to Terminal: I.R. at +25 C is 10,000 MEGS x MFD minimum, but does not have to exceed 25,000 Megohms I.R. at +85°C is 300MEGS x MFD minimum, but does not have to exceed 2,000 Megohms. Terminal to Case: Where the case is not a terminal: I.R. shall exceed 10,000 Megohms at +25°C.

DIELECTRIC STRENGTH
Capacitors with ratings up to 10,000 VDC shall be tested at 200% of rated voltage. Capacitors with voltage ratings in excess of 10,000 VDC shall be tested at 150% of rated voltage. Terminal to case test, where the case is not a terminal, shall be performed at test voltage plus 1000 VDC. Duration of test shall be one minute and a resistance of one OHM/VOLT minimum shall be in series with the capacitor during test and discharge.

LIFE TEST AND EXPECTANCY
Capacitors shall withstand a life test of 500 hours at +85°C and at a voltage as per watt-second table below. One failure out of 24 samples tested is permissible.

Group I
Capacitors with: 5 watt-seconds and less
5.1 to 50 watt-seconds with capacitance less than 15 µf
51 to 200 watt-seconds with capacitance less than 5 µf
Life Test Voltage: 140% rated VDC
Life Expectancy: 4400 hours without derating at +85°C

Group II
Capacitors with: 5.1 to 50 watt-seconds with capacitance of 15 µf or more
51 to 200 watt-seconds with capacitance of 5 µf or more
201 watt-seconds and over with capacitance less than 2 µf
Life Test Voltage: 120% of rated VDC
Life Expectancy 3300 hours without derating at +85°C

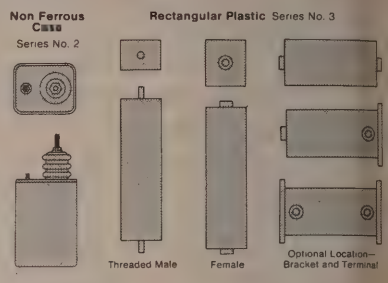
Group III
Capacitors with: 201 watt-seconds and over with capacitance of 2 µf or more
Life Test Voltage 100% of rated VDC
Life Expectancy: 1800 hours without derating at +85°C

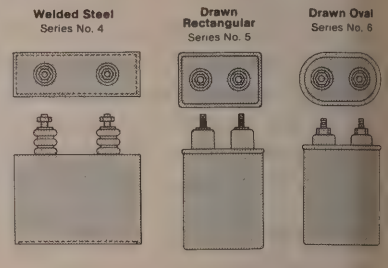
RIPPLE VOLTAGE
The sum of the peak AC voltage and the DC voltage shall not exceed the rated DC voltage. The peak AC voltage should not exceed: 25% at 60 Hz. 20% at 120 Hz. 8% at 400 Hz. 5% at 1 KHz.

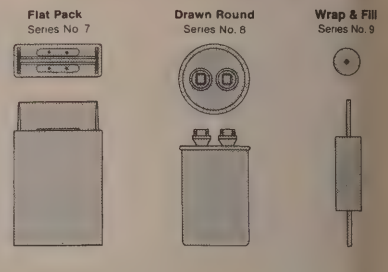
ENVIRONMENTAL TESTS
NWL High Voltage Capacitors will meet requirements of MIL-C-25 and/or MIL-C-19978 wherever applicable.

CONSULTING SERVICE
The Engineering Department is available for assistance on any problems or applications that require special design or configuration.

A sampling of the various configurations and materials within our manufacturing capability. For easy reference refer to Series Numbers.







Capacitor Application Chart

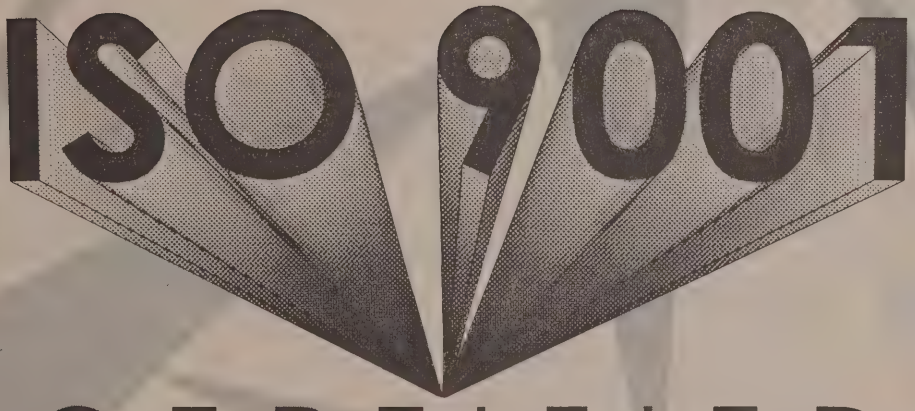
DIELECTRIC	VOLTAGE RANGE	CAPACITY RANGE	STABILITY −20°C TO +50°C	TEMPERATURE RANGE	TEMPERATURE COEFFICIENT OR CAPACITY	DISSIPATION FACTOR @+25°C	INSULATION RESISTANCE MEG X MFD @ +25°C	DIELECTRIC ABSORPTION	USABLE FREQUENCY RANGE	APPLICATION
KRAFT PAPER PLUS MYLAR	1KVDC TO 200 KVDC AVAILABLE TO 75 KVAC	.001 Mfd TO 500 Mfd	1.0% PER YEAR	−55°C TO +85°C AVAILABLE TO −55°C TO +125°C	+5%	.6% TYPICAL	10,000 MEGOHM x Mfd	5% TYPICAL	DC TO 5 KHz	All D.C. Applications. Power Supply Filters. Heavy & Light Duty Energy Discharge. Laser Drive
KRAFT PAPER PLUS POLY-PROPYLENE	600 VDC TO 200 KVDC AVAILABLE TO 75 KVAC	.0001 Mfd TO 250 Mfd.	1.0% PER YEAR	−55 C TO +85°C	+5%	.25% TYPICAL	50,000 MEGOHM x Mfd	.3% TYPICAL	DC TO 50 KHz	PFN & Laser Drive All D.C. Applications, Heavy & Light Duty Energy Discharge, Ferro-Resonant Power Supplies, Power Factor Correction A.C. Applications, High Frequency A.C. SCR Commutating Applications
POLY-PROPYLENE	50 VDC TO 100 KVDC	.001 Mfd TO 100 Mfd	.2% PER YEAR	−55 C TO +105 C	−250 PPM/ C	.02% TYPICAL	200,000 MEGOHM x Mfd	.2% TYPICAL	DC TO 10 MHz	PFN, High Frequency A.C. RF Coupling & Bypass. High Power Plate Blocking Applications. General Usage where Low Losses are Required. SCR, Snubber.
METALLIZED POLY-PROPYLENE	50 VDC TO 1000 VDC TO 440 VAC	.001 Mfd TO 100 Mfd	.2% PER YEAR	−55 C TO +105°C	−250 PPM/ C	.05% TYPICAL	100,000 MEGOHM x Mfd	.25% TYPICAL	DC TO 10 KHz	Affords all the Properties of Polypropylene Dielectric Capacitors, with the Addition of High Volumetric Efficiency & Self-Healing Characteristics
MYLAR	50 VDC TO 1000 VDC	001 Mfd TO 100 Mfd	.2% PER YEAR	−55 C TO +125°C WITH DERATING	−5% @ −55°C +14%@ +125°C	.5% TYPICAL	100,000 MEGOHM x Mfd	.25% TYPICAL	DC to 50 KHz	Low Voltage Power Supply Filters. Coupling, Decoupling, & Bypass Requiring Low Impedences. Low Frequency, Low Power Switching & Triggering.
K FILM	3 KVDC TO 6 KVDC	1 Mfd TO 100 Mfd	1.0% Per Year	−20 C TO 60°C	+10%	2% TYPICAL	1,000 MEGOHM X Mfd	2% TYPICAL	DC	Defribillators.
MICA	500v PEAK TO 35KvPEAK	100 Pf TO 250,000	(+−) .5% (+−) .1 Pf	−55 TO+125°C	(+−) 200 PPM/°C	.1% TYPICAL	> 7,500 MEGOHMS	—	DC TO 15 MHz	Broadcast, rf heating, rf coupling welding

NWL CAPACITORS
Contact: 8050 Monetary Drive, P.O. Box 10416, Riviera Beach, FL 33419, (407) 848-9009, FAX: (407) 848-9011
204 Carolina Drive, Snow Hill, P.O. Box 97, NC 28580, (919) 747-5943, FAX: (919) 747-8979

OKAYA ELECTRIC AMERICA

X-Capacitors - Spark Quenchers

Noise Filters - TVS Devices



CERTIFIED

Since November 1992

OKAYA ELECTRIC AMERICA, INC.

503 Wall Street, Valparaiso, IN. 46383

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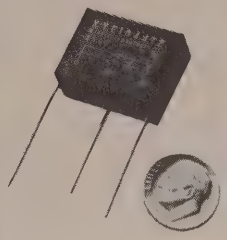
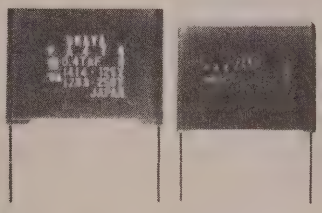
AC NOISE SUPPRESSION CAPACITORS



XYE DELTA NETWORK

- Installed cost savings with single package design and small PCB footprint.
- Both normal & common mode attenuation using one X and two Y noise suppression networks.
- Designed with self-healing metallized polyester film, double wound construction and oil impregnated for high reliability.
- Meets eight safety agency requirements at 250 VAC 50/60 Hz.
- Case material and internal potting rated UL 94-VO.
- The XYE series consists of 75 models in three distinct packaging styles.



PA SERIES

- -40°C to +100°C operating temperature range.
- Popular capacitance values from 0.01 UFD to 2.2 UFD at 250 VAC 50/60 Hz.
- New X2 class capacitor series is perfect for high volume, low cost applications.
- Case material is PBT plastic and encapsulation material is polyurethane, both are rated UL 94-VO.
- Case dimensions for capacitance values meet popular industry norms.
- Safety agency approvals include UL, CSA, VDE and SEV.

XA/XE SERIES

- Best performance series in most popular applications.
- Drop in replacement for most popular configurations.
- Dielectric withstand voltage twice safety agency requirements.
- High DV/DT surge resistance and I/R ratings.
- Case material and internal potting rated UL 94-VO.
- Double wound construction metallized polyester film for high DV/DT.

SPARK QUENCHERS

XE SERIES

- Our best size/performance series with broad applications in industrial controls.
- Widest safety agency approvals.
- High peak pulse withstand capability.
- Large product selection range with 1/4, 1/2 and 1 watt non- inductive, high pulse resistors.
- Capacitance values from 0.01 UFD to 1.0 UFD at 250 VAC 50/60 Hz.

3CRE SERIES

- For use in three-phase industrial applications.
- Two different circuit configurations for wide use conditions.
- Flexible wire leads and external mounting tab.
- 1/2 watt non-inductive, high pulse resistors.
- 500 volt versions also available.
- UL approval.

XEB SERIES

- Flexible wire leads with mounting tabs on some models.
- Our best performance series with broad applications in motor and controls.
- Large product selection range with 1/4, 1/2 and 1 watt non-inductive, high pulse resistors.
- Capacitance ranges from 0.01 UFD to 1.0 UFD at 250 VAC, 50/60 Hz.

FOR COMPLETE INFORMATION AND SERVICE, CALL OR FAX US NOW!

MINIGLOSSARY
BASIC CAPACITOR FORMULAS

I. Capacitance (farads)

English: $C = \frac{.224\,K\,A}{t_D}$

Metric: $C = \frac{.0884\,K\,A}{t_D}$

II. Energy stored in capacitors (Joules, watt-sec)

$E = \frac{1}{2}\,CV^2$

III. Linear charge of a capacitor (Amperes)

$I = C\frac{dV}{dt}$

IV. Total Impedance of a capacitor (ohms)

$Z = \sqrt{R_s^2 + (X_C - X_L)^2}$

Where Rs = ESR

V. Capacitive Reactance (ohms)

$X_C = \frac{1}{2\pi fC}$

VI. Inductive Reactance (ohms)

$X_L = 2\pi fL$

VII. Phase Angles:

Ideal Capacitors: Current leads voltage 90°
Ideal Inductors: Current lags voltage 90°
Ideal Resistors: Current in phase with voltage

VIII. Dissipation Factor

$DF = \tan\delta \text{ (loss angle)} = \frac{ESR}{X_c} = (2\pi fC)\,(ESR)$

IX. Power Factor

PF = Sine δ (loss angle) = Cos φ (phase angle)
PF = DF (when less than 10%)

X. Quality Factor (dimensionless)

$Q = \text{Cotan } \delta \text{ (loss angle)} = \frac{1}{DF}$

XI. Equivalent Series Resistance (ohms)

$ESR = (DF)\,(Xc) = (DF)\,(\frac{1}{2}\pi fC)$

XII. Power Loss (watts)

Power loss $= (2\pi fCV^2)\,(DF)$

XIII. KVA (Kilowatts)

$KVA = 2\pi fCV^2 \times 10^{-3}$

XIV. Temperature Characteristic (ppm/°C)

$TC = \frac{Ct - C_{25}}{C_{25}\,(T_t - 25)} \times 10^6$

XV. Cap Drift (%)

$C.D. = \frac{C_1 - C_2}{C_1} \times 100$

XVI. Reliability of Ceramic Capacitors

$\frac{L_O}{L_t} = \left(\frac{V_t}{V_O}\right)^x \left(\frac{T_t}{T_O}\right)^\tau$

XVII. Capacitors in Series (current the same)

Any number: $\frac{1}{C_T} = \frac{1}{C_1} + \frac{1}{C_2} \text{ --- } + \frac{1}{C_N}$

Two: $C_T = \frac{C_1\,C_2}{C_1 + C_2}$

XVIII. Capacitors in Parallel (voltage the same)

$C_T = C_1 + C_2 \text{ --- } + C_N$

XIX. Aging Rate

A.R. = % Δ C/decade of time

XX. Decibels

$db = 20 \log \frac{V_1}{V_2}$

Metric prefixes:

Pico	X 10^{-12}
Nano	X 10^{-9}
Micro	X 10^{-6}
Milli	X 10^{-3}
Deci	X 10^{-1}
Deca	X 10
Kilo	X 10^3
Mega	X 10^6
Giga	X 10^9
Tera	X 10^{12}

Symbols:

K	=	Dielectric Constant
A	=	Area of electrode overlap
t_D	=	Dielectric thickness
V	=	Voltage (volts)
t	=	time (hours)
R_S	=	Series Resistance (ohms)
f	=	frequency (Hertz)
L	=	Inductance (henries)
δ	=	Loss angle
ø	=	Phase angle
x+y	=	Exponent effect of voltage and temperature
L_O	=	Operating life (hours)
L_t	=	Test life (hours)
V_t	=	Test voltage (volts)
V_o	=	Operating voltage (volts)
T_t	=	Test temperature (°C)
T_o	=	Operating temperature (°C)

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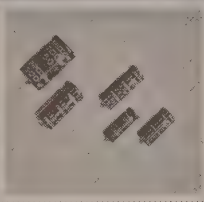
Electrolytic Capacitors

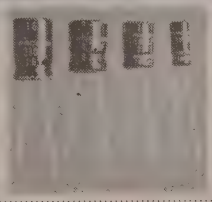
EV
GENERAL PURPOSE

Capacitance Range: 0.1~F to 10,000µF
Voltage Range: 6.3V to 450V
Operating Temp: –40°C to +85°C
Tolerance: ±20% (M) Std., ±10% (K) Opt.
Leakage Current: ≤ 0.01CV or 3µA 6.3 to 100
Style: Radial
Solvent Tolerant End Seal: Standard
Epoxy End Seal: Optional
Tape & Reel/Ammo Pack: Available



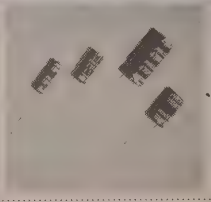
EH
GENERAL PURPOSE

Capacitance Range: 0.1µF to 10,000µF
Voltage Range: 6.3V to 100V
Operating Temp: –40°C to +85°C
Tolerance: ±20% (M) Std.
Leakage Current: 0.01CV or 3µA
Style: Radial
Solvent Tolerant End Seal: Standard
Epoxy End Seal: Optional
Tape & Reel/Ammo Pack: Available



EVU
EXTENDED TEMP

Capacitance Range: 0.1µF to 10,000µF
Voltage Range: 6.3V to 250V
Operating Temperature: –40°C to +105°c
Tolerance: ±20% (M) Std.
Leakage Current: 0.01CV or 3µA
Style: Radial
Solvent Tolerant End Seal: Standard
Epoxy End Seal: Optional
Tape & Reel/Ammo Pack: Available



EVR/EVRS
REDUCED SIZE

Capacitance Range: 0.1µF to 10,000µF
Voltage Range: 6.3V to 250V
Operating Temp: –40°C to +85°C
Tolerance: ±20% (M) Std.
Leakage Current: ≤ 0.01CV or 3µA 6.3 to 100V
Style: Radial
Solvent Tolerant End Seal: Standard
Epoxy End Seal: Optional
Tape & Reel/Ammo Pack: Available

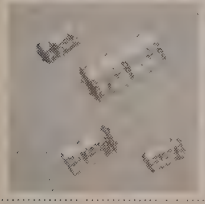
EVL/EVSL
LOW LEAK/SUB MIN LOW LEAK

Capacitance Range: 0.1µF to 2200µF
Voltage Range: 6.3V to 100V
Operating Temp: –40°C to +85°C
Tolerance: ±20% (M) Std., ±10% (K)
Leakage Current: ≤ 0.002CV or 4µA
Style: Radial
Solvent Tolerant End Seal: Standard
Epoxy End Seal: Optional
Tape & Reel/ Ammo Pack: Available

EVN
NON POLAR

Capacitance Range: 0.47µF to 1000µF
Voltage Range: 10V to 50V
Operating Temp: –40°C to +85°C
Tolerance: ±20% (W) Std.
Leakage Current: ≤ 0.03CV or 3µA
Style: Radial
Solvent Tolerant Seal: Standard
Epoxy End Seal: Optional
Tape & Reel/Ammo Pack: Available

Electrolytic Capacitors



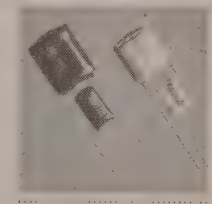
RX
LOW ESR

Capacitance Range: 1µF to 1000µF
Voltage Range: 6.3V to 50V
Operating Temperature: –55°C to +105°C
Tolerance: ±20% (M) Std.
Leakage Current: ≤ .002CV or 2µA
Style: Radial
Solvent Proof End Seal: Standard
Epoxy End Seal: Optional
Tape & Reel/Ammo Pack: Available

EVS/EVSS
SUB MIN

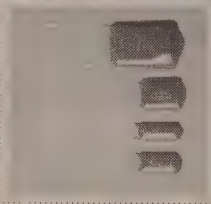
Capacitance Range: 0.1µF to 100µF
Voltage Range: 6.3V to 100V
Operating Temp: –40°C to +85°C
Tolerance: ±20% (M) Std.
Leakage Current: ≤ 0.01CV or 3µA
Style: Radial Subminiature
Solvent Tolerant End Seal: Standard
Tape & Reel/Ammo Pack: Available

Film Capacitors



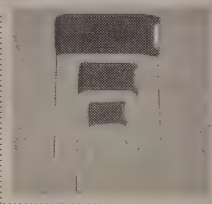
PQ92/PEI
POLYESTER

Cap. Range: .001µF to .47µF
Voltage Range: 100V to 400V
Operating Temp: –40°C to +85°C
Tolerance: ±5% (J), ±10% (K), ±20% (M)
Style: Radial
Construction: Inductively Wound, Epoxy Resin Dipped
Tape & Reel/ Ammo Pack: Available



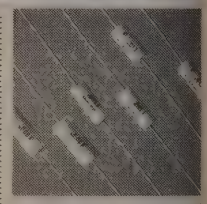
PPI
POLYPROPYLENE

Cap. Range: .001µF to .47µF
Voltage Range: 100V
Operating Temp: –40°C to +85°C
Tolerance: ±2% (G), ±5% (J), ±10% (K)
Style: Radial
Construction: Inductively Wound Polypropolyne Epoxy Resin Dipped
Tape & Reel/ Ammo Pack: Available



MEF
METALLIZED, POLYESTER

Cap. Range: .01µF to 6.8µF
Voltage Range: 100V to 630V
Operating Temp: –40°C to +85°C
Tolerance: ±5% (J), ±10% (K), ±20% (M)
Style: Radial
Construction: Metallized Non-Inductive Epoxy Resin Dipped
Bulk Only: Available



MET
METALLIZED, POLYESTER

Cap. Range: .001µF to 18.0µF
Voltage Range: 100V to 630V
Operating Temp: –40°C to +85°C
Tolerance: ±2% (G), ±5% (J), ±10% (K), ±20% (M)
Style: Axial
Construction: Metallized Non-Inductive Tubular
Tape & Reel/ Ammo Pack: Available

For Information On Our Resistors, Please See Our Data Page In Section 4700.

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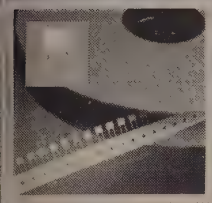
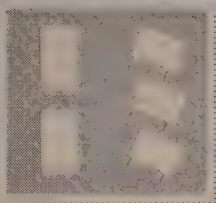


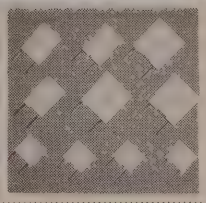
68/85
MIN. BOX, METALLIZED POLYESTER

Capacitance Range: .001µF to 1µF
Voltage Range: 50V to 400V
Operating Temp: –40°C to +85°C
Tolerance: ±5% (J), ±10% (K), ±20% (M)
Style: Radial
Construction: Metallized Non-Inductive Miniature Box Style
Tape & Reel/Ammo Pack: Available



71
METALLIZED POLYPROPYLENE

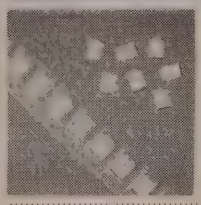
Capacitance Range: .001µF to 10µF
Voltage Range: 160V to 630V
Operating Temperature: –40°C to +85°c
Tolerance: ±5% (J), ±10% (K), ±20% (M)
Style: Radial
Construction: Metallized Non-Inductive Box Type
Tape & Reel/Ammo Pack: Available



60
BOX METALLIZED POLYESTER

Capacitance Range: .001µF to 10µF
Voltage Range: 63V to 1000V
Operating Temp: –40°C to +85°C
Tolerance: ±5% (J), ±10% (K), ±20% (M)
Style: Radial
Construction: Metallized Non-Inductive Box Type
Tape & Reel/Ammo Pack: Available

Surface Mount (SMT)



CHE/CME
METALLIZED FILM SURFACE MOUNT

Cap. Range: 0.0033µF to 0.10µF
Rated Voltage: 25VDC
Insulation Resistance: 9000MΩ min.
Operating Temp: –40°C to +85°C
Max. Solder Temp: 250°C
Tolerance: ±5% (J), ±10% (K)
Construction: Metallized Polyester
Tape & Reel: Standard

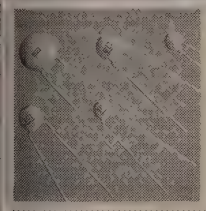
MT
CERAMIC SURFACE MOUNT

Cap. Range: 0.5pF to 0.33µF
Temp. Coefficient: NPO to Z5U
Operating Temp: –55°C to +125°c
Voltage Range: 50V to 100V
Tolerance: ±5% (J), ±10% (K), ±20% (M), +80% –20% (Z)
Construction: Multi Layer Ceramic
Tape & Reel: Standard

TC
TANTALUM SURFACE MOUNT

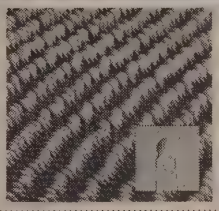
Cap. Range: 0.1µF to 100µF
Leakage Current: ≤ 0.01CV to 0.5µA
Voltage Range: 4V to 35V
Operating Temp: –55°C to +125°C
Tolerance: ±10% (K), ±20% (M)
Construction: Solid Tantalum
Tape & Reel: Standard

Ceramic Capacitors



PC
TEMPERATURE COMPENSATING

Capacitance Range: 1pF to 560pF
Voltage Range: 50 to 500 WVDC
Operating Temperature: –25°C to +85°C
Tolerance: ±0.25pF (C) to ±10% (K)
Temperature Characteristics: NPO to SL
EIA RS 198 Type: Class 1
Style: Radial Lead
Construction: Durez Phenolic
Tape & Reel/Ammo Pack: Available



PK
GENERAL PURPOSE

Capacitance Range: 100pF to 0.1µF
Voltage Range: 50 to 500 WVDC
Operating Temp: –25°C to +85°C
Tolerance: ±10% (K), to +80 –20% (Z)
Temperature Characteristics: Y5F, Y5P, Y5U, Z5V
EIA RS198 Type: Class 2
Style: Radial Lead
Construction: Durez Phenolic
Tape & Reel/Ammo Pack: Available

PS
SEMICONDUCTOR TYPE

Capacitance Range: .01µF to .47µF
Voltage Range: 16 to 50 WVDC
Operating Temp: –25°C to +85°C
Tolerance: ±10% (K), to +80 –20% (Z)
Temperature Characteristics: Y5P, Y5V, Z5U
EIA RS198 Type: Class 3
Style: Radial Lead
Construction: Durez
Tape & Reel/ Ammo Pack: Available

PH
HIGH VOLTAGE

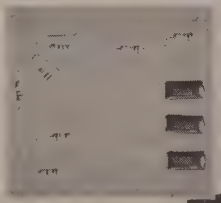
Capacitance Range: 1pF to .01µF
Voltage Range: 1KV to 3KV
Operating Temp: –25°C to +85°C
Tolerance: ±5% (J), ±10% (K), ±100-0% (P)
Temperature Characteristics: NPO to SL, Y5F-Z5V
Style: Radial Lead
Construction: Durez Phenolic
Tape & Reel: Available

Packaging

AMMO PACK

TAPE & REEL

Special Services



LEAD FORMING

BRIDGING

For Information On Our Resistors, Please See Our Data Page In Section 4700.

Philips Components

Discrete Products Division

A North American Philips Company

TANTALUM SOLID, WET AND CHIP CAPACITORS

1440 W. Indiantown Rd. Jupiter, FL 33458 (407) 744-4200, FAX: (407) 744-4281

Type MIL-Slash No.	Designation	Style	Description	Capacitance Range	Voltage Range
WET SLUG MIL-C-3965					
/1	CL14 CL16	43XW	Hermetic Seal, Screw Mount, Cylindrical Case	3.5- 200 µf	20-630v
/19	CL17 CL18	43XW	Hermetic Seal, Stud Mount, Cylindrical Case	12-1300 µf	30-630v
/21	CL55	43JW	Hermetic Seal, Rectangular Module	70-2400 µf	15-150v
/4	CL64 CL65	40LW	Elastomer Seal, Axial Lead, Tubular Case	1.7- 560 µf	6-125v
/24	CL66 CL67	40SW	Hermetic Seal, Axial Lead, Tubular Case	1.7- 560 µf	6-125v
MIL-C-39006			Established Reliability		
/18	CLR10	43XW	Extended Range, Axial Lead, Tubular Case	2.0- 140 µf	8-360v
/19	CLR14	43XW	Extended Range, Cylindrical Case, Solder Lug Terminal	3.5- 200 µf	20-630v
/20	CLR17	43XW	Extended Range, Cylindrical Case, Solder Lug Terminal	12-1300 µf	30-630v
/09	CLR65-8000	40SW	Glass-to-Tantalum Hermetic Seal, Axial Lead, Tubular Case	1.7-1200 µf	6-125v
/22	CLR79	40AW	Hermetic Seal, Non-Silver Case, Axial Lead, Tubular Case	1.7-1200 µf	6-125v
/25	CLR81	40BW	Extended Range, Hermetic Seal, Non-Silver Case, Axial Lead, Tubular Case	6.8-2200 µf	6-125v
SOLID SLUG MIL-C-26655B					
/12	CS12 CS13	40SS	Hermetic Seal, Axial Lead, Tubular Case	.0047- 330 µf	6-100v
MIL-C-39003			Established Reliability		
/01	CSR13	40SS	Polar, Hermetic Seal, Axial Lead, Tubular Case	.0047- 330 µf	6-100v
/09	CSR21	40ZS	Polar, High Frequency Hermetic, Tubular Case, Axial Lead	5.6- 300 µf	6- 50v
/03	CSR23	40XS	Polar, Extended Range, Hermetic Seal, Axial Lead, Tubular Case	1.2-1000 µf	6- 50v
/06	CSR33	40YS	Polar, Extended Range, Hermetic Seal, for Low Impedance Application	1.2-1000 µf	6- 50v
/04	CSR91	40NS	Non-Polar, Hermetic Seal, Axial Lead, Tubular Case	.0023- 160 µf	6-100v
SOLID CHIP MIL-C-55365/4			Established Reliability		
	CWR06	49BC	Polar Hybrid Tantalum Chip	.1- 100 µf	4- 50v
	CWR11	49MC	Polar Molded Tantalum Chip	.1- 47 µf	6- 50v
WET SLUG		40AW	Hermetic, Non-Silver Case, Axial Lead, Tubular Case	1.7-1200 µf	6-125v
		40BW	Extended Range, Hermetic, Non-Silver Case, Axial Lead, Tubular Case	6.8-2200 µf	6-125v
		40EW	Extended Range, Polar, Non-Hermetic, Tubular, Axial	6.8-1800 µf	6-125v
		43JW	Hermetic, Rectangular Module, Spade Lugs	35-22000 µf	6-150v
		40LW	Polar, Non-Hermetic, Tubular, Axial Lead	1.7-1200 µf	6-125v
		40SW	Hermetic, Polar, Glass to Tantulum Seal, Tubular, Axial	1.7-1200 µf	6-125v
		40TW	Hermetic, Non-Silver Case, Tubular, Axial, High Temp.	1.7-1200 µf	6-125v
		43XW	Hermetic, Cylindrical Case, Stud or Screw Mount	3.5-1300 µf	20-630v
SOLID CHIP		49BC	Polar, Hybrid Tantalum Chip, High Reliability	0.1- 100 µf	4- 50v
		49SC	Polar, Hybrid Tantalum Chip, Industrial	0.47- 100 µf	4- 50v
		49UC	Polar, Hybrid, Miniature Industrial Tantalum Chip	0.1-6.8 µf	4- 50v
		49MC	Polar, Hybrid, Commerical Chip, EIA Sizes	0.1- 100 µf	4- 50v
		49XC	Polar, Hybrid, Extended Industrial Chip	1.0- 220 µf	4- 50v
SOLID SLUG		40NS	Non-Polar, Hermetic, Tubular Case, Axial Lead	.0023- 160 µf	6-100v
		40SS	Polar, Standard Hermetic, Tubular Case, Axial Lead	.0047- 330 µf	6-100v
		40XS	Polar, Extended Range, Hermetic Tubular, Axial Lead	0.82-1000 µf	6- 60v
		40YS	Polar, Extended Range, Hermetic, For Low Impedance Applications	1.0-1000 µf	6- 60v
		40ZS	Polar, High Frequency Hermetic, Tubular Case, Axial Lead	5.6- 330 µf	6- 50v

Philips Components

Discrete Products Division

North American Philips Company

ALUMINUM ELECTROLYTIC CAPACITORS

071 St. Andrews Road, Columbia, SC 29212-3196 (803) 772-2500, FAX: (803) 772-2445

Designation	Description	Capacitance Range (uf)	Working Voltage Range (Volts)	Operating Temp. Range (°C)	Load* Life (hrs)
AC MOTOR START					
3500	Motor Start	21-1,200	110-330	−20 +85	
COMPUTER GRADE–SCREW TERMINALS, P.C. MOUNTED					
3186	Standard	250-1900000	6.5-450	−40 +85	1000
3188	Long Life	310-1900000	5-400	−40 +105	2000
3191	Sym. Tolerance, SMPS Output	2800-170000	7.5-55	−40 +85	1500
SNAP-IN					
3407	Standard (High WVDC)	56-2700	160-450	−40 +85	2,000
3408	Standard 105°C (High WVDC)	180-1500	160-250	−40 +105	2000
3487	Standard	82-120000	6.3-450	−40 +85	1000
3488	High Temperature	220-120000	6.3-250	−40 +105	1000
2222-056	Standard	470-68000	10-100	−40 +85	5000
2222-058	High Temperature	330-47000	10-100	−40 +105	5000
SURFACE MOUNTED					
2222-085	General Purpose	0.1-22	6.3-100	−40 +85	1000
2222-139	Long Life	.22-220	6.3-100	−40 +105	1000
AXIAL ELECTROLYTIC					
2222-021	General Purpose	.22-15000	6.3-100	−40 +85	1000/5000
2222-030-033	Small General Purpose	.33-15000	6.3-100	−40 +85	1000/2000/5000
2222-041-043	Small General Purpose	1-220	160-450	−40 +85	2000/5000
2222-049	High Capacitance	330-72000	10-63	−40 +85	2000
2222-065	Low Leakage Current	0.47-68	6.3-25	−55 +85	2000
2222-118	Ext. Temp. Long Life	1.0-15000	6.3-200	−55 +125/−40 +125	2000/3000
2222-119	Ext. Temp. Long Life	1.0-4700	10-200	−55 +125	2000/4000
2222-132-133	Very Long Life	1.0-4700	10-400	−40 +85	6000/8000
3070 Series Is Equal To The Series 2222-021 through -043.					
RADIAL ELECTROLYTIC					
2222-035	General Purpose	.1-4700	6.3-100	−40 +85	1000
2222-037	General Purpose, High Cap	.1-10000	6.3-100	−40 +85	1000/2000
2222-044	General Purpose	1.0-68	160-385	−25 to +85	2000
2222-045	Standard	47-6800	16-63	−40 +105	1000
2222-046	Long Life	47-10000	6.3-63	−40 +105	2000
2222-047	Standard	68-10000	16-63	−40 +105	1000
2222-048	Long Life	68-15000	6.3-63	−40 +105	2000
2222-116	Miniature Long Life	.47-470	6.3-50	−55 +105	1500
2242-164	Extended Long Life	47-10000	10-63	−40 +105	3000
2242-165	High Temp.	33-4700	10-50	−40 +125	1000
SOLID ALUMINUM PRODUCTS					
2222-123	Axial Leaded	1.0-2200	4-40	−55 +125	8000
2222-128	Resin Dipped	.1-68	6.3-40	−55 +125	2000

*See the 1993 Resistor Capacitor Data Book for Details.

Philips Components

Discrete Products Division

A North American Philips Company

FILM CAPACITORS

6071 St. Andrews Road, Columbia, SC 29212-3198 (803) 772-2500, FAX: (803) 772-2445

Designation	Construction	Enclosure	Lead	Voltage VDC/VAC	Capacitance (ufd)	Tolerance (+/−)
POLYESTER						
365-369 (712A1)	Metalized (MKT)	Epoxy	Radial	VDC63-630 VAC 40-220	.001-6.8	5%, 10%
370 & 371 (719A1)	Metalized (MKT)	Potted	Radial	VDC 63-400 VAC 40-220	.001-1.0	5%, 10%
372 (719A2)	Metalized (MKT)	Potted	Radial	VDC 63-400 VAC 40-220	.0047-.47	5%, 10%
373 (719A3)	Metalized (MKT)	Potted	Radial	VDC 63-400 VAC 40-220	.047-15	5%, 10%
POLYCARBONATE						
344 (719B1)	Metalized (MKC)	Potted	Redial	VDC 63-630 VAC 40-220	.01-6.8	5%, 10%
POLYSTYRENE						
424-431 (704C1)	Film/Foil (KS)	Cell	Axial	VDC 63-630 VAC 25-200	51pf-.039	1%, 2%, 5%
443 (719C1)	Film/Foil (KS)	Potted	Radial	VDC 63 VAC 25	100pf-.033	1%
POLYPROPYLENE						
460-464 (703E1)	Film/Foil (KP)	Conformal	Axial	VDC 63-630 VAC 40-200	47pf-.062	1%, 2%, 5%
376 (719F1)	F/F & Met'l (KP/MMKP)	Potted	Radial	VDC 630-2000 VAC 300-600	.001-0.27	3.5%, 5%
378 (719F2)	Metalized (MKP)	Potted	Radial	VDC 250-2000 VAC 160-600	.0033-3.3	5%
FILM & PAPER CLASS X2						
330.4 (719J1)	Metalized VDE 565-1, IMQ (CEI 40-7), SEMKO, UL 1283	Potted	Radial	VAC 250	.01-1.0	10%, 20%
331.6 (719J2)	Metalized VDE 565-1, UL 1283, SEV	Potted	Radial	VAC 300	.01-1.0	10%, 20%
333.4 (719J4)	Metalized VDE 565-1, FI, S, D, N, SEV 1055, 1978, UL 1414, CSA	Potted	Radial	VAC 250	.01-.68	10%
335.2	Metalized UL-144, C22.2 Nº 1	Potted	Radial	VAC 250	.01-.68	20%
SMD (PPS)						
392, 393, 394	Metalized	Unencapsulated	SMD	VDC 25, VDC 160	.00022-.47	5%, 10%

VARIABLE CAPACITORS

6071 St. Andrews Road, Columbia, SC 29212-3198 (803) 772-2500, FAX: (803) 772-2445

Designation	Voltage Rating (DC)	Capacitance Range	Temperature (°C)	Description
(2800C/K) 808/810	150/250 Leaded	1.5-5 pf 7-100 pf	−40 to +70 −40 to +85	Film Dielectric Variable Capacitor For Commercial and Industrial Applications
(2800D/E/L/M) 809/811	200/300 Leaded	0.6-2 pf 7-150 pf	−40 to +125	Film Dielectric Variable Capacitor For Professional Applications
811	300 SMD	5, 10, 15, 20 pf	−40 to +125	Film Dielectric SMD Variable Capacitor For Professional Applications
2807S	100 SMD	5, 10, 15, 20 pf	−40 to +85	Film Dielectric SMD Variable Capacitor For Professional Applications

Philips Components

Discrete Products Division

A North American Philips Company

MULTILAYER CERAMIC CHIP CAPACITORS

440 W. Indiantown Rd. Jupiter, FL 33458 (407) 744-4200 FAX: (407) 744-4281

Case Size	DIELECTRIC/CAPACITANCE RANGE			Voltage
	NPO	X7R	50 VDC Z5U	
0603	0.47-270pF	100-.01μF	Not Available	50
0805	0.47-1000pF	180-.033μF	.01μF-.1μF	50, 100
1206	.047-3800pF	680-.1μF	.01-.33μF	50, 100
1210	47-4700pF	2200-.22μF		50, 100
1812	330-5600pF	4700-.47μF		50, 100
Tolerances Available: C, D, F, G, J, K, M, Z				
Packaging: Bulk, tape and reel per EIA RS481				

ELECTRICAL PARAMETERS

TEMPERATURE CHARACTERISTICS:
NPO: 0±30ppm/°C, −55°C to +125°C; **X7R:** ±15%, △C, −55°C to +125°C; **Z5U:** 22%-56%, △C, +10°C to +85°C

INSULATION RESISTANCE:
100K megohms or 1000 megohm microfarads, whichever is less at 25°C. Measured after 2 min. with 50 mA limiting current.

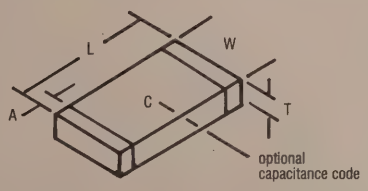
TERMINATIONS AVAILABLE:
Dipped Palladium Silver; Nickel Barrier, 100% Tin; Nickel Barrier, Tin/lead.

DISSIPATION FACTOR:
NPO: .1% maximum @ 25°C, 1.0 VRMS ±.25 VRMS @ 1 KHz. 1 MHz for values less than 1000 pF; **X7R:** 2.5% maximum @ 25°C, 1.0 VRMS ±.25 VRMS @ 1 KHz; **Z5U:** 4.0% max @ 25°C 0.5± .1VRMS @ 1KHz.

DIELECTRIC STRENGTH:
NPO, X7R, Z5U: 250% rated voltage with 50mA maximum charging current.

MECHANICAL PARAMETER

INCH (MILLIMETER) INCH (MILLIMETER)



EIA SIZE CODE	L	W	T MAX.	A MIN./MAX.
0603	.063±0.004 (1.60±0.10)	.032±0.004 (0.08±0.10)	.036 (0.90)	.010/.026 (0.025/0.65)
0805	.079±.008 (2.03±.020)	.049±.008 (1.25±0.20)	.050 (1.27)	.010/.030 (0.25/0.76)
1206	.126±.008 (3.20±0.20)	.063±.008 (1.60±0.20)	.059 (1.25)	.010/.030 (0.25/0.76)
1210	.126±.008 (3.20±0.20)	.098±.008 (2.51±0.20)	.065 (1.65)	.010/.035 (0.25/0.89)
1812	.177±.012 (4.54±.30)	.126±.008 (3.20±.20)	.065 (1.65)	.010/.035 (0.25/0.89)

Philips Components

Discrete Products Division

A North American Philips Company

1440 W. Indiantown Rd. Jupiter, Fl 33458, (407) 744-4200 FAX: (407) 744-4281

CERAMIC MULTILAYER CAPACITORS

Series	Description	Capacitance Range	Working Voltage Range (VDC)
A	Mono-Axial™ MULTILAYER Conformal Coated Axial Leaded	10pF to 1.0μF	50VDC and 100VDC
G	Mono-Glass™ MULTILAYER Glass Encapsulated Axial Leaded	10pF to .56μF	50VDC and 100VDC
K	Mono-Kap™ MULTILAYER Conformal Coated Radial Leaded	10pF to 10.0μF	50VDC and 100VDC
P	Mono-Pak™ MULTILAYER Dual in-Line Molded Package	10pF to .33μF	50VDC and 100VDC

CERAMIC DISC CAPACITORS

Series	Description	Capacitance Range	Working Voltage Range (VDC)
D & S	General Purpose and Temperature Stable Class 1, 2, & 3	1.0pF to .10μF	50VDC to 6KVDC
S	Gap-Kap™ Circuit Protection	.75pF to .02μF	Up to 3KVDC Up to 8KVDC Arc
S-UL	UL/VDE/CSA AC Rated Discs	100pF to .01μF	125VAC, 250VAC, and 400VAC
U	Ultra-Kap™ Class IV	.01μF to .47μF	12VDC to 75VDC
R	General Purposes and Temperature Stable Single Plate Caps	1.0pF to .22μF	50VDC and 100VDC

RF TRANSMITTING CAPACITORS

Series	Description	Capacitance Range	Working Voltage Range (VDC)
T	RF Rated, Special Application Transmitting Capacitors	3.0pF to .001μF	5KV, 7.5KV 15KV, and 20KVDC

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EEM FILE SYSTEM,
645 stewart ave., garden city, ny 11530

PEC 831 Metallized Polyester Film

General Characteristics

The PEC 831 is manufactured using a unique packaging process which allows the production of a compact body size for a given capacitance. This allows the designer to specify an automatically insertable, axial lead capacitor allowing higher circuit board densities than were previously possible. The general characteristics of the PEC 831 make it an ideal choice for general coupling, decoupling and filtering applications. All PPD capacitors are made in the U.S. and are available taped and reeled for automatic insertion.

Physical and Electrical Characteristics.

Capacitance range	1000 pF to 6.8 μF
Capacitance tolerance	±5%, ±10%, ±20%
Voltage Ratings AC ratings are at 60Hz	40VDC/24VAC, 100VDC/63VAC, 200VDC/125VAC, 400VDC/200VAC
Temperature range	−55°C to +125° C. Over 85°C the voltage is derated linearly to 50% at 125°C.
Moisture resistance	After 72 hours at 75°C and 95%RH, the IR shall exceed 30% of the initial requirement.
Dielectric and electrodes	Polyester film vacuum metallized with aluminum.
Coating	Conformally coated with epoxy. Coating material meets UL 94V-0.
Leads	Solder coated copper clad steel wire.
Temperature coefficient	See capacitance vs. temperature curve
Capacity stability	±2% over period of 2 years
Dielectric strength	160% rated DC voltage for 2 seconds.
Life test	140% rated DC voltage at 85°C for 250 hours.

Insulation resistance	C≤.33μF and V>100VDC: 30,000MΩ Min.
2 Min. Electrification, 25°C	C>.33μF and V ≥100VDC: 10,000 MΩ × μF Min.
10 VDC for V<100 VDC	C≤.1μF and V≤100VDC: 10,000 MΩ Min.
100VDC for V≥100VDC	C>.1μF and V<100VDC: 1,000 MΩ × μF Min.
Dissipation Factor	C≤1μF 0.8% max. (0.5% average) at 1KHz C>1μF 1.0% max. (0.6% average) at 1KHz
Self Inductance	10nH/cm along length of body and leads

MAXIMUM PULSE RISE TIME

	V/μs					
	CASE					
VDC	A	B	C	D	E	F
40V	6.2	3.6	1.9	1.5	1.1	0.84
63V	7.3	4.6	2.3	1.8	1.4	1.0
100V	12.1	7.3	3.8	2.9	2.3	1.7
200V	16.2	9.7	5.1	3.9	3.0	2.2
400V	51.0	25.0	11.6	8.6	6.5	4.7

Pulse Current = Cap. (μF) × Pulse Rise Time

CAP. μF	CASE A	B	C	D	E	F
.001	400					
.0012	400					
.0015	400					
.0018	400					
.0022	400					
.0027	400					
.0033	400					
.0039	400					
.0047	400					
.0056	200	400				
.0068	200	400				
.0082	200	400				
.01	200	400				
.012	200	—	400			
.015	200	—	400			
.018	200	—	400			
.022	200	—	—	400		
.027	200	—	—	400		
.033	100	200	—	400		
.039	100	200	—	400		
.047	100	200	—	400		
.056	63	200	—	400		
.068	63	100	200	—	400	
.082	63	100	200	—	400	
.1	63	100	200	—	400	
.12	40	100	—	200	400	
.15	40	63	100	200	400	
.18	40	63	100	200	400	
.22	40	63	—	200	—	400
.27		63	—	200	—	400
.33			63	100	200	400
.39			63	100	200	—
.47				100	200	—
.56				100	200	—
.68				63	200	—
.82				63	200	—
1.0				63	100	200
1.5					100	200
2.2					63	100
3.3					63	—
4.7						63
6.8			VOLTS			63

CASE SIZE

	A	B	C	D	E	F
	D x L	D x L	D x L	D x L	D x L	D x L
IN	.177 x .250	.177 x .355	.195 x .497	.247 x .610	.345 x .745	.347 x .970
MM	4.5×6.4	4.5×9.0	5.0×12.6	6.3×15.5	8.8×18.9	8.8×24.6

CAP. μF	VOLTAGE (DC) 40V	63V	100V	200V	400V
.001					A
.0012					A
.0015					A
.0018					A
.0022					A
.0027					A
.0033					A
.0039					A
.0047					A
.0056				A	B
.0068				A	B
.0082				A	B
.01				A	B
.012				A	C
.015				A	C
.018				A	C
.022				A	D
.027				A	D
.033			A	B	D
.039			A	B	D
.047			A	B	D
.056		A	B	B	D
.068		A	B	C	E
.082		A	B	C	E
.1		A	B	C	E
.12	A	B	B	D	E
.15	A	B	C	D	E
.18	A	B	C	D	E
.22	A	B	D	D	F
.27	B	B	D	D	F
.33	C	C	D	E	F
.39	C	C	D	E	
.47	D	D	D	E	
.56	D	D	D	E	
.68	D	D	E	E	
.82	D	D	E	E	
1.0	D	D	E	F	
1.5	E	E	E	F	
2.2	E	E	F		
3.3	E	E			
4.7	F	F			
6.8	F	F			

PPD

PPD FILM CAPACITORS, INC.
6001 Resco Court, Raleigh, N.C. 27613
(919) 781-3955
FAX (919) 781-4980

Specifications subject to change without notice.

PPC 830 Polypropylene Film/Foil

General Characteristics.

The PPC 830 is an axial lead, polypropylene film capacitor that features small size, low price and flame retardant coating. The electrical stability of polypropylene and its characteristic high resistance to moisture allow these units to retain their original capacitance over long periods of time without degradation due to changing environmental conditions. The PPC 830 has the excellent characteristics previously found only in polystyrene capacitors but offers a higher temperature rating and, of course, flame resistance. The low negative TC and very low dissipation factor of the PPC 830 provide for a stable frequency response curve and high Q in resonant and filtering circuit applications. Since the PPC 830 also exhibits high insulation resistance (I.R.) and low dielectric absorption (D.A.), it is a good choice for storage and timing circuit applications. All PPD capacitors are made in the U.S. and are available taped and reeled for automatic insertion.

Physical and Electrical Characteristics

Capacitance range	150pF to .56μF
Capacitance tolerance	±1% thru ±10%
Voltage ratings AC ratings are at 60Hz (higher voltages available upon request)	160VDC/90VAC, 400VDC/160VAC, 630VDC/200VAC
Temperature range	−55°C to 105°C. Over 85°C the voltage is derated linearly to 50% at 105°C.
Humidity range	95% RH max., 85% yearly average
Dielectric	Polypropylene film
Electrodes	Aluminum foil
Coating	Conformally coated with epoxy. Coating material meets UL 94V-0
Leads	Solder coated copper clad steel wire.
Temperature coefficient of capacitance	−150 ± 100 ppm/°C
Capacitance stability	< ± 0.5% drift over period of 2 years
Test voltage/Dielectric strength	2.5 x rated voltage for 2 seconds
Insulation resistance	> 100,000 MΩ after 2 mins. at 100V, 25°C
Life test	140% rated voltage at 105°C for 250 hrs.
Dissipation factor	≤ .07% at 10KHz
Dielectric absorption	< .05%
Self inductance	10nH/cm along length of body and leads
Max pulse rise time	500V/μ sec

	160VDC/90VAC				400VDC/160VAC				630VDC/200VAC			
	mm		in		mm		in		mm		in	
PF	**D**	**L**	**D**	**L**	**D**	**L**	**D**	**L**	**D**	**L**	**D**	**L**
150	4.4	10	.172	.394	4.4	10	.172	.394	4.8	10	.188	.394
220	4.4	10	.172	.394	4.4	10	.172	.394	4.8	10	.188	.394
330	4.4	10	.172	.394	4.4	10	.172	.394	4.8	10	.188	.394
470	4.4	10	.172	.394	4.4	10	.172	.394	4.8	10	.188	.394
680	4.4	10	.172	.394	4.4	10	.172	.394	4.8	10	.188	.394
735	4.4	10	.172	.394	4.4	10	.172	.394	4.8	10	.188	.394
820	4.4	10	.172	.394	4.4	10	.172	.394	4.8	10	.188	.394
1000	4.4	10	.172	.394	4.4	10	.172	.394	4.8	10	.188	.394
1500	4.4	10	.172	.394	4.4	10	.172	.394	4.8	10	.188	.394
2200	4.8	10	.188	.394	4.8	10	.188	.394	5.2	10	.205	.394
3300	4.8	10	.188	.394	4.8	10	.188	.394	6.1	10	.240	.394
4100	4.8	10	.188	.394	5.2	10	.205	.394	6.5	10	.255	.394
4300	4.8	10	.188	.394	5.2	10	.205	.394	6.6	10	.260	.394
4700	4.8	10	.188	.394	5.3	10	.210	.394	5.8	12	.230	.475
4900	5	10	.195	.394	5.5	10	.215	.394	6	12	.235	.475
5600	5	10	.195	.394	5.6	10	.220	.394	6.2	12	.245	.475
6800	5	10	.195	.394	6	10	.235	.394	6.7	12	.265	.475
8200A	6	10	.235	.394	—	—	—	—	—	—	—	—
8200B	5	12	.195	.475	5.6	12	.220	.475	7.1	12	.280	.475
MFD												
.01A	6.2	10	.245	.394	—	—	—	—	—	—	—	—
.01B	5	12	.195	.475	6.4	12	.250	.475	7.7	12	.305	.475
.013	5.5	12	.215	.475	6.9	12	.270	.475	8.5	12	.335	.475
.015	5.7	12	.225	.475	7.1	12	.280	.475	7.9	14.7	.310	.580
.018	6	12	.235	.475	7.5	12	.295	.475	8.3	14.7	.325	.580
.022	6.5	12	.255	.475	8	12	.315	.475	8.8	14.7	.345	.580
.025	6.9	12	.270	.475	7.9	14.7	.310	.580	9.5	14.7	.375	.580
.027	7.1	12	.280	.475	8.1	14.7	.320	.580	9.9	14.7	.390	.580
.033	7.6	12	.300	.475	8.9	14.7	.350	.580	9	18.3	.355	.720
.047	7.9	14.7	.310	.580	10.3	14.7	.405	.580	9.9	18.3	.390	.720
.056	8.8	14.7	.345	.580	11	14.7	.435	.580	10.4	18.3	.410	.720
.060	9	14.7	.355	.580	9.1	18.3	.360	.720	10.8	22	.425	.865
.068	9.4	14.7	.370	.580	10.3	18.3	.405	.720	11.4	22	.450	.865
.082	8.4	18.3	.330	.720	11.4	18.3	.450	.720	12.4	22	.490	.865
.1A	9.1	18.3	.360	.720	11.9	18.3	.470	.720	—	—	—	—
.1B	8.1	22	.320	.865	10.3	22	.405	.865	13.5	22	.530	.865
.15	9.5	22	.375	.865	11.8	22	.465	.865	13.9	25.1	.548	.990
.22	11.4	22	.450	.865	13	22	.510	.865				
.27	12.4	22	.490	.865								
.33	11.9	22	.470	.865								
.47	12.7	25.1	.500	.990								
.56	14	25.1	.550	.990								

PPD

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FAX (919) 781-4980

Specifications subject to change without notice.

PPC 831 Metallized Polypropylene Film

General Characteristics

The PPC 831 is an axial lead, metallized polypropylene film capacitor featuring small size, high performance, low price and conformal encapsulation with a flame retardant coating.

The physical and electrical characteristics of polypropylene as a dielectric are commendable. Polypropylene is relatively impervious to moisture. It is also extremely stable. The PPC 831 will, therefore, retain its original properties over extended periods of time in a fluctuating environment.

Other noteworthy attributes of the PPC 831 are high insulation resistance (IR) and a low dielectric absorption (DA) factor. Both of these parameters are of critical importance in the selection of a sample-and-hold capacitor in data acquisition applications. The DA of polypropylene is about 10 times less than that of polyester and is significantly less than that of polycarbonate or polystyrene.

Also to be considered are the gently sloping curves for temperature coefficient (TC), dissipation factor (DF) and capacitance variation with frequency. The relatively flat response of the PPC 831 assures dependable, stable performance when incorporated into critical resonant and filtering circuit applications.

Physical and electrical characteristics:

Capacitance	Measured at 1,000 Hz
Capacitance range	1000 pF to 1.0 μF
Capacitance tolerance	1%, 2.5%, 5%, 10%, 20%
Voltage ratings AC ratings at 60 Hz	160 VDC/ 90 VAC, 250 VDC/ 220 VAC, 400 VDC/ 250 VAC, 630 VDC/ 300 VAC
Temperature range	−55°C to 105°C. Over 85°C the voltage is derated linearly to 50% at 105°C.
Dielectric	Aluminum metallized polypropylene film
Coating	Conformally coated with epoxy. Coating material meets UL 94V-0
Leads	Solder coated copper clad steel wire
Dissipation factor Measured at 25°C, 1 KHz	Less than .1%, Figures I & II
Dielectric absorption Per MIL-C-19978	Less than .05%, Figure III

Insulation resistance		+25°C	+85°C	+105°C
Rated voltage, 2 min. electrification	MΩ × μF	100,000	5,000	500
	≤MΩ	200,000	10,000	1,000

Life test 1Ω/ Volt in series	1000 hours, 85°C, 140% voltage
Humidity	72 hours, 75°C, 95% R.H. (Ref. EIA RS377, IR shall exceed 30% of minimum)
Dielectric strength 100Ω/ Volt in series	200% rated voltage, 1 min.
Capacitance drift	± .5% over 2 years 20°C to 40°C, 40% to 60% R.H.
Temperature coefficient	Figure IV
Self inductance	10nH/cm along leads and body

MAXIMUM PULSE RISE TIME

	V/μs				
	CASE				
VDC	B	C	D	E	F
160V	8.3	4.6	3.5	2.7	2
250V	15.7	8	5.8	4.3	3.1
400V	21	10.7	7.8	5.8	4.2
630V	43	18.5	13	9.6	6.7

Pulse Current = Cap. (μF) × Pulse Rise Time

CAP. μF	CASE B	C	D	E	F
.001	630				
.0012	630				
.0015	630				
.0018	630				
.0022	630				
.0027	400	630			
.0033	400	630			
.0039	400	630			
.0047	400	630			
.0056	400	630			
.0068	400	630			
.0082	400	—	630		
.01	250	400	630		
.012	250	400	630		
.015	250	400	630		
.018	160	250	630		
.022	160	250	630		
.027	160	250	400	630	
.033	160	—	400	630	
.039	160	—	400	630	
.047	160	—	400	630	
.056		160	250	630	
.068		160	250	400	630
.082		160	250	400	630
.1		160	250	400	630
.12			160	400	630
.15			160	400	630
.18			160	250	400
.22			160	250	400
.27				250	400
.33				160	250
.39				160	250
.47				160	250
.56				160	250
.68				160	—
.82			VOLTS		160
1.0					160

CASE SIZE

	B	C	D	E	F
	D × L	D × L	D × L	D × L	D × L
IN.	.177 × .355	.195 × .497	.247 × .610	.345 × .745	.347 × .970
MM	4.5 × 9.0	5.0 × 12.6	6.3 × 15.5	8.8 × 18.9	8.8 × 24.6

CAP. μF	VOLTAGE (DC) 160V	250V	400V	630V
.001				B
.0012				B
.0015				B
.0018				B
.0022				B
.0027			B	C
.0033			B	C
.0039			B	C
.0047			B	C
.0056			B	C
.0068			B	C
.0082			B	D
.01		B	C	D
.012		B	C	D
.015		B	C	D
.018	B	C	D	D
.022	B	C	D	D
.027	B	C	D	E
.033	B	D	D	E
.039	B	D	D	E
.047	B	D	D	E
.056	C	D	E	E
.068	C	D	E	F
.082	C	D	E	F
.1	C	D	E	F
.12	D	E	E	F
.15	D	E	E	F
.18	D	E	F	
.22	D	E	F	
.27	E	E	F	
.33	E	F		
.39	E	F		
.47	E	F		
.56	E	F		
.68	E			
.82	F			
1.0	F			

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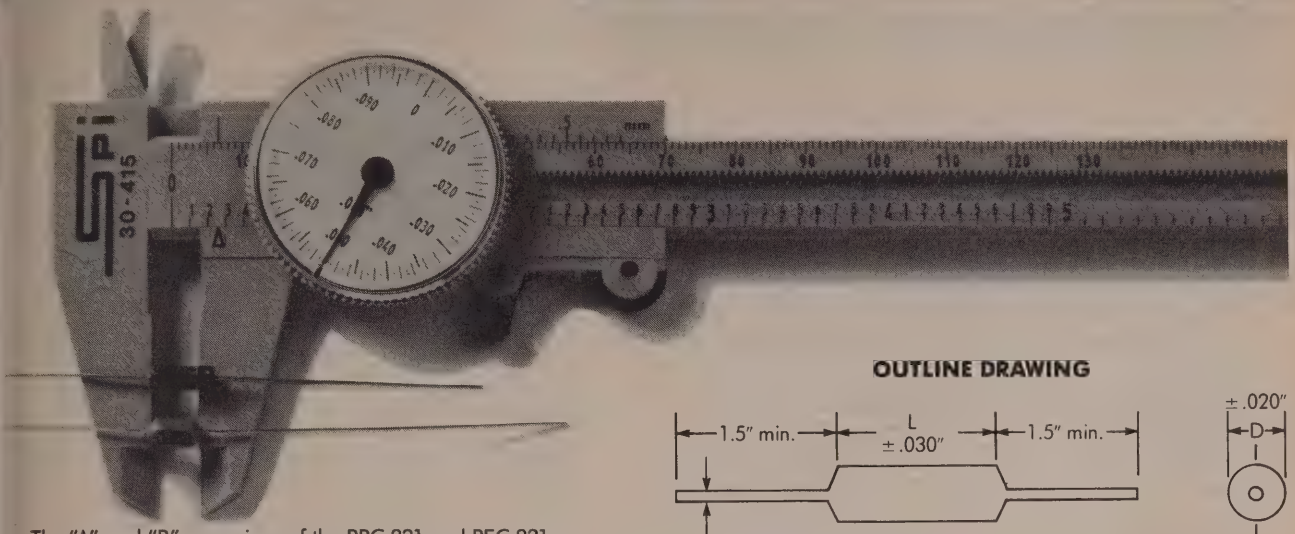
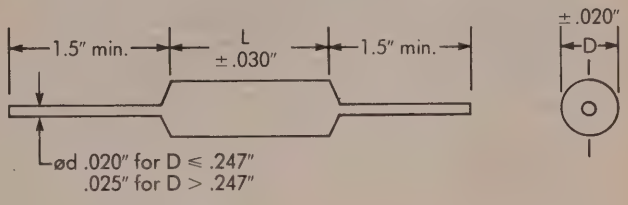


The "A" and "B" case sizes of the PPC 831 and PEC 831 style capacitors are computer designed with today's manufacturing and design criteria firmly in mind — namely, automation.

Until now, the most useful configuration for automated assembly, with respect to general bypassing, filtering and timing requirements, has been the box style capacitor. This is because the corresponding axial style devices are of physical proportions incompatible with automatic insertion equipment. Unfortunately, the box capacitor presents the modern factory with its own unique problems. An expensive radial insertion machine must be obtained. Box insertion requires an additional step in the assembly process which adds both direct and indirect production costs. In comparison, axials insert 3 times faster than radials.

PPD has been studying this situation for some time now. The culmination of this work has been the development of the "A" and "B" case film capacitors. The designer is now presented with the capability of specifying axial lead, automatically insertable, metallized film capacitors in the range of .001 µF to .27 µF. Examination of the dimensions of the "A" and "B" cases will reveal that, in length, they closely approximate the dimensions of RN55 and RN60 style resistors. Both "A" and "B" cases have a .177" ± .020" diameter. They can, therefore, be taped on 0.2" centers. Ultimately, these devices can be sequenced on standard axial lead insertion machinery to provide high volume, low cost production.

OUTLINE DRAWING



CASE SIZE

	A	B	C	D	E	F
	D x L	D x L	D x L	D x L	D x L	D x L
IN.	.177×.250	.177×.355	.195×.497	.247×.610	.345×.745	.347×.970
MM.	4.50×6.35	4.50×9.02	4.95×12.62	6.27×15.49	8.76×18.92	8.81×24.64

PART NUMBERING INFORMATION

PPC 830

PPC830 / 1003 B / 400 / 2.5

- 2.5 — Tolerance
- 400 — Voltage (DC)
- B — A or B where alternate sizes available
- 1003 — Capacitance in pF, 3 significant figures and multiplier, ex. .1uF = 100, 000pF = 1003
- PPC830 — Type: PPC 830

PPC831 and PEC 831

PEC831 / .001 / 250 / 5

- 5 — Tolerance
- 250 — Voltage (VDC)
- .001 — Capacitance in uF
- PEC831 — Type: PEC 831 or PPC 831

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Typical Performance Characteristics

Polypropylene — Polyester

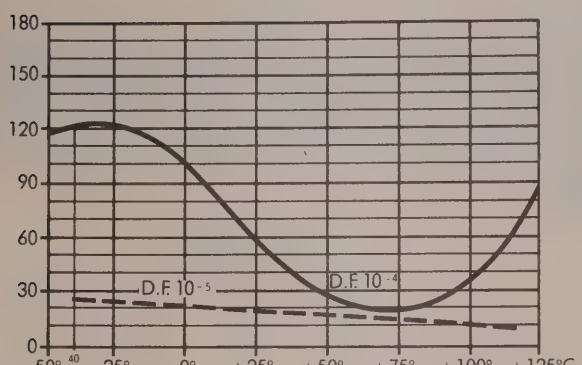

Fig. I *Dissipation factor variation with temperature*

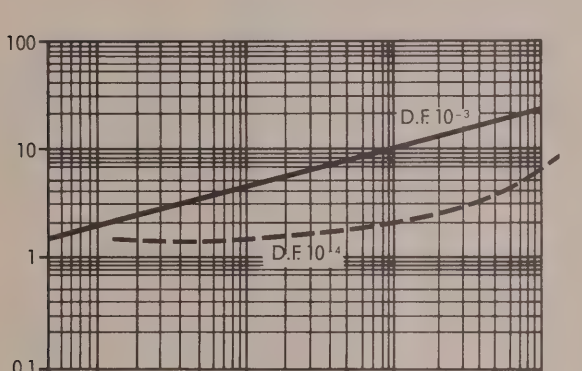

Fig. II *Dissipation factor variation with frequency*

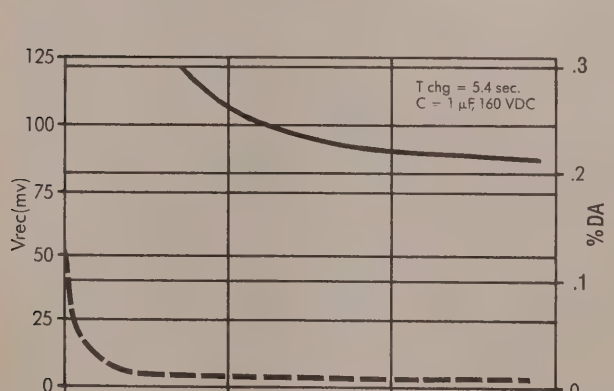

Fig. III *Dielectric absorption*

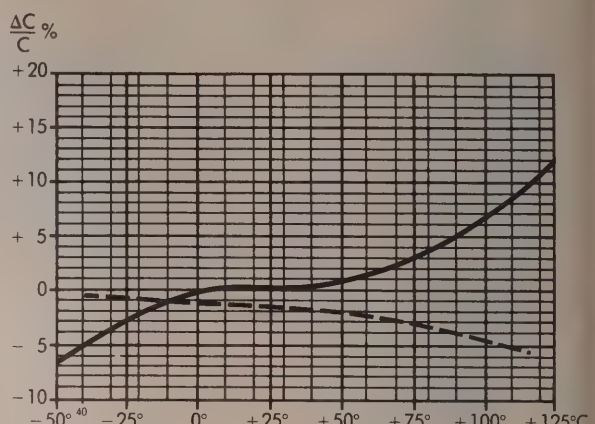

Fig. IV *Capacitance variation with temperature*

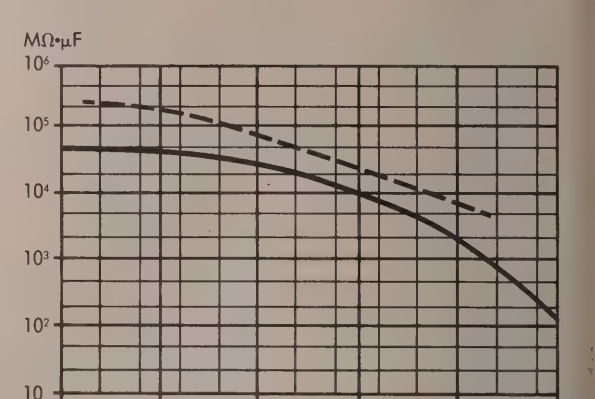

Fig. V *Insulation resistance variation with temperature*

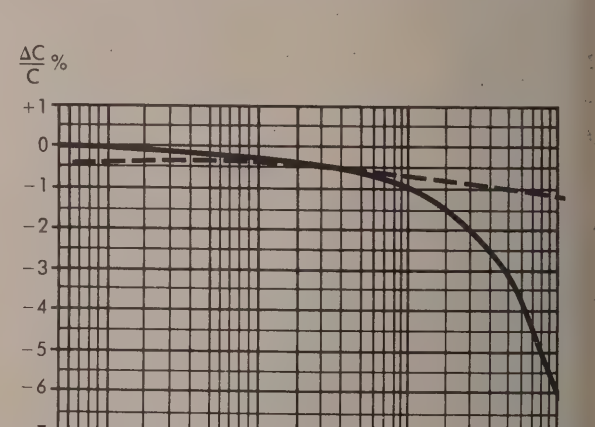

Fig. VI *Capacitance variation with frequency*

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Printed in U.S.A.

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SAC 931 Metallized Polypropylene Capacitors For AC Applications

SERIES-WOUND CONSTRUCTION

Engineered to reduce or eliminate corona problems

General Characteristics

The SAC931 is an axial lead, premium quality capacitor, designed for 50-60 Hz applications. Wound with metallized polypropylene, it has multilayer, spray deposited end connections, for low ESR, and reliable operation. The firmly wound series sections are housed with a tough, flame retardant outer wrap, and with epoxy end seals.

Physical and Electrical Characteristics

Capacitance	Measured at 1 KHz
Capacitance range	0.01μF to 3.0μF
Capacitance tolerance	$\pm$5%, $\pm$10%, $\pm$20%
AC voltage ratings (50-60Hz)	400, 480, 540, 600V AC
Temperature range	$-$55 to +85°C
Dielectric	Metallized polypropylene film
Case insulation	Flame retardant outer wrap
Leads	Tinned, copper clad, steel wire
DF at +25°C, 1 KHz	Less than 0.07%

Insulation resistance (100VDC, 2 minute electrification)

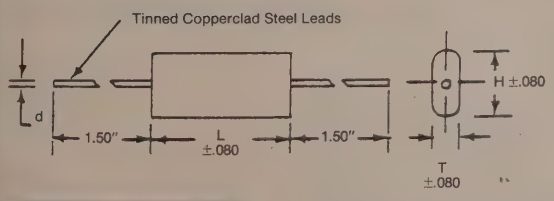
	+25°C	+85°C
MΩ $\times$ μF	100000	5000
MΩ	200000	10000

Additional information on request

STANDARD RATINGS

Dimensions in Inches — Voltage Ratings at +85°C

CAP μF	400VAC @ 60 Hz (600VDC)				480VAC @ 60 Hz (800VDC)				540VAC @ 60 Hz (1000VDC)				600VAC @ 60 Hz (1200VDC)			
	T	H	L	d	T	H	L	d	T	H	L	d	T	H	L	d
.01													.167	.311	1.187	.025
.018													.233	.324	1.187	.025
.022									.193	.292	1.187	.025	.250	.349	1.187	.025
.027					.168	.268	1.187	.025	.248	.348	1.187	.025	.278	.377	1.187	.025
.037					.201	.301	1.187	.025	.295	.395	1.187	.025	.328	.427	1.187	.025
.047	.166	.266	1.187	.025	.231	.331	1.187	.025	.336	.436	1.187	.025	.237	.484	1.50	.032
.10	.256	.356	1.187	.025	.352	.452	1.187	.025	.449	.549	1.187	.025	.382	.629	1.50	.032
.18	.230	.477	1.50	.032	.350	.597	1.50	.032	.460	.707	1.50	.032	.545	.792	1.50	.032
.22	.261	.508	1.50	.032	.369	.643	1.50	.032	.519	.766	1.50	.032	.522	.769	1.75	.032
.27	.297	.574	1.50	.032	.447	.694	1.50	.032	.584	.831	1.50	.032	.589	.836	1.75	.032
.33	.335	.600	1.50	.032	.504	.751	1.50	.032	.625	.872	1.50	.032	.663	.910	1.75	.032
.47	.440	.687	1.50	.032	.620	.867	1.50	.032	.714	1.09	1.75	.032	.812	1.06	1.75	.032
.68	.547	.794	1.50	.032	.620	.877	1.75	.032	.814	1.66	1.75	.040	.859	1.11	2.25	.040
1.0	.563	.810	1.75	.032	.763	1.01	1.75	.040	.886	1.13	2.25	.040				
1.5	.714	.961	1.75	.040	.852	1.10	2.25	.040								
2.0	.749	.996	1.75	.040												
2.7	.863	1.11	2.25	.040												
3.0	.912	1.16	2.25	.040												



Order by complete part number

SAC931 / .47 / 400 / K

- K — Capacitance Tolerance (J ± 5%, K ± 10%, M ± 20%)
- 400 — Voltage (VAC) rms @ 50-60 Hz
- .47 — Capacitance in μF
- SAC931 — Type: SAC931

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■ POLYCARBONATE & FOIL ■ METALLIZED POLYCARBONATE ■ POLYSTYRENE & FOIL ■ POLYPROPYLENE & FOIL ■ METALLIZED POLYPROPYLENE ■ POLYESTER & FOIL ■ METALLIZED POLYESTER ■ TEFLON & FOIL ■ METALLIZED TEFLON ■ KAPTON & FOIL ■ MIL-C-83421/1 ■ MIL-C-39022/9 ■ MIL-C-39022/10 ■ MULTIPLE-SECTION CAPACITORS

NEW DESIGN: *Multiple-section capacitors, polystyrene and polypropylene & foil; metallized polypropylene. A patented capacitor design that places multiple capacitors in parallel (coaxially wound) for extremely low ESL & ESR in a single package. Very high resonant frequency. Especially useful in switching power supplies, pulse, and discharge applications. For additional information on this series, call 916/885-2279.*

Examples of our most popular items:

TYPE	CAPACITANCE RANGE	VOLTAGE RANGE	D.F.	I.R.	OPERATING TEMPERATURE	COMMENTS
RT Series Polystyrene & Foil	.001µf to 3.0µf	100,200, 400,600 vdc	<.02% 1KHz 25°C	500K megohm x µf	-55°C to +85°C	High I.R., low D.F. & excellent stability & retrace.
PPT Series Polypropylene & Foil	.001µf to 5.0µf	200,400, 600 vdc	<.03% 1KHz 25°C	300K megohm x µf	-55°C to +105°C	Ideal for use in computer integrators, timing circuits, & laboratory standards. Low ESR & high-current applications.
PPMF Series Metallized Polypropylene	.001µf to 40.0µf	100,200 400,600 vdc (40µf 100vdc)	<.05% 1KHz 25°C	300K megohm x µf	-55°C to +105°C	Especially useful in switching power supply applications.
PCMF Series Metallized Polycarbonate	.001µf to 25.0µf	200,400, 600 vdc (8.0 & up, 200 vdc)	<.5% 1KHz 25°C	100K megohm x µf	-55°C to +125°C	Excellent insulation resistance, low temperature coefficient, high dielectric strength. Used in RC timers, discriminators, integrators, & differentiator circuits.
VMF Series Metallized Polyester	.001µf to 30.0µ	200,400 600 vdc (8.0 & up 200 vdc)	<1.0% 1KHz 25°C	10K megohm x µf	-55°C to +85°C	Outstanding insulation resistance & high dielectric strength plus reduced size & self-healing properties.

Tolerances vary from 1% to 20% depending on customer's requirements.
Other types have greater capacitor range.

■ MIL-SPEC QPL SERIES

Polycarbonate/super metallized, hermetically sealed, established reliability. Failure rate R.

Mil-C-83421/1 PCMS. Capacitances: .0010µf to 22.0µf. Voltages: grounded & nongrounded 30, 50, 100, 200, 300, 400. Tolerances: to=1/4%
Mil-C-39022/9 Type CHR01. Specs same as above.
Mil-C-39022/10 Type CHR10. Capacitances: .047µf to 22.0µf. Voltages & tolerances same as above.

RELCAP reliable capacitors

Hi-Rel Capacitor, Inc.

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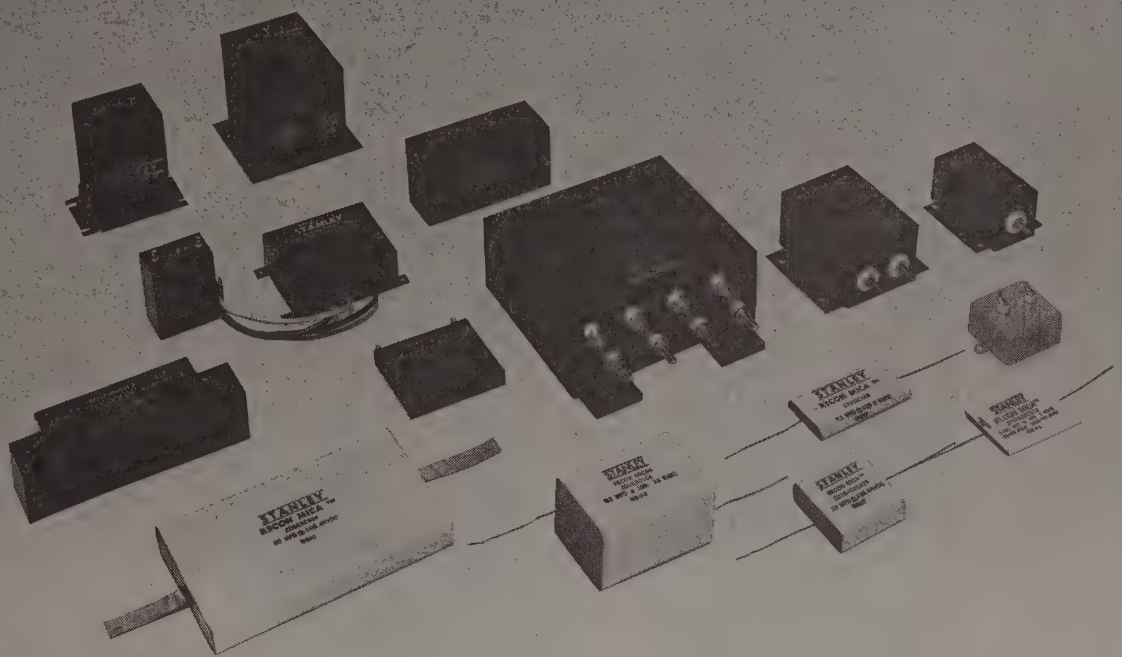
RFI Corporation

HIGH VOLTAGE PRODUCTS

STANLEY RECON-MICA CAPACITORS



RFI/STANLEY Recon-Mica™ capacitors provide the designer of high voltage electronic and electrical equipment substantial savings in size and weight over the conventional oil-filled, ceramic insulated types by combining the well-known characteristics of mica and the versatility of polyester resin.

Very low inductance is realizable as a result of the dry construction which eliminates the need for inherently high inductance ceramic insulating bushings. Because there is no oil to leak, **RFI/STANLEY Recon-Mica**™ capacitors offer the system designer greater reliability than would be encountered when using oil-filled components.

Features:

- Energy Storage
- High Energy Densities
- High Corona Resistance
- Pulse Repetitive Discharge
- Low Capacitance Change with Temperature and Frequency
- High Radiation Resistance
- Dry Solid State Package-No Leaks
- No Cumbersome High Voltage Bushings
- Compatible for use in Dielectric Fluids
- Wide Temperature Capability

Applications:

- High Voltage D-C
- Low Inductance Energy Discharge
- Pulse Forming Networks
- D-C Filtering
- By-Pass
- Laser Power Supplies
- Marx Generator
- Power Factor Correction
- Voltage Doubling

Applicable Military Specifications:
Meets Life requirements, Vibration and Shock, Moisture Resistance and Thermal Shock as specified in applicable portions of Mil-C-5, MIL-C-25, Mil-C-19978, Mil-N-23182.

RFI Corporation
A DEL ELECTRONICS COMPANY

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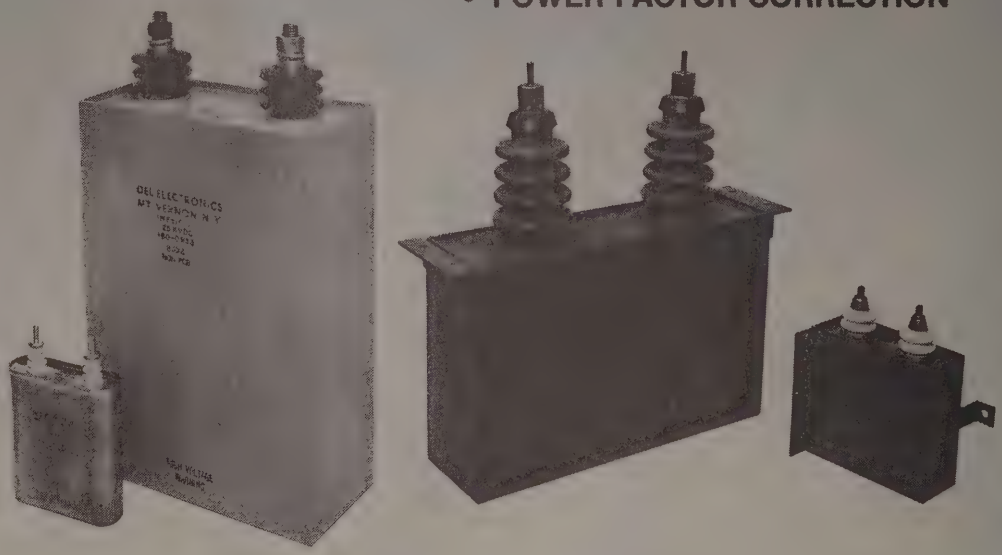
RFI Corporation

DEL CAPACITORS

• HIGH VOLTAGE • HERMETICALLY SEALED • OIL IMPREGNATED

FOR USE IN:

- HIGH VOLTAGE D.C.
- HIGH FREQUENCY A.C.
- ENERGY STORAGE
- PULSE FORMING NETWORKS
- PARTIALLY DISCHARGED
- MEDIUM CURRENT INVERTERS
- POWER FACTOR CORRECTION



Our task is to choose the optimum materials and configuration to meet the specific electrical and environmental conditions of your system.

We, therefore, use a variety of quality film and tissue with the lowest loss characteristics to minimize heating effects. All capacitors are impregnated with the highest purity fluid, then completely filled in a hermetic envelope to increase the corona inception voltage to the highest level attainable.

When required we utilize oil expansion compensation devices to compensate for oil expansion at temperature variations. In extreme conditions fluid cooling may be required to thermally stabilize the assembly.

Our thirty years of experience in the design and manufacture of this family of capacitor is enhanced by our years of application experience in the various products we offer such as pulse forming networks and power supplies.

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COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A

A/D acrylonitrile butadiene-styrene
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AFC audio frequency control
AFT automatic filter test
ALGOL algorithmic language
AM a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
ASIC application specific IC
ATE automatic test equipment
ATG automatic test generation
AWG American wire gauge

B

BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility syste

C

CAD computer-aided design
CAE computer-aided engineering
CAM computer-aided manufacture
CAMAC computer-automated measurement and control
CAPP computer-aided process planning
CAT computer-aided test
CATV cable television or community antenna television
CCC (leaded) ceramic chip carriers
CCD computer-controlled display
CERMET ceramic metal element
CIE computer-integrated engineering
CIM computer-integrated manufacturing
CLCC ceramic leadless chip carriers
CMOS complementary metal-oxide semiconductor
Comm. communications
CPS characters per second
CPU central processing unit

D

D/A digital to analog
DAC digital to analog converter
DBMS data base management system
DC direct current
DFT design for testability
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DRAM dynamic RAM
DTL diode transistor logic

E

EDA electronic design automation
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EIA Electronic Industries Association
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM erasable programmable ROM
ESR equivalent series resistance

F

FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G

GaAsFET gallium arsenide FET
CMIP commn management information protocol
GPIB general purpose interface bus
GPS global positioning system

H

HF high frequency (3 to 30 MHz)
HIPOT test, measurement, and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I

IAB Internet Activities Board
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared
ISDN integrated services digital network
ISO International Standards Organization

J

JEDEC Joint Electronic Device Engineering Council
JFET junction FET
JMOS junction MOS

K

kHz kilohertz (10^3 hertz)
KSR keyboard send /receive

L

LAN local area network
LC (filters) inductance/capacitance
LCC leaded chip carrier
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M

MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
µF microfarad
MHz megahertz
MIC microwave IC
MIPS million instructions per second
MIB microcomputer interface board
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor FET
MOSIGT metal oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N

NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM national instrumentation module
NOR not OR
NTC negative temperature coefficient

O

OCR optical character reader
OEM original equipment manufacturer
OR a logical operator
OSI open systems interconnection

P

PAL programmable array logic
PC printed circuit
PCB printed circuit board
PCM pulse code modulation
PCS plastic clad silica
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLCC plastic leaded chip carrier
PLL phased lock loop
PPI plan position indicator
PROM programmable ROM
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q

QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R

RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S

SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon-controlled switch
SDA source & detector assemblies
SGMP simple gateway monitoring protocol
SIDAC bidirectional voltage-triggered switch
SIMM single in-line memory module
SIP single in-line package
SMD surface mount device
SMT surface mount technology
SNMP simpole network management protocol
SO small outline
SOIC small outline IC
SOT small outline transistor
SSI small scale integration
SSR solid-state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T

TC temperature coefficient
TCE thermal coefficient of expansion
TXCO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U

UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

V

VAC volts (of) alternating current
VAN value-added network
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency (30 kHz to 300 MHz)
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W

WPS word processing software

Y

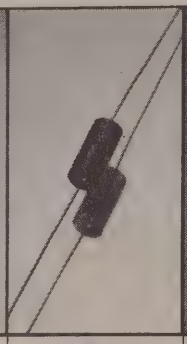
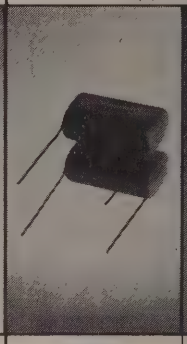
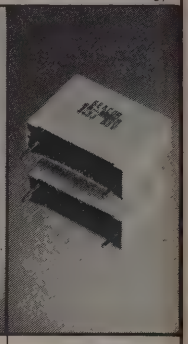
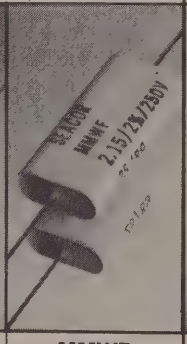
YIG yttrium iron garnet

Z

ZIF zero insertion force

Film Capacitors from SEACOR

Film Capacitors from SEACOR

	POLYESTER				POLYPROPYLENE	
CONSTRUCTION	FILM-FOIL				FILM-FOIL	
Insulation Resistance	IR ≥ 50000 MΩ				IR ≥ 50000 MΩ	
Test Volt. / DF Temperature Range	TEST V_T = 2 or 2.5×V_R DF<.75% −55 C to +85 C (up to 100 C with derating)				TEST V_T = 2 or 2.5×V_R DF<.2% −40 C to + 85 C (up to +105 C with derating)	
						
TYPE	**UNITS**	**MFDR**	**MFKR**	**MFWA**	**MVDS**	**PFDR**	**PFKR**
Capacity Range	µF	.001–.47	.0003–.47	.001–1.0	.001–.47	.001 to .47	.001 to .47
Tolerance	%	±5 to ±20	±5 to ±20	±5 to ±20	±5 to ±20	±1 to ±20	±1 to ±20
Rated Voltage	V_RDC	100 to 600	100 to 1000	100 to 1000	50 to 400	100 to 1500	100 to 1000
Lead Spacing	Inches (mm)	.296 to 1.064 (7.5) TO (27)	.296 to .591 (7.5) TO (15)	Axial Axial	.120 to .400 (3) to (10)	.394 to 1.180 (10) to (30)	.296 to .890 (7.5) to (22.5)
Taping		—	—	Available	Available	—	—
CONSTRUCTION	METALLIZED				METALLIZED	
Insulation Resistance	(V_R ≤ 100) IR ≥ 5000* MΩ×µF(sec.); (V_R > 100) IR ≥ 10000* MΩ×µF(sec.)				IR ≥ 50000 MΩ	
Test Volt. / DF Temperature Range	Test V_T = 1.6×V_R DF>.75% −55 C to +85 C (up to 100 C with derating)				TEST V_T = 1.6×V_R DF<.2% −40 C to + 85 C (up to +105 C with derating)	
						
TYPE	**UNITS**	**MMDR**	**MMKR**	**MMWA**	**MMWF**	**PMDR**	**PMKR**
Capacity Range	µF	.001 to 10.0	.001 to 10.0	.01 to 22.0	.01 to 22.0	.01 to 6.8	.01 to 2.2
Tolerance	%	±5 to ±20	±5 to ±20	±5 to ±20	±5 to ±20	±5 to ±20	±1 to ±20
Rated Voltage	V_RDC	63 to 630	50 to 1000	100 to 1000	100 to 1000	100 to 630	250 to 630
Lead Spacing	Inches (mm)	.197 to 1.182 (5) to (30)	.197 to 1.182 (5) to (27.5)	Axial	Axial	.394 to 1.083 (10) to (27.5)	.296 to 1.083 (7.5) to (27.5)
Taping		Available	Available	Available	Available	—	—

*IR in MΩ need not exceed values = 3×MΩ×µF(sec.) listed

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FAX 201-664-8544

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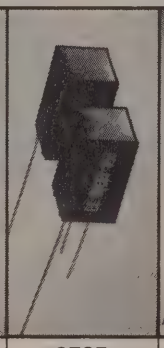
	POLYPROPYLENE		POLYCARBONATE		POLYSTYRENE		
CONSTRUCTION	FILM-FOIL		METALIZED		FILM FOIL		
Insulation Resistance	IR ≥ 50000 MΩ		($V_R \leq 100$) IR ≥ 5000*M×F(sec.) ($V_R > 100$) IR ≥ 10,000*MΩ×μF(sec.)		IR > 100000MΩ		
Test Volt. / DF Temperature Range	TEST V_T = 2 or 2.5xV_R DF<.2% −40 C to + 85 C (up to +105 C with derating)		Test V_T = 1.6×V_R DF < .4% −40 C to +85 C (up to 125 C with derating)		V_T < 2.5xV_R DF < .05% -55 C to + 70 C		
							
TYPE	**UNITS**	**PFWA**	**PVDS**	**CMDR**	**CMKR**	**SFKR**	**SFSR**	**SFWA**
Capacity Range	μF	.001–.47	.001–.22	.01 to 6.8	.001 to 22.0	.000051 to .448	.0001 to .18	.0001 to .603
Tolerance	%	±1 to ±20	±2 to ±20	±5 to ±20	±1 to ±20	±.5 to ±5	±1 to±5	±1 to ±5
Rated Voltage	V_RDC	100 to 630	50 to 200	100 to 400	63 to 630	63 to 630	63	63 to 1000
Lead Spacing	Inches (mm)	Axial	.138 to .236 (3.5) to (6)	.394 to 1.083 (10) to (27.5)	.296 to 1.083 (7.5) to (27.5)	.493 to 1.083 (12.5) to (27.5)	.197×.197 to .591×.591 (5×5) to (15×15)	Axial
Taping		Available	Available	—		—	—	Available

	METALLIZED		METALLIZED		FILM FOIL		
CONSTRUCTION							
Insulation Resistance	IR ≥ 10,000* MΩ×μF (sec.)		($V_R \leq 100$) IR ≥ 5000*M×F(sec.) ($V_R > 100$) IR ≥ 10,000*MΩ×μF(sec.)		IR > 100000MΩ		
Test Volt. / DF Temperature Range	TEST V_T = 1.6xV_R DF<.2% −40 C to + 85 C (up to +105 C with derating)		Test V_T = 1.6×V_R DF < .4% −40 C to +85 C (up to 125 C with derating)		V_T < 2.5xV_R DF < .05% -55 C to + 70 C		
TYPE	**UNITS**	**PMWA**	**PMWF**	**CMWA**	**CMWF**	**SVVO**	**SVVR**	**SVVA**
Capacity Range	μF	.01 to 10.0	.1 to 6.8	.0001 to 22.0	.01 to 22.0	.00001 to .022	.000047 to .027	.00001 to .015
Tolerance	%	±1 to ±20	±1 to ±20	±1 to ±20	±5 to ±20	±1 to ±20	±2 to ±20	±10 to ±20
Rated Voltage	V_RDC	100 to 630	250 to 630	63 to 630	63 to 630	25 to 1000	63 to 630	2000 to 10000
Lead Spacing	Inches (mm)	Axial	Axial	Axial	Axial	Axial	.118 to .591 (3) to (15)	Axial
Taping		Available	Available	Available	Available	—	—	Available

*IR in MΩ need not exceed values = 3×MΩ×μF(sec.) listed

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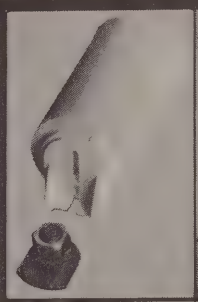
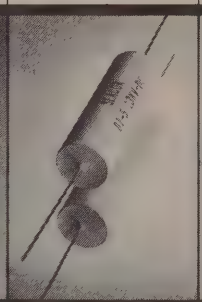
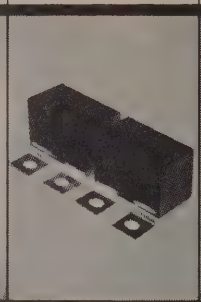
AC, HIGH VOLTAGE AND SPECIAL PURPOSE CAPACITORS



TYPE	PNM	PNP	PNAF	PNLP	THY	MSR
Application	Motor Run	Motor Run	Motor Run	Motor Run	Snubber for Thyristors	High Voltage Current AC-DC Professional use
Dielectric	Polypropylene Oil-Filled	Polypropylene Dry	Polypropylene	Polypropylene	Polypropylene	Polypropylene Oil-Filled
Capacity Range	.5 to 60µF	1 to 100µF	.5 to 4µF	1 to 30µF	.2 to 6µF	.1 to 47µF
Tolerance	±5 to ±10%	±5 to ±10%	±5 to ±20%	±5 to ±10%	±10%	±5 to ±10%
Rated Voltage	250V to 500VAC	250V to 500VAC	200V to 400VAC	250V to 500VAC	500V to 1250VAC RMS	400 V to 935VAC RMS
Current	—	—	—	—	10A to 150A	16A to 70A
DV/DT	—	—	—	—	700 to 4000V/µs	70 to 800V/µs
Safety Features	Pressure Interruptor	—	—	—	—	Pressure Interruptor
Approvals	UL; VDE CSA* SEV; IMQ	VDE SEV; IMQ	VDE	—	—	—

TYPE	BIO	PNKR	PNKY	MMWS	PMBK	MNRR
Application	High Voltage Current AC-DC Professional use	Interference Suppressors X	Interference suppressors Y	High Voltage	Snubber—SCR IGBT Protection Commutation	Spark Quencher R-C Network
Dielectric	Mixed Oil-Filled	Polypropylene	Polypropylene	Polyester	Polypropylene	Polyester
Capacity Range	.1 to 8000 µF	.015 to 1 µF	.001 to .022µF	.0015 to .68µF	.27 to 1.75µF	.1 to 1µF +100 to 680Ω
Tolerance	±10%	±10 to ±20%	±20%	±5 to ±20%	±5 to ±20%	±10 to ±20%
Rated Voltage	400V to 4200V RMS	250VAC	250VAC	1600 to 13000VDC	450 to 630VAC	125VAC to 250VAC
Current	40A–300A	—	—	—	6A to 8A	—
DV/DT	5 to 5000V/µs	—	—	—	250 to 750V/µs	—
Safety Feature	Pressure Interruptor	—	—	—	—	—
Approvals	—	UL; VDE CSA SEV; SEMCO	UL; VDE CSA OVE; SEMCO	—	—	—

*CSA Pending

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MINIGLOSSARY CAPACITORS

Anode: One of two plates or conductors. In polarized capacitors, the anode should be connected to the positive conductor in the circuit.

Capacitive Reactance: The opposition (in ohms) of capacitance to the flow of alternating current, equal to the reciprocal of the product of the angular frequency (2π times frequency in Hertz) of the current times the capacitance in farads.

Cathode: One of two plates or conductors. In electrostatic capacitors the cathode is metallic. In electrolytic capacitors the cathode is a liquid, gel or other conductive material which is in intimate contact with a metallic cathodic connection.

Dielectric Constant: The ratio of the capacitance of a capacitor with some material other than air between the capacitor plates to the capacitance of the same capacitor with air between the plates. For example, the dielectric constants of air, Teflon®, polystyrene and ruby mica are 1, 2.1, 2.6 and 5.4, respectively.

Electrolytic: A capacitor with one metallic conductor (generally the anode) and with a liquid or semiconductor cathode. Nonpolarized electrolytic capacitors generally have two equal anodes as well as the liquid cathode. These anodes operate alternately as anode and cathodic connection as alternating current is applied.

Electrostatic: One of two general classes of capacitors in which two or more discrete metallic conductors are present and separated by an insulating dielectric material. Examples include: mica, ceramic, film, and paper types.

Farad: The basic unit of measure in capacitors. A capacitor charged to one volt with a charge of one coulomb (one ampere flowing for one second) has a capacitance of one farad. Capacitors are generally rated at portions of a farad (microfarads or picofarads).

1 farad (F) = 1,000,000 microfarads (μF) 1 microfarad (μF) = 1,000,000 picofarads (pF)

Impedance: All capacitors exhibit impedance. It is a function of capacitor type and internal construction. This can be particularly important in certain applications such as filters for switching power supplies. Capacitors used in these applications often have special multiple tab construction to shorten current paths and to reduce internal resistance.

Leakage Current: Expressed as dcl for electrolytic capacitors, a measure of the intrinsic losses in a charged capacitor. Generally speaking, the lower the dcl, the higher quality the capacitor.

Power Factor: A measure of the overall efficiency of a capacitor. Power factor ratings take all internal losses into consideration in a complex formula. This parameter of certain capacitors is often very important in AC applications such as motor-start and/or motor-run capacitors

Rated Voltage: The rated working voltage of a capacitor. Generally expressed in DC Volts (Vdcw). This is the voltage at which a capacitor may be safely operated at 25°C continuously within its overall parameters.

Ripple Current: The total amount of alternating and direct current that may be applied to an electrolytic capacitor under stated conditions. In general, the higher the ripple current applied, the shorter the operating life of the capacitor will be. Application of significantly higher than rated ripple currents can shorten the capacitor life dramatically and may even cause catastrophic failure (explosion).

Surge Voltage: The momentary surge voltage which may be applied for a stated length of time without doing permanent damage to the unit.

Temperature: Capacitors are generally rated at 25°C at sea level under specific humidity conditions. Operating temperature ranges are also given, along with derating (reliability) curves for operation at temperatures other than 25°C.

Temperature Coefficient: Expressed as TC in ppm (parts per million) or in percent (%) from the norm of 25°C. This is seldom a straight line and may vary widely for certain types. Most capacitors have positive TC in that the capacitance increases as temperature increases. Some types, however, have negative TC in that the capacitance decreases as temperature increases.

Ceramic Capacitor Codes
(Capacitance Given In pF)

Color	Digit	Multiplier	Tolerance			Temperature Coefficient ppm°C	Significant Figure	Multiplier
			Class 1		Class 2			
			10pF or less	Over 10pF				
Black	0	1	±2.0pF	±20%	±20%	0	0.0	–1
Brown	1	10	±0.1pF	±1%		–33		–10
Red	2	100		±2%		–75	1.0	–100
Orange	3	1000		±3%		–150	1.5	–1000
Yellow	4	10000			+100% –0%	–220	2.0	–10000
Green	5		±0.5pF	±5%	±5%	–330	3.3	+1
Blue	6					–470	4.7	+10
Violet	7					–750	7.5	+100
Gray	8	0.01	±0.25pF		+80% –20%	+150 to –1500		+1000
White	9	0.1	±1.0pF	±10%	±10%	+100 to –750		+10000
Silver								
Gold								

SPRAGUE GOODMAN

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GLASS AND QUARTZ PISTONCAPS®

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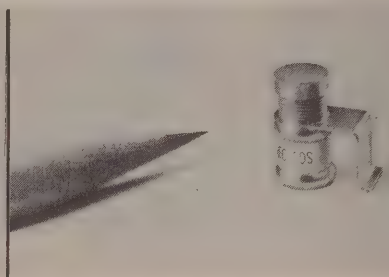
- QPL models
- Extremely stable over temperature, frequency, voltage, etc.
- Cap ranges: 0.5-3.0 pF to 1.0-120 pF
- Zero backlash multiturn adjust mechanism
- Operating temp: −55° to +125°C (models to +200°C)
- Q to 1500 at 20 MHz
- Wide variety of configurations for PC and panel mounting
- Voltage ratings from 500 to 5000 V

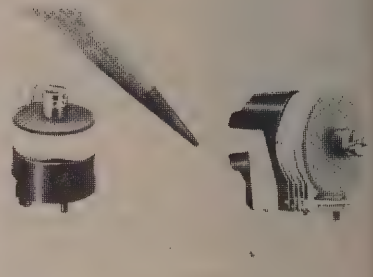
For more information, ask for Bulletin SG-205.



AIRTRIM® MULTITURN AIR DIELECTRIC

- Q.: >5000 at 100 MHz
- Nine mounting styles including surface mount
- Designed to meet MIL-C-14409D
- Operating temp: -65° to +125°C
- Standard cap ranges: 0.35 to 3.5 pF, 0.6 to 6 pF, and 0.8 to 10 pF
- Multiturn resolution
- Extremely stable over temperature, frequency, voltage, etc.
- Rated voltage: 250 VDC
- Self-resonant frequency: >5 GHz
- Insulation resistance: $>10^6$ MΩ

For more information, ask for Bulletin SG-660.



FILMTRIM® SINGLE TURN PLASTIC

- Cap ranges: 1.0-5.0 pF to 25-500 pF
- Q to 5000 at 1 MHz
- Operating temp:
  PTFE, Polycarbonate, Polyimide: −40° to +85°C
  Polypropylene: −40° to +70°C
  High temp PTFE: −40° to +125°C
- 6 sizes from 5 mm to 16 mm
- More stable with temperature than other single turn trimmers

For more information, ask for Bulletin SG-402.

SAPPHIRE PISTONCAPS®

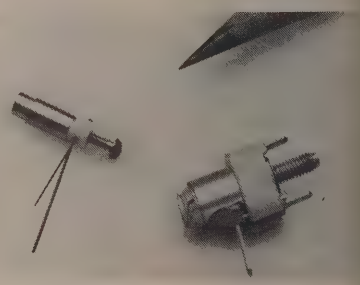
- Q to 4000 at 250 MHz
- 6 mounting styles suitable for all RF structures
- Designed to meet MIL-C-14409D
- Operating temp: −55° to +125°C
- Cap ranges: 0.3-1.2 pF to 0.8-8.0 pF
- Subminiature size
- Multiturn resolution
- Extremely stable over temperature, frequency, voltage, etc.

For more information, ask for Bulletin SG-207.

AIRTRIM® SINGLE TURN AIR DIELECTRIC

- Cap ranges: 1.0-3.7 pF to 2.9-24.0 pF
- Q typically 8000 at 1 MHz; 4000 at 100 MHz; 1500 at 200 MHz
- Operating temp: −55° to 85°C
- Temp coefficient as low as 10 ± 10 ppm/°C
- 2 sizes and 10 mounting configurations for printed circuit and panel mounting
- Machined from solid brass

For more information, ask for Bulletin SG-600.



MULTITURN PLASTIC

- Cap ranges: 0.25-1.5 pF; 2.0-10 pF
- Multiturn resolution at low cost
- Q typically > 2000 to VHF
- Temp coefficient of capacitance: 50 ± 50 ppm/°C; 0 ± 200 ppm/°C
- Operating temp: −55° to 125°C; −40° to 100°C

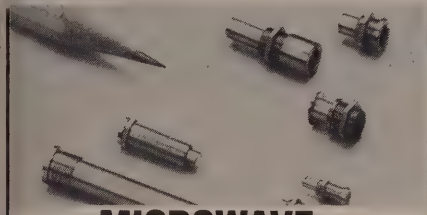
For more information, ask for Bulletin SG-401.

Tuning tools are available for all models. Ask for bulletin SG-206.

Sprague-Goodman Electronics, Inc.
134 Fulton Ave., Garden City Park, N.Y. 11040-5395
Tel: 516-746-1385 • Fax: 516-746-1396

SPRAGUE GOODMAN

TRIMMER CAPACITORS, INDUCTORS AND MICROWAVE TUNING ELEMENTS



MICROWAVE TUNING ELEMENTS

Metallic tuning elements
- 4 to 33 GHz
- For waveguide filters, attenuators

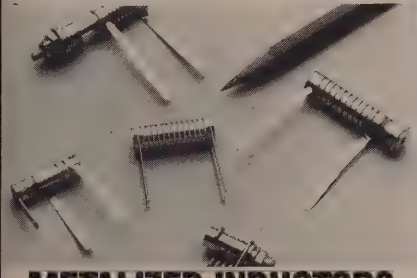
Dielectric tuning elements
- Alumina, quartz, sapphire
- 8 to 100 GHz
- For IMPATT, Gunn devices

Dielectric resonator tuners
- 2 to 18 GHz
- For filters, oscillators

LC tuning elements
- 5 to 11 GHz
- High Q wideband tuning

Resistive tuning elements
- 1 to 18 GHz
- Trim amplifier, oscillator power

For more information, ask for Bulletin SG-670.

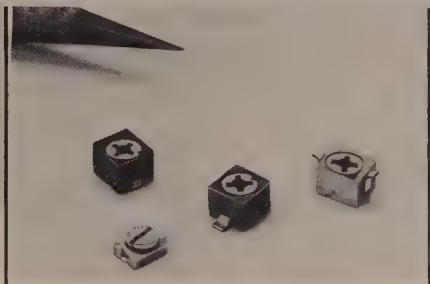


METALIZED INDUCTORS & LC TUNERS

Metalized Inductors
- Variables (±10%): overlapping ranges from 0.29 to 1.5 µH
- Fixed: 0.05 to 2.00 µH
- Min. SRF to 900 MHz, Min. Q to 200
- Temperature coefficient only ±10 ppm/°C over −55° to +125°C

LC Tuners
- Series resonant with SRF from 150 to 725 MHz in 4 ranges
- Parallel resonant with SRF from 170 to 1000 MHz in 5 ranges
- Temperature coefficient less than 40 ± 30 ppm/°C over −55° to +125°C

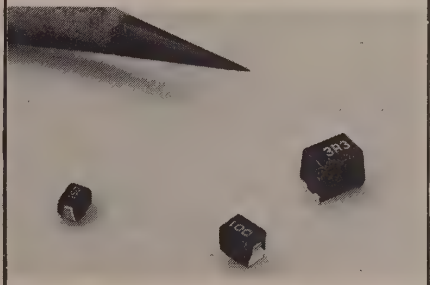
For more information, ask for Bulletin SG-700.



SURFTRIM® SURFACE MOUNT

- 2 sizes:
  3.2 × 4.5 × 1.6 mm
  4.0 × 4.5 × 2.7 mm (sealed)
- 4 mounting configurations
- Carrier and reel or bulk pack
- 1.7 to 50 pF in 7 cap ranges
- Operates to 85°C

For more information, ask for Bulletin SG-305.



SURFCOIL® SMT INDUCTORS

- Inductance from 10 nH to 1 mH
- 8 model series in 3 sizes:
  2.5 × 2.0 × 1.6 mm
  (0.098″ × 0.079″ × 0.063″)
  3.2 × 2.5 × 2.2 mm
  (0.126″ × 0.098″ × 0.087″)
  4.5 × 3.2 × 3.2 mm
  (0.177″ × 0.126″ × 0.126″)
- Shielded, unshielded, ferrite core and nonmagnetic models
- Operating temp: −20° to +85°C
- Carrier and reel standard
- Fully encapsulated

For more information, ask for Bulletin SG-800.

CERAMIC DIELECTRIC

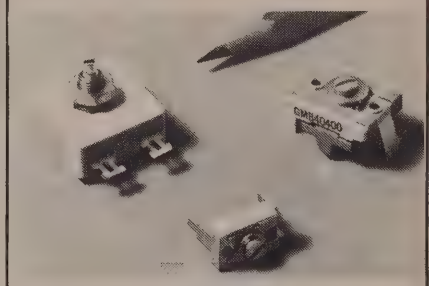
Rugged 5 & 7 mm types
- Operating temp: −55° to +125°C
- Cap ranges: 1.3-2.0 pF to 12-160 pF

Miniature types suitable for hybrids
- Operating temp: −25° to +85°C
- 3 series: 2.0 × 1.2 mm; 3.0 × 1.5 mm; 5.0 × 2.0 mm
- Cap ranges: 2.5-10 pF to 5.5-40 pF

Microwave types
- Operating temp: −55° to 85°C
- Cap ranges: 0.5-2.0 pF; 1-4.0 pF; 2.0-10 pF
- Q > 500 at 100 MHz

Plastic encased 4 × 4.5 mm and 5 mm types
- Designed for volume applications
- SMT and printed-thru-hole models
- Cap ranges: 1.7-3.0 pF to 10-50 pF

For more information, ask for Bulletin SG-305.



MICA COMPRESSION

- Cap ranges: 2.5-7.0 pF to 1400-3055 pF
- Q to 600 at 1 MHz
- Rated working voltage to 500 V
- Can handle higher RF currents
- Operating temp: −35° to 85°C
- 8 mounting styles for PC, panel, and bracket mounting

For more information, ask for Bulletin SG-500.

Tuning tools are available for all models. Ask for bulletin SG-206.

Sprague-Goodman Electronics, Inc.
134 Fulton Ave., Garden City Park, N.Y. 11040-5395
Tel: 516-746-1385 • Fax: 516-746-1396

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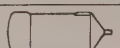
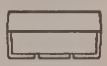
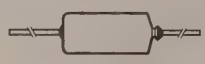
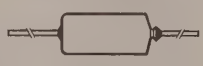
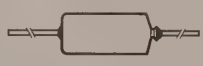
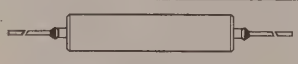
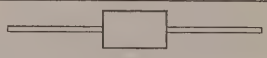
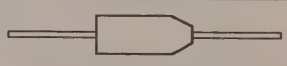
Parameter Comparison Guide

SOLID ELECTROLYTE TANTALUM CHIP CAPACITORS

MODEL	MIL SPEC/ TYPE	OUTLINE DRAWING	CAPACITANCE RANGE (µF)	WORKING VOLTAGES (VDC)	PACKAGING AVAILABLE (Case Sizes)				
					8mm TAPE*	12mm TAPE*	16mm TAPE*	WAFFLE PACK	BULK
194D	MIL-C-55365/4 (CWR06)		0.10-150	4-50	A	B, C, D, E, F	G, H	A, H	—
195D	MIL-C-55365/7 (CWR10)	 EIA-535BAAD	0.10-330	41-50	C, S, V	X, Y, Z, R	—	—	S, V, X, Y Z, R
595D	—		0.10-470	4-50	A, B, T	C, D, R	—	—	—
695D	—		0.10-270	4-50	A	B, D, E, G	H	—	—
293D	MIL-C-55365/ (CWR11)	EIA-535BAAC	0.10-100	4-50	A, B	C, D, E	—	—	—
894D	—		1.0-47	6.3-50	B	C, D, E	—	—	—

SOLID ELECTROLYTE TANTALUM LEADED CAPACITORS

	MODEL	MIL SPEC/ TYPE	OUTLINE DRAWING	CAPACITANCE RANGE (µF)	WORKING VOLTAGES	PACKAGING AVAILABLE (Case Sizes)
HERMETIC SEAL	150D - Polar	MIL-39003/1 (CSR13)		.0047-330	6-125 VDC	A, B, R, S
	152D - Polar	MIL-39003/03/06 (CSR23/33)		1.2-1000	6-50 VDC	A, B, R, S
	550D - Polar	MIL-39003/09 (CSR21)		5.6-330	6-50 VDC	R, S
	151D - Non Polar	MIL-C-39003/04 (CSR91)		.0023-160	6-125 VNP	W, X, Y, Z
	Military Parts	MIL-C-39003 (CSR09-91)		.047-18	6-75 VDC	J, L
NON-HERMETIC SEAL	173D - Molded Axial	MIL-C-49137/05 (CX05)		.1-220	2-50 VDC	U, V, W, X, Y
	199D - Dipped Radial	MIL-C-49137/02 (CX02, CX12)		.1-680	3-50 VDC	A, B, C, D E, F
	299D - Dipped Radial	—		.1-680	3-50 VDC	A, B, C, D E, F
	197D - Molded Case Radial	—		.47-100	10-50 VDC	G, H, J

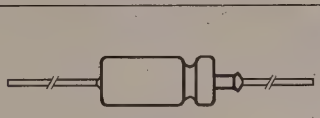
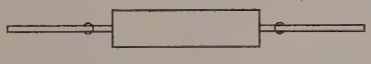
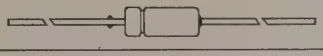
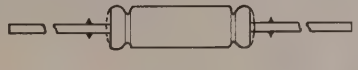
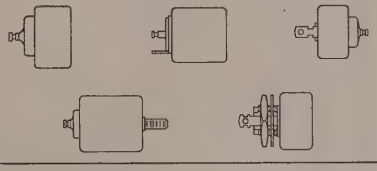
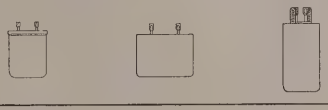
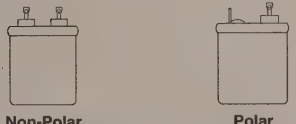
NOTES: 1. All Axial Polar capacitors are available tape and reeled per EIA RS-296.* 2. Type 199D/299D capacitors are available tape and reeled per EIA RS-468.*
* Variations (tape spacing, etc.) are available. Consult your local Sprague office or the factory for details.

Solid Tantalum Capacitors: **SPRAGUE**, 678 Lower Main Street, Sanford, ME 04073, Phone: (207) 324-4140, Fax: (207) 324-7223
SPRAGUE, 70 Pembroke Road, Concord, NH 03301, Phone: (603) 224-1961, Fax: (603) 224-1430
Wet and Foil Tantalum Capacitors: **SPRAGUE**, 1600 Curran Memorial Highway, North Adams, MA 01247, Phone: (413) 664-4431, Fax: (413) 662-2494

Parameter Comparison Guide

A COMPANY OF VISHAY SPRAGUE

TANTALUM CAPACITOR CHARACTERISTICS

		MODEL	OUTLINE DRAWING	MIL SPEC/ TYPE	CAPACITANCE RANGE (µF)	WORKING VOLTAGE @ + 85°C (WVDC)
HERMETIC SEAL	WET SLUG	137D		M3965 (CL66, 67)	1.7-2200	6-150
		138D		M39006/9/21 (CLR65, 69)	1.7-2200	6-150
		135D		M39006/22/25 (CLR79, 81)	1.7-2200	6-125
	FOIL	280D		M39006/03 (CLR35)	.12-100	15-300
		281D*		M39006/04 (CLR37)	.27-160	15-300
		281D		M39006/01 (CLR25)	1-580	15-150
		283D*		M39006/02 (CLR27)	.5-350	15-150
	MILITARY PARTS			MIL-C-39006 (CLR14-81)		
NON-HERMETIC SEAL	WET SLUG	109D		M3965 (CL64, 65)	1.7-2200	6-150
	FOIL	110D 111D* 112D 113D*		—	.25-1300 .15-470 1.0-2500 .5-2000	3-300 6-250 15-300 15-150
ASSEMBLIES	WET SLUG	140D 141D		M39006/19, 20 (CLR14, 17)	3.5-240	18-630
		200D 202D		M3965 (CL55)	70-51000	6-150
	FOIL	300D 301D 302D 303D	 Non-Polar Polar	M3965 (CL51) M3965 (CL52) M3965 (CL53) M3965 (CL54)	25-8700	15-150
	CUSTOM DESIGNS		May include Solid, Wet Slug and Foil capacitor sections.			

* Non-Polar.

TANTALUM CAPACITOR CHARACTERISTICS

	SOLID-ELECTROLYTE	WET SLUG	FOIL
Capacitance Range	0.0047-1000µF	1.7-2200µF	0.15-2500µF
Voltage Range	3-125 V	6-150 V	6-300 V
Leakage Current	Lower	Lowest	Low
Reverse Voltage	10% - 15%	3 V**	3 V
Non-Polar	Yes	No	Yes
Inrush Current	Good	Very Good	Very Good
ESR	Lowest	Low	Low
Stability	Best	Good	Good
Temperature Range	-55°C to + 125°C		

** Tantalum-Case Tantalum Only.

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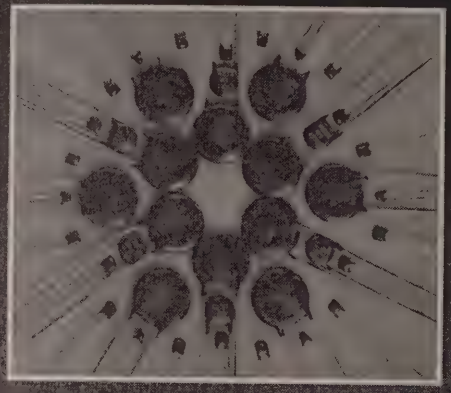
SPRAGUE, 70 Pembroke Road, Concord, NH 03301, Phone: (603) 224-1961, Fax: (603) 224-1430
Wet and Foil Tantalum Capacitors: **SPRAGUE**, 1600 Curran Memorial Highway, North Adams, MA 01247, Phone: (413) 664-4431, Fax: (413) 662-2494

TUSONIX

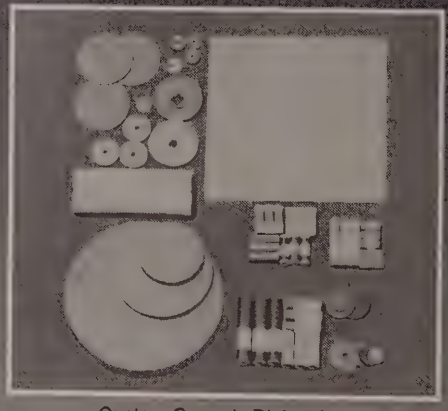
If you're looking for a reliable source for Ceramic Capacitors and Custom Dielectrics

Ceramic Trimmer Capacitors



Single Plate and Disc Ceramic Capacitors

Feed-Thru and Stand-Off Ceramic Capacitors



Custom Ceramic Dielectrics

Tusonix has the product versatility, QPL approvals and delivers what you want, when you want it.

Tusonix should be your first source for reliable fixed and variable capacitors, custom ceramic dielectrics and EMI/RFI ceramic filters. Single plate Weecon ceramic capacitors have long been an industry standard, offering the widest selection of ceramic formulations and miniature package sizes available. Our variable ceramic capacitors are available in an almost endless variety of capacitance ranges and miniature sizes. In addition, Tusonix offers a broad range of ceramic capacitor types, including high voltage, tubular, disc, stand-off and feed-thrus.

Tusonix' extensive ceramic technology and manufacturing capabilities enable us to satisfy special dielectric needs with extensive shapes, sizes and technical formulations.

Tusonix also offers a broad line of EMI/RFI filters as well as EMI filter/capacitor custom assemblies.

So if you're looking for a consistently reliable source, look to Tusonix first. Please call 602-744-0400.

TUSONIX

P.O. Box 37144, Tucson, AZ 85740-7144
Phone: 602-744-0400 FAX: 602-744-6155

TUSONIX

QPL CROSS REFERENCE

MIL-F-15733 (EMI FILTERS)

MIL Part No.	TUSONIX Part No.
M15733/28-0001	4201-501
M15733/28-0002	4201-503
M15733/28-0003	4251-503*
M15733/33-0001	4101-502
M15733/33-0002	4101-503
M15733/40-0001	4106-500
M15733/43-0001	4204-501
M15733/43-0002	4201-506
M15733/44-0001	4251-500*
M15733/44-0002	4205-500*
M15733/44-0003	4205-501*
M15733/46-0001	4207-500
M15733/51-0001	4101-504
M15733/51-0002	4151-501*
M15733/61-0001	4204-500
M15733/61-0002	4202-501
M15733/61-0003	4206-502
M15733/61-0004	4206-501
M15733/61-0005	4203-502
M15733/61-0006	4203-501
M15733/61-0007	4203-552
M15733/61-0008	4201-502
M15733/61-0009	4253-500*
M15733/61-0010	4203-553
M15733/61-0011	4203-551
M15733/61-0012	4253-501*
M15733/61-0013	4251-502*
M15733/61-0014	4251-501*
M15733/62-0001	4101-501
M15733/62-0002	4100-500
M15733/62-0003	4101-505*
M15733/62-0004	4151-500*
M15733/66-0001	4101-500

*Qualification in Progress

MIL-C-20 (TUBULAR - DISCS)

MIL Part No.	TUSONIX Part No.
CC 20	301-651
CC 22	331-051
CC 27	332-051
CC 30	308-651
CC 50	831-020
CC 51	801-020
CC 52	811-020
CC 53	821-020

MIL-C-11015 (DISCS-TUBULAR-FEED/THRU)

MIL Part No.	TUSONIX Part No.
CK 22	331-052
CK 27	332-052
CK 60	831-040 (500V)
CK 60	831-050 (500V & Epoxy)
CK 60	838-040 (1000V)
CK 60	838-050 (1000V & Epoxy)
CK 61	801-040
CK 61	801-050 (Epoxy)
CK 62	811-040 (500V)
CK 62	811-050 (500V & Epoxy)
CK 62	818-041 (1500V)
CK 62	818-051 (1500V & Epoxy)
CK 63	841-040 (500V)
CK 63	841-050 (500V & Epoxy)
CK 63	848-040 (1000V)
CK 63	848-050 (1000V & Epoxy)
CK 64	828-540
CK 64	828-541 (Epoxy)
CK 65	3848-540
CK 65	3848-571 (Epoxy)
CK 66	3878-540
CK 66	3878-541 (Epoxy)
CK 67	3878-570
CK 67	3878-571 (Epoxy)
CK 70	327-042 (500V)
CK 70	327-062 (1000V)
CK 72	2432-012
CK 74	2404-613
CK 75	2404-614
CK 78	2482-030
CK 79	2482-029
CK 80	326-010

MIL-C-81 (TRIMMERS)

MIL Part No.	TUSONIX Part No.
CV31	538-054
CV32	538-067
CV35	518-016
CV36	518-017

MIL-C-39014 (FEED/THRU-STAND/OFF)

MIL Part No.	TUSONIX Part No.
39014/16 CKR 75 Failure Rate Level M (1%)	2499-032
39014/17 CKR 82 Failure Rate Level M (1%)	2499-035
39014/18 CKR 76 Failure Rate Level M (1%)	2425-049
39014/19 CKR 83 Failure Rate Level M (1%)	2425-074

Authorized Distributors:

Newark Electronics	312-784-5100
Penstock, Inc.	408-730-0300
T.T.I., Inc.	817-740-9000

TUSONIX
P.O. Box 37144, Tucson, AZ 85740-7144
Phone: 602-744-0400 Fax: 602-744-6155

MINIGLOSSARY
BASIC CAPACITOR FORMULAS

I. Capacitance (farads)

English: $C = \frac{.224\,K\,A}{t_D}$

Metric: $C = \frac{.0884\,K\,A}{t_D}$

II. Energy stored in capacitors (Joules, watt-sec)

$E = \frac{1}{2}\,CV^2$

III. Linear charge of a capacitor (Amperes)

$I = C\frac{dV}{dt}$

IV. Total Impedance of a capacitor (ohms)

$Z = \sqrt{R_s^2 + (X_C - X_L)^2}$

Where Rs = ESR

V. Capacitive Reactance (ohms)

$X_C = \frac{1}{2\pi fC}$

VI. Inductive Reactance (ohms)

$X_L = 2\pi fL$

VII. Phase Angles:

Ideal Capacitors: Current leads voltage 90°
Ideal Inductors: Current lags voltage 90°
Ideal Resistors: Current in phase with voltage

VIII. Dissipation Factor

$DF = \tan\delta\ (\text{loss angle}) = \frac{ESR}{X_c} = (2\pi fC)\ (ESR)$

IX. Power Factor

PF = Sine δ (loss angle) = Cos ϕ (phase angle)
PF = DF (when less than 10%)

X. Quality Factor (dimensionless)

$Q = \text{Cotan}\ \delta\ (\text{loss angle}) = \frac{1}{DF}$

XI. Equivalent Series Resistance (ohms)

$ESR = (DF)\ (Xc) = (DF)\ (\frac{1}{2}\pi fC)$

XII. Power Loss (watts)

Power loss $= (2\pi fCV^2)\ (DF)$

XIII. KVA (Kilowatts)

$KVA = 2\pi fCV^2 \times 10^{-3}$

XIV. Temperature Characteristic (ppm/°C)

$TC = \frac{Ct - C_{25}}{C_{25}\,(T_t - 25)} \times 10^6$

XV. Cap Drift (%)

$C.D. = \frac{C_1 - C_2}{C_1} \times 100$

XVI. Reliability of Ceramic Capacitors

$\frac{L_o}{L_t} = \left(\frac{V_t}{V_o}\right)^x \left(\frac{T_t}{T_o}\right)^\tau$

XVII. Capacitors in Series (current the same)

Any number: $\frac{1}{C_T} = \frac{1}{C_1} + \frac{1}{C_2} \cdots + \frac{1}{C_N}$

Two: $C_T = \frac{C_1\,C_2}{C_1 + C_2}$

XVIII. Capacitors in Parallel (voltage the same)

$C_T = C_1 + C_2 \cdots + C_N$

XIX. Aging Rate

A.R. = % Δ C/decade of time

XX. Decibels

$db = 20 \log \frac{V_1}{V_2}$

Metric prefixes:

Pico	X 10^{-12}
Nano	X 10^{-9}
Micro	X 10^{-6}
Milli	X 10^{-3}
Deci	X 10^{-1}
Deca	X 10
Kilo	X 10^3
Mega	X 10^6
Giga	X 10^9
Tera	X 10^{12}

Symbols:

K	=	Dielectric Constant
A	=	Area of electrode overlap
t_D	=	Dielectric thickness
V	=	Voltage (volts)
t	=	time (hours)
R_S	=	Series Resistance (ohms)
f	=	frequency (Hertz)
L	=	Inductance (henries)
δ	=	Loss angle
ø	=	Phase angle
x+y	=	Exponent effect of voltage and temperature
L_O	=	Operating life (hours)
L_t	=	Test life (hours)
V_t	=	Test voltage (volts)
V_o	=	Operating voltage (volts)
T_t	=	Test temperature (°C)
T_o	=	Operating temperature (°C)

We are United Chemi-Con.

United Chemi-Con should be your capacitor source.

UNITED CHEMI-CON

Since 1931, the recognized leader in the design and manufacture of Aluminum Electrolytic Capacitors.

- **Manufacturing facilities in the United States and Asia**
- **Warehouses in North Carolina and California**

Miniature
High Voltage
High Temperature
Long Life
Low Impedance
Low Leakage Current
Bi-Polar
Leadless Chip
High Ripple
Photoflash
Computer Grade

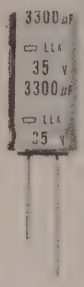
Advanced technology, documented quality and reliable deliveries!

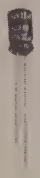
UNITED CHEMI-CON INC.

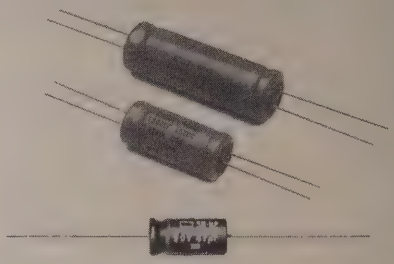
9801 West Higgins Road, Rosemont, Illinois 60018
Phone 708-696-2000 Fax 708-696-0857

UNITED CHEMI-CON

Aluminum Electrolytic Capacitors







SERIES	DESCRIPTION	LOAD LIFE °C	LOAD LIFE HOURS	MINIATURIZED	SOLVENT PROOF	TERMINAL TYPE	VOLTAGE RANGE (VDC)	CAPACITANCE RANGE (μF)	EQUIVALENT MIL APPROVAL
SURFACE MOUNT									
MF	Low Profile, For Reflow	85	2000	•	•	SMD	4-50	0.1-150	
MFK	Low Profile, For Reflow	105	1000-2000	•	•	SMD	6.3-50	0.1-33 (1000)	
MV	For Reflow	85	1000-2000	•	•	SMD	4-50	0.1-220	
MVK	For Reflow	105	1000-2000	•	•	SMD	6.3-50	0.1-470	
GENERAL PURPOSE									
SME	General, Miniaturized	85	2000	•	o	Radial/Axial	6.3-400	0.1-22,000	
KME	General, Miniaturized, Low Leakage	105	1000R	•	o	Radial/Axial	6.3-400	0.1-22,000	
SMG	General, Miniaturized	85	2000	•	o	Radial	6.3-450	0.1-22,000	
KMG	General, Miniaturized	105	1000R	•	o	Radial	6.3-450	0.1-22,000	
510DX	Premium Grade, High Temperature	125	2000			Radial	6.3-63	1.0-6,800	
SREC	Low Profile 5mm Height	85	1000	•	•	Radial	4-50	0.1-100	
KRE	Low Profile 5mm Height	105	1000	•	•	Radial	4-50	0.1-100	
SRAC	Low Profile 7mm Height	85	1000	•	•	Radial	4-63	0.1-470	
KMA	Low Profile 7mm Height	105	1000	•	•	Radial	4-63	0.1-220	
SRG	Low Profile 7-25mm Height	85	1000-2000	•	•	Radial	4-50	0.1-10,000	
KRG	Low Profile 7-25mm Height	105	1000	•	•	Radial	6.3-50	0.1-10,000	
LOW LEAKAGE									
LLA	Low Leakage	85	1000	•	•	Radial	6.3-50	0.1-15,000	
511D	Low Leakage	105	1000-2000			Radial	6.3-250	1.0-10,000	
TUBULAR AXIAL									
600D	Premium Grade, High Temperature	125	2000			Axial	5.0-250	2.2-2,700	M39018/01
53D	General, High CV	85	1000			Axial	6.3-450	15-220,000	
601D	High Reliability	105	2000			Axial	6.3-300	12-33,000	M39018/03
604D	4-Terminal, Very Low Inductance	105	2000			Axial	5.0-200	47-22,000	M39018/07
BI-POLAR									
SME-BP	General, Bi-Polar	85	2000	•	•	Radial	6.3-100	0.47-6,800	
KME-BP	High Temperature, Bi-Polar	105	1000	•	•	Radial	6.3-100	0.47-6,800	
SM-NP	General, Bi-Polar	85	1000			Axial	16-50	1.0-2,200	
KSA-BP	For Horizontal Deflection	105	1000R			Radial	50	2.2-15	
610D	Premium Grade, Non-Polar	125	2000			Axial	7.0-250	0.68-680	M39018/02
HIGH RELIABILITY									
LX	General, Long Life	105	5000	•	•	Radial	100-250	0.47-68	
LXA	General, Long Life	105	5000-7000	•	•	Radial	10-63	0.47-4,700	
GX	130°C	130	1000			Radial/Axial	10-63	0.47-1,000	
GXC	130°C	130	1000		•	Radial/Axial	10-63	0.47-1,000	

R = Suffix indicates load life with ripple current.
o = Some units in the series are not solvent-proof.

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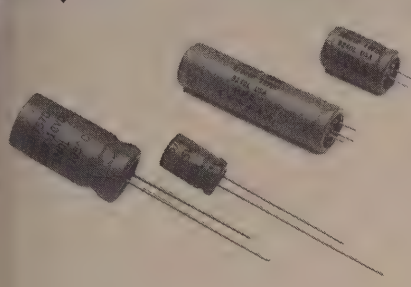
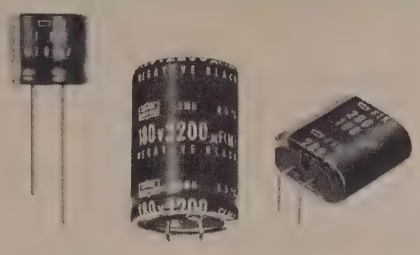
UNITED CHEMI-CON

Aluminum Electrolytic Capacitors

SERIES	DESCRIPTION	LOAD LIFE °C	LOAD LIFE HOURS	MINIATURIZED	SOLVENT PROOF	TERMINAL TYPE	VOLTAGE RANGE (VDC)	CAPACITANCE RANGE (µF)	EQUIVALENT MIL APPROVAL
LOW IMPEDANCE									
LXF	General, Long Life	105	2000-15000R	•	•	Radial	6.3-63	3.3-15,000	
KMF	General	105	2000-5000R	•	•	Radial	6.3-100	0.47-15,000	
673D/674D	Low ESR	105	2000			Radial	6.3-250	27-27,000	M39018/09
676D/677D	Low Impedance, High Ripple Current	105	2000			Radial	6.3-63	220-39,000	
767D	Lowest Impedance	105	5000			Radial	6.3-35	820-39,000	
757D	Long Life, Lowest Impedance	105	5000			Radial	6.3-35	120-15,000	
678D	Low Impedance	105	3000-4000	•		Radial	6.3-63	39-10,000	
672D	High Reliability, Lowest Impedance	105	3000-4000			Radial	100-250	4.7-390	
RZL	Long Life, Low Impedance	105	30,000R			Radial	10-250	33-15,000	
LARGE CAPACITANCE LEAD TYPE									
SMG	General, 20-40mm Height	85	2000	•	o	Radial	6.3-450	22-39,000	
KRF	20-50mm Height	150	1000	•	•	Radial	10-250	68-39,000	
GX-VH	130°C	130	1000			Radial	10-250	56-18,000	
SNAP MOUNT									
SMH	General Purpose	85	2000R	•		Lug	6.3-450	56-100,000	
KMH	General Purpose	105	2000R	•		Lug	6.3-450	68-82,000	
VD	For V.D.E.	105	2000R	•		Lug	250	82-2,200	
LXG	Long Life	105	5000R	•		Lug	10-400	56-47,000	
TXG	Long Life	105	10,000R	•		Lug	10-250	150-47,000	
81DA	High Temperature	105	2000	•		Lug	6.3-400	56-270,000	
81D	High Ripple Current	105	2000			Lug	6.3-400	47-180,000	
82DA	High CV	85	2000	•		Lug	6.3-500	33-270,000	
82D	General Purpose	85	2000			Lug	6.3-450	39-180,000	
SPECIAL APPLICATIONS									
EL	For Electronic Ballast	105	5000R			Radial/Lug	160-350	22-330	
FTK	Flat Shape	105	2000			Radial	200, 400	33-560	
PH	For Photoflash	55	—			Radial/Lug	330	60-1,200	
LARGE CAN									
36DA	High CV, Extended Voltage	85	2000	•		Screw	6.3-500	100-2,000,000	
36DY	High Ripple Current	85	2000			Screw	6.3-450	100-2,200,000	
777D	High Temperature	105	2000			Screw	6.3-450	100-470,000	
602D	High Reliability, High Ripple Current	85	2000			Screw	6.3-250	180-1,000,000	M39018/04
622D	Low Impedance	85-95	2000-1000			Screw	5.0-60	2,300-180,000	
747D	Lowest Impedance, High Temperature	105	2000			Screw	6.3-35	4,800-310,000	
RWE	For Inverter	85	2000R	•		Screw	350-550	100-12,000	
RWF	For Inverter, High Ripple	85	5000R	•		Screw	350-450	2,700-15,000	
KME	General Purpose	105	2000R			Screw	10-400	220-680,000	
LX	Long Life	105	5000R	•		Screw	10-450	220-330,000	

R = Suffix indicates load life with ripple current.
o = Some units in the series are not solvent-proof.

UNITED CHEMI-CON, INC. 9801 West Higgins Road, Rosemont, Illinois 60018 Phone 708-696-2000 Fax 708-696-0857

WESCO METALLIZED POLYESTER CAPACITORS

SPECIFICATIONS

DIELECTRIC WITHSTANDING VOLTAGE

200% of rated voltage applied through a minimum limiting resistance of 100 Ohms/Volt. Duration of voltage stress shall be 15 seconds minimum and 1 minute maximum at 25°C.

TEMPERATURE RANGE

−55°C to +85°C with full rated voltage applied. To +125°C with 50% of rated voltage.

INSULATION RESISTANCE

At 25°C after 2 minutes of electrification at rated voltage of 500 VDC, whichever is less, the minimum product of Insulation Resistance and Capacitance shall be 30,000 megohms-microfarads, but need not exceed 30,000 megohms.

DISSIPATION FACTOR

Shall not exceed 1.0% when measured at 25°C and 1000 Hz, ±20 Hz. See characteristic curves for D.F. ratings at other temperatures.

CAPACITANCE AND TOLERANCE

Shall be measured within the tolerance limits specified. Measurements will be made at 25°C and 1000 Hz, ±20 Hz.

LIFE TEST

Shall withstand 140% of rated voltage at 85°C for 250 hours. One failure in twelve shall be permitted.

CAPACITANCE STABILITY (DRIFT)

Less than 0.3% when measured in the following manner: three capacitance readings at 25°C, each made prior to and after temperature cycling from room to 85°C, and room to −55°C. The mathemtaical difference between the two extremes, divided by the intermediate value, and then multiplied by 100, yields the stability expressed in percent.

HUMIDITY RESISTANCE

Meets requirements of Mil-C-27287, Para. 3.12 when tested in accordance with Mil-STD-202C, Method 103 B, Condition B.

LEAD PULL AND BEND TEST

Steady pull of 5 pounds applied axially to leads for one minute. Bend test shall consist of one bend from the point of egress, first 90° in one direction, back to the original axial position, and then 90° in the opposite direction with no evidence of breakage.

32MM RATINGS AND DIMENSIONS

Capacity in µF	35 VDC D	35 VDC L	50 VDC D	50 VDC L	100 VDC D	100 VDC L	200 VDC D	200 VDC L	400 VDC D	400 VDC L	600 VDC D	600 VDC L
.0068	—	—	—	—	—	—	—	—	.218	.53	.312	.53
.0082	—	—	—	—	—	—	—	—	.234	.53	.171	.65
.01	—	—	—	—	—	—	—	—	.265	.53	.250	.65
.012	—	—	—	—	—	—	—	—	.203	.65	.265	.65
.015	—	—	—	—	—	—	—	—	.218	.65	.296	.65
.018	—	—	—	—	—	—	.203	.40	.234	.65	.328	.65
.022	—	—	—	—	—	—	.218	.40	.250	.65	.375	.65
.027	—	—	—	—	.171	.40	.234	.40	.265	.65	.390	.65
.033	—	—	—	—	.187	.40	.265	.40	.296	.65	.437	.65
.039	—	—	—	—	.187	.40	.203	.53	.234	.90	.328	.90
.047	—	—	—	—	.203	.40	.218	.53	.265	.90	.375	.90
.056	—	—	—	—	.218	.40	.234	.53	.265	.90	.390	.90
.068	—	—	—	—	.250	.40	.250	.53	.296	.90	.437	.90
.082	—	—	—	—	.187	.53	.265	.53	.328	.90	.468	.90
.1	—	—	—	—	.203	.53	.281	.53	.343	.90	.515	.90
.12	—	—	—	—	.218	.53	.312	.53	.328	1.18	.453	1.18
.15	—	—	—	—	.234	.53	.343	.53	.343	1.18	.515	1.18
.18	—	—	.187	.40	.250	.53	.296	.65	.375	1.18	.562	1.18
.22	—	—	.203	.40	.234	.65	.328	.65	.406	1.18	.625	1.18
.27	.171	.40	.218	.40	.250	.65	.359	.65	.453	1.18	.687	1.18
.33	.187	.40	.234	.40	.265	.65	.406	.65	.437	1.45	.656	1.45
.39	.203	.40	.250	.40	.281	.65	.437	.65	.468	1.45	.703	1.45
.47	.218	.40	.187	.53	.312	.65	.468	.65	.515	1.45	.781	1.45
.56	.250	.40	.203	.53	.343	.65	.406	.90	.546	1.45	.843	1.45
.68	.171	.53	.218	.53	.375	.65	.437	.90	.609	1.45	.921	1.45
.82	.187	.53	.250	.53	.359	.78	.406	1.18	.593	1.70	.906	1.70
1.00	.203	.53	.218	.65	.390	.78	.437	1.18	.656	1.70	1.000	1.70
1.25	.234	.53	.234	.65	.421	.78	.500	1.18	.734	1.70	1.171	1.70
1.50	.250	.53	.265	.65	.421	.90	.531	1.18	.796	1.70	1.265	1.70
1.80	.218	.65	.281	.65	.453	.90	.593	1.18	.875	1.70	1.375	1.70
2.00	.234	.65	.312	.65	.484	.90	.625	1.18	.921	1.70	1.406	1.70
3.00	.281	.65	.312	.78	.484	1.18	.656	1.45	—	—	—	—
4.00	.343	.65	.375	.78	.562	1.18	.750	1.45	—	—	—	—
5.00	.375	.65	.421	.78	.625	1.18	.765	1.70	—	—	—	—
8.00	.390	.78	.453	.90	.703	1.45	.828	2.06	—	—	—	—
10.00	.390	.90	.453	1.03	.781	1.45	.921	2.06	—	—	—	—
15.00	.468	.90	.546	1.03	—	—	—	—	—	—	—	—
20.00	.546	.90	.593	1.18	—	—	—	—	—	—	—	—
25.00	.500	1.18	.656	1.18	—	—	—	—	—	—	—	—
30.00	.562	1.18	.718	1.18	—	—	—	—	—	—	—	—

LEAD MATERIAL: TINNED COPPER SOLID WIRE. **STANDARD LEAD SIZES:** #24 AWG: Up to and including .203" Dia.; #22 AWG: from .204" thru .312" Dia.; #20 AWG: .313" Dia. and over. **CAPACITY TOLERANCE:** STANDARD... ±10% OTHER... from ±20% to ±2%. Other values as well as voltage ratings are available on request. **MARKING:** WESCO Logo, Capacity, Tolerance, VDC Rating and Date Code. (Note: On smaller units, ⑦ trademark will be substituted for WESCO logo.)

METALLIZED POLYCARBONATE CAPACITORS

SPECIFICATIONS

DIELECTRIC WITHSTANDING VOLTAGE

200% of rated voltage applied through a minimum limiting resistance of 100 Ohms/Volt. Duration of voltage stress shall be 15 seconds minimum and 1 minute maximum at 25°C.

TEMPERATURE RANGE

−55°C to +85°C with full rated voltage applied. To +125°C with 50% of rated voltage.

INSULATION RESISTANCE

At 25°C after 2 minutes of electrification at rated voltage or 500 VDC, whichever is less, the minimum product of Insulation Resistance and Capacitance shall be 50,000 megohms-microfarads, but need not exceed 50,000 megohms.

DISSIPATION FACTOR

Shall not exceed 0.3% when measured at 25°C and 1000 Hz, ±20 Hz. See characteristic curves for D.F. ratings at other temperatures.

CAPACITANCE AND TOLERANCE

Shall be measured within the tolerance limits specified. Measurements will be made at 25°C and 1000 Hz, ±20 Hz.

LIFE TEST

Shall withstand 140% of rated voltage at 85°C for 250 hours. One failure in twelve shall be permitted.

CAPACITANCE STABILITY (DRIFT)

Less than 0.3% when measured in the following manner: three capacitance readings at 25°C, each made prior to and after temperature cycling from room to 85°C, and room to −55°C. The mathemtaical difference between the two extremes, divided by the intermediate value, and then multiplied by 100, yields the stability expressed in percent.

HUMIDITY RESISTANCE

Meets requirements of Mil-C-27287, Para. 3.12 when tested in accordance with Mil-STD-202C, Method 103B, Condition B.

LEAD PULL AND BEND TEST

Steady pull of 5 pounds applied axially to leads for one minute. Bend test shall consist of one bend from the point of egress, first 90° in one direction, back to the original axial position, and then 90° in the opposite direction with no evidence of breakage.

TYPE 32MPC RATINGS AND DIMENSIONS

Capacity in µF	35VDC D	35VDC L	Cat. No. 32MPC —K-03.5	50VDC D	50VDC L	Cat. No. 32MPC —K-05	100VDC D	100VDC L	Cat. No. 32MPC —K-1
.033	—	—	—	—	—	—	.156	.40	3302
.039	—	—	—	—	—	—	.171	.40	3902
.047	—	—	—	—	—	—	.187	.40	4702
.056	—	—	—	—	—	—	.203	.40	5602
.068	—	—	—	—	—	—	.218	.40	6802
.082	—	—	—	.156	.40	8202	.171	.53	8202
.1	—	—	—	.156	.40	1003	.187	.53	1003
.12	—	—	—	.171	.40	1203	.203	.53	1203
.15	—	—	—	.181	.40	1503	.218	.53	1503
.18	.156	.40	1803	.203	.40	1803	.234	.53	1803
.22	.171	.40	2203	.156	.53	2203	.250	.53	2203
.27	.187	.40	2703	.171	.53	2703	.234	.65	2703
.33	.203	.40	3303	.188	.53	3303	.250	.65	3303
.39	.218	.40	3903	.203	.53	3903	.265	.65	3903
.47	.234	.40	4703	.218	.53	4703	.296	.65	4703
.56	.171	.53	5603	.234	.53	5603	.312	.65	5603
.68	.187	.53	6803	.203	.65	6803	.296	.78	6803
.82	.203	.53	8203	.218	.65	8203	.328	.78	8203
1.0	.218	.53	1004	.250	.65	1004	.359	.78	1004
1.25	.250	.53	1254	.281	.65	1254	.390	.78	1254
1.50	.218	.65	1504	.296	.65	1504	.421	.78	1504
1.80	.234	.65	1804	.281	.78	1804	.421	.90	1804
2.0	.250	.65	2004	.296	.78	2004	.437	.90	2004
3.0	.296	.65	3004	.359	.78	3004	.453	1.18	3004
4.0	.296	.78	4004	.406	.78	4004	.515	1.18	4004
5.0	.328	.78	5004	.406	.90	5004	.515	1.45	5004
8.0	.406	.78	8004	.422	1.18	8004	.562	1.78	8004
10.0	.453	.78	1005	.484	1.18	1005	.625	1.78	1005
15.0	.421	1.18	1505	.578	1.18	1505	.718	2.06	1505
20.0	.476	1.18	2005	.578	1.45	2005	.828	2.06	2005
25.0	.546	1.18	2505	.656	1.45	2505	—	—	—
30.0	.593	1.18	3005	—	—	—	—	—	—

LEAD MATERIAL: TINNED COPPER SOLID WIRE. **STANDARD LEAD SIZES:** #24 AWG: Up to and including .203" Dia.; #22 AWG: from .204" thru .312" Dia.; #20 AWG: .313" Dia. and over. **CAPACITY TOLERANCE:** STANDARD... ±10%/OTHER... from ±20% to ±1%. Other values as well as voltage ratings are available on request. **MARKING:** WESCO Logo, Capacity, Tolerance, VDC Rating and Date Code. (Note: On smaller units, ⑦ trademark will be substituted for WESCO logo.)

J K ELECTRONICS, INC d/b/a

WESCO ELECTRICAL COMPANY

201 MUNSON ST. • GREENFIELD • MASSACHUSETTS • 01301

TELEPHONE: 413-774-4358

WESCO METALLIZED POLYPROPLENE CAPACITORS

SPECIFICATIONS

DIELECTRIC WITHSTANDING VOLTAGE
200% of rated voltage applied through a minimum limiting resistance of 100 Ohms/Volt. Duration of voltage stress shall be 15 seconds minimum and 1 minute maximum at 25°C.

INSULATION RESISTANCE
At 25°C after 2 minutes of electrification at rated voltage or 500 VDC, whichever is less, the minimum product of Insulation Resistance and Capacitance shall be 100,000 megohms-microfarads, but need not exceed 100,000 megohms.

DISSIPATION FACTOR
Shall not exceed 0.1% when measured at 25°C and 1000 Hz, ±20 Hz. See characteristic curves for D.F. ratings at other temperatures.

CAPACITANCE AND TOLERANCE
Shall be measured within the tolerance limits specified. Measurements will be made at 25°C and 1000 Hz, ±20 Hz.

LIFE TEST
Shall withstand 140% of rated voltage at 85°C for 250 hours. One failure in twelve shall be permitted.

TEMPERATURE COEFFICIENT
Capacitance shall change linearly over operating temperature range of −55°C to +85°C at rate of −290, ±75 parts per million/°C.

CAPACITANCE STABILITY (DRIFT)
Less than .2% when measured in the following manner: three capacitance readings at 25°C, each made prior to and after temperature cycling from room to 105°C, and room to −55°C. The mathematical difference between the two extremes, divided by the intermediate value, and then multiplied by 100, yields the stability expressed in percent.

HUMIDITY RESISTANCE
Meets requirements of Mil-C-27287, Para. 3.12 when tested in accordance with Mil-STD-202C, Method 103 B, Condition B.

LEAD PULL AND BEND TEST
Steady pull of 5 pounds applied axially to leads for one minute. Bend test shall consist of one bend from the point of egress, first 90° in one direction, back to the original axial position, and then 90° in the opposite direction with no evidence of breakage.

TEMPERATURE RANGE
−55°C to +85°C with full rated voltage applied.

DIELECTRIC ABSORPTION
Shall not exceed .05% when tested in accordance with Mil-C-19978.

Capacity in µF	100 VDC D	L	Cat. No. 32MPL —K-1	200 VDC D	L	Cat. No. 32MPL —K-2	400 VDC D	L	Cat. No. 32MPL —K-4
.01	.171	.406	1002	.171	.406	1002	1.87	.531	1002
.012	.171	.406	1202	.171	.406	1202	.203	.531	1202
.015	.171	.406	1502	.187	.406	1502	.234	.531	1502
.018	.171	.406	1802	.203	.406	1802	.250	.531	1802
.022	.171	.406	2202	.171	.531	2202	.265	.531	2202
.027	.171	.406	2702	.171	.531	2702	.296	.531	2702
.033	.187	.406	3302	.187	.531	3302	.312	.531	3302
.039	.203	.406	3902	.203	.531	3902	.343	.531	3902
.047	.218	.406	4702	.218	.531	4702	.281	.656	4702
.056	.234	.406	5602	.234	.531	5602	.312	.656	5602
.068	.187	.531	6802	.250	.531	6802	.343	.656	6802
.082	.187	.531	8202	.275	.531	8202	.375	.656	8202
.1	.218	.531	1003	.250	.656	1003	.343	.781	1003
.12	.234	.531	1203	.265	.656	1203	.375	.781	1203
.15	.250	.531	1503	.296	.656	1503	.421	.781	1503
.18	.275	.531	1803	.328	.656	1803	.453	.781	1803
.22	.312	.531	2203	.359	.656	2203	.437	.906	2203
.27	.328	.531	2703	.359	.781	2703	.484	.906	2703
.33	.281	.656	3303	.359	.781	3303	.546	.906	3303
.39	.312	.656	3903	.406	.781	3903	.578	.906	3903
.47	.343	.656	4703	.390	.906	4703	.531	1.187	4703
.56	.375	.656	5603	.437	.906	5603	.578	1.187	5603
.68	.375	.781	6803	.484	.906	6803	.625	1.187	6803
.82	.390	.781	8203	.515	.906	8203	.687	1.187	8203
1.0	.421	.781	1004	.484	1.187	1004	.671	1.437	1004
1.25	.421	.906	1254	.531	1.187	1254	.750	1.437	1254
1.50	.453	.906	1504	.578	1.187	1504	.812	1.437	1504
1.80	.500	.906	1804	.640	1.187	1804	.796	1.687	1804
2.00	.515	.906	2004	.671	1.187	2004	.843	1.687	2004
3.00	.531	1.187	3004	.718	1.437	3004	1.03	1.687	3004
4.00	.609	1.187	4004	.828	1.437	4004	—	—	—
5.00	.671	1.187	5004	.828	1.687	5004	—	—	—
8.00	.750	1.437	8004	.937	2.062	8004	—	—	—
10.00	.843	1.437	1005	1.03	2.062	1005	—	—	—
12.00	.828	1.687	1205	—	—	—	—	—	—
15.00	.921	1.687	1505	—	—	—	—	—	—

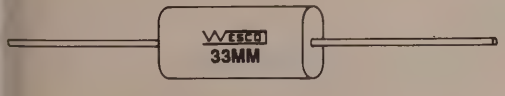
LEAD MATERIAL: TINNED COPPER SOLID WIRE. **STANDARD LEAD SIZES:** #24 AWG: Up to and including .203" Dia.; #22 AWG: from .204" thru .312" Dia.; #20 AWG: .313" Dia. and over. **CAPACITY TOLERANCE:** STANDARD...±10%/OTHER...from ±20% to ±1%. Other values as well as voltage ratings are available on request. **MARKING:** WESCO Logo, Capacity, Tolerance, VDC Rating and Date Code. (Note: On smaller units, Ⓦ trademark will be substituted for WESCO logo.)

TYPICAL CASE STYLES

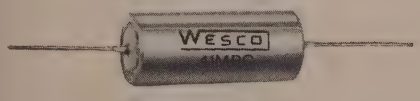
AXIAL LEADS

TYPE 32: WRAP & FILL

TYPE 33: WRAP & FILL

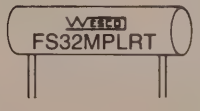


TYPE 41: HERMETICALLY SEALED

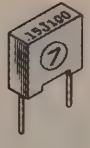


RADIAL LEADS

WRAP & FILL



"BOX"



OTHER AVAILABLE PRODUCTS

Data Sheet	Dielectric	Type
101	POLYESTER FILM-FOIL	32M - 33M
201	METALIZED POLYESTER	33MM
"BOX" CAPACITORS	METALIZED POLYESTER (Radial Leads)	60MM - 66MM 67MM - 68MM
402	METALIZED POLYCARBONATE (Hermetically Sealed)	41MPC
501	POLYSTYRENE FILM-FOIL	32P
601	POLYPROPYLENE FILM-FOIL	32PL
602	POLYPROPYLENE FILM-FOIL (Radial Leads)	F32PLRT
604	POLYPROPYLENE FILM-FOIL (AC Rated)	432PL

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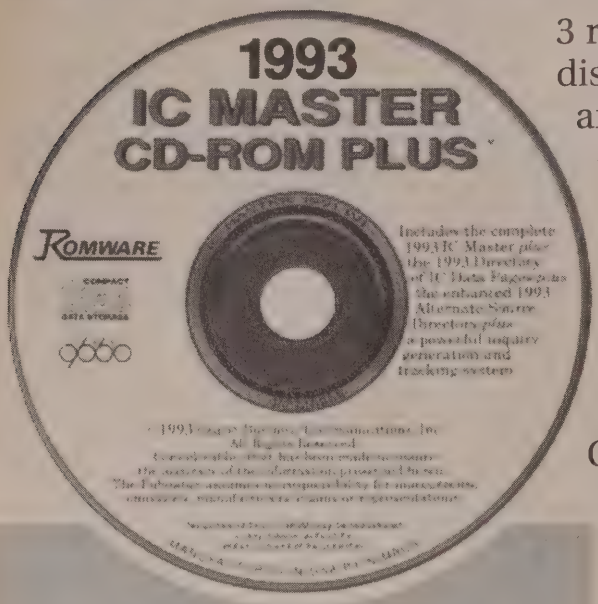

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W O R L D P R O D U C T S

INTERFERENCE SUPPRESSORS

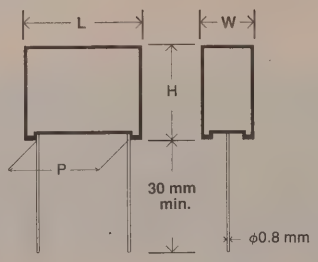
WXE AND WYE SERIES 0.001μF-2.2μF
Y2 CLASS-275 VAC Y CLASS-250 VAC
4.5KV surge approved for IEC-950 applications

Part Number	μF	L max mm	H max mm	W max mm	P ±0.4 mm	Dv/Dt V/μs
WYE-102M	0.001	13.0	10.5	4.5	10.0	2000
WYE-152M	0.0015	13.0	10.5	4.5	10.0	2000
WYE-222M	0.0022	13.0	10.5	5.5	10.0	2000
WYE-252M	0.0025	13.0	10.5	5.5	10.0	2000
WYE-332M	0.0033	13.0	12.5	5.5	10.0	2000
WYE-392M	0.0039	13.0	12.5	5.5	10.0	2000
WYE-472M	0.0047	13.0	13.5	5.5	10.0	2000
WYE-682M	0.0068	18.0	14.0	5.5	15.0	1400
WYE-103M	0.01	18.0	13.5	7.5	15.0	1400
WYE-153M	0.015	18.0	14.5	8.5	15.0	1400
WYE-223M	0.022	18.0	17.0	8.5	15.0	1400
WXE-103K	0.01	18.0	10.5	5.5	15.0	1200
WXE-153K	0.015	18.0	10.5	5.5	15.0	1200
WXE-223K	0.022	18.0	10.5	5.5	15.0	1200
WXE-333K	0.033	18.0	10.5	5.5	15.0	1200
WXE-473K	0.047	18.0	12.5	6.5	15.0	1200
WXE-683K	0.068	18.0	13.5	7.5	15.0	1200
WXE-104K	0.1	18.0	14.5	8.5	15.0	600
WXE-154K	0.15	26.5	15.5	7.5	22.5	600
WXE-224K	0.22	26.5	16.5	8.5	22.5	600
WXE-334K	0.33	26.5	18.5	10.5	22.5	400
WXE-474K	0.47	31.5	20.5	11.5	27.5	400
WXE-684K	0.68	31.5	23.5	13.5	27.5	400
WXE-105K	1.0	31.5	24.5	15.0	27.5	400
WXE-155K	1.5	41.5	28.5	16.0	37.5	400
WXE-225K	2.2	41.5	33.0	18.0	37.5	400

ORDERING INFORMATION

Suppressor Type	Value Code	Capacitor Tolerance	Special Codes
WXE WYE	104 472	K = ±10% M = ±20%	L06

OUTLINE DRAWING



SEE OUR OTHER DATA PAGES IN SECTIONS 2450, 4300, 4700 AND 4800.

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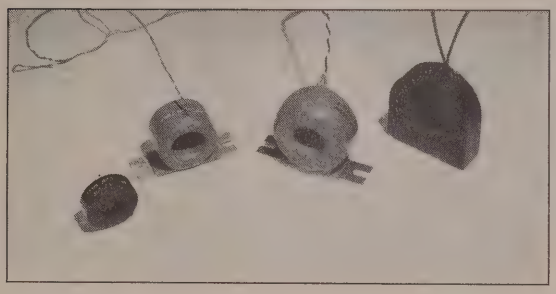
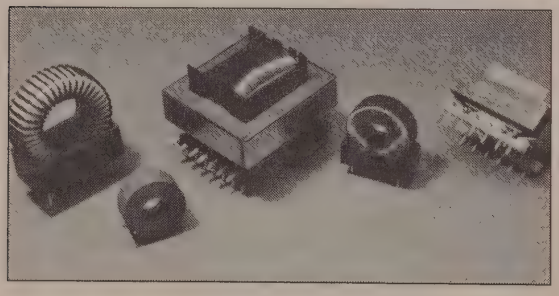
"Snap-On" 5-50A Load Detector

The LD-50 is ±3% accurate from 5A to 50A and can handle short term currents up to 150A! It costs a fraction of sensors with comparable range and accuracy *and* it's designed for pc-mounting and auto-insertion. And the LD-50 features a revolutionary snap-on design that simplifies installation – even in pre-wired systems!
New for '93: LD-100 10-100A detector.
Available Sept. '92. See pages A•1154 - A•1157.



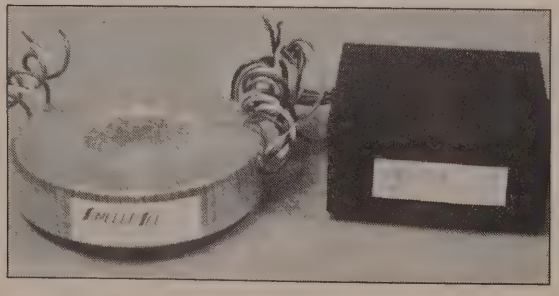
Toroidal Current Transformers

A complete line of CTs for current sensing, measurement and detection in controls and automation. For current-to-voltage and current-to-current applications.
Amecon CTs are smaller, lighter and more compact.
Three families are available: low profile/high accuracy; standard size/high accuracy; standard size/normal accuracy.
New for '93: electronic metering transformers.
See pages in this volume, section 5600.



Switch Mode Power Supply Transformers and Inductors

Current sense transformers, inverter transformers and filter inductors. A large selection of sizes are available, including miniature and low profile; in open winding, encapsulated and semi-encapsulated configurations. Custom designs to 200A. High frequency inverter transformers for power transistors and MOSFETs with power levels from 10VA to 1.0kVA covering frequencies from 5 to 100kHz with low power losses.
See pages in this volume, section 5600.



Toroidal Power Transformers

Low-noise, high efficiency power transformers are available with ratings from 10VA to 10kVA. In custom configurations and off-the-shelf models.
See pages in this volume, section 5600.

coils, chokes, inductors-1800

OILS, CHOKES, & INDUCTORS

Manufacturer	Starting EEM Page No.	AF	RF	IF	High Q	Shielded	Variable (Adjustable)	Choke/Filter	Chip	Spiral	Toroidal	Power, Switch Mode	Suppression, Common Mode	Other Types
Abracon	A•1180		√§		√§	√§	√§	√§	√§			√§	√§	
Albar Inc.	A•1181							√			√	√		
Amecon	A•1182	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	Heavy current toroidal; Heavy current non-toroidal
American Precision Industries	A•1186		√§*			√*	√	√§*	√§*		√*			
Bell Industries/ I.W. Miller Div.	A•1190		√§	√	√	√	√	√	√§		√			
BH Electronics	A•1196		√§					√§			√§	√	√§	
Caddell Burns	A•1198	√	√	√	√	√	√	√			√	√	√	
Caddell Coil Corp.	A•1213	√	√*	√	√	√	√	√			√	√	√	
Coilcraft	A•1215		√§	√§	√§	√	√	√§	√§		√§	√§	√§	
Coil-Q Corp.	A•1222		√	√	√	√	√							Pot core
Communication Coil	A•1224		√§*	√§*	√§*	√§*	√§*	√§*	√§*	√§*	√§*	√§*	√§*	
Dale Electronics	A•1225	√	√	√	√	√	√	√	√		√	√		
Ecliptek Corp.	A•1258	√	√			√	√	√			√			
EWC Inc.	A•1235	√§*	√§*		√§*		√	√§*			√§*	√§*	√§*	
Frontier Electronics	A•1236		√		√	√	√	√			√	√	√	
Gowanda Electronics	A•1239	√	√§*	√§*	√§*	√*	√*	√*	√§		√§	√§	√	Tunable coil forms; Bobbin core chokes; Miniature high current chokes; Encapsulated power chokes-toroidal
KOA Speer	A•1242								√§					
Lodestore Pacific	A•1244	√	√	√	√			√						
Magnetek Triad	A•1248	√	√	√				√			√			
Magnetic Component Engineering	A•1251	√	√	√	√	√	√	√			√	√	√	
Microtran Co. Inc.	A•1254	√§*			√*			√*			√*	√*	√*	
Multi-Comp	A•1255	√	√	√	√			√			√	√	√	Custom
Murata Erie North America	A•1256		√§					√	√§				√	
Ohmite Manufacturing Co.	A•1259		√											
Penn Tran Corp.	A•1260		√			√	√	√			√	√	√	
Pico Electronics	A•1263	√§*			√§*	√§*		√§*			√§*	√§*	√§*	
Piconics	A•1274		√§*	√§*	√§*		√§*		√§*	√§*	√§*			Microwave high Q air core
Prem Magnetics	A•1277	√	√			√		√				√		Linearity Coils (CRT Applications)
RCD Components	A•1282	√§*	√§*	√§*	√§*	√§*	√	√	√§*		√§*	√§*	√§*	
Renco Electronics	A•1283	√§	√§	√§	√§	√§	√§	√§	√§	√§	√§	√§	√§	
Standex Electronics	A•1290		√§*	√	√	√	√	√*			√*	√	√	
Tamura Corp. of America	A•1297	√	√	√	√			√		√	√	√	√	
TMP Inc.	A•1300	√	√	√				√		√			√	Voice coil
Torotel Products Inc.	A•1301	√*	√§*	√*	√§*	√§*		√§*			√§*	√*	√*	
Vernitron International	A•1308	√	√			√	√	√		√	√§	√	√	
Wilco	A•1309		√		√	√		√			√	√	√	Pot core; Multi-pi; Ferrite bobbin air coils; Wide band balun; ferrite drum
Z-Man Magnetics	A•1315	√	√	√	√§		√§	√§		√	√§	√§	√	

* MIL Spec. § Surface Mount.

ABRACON CORPORATION

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QUALITY INDUCTORS

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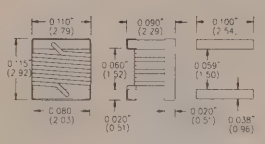
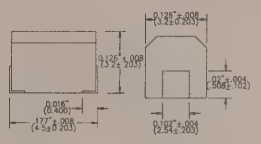
- Ferrite Beads
- Wide Band Chokes
- Peaking Coil
- Trigger Coil
- Epoxy Coated
- RF Molded
- RF Shielded
- Axial-Radial
- Surface Mount
- Adjustable
- Toroidal
- Transformers
- Power Chokes
- Subminiatures
- Air Coils
- Custom Winding

SURFACE MOUNT

1008



1812M



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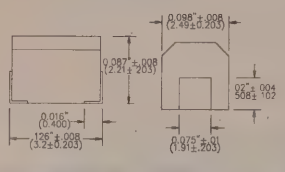

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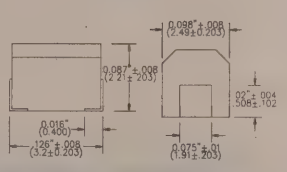

VARIABLES

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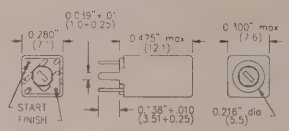
AVS-1



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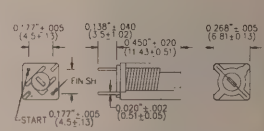
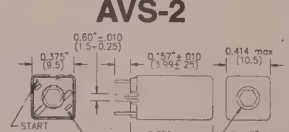
AVU-1



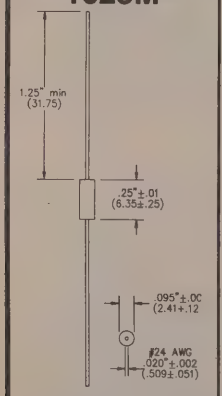
SHIELDED
AVS-2



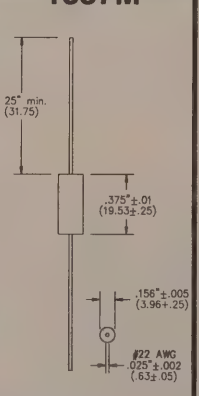
UNSHIELDED
AVU-2

MOLDED

1025M

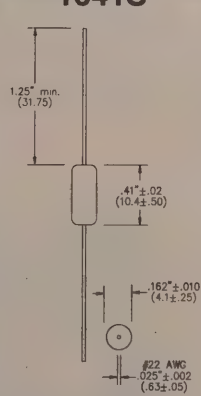


1537M



SHIELDED

1641S



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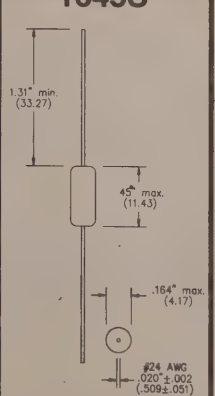
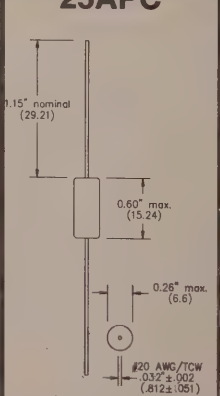


POWER CHOKES

25APC



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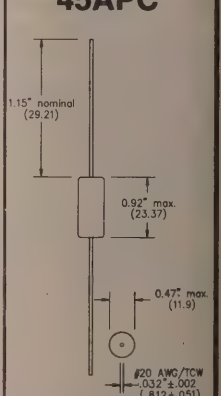

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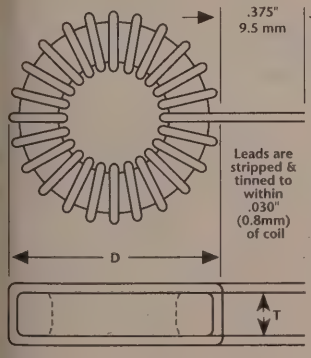
ALBAR's Toroidal Inductors

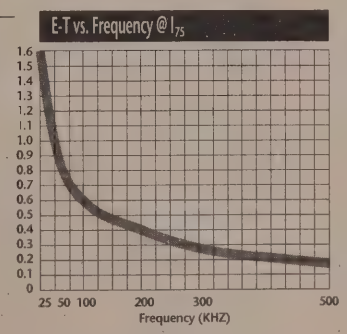
Part Number	L_o(µh)	I_{75} (amps)	DCR (ohms)	E-T(volt-µsec) @I_{75},@40°C, @50 KHZ	Dimensions D	T	P_{40} (watts)	Lead Diameter (in./mm)
6082-001	40	2.5	.046	100	.60/15.2	.30/7.6	0.6	.022/.56
6082-002	10	5.0	.009	55	.60/15.2	.30/7.6	0.6	.033/.84
6082-003	5	7.0	.004	38	.60/15.2	.30/7.6	0.6	.041/1.05
6082-101	120	2.0	.086	261	.75/19.0	.35/8.9	1.0	.022/.56
6082-102	30	4.0	.017	134	.75/19.0	.35/8.9	1.0	.033/.84
6082-103	20	5.0	.009	89	.75/19.0	.35/8.9	1.0	.041/1.05
6082-201	200	2.0	.121	347	.90/22.3	.35/8.9	1.2	.022/.56
6082-202	65	3.5	.027	217	.90/22.3	.35/8.9	1.2	.033/.84
6082-203	35	5.0	.013	154	.90/22.3	.35/8.9	1.2	.041/1.05
6082-301	350	2.0	.162	525	1.00/25.4	.40/10.2	1.5	.022/.56
6082-302	120	3.5	.037	324	1.00/25.4	.40/10.2	1.5	.033/.84
6082-303	650	5.0	.017	250	1.00/25.4	.40/10.2	1.5	.041/1.05
6082-401	650	2.0	.235	837	1.20/30.5	.57/14.5	2.2	.022/.56
6082-402	220	3.5	.052	565	1.20/30.5	.57/14.5	2.2	.033/.84
6082-403	130	4.5	.026	458	1.20/30.5	.57/14.5	2.2	.041/1.05
6082-501	1100	1.2	.332	1572	1.45/36.8	.55/14.0	3.0	.022/.56
6082-502	420	2.0	.082	978	1.45/36.8	.55/14.0	3.0	.033/.84
6082-503	240	2.6	.039	734	1.45/36.8	.55/14.0	3.0	.041/1.05
6082-601	500	3.6	.063	1274	1.80/45.7	.75/19.1	4.6	.041/1.05
6082-602	280	5.0	.030	944	1.80/45.7	.75/19.1	4.6	.051/1.30
6082-603	160	6.5	.014	772	1.80/44.7	.75/19.1	4.6	.065/1.66
6082-701	860	4.0	.082	1827	2.10/53.3	.95/24.1	6.3	.041/1.05
6082-702	480	5.4	.038	1433	2.10/53.3	.95/24.1	6.3	.051/1.30
6082-703	260	7.1	.018	1075	2.10/53.3	.95/24.1	6.3	.065/1.66

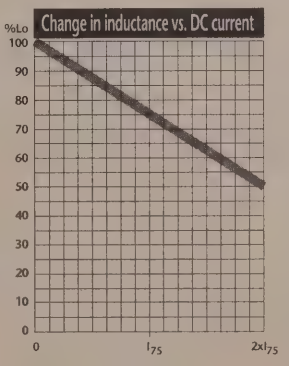
ALBAR's high-quality, low cost toroidal inductors are now available as standard parts ready to integrate into your application. Using a single-layer design for these off-the -shelf parts we lower costs without sacrificing performance.

ALBAR's toroids are designed to meet the requirements of most switch mode power supplies. Each toroid is carefully tested before shipment.

Mounting hardware is available if your application requires it. Just ask us.







L_o: Inductance with no DC current
I_{75}:DC current at which inductance is reduced to 75% of L_o
E-T: AC excitation expressed in volt-µsec
P_{40}: Power dissipation which produces a temperature rise of 40°C
DCR: DC resistance @ 40°C rise over 20° ambient

We're here to help.

If you have a special application or just want to ask a question, call ALBAR toll-free at **1-800-822-5227.**

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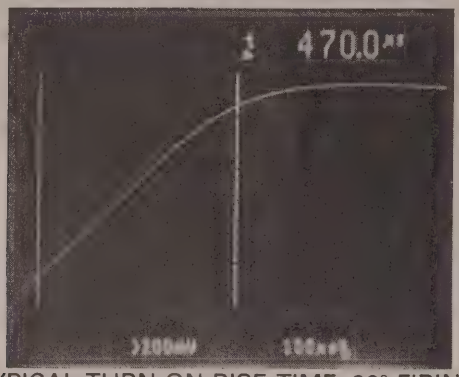
FOR PROFESSIONAL LIGHT DIMMERS, MOTOR CONTROLS, SCR CONTROLS & LINE FILTERS

- **AVAILABLE IN SEMI OR FULL EPOXY MOLDED**
- **HORIZONTAL & VERTICAL MOUNTING**
- **ALL "UL" RECOGNIZABLE MATERIALS**
- **ABSOLUTELY LATEST "STATE OF THE ART" MATERIALS, PRODUCTION & TESTING TECHNOLOGIES ARE EMPLOYED THROUGHOUT ALL PHASES OF THIS PRODUCT LINE**
- **SPECIFICALLY DESIGNED FOR EITHER 120 OR 240 VOLTS**



TYPICAL TURN ON RISE TIME 90° FIRING

NEW

VERTICAL MTG. SHOWN LEFT TO RIGHT. 10A, DUAL 20A., 50A & 100.A.

SPECIFICALLY DESIGNED FOR 240 VOLTS

Part No.	Rating Amps Rms	di/dt 10% 90% µs.	△t°C Above Ambient	DCR Ohms 100°C	Dimensions* Open Style O.D. x Ht.
2634-116159	8.3	300	99	0.2584	2.80 x 1.30
3521-115198	10	300	101	0.2210	3.70 x 0.90
3032-114159	10	300	85	0.1640	3.20 x 1.30
2634-116159	10	300	123	0.2570	2.80 x 1.30
3532-114172	10	400	87	0.1895	3.70 x 1.30
3526-115188	10	350	101	0.2310	3.70 x 1.10
3532-115192	10	450	105	0.2630	3.70 x 1.20
3040-112125	15	300	91	0.0947	3.30 x 1.60
4021-113155	15	300	105	0.1257	4.20 x 0.90
3056-112120	15	400	93	0.1115	3.30 x 2.10
3048-113138	15	400	112	0.1450	3.30 x 1.80
3552-112134	15	500	97	0.1237	3.70 x 1.90
3542-113157	15	500	117	0.1600	3.70 x 1.60
3542-110098	20	300	84	0.0519	3.80 x 1.70
4026-111122	20	300	100	0.0703	4.20 x 1.20
4032-111131	20	400	108	0.0828	4.20 x 1.30
3542-112128	20	400	126	0.1044	3.70 x 1.60
4042-111128	20	500	110	0.0913	4.20 x 1.60
4032-110115	20	350	89	0.0587	4.30 x 1.40
3542-111113	20	350	103	0.0744	3.70 x 1.60
4042-110114	20	450	93	0.0656	4.30 x 1.70
3542-112139	20	440	133	0.1140	3.70 x 1.60

Part No.	Rating Amps Rms	di/dt 10% 90% µs.	△t°C Above Ambient	DCR Ohms 100°C	Dimensions* Open Style O.D. x Ht.
4032-109100	25	300	92	0.0413	4.30 x 1.40
3542-109096	25	300	93	0.041è	3.80 x 1.70
3552-109092	25	350	94	0.0445	3.80 x 2.00
4042-109101	25	400	97	0.0470	4.30 x 1.70
4047-109101	25	450	99	0.0498	4.30 x 1.90
4042-110113	25	450	115	0.0650	4.30 x 1.70
4052-109101	25	500	100	0.0523	4.30 x 2.00
4058-109101	25	550	102	0.0558	4.30 x 2.20
4052-110112	25	550	118	0.0717	4.30 x 2.00
4032-109098	30	300	110	0.0404	4.30 x 1.40
4042-109100	300	400	116	0.0465	4.30 x 1.70
4052-109100	30	500	119	0.0521	4.30 x 2.00
4063-210052	40	300	95	0.0187	4.30 x 2.30
4052-211061	40	300	111	0.0246	4.20 x 2.00
4067-211062	40	400	116	0.0292	4.20 x 2.50
5252-210077	40	450	103	0.0263	5.50 x 2.00
4063-210051	50	300	116	0.0184	4.30 x 2.30
5252-209068	50	400	107	0.0187	5.50 x 2.00
5252-209084	50	500	119	0.0231	5.50 x 2.00
5252-208052	60	300	100	0.0116	5.50 x 2.10
5252-209067	60	400	125	0.0185	5.50 x 2.00
5278-208057	60	500	112	0.0158	5.50 x 2.90

* Semi Epoxy Molded, Add 0.20" O.D. & 0.09" Ht. Full Epoxy Molded, Add 0.20" O.D. & Ht.
NOTES: Dimensions stated are based on perfect windings not always achieveable. Electrical data accurate to within ±6%.

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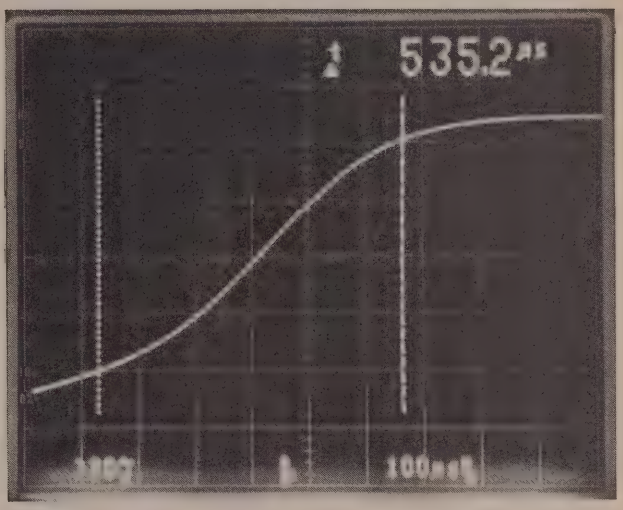

TYPICAL TURN ON RISE TIME 90° FIRING

SPECIFICALLY DESIGNED FOR 120 VOLTS

Part No.	Rating Amps Rms	di/dt 10% 90% μs.	△t°C Above Ambient	DCR Ohms 100°C	Dimensions* Open Style O.D. x Ht.
1618-119128	5	150	85	0.241	1.70 x 0.75
2017-118150	5	200	70	0.237	2.10 x 0.75
2017-119180	5	250	92	0.355	2.10 x 0.75
1618-118090	6.66	100	83	0.134	1.70 x 0.75
2017-117112	6.66	150	71	0.140	2.20 x 0.75
2023-117115	6.66	200	74	0.165	2.20 x 0.88
2017-115110	8.33	150	70	0.092	2.20 x 0.75
2617-115136	8.33	250	72	0.126	2.80 x 0.75
2622-115130	8.33	300	72	0.133	2.80 x 0.90
2626-115128	8.33	350	73	0.141	2.80 x 1.00
2626-116145	8.33	400	90	0.200	2.80 x 1.00

Part No.	Rating Amps Rms	di/dt 10% 90% μs.	△t°C Above Ambient	DCR Ohms 100°C	Dimensions* Open Style O.D. x Ht.
3024-115164	8.33	450	77	0.180	3.20 x 1.00
2617-115134	10	250	90	0.123	2.80 x 0.75
2622-115125	10	300	88	0.128	2.80 x 0.90
2626-114125	10	350	79	0.113	2.80 x 1.10
2626-115140	10	400	97	0.158	2.80 x 1.00
3024-114145	10	400	77	0.128	3.20 x 1.00
2634-114122	10	450	80	0.127	2.80 x 1.30
3024-115176	10	450	100	0.194	3.20 x 1.00
2634-115134	10	500	96	0.173	2.80 x 1.30
3032-114135	10	500	76	0.137	3.20 x 1.30

* Semi Epoxy Molded, Add 0.20" O.D. & 0.09" Ht. Full Epoxy Molded, Add 0.20" O.D. & Ht.
NOTES: Dimensions stated are based on perfect windings not always achieveable. Electrical data accurate to within ±6%.

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PRECISION WOUND HEAVY DUTY TOROIDAL INDUCTORS

SPECIFICALLY DESIGNED FOR 120 VOLTS

Part No.	Rating Amps Rms	di/dt 10% 90% μs.	△t°C Above Ambient	DCR Ohms 100°C	Dimensions* Open Style O.D. x Ht.
2626-113106	12.5	300	80	0.076	2.80 x 1.10
2634-112095	12.5	350	69	0.065	2.80 x 1.40
2634-113108	12.5	400	84	0.090	2.80 x 1.30
3521-114148	12.5	450	95	0.133	3.70 x 0.90
3032-113134	12.5	500	86	0.110	3.20 x 1.30
3024-112108	15	300	78	0.062	3.30 x 1.10
2634-112095	15	350	84	0.065	2.80 x 1.40
3032-111106	15	400	72	0.057	3.30 x 1.30
3032-112118	15	450	86	0.079	3.30 x 1.30
2634-113106	15	400	102	0.089	2.80 x 1.30
3526-112133	15	500	87	0.086	3.70 x 1.10
3032-113130	15	500	104	0.107	3.20 x 1.30
3532-111118	15	550	75	0.068	3.70 x 1.30
3024-112104	20	300	107	0.060	3.30 x 1.10
3521-111100	20	300	86	0.049	3.80 x 1.00
3032-110092	20	350	79	0.040	3.30 x 1.40
3526-112095	20	350	97	0.059	3.70 x 1.10
4021-110104	20	400	77	0.045	4.30 x 1.00
3526-110106	20	400	81	0.045	3.80 x 1.20
4021-110115	20	450	82	0.050	4.30 x 1.00
3526-111118	20	450	99	0.062	3.80 x 1.20
3532-110106	20	500	84	0.050	3.80 x 1.40
4021-111128	20	500	99	0.069	4.30 x 1.00
3532-111115	20	550	100	0.067	3.80 x 1.40
4026-110113	20	550	84	0.053	4.30 x 1.20
3521-110096	25	300	95	0.037	3.80 x 1.00
3526-110092	25	350	95	0.038	3.80 x 1.20
3532-110085	25	400	93	0.039	3.80 x 1.40
4021-109100	25	400	85	0.036	4.30 x 1.10
4026-109092	25	450	84	0.035	4.30 x 1.20
3532-110094	25	450	99	0.044	3.80 x 1.40
4026-109101	25	500	80	0.039	4.30 x 1.20
3532-110104	25	500	107	0.049	3.80 x 1.40
4032-109092	25	550	87	0.038	4.30 x 1.40

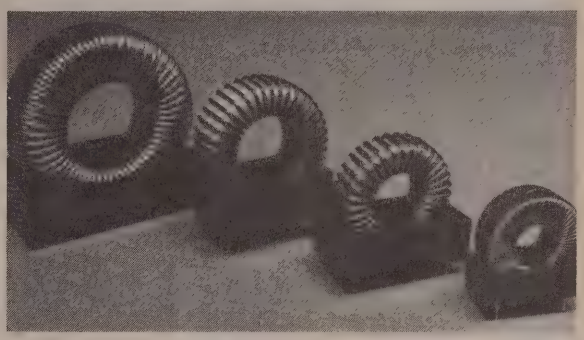
Part No.	Rating Amps Rms	di/dt 10% 90% μs.	△t°C Above Ambient	DCR Ohms 100°C	Dimensions* Open Style O.D. x Ht.
4026-110111	25	550	107	0.052	4.30 x 1.20
4026-108065	30	300	73	0.020	4.30 x 1.30
4021-109090	30	350	97	0.032	4.30 x 1.10
4032-109068	30	400	87	0.027	4.30 x 1.40
3532-109084	30	400	100	0.032	3.80 x 1.40
4042-108060	30	450	77	0.022	4.30 x 1.80
3542-109073	30	450	95	0.031	3.80 x 1.70
4042-108065	30	500	82	0.025	4.30 x 1.80
3542-109082	30	500	103	0.035	3.80 x 1.70
4042-109072	30	550	97	0.034	4.30 x 1.70
3542-109088	30	550	108	0.038	3.70 x 1.70
3542-211057	35	350	90	0.019	3.80 x 1.60
4042-211053	35	400	88	0.019	4.20 x 1.60
4042-211058	35	450	92	0.021	4.30 x 1.70
4047-211058	35	500	94	0.022	4.30 x 1.80
4047-211063	35	550	98	0.024	4.30 x 1.80
3547-210051	40	350	88	0.015	3.80 x 1.80
4042-210052	40	400	89	0.015	4.30 x 1.70
4047-210052	40	450	91	0.016	4.30 x 1.80
4042-211058	40	450	105	0.021	4.30 x 1.70
4047-211057	40	500	106	0.022	4.30 x 1.80
4047-211062	40	550	111	0.024	4.30 x 1.80
4042-209049	50	400	95	0.011	4.30 x 1.70
4042-210056	50	450	115	0.016	4.30 x 1.70
4047-210051	50	450	111	0.016	4.30 x 1.80
4052-210051	50	500	113	0.017	4.30 x 2.00
4052-210055	50	550	118	0.018	4.30 x 2.00
4047-209045	60	400	111	0.011	4.30 x 1.90
4052-209046	60	450	114	0.012	4.30 x 2.00
4063-209042	60	500	112	0.012	4.30 x 2.40
4063-209046	60	550	117	0.013	4.30 x 2.40
5252-308036	75	400	88	0.005	5.50 x 2.10
5252-208036	75	400	101	0.008	5.50 x 2.10
5252-408032	100	375	95	0.004	5.50 x 2.10
5252-308034	100	400	108	0.005	5.50 x 2.10

* Semi Epoxy Molded, Add 0.20″ O.D. & 0.09″ Ht. Full Epoxy Molded, Add 0.20″ O.D. & Ht.
NOTES: Dimensions stated are based on perfect windings not always achieveable. Electrical data accurate to within ±6%.

AMECON
QUALITY MAGNETIC COMPONENTS FOR S.M.P.S. SINCE 1972
1900 CHRIS LANE / ANAHEIM, CA 92805 / 714-634-2220 / FAX 714-634-0905

SWITCH MODE POWER SUPPLY FILTER INDUCTORS

- Minimum possible size • Low profile
- Performance verified in 25KHZ switching power supply
- Large selection of sizes available
- Available with open winding type or encapsulated and semi-encapsulated constructions.
- Custom designs are available up to 200AMPS.
- Advanced materials • Best production technologies, with 27 yrs. of SMPS expertise



I_{dc} (AMPS)	Part Number	L_{MIN} (μh) @ Rated I_{dc}	L_{MIN} (μh) @ Zero I_{dc}	DCR_{NOM} (OHMS)	Min Energy Storage (μ-Joule)	Mechanical Specifications (inch)	
						$OD_{NOM.}$	$HT_{NOM.}$
5 VOLTS POWER INDUCTORS							
1	5500	480	430	0.360	240	1.12	0.49
2	5501	275	330	0.150	550	1.14	0.52
3	5502	160	210	0.080	720	1.17	0.54
5	5503	104	160	0.055	1250	1.20	0.58
8	5504	60	84	0.015	1920	1.25	0.76
10	5505	50	62	0.012	2500	1.30	0.81
12	5506	40	48	0.009	3456	1.32	0.84
15	5507	30	50	0.009	3712	1.52	0.57
20	5508	25	40	0.006	5000	1.56	0.72
25	5509	20	26	.004	6250	1.62	0.76
30	5510	16	28	.004	7200	1.65	1.25
40	5511	12	20	.003	9600	1.72	1.28
50	5512	10	14	.002	12500	2.12	1.00
60	5513	8	12	.0015	14400	2.20	1.10
100	5514	5	7	.001	25000	2.12	1.00
10 VOLTS POWER INDUCTORS							
1	5520	1000	850	0.53	500	1.12	0.63
2	5521	500	510	0.27	1000	1.14	0.66
3	5522	310	320	0.13	1395	1.17	0.68
5	5523	180	210	0.17	2250	1.42	0.55
8	5524	120	150	0.04	3840	1.72	0.73
10	5525	100	140	0.03	5000	1.75	0.76
12	5526	75	110	0.02	7920	1.78	0.80
15	5527	68	100	0.016	8437	1.81	0.82
20	5528	51	65	0.010	10200	2.10	1.00
30	5529	32	42	0.010	14400	1.90	1.87
15 VOLTS POWER INDUCTORS							
1	5530	1250	1250	0.650	625	1.60	0.52
2.5	5531	500	520	0.170	1000	1.62	0.54
5.0	5532	250	315	0.080	3937	1.70	0.70
7.5	5533	170	225	0.050	4780	1.75	0.75
10	5534	125	170	0.030	6250	1.78	0.78
15	5535	85	130	0.017	9560	2.06	0.94
25	5536	50	90	0.009	15625	2.12	1.00
30	5537	43	75	0.008	19350	2.31	1.42
24 VOLTS POWER INDUCTORS							
2	5540	1100	1050	0.22	2200	1.95	0.82
5	5541	550	510	0.10	6875	2.00	0.87
7.5	5542	300	380	0.06	8437	2.12	1.00
10	5543	225	300	0.04	11250	2.25	1.12
15	5544	150	220	0.026	16875	2.35	1.31
25	5545	90	150	0.013	28125	2.30	1.88
35	5546	65	95	0.008	39812	2.4	2.06
48 VOLTS POWER INDUCTORS							
5	5550	750	820	0.14	9375	2.0	1.6
10	5551	375	520	2.06	18750	2.25	1.87
15	5552	250	450	0.05	28125	2.37	1.93
25	5553	150	280	0.03	46875	2.5	2.5

DELEVAN / SMD Divisions — AMERICAN PRECISION INDUSTRIES, Electronic Components Group

MOLDED RF COILS

Series 1025 & 1026 Unshielded

Delevan Part Number	Inductance Microhenries ± 10%	Q Min.	Test Frequency (MHz)	Core Material
1025-94	.10 ± 10%	40	25.0	PHENOLIC (LT4K)
1025-96	.12 ± 10%	40	25.0	
1025-00	.15 ± 10%	38	25.0	
1025-02	.18 ± 10%	35	25.0	
1025-04	.22 ± 10%	33	25.0	
1025-06	.27 ± 10%	33	25.0	
1025-08	.33 ± 10%	30	25.0	
1025-10	.39 ± 10%	30	25.0	
1025-12	.47 ± 10%	30	25.0	
1025-14	.56 ± 10%	30	25.0	
1025-16	.68 ± 10%	28	25.0	
1025-18	.82 ± 10%	28	25.0	
1025-20	1.00 ± 10%	25	25.0	
1025-22	1.20 ± 10%	25	7.9	IRON (LT10K)
1025-24	1.50 ± 10%	28	7.9	
1025-26	1.80 ± 10%	30	7.9	
1025-28	2.20 ± 10%	30	7.9	
1025-30	2.70 ± 10%	37	7.9	
1025-32	3.30 ± 10%	45	7.9	
1025-34	3.90 ± 10%	45	7.9	
1025-36	4.70 ± 10%	45	7.9	
1025-38	5.60 ± 10%	50	7.9	
1025-40	6.80 ± 10%	50	7.9	
1025-42	8.20 ± 10%	55	7.9	
1025-44	10.0 ± 10%	55	7.9	
1025-46	12.0 ± 10%	45	2.5	
1025-48	15.0 ± 10%	45	2.5	
1025-50	18.0 ± 10%	50	2.5	
1025-52	22.0 ± 10%	50	2.5	
1025-54	27.0 ± 10%	50	2.5	
1025-56	33.0 ± 10%	45	2.5	FERRITE (LT10K)
1025-58	39.0 ± 10%	45	2.5	
1025-60	47.0 ± 10%	45	2.5	
1025-62	56.0 ± 10%	45	2.5	
1025-64	68.0 ± 10%	50	2.5	
1025-66	82.0 ± 10%	50	2.5	
1025-68	100.0 ± 10%	50	2.5	
1025-70	120.0 ± 10%	30	.79	
1025-72	150.0 ± 10%	30	.79	
1025-74	180.0 ± 10%	30	.79	
1025-76	220.0 ± 10%	30	.79	
1025-78	270.0 ± 10%	30	.79	
1025-80	330.0 ± 10%	30	.79	
1025-82	390.0 ± 10%	30	.79	
1025-84	470.0 ± 10%	30	.79	
1025-86	560.0 ± 10%	30	.79	
1025-88	680.0 ± 10%	30	.79	
1025-90	820.0 ± 10%	30	.79	
1025-92	1000.0 ± 10%	30	.79	
1026-00	.022 ± 20%	50	50	PHENOLIC (LT4K)
1026-02	.027 ± 10%	40	25	
1026-04	.033 ± 10%	40	25	
1026-06	.039 ± 10%	40	25	
1026-08	.047 ± 10%	40	25	
1026-10	.056 ± 10%	40	25	
1026-12	.068 ± 10%	40	25	
1026-14	.082 ± 10%	40	25	

Series 1537 Unshielded

Delevan Part Number	Inductance Microhenries	Q Min.	Test Frequency (MHz)	Core Material
1537-00	.15 ± 20%	50	25.0	PHENOLIC (LT4K)
1537-02	.22 ± 20%	50	25.0	
1537-04	.33 ± 20%	45	25.0	
1537-06	.47 ± 20%	45	25.0	
1537-07	.56 ± 10%	50	25.0	
1537-08	.68 ± 10%	50	25.0	
1537-10	.82 ± 10%	50	25.0	
1537-12	1.00 ± 10%	50	25.0	
1537-14	1.20 ± 10%	33	7.9	
1537-16	1.50 ± 10%	33	7.9	
1537-18	1.80 ± 10%	33	7.9	
1537-20	2.20 ± 10%	33	7.9	
1537-22	2.70 ± 10%	33	7.9	
1537-24	3.30 ± 10%	33	7.9	
1537-26	3.90 ± 10%	33	7.9	
1537-28	4.70 ± 10%	33	7.9	
1537-30	5.60 ± 10%	45	7.9	IRON (LT10K)
1537-32	6.80 ± 10%	50	7.9	
1537-34	8.20 ± 10%	50	7.9	
1537-36	10.0 ± 10%	55	7.9	
1537-38	12.0 ± 10%	65	2.5	
1537-40	15.0 ± 10%	65	2.5	
1537-42	18.0 ± 10%	75	2.5	
1537-44	22.0 ± 10%	75	2.5	
1537-46†	24.0 ± 5%	60	2.5	
1537-47	27.0 ± 10%	60	2.5	
1537-48†	27.0 ± 5%	60	2.5	
1537-50†	30.0 ± 5%	65	2.5	
1537-51	33.0 ± 10%	65	2.5	
1537-52†	33.0 ± 5%	65	2.5	
1537-54	36.0 ± 5%	60	2.5	
1537-56	39.0 ± 5%	60	2.5	
1537-58	43.0 ± 5%	60	2.5	
1537-60	47.0 ± 5%	55	2.5	
1537-62	51.0 ± 5%	55	2.5	
1537-64	56.0 ± 5%	55	2.5	
1537-66	62.0 ± 5%	55	2.5	
1537-68	68.0 ± 5%	55	2.5	
1537-70	75.0 ± 5%	55	2.5	
1537-72	82.0 ± 5%	50	2.5	
1537-74	91.0 ± 5%	50	2.5	
1537-76	100.0 ± 5%	50	2.5	
1537-78	110.0 ± 5%	60	.79	
1537-80	120.0 ± 5%	65	.79	
1537-82	130.0 ± 5%	65	.79	
1537-84	150.0 ± 5%	65	.79	
1537-86	160.0 ± 5%	65	.79	
1537-88	180.0 ± 5%	65	.79	
1537-90	200.0 ± 5%	65	.79	
1537-92	220.0 ± 5%	65	79	
1537-94	240.0 ± 5%	65	.79	

Series 2500 Unshielded

Delevan Part Number	Inductance Microhenries	Q Min.	Test Frequency (MHz)	Mold Size	Core Material
2500-00	270±5%	65	.790	A	PHENOLIC (LT4K)
2500-02	300±5%	65	.790	A	
2500-04	330±5%	65	.790	A	
2500-06	360±5%	65	.790	A	
2500-08	390±5%	65	.790	A	
2500-10	430±5%	65	.790	A	
2500-12	470±5%	65	.790	A	
2500-14†	500±5%	65	.790	A	
2500-15	510±5%	65	.790	A	
2500-16	560±5%	65	.790	A	
2500-18	620±5%	60	.790	A	
2500-20	680±5%	60	.790	A	
2500-22	750±5%	60	.790	A	
2500-24	820±5%	60	.790	A	
2500-26	910±5%	60	.790	A	
2500-28	1000±5%	60	.790	A	
2500-30	1100±5%	60	.250	B	IRON (LT10K)
2500-32	1200±5%	60	.250	B	
2500-34	1300±5%	60	.250	B	
2500-36	1500±5%	65	.250	B	
2500-38	1600±5%	65	.250	B	
2500-40	1800±5%	65	.250	B	
2500-42	2000±5%	65	.250	B	
2500-44	2200±5%	70	.250	B	
2500-46	2400±5%	70	.250	B	
2500-48	2700±5%	70	.250	B	
2500-50	3000±5%	70	.250	B	
2500-52	3300±5%	70	.250	B	
2500-54	3600±5%	70	.250	B	
2500-56	3900±5%	80	.250	C	
2500-58	4300±5%	80	.250	C	
2500-60	4700±5%	80	.250	C	
2500-62	5000±5%	80	.250	C	
2500-63†	5100±5%	80	.250	C	
2500-64	5600±5%	80	.250	C	
2500-66	6200±5%	80	.250	C	
2500-68	6800±5%	80	.250	C	
2500-70	7500±5%	80	.250	C	
2500-72	8200±5%	80	.250	C	
2500-74	9100±5%	80	.250	C	
2500-76	10000±5%	80	.250	C	

Series 2890 Unshielded

Delevan Part Number	Inductance Microhenries ±10%	Q Min.	Test Frequency (MHz)	Core Material
2890-00	1.2	60	7.9	PHENOLIC (LT4K)
2890-02	1.5	60	7.9	
2890-03	1.8	60	7.9	
2890-04	2.2	60	7.9	
2890-06	2.7	60	7.9	
2890-08	3.3	60	7.9	
2890-10	3.9	60	7.9	
2890-12	4.7	60	7.9	
2890-14	5.6	60	7.9	
2890-16	6.8	60	7.9	
2890-18	8.2	60	7.9	
2890-20	10.0	60	7.9	
2890-22	12.0	40	2.5	
2890-24	15.0	40	2.5	
2890-26	18.0	40	2.5	
2890-28	22.0	50	2.5	IRON (LT10K)
2890-30	27.0	45	2.5	
2890-32	33.0	60	2.5	
2890-34	39.0	55	2.5	
2890-36	47.0	65	2.5	
2890-38	56.0	65	2.5	
2890-39	68.0	75	2.5	
2890-40	82.0	75	2.5	
2890-42	100.0	75	2.5	
2890-44	120.0	95	0.79	

Series 2500 Unshielded

Physical Parameters

Mold Size	A	B	C
Diameter ± .010 Inches ± .25 mm	.190 [4.83]	.215 [5.46]	240 [6.10]
Length ± .010 Inches ± .25 mm	.440 [11.18]	.560 [14.22]	.740 [18 80]
Lead Type & Size Inches ± .002 ± .051 mm	AWG #22 TCW 025 [.635]	AWG #21 TCW .028 [.711]	AWG #20 TCW 032 [.813]

Core Material Iron

Military Specifications:
MS-90539 (LT 10K) MS-90540 (LT 10K)
MS-90541 (LT 10K)

Series 2890 Unshielded

Physical Parameters

	Inches	Millimeters
Length	.900 ± .010	[22.86 ± .25]
Diameter	.280 ± .010	[7.11 ± .25]
Lead Size AWG #21 TCW:	.028 ± .002	[.711 ± .051]

Military Specifications:
MS-75103 (LT10K) MS-91189 (LT4K)

Series 1025 & 1026 Unshielded

Physical Parameters

	Inches	Millimeters
Length	.250 ± .010	[6.35 ± .25]
Diameter	.095 ± .010	[2.41 ± .25]
Lead Size AWG #24 TCW:	.020 ± .0015	[.508 ± .038]

Military Specifications:
MS-75083 (LT4K)
MS-75084 (LT10K)
MS-75085 (LT10K)

Series 1537 Unshielded

Physical Parameters

	Inches	Millimeters
Length	.375 ± .010	[9.53 ± .25]
Diameter	.156 ± .010	[3.96 ± .25]
Lead Size AWG #22 TCW:	.025 ± .002	[.635 ± .051]

Military Specifications:
MS-14046 (LT10K)
MS-18130 (LT4K)
MS-90538 (LT10K)

UNSHIELDED RF COILS

Coils range in value from .022μH through 10,000μH. Special values, tighter tolerances and sizes are also available on a custom design basis. Coils can also be supplied in open construction or with reel tape packaging of axial leaded coils to our standard or to your specification. Laser marking with inductance, tolerance & date code available.

For complete information call your local Delevan/SMD Distributor or Representative listed in the yellow pages or contact the factory direct **(716) 652-3600, FAX (716) 652-4814.**

ER Series MIL-C-39010 Established Reliability Inductors – (For all HI-REL Applications)

Approved through failure rate R .01%/ 1000 hrs. Contact your distributor or Delevan Rep for details.

DELEVAN / SMD Divisions — AMERICAN PRECISION INDUSTRIES, Electronic Components Group

SHIELDED RF COILS

Series 2534 Unshielded

Delevan Part Number	Inductance Millihenries	Q Min.	Test Frequency (KHz)	Core Material
534-00	.10 ± 10%	80	790	FERRITE
534-02	.12 ± 10%	80	790	
534-04	.15 ± 10%	75	790	
534-06	.18 ± 10%	70	790	
534-08	.22 ± 10%	65	790	
534-10	.27 ± 10%	80	790	
534-12	.33 ± 10%	75	790	
534-14	.39 ± 10%	70	790	
534-16	.47 ± 10%	65	790	
534-18	.56 ± 10%	65	790	
534-20	.68 ± 10%	60	790	
534-22	.82 ± 10%	50	790	
534-24	1.00 ± 10%	45	790	
534-26	1.20 ± 10%	70	250	
534-28	1.50 ± 10%	70	250	
534-30	1.80 ± 10%	70	250	
534-32	2.20 ± 10%	70	250	
534-34	2.70 ± 10%	65	250	
534-36	3.30 ± 10%	65	250	
534-38	3.90 ± 10%	65	250	
534-40	4.70 ± 10%	60	250	
534-42	5.60 ± 10%	60	250	
534-44	6.80 ± 10%	55	250	
534-46	8.20 ± 10%	50	250	
534-48	10.0 ± 10%	45	250	
534-50	12.0 ± 15%	35	79	
534-52	15.0 ± 15%	35	79	
534-54	18.0 ± 15%	35	79	
534-56	22.0 ± 15%	35	79	
534-58	27.0 ± 15%	35	79	
534-60	33.0 ± 15%	30	79	
534-62	39.0 ± 15%	30	79	
534-64	47.0 ± 15%	30	79	
534-66	56.0 ± 15%	25	79	
534-68	68.0 ± 15%	20	79	
534-70	82.0 ± 15%	18	79	
534-72	100.0 ± 15%	15	79	FERRITE
534-74	120.0 ± 15%	10	50	
534-76	150.0 ± 15%	10	50	

Series 2534 Unshielded Physical Paramaters

	Inches	Millimeters
Height	.345 Max.	[8.76 Max.]
Diameter	.25±.010	[6.35±.25]
Lead Size AWG		
#24 TCW:	.020±.0015	[.508±.038]
Lead Spacing	.170–.210	[4.32–5.33]

Core Material Ferrite)

MIL-R-1840
MIL-C-39010/04
MIL-C-39010/05

MIL-R-1641
MIL-C-39010/01 (.10μH-82μH)
MIL-C-39010/02 (.91μH-12.0μH)
MIL-C-39010/03

MIL-R-1537
MIL-C-39010/06 (15μH-4.7μH)
MIL-C-39010/07 (5.1μH-33μH)

MIL-R-1025
MIL-C-39010/08 (.10μH-1.00μH)
MIL-C-39010/09 (1.1μH-27.0μH)
MIL-C-39010/10 (30μH-1000μH)

SN10 Hi-Temp Solder

MOLDED RF COILS—SHIELDED
Coils are electromagnetically shielded with inductance values of .1μH through 10,000μH. Inductance Tolerances of ±5% are available by special request. Shielded coils reduce magnetic coupling between components and should be used only where coupling problems exist, since cost is normally higher.

LCR SERIES RF COILS
A unique series of inductors designed for overseas manufacturers who wish to eliminate problems when correlating inductance values of coils manufactured to Q-Meter specifications (according to U.S. military requirements) when they are measured on an HP impedance analyzer or LCR meter. Equivalent Domestic Use Part Numbers include: Series No. 1025, 1026, 1537, 1840, & 2500.

TOROIDAL INDUCTORS

Series 2020

Delevan Part Number	Inductance Microhenries	Q Min.	Test Frequency (MHz)
2020-00	.10±10%	55	25
2020-02	.12±10%	60	25
2020-04	.15±10%	60	25
2020-06	.18±10%	60	25
2020-08	.22±10%	65	25
2020-10	.27±10%	65	25
2020-12	.33±10%	65	25
2020-14	.39±10%	65	25
2020-16	.47±10%	65	25
2020-18	.56±10%	70	25
2020-20	.68±10%	70	25
2020-22	.82±10%	70	25
2020-24	1.0 ± 5%	70	25
2020-26	1.2 ± 5%	60	7.9
2020-28	1.5 ± 5%	60	7.9
2020-30	1.8 ± 5%	60	7.9
2020-32	2.2 ± 5%	60	7.9
2020-34	2.7 ± 5%	60	7.9
2020-36	3.3 ± 5%	60	7.9
2020-38	3.9 ± 5%	60	7.9
2020-40	4.7 ± 5%	60	7.9
2020-42	5.6 ± 5%	60	7.9
2020-44	6.8 ± 5%	60	7.9
2020-46	8.2 ± 5%	60	7.9
2020-48	10.0 ± 5%	60	7.9

Series 2020
Physical Parameters
Dimensions in inches [millimeters].

Ltr.	Minimum		Maximum	
A	.200	[5.08]	.230	[5.84]
B	.190	[4.83]	.210	[5.33]
C	.090	[2.29]	.110	[2.79]

Lead Size
AWG #24 TCW
Lead Spacing: .090 - 2.29 [.110 - 2.79]
Current Rating at 90°C AMB. 35°C Rise
Core Material Iron
Military Specifications: MS-21422 (LT 4K)

Series 0925

Delevan Part Number	Inductance Microhenries ±10%	Q Min.	Test Frequency (MHz)
0925-101	.10	54	25.0
0925-121	.12	52	25.0
0925-151	.15	50	25.0
0925-181	.18	49	25.0
0925-221	.22	47	25.0
0925-271	.27	46	25.0
0925-331	.33	44	25.0
0925-391	.39	42	25.0
0925-471	.47	41	25.0
0925-561	.56	41	25.0
0925-681	.68	39	25.0
0925-821	.82	38	25.0
0925-102	1.00	37	25.0
0925-122	1.20	40	7.9
0925-152	1.50	41	7.9
0925-182	1.80	43	7.9
0925-222	2.20	45	7.9
0925-272	2.70	48	7.9
0925-332	3.30	49	7.9
0925-392	3.90	50	7.9
0925-472	4.70	53	7.9
0925-562	5.60	54	7.9
0925-682	6.80	55	7.9
0925-822	8.20	55	7.9
0925-103	10.0	57	7.9
0925-123	12.0	36	2.5
0925-153	15.0	38	2.5
0925-183	18.0	40	2.5
0925-223	22.0	40	2.5
0925-273	27.0	40	2.5
0925-333	33.0	41	2.5
0925-393	39.0	42	2.5
0925-473	47.0	44	2.5
0925-563	56.0	44	2.5
0925-683	68.0	45	2.5
0925-823	82.0	45	2.5
0925-104	100.0	40	2.5
0925-124	120.0	31	.79
0925-154	150.0	33	.79
0925-184	180.0	33	.79
0925-224	220.0	35	.79
0925-274	270.0	37	.79
0925-334	330.0	40	.79
0925-394	390.0	38	.79
0925-474	470.0	36	.79
0925-564	560.0	36	.79

Series 0925 Shielded
Physical Parameters

	Inches	Millimeters
Length	.250±.010	[6.35±.25]
Diameter	.095±.010	[2.41±.25]
Lead Size AWG		
#24 TCW:	.020±.0015	[.508±.038]

Coupling 3% Max.
Core Material

Dash No.	Core	Sleeve
-101 thru -104	Iron	Iron
-124 thru -564	Ferrite	Ferrite

Military Specifications:
MS-21426 (LT10K)
MS-21427 (LT10K)

Dimensions in inches and [Millimeters]

Series 1641

Delevan Part Number	Inductance Microhenries ±10%	Q Min.	Test Frequency (MHz)	Current Rating Max. (mA)
1641-101	.10	50	25	1830
1641-121	.12	51	25	1570
1641-151	.15	51	25	1500
1641-181	.18	50	25	1330
1641-221	.22	49	25	1120
1641-271	.27	47	25	870
1641-331	.33	46	25	800
1641-391	.39	44	25	680
1641-471	.47	44	25	580
1641-561	.56	43	25	505
1641-681	.68	42	25	430
1641-821	.82	40	25	375
1641-102	1.0	44	25	1090
1641-122	1.2	44	7.9	900
1641-152	1.5	44	7.9	835
1641-182	1.8	44	7.9	775
1641-222	2.2	44	7.9	665
1641-272	2.7	44	7.9	545
1641-332	3.3	44	7.9	490
1641-392	3.9	44	7.9	455
1641-472	4.7	44	7.9	390
1641-562	5.6	44	7.9	340
1641-682	6.8	50	7.9	285
1641-822	8.2	50	7.9	250
1641-103	10.0	50	7.9	228
1641-123	12.0	55	2.5	205
1641-153	15.0	45	2.5	325
1641-183	18.0	45	2.5	305
1641-223	22.0	45	2.5	295
1641-273	27.0	45	2.5	265
1641-333	33.0	45	2.5	248
1641-393	39.0	50	2.5	209
1641-473	47.0	50	2.5	200
1641-563	56.0	50	2.5	194
1641-683	68.0	50	2.5	176
1641-823	82.0	50	2.5	186
1641-104	100	50	2.5	164
1641-124	120	55	.79	153
1641-154	150	55	.79	143
1641-184	180	55	.79	138
1641-224	220	55	.79	130
1641-274	270	55	.79	120
1641-334	330	55	.79	115
1641-394	390	60	.79	107
1641-474	470	60	.79	94
1641-564	560	60	79	90
1641-684	680	60	.79	84
1641-824	820	60	79	80
1641-105	1000	60	.79	70

Series 1641 Shielded
Physical Parameters

	Inches	Millimeters
Length	.410±.020	[10.41±.51]
Diameter	.162±.010	[4.11±.25]
Lead Size AWG		
#22 TCW:	.025±.002	[.635±.051]

Coupling 3% Max.
Core Material

Dash No.	Core	Sleeve
-101 thru 821	Phenolic	Iron
102 thru 123	Iron	Iron
153 thru 105	Ferrite	Ferrite

Military Specifications:
MS-75087 (LT4K) MS-75088 (LT10K)
MS-75089 (15μH - 1000μH only) (LT10K)

For complete information call your local Delevan/SMD Distributor or Representative listed in the yellow pages or contact the factory direct **(716) 652-3600, FAX (716) 652-4814.**

DELEVAN / SMD Divisions — American Precision Industries, Electronic Components Group

POWER CHOKES
Series 3443

MICRO-i® CHIPS
Series 103 & 105

SURFACE MOUNT
Series 1010 Unshielded

Series 1812

Delevan Part Number	Inductance Microhenries ± 10% @ 1 KHz	Current Rating Max. (Amps)
3443-00	1.0	17.8
3443-04	1.5	16.2
3443-08	2.2	15.0
3443-12	3.3	14.0
3443-16	4.7	13.0
3443-20	6.8	12.5
3443-24	10.0	10.0
3443-28	15.0	8.5
3443-32	22.0	6.5
3443-36	33.0	5.5
3443-40	47.0	4.5
3443-44	68.0	4.0
3443-48	100	3.3
3443-50	120	3.0
3443-52	150	2.7
3443-56	220	2.2
3443-58	270	1.95
3443-60	330	1.7
3443-64	470	1.6
3443-68	680	1.3
3443-72	1000	1.0
3443-76	1500	.84
3443-80	2200	.69
3443-84	3300	.55
3443-88	4700	.45
3443-92	6800	.36
3443-94	10000	.33
3443-98	15000	.26

Physical Parameters

Letter	Inches	Millimeters
B	.600 Max.	[15.27] Max.
D	.870 Max.	[22.14] Max.
E	.515 Max.	[13.10] Max.
F	AWG #18 TCW	

Core Material: Ferrite
Current Rating: Based on continuous operation at room temperature. Derating is required at elevated ambient temperatures. Consult factory for details.

MICRO-i® INDUCTORS are available in a variety of inductance ranges. A number of low profile styles are provided for use on thick film hybrid packages. Inductive values with tighter tolerances and a variety of optional termination materials are available for specialized applications. Parts are available with ribbon leads, reflow solder pads or in a wire bondable pad configuration.

Series 103 & 105

Dim.	Inches	Millimeters
A	.100±.010	[2.54±.25]
B	.100±.010	[2.54±.25]
C	.075 Max.	[1.91 Max.]

Mechanical Configuration:
1) Series 103 and Series 105 Units are epoxy encapsulated
2) Contact areas for reflow soldering are gold plated per MIL-G-45204 Type 1-Grade A
3) Internal connections are thermal compression bonded

Current Rating at 90°C AMB. 35°C Rise

Termination Finish Options Gold over Nickel (Standard). Tin/Lead over Nickel:

Delevan Part Number	Inductance Microhenries ± 10%	Q Min.	Test Frequency (MHz)
Series 103 Core Material — Phenolic			
103-100(*)	.010 ± (*)	60	
103-120K	.012 ± 10%	57	
103-150(*)	.015 ± (*)	55	
103-180K	.018 ± 10%	52	
103-220(*)	.022 ± (*)	50	
103-270K	.027 ± 10%	49	
103-330(*)	.033 ± (*)	48	50
103-390K	.039 ± 10%	45	
103-470(*)	.047 ± (*)	42	
103-560K	.056 ± 10%	39	
103-680(*)	.068 ± (*)	36	
103-820K	.082 ± 10%	34	
103-101(*)	100 ± (*)	32	
Series 103 Core Material — Ferrite			
103-121K	12 ± 10%	30	
103-151K	15 ± 10%	25	
103-181K	18 ± 10%	25	
103-221K	22 ± 10%	25	
103-271K	27 ± 10%	25	
103-331K	33 ± 10%	25	25
103-391K	39 ± 10%	22	
103-471K	47 ± 10%	22	
103-561K	56 ± 10%	22	
103-681K	68 ± 10%	22	
103-821K	82 ± 10%	22	
103-102K	1.0 ± 10%	22	
103-122K	1.2 ± 10%	22	
103-152K	1.5 ± 10%	22	
103-182K	1.8 ± 10%	22	
103-222K	2.2 ± 10%	22	7.9
103-272K	2.7 ± 10%	24	
103-332K	3.3 ± 10%	24	
103-392K	3.9 ± 10%	24	
103-472K	4.7 ± 10%	24	
103-562K	5.6 ± 10%	22	
103-682K	6.8 ± 10%	22	
103-822K	8.2 ± 10%	22	7.9
103-103K	10.0 ± 10%	24	
103-123K	12.0 ± 10%	25	
103-153K	15.0 ± 10%	25	
103-183K	18.0 ± 10%	25	2.5
103-223K	22.0 ± 10%	25	
103-273K	27.0 ± 10%	25	
Series 105 Core Material — Iron			
105-121M	12 ± 20%	40	
105-151M	.15 ± 20%	40	
105-181M	.18 ± 20%	40	
105-221K	.22 ± 10%	40	
105-271K	.27 ± 10%	40	
105-331K	.33 ± 10%	35	
105-391K	.39 ± 10%	35	25
105-471K	.47 ± 10%	35	
105-561K	.56 ± 10%	35	
105-681K	.68 ± 10%	35	
105-821K	.82 ± 10%	30	
105-102K	1.0 ± 10%	30	
105-122K	1.2 ± 10%	25	
105-152K	1.5 ± 10%	25	
105-182K	1.8 ± 10%	25	
105-222K	2.2 ± 10%	25	
105-272K	2.7 ± 10%	25	
105-332K	3.3 ± 10%	25	7.9
105-392K	3.9 ± 10%	25	
105-472K	4.7 ± 10%	30	
105-562K	5.6 ± 10%	30	
105-682K	6.8 ± 10%	30	
105-822K	8.2 ± 10%	30	
105-103K	10.0 ± 10%	30	

(*)-MS slash numbers available in 10% (Suffix "K") and 20% (Suffix "M") tolerances.

Military Specifications:
Series 103 MIL-C-83446/4
Series 105 MIL-C-83446 (Design only)

Notes:
1) Designed specifically for reflow soldering and other high temperature processes with metalized edges to exhibit solder fillet
2) Series 105 Micro-i inductors utilize a powdered iron core for improved temperature stability

API/SMD Part Number	Inductance Microhenries ± 10%	Q Min.	Test Frequency (MHz)
Core Material — Phenolic			
1010-120	.012	56	
1010-180	.018	52	
1010-270	.027	49	
1010-390	.039	45	
1010-560	.056	39	50
1010-820	.082	34	
Core Material — Ferrite			
1010-121	.12	30	
1010-151	.15	25	
1010-181	.18	25	25
1010-221	.22	25	
1010-271	.27	25	
1010-331	.33	25	
1010-391	.39	22	
1010-471	.47	22	
1010-561	.56	22	
1010-681	.68	22	
1010-821	.82	22	
1010-102	1.0	22	
1010-122	1.2	22	
1010-152	1.5	22	7.9
1010-182	1.8	22	
1010-222	2.2	22	
1010-272	2.7	24	
1010-332	3.3	24	
1010-392	3.9	24	
1010-472	4.7	24	
1010-562	5.6	22	
1010-682	6.8	22	7.9
1010-822	8.7	22	
1010-103	10.0	24	
1010-123	12.0	25	
1010-153	15.0	25	
1010-183	18.0	25	2.5
1010-223	22.0	25	
1010-273	27.0	25	

Series 1210**

Core Material — Iron			
1210-101K	.10	30	
1210-121K	.12	30	
1210-151K	.15	30	
1210-181K	.18	30	
1210-221K	.22	30	
1210-271K	.27	30	
1210-331K	.33	30	25.0
1210-391K	.39	30	
1210-471K	.47	30	
1210-561K	.56	30	
1210-681K	.68	30	
1210-821K	.82	30	
Core Material — Ferrite			
1210-102K	1.0	30	25.0
1210-122K	1.2	30	
1210-152K	1.5	30	
1210-182K	1.8	30	
1210-222K	2.2	30	
1210-272K	2.7	30	
1210-332K	3.3	30	7.9
1210-392K	3.9	30	
1210-472K	4.7	30	
1210-562K	5.6	30	
1210-682K	6.8	30	
1210-822K	8.2	30	
1210-103K	10.0	30	
1210-123K	12.0	30	
1210-153K	15.0	30	
1210-183K	18.0	30	
1210-223K	22.0	30	
1210-273K	27.0	30	
1210-333K	33.0	30	2.5
1210-393K	39.0	30	
1210-473K	47.0	30	
1210-563K	56.0	30	
1210-683K	68.0	30	
1210-823K	82.0	30	
1210-104K	100.0	30	

API/SMD Part Number	Inductance Microhenries ± 10%	Q Min.	Test Frequency (MHz)
Core Material — Phenolic			
1812-101K	.10	30	
1812-121K	.12	30	
1812-151K	.15	30	
1812-181K	.18	30	
1812-221K	.22	30	
1812-271K	.27	30	
1812-331K	.33	30	25.0
1812-391K	.39	30	
1812-471K	.47	30	
1812-561K	.56	30	
1812-681K	.68	30	
1812-821K	.82	30	
Core Material — Ferrite			
1812-102K	1.0	50	25.0
1812-122K	1.2	50	
1812-152K	1.5	50	
1812-182K	1.8	50	
1812-222K	2.2	50	
1812-272K	2.7	50	
1812-332K	3.3	50	7.9
1812-392K	3.9	50	
1812-472K	4.7	50	
1812-562K	5.6	50	
1812-682K	6.8	50	
1812-822K	8.2	50	
1812-103K	10.	50	
1812-123K	12.	50	
1812-153K	15.	50	
1812-183K	18.	50	
1812-223K	22.	50	
1812-273K	27.	50	
1812-333K	33.	50	2.5
1812-393K	39.	50	
1812-473K	47.	50	
1812-563K	56.	50	
1812-683K	68.	50	
1812-823K	82.	50	
1812-104K	100.	50	
1812-124K	120.	40	
1812-154K	150.	40	
1812-184K	180.	40	
1812-224K	220.	40	
1812-274K	270.	40	0.79
1812-334K	330.	40	
1812-394K	390.	40	
1812-474K	470.	40	
1812-564K	560.	30	

For values above 560μH, consult factory.

Series 1010 Physical Parameters*

Dimensions*	Inches	Millimeters
A	.100	[2.54]
B	.085	[2.16]
C	.095	[2.41]

Series 1210 Physical Parameters* (Shielded)

Dimensions*	Inches	Millimeters
A	.118	[3.0]
B	.081	[2.1]
C	.085	[2.2]

**Phenolic Core #1210 Inductors from 0.010μH to 0.082μH are also available.

Series 1812 Physical Parameters*

Dimensions*	Inches	Millimeters
A	.17	[4.4]
B	.12	[3.2]
C	.12	[3.2]

Laser marking is used to identify all SMD inductors
*Nominal dimensions over end caps are approximate.

DELEVAN / SMD Divisions — AMERICAN PRECISION INDUSTRIES, Electronic Components Group

SURFACE MOUNT INDUCTORS

Series 2510 Unshielded

API/SMD Part Number	Inductance Microhenries ± 10%	Q Min.	Test Frequency (MHz)	Core Material
2510-00K	.10	25	25.	PHENOLIC
2510-02K	.12	25	25.	
2510-04K	.15	25	25.	
2510-06K	.18	25	25.	
2510-08K	.22	25	25.	
2510-10K	.27	25	25.	
2510-12K	.33	25	25.	
2510-14K	.39	25	25.	
2510-16K	.47	25	25.	
2510-18K	.56	35	25.	IRON
2510-20K	.68	35	25.	
2510-22K	.82	35	25.	
2510-24K	1.0	35	25.	
2510-26K	1.2	25	7.9	
2510-28K	1.5	30	7.9	
2510-30K	1.8	30	7.9	
2510-32K	2.2	30	7.9	
2510-34K	2.7	30	7.9	
2510-36K	3.3	35	7.9	
2510-38K	3.9	35	7.9	
2510-40K	4.7	35	7.9	
2510-42K	5.6	35	7.9	
2510-44K	6.8	35	7.9	
2510-46K	8.2	35	7.9	
2510-48K	10.	35	7.9	
2510-50K	12.	25	2.5	
2510-52K	15.	25	2.5	
2510-54K	18.	25	2.5	
2510-56K	22.	25	2.5	
2510-58K	27.	25	2.5	
2510-60K	33.	25	2.5	
2510-62K	39.	25	2.5	
2510-64K	47.	25	2.5	
2510-66K	56.	25	2.5	
2510-68K	68.	25	2.5	
2510-70K	82.	25	2.5	
2510-72K	100.	25	2.5	
2510-74K	120.	15	.79	FERRITE
2510-76K	150.	15	.79	
2510-78K	180.	15	.79	
2510-80K	220.	15	.79	
2510-82K	270.	15	.79	
2510-84K	330.	15	.79	
2510-86K	390.	15	.79	
2510-88K	470.	15	.79	
2510-90K	560.	15	.79	
2510-92K	680.	15	.79	
2510-94K	820.	15	.79	
2510-96K	1000.	15	.79	

Series 1330 Unshielded

API/SMD Part Number	Inductance Microhenries ± 10%	Q Min.	Test Frequency (MHz)	Core Material
1330-94	.10	40	25.0	PHENOLIC (LT4K)
1330-96	.12	40	25.0	
1330-00	.15	38	25.0	
1330-02	.18	35	25.0	
1330-04	.22	33	25.0	
1330-06	.27	33	25.0	
1330-08	.33	30	25.0	
1330-10	.39	30	25.0	
1330-12	.47	30	25.0	
1330-14	.56	30	25.0	
1330-16	.68	28	25.0	
1330-18	.82	28	25.0	
1330-20	1.00	25	25.0	
1330-22	1.20	25	7.9	IRON (LT10K)
1330-24	1.50	28	7.9	
1330-26	1.80	30	7.9	
1330-28	2.20	30	7.9	
1330-30	2.70	37	7.9	
1330-32	3.30	45	7.9	
1330-34	3.90	45	7.9	
1330-36	4.70	45	7.9	
1330-38	5.60	50	7.9	
1330-40	6.80	50	7.9	
1330-42	8.20	55	7.9	
1330-44	10.0	55	7.9	
1330-46	12.0	45	2.5	
1330-48	15.0	45	2.5	
1330-50	18.0	45	2.5	
1330-52	22.0	45	2.5	
1330-54	27.0	45	2.5	
1330-56	33.0	35	2.5	
1330-58	39.0	35	2.5	FERRITE (LT10K)
1330-60	47.0	35	2.5	
1330-62	56.0	35	2.5	
1330-64	68.0	35	2.5	
1330-66	82.0	35	2.5	
1330-68	100.0	35	2.5	
1330-70	120.0	30	.79	
1330-72	150.0	30	.79	
1330-74	180.0	30	.79	
1330-76	220.0	30	.79	
1330-78	270.0	30	.79	
1330-80	330.0	30	.79	
1330-82	390.0	30	.79	
1330-84	470.0	30	.79	
1330-86	560.0	30	.79	
1330-88	680.0	30	.79	
1330-90	820.0	30	.79	
1330-92	1000.0	30	.79	

Series 1331 Shielded

API/SMD Part Number	Inductance Microhenries ± 10%	Q Min.	Test Frequency (MHz)	Current Rating Max. (mA)	Core Material
1331-101	.10	45	25.0	670	PHENOLIC (LT4K)
1331-121	.12	45	25.0	635	
1331-151	.15	45	25.0	610	
1331-181	.18	45	25.0	585	
1331-221	.22	45	25.0	545	
1331-271	.27	45	25.0	530	
1331-331	.33	44	25.0	495	
1331-391	.39	42	25.0	485	
1331-471	.47	41	25.0	460	
1331-561	.56	41	25.0	440	
1331-681	.68	39	25.0	430	
1331-821	.82	38	25.0	405	
1331-102	1.00	37	25.0	385	
1331-122	1.20	40	7.9	247	IRON (LT10K)
1331-152	1.50	41	7.9	228	
1331-182	1.80	43	7.9	217	
1331-222	2.20	45	7.9	202	
1331-272	2.70	48	7.9	193	
1331-332	3.30	49	7.9	185	
1331-392	3.90	50	7.9	173	
1331-472	4.70	50	7.9	136	
1331-562	5.60	50	7.9	124	
1331-682	6.80	50	7.9	118	
1331-822	8.20	50	7.9	111	
1331-103	10.0	50	7.9	106	
1331-123	12.0	36	2.5	122	
1331-153	15.0	38	2.5	115	
1331-183	18.0	40	2.5	108	
1331-223	22.0	40	2.5	96	
1331-273	27.0	40	2.5	88	
1331-333	33.0	41	2.5	83	
1331-393	39.0	42	2.5	75	FERRITE (LT10K)
1331-473	47.0	44	2.5	69	
1331-563	56.0	44	2.5	64	
1331-683	68.0	45	2.5	61	
1331-823	82.0	45	2.5	59	
1331-104	100.0	40	2.5	51	
1331-124	120.0	31	.79	88	
1331-154	150.0	33	.79	75	
1331-184	180.0	33	.79	69	
1331-224	220.0	35	.79	64	
1331-274	270.0	35	.79	61	
1331-334	330.0	35	.79	53	
1331-394	390.0	35	.79	46	
1331-474	470.0	35	.79	43	
1331-564	560.0	35	.79	40	

Series 2510 Unshielded

Dimensions	Inches	Millimeters
A	.235 to .255	[5.97 to 6.48]
B	.090 to .110	[2.29 to 2.79]

Dimensions "A" and "B" include measurements over end caps and are approximate for reference only.

Series 1330 Unshielded
Series 1331 Shielded

Dimensions	Inches	Millimeters
A	.125 to .145	[3.18 to 3.68]
B	.300 to .320	[7.62 to 8.13]

Dimensions "A" and "B" include measurements over end caps and are approximate for reference only.

Shielded
Coupling 3% Max.

Core Material	DASH NO.	CORE	SLEEVE
	-101 thru- 104	Iron	Iron
	-124 thru- 564	Ferrite	Ferrite

Dimensions in inches and [Millimeters]

SURFACE MOUNT INDUCTORS

Coils are available in unshielded designs with inductance values ranging from .010μH thru 1,000 μH ± 10%. Shielded versions to reduce magnetic coupling between components are available from .010μH to 560 μH ± 10%. Closer inductance tolerances are available on special order.

Their rectangular outline package with symmetrical orientation is ideal for automatic indexing and assembly methods. Their parallel flat surfaces are well adapted to all methods of vacuum pickup and indexing. Coils can be supplied in bulk or reel tape.

Delevan/SMD components are compatible with all state-of-the-art attachments and soldering methods. Standard metalized ends are solder coated copper.

They are molded in thermally stable flame retardant epoxy resin. High temperature solder is used for internal joints to insure maximum reliability during assembly and attachment operations.

Our inductors are made in accordance with the basic requirements of MIL-C-83446 and are available on reel or bulk packaging.

* NEW power series available. Contact factory for latest brochure.

Many of the electrical parameters for new or prototype products have been calculated and are to be used for reference only. Please consult our current catalog or contact our factory when critical design data are required.

SMD Inductors are covered by U.S. Patent Nos. 4,801,912; 4,914,804 and 4,934,048

Laser marking is used to identify all SMD inductors

AMERICAN PRECISION INDUSTRIES

Delevan / SMD Division

For complete information on all Delevan/SMD Divisions inductive components call your local Delevan/SMD Distributor or Representative listed in the yellow pages or contact the factory direct **(716) 652-3600, FAX (716) 652-4814**

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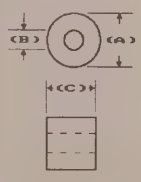
CORES

FERRITE BEADS

Miller Number	Ferrite Material No.	Suggested Frequency Range
FB73-085	73	Up to 40 MHz
FB43-226	43	40 to 200 MHz
FB73-226	73	Up to 40 MHz
FB43-110	43	40 to 200 MHz
FB64-110	64	Above 200 MHz
FB73-110	73	Up to 40 MHz
FB43-422	43	40 to 200 MHz
FB73-422	73	Up to 40 MHz
FB43-287	43	40 to 200 MHz
FB73-287	73	Up to 40 MHz

The addition of a Ferrite Bead to a piece of wire causes the impedance of the lead to increase and acts like a small RF choke at high frequencies. It is possible to dissipate high frequency parasitic signals and attenuate undesirable frequencies that travel on DC circuits by the use of beads.

(A) Outside Diameter Min.	Max.	(B) Inside Diameter Min.	Max.	(C) Length Min.	Max.
.052	.056	.027	.031	.085	.095
.13	.146	.047	.055	.226	.246
.13	.146	.047	.055	.226	.246
.13	.146	.047	.055	.118	.138
.13	.146	.047	.055	.118	.138
.13	.146	.047	.055	.118	.138
.19	.210	.057	.055	.422	.452
.19	.210	.057	.067	.422	.452
.291	.301	.089	.067	.287	.307
.291	.301	.089	.099	.287	.307



WIDE-BAND CHOKES

Miller Number	Core Material	No. of Turns	Min. Z (Ω)	Freq. (MHz)	Fig.
FB20009-3B	3B	1½	300	120	A
FB20019-4B	4B	1½	350	250	A
FB20010-3B	3B	2½	600	50	B
FB20020-4B	4B	2½	700	180	B
FB20011-3B	3B	2 x 1½	700*	50	C
FB20021-4B	4B	2 x 1½	800*	110	C

*Measured with the two 1½ turn windings in series.

Figure A

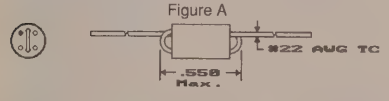


Figure B

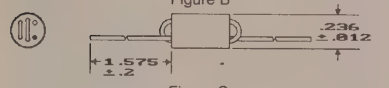
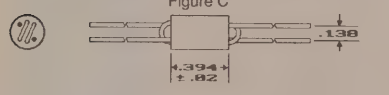


Figure C



UNSHIELDED CHIP INDUCTORS

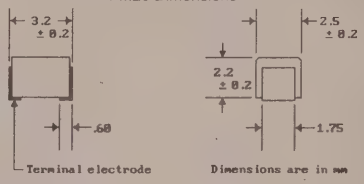
PM20 SERIES

MILLER NUMBER	L ±20% µH	Q Min.	Test Freq. MHz	Fo Min. MHz	R,dc MAX. Ohms	I,dc Max. mA
PM20-R010M	0.010	15	100	2500	0.13	450
PM20-R012M	0.012	17	100	2300	0.14	450
PM20-R015M	0.015	19	100	2100	0.16	450
PM20-R018M	0.018	21	100	1900	0.18	450
PM20-R022M	0.022	23	100	1700	0.20	450
PM20-R027M	0.027	23	100	1500	0.22	450
PM20-R033M	0.033	25	100	1400	0.24	450
PM20-R039M	0.039	25	100	1300	0.27	450
PM20-R047M	0.047	26	100	1200	0.30	450
PM20-R056M	0.056	26	100	1100	0.33	450
PM20-R068M	0.068	27	100	1000	0.36	450
PM20-R082M	0.082	27	100	900	0.40	450
PM20-R10M	0.10	28	100	700	0.44	450
PM20-R12M	0.12	28	25.2	500	0.22	450
PM20-R15M	0.15	28	25.2	450	0.25	450
PM20-R18M	0.18	28	25.2	400	0.28	450
PM20-R22M	0.22	28	25.2	350	0.32	450
PM20-R27M	0.27	28	25.2	320	0.36	450
PM20-R33M	0.33	28	25.2	300	0.40	450
PM20-R39M	0.39	28	25.2	250	0.45	450
PM20-R47M	0.47	28	25.2	220	0.50	450
PM20-R56M	0.56	28	25.2	180	0.55	450
PM20-R68M	0.68	28	25.2	160	0.60	450
PM20-R82M	0.82	28	25.2	140	0.65	450
	L ±10% µH					
PM20-1R0K	1.0	28	7.96	120	0.70	400
PM20-1R2K	1.2	28	7.96	100	0.75	390
PM20-1R5K	1.5	28	7.96	85	0.85	370
PM20-1R8K	1.8	28	7.96	80	0.90	350
PM20-2R2K	2.2	30	7.96	75	1.0	320
PM20-2R7K	2.7	30	7.96	70	1.1	290
PM20-3R3K	3.3	30	7.96	60	1.2	260
PM20-3R9K	3.9	30	7.96	55	1.3	250
PM20-4R7K	4.7	30	7.96	50	1.7	220
PM20-5R6K	5.6	30	7.96	47	1.8	200

PM20 SERIES *(continued)*

MILLER NUMBER	L ±20% µH	Q Min.	Test Freq. MHz	Fo Min. MHz	R,dc MAX. Ohms	I,dc Max. mA
PM20-6R8K	6.8	30	7.96	43	2.0	180
PM20-8R2K	8.2	30	7.96	40	2.3	170
PM20-100K	10	30	2.52	36	2.5	150
PM20-120K	12	30	2.52	33	2.8	140
PM20-150K	15	30	2.52	30	3.2	130
PM20-180K	18	30	2.52	27	3.6	120
PM20-220K	22	30	2.52	25	4.0	110
PM20-270K	27	30	2.52	20	5.0	80
PM20-330K	33	30	2.52	17	5.6	70
PM20-390K	39	30	2.52	16	6.4	65
PM20-470K	47	30	2.52	15	7.0	60
PM20-560K	56	30	2.52	13	8.0	55
PM20-680K	68	30	2.52	12	9.0	50
PM20-820K	82	30	2.52	11	10	45
PM20-101K	100	20	0.796	10	10	40
PM20-121K	120	20	0.796	10	11	70
PM20-151K	150	20	0.796	8	15	65
PM20-181K	180	20	0.796	7	17	60
PM20-221K	220	20	0.796	7	21	50

PM20 Dimensions

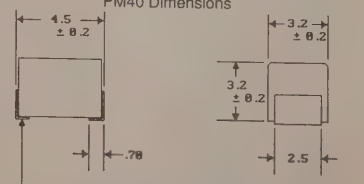


PM20 Packaged 2000/reel [Minimum order 1 reel]

PM40 SERIES

MILLER NUMBER	L ±20% µH	Q Min.	Test Freq. MHz	Fo Min. MHz	R,dc MAX. Ohms	I,dc Max. mA
PM40-R-10M	0.10	28	25.2	700	0.44	450
PM40-R-12M	0.12	30	25.2	500	0.22	450
PM40-R-15M	0.15	30	25.2	450	0.25	450
PM40-R-18M	0.18	30	25.2	400	0.28	450
PM40-R-22M	0.22	30	25.2	350	0.32	450
PM40-R-27M	0.27	30	25.2	320	0.36	450
PM40-R-33M	0.33	30	25.2	300	0.40	450
PM40-R-39M	0.39	30	25.2	350	0.45	450
PM40-R-47M	0.47	30	25.2	220	0.50	450
PM40-R-56M	0.56	30	25.2	180	0.55	450
PM40-R-68M	0.68	30	25.2	160	0.60	450
PM40-R-82M	0.82	30	25.2	140	0.67	450
	L ±10% µH					
PM40-1R0K	1.0	50	7.96	100	0.50	450
PM40-1R2K	1.2	50	7.96	80	0.55	430
PM40-1R5K	1.5	50	7.96	70	0.60	410
PM40-1R8K	1.8	50	7.96	60	0.65	390
PM40-2R2K	2.2	50	7.96	55	0.70	380
PM40-2R7K	2.7	50	7.96	50	0.75	370
PM40-3R3K	3.3	50	7.96	45	0.80	355
PM40-3R9K	3.9	50	7.96	40	0.90	330
PM40-4R7K	4.7	50	7.96	35	1.0	315
PM40-5R6K	5.6	50	7.96	33	1.1	300
PM40-6R8K	6.8	50	7.96	27	1.2	285
PM40-8R2K	8.2	50	7.96	25	1.4	270
PM40-100K	10	50	2.52	20	1.6	250
PM40-120K	12	50	2.52	18	2.0	225
PM40-150K	15	50	2.52	17	2.5	200
PM40-180K	18	50	2.52	15	2.8	190
PM40-220K	22	50	2.52	13	3.2	180
PM40-270K	27	50	2.52	12	3.6	170
PM40-330K	33	50	2.52	11	4.0	160
PM40-390K	39	50	2.52	10	4.5	150
PM40-470K	47	50	2.52	10	5.0	140
PM40-560K	56	50	2.52	9.0	5.5	135
PM40-680K	68	50	2.52	9.0	6.0	130
PM40-820K	82	50	2.52	8.0	7.0	120
PM40-101K	100	40	0.796	7.0	8.0	110
PM40-121K	120	40	0.796	6.0	8.0	110
PM40-151K	150	40	0.796	5.0	9.0	105
PM40-181K	180	40	0.796	5.0	9.5	102
PM40-221K	220	40	0.796	4.0	10	100
PM40-271K	270	30	0.796	3.0	18	92
PM40-331K	330	30	0.796	3.0	20	85
PM40-391K	390	30	0.796	3.0	23	80
PM40-471K	470	30	0.796	3.0	26	62
PM40-561K	560	30	0.796	2.0	30	50
PM40-681K	680	30	0.796	2.0	40	50
PM40-821K	820	30	0.796	2.0	45	30
PM40-102K	1000	30	0.796	2.0	50	30

PM40 Dimensions



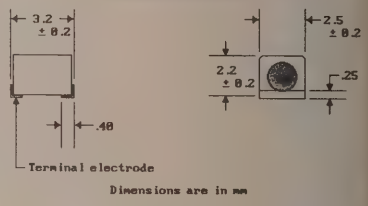
PM40 Packaged 500/reel [Minimum order 1 reel]

SHIELDED CHIP INDUCTORS AND BEADS

PM20S SERIES

MILLER NUMBER	L ±20% µH	Q Min.	Test Freq. MHz	Fo Min. MHz	R,dc MAX. Ohms	I,dc Max. mA
PM20S-R10M	.10	30	25.2	750	0.35	500
PM20S-R12M	.12	30	25.2	600	0.18	500
PM20S-R15M	.15	35	25.2	500	0.19	500
PM20S-R18M	.18	35	25.2	500	0.20	500
PM20S-R22M	.22	35	25.2	450	0.22	500
PM20S-R27M	.27	35	25.2	400	0.25	500
PM20S-R33M	.33	35	25.2	400	0.28	500
PM20S-R39M	.39	35	25.2	350	0.32	500
PM20S-R47M	.47	35	25.2	350	0.35	500
PM20S-R56M	.56	35	25.2	300	0.37	500
PM20S-R68M	.68	35	25.2	300	0.42	500
PM20S-R82M	.82	35	25.2	250	0.45	500
	L ±10% µH					
PM20S-1R0K	1.0	35	7.96	220	0.50	500
PM20S-1R2K	1.2	35	7.96	180	0.50	500
PM20S-1R5K	1.5	35	7.96	170	0.55	500
PM20S-1R8K	1.8	35	7.96	150	0.60	500
PM20S-2R2K	2.2	35	7.96	145	0.70	500
PM20S-2R7K	2.7	35	7.96	100	0.72	500
PM20S-3R3K	3.3	35	7.96	100	0.80	500
PM20S-3R9K	3.9	35	7.96	90	0.85	500
PM20S-4R7K	4.7	35	7.96	80	0.95	500
PM20S-5R6K	5.6	35	7.96	60	1.10	500
PM20S-6R8K	6.8	35	7.96	60	1.25	500
PM20S-8R2K	8.2	35	7.96	60	1.35	500
PM20S-100K	10	35	2.52	45	1.45	450
PM20S-120K	12	35	2.52	45	1.70	450
PM20S-150K	15	35	2.52	40	2.0	450
PM20S-180K	18	35	2.52	32	3.0	280
PM20S-220K	22	35	2.52	30	3.2	250
PM20S-270K	27	35	2.52	28	3.5	220
PM20S-330K	33	35	2.52	20	4.0	200
PM20S-390K	39	35	2.52	20	4.5	200
PM20S-470K	47	35	2.52	15	7.0	160
PM20S-560K	56	35	2.52	14	8.0	150
PM20S-680K	68	35	2.52	12	9.0	140
PM20S-820K	82	35	2.52	10	10	100
PM20S-101K	100	30	.796	10	10	100
PM20S-121K	120	30	.796	10	11	100
PM20S-151K	150	30	.796	9	15	90
PM20S-181K	180	30	.796	8	17	90
PM20S-221K	220	30	.796	6	21	90

PM20S Dimensions



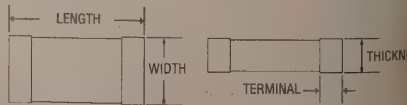
PM20S Packaged 2000/reel [Minimum order 1 reel]

CHIP BEADS

MILLER NUMBER	Z @ 100 MHz Ohms	R,dc Max. Ohms	I,dc Max. mA	LENGTH ±.2 mm	WIDTH ±.2 mm
PMB0805-1	10	.10	600	2.00	1.25
PMB0805-2	15	.10	600	2.00	1.25
PMB1206-1	30	.12	500	3.20	1.60
PMB1206-2	35	.12	500	3.20	1.60
PMB1210-1	65	.15	400	3.20	2.50
PMB1210-2	75	.15	400	3.20	2.50
PMB1806-1	50	.18	300	4.50	1.60
PMB1806-2	60	.18	300	4.50	1.60
PMB1812-1	100	.20	300	4.50	3.20
PMB1812-2	120	.20	300	4.50	3.20

MATERIAL CHARACTERISTICS

Properties	-1 Mat.	-2 Mat.
Initial Permeability	180	400
Saturation flux density @ 10 Oersteds	2950	2500
Curie temperature	170°C	125°C
Volume resistivity in Ohms/Cm	10^7	10^7



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IGH SATURATION FLUX DENSITY
ERRITE RODS & BOBBINS.
IGH CURRENT TOROIDS

5700 SERIES

ILLER UMBER	L µH ± 15% @ 1kHz	I,dc Max. AMPS	Min. L µH @ I, dc	R,dc Max. OHMS	Dim. A Max.	Dim. B Max.	Dim. C Min.
'01	10	11.00	5	.008	.875	.437	.187
'02	25	5.50	12	.014	.875	.437	.187
'03	125	2.75	70	.12	.875	.437	.187
'04	275	2.00	150	.24	.875	.437	.187
'06	450	1.50	250	.49	.875	.437	.187
'06	25	9.00	15	.012	1.125	.562	.312
'07	75	5.00	40	.04	1.125	.562	.312
'08	400	2.25	225	.33	1.125	.562	.312
'09	800	1.75	475	.64	1.125	.562	.312
'10	1000	1.50	575	.98	1.125	.562	.312
'11	50	9.50	25	.012	1.250	.625	.375
'12	150	4.75	85	.046	1.250	.625	.375
'13	700	2.25	400	.42	1.250	.625	.375
'14	1250	1.75	750	.86	1.250	.625	.375
'15	1600	1.50	950	1.27	1.250	.625	.375
'16	125	7.75	65	.032	1.812	.750	.750
'17	500	4.00	275	.15	1.812	.750	.750
'18	1100	2.50	660	.33	1.812	.750	.750
'19	2250	1.75	1350	.92	1.812	.750	.750
'20	4500	1.25	2700	2.64	1.812	.750	.750
'21	250	8.00	125	.041	2.125	.937	.625
'22	900	3.75	500	.175	2.125	.937	.625
'23	1800	2.50	1000	.55	2.125	.937	.625
'24	4000	1.75	2100	1.16	2.125	.937	.625
'25	8000	1.00	4500	3.34	2.125	.937	.625

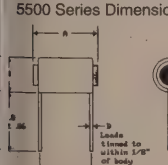
5600 SERIES

ILLER UMBER	L µH ± 10% @ 1kHz	R,dc Max. OHMS	I,dc Max. AMPS	Dim. A Max.	Dim. B Max.	Dim. C ± .06	Dim. D ± .005
30'	5	.007	15	.83	.91	.59	.065
302	10	.008	14	.83	.91	.60	.065
303	25	.023	8	.83	.91	.57	.042
304	50	.034	6.6	.83	.91	.65	.042
305	100	.072	4.5	.83	.91	.69	.042
306	250	.173	2.9	.83	.91	.65	.042
307	500	.378	2	.83	.91	.68	.042
308	1,000	.801	1.3	.83	.91	.66	.042
309	2,500	2.04	.85	.83	.91	.71	.042
310	5	.005	20	1.22	1.11	.94	.082
311	10	.006	17	1.22	1.11	.95	.082
312	25	.009	14	1.22	1.11	.93	.082
313	50	.017	10	1.22	1.11	.99	.065
314	100	.034	7	1.22	1.11	.85	.053
315	250	.083	4.6	1.22	1.11	.97	.053
316	500	.129	3.7	1.22	1.11	1.12	.053
317	1,000	.279	2.5	1.22	1.11	1.05	.053
318	2,500	.690	1.6	1.22	1.11	1.05	.053
319	50	.012	14	1.50	1.11	1.23	.082
320	100	.025	9.8	1.50	1.11	1.12	.065
321	250	.059	6.4	1.50	1.11	1.10	.053
322	500	.090	5	1.50	1.11	1.14	.053
323	1,000	.195	3.5	1.50	1.11	1.36	.053
324	2,500	.499	2.2	1.50	1.11	1.32	.053
325	5,000	1.08	1.5	1.50	1.11	1.27	.053
326	100	.018	14	1.50	1.50	1.18	.082
327	250	.040	9	1.50	1.50	1.12	.065
328	500	.085	6.5	1.50	1.50	1.06	.053
329	1,000	.183	4.4	1.50	1.50	1.23	.053
330	2,500	.464	2.8	1.50	1.50	1.21	.053
331	5,000	.714	2.2	1.50	1.50	1.32	.053
332	10,000	1.55	1.5	1.50	1.50	1.25	.053

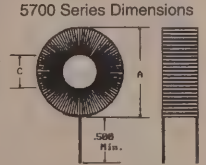
5500 SERIES

ILLER UMBER	L µH ± 10% @ 1kHz	R,dc Max. OHMS	I,dc Max. AMPS	Dim. A Max.	Dim. B Max.	Dim. C ± .06	Dim. D ± .005
501	5	.013	10	.88	.63	.50	.042
502	10	.017	9	1.22	.63	.69	.042
503	27	.030	7	.88	.81	.44	.042
504	50	.045	5.6	1.12	.81	.75	.042
505	100	.061	4.9	1.12	.81	.94	.042
506	150	.069	4.6	1.38	.81	1.06	.042
507	250	.089	4	1.62	.81	1.31	.042
508	5	.009	14	.88	.64	.75	.053
509	10	.012	12	1.12	.64	1	.053
510	27	.022	9	.88	.88	.56	.053
511	50	.028	8	1.12	.88	.75	.053
512	68	.034	7.3	1.12	.88	.88	.053
513	100	.038	6.8	1.38	.88	1	.053
514	150	.046	6.3	1.62	.88	1.25	.053
515	5	.006	19	1.12	.69	.81	.065
516	10	.008	16	1.38	.69	1.22	.065
517	27	.014	12.5	1.12	.94	.69	.065
518	50	.020	10.5	1.38	.94	.94	.065
519	68	.023	10	1.38	.94	1.12	.065
520	100	.027	10	1.62	.94	1.31	.065
521	5	.004	23	1.38	.72	.94	.082
522	10	.006	20	1.69	.72	1.50	.082
523	27	.010	15	1.38	1	.94	.082
524	50	.013	15	1.62	1	1.12	.082

5500 Series Dimensions



5700 Series Dimensions



5600 Series Dimensions

RF CHOKES

HASH CHOKES

MILLER NUMBER	L ± 20% µH	R,dc Max. Ohms	I,dc Max. Amps	Coil Dia. Max.	Form Length	Lead Wire Size
5218	3.35	.01	20	.6	1.25	AWG 12
5219	4.9	.016	15	.6	1.25	AWG 14
5220	8.8	.021	10	.56	1.25	AWG 16
5230	4	.012	8	.38	.875	AWG 20
5240	40	.082	3	.31	1.25	AWG 20
5248	68	.054	5	.56	1.25	AWG 20
5250	100	.216	2	.38	1.25	AWG 20
5252	125	.08	3.5	.5	1.25	AWG 20
5254	250	.17	2.5	.44	1.25	AWG 20
5256	500	.26	2	.56	1.25	AWG 20
5258	1,000	.55	1	.5	1.25	AWG 20

MOLDED RF CHOKES

9230 SERIES

Miller Number	L µH ± 10%	Q Min.	Test Freq. MHz	Fo Min. MHz	R,dc Max. Ohms	I,dc Max. mA	Core Material
9230-94	.1	40	25	690	.07	1100	Phenolic
9230-96	.12	40	25	650	.08	1100	Phenolic
9230-00	.15	38	25	600	.1	1100	Phenolic
9230-02	.18	35	25	550	.12	1010	Phenolic
9230-04	.22	33	25	510	.14	935	Phenolic
9230-06	.27	33	25	430	.16	875	Phenolic
9230-08	.33	30	25	410	.2	780	Phenolic
9230-10	.39	30	25	380	.3	640	Phenolic
9230-12	.47	30	25	340	.35	590	Phenolic
9230-14	.56	30	25	300	.5	495	Phenolic
9230-16	.68	28	25	275	.6	450	Phenolic
9230-18	.82	28	25	250	.85	380	Phenolic
9230-20	1	25	25	230	1	350	Phenolic
9230-22	1.2	25	7.9	150	.18	825	Iron
9230-24	1.5	28	7.9	140	.22	745	Iron
9230-26	1.8	30	7.9	125	.3	640	Iron
9230-28	2.2	30	7.9	115	.4	550	Iron
9230-30	2.7	37	7.9	100	.5	495	Iron
9230-32	3.3	45	7.9	90	.85	380	Iron
9230-34	3.9	45	7.9	82	1	350	Iron
9230-36	4.7	45	7.9	75	1.2	320	Iron
9230-38	5.6	50	7.9	68	1.8	260	Iron
9230-40	6.8	50	7.9	60	2	245	Iron
9230-42	8.2	55	7.9	55	2.7	210	Iron
9230-44	10	55	7.9	50	3.7	180	Iron
9230-46	12	45	2.5	40	2.7	210	Iron
9230-48	15	45	2.5	35	2.8	205	Iron
9230-50	18	50	2.5	32	3.1	195	Iron
9230-52	22	50	2.5	25	3.3	190	Iron
9230-54	27	50	2.5	22	3.5	185	Iron
9230-56	33	45	2.5	24	3.4	187	Ferrite
9230-58	39	45	2.5	22	3.6	180	Ferrite
9230-60	47	45	2.5	20	4.5	165	Ferrite
9230-62	56	45	2.5	18	5.7	145	Ferrite
9230-64	68	50	2.5	15	6.7	135	Ferrite
9230-66	82	50	2.5	14	7.3	130	Ferrite
9230-68	100	50	2.5	13	8	125	Ferrite
9230-70	120	30	.79	12	13	97	Ferrite
9230-72	150	30	.79	11	15	85	Ferrite
9230-74	180	30	.79	10	17	79	Ferrite
9230-76	220	30	.79	9	21	73	Ferrite
9230-78	270	30	.79	8	25	65	Ferrite
9230-80	330	30	.79	7	28	62	Ferrite
9230-82	390	30	.79	6.5	35	55	Ferrite
9230-84	470	30	.79	6	42	50	Ferrite
9230-86	560	30	.79	5	46	48	Ferrite
9230-88	680	30	.79	4.2	60	42	Ferrite
9230-90	820	30	.79	3.8	65	40	Ferrite
9230-92	1000	30	.79	3.4	72	38	Ferrite

9230 Dimensions

Reference: MIL-C-15305, MS 75083, MS 75084 & MS 75085

9310 SERIES

Miller Number	MS Type	L µH ± 20%	Q Min.	Test Freq. MHz	Fo Min. MHz	R,dc Max. Ohms	I,dc Max. mA
9310-00	18130-1	.15	50	25	525	.03	2450
9310-02	18130-2	.22	50	25	450	.055	1900
9310-04	18130-3	.33	45	25	360	.09	1400
9310-06	18130-4	.47	45	25	310	.12	1225
		L µH ± 10%					
9310-07	18130-5	.56	50	25	280	.135	1220
9310-08	18130-6	.68	50	25	250	.15	1100
9310-10	18130-7	.82	50	25	220	.22	900
9310-12	18130-8	1	50	25	200	.29	830
9310-14	18130-9	1.2	33	7.9	180	.42	650
9310-16	18130-10	1.5	33	7.9	160	.5	600
9310-18	18130-11	1.8	33	7.9	150	.65	525
9310-20	18130-12	2.2	33	7.9	135	.95	435
9310-22	18130-13	2.7	33	7.9	120	1.2	385
9310-24	18130-14	3.3	33	7.9	110	2	300
9310-26	18130-15	3.9	33	7.9	100	2.3	280
9310-28	18130-16	4.7	33	7.9	90	2.6	260
9310-30	18130-17	5.6	45	7.9	60	.32	750
9310-32	18130-18	6.8	50	7.9	55	.5	600
9310-34	18130-19	8.2	50	7.9	50	.6	545

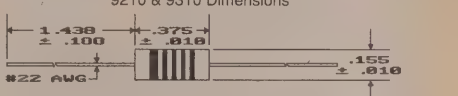
9310 SERIES *(continued)*

Miller Number	MS Type	L µH ± 20%	Q Min.	Test Freq. MHz	Fo Min. MHz	R,dc Max. Ohms	I,dc Max. mA
9310-36	18130-20	10	55	7.9	45	.9	445
9310-38	18130-21	12	65	2.5	42	1.1	404
9310-40	18130-22	15	65	2.5	40	1.4	370
9310-42	18130-23	18	75	2.5	34	2.25	280
9310-44	18130-24	22	75	2.5	30	2.5	265
9310-46		24	60	2.5	26	2.5	265
9310-48	18130-25	27	60	2.5	25	2.6	260
9310-50		30	65	2.5	19	2.8	255
9310-52	18130-26	33	65	2.5	19	3	250

9210 SERIES

Miller Number	MS Type	L µH ± 5%	Q Min.	Test Freq. MHz	Fo Min. MHz	R,dc Max. Ohms	I,dc Max. mA
9210-54	90538-01	36	60	2.5	15.5	2.5	180
9210-56	90538-02	39	60	2.5	14.5	2.6	176
9210-58	90538-03	43	60	2.5	13.7	2.7	172
9210-60	90538-04	47	55	2.5	13	2.75	170
9210-62	90538-05	51	55	2.5	12.7	2.85	167
9210-64	90538-06	56	55	2.5	12	3	164
9210-66	90538-07	62	55	2.5	11.5	3.15	160
	9210-6890538-08			68	55	2.5	11
9210-70	90538-09	75	55	2.5	10.5	3.7	147
9210-72	90538-10	82	50	2.5	10.3	3.9	143
9210-74	90538-11	91	50	2.5	10	4.3	136
	9210-7690538-12			100	50	2.5	9.5
9210-78	90538-13	110	60	.79	8.9	4.9	128
9210-80	90538-14	120	65	.79	8.7	5.2	124
9210-82	90538-15	130	65	.79	8.5	5.45	121
9210-84	90538-16	150	65	.79	8	6.05	114
9210-86	90538-17	160	65	.79	7.5	6.4	111
9210-88	90538-18	180	65	.79	7	6.75	108
9210-90	90538-19	200	65	.79	6.5	7.1	106
9210-92	90538-20	220	65	.79	6.2	7.45	103
9210-94	90538-21	240	65	.79	5.9	7.8	101

9210 & 9310 Dimensions



9310 Series Reference: MIL-C-15305, MS 18130, MS14046 & MS 16225

9210 Series Reference: MIL-C-15305 & MS 90538

SHIELDED MOLDED RF CHOKES

9250 SERIES

Miller Number	MS Type	L µH ± 10%	Q Min.	Test Freq. MHz	Fo Min. MHz	R,dc Max. Ohms
9250-101	75087-1	.1	50	25	250	.025
9250-121	75087-2	.12	51	25	250	.034
9250-151	75087-3	.15	51	25	250	.037
9250-181	75087-4	.18	50	25	250	.047
9250-221	75087-5	.22	49	25	250	.067
9250-271	75087-6	.27	47	25	250	.11
9250-331	75087-7	.33	46	25	250	.13
9250-391	75087-8	.39	44	25	250	.18
9250-471	75087-9	.47	44	25	235	.25
9250-561	75087-10	.56	43	25	210	.33
9250-681	75087-11	.68	42	25	190	.45
9250-821	75087-12	.82	40	25	180	.59
9250-102	75088-1	1	44	25	140	.07
9250-122	75088-2	1.2	44	7.9	130	.1
9250-152	75088-3	1.5	44	7.9	115	.12
9250-182	75088-4	1.8	44	7.9	105	.14
9250-222	75088-5	2.2	44	7.9	100	.19
9250-272	75088-6	2.7	44	7.9	92	.28
9250-332	75088-7	3.3	44	7.9	85	.35
9250-392	75088-8	3.9	44	7.9	75	.4
9250-472	75088-9	4.7	44	7.9	70	.55
9250-562	75088-10	5.6	44	7.9	65	.72
9250-682	75088-11	6.8	50	7.9	55	1.02
9250-822	75088-12	8.2	50	7.9	50	1.32
9250-103	75088-13	10	50	7.9	46	1.62
9250-123	75088-14	12	55	2.5	44	2
9250-153	75089-1	15	45	2.5	49	.8
9250-183	75089-2	18	45	2.5	45	.89
9250-223	75089-3	22	45	2.5	41	.96
9250-273	75089-4	27	45	2.5	38	1.19
9250-333	75089-5	33	45	2.5	34	1.37
9250-393	75089-6	39	50	2.5	29	1.93
9250-473	75089-7	47	50	2.5	27	2.11
9250-563	75089-8	56	50	2.5	25	2.23
9250-683	75089-9	68	50	2.5	21	2.7
9250-823	75089-10	82	50	2.5	10.5	2.44
9250-104	75089-11	100	50	2.5	10	3.12
9250-124	75089-12	120	55	.79	9.7	3.6
9250-154	75089-13	150	55	.79	8.5	4.1
9250-184	75089-14	180	55	.79	8	4.4
9250-224	75089-15	220	55	.79	7.5	5
9250-274	75089-16	270	55	.79	7	5.8
9250-334	75089-17	330	55	.79	6.5	6.4
9250-394	75089-18	390	60	.79	6.2	7.4
9250-474	75089-19	470	60	.79	5.7	9.5
9250-564	75089-20	560	60	.79	4.7	10.5
9250-684	75089-21	680	60	.79	4.5	11.8
9250-824	75089-22	820	60	.79	4.2	13
9250-105	75089-23	1,000	60	.79	3.8	17.5
9250-125	75088-24	1,200	45	.25	1.5	22.1

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SHIELDED MOLDED RF CHOKES *(continued)*

9250 SERIES *(continued)*

Miller Number	MS Type	L μH ± 10%	Q Min.	Test Freq. MHz	Fo Min. MHz	R,dc Max. Ohms
9250-155	75089-25	1,500	45	.25	1.2	26.5
9250-185	75089-26	1,800	45	.25	1	29.9
9250-225	75089-27	2,200	45	.25	.97	33.8
9250-275	75089-28	2,700	45	.25	.92	47.3
9250-335	75089-29	3,300	45	.25	.84	53
9250-395	75089-30	3,900	45	.25	.8	73.8
9250-475	75089-31	4,700	45	.25	.74	81.6
9250-565	75089-32	5,600	44	.25	.73	98.9
9250-685	75089-33	6,800	40	.25	.66	111
9250-825	75089-34	8,200	40	.25	.54	119
9250-106	75089-35	10,000	40	.25	.47	137
9250-126	75089-36	12,000	30	.079	.33	143
9250-156	75089-37	15,000	30	.079	.29	157
9250-186	75089-38	18,000	30	.079	.28	175
9250-226	75089-39	22,000	27	.079	.25	274
9250-276	75089-40	27,000	27	.079	.21	308
9250-336	75089-41	33,000	27	.079	.19	343
9250-396	75089-42	39,000	27	.079	.17	376
9250-476	75089-43	47,000	23	.079	.16	473
9250-566	75089-44	56,000	23	.079	.14	512
9250-686	75089-45	68,000	23	.079	.13	580
9250-826	75089-46	82,000	21	.079	.12	618
9250-107	75089-47	100,000	18	.079	.11	678

9250 Dimensions

Electromagnetic Shielding

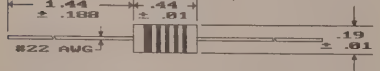
Reference: MIL-C-15305, MS 75087, MS 75088, MS 75089 & MS 90537

MOLDED RF CHOKES

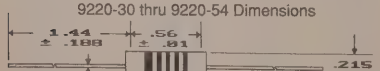
9220 SERIES

Miller Number	MS Type	L μH ± 5%	Q Min.	Test Freq. MHz	Fo Min. MHz	R,dc Max. Ohms	I,dc Max. mA
9220-00	90539-01	270	65	.79	5.6	8.2	110
9220-02	90539-02	300	65	.79	5.3	8.7	107
9220-04	90539-03	330	65	.79	5	9.1	105
9220-06	90539-04	360	65	.79	4.7	9.6	102
9220-08	90539-05	390	65	.79	4.5	10	100
9220-10	90539-06	430	65	.79	4.3	10.6	97
9220-12	90539-07	470	65	.79	4	11.1	95
9220-14		500	65	.79	3.8	11.6	93
9220-15	90539-08	510	65	.79	3.8	11.6	92
9220-16	90539-09	560	65	.79	3.6	12.3	91
9220-18	90539-10	620	60	.79	3.5	13	88
9220-20	90539-11	680	60	.79	3.4	13.7	85
9220-22	90539-12	750	60	.79	3.3	14.4	83
9220-24	90539-13	820	60	.79	3.1	15.1	81
9220-26	90539-14	910	60	.79	2.9	15.8	79
9220-28	90539-15	1,000	60	.79	2.8	16.5	78
9220-30	90540-01	1,100	60	.25	2.8	21	78
9220-32	90540-02	1,200	60	.25	2.7	22	76
9220-34	90540-03	1,300	60	.25	2.6	23	75
9220-36	90540-04	1,500	65	.25	2.4	25	72
9220-38	90540-05	1,600	65	.25	2.3	26	70
9220-40	90540-06	1,800	65	.25	2.2	28	68
9220-42	90540-07	2,000	65	.25	2.1	29	67
9220-44	90540-08	2,200	70	.25	2	30	66
9220-46	90540-09	2,400	70	.25	1.9	31	64
9220-48	90540-10	2,700	70	.25	1.8	33	62
9220-50	90540-11	3,000	70	.25	1.7	35	61
9220-52	90540-12	3,300	70	.25	1.6	38	58
9220-54	90540-13	3,600	70	.25	1.5	40	57
9220-56	90541-01	3,900	80	.25	1.45	44	61
9220-58	90541-02	4,300	80	.25	1.4	46	59
9220-60	90541-03	4,700	80	.25	1.35	48	58
9220-62	90541-04	5,000	80	.25	1.3	50	57
9220-64	90541-05	5,600	80	.25	1.25	53	56
9220-66	90541-06	6,200	80	.25	1.2	56	54
9220-68	90541-07	6,800	80	.25	1.15	59	52
9220-70	90541-08	7,500	80	.25	1.1	62	51
9220-72	90541-09	8,200	80	.25	1.05	65	50
9220-74	90541-10	9,100	80	.25	1	68	49
9220-76	90541-11	10,000	80	.25	.95	72	47

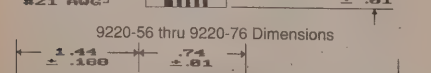
9220-00 thru 9220-28 Dimensions



9220-30 thru 9220-54 Dimensions



9220-56 thru 9220-76 Dimensions



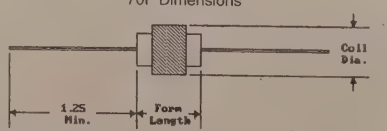
Reference: MIL-C-15305, MS 90539, MS 90540 & MS 90541

RF CHOKES

70F SERIES

MILLER NUMBER	L ± 20% μH	Q Min.	Test Freq. MHz	Fo Min. MHz	R,dc MAX. Ohms	I,dc Max. mA
70F107AP	.1	49	25	600	.013	3922
70F157AP	.15	52	25	490	.025	2828
70F227AP	.22	48	25	400	.038	2294
70F337AP	.33	47	25	330	.07	1690
70F477AP	.47	46	25	280	.125	1264
70F687AP	.68	48	25	240	.2	1000
70F757AP	.75	48	25	224	.264	870
70F827AP	.82	48	25	216	.29	830
70F106AI	1.0	41	25	118	.048	2041
	L ± 10% μH					
70F126AI	1.2	45	7.9	118	.072	1666
70F156AI	1.5	42	7.9	102	.096	1443
70F186AI	1.8	31	7.9	89	.096	1443
70F226AI	2.2	43	7.9	87	.156	1132
70F276AI	2.7	34	7.9	74	.168	1091
70F336AI	3.3	40	7.9	66	.24	912
70F396AI	3.9	35	7.9	61	.264	870
70F476AI	4.7	43	7.9	53	.457	661
70F566AI	5.6	41	7.9	49	.492	637
70F686AI	6.8	40	7.9	49	.624	566
70F756AI	7.5	32	7.9	44	.624	566
70F826AI	8.2	37	7.9	41	.744	518
70F916AI	9.1	41	7.9	21	1.44	288
70F105AI	10	36	7.9	19	1.56	277
70F125AI	12	52	2.5	19	1.68	267
70F155AI	15	52	2.5	16	1.92	250
	L ± 5% μH					
70F185AI	18	52	2.5	15	2.28	229
70F225AI	22	51	2.5	13	2.28	229
70F255AI	25	48	2.5	13	2.64	213
70F275AI	27	49	2.5	12	2.64	213
70F335AI	33	50	2.5	10	2.76	208
70F395AI	39	48	2.5	9.3	3.36	188
70F475AI	47	44	2.5	9.1	3.36	188
70F565AI	56	45	2.5	8.6	3.84	176
70F685AI	68	42	2.5	8.1	4.2	169
70F755AI	75	38	2.5	7.2	4.56	162
70F825AI	82	41	2.5	6.7	4.8	158
70F915AI	91	41	2.5	6.7	4.92	156
70F104AI	100	25	2.5	3.6	7.68	139
70F124AI	120	40	.79	3.2	8.16	135
70F154AI	150	47	.79	3	8.16	135
70F184AI	180	48	.79	2.8	8.16	135
70F204AI	200	47	.79	2.7	10.3	120
70F224AI	220	46	.79	2.5	11.5	114
70F254AI	250	49	.79	2.5	12.1	111
70F274AI	270	46	.79	2.5	13.2	106
70F304AI	300	46	.79	2.2	13.2	106
70F334AI	330	41	.79	2	13.9	103
70F354AI	350	46	.79	2	14.4	102
70F394AI	390	45	.79	2	15.8	97
70F474AI	470	35	.79	1.8	16.3	95
70F504AI	500	49	.79	1.8	18	91
70F564AI	560	41	.79	1.7	19.2	88
70F684AI	680	37	.79	1.6	19.8	87
70F754AI	750	40	.79	1.6	22.9	80
70F824AI	820	33	.79	1.6	22.9	80
70F914AI	910	32	.79	1.4	24	79
70F103AI	1,000	30	.79	1.4	24	79
70F123AI	1,200	34	.25	1.2	33.6	66
70F153AI	1,500	40	.25	1.1	37.2	63
70F183AI	1,800	40	.25	.96	42	59
70F223AI	2,200	40	.25	.96	45.6	57
70F253AI	2,500	48	.25	.96	45.6	57
70F273AI	2,700	50	.25	.88	45.6	57
70F333AI	3,300	52	.25	.8	51.6	53
70F393AI	3,900	53	.25	.76	57.6	51
70F473AI	4,700	49	.25	.68	64.8	48
70F563AI	5,600	53	.25	.68	69.6	46
70F683AI	6,800	51	.25	.64	78	43
70F753AI	7,500	49	.25	.6	85.2	41
70F823AI	8,200	48	.25	.6	92.4	40
70F913AI	9,100	52	.25	.56	98.4	39
70F102AI	10,000	41	.25	.52	101	38
70F122AI	12,000	46	.079	.36	100	50
70F152AI	15,000	50	.079	.32	113	47
70F182AI	18,000	49	.079	.29	128	44
70F222AI	22,000	50	.079	.27	144	41
70F252AF	25,000	59	.079	.25	115	46
70F272AF	27,000	61	.079	.244	120	45
70F332AF	33,000	61	.079	.232	134	43
70F392AF	39,000	59	.079	.22	147	41
70F472AF	47,000	57	.079	.206	168	38
70F502AF	50,000	57	.079	.196	175	37
70F562AF	56,000	57	.079	.188	189	36
70F682AF	68,000	57	.079	.18	215	34
70F752AF	75,000	53	.079	.174	222	33
70F822AF	82,000	50	.079	.168	238	32
70F912AF	91,000	51	.079	.166	250	31
70F101AF	100,000	48	.079	.157	278	29
70F121AF	120,000	46	.025	.084	288	48
70F151AF	150,000	49	.025	.077	328	44
70F181AF	180,000	51	.025	.075	374	41
70F221AF	220,000	51	.025	.07	424	39
70F251AF	250,000	52	.025	.065	468	37
70F271AF	270,000	53	.025	.062	490	36
70F331AF	330,000	54	.025	.06	540	34
70F391AF	390,000	54	.025	.056	617	33
70F471AF	470,000	55	.025	.054	704	30
70F501AF	500,000	53	.025	.052	736	30

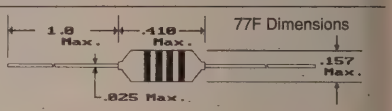
70F Dimensions



CONFORMAL COATED RF CHOKES

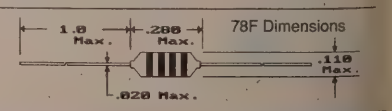
MILLER NUMBER	L ± 10% μH	Q Min.	Test Freq. MHz	Fo Min. MHz	R,dc MAX. Ohms	I,dc Max. mA
77F1R0K	1.0	45	25	157	0.17	920
77F1R2K	1.2	50	7.9	144	0.21	880
77F1R5K	1.5	50	7.9	131	0.23	830
77F1R8K	1.8	55	7.9	121	0.25	790
77F2R2K	2.2	55	7.9	110	0.28	750
77F2R7K	2.7	60	7.9	100	0.30	720
77F3R3K	3.3	65	7.9	94	0.34	670
77F3R9K	3.9	65	7.9	86	0.37	640
77F4R7K	4.7	70	7.9	80	0.39	620
77F5R6K	5.6	70	7.9	74	0.43	590
77F6R8K	6.8	75	7.9	68	0.48	550
77F8R2K	8.2	80	7.9	53	0.52	530
77F100K	10	85	7.9	45	0.58	500
77F120K	12	75	2.5	34	0.63	480
77F150K	15	70	2.5	20	0.72	460
77F180K	18	65	2.5	14	0.77	430
77F220K	22	60	2.5	9.9	0.84	410
77F270K	27	55	2.5	7.6	0.94	390
	L ± 5% μH					
77F330J	33	55	2.5	6.3	1.03	370
77F390J	39	50	2.5	6.3	1.12	350
77F470J	47	45	2.5	6.3	1.22	340
77F560J	56	40	2.5	6.2	1.34	320
77F680J	68	40	2.5	5.7	1.47	305
77F820J	82	35	2.5	5.3	1.62	290
77F101J	100	30	2.5	4.8	1.80	275
77F121J	120	70	0.79	3.8	3.70	185
77F151J	150	70	0.79	3.5	4.20	175
77F181J	180	70	0.79	3.3	4.60	165
77F221J	220	70	0.79	3.0	5.10	155
77F271J	270	65	0.79	2.8	5.80	145
77F331J	330	65	0.79	2.6	6.40	137
77F391J	390	65	0.79	2.4	7.00	133
77F471J	470	60	0.79	2.25	7.70	126
77F561J	560	60	0.79	2.1	8.50	120
77F681J	680	55	0.79	1.95	9.40	113
77F821J	820	55	0.79	1.85	10.5	105
77F102J	1000	50	0.79	1.40	14.0	100

77F Dimensions



MILLER NUMBER	L ± 20% μH	Q Min.	Test Freq. MHz	Fo Min. MHz	R,dc MAX. Ohms	I,dc Max. mA
78FR10M	0.10	40	25	400	0.06	500
78FR12M	0.12	40	25	400	0.06	500
78FR15M	0.15	40	25	400	0.07	500
78FR18M	0.18	40	25	400	0.08	450
	L ± 10% μH					
78FR22K	0.22	40	25	380	0.08	1025
78FR27K	0.27	40	25	360	0.08	950
78FR33K	0.33	40	25	350	0.08	815
78FR39K	0.39	40	25	320	0.09	700
78FR47K	0.47	40	25	300	0.10	650
78FR56K	0.56	40	25	280	0.11	545
78FR68K	0.68	40	25	250	0.12	495
78FR82K	0.82	40	25	200	0.12	415
78F1R0K	1.0	40	25	180	0.15	385
78F1R2K	1.2	40	7.9	165	0.18	590
78F1R5K	1.5	45	7.9	150	0.20	535
78F1R8K	1.8	50	7.9	125	0.25	455
78F2R2K	2.2	50	7.9	110	0.28	395
78F2R7K	2.7	50	7.9	95	0.30	355
	L ± 5% μH					
78F3R3J	3.3	50	7.9	70	0.34	270
78F3R9J	3.9	45	7.9	65	0.32	250
78F4R7J	4.7	45	7.9	50	0.35	230
78F5R6J	5.6	45	7.9	40	0.40	185
78F6R8J	6.8	40	7.9	30	0.45	175
78F8R2J	8.2	40	7.9	28	0.55	155
78F100J	10	40	7.9	22	0.72	130
78F120J	12	45	2.5	20	0.80	155
78F150J	15	50	2.5	16	0.88	150
78F180J	18	50	2.5	15	1.00	145
78F220J	22	50	2.5	13	1.20	140
78F270J	27	50	2.5	11	1.35	135
78F330J	33	50	2.5	10	1.50	193
78F390J	39	50	2.5	9.5	1.70	185
78F470J	47	60	2.5	8.5	2.30	167
78F560J	56	60	2.5	7.5	2.60	150
78F680J	68	60	2.5	6.5	2.90	137
78F820J	82	60	2.5	6.0	3.20	132
78F101J	100	60	2.5	5.5	3.50	125
78F121J	120	60	0.79	5.4	3.80	100
78F151J	150	60	0.79	4.7	4.40	90
78F181J	180	60	0.79	4.3	5.00	84
78F221J	220	60	0.79	4.0	5.70	76
78F271J	270	60	0.79	3.7	6.50	70
78F331J	330	60	0.79	3.4	9.50	65
78F391J	390	60	0.79	2.8	10.5	60
78F471J	470	60	0.79	2.5	11.6	53
78F561J	560	60	0.79	2.3	13.0	51
78F681J	680	60	0.79	2.0	18.0	45
78F821J	820	60	0.79	1.5	23.0	43
78F102J	1000	60	0.79	1.2	26.0	41

78F Dimensions



.W. MILLER DIVISION, BELL INDUSTRIES/DEPT. EM • 306 E. Alondra Blvd. • Gardena, CA 90247 • 310-515-1720 • FAX 310-515-1962

ADJUSTABLE RF COILS

MILLER NUMBER	L µH Min.	L µH Nom.	L µH Max.	Q MIN.	Max. I, dc Amps	No. Turns
48A518MPC	.046	.051	.05 5	100	2	1-1/2
48A778MPC	.071	.077	.082	100	2	2-1/2
48A117MPC	.099	.111	.122	100	2	3-1/2
48A147MPC	.118	.138	.157	100	2	4-1/2
48A187MPC	.15	.179	.207	100	2	5-1/2
48A227MPC	.181	.215	.278	100	2	6-1/2
48A257MPC	.209	.245	.283	100	2	7-1/2
48A287MPC	.241	.284	.316	100	2	8-1/2
48A317MPC	.27	.311	.351	100	2	9-1/2

Frequency range 30-250 MHz; Wire size AWG 20 TCW; Core 10-32 x 3/8 Carbonyl J. May easily be tapped at 1/8, 1/4, 3/8, 5/8, 3/4 or 7/8 turn if desired.

MILLER NUMBER	L µH Min.	L µH Nom.	L µH Max.	Q MIN.	Max. I, dc Amps	No. Turns
49A678MPC	.06	.067	.074	100	1.5	2-1/3
49A127MPC	.1	.116	.132	100	1.5	3-1/3
49A167MPC	.134	.164	.194	100	1.5	4-1/3
49A217MPC	.17	.214	.258	100	1.5	5-1/3
49A347MPC	.26	.338	.415	100	1.5	7-1/3
49A537MPC	.393	.525	.657	70	1.5	10-1/3
49A757MPC	.6	.75	.9	70	1.5	14-1/3
49A997MPC	.81	.99	1.16	70	1.5	18-1/3
49A126MPC	.96	1.15	1.34	70	1.5	21-1/3
49A146MPC	1.18	1.36	1.53	70	1.5	24-1/3

Frequency range 10-250 MHz. Wire size AWG 22 polyurethane coated, with tinned beads. OD at base = .46". Coil OD = .285". Core = 10-32 x 3/8 Carbonyl J.

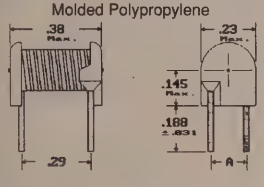
49A Series Dimensions

PRINTED CIRCUIT RF CHOKES

75F SERIES

MILLER NUMBER	L±10% µH	Q Ref.	Test Freq. MHz	Turns	A Dim.
75F238MPC	.032	105	50	2 ½	.148
75F328MPC	.039	95	40	3 ½	.148
75F518MPC	.049	104	40	4 ½	.148
75F117MPC	.108	90	25	8 ½	.148
75F157MPC	.142	90	25	10 ½	.148
75F277MPC	.275	92	25	14 ½	.153
75F397MPC	.364	93	25	15 ½	.154
75F477MPC	.49	89	25	17 ½	.159
75F597MPC	.57	92	25	19 ½	.159

Molded Polypropylene

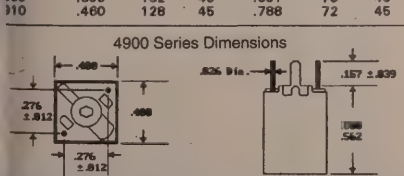


SHIELDED ADJUSTABLE RF COILS

4900 SERIES

MILLER NUMBER	L Min. µH	Q Min.@ L Min.	Test Freq.	L Max. µH	Q Min. @ L Max.	Test Freq.
901-S	.037	90	80	.039	85	80
902-S	.059	100	75	.071	95	75
903-S	.086	105	75	.107	90	75
904-S	.117	90	50	.159	90	50
905-S	.150	90	45	.208	80	45
906-S	.184	85	45	.262	70	45
907-S	.226	85	45	.311	65	45
908-S	.258	85	45	.363	60	45
909-S	.296	85	45	.417	55	45
910-S	.335	80	45	.454	50	45
901	.041	113	80	.050	136	80
902	.070	155	75	.100	139	75
903	.103	147	75	.152	133	75
904	.148	146	50	.252	162	50
905	.193	138	45	.337	142	45
906	.238	137	45	.417	122	45
907	.286	135	45	.508	105	45
908	.339	126	45	.600	89	45
909	.390	132	45	.691	76	45
910	.460	128	45	.788	72	45

4900 Series Dimensions



RF CHOKES

4600 SERIES

MILLER NUMBER	L±20% µH	Q Min.	Test Freq. MHz	Fo Min. MHz	R,dc MAX. Ohms	I,dc Max. mA
4602	1	60	7.9	190	.05	2000
	L±10% µH					
4604	1.5	58	7.9	149	.093	1800
4606	2.4	56	7.9	120	.19	1500
4608	3.9	60	7.9	93	.45	1000
4609	5.5	57	7.9	80	.67	850
4610	6.2	57	7.9	76	.83	700
4611	8.2	57	7.9	65	1.2	600
4612	10	36	2.5	61	1.5	500
	L± 5% µH					
4622	10	69	2.5	40	.11	1500
4624	15	62	2.5	33	.17	1000
4626	24	65	2.5	25	.34	800
4628	39	70	2.5	20	.65	600
4629	55	72	2.5	17	1	500
4630	62	83	2.5	16	1.2	475
4631	82	85	2.5	13	1.9	450
4632	100	107	.79	12	3	400
4642	100	49	.79	11	5.4	160
4644	150	53	.79	8.8	6.5	160
4646	240	56	.79	7.2	8.5	160
4648	390	57	.79	5.6	11	160
4649	550	58	.79	4.8	13	160
4650	620	59	.79	4.5	15	160
4651	750	56	.79	4	16	160
4652	1,000	59	.25	3.7	19	160
	L± 5% µH @ 1kHz	Q	Q Test Freq. MHz			
4662	1,000	83	.25	2.6	8.6	160
4664	1,500	82	.25	2.1	11	160
4666	2,400	80	.25	1.7	15	160
4668	3,900	73	.25	1.4	20	160
4669	5,500	69	.25	1.1	25	160
4670	6,200	89	.25	1	37	100
4671	8,200	83	.25	.94	46	100
4672	10,000	68	.079	.82	50	100

5300 SERIES

MILLER NUMBER	L±5% µH @ 1kHz	Q Min.	Q Test Freq. MHz	Fo Min. MHz	R,dc MAX. Ohms	I,dc Max. mA
6302	2,500	106	.25	1.3	9	160
6304	5,000	91	.25	1	14	160
6306	10,000	108	.079	.71	31	100
6308	25,000	102	.079	.47	82	65
6310	50,000	113	.079	.33	127	65

3-Pi Universal Wound Ferrite Core
Varnish Impregnated.

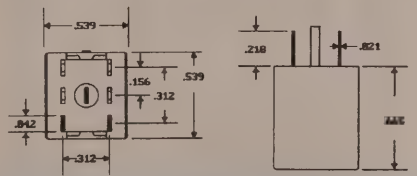
Form length .875"
Leads AWG # 20 TCW 1.5" ± .13" long

SHIELDED ADJUSTABLE RF COILS

9050 SERIES

MILLER NUMBER	L Min. µH	Q Min.@ L Min.	Test Freq.	L Max. µH	Q Min. @ L Max.	Test Freq.
9050	1.5	40	7.9	3	41	7.9
9051	3	46	7.9	7	45	7.9
9052	7	40	7.9	14	62	2.5
9053	14	48	2.5	28	66	2.5
9054	28	48	2.5	60	45	2.5
9055	60	40	2.5	120	69	.79
9056	120	52	.79	280	68	.79
9057	280	52	.79	650	62	.79
9058	650	36	.79	1,300	68	.25
9059	1,300	43	.25	3,000	53	.25
9059-1	1,800	116	.25	2,200	129	.25
9060	3,000	32	.25	10,000	32	.079
9061	8,000	35	.25	20,000	38	.079
9062	15,000	25	.079	40,000	40	.079
9063	20,000	36	.079	60,000	60	.079

9050 Series Dimensions

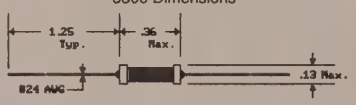


MINIATURE HIGH CURRENT RF CHOKES

5300 SERIES

MILLER NUMBER	± 10% @ 0 DC	L (µH) Max DCR OHMS	Min SRF MHz	RATED I,dc mA	INCR I mA
5300-01	1.0	.018	190	3300	3000
5300-02	1.2	.019	170	3200	2700
5300-03	1.5	.020	160	3100	2500
5300-04	1.8	.023	150	2900	2100
5300-05	2.2	.031	130	2600	2000
5300-06	2.7	.033	120	2500	1900
5300-07	3.3	.054	110	1900	1700
5300-08	3.9	.060	100	1800	1500
5300-09	4.7	.068	86	1700	1400
5300-10	5.6	.074	64	1600	1300
5300-11	6.8	.080	44	1600	1200
5300-12	8.2	.087	32	1500	1100
5300-13	10	.095	25	1500	970
5300-14	12	.11	17	1400	880
5300-15	15	.15	13	1200	790
5300-16	18	.16	10	1100	710
5300-17	22	.19	8.4	1000	640
5300-18	27	.22	8.0	950	580
5300-19	33	.24	7.6	910	530
5300-20	39	.26	7.1	880	480
5300-21	47	.35	6.0	760	430
5300-22	56	.47	5.8	650	400
5300-23	68	.53	4.3	610	370
5300-24	82	.60	4.1	580	330
5300-25	100	.67	3.9	550	300
5300-26	120	.90	3.6	470	270
5300-27	150	1.2	3.2	410	250
5300-28	180	1.4	2.8	380	220
5300-29	220	1.9	2.3	320	200
5300-30	270	2.1	2.1	310	180
5300-31	330	2.4	1.9	280	170
5300-32	390	3.0	1.7	260	150
5300-33	470	3.4	1.4	240	140
5300-34	560	4.7	1.3	210	130
5300-35	680	6.4	1.2	180	110
5300-36	820	7.1	1.1	170	100
5300-37	1,000	7.9	1.0	160	95
5300-38	1,200	9.0	.94	150	87
5300-39	1,500	12	.76	130	78
5300-40	1,800	14	.72	120	71
5300-41	2,200	19	.64	100	64
5300-42	2,700	25	.56	90	58
5300-43	3,300	29	.53	83	52
5300-44	3,900	34	.48	77	48
5300-45	4,700	37	.45	74	44
5300-46	5,600	50	.40	63	40
5300-47	6,800	58	.36	59	36
5300-48	8,200	68	.29	54	33
5300-49	10,000	76	.27	52	30

5300 Dimensions



NOTES:

1. Inductance: For 1.0 µH through 8.2 µH, effective inductance is measured at 7.9 MHz in accordance with MIL-C-15305. For 10 µH through 10,000 µH inductance is measured at 1 kHz.
2. Incremental current (INCR I) is the minimum current at which the inductance will be decreased by 5% from its initial (zero-DC) value because of saturation.
3. Operating temperature range -55°C to +105°C.
4. Marking: Color coded to indicate inductance value.

HIGH CURRENT RF CHOKES

5800 SERIES

MILLER NUMBER	L (µH) ± 15% @ 0 DC	Max. DCR Ω @ +20°C	Saturation Current (DC Amps)	Suggested Rated Current(AC)
5800-3R9	3.9	.019	7.3	1.28
5800-4R7	4.7	.022	6.3	1.28
5800-5R6	5.6	.024	5.6	1.28
5800-6R8	6.8	.026	5.3	1.28
5800-8R2	8.2	.028	4.5	1.28
5800-100	10	.033	4.1	1.28
5800-120	12	.037	3.6	1.28
5800-150	15	.040	3.3	1.28
5800-180	18	.044	3.0	1.28
5800-220	22	.050	2.7	1.28
5800-270	27	.058	2.5	1.28
5800-330	33	.075	2.2	1.008
5800-390	39	.094	2.0	0.804
5800-470	47	.109	1.8	0.804
5800-560	56	.140	1.7	0.804

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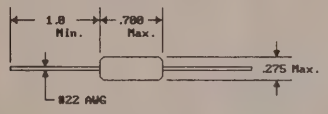
HIGH CURRENT RF CHOKES *(continued)*

5800 SERIES *(continued)*

MILLER NUMBER	L (μH) ± 15% @ 0 DC	Max. DCR Ω @ +20°C	Saturation Current (DC Amps)	Suggested Rated Current(AC)
5800-680	68	.145	1.5	0.804
5800-820	82	.152	1.4	0.804
5800-101	100	.208	1.2	0.632
5800-121	120	.283	1.1	0.508
5800-151	150	.340	1.0	0.508
5800-181	180	.362	.95	0.508
5800-221	220	.430	.86	0.508
5800-271	270	.557	.77	0.400
5800-331	330	.665	.70	0.400
5800-391	390	.772	.64	0.400
5800-471	470	1.15	.59	0.315
5800-561	560	1.27	.54	0.315
5800-681	680	1.61	.49	0.250
5800-821	820	1.96	.44	0.200
5800-102	1,000	2.30	.40	0.200
5800-122	1,200	2.65	.35	0.200
5800-152	1,500	3.45	.33	0.158
5800-182	1,800	4.03	.29	0.158
5800-222	2,200	4.48	.27	0.158
5800-272	2,700	5.90	.24	0.125
5800-332	3,300	6.56	.22	0.125
5800-392	3,900	8.63	.20	0.100
5800-472	4,700	10.5	.18	0.100
5800-562	5,600	13.9	.166	0.082
5800-682	6,800	16.3	.151	0.082
5800-822	8,200	20.8	.136	0.065
5800-103	10,000	26.4	.125	0.050
5800-123	12,000	29.9	.114	0.050
5800-153	15,000	42.5	.098	0.039
5800-183	18,000	48.3	.091	0.039

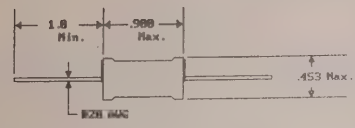
5800 Dimensions



5900 SERIES

MILLER NUMBER	L (μH) ± 15% @ 0 DC	Max. DCR Ω @ +20°C	Saturation Current (DC Amps)	Suggested Rated Current(AC)
5900-3R9	3.9	.007	15.5	4.0
5900-4R7	4.7	.008	13.9	4.0
5900-5R6	5.6	.011	12.6	4.0
5900-6R8	6.8	.011	11.6	4.0
5900-8R2	8.2	.013	9.89	4.0
5900-100	10	.017	8.70	4.0
5900-120	12	.019	8.21	4.0
5900-150	15	.022	7.34	4.0
5900-180	18	.023	6.64	4.0
5900-220	22	.026	6.07	4.0
5900-270	27	.027	5.36	4.0
5900-330	33	.032	4.82	4.0
5900-390	39	.033	4.36	4.0
5900-470	47	.035	3.98	4.0
5900-560	56	.037	3.66	3.2
5900-680	68	.047	3.31	2.5
5900-820	82	.060	3.10	2.0
5900-101	100	.090	2.79	1.6
5900-121	120	.113	2.54	1.6
5900-151	150	.129	2.22	1.6
5900-181	180	.150	1.98	1.6
5900-221	220	.162	1.89	1.6
5900-271	270	.208	1.63	1.6
5900-331	330	.212	1.51	1.6
5900-391	390	.281	1.39	1.6
5900-471	470	.380	1.24	1.2
5900-561	560	.420	1.17	1.0
5900-681	680	.548	1.05	1.0
5900-821	820	.655	.97	0.8
5900-102	1,000	.844	.87	0.8
5900-122	1,200	1.04	.79	0.6
5900-152	1,500	1.18	.70	0.6
5900-182	1,800	1.56	.64	0.6
5900-222	2,200	2.00	.58	0.5
5900-272	2,700	2.06	.53	0.4
5900-332	3,300	2.53	.47	0.4
5900-392	3,900	2.75	.43	0.4
5900-472	4,700	3.19	.39	0.4
5900-562	5,600	3.92	.359	0.315
5900-682	6,800	5.69	.322	0.250
5900-822	8,200	6.32	.293	0.250
5900-103	10,000	7.30	.266	0.250
5900-123	12,000	9.21	.241	0.200
5900-153	15,000	10.5	.214	0.200
5900-183	18,000	14.8	.198	0.158
5900-223	22,000	21.8	.180	0.125
5900-273	27,000	22.7	.162	0.125
5900-333	33,000	25.7	.146	0.125
5900-393	39,000	31.8	.135	0.100
5900-473	47,000	36.1	.122	0.100
5900-563	56,000	40.9	.112	0.100
5900-683	68,000	57.3	.101	0.082
5900-823	82,000	79.3	.090	0.065
5900-104	100,000	89.7	.081	0.065

5900 Dimensions



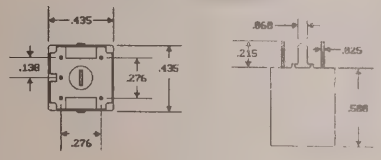
NOTES:
1. Inductance is measured at 1 kHz.
2. Saturation current lowers inductance 10%.
3. Coils finished with sleeving VW1 Rated.
4. Available taped & reeled for auto insertion.
5. Operating Temperature -55°C to +105°C.
6. Nonstandard values available.
7. 10% and 5% tolerances optional.

SHIELDED ADJUSTABLE RF COILS

9100 SERIES

MILLER NUMBER	L Min. μH	Q Min.@ L Min.	Test Freq.	L Max. μH	Q Min. @ L Max.	Test Freq.
9101	.099	64	25	.134	65	25
9102	.129	70	25	.192	93	25
9103	.165	77	25	.258	100	25
9104	.246	83	25	.418	102	25
9105	.366	88	25	.627	93	25
9106	.588	40	25	.95	60	25
9107	.83	43	25	1.54	80	7.9
9108	1.44	34	7.9	2.94	84	7.9
9109	2.52	40	7.9	5.7	77	7.9
9110	5.35	50	7.9	13.49	60	2.5
9111	12.5	31	2.5	29.45	60	2.5
9112	26.25	35	2.5	71.25	54	2.5
9113	64.57	36	2.5	163	50	79
9114	147	31	.79	430	52	79
9115	422	40	.79	1,100	42	.25
9116	1,050	39	.79	3,740	65	25
9117	3,360	40	.25	11,120	50	079

9100 Series Dimensions



LOW COST MOLDED RF CHOKES

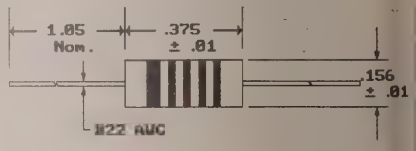
9110 SERIES

MILLER NUMBER	L ± 20% μH	Q Min.	Test Freq. MHz	Fo Min. MHz	R,dc MAX. Ohms	I,dc Max. mA
9110-00	0.15	50	25	525	0.03	2740
9110-02	0.22	50	25	450	0.055	2020
9110-04	0.33	45	25	360	0.09	1580
9110-06	0.47	45	25	310	0.12	1370
	L ± 10% μH					
9110-07	0.56	50	25	280	0.135	1290
9110-08	0.68	50	25	250	0.15	1220
9110-10	0.82	50	25	220	0.22	1020
9110-12	1.0	50	25	200	0.29	880
9110-14	1.2	33	7.9	180	0.42	730
9110-16	1.5	33	7.9	160	0.50	670
9110-18	1.8	33	7.9	150	0.65	590
9110-20	2.2	33	7.9	135	0.95	485
9110-22	2.7	33	7.9	120	1.20	430
9110-24	3.3	33	7.9	110	2.00	335
9110-26	3.9	33	7.9	100	2.30	310
9110-28	4.7	33	7.9	90	2.60	294
9110-30	5.6	45	7.9	60	0.32	565
9110-32	6.8	50	7.9	55	0.50	450
9110-34	8.2	50	7.9	50	0.60	410
9110-36	10	55	7.9	45	0.90	335
9110-38	12	65	2.5	42	1.1	305
9110-40	15	65	2.5	40	1.4	271
9110-42	18	75	2.5	34	2.25	213
9110-44	22	75	2.5	30	2.5	202
9110-46	24	60	2.5	26	2.5	202
9110-48	27	60	2.5	25	2.6	198
9110-50	30	65	2.5	21	2.8	191
9110-52	33	65	2.5	19	3.0	185
	L ± 5% μH					
9110-54	36	60	2.5	16.5	2.5	202
9110-56	39	60	2.5	14.5	2.6	198
9110-58	43	60	2.5	13.7	2.7	194
9110-60	47	55	2.5	13	2.8	193
9110-62	51	55	2.5	12.7	2.85	189

9110 SERIES *(continued)*

MILLER NUMBER	L ± 20% μH	Q Min.	Test Freq. MHz	Fo Min. MHz	R,dc MAX. Ohms	I,dc Max. mA
9110-64	56	55	2.5	12	3.0	184
9110-66	62	55	2.5	11.5	3.15	180
9110-68	68	55	2.5	11	3.3	176
9110-70	75	55	2.5	10.5	3.7	166
9110-72	82	50	2.5	10.3	3.9	162
9110-74	91	50	2.5	10	4.3	154
9110-76	100	50	2.5	9.5	4.5	151
9110-78	110	60	0.79	8.9	4.9	144
9110-80	120	65	0.79	8.7	5.2	140
9110-82	130	65	0.79	8.5	5.45	137
9110-84	150	65	0.79	8	6.05	130
9110-86	160	65	0.79	7.5	6.4	126
9110-88	180	65	0.79	8	6.75	130
9110-90	200	65	0.79	6.5	7.1	123
9110-92	220	65	0.79	6.2	7.45	117
9110-94	240	65	0.79	5.9	7.8	115
9110-96	270	65	0.79	5.7	11.0	143
9110-98	300	65	0.79	5.4	11.5	140
9110-100	330	65	0.79	5.1	12.0	136
9110-102	360	65	0.79	4.8	12.5	134
9110-104	390	65	0.79	4.5	16.3	117
9110-106	430	65	0.79	4.2	17.1	115
9110-108	470	65	0.79	3.9	17.9	112
9110-110	510	65	0.79	3.7	18.8	109
9110-112	560	65	0.79	3.8	19.5	107
9110-114	620	65	0.79	3.3	25.9	93
9110-116	680	65	0.79	3.1	27.2	91
9110-118	750	65	0.79	2.9	28.6	88
9110-120	820	65	0.79	2.7	30.0	86
9110-122	910	65	0.79	2.5	31.5	84
9110-124	1000	65	0.79	2.3	33.0	82

9110 Dimensions



NOTES:
1. Operating temperature -55° to +125°C on phenolic parts.
2. Operating temperature -55° to +105°C on ferrite parts.
3. Core material 9110-00 thru -28 is phenolic. Core material 9130-94 thru -20 is phenolic. all other cores are ferrite.
4. Dielectric strength 1000 volts RMS at sea level.
5. Rated current is based on coil temperature rise not to exceed 35°C at 90°C ambient temperature.
6. Terminal strength 5 lb pull test per MIL-STD-202E, Method 211A.
7. Marking 5 band color code per MIL-C-15305.

9130 SERIES

MILLER NUMBER	L ± 10% μH	Q Min.	Test Freq. MHz	Fo Min. MHz	R,dc MAX. Ohms	I,dc Max. mA
9130-94	0.10	40	25	680	0.08	1100
9130-96	0.12	40	25	640	0.09	1100
9130-00	0.15	38	25	600	0.10	1100
9130-02	0.18	35	25	550	0.12	1010
9130-04	0.22	33	25	510	0.14	935
9130-06	0.27	33	25	430	0.16	875
9130-08	0.33	30	25	410	0.22	760
9130-10	0.39	30	25	365	0.30	640
9130-12	0.47	30	25	330	0.35	590
9130-14	0.56	30	25	300	0.50	495
9130-16	0.68	28	25	275	0.60	450
9130-18	0.82	28	25	250	0.85	380
9130-20	1.0	25	25	230	1.00	350
9130-22	1.2	25	7.9	150	0.18	825
9130-24	1.5	28	7.9	140	0.22	745
9130-26	1.8	30	7.9	125	0.30	640
9130-28	2.2	30	7.9	115	0.40	550
9130-30	2.7	37	7.9	100	0.55	495
9130-32	3.3	45	7.9	90	0.85	380
9130-34	3.9	45	7.9	80	1.0	350
9130-36	4.7	45	7.9	75	1.2	320
9130-38	5.6	50	7.9	65	1.8	260
9130-40	6.8	50	7.9	60	2.0	245
9130-42	8.2	55	7.9	55	2.7	210
9130-44	10	55	7.9	50	3.7	180
9130-46	12	45	2.5	40	2.7	210
9130-48	15	40	2.5	35	2.8	205
9130-50	18	50	2.5	30	3.1	195
9130-52	22	50	2.5	25	3.3	190
9130-54	27	50	2.5	20	3.5	185
9130-56	33	45	2.5	24	3.4	187
9130-58	39	45	2.5	22	3.6	180
9130-60	47	45	2.5	20	4.5	165
9130-62	56	45	2.5	18	5.7	145
9130-64	68	50	2.5	15	6.7	135

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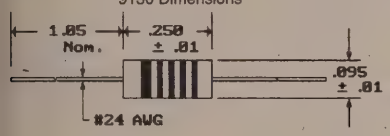
LOW COST MOLDED RF CHOKES *(continued)*

9130 SERIES *(continued)*

MILLER NUMBER	L±10% µH	Q Min.	Test Freq. MHz	Fo Min. MHz	R,dc MAX. Ohms	I,dc Max. mA
9130-66	82	50	2.5	14	7.3	130
9130-68	100	50	2.5	13	8.0	125
9130-70	120	30	0.79	12	13	97
9130-72	150	30	0.79	11	15	85
9130-74	180	30	0.79	10	17	79
9130-76	220	30	0.79	9	21	73
9130-78	270	30	0.79	8	25	65
9130-80	330	30	0.79	7	28	62
9130-82	390	30	0.79	6.5	35	55
9130-84	470	30	0.79	6	42	50
9130-86	560	30	0.79	5	46	48
9130-88	680	30	0.79	4	60	42
9130-90	820	30	0.79	3.8	65	40
9130-92	1000	30	0.79	3.4	72	38

9130 Dimensions



CONFORMAL COATED RF CHOKES

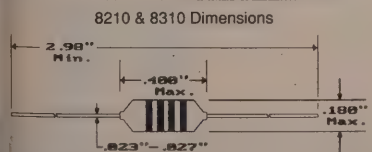
8310 SERIES

MILLER NUMBER	L µH ± 20%	Q Min.	Test Freq. MHz	Fo Min. MHz	R,dc Max. Ohms	I,dc Max. mA	Core Material
310-00	.15	50	25	525	.03	2450	Phenolic
310-02	.22	50	25	450	.055	1900	Phenolic
310-04	.33	45	25	360	.09	1400	Phenolic
310-06	.47	45	25	310	.12	1225	Phenolic
	L µH ± 10%						
310-07	.56	50	25	280	.135	1220	Phenolic
310-08	.68	50	25	250	.15	1100	Phenolic
310-10	.82	50	25	220	.22	900	Phenolic
310-12	1	50	25	200	.29	830	Phenolic
310-14	1.2	33	7.9	180	.42	650	Phenolic
310-16	1.5	33	7.9	160	.5	600	Phenolic
310-18	1.8	33	7.9	150	.65	525	Phenolic
310-20	2.2	33	7.9	135	.95	435	Phenolic
310-22	2.7	33	7.9	120	1.2	385	Phenolic
310-24	3.3	33	7.9	110	2	300	Phenolic
310-26	3.9	33	7.9	100	2.3	280	Phenolic
310-28	4.7	33	7.9	90	2.6	260	Phenolic
310-30	5.6	45	7.9	60	.32	750	Iron
310-32	6.8	50	7.9	55	.5	600	Iron
310-34	8.2	50	7.9	50	.6	545	Iron
310-36	10	[illegible]	7.9	45	.9	445	Iron
310-38	12	65	2.5	42	1.1	404	Iron
310-40	15	65	2.5	40	1.4	370	Iron
310-42	18	75	2.5	34	2.25	280	Iron
310-44	22	75	2.5	30	2.5	265	Iron
310-46	24	60	2.5	26	2.5	265	Iron
310-48	27	60	2.5	25	2.6	260	Iron
310-50	30	65	2.5	19	2.8	255	Iron
310-52	33	65	2.5	19	3	250	Iron

8210 SERIES

MILLER NUMBER	L µH ± 5%	Test Q Min.	Fo Freq. MHz	R,dc Min. MHz	I,dc Max. Ohms	Max. mA	Core Material
210-54	36	60	2.5	15.5	2.5	180	Iron
210-56	39	60	2.5	14.5	2.6	176	Iron
210-58	43	60	2.5	13.7	2.7	172	Iron
210-60	47	55	2.5	13	2.75	170	Iron
210-62	51	55	2.5	12.7	2.85	167	Iron
210-64	56	55	2.5	12	3	164	Iron
210-66	62	55	2.5	11.5	3.15	160	Iron
210-68	68	55	2.5	11	3.3	156	Iron
210-70	75	55	2.5	10.5	3.7	147	Iron
210-72	82	50	2.5	10.3	3.9	143	Iron
210-74	91	50	2.5	10	4.3	136	Iron
210-76	100	50	2.5	9.5	4.5	133	Iron
210-78	110	60	.79	8.9	4.9	128	Iron
210-80	120	65	.79	8.7	5.2	124	Iron
210-82	130	65	.79	8.5	5.45	121	Iron
210-84	150	65	.79	8	6.05	114	Iron
210-86	160	65	.79	7.5	6.4	111	Iron
210-88	180	65	.79	7	6.75	108	Iron
210-90	200	65	.79	6.5	7.1	106	Iron
210-92	220	65	.79	6.2	7.45	103	Iron
210-94	240	65	.79	5.9	7.8	101	Iron

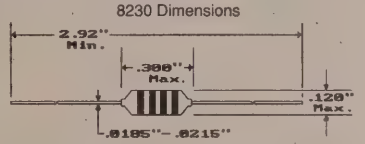
8210 & 8310 Dimensions



8230 SERIES

MILLER NUMBER	L µH ± 10%	Q Min.	Test Freq. MHz	Fo Min. MHz	R,dc Max. Ohms	I,dc Max. mA	Core Material
8230-94	.1	40	25	690	.07	1100	Phenolic
8230-96	.12	40	25	650	.08	1100	Phenolic
8230-00	.15	38	25	600	.1	1100	Phenolic
8230-02	.18	35	25	550	.12	1010	Phenolic
8230-04	.22	33	25	510	.14	935	Phenolic
8230-06	.27	33	25	430	.16	875	Phenolic
8230-08	.33	30	25	410	.2	780	Phenolic
8230-10	.39	30	25	380	.3	640	Phenolic
8230-12	.47	30	25	340	.35	590	Phenolic
8230-14	.56	30	25	300	.5	495	Phenolic
8230-16	.68	28	25	275	.6	450	Phenolic
8230-18	.82	28	25	250	.85	380	Phenolic
8230-20	1	25	25	230	1	350	Phenolic
8230-22	1.2	25	7.9	150	.18	825	Iron
8230-24	1.5	28	7.9	140	.22	745	Iron
8230-26	1.8	30	7.9	125	.3	640	Iron
8230-28	2.2	30	7.9	115	.4	550	Iron
8230-30	2.7	37	7.9	100	.5	495	Iron
8230-32	3.3	45	7.9	90	.85	380	Iron
8230-34	3.9	45	7.9	82	1	350	Iron
8230-36	4.7	45	7.9	75	1.2	320	Iron
8230-38	5.6	50	7.9	68	1.8	260	Iron
8230-40	6.8	50	7.9	60	2	245	Iron
8230-42	8.2	55	7.9	55	2.7	210	Iron
8230-44	10	55	7.9	50	3.7	180	Iron
8230-46	12	45	2.5	40	2.7	210	Iron
8230-48	15	45	2.5	35	2.8	205	Iron
8230-50	18	50	2.5	32	3.1	195	Iron
8230-52	22	50	2.5	25	3.3	190	Iron
8230-54	27	50	2.5	22	3.5	185	Iron
8230-56	33	45	2.5	24	3.4	187	Ferrite
8230-58	39	45	2.5	22	3.6	180	Ferrite
8230-60	47	45	2.5	20	4.5	165	Ferrite
8230-62	56	45	2.5	18	5.7	145	Ferrite
8230-64	68	50	2.5	15	6.7	135	Ferrite
8230-66	82	50	2.5	14	7.3	130	Ferrite
8230-68	100	50	2.5	13	8	125	Ferrite
8230-70	120	30	.79	12	13	97	Ferrite
8230-72	150	30	.79	11	15	85	Ferrite
8230-74	180	30	.79	10	17	79	Ferrite
8230-76	220	30	.79	9	21	73	Ferrite
8230-78	270	30	.79	8	25	65	Ferrite
8230-80	330	30	.79	7	28	62	Ferrite
8230-82	390	30	.79	6.5	35	55	Ferrite
8230-84	470	30	.79	6	42	50	Ferrite
8230-86	560	30	.79	5	46	48	Ferrite
8230-88	680	30	.79	4.2	60	42	Ferrite
8230-90	820	30	.79	3.8	65	40	Ferrite
8230-92	1000	30	.79	3.4	72	38	Ferrite

8230 Dimensions



MOLDED RF CHOKES

S SERIES

MILLER NUMBER	L µH ± 10%	Q Min.	Q Test Freq. MHz	Fo. Min. MHz	R,dc Max. Ohms	I,dc MAx. mA	Core Material
100170	.1	85	50	>500	.02	4000	Phenolic
100171	.12	85	50	>500	.025	3500	Phenolic
100172	.15	85	50	>500	.03	3000	Phenolic
100173	.18	75	50	500	.03	3000	Phenolic
100174	.22	75	50	500	.03	3000	Phenolic
100175	.27	70	45	470	.04	2700	Phenolic
100176	.33	70	40	440	.05	2500	Phenolic
100177	.39	65	40	400	.08	2000	Phenolic
100178	.47	60	25	360	.08	2000	Phenolic
100179	.56	55	25	330	.1	1700	Phenolic
100180	.68	55	25	300	.12	1500	Phenolic
100181	.82	50	25	275	.18	1300	Phenolic
100182	1	50	20	250	.24	1100	Phenolic
100183	1.2	45	20	220	.35	1000	Phenolic
100184	1.5	45	15	200	.43	850	Phenolic
100185	1.8	45	15	180	.65	720	Phenolic
100186	2.2	45	15	165	.8	610	Phenolic
100187	2.7	55	10	110	.12	1600	Iron
100188	3.3	55	10	100	.15	1400	Iron
100189	3.9	60	10	95	.23	1200	Iron
100190	4.7	70	7.9	90	.3	1000	Iron
100191	5.6	65	7.9	80	.45	900	Iron
100192	6.8	65	7.9	70	.55	800	Iron
100193	8.2	60	7.9	65	.65	720	Iron
100194	10	60	5	60	.73	650	Iron
100195	12	65	5	53	1.1	590	Iron
100196	15	80	2.5	47	1.4	500	Iron
100197	18	75	2.5	43	1.6	460	Iron
100198	22	75	2.5	40	1.8	430	Iron
	L µH ± 5%						
100199	27	75	2.5	36	2.7	360	Iron
100200	33	85	2.5	32	3.5	300	Iron
100201	39	80	2.5	26	3.8	290	Iron
100202	47	80	2.5	22	4	275	Iron
100203	56	75	2.5	19	4.4	265	Iron
100204	68	75	2.5	16	4.7	250	Iron
100205	82	75	2.5	13	5.3	235	Iron
100206	100	75	1.5	10	6	220	Iron

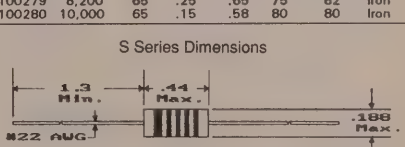
M SERIES

MILLER NUMBER	L µH ± 10%	Q Min.	Q Test Freq. MHz	Fo. Min. MHz	R,dc Max. Ohms	I,dc MAx. mA	Core Material
100207	1	100	15	170	.04	2700	Iron
100208	1.2	100	15	155	.04	2700	Iron
100209	1.5	100	10	140	.04	2700	Iron
100210	1.8	95	10	125	.05	2500	Iron
100211	2.2	95	10	110	.05	2500	Iron
100212	2.7	68	7.9	95	.05	2500	Iron
100213	3.3	60	7.9	90	.05	2500	Iron
100214	3.9	60	7.9	87	.07	2100	Iron
100215	4.7	60	7.9	75	.09	1800	Iron
100216	5.6	65	7.9	70	.14	1550	Iron
100217	6.8	70	7.9	65	.17	1300	Iron
100218	8.2	65	7.9	57	.25	1150	Iron
100219	10	65	5	50	.32	1000	Iron
100220	12	65	5	45	.47	870	Iron
100221	15	75	4	40	.62	730	Iron
100222	18	65	4	37	.72	660	Iron
100223	22	65	2.5	35	.8	600	Iron
	L µH ± 5%						
100224	27	65	2.5	31	1.2	520	Iron
100225	33	80	2.5	27	1.5	450	Iron
100226	39	80	2.5	25	2.3	380	Iron
100227	47	100	2.5	24	3	300	Iron
100228	56	100	2.5	22	4.2	270	Iron
100229	68	100	2.5	20	5.2	250	Iron
100230	82	100	2.5	18	6.2	220	Iron
100231	100	100	1.5	17	7	200	Iron
100232	120	95	1.5	14	7.5	200	Iron
100233	150	90	1	11	8	190	Iron
100234	180	85	1	9	9	185	Iron
100235	220	85	1	7	10	180	Iron
100236	270	80	1	5.5	11	172	Iron
100237	330	80	.8	4.5	12	165	Iron
100238	390	75	.8	4	13	157	Iron
100239	470	75	.8	3.5	14	150	Iron
100240	560	65	.8	3.1	16	145	Iron
100241	680	65	.8	2.7	17	140	Iron
100242	820	65	.8	2.5	19	132	Iron
100243	1,000	70	.5	2.3	21	125	Iron

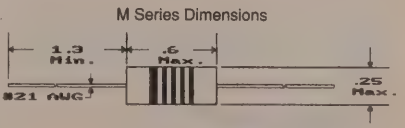
L SERIES

MILLER NUMBER	L µH ± 10%	Q Min.	Q Test Freq. MHz	Fo. Min. MHz	R,dc Max. Ohms	I,dc MAx. mA	Core Material
100244	10	75	5	50	.15	1800	Iron
100245	12	75	5	45	.23	1600	Iron
100246	15	75	5	40	.3	1300	Iron
100247	18	75	5	36	.4	1150	Iron
100248	22	75	2.5	32	.5	1000	Iron
	L µH ± 5%						
100249	27	70	2.5	30	.6	900	Iron
100250	33	70	2.5	28	.7	850	Iron
100251	39	70	2.5	26	1.1	720	Iron
100252	47	75	2.5	25	1.3	620	Iron
100253	56	80	2.5	22	1.8	540	Iron
100254	68	100	2.5	20	2.4	450	Iron
100255	82	100	2.5	18	2.8	425	Iron
100256	100	100	1.5	17	3.2	400	Iron
100257	120	100	1.5	15	4.8	360	Iron
100258	150	100	1	14	6.4	280	Iron
100259	180	95	1	12	9.5	240	Iron
100260	220	95	1	11	12	200	Iron
100261	270	70	1	9	13	195	Iron
100262	330	65	.79	7.5	14	190	Iron
100263	390	65	.79	6.5	15.5	180	Iron
100264	470	60	.79	5.5	17	170	Iron
100265	560	75	.5	4	18.5	165	Iron
100266	680	75	.5	3.2	20	155	Iron
100267	820	75	.5	2.8	22	150	Iron
100268	1,000	75	.5	2.4	24	145	Iron
100269	1,200	75	.5	2.1	27	137	Iron
100270	1,500	75	.4	1.9	29	130	Iron
100271	1,800	65	.4	1.7	32	125	Iron
100272	2,200	65	.25	1.5	35	120	Iron
100273	2,700	65	.25	1.3	40	112	Iron
100274	3,300	65	.25	1.2	45	105	Iron
100275	3,900	65	.25	1.05	49	100	Iron
100276	4,700	65	.25	.95	53	95	Iron
100277	5,600	65	.25	.85	60	90	Iron
100278	6,800	65	.25	.75	67	85	Iron
100279	8,200	65	.25	.65	75	82	Iron
100280	10,000	65	.15	.58	80	80	Iron

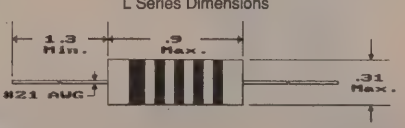
S Series Dimensions



M Series Dimensions



L Series Dimensions



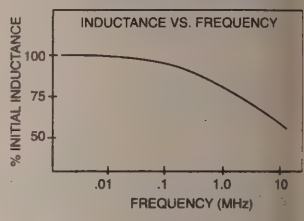
BH Electronics

Toroid Inductors for Switching Power Supplies

- Current Range, 1 Amp to 50 Amps
- Cost Effective Design
- Wide Range Inductance
- Maximum Temperature Rise, 40°C Above Ambient
- PC Mount

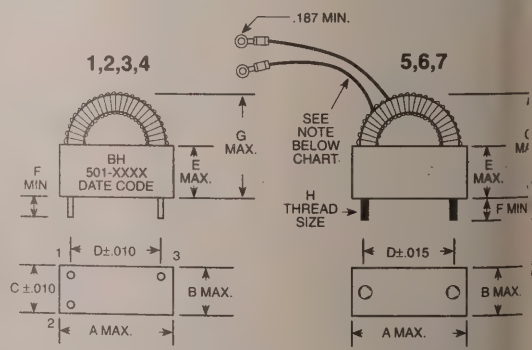
BH PART NUMBER	RATED DC CURRENT (AMPS)	MINIMUM INDUCTANCE AT RATED DC (μ H)	MINIMUM INDUCTANCE AT ZERO DC (μ H)	DC RESISTANCE MAXIMUM (μ)	MINIMUM ENERGY STORAGE 1/2 LI^2	PACKAGE STYLE	LEAD DIA. INCHES
501-1001	1.0	725	1400	.75	366	1	.025
501-1002	2.5	115	230	.12	366	1	.025
501-1003	2.5	370	740	.23	1166	2	.025
501-1004	4.1	40	80	.045	361	1	.032
501-1005	4.1	140	280	.086	1185	2	.032
501-1006	4.1	360	720	.177	3034	3	.032
501-1007	6.5	15	30	.018	359	1	.040
501-1008	6.5	50	100	.035	1162	2	.040
501-1009	6.5	140	280	.070	3000	3	.040
501-1010	6.5	290	580	.098	6190	4	.040
501-1011	10.0	7	14	.0075	350	1	.051
501-1012	10.0	20	40	.014	1150	2	.051
501-1013	10.0	60	120	.028	3000	3	.051
501-1014	10.0	120	240	.040	6200	4	.051
501-1015	20.0	6	12	.004	1200	5	N/A
501-1016	20.0	15	30	.0072	2800	6	N/A
501-1017	20.0	30	60	.010	6400	7	N/A
501-1018	40.0	3.5	7.0	.0017	2800	6	N/A
501-1019	40.0	7	14	.0024	5920	7	N/A
501-1020	50.0	4.5	9	.0016	5875	7	N/A

TYPICAL INDUCTANCE CHARACTERISTICS



PACKAGE STYLES

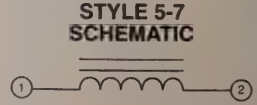
STYLE	A	B	C	D	E	F	G	H
1	1.05 / 26,67	.55 / 13,97	.400 / 10,16	.800 / 20,32	.55 / 13,97	.20 / 5,08	1.10 / 27,94	N/A
2	1.45 / 36,83	.80 / 20,32	.600 / 15,24	.900 / 22,86	.58 / 14,73	.20 / 5,08	1.40 / 35,56	N/A
3	2.00 / 50,80	.95 / 24,13	700 / 17,78	1.20 / 30,48	.75 / 19,05	.20 / 5,08	1.90 / 48,26	N/A
4	2.16 / 54,86	1.12 / 28,45	.900 / 22,86	1.50 / 38,10	1.05 / 26,67	.20 / 5,08	2.20 / 55,88	N/A
5	1.45 / 36,83	.80 / 20,32	N/A	.900 / 22,86	.58 / 14,73	.25 / 6,35	1.40 / 15,56	6/32
6	2.00 / 50,80	.95 / 24,13	N/A	1.20 / 30,48	.75 / 19,05	.25 / 6,35	1.90 / 48,26	8/32
7	2.16 / 54,86	1.12 / 28,45	N/A	1.50 / 38,10	1.05 / 26,67	.25 / 6,35	2.20 / 55,88	10/32



NOTE: STYLE 5,6,7 LEADS CUT TO 6" LENGTH
CUSTOM LENGTHS AVAILABLE UPON REQUEST

STYLE 1-4 SCHEMATIC

STYLE 5-7 SCHEMATIC



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BH Electronics

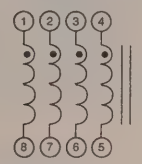
Common Mode Chokes for Data Communication Circuits

- Intended for the Rejection of RFI and EMI on Unshielded Twisted Pair Lines
- Custom Designed in a Wide Variety of Packages
- 1000 VDC Isolation
- PC Mount is Standard - Surface Mount Available

Electrical Specifications

BH PART NUMBER	TURNS RATIO	SINE WAVE O_{CL} ± 25% @ 100 KHz	Ciw MAX. ANY WINDING	DCR.MAX.	SCHEMATIC STYLE	FIGURE
500-1164	1:1	33 uH	20 pF	.05 OHMS	2	1
500-1165	1:1:1:1	27 uH	20 pF	.05 OHMS	1	1
500-1179	1:1:1:1	53 uH	30 pF	.1 OHMS	1	1
500-1266	1:1	15 uH	260 pF	1.0 OHMS	2	1
500-1267	1:1	125 uH	150 pF	.05 OHMS	2	1
500-1291	1:1	53 uH	30 pF	.1 OHMS	2	1
500-1299	1:1	475 uH	11 pF	.5 OHMS	3	2
500-1433	1:1	750 uH	15 pF	.5 OHMS	3	2
500-1517	1:1:1:1	50 uH MIN.	20 pF	.1 OHMS	1	1
500-1532	1:1:1	12 uH	10 pF	.1 OHMS	1	1
500-1845	1:1	2.5 uH MIN.	25 pF	1.0 OHMS	1	3
500-1846	1:1	2.5 uH MIN.	20 pF	1.0 OHMS	1	3
500-1841	1:1:1:1	8 uH	10 pF	.20 OHMS	1	4

SCHEMATIC 1



SCHEMATIC 2

SCHEMATIC 3

FIGURE 1

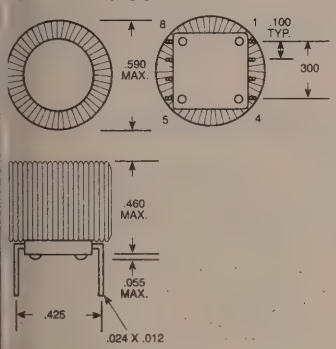


FIGURE 2

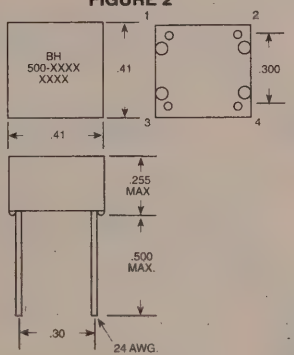


FIGURE 3

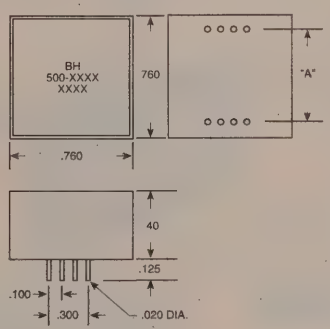
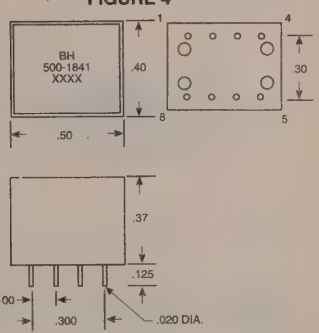


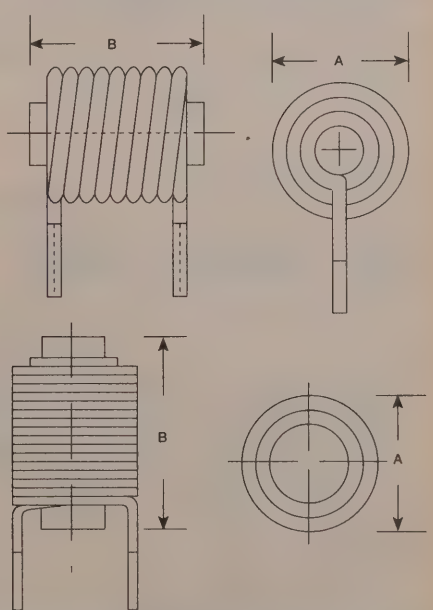
FIGURE 4



Ferrite Rod Power Inductors

- High saturation and flux density
- Ideal for RFI/EMI filter applications
- Suitable for energy storage inductors in switch mode power circuits
- Epoxy Coverd coil
- ±10% tolerance on inductance values

HORIZONTAL MOUNT PART NUMBER	VERTICAL MOUNT PART NUMBER	O_{CL} µH	MAX. CUR (AMPS)	DCR. (Ω) MAX.	DIM'S. (mm) A	B
501-0425	501-0439	5	3	0.015	15	22
501-0426	501-0440	10	3	0.018	15	29
501-0427	501-0441	27	3	0.035	20	22
501-0428	501-0441	50	3	0.050	20	28
501-0429	501-0443	100	3	0.065	20	35
501-0430	501-0444	150	3	0.075	20	35
501-0431	501-0445	270	3	0.095	20	41
501-0432	501-0446	5	5	0.120	17	22
501-0433	501-0447	10	5	0.150	17	29
501-0434	501-0448	27	5	0.250	22	22
501-0435	501-0449	50	5	0.300	22	29
501-0436	501-0450	68	5	0.350	22	29
501-0437	501-0451	100	5	0.500	22	35
501-0438	501-0452	150	5	0.600	22	42



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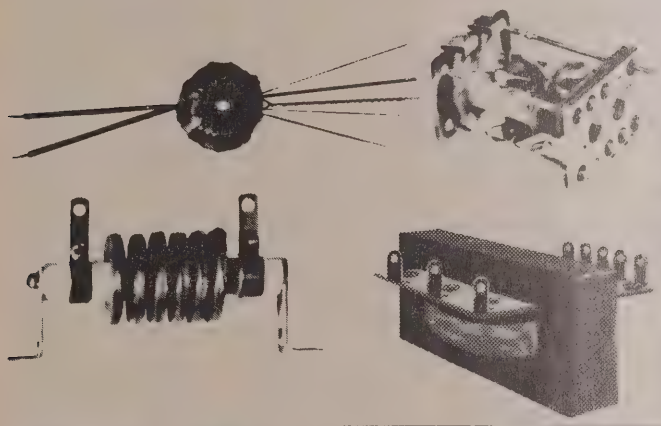
OVER 47 YEARS OF DEPENDABILITY

in the design and manufacture of coils and transformers for industry and defense. We specialize in the manufacture of coils and assemblies to the most rigid military specifications.

CUSTOM WINDINGS COMPLETE FACILITIES

for custom winding to your specifications.



FERRITE POT CORE INDUCTORS & TRANSFORMERS

Caddell-Burns has complete facilities for winding and assembling all types of pot core assemblies, both fixed and variable. Write or phone in your specifications.

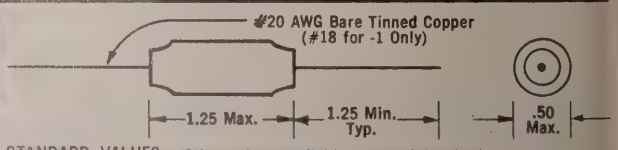
MODIFIED STOCK COILS

Any of the coils shown on these pages can be wound to intermediate inductance values or modified to meet customer requirements, often at no additional cost.

HIGH CURRENT CHOKES

TYPE 6150 10-100μH
Recommended mounting pitch — 1.50″

FOR SWITCHING REGULATORS AND POWER FILTERS



NOTES:

1. Effective inductance and Q measured on Boonton 260A Q-meter at frequencies specified, in accordance with MIL-C-15305.
2. Current rating (Rated IDC) is based on .75 watt power dissipation for approx. 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
3. Incremental current (INCR I) is the minimum current at which the inductance will be decreased by 5% from its initial (zero — DC) value.
4. Dielectric Withstanding Voltage — 1000 VRMS.
5. Operating Temperature Range — −55°C to +85°C.
6. Materials:
   Coil Form — Ferrite.
   Magnet Wire — Type B per MIL-W-583.
   Jacket — PVC shrink tube.

6150

STANDARD VALUES: (Other values available on special order.)

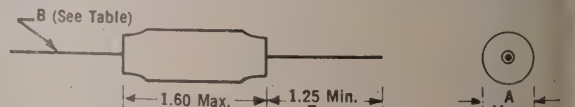
Part No.	Nominal Inductance*	Min. Q	Test Freq. MHz	Max. DCR Ohms	Min. SRF MHz	Rated I_{DC} Amps	Incr I Amps
6150-1	10μH	30	2.5	.018	10	6.40	21
6150-2	20	18	2.5	.036	7.2	4.50	15
6150-3	30	12	2.5	.063	5.0	3.40	13
6150-4	40	12	2.5	.096	4.3	2.75	12
6150-5	50	10	2.5	.110	3.7	2.60	10
6150-6	75	8	2.5	.200	3.2	1.90	9
6150-7	100	26	.79	.400	2.2	1.30	7.8

*(−10, +20%)

HIGH CURRENT CHOKES

TYPE 6490 10μH-1.0mH 10% Tolerance
Recommended mounting pitch — 1.75″

FOR SWITCHING REGULATORS AND POWER FILTERS



NOTES:

1. Inductance measured on General Radio 1650B Impedance Bridge at 1 kHz.
2. Current rating (Rated IDC) is based on 1.0 watt power dissipation for approx. 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
3. Incremental current (INCR I) is the minimum current at which the inductance will be decreased by 5% from its initial (zero — DC) value.
4. Dielectric Withstanding Voltage — 1000 VRMS.
5. Operating Temperature Range — −55°C to +85°C.
6. Materials:
   Coil Form — Ferrite.
   Magnet Wire — Type B per MIL-W-583.
   Jacket — PVC shrink tube.
   Lead Wires — Bare tinned copper.

6490

STANDARD VALUES: (Other values available on special order.)

Part No.	Nominal Inductance	Max. DCR Ohms	Min. SRF MHz	Rated I_{DC} Amps	Incr I Amps	A Dia. In.	B Lead Size AWG
6490-1	10μH	.010	12.0	10.0	20	.65	14
6490-2	20	.017	9.0	7.7	16	.62	16
6490-3	30	.031	6.0	5.7	12	.61	18
6490-4	40	.050	5.0	4.5	11	.60	20
6490-5	50	.068	4.5	3.8	10	.59	20
6490-6	75	.13	3.4	2.8	9.0	.58	20
6490-7	100	.056	1.5	4.2	7.0	.79	18
6490-8	250	.14	0.90	2.7	4.5	.75	20
6490-9	500	.30	0.60	1.8	3.3	.72	20
6490-10	750	.56	0.45	1.3	2.6	.68	20
6490-11	1.0mH	.80	0.35	1.1	2.3	.66	20

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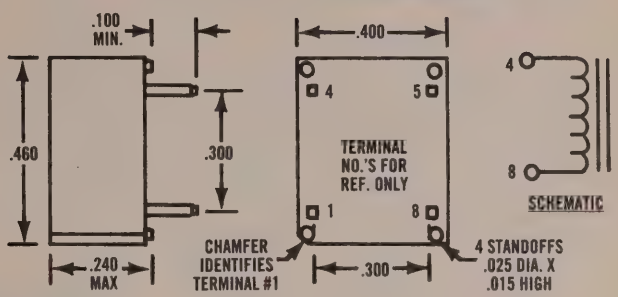
DIP CHOKES (SURFACE MOUNTABLE)

TYPE 7400 1.0 µH-10mH-10% Tolerance

FITS STANDARD 8-PIN DIP LAYOUT.
TERMINALS MAY BE FORMED INTO J-LEADS
OR GULLWINGS FOR SURFACE MOUNTING

7400



NOTES:

1. INDUCTANCE: For 1.0 µH through 8.2 µH; effective inductance measured on HP4342 Q-Meter at 7.9 MHz in accordance with MIL-C-15305. For 10 µH through 10mH; inductance measured on Cambridge Technology type 520 L/C Meter at 1 KHz.
2. CURRENT RATING (Rated IDC) is based on 0.25 watt power dissipation for approximately 20°C temperature rise. Depending on the application, these parts may be operated at higher currents.
3. INCREMENTAL CURRENT (INCR I) is the current at which the inductance will be decreased approximately 5% from its initial (zero-DC) value because of saturation.
4. DIELECTRIC WITHSTANDING VOLTAGE: 1000 VRMS.
5. OPERATING TEMPERATURE RANGE: -55° to +105°C.
6. MARKING: Printed with Caddell-Burns Part Number.
7. MATERIALS:
   Core: Ferrite
   Magnet Wire: Per FED SPEC J-W 001177/9
   Case: Glass-filled Polyphenylene Sulfide (RYTON)
   Terminals: .016 x .019 Brass, tin over nickel plating.

STANDARD VALUES: (Other values available on special order)

Part No.	Nominal Inductance	DCR ± 20% Ohms	Min. SRF MHz	Rated IDC Amps	INCR I Amps
7400-01	1.0 µH	0.024	190	3.2	7.0
7400-02	1.2	0.026	140	3.1	6.4
7400-03	1.5	0.028	130	3.0	5.7
7400-04	1.8	0.030	110	2.9	5.2
7400-05	2.2	0.032	100	2.8	4.7
7400-06	2.7	0.035	95	2.7	4.3
7400-07	3.3	0.040	90	2.5	3.9
7400-08	3.9	0.043	84	2.4	3.5
7400-09	4.7	0.050	80	2.2	3.2
7400-10	5.6	0.054	67	2.1	3.0
7400-11	6.8	0.060	42	2.0	2.7
7400-12	8.2	0.067	26	1.9	2.4
7400-13	10	0.073	19	1.9	2.2
7400-14	12	0.080	14	1.8	2.0
7400-15	15	0.090	9.6	1.7	1.8
7400-16	18	0.10	7.6	1.6	1.6
7400-17	22	0.11	7.4	1.5	1.5
7400-18	27	0.13	7.0	1.4	1.3
7400-19	33	0.14	6.1	1.3	1.2
7400-20	39	0.19	5.6	1.1	1.1
7400-21	47	0.21	5.2	1.1	1.0
7400-22	56	0.23	4.8	1.0	0.94
7400-23	68	0.26	4.4	0.98	0.85
7400-24	82	0.35	4.0	0.85	0.77

Part No.	Nominal Inductance	DCR ± 20% Ohms	Min. SRF MHz	Rated IDC Amps	INCR I Amps
7400-25	100 µH	0.40	3.4	0.79	0.70
7400-26	120	0.52	3.1	0.69	0.64
7400-27	150	0.59	2.8	0.65	0.57
7400-28	180	0.65	2.7	0.62	0.52
7400-29	220	0.90	2.4	0.53	0.47
7400-30	270	1.0	2.2	0.50	0.43
7400-31	330	1.4	1.8	0.42	0.39
7400-32	390	1.5	1.7	0.41	0.35
7400-33	470	1.7	1.5	0.38	0.32
7400-34	560	2.3	1.4	0.33	0.30
7400-35	680	2.6	1.3	0.31	0.27
7400-36	820	3.6	1.1	0.26	0.24
7400-37	1.0 mH	4.0	1.0	0.25	0.22
7400-38	1.2	4.5	0.96	0.24	0.20
7400-39	1.5	6.1	0.80	0.20	0.18
7400-40	1.8	6.8	0.76	0.19	0.16
7400-41	2.2	8.7	0.69	0.17	0.15
7400-42	2.7	10	0.54	0.16	0.13
7400-43	3.3	14	0.48	0.13	0.12
7400-44	3.9	16	0.46	0.13	0.11
7400-45	4.7	21	0.35	0.11	0.10
7400-46	5.6	24	0.32	0.10	0.094
7400-47	6.8	33	0.30	0.087	0.085
7400-48	8.2	38	0.29	0.081	0.077
7400-49	10	50	0.27	0.071	0.070

INDUCTOR SELECTION KITS FOR DESIGN ENGINEERS

Type 7400 DIP Chokes are available in kits to assist the designer of switching regulators, power supplies, and filters in selecting the optimal inductor for a given application.

Each kit contains 25 inductors, covering two decades of inductance values.

FREE REFILL order forms are included, to replace parts as they are used, or to obtain samples of additional values not included with the kits.

Kit Part No.	Dash No.'s included	Inductance Range
7400 KIT-1	-01 thru -25 (1 ea)	1.0µH-100µH
7400 KIT-2	-13 thru -37 (1 ea)	10µH-1.0mH
7400 KIT-3	-25 thru -49 (1 ea)	100µH-10mH

Custom kits are also available.

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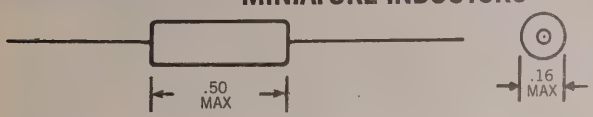
7120-KIT LOW POWER MINIATURE INDUCTORS



This kit contains 2 each of the following:

Part No.	L	R	I PEAK
7120-13	10 µH	.08 Ω	970 ma
7120-15	15 µH	.13 Ω	790 ma
7120-17	22 µH	.16 Ω	640 ma
7120-19	33 µH	.20 Ω	530 ma
7120-21	47 µH	.29 Ω	430 ma
7120-23	68 µH	.44 Ω	370 ma
7120-25	100 µH	.56 Ω	300 ma
7120-27	150 µH	1.0 Ω	250 ma
7120-29	220 µH	1.6 Ω	200 ma
7120-31	330 µH	2.0 Ω	170 ma
7120-33	470 µH	2.8 Ω	140 ma
7120-37	1.0 mH	6.6 Ω	95 ma

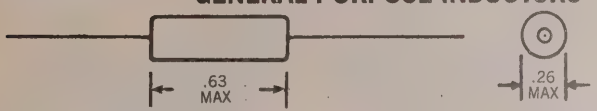
INDUCTOR SELECTION KITS FOR DESIGN ENGINEERS

These kits are intended as an aid to the designer of switching regulators, power supplies, and filters. Each kit contains an assortment of the most popular inductance values, allowing selection of the optimal inductor for a given application.

FREE REFILL ORDER FORMS are included, to replace parts as they are used or to obtain additional values not included with the kits.

FOR COMPLETE SPECIFICATIONS, SEE CATALOG DATA SHEETS.

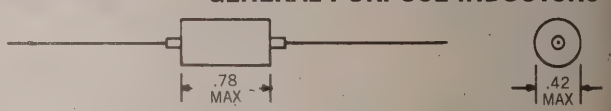
7070-KIT MEDIUM POWER GENERAL PURPOSE INDUCTORS



This kit contains 2 each of the following:

Part No.	L	R	I PEAK
7070-13	10 µH	.032 Ω	1,900 ma
7070-15	15 µH	.041 Ω	1,500 ma
7070-17	22 µH	.049 Ω	1,300 ma
7070-19	33 µH	.064 Ω	1,000 ma
7070-21	47 µH	.078 Ω	870 ma
7070-23	68 µH	.11 Ω	710 ma
7070-25	100 µH	.20 Ω	590 ma
7070-27	150 µH	.36 Ω	480 ma
7070-29	220 µH	.46 Ω	400 ma
7070-31	330 µH	.60 Ω	320 ma
7070-33	470 µH	.73 Ω	270 ma
7070-37	1.0 mH	1.6 Ω	190 ma

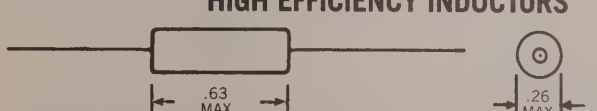
6860-KIT HIGH POWER GENERAL PURPOSE INDUCTORS



This kit contains 2 each of the following:

Part No.	L	R	I PEAK
6860-01	10 µH	.019 Ω	3.2 amps
6860-03	15 µH	.025 Ω	2.6 amps
6860-05	22 µH	.029 Ω	2.2 amps
6860-07	33 µH	.036 Ω	1.8 amps
6860-09	47 µH	.045 Ω	1.5 amps
6860-11	68 µH	.057 Ω	1.2 amps
6860-13	100 µH	.082 Ω	1.0 amps
6860-15	150 µH	.15 Ω	.83 amps
6860-17	220 µH	.23 Ω	.68 amps
6860-19	330 µH	.29 Ω	.56 amps
6860-21	470 µH	.37 Ω	.46 amps
6860-25	1.0 mH	.80 Ω	.32 amps

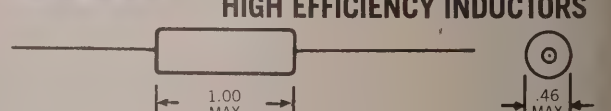
7300-KIT MEDIUM POWER HIGH EFFICIENCY INDUCTORS



This kit contains 2 each of the following:

Part No.	L	R	I PEAK
7300-01	10 µH	.055 Ω	2.8 amps
7300-03	15 µH	.069 Ω	2.2 amps
7300-05	22 µH	.084 Ω	1.9 amps
7300-07	33 µH	.11 Ω	1.5 amps
7300-09	47 µH	.13 Ω	1.3 amps
7300-11	68 µH	.15 Ω	1.1 amps
7300-13	100 µH	.27 Ω	.89 amps
7300-15	150 µH	.36 Ω	.72 amps
7300-17	220 µH	.45 Ω	.58 amps
7300-19	330 µH	.58 Ω	.47 amps
7300-21	470 µH	.86 Ω	.39 amps
7300-25	1.0 mH	2.0 Ω	.27 amps

7200-KIT HIGH POWER HIGH EFFICIENCY INDUCTORS



This kit contains 2 each of the following:

Part No.	L	R	I PEAK
7200-01	10 µH	.010 Ω	9.4 amps
7200-03	15 µH	.014 Ω	7.5 amps
7200-05	22 µH	.017 Ω	6.3 amps
7200-07	33 µH	.021 Ω	5.2 amps
7200-09	47 µH	.026 Ω	4.3 amps
7200-11	68 µH	.040 Ω	3.5 amps
7200-13	100 µH	.059 Ω	2.9 amps
7200-15	150 µH	.078 Ω	2.4 amps
7200-17	220 µH	.12 Ω	1.9 amps
7200-19	330 µH	.18 Ω	1.6 amps
7200-21	470 µH	.26 Ω	1.3 amps
7200-25	1.0 mH	.59 Ω	.92 amps

NOTE:

The 7200 and 7300 series use high permeability/high flux density cores for maximum current capacity. Core losses may reduce efficiency at higher (above 40–50 KHz) frequencies.

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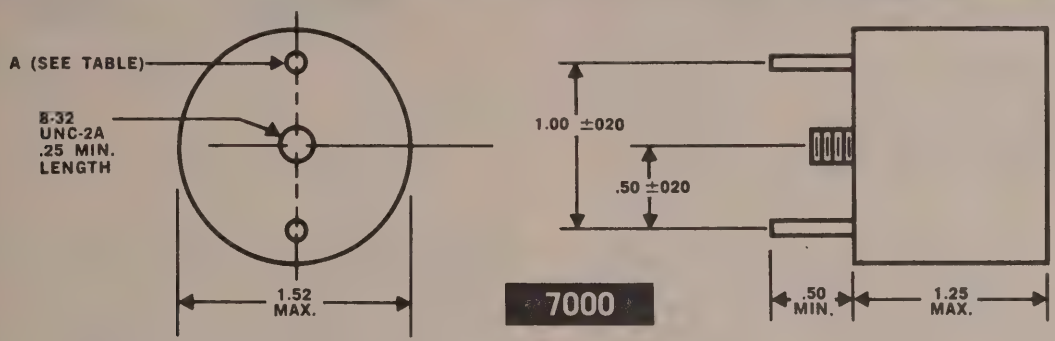
HIGH CURRENT CHOKES

FOR SWITCHING REGULATORS AND POWER FILTERS

TYPE 7000 10μH — 10 mH — 10% Tolerance



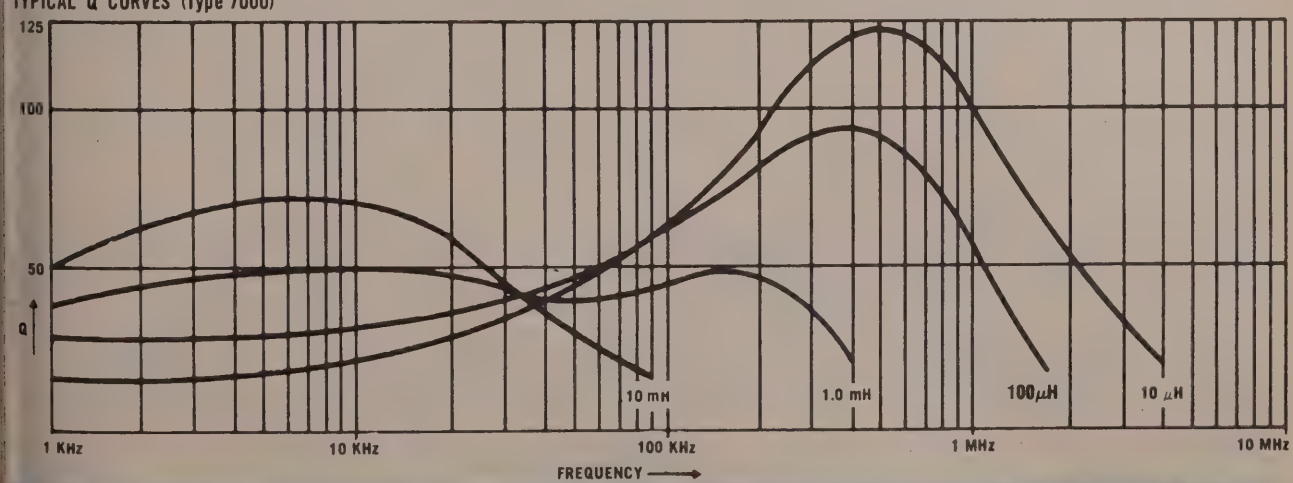
NOTES:

1. Inductance measured on General Radio 1650 B Impedance Bridge at 1 KHz.
2. Current Rating (Rated IDC) is based on 3.0 watts power dissipation for approximately 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
3. Incremental Current (INCR I) is the minimum current at which the inductance will be decreased by 5% from its initial (zero-DC) value.
4. Dielectric withstanding voltage (winding to case and mounting stud) — 500 VRMS.
5. Operating temperature range: −55°C to +105°C.
6. Materials:
   Coil Form — Ferrite.
   Magnet Wire — per FED. SPEC. J-W-001177/9 (MIL-W-583 Type B).
   Leads — Bare tinned copper.
   Mounting Stud — 18-8 stainless steel.
   Case — epoxy encapsulated.
7. Marking — Printed with Caddell-Burns Part Number.

STANDARD VALUES: (other values available on special order)

Part No.	Nominal Inductance	Max. DCR Ohms	Min. SRF MHz	Rated IDC Amps (2)	INCR I Amps (3)	A Lead Size AWG
7000-01	10 μH	.004	9.0	27	65	10
7000-02	12	.004	7.2	27	58	10
7000-03	15	.005	5.2	24	52	10
7000-04	18	.006	4.4	22	44	11
7000-05	22	.007	3.8	21	41	11
7000-06	27	.008	3.5	19	38	12
7000-07	33	.011	2.8	17	33	13
7000-08	39	.012	2.7	16	31	13
7000-09	47	.013	2.5	15	28	13
7000-10	56	.014	2.4	14	26	13
7000-11	68	.017	2.1	13	23	13
7000-12	82	.019	2.0	13	21	13
7000-13	100	.022	1.8	12	19	13
7000-14	120	.027	1.4	11	17	14
7000-15	150	.030	1.3	10	15	14
7000-16	180	.039	1.1	8.8	14	15
7000-17	220	.054	.90	7.5	13	16
7000-18	270	.060	.85	7.1	12	16
7000-19	330	.070	.75	6.5	11	16
7000-20	390 μH	.090	.65	5.8	10	17
7000-21	470	.10	.62	5.5	8.8	17
7000-22	560	.11	.56	5.2	8.0	17
7000-23	680	.14	.51	4.6	7.5	18
7000-24	820	.17	.49	4.2	6.7	18
7000-25	1.0 mH	.22	.43	3.7	6.0	19
7000-26	1.2	.25	.37	3.5	5.4	19
7000-27	1.5	.29	.36	3.2	4.8	19
7000-28	1.8	.32	.33	3.1	4.4	19
7000-29	2.2	.44	.31	2.6	4.0	20
7000-30	2.7	.50	.27	2.4	3.6	20
7000-31	3.3	.69	.23	2.1	3.2	21
7000-32	3.9	.75	.21	2.0	3.0	21
7000-33	4.7	1.0	.20	1.7	2.8	22
7000-34	5.6	1.1	.18	1.6	2.6	22
7000-35	6.8	1.3	.17	1.5	2.3	22
7000-36	8.2	1.6	.14	1.4	2.1	23
7000-37	10	1.8	.13	1.3	1.9	23

TYPICAL Q CURVES (Type 7000)



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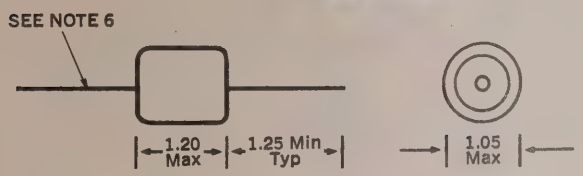
HIGH CURRENT CHOKES

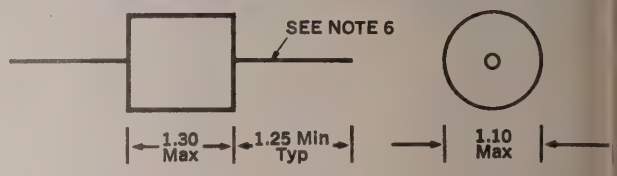
FOR SWITCHING REGULATORS AND POWER FILTERS

TYPE 7140

7140 — 10 μH-100 mH. 10% Tolerance
Recommended Mounting Pitch—1.50"

7150 — TYPE 7150 (EPOXY ENCAPSULATED VERSION)





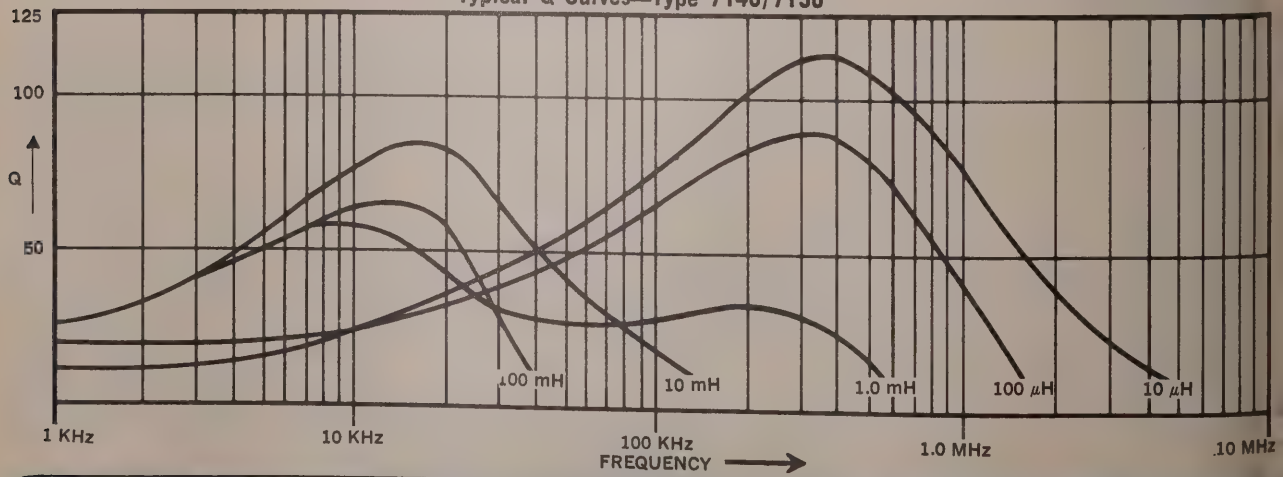
NOTES: (FOR BOTH TYPES)
1. Inductance measured on Cambridge Technology type 520 L/C Meter at 1 KHz.
2. Current rating (Rated IDC) is based on 1.5 watt power dissipation for approximately 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
3. Incremental Current (INCR I) is the minimum current at which the inductance will be decreased by 5% from its initial (zero-DC) value because of saturation.
4. Dielectric Withstanding Voltage—1000 VRMS.
5. Operating temperature range −55° to +105°C.
6. Leads are bare tinned copper: -01 thru -10, #14 AWG; -11, #15 AWG; -12 thru -49, #16 AWG.
7. Marking—Printed with Caddell-Burns Part Number.
8. Materials: (See below)
   TYPE 7140
   Coil Form: Ferrite
   Magnet Wire: Per FED SPEC J-W-001177/9
   Jacket: Flame Retardant PVC shrink tube UL Type FR-1 Per MIL-I-23053
   TYPE 7150
   Coil Form: Ferrite
   Magnet Wire: Per FED SPEC J-W-001177/9
   Cover and Coating: Epoxy encapsulated

STANDARD VALUES: (Electrical characteristics are identical for both types. Other values are available on special order.)

Dash No.	Nominal Inductance	DCR ± 20% Ohms	Min. SRF MHz	Rated IDC Amps	INCR I Amps
-01	10 μH	0.0060	8.8	16	43
-02	12	0.0065	8.0	15	39
-03	15	0.0070	7.4	15	36
-04	18	0.0080	5.4	14	32
-05	22	0.0085	3.9	13	29
-06	27	0.0090	3.3	13	26
-07	33	0.010	3.1	12	24
-08	39	0.011	2.7	12	21
-09	47	0.012	2.6	11	20
-10	56	0.013	2.3	11	18
-11	68	0.017	2.1	9.4	16
-12	82	0.023	1.8	8.1	15
-13	100	0.025	1.6	7.7	14
-14	120	0.028	1.5	7.3	12
-15	150	0.032	1.4	6.8	11
-16	180	0.042	1.2	6.0	10
-17	220	0.048	1.1	5.6	9.2
-18	270	0.055	1.0	5.2	8.0
-19	330	0.072	0.96	4.6	7.4
-20	390	0.079	0.84	4.4	6.8
-21	470	0.11	0.72	3.7	6.2
-22	560	0.12	0.64	3.5	5.7
-23	680	0.14	0.62	3.3	5.1
-24	820	0.18	0.60	2.9	4.7
-25	1.0 mH	0.20	0.52	2.7	4.2

Dash No.	Nominal Inductance	DCR ± 20% Ohms	Min. SRF MHz	Rated IDC Amps	INCR I Amps
-26	1.2 mH	0.23	0.48	2.6	3.8
-27	1.5	0.31	0.40	2.2	3.4
-28	1.8	0.35	0.37	2.1	3.1
-29	2.2	0.46	0.32	1.8	2.8
-30	2.7	0.54	0.30	1.7	2.6
-31	3.3	0.72	0.27	1.4	2.3
-32	3.9	0.79	0.25	1.4	2.1
-33	4.7	0.90	0.24	1.3	1.9
-34	5.6	1.2	0.20	1.1	1.8
-35	6.8	1.3	0.19	1.1	1.6
-36	8.2	1.7	0.16	0.94	1.5
-37	10	2.0	0.15	0.87	1.3
-38	12	2.7	0.12	0.75	1.2
-39	15	3.1	0.11	0.70	1.1
-40	18	3.5	0.10	0.65	1.0
-41	22	4.7	0.096	0.56	0.90
-42	27	5.3	0.088	0.53	0.81
-43	33	7.1	0.076	0.46	0.74
-44	39	7.9	0.070	0.44	0.68
-45	47	11	0.067	0.37	0.62
-46	56	12	0.062	0.35	0.57
-47	68	14	0.054	0.33	0.51
-48	82	18	0.051	0.29	0.46
-49	100	21	0.042	0.27	0.42

Typical Q Curves—Type 7140/7150



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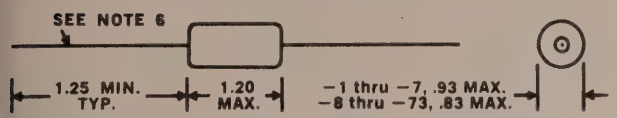
HIGH CURRENT CHOKES

FOR SWITCHING REGULATORS AND POWER FILTERS **6950**

TYPE 6950 10μH - 10H — 10% Tolerance
Recommended mounting pitch — 1.40"



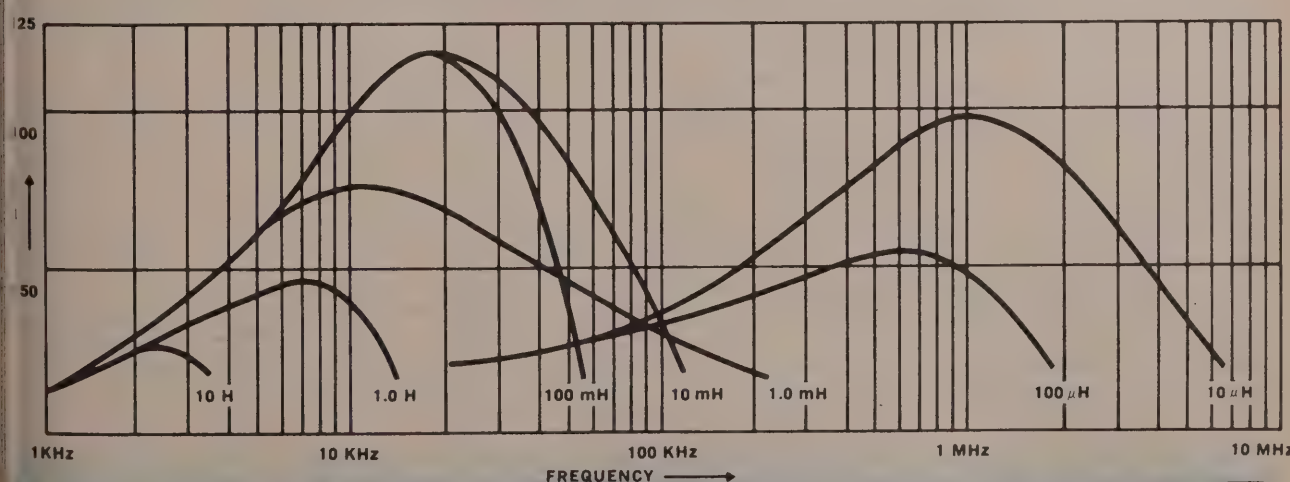
NOTES:

1. Inductance measured on General Radio 1650B Impedance Bridge at 1 KHz.
2. Current rating (Rated IDC) is based on 1.0 watt power dissipation for approximately 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
3. Incremental current (INCR I) is the minimum current at which the inductance will be decreased by 5% from its initial (zero-DC) value.
4. Dielectric withstanding voltage — 1000 VRMS.
5. Operating temperature range: −55° to +105°C.
6. Leads are bare tinned copper: −1 thru −7, #14 AWG; −8 and −9, #16 AWG; −10 thru −14, #18 AWG; −15 thru −17, #19 AWG; −18 thru −73, #20 AWG.
7. Materials:
   Coil Form — Ferrite
   Magnet Wire — Per FED. SPEC. J-W-001177/9 (MIL-W-583 Type B)
   Jacket — PVC Shrink Tube — FLAME RETARDANT UL TYPE FR-1 PER MIL-I-23053
8. Marking — Printed with Caddell-Burns Part Number.

STANDARD VALUES: (Other values available on special order)

Part No.	Nominal Inductance	Max. DCR Ohms	Min. SRF MHz	Rated IDC ma (2)	INCR I ma (3)
6950-01	10 μH	.007	12	12,000	35,000
6950-02	12	.008	8.0	11,200	32,600
6950-03	15	.009	6.0	10,500	28,400
6950-04	18	.010	5.7	10,000	25,900
6950-05	22	.011	5.3	9500	23,800
6950-06	27	.012	5.0	9100	21,000
6950-07	33	.013	4.5	8800	18,700
6950-08	39	.020	3.4	7100	17,600
6950-09	47	.022	3.2	6700	16,300
6950-10	56	.034	2.6	5400	14,700
6950-11	68	.038	2.4	5100	13,300
6950-12	82	.042	2.2	4900	12,400
6950-13	100	.048	1.9	4600	11,100
6950-14	120	.054	1.7	4300	10,100
6950-15	150	.073	1.5	3700	9100
6950-16	180	.082	1.3	3500	8300
6950-17	220	.091	1.2	3300	7500
6950-18	270	.12	1.1	2900	6800
6950-19	330	.13	1.0	2800	6100
6950-20	390	.18	.92	2400	5600
6950-21	470	.20	.84	2200	5100
6950-22	560	.26	.78	2000	4700
6950-23	680	.30	.69	1800	4300
6950-24	820	.40	.56	1600	3900
6950-25	1.0 mH	.45	.54	1500	3500
6950-26	1.2	.50	.50	1400	3200
6950-27	1.5	.70	.45	1200	2900
6950-28	1.8	.80	.43	1100	2600
6950-29	2.2	1.1	.42	950	2400
6950-30	2.7	1.2	.40	910	2100
6950-31	3.3	1.6	.28	790	1900
6950-32	3.9	1.8	.26	750	1800
6950-33	4.7	2.4	.23	650	1600
6950-34	5.6	2.6	.21	620	1500
6950-35	6.8	3.0	.20	580	1300
6950-36	8.2	4.0	.19	500	1200
6950-37	10	4.6	.18	470	1100

Part No.	Nominal Inductance	Max. DCR Ohms	Min. SRF MHz	Rated IDC ma (2)	INCR I ma (3)
6950-38	12 mH	6.1	.16	400	1000
6950-39	15	7.1	.15	380	910
6950-40	18	9.6	.14	320	830
6950-41	22	11	.12	300	750
6950-42	27	13	.095	280	680
6950-43	33	15	.085	260	610
6950-44	39	21	.077	220	560
6950-45	47	24	.067	200	510
6950-46	56	33	.065	180	470
6950-47	68	36	.062	170	430
6950-48	82	41	.057	160	390
6950-49	100	55	.051	140	350
6950-50	120	60	.048	130	320
6950-51	150	84	.040	110	290
6950-52	180	94	.033	100	260
6950-53	220	110	.032	95	240
6950-54	270	127	.030	88	210
6950-55	330	165	.027	78	190
6950-56	390	220	.023	67	180
6950-57	470	240	.021	65	160
6950-58	560	330	.020	55	150
6950-59	680	360	.017	53	130
6950-60	820	400	.016	50	120
6950-61	1.0 H	570	.014	42	110
6950-62	1.2	650	.013	40	100
6950-63	1.5	740	.012	37	90
6950-64	1.8	1000	.011	32	83
6950-65	2.2	1100	.010	30	75
6950-66	2.7	1500	.0090	26	68
6950-67	3.3	1700	.0085	24	61
6950-68	3.9	2200	.0080	21	56
6950-69	4.7	2500	.0073	20	51
6950-70	5.6	3500	.0062	17	47
6950-71	6.8	4000	.0058	16	43
6950-72	8.2	4800	.0050	15	39
6950-73	10	5400	.0042	14	35



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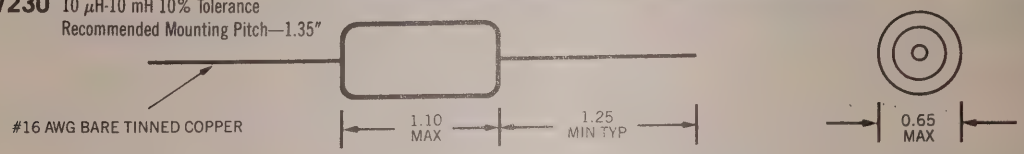
HIGH CURRENT CHOKES

FOR SWITCHING REGULATORS AND POWER FILTERS

7230

TYPE 7230 10 μH-10 mH 10% Tolerance
Recommended Mounting Pitch—1.35"



NOTES:

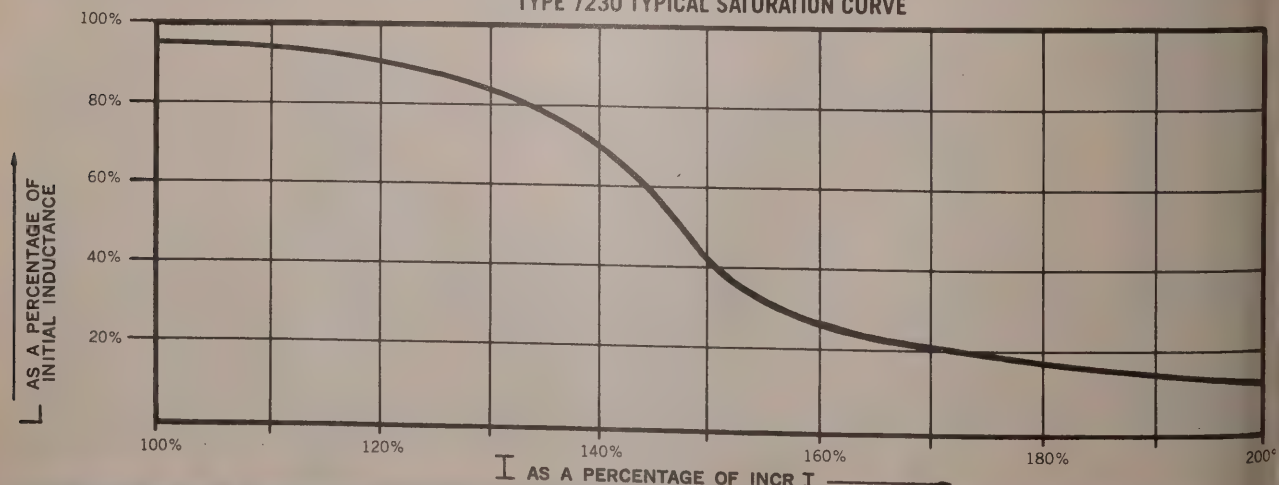
1. Inductance measured on Cambridge Technology type 520 L/C Meter at 1 KHz.
2. The current rating (Rated IDC) is based on 0.75 watt power dissipation (I^2R) for an approximate 20°C temperature rise. Depending on the application, these units may be operated at higher currents.
   The core material for the 7230 series has been chosen for optimum current handling capability. Because this material has a relatively low volume resistivity, the core will appear as a shunt resistance on the order of 1 Kilohm, which may have to be taken into account when determining total power dissipation; e.g., if the induced voltage across the coil is 10 volts, there will be a V^2/R loss on the order of 0.10 watt, in addition to the I^2R losses associated with the winding.
3. The incremental current (INCR I) is the approximate current at which the inductance will be decreased by 5% from its initial (zero-DC) value because of saturation. If the current is increased beyond INCR I, the inductance will continue to decrease as shown by the saturation curve below.
4. Dielectric Withstanding Voltage: 1000 VRMS.
5. Operating Temperature Range: −55° to +105°C.
6. Marking: Printed with Caddell-Burns Part Number.
7. Materials:
   Coil Form: Ferrite
   Magnet Wire: Per FED SPEC J-W-001177/9
   Jacket: Flame Retardant PVC shrink tube UL Type FR-1 per MIL-I-23053

STANDARD VALUES: (Other values available on special order)

Part No.	Nominal Inductance	DCR ± 20% Ohms	Min. SRF MHz	Rated IDC Amps	INCR I Amps
7230-01	10 μH	0.0065	5.4	11	23
7230-02	12	0.0070	4.7	10	22
7230-03	15	0.0080	4.2	9.7	19
7230-04	18	0.011	3.8	8.3	18
7230-05	22	0.016	3.4	6.9	16
7230-06	27	0.021	3.1	6.0	14
7230-07	33	0.023	2.8	5.7	13
7230-08	39	0.025	2.5	5.5	12
7230-09	47	0.028	2.2	5.2	11
7230-10	56	0.031	2.0	4.9	10
7230-11	68	0.043	1.8	4.2	9.0
7230-12	82	0.047	1.6	4.0	8.3
7230-13	100	0.063	1.5	3.5	7.6
7230-14	120	0.086	1.4	3.0	6.8
7230-15	150	0.097	1.2	2.8	6.1
7230-16	180	0.11	1.1	2.6	5.6
7230-17	220	0.12	0.95	2.5	5.1
7230-18	270	0.17	0.85	2.1	4.6
7230-19	330	0.19	0.77	2.0	4.1

Part No.	Nominal Inductance	DCR ± 20% Ohms	Min. SRF MHz	Rated IDC Amps	INCR I Amps
7230-20	390 μH	0.21	0.70	1.9	3.8
7230-21	470	0.29	0.63	1.6	3.5
7230-22	560	0.32	0.56	1.5	3.2
7230-23	680	0.43	0.51	1.3	2.9
7230-24	820	0.47	0.45	1.3	2.6
7230-25	1.0 mH	0.54	0.41	1.2	2.4
7230-26	1.2	0.71	0.36	1.0	2.2
7230-27	1.5	1.0	0.33	0.87	1.9
7230-28	1.8	1.1	0.30	0.83	1.8
7230-29	2.2	1.3	0.27	0.76	1.6
7230-30	2.7	1.7	0.24	0.66	1.4
7230-31	3.3	2.3	0.22	0.57	1.3
7230-32	3.9	2.5	0.20	0.55	1.2
7230-33	4.7	2.8	0.18	0.52	1.1
7230-34	5.6	3.1	0.16	0.49	1.0
7230-35	6.8	4.2	0.14	0.42	0.91
7230-36	8.2	4.7	0.13	0.40	0.83
7230-37	10	5.3	0.12	0.38	0.75

TYPE 7230 TYPICAL SATURATION CURVE



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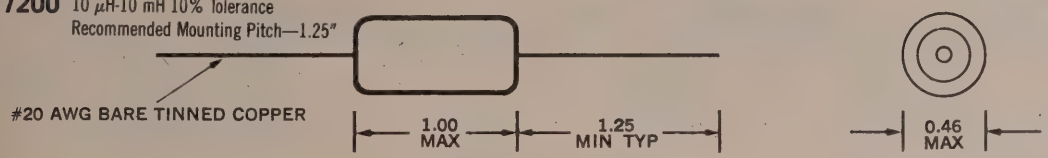
HIGH CURRENT CHOKES

FOR SWITCHING REGULATORS AND POWER FILTERS

7200

TYPE 7200 10 μH-10 mH 10% Tolerance
Recommended Mounting Pitch—1.25"



NOTES:

1. Inductance measured on Cambridge Technology type 520 L/C Meter at 1 KHz.
2. The current rating (Rated IDC) is based on 0.5 watt power dissipation (I^2R) for an approximate 20°C temperature rise. Depending on the application, these units may be operated at higher currents.

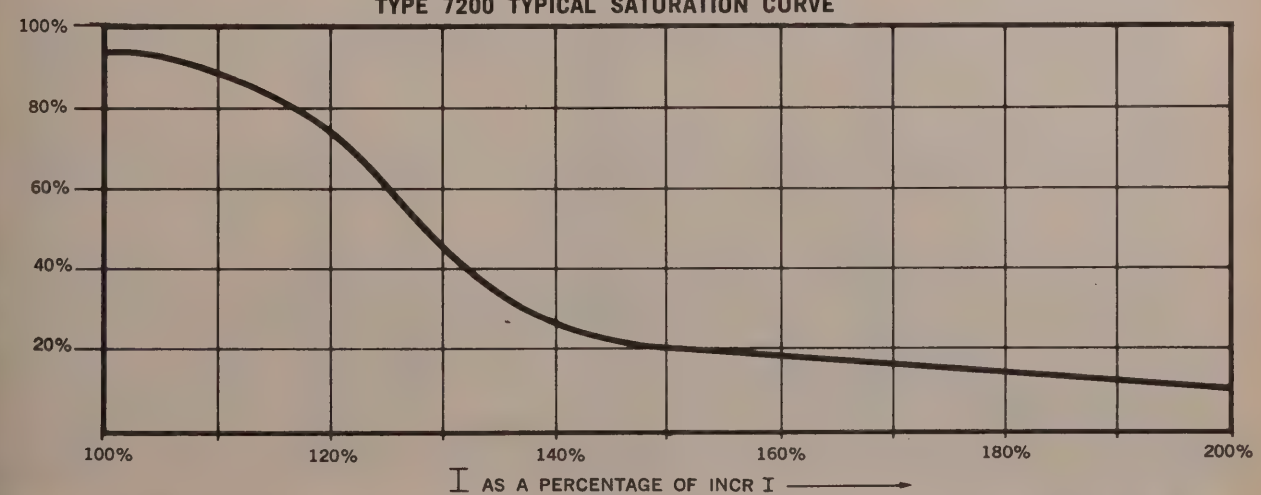
   The core material for the 7200 series has been chosen for optimum current handling capability. Because this material has a relatively low volume resistivity, the core will appear as a shunt resistance on the order of 1 Kilohm, which may have to be taken into account when determining total power dissipation; e.g., if the induced voltage across the coil is 10 volts, there will be a V^2/R loss on the order of 0.10 watt, in addition to the I^2R losses associated with the winding.
3. The incremental current (INCR I) is the approximate current at which the inductance will be decreased by 5% from its initial (zero-DC) value because of saturation. If the current is increased beyond INCR I, the inductance will continue to decrease as shown by the saturation curve below.
4. Dielectric Withstanding Voltage: 1000 VRMS.
5. Operating Temperature Range: −55° to +105°C.
6. Marking: Printed with Caddell-Burns Part Number.
7. Materials:

   Coil Form: Ferrite
   Magnet Wire: Per FED SPEC J-W-001177/9
   Jacket: Flame Retardant PVC shrink tube UL Type FR-1 per MIL-I-23053

STANDARD VALUES: (Other values available on special order)

Part No.	Nominal Inductance	DCR ± 20% Ohms	Min. SRF MHz	Rated IDC Amps	INCR I Amps
7200-01	10 μH	0.010	6.0	7.1	9.4
7200-02	12	0.012	4.8	6.5	8.3
7200-03	15	0.014	4.0	6.0	7.5
7200-04	18	0.015	3.3	5.8	7.1
7200-05	22	0.017	2.9	5.4	6.3
7200-06	27	0.018	2.5	5.3	5.8
7200-07	33	0.021	2.2	4.9	5.2
7200-08	39	0.023	2.0	4.7	4.7
7200-09	47	0.026	1.7	4.4	4.3
7200-10	56	0.030	1.5	4.1	3.8
7200-11	68	0.040	1.3	3.5	3.5
7200-12	82	0.053	1.2	3.1	3.2
7200-13	100	0.059	1.1	2.9	2.9
7200-14	120	0.068	1.0	2.7	2.6
7200-15	150	0.078	0.90	2.5	2.4
7200-16	180	0.089	0.82	2.4	2.2
7200-17	220	0.12	0.74	2.0	1.9
7200-18	270	0.16	0.68	1.8	1.8
7200-19	330	0.18	0.61	1.7	1.6
7200-20	390 μH	0.20	0.56	1.6	1.5
7200-21	470	0.26	0.51	1.4	1.3
7200-22	560	0.29	0.47	1.3	1.2
7200-23	680	0.39	0.43	1.1	1.1
7200-24	820	0.44	0.39	1.1	1.0
7200-25	1.0 mH	0.59	0.36	0.92	0.92
7200-26	1.2	0.66	0.33	0.87	0.84
7200-27	1.5	0.77	0.31	0.81	0.75
7200-28	1.8	0.87	0.29	0.76	0.68
7200-29	2.2	1.2	0.27	0.65	0.62
7200-30	2.7	1.6	0.25	0.56	0.56
7200-31	3.3	1.8	0.23	0.53	0.51
7200-32	3.9	2.0	0.22	0.50	0.47
7200-33	4.7	2.6	0.20	0.44	0.42
7200-34	5.6	2.9	0.19	0.42	0.39
7200-35	6.8	3.4	0.18	0.38	0.35
7200-36	8.2	4.4	0.17	0.34	0.32
7200-37	10	6.0	0.16	0.29	0.29

TYPE 7200 TYPICAL SATURATION CURVE



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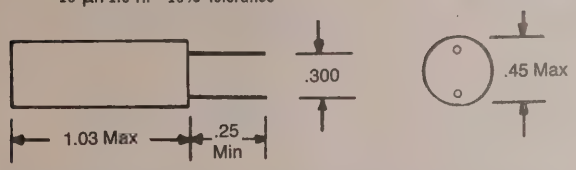
HIGH CURRENT CHOKES

TYPE 6890

6890

10 µH-1.0 H. 10% Tolerance

FOR SWITCHING REGULATORS AND POWER FILTERS



SPECIAL FEATURES

- **SINGLE ENDED** for minimum footprint
- **ENCAPSULATED** to withstand harsh environments
- **LOW RESISTANCE** for maximum efficiency

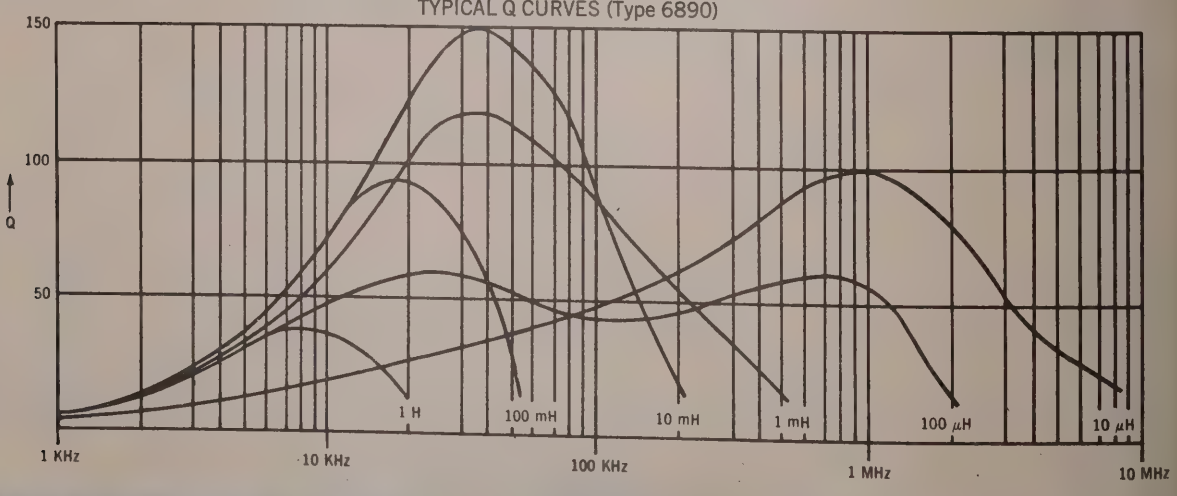
NOTES:

1. INDUCTANCE measured on Cambridge Technology type 520 L/C Meter at 1 KHz.
2. CURRENT RATING (Rated IDC) is based on 0.5 watt power dissipation for approximately 20°C temperature rise. Depending on the application, these units may be operated at higher currents.
3. INCREMENTAL CURRENT (INCR I) is the minimum current at which the inductance will be decreased by 5% because of saturation.
4. DIELECTRIC WITHSTANDING VOLTAGE: 1000 VRMS
5. OPERATING TEMPERATURE RANGE: –55° to +105°C.
6. MATERIALS:
   Coil Form: Ferrite
   Magnet Wire: Per FED SPEC J-W-001177/9
   Case: Epoxy encapsulated
   Leads: #20 AWG (.032 dia) tinned copper.

STANDARD VALUES: (Other values available on special order)

Part No.	Nominal Inductance	Max. DCR Ohms	Min. SRF MHz	Rated IDC ma	INCR I ma
6890-01	10 µH	.023	45	4600	3200
6890-02	12	.025	40	4500	2900
6890-03	15	.030	32	4100	2600
6890-04	18	.032	21	3900	2400
6890-05	22	.035	12	3700	2200
6890-06	27	.038	8.5	3600	2000
6890-07	33	.043	5.8	3400	1800
6890-08	39	.047	3.5	3200	1700
6890-09	47	.054	3.2	3000	1500
6890-10	56	.060	2.9	2900	1400
6890-11	68	.068	2.7	2700	1200
6890-12	82	.073	2.5	2600	1100
6890-13	100	.098	2.3	2300	1000
6890-14	120	.14	2.1	1900	930
6890-15	150	.18	1.9	1700	830
6890-16	180	.20	1.5	1600	760
6890-17	220	.28	1.3	1400	680
6890-18	270	.31	1.3	1300	620
6890-19	330	.35	1.2	1200	560
6890-20	390	.38	1.1	1100	510
6890-21	470	.44	1.0	1050	460
6890-22	560	.48	.90	1000	430
6890-23	680	.63	.80	890	390
6890-24	820	.87	.72	760	350
6890-25	1.0 mH	.96	.65	720	320
6890-26	1.2	1.3	.62	620	290
6890-27	1.5	1.4	.58	600	260
6890-28	1.8	1.7	.53	540	240
6890-29	2.2	2.3	.44	470	220
6890-30	2.7	2.6	.39	440	190
6890-31	3.3	3.5	.36	380	180
6890-32	3.9 mH	3.8	.34	360	160
6890-33	4.7	4.3	.32	340	150
6890-34	5.6	5.6	.26	300	140
6890-35	6.8	6.3	.24	280	120
6890-36	8.2	8.6	.21	240	110
6890-37	10	9.7	.20	220	100
6890-38	12	11	.19	210	92
6890-39	15	15	.17	180	84
6890-40	18	20	.14	160	75
6890-41	22	24	.13	140	68
6890-42	27	26	.12	130	62
6890-43	33	35	.10	120	56
6890-44	39	38	.095	110	51
6890-45	57	50	.080	100	47
6890-46	56	55	.072	95	43
6890-47	68	76	.066	81	39
6890-48	82	86	.062	76	35
6890-49	100	99	.057	71	32
6890-50	120	110	.052	67	29
6890-51	150	200	.047	50	26
6890-52	180	220	.043	48	24
6890-53	220	300	.038	41	22
6890-54	270	320	.035	40	20
6890-55	330	420	.032	35	18
6890-56	390	480	.029	32	16
6890-57	470	670	.026	27	15
6890-58	560	730	.024	26	14
6890-59	680	870	.019	24	12
6890-60	820	950	.018	23	11
6890-61	1.0 H	1100	.017	21	10

TYPICAL Q CURVES (Type 6890)



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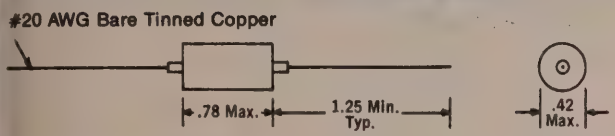
HIGH CURRENT CHOKES

FOR SWITCHING REGULATORS AND POWER FILTERS

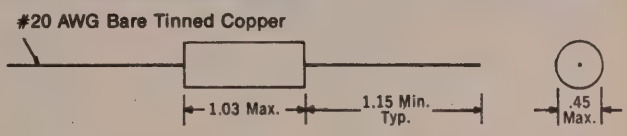
TYPE 6860

6860 10 μH-1.0 mH. 10% Tolerance
Recommended Mounting Pitch—1.25"



TYPE 6870 (EPOXY ENCAPSULATED VERSION)

6870



NOTES: (FOR BOTH TYPES)

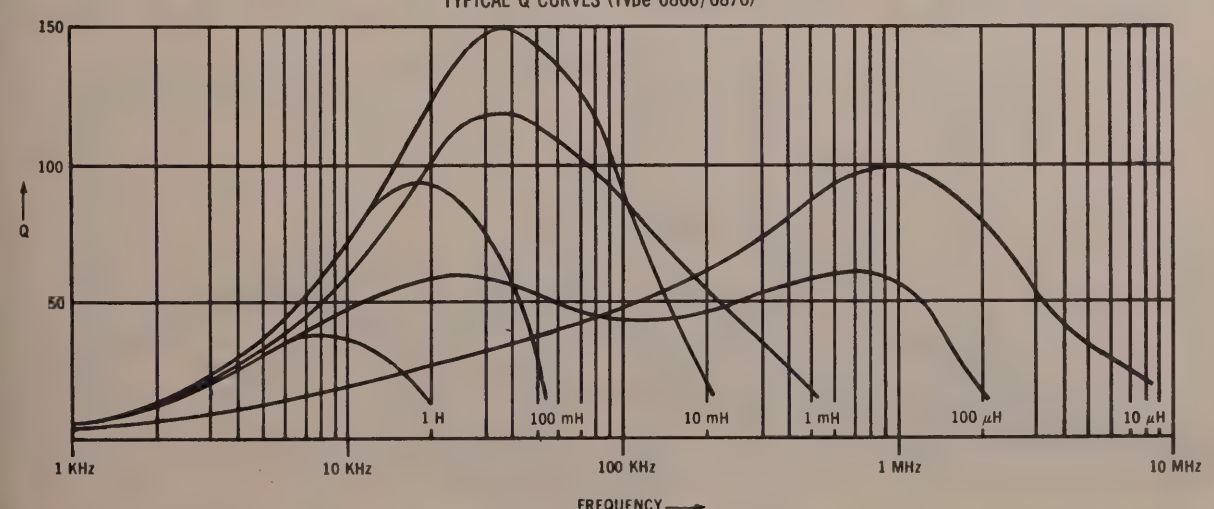
1. Inductance (Ls) measured on General Radio 1650B Impedance Bridge at 1 KHz.
2. Current rating (Rated IDC) is based on 0.5 watt power dissipation for approximately 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
3. Incremental current (INCR I) is the minimum current at which the inductance will be decreased by 5% from its initial (zero-DC) value.
4. Dielectric Withstanding Voltage — 1000 VRMS.
5. Operating temperature range — 55° to + 105°C.
6. Materials:
   Coil Form: Ferrite.
   Cover: TYPE 6860 - Polyester alpha-cellulose.
   Coating: Polyurethane per MIL-1-46058.
   TYPE 6870- Cover & Coating: Epoxy encapsulated.
   Magnet Wire: Per FED SPEC J-W-001177/9 (MIL-W-583 Type B)

STANDARD VALUES: (Electrical characteristics are identical for both types. Other values are available on special order.)

Dash No.	Nominal Inductance	Max. DCR Ohms	Min. SRF MHz	Rated IDC ma	INCR I ma
-01	10 μH	.023	45	4600	3200
-02	12	.025	40	4500	2900
-03	15	.030	32	4100	2600
-04	18	.032	21	3900	2400
-05	22	.035	12	3700	2200
-06	27	.038	8.5	3600	2000
-07	33	.043	5.8	3400	1800
-08	39	.047	3.5	3200	1700
-09	47	.054	3.2	3000	1500
-10	56	.060	2.9	2900	1400
-11	68	.068	2.7	2700	1200
-12	82	.073	2.5	2600	1100
-13	100	.098	2.3	2300	1000
-14	120	.14	2.1	1900	930
-15	150	.18	1.9	1700	830
-16	180	.20	1.5	1600	760
-17	220	.28	1.3	1400	680
-18	270	.31	1.3	1300	620
-19	330	.35	1.2	1200	560
-20	390	.38	1.1	1100	510
-21	470	.44	1.0	1050	460
-22	560	.48	.90	1000	430
-23	680	.63	.80	890	390
-24	820	.87	.72	760	350
-25	1.0 mH	.96	.65	720	320
-26	1.2	1.3	.62	620	290
-27	1.5	1.4	.58	600	260
-28	1.8	1.7	.53	540	240
-29	2.2	2.3	.44	470	220
-30	2.7	2.6	.39	440	190
-31	3.3	3.5	.36	380	180

Dash No.	Nominal Inductance	Max. DCR Ohms	Min. SRF MHz	Rated IDC ma	INCR I ma
-32	3.9 mH	3.8	.34	360	160
-33	4.7	4.3	.32	340	150
-34	5.6	5.6	.26	300	140
-35	6.8	6.3	.24	280	120
-36	8.2	8.6	.21	240	110
-37	10	9.7	.20	220	100
-38	12	11	.19	210	92
-39	15	15	.17	180	84
-40	18	20	.14	160	75
-41	22	24	.13	140	68
-42	27	26	.12	130	62
-43	33	35	.10	120	56
-44	39	38	.095	110	51
-45	47	50	.080	100	47
-46	56	55	.072	95	43
-47	68	76	.066	81	39
-48	82	86	.062	76	35
-49	100	99	.057	71	32
-50	120	110	.052	67	29
-51	150	200	.047	50	26
-52	180	220	.043	48	24
-53	220	300	.038	41	22
-54	270	320	.035	40	20
-55	330	420	.032	35	18
-56	390	480	.029	32	16
-57	470	670	.026	27	15
-58	560	730	.024	26	14
-59	680	870	.019	24	12
-60	820	950	.018	23	11
-61	1.0 H	1100	.017	21	10

TYPICAL Q CURVES (Type 6860/6870)



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MINIATURE HIGH CURRENT CHOKES

FOR SWITCHING REGULATORS AND POWER FILTERS

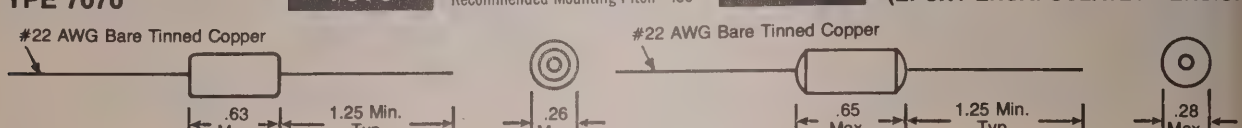
TYPE 7070

7070

1.0μH-100mH. 10% Tolerance
Recommended Mounting Pitch—.80"

7080

TYPE 7080
(EPOXY ENCAPSULATED VERSION)



NOTES: (FOR BOTH TYPES)

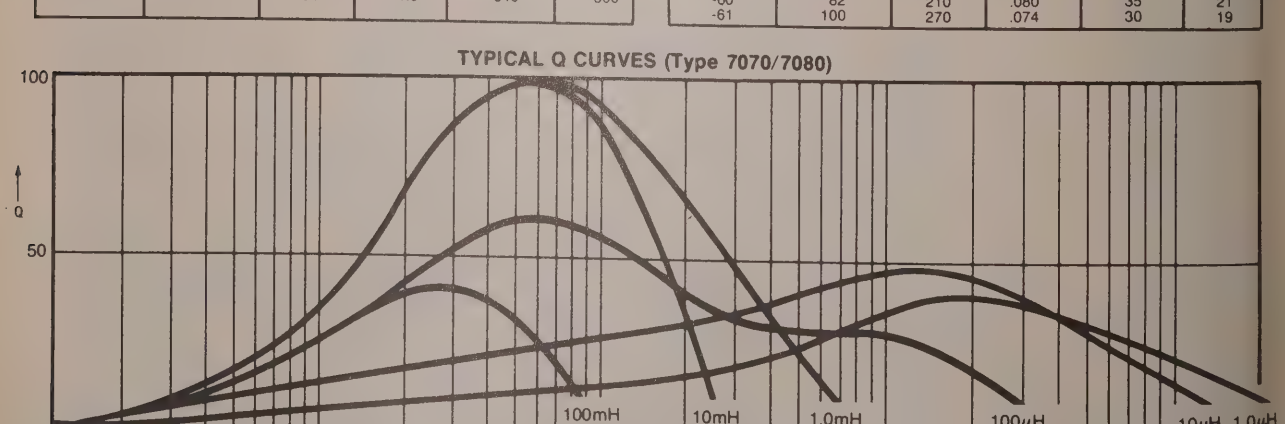
1. INDUCTANCE:
   For 1.0μH thru 8.2μH; effective inductance measured on Boonton 260A Q-meter at 7.9 MHz in accordance with MIL-C-15305.
   For 10μH thru 100mH; inductance (Ls) measured on General Radio 1650B Impedance Bridge at 1 KHz.
2. Current rating (Rated IDC) is based on 0.25 watt power dissipation for approximately 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
3. Incremental current (INCR I) is the minimum current at which the inductance will be decreased by 5% from its initial (zero-DC) value.
4. Dielectric Withstanding Voltage — 1000 VRMS.
5. Operating temperature range −55° to +105°C.
6. Materials:
   Coil Form: Ferrite
   Cover: TYPE 7070 - PVC shrink tube-flame retardant UL type FR-1 per MIL-I-23053
   TYPE 7080 - Epoxy encapsulated.
   Magnet Wire: Per FED SPEC J-W-001177/9 (MIL-W-583 Type B)

STANDARD VALUES: (Electrical characteristics are identical for both types. Other values are available on special order.)

Dash No.	Nominal Inductance	Max. DCR Ohms	Min. SRF MHz	Rated IDC ma	INCR I ma
-01	1.0μH	.010	155	5,000	6,400
-02	1.2	.011	148	4,800	6,000
-03	1.5	.012	128	4,600	5,000
-04	1.8	.013	120	4,400	4,500
-05	2.2	.014	108	4,200	4,100
-06	2.7	.015	100	4,100	3,600
-07	3.3	.016	96	4,000	3,200
-08	3.9	.017	90	3,800	3,000
-09	4.7	.022	85	3,400	2,700
-10	5.6	.028	76	3,000	2,500
-11	6.8	.031	70	2,800	2,300
-12	8.2	.035	51	2,700	2,000
-13	10	.038	35	2,600	1,900
-14	12	.043	21	2,400	1,700
-15	15	.049	14	2,300	1,500
-16	18	.054	10	2,200	1,400
-17	22	.059	8.0	2,100	1,300
-18	27	.070	6.5	1,900	1,100
-19	33	.077	6.1	1,800	1,000
-20	39	.084	5.7	1,700	940
-21	47	.093	5.1	1,600	870
-22	56	.12	4.3	1,500	790
-23	68	.13	3.6	1,400	710
-24	82	.16	3.2	1,300	650
-25	100	.24	3.0	1,000	590
-26	120	.32	2.7	880	540
-27	150	.43	2.1	760	480
-28	180	.48	1.7	720	440
-29	220	.55	1.6	670	400
-30	270	.62	1.5	640	360

Dash No.	Nominal Inductance	Max. DCR Ohms	Min. SRF MHz	Rated IDC ma	INCR I ma
-31	330μH	.72	1.4	590	320
-32	390	.79	1.3	560	300
-33	470	.88	1.2	530	270
-34	560	1.2	1.1	460	250
-35	680	1.5	1.0	410	230
-36	820	1.7	.96	380	210
-37	1.0mH	1.9	.88	360	190
-38	1.2	2.4	.78	320	170
-39	1.5	2.8	.64	300	150
-40	1.8	3.1	.60	280	140
-41	2.2	4.5	.54	240	120
-42	2.7	5.8	.44	210	110
-43	3.3	8.1	.43	180	100
-44	3.9	8.9	.40	170	95
-45	4.7	10	.38	160	86
-46	5.6	11	.35	150	79
-47	6.8	15	.29	130	72
-48	8.2	17	.26	120	65
-49	10	22	.24	110	59
-50	12	26	.23	100	54
-51	15	34	.19	86	48
-52	18	39	.17	80	44
-53	22	54	.16	68	40
-54	27	62	.15	64	36
-55	33	82	.12	55	32
-56	39	93	.11	52	30
-57	47	120	.096	46	27
-58	56	130	.092	44	25
-59	68	190	.088	36	23
-60	82	210	.080	35	21
-61	100	270	.074	30	19

TYPICAL Q CURVES (Type 7070/7080)



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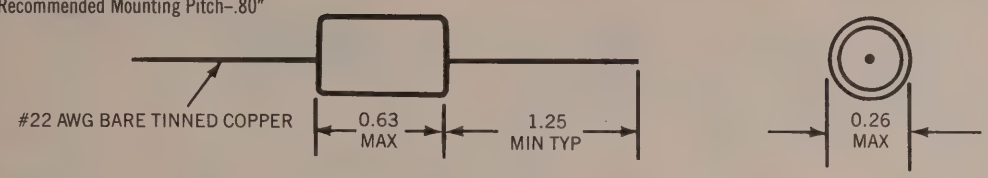
MINIATURE HIGH CURRENT CHOKES

FOR SWITCHING REGULATORS AND POWER FILTERS **7300**

TYPE 7300 10μH–10mH 10% Tolerance
Recommended Mounting Pitch–.80"



NOTES:

1. Inductance measured on Cambridge Technology type 520 L/C Meter at 1 KHz.
2. The current rating (Rated IDC) is based on 0.25 watt power dissipation (I^2R) for an approximate 20°C temperature rise. Depending on the application, these units may be operated at higher currents.

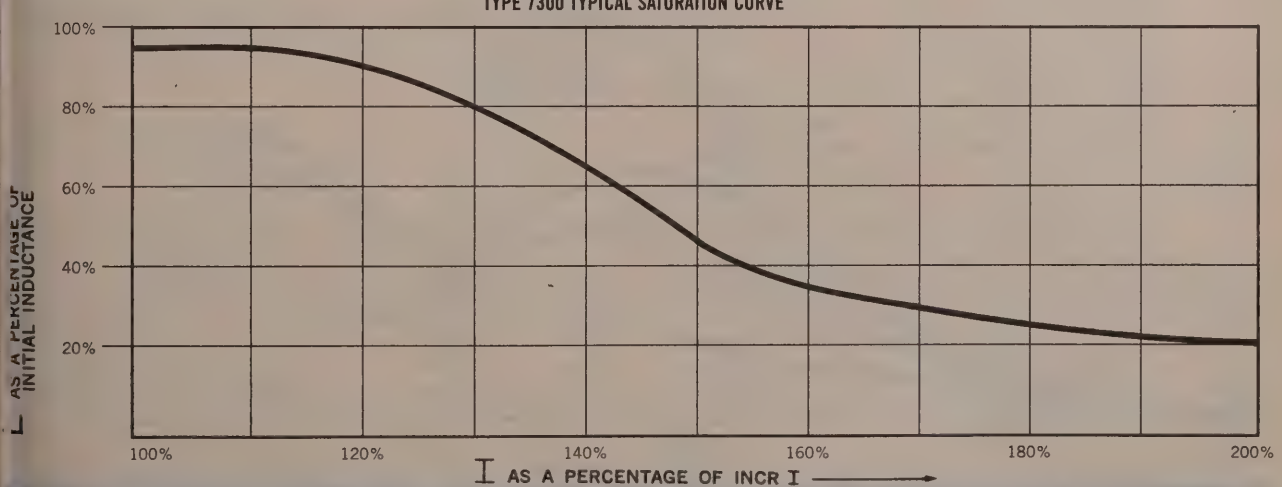
   The core material for the 7300 series has been chosen for optimum current handling capability. Because this material has a relatively low volume resistivity, the core will appear as a shunt resistance on the order of 1 Kilohm, which may have to be taken into account when determining total power dissipation; e.g., if the induced voltage ($2\pi fLI$) across the coil is 10 volts, there will be a V^2/R loss on the order of 0.10 watt, in addition to the I^2R losses associated with the winding. This is not usually a factor unless the choke is operated at high levels of R.F. excitation.
3. The incremental current (INCR I) is the approximate current at which the inductance will be decreased by 5% from its initial (zero-DC) value because of saturation. If the current is increased beyond INCR I, the inductance will continue to decrease as shown by the saturation curve below.
4. Dielectric Withstanding Voltage: 1000 VRMS.
5. Operating Temperature Range: −55° to +105°C.
6. Marking: Printed with Caddell-Burns Part Number.
7. Materials:
   Coil Form: Ferrite
   Magnet Wire: Per FED SPEC J-W 001177/9
   Jacket: Flame Retardant PVC shrink tube UL Type FR-1 per MIL-I-23053.

STANDARD VALUES: (Other values available on special order)

Part No.	Nominal Inductance	DCR ± 20% Ohms	Min. SRF MHz	Rated IDC Amps	INCR I Amps
7300-01	10 μH	0.055	9.0	2.1	2.8
7300-02	12	0.061	8.0	2.0	2.6
7300-03	15	0.069	7.0	1.9	2.2
7300-04	18	0.077	6.2	1.8	2.1
7300-05	22	0.084	5.6	1.7	1.9
7300-06	27	0.093	5.0	1.6	1.7
7300-07	33	0.11	4.4	1.5	1.5
7300-08	39	0.12	3.8	1.4	1.4
7300-09	47	0.13	3.4	1.4	1.3
7300-10	56	0.14	3.0	1.3	1.2
7300-11	68	0.15	2.7	1.3	1.1
7300-12	82	0.17	2.4	1.2	0.98
7300-13	100	0.27	2.1	0.96	0.89
7300-14	120	0.31	1.9	0.90	0.80
7300-15	150	0.36	1.7	0.83	0.72
7300-16	180	0.39	1.5	0.80	0.66
7300-17	220	0.45	1.3	0.75	0.58
7300-18	270	0.49	1.2	0.71	0.54
7300-19	330	0.58	1.0	0.66	0.47

Part No.	Nominal Inductance	DCR ± 20% Ohms	Min. SRF MHz	Rated IDC Amps	INCR I Amps
7300-20	390 μH	0.64	0.90	0.63	0.43
7300-21	470	0.86	0.80	0.54	0.39
7300-22	560	0.93	0.72	0.52	0.37
7300-23	680	1.1	0.64	0.48	0.33
7300-24	820	1.5	0.56	0.41	0.30
7300-25	1.0 mH	2.0	0.50	0.35	0.27
7300-26	1.2	2.2	0.44	0.34	0.25
7300-27	1.5	3.0	0.40	0.29	0.22
7300-28	1.8	3.4	0.35	0.27	0.20
7300-29	2.2	3.8	0.32	0.26	0.18
7300-30	2.7	4.4	0.28	0.24	0.16
7300-31	3.3	5.9	0.25	0.21	0.15
7300-32	3.9	7.9	0.22	0.18	0.14
7300-33	4.7	8.9	0.19	0.17	0.12
7300-34	5.6	12	0.17	0.14	0.11
7300-35	6.8	13	0.15	0.14	0.10
7300-36	8.2	14	0.14	0.13	0.094
7300-37	10	17	0.12	0.12	0.084

TYPE 7300 TYPICAL SATURATION CURVE



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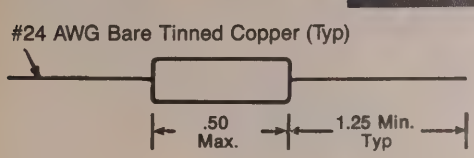
MINIATURE HIGH CURRENT CHOKES

FOR SWITCHING REGULATORS AND POWER FILTERS

TYPE 7120

7120

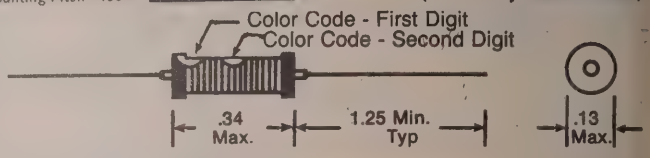
1.0μH-10mH. 10% Tolerance
Recommended Mounting Pitch—.60"



TYPE 7130

(conformally coated version)

7130



NOTES: (FOR BOTH TYPES)

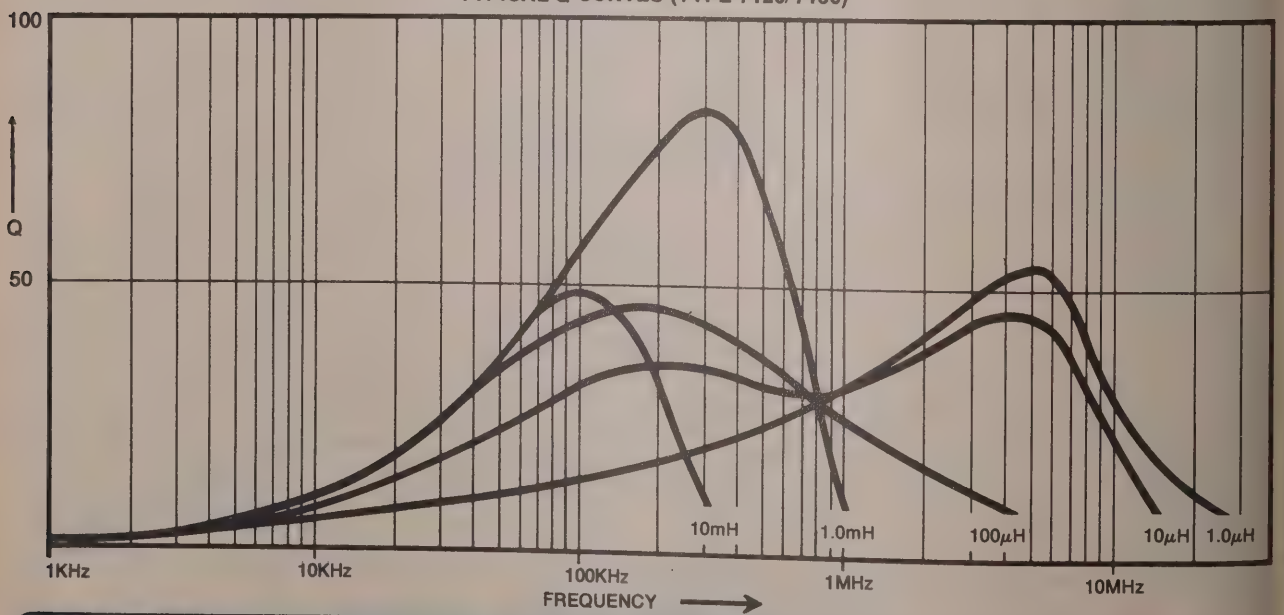
1. Inductance:
   For 1.0μH thru 8.2μH; effective inductance measured on Boonton 260A Q-meter at 7.9 MHz in accordance with MIL-C-15305. For 10μH thru 10mH, inductance (Ls) measured on General Radio 1650 B Impedance Bridge at 1 KHz.
2. Current Rating (Rated 1 DC) is based on 0.2 watt power dissipation for approximately 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
3. Incremental current (INCR 1) is the minimum current at which the inductance will be decreased by 5% from its initial (zero - DC) value because of saturation.
4. Dielectric Withstanding Voltage:
   Type 7120 - 1000 VRMS
   Type 7130 - 100 VRMS
5. Operating temperature range -55° to +105°C.
6. Materials:
   Coil Form: Ferrite
   Cover: Type 7120 - PVC shrink tube - flame retardant UL type FR-1 per MIL-I-23053
   Type 7130 - conformally coated with Polyurethane per MIL-I-46058
   Magnet Wire: Per FED SPEC J-W-001177/9
   (MIL-W-583 Type B)
7. Marking:
   Type 7120 - Printed with part number
   Type 7130 - Color coded per dash number using standard EIA color code.

STANDARD VALUES (Electrical Characteristics are identical for both types. Other values are available on special order.)

Dash No.	Nominal Inductance	Max. DCR Ohms	Min. SRF MHz	Rated IDC ma	INCR I ma
-01	1.0 μH	.018	190	3300	3000
-02	1.2	.019	170	3200	2700
-03	1.5	.020	160	3100	2500
-04	1.8	.023	150	2900	2100
-05	2.2	.031	130	2600	2000
-06	2.7	.033	120	2500	1900
-07	3.3	.054	110	1900	1700
-08	3.9	.060	100	1800	1500
-09	4.7	.068	86	1700	1400
-10	5.6	.074	64	1600	1300
-11	6.8	.080	44	1600	1200
-12	8.2	.087	32	1500	1100
-13	10	.095	25	1500	970
-14	12	.11	17	1400	880
-15	15	.15	13	1200	790
-16	18	.16	10	1100	710
-17	22	.19	8.4	1000	640
-18	27	.22	8.0	950	580
-19	33	.24	7.6	910	530
-20	39	.26	7.1	880	480
-21	47	.35	6.0	760	430
-22	56	.47	5.8	650	400
-23	68	.53	4.3	610	370
-24	82	.60	4.1	580	330
-25	100	.67	3.9	550	300

Dash No.	Nominal Inductance	Max. DCR Ohms	Min. SRF MHz	Rated IDC ma	INCR I ma
-26	120 μH	.90	3.6	470	270
-27	150	1.2	3.2	410	250
-28	180	1.4	2.8	380	220
-29	220	1.9	2.3	320	200
-30	270	2.1	2.1	310	180
-31	330	2.4	1.9	290	170
-32	390	3.0	1.7	260	150
-33	470	3.4	1.4	240	140
-34	560	4.7	1.3	210	130
-35	680	6.4	1.2	180	110
36	820	7.1	1.1	170	100
-37	1.0 mH	7.9	1.0	160	95
-38	1.2	9.0	.94	150	87
-39	1.5	12	.76	130	78
-40	1.8	14	.72	120	71
-41	2.2	19	.64	100	64
-42	2.7	25	.56	90	58
-43	3.3	29	.53	83	52
-44	3.9	34	.48	77	48
-45	4.7	37	.45	74	44
-46	5.6	50	.40	63	40
-47	6.8	58	.36	59	36
-48	8.2	68	.29	54	33
-49	10	75	.27	52	30

TYPICAL Q CURVES (TYPE 7120/7130)



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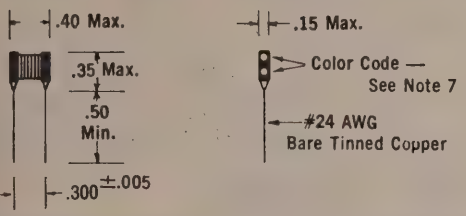
PRINTED CIRCUIT CHOKES TYPE 6550 1.0μH-10mH 10% Tolerance

6550



NOTES:
1. Effective inductance and Q measured on Boonton 260A Q-meter at frequencies specified, in accordance with MIL-C-15305.
2. Current rating (Rated IDC) is based on 0.2 watt power dissipation for approx. 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
3. Incremental current (INCR I) is the minimum current at which the inductance will be decreased by 5% from its initial (zero — DC) value.
4. Dielectric Withstanding Voltage — 100 VRMS.
5. Operating Temperature Range — −55°C to +105°C.
6. Materials:
   Coil Form — Ferrite.
   Magnet Wire — Type B per MIL-W-583.
   Coating — Polyurethane per MIL-I-46058.
7. Marking — color coded per dash number using standard EIA color code.

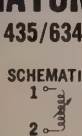
STANDARD VALUES: (Other values available on special order.)

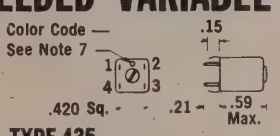
Part No.	Nominal Inductance	Min. Q	Test Freq. MHz	Max. DCR Ohms	Min. SRF MHz	Rated IDC ma See Note 2	INCR I ma See Note 3
6550-1	1.0μH	90	7.9	.015	180	3600	7000
6550-2	2.5	85	7.9	.03	110	2500	4100
6550-3	5.0	90	7.9	.06	75	1800	2900
6550-4	7.5	95	7.9	.11	70	1300	2500
6550-5	10	90	7.9	.19	55	1020	2100
6550-6	25	80	2.5	.50	18	630	1300
6550-7	50	70	2.5	1.1	11	420	1000
6550-8	75	45	2.5	1.2	5.5	400	860
6550-9	100	85	.79	1.5	2.8	365	700
6550-10	250	55	.79	2.7	1.6	270	450
6550-11	500	35	.79	3.3	1.3	240	340
6550-12	750	30	.79	4.2	1.2	215	280
6550-13	1.0mH	80	.25	8.6	1.0	150	210
6550-14	2.5	75	.25	16	.53	110	140
6550-15	5.0	45	.25	31	.45	80	100
6550-16	7.5	25	.25	50	.32	63	80
6550-17	10	50	.079	70	.26	53	70

MINIATURE SHIELDED VARIABLE INDUCTORS

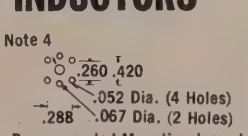
TYPES 435/6344 .25-70μH

SCHEMATIC



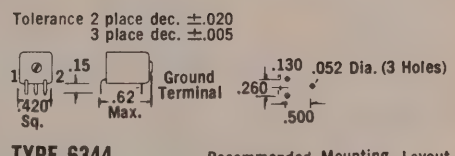


TYPE 435
vertical mount



Recommended Mounting Layout

435



TYPE 6344
horizontal mount

Recommended Mounting Layout

6344

NOTES:
1. For vertical mount, order as 435-1 . . . etc. For horizontal mount, order as 6344-1 . . . etc.
2. Effective inductance and Q measured on Boonton 260A Q-meter at frequencies specified, in accordance with MIL-C-15305.
3. Self-resonant frequencies are measured at maximum inductance.
4. Unit can be tuned from top or bottom with ⅛" insulated screwdriver (part no. C-B 2102). For type 435 only, provide .156 dia. hole if bottom access to tuning core is desired.
5. Current rating is based on .15 watt power dissipation for approx. 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
6. Materials:
   Terminals — Tin-plated brass. Core — Ferrite.
   Coil Form and Base — Molded nylon. Shield Can — Cadmium-plated brass.
7. Marking — Marked with Caddell-Burns Part No. on side of can, and color-coded per dash number on bottom between two active terminals.

STANDARD VALUES: (Other values available on special order.)

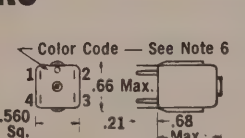
Part No.	Minimum Range L Min.	Minimum Range L Max.	Minimum Q @ L Min.	Minimum Q @ L Max.	Test Freq. MHz	Min. SRF MHz Note 3	Max. DCR Ohms	Current Rating ma
435/6344-1	.25μH	.50μH	75	50	25	200	.03	2200
435/6344-2	.48	1.0	70	45	25	150	.08	1300
435/6344-3	.90	2.1	70	45	25/7.9	110	.17	930
435/6344-4	1.7	3.9	50	55	7.9	80	.60	500
435/6344-5	3.5	8.5	50	45	7.9	55	1.2	350
435/6344-6	7.5	17	60	40	7.9/2.5	40	2.3	250
435/6344-7	16.5	35	50	50	2.5	11	1.9	280
435/6344-8	33	70	45	45	2.5	8	2.9	220

MINIATURE SHIELDED VARIABLE INDUCTORS

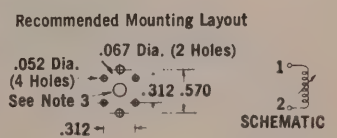
434

TYPE 434 .55-64μH

Tol: 2 Place Dec. ±.020
3 Place Dec. ±.005



Recommended Mounting Layout



NOTES:
1. Effective inductance and Q measured on Boonton 260A Q-meter at frequencies specified, in accordance with MIL-C-15305.
2. Self-resonant frequencies are measured at maximum inductance.
3. Provide .187 dia. hole if bottom access to tuning core is desired. Unit can be tuned from top or bottom with standard .060 square tuning tool (Part No. C-B2102).
4. Current rating is based on .2 watt power dissipation for approx. 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
5. Materials:
   Terminals — Tin-plated brass.
   Coil Form and Base — Molded nylon.
   Core — Moisture proofed powdered iron.
   Shield Can — Aluminum plain finish.
6. Marking — Marked with Caddell-Burns No. on side of can; and color-coded per dash number on bottom between two active terminals.

STANDARD VALUES: (Other values available on special order.)

Part No.	Minimum Range L Min.	Minimum Range L Max.	Minimum Q @ L Min.	Minimum Q @ L Max.	Test Freq. MHz	Min. SRF MHz Note 2	Max. DCR Ohms	Current Rating ma
434-1	.55μH	.90μH	90	85	25	160	.06	1800
434-2	.90	1.4	90	70	25/7.9	130	.12	1200
434-3	1.4	2.4	60	70	7.9	100	.25	890
434-4	2.2	4.1	60	80	7.9	80	.60	570
434-5	3.9	7.7	55	55	7.9	52	1.0	440
434-6	7.5	11	35	70	7.9/2.5	21	1.2	400
434-7	11	17	55	75	2.5	16	1.4	370
434-8	18	27	55	75	2.5	14	1.8	330
434-9	27	42	55	70	2.5	13	2.4	280
434-10	42	64	55	65	2.5	11	3.1	250

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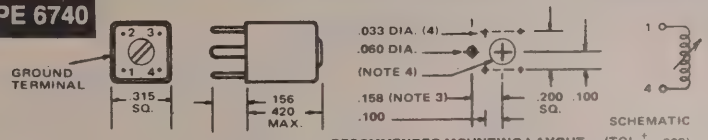
SUBMINIATURE SHIELDED VARIABLE INDUCTORS

TYPE 6740



STANDARD VALUES (Intermediate and special values available on special order.)

Part No.	Nominal Inductance	Minimum Range LMin.	LMax.	Min. Q @LNom.	Test Freq. M Hz	Max. DCR Ohms	Min. SRF M Hz Note 2	Max. IDC mA Note 5
6740-01	.10 µH	.08µH	.12µH	80	25	.02	250	3500
6740-03	.15	.12	.18	85	25	.03	250	2800
6740-05	.22	.18	.27	85	25	.04	250	2500
6740-07	.33	.27	.39	90	25	.05	250	2200
6740-09	.47	.39	.56	90	25	.13	230	1350
6740-11	.68	.56	.82	90	25	.17	200	1200
6740-13	1.0	.82	1.2	90	25	.31	160	850
6740-15	1.5	1.0	1.8	60	7.9	.33	125	850
6740-17	2.2	1.5	2.7	65	7.9	.72	110	550
6740-19	3.3	2.2	3.9	65	7.9	1.3	95	425
6740-21	4.7	3.3	5.6	60	7.9	1.5	80	400
6740-23	6.8	4.7	8.2	60	7.9	1.8	62	350
6740-25	10	6.8	12	60	7.9	2.2	45	325
6740-27	15	10	18	72	2.5	1.5	12	400
6740-29	22	15	27	67	2.5	1.8	9.5	350
6740-31	33	22	39	65	2.5	2.1	7.8	325
6740-33	47	33	56	57	2.5	2.6	6.6	300
6740-35	68	47	82	47	2.5	3.0	5.3	275
6740-37	100	68	120	45	2.5	3.5	5.0	250
6740-39	150	100	180	70	.79	3.6	3.4	250
6740-41	220	150	270	65	.79	6.0	2.8	200
6740-43	330	220	390	60	.79	7.9	2.3	150
6740-45	470	330	560	40	.79	11	1.9	125
6740-47	680	470	820	35	.79	13	1.7	125
6740-49	1.0 mH	.68mH	1.2mH	32	.79	17	1.5	100
6740-51	1.5	1.0	1.8	37	.25	32	.86	85
6740-53	2.2	1.5	2.7	37	.25	41	.72	75
6740-55	3.3	2.2	3.9	40	.25	51	.69	65
6740-57	4.7	3.3	5.6	27	.25	80	.47	55
6740-59	6.8	4.7	8.2	25	.25	90	.39	50
6740-61	10	6.8	12	25	.25	110	.37	45

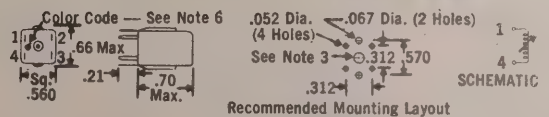
NOTES:

1. Effective inductance and Q measured on Boonton 260A Q-meter in accordance with MIL-C-15305.
2. Self-resonant frequencies are measured at nominal inductance.
3. Ground terminal may be bent as required to fit existing layouts.
4. Provide .156 DIA. hole if bottom access to tuning core is desired. Tuning range on -38 thru -61 may be extended by allowing core to extend 1/16" below mounting surface (when Lmin ≈ 1/2Lnom.)
5. Current rating is basd on 1/4 watt power dissipation.
6. MATERIALS—
   Terminals: tin plated copper.
   Terminal Base: molded phenolic
   Coil Form: polyester fiberglass.
   Core: moisture-proofed powdered iron or ferrite.
   Shield Can: tin plated copper.
   Impregnation: varnish per MIL-V-173

MINIATURE SHIELDED VARIABLE INDUCTORS

TYPE 6380

.08-370µH
Tol: 2 Place Dec. ±.020
3 Place Dec. ±.005



NOTES:

1. Effective inductance and Q measured on Boonton 260A Q-meter at frequencies specified, in accordance with MIL-C-15305.
2. Self-resonant frequencies are measured at maximum inductance.
3. Provide .187 dia. hole if bottom access to tuning core is desired. Unit can be tuned from top or bottom with standard .060 square tuning tool (Part No. C-B2102).
4. Current rating is basd on .2 watt power dissipation for approx. 20°C temperature rise. Depending on the application, these units may be operated at up to twice the rated current.
5. MATERIALS:
   Terminals — Tin- plated brass.
   Coil Form and Base — Molded nylon
   Core — Moisture-proofed powered iron or ferrite.
   Shield Can — Aluminum plain finish.
6. Marking — Marked with Caddell-Burns Part No. on side of can; and color-coded per dash number on bottom between two active terminals.

STANDARD VALUES: (Other values available on special order.)

Part No.	Minimum Range L Min.	L Max.	MINIMUM Q @ L Min.	@ L Max.	Test Freq. MHz	Min. SRF MHz Note 2	Max. DCR Ohms	Current Rating ma
6380-1	.08 µH	.11 µH	65	75	25	300	.012	4000
6380-2	.10	.17	75	85	25	280	.014	3700
6380-3	.13	.23	75	90	25	260	.015	3600
6380-4	.17	.28	80	90	25	230	.016	3500
6380-5	.25	.44	90	95	25	180	.024	2800
6380-6	.29	.53	90	95	25	170	.026	2700
6380-7	.48	.84	90	90	25	140	.058	1800
6380-8	.71	2.5	90	85	25/7.9	80	.10	1400
6380-9	1.8	5.7	70	110	7.9	50	.50	630
6380-10	4.5	14	55	120	7.9/2.5	18	.85	480
6380-11	12	40	60	115	2.5	10	1.6	350
6380-12	30	99	55	80	2.5	5.6	2.4	280
6380-13	73	190	55	115	2.5/.79	4.8	3.8	220
6740-14	148	370	75	120	.79	3.5	5.6	180

LOW-COST PRINTED-CIRCUIT VARIABLE INDUCTORS

TYPE 6460

Variable R.F. Inductors
Four Printed Circuit Terminals, Mounting—5" x .8" Centers
Size 5/8" x 5/8" x 985 Long
Polyester Cellulose Coil Form

Part No.	Inductance Range Microhenries Min.	Max.	Q'	Q"	Nom. D.C. Res. Ohms	Wire Size AWG
6460-1	.06	.09	80	105	.008	22
6460-2	.09	.16	100	130	.010	22
6460-3	.15	.29	120	140	.011	22
6460-4	.19	.40	130	145	.012	22
6460-5	.32	.68	80	105	.08	20/40
6460-6	.60	1.35	80	125	.11	20/40
6460-7	1.14	2.5	90	135	.15	20/40
6460-8	2.0	4.0	100	140	.21	20/40
6460-9	3.1	5.6	110	120	.26	20/40
6460-10	4.5	8.1	48	85	.29	20/40
6460-11	7.0	11.4	43	150	.37	20/40
6460-12	9.7	16.4	80	140	.47	20/40
6460-13	15.6	26.2	90	155	.61	20/40
6460-14	19.2	44	80	110	1.80	7/44
6460-15	41	95	80	90	2.56	7/44
6460-16	70	183	65	100	3.24	7/44
6460-17	180	525	90	98	5.76	7/44
6460-18	445	1040	94	105	9.32	7/44

Note: Inductance & Q at various frequencies can be altered by changing type of core used (see parts section for cores available.) Dash No. 1 thru 15 uses Powdered Iron Core 302—250—6R. Dash No. 16 thru 18 uses Fernte Core 303—250—5R.

TYPE 6461

Variable R.F. Coil Series
Size 5/8" x 5/8" x .625 Long
0.5" P.C. Mounting

Part No.	Inductance Range Microhenries Min.	Max.	Q'	Q"	Nom. D.C. Res. Ohms	Wire Size AWG
6461-1	.09	.12	58	66	.007	22
6461-2	.1	.14	102	128	.009	22
6461-3	.14	.22	128	150	.01	22
6461-4	.18	.33	134	155	.011	22
6461-5	.23	.44	140	154	.013	22
6461-6	.37	.68	87	105	.102	7/41
6461-7	.58	1.1	87	100	.136	7/41
6461-8	1.1	2.2	72	115	.2	7/41
6461-9	2	4.4	80	112	.29	7/41
6461-10	3.3	8	96	140	.77	7/44
6461-11	7	13.6	70	130	1.02	7/44
6461-12	12.4	25.5	85	134	1.42	7/44
6461-13	22.5	49	90	127	1.93	7/44
6461-14	47	100	86	97	2.8	7/44
6461-15	99	174	75	142	4.2	7/44
6461-16	170	332	95	146	6.0	7/44
6461-17	322	570	102	140	8.5	7/44
6461-18	525	910	97	125	10.4	7/44

TYPE 6462

Variable R.F. Coil with Powered Iron Shield
Size 5/8" x 5/8" x .730 Long
0.5" P.C. Mounting

Part No.	Inductance Range Microhenries Min.	Max.	Q'	Q"	Nom. D.C. Res. Ohms	Wire Size AWG
6462-1	.08	.10	84	89	.007	22
6462-2	.4	.8	82	100	.11	7/41
6462-3	.6	1.3	85	105	.14	7/41
6462-4	1.1	2.6	71	115	.20	7/41
6462-5	2.1	5.1	85	145	.55	7/44
6462-6	3.4	8.6	96	145	.75	7/44
6462-7	8.0	16.9	70	150	1.14	7/44
6462-8	16.2	39.5	94	142	1.52	7/44
6462-9	34	84	86	110	2.21	7/44
6462-10	57	124	80	145	2.74	7/44
6462-11	67	141	80	148	3.16	7/44

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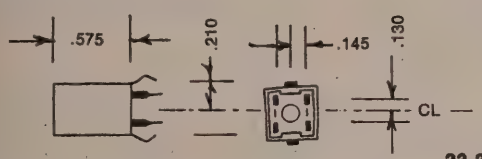
- Pot Core Inductors
- High Current Chokes
- Surface Mount
- Encapsulated Coils

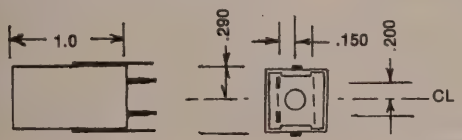
SHIELDED VARIABLE INDUCTORS

NYLON SHIELDED FORM



VSI .33-36 µH

NYLON PRINTED CIRCUIT FORM



VS2 2.2-4000 µH

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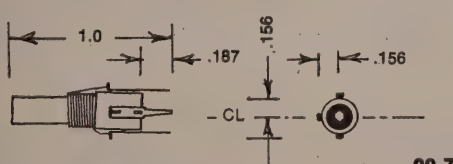
• Test Equipment • Electro-Medical Equipment
• Microwave • Measuring Devices • Military

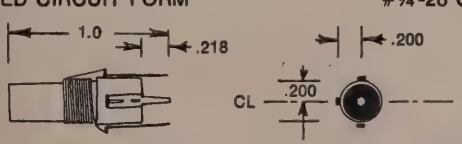
VARIABLE COILS

PRINTED CIRCUIT FORM #10-32 CORE



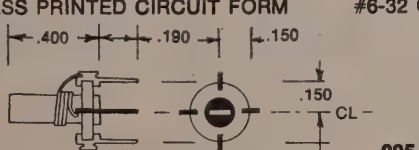
VP1 .09-780 µH

PRINTED CIRCUIT FORM #¼-28 CORE



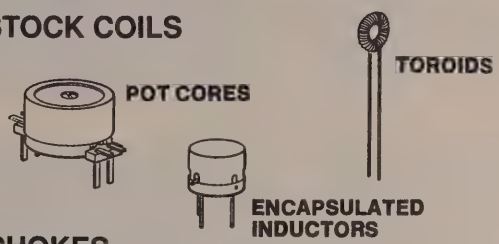
VP2 .10-1000 µH

FIBERGLASS PRINTED CIRCUIT FORM #6-32 CORE



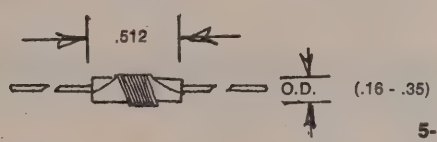
VP3 .095-11 µH

STOCK COILS



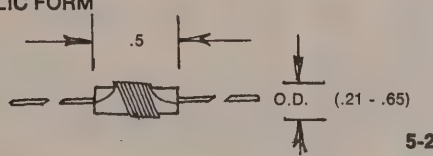
CHOKES

POWDERED IRON FORM



CPI 5-500 µH

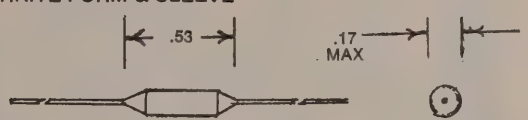
PHENOLIC FORM



CQI 5-2500 µH

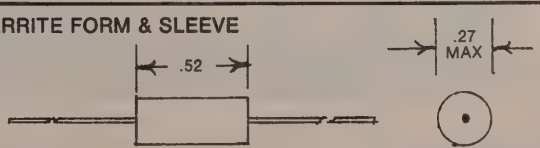
MINIATURE SHIELDED CHOKES

FERRITE FORM & SLEEVE



CF3 1-1000 µH

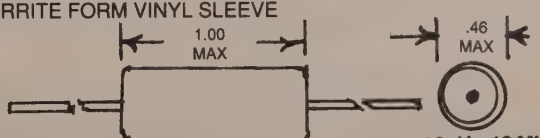
FERRITE FORM & SLEEVE



CF4 100µH-100 MH

HIGH CURRENT CHOKES

FERRITE FORM VINYL SLEEVE



CF9 10µH - 10 MH

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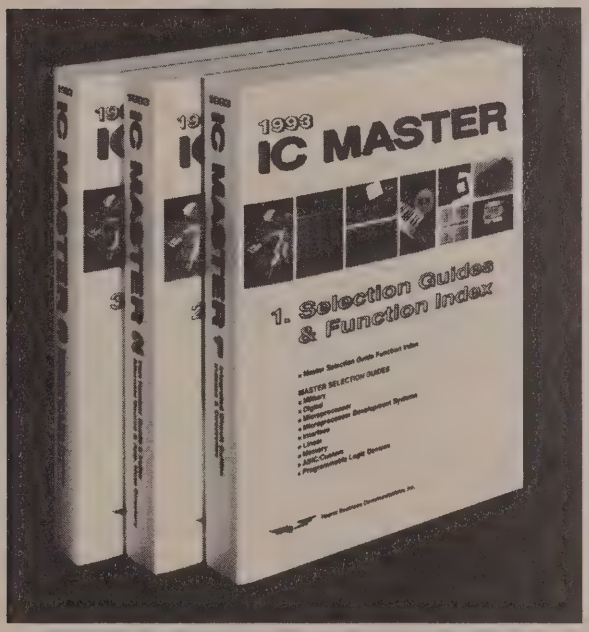

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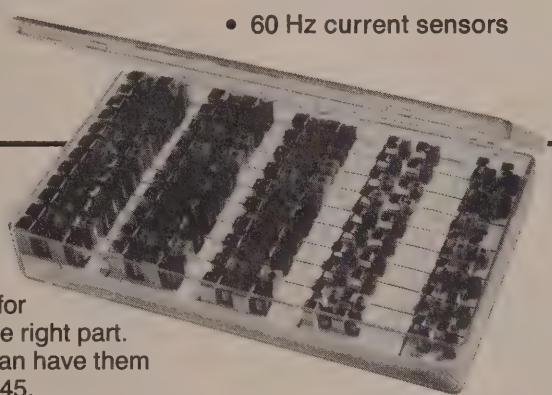

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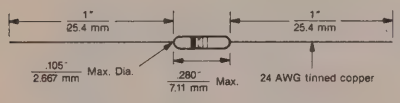


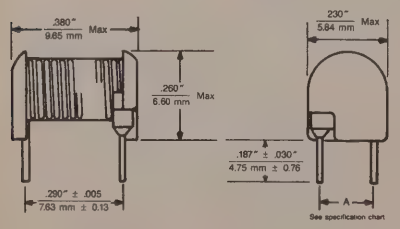
Part Number	L µH ± 10%	Q Min.	Test Freq. MHz	DCR Max. Ohms	SRF Min. MHz.	Max Current mA
90-01	0.1	38	25	0.08	680	1380
90-02	0.12	38	25	0.09	640	1300
90-03	0.15	38	25	0.11	600	1230
90-04	0.18	35	25	0.12	550	1120
90-05	0.22	33	25	0.14	510	1040
90-06	0.24	33	25	0.16	460	975
90-07	0.33	30	25	0.22	410	830
90-08	0.39	30	25	0.3	365	710
90-09	0.47	30	25	0.35	330	660
90-10	0.56	30	25	0.5	310	550
90-11	0.68	28	25	0.6	280	500
90-12	0.82	28	25	0.85	260	420
90-13	1	25	25	1	240	390
90-14	1.2	60	7.9	0.15	150	620
90-15	1.5	60	7.9	0.16	140	560
90-16	1.8	60	7.9	0.2	125	480
90-17	2.2	60	7.9	0.29	115	415
90-18	2.7	50	7.9	0.4	100	355
90-19	3.3	50	7.9	0.42	90	285
90-20	3.9	50	7.9	0.6	80	263
90-21	4.7	40	7.9	0.66	60	239
90-22	5.6	40	7.9	0.7	45	195
90-23	6.8	40	7.9	0.9	40	185
90-24	8.2	40	7.9	1	28	160
90-25	10	35	7.9	1.1	24	144
90-26	12	60	2.5	1.62	20	160
90-27	15	60	2.5	1.75	17	157
90-28	18	60	2.5	1.85	16	149
90-29	22	50	2.5	2	14	144
90-30	27	50	2.5	2.1	12	140
90-31	33	50	2.5	2.2	10	130
90-32	39	50	2.5	2.3	9.5	125
90-33	47	50	2.5	2.4	9	110
90-34	56	50	2.5	3	7.8	100
90-35	68	50	2.5	3.4	7	92
90-36	82	50	2.5	3.8	6.7	88
90-37	100	50	2.5	4.1	6.1	84
90-38	120	60	0.79	6.5	4.8	66
90-39	150	60	0.79	8.3	4.1	61
90-40	180	60	0.79	8.9	4	57
90-41	220	60	0.79	10.1	3.6	52
90-42	270	60	0.79	11	3.3	47
90-43	330	60	0.79	12.4	3.1	45
90-44	390	60	0.79	13.6	2.9	40
90-45	470	60	0.79	18.4	2.4	36
90-46	560	60	0.79	20.3	2.2	35
90-47	680	60	0.79	22.3	2	30
90-48	820	60	0.79	25	1.9	29
90-49	1000	60	0.79	27.4	1.8	28

NOTES:

1) Inductance measured with a Coilcraft AXL-A test fixture and HP4191/4192 Impedance Analyzers.
2) Q measured on HP4191/4192 with AXL-A, direct-connected to HP4342 Q-Meter.
3) Temperature rise at rated current and 90°C ambient
   .10 - 1.0 uH: 35°C
   1.2 - 1000 uH: 15°C
4) Maximum operating temperature
   .10 - 1.0 uH: 125°C
   1.2 - 1000 uH: 105°C
5) Color coding per MIL-C-15305C
6) Epoxy coating: flame resistant 94 FO
7) Designed to meet requirements of Military Specifications MS75083, MS75084 and MS75085.

132 SERIES

Very high Q and 5% tolerance make these coils an attractive alternative to axial inductors. Precision insert molding assures constant winding pitch and long-term stability. Coilcraft **Designer's Kit M104** contains samples of each value. To order, please contact Coilcraft.



Part Number	Color	Turns	Dim A	L nH ±5%	Q Min
132-01	Brown	1½	.148 inches/3.76 mm	31.5	60 @ 50 MHz
132-02	Red	2½	.148 inches/3.76 mm	36.5	64 @ 50 MHz
132-03	Orange	3½	.148 inches/3.76 mm	44.0	68 @ 50 MHz
132-04	Yellow	4½	.148 inches/3.76 mm	53.5	72 @ 50 MHz
132-05	Green	5½	.148 inches/3.76 mm	64.0	75 @ 50 MHz
132-06	Blue	6½	.148 inches/3.76 mm	79.0	80 @ 50 MHz
132-07	Violet	7½	.148 inches/3.76 mm	99.0	66 @ 25 MHz
132-08	Gray	8½	.148 inches/3.76 mm	117	68 @ 25 MHz
132-09	White	9½	.148 inches/3.76 mm	138	68 @ 25 MHz
132-10	Black	10½	.148 inches/3.76 mm	158	68 @ 25 MHz
132-11	Brown	11½	.148 inches/3.76 mm	197	66 @ 25 MHz
132-12	Red	12½	.153 inches/3.89 mm	235	72 @ 25 MHz
132-13	Orange	13½	.153 inches/3.89 mm	260	70 @ 25 MHz
132-14	Yellow	14½	.153 inches/3.89 mm	290	70 @ 25 MHz
132-15	Green	15½	.154 inches/3.91 mm	345	72 @ 25 MHz
132-16	Blue	16½	.156 inches/3.96 mm	410	72 @ 25 MHz
132-17	Violet	17½	.156 inches/3.96 mm	475	66 @ 25 MHz
132-18	Gray	18½	.156 inches/3.96 mm	550	66 @ 25 MHz
132-19	White	19½	.156 inches/3.96 mm	600	68 @ 25 MHz
132-20	Black	20½	.160 inches/4.06 mm	720	66 @ 25 MHz

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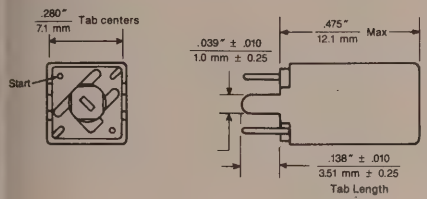
TUNEABLE RF COILS

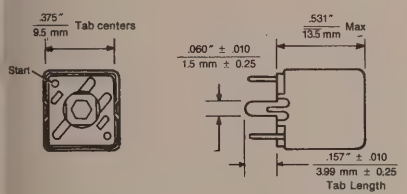
These Coilcraft variable inductors are precision molded in plastic to assure constant winding pitch and a consistent relationship to the printed circuit board. They're ideal for applications requiring low inductance and are more economical than any similar coil. Typical applications include RF coils, IF coils, oscillators, chokes, and helical resonators. Coilcraft **Designer's Kit M102** contains 49 shielded and 49 unshielded coils (2 each). To order, please contact Coilcraft.

- Compact 10mm or 7mm size (5mm parts also available)
- Molded-in windings assure tight tolerances
- Highly resistant to humidity, temperature, shock and vibration
- Threaded cores allow precise tuning
- Custom values and unshielded parts with higher values also available

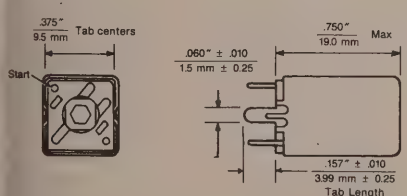
146/150 7mm "UNICOIL"



142 10mm "UNICOIL"



143/144 10mm "UNICOIL"



Part Number	Color	Turns	No Core µH	L Min µH	L Nom µH	L Max µH	Min Q @ L Nom
150-01J08S	Brown	1½	.0425	.0435	.0445	.0455	72 @ 50 MHz
150-02J08S	Red	2½	.054	.056	.060	.064	80 @ 50 MHz
150-03J08S	Orange	3½	.068	.071	.076	.081	84 @ 50 MHz
150-04J08S	Yellow	4½	.0825	.086	.095	.104	85 @ 50 MHz
150-05J08S	Green	5½	.0955	.107	.115	.123	84 @ 50 MHz
150-06J08S	Blue	6½	.109	.125	.134	.143	82 @ 50 MHz
150-07J08S	Violet	7½	.123	.150	.156	.162	80 @ 50 MHz
146-01J08S	Brown	1½	.044	.045	.046	.047	76 @ 50 MHz
146-02J08S	Red	2½	.059	.062	.065	.068	78 @ 50 MHz
146-03J08S	Orange	3½	.075	.080	.085	.090	78 @ 50 MHz
146-04J08S	Yellow	4½	.095	.100	.110	.120	78 @ 50 MHz
146-05J08S	Green	5½	.115	.120	.135	.150	76 @ 50 MHz
146-06J08S	Blue	6½	.136	.142	.163	.184	72 @ 50 MHz
146-07J08S	Violet	7½	.155	.172	.194	.216	68 @ 50 MHz
146-08J08S	Gray	8½	.176	.200	.224	.248	66 @ 50 MHz
146-09J08S	White	9½	.202	.234	.260	.284	60 @ 50 MHz
146-10J08S	Black	10½	.224	.260	.288	.315	56 @ 50 MHz
144-01J12S	Brown	1½	.050	.052	.053	.054	—
144-02J12S	Red	2½	.067	.070	.074	.078	—
144-03J12S	Orange	3½	.088	.092	.099	.106	—
144-04J12S	Yellow	4½	.106	.111	.122	.133	—
144-05J12S	Green	5½	.126	.132	.149	.165	—
144-06J12S	Blue	6½	.147	.154	.175	.196	106 @ 40 MHz
144-07J12S	Violet	7½	.168	.176	.200	.223	104 @ 40 MHz
144-08J12S	Gray	8½	.190	.202	.226	.250	108 @ 40 MHz
144-09J12S	White	9½	.210	.239	.256	.274	108 @ 40 MHz
144-10J12S	Black	10½	.232	.270	.282	.295	106 @ 40 MHz
142-01J08S	Brown	1½	.058	.058	.0595	.061	—
142-02J08S	Red	2½	.081	.084	.086	.089	—
142-03J08S	Orange	3½	.110	.115	.120	.121	—
142-04J08S	Yellow	4½	.140	.147	.156	.160	88 @ 40 MHz
142-05J08S	Green	5½	.174	.182	.197	.205	94 @ 40 MHz
142-06J08S	Blue	6½	.210	.220	.240	.248	92 @ 40 MHz
142-07J08S	Violet	7½	.247	.259	.280	.290	90 @ 40 MHz
142-08J08S	Gray	8½	.284	.299	.322	.337	86 @ 40 MHz
142-09J08S	White	9½	.319	.338	.363	.377	88 @ 40 MHz
142-10J08S	Black	10½	.357	.382	.410	.422	82 @ 40 MHz
143-09J12S	White	9½	.300	.315	.369	.423	80 @ 40 MHz
143-10J12S	Black	10½	.338	.355	.416	.477	82 @ 40 MHz
143-11J12S	Brown	11½	.377	.396	.468	.540	78 @ 40 MHz
143-12J12S	Red	12½	.412	.433	.509	.585	80 @ 40 MHz
143-13J12S	Orange	13½	.452	.475	.556	.637	80 @ 40 MHz
143-14J12S	Yellow	14½	.490	.515	.604	.693	78 @ 40 MHz
143-15J12S	Green	15½	.522	.583	.660	.738	80 @ 40 MHz
143-16J12S	Blue	16½	.575	.638	.720	.801	76 @ 40 MHz
143-17J12S	Violet	17½	.612	.693	.770	.846	76 @ 40 MHz
143-18J12S	Gray	18½	.650	.754	.814	.874	82 @ 40 MHz
143-19J12S	White	19½	.675	.792	.846	.900	80 @ 40 MHz
143-20J12S	Black	20½	.715	.847	.896	.945	74 @ 40 MHz

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"SLOT 10" 10mm TUNEABLE RF COILS

These veratile Coilcraft variable inductors operate over a wide range of frequencies. Standard inductance values are available from less than 1 μH to over 1 mH. Custom values can also be provided upon request.

Coilcraft "Slot Ten" RF coils come in an international 10mm package. Their precision-molded slotted bobbins assure tight tolerances and high stability.

A variety of magnetic and electrostatic shielding options are offered. "Slot Ten" coils are tuned by means of ferrite or powdered iron tuning cores with a hex hole for easy, positive adjustment.

Coilcraft **Designer's Kit M100** contains 18 shielded and 18 unshielded coils (3 each) plus extra cores and sleeves to create all of the standard values shown. To order, please contact Coilcraft.

SELECTION GUIDE

Coilcraft "Slot Ten" coils come in five different styles. Consult this table for the inductance range, relative Q, and shielding options of each style. Then use the appropriate specification chart to pick a specific part number.

Style	L (μH)	Electrostatic Shield	Magnetic Shield	Recommended Frequency	Tuning Core	Relative Q	Relative Cost
Style 1	.8 — 624	No	No	Higher	Iron	Hi	Low
Style 2	.8 — 927	No	No	Higher	Ferrite	Hi	Low
Style 3	.7 — 450	Yes	No	Higher	Iron	Low	Med
Style 4	.8 — 624	Yes	Yes (Iron)	Lower	Iron	Med	Hi
Style 5	.9 — 1143	Yes	Yes (Ferrite)	Lower	Ferrite	Med	Hi

1 All readings taken on H.P. 4342-A Q Meter.
2 L min is achieved at maximum extension of the core toward PC board. Complete tuning range is reached within the boundaries of the coil form.
3 All specifications are recommended at standard "Q" meter frequency as a simple way to assure the quality of our parts. L and Q readings will vary with frequency change.
4 Unshielded parts are coated with lacquer to protect the winding.
5 Shielded parts have a sleeve insert to protect the winding.

STYLE 1
Unshielded with carbonyl E core

Part Number	Color	L min (μH)	L max (μH)	L nom (μH)	Min Q @ L nom	Test Frequency
SLOT TEN-1-01	Brown	.800	1.2	1.0	48	7.9 MHz
SLOT TEN-1-02	Red	1.2	1.8	1.5	50	7.9 MHz
SLOT TEN-1-03	Orange	1.76	2.64	2.2	56	7.9 MHz
SLOT TEN-1-04	Yellow	2.56	3.84	3.2	54	7.9 MHz
SLOT TEN-1-05	Green	3.6	5.4	4.5	54	7.9 MHz
SLOT TEN-1-06	Blue	5.2	7.8	6.5	51	7.9 MHz
SLOT TEN-1-07	Violet	7.6	11.4	9.5	48	7.9 MHz
SLOT TEN-1-08	Grey	11.2	16.8	14.0	38	2.5 MHz
SLOT TEN-1-09	White	16.0	24.0	20.0	38	2.5 MHz
SLOT TEN-1-10	Black*	22.4	33.6	28.0	38	2.5 MHz
SLOT TEN-1-11	Brown*	32.0	48.0	40.0	38	2.5 MHz
SLOT TEN 1-12	Red*	46.4	69.6	58.0	47	2.5 MHz
SLOT TEN-1-13	Orange*	67.2	100.2	84.0	48	2.5 MHz
SLOT TEN-1-14	Yellow*	96	144	120.0	40	790 KHz
SLOT TEN-1-15	Green*	137.6	206.4	172.0	34	790 KHz
SLOT TEN-1-16	Blue*	200	300	250.0	39	790 KHz
SLOT TEN-1-17	Violet*	280	432	360.0	30	790 KHz
SLOT TEN-1-18	Grey*	416	624	520.0	35	790 KHz

STYLE 2
Unshielded with ferrite core

Part Number	Color	L min (μH)	L max (μH)	L nom (μH)	Min Q @ L nom	Test Frequency
SLOT TEN-2-01	Brown	.80	1.7	1.2	47	7.9 MHz
SLOT TEN-2-02	Red	1.25	2.75	2.0	48	7.9 MHz
SLOT TEN-2-03	Orange	1.75	4.0	2.9	48	7.9 MHz
SLOT TEN-2-04	Yellow	2.4	5.4	3.9	47	7.9 MHz
SLOT TEN-2-05	Green	3.5	7.8	5.6	47	7.9 MHz
SLOT TEN-2-06	Blue	4.7	10.6	7.6	46.4	7.9 MHz
SLOT TEN-2-07	Violet	7.4	15.6	11.5	38	2.5 MHz
SLOT TEN-2-08	Grey	11	25	18.2	40	2.5 MHz
SLOT TEN-2-09	White	16	35	25.3	40	2.5 MHz
SLOT TEN-2-10	Black*	22	50	36.5	40	2.5 MHz
SLOT TEN-2-11	Brown*	33	72	52.5	39	2.5 MHz
SLOT TEN-2-12	Red*	46	103	74.8	51	2.5 MHz
SLOT TEN-2-13	Orange*	66	136	100	40	790 KHz
SLOT TEN-2-14	Yellow*	95	198	146	44	790 KHz
SLOT TEN-2-15	Green*	136	297	216	40	790 KHz
SLOT TEN-2-16	Blue*	198	426	312	45	790 KHz
SLOT TEN-2-17	Violet*	286	630	530	33	790 KHz
SLOT TEN-2-18	Grey*	418	927	790	38	790 KHz

* Coils 10 thru 18 have a brown color dot on bottom of coil base.

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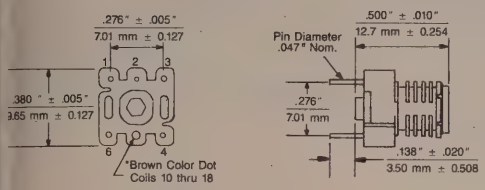
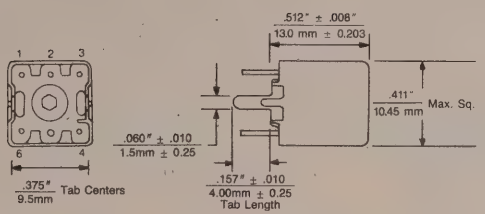
UNSHIELDED (Styles 1 and 2)



WITH SHIELD CAN (Styles 3, 4, and 5)



SCHEMATIC

STYLE 3
Shielded with carbonyl E core and plastic sleeve

STYLE 4
Shielded with carbonyl E core and sleeve

STYLE 5
Shielded with ferrite core and sleeve

Part Number	Color	L min (μH)	L max (μH)	L nom (μH)	Min Q @ L nom	Test Frequency
SLOT TEN-3-01	Brown	.70	.94	.82	65	25 MHz
SLOT TEN-3-02	Red	1.05	1.41	1.23	37	7.9 MHz
SLOT TEN-3-03	Orange	1.5	2.0	1.75	40	7.9 MHz
SLOT TEN-3-04	Yellow	2.04	2.76	2.4	40	7.9 MHz
SLOT TEN-3-05	Green	2.9	3.9	3.4	39	7.9 MHz
SLOT TEN-3-06	Blue	4.25	5.75	5.0	38	7.9 MHz
SLOT TEN-3-07	Violet	6	8.2	7.1	35	7.9 MHz
SLOT TEN-3-08	Grey	9.4	12.6	11.0	25	2.5 MHz
SLOT TEN-3-09	White	12.8	17.2	15.0	25	2.5 MHz
SLOT TEN-3-10	Black*	18.7	25.3	22.0	26	2.5 MHz
SLOT TEN-3-11	Brown*	26.4	35.6	31.0	25	2.5 MHz
SLOT TEN-3-12	Red*	37.4	50.6	44	29	2.5 MHz
SLOT TEN-3-13	Orange*	52.7	71.3	62	30	2.5 MHz
SLOT TEN-3-14	Yellow*	79	105	92	28	2.5 MHz
SLOT TEN-3-15	Green*	108.8	147.2	128	18	790 KHz
SLOT TEN-3-16	Blue*	155	208	182	20	790 KHz
SLOT TEN-3-17	Violet*	230	310	270	16	790 KHz
SLOT TEN-3-18	Grey*	336	450	390	18	790 KHz
SLOT TEN-4-01	Brown	.80	1.2	1.0	44	7.9 MHz
SLOT TEN-4-02	Red	1.2	1.8	1.5	45	7.9 MHz
SLOT TEN-4-03	Orange	1.76	2.64	2.2	48	7.9 MHz
SLOT TEN-4-04	Yellow	2.56	3.84	3.2	48	7.9 MHz
SLOT TEN-4-05	Green	3.6	5.4	4.5	46	7.9 MHz
SLOT TEN-4-06	Blue	5.2	7.8	6.5	43	7.9 MHz
SLOT TEN-4-07	Violet	7.6	11.4	9.5	40	7.9 MHz
SLOT TEN-4-08	Grey	11.2	16.8	14	32	2.5 MHz
SLOT TEN-4-09	White	16.0	24.0	20	33	2.5 MHz
SLOT TEN-4-10	Black*	22.4	33.6	28	32	2.5 MHz
SLOT TEN-4-11	Brown*	32.0	48.0	40	32	2.5 MHz
SLOT TEN-4-12	Red*	46.4	69.6	58	40	2.5 MHz
SLOT TEN-4-13	Orange*	67.2	100.8	85	40	2.5 MHz
SLOT TEN-4-14	Yellow*	96	144	120	33	790 KHz
SLOT TEN-4-15	Green*	137.6	206.4	172	28	790 KHz
SLOT TEN-4-16	Blue*	200.0	300.0	250	32	790 KHz
SLOT TEN-4-17	Violet*	288	432	360	26	790 KHz
SLOT TEN-4-18	Grey*	416	624	520	29	790 KHz
SLOT TEN-5-01	Brown	.86	2.0	1.4	43	7.9 MHz
SLOT TEN-5-02	Red	1.27	3.25	2.25	44	7.9 MHz
SLOT TEN-5-03	Orange	1.83	4.6	3.25	41	7.9 MHz
SLOT TEN-5-04	Yellow	2.48	6.4	4.5	40	7.9 MHz
SLOT TEN-5-05	Green	3.58	9.3	6.5	40	7.9 MHz
SLOT TEN-5-06	Blue	5.0	12.7	8.8	38	7.9 MHz
SLOT TEN-5-07	Violet	7.7	18.4	13.0	30	2.5 MHz
SLOT TEN-5-08	Grey	12.0	30.0	20.9	35	2.5 MHz
SLOT TEN-5-09	White	16	42	29.4	34	2.5 MHz
SLOT TEN-5-10	Black*	25	60	42.3	32	2.5 MHz
SLOT TEN-5-11	Brown*	36	90	62.8	30	2.5 MHz
SLOT TEN-5-12	Red*	48	126	87.2	42	2.5 MHz
SLOT TEN-5-13	Orange*	72	163	116	35	790 KHz
SLOT TEN-5-14	Yellow*	102	238	168	36	790 KHz
SLOT TEN-5-15	Green*	147	360	252	36	790 KHz
SLOT TEN-5-16	Blue*	215	522	312	45	790 KHz
SLOT TEN-5-17	Violet*	303	765	530	33	790 KHz
SLOT TEN-5-18	Grey*	440	1143	790	38	790 KHz

* Coils 10 tru 18 have a brown color dot on bottom of coil base.

"SLOT 7" 7mm TUNEABLE RF COILS

These versatile Coilcraft variable inductors operate over a wide range of frequencies. Standard inductance values are available from less than 100 nH to over 250 µH. Custom values can also be provided upon request.

Coilcraft "Slot Seven" RF coils come in an international 7 mm package. Their precision-molded slotted bobbins assure tight tolerances and high stability.

A variety of magnetic and electrostatic shielding options are offered. "Slot Seven" coils are tuned by means of slotted ferrite tuning cores for easy, positive adjustment.

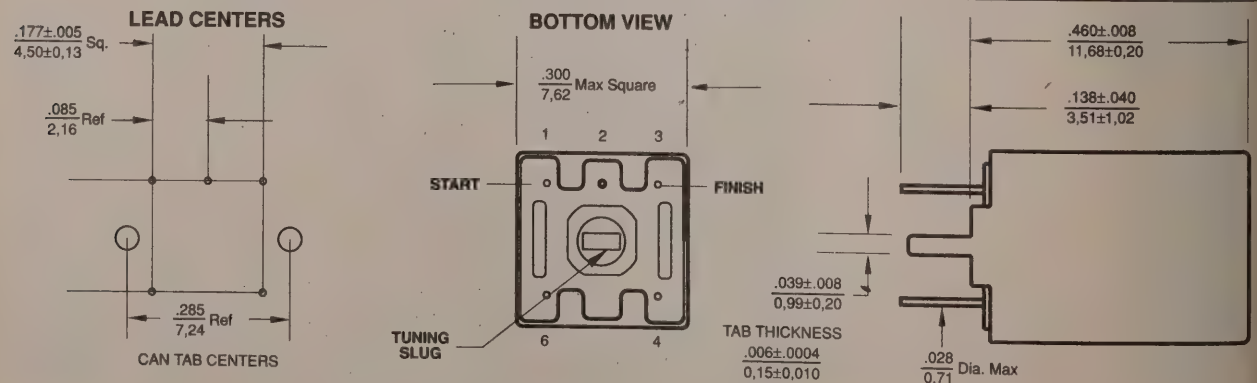
Coilcraft **Designer's Kit M106** contains 39 coils (3 each). To order, please contact Coilcraft.

SERIES 7M2 - WITH PLASTIC SLEEVE

Part Number	L Min (uH)	L Nom (uH)	L Max (uH)	Test Frequency	Q Min @ L Nom	DCR Max (ohms)
7M2-101	0.094	0.100	0.106	25 MHz	27	0.124
7M2-121	0.113	0.120	0.127	25 MHz	27	0.124
7M2-151	0.141	0.150	0.159	25 MHz	30	0.151
7M2-181	0.169	0.180	0.191	25 MHz	30	0.151
7M2-221	0.207	0.220	0.233	25 MHz	35	0.176
7M2-271	0.254	0.270	0.286	25 MHz	35	0.198
7M2-331	0.310	0.330	0.350	25 MHz	40	0.248
7M2-391	0.367	0.390	0.413	25 MHz	40	0.271
7M2-471	0.442	0.470	0.498	25 MHz	40	0.291
7M2-561	0.526	0.560	0.594	25 MHz	40	0.317
7M2-681	0.612	0.680	0.748	25 MHz	40	0.333
7M2-821	0.738	0.820	0.902	25 MHz	45	0.368
7M2-102	0.9	1.0	1.1	25 MHz	45	0.396
7M2-122	1.1	1.2	1.3	7.9 MHz	27	0.412
7M2-152	1.4	1.5	1.7	7.9 MHz	27	0.466
7M2-182	1.6	1.8	2.0	7.9 MHz	27	0.544
7M2-222	2.0	2.2	2.4	7.6 MHz	27	0.595
7M2-272	2.4	2.7	3.0	7.9 MHz	27	0.898
7M2-332	3.0	3.3	3.6	7.9 MHz	27	1.04
7M2-392	3.5	3.9	4.3	7.9 MHz	27	1.12
7M2-472	4.2	4.7	5.2	7.9 MHz	27	1.38
7M2-562	5.0	5.6	6.2	7.9 MHz	27	1.42
7M2-682	6.1	6.8	7.5	7.9 MHz	27	1.49
7M2-822	7.4	8.2	9.0	7.9 MHz	27	1.65
7M2-103	9.0	10	11	7.9 MHz	27	2.42
7M2-123	10	12	14	2.5 MHz	20	2.75
7M2-153	13	15	17	2.5 MHz	20	3.71
7M2-183	15	18	21	2.5 MHz	20	4.01
7M2-223	19	22	25	2.5 MHz	20	7.37
7M2-273	23	27	31	2.5 MHz	20	8.48
7M2-333	28	33	38	2.5 MHz	20	13.34
7M2-393	33	39	45	2.5 MHz	20	14.72
7M2-473	40	47	54	2.5 MHz	20	16.42
7M2-563	48	56	64	2.5 MHz	20	17.76
7M2-683	58	68	78	2.5 MHz	20	19.76
7M2-823	70	82	94	2.5 MHz	20	22.01
7M2-104	85	100	115	2.5 MHz	20	24.25

SERIES 7M3 - WITH FERRITE MAGNETIC SHIELD

Part Number	L Min (uH)	L Nom (uH)	L Max (uH)	Test Frequency	Q Min @ L Nom	DCR Max (ohms)
7M3-151	0.128	0.150	0.173	25 MHz	40	0.124
7M3-181	0.153	0.180	0.207	25 MHz	45	0.124
7M3-221	0.187	0.220	0.253	25 MHz	45	0.151
7M3-271	0.230	0.270	0.311	25 MHz	50	0.151
7M3-331	0.281	0.330	0.380	25 MHz	50	0.151
7M3-391	0.332	0.390	0.449	25 MHz	55	0.176
7M3-471	0.400	0.470	0.541	25 MHz	55	0.198
7M3-561	0.476	0.560	0.644	25 MHz	60	0.198
7M3-681	0.544	0.680	0.816	25 MHz	60	0.248
7M3-821	0.656	0.820	0.984	25 MHz	60	0.271
7M3-102	0.8	1.0	1.2	25 MHz	60	0.317
7M3-122	1.0	1.2	1.4	7.9 MHz	45	0.333
7M3-152	1.2	1.5	1.8	7.9 MHz	45	0.368
7M3-182	1.4	1.8	2.2	7.9 MHz	45	0.396
7M3-222	1.8	2.2	2.6	7.9 MHz	45	0.412
7M3-272	2.2	2.7	3.2	7.9 MHz	45	0.466
7M3-332	2.6	3.3	4.0	7.9 MHz	40	0.544
7M3-392	3.1	3.9	4.7	7.9 MHz	40	0.595
7M3-472	3.8	4.7	5.6	7.9 MHz	40	0.898
7M3-562	4.5	5.6	6.7	7.9 MHz	40	1.04
7M3-682	5.4	6.8	8.2	7.9 MHz	35	1.04
7M3-822	6.6	8.2	9.8	7.9 MHz	35	1.12
7M3-103	8	10	12	7.9 MHz	35	1.38
7M3-123	9	12	15	2.5 MHz	35	1.49
7M3-153	11	15	19	2.5 MHz	35	1.65
7M3-183	14	18	23	2.5 MHz	35	2.42
7M3-223	17	22	28	2.5 MHz	35	2.75
7M3-273	20	27	34	2.5 MHz	40	3.71
7M3-333	25	33	41	2.5 MHz	40	3.71
7M3-393	29	39	49	2.5 MHz	40	4.01
7M3-473	35	47	59	2.5 MHz	40	7.37
7M3-563	42	56	70	2.5 MHz	40	8.48
7M3-683	51	68	85	2.5 MHz	40	13.34
7M3-823	62	82	103	2.5 MHz	40	14.72
7M3-104	75	100	125	2.5 MHz	40	16.42
7M3-124	90	120	150	2.5 MHz	40	17.76
7M3-154	113	150	188	2.5 MHz	40	19.76
7M3-184	135	180	225	2.5 MHz	40	22.01
7M3-224	165	220	275	2.5 MHz	40	24.25



Coilcraft Dept. E, 1102 Silver Lake Road, Cary, IL 60013 • TLX 216378 • Fax708/639-1469 • 800/322-2645

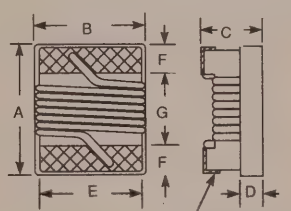
SURFACE MOUNT INDUCTORS

Coilcraft "CS" series chip inductors are designed especially for the needs of today's high frequency designer. Their ceramic construction delivers the highest possible SRF's as well as excellent Q values. The non-magnetic coilform also assures the utmost in thermal stability, predictability, and batch consistency. Parts are suitable for automatic placement and IR or other reflow solder processes. Coilcraft Designer's Kit C100 contains samples of most of the parts shown. To order, contact Coilcraft.

- Ceramic bodies, platinum palladium silver metallized terminations
- All parts available with flat top and wraparound terminal
- Options: tape and reel, nickel barrier, 100% testing, custom values, tighter tolerance.

Part Number	Inductance	Q Min	Test Frequency MHz	Self Resonsance MHz Min	R_{DC}Max Ohms	I_{DC}Max mA
0805CS-030	3.3nH±20%	50	250	>3000	.08	600
0805CS-060	6.8	50	250	>3000	.11	600
0805CS-080	8.2	50	250	>3000	.12	600
0805CS-120	12	45	250	2750	.15	600
0805CS-150	15	45	250	2500	.17	600
0805CS-180	18	45	250	2400	.20	600
0805CS-220	22	45	250	2200	.22	500
0805CS-270	27	45	250	2000	.25	500
0805CS-330	33	40	250	1800	.27	500
0805CS-390	39	40	250	1600	.29	500
0805CS-470	47	40	200	1400	.31	500
0805CS-560	56 nH±10%	40	200	1300	.34	500
0805CS-680	68	40	200	1200	.38	500
0805CS-820	82	40	150	1020	.42	400
0805CS-101	100	40	150	950	.46	400
0805CS-121	120	35	150	860	.51	400
0805CS-151	150	35	100	780	.56	400
0805CS-181	180	35	100	710	.64	400
0805CS-221	220	30	100	630	.70	400
1008CT-040	4.7nH±20%	50	50	>3000	.15	900
1008CT-080	8.2	50	50	>3000	.22	900
1008CS-100	10	50	50	>3000	.08	1000
1008CS-120	12	50	50	>3000	.09	1000
1008CS-150	15	50	50	>3000	.10	1000
1008CS-180	18	50	50	2500	.11	1000
1008CS-220	22	50	50	2000	.12	1000
1008CS-270	27	50	50	1500	.13	1000
1008CS-330	33	50	50	1500	.14	1000
1008CS-390	39	50	50	1500	.15	1000
1008CS-470	47	50	50	1350	.16	1000
1008CS-560	56 nH±10%	50	50	1150	.18	1000
1008CS-680	68	50	50	1050	.20	1000
1008CS-820	82	50	50	950	.22	1000
1008CS-101	100	25	25	950	.56	800
1008CS-121	120	25	25	900	.63	800
1008CS-151	150	25	25	850	.70	800
1008CS-181	180	25	25	700	.77	750
1008CS-221	220	28	25	600	.84	720
1008CS-271	270	28	25	550	.91	690
1008CS-331	330	30	25	500	1.05	660
1008CS-391	390	30	25	465	1.12	630
1008CS-471	470	30	25	425	1.19	600
1008CS-561	560	30	25	415	1.33	580
1008CS-621	620	30	25	375	1.40	560
1008CS-681	680	30	25	340	1.47	540
1008CS-751	750	33	25	330	1.54	520
1008CS-821	820	33	25	325	1.61	500
1008CS-911	910	33	25	305	1.68	480
1008CS-102	1000	33	25	290	1.75	460
1008CS-122	1.2uH±10%	20	7.9	200	2.0	440
1008CS-152	1.5	20	7.9	165	2.3	420
1008CS-182	1.8	20	7.9	150	2.6	400
1008CS-222	2.2	20	7.9	140	2.8	380
1008CS-272	2.7	20	7.9	110	3.2	360
1008CS-332	3.3	20	7.9	90	3.4	350
1008CS-392	3.9	20	7.9	70	3.6	340
1008CS-472	4.7	20	7.9	60	4.0	330
1812LS-123	12.0	42	2.5	55	2.0	310
1812LS-153	15.0	42	2.5	45	2.5	290
1812LS-183	18.0	45	2.5	37	2.8	270
1812LS-223	22.0	45	2.5	32	3.2	260
1812LS-273	27.0	45	2.5	27	3.6	240
1812LS-333	33.0	45	2.5	23	4.0	230
1812LS-393	39.0	45	2.5	19	4.5	210
1812LS-473	47.0	42	2.5	16	5.0	200

Part Number	Inductance	Q Min	Test Frequency MHz	Self Resonsance MHz Min	R_{DC}Max Ohms	I_{DC}Max mA
1812LS-563	56.0	42	2.5	13	5.5	190
1812LS-683	68.0	40	2.5	10	6.0	180
1812LS-823	82.0	40	2.5	9	7.0	170
1812LS-104	100	40	2.5	8.5	8.0	150
1812LS-124	120	33	0.79	8.5	11.5	135
1812LS-154	150	36	0.79	8.5	13.0	125
1812LS-184	180	36	0.79	8.0	14.2	120
1812LS-224	220	38	0.79	6.0	16.2	115
1812LS-274	270	38	0.79	5.0	20.5	105
1812LS-334	330	38	0.79	4.5	22.5	100
1812LS-394	390	38	0.79	3.5	24.5	90
1812LS-474	470	38	0.79	3.0	26.5	85
1812LS-564	560	33	0.79	2.0	28.5	75
1812LS-684	680	33	0.79	1.9	38.0	60
1812LS-825	820	30	0.79	1.6	41.0	55
1812LS-105	1000	30	0.79	1.5	44.0	50

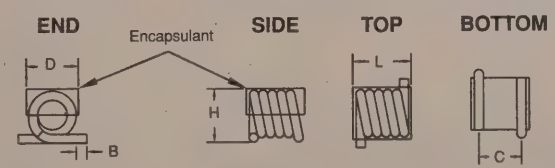


TERMINAL WRAPAROUND: APPROX. .015/0.38 BOTH ENDS

Series	A Max	B Max	C Max	D Max	E	F	G
0805CS	.095/2,41	.070/1,78	.070/1,78	.020/0,51	.050/1,27	.020/0,51	.040/1,02
1008CT	.115/2,92	.110/2,79	.055/1,40	.020/0,51	.080/2,03	.020/0,51	.060/1,52
1008CS	.115/2,92	.110/2,79	.090/2,29	.020/0,51	.080/2,03	.020/0,51	.060/1,52
1812LS	.195/4,95	.150/3,81	.135/3,34	.070/1,78	.100/2,54	.025/0,64	.128/3,25

AIR CORE SPRINGS

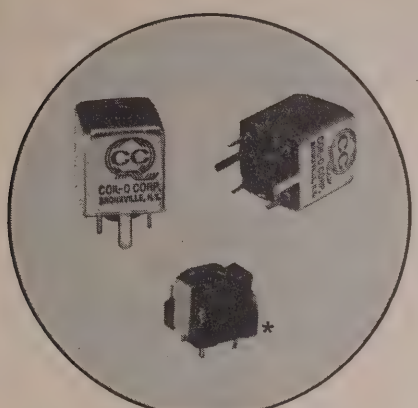
Part Number	Turns	Inductance nH	Q Min	Test Freq. MHz	SRF GHz Min
A01T	1	2.5 ± 10%	145	150	>3
A02T	2	5.0 ± 10%	140	150	>3
A03T	3	8.0 ± 5%	140	150	>3
A04T	4	12.5 ± 5%	137	150	>3
A05T	5	18.5 ± 5%	132	150	>3
B06T	6	17.5 ± 5%	100	150	>3
B07T	7	22.0 ± 5%	102	150	>3
B08T	8	28.0 ± 5%	105	150	2.6
B09T	9	35.5 ± 5%	112	150	1.8
B10T	10	43.0 ± 5%	106	150	1.5



Series	D	H	L	B	C
A	.120/3,05	.125/3,18	.145/3,68	.023 ± .015 / 0,58 ± 0,38	.115 ± .010 / 2,92 ± 0,25
B	.120/3,05	.125/3,18	.270/6,86	.023 ± .015 / 0,58 ± 0,38	.230 ± .015 / 5,84 ± 0,25

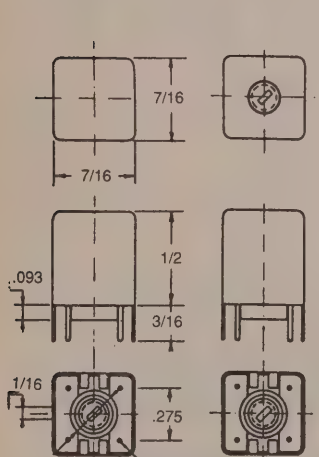
High Q RF Coils and transformers

High stability for the most exacting tuning and filter applications. TC 30 ppm/°C



Features

- Highest Q for its size without the use of ferrites
- Very low TC, typically 30 ppm./°C
- Magnetic and electrostatic shielding
- Moisture sealed construction
- Very low distributed capacitance, high Fo
- Designed to meet Mil-C-15305 C, Grade 1



Q1 SERIES **Q2 SERIES**

For values above 1000µH, the Q2 & Q1 series is also available. In this range of L values, Q's of 150 to 300 are available in miniature pot core coils.*

We will also handle custom designing of any coil you have created or wish to have created.

RF Coils, Q1 series

Part No.	L nom µH	F test MHz	Q @ L nom	Fo @ L nom MHz	DCR Ohms
Q1 .10	.10	25	120	>500	<.1
Q1 .12	.12	25	125	>500	<.1
Q1 .15	.15	25	135	>500	<.1
Q1 .18	.18	25	145	450	<.1
Q1 .22	.22	25	150	390	<.1
Q1 .27	.27	25	155	340	<.1
Q1 .33	.33	25	158	320	<.1
Q1 .39	.39	25	160	290	<.1
Q1 .47	.47	25	160	250	<.1
Q1 .56	.56	25	160	240	<.1
Q1 .68	.68	25	155	220	<.1
Q1 .82	.82	25	155	200	<.1
Q1 1.0	1.0	25	150	175	<.1
Q1 1.2	1.2	7.9	150	160	<.1
Q1 1.5	1.5	7.9	150	140	.1
Q1 1.8	1.8	7.9	160	135	.15
Q1 2.2	2.2	7.9	150	125	.15
Q1 2.7	2.7	7.9	160	110	.20
Q1 3.3	3.3	7.9	165	96	.20
Q1 3.9	3.9	7.9	160	95	.30
Q1 4.7	4.7	7.9	160	86	.40
Q1 5.6	5.6	7.9	160	78	.40
Q1 6.8	6.8	7.9	155	68	.40
Q1 8.2	8.2	7.9	150	62	.70
Q1 10	10	7.9	145	55	.80
Q1 12	12	2.5	165	47	.42
Q1 15	15	2.5	165	40	.60
Q1 18	18	2.5	165	35	.60
Q1 22	22	2.5	165	31	.90
Q1 27	27	2.5	165	29	1.0
Q1 33	33	2.5	160	25	1.1
Q1 39	39	2.5	160	21.5	1.2
Q1 47	47	2.5	155	20.5	1.8
Q1 56	56	2.5	150	20	2.0
Q1 68	68	2.5	148	16.5	1.7
Q1 82	82	2.5	140	14.5	1.8
Q1 100	100	2.5	135	13.5	2.1
Q1 120	120	.79	137	10.8	2.2
Q1 150	150	.79	137	9.6	2.6
Q1 180	180	.79	135	9.5	4.2
Q1 220	220	.79	135	8.3	4.5
Q1 270	270	.79	135	7.1	4.9
Q1 330	330	.79	135	5.5	5.5
Q1 390	390	.79	140	5.6	6.8
Q1 470	470	.79	142	5.2	7.4
Q1 560	560	.79	132	4.8	10.8
Q1 680	680	.79	130	4.5	11.5
Q1 820	820	.79	130	4.0	13.0
Q1 1000	1,000	.79	125	3.8	15.0

RF Coils, Q2 series: Tunable from top and bottom. Characteristics essentially as those of the Q1 series.

Transformers: All of the tabulated inductors are available as transformers or tapped coils to individual requirements.

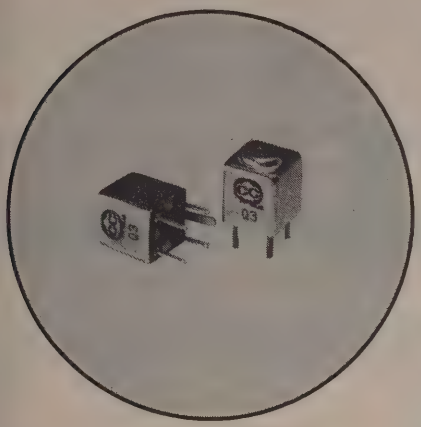
Nanohenry Coils, Tunable, High Q For UHF

Part No.	L nom µH	F test MHz	Q @ L nom
Q1V 027	.024-.029	100	140
Q1V 033	.029-.036	100	140
Q1V 043	.036-.047	100	150
Q1V 056	.047-.063	100	150
Q1V 068	.060-.080	100	160
Q1V 082	.075-.100	100	160

coil-Q corp.

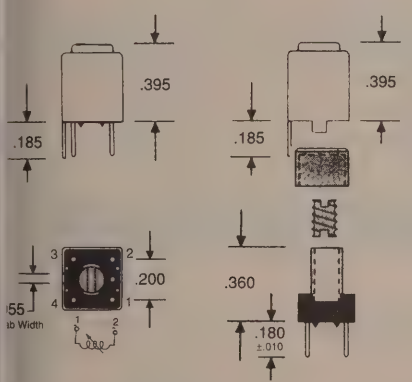
340 Bronxville Road
Bronxville, New York 10708
Tel: 914-337-4775 Fax 914-779-7109

High Q turnable Coils
High Stability, TC<35 ppm/°C
Miniature size
For High Performance
Filter Applications



Features

- Highest Q for its size without the use of ferrites
- Sealed in epoxy for moisture protection
- Magnetic and electrostatic shielding
- Very low TC<35 ppm/°C
- Very low distributed capacitance (high Fo)
- Designed to meet Mil-C-15305 C, grade 1



The tabulated data represent the group of our standard values of inductors. We will modify, invent and create any inductive component you may need. See the yellow pages under our heading for the extent of our design and manufacture capabilities of signal processing components.

High Q Coils for VHF-UHF

Part No.	L nom nH	L range nH	Q @ L nom	F Test MHz	Fo @ L nom MHz	NOTES
Q3-.015	15	14-16	90	100	1800	Q and inductance were measured on a Boonton 190A Q meter. Inductance is net, i.e. parasitics were subtracted from readings. Q was obtained by the use of soldered lead extensions to the terminals.
Q3-.018	18	16.5-19.5	90	100	1560	
Q3-.022	22	20-24	100	100	1450	
Q3-.027	27	24-29	100	100	1400	
Q3-.033	33	28-36	105	100	1330	
Q3-.039	39	35-43	110	100	1280	
Q3-.047	47	40-55	110	100	1100	
Q3-.056	56	49-63	120	100	1000	
Q3-.068	68	61-76	120	100	900	
Q3-.082	82	73-94	120	100	800	

High Q Coils for HF

Part No.	L nom µH	L range µH	Q @ L nom	F Test MHz	Fo @ L nom MHz	NOTES
Q3-.10	.10	.085-.115	95	25	650	The inductance adjustment range of Q3 type coils was deliberately stated below the attainable values by mechanically adjusting capability, in order to keep Q variations below 7%. Of couse a larger adjustment range is possible if Q variation is not of great importance to the circuit. Inductance and Q of the HF coils were measured on the HP 4324A Q meter. Data was obtained by the use of soldered leads, in order to avoid errors due to contact resistance. Please note that the VHF-UHF coil inductance is indicated in nanohenries. The HF portion of the listing is stated in microhenries.
Q3-.12	.12	.10-.14	102	25	580	
Q3-.15	.15	.135-.165	102	25	520	
Q3-.18	.18	.14-.23	105	25	480	
Q3 -.22	.22	.20-.24	110	25	400	
Q3-.27	.27	.24-.35	110	25	380	
Q3-.33	.33	.27-.45	110	25	365	
Q3-.39	.39	.34-.46	105	25	300	
Q3-.47	.47	.39-.54	105	25	270	
Q3-.56	.56	.42-.66	105	25	250	
Q3-.68	.68	.56-.78	110	25	220	
Q3-.82	.82	.62-.94	110	25	200	
Q3-1.0	1.0	.75-1.2	110	25	185	
Q3-1.2	1.2	.98-1.4	98	7.9	160	
Q3-1.5	1.5	1.2-1.8	105	7.9	135	
Q3-1.8	1.8	1.3-2.1	102	7.9	145	
Q3-2.2	2.2	1.8-2.6	102	7.9	125	
Q3-2.7	2.7	2.3-3.1	111	7.9	105	
Q3-3.3	3.3	2.6-3.8	104	7.9	95	
Q3-3.9	3.9	3.0-4.6	100	7.9	80	
Q3-4.7	4.7	3.5-6.0	95	7.9	70	
Q3-5.6	5.6	4.5-6.2	102	7.9	60	
Q3-6.8	6.8	5.6-8.2	110	7.9	55	
Q3-8.2	8.2	7.0-9.2	112	7.9	48	
Q3-10	10.0	8.8-12	108	7.9	47.5	
Q3-12	12.0	10-14	106	2.5	40.5	
Q3-15	15	13-17	106	2.5	40	
Q3-18	18	14-24	105	2.5	35	
Q3-22	22	17-26	126	2.5	29	
Q3-27	27	22-32	117	2.5	24.5	
Q3-33	33	27-38	122	2.5	23	
Q3-39	39	32-45	114	2.5	21	
Q3-47	47	37-57	118	2.5	19	
Q3-56	56	45-65	106	2.5	16	
Q3-68	68	60-82	104	2.5	12.5	
Q3-82	82	65-95	112	2.5	11.8	
Q3-100	100	80-120	100	2.5	11	
Q3-120	120	100-140	80	.79	10.5	
Q3-150	150	130-165	85	.79	10.2	
Q3-180	180	140-220	78	.79	8.5	
Q3-220	220	180-245	80	.79	6.5	
Q3-270	270	220-320	80	.79	6.0	
Q3-330	330	280-380	63	.79	5.7	
Q3-390	390	330-450	63	.79	5.3	
Q3-470	470	390-520	65	.79	4.8	
Q3-560	560	460-680	68	.79	4.3	
Q3-680	680	545-810	65	.79	3.8	
Q3-820	820	660-980	65	.79	3.6	
Q3-1000	1,000	800-1200	65	.79	3.2	

MATERIALS

Pins are tin plated.

Coil base is made of temperature resistant DAP.

Coil form is made of glass woven polyester.

The core structure of the coil consists of cup core and a threaded center core which combine to give good magnetic shield.

Both core elements are made of powdered iron, to minimize performance variation with temperature.

Electrostatic shield consists of a copper can, tin plated.

coil-Q corp.
340 Bronxville Rd., Bronxville, New York 10708 · 914 DE 7-4775

340 Bronxville Road
Bronxville, New York 10708
Tel. 914-337-4775 Fax 914-779-7109

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INDUCTORS ✦ BALUNS

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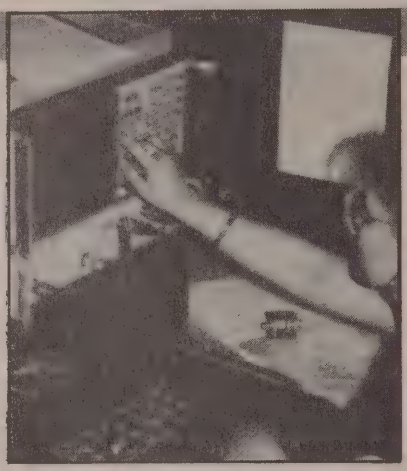

COMMUNICATION COIL, INC. has been designing and producing high reliability RF Coils, Chokes, Inductors, Baluns and Toroids since 1944... to high exacting standards for communications and signal processing in military, industrial, avionics, satellite, telemetry, marine, GPS and commercial applications.

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RF MAGNETICS

- OPEN AIRWOUND
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- TOROIDAL
- MOLYPERM
- SATURABLE
- MOLDED CASE
- SUBMINIATURE
- SHIELDED
- METAL CASE
- EPOXY COATED
- HERMETICALLY SEALED
- AXIAL-RADIAL
- MIL-C-15305
- MIL-I-45208
- FERRITE CORE
- SURFACE MOUNT
- POWERED IRON
- VARIABLE INDUCTANCE
- ENCAPSULATED
- MINIATURE
- PI-MULTI-PI
- FIXED
- BEAD CORES
- IMPREGNATED
- RF BALUNS
- MIL-T-27
- MIL-T-21038

APPLICATIONS • MILITARY • INDUSTRIAL • COMMERCIAL • AVIONICS • TELECOMMUNICATIONS • GPS • RFI • EMI • SATCOM • SWITCHMODE POWER SOURCES • UPS • TELEMETRY • INSTRUMENTATION • MEDICAL • MARINE

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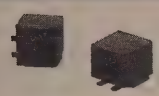
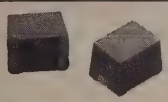
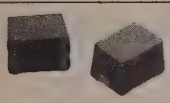
...BALUNS, COILS, CHOKES, INDUCTORS, TOROIDS, FILTERS, TRANSFORMERS...

SURFACE MOUNT
Inductive Components
Quick Reference Guide

A COMPANY OF VISHAY DALE®

STANDARD PRODUCTS			
1.		**MODELS IS-21 and IS-22 Inductors Toroidal or Pot Core** 100µH to 40,000µH	Molded shell design. High Q. Low EMI. EIA PDP-100 P/N SOPM6464 package. Pick and place compatible.
2.		**MODEL PT-100-09 Transformers ISDN** S/T and U Interfaces	CCITT I.430 pulse wave form. Digital communications. Pulse coupling. Pick and place compatible.
3.		**MODEL IMC-1812 Inductors Molded Chips** 0.01µH to 1,000µH	RF circuits. Rugged construction. Size is .177" [4.50] L x .126" [3.20] W x .126" [3.20] H. Pick and place compatible.
4.		**MODEL ISC-1812 Inductors Shielded Molded Chips** 0.1µH to 1,000µH	RF circuits. Rugged construction. Size is .177" [4.50] L x .126" [3.20] W x .126" [3.20] H. Pick and place compatible.
5.		**MODEL IMC-1210 Inductors Molded Chips** 0.01µH to 100µH	RF circuits. Rugged construction. Size is .126" [3.20] L x .098" [2.49] W x .087" [2.21] H. Pick and place compatible.
CUSTOM VARIATIONS OF STANDARD PRODUCTS			
6.		**Toroid or Pot Core Inductors and Transformers, Slug Core Inductors**	Modification of IS-21 and IS-22. Ferrite, molypermalloy, and powdered iron cores. Pick and place compatible.
CUSTOM PRODUCTS			
7.		**Toroidal Type Inductors or Transformers**	Low Cost. Low EMI. Sizes down to 0.10" [2.54] OD.
8.		**Slug Core Style Inductors**	Low Cost. Large D-C current capability.
9.		**LP Series Inductors or Transformers**	Multiple sizes. On-board power supplies. Industry interchangeable. Pick and place compatible.
PRODUCTS UNDER DEVELOPMENT			
10.		**Toroidal Type Inductors or Transformers** Molded Construction	Modified C style solder pads. Switching regulators. Common mode chokes. Rugged construction. Pick and place compatible.
11.		**Ferrite Core Inductors** Metalized Solder Pads	Ultra low profile. Very high inductance. Shielded. Low EMI. Pick and place compatible.
12.		**Ferrite Cup Core Inductors or Transformers**	Shielded. Low EMI. Large D-C current capability. Low cost. Pick and place compatible.

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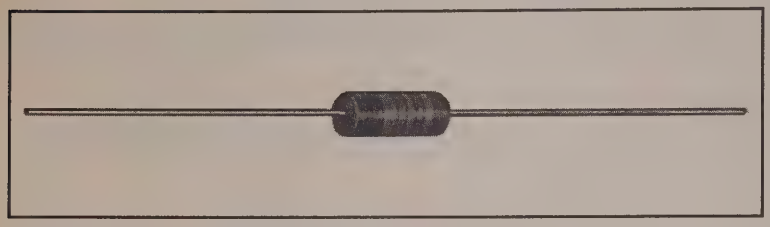
MODEL IMS-5 Inductors

Military, MIL-C-15305 Qualified and Commercial, Molded, Shielded



FEATURES

- Wide inductance range in small package
- Flame retardant coating
- Electromagnetic shield-finest shield available
- Epoxy molded construction provides superior moisture protection
- Precision performance, excellent reliability, sturdy construction

ELECTRICAL SPECIFICATIONS

Inductance Tolerance: ± 10% standard. ± 5% available.

Insulation Resistance: 1000 Megohm minimum per MIL-STD-202, Method 302, Test Condition B.

Dielectric Withstanding Voltage: 1000 VAC per MIL-STD-202, Method 301 (sea level).

Percent Coupling: 3% maximum per MIL-C-15305.

Operating Temperature Range: - 55°C to + 105°C.

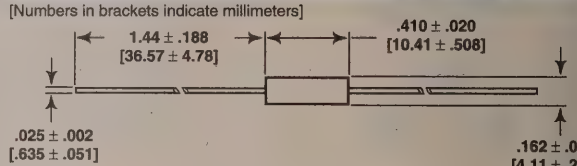
INDUCTANCE RANGE AND MILITARY STANDARD

INDUCTANCE RANGE		CLASSIFICATION		MATERIAL		MILITARY STANDARD
FROM	TO	GRADE	CLASS	CORE	SHIELD	
.10µH	.82µH	1	A	Phenolic	Powd. Iron	MS75087
1.0µH	12.0µH	1	A	Powd. Iron	Powd. Iron	MS75088
15.0µH	100,000µH	1	A	Ferrite	Ferrite	MS75089*

* Not QPL'd.

DIMENSIONAL CONFIGURATIONS

[Numbers in brackets indicate millimeters]



NOTE: Listing of Military Standard does not imply qualification. Contact factory for latest government QPL information.

A COMPANY OF VISHAY DALE®

MODEL IMS-2 Inductors

Military, MIL-C-15305 Qualified and Commercial, Molded, Shielded, Miniature

FEATURES

- Flame retardant coating
- Electromagnetic shield
- Small package for a shielded inductor
- Epoxy molded construction provides superior moisture protection
- Precision performance, excellent reliability, sturdy construction

ELECTRICAL SPECIFICATIONS

Inductance Tolerance: ± 10% standard. ± 5% available.

Insulation Resistance: 1000 Megohm minimum per MIL-STD-202, Method 302, Test Condition B.

Dielectric Withstanding Voltage: 200 VAC per MIL-STD-202, Method 301 (sea level).

Percent Coupling: 3% maximum per MIL-C-15305.

Operating Temperature Range: - 55°C to + 105°C.

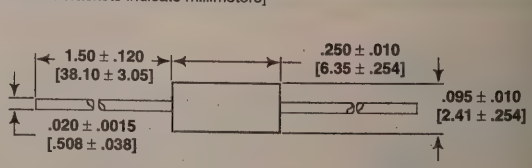
INDUCTANCE RANGE AND MILITARY STANDARD

INDUCTANCE RANGE		CLASSIFICATION		MATERIAL		MILITARY STANDARD
FROM	TO	GRADE	CLASS	CORE	SHIELD	
.10µH	100µH	1	A	Powd. Iron	Powd. Iron	MS21426
120µH	560µH	1	A	Ferrite	Ferrrite	MS21427

NOTE: Listing of Military Standard does not imply qualification. Contact factory for latest government QPL information.

DIMENSIONAL CONFIGURATIONS

[Numbers in brackets indicate millimeters]



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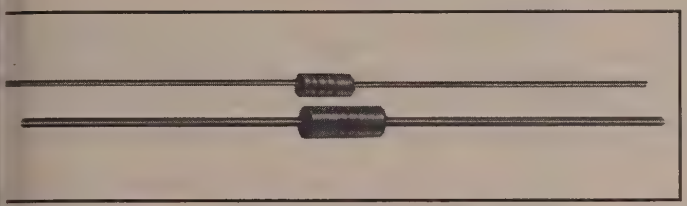
MODEL IM Inductors

Military, MIL-C-15305 Qualified and Commercial, Molded



FEATURES

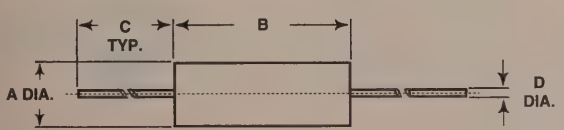
- Wide inductance range in small package
- Flame retardant coating
- Precision performance, excellent reliability, sturdy construction
- Epoxy molded construction provides superior moisture protection

INDUCTANCE RANGE AND MILITARY STANDARD

MODEL	INDUCTANCE RANGE Mil. Range in bold face FROM	TO	CLASSIFICATION GRADE	CLASS	MILTARY STANDARD
IM-1	.10µH	100µH	—	—	—
IM-2	.022µH	.082µH	—	—	—
	.10µH	**1µH**	1	B	MS75083
	1.2µH	**27µH**	1	A	MS75084
	33µH	**1000µH**	1	A	MS75085
IM-4	**.15µH**	**4.7µH**	1	B	MS18130
	5.6µH	**33µH**	1	A	MS14046
	36µH	**240µH**	1	A	MS90538
	270µH	1800µH	—	—	—
IM-6	.10µH	2.7µH	1	B	MS75008 Not QPL'd
	3.3µH	27µH	1	A	MS75101 Not QPL'd
	33µH	220µH	—	—	—
	270µH	1000µH	1	A	MS90539 Not QPL'd
IM-8	1100µH	3600µH	1	A	MS90540 Not QPL'd
IM-9	68µH	150µH	1	A	MS14047 Not QPL'd
IM-10	3900µH	10,000µH	1	A	MS90541 Not QPL'd

DIMENSIONAL CONFIGURATIONS

Numbers in brackets indicate millimeters]



MODEL		A (Dia.)	B	C (Typ.)	D (Dia.)
IM-1	Maximum	.086 [2.18]	.210 [5.33]	1.62 [41.15]	.0215 [.546]
	Minimum	.070 [1.78]	.190 [4.83]	1.38 [35.05]	.0185 [.470]
IM-2	Maximum	.105 [2.67]	.260 [6.60]	1.63 [41.40]	.0215 [.546]
	Minimum	.085 [2.16]	.240 [6.10]	1.25 [31.75]	.0185 [.470]
IM-4	Maximum	.165 [4.19]	.385 [9.78]	1.63 [41.40]	.027 [.686]
	Minimum	.145 [3.68]	.365 [9.27]	1.25 [31.75]	.023 [.584]
IM-6	Maximum	.200 [5.08]	.450 [11.43]	1.63 [41.40]	.027 [.686]
	Minimum	.180 [4.57]	.430 [10.92]	1.25 [31.75]	.023 [.584]
IM-8	Maximum	.225 [5.72]	.570 [14.48]	1.63 [41.40]	.030 [.762]
	Minimum	.205 [5.21]	.550 [13.97]	1.25 [31.75]	.026 [.660]
IM-9	Maximum	.260 [6.60]	.570 [14.48]	1.63 [41.40]	.027 [.686]
	Minimum	.240 [6.10]	.550 [13.97]	1.25 [31.75]	.023 [.580]
IM-10	Maximum	.250 [6.35]	.750 [19.05]	1.63 [41.40]	.034 [.864]
	Minimum	.230 [5.84]	.730 [18.54]	1.25 [31.75]	.030 [.762]

ELECTRICAL SPECIFICATIONS

Inductance Tolerance: ± 1%, ± 3%, ± 5%, ± 10%, ± 20%.

Insulation Resistance: 1000 Megohm minimum per MIL-STD-202, Method 302, Test Condition B.

Dielectric Strength: Per MIL-STD-202, Method 301: 1000 VAC for IM-2, -4, -6, -8, -9 and -10. 200 VAC for IM-1.

MECHANICAL SPECIFICATIONS

Terminal Strength: Per MIL-STD-202, Method 211, Test Condition A: For IM-1, 3 pounds pull. For IM-2, -4, -6, -8, -9 and -10, 5 pounds pull and twist.

Weight: IM-1 = .25 gram maximum,
IM-2 = .30 gram maximum,
IM-4 = .65 gram maximum,
IM-6 = .95 gram maximum,
IM-8 = 1.5 gram maximum,
IM-9 = 2.0 gram maximum,
IM-10 = 2.5 gram maximum.

MATERIAL SPECIFICATIONS

Encapsulant: Epoxy.

Standard Terminals: IM-1 and IM-2, 24 AWG; IM-4, IM-6 and IM-9, 22 AWG; IM-8, 21 AWG; and IM-10, 20 AWG, Tinned Copper.

TEST EQUIPMENT*

- H/P 4342A Q-Meter.
- Measurements Corporation Megacycle Meter, Model 59.
- Wheatstone Bridge.

* Test procedures per MIL-C-15305.

MAXIMUM TEMPERATURE RISE

		OPERATING TEMP. RANGE
IM-1	.10 to .47µH = 35°C at 90°C ambient.	- 55°C to + 125°C
	.56 to 1000µH = 15°C at 90°C ambient.	- 55°C to + 105°C
IM-2	.1 to 1.0µH = 35°C at 90°C ambient.	- 55°C to + 125°C
	1.2 to 27µH = 15°C at 90°C ambient.	- 55°C to + 105°C
	33 to 1000µH = 15°C at 90°C ambient.	- 55°C to + 105°C
IM-4	.15 to 4.7µH = 35°C at 90°C ambient.	- 55°C to + 125°C
	5.6 to 33µH = 15°C at 90°C ambient.	- 55°C to + 105°C
	36 to 240µH = 15°C at 90°C ambient.	- 55°C to + 105°C
	270 to 1800µH = 35°C at 90°C ambient.	- 55°C to + 125°C
IM-6	.1 to 2.7µH = 35°C at 90°C ambient.	- 55°C to + 125°C
	3.3 to 1000µH = 15°C at 90°C ambient.	- 55°C to + 105°C
IM-8, IM-9, IM-10	= 15°C at 90°C ambient.	- 55°C to + 105°C

NOTE: Listing of Military Standard does not imply qualification. Contact factory for latest government QPL information.

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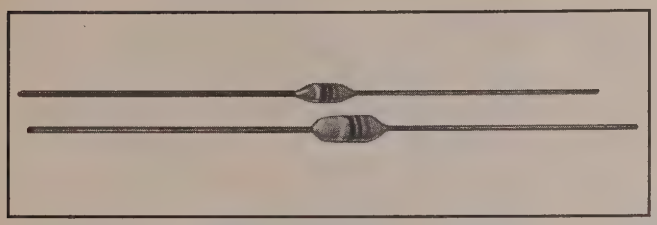
MODEL IR Inductors

Epoxy Conformal Coated Uniform Roll Coated



FEATURES

- Flame-retardant coating and color band identification
- Excellent environmental characteristics
- Uniform coating is excellent for automatic insertion
- Comparable in quality to molded chokes at a lower price
- Epoxy coating is more durable than lacquer coated models, yet is priced comparably

ELECTRICAL SPECIFICATIONS

Inductance Tolerance: ± 1%, ± 3%, ± 5%, ± 10%, ± 20%.
Insulation Resistance: 1000 Megohm minimum per MIL-STD-202, Method 302, Test Condition B.
Dielectric Strength: 1000 VAC per MIL-STD-202, Method 301.

MATERIAL SPECIFICATIONS

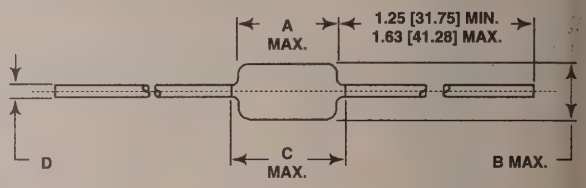
Coating: Epoxy-uniform roll coated.
Lead: Tinned Copper.

MAXIMUM TEMPERATURE RISE

		OPERATING TEMP. RANGE
IR-2	.1 to 1.0µH = 35°C at 90°C ambient.	- 55°C to + 125°C
	1.2 to 27µH = 15°C at 90°C ambient.	- 55°C to + 105°C
	33 to 1000µH = 15°C at 90°C ambient.	- 55°C to + 105°C
IR-4	.15 to 4.7µH = 35°C at 90°C ambient.	- 55°C to + 125°C
	5.6 to 33µH = 15°C at 90°C ambient.	- 55°C to + 105°C
	36 to 240µH = 15°C at 90°C ambient.	- 55°C to + 105°C
	270 to 1800µH = 35°C at 90°C ambient.	- 55°C to + 125°C

DIMENSIONAL CONFIGURATIONS

[Numbers in brackets indicate millimeters]



MODEL	A (Max.)	B (Max.)	C (Max.)	D
IR-2	.260 [6.60]	.120 [3.05]	.330 [8.38]	.0200 ± .0015 [.508 ± .038]
IR-4	.385 [9.78]	.180 [4.57]	.440 [11.18]	.025 ± .002 [.635 ± .051]

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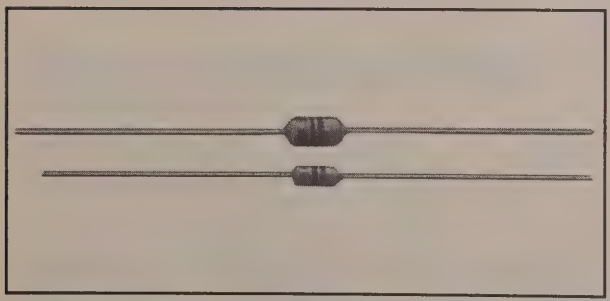
MODEL IRF Inductors

Epoxy Conformal Coated Uniform Roll Coated



FEATURES

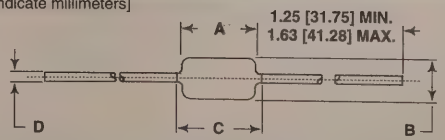
- Flame-retardant coating and color band identification
- Uniform coating is excellent for automatic insertion
- Available in bulk, ammo and reel pack per EIA RS-296
- Superior electrical specifications, high Q and self resonant frequency, low DC resistance, high rated DC current

ELECTRICAL SPECIFICATIONS

Inductance Tolerance: ± 5%, ± 10%, ± 20%.
Insulation Resistance: 1000 Megohm minimum per MIL-STD-202, Method 302, Test Condition B.
Operating Temperature Range: - 55°C to + 105°C.

DIMENSIONAL CONFIGURATIONS

[Numbers in brackets indicate millimeters]



MODEL	A (Max.)	B (Max.)	C (Max.)	D
IRF-1	.260 [6.60]	.120 [3.05]	.330 [8.38]	.0200 ± .0015 [.508 ± .038]
IRF-3	.385 [9.78]	.165 [4.19]	.410 [10.41]	.025 ± .002 [.635 ± .051]

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MODELS 09/15/15S/19/22/24/25/28/31/37/46 Inductors

Military, MIL-C-15305 Qualified and Commercial, Molded

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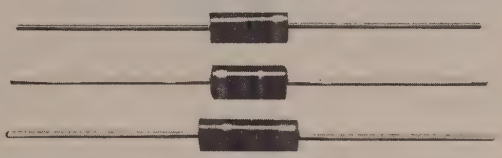
MODEL 09
MS75083, MS75084, MS75085

MODEL 15
MS14046, MS18130, MS90538

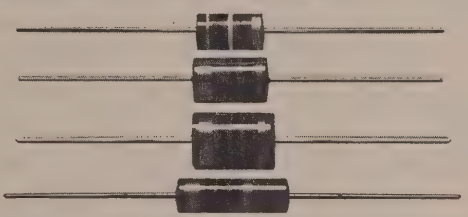
MODEL 15S
MS75087, MS75088, MS75089

MODEL 19
MS75008, MS75101, MS90539

MODELS 22, 24, 25
MS14047, MS14052, MS90540, MS90541, MS90542



MODELS 28, 31, 37, 46
MS14048, MS14049, MS14050, MS75103, MS91189



FEATURES

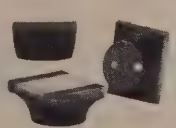
- High Q and SRF
- Non standard tolerances are also available in all types
- Maximum protection with minimum size as a result of full encapsulation in a thermo-setting mineral filled plastic jacket
- Assured uniformity of product, a result of stringent Quality Control and Inspection procedures at every production stage

MODELS M83446/01,/04, WCx, UCx Inductors

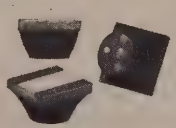
Military, MIL-C-83446 Qualified and Commercial Coated, Uncoated, Surface Mount

A COMPANY OF VISHAY DALE®

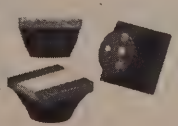
M83446/01: Military MIL-C-83446 Qualified and Commercial Conformal Coated Surface Mount



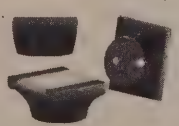
M83446/04: Military MIL-C-83446 Qualified and Commercial Conformal Coated Surface Mount



MODEL WCM Commercial Conformal Coated Surface Mount

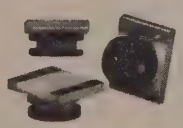


MODEL WCS Commercial Conformal Coated Surface Mount



MODEL UCM Commercial Uncoated Surface Mount

MODEL UCS Commercial Uncoated Surface Mount



FEATURES

M83446/01 and M83446/04 WCM, WCS, UCM, UCS:

- High Q and SRF
- Non standard tolerances are also available in all types
- Maximum protection with minimum size as a result of full encapsulation in a thermo-setting mineral filled plastic jacket
- Assured uniformity of product, a result of stringent Quality Control and Inspection procedures at every production stage

M83446/01 and M83446/04 WCM and WCS:

- Conformally coated models offer similar electrical and mechanical properties to the molded military and industrial models

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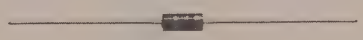
MODELS 17S/DKM/13S/10/09C/15C/HCFC/WCV/VC
Inductors
Commercial, Molded, Shielded, Coated Radial Leaded, Versacoil™ Variable

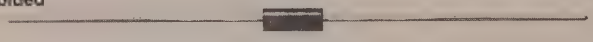
MODEL 17S
Molded, Shielded

MODEL DKM
Molded, Shielded

MODEL 13S
Molded



MODEL 10
Molded



FEATURES

MODELS 17S, DKM, 13S, 10:

- High Q and SRF
- Non standard tolerances are also available in all types
- Maximum protection with minimum size as a result of full encapsulation in a thermo-setting mineral filled plastic jacket
- Assured uniformity of product, a result of stringent Quality Control and Inspection procedures at every production stage

MODEL 09C
Conformal Coated

MODEL 15C
Conformal Coated

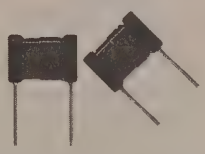
FEATURES

MODELS 09C and 15C:

- High Q and SRF
- Non standard tolerances are also available in all types
- Maximum protection with minimum size as a result of full encapsulation in a thermo-setting mineral filled plastic jacket
- Conformally coated models offer similar electrical and mechanical properties to the molded military and industrial models
- Assured uniformity of product, a result of stringent Quality Control and Inspection procedures at every production stage

MODEL HCFC
High Current
Epoxy Coated

MODEL WCV
Radial Leaded



FEATURES

MODELS HCFC and WCV:

- High Q and SRF
- Non standard tolerances are also available in all types
- Maximum protection with minimum size as a result of full encapsulation in a thermo-setting mineral filled plastic jacket
- Assured uniformity of product, a result of stringent Quality Control and Inspection procedures at every production stage

MODEL VC
Versacoil™
Variable Inductors
Complete Range
.10μH to 100,000μH

FEATURES

- The Model VC, Versacoil™ variable inductor can be furnished as a horizontal mount unit or a vertical mount unit. Both are intended for P. C. board use.
- Classification is Grade 1, Class B
- Unitork adjustment

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MODELS MD, Px, RFC, SWWD, Sxx, VIx, WD, WVL Inductors

Military/E-Rel, MIL-C-39010 Qualified
Military, MIL-C-15305 Qualified and Commercial

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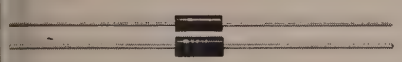
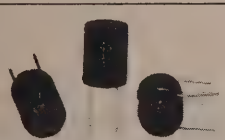
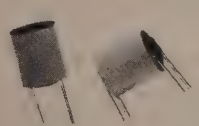
	MODEL SWD-ER, Military/E-Rel, MIL-C-39010 Qualified, M39010/01/02/03, Magnetic Shield /01 - Phenolic Core/Iron Sleeve. /02 - Iron Core/Iron Sleeve. /03 - Ferrite Core/Ferrite Sleeve.
	MODEL RFC-S-ER and RFC-SS-ER, Military/E-Rel, MIL-C-39010 Qualified, M39010/04/05/06/07 /04 (Phenolic Core). /05 (Iron Core). /06 (Phenolic Core). /07 (Iron Core).
	MODEL MD-ER, Military/E-Rel, MIL-C-39010 Qualified, M39010/08/09/10 /08 (Phenolic Core). /09 (Iron Core). /10 (Ferrite Core).
	**MODEL SWD-A, Military, MIL-C-15305 Qualified, MS75087, MS75088, MS75089 and Commercial** **MODEL SWD, Military, MIL-C-15305 Qualified, MS90537 and Commercial** Ultra-reliable, molded, shielded, miniature. Classification - Grade 1, Class B. Molded epoxy envelope and shielding. Offers reliability, electrical performance and minimum coupling in high density packaging. **MODEL SWWD, Military, MIL-C-15305 Qualified, MS21399, MS21400, MS21401 and Commercial** Subminiature, Molded, Shielded. Classification - Grade 1, Class A. Inductance range - .10µH to 10000µH. .136" [3.45] diameter by .335" [8.51] length. Molded epoxy envelope. Use of unique "T" lead construction on 15µH to 10000µH values assures exceptional reliability where fine wire sizes are used. Utmost reliability, electrical performance and minimum coupling in high density packaging.
	MODEL MD, Military, MIL-C-15305 Qualified, MS75083, MS75084, MS75085 and Commercial Subminiature, Molded. Classification - Grade 1, Class B for MS75083. Grade 1, Class A for MS75084 and MS75085. Molded epoxy envelope. Features reliability and uniformity.
	MODEL RFC-SS, Military, MIL-C-15305 Qualified, MS18130, MS14046, MS90538 and Commercial Molded. Classification - Grade 1, Class B for .15µH to 4.7µH. Grade 1, Class A for 5.6µH to 240µH. Inductance range - .15µH to 240µH. **MODEL RFC-S, Military, MIL-C-15305 Qualified, MS21389, MS21390 and Commercial** Molded. Classification - Grade 1, Class B. Inductance range - .10µH to 1000µH. **MODEL RFC-SA, Military, MIL-C-15305 Qualified, MS75008, MS75101, MS90539 and Commercial** Molded. Classification - Grade 1, Class B for .15µH to 2.7µH. Grade 1, Class A for 3.3µH to 1000µH. Inductance range - .15µH to 1000µH. **MODEL RFC-M, Military, MIL-C-15305 Qualified, MS21388 and Commercial** Molded. Classification - Grade 1, Class B. Inductance range is 1µH to 2200µH. **MODEL RFC-L, Military, MIL-C-15305 Qualified, MS21380 and Commercial** Molded. Classification - Grade 1, Class B. Inductance range - 1µH to 10,000µH. Proven reliability.
	**MODEL WVL, Military, MIL-C-15305 Qualified, MS21381, MS21402** Variable, Subminiature Shielded. Grade 1, Class A for MS. Grade 3, Class A for WVL. High Q values. Vertical or horizontal mounting. Unitized epoxy-molded construction. Inductance range - .10µH to 10,000µH. .300" [7.62] diameter by .400" [10.16] length. Shield construction allows maximum density packaging.
	MODEL PC Subminiature, Shielded, Radial Leaded. Classification - Grade 1, Class B. High Q values. Unitized epoxy-molded construction. Inductance range - .10µH to 100,000µH. Shielded construction allows maximum density packaging.
	MODEL PL High Current, Power Chokes. Inductance range - 10µH to 100,000µH.
	MODEL SPL Miniature, High Current, Power Chokes. Inductance range - 1µH to 10,000µH.
	**MODELS VIV and VIH** Miniature, Variable, Vertical and Horizontal Styles. Classification - Grade 2, Class B. Encapsulated in epoxy resin for reliability. High reliability and exceptional stability over extreme temperature variations.

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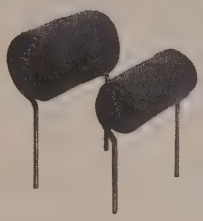
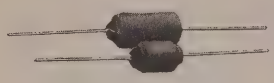
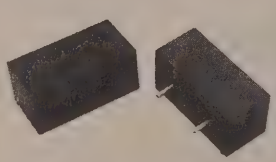
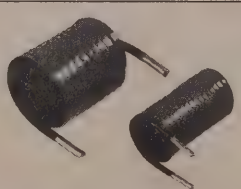
MODELS IH, IHx, IHM-2 Inductors

High Current, Filter

	**MODEL IH** **Filter Inductors** **High Current**	**FEATURES** • Printed circuit mounting • Pre-tinned leads • Protected by polyolefin tubing - flame retardant UL type VW-1 per MIL-I-23053/5, Class 3 requirements	**APPLICATIONS** Noise filtering for switching regulators, power amplifiers, power supplies and SCR or Triac control circuits. **ELECTRICAL SPECIFICATIONS** **Inductance:** Measured at 1.0 volt with zero DC current. **Operating Temperature:** - 55°C to + 125°C (no load). - 55°C to 75°C (at full rated current).
	**MODEL IHA** **Filter Inductors** **High Current**	**FEATURES** • Printed circuit mounting (axial leads) • Pre-tinned leads • Low cost construction • Designed for use with switching power supplies • Protected by polyolefin sleeve - flame retardant UL type VW-1 per MIL-I-23053/5, Class 3 requirements	**ELECTRICAL SPECIFICATIONS** **Inductance:** Measured at 1 V with no DC current. **Current Rating:** Maximum continuous operating current (DC or RMS) based on 50°C temperature rise. **Dielectric Rating:** 2500 V RMS, 60 Hz, applied for one minute between winding and outer circumference to within .250" [6.35] of the insulation sleeve edge. **Operating Temperature:** - 55°C to + 125°C (no load). - 55°C to + 75°C (at full rated current).
	MODEL IHD **Filter Inductors** **High Current**	**FEATURES** • Printed circuit mounting (axial leads) • Protected by polyolefin sleeve • High saturation bobbin used allowing high inductance with low DC resistance • Pre-tinned leads • High resistivity core offers very high parallel resistance, resulting in maximum coil performance	**ELECTRICAL SPECIFICATIONS** **Inductance:** Measured at 1 V with no DC current. **Dielectric Rating:** 2500 V RMS between winding and outer circumference to within .250" [6.35] of the insulating sleeve edge. **Operating Temperature:** - 55°C to + 125°C (no load). - 55°C to + 85°C (at full rated current).
	MODEL IHB **Filter Inductors** **High Current**	**FEATURES** • Printed circuit mounting • Wide range of inductance and current ratings • Pre-tinned leads • Optional insulating covering and printing available at additional cost	**ELECTRICAL SPECIFICATIONS** **Inductance:** Measured at 1 V with no DC current. **Dielectric:** 2500 V RMS between winding and .250" [6.35] of insulating covering edge (with optional insulating covering). **Operating Temperature:** - 55°C to + 130°C (no load). - 55°C to + 80°C (at full rated current).
	**MODEL IHM-2** **Filter Inductors** **High Current**	**FEATURES** • Totally encapsulated using a potted flame-resistant shell • Pre-tinned leads • Printed circuit mounting	**ELECTRICAL SPECIFICATIONS** **Inductance:** Measured at 1 V with no DC current. **Current Rating:** Maximum continuous operating current based on 50°C temperature rise. **Dielectric Rating:** 1500 V RMS between windings and top of component. **Operating Temperature:** - 55°C to + 125°C (no load). - 55°C to + 75°C (at full rated current).
	**MODEL IHV** **Filter Inductors** **High Current**	**FEATURES** • Printed circuit mounting • Low cost construction • Designed for use with switching power supplies • Pre-tinned leads • Epoxy coated for durability and reliability	**ELECTRICAL SPECIFICATIONS** **Inductance:** Measured at 1 V with no DC current. **Dielectric:** 2500 V RMS between winding and outer circumference to within .250" [6.35] of the insulation sleeve edge. **Operating Temperature:** - 55°C to + 125°C (no load). Storage: - 55°C to + 75°C (at full rated current).

MODELS TE and TD
Filter Inductors
Toroid

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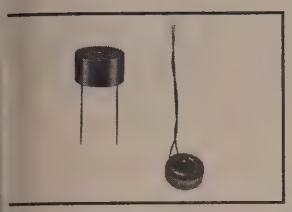


FEATURES

- Choice of encapsulated (TE) or dipped (TD) styles
- TD style combines low cost with excellent performance in commercial applications
- High Q and wide selection of Q versus frequency ranges in one small package. Large number of standard inductance values.

STANDARD ELECTRICAL SPECIFICATIONS (Applies to Core Only)

MODEL				T. C. CODE	TEMPERATURE COEFFICIENT	TEMPERATURE RANGE	T. C. AVAILABILITY		
TE-2 TD-2	TE-3 TD-3	TE-4 TD-4	TE-5 TD-5				Q0	Q3	Q4
X	X	X	X	TA	0 ± 1%	- 55°C to + 125°C		X	X
		X	X	TB	0 ± 0.1%	+ 13°C to + 35°C		X	X
X	X	X	X	TD	0 ± 0.1%	0°C to + 55°C		X	X
		X	X	TE	0 ± 0.15%	0°C to + 55°C			X
	X	X	X	TL*	+ 40 to + 110 PPM/°C + 85 to + 185 PPM/°C	- 55°C to + 25°C + 25°C to + 85°C			X
X	X	X	X	TM	0 ± 0.25%	- 65°C to + 125°C		X	X
X	X	X	X	TR	50 PPM/°C (Typical)	- 65°C to + 125°C	X		
X	X	X	X	TW	0 ± 0.25%	- 55°C to + 85°C		X	X

* Inverse of typical Temperature Coefficient of polystyrene capacitor.

INDUCTANCE RANGES

T. C. CODE	TE-2 TD-2	TE-3 TD-3	TE-4 TD-4	TE-5 TD-5
Q0	40µH to 15mH	50µH to 15mH	150µH to 20mH	1mH to 100mH
Q3	475µH to 120mH	500µH to 1H	1mH to 2H	5mH to 2H
Q4	1mH to 250mH	1mH to 4H	2mH to 5H	10mH to 5H

ELECTRICAL SPECIFICATIONS

Tolerance: TE-2, TD-2 = ± 1% > 2mH, ± 2% = .05mH to 2mH. TE-3, TD-3 = ± 1% > 2mH, ± 2% 154µH to 2mH, ± 5% < 150µH. TE-4, TD-4 = ± 1% > 2mH, ± 2% < 2mH. TE-5, TD-5 = ± 1% > 2mH, ± 2% < 2mH.

Insulation Resistance: 1000 Megohm minimum.

Dielectric Strength: 1000 V minimum (TE). 500 V minimum (TD).

MECHANICAL SPECIFICATIONS

Terminal Strength: 2 pounds pull test (TE).

Vibration: Per MIL-T-27 (TE).

Shock: Per MIL-T-27 (TE).

Weight: TE-2 = 2 grams, TD-2 = 1.6 grams typical. TE-3 = 5.1 grams, TD-3 = 4.9 grams typical. TE-4 = 20 grams, TD-4 = 17 grams typical. TE-5 = 53 grams, TD-5 = 52 grams typical.

MATERIAL SPECIFICATIONS

Coating: Vinyl (TD), non-flammable, abrasion and moisture resistant. Resists most cleaning agents. (Consult factory for chemicals which may be used.)

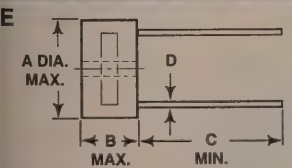
Standard Terminals: Tinned copper (TE); Stranded, tinned copper, Teflon insulated (TD).

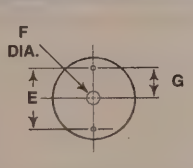
Encapsulant: Epoxy (TE).

Gauge: TE-2 = 24 AWG, TD-2 = 30 AWG. TE-3 = 22 AWG, TD-3 = 26 AWG. TE-4 = 20 AWG, TD-4 = 24 AWG. TE-5 = 20 AWG, TD-5 = 24 AWG.

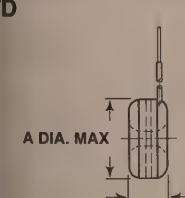
DIMENSIONAL CONFIGURATIONS [Numbers in brackets indicate millimeters]

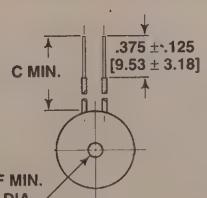
TE





TD





MODEL	A	B	C	D	E	F	G
TE-2	.437 [11.10]	.270 [6.86]	1.0 [25.40]	.020 [.508]	.300 [7.62]	—	—
TD-2	.437 [11.10]	.250 [6.35]	2.0 [50.80]	—	—	—	—
TE-3	.685 [17.40]	.385 [9.78]	1.0 [25.40]	.025 [.635]	.500 [12.70]	.093 [2.36]	.250 [6.35]
TD-3	.685 [17.40]	.320 [8.13]	3.0 [76.20]	—	—	.125 [3.18]	—
TE-4	1.06 [26.92]	.500 [12.70]	1.0 [25.40]	.032 [.813]	.900 [22.86]	.120 [3.05]	.450 [11.43]
TD-4	1.06 [26.92]	.437 [11.10]	4.0 [101.60]	—	—	.220 [5.59]	—
TE-5	1.32 [33.53]	.725 [18.42]	1.0 [25.40]	.032 [.813]	1.0 [25.40]	.144 [3.66]	.500 [12.70]
TD-5	1.32 [33.53]	.688 [17.48]	6.0 [152.40]	—	—	.220 [5.59]	—

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PRODUCT SELECTION GUIDES

TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 93/94 EDITION OF EEM

AC Power Supplies, Product Selection Guide D•2221
Batteries, Product Selection Guide D•1419
Cabinets, Enclosures, Racks & Chassis, Product Selection Guide C•1003
Capacitors, Product Selection Guide A•1003
Coils, Chokes, Inductors, Product Selection Guide A•1179
Connectors, Terminals & Sockets, Product Selection Guide C•1139
Cores, Magnets & Ferrites A•1317
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide A•1326
DC-DC Converters D•2049
DC Power Supplies, Product Selection Guide D•1488
Delay Lines, Product Selection Guide A•1513
Discrete Semiconductors, Product Selection Guide A•2130
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Fiber Optics, Product Selection Guide B•1200
Filters, Power, Product Selection Guide A•1584
Filters, Signal, Product Selection Guide A•1617
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Oscilloscopes, Product Selection Guide D•1402
Panel Hardware, Product Selection Guide C•1522
Panel Meters, Analog & Digital, Product Selection Guide D•1336
Potentiometers, Trimmers, Controls, & Rheostats, Product Selection Guide A•2053
Power Supplies, AC, Product Selection Guide D•2221
Power Supplies, DC, Product Selection Guide D•1488
Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide B•1341
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- Switch mode transformers to 500 KHz
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- Data bus transformers

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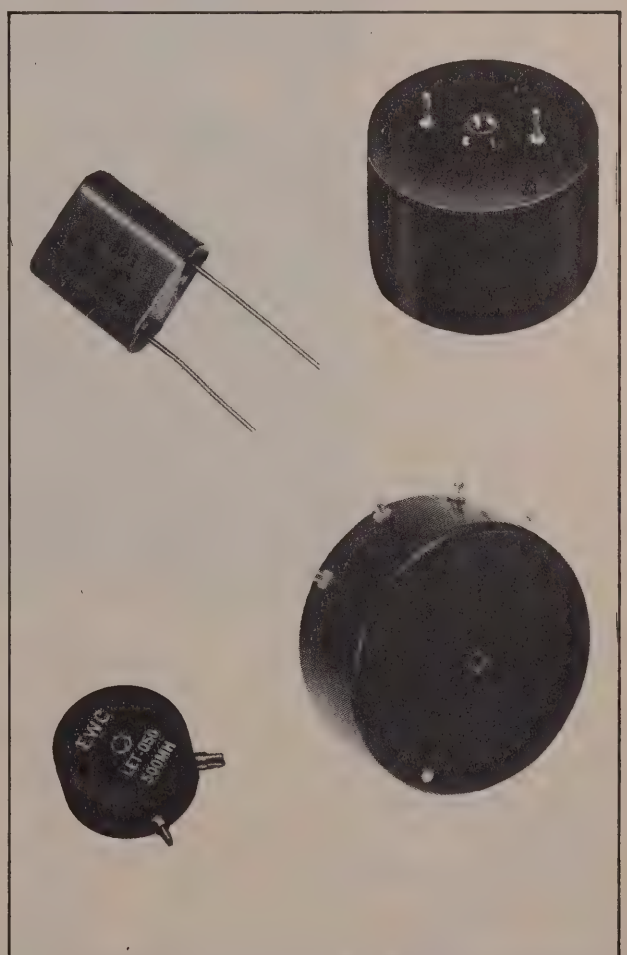
- Facilities — modern efficient plant



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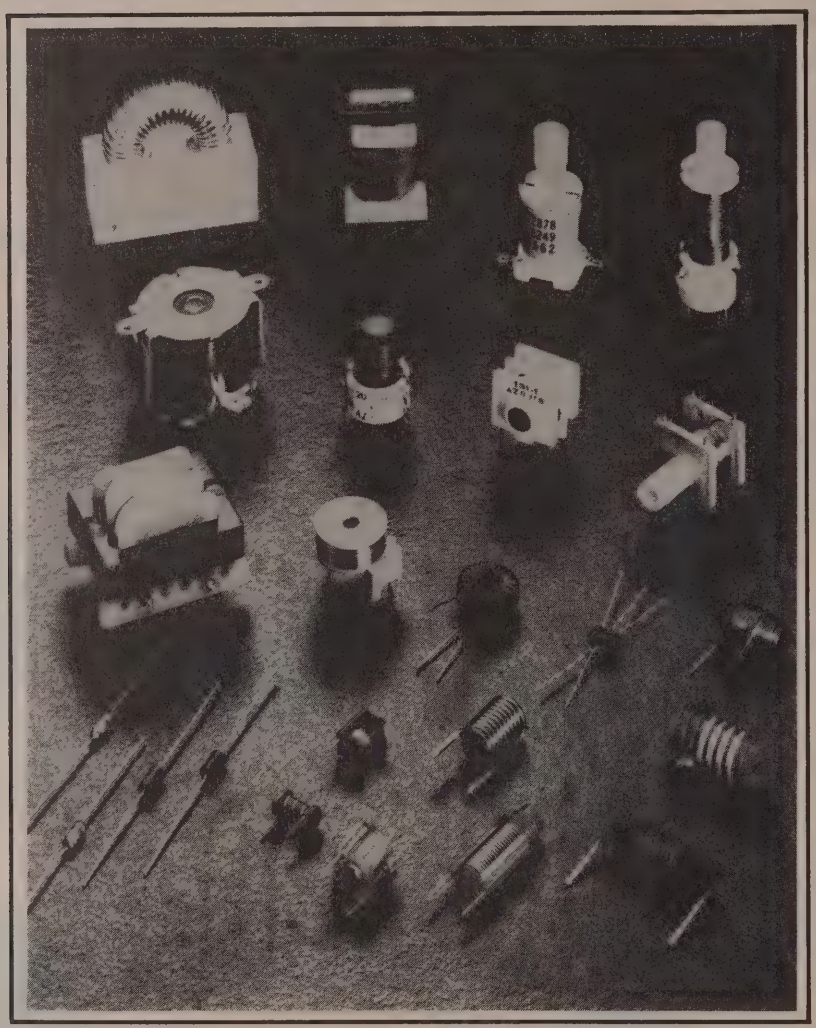

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- Driver Transformers
- Switch Mode Transformers

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- Bridge Assemblies
- Schottky Diodes
- Super Fast Recovery

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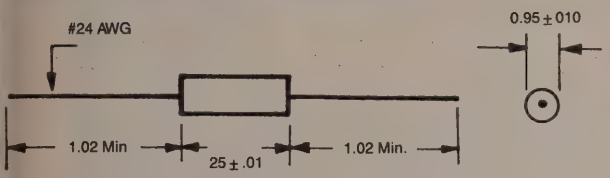
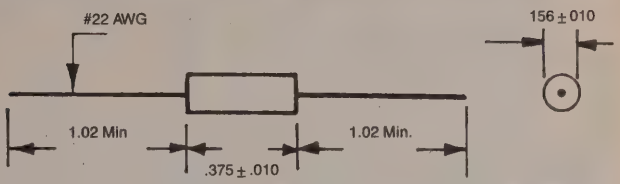
1303 RF MOLDED CHOKES



Part No.	Inductance uh ± 10%	Q Min	Test Freq. (MHz)	SRF Min (MHz)	DCR Max (Ohms)	Rated Current (mA)
1303-01K	.10	40	25.0	680	.08	1380
1303-02K	.12	40	25.0	640	.09	1300
1303-03K	.15	38	25.0	600	.10	1230
1303-04K	.18	35	25.0	550	.12	1120
1303-05K	.22	33	25.0	510	.14	1040
1303-06K	.27	33	25.0	430	.16	975
1303-07K	.33	30	25.0	410	.22	830
1303-08K	.39	30	25.0	365	.30	710
1303-09K	.47	30	25.0	330	.35	660
1303-10K	.56	30	25.0	300	.50	550
1303-11K	.68	28	25.0	275	.60	500
1303-12K	.82	28	25.0	250	.85	420
1303-13K	1.00	25	25.0	230	1.00	390
1303-14K	1.20	25	7.9	150	.18	620
1303-15K	1.50	28	7.9	140	.22	560
1303-16K	1.80	30	7.9	125	.30	480
1303-17K	2.20	30	7.9	115	.40	415
1303-18K	2.70	37	7.9	100	.55	355
1303-19K	3.30	45	7.9	90	.85	285
1303-20K	3.90	45	7.9	80	1.00	263
1303-21K	4.70	45	7.9	75	1.20	239
1303-22K	5.60	50	7.9	65	1.80	195
1303-23K	6.80	50	7.9	60	2.00	185
1303-24K	8.20	55	7.9	55	2.70	160
1303-25K	10.0	55	7.9	50	3.30	144
1303-26K	12.0	45	2.5	40	2.70	160
1303-27K	15.0	45	2.5	35	2.80	157
1303-28K	18.0	50	2.5	30	3.10	149
1303-29K	22.0	50	2.5	25	3.30	144
1303-30K	27.0	50	2.5	20	3.50	140
1303-31K	33.0	45	2.5	24	3.40	130
1303-32K	39.0	45	2.5	22	3.60	125
1303-33K	47.0	45	2.5	20	4.50	110
1303-34K	56.0	45	2.5	18	5.70	100
1303-35K	68.0	50	2.5	15	6.70	92
1303-36K	82.0	50	2.5	14	7.30	88
1303-37K	100.0	50	2.5	13	8.00	84
1303-38K	120.0	30	.79	12	13.00	66
1303-39K	150.0	30	.79	11	15.00	61
1303-40K	180.0	30	.79	10	17.00	57
1303-41K	220.0	30	.79	9	21.00	52
1303-42K	270.0	30	.79	8	25.00	47
1303-43K	330.0	30	.79	7	28.00	45
1303-44K	390.0	30	.79	6.5	35.00	40
1303-45K	470.0	30	.79	6	42.00	36
1303-46K	560.0	30	.79	5	46.00	35
1303-47K	680.0	30	.79	4.2	60.00	30
1303-48K	820.0	30	.79	3.8	65.00	29
1303-49K	1000.0	30	.79	3.4	72.00	28

Tolerance: J for 5%, K for 10%, M for 20%

1304 RF MOLDED CHOKES



Part No.	Inductance uh	Q Min	Test Freq. (MHz)	SRF Min (MHz)	DCR Max (Ohms)	Rated Current (mA)
1304-01M	.15	50	25.0	525	.03	2740
1304-02M	.22	50	25.0	450	.055	2020
1304-03M	.33	45	25.0	360	.09	1580
1304-04M	.47	45	25.0	310	.12	1370
1304-05K	.56	50	25.0	280	.135	1290
1304-06K	.68	50	25.0	250	.15	1220
1304-07K	.82	50	25.0	220	.22	1020
1304-08K	1.00	50	25.0	200	.29	880
1304-09K	1.20	33	7.9	180	.42	730
1304-10K	1.50	33	7.9	160	.50	670
1304-11K	1.80	33	7.9	150	.65	590
1304-12K	2.20	33	7.9	135	.95	485
1304-13K	2.70	33	7.9	120	1.20	430
1304-14K	3.30	33	7.9	110	2.00	335
1304-15K	3.90	33	7.9	100	2.30	310
1304-16K	4.70	33	7.9	90	2.60	294
1304-17K	5.60	45	7.9	60	.32	565
1304-18K	6.80	50	7.9	55	.50	450
1304-19K	8.20	50	7.9	50	.60	410
1304-20K	10.0	55	7.9	45	.90	335
1304-21K	12.0	65	2.5	42	1.10	305
1304-22K	15.0	65	2.5	40	1.40	271
1304-23K	18.0	75	2.5	34	2.25	213
1304-24K	22.0	75	2.5	30	2.50	202
1304-25K	24.0	60	2.5	26	2.50	202
1304-26K	27.0	60	2.5	25	2.60	198
1304-28K	30.0	65	2.5	21	2.80	191
1304-29K	33.0	65	2.5	19	3.00	185
1304-31J	36.0	60	2.5	15.5	2.50	202
1304-32J	39.0	60	2.5	14.5	2.60	198
1304-33J	43.0	60	2.5	13.7	2.70	194
1304-34J	47.0	55	2.5	13.0	2.75	193
1304-35J	51.0	55	2.5	12.7	2.85	189
1304-36J	56.0	55	2.5	12.0	3.00	184
1304-37J	62.0	55	2.5	11.5	3.15	180
1304-38J	68.0	55	2.5	11.0	3.30	176
1304-39J	75.0	55	2.5	10.5	3.70	166
1304-40J	82.0	50	2.5	10.3	3.90	162
1304-41J	91.0	50	2.5	10.0	4.30	154
1304-42J	100.0	50	2.5	9.5	4.50	151
1304-43J	110.0	60	.79	8.9	4.90	144
1304-44J	120.0	65	.79	8.7	5.20	140
1304-45J	130.0	65	.79	8.5	5.45	137
1304-46J	150.0	65	.79	8.0	6.05	130
1304-47J	160.0	65	.79	7.5	6.40	126
1304-48J	180.0	65	.79	8.0	6.05	130
1304-49J	200.0	65	.79	6.5	7.10	123
1304-50J	220.0	65	.79	6.2	7.45	117
1304-51J	240.0	65	.79	5.9	7.80	115
1304-52J	270.0	65	.79	5.7	11.0	143
1304-53J	300.0	65	.79	5.4	11.5	140
1304-54J	330.0	65	.79	5.1	12.0	136
1304-55J	360.0	65	.79	4.8	12.5	134
1304-56J	390.0	65	.79	4.5	16.3	117
1304-57J	430.0	65	.79	4.2	17.1	115
1304-58J	470.0	65	.79	3.9	17.9	112
1304-59J	510.0	65	.79	3.7	18.8	109
1304-60J	560.0	65	.79	3.8	19.5	107
1304-61J	620.0	65	.79	3.3	25.9	93
1304-62J	680.0	65	.79	3.1	27.2	91
1304-63J	750.0	65	.79	2.9	28.6	88
1304-64J	820.0	65	.79	2.7	30.0	86
1304-65J	910.0	65	.79	2.5	31.5	84
1304-66J	1000.0	65	.79	2.3	33.0	82

*Tolerance: J for 5%, K for 10%, M for 20%

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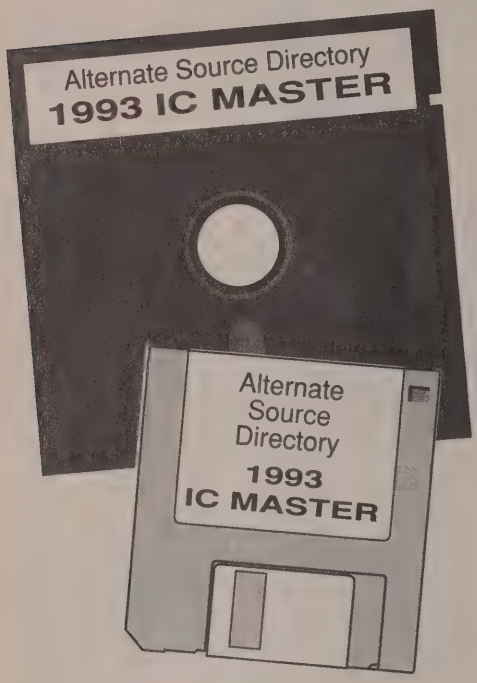

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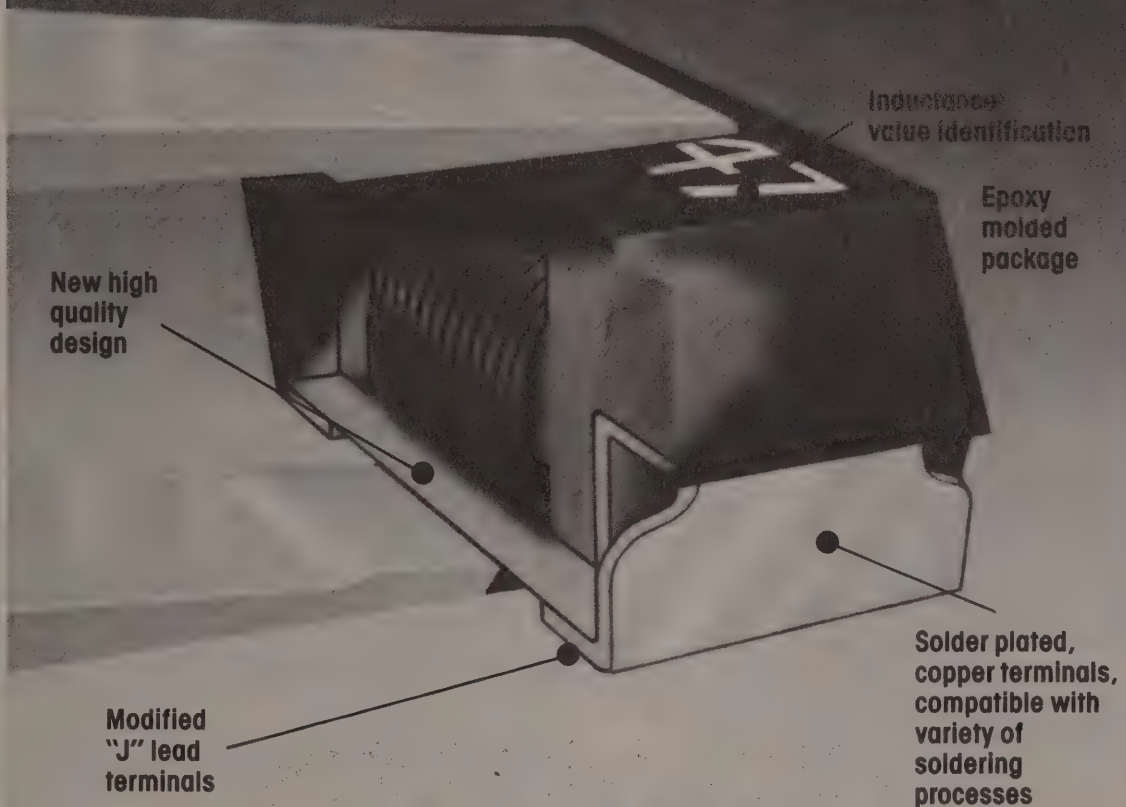
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(utilizing Hi-Flux MPP cores)
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horizontal open construction
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Inductance 10mH-100mH 38 values (2 of each)
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10 SERIES RF MOLDED CHOKES
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Inductance .15uH-240uH 47 values (2 of each)
KIT G-108 **$50.**

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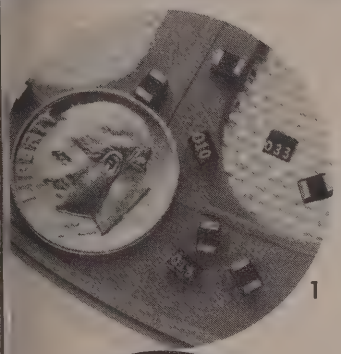
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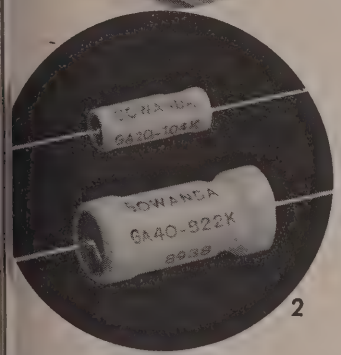

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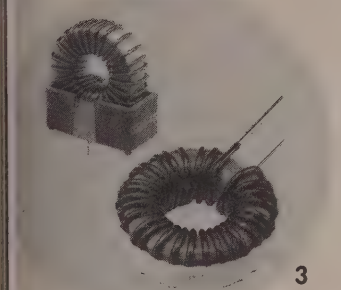
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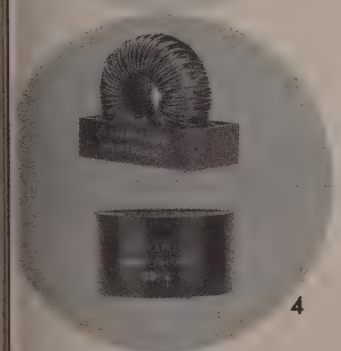
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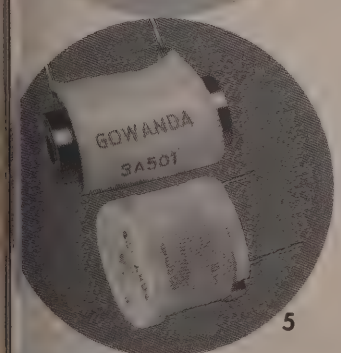

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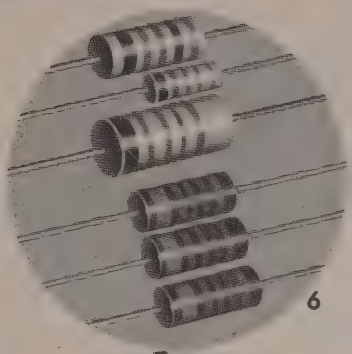
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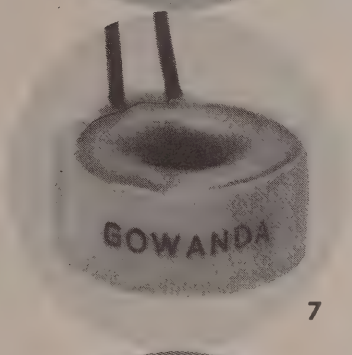

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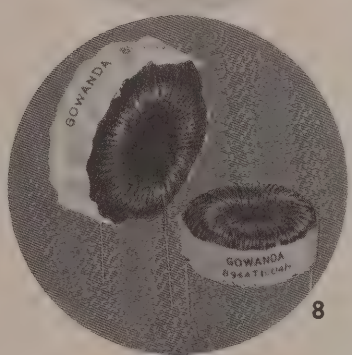

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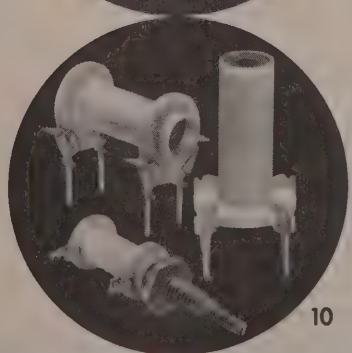
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GA-10 series, 38 inductance values 10 μH to 100 mH. GA-30 series, 37 inductance values 10 μH to 10 mH. Manufactured with heat-shrinkable flame retardant tubing and high resistivity Ferrite coil form. GA-20 and GA-40 series, 37 inductance values 10 μH to 10 mH. Produced with heat shrinkable, flame retardant tubing and Ferrite coil form.

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GT series, basic coil and mounting base models. Low loss powdered iron cores. Mounting base meets flame retardant requirements of UL 94V-0. Inductance values, 25 μH to 450 μH.

4. ENCAPSULATED TOROIDAL POWER CHOKES
MPP core, vertical and horizontal models designed for printed circuit mounting. Pre-tinned leads. Inductance rating from 10 μH to 1000 μH. Current rating from 1.0 amps to 10.0 amps.

5. BOBBIN CORE CHOKES
Epoxy insulated cores. Designed for switching power supply applications. Inductance range 3.3 μH to 15,000 μH. Current ratings from 0.80 amps to 27.0 amps.

6. RF MOLDED AND SHIELDED CHOKES
Manufactured to MIL-C-15305 standards. Inductance values from .10 μH to 10,000 μH. Standard series for both Q-meter and LCR bridge testing.

7. TOROIDAL INDUCTORS
Vinyl coated, non-flammable. Abrasion and moisture resistant. High Q and wide selection of Q vs. frequency ranges. Standard inductance TOL ± 2%. Other tolerances available. Custom designs available.

8. TOROIDAL POWER CHOKES
MPP core, high current filter chokes with printed circuit mounting and pre-tinned leads. Inductance values 10 μH to 1000 μH. Current rating 1.0 amps to 10.0 amps.

9. COMMON MODE INDUCTORS
Custom designed to your requirements. Open, partially or fully encapsulated construction in both toroidal or bobbin wound forms.

10. TUNABLE COIL FORMS
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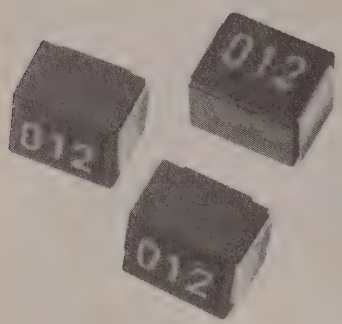
CHIP INDUCTOR
KL32

KL32



- UL94V - 0 Epoxy Case
- Suitable for Reflow & Wave Solder
- 1210 Size - Surface Mount Type
- E - 12 Series of Values
- Wound Coil Type

STANDARD APPLICATIONS

Ordering Code	Inductance (µH)	Inductance Tolerance (%) M	K	J	Quality Factor (Min)	Self Resonance (Min)(MHz)	DC Res. (Max) (Ohms)	Allowable DC Current (mA)	Measuring Frequency (MHz)
KL32TE005*	.005				11	2700	0.12		
KL32TE010*	.010				15	2500	0.13		
KL32TE012*	.012				17	2300	0.14		
KL32TE015*	.015				19	2100	0.16		
KL32TE018*	.018				21	1900	0.18		
KL32TE022*	.022				23	1700	0.20		
KL32TE027*	.027				23	1500	0.22		
KL32TE033*	.033				25	1400	0.24		100
KL32TE039*	.039					1300	0.27		
KL32TE047*	.047				26	1200	0.30		
KL32TE056*	.056					1100	0.33		
KL32TE068*	.068				27	1000	0.36		
KL32TE082*	.082					900	0.40		
KL32TER10*	.10				28	700	0.44	450	
KL32TER12*	.12	±20				500	0.22		
KL32TER15*	.15					450	0.25		
KL32TER18*	.18					400	0.28		
KL32TER22*	.22				30	350	0.32		
KL32TER27*	.27					320	0.36		
KL32TER33*	.33		±10	±5		300	0.40		
KL32TER39*	.39					250	0.45		25.2
KL32TER47*	.47					220	0.50		
KL32TER56*	.56					180	0.55		
KL32TER68*	.68					160	0.60		
KL32TER82*	.82					140	0.65		
KL32TE1R0*	1.0					120	0.70	400	
KL32TE1R2*	1.2					100	0.75	390	
KL32TE1R5*	1.5					85	0.85	370	
KL32TE1R8*	1.8					80	0.90	350	
KL32TE2R2*	2.2					75	1.0	320	
KL32TE2R7*	2.7					70	1.1	290	
KL32TE3R3*	3.3					60	1.2	260	7.96
KL32TE3R9*	3.9					55	1.3	250	
KL32TE4R7*	4.7					50	1.5	220	
KL32TE5R6*	5.6					47	1.6	200	
KL32TE6R8*	6.8					43	1.8	180	
KL32TE8R2*	8.2					40	2.0	170	
KL32TE100*	10.					36	2.1	150	
KL32TE120*	12.					33	2.5	140	
KL32TE150*	15.					30	2.8	130	
KL32TE180*	18.					27	3.3	120	
KL32TE220*	22.					25	3.7	110	
KL32TE270*	27.					20	5.0	80	2.52
KL32TE330*	33.					17	5.6	70	
KL32TE390*	39.					16	6.4	65	
KL32TE470*	47.					15	7.0	60	
KL32TE560*	56.					13	8.0	55	
KL32TE680*	68.					12	9.0	50	
KL32TE820*	82.					11	10	45	
KL32TE101*	100.					10	10	40	
KL32TE121*	120.					10	11	70	
KL32TE151*	150.				20	8	15	65	0.796
KL32TE181*	180.					7	17	60	
KL32TE221*	220.					7	21	50	

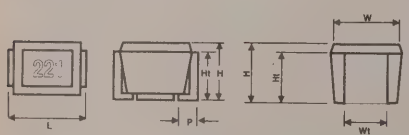
TE: Embossed Plastic *Tolerance Character (J, K, M)

MARKING ON INDUCTOR CHIP

The marking consists of three characters as detailed below:

Value	Code
0.005µH to 0.082µH	005 to 082
0.10µH to 8.2µH	R10 to 8R2 "R" indicates decimal pt.
10µH to 220µH	100 to 221 1st two figures are significant, the last figure indicates the number of zeros to follow

DIMENSIONS



Dimensions	L	W	Wt	H	Ht	P
MM	3.2 ±0.2	2.5 ±0.2	1.7 ±0.1	2.2 ±0.2	1.9 ±0.1	0.5 nominal
INCH	.126 ±.008	.098 ±.008	.067 ±.004	.087 ±.008	.075 ±.004	.02 nominal

ORDERING & SPECIFYING INFORMATION

KL	32	TE	221	K
Type	**Size Code**	**Packaging**	**Nominal Inductance**	**Tolerance**
Wound Coil	3.2 x 2.5 x 2.2 (mm) 1210 Size	TE: Embossed Taping, 2000 pcs. No Suffix: Bulk, 1000 pcs.	Value designation same as marking on inductor chip	J: ±5% K:±10% M: 20%

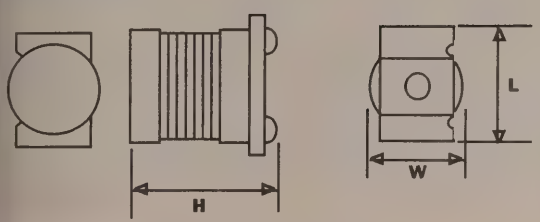
KOA SPEER ELECTRONICS, INC

CHIP COIL
LPC4045
Wire Wound SMT Choke Coil

CHIP COIL

- Small size allows for High Mounting Density
- Large DC Current capability with Low DC resistance
- Embossed Carrier Tape Available
- Polarity Identification available
- E - 6 Series of Values (Custom Available)

DIMENSIONS



DIMENSIONS	L	W	H
mm	4.5± 0.2	4.0±0.2	4.5 max
in	0.178±.008	0.157±.008	0.178 max

STANDARD APPLICATIONS

ORDERING CODE	INDUCTANCE (µH)	INDUCTANCE TOLERANCE (%)	QUALITLY FACTOR (MIN)	SELF RESONACE (MIN)(MHz)	DC RES. (±15%) (OHMS)	ALLOWABLE DC CURRENT (mA)	MEASURING FREQUENCY (Hz)
LPC4045TE100K	10	10	20	23.5	0.08	1.02	1000
LPC4045TE150K	15			18.5	0.13	0.84	
LPC4045TE220K	22			14.0	0.18	0.70	
LPC4045TE330K	33			12.0	0.35	0.52	
LPC4045TE470K	47			10.5	0.45	0.46	
LPC4045TR680K	68			8.0	0.58	0.40	
LPC4045TE101K	100			6.3	0.80	0.28	
LPC4045TE151K	150		40	5.2	1.56	0.25	
LPC4045TE221K	220			3.9	1.95	0.18	
LPC4045TE331K	330			3.0	3.71	0.15	
LPC4045TE471K	470			2.7	4.55	0.14	
LPC4045TE681K	680			2.2	5.80	0.12	

TE: Embossed Plastic Tape

ORDERING AND SPECIFING INFORMATION

LPC	4045	TE	221	K
TYPE	SIZE CODE	PACKAGING	NOMINAL INDUCTANCE	TOLERANCE
	4.0 x 4.5 x 4.5 (mm)	TE: Embossed Plastic 2500 pcs NONE: Bulk	2 Significant Figures & 1 Multiplier R Indicates Decimal on Values < 10	K: ± 10%

LODESTONE PACIFIC

4065 E. LaPalma Ave., Bldg. G
Anaheim, CA 92807

FAX: (714) 630-8480
PHONE: (714) 630-1343

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EMI/RFI Suppressors
Broadband Transformers

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Samples the Next Day
Closely Scheduled Delivery
All Industry Shapes & Sizes

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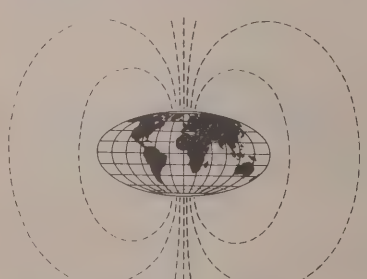
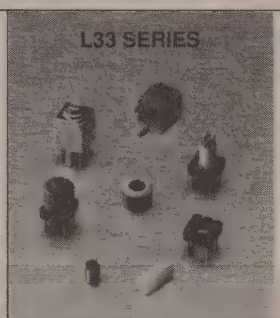
Ask for a catalog and samples of Lodestone Pacific's family of Shielded Coil Forms. Manufactured in the USA, these assemblies have been used in "Fishfinders to Sidewinders" for over 25 years and our customers have come to expect:

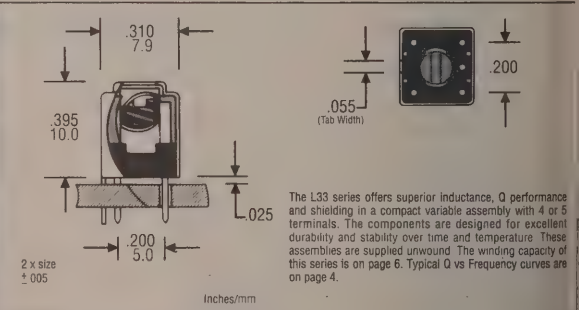
High Q
High Reliability
Great Temp Stability
Closely Scheduled Deliveries
Most Configurations in Stock
Pins to MIL-STD-202, Meth 208
Full Line Catalog and Design Aids

Lodestone Pacific is not a coil winder. The values in the Q vs Frequency curves are to show the assembly's potential performance.



FINEST IN THE FIELD

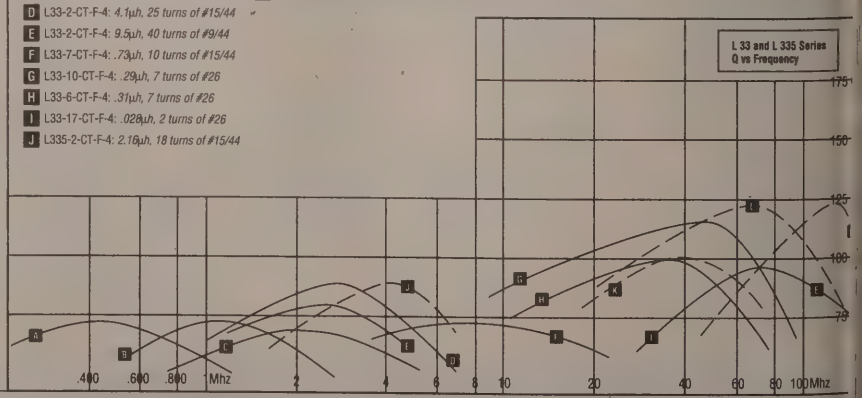




The L33 series offers superior inductance, Q performance and shielding in a compact variable assembly with 4 or 5 terminals. The components are designed for excellent durability and stability over time and temperature. These assemblies are supplied unwound. The winding capacity of this series is on page 6. Typical Q vs Frequency curves are on page 4.

ASSEMBLY PART NO.	COLOR CODE	MAGNETIC MATERIAL (1)	FREQUENCY RANGE (2)	MATERIAL PERMEABILITY	ASSEMBLY A_L nH/turn² (3)	MAX µh 100 turns	MIN µh (4) 100 turns	TEMPERATURE STABILITY (5)
L33-1-CT-F-4	BLUE	CARBONYL C	.15-2.0 MHZ	20.0	7.6	76	45	280 ppm/°C
L33-2-CT-F-4	RED	CARBONYL E	.25-10 MHZ	10.0	6.8	68	45	95 ppm/°C
L33-3-CT-F-4	GREY	CARBONYL HP	.02-1.0 MHZ	35.0	8.0	80	46	370 ppm/°C
L33-6-CT-F-4	YELLOW	CARBONYL SF	2.0-50 MHZ	8.5	6.0	60	38	35 ppm/°C
L33-7-CT-F-4	WHITE	CARBONYL TH	1.0-20 MHZ	9.0	6.4	64	40	30 ppm/°C
L33-10-CT-F-4	BLACK	CARBONYL W	10-100 MHZ	6.0	5.4	54	37	150 ppm/°C
L33-17-CT-F-4	LAVENDER	CARBONYL	20-200 MHZ	4.0	4.8	48	37	50 ppm/°C
L33-50-CT-F-4	ORANGE	FERRITE 61	.01-1.0 MHZ	125.0	9.5	95	48	1500 ppm/°C

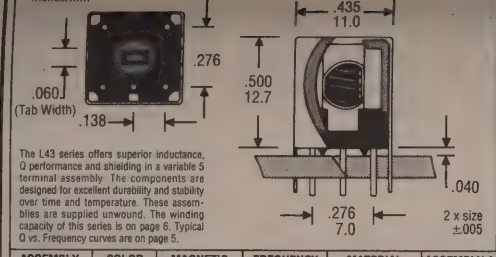
- A L33-3-CT-F-4: *180µh, 150 turns of #3/44*
- B L33-1-CT-F-4: *42.5µh, 75 turns of #3/44*
- C L33-7-CT-F-4: *5.05µh, 29 turns of #15/44*
- D L33-2-CT-F-4: *4.1µh, 25 turns of #15/44*
- E L33-2-CT-F-4: *9.5µh, 40 turns of #9/44*
- F L33-7-CT-F-4: *.73µh, 10 turns of #15/44*
- G L33-10-CT-F-4: *.29µh, 7 turns of #26*
- H L33-6-CT-F-4: *.31µh, 7 turns of #26*
- I L33-17-CT-F-4: *.028µh, 2 turns of #26*
- J L335-2-CT-F-4: *2.16µh, 18 turns of #15/44*
- K L335-6-CT-F-4: *.24µh, 6 turns of #26*
- L L335-10-CT-F-4: *.16µh, 5 turns of #26*
- M L335-17-CT-F-4: *.03µh, 2 turns of #26*

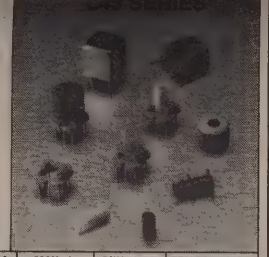


SHIELDED COIL FORM HARDWARE

LODESTONE PACIFIC
FAX: (714) 630-8480
PHONE: (714) 630-1343

Inches/mm

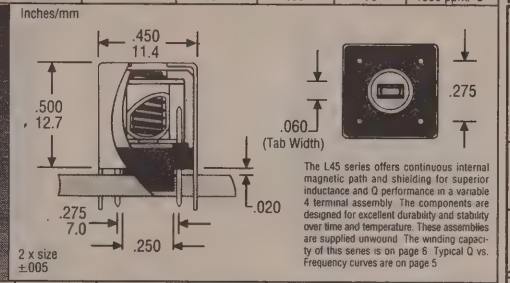




The L43 series offers superior inductance, Q performance and shielding in a variable 5 terminal assembly. The components are designed for excellent durability and stability over time and temperature. These assemblies are supplied unwound. The winding capacity of this series is on page 6. Typical Q vs. Frequency curves are on page 5.

ASSEMBLY PART NO.	COLOR CODE	MAGNETIC MATERIAL (1)	FREQUENCY RANGE (2)	MATERIAL PERMEABILITY	ASSEMBLY A_L nH/turns² (3)	MAX µh 100 turns	MIN µh (4) 100 turns	TEMPERATURE STABILITY (5)
L43-1-CT-F-5	BLUE	CARBONYL C	.15-2.0 MHZ	20.0	11.5	115	54	280 ppm/°C
L43-2-CT-F-5	RED	CARBONYL E	.25-10 MHZ	10.0	9.8	98	48	95 ppm/°C
L43-3-CT-F-5	GREY	CARBONYL HP	.02-1.0 MHZ	35.0	13.3	133	60	370 ppm/°C
L43-6-CT-F-5	YELLOW	CARBONYL SF	2.0-50 MHZ	8.5	8.5	85	44	35 ppm/°C
L43-7-CT-F-5	WHITE	CARBONYL TH	1.0-20 MHZ	9.0	9.3	93	46	30 ppm/°C
L43-10-CT-F-5	BLACK	CARBONYL W	10-100 MHZ	6.0	7.2	72	43	150 ppm/°C
L43-17-CT-F-5	LAVENDER	CARBONYL	20-200 MHZ	4.0	5.6	56	43	50 ppm/°C
L43-50-CT-F-5	ORANGE	FERRITE 61	01-.500 MHZ	125.0	19	190	70	1500 ppm/°C

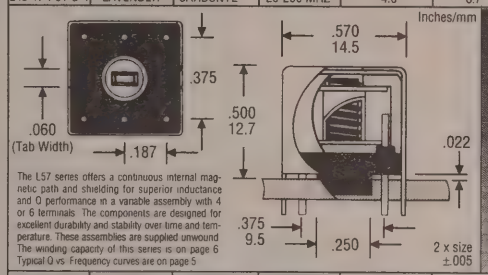
Inches/mm



The L45 series offers continuous internal magnetic path and shielding for superior inductance and Q performance in a variable 4 terminal assembly. The components are designed for excellent durability and stability over time and temperature. These assemblies are supplied unwound. The winding capacity of this series is on page 6. Typical Q vs. Frequency curves are on page 5.

ASSEMBLY PART NO.	COLOR CODE	MAGNETIC MATERIAL (1)	FREQUENCY RANGE (2)	MATERIAL PERMEABILITY	ASSEMBLY A_L nH/turns² (3)	MAX µh 100 turns	MIN µh (4) 100 turns	TEMPERATURE STABILITY (5)
L45-1-PCT-B-4	BLUE	CARBONYL C	.15-2.0 MHZ	20.0	17.5	175	58	280 ppm/°C
L45-2-PCT-B-4	RED	CARBONYL E	.25-10 MHZ	10.0	12.5	125	52	95 ppm/°C
L45-3-PCT-B-4	GREY	CARBONYL HP	.02-1.0 MHZ	35.0	20.4	204	64	370 ppm/°C
L45-3F-PCT-B-4	GREY/ORANGE	HP/FERRITE	.01-1.0 MHZ	80.0	31.5	315	79	1000 ppm/°C
L45-6-PCT-B-4	YELLOW	CARBONYL SF	2.0-50 MHZ	8.5	11.5	115	47	35 ppm/°C
L45-7-PCT-B-4	WHITE	CARBONYL TH	1.0-20 MHZ	9.0	12	120	48	30 ppm/°C
L45-10-PCT-B-4	BLACK	CARBONYL W	10-100 MHZ	6.0	10	100	46	150 ppm/°C
L45-17-PCT-B-4	LAVENDER	CARBONYL	20-200 MHZ	4.0	6.7	67	45	50 ppm/°C

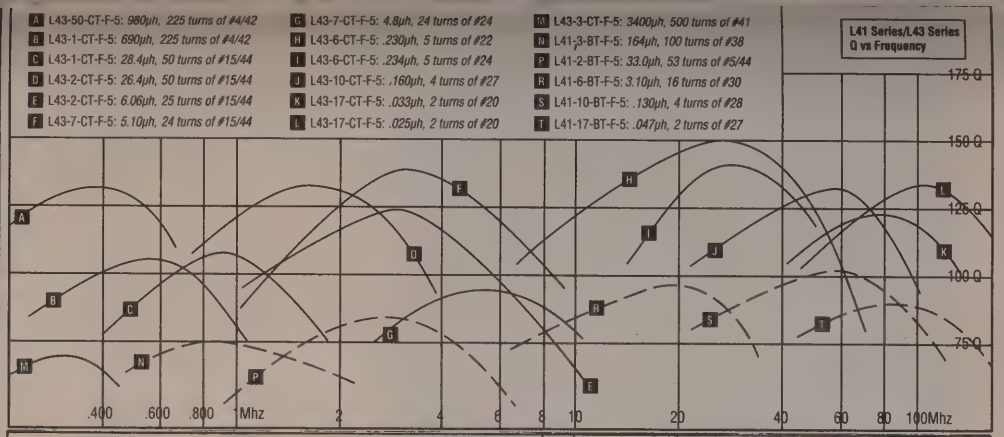
Inches/mm



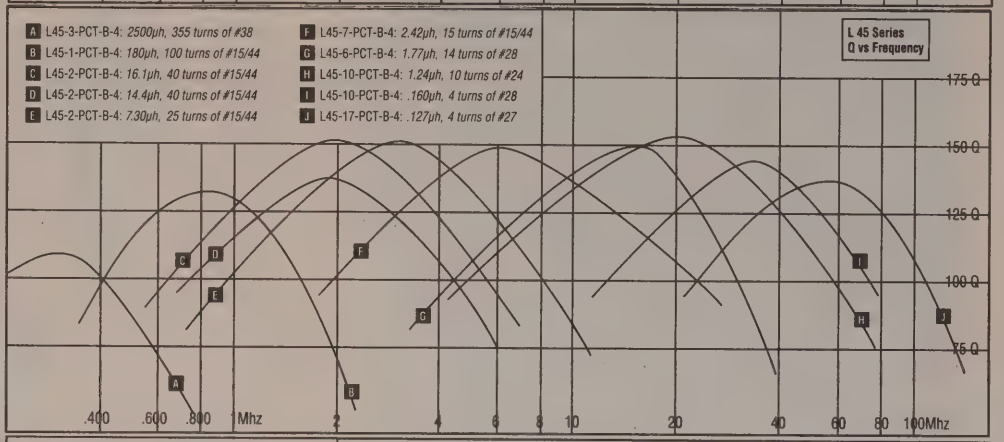
The L57 series offers a continuous internal magnetic path and shielding for superior inductance and Q performance in a variable assembly with 4 or 6 terminals. The components are designed for excellent durability and stability over time and temperature. These assemblies are supplied unwound. The winding capacity of this series is on page 6. Typical Q vs. Frequency curves are on page 5.

ASSEMBLY PART NO.	COLOR CODE	MAGNETIC MATERIAL (1)	FREQUENCY RANGE (2)	MATERIAL PERMEABILITY	ASSEMBLY A_L nH/turns² (3)	MAX µh 100 turns	MIN µh (4) 100 turns	TEMPERATURE STABILITY (5)
L57-1-PCT-B-4	BLUE	CARBONYL C	.15-2.0 MHZ	20.0	18.5	185	60	280 ppm/°C
L57-2-PCT-B-4	RED	CARBONYL E	.25-10 MHZ	10.0	13.0	130	54	95 ppm/°C
L57-3-PCT-B-4	GREY	CARBONYL HP	.02-1.0 MHZ	35.0	21.5	215	70	370 ppm/°C
L57-3F-PCT-B-4	GREY/ORANGE	HP/FERRITE	.01-1.0 MHZ	80.0	32.0	320	81	1000 ppm/°C
L57-6-PCT-B-4	YELLOW	CARBONYL SF	10-50 MHZ	8.5	12.0	120	51	35 ppm/°C
L57-7-PCT-B-4	WHITE	CARBONYL TH	1.0-20 MHZ	9.0	12.5	125	52	30 ppm/°C
L57-10-PCT-B-4	BLACK	CARBONYL W	10-100 MHZ	6.0	10.5	105	50	150 ppm/°C
L57-17-PCT-B-4	LAVENDER	CARBONYL	20-200 MHZ	4.0	7.0	70	50	50 ppm/°C

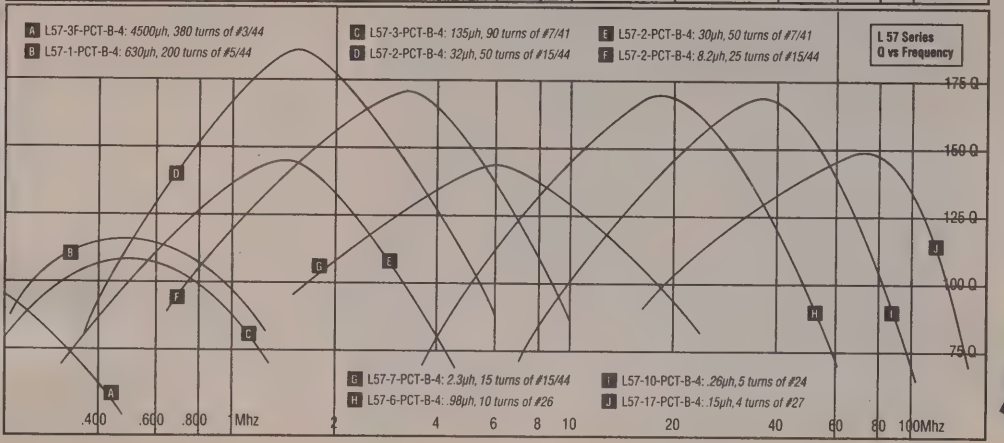
A L43-50-CT-F-5: *980µh, 225 turns of #4/42*
B L43-1-CT-F-5: *690µh, 225 turns of #4/42*
C L43-1-CT-F-5: *28.4µh, 50 turns of #15/44*
D L43-2-CT-F-5: *26.4µh, 50 turns of #15/44*
E L43-2-CT-F-5: *6.06µh, 25 turns of #15/44*
F L43-7-CT-F-5: *5.10µh, 24 turns of #15/44*
G L43-7-CT-F-5: *4.8µh, 24 turns of #24*
H L43-6-CT-F-5: *.230µh, 5 turns of #22*
I L43-6-CT-F-5: *.234µh, 5 turns of #24*
J L43-10-CT-F-5: *.160µh, 4 turns of #27*
K L43-17-CT-F-5: *.033µh, 2 turns of #20*
L L43-17-CT-F-5: *.025µh, 2 turns of #20*
M L43-3-CT-F-5: *3400µh, 500 turns of #41*
N L41-3-BT-F-5: *164µh, 100 turns of #38*
P L41-2-BT-F-5: *33.0µh, 53 turns of #5/44*
R L41-6-BT-F-5: *3.10µh, 16 turns of #30*
S L41-10-BT-F-5: *.130µh, 4 turns of #28*
T L41-17-BT-F-5: *.047µh, 2 turns of #27*



A L45-3-PCT-B-4: *2500µh, 355 turns of #38*
B L45-1-PCT-B-4: *180µh, 100 turns of #15/44*
C L45-2-PCT-B-4: *16.1µh, 40 turns of #15/44*
D L45-2-PCT-B-4: *14.4µh, 40 turns of #15/44*
E L45-2-PCT-B-4: *7.30µh, 25 turns of #15/44*
F L45-7-PCT-B-4: *2.42µh, 15 turns of #15/44*
G L45-6-PCT-B-4: *1.77µh, 14 turns of #28*
H L45-10-PCT-B-4: *1.24µh, 10 turns of #24*
I L45-10-PCT-B-4: *.160µh, 4 turns of #28*
J L45-17-PCT-B-4: *.127µh, 4 turns of #27*



A L57-3F-PCT-B-4: *4500µh, 380 turns of #3/44*
B L57-1-PCT-B-4: *630µh, 200 turns of #5/44*
C L57-3-PCT-B-4: *135µh, 90 turns of #7/41*
D L57-2-PCT-B-4: *32µh, 50 turns of #15/44*
E L57-2-PCT-B-4: *30µh, 50 turns of #7/41*
F L57-2-PCT-B-4: *8.2µh, 25 turns of #15/44*
G L57-7-PCT-B-4: *2.3µh, 15 turns of #15/44*
H L57-6-PCT-B-4: *.98µh, 10 turns of #26*
I L57-10-PCT-B-4: *.26µh, 5 turns of #24*
J L57-17-PCT-B-4: *.15µh, 4 turns of #27*



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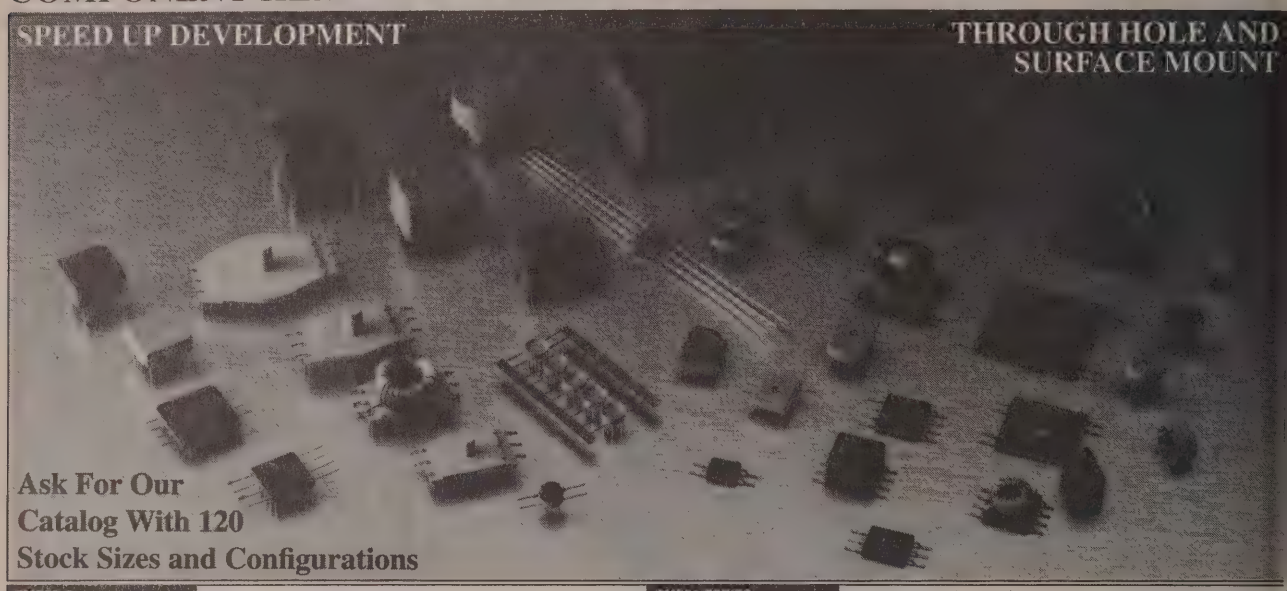


TM280-4

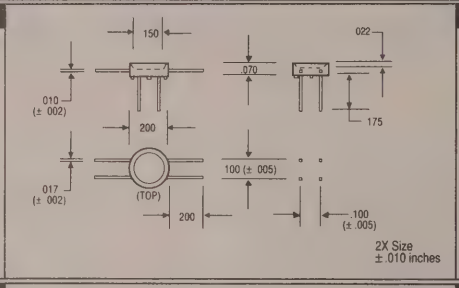
MOULDING: Diallyl Phthalate (Green)

RATING: UL 94-VO MIL-STD-2000

4 TERMINALS: Alloy 42 .017 x .010 Lead Frame 100% Tin Plated

SOLDERABILITY: Per MIL-STD-202 Method 208

APPLICATION: For horizontal mounting of toroids with wound diameters from .050 to 180 inches



TM501 SERIES

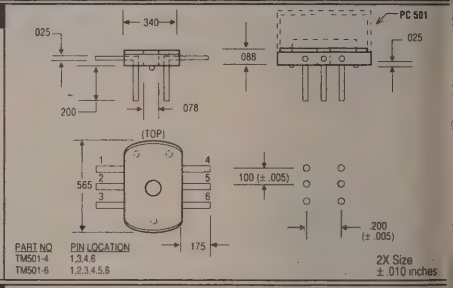
MOULDING: Diallyl Phthalate (Green)

RATING: UL 94-VO MIL-STD-2000

TERMINALS: Copper Wire .025 Dia. (#22 AWG) 100% Tin Plated

SOLDERABILITY: Per MIL-STD-202 Method 208

APPLICATION: For industry standard for 20 years, this series is suitable for components and wound toroids up to .550 inches. Potting cup PC501 is available for encapsulation. (Sold Separately)



STM280-8

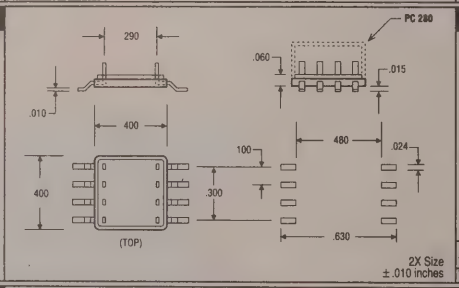
MOULDING: Epoxy (Black)

RATING: UL 94-VO

8 TERMINALS: Alloy 42 .024 X .010 Lead Frame 90/10 Tin Plated

SOLDERABILITY: Per MIL-STD-202 Method 208

APPLICATION: For surface mounting of components and wound toroids up to .280 inches in diameter. Potting cup PC280 may be used to encapsulate the component and its connections. (Sold Separately)



TM506-4 & TM507-4

MOULDING: Diallyl Phthalate (Green) & (Black)

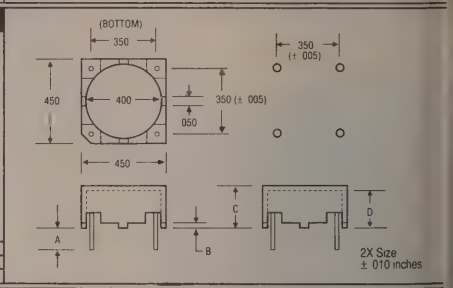
RATING: UL 94-VO MIL-STD-2000

4 TERMINALS: Copper Wire .025 Dia. (#22 AWG) 100% Tin Plated

SOLDERABILITY: Per MIL-STD-202 Method 208

APPLICATION: For enclosed horizontal mounting of wound toroids up to .400 inches in diameter. Ideal for automatic pick and place.

	A	B	C	D
TM506-4	120	025	236	197
TM507-4	158	025	287	248



STM390-8

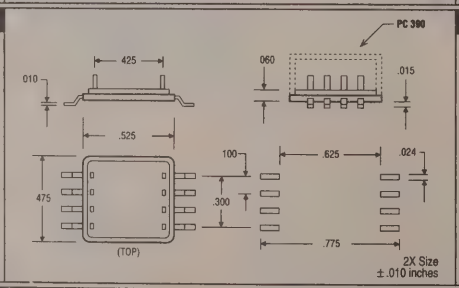
MOULDING: Epoxy (Black)

RATING: UL 94-VO

8 TERMINALS: Alloy 42 .024 X .010 Lead Frame 90/10 Tin Plated

SOLDERABILITY: Per MIL-STD-202 Method 208

APPLICATION: For surface mounting of components and wound toroids up to .400 inches in diameter. Potting cup PC390 may be used to encapsulate the component and its connections



TM550-8

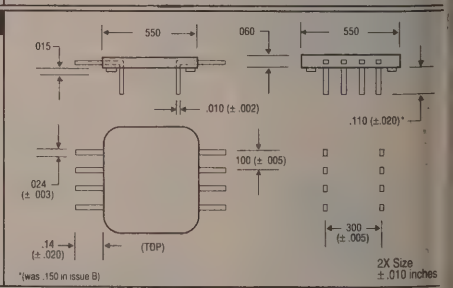
MOULDING: Epoxy (Black)

RATING: UL 94-VO MIL-STD-2000

8 TERMINALS: Alloy 42 .024 x .010 Lead Frame 90/10 Tin Plated

SOLDERABILITY: Per MIL-STD-202 Method 208

APPLICATION: For horizontal mounting of components and wound toroids up to .550 inches in diameter.



TM401 SERIES

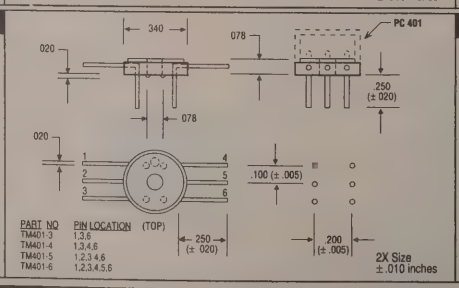
MOULDING: Diallyl Phthalate (Green)

RATING: UL 94-VO MIL-STD-2000

TERMINALS: Copper Wire .020 Dia. (#24 AWG) 100% Tin Plated

SOLDERABILITY: Per MIL-STD-202 Method 208

APPLICATION: An industry standard for 20 years, this series is suitable for components and wound toroids up to .340 inches. Potting cup PC401 is available for encapsulation of the component on the TM401 series. (Sold Separately)

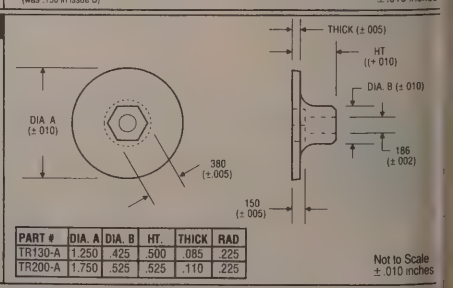


TR SERIES

MOULDING: Nylon 6/6

RATING: UL 94-VO

APPLICATION: The Toroid Retainer series is designed to bolt toroids from 1.30 up to 3.00 inches in diameter to a circuit board or assembly chasis. Each Toroid Retainer requires a 10/32 bolt and nut, sold separately.



PART #	DIA. A	DIA. B	HT.	THICK	RAD
TR130-A	1.250	.425	.500	.085	.225
TR200-A	1.750	.525	.525	.110	.225

Not to Scale ± .010 inches

LODESTONE PACIFIC

FREE TOROID MOUNT AND COMPONENT HEADER CATALOG!

FAX: (714) 630-8480
PHONE: (714) 630-1343

VTM SERIES

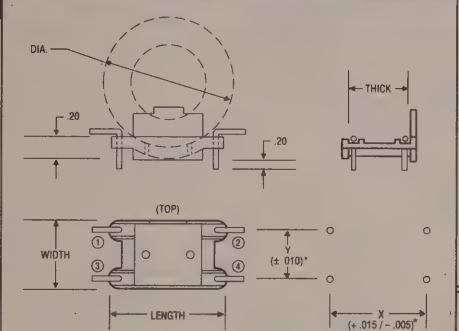
MOULDING: Nylon 6/6 (Tan)

RATING: UL 94-VO

4 TERMINALS: Copper Wire .050 Dia. (#16 AWG) 100% Tin Plated

SOLDERABILITY: Per MIL-STD-202 Method 208

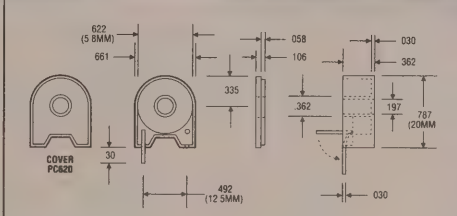
APPLICATION:
An industry standard for vertical mounting of wound toroids from 1.00 to 2.8 inches in diameter. The VTM series is available with the four terminals shown or without terminals (.048 through hole). Non-standard through holes of .067, .082 and .089 are available. Example of a non-standard holesize part No. is VTM160-0/082. (#16 AWG (.050) is the only terminal size available)



(* Tolerance at end of terminal)

Not to scale ± .010 inches

PART NO.	LENGTH	WIDTH	THICK	DIA.	X	Y	TERMINALS
VTM120-0 VTM120-4	1.00	.60	.51	1.20	.80	.40	None (.048 Holes) 4-#16 AWG (.050)
VTM160-0 VTM160-4	1.10	.80	.71	1.60	.90	.60	None (.048 Holes) 4-#16 AWG (.050)
VTM254-0 VTM254-4	1.40	.90	.81	2.54	1.20	.70	None (.048 Holes) 4-#16 AWG (.050)
VTM280-0 VTM280-4	1.70	1.10	1.01	2.80	1.50	.90	None (.048 Holes) 4-#16 AWG (.050)



Actual Size ± .010 inches

VTM620-2

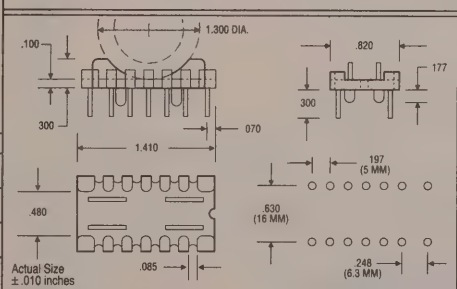
MOULDING: Phenolic (Black)

RATING: UL 94-VO

2 TERMINALS: Copper Wire .020 Dia. (#24 AWG) 100% Tin Plate

SOLDERABILITY: Per MIL-STD-202 Method 208

APPLICATION:
For vertical mounted inductors or current sensors. Terminals are shipped in the horizontal position to facilitate toroid lead connection. Terminals are then moved to the vertical position for circuit board insertion. Optional snap-on cover PC620 to seal the assembly. (Sold Separately)



Actual Size ± .010 inches

VTM1300-14

MOULDING: Phenolic (Black)

RATING: UL 94-VO

8 TERMINALS: Copper Wire .040 Dia. (#18 AWG) 100% Tin Plated

SOLDERABILITY: Per MIL-STD-202 Method 208

APPLICATION:
For vertical mounting of wound toroids up to 1.3 inches in diameter requiring up to 14 terminations.

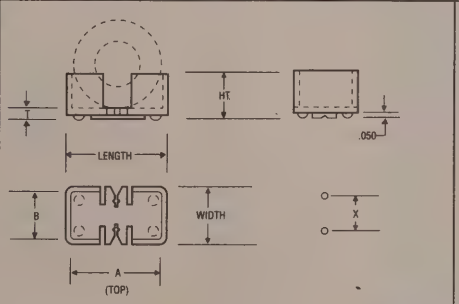
KM SERIES

MOULDING: Vydyne (Black)

RATING: UL 94-VO

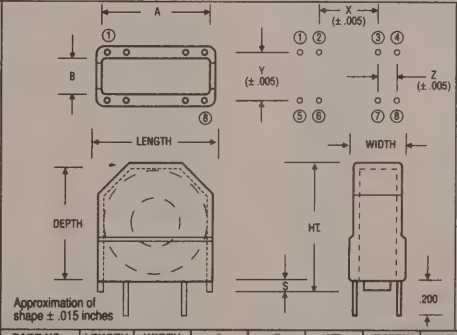
TERMINALS: None

APPLICATION:
Klip mounts are designed as a self leaded inductor mount for wound toroids from .030 to 1.10 inches in diameter. The moulded "Klip" holds the toroid leads for circuit board termination. (Patented)



Not to Scale ± .010 inches

PART NO.	LENGTH	WIDTH	A	B	HT.	T	X	KLIP WIRE SIZE	TOROID DIA.
KM44-01 KM44-02	.580	.340	.480	.240	.280	.110	.220	24-23 AWG 22-21 AWG	.450
KM50-01 KM50-02	.650	.450	.550	.350	.300	.110	.300	24-21 AWG 20-18 AWG	.550
KM68-01 KM68-02	.830	.450	.730	.350	.370	.110	.300	24-21 AWG 20-18 AWG	.725
KM80-01 KM80-02	.950	.600	.850	.500	.420	.110	.450	22-19 AWG 18-17 AWG	.850
KM106-01 KM106-02	1.250	.700	1.150	.600	.580	.130	.500	22-19 AWG 18-17 AWG	1.150



Approximation of shape ± .015 inches

VTC SERIES

MOULDING: Nylon 6/6 (Grey)

RATING: UL 94-VO

TERMINALS: Copper/Zinc .026 x .026 60/40 Tin Plated

SOLDERABILITY: Per MIL-STD-202 Method 208

APPLICATION:
A European standard for enclosed vertical mounting of wound toroids from .500 to 1.46 inches in diameter. Four terminals in positions 2, 3, 6, 7 or no terminals (ie: VTC1156-0) is standard. Any terminal pattern can be provided. Example part number for a special terminal pattern is VTC774-5/12356. (five terminals in positions 1, 2, 3, 5, 6).

PART NO.	LENGTH	WIDTH	A	B	HT.	DEPTH	S	X	Y	Z
VTC 512-0 VTC 512-4	.750	.350	.510	.270	.600	.500	.050	.600 (15mm)	.200 (5mm)	
VTC 613-0 VTC 613-4	.710	.510	.610	.310	.780	.670	.060	200 (5mm)	400 (10mm)	200 (5mm)
VTC 774-0 VTC 774-4	.900	.610	.780	.400	980	.870	.060	400 (10mm)	.500 (12.5mm)	200 (5mm)
VTC 935-0 VTC 935-4	1.070	.710	.920	.500	1.180	1.050	.060	500 (12.5mm)	.600 (15mm)	200 (5mm)
VTC 1156-0 VTC 1156-4	1.260	.710	1.150	.500	1.370	1.230	.080	500 (12.5mm)	600 (15mm)	.300 (7.5mm)
VTC 1227-0 VTC 1227-4	1.380	.910	1.220	.640	1.420	1.300	.050	.600 (15mm)	.800 (20mm)	.300 (7.5mm)
VTC 1468-0 VTC 1468-4	1.650	1.100	1.465	.840	1.770	1.680	.060	1.000 (25mm)	1.000 (25mm)	.300 (7.5mm)

MagneTek Triad

Inductors, Common Mode and Current Sense

DESCRIPTION: Highly dependable TRIAD common mode EMI suppression inductors manufactured by MagnaTek are used in various types of power supplies to eliminate noise common to all lines. These units also provide effective differential mode filtering. Meeting VDE, IEC, UL, and CSA requirements, they minimize AC line transmitted interference often created by high frequency switching power supplies. Normally placed close to the input power source, these compact inductors are constructed with UL rated 130°C materials.

E-Core Inductors

A CME375-KIT is available which includes each one of the components in section A.
A CME2425-KIT is available which includes each one of the components in section B.

Section	Type No.	Figure	Inductance	Amps R.M.S.	DC Resistance	Leakage	Dim.	Wt. Lbs.
A	CME375-1	A	4.40 mH	5.50	.049 Ohms	45.0 µH	H: 1.18	.054
	CME375-2		6.90 mH	4.40	.077 Ohms	45.0 µH	W: 1.26	
	CME375-3		10.9 mH	3.50	.122 Ohms	125.0 µH	L: 1.50	
	CME375-4		17.8 mH	2.70	.196 Ohms	180.0 µH	A: .150	
	CME375-5		28.6 mH	2.20	.316 Ohms	300.0 µH	B: .600	
	CME375-6		43.6 mH	1.75	.489 Ohms	440.0 µH	C: .200	
	CME375-7		70.3 mH	1.38	.785 Ohms	720.0 µH	D: .036	
	CME375-8		111.6 mH	1.10	1.240 Ohms	1.10 mH	Sq.	
	CME375-9		176.1 mH	.087	1.980 Ohms	1.80 mH		
B	CME2425-1	B	2.10 mH	2.50	.050 Ohms	9.00 µH	H: 1.075	.154
	CME2425-2		3.50 mH	2.00	.080 Ohms	14.0 µH	W: 1.050	
	CME2425-3		5.50 mH	1.60	.127 Ohms	25.0 µH	L: 1.050	
	CME2425-4		9.00 mH	1.28	.202 Ohms	36.0 µH	A: .125	
	CME2425-5		13.9 mH	1.00	.319 Ohms	60.0 µH	B: .200	
	CME2425-6		22.4 mH	0.80	.500 Ohms	90.0 µH	C: .610	
	CME2425-7		36.0 mH	0.63	.820 Ohms	144.0 µH	D: .80	
	CME2425-8		54.0 mH	0.50	1.260 Ohms	240.0 mH		
	CME2425-9		86.9 mH	0.40	2.020 Ohms	360.0 mH		

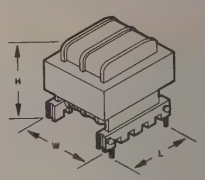


Figure A

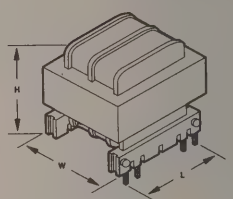


Figure B

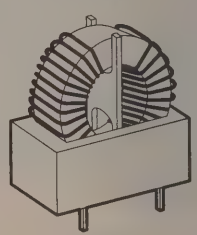


Figure C

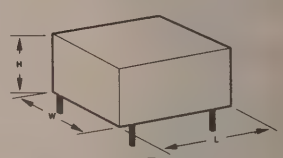


Figure D

Encapsulated Toroidal Inductors

A CMT908-KIT is available which includes one of each of the below listed components.

Section	Type No.	Figure	Inductance	Amps R.M.S.	DC Resistance	Leakage	Dim.	Wt. Lbs.
C	CMT908-V1	C	2.00 mH	7.50	.020 Ohms	25.0 µH	H: 1.50	.08
	CMT908-V2		4.00 mH	5.20	.040 Ohms	45.0 µH	W: .800	
	CMT908-V3		8.00 mH	3.20	.120 Ohms	90.0 µH	L: 1.56	
	CMT908-V4		16.0 mH	2.60	.160 Ohms	180.0 µH	A: .9	
							B: .6	
D	CMT908-H1	D	2.00 mH	7.50	.020 Ohms	25.0 µH	H: .44	.120
	CMT908-H2		4.00 mH	5.20	.040 Ohms	45.0 µH	W: 1.5	
	CMT908-H3		8.00 mH	3.20	.120 Ohms	90.0 µH	L: 1.5	
	CMT908-H4		16.0 mH	2.60	.160 Ohms	180.0 µH	A: 1.08	
							B: 1.28	

Common Mode Inductors

TECHNICAL NOTES:
1. Hi-pot tested at 2,500 VRMS.
2. DC resistance at 20°C +/- 10%.
3. Inductances are minimum measured at 10 Gauss.
4. Current ratings for approximately 40°C temperature rise.

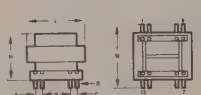


Figure A

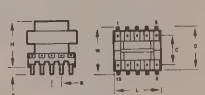


Figure B

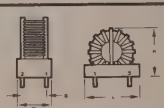


Figure C

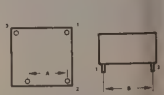


Figure D

DESCRIPTION: Designed for switching power supply applications, TRIAD current sense inductors from MagnaTek are used to detect the current passing through a conductor. These inductors are very reliable and operate effectively over the frequency range of 20-200kHz. They are constructed of UL rated 130°C materials. Both models are available with a center tap option.

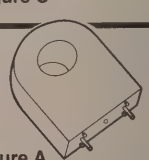


Figure A

Figure B

Current Sense Inductors

Section	Type No.	Figure	Inductance	REF 20 kHz ET Products	Min. Inductance	DCR Ohms	Pri. Amps	Wt. Lbs.
A	CST206-1A	A	100	2.0 VmSec	14.0 mH	.400 Max.	110.0 RMS	.03
	CST206-1T		100 CT	2.0 VmSec	14.0 mH	.400 Max.	110.0 RMS	
	CST206-2A		200	4.0 VmSec	56.0 mH	1.35 Max.	80.0 RMS	
	CST206-2T		200 CT	4.0 VmSec	56.0 mH	1.35 Max.	80.0 RMS	
	CST206-3A		300	6.0 VmSec	130.0 mH	12.0 Max.	70.0 RMS	
	CST206-3T		300 CT	6.0 VmSec	130.0 mH	12.0 Max.	70.0 RMS	
B	CST306-1A	B	50	500.0 VmSec	3.5 mH	.330 Max.	25.0 RMS	.012
	CST306-1A		50 CT	500.0 VmSec	3.5 mH	.330 Max.	25.0 RMS	
	CST306-1A		100	1.0 VmSec	14.0 mH	1.350 Max.	25.0 RMS	
	CST306-1A		100 CT	1.0 VmSec	14.0 mH	1.350 Max.	25.0 RMS	
	CST306-1A		200	2.0 VmSec	55.0 mH	2.750 Max.	35.0 RMS	
	CST306-1A		200 CT	2.0 VmSec	55.0 mH	2.750 Max.	35.0 RMS	

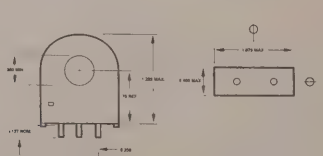


Figure A

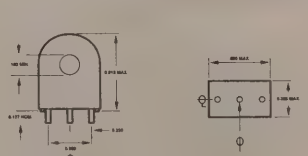


Figure B

TECHNICAL NOTES: 1. Derate ET product by 32% for 50 kHz, 52% for 100kHz and 50% for unidirectional operation.
2. Rated primary current renders approximately 40°C temperature rise.
3. CST-206 models have maximum recommended terminating resistance of 1 ohm per turn.

MagneTek Triad
90 E. Union Street
Goodland, IN 47948
Phone: 800-624-638
FAX: (219) 297-311

MagneTek Triad

Inductors, Rod Core and Output Toroidal Filters

Figure A

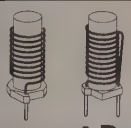


Figure B

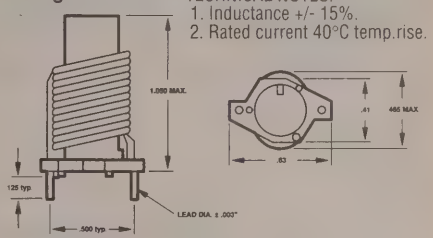
DESCRIPTION: TRIAD high current rod core inductors from MagneTek provide cost effective energy storage. By conditioning the output signal, the inductor smoothes out the current waveform to provide a more stable current. These low cost inductors are designed to be compatible with automated P.C.B. installation.

High Current Rod Core Inductors

A FIRCH-KIT is available which includes one of each of the below listed components.

Section	Type No.	Figure	Inductance	Rated DC Current	Max. DC Resistance	Lead Dia.	Wt.(Lbs.)
A	FIRCH-1	A	2.54 µH	11.6A	5.50 mOhms	.050"	.03
	FIRCH-2		3.05 µH	9.70A	7.31 mOhms	.045"	
	FIRCH-3		3.60 µH	8.10A	9.95 mOhms	.040"	
	FIRCH-4		5.00 µH	6.80A	14.1 mOhms	.036"	
	FIRCH-5		5.90 µH	5.70A	18.5 mOhms	.032"	
	FIRCH-6		7.22 µH	4.80A	26.1 mOhms	.028"	

Figure A



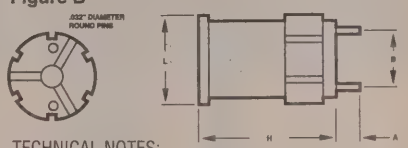
TECHNICAL NOTES:
1. Inductance +/- 15%.
2. Rated current 40°C temp.rise.

Rod Core Inductors

A RC-KIT is available which includes one of each of the below listed components.

Section	Type No.	Figure	Inductance	DC Current	DC Resistance	Dim.	Wt.(Oz.)
B	RC-1	B	5.6 mH	.250A	6.10 Ohms	H: .930 L: .600 A: .150 B: .375	.03
	RC-2		3.9 mH	.320A	3.90 Ohms		
	RC-3		2.5 mH	.400A	2.45 Ohms		
	RC-4		1.5 mH	.500A	1.53 Ohms		
	RC-5		960.0 µH	.625A	1.00 Ohms		
	RC-6		560.0 µH	.800A	.600 Ohms		
	RC-7		450.0 µH	1.00A	.420 Ohms		
	RC-8		250.0 µH	1.25A	.210 Ohms		
	RC-9		200.0 µH	1.60A	.200 Ohms		
	RC-10		100.0 µH	2.00A	.077 Ohms		
	RC-11		75.0 µH	2.50A	.070 Ohms		

Figure B



TECHNICAL NOTES:
1. Rated current 10 amps per pin max.
2. Rated current renders @ 40°C temp. rise.

DESCRIPTION: TRIAD output filter inductors from MagneTek are used in output circuit applications to provide a more constant current source by storing energy. These inductors have exceptional performance characteristics across the entire specification range with their primary storage function being energy storage. As opposed to other output filter inductor designs offering only a single winding, these devices offer design flexibility so that several outputs can be fed through different windings on the same core.

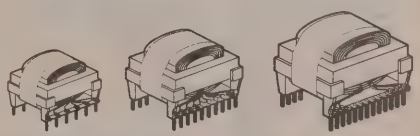


Figure A Figure B Figure C

High Current DC Filter Inductors

Section	Type	Figure	Inductance @ No DC	DC Amps	DC Resistance	Inductance @ DC Bias	WT.(Lbs.)
A	FIE137-1	A	17.9 µH	35.0	2.00 µOhms	9.0 µH	.20
	FIE137-2		29.7 µH	25.0	4.00 µOhms	15.5 µH	
B	FIE168-1	B	19.2 µH	70.0	1.0 µOhms	10.2 µH	.54
	FIE168-2		31.2 µH	50.0	2.00 µOhms	16.0 µH	
C	FIE220-1	C	11.7 µH	120.0	1.00 µOhms	5.0 µH	1.03
	FIE220-2		46.8 µH	60.0	3.00 µOhms	21.3 µH	

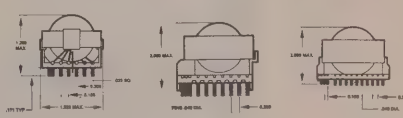


Figure A Figure B Figure C

TECHNICAL NOTES: 1. DC resistance +/- 15%.
2. Inductance +/- 10%.

Toroidal Filter Inductors

A FIT-KIT is available which includes one of each of the below listed components

Section	Type No.	Min. Inductance (µH)		Rated DC Amps	Max. DCR (mOhms)	Dimensions		Wt.(Lbs.)
		No Bias	At Bias			A-E	F	
A	FIT44-1	18.85	12.72	2.8	44.8	A: 0.625	F: 0.020	.008
	FIT44-2	14.75	9.82	3.4	30.7	B: 0.350	0.022	
	FIT44-3	12.30	7.75	4.0	23.4	C: 0.700	0.025	
	FIT44-4	8.06	5.22	4.8	15.9	D: 0.250	0.028	
						E: 0.350		
B	FIT50-1	47.40	29.00	2.8	78.9	A: 0.700	F: 0.020	.012
	FIT50-2	35.48	23.77	3.4	57.8	B: 0.475	0.022	
	FIT50-3	27.16	16.13	4.0	40.1	C: 0.750	0.025	
	FIT50-4	21.65	12.27	4.8	29.2	D: 0.300	0.028	
	FIT50-5	16.76	10.41	5.7	17.0	E: 0.474	0.032	
	FIT50-6	12.50	6.75	6.8	11.8		0.036	
	FIT50-7	8.86	5.47	8.1	8.0		0.040	
C	FIT68-1	89.50	57.99	2.8	108.0	A: 0.875	F: 0.020	.026
	FIT68-2	71.10	41.59	3.4	86.1	B: 0.475	0.023	
	FIT68-3	54.81	33.05	4.0	59.9	C: 0.950	0.026	
	FIT68-4	43.30	26.63	4.8	42.4	D: 0.300	0.028	
	FIT68-5	33.15	18.79	5.7	28.8	E: 0.474	0.032	
	FIT68-6	24.31	13.56	6.8	20.2		0.036	
	FIT68-7	18.64	10.23	8.1	14.8		0.040	
D	FIT80-1	132.70	74.04	4.0	95.2	A: 0.975	F: 0.026	.045
	FIT80-2	107.50	58.05	4.8	67.9	B: 0.625	0.029	
	FIT80-3	80.75	45.22	5.7	44.8	C: 1.100	0.032	
	FIT80-4	65.04	31.60	6.8	32.8	D: 0.450	0.036	
	FIT80-5	47.79	22.79	8.1	22.5	E: 0.624	0.040	
	FIT80-6	38.07	18.11	9.7	15.8		0.045	
E	FIT106-1	253.00	153.00	4.0	139.0	A: 1.300	F: 0.026	.090
	FIT106-2	197.00	113.00	4.8	106.0	B: 0.725	0.029	
	FIT106-3	154.00	86.00	5.7	74.0	C: 1.400	0.032	
	FIT106-4	116.00	61.90	6.8	48.5	D: 0.500	0.036	
	FIT106-5	94.48	49.31	8.1	39.1	E: 0.724	0.040	
	FIT106-6	70.05	35.50	9.7	21.8		0.045	

DESCRIPTION: TRIAD toroidal filter inductors from MagneTek are specially designed to minimize transients. These devices store energy, and therefore, condition the output signal by leveling out the current waveform providing a more stable current supply. Generally used in high frequency circuits, our standardized design provides an economical solution for use in differential mode applications or as an output filter inductor.

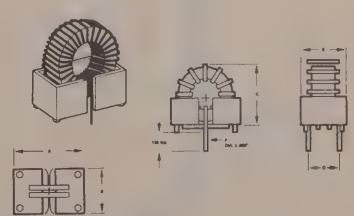


Figure A

TECHNICAL NOTES:
1. Nominal inductance values are typically 10% higher than minimum rating.
2. Biased inductance measured at rated DC amps.
3. Operation at rated current yields @ 40°C rise over 20°C ambient.

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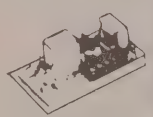
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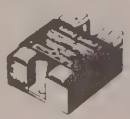
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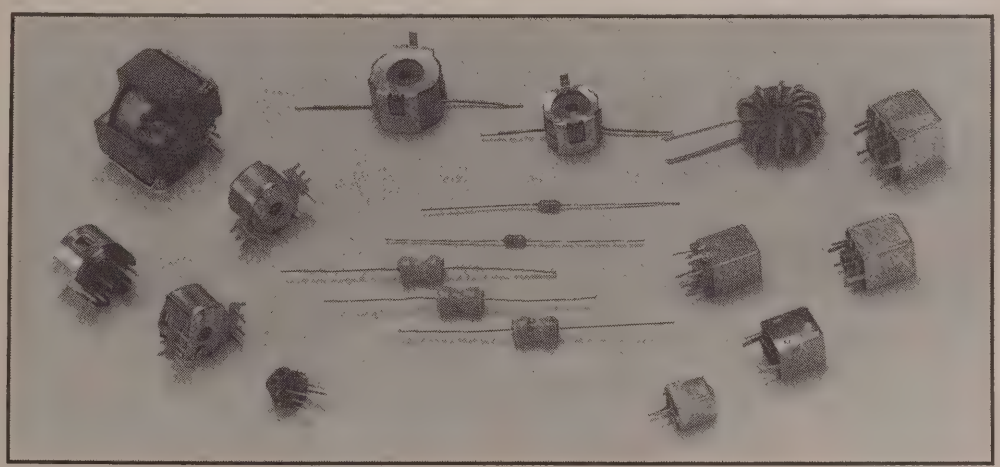
A large cross-section of coils are available both shielded and unshielded. Tunable coils will be designed around your specifications and requirements. The inductance range available with standard hardware is form 50nH to 480mH. Inductance values outside this range can be custom designed. Our coils offer a wide range of frequencies, high Q, and high quality.



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- Very high reliability.
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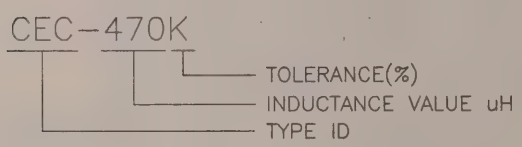
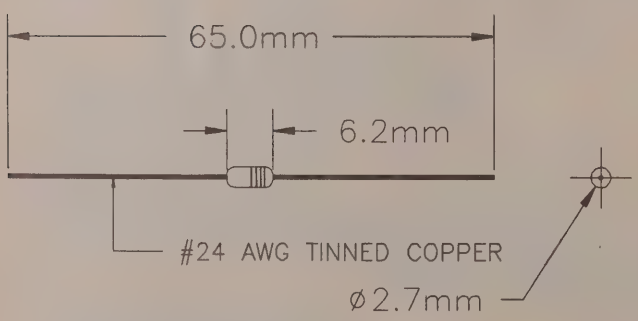
- Available bulk packaged or taped for automatic insertion.
- Color coded for easy indentification.

Engineering Design Kit K-CEC-000 available.
The kit contains 250 inductors (25 values X 10 inductors)





PART NO.	INDUCTANCE. (uH)	TOL.	Q MIN	TEST FREQ (MHZ)	SRF MIN (MHZ)	DCR MAX (OHM)	DCI MAX (MA)
CEC-R10M	0.10	±20%	60	25.20	255	0.08	1520
CEC-R12M	0.12	±20%	60	25.20	252	0.08	1500
CEC-R15-M	0.15	±20%	60	25.20	250	0.09	1450
CEC-R18-M	0.18	±20%	60	25.20	245	0.09	1400
CEC-R22-M	0.22	±20%	70	25.20	240	0.1	1350
CEC-R27M	0.27	±20%	70	25.20	230	0.1	1300
CEC-R33M	0.33	±20%	70	25.20	235	0.11	1250
CEC-R39M	0.39	±20%	70	25.20	250	0.12	1200
CEC-R47M	0.47	±20%	70	25.20	252	0.12	1100
CEC-R56M	0.56	±20%	70	25.20	254	0.13	1050
CEC-R68M	0.68	±20%	70	25.20	250	0.15	1000
CEC-R82M	0.82	±20%	80	25.20	252	0.19	950
CEC-1ROM	1.00	±20%	80	25.20	254	0.20	880
CEC-1R2M	1.20	±20%	80	7.96	230	0.22	820
CEC-1R5M	1.50	±20%	80	7.96	232	0.23	780
CEC-1R8K	1.80	±10%	80	7.96	220	0.25	730
CEC-2R2K	2.20	±10%	80	7.96	226	0.3	690
CEC-2R7K	2.70	±10%	80	7.96	220	0.35	650
CEC-3R3K	3.30	±10%	80	7.96	98	0.5	630
CEC-3R9K	3.90	±10%	80	7.96	92	0.6	610
CEC-4R7K	4.70	±10%	80	7.96	90	0.8	540
CEC-5R6K	5.60	±10%	80	7.96	95	0.9	520
CEC-6R8K	6.80	±10%	80	7.96	85	1.0	480
CEC-8R2K	8.20	±10%	80	7.96	89	1.0	430
CEC-100K	10.00	±10%	80	7.96	80	1.1	400
CEC-120K	12.00	±10%	70	2.52	37	1.3	380
CEC-150K	15.00	±10%	70	2.52	25	1.5	360
CEC-180K	18.00	±10%	70	2.52	18	1.6	340
CEC-220K	22.00	±10%	70	2.52	16	1.7	300
CEC-270K	27.00	±10%	70	2.52	15	1.9	290
CEC-330K	33.00	±10%	70	2.52	13	2.1	280
CEC-390K	39.00	±10%	70	2.52	13	2.4	260
CEC-470K	47.00	±10%	70	2.52	13	2.6	250
CEC-560K	56.00	±10%	70	2.52	13.5	2.8	240
CEC-680K	68.00	±10%	70	2.52	13	3.0	230
CEC-820K	82.00	±10%	70	2.52	13	3.4	220
CEC-101K	100.00	±10%	70	2.52	13	3.8	200
CEC-121K	120.00	±10%	70	0.796	13	4.5	180
CEC-151K	150.00	±10%	60	0.796	13	5	170
CEC-181K	180.00	±10%	60	0.796	13.5	7.5	160
CEC-221K	220.00	±10%	60	0.796	13	8.8	140
CEC-271K	270.00	±10%	60	0.796	13	9.5	130
CEC-331K	330.00	±10%	60	0.796	10	10.8	110
CEC-391K	390.00	±10%	40	0.796	7.2	17	100
CEC-471K	470.00	±10%	40	0.796	3.8	20	95
CEC-561K	560.00	±10%	40	0.796	3.5	22	80
CEC-681K	680.00	±10%	40	0.796	3.4	23	70
CEC-821K	820.00	±10%	40	0.796	3.2	25	65
CEC-102K	1000.00	±10%	40	0.796	3.0	29	60

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MCE

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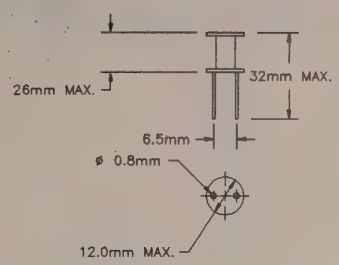
CW Type

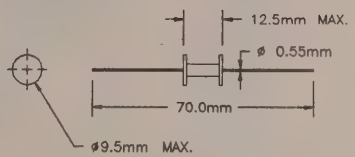
This fixed inductor can be supplied with or without UL tubing on the outside. The vertical package allows for a small footprint. These inductors are widely used in power supplies, radios, and communication devices. The CW series are normally supplied in bulk packaging, but upon request can be supplied on tape for automatic insertion.



TYPE:	CW
INDUCTANCE RANGE:	1uH – 100 mH
FREQUENCY RANGE	1KHz – 25MHz
MINIMUM Q:	30 @ F>7.9MHz
MAXIMUM CURRENT:	1.5 A

CWR Type

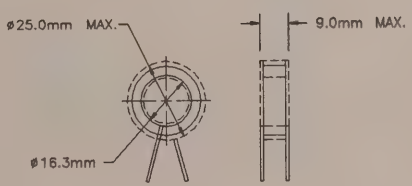
The CWR series fixerd inductors give high inductance values in a small package. The inductor can be supplied with or without UL tubing. These compact inductors are designed for low cost and high reliability applications where a relatively high Q is required. CWR type can be supplied in bulk packaging or on tape and reel for automatic insertion.



TYPE:	CWR
INDUCTANCE RANGE:	1uH – 100 mH
FREQUENCY RANGE	1KHz – 20MHz
MINIMUM Q:	50 @ F>7.9MHz
MAXIMUM CURRENT:	1.5 A

RI Type

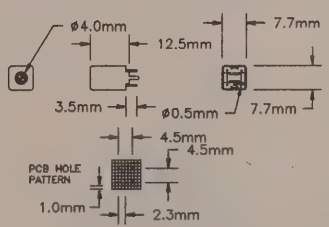
The RI series is a toroidal configuration inductor that performs well under high current applications. These chokes are excellent for EMI/RFI filtering. They are also ideal for use as energy storage inductors in switching power supplies and such.



TYPE:	RI
INDUCTANCE RANGE:	1uH – 5mH
FREQUENCY RANGE	120Hz – 1KHz
MINIMUM Q:	5
MAXIMUM CURRENT:	20 A

AH-7 Type

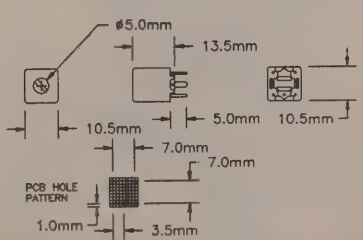
The AH-7 series tunable inductors are provided in an international standard 7mm package. These precision coils can be made to meet your inductance values giving a 10+% tuning range. These are available with or without magnetic shielding. These are ideal for IF coils, oscillators and RF coil applications.



TYPE:	AH-7
INDUCTANCE RANGE:	0.1uH – 1.5 mH
FREQUENCY RANGE	10KHz – 20MHz
MINIMUM Q:	75
INITIAL CAP:	10pF – 430pF

KT-10 Type

The KT-10 series tunable coils are provided in an international standard 10mm package. These precision coils can be made to meet your inductance values giving a 10+% tuning range. These are available with or without magnetic shielding and are ideal for many uses including IF coils, oscillators, and RF coil applications.



TYPE:	KT-10
INDUCTANCE RANGE:	1uH – 480mH
FREQUENCY RANGE	10KHz – 200MHz
MINIMUM Q:	50
INITIAL CAP:	10pF – 1000pF

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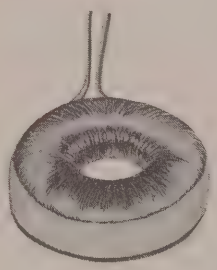
TOROIDAL INDUCTORS

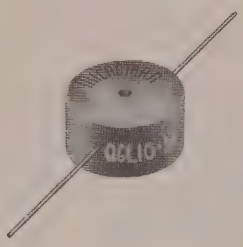
MICROTRAN company, inc.

For SMPS inductors and additional magnetic products, see Transformer Section 5600

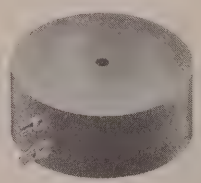
QE-M Molded



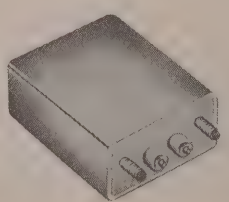
QG-F, QI-F, QK-F, QPL-F, QTL-F
Open Frame



QG-M Molded



QI-M, QK-M, QPL-M, QTL-M Molded



QI-H, QK-H 2 studs, QPL-H, QTL-H
4 studs Hermetic

QE SERIES

Ultra miniaturized with low height design. Exceptionally high "Q" and wide frequency range. Frequency range of QEL Series 1 to 300 kHz; QEM, 3 to 500 kHz. Accuracy, ±2%. Molded in epoxy resin with .020" × 2" tinned copperweld leads. Size, .450" dia. × .285".

QEL-M SERIES				QEM-M SERIES			
Part No.	Inductance	Typ. DCR	Typ. Dist. Cap., pF	Part No.	Inductance	Typ. DCR	Typ. Dist. Cap., pF
QEL1-M	1 mH	2.1	25	QEM05-M	0.5 mH	2.1	20
QEL2-M	2	3.6	30	QEM1-M	1	3.8	30
QEL5-M	5	7.3	35	QEM2-M	2	6.2	35
QEL10-M	10	15.8	45	QEM5-M	5	15.9	45
QEL15-M	15	20	45	QEM10-M	10	19	50
QEL25-M	25	32	50	QEM15-M	15	42	55
QEL50-M	50	69	50	QEM25-M	25	88	60
QEL100-M	100	185	70	QEM50-M	50	193	70

QG SERIES

Frequency range of QGL Series, to 20kHz; QGM Series, 2 to 100 kHz. Accuracy, ±2%. **QG-F:** Open frame, microcrystalline wax dipped with 4" #28 AWG leads. Size .625" dia. × .281". **QG-M:** Molded in high temperature epoxy resin with .020" × 2" tinned copperweld leads. Leads may be bent downward for plug-in printed circuit use. Size, .875" dia. × .375".

QGL SERIES				QGM SERIES			
QGL5-	5 mH	2.5	30	QGM1-	1 mH	1.4	22
QGL10-	10	5	33	QGM2-	2	2.5	25
QGL15-	15	8	34	QGM5-	5	6	28
QGL30-	30	17	37	QGM10-	10	12	31
QGL50-	50	28	40	QGM15-	15	18	32
QGL100-	100	50	42	QGM25-	25	30	35
QGL250-	250	130	46	QGM50-	50	52	37
QGL500-	500	290	48	QGM100-	100	115	39
QGL1000-	1.0 H	530	51				
QGL1500-	1.5	825	53				

QI SERIES

Frequency range to 20 kHz; accuracy, ±2%. **QIL-M:** Molded in high temperature epoxy with silver plated turret lugs. Size, 1.187" dia. × .50". **QIL-H:** Hermetically sealed in metal case with Teflon terminals. Size, 1.062" × .50" × 1.219". **QIL-F:** Open frame. Microcrystalline wax dipped with 4" #28 plastic leads. Size, 1" dia. × .406".

QIL SERIES							
QIL3-	3 mH	.73	36	QIL150-	150 mH	34	50
QIL5-	5	1.1	38	QIL250-	250	55	53
QIL10-	10	2.1	40	QIL500-	500	95	55
QIL15-	15	3.3	42	QIL1000-	1.0 H	210	57
QIL25-	25	5.3	45	QIL1500-	1.5	335	59
QIL50-	50	11	47	QIL2500-	2.5	550	61
QIL100-	100	22	49				

QK SERIES

Frequency range of QKL Series to 10 kHz; QKM Series, 5 to 50 kHz. Accuracy, ±2%. **QK-F:** Open frame, microcrystalline wax dipped; 4" #28 AWG leads. Size, 1.25" dia × .625". **QK-H:** Hermetically sealed with Teflon terminals. Size, 1.469" × .781" × 1.734". **QK-M:** Molded in high temperature epoxy resin, silver plated turret lugs. Size, 1.375" dia. × .75"; #8 clearance hole.

QKL SERIES							
QKL5-	5 mH	.62	60	QKL250-	250 mH	28	87
QKL10-	10	1.1	66	QKL500-	500	63	91
QKL15-	15	1.7	68	QKL1000-	1.0 H	110	96
QKL25-	25	2.8	72	QKL1500-	1.5	175	98
QKL50-	50	6	76	QKL2500-	2.5	275	103
QKL100-	100	11	81	QKL5000-	5	645	108
QKL150-	150	17	83	QKL10,000-	10	1175	112
QKM SERIES							
QKM2-	2 mH	.45	52	QKM100-	100 mH	25	79
QKM5-	5	1.1	58	QKM250-	250	65	87
QKM10-	10	2.5	62	QKM500-	500	115	92
QKM25-	25	6.5	70	QKM1000-	1.0 H	250	97
QKM50-	50	11	74				

QP SERIES

Frequency range to 10 kHz; accuracy ±2%. **QPL-F:** Open frame, microcrystalline wax dipped; 4" #24 leads. Size, 1.938" × .875". **QPL-H:** Hermetically sealed with Teflon terminals. Size, 1.938" × 1.063" × 2.281". **QPL-M:** Molded in high temperature epoxy resin; silver plated turret lugs. Size, 2" dia. × 1".

QPL SERIES							
QPL25-	25 mH	1.5	100	QPL2500-	2.5 H	150	133
QPL50-	50	2.5	105	QPL5000-	5.0	350	138
QPL100-	100	6	110	QPL7500-	7.5	525	140
QPL250-	250	15	115	QPL10,000-	10	600	142
QPL500-	500	25	120	QPL15,000-	15	900	146
QPL1000-	1.0 H	60	125	QPL25,000-	25	1500	150
QPL1500-	1.5	90	130				

QT SERIES

Frequency range to 15 kHz; accuracy, ±2%. **QTL-F:** Open frame, microcrystalline wax dipped; 4" #24 leads. Size, 2.438" dia. × 1". **QTL-H:** Hermetically sealed with Teflon terminals. Size, 2.563" × 1.313" × 2.813". **QTL-M:** Molded in epoxy resin. Size, 2.875" × 1.375".

QTL SERIES							
QTL25-	25 mH	0.85	127	QTL1500-	1.5 H	40	177
QTL50-	50	1.5	136	QTL2500-	2.5	70	184
QTL100-	100	2.8	144	QTL5000-	5	140	192
QTL150-	150	3.9	149	QTL10,000-	10	270	200
QTL250-	250	7	156	QTL15,000-	15	430	205
QTL500-	500	15	164	QTL25,000-	25	850	212
QTL1000-	1.0 H	27	173	QTL50,000-	50	1500	221

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- SURFACE MOUNT AND/OR ENCAPSULATION AVAILABLE

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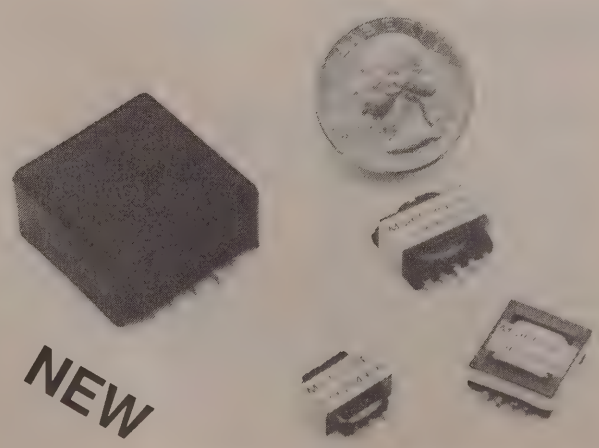

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MURATA ERIE NORTH AMERICA

chip inductors

Murata Erie's SMT inductors utilize a new coil winding technology, permitting high current capabilities and excellent frequency characteristics in an extremely small chip design. Available in a wide range of inductance values ranging from 4.7nH to 2.2mH. Using Nickel Alloy metalization material for electrodes, these chip inductors can be either flow soldered or reflow soldered. Their square design allows automated processes.

PACKAGING

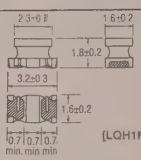
All products are supplied in plastic tape and reel conforming to EIAJ-RC-1009B.

FEATURES

- Miniature size
- Available in ferrite and ceramic cores
- Tape packaged for universal mounting equipment (per EIAJ-RC-1009B)
- Wide standard inductance range– 4.7nH to 2200µH
- High Q factor at frequencies to 100Mz for ferrite cores and to more than 1GHz for ceramic cores

DIMENSIONS: mm

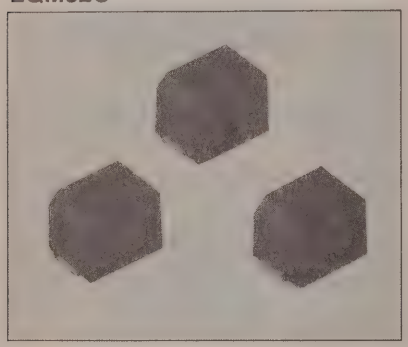
LQN1A (ceramic)
LQH1N (ferrite)
LQN2A (ceramic)
LQH3N (ferrite)
LQH3C (ferrite)
LQH4N (ferrite)



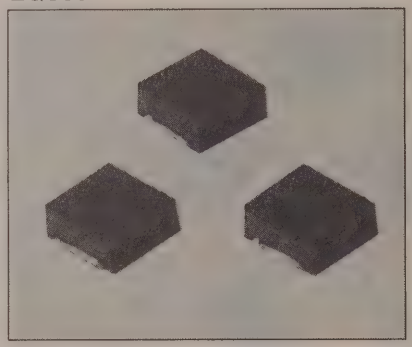
[LQH1N Type]

	LQH1N	LQN2A	LQH3N LQH3C	LQH4N LQN4N
A	2.3±0.2	2.5±0.2	2.5±0.2	3.6±0.2
B	1.8±0.2	1.6±0.2	2.0±0.2	2.6±0.2
C	1.6±0.2	2.5±0.2	2.5±0.2	3.2±0.2
D	1.6±0.2	2.5±0.2	2.5±0.3	3.2±0.3
E	3.2±0.3	3.2±0.3	3.2±0.3	4.5±0.3

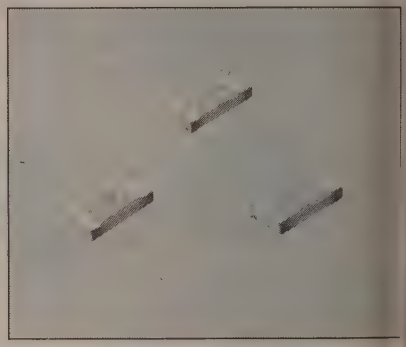
LQM32C



LQS33N



LQP31A



LQH/LQN□N Series Standard Type

Part Number *1	Nominal Inductance min.	Nominal Inductance max.	Tolerance *2 J	Tolerance *2 K	Tolerance *2 M	Q (Typ.)	DC*3 Resistance (Ω) max.	Self*3 Resonance Freq. (MHz) min.	Allowable*3 Current (mA)
LQH1N○○○□04M00	0.15µH	8.2µH		○	O	50	0.39 ±40%	250	250
	10µH	100µH	○	O		60	2.5 ±30%	20	100
LQH3N○○○□04M00	0.10µH	1.2µH			O	50	0.25	200	700
	1.5µH	8.2µH		○	O	50	0.6	70	400
	10µH	330µH	○	O		50	1.8	20	190
LQH4N○○○□04M00	10µH	1.5mH		O		50	0.56	23	400
LQN4N○○○□04M00	1.8mH	2.2mH		O		50	45	1.5	35

Power Line Choke LQH/LQM Series

Part Number *1	Nominal Inductance min.	Nominal Inductance max.	Tolerance *2 J	Tolerance *2 K	Tolerance *2 M	DC*3 Resistance (Ω)	Self*3 Resonance Freq. (MHz) min.	Allowable Current (mA)
LQH1C○○○□04M00	0.12µH	4.7µH			O	0.08 ±40%	250	970
	10µH	100µH		O		1.3 ±30%	20	230
LQH3C○○○□04M00	1.0µH	4.7µH			O	0.09 ±30%	96	800
	10µH	560µH		O		0.44 ±30%	26	300
LQM32○○○□04M00	470µH	1000µH			O	13 ±30%	4.5	80

* 1...Inductance code is shown in ○○○ 1.2µH = 1R2, 10µH = 100, 100µH = 101
Tolerance code is shown in □ : ±5% = J, ±10% = K, ±20% = M

* 2O: Standard. ○: Available.
* 3 DC resistance, self-resonant frequency and allowable current are shown with the minimum value inductance.

chip inductors

MURATA ERIE NORTH AMERICA

LQS33N Series with magnetic shielding

Part Number *1	Nominal Inductance		Tolerance*2			Q (Typ.)	DC*3 Resistance (Ω) max.	Self *3 Resonance Freq. (MHz) min.	Allowable*3 Current (mA)
	min.	max.	G	J	K				
LQS33N○○○□04M00	1.0μH	100μH	O	○		100	0.19 ± 30%	120	70

* 1...Inductance code is shown in ○○○ 1.2μH = 1R2,10μH = 100, 100μH = 101
Tolerance code is shown in □ ±2% = G, ±5% = J, ±10% = K

* 2O: Standard. ○: Available.
* 3 DC resistance, self-resonant frequency and allowable current are shown with the minimum value inductance.

LQN1A/LQN2A Series High Q, for high frequency applications

Part Number *1	Nominal Inductance		Tolerance*2			Q (Typ.)	DC*3 Resistance (Ω) max.	Self *3 Resonance Freq. (MHz) min.	Allowable*3 Current (mA)
	min.	max.	J	K	M				
LQN1A○○○□04M00	8.8nH	100nH	O	○		100	0.029 ± 40%	1000	750
LQN2A○○○□04M00	10nH	82nH		○	O	60	0.25	1000	770
	100nH	220nH		O		40	0.40	400	380

* 1...Inductance code is shown in ○○○ 1.2μH = 1R2,10μH = 100, 100μH = 101
Tolerance code is shown in □ ±2% = G, ±5% = J, ±10% = K

* 2O: Standard. ○: Available.
* 3 DC resistance, self-resonant frequency and allowable current are shown with the minimum value inductance.

LQP31A Series High Q for ultra high frequency

Part Number *1	Nominal Inductance		Tolerance*2			Q (Typ.)	DC*3 Resistance (Ω) max.	Self *3 Resonance Freq. (MHz) min.	Allowable*3 Current (mA)
	min.	max.	G	J	K				
LQP31A○○○□ 04M00	4.7nH	6.8nH		O		30	1	2000	250
	10nH	100nH	O	○		30	1	1000	230

* 1...Inductance code is shown in ○○○ :4.7nH = 4N7, 10nH = 10N, 100nH = R10
Tolerance code is shown in □ ±2% = G, ±5% = J, ±10% = K, ±20% = M
* 2O: Standard. ○: Available.
* 3 DC resistance, self-resonant frequency and allowable current are shown with the minimum value of inductance.

Packaging Per EIAJ - RC - 1009B

DIMENSIONS: mm

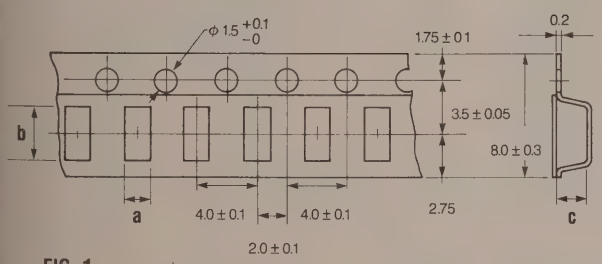


FIG. 1

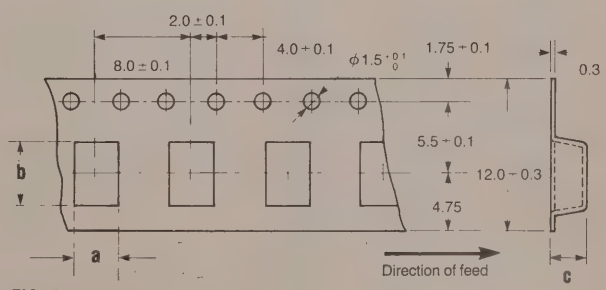


FIG. 2

Type	Fig.	a	b	c	Packaging Units	
					180mm Dia. Reel	330mm Dia. Reel
LQH1N/LQH1C/LQN1A	1	1.9	3.6	2.0	2000	–
LQN2A	1	2.9	3.6	1.8	2500	–
LQH3N/LQH3C	1	2.9	3.6	2.2	2000	–
LQM32C	1	2.9	4.0	2.8	1000	–
LQP31A	1	1.9	3.6	0.9	2000	–
LQS33N	2	3.9	3.7	1.9	1000	–
LQH4N/LQN4N	2	3.6	4.9	2.9	500	2500

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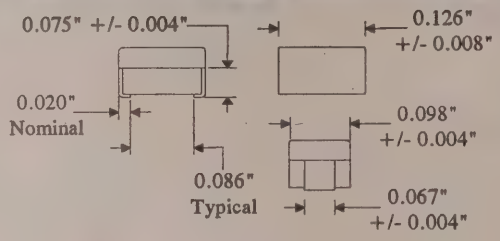
ECLIPTEK CORPORATION

SURFACE MOUNT INDUCTORS

EC1210 Series
EC1812 Series

Ecliptek's line of highly reliable surface mount inductors offer precision performance over a wide inductance range in a very small package. Both the EC1210 series and the EC1812 series by Ecliptek feature a molded epoxy case. Standard tolerances for the EC1812 series are 10 and 20%, (5% available) while the EC1210 series features standard tolerances of 5, 10 and 20%.

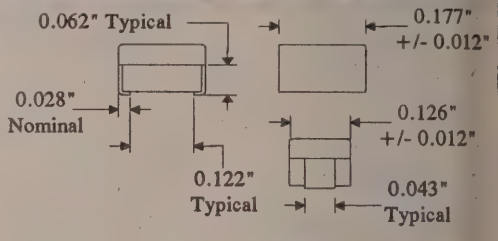
DIMENSIONS • EC1210 SERIES



METRIC CONVERSION

0.126" = 3.200mm	0.098" = 2.500mm	0.086" = 2.180mm
0.075" = 1.900mm	0.067" = 1.700mm	0.020" = 0.500mm
0.008" = 0.200mm	0.004" = 0.100mm	

DIMENSIONS • EC1812 SERIES



METRIC CONVERSION

0.177" = 4.500mm	0.126" = 3.200mm	0.122" = 3.100mm
0.062" = 1.570mm	0.043" = 1.100mm	0.028" = 0.700mm
0.012" = 0.300mm		

STANDARD SPECIFICATIONS	EC1210 SERIES	EC1812 SERIES
Dielectric Strength (sea level)	5 seconds with 1000V DC applied to both terminals and case	5 seconds with 1000V DC applied to both terminals and case
Operating Temperature Range	-40°C to + 100°C	-25°C to +85°C
Ambient Temperature	25°C	25°C
Terminal Pull	1.1 Pounds	Not Applicable
Tensile Strength	Not Applicable	2.2 pounds for 5 seconds in both X and Y directions
Casing	Molded Epoxy	Molded Epoxy
Solderability	95% of Terminal Covered within 3+/-0.5 seconds at 230 (+/-5°C)	90% of terminal covered within 2+/-0.5 seconds at 230 (+/-5°C)

COMMON PART NUMBERS • EC1210 SERIES

ECLIPTEK PART NUMBER	L (uH)	Q (Min)	Test Freq. (MHz)	SRF Min. (MHz)	DCR Max. (ohms)	Rated DC Curr. (mA)
EC1210-.005M	0.005	11	100	2700	0.12	450
EC1210-.010K	0.010	15	100	2500	0.13	450
EC1210-.015K	0.015	19	100	2100	0.16	450
EC1210-.022K	0.022	23	100	1700	0.20	450
EC1210-.033K	0.033	25	100	1400	0.24	450
EC1210-.039K	0.039	25	100	1300	0.27	450
EC1210-.047K	0.047	26	100	1200	0.30	450
EC1210-.068K	0.068	27	100	1000	0.36	450
EC1210-.10K	0.10	28	100	700	0.44	450
EC1210-.12K	0.12	30	25.2	500	0.22	450
EC1210-.18K	0.18	30	25.2	400	0.28	450
EC1210-.27K	0.27	30	25.2	320	0.36	450
EC1210-.47K	0.47	30	25.2	220	0.50	450
EC1210-.56K	0.56	30	25.2	180	0.55	450
EC1210-.82K	0.82	30	25.2	140	0.65	450
EC1210-1.0K	1.0	30	7.96	120	0.70	400
EC1210-1.5K	1.5	30	7.96	85	0.85	370
EC1210-2.7K	2.7	30	7.96	70	1.1	290
EC1210-4.7K	4.7	30	7.96	50	1.5	220
EC1210-6.8K	6.8	30	7.96	43	1.8	180
EC1210-10K	10	30	2.52	36	2.1	150
EC1210-12K	12	30	2.52	33	2.5	140
EC1210-18K	18	30	2.52	27	3.3	120
EC1210-22K	22	30	2.52	25	3.7	110
EC1210-33K	33	30	2.52	17	5.6	70
EC1210-39K	39	30	2.52	16	6.4	65
EC1210-56K	56	30	2.52	13	8.0	55
EC1210-82K	82	30	2.52	11	10	45
EC1210-100K	100	20	0.796	10	10	40
EC1210-220K	220	20	0.796	7	21	50

COMMON PART NUMBERS • EC1812 SERIES

ECLIPTEK PART NUMBER	L (uH)	Q (Min)	Test Freq. (MHz)	SRF Min. (MHz)	DCR Max. (ohms)	Rated DC Curr. (mA)
EC1812-.22M	0.22	40	25.2	150	0.15	710
EC1812-.27M	0.27	40	25.2	150	0.15	710
EC1812-.33M	0.33	40	25.2	150	0.16	670
EC1812-.39M	0.39	40	25.2	150	0.18	650
EC1812-.47M	0.47	50	25.2	150	0.20	620
EC1812-.68M	0.68	50	25.2	130	0.22	580
EC1812-.82M	0.82	50	25.2	110	0.24	560
EC1812-1.0M	1.0	50	25.2	100	0.27	530
EC1812-1.2M	1.2	50	7.96	80	0.30	500
EC1812-1.5M	1.5	50	7.96	70	0.33	480
EC1812-1.8M	1.8	50	7.96	60	0.36	460
EC1812-2.2M	2.2	50	7.96	55	0.41	430
EC1812-3.3K	3.3	50	7.96	45	0.48	400
EC1812-3.9K	3.9	50	7.96	40	0.53	380
EC1812-4.7K	4.7	50	7.96	35	0.57	360
EC1812-5.6K	5.6	40	7.96	30	0.63	350
EC1812-6.8K	6.8	40	7.96	25	0.69	330
EC1812-10K	10	40	7.96	20	0.84	300
EC1812-12K	12	40	2.52	19	1.35	230
EC1812-15K	15	40	2.52	18	1.5	220
EC1812-22K	22	40	2.52	16	1.8	200
EC1812-27K	27	40	2.52	15	2.1	190
EC1812-33K	33	40	2.52	14	2.4	180
EC1812-39K	39	40	2.52	13	2.6	170
EC1812-47K	47	40	2.52	12	2.9	160
EC1812-56K	56	40	2.52	11	4.2	130
EC1812-82K	82	50	2.52	9.0	4.9	120
EC1812-100K	100	50	2.52	8.5	5.6	110
EC1812-120K	120	50	0.796	6.0	10.6	80
EC1812-220K	220	50	0.796	5.0	13.7	70

PART NUMBERING GUIDE

EC 1210 - 47 J T&R

- BODY STYLE: Surface Mount Package
- BODY SIZE: 0.126" x 0.098"
- VALUE: in uH
- TOLERANCE: M=+/-20%, K=+/-10%, J=+/-5%
- add "T & R" for Tape and Reel packaging

PART NUMBERING GUIDE

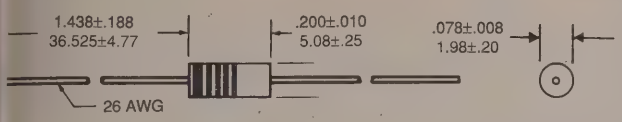
EC 1812 - 47 K T&R

- BODY STYLE: Surface Mount Package
- BODY SIZE: 0.177" x 0.126"
- VALUE: in uH
- TOLERANCE: M=+/-20%, K=+/-10%, J=+/-5%
- add "T & R" for Tape and Reel packaging

INDUCTIVE COMPONENTS

OHMITE Manufacturing Company

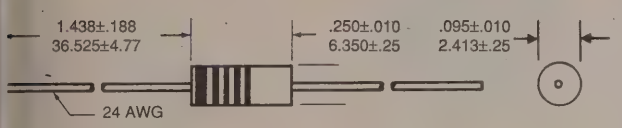
H Series R.F. Molded Chokes



Ratings	Phenolic	Powdered Iron and Ferrite
Style	LT4	LT10
Grade	1	1
Class	B	A
Maximum Operating Temperature	125°C	105°C
Maximum Temperature Rise	35°C	15°C
Ambient Temperature	90°C	90°C
Dielectric Withstanding Voltage (sea level)	1000VRMS	1000VRMS
(reduced barometric pressure)	200VRMS	200VRMS
Terminal Pull	3 lbs.	3 lbs.
Altitude	70,000 ft.	70,000 ft.
	.10-.47 µH Phenolic	.56-100 µH Powdered Iron 120-270 µH Ferrite

Color coded in accordance with MIL-C-15305. Letter suffix on part number denotes tolerance.

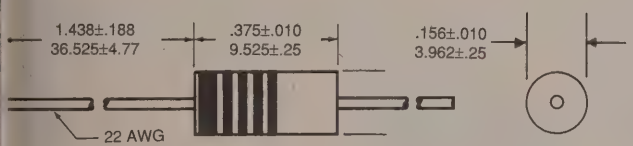
J Series R.F. Molded Chokes



Ratings	Phenolic	Powdered Iron and Ferrite
Style	LT4	LT10
Grade	1	1
Class	B	A
Maximum Operating Temperature	125°C	105°C
Maximum Temperature Rise	35°C	15°C
Ambient Temperature	90°C	90°C
Dielectric Withstanding Voltage (sea level)	1000VRMS	1000VRMS
(reduced barometric pressure)	300VRMS	200VRMS
Terminal Pull	5 lbs.	5 lbs.
Altitude	70,000 ft.	70,000 ft.
	.10-1.0 µH Phenolic	1.2-27 µH Powdered Iron 33-1000 µH Ferrite

Color coded in accordance with MIL-C-15305. Letter suffix on part number denotes tolerance.

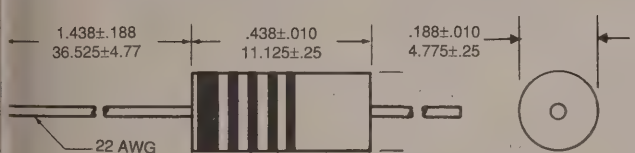
K Series R.F. Molded Chokes



Ratings	Phenolic	Powdered Iron and Ferrite
Style	LT4	LT10
Grade	1	1
Class	B	A
Maximum Operating Temperature	125°C	105°C
Maximum Temperature Rise	35°C	15°C
Ambient Temperature	90°C	90°C
Dielectric Withstanding Voltage (sea level)	1000VRMS	1000VRMS
(reduced barometric pressure)	200VRMS	200VRMS
Terminal Pull	5 lbs.	5 lbs.
Altitude	70,000 ft.	70,000 ft.
	.15-4.7 µH Phenolic	5.6-1000 µH Powdered Iron

Color coded in accordance with MIL-C-15305. Letter suffix on part number denotes tolerance. Other tolerances available.

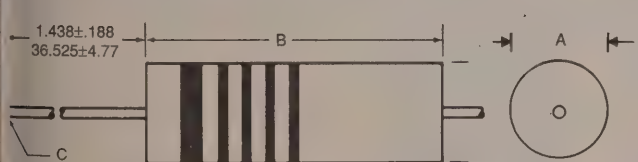
R Series R.F. Molded Chokes



Ratings	Phenolic	Powdered Iron and Ferrite
Style	LT4	LT10
Grade	1	1
Class	B	A
Maximum Operating Temperature	125°C	105°C
Maximum Temperature Rise	35°C	15°C
Ambient Temperature	90°C	90°C
Dielectric Withstanding Voltage (sea level)	1000VRMS	1000VRMS
(reduced barometric pressure)	200VRMS	200VRMS
Terminal Pull	5 lbs.	5 lbs.
Altitude	70,000 ft.	70,000 ft.
	.15-2.7 µH Phenolic	3.3-27 µH Powdered Iron

Color coded in accordance with MIL-C-15305. Letter suffix on part number denotes tolerance. Other tolerances available.

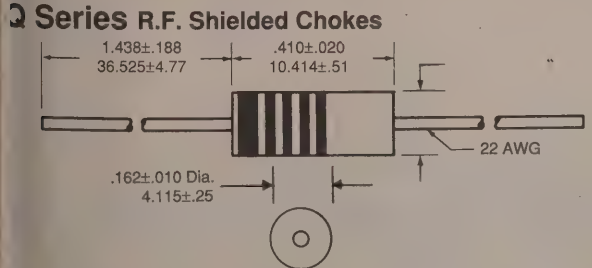
S, V, and X Series R.F. Molded Chokes



Ratings	
Style	LT10
Grade	1
Class	A
Maximum Operating Temperature	105°C
Maximum Temperature Rise	15°C
Ambient Temperature	90°C
Dielectric Withstanding Voltage (sea level)	700VRMS
(reduced barometric pressure)	180VRMS
Terminal Pull	5 lbs.
Operating Temperature	-55 to 105°C
Altitude	70,000 ft.

Color coded in accordance with MIL-C-15305. Letter suffix on part number denotes tolerance.

Q Series R.F. Shielded Chokes



Ratings	
Style	LT10
Grade	1
Class	A
Maximum Operating Temperature	105°C
Maximum Temperature Rise	15°C
Ambient Temperature	90°C
Dielectric Withstanding Voltage (sea level)	1000VRMS
(reduced barometric pressure)	200VRMS
Terminal Pull	5 lbs.
Operating Temperature	-55 to 105°C
Altitude	70,000 ft.
Percent Coupling	3% max.
Weight	0.750 g or less

Color coded in accordance with MIL-C-15305. Letter suffix on part number denotes tolerance.

Ohmite Manufacturing Company, 3601 Howard St., Skokie, Illinois 60076, Tel. 708/675-2600, FAX 708/675-1505

Penn-Tran Corporation

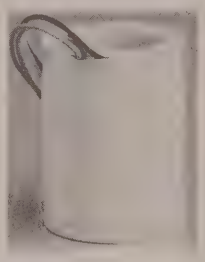
Designers and Manufacturers of CRT Deflection Components

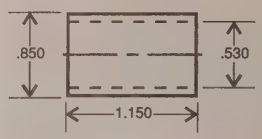
A Spectrum Electronics Corporation

Stator Yokes

Engineers know us for quality and innovation in the design and manufacture of deflection components for CRT Displays and television cameras.

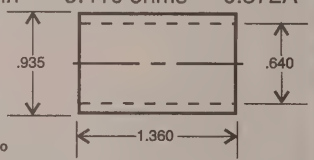
The new Penn-Tran is versatility and dimension in precision stator yokes for the exacting needs of today's high tech displays. The new Penn-Tran also has the same reliability and custom design capabilities engineers have received from us for 46 years.





9137562—13mm/18°

HOR	0.100 mh	0.947 ohms	1.098A
VERT	1.000 mh	9.410 ohms	0.372A

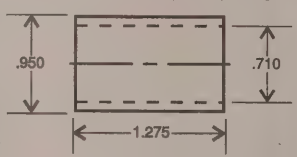


9137564—16mm/18°

HOR	0.100 mh	0.931 ohms	1.011A
VERT	1.000 mh	9.009 ohms	0.308A

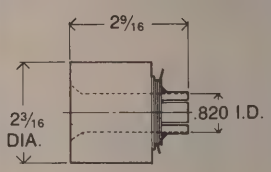
9137565—16mm/18° High Frequency Applications

HOR	0.100 mh	0.923 ohms	1.195A
VERT	1.000 mh	9.561 ohms	0.420A



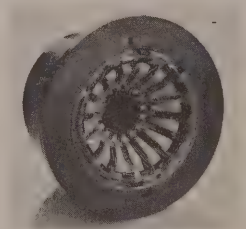
9137566—18mm/18°

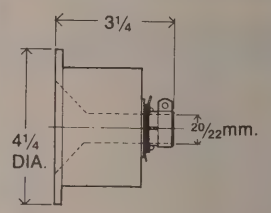
HOR	0.100 mh	1.221 ohms	1.189A
VERT	1.000 mh	10.909 ohms	0.430A



9136250—20mm/55°

HOR	.100 mh	.25 ohms	2.5A
VERT	5.0 mh	12.5 ohms	.375A



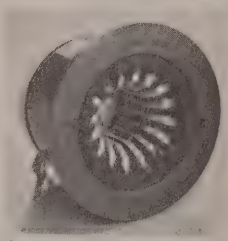


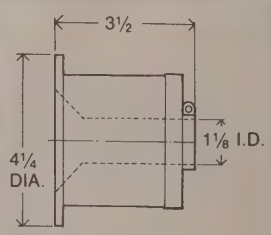
9136248—20mm/90°

HOR	.100 mh	.26 ohms	3.95A
VERT	5.0 mh	8.25 ohms	.635A

9136249—20mm/70°

HOR	.100 mh	.3 ohms	3.19A
VERT	5.0 mh	15.0 ohms	0.527A



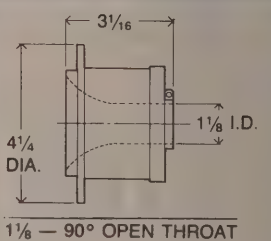


9136251—29mm/70°

HOR	.100 mh	.31 ohms	3.11A
VERT	5.0 mh	12.0 ohms	.466A

9136252—29mm/90°

HOR	.100 mh	.33 ohms	4.44A
VERT	5.0 mh	10.0 ohms	.666A



9136253—29mm/70° Open throat

HOR	.100 mh	.195 ohms	3.4A
VERT	5.0 mh	8.75 ohms	.62A

9136254—29mm/90° Open throat

HOR	.100 mh	.27 ohms	4.12A
VERT	5.0 mh	7.6 ohms	.695A

For all units the current (AMP) shown is to deflect 1 radius at 10KV.

Penn-Tran Corporation Penn-Tran Corporation, Route 144 North, P.O. Box 1321, Wingate, PA 16880
814-355-1521 Fax 814-355-1524

Penn-Tran Corporation

Designers and Manufacturers of CRT Deflection Components

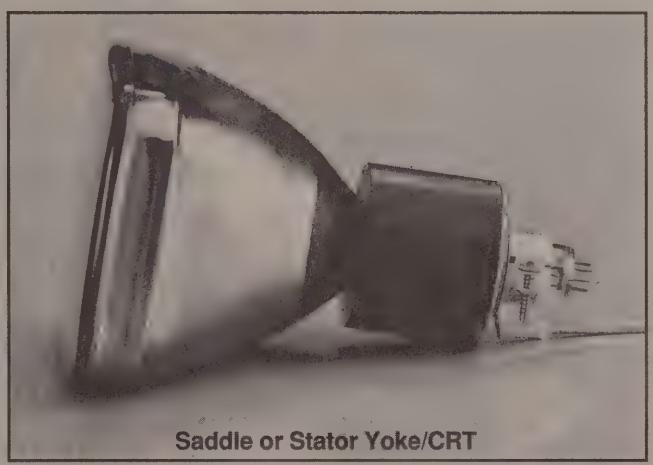
A Spectrum Electronics Corporation

Penn-Tran reaches beyond mere component manufacturing by creating High Voltage Modules (Horizontal Drive Boards) of matched magnetic components. These two examples package the Flyback Transformer, Yoke, Width Coil, Linearity Coil and Drive Transformer. The addition of an appropriate Penn-Tran High Voltage Power Supply completes the system.

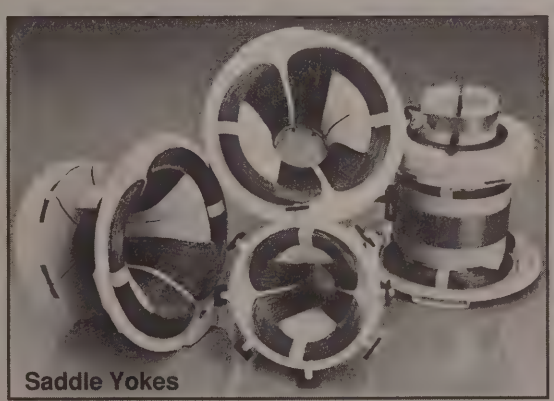
Let our component teams and our 46 years of deflection experience save time, money and the difficulty of matching random components from multiple manufacturers. All we need is the parameters of your display's horizontal drive section. Penn-Tran engineering does the rest.

Yoke—CRT Matching

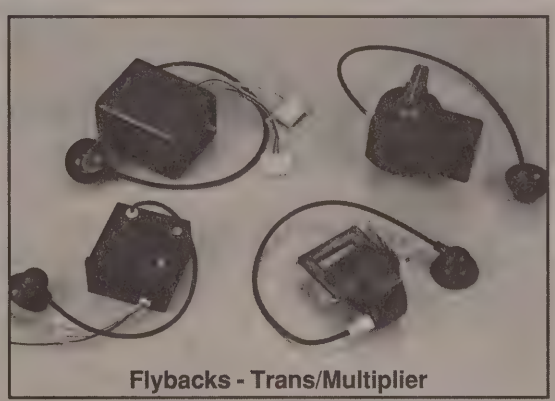
Ship your CRT to us and we will manufacture a deflection yoke, match it to your CRT, deliver a package to you ready to place in your monitor and use without further adjustment.



Saddle or Stator Yoke/CRT



Saddle Yokes



Flybacks - Trans/Multiplier

YOKE TYPE	CRT Size		L(mh)	R(Ohms)	Axis I(Amps)
175-13	29 mm	H	0.10	0.17	4.49
	110°	V	10.00	5.00	0.45
211-13	29 mm	H	0.10	0.17	4.32
	110°	V	10.00	10.00	0.40
217-13	36 mm	H	0.10	0.15	4.06
	90°	V	10.00	9.75	0.35
108-13	20 mm	H	0.10	0.20	3.22
MP	90°	V	10.00	5.00	0.35

FLYBACK - TRANS/MULTIPLIER

TYPE	High Voltage	Frequency
1317-51	3 to 20 KV	15 to 92 KHZ
Additional low voltage outputs as required Commercial & Military Applications		
3462-51	3 to 25 KV	15 to 92 KHZ
Additional low voltage outputs as required Commercial & Military Applications		

Parameters shown above typical. Coils can be wound to fit your circuit. All units UL approved. Other sizes available. Call for full information.

Penn-Tran Corporation Penn-Tran Corporation, Route 144 North, P.O. Box 1321, Wingate, PA 16880
814-355-1521 Fax 814-355-1524

PRODUCT SELECTION GUIDES

TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 93/94 EDITION OF EEM

AC Power Supplies, Product Selection Guide **D•2221**

Batteries, Product Selection Guide **D•1419**

Cabinets, Enclosures, Racks & Chassis, Product Selection Guide **C•1003**

Capacitors, Product Selection Guide **A•1003**

Coils, Chokes, Inductors, Product Selection Guide **A•1179**

Connectors, Terminals & Sockets, Product Selection Guide **C•1139**

Cores, Magnets & Ferrites **A•1317**

Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide **A•1326**

DC-DC Converters **D•2049**

DC Power Supplies, Product Selection Guide **D•1488**

Delay Lines, Product Selection Guide **A•1513**

Discrete Semiconductors, Product Selection Guide **A•2130**

Displays, Readouts, & CRTs, Product Selection Guide **B•1017**

Fans, Blowers, Cooling Equipment, & Heat Exchangers, Product Selection Guide **C•1557**

Fiber Optics, Product Selection Guide **B•1200**

Filters, Power, Product Selection Guide **A•1584**

Filters, Signal, Product Selection Guide **A•1617**

Instruments, Test & Measuring, Product Selection Guide **D•1215**

Interconnection Systems, Product Selection Guide **C•1670**

Keyboards & Keypads, Product Selection Guide **B•1818**

Lamps, Lights, & Indicators, Product Selection Guide **B•1131**

Microwave Components, Product Selection Guide **A•1719**

Military Qualified Products List **B•1002**

Motors, Drives, & Rotating Components, Product Selection Guide **B•1231**

Oscilloscopes, Product Selection Guide **D•1402**

Panel Hardware, Product Selection Guide **C•1522**

Panel Meters, Analog & Digital, Product Selection Guide **D•1336**

Potentiometers, Trimmers, Controls, & Rheostats, Product Selection Guide **A•2053**

Power Supplies, AC, Product Selection Guide **D•2221**

Power Supplies, DC, Product Selection Guide **D•1488**

Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide **B•1341**

Relays, Product Selection Guide **B•1401**

Resistors, Product Selection Guide **A•1859**

Solenoids, Product Selection Guide **B•1626**

Switches, Product Selection Guide **B•1658**

Thermal Components, Product Selection Guide **B•1857**

Transducers & Encoders, Product Selection Guide **B•1911**

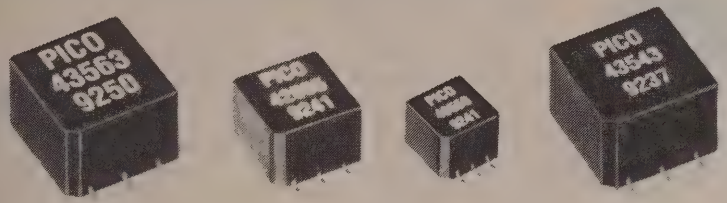
Transformers, Product Selection Guide **A•2229**

Wire & Cable, Product Selection Guide **C•1701**

PICO's Miniaturized Power Inductors

PICO Surface Mount Power Inductors are ideal for Noise, Spike and Power Filtering Applications in Power Supplies, DC-DC Converters and Switching Regulators

SURFACE MOUNT
PICO surface mount units utilize materials and methods to withstand extreme temperature (220°C) of vapor phase, I.R., and other reflow procedures without degradation of electrical or mechanical characteristics.



- Minimum possible size
- Manufactured to MIL-T-27 (TF5S04ZZ)
- Special high frequency core material to insure low losses
- All units have split windings
- Large selection of sizes available

All inductors have split windings—ratings shown in table are for series connection. Parallel connection will have ¼ inductance at twice the DC current and ¼ the DC resistance, ie. parallel connection of PICO-41400 will have 5 millihenry at .12 Amps DC with DC resistance of 13.5 Ohms

SURFACE MOUNT

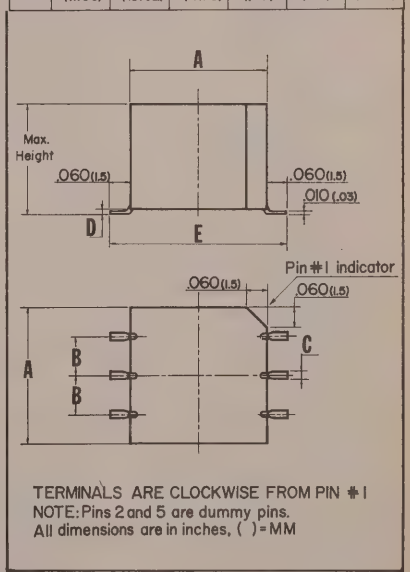
Inductance	I_{DC} (Amps)	R_{DC} (Ohms)	SRF MHz	Size	Model Number	Price*** 1–9
20 Milli-Henry	.06	54	0.275	1	41320	20.87
	.10	29	0.207	2	42405	20.87
	.14	20	0.230	3	43403	20.87
15 Milli-Henry	.07	40.5	0.320	1	41340	20.87
	.12	22	0.240	2	42425	20.87
	.16	15	0.235	3	43423	20.87
10 Milli-Henry	.05	60	0.400	0	40350	20.87
	.08	27	0.380	1	41360	20.87
	.14	14.6	0.390	2	42445	20.87
	.20	10	0.340	3	43443	20.87
7.5 Milli-Henry	.058	45	0.500	0	40370	20.87
	.10	20.3	0.450	1	41380	20.87
	.17	11	0.430	2	42465	20.87
	.24	7.5	0.390	3	43463	20.87
5 Milli-Henry	.071	30	0.650	0	40390	20.87
	.12	13.5	0.600	1	41400	20.87
	.21	7.3	0.490	2	42485	20.87
	.30	5	0.550	3	43483	20.87
3 Milli-Henry	.091	18	0.800	0	40410	20.87
	.16	8.1	0.710	1	41420	20.87
	.27	4.4	0.650	2	42505	20.87
	.38	3	0.570	3	43503	20.87

SURFACE MOUNT

Inductance	I_{DC} (Amps)	R_{DC} (Ohms)	SRF MHz	Size	Model Number	Price*** 1–9
2 Milli-Henry	.112	15	1.000	0	40430	20.87
	.19	5.4	0.950	1	41440	20.87
	.33	2.9	0.850	2	42525	20.87
	.47	2	0.800	3	43523	20.87
1 Milli-Henry	.158	6	1.650	0	40450	20.87
	.27	2.7	1.500	1	41460	20.87
	.47	1.5	1.200	2	42545	20.87
	.66	1	1.100	3	43543	20.87
750 Micro-Henry	.182	5	1.700	0	40470	20.87
	.31	2	1.550	1	41480	20.87
	.54	1	1.400	2	42565	20.87
	.76	.75	1.400	3	43563	20.87
500 Micro-Henry	.224	4	2.300	0	40490	20.87
	.38	1.3	2.100	1	41500	20.87
	.66	.66	1.900	2	42585	20.87
	.93	.5	1.600	3	43583	20.87
250 Micro-Henry	.316	1.5	3.300	0	40510	20.87
	.53	.66	3.000	1	41520	20.87
	.93	.33	2.500	2	42605	20.87
	1.3	.25	2.400	3	43603	20.87
100 Micro-Henry	.50	.6	4.500	0	40530	20.87
	.78	.300	4.000	1	41540	20.87
	1.35	.170	3.900	2	42625	20.87
	1.95	.110	3.500	3	43623	20.87
40 Micro-Henry	.79	.32	5.500	0	40550	20.87
	1.18	.141	5.000	1	41560	20.87
	2.03	.070	4.500	2	42645	20.87
	2.68	.060	4.500	3	43643	20.87

SURFACE MOUNT

Size	Max. Height	A	B	C	D	E
0	.280 (7.11)	.325 (8.26)	.085 (2.16)	.020 (.51)	.012 (.30)	.445 (11.30)
1	.310 (7.87)	.400 (10.16)	.115 (2.92)	.020 (.51)	.012 (.30)	.520 (13.21)
2	.365 (9.27)	.495 (12.57)	.140 (3.56)	.027 (.69)	.015 (.38)	.615 (15.62)
3	.460 (11.68)	.615 (15.62)	.185 (4.70)	.027 (.69)	.020 (.51)	.735 (18.66)



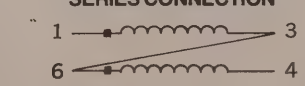
TERMINALS ARE CLOCKWISE FROM PIN #1
NOTE: Pins 2 and 5 are dummy pins.
All dimensions are in inches, ( ) = MM

SPECIFICATIONS:

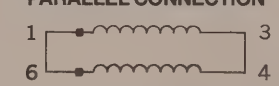
- All units manufactured to MIL-T-27 and are type TF5S04ZZ
- Inductance measured at 0.1 VRMS-10 kHz
- Temperature rise at rated D.C. current is less than 30°C
- Maximum ambient is 100°C

***Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

SURFACE MOUNT TERMINAL ARRANGEMENT SERIES CONNECTION



SURFACE MOUNT PARALLEL CONNECTION



Delivery— stock to one week

*For immediate engineering assistance or to place an order—**Call Toll Free 800-228-9747***

PICO Electronics, Inc.

453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552 • • FAX 914-699-5565

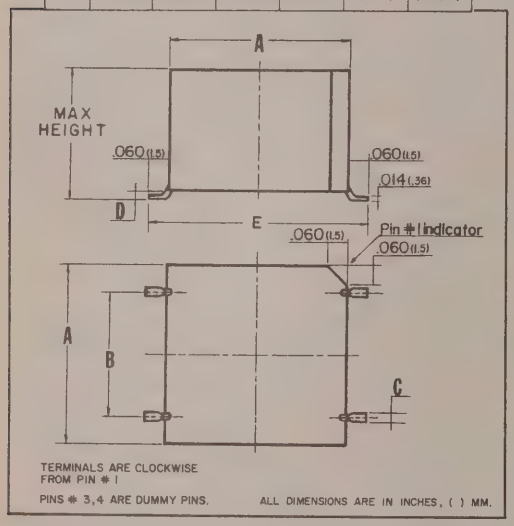
Low Profile Surface Mount Power Inductors

SURFACE MOUNT
PICO surface mount units utilize materials and methods to withstand extreme temperature (220°C) of vapor phase, I.R., and other reflow procedures without degradation of electrical or mechanical characteristics.

These inductors utilize special techniques to minimize cross coupling and give the utmost in shielding efficiency. They are ideal for Noise, Spike and Power Filtering Applications in Power Supplies, DC-DC Converters and Switching Regulators

- Handle large transient DC currents
- Minimum possible size
- Manufactured to MIL-T-27 (TF5S04ZZ)
- Special high frequency core material to insure low losses
- Large selection of sizes available

Size	Max. Height	A	B	C	D	E
1	.305 (7.75)	.450 (11.43)	.300 (7.62)	.027 (.69)	.020 (.51)	.570 (14.48)
2	.360 (9.14)	.550 (14.00)	.400 (10.16)	.037 (.94)	.025 (.64)	.670 (17.02)
3	.360 (9.14)	.650 (16.51)	.500 (12.70)	.037 (.94)	.025 (.64)	.770 (19.56)



TERMINALS ARE CLOCKWISE FROM PIN # 1
PINS # 3,4 ARE DUMMY PINS. ALL DIMENSIONS ARE IN INCHES, ( ) MM.

SIZE 1

LODC MICROHY (µH)	IDC for 10% DROP in L AMPS	IDC for 20% DROP in L AMPS	IDC for 30% DROP in L AMPS	RDC OHMS	SRF MHz	PICO PART NUMBER	PRICE (1-9)
25	1.9	2.6	3.3	.032	4.5	73005	22.50
50	1.34	1.84	2.33	0.064	3.3	73010	22.50
75	1.10	1.50	1.91	0.096	2.7	73015	22.50
100	0.95	1.30	1.65	0.128	2.25	73020	22.50
250	0.60	0.82	1.04	0.320	1.5	73025	22.50
750	0.35	0.47	0.60	0.960	.85	73030	22.50
1000	0.30	0.41	0.52	1.280	.73	73035	22.50
1500	0.25	0.34	0.43	1.920	.6	73040	22.50
2500	0.19	0.26	0.33	3.20	.45	73045	22.50
5000	0.13	0.18	0.23	6.40	.33	73050	22.50

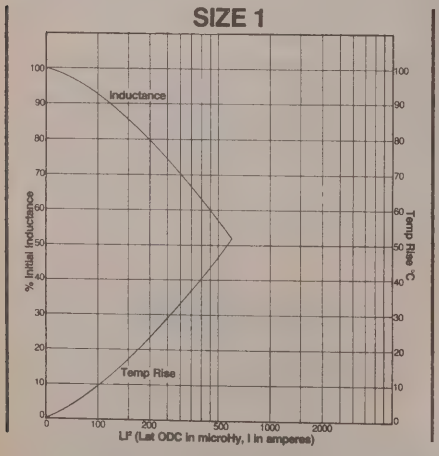
SIZE 2

LODC MICROHY (µH)	IDC for 10% DROP in L AMPS	IDC for 20% DROP in L AMPS	IDC for 30% DROP in L AMPS	RDC OHMS	SRF MHz	PICO PART NUMBER	PRICE (1-9)
25	2.5	3.7	4.7	.020	4.5	73115	22.50
50	1.77	2.61	3.30	0.040	3.3	73120	22.50
75	1.44	2.14	2.71	0.060	2.7	73125	22.50
100	1.25	1.85	2.35	0.080	2.25	73130	22.50
250	0.79	1.17	1.49	0.20	1.5	73135	22.50
750	0.46	0.68	0.86	0.60	.85	73140	22.50
1000	0.40	0.59	0.74	0.80	.73	73145	22.50
1500	0.32	0.48	0.61	1.20	.6	73150	22.50
2500	0.25	0.37	0.47	2.00	.45	73155	22.50
5000	0.18	0.26	0.33	4.00	.33	73160	22.50

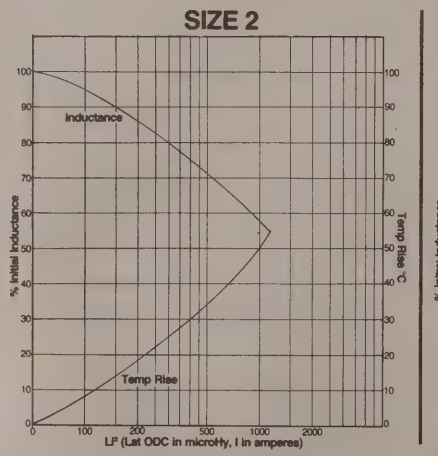
SIZE 3

LODC MICROHY (µH)	IDC for 10% DROP in L AMPS	IDC for 20% DROP in L AMPS	IDC for 30% DROP in L AMPS	RDC OHMS	SRF MHz	PICO PART NUMBER	PRICE (1-9)
25	3.0	4.4	5.6	.015	4.0	73205	22.50
50	2.12	3.11	4.00	0.03	3.0	73210	22.50
75	1.73	2.54	3.23	0.05	2.4	73215	22.50
100	1.50	2.20	2.80	0.06	2.0	73220	22.50
250	0.95	1.39	1.77	0.15	1.3	73225	22.50
750	0.55	0.80	1.02	0.45	.75	73230	22.50
1000	0.47	0.70	0.89	0.60	.65	73235	22.50
1500	0.39	0.57	0.72	0.90	.55	73240	22.50
2500	0.30	0.44	0.56	1.50	.40	73245	22.50
5000	0.21	0.31	0.40	3.00	.30	73250	22.50

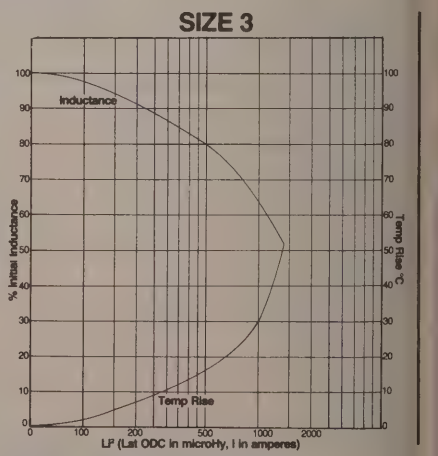
SIZE 1



SIZE 2



SIZE 3



*For immediate engineering assistance or to place an order–**Call Toll Free 800-228-9747***

Delivery– stock to one week

PICO Electronics, Inc.
453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552 • • FAX 914-699-5565

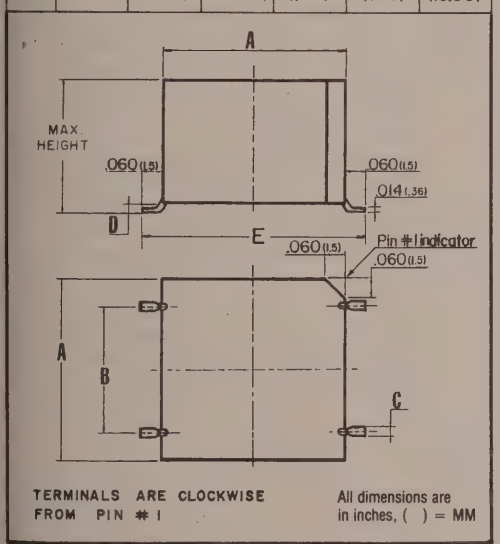
EMI Common Mode Suppression Inductors

SURFACE MOUNT
PICO surface mount units utilize materials and methods to withstand extreme temperature (220°C) of vapor phase, I.R., and other reflow procedures without degradation of electrical or mechanical characteristics.

SURFACE MOUNT
Delivery-stock to one week

These Inductors are well suited for use in Switching Regulators, DC to DC Power Supplies and all types of Electrical Equipment where the elimination of line transmitted Electromagnetic Interference is important. Electrical equipment will generate noise due to switching operations of transistors, SCR's, relays, triacs, etc. By using these Inductors, noise being fed back to the power line is minimized to an acceptable level and this noise will not interfere with other equipment operating on the same power line.

Size	Max. Height	A	B	C	D	E
1	.305 (7.75)	.450 (11.43)	.300 (7.62)	.027 (.69)	.020 (.51)	.570 (14.48)
2	.360 (9.14)	.550 (13.97)	.400 (10.16)	.037 (.94)	.025 (.64)	.670 (17.02)
3	.440 (11.18)	.650 (16.51)	.500 (12.70)	.037 (.94)	.025 (.64)	.770 (19.56)



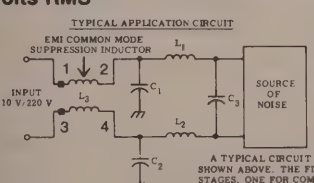
- **Minimum possible size**
- **130°C operation (Ambient + Temp. Rise)**
- **Windings Balance ± 1%**
- **Dielectric Strength .... 1500 Volts RMS**

INDUCTANCE	IRMS (AMPS) TEMP. RISE 60°C	IRMS (AMPS) TEMP. RISE 40°C	IRMS (AMPS) TEMP. RISE 25°C	RDC. (OHMS) EACH WDG.	APPROX. LEAKAGE INDUCTANCE (MICRO-HENRY)	SIZE	MODEL NUMBER	PRICE 1–9
50	3.4	2.8	2.6	.0125	.40	1	46470	20.37
µH-	6.0	5.2	4.4	.0063	.34	2	47570	20.37
	9.9	8.2	7.2	.0033	.29	3	48670	22.40
75	2.6	2.1	1.9	.0212	.60	1	46465	20.37
µH	4.8	4.2	3.8	.0094	.54	2	47565	20.37
	8.0	6.7	5.9	.0049	.43	3	48665	22.40
100	2.3	1.8	1.7	.0288	.80	1	46460	20.37
µH	4.2	3.7	3.1	.0125	.68	2	47560	20.37
	6.9	5.7	5.0	.0066	.58	3	48660	22.40
250	1.4	1.1	1.1	.070	2.0	1	46455	20.37
µH	2.6	2.3	1.9	.0313	1.7	2	47555	20.37
	4.4	3.7	3.3	.0163	1.4	3	48655	22.40
500	1.1	.9	.8	.1250	4.0	1	46450	20.37
µH	1.8	1.7	1.4	.0625	3.4	2	47550	20.37
	3.1	2.6	2.3	.0325	2.9	3	48650	22.40
750	.8	.7	.6	.2125	6.0	1	46445	20.37
µH	1.5	1.3	1.1	.0938	5.1	2	47545	20.37
	2.6	2.1	1.8	.0488	4.3	3	48645	22.40
1.0	0.81	0.66	0.61	0.23	8.0	1	46440	20.37
mH	1.5	1.3	1.1	0.1	6.8	2	47540	20.37
	2.5	2.1	1.8	0.0530	5.750	3	48640	22.40
2.5	0.52	0.42	0.39	0.56	20	1	46435	20.37
mH	0.96	0.84	0.71	0.25	17	2	47535	20.37
	1.6	1.3	1.2	0.1310	14.400	3	48635	22.40
5.0	0.37	0.3	0.28	1.1	40	1	46430	20.37
mH	0.68	0.59	0.5	0.5	34	2	47530	20.37
	1.1	0.9	0.82	0.2630	28.800	3	48630	22.40
7.5	0.3	0.24	0.22	1.7	60	1	46425	20.37
mH	0.55	0.48	0.41	0.75	51	2	47525	20.37
	0.9	0.8	0.67	0.3940	43.100	3	48625	22.40
10	0.26	0.21	0.19	2.3	80.0	1	46420	20.37
mH	0.48	0.42	0.35	1.0	68.0	2	47520	20.37
	0.8	0.7	0.57	0.5300	57.5	3	48620	22.40
15	0.21	0.17	0.16	3.4	120	1	46415	20.37
mH	0.39	0.34	0.29	1.5	102	2	47515	20.37
	0.64	0.53	0.47	0.7900	86	3	48615	22.40
17.5	0.2	0.16	0.15	3.94	140	1	46410	20.37
mH	0.36	0.32	0.27	1.75	119	2	47510	20.37
	0.59	0.49	0.44	0.9190	101	3	48610	22.40
20	0.18	0.15	0.14	4.5	160	1	46405	20.37
mH	0.34	0.30	0.25	2.0	136	2	47505	20.37
	0.56	0.46	0.41	1.0500	115	3	48605	22.40

SPECIFICATIONS

- **All units manufactured to MIL-T-27 and are type TF5S04ZZ**
- **Dielectric Strength .... 1500 Volts RMS**
- **Windings Balanced ± 1%**
- **Maximum ambient plus temp. rise limited to 130°C**

TYPICAL APPLICATION CIRCUIT



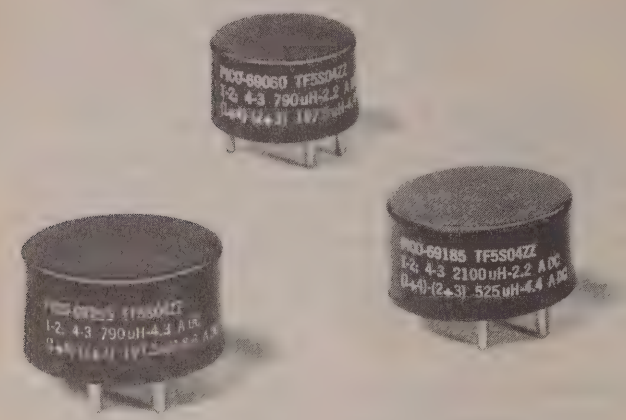
A TYPICAL CIRCUIT FOR THE ELIMINATION OF NOISE IS SHOWN ABOVE. THE FILTER CONTAINS TWO STAGES, ONE FOR COMMON MODE NOISE (L_3, C_1, C_2) AND ONE FOR CONDUCTED NOISE (L_1, L_2, AND C_3).

*For immediate engineering assistance or to place an order—**Call Toll Free 800-228-9747***

Delivery—stock to one week

PICO Electronics, Inc.
453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552 • • FAX 914-699-5565

PICO's POWER INDUCTORS



FOR MULTIPLE OUTPUT REGULATORS WE CAN SUPPLY ALL NECESSARY INDUCTANCE VALUES ON ONE CORE
This technique provides minimum possible size and gives excellent dynamic and DC cross-regulation . . .
Contact factory for these special inductors.

- **Handle large transient DC currents**
- **Minimum possible size**
- **Manufactured to MIL-T-27 (TF5S04ZZ)**
- **Special high frequency core material to insure low losses**
- **All units have split windings**
- **Large selection of sizes available**
- **All units are magnetically shielded**

All inductors have split windings (except size AA)— ratings shown in table are for series connection. Parallel connection will have ¼ inductance at twice the DC current and ¼ the DC resistance, ie. parallel connection of PICO-69010 will have 32.5 microhenry with DC resistance of .015 Ohms at 6 Amps DC current (10% drop in L)

TERMINAL ARRANGEMENT SERIES CONNECTION

PARALLEL CONNECTION

SIZE AA

LODC MICROHY (μH)	IDC for 10% DROP in L AMPS	IDC for 20% DROP in L AMPS	IDC for 30% DROP in L AMPS	RDC OHMS	SRF MHz	PICO PART NUMBER	PRICE (1-9)
25	3.53	4.80	5.94	.012	4.0	69410	26.27
50	2.5	3.4	4.2	.024	3.0	69420	26.27
75	2.04	2.78	3.43	.036	2.4	69430	26.27
100	1.77	2.4	2.99	.048	2.0	69440	26.27
250	1.12	1.52	1.88	.12	1.3	69450	26.27
750	.65	.88	1.08	.36	.75	69460	26.27
1000	.56	.76	.94	.48	.65	69470	26.27
1500	.46	.62	.77	.72	.55	69480	26.27
2500	.35	.48	.59	1.2	.4	69490	26.27
5000	.25	.34	.42	2.4	.3	69500	26.27

SIZE A

130	3.0	4.5	5.5	.060	1.7	69010	26.27
210	2.5	3.5	4.5	.11	1.4	69020	26.27
260	2.2	3.2	3.9	.14	1.25	69030	26.27
315	2.0	2.9	3.5	.17	1.14	69040	26.27
525	1.6	2.2	2.7	.28	0.9	69050	26.27
790	1.2	1.8	2.2	.42	0.7	69060	26.27
1050	1	1.6	1.9	.56	0.6	69070	26.27
1300	.95	1.4	1.7	.7	0.4	69080	26.27

SIZE B

228	3.5	5.2	6.8	.070	1.1	69105	28.91
323	2.7	4.0	5.0	.105	0.9	69115	28.91
460	2.5	3.7	4.8	.15	0.8	69125	28.91
787	1.9	2.8	3.7	.26	0.6	69135	28.91
1050	1.6	2.4	3.2	.34	0.5	69145	28.91
1310	1.5	2.2	2.8	.43	0.45	69155	28.91
1600	1.3	2.0	2.6	.52	0.4	69165	28.91
1840	1.2	1.8	2.4	.60	0.38	69175	28.91
2100	1.1	1.7	2.2	.70	0.33	69185	28.91

SIZE C

165	5.0	7.0	9.5	.040	1.4	69205	31.76
191	4.7	7.0	8.8	.050	1.3	69215	31.76
262	4.0	5.6	7.5	.07	1.1	69225	31.76
390	3.3	4.6	6.2	.10	0.9	69235	31.76
525	2.8	4.0	5.3	.14	0.8	69245	31.76
790	2.3	3.2	4.3	.20	0.6	69255	31.76
1050	2.0	2.8	3.8	.27	0.55	69265	31.76
1310	1.8	2.5	3.4	.34	0.5	69275	31.76
1580	1.6	2.3	3.0	.41	0.45	69285	31.76
1838	1.5	2.1	2.8	.48	0.4	69295	31.76

SIZE D

150	6.35	9.23	11.5	.027	1.4	69310	34.95
250	4.9	7.15	9	.045	1.2	69320	34.95
500	3.5	5	6.32	.09	.8	69330	34.95
750	2.8	4.13	5.16	.135	.65	69340	34.95
1000	2.5	3.6	4.5	.18	.55	69350	34.95
2500	1.55	2.26	2.8	.45	.35	69360	34.95
5000	1.1	1.6	2	.9	.25	69370	34.95

SIZE E

1500	2.6	4.5	6.0	.13	.4	69605	37.95
2000	2.25	3.9	5.2	.17	.35	69615	37.95
3000	1.85	3.2	4.25	.26	.3	69625	37.95
4000	1.6	2.8	3.7	.35	.25	69635	37.95
5000	1.45	2.5	3.3	.45	.2	69645	37.95
7500	1.15	2.0	2.7	.65	.18	69655	37.95
10000	1.0	1.75	2.35	.85	.15	69665	37.95

Delivery— stock to one week

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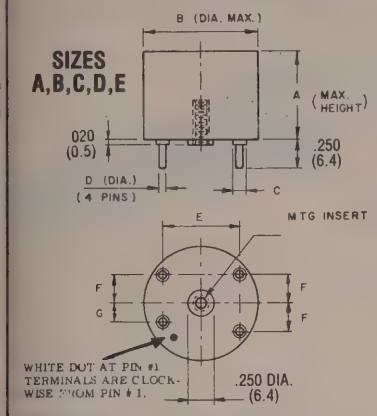
PICO Electronics, Inc.

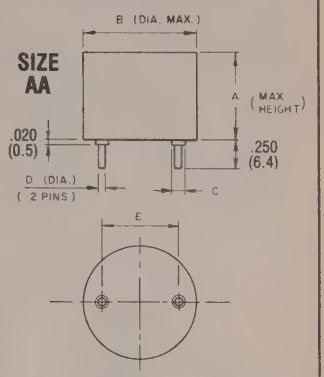
453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552 • • FAX 914-699-5565

These PICO Power Inductors Can Handle Large Transient DC Currents

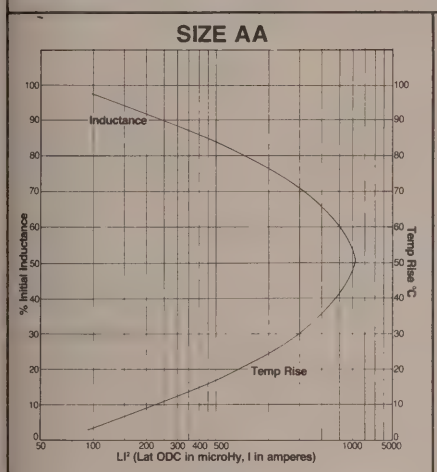
They are ideal for Noise, Spike and Power Filtering Applications in Power Supplies, DC-DC Converters and Switching Regulators

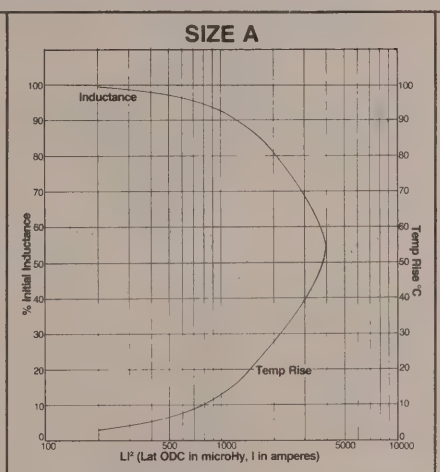


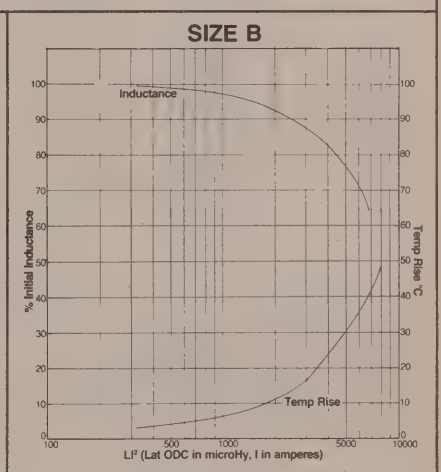
Size	A Max. Height	B Max. Dia.	C	D Terminal Dia.	E	F	G	Mtg. Insert	Wt. Nominal Grams
AA	.45" (11.4)	.75 (19.1)	.1 (2.54)	.07 (1.78)	.5" (12.7)	—	—	—	7
A	.56 (14.2)	.96 (24)	.1 (2.54)	.07 (1.78)	.6 (15.2)	.2 (5.1)	.1 (2.5)	4-40 UNC 5 Threads Deep	23
B	.635 (16.1)	1.215 (30.9)	.1 (2.54)	.07 (1.78)	.8 (20.3)	.25 (6.4)	.15 (3.8)	4-40 UNC 5 Threads Deep	44
C	.72 (18.3)	1.33 (33.8)	.125 (3.2)	.094 (2.4)	.9 (22.9)	.25 (6.4)	.15 (3.8)	6-32 UNC 6 Threads min.	60
D	.76 (19.3)	1.5 (38.1)	.125 (3.2)	.094 (2.4)	1.1 (27.9)	.3 (7.6)	.2 (5.1)	6-32 UNC 6 Threads min.	80
E	1.1 (27.9)	2.150 (54.6)	.15 (3.8)	.125 (3.2)	1.7 (43.2)	.4 (10.2)	.3 (7.6)	6-32 UNC 6 Threads min.	170

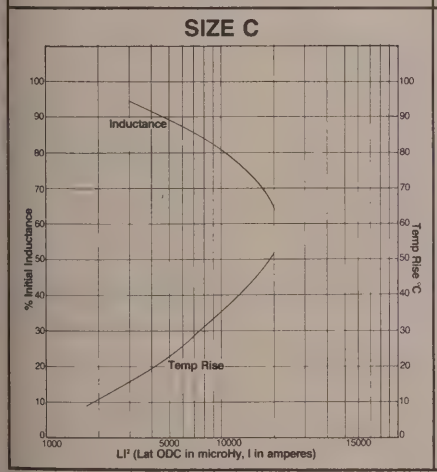


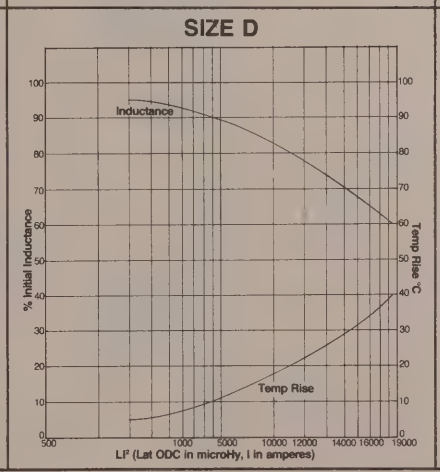
All dimensions are in inches, ( ) = MM

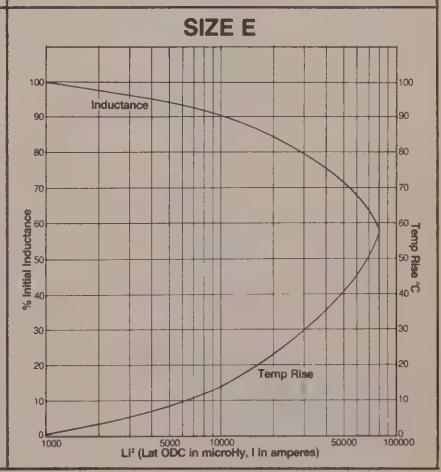


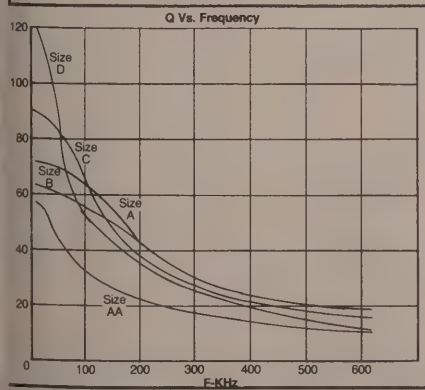












For immediate engineering assistance or to place an order—

Call Toll Free 800-228-9747

Delivery: Stock to one week

FAX: 914-699-5565

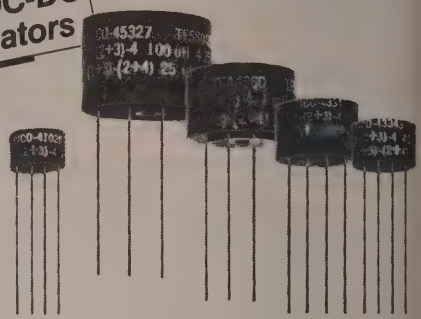
PICO Electronics, Inc.

453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552

PICO's Miniaturized Power Inductors

PICO Plug-In Inductors are ideal for Noise, Spike and Power Filtering Applications in Power Supplies, DC-DC Converters and Switching Regulators

Plug-in units can be manufactured and tested to MIL-T-27/356. Contact Factory for price and delivery information and appropriate part numbers (MIL-T-27/356-01 thru MIL-T-27/356-63).

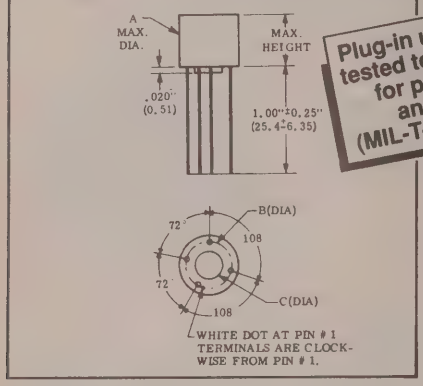


All inductors have split windings—ratings shown in table are for series connection. Parallel connection will have ¼ inductance at twice the DC current and ¼ the DC resistance, ie. parallel connection of PICO-41020 will have 5 millihenry at .12 Amps DC with DC resistance of 13.5 Ohms

PLUG-IN

Size	Max. Height	A Max. Dia.	B Bolt Circle	C Stand-Off	Terminal Dia.
0	.250 (6.35)	.320 (8.13)	.21 (5.33)	.13 (3.30)	.012 (.31)
1	.260 (7.11)	.410 (10.41)	.260 (6.6)	.160 (4.06)	.012 (.31)
2	.340 (8.63)	.500 (12.7)	.350 (8.89)	.250 (6.35)	.012 (.31)
3	.415 (10.54)	.630 (16.0)	.440 (11.17)	.340 (8.64)	.016 (.41)

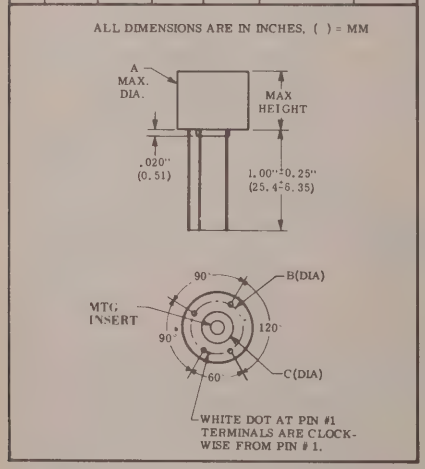
ALL DIMENSIONS ARE IN INCHES. ( ) = MM



PLUG-IN

Size	Max. Height	A Max. Dia.	B Bolt Circle	C Stand-Off	Mtg. Insert	Terminal Dia.
4	.500 (12.7)	.800 (20.32)	.560 (14.22)	.460 (11.68)	—	.016 (.41)
5	.650 (16.51)	.950 (24.13)	.670 (17.0)	.570 (14.48)	6-32 UNC 8 Threads Deep	.020 (.51)

ALL DIMENSIONS ARE IN INCHES. ( ) = MM



PLUG-IN

Induct-ance	I_{DC} (Amps)	R_{DC} (Ohms)	SRF MHz	Size	Model Number	Price 1–9
20 Milli-Henry	.06	54	0.275	1	41020	18.97
	.10	29	0.207	2	42105	18.97
	.14	20	0.230	3	43103	18.97
	.22	12.4	0.210	4	44500	22.70
	.29	10.2	0.180	5	45107	22.70
15 Milli-Henry	.07	40.5	0.320	1	41040	18.97
	.12	22	0.240	2	42125	18.97
	.16	15	0.235	3	43123	18.97
	.23	9.3	0.280	4	44520	22.70
	.33	7.7	0.245	5	45127	22.70
10 Milli-Henry	.05	60	0.400	0	40050	18.97
	.08	27	0.380	1	41060	18.97
	.14	14.6	0.390	2	42145	18.97
	.20	10	0.340	3	43143	18.97
	.31	6.2	0.290	4	44560	22.70
	.40	5.1	0.300	5	45147	22.70
7.5 Milli-Henry	.058	45	0.500	0	40070	18.97
	.10	20.3	0.450	1	41080	18.97
	.17	11	0.430	2	42165	18.97
	.24	7.5	0.390	3	43163	18.97
	.38	4.7	0.350	4	44580	22.70
	.49	3.8	0.340	5	45167	22.70
5 Milli-Henry	.071	30	0.650	0	40090	18.97
	.12	13.5	0.600	1	41100	18.97
	.21	7.3	0.490	2	42185	18.97
	.30	5	0.550	3	43183	18.97
	.47	3.1	0.460	4	44600	22.70
	.6	2.6	0.410	5	45187	22.70
3 Milli-Henry	.091	18	0.800	0	40110	18.97
	.16	8.1	0.710	1	41120	18.97
	.27	4.4	0.650	2	42205	18.97
	.38	3	0.570	3	43203	18.97
	.6	1.9	0.600	4	44620	22.70
	.78	1.5	0.550	5	45207	22.70

PLUG-IN

Induct-ance	I_{DC} (Amps)	R_{DC} (Ohms)	SRF MHz	Size	Model Number	Price 1–9
2 Mili-Henry	.112	14	1.000	0	40130	18.97
	.19	5.4	0.950	1	41140	18.97
	.33	2.9	0.850	2	42225	18.97
	.47	2	0.800	3	43223	18.97
	.74	1.3	0.700	4	44640	22.70
	.95	1	0.650	5	45227	22.70
1 Milli-Henry	.158	6	1.650	0	40150	18.97
	.27	2.7	1.500	1	41160	18.97
	.47	1.5	1.200	2	42245	18.97
	.66	1	1.100	3	43243	18.97
	1	.62	1.050	4	44660	22.70
	1.3	.5	1.000	5	45247	22.70
750 Micro-Henry	.182	5	1.700	0	40170	18.97
	.31	2	1.550	1	41180	18.97
	.54	1	1.400	2	42265	18.97
	.76	.75	1.400	3	43263	18.97
	1.2	.47	1.200	4	44680	22.70
	1.6	.38	1.150	5	45267	22.70
500 Micro-Henry	.224	4	2.300	0	40190	18.97
	.38	1.3	2.100	1	41200	18.97
	.66	.66	1.900	2	42285	18.97
	.93	.5	1.600	3	43283	18.97
	1.47	.31	1.500	4	44700	22.70
	1.9	.25	1.450	5	45287	22.70
250 Micro-Henry	.316	1.5	3.300	0	40210	18.97
	.53	.66	3.000	1	41220	18.97
	.93	.33	2.500	2	42305	18.97
	1.3	.25	2.400	3	43303	18.97
	2.08	.16	2.100	4	44720	22.70
	2.7	.13	2.010	5	45307	22.70
100 Micro-Henry	.50	.6	4.500	0	40230	18.97
	.78	.300	4.000	1	41240	18.97
	1.35	.170	3.900	2	42325	18.97
	1.95	.110	3.500	3	43323	18.97
	3.08	.070	3.300	4	44740	22.70
	3.88	.060	3.200	5	45327	22.70
40 Micro-Henry	.79	32	5.500	0	40250	18.97
	1.18	.141	5.000	1	41260	18.97
	2.03	.070	4.500	2	42345	18.97
	2.68	.060	4.500	3	43343	18.97

*** Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%, 50-99 less 23%; 100-499 less 30%

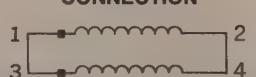
SPECIFICATIONS:

- All units manufactured to MIL-T-27 and are type TF5S04ZZ
- Inductance measured at 0.1 VRMS-10 kHz
- Temperature rise at rated D.C. current is less than 30°C
- Maximum ambient is 100°C
- Unit has magnetic shield

Delivery— stock to one week

PLUG-IN TERMINAL ARRANGEMENT SERIES CONNECTION

PLUG-IN PARALLEL CONNECTION



Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

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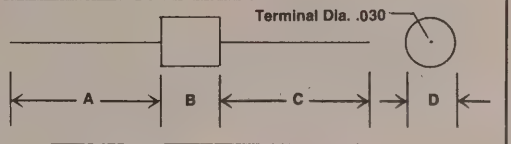
Miniaturized Power Inductors with Axial Leads, Shielded Construction

These inductors utilize special techniques to minimize cross coupling and give the utmost in shielding efficiency. They are ideal for Noise, Spike and Power Filtering Applications in Power Supplies, DC-DC Converters and Switching Regulators

- Minimum possible size
- Shielded construction
- Mountable through PC board or to posts
- Manufactured to MIL-T-27 (TF5S04ZZ)
- Suitable for reel-mounted assembly
- Low losses

SPECIFICATIONS

- All units meet MIL-T-27 (TF5S04ZZ)
- Inductance measured at 0.1VRMS–100KHz
- Maximum ambient plus temp. rise limited to 130°C
  (i.e. temp. rise for 72205 at .425 AMPS will be 12°C, ambient should be limited to 118°C –at .64AMPS temp. rise is 30°C, ambient should be limited to 100°C)



SIZE	A	B	C	D
A	1.25 (31.7)	.450 (11.4)	1.25 (31.7)	.350 (8.89)
B	1.25 (31.7)	.500 (12.7)	1.25 (31.7)	.420 (10.7)
C	1.25 (31.7)	.600 (15.2)	1.25 (31.7)	.500 (12.7)
D	1.25 (31.7)	.75 (19.1)	1.25 (31.7)	.560 (12.7)

All dimensions are in inches, ( ) = MM

SIZE A

LODC MICROHY (μH)	IDC FOR 10% DROP in L AMPS	IDC FOR 20% DROP in L AMPS	IDC FOR 30% DROP in L AMPS	RDC OHMS	SRF MHz	Q @ 100KHz	PICO PART NUMBER	PRICE (1–9)
500	425	640	848	74	1 4	25	72205	17 12
375	490	740	98	55	1 6	25	72215	17 12
250	600	906	1 2	36	2 0	25	72225	17 12
150	775	1 17	1 55	22	2 5	25	72235	17 12
100	950	1 43	1 90	15	3 0	25	72245	17 12
75	1 01	1 65	2 2	11	3 6	25	72255	17 12
50	1 34	2 02	2 7	075	4 4	25	72265	17 12

SIZE B

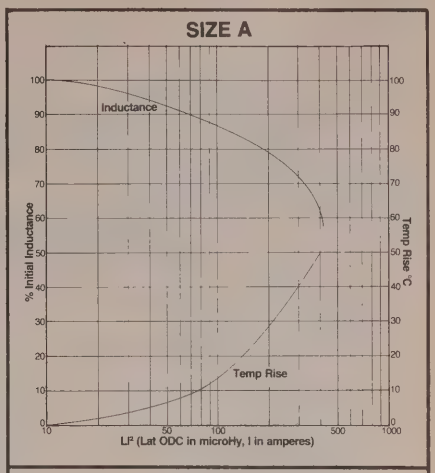
1000	0 450	0 600	0 750	0 85	0 9	25	72310	17 12
750	0 52	0 693	0 866	0 64	1 04	25	72320	17 12
500	0 63	0 848	1 06	0 43	1 3	25	72330	17 12
375	0 73	0 980	1 22	0 32	1 5	25	72340	17 12
250	0 90	1 20	1 5	0 22	1 8	25	72350	17 12
150	1 16	1 550	1 93	0 13	2 3	25	72360	17 12
100	1 42	1 9	2 37	0 085	2 8	25	72370	17 12
75	1 64	2 2	2 73	0 064	3 3	25	72380	17 12
50	2 0	2 7	3 35	0 043	4 0	25	72390	17 12

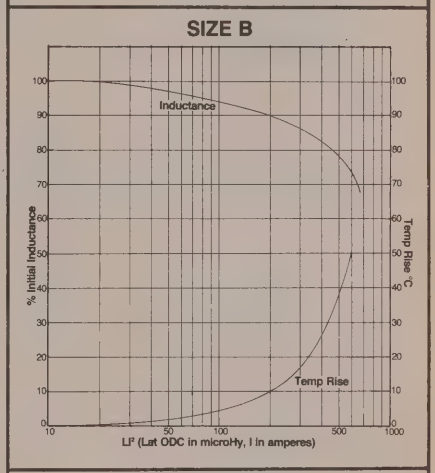
SIZE C

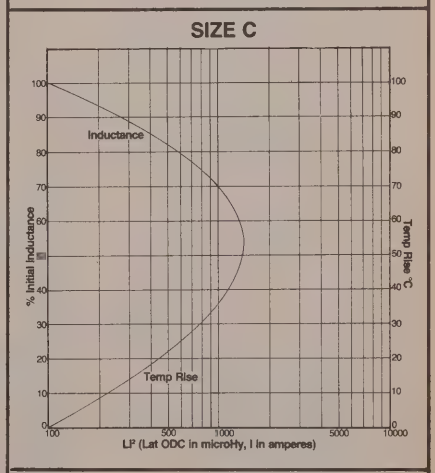
1000	0 500	0 750	1 0	700	85	25	72405	17 12
750	0 580	0 866	1 15	520	1 0	25	72415	17 12
500	0 707	1 06	1 41	350	1 2	25	72425	17 12
375	0 816	1 22	1 63	260	1 4	25	72435	17 12
250	1 0	1 50	2 0	175	1 7	25	72445	17 12
150	1 29	1 93	2 58	105	2 2	25	72455	17 12
100	1 58	2 37	3 16	070	2 7	25	72465	17 12
75	1 82	2 73	3 65	053	3 1	25	72475	17 12
50	2 25	3 35	4 5	035	4 0	25	72485	17 12

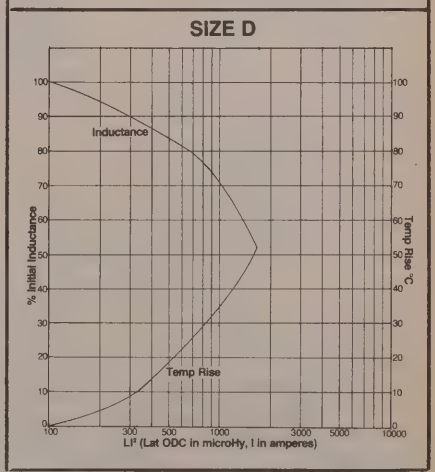
SIZE D

200	1 4	2 14	2.76	107	1.7	35	72500	18 83
175	1 5	2 29	2 95	093	2 0	35	72510	18 83
150	1 6	2 47	3 18	08	2 2	35	72520	18 83
125	1 78	2 7	3 49	066	2 5	35	72530	18 83
100	1 99	3 03	3 9	.053	2 7	35	72540	18 83
75	2.3	3 5	4 5	040	3 1	35	72550	18 83
50	2 8	4.3	5.5	0.27	4 0	35	2560	18 83
25	3 98	6 06	7 79	014	4 5	35	72570	18 83
15	5 14	7 82	10	007	5 1	35	72580	18 83









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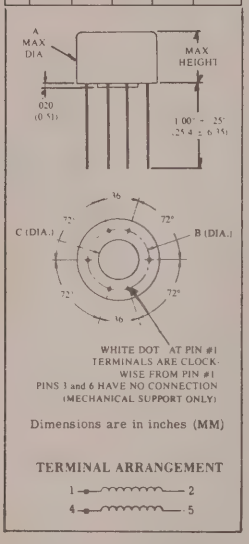
PLUG-IN
Delivery-Stock to 1 week
For Surface Mount see page A•1265

Common EMI Mode Suppression Inductors

- **Minimum possible size**
- **130°C operation (Ambient + Temp. Rise)**
- **Windings Balance ± 1%**
- **Dielectric Strength .... 1500 Volts RMS**
- **All units are magnetically shielded**

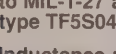
These Inductors are well suited for use in Switching Regulators, DC to DC Power Supplies and all types of Electrical Equipment where the elimination of line transmitted Electromagnetic Interference is important. Electrical equipment will generate noise due to switching operations of transistors, SCR's, relays, triacs, etc. By using these Inductors, noise being fed back to the power line is minimized to an acceptable level and this noise will not interfere with other equipment operating on the same power line.

Size	Max Height	A Max Dia	B Bolt Circle	C Stand-Off	Terminal Dia.
1	.280 (7.11)	.410 (10.41)	.260 (6.6)	.160 (4.06)	.012 (.31)
2	.340 (8.63)	.500 (12.7)	.350 (8.89)	.250 (6.35)	.012 (.31)
3	.415 (10.54)	.630 (16.0)	.440 (11.17)	.340 (8.64)	.016 (.41)

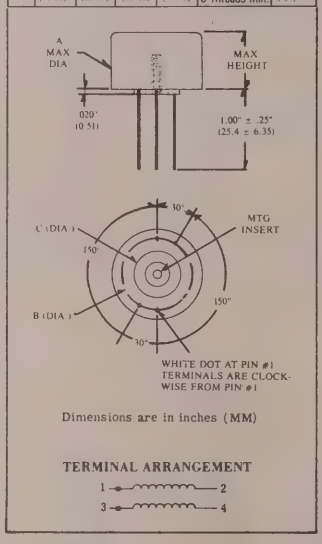


Dimensions are in inches (MM)

TERMINAL ARRANGEMENT

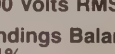


Size	Max Height	A Max Dia	B Bolt Circle	C Stand-Off	Mtg. Insert	Terminal Dia.
4	.500 (12.7)	.800 (20.32)	.560 (14.22)	.460 (11.68)	2-56 UNC 6 Threads min.	.016 (.41)
5	.650 (16.51)	.950 (24.13)	.670 (17.0)	.570 (14.48)	6-32 UNC 6 Threads min.	.020 (.51)
6	.745 (18.92)	1.125 (28.57)	.800 (20.32)	.700 (17.78)	6-32 UNC 6 Threads min.	.020 (.51)



Dimensions are in inches (MM)

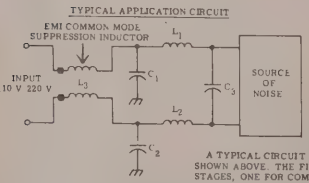
TERMINAL ARRANGEMENT



SPECIFICATIONS

- **All units manufactured to MIL-T-27 and are type TF5S04ZZ**
- **Inductance measured at 0.1VRMS-10kHz**
- **Unit has magnetic shield**
- **Dielectric Strength .... 1500 Volts RMS**
- **Windings Balanced ± 1%**
- **Maximum ambient plus temp. rise limited to 130°C (ie maximum ambient of part no. 46283 would be 105°C if IRMS is 1.29 AMPS)**

TYPICAL APPLICATION CIRCUIT



A TYPICAL CIRCUIT FOR THE ELIMINATION OF NOISE IS SHOWN ABOVE. THE FILTER CONTAINS TWO STAGES, ONE FOR COMMON MODE NOISE (L_3, C_1, C_2) AND ONE FOR CONDUCTED NOISE (L_1, L_2, AND C_3).

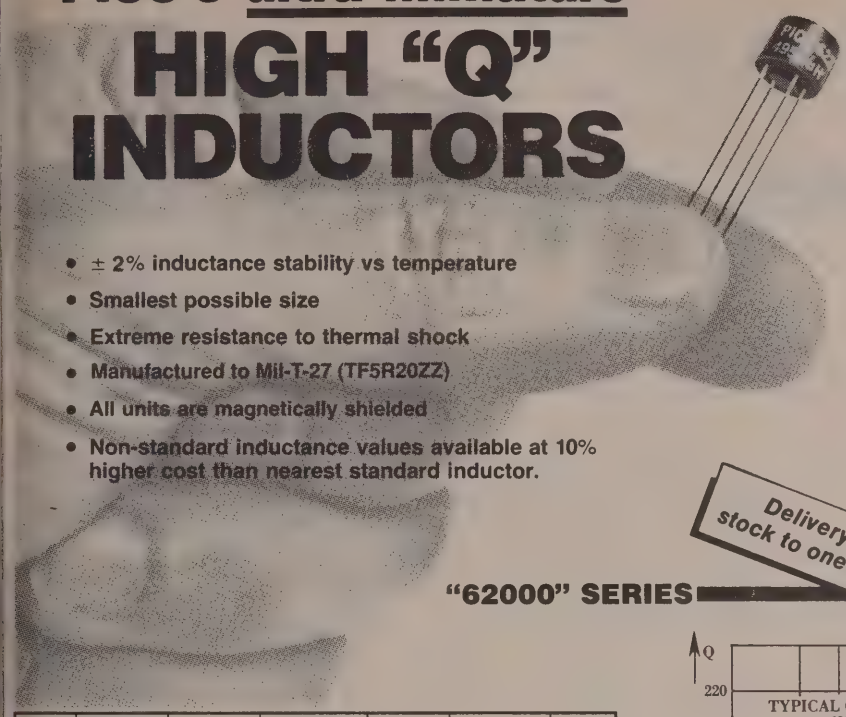
INDUCTANCE	IRMS (AMPS) TEMP. RISE 60°C	TEMP. RISE 40°C	TEMP. RISE 25°C	RDC. (OHMS) EACH WDG.	APPROX. LEAKAGE INDUCTANCE (MICRO-HENRY)	SIZE	MODEL NUMBER	PRICE 1–9
	1.25	1.00	.959	.125	5	1	46263	24.17
185	1.61	1.39	1.19	.083	5	2	47271	24.17
MICRO-	2.80	2.39	2.04	.038	4.5	3	48361	29.01
HENRY	4.58	3.83	3.06	.019	4.5	4	49461	29.01
	.862	.691	.572	.263	9	1	46243	24.17
375	1.14	.986	.851	.163	8	2	47251	24.17
MICRO-	1.98	1.70	1.44	.075	8	3	48341	29.01
HENRY	3.23	2.70	2.16	.037	7.5	4	49441	29.01
	4.70	4.18	3.04	.021	6.5	5	50241	29.01
	.711	.568	.472	.31	10.3	1	46223	24.17
550	.924	.792	.686	.20	8.9	2	47231	24.17
MICRO-	1.62	1.38	1.18	.09	8.4	3	48321	29.01
HENRY	2.64	2.20	1.77	.045	7.7	4	49421	29.01
	3.80	3.39	2.46	.026	7.5	5	50221	29.01
	.619	.495	.410	.41	13.8	1	46203	24.17
	.814	.694	.601	.26	11.9	2	47211	24.17
750	1.40	1.20	1.02	.12	11.3	3	48301	24.17
MICRO-	2.29	1.91	1.53	.06	10.3	4	49401	29.01
HENRY	3.33	2.96	2.15	.034	10.0	5	50201	29.01
	5.10	4.23	3.77	.022	9.4	6	51303	31.85
	.437	.349	.290	.82	27.5	1	46183	24.17
	.575	.491	.425	.52	23.8	2	47191	24.17
1.5	.986	.847	.722	.24	22.5	3	48281	24.17
MILLI-	1.61	1.36	1.08	.12	20.6	4	49381	29.01
HENRY	2.31	2.06	1.50	.07	20	5	50181	29.01
	3.78	3.14	2.80	.04	18.8	6	51283	31.85
	.308	.246	.204	1.65	55	1	46163	24.17
	.405	.345	.299	1.05	47.5	2	47171	24.17
3	.708	.605	.516	.47	45.0	3	48261	24.17
MILLI-	1.14	.959	.766	.24	41.3	4	49361	29.01
HENRY	1.64	1.45	1.06	14	40.0	5	50161	29.01
	2.53	2.09	1.86	09	37.5	6	51263	31.85
	.205	.165	.136	3.71	123.8	1	46143	24.17
	.270	.231	.200	2.36	106.9	2	47151	24.17
6.75	.468	.401	.342	1.07	101.3	3	48241	24.17
MILLI-	.769	.643	.516	.53	92.8	4	49341	29.01
HENRY	1.10	.977	.711	.31	90.0	5	50141	29.01
	1.69	1.41	1.25	.20	84.4	6	51243	31.85
	.154	.123	.101	6.6	220	1	46123	24.17
12	.202	.172	.150	4.2	190	2	47131	24.17
MILLI-	.352	.299	.255	1.9	180	3	48221	24.17
HENRY	.572	.480	.378	.95	165	4	49321	29.01
	.827	.730	.528	.55	160	5	50121	29.01
	1.28	1.06	.942	.35	150	6	51223	31.85

For immediate engineering assistance or to place an order– ***Call Toll Free 800-228-9747***

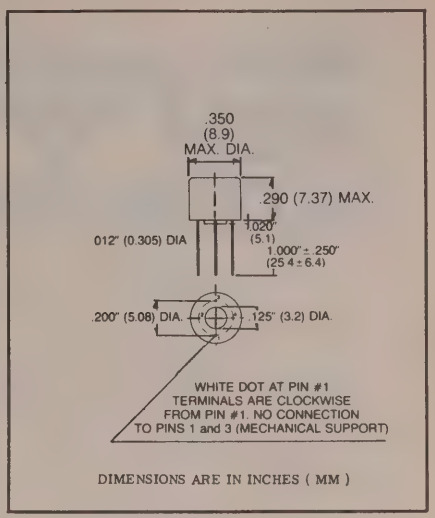
Delivery–stock to one week

PICO Electronics, Inc.
453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552 • • FAX 914-699-5565

PICO's ultra-miniature HIGH "Q" INDUCTORS



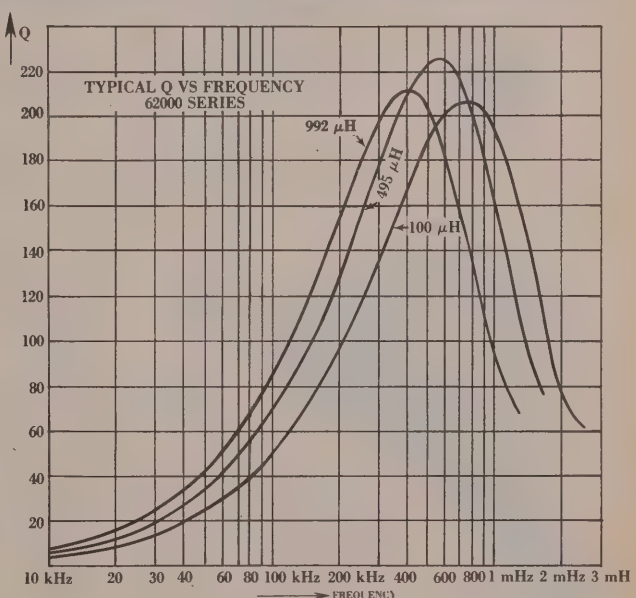
- ± 2% inductance stability vs temperature
- Smallest possible size
- Extreme resistance to thermal shock
- Manufactured to Mil-T-27 (TF5R20ZZ)
- All units are magnetically shielded
- Non-standard inductance values available at 10% higher cost than nearest standard inductor.



Delivery— stock to one week

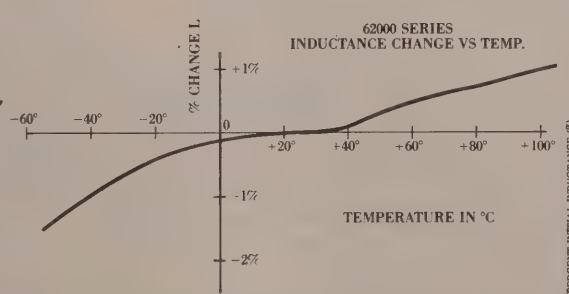
"62000" SERIES

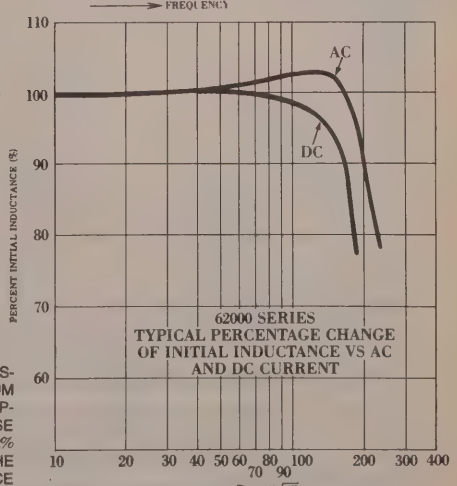
PART NUMBER	INDUCTANCE (MICRO-HENRYS)	D.C. RESISTANCE (OHMS)	APPROXIMATE SELF RESONANT FREQUENCY (MHz)	MAXIMUM DC CURRENT (mA)	MINIMUM Q	PRICE (1-9)
62112	2500	18	1.15	80	130 at (400 kHz)	31.90
62132	1500	10	1.5	100	130 at (400 kHz)	31.90
62152	992	7	1.8	125	160 at (400 kHz)	31.90
62172	900	6.5	1.9	130	160 at (400 kHz)	31.90
62192	800	6.0	2.1	140	160 at (400 kHz)	31.90
62212	742	5.7	2 3	150	150 at (500 kHz)	31.90
62232	702	5.5	2.5	155	150 at (500 kHz)	31.90
62252	700	5.0	2.7	160	160 at (500 kHz)	31.90
62272	695	4.5	3	170	160 at (500 kHz)	31.90
62292	400	3.7	3 3	185	160 at (500 kHz)	31.90
62312	298	2.8	3.8	215	170 at (500 kHz)	31.90
62332	248	2.3	4.2	235	170 at (500 kHz)	31 90
62352	196	1.8	4.75	265	160 at (500 kHz)	31.90
62372	150	1.4	5.5	300	160 at (500 kHz)	31.90
62392	100	1.2	6.8	330	140 at (400 kHz)	31.90


Q
TYPICAL Q VS FREQUENCY
62000 SERIES
992 μH
495 μH
100 μH
10 kHz 20 30 40 60 80 100 kHz 200 kHz 400 600 800 1 mHz 2 mHz 3 mH
FREQUENCY

SPECIFICATIONS

- INDUCTANCE TOLERANCE ±4% AT 0.1V-100KHZ
- INDUCTANCE STABILITY VS TEMPERATURE ±2% -55°C to 105°C
- MANUFACTURED TO MIL-T-27 TF5R20ZZ
- WEIGHT 2 GRAMS
- THERMAL SHOCK 100 CYCLES, METHOD 107D MIL-STD 202E TEST CONDITION A3
- UNIT HAS MAGNETIC SHIELD





ALL INDUCTORS ARE MEASURED AT 0 DC. THE MAXIMUM DC LISTINGS ARE FOR APPROXIMATELY 30°C HEAT RISE AND APPROXIMATELY 2% DROP IN INDUCTANCE. THE CHANGE OF INDUCTANCE WITH AC OR DC CURRENTS IS ILLUSTRATED BY THE CURVES. THE EXCITATION IS PLOTTED IN mA ×√mHy. FOR EXAMPLE THE 0.495 mH INDUCTOR (62272) WITH 170 mA DC FLOWING WILL HAVE AN EXCITATION OF mA ×√mHy = 120, AND THE INDUCTANCE WILL DROP FROM 495 uH to 485 uH. IF THE 170 mA WAS AC, THE INDUCTANCE WOULD BE 510 uH.

For immediate engineering assistance or to place an order—
Call Toll Free 800-228-9747

PICO Electronics, Inc.
453 North MacQuesten Pkwy., Mt. Vernon, N.Y. 10552
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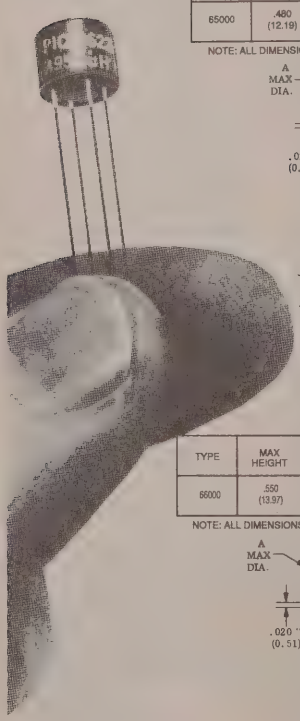
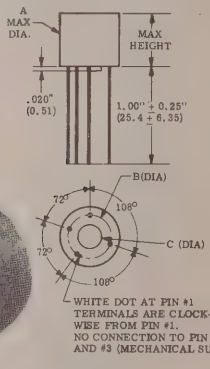
PICO's miniature HIGH "Q" INDUCTORS

- ± 1% inductance stability vs temperature
- Smallest possible size
- Extreme resistance to thermal shock
- Manufactured to Mil-T-27 (TF5R20ZZ)
- All units are magnetically shielded



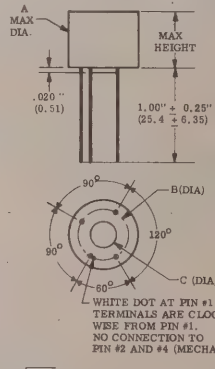
TYPE	MAX HEIGHT	A MAX DIA.	B BOLT CIRCLE	C STAND-OFF
63000	.325 (7.87)	.430 (10.69)	.260 (6.6)	.160 (4.06)
64000	.360 (8.89)	.530 (13.5)	.350 (8.89)	.250 (6.35)
65000	.480 (12.19)	.670 (17.0)	.440 (11.17)	.340 (8.64)

NOTE: ALL DIMENSIONS ARE IN INCHES. ( ) = MM


A MAX DIA.
MAX HEIGHT
.020" (0.51)
1.00" ± 0.25" (25.4 ± 6.35)
B(DIA)
72°
108°
C (DIA)
WHITE DOT AT PIN #1 TERMINALS ARE CLOCK-WISE FROM PIN #1. NO CONNECTION TO PIN #1 AND #3 (MECHANICAL SUPPORT)

TYPE	MAX HEIGHT	A MAX DIA	B BOLT CIRCLE	C STAND-OFF
66000	.550 (13.97)	.840 (21.34)	.560 (14.22)	.460 (11.68)

NOTE: ALL DIMENSIONS ARE IN INCHES. ( ) = MM



ALL INDUCTORS ARE MEASURED AT 0 DC. THE MAXIMUM DC LISTINGS ARE FOR APPROXIMATELY 5% DROP IN INDUCTANCE AND NEGLIGIBLE HEAT RISE. THE CHANGE OF INDUCTANCE WITH AC OR DC CURRENTS IS ILLUSTRATED BY THE CURVES SHOWN FOR EACH INDUCTOR TYPE. THE EXCITATION IS PLOTTED IN mA X $\sqrt{mHy}$. FOR EXAMPLE THE 10 mH INDUCTOR (64314) WITH 79 mA DC FLOWING WILL HAVE AN EXCITATION OF mA X $\sqrt{mH}$ = 79 X $\sqrt{10}$ = 250 AND THE INDUCTANCE WILL DROP FROM 10 mH TO 9mH. IF THE 79 mA WAS AC THE INDUCTANCE WOULD BE 9.65 mH.

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453 N. MacQuesten Pkwy. Mt. Vernon, N.Y. 10552
• FAX 914-699-5565

"63000" SERIES

PART NUMBER	INDUCTANCE	D.C. RESISTANCE (OHMS)	APPROXIMATE SELF RESONANT FREQUENCY (KHz)	MAXIMUM DC CURRENT (mA)	MINIMUM Q	*** PRICE (1–9)
63120	1 Hy	1840	47	5.7	30 at (15 kHz)	35.88
63140	750 mH	1380	54	6.6	30 at (15 kHz)	34.63
63160	500 mH	920	66	8	30 at (15 kHz)	32.62
63180	200 mH	368	105	12.5	60 at (25 kHz)	32.62
63200	100 mH	185	148	18	60 at (25 kHz)	32.62
63220	75 mH	140	172	20.8	100 at (50 kHz)	32.62
63240	50 mH	90	210	25.5	100 at (50 kHz)	32.62
63260	30 mH	55	270	33	100 at (50 kHz)	32.62
63280	20 mH	37	332	40	100 at (50 kHz)	32.62
63300	15 mH	28	383	46	100 at (50 kHz)	32.62
63320	10 mH	18.5	470	57	100 at (50 kHz)	32.62
63340	5 mH	10	665	80	100 at (50 kHz)	32.62
63360	1 mH	.2	1480	180	100 at (50 kHz)	35.88

"64000" SERIES

PART NUMBER	INDUCTANCE	D.C. RESISTANCE (OHMS)	APPROXIMATE SELF RESONANT FREQUENCY (KHz)	MAXIMUM DC CURRENT (mA)	MINIMUM Q	*** PRICE (1–9)
64114	5 Hy	3000	17	2.8	15 at (4 kHz)	39.05
64134	3 Hy	1800	22	3.6	30 at (6 kHz)	37.66
64154	2 Hy	1200	27	4.4	30 at (6 kHz)	35.88
64174	1 Hy	600	38	6.3	30 at (6 kHz)	32.62
64194	750 mH	450	44	7.3	30 at (6 kHz)	32.62
64214	500 mH	300	54	9	30 at (6 kHz)	32.62
64234	250 mH	150	76	13	65 at (15 kHz)	32.62
64254	100 mH	60	120	20	65 at (15 kHz)	32.62
64274	75 mH	45	139	23	120 at (25 kHz)	32.62
64294	50 mH	30	170	28	120 at (25 kHz)	32.62
64314	10 mH	6	380	63	200 at (50 kHz)	32.62
64334	5 mH	3	537	89	200 at (50 kHz)	32.62
64354	1 mH	.6	1200	200	200 at (50 kHz)	35.88

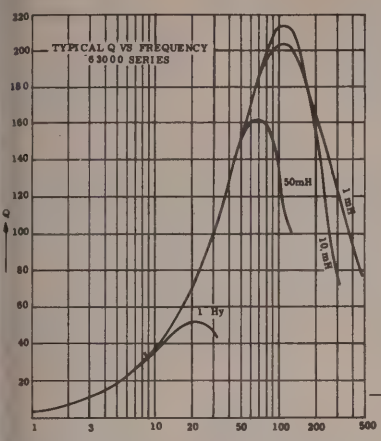
"65000" SERIES

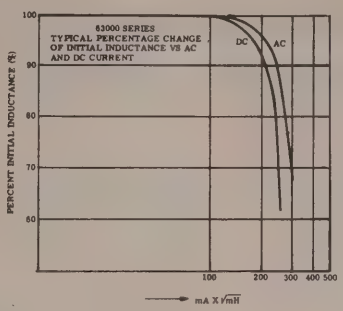
PART NUMBER	INDUCTANCE	D.C. RESISTANCE (OHMS)	APPROXIMATE SELF RESONANT FREQUENCY (KHz)	MAXIMUM DC CURRENT (mA)	MINIMUM Q	*** PRICE (1–9)
65413	10 Hy	3800	11.7	2.8	28 at (4 kHz)	39.05
65433	5 Hy	1900	16.5	3.9	28 at (4 kHz)	37.66
65453	3 Hy	1140	21	5.1	28 at (4 kHz)	35.88
65473	2 Hy	760	26	6.3	56 at (6 kHz)	35.88
65493	1 Hy	380	37	8.8	56 at (6 kHz)	32.62
65513	500 mH	190	52	12.5	56 at (6 kHz)	32.62
65533	250 mH	95	74	17.7	140 at (15 kHz)	32.62
65553	100 mH	38	117	28	140 at (15 kHz)	32.62
65573	50 mH	19	165	39.6	240 at (25 kHz)	32.62
65593	10 mH	3.8	370	88.5	240 at (25 kHz)	32.62

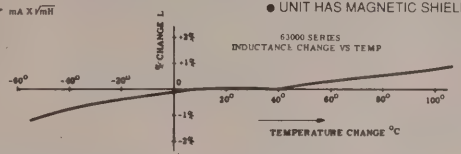
"66000" SERIES

PART NUMBER	INDUCTANCE	D.C. RESISTANCE (OHMS)	APPROXIMATE SELF RESONANT FREQUENCY (KHz)	MAXIMUM DC CURRENT (mA)	MINIMUM Q	*** PRICE (1–9)
66218	10 Hy	2200	11	4.2	40 at (4 kHz)	39.05
66238	5 Hy	1100	15.7	6	40 at (4 kHz)	37.66
66258	3 Hy	660	20	7.7	70 at (6 kHz)	37.66
66278	2 Hy	440	25	9.4	70 at (6 kHz)	32.66
66298	1 Hy	220	35	13	70 at (6 kHz)	32.66
66318	500 mH	110	49	18.8	70 at (6 kHz)	32.66
66338	250 mH	55	70	26.6	200 at (15 kHz)	32.66
66358	100 mH	22	110	42	200 at (15 kHz)	32.66
66378	50 mH	11	156	59	200 at (15 kHz)	32.66
66398	10 mH	2.2	350	133	200 at (15 kHz)	32.66

***Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%
Ordering Instruction: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.



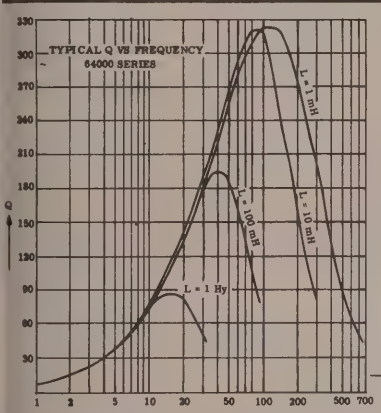


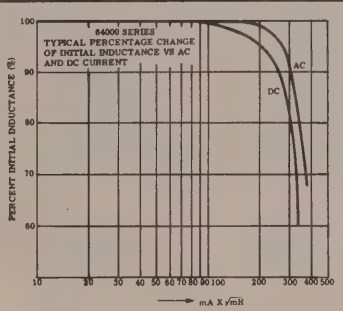


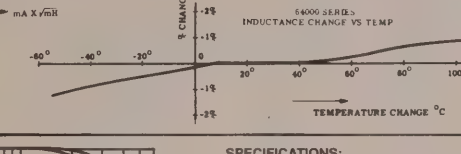
SPECIFICATIONS:

"63000" SERIES

- INDUCTANCE TOLERANCE ±5% AT .IV-4kHz.
- INDUCTANCE STABILITY VS TEMP. ± 1% - 30° TO + 105°C + 1% - 55°C To + 105°C - 2%
- MANUFACTURED TO MIL-T-27 (MIL TYPE TF5R20ZZ)
- WEIGHT 3.5 GRAMS
- THERMAL SHOCK: 100 CYCLES, METHOD 107D, MIL-STD 202 E, TEST CONDITION A-3
- UNIT HAS MAGNETIC SHIELD



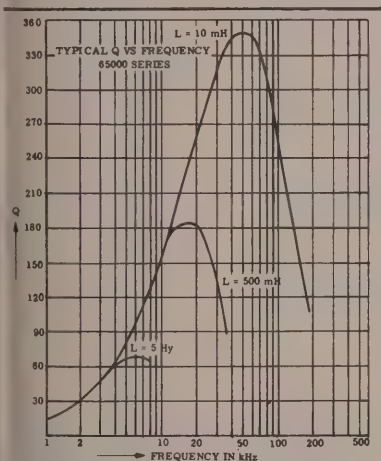


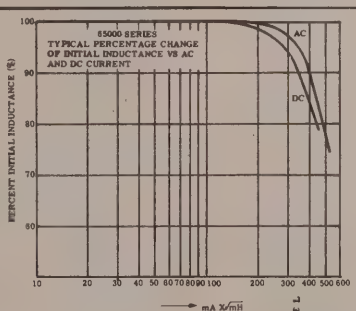


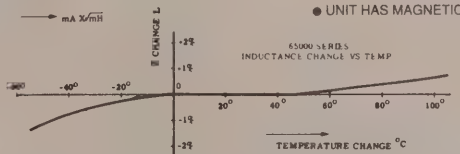
SPECIFICATIONS:

"64000" SERIES

- INDUCTANCE TOLERANCE ±5% AT .IV-2kHz.
- INDUCTANCE STABILITY VS TEMP. ± 1% - 30° TO + 105°C + 1% - 55°C TO + 105°C - 2%
- MANUFACTURED TO MIL-T-27 (MIL TYPE TF5R20ZZ)
- WEIGHT 6 GRAMS
- THERMAL SHOCK: 100 CYCLES, METHOD 107D, MIL-STD 202 E, TEST CONDITION A-3
- UNIT HAS MAGNETIC SHIELD



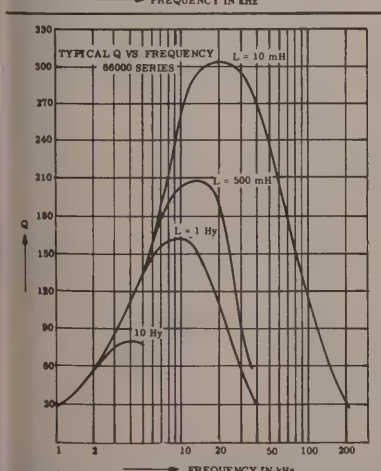


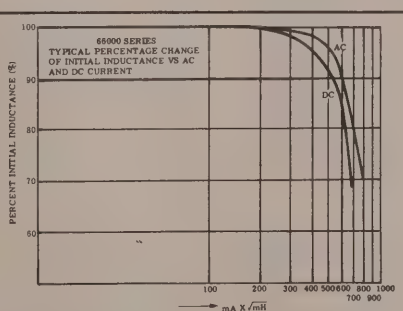


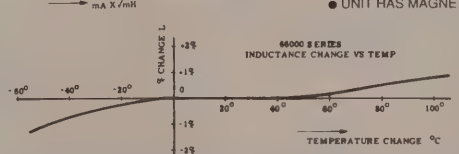
SPECIFICATIONS:

"65000" SERIES

- INDUCTANCE TOLERANCE ±5% AT .IV-1kHz.
- INDUCTANCE STABILITY VS TEMP. ± 1% - 30° TO + 105°C + 1% - 55°C TO + 105°C - 2%
- MANUFACTURED TO MIL-T-27 (MIL TYPE TF5R20ZZ)
- WEIGHT 12 GRAMS
- THERMAL SHOCK 100 CYCLES, METHOD 107D, MIL-STD 202 E, TEST CONDITION A-3
- UNIT HAS MAGNETIC SHIELD







SPECIFICATIONS:

"66000" SERIES

- INDUCTANCE TOLERANCE ±5% AT .IV-4kHz.
- INDUCTANCE STABILITY VS TEMP ± 1% - 30° TO + 105°C + 1% - 55°C TO + 105°C - 2%
- MANUFACTURED TO MIL-T-27 (MIL TYPE TF5R20ZZ)
- WEIGHT 22 GRAMS
- THERMAL SHOCK: 100 CYCLES, METHOD 107D, MIL-STD 202 E, TEST CONDITION A-3
- UNIT HAS MAGNETIC SHIELD

PICONICS MICRO INDUCTOR PRODUCTS AND APPLICATIONS

The principal application for Piconics' Inductors has traditionally been in linear hybrid amplifier, micro-strip and stripline circuits. These designs have been used in a wide range of systems from the Space Shuttle Program to commercial microwave applications. Major use is in military systems where excellence and tight quality controls are required.

Piconics' components feature excellent stability, high Q and controlled characteristics. They are packaged in various configurations with a wide range of lead materials. Internal connections are welded to avoid the problems associated with high temperature soldering. Encapsulation is mechanically interlocked to strengthen all surface (shear) bonds. The materials and methods used at Piconics are compatible with normal requirements in hybrid circuit manufacturing.

Piconics' custom design capability has led to the development of unique products. Should your inductor requirements be outside the parameters of our standard listings, contact Piconics directly for a prompt quotation to your needs.

Leaded Inductor Selection Table — Tunable/Fixed **MIL-C-15305**

Series	Length	Width	Height	Inductance	Case	Adjustment	QPL
B	.325-.475	.110	.150	.025μH to 1mH	Molded	Screw (side)	Yes
G	.180	.090	.105	.025μH to 1mH	Conformal Coating	Slide	In Process
ST	.200	.100	.275	.020μH to 1mH	Molded	Screw (top)	Yes
TT	.285	.110	.325-.450	.020μH to 1mH	Molded	Screw (top)	Yes

Series	Length	Width	Height	Inductance	NOTES	QPL
C	.200	.090	.105	.010μH to 1mH	Conformal Coating	In Process
D	.200	.085 or .095	.085 or .095	.010μH to 1mH	Molded Case	In Process
JA	.110 or .180	.060 or .075	.060 or .075	.045 μH to 1mH	Epoxy Coated, Open Frame Case, Self-Leaded	In Process
JC	.180	.085	.085	.045 μH to 1mH	Bonded, Open Frame Case Self-Leaded	In Process

Chip Inductor Selection Table — Tunable/Fixed **MIL-C-83446**

Series	Length	Width	Height	Inductance	Case	Adjustment	QPL
PGV	.160	.125	.330	.012μH to 1mH	Molded	Screw (top)	Yes
PSV	.320	.165	.130	.012μH to 1mH	Molded	Screw (side)	Yes
PV	.150-.300	.140	.065 or .095	.012μH to 1mH	Conformal Coating	Slide	Yes
PVW	.150-.300	.140	.065 or .095	.010μH to 1mH	Conformal Coating	Slide	Yes

Series	Length	Width	Height	Inductance	NOTES	QPL
P	.180	.140	.065 or .095	.010μH to 1mH	Conformal Coating	Yes
PA	.100	.100	.100	.010μH to 1mH	Molded Epoxy - Minimum Area Profile	Yes
PG	.160	.125	.130	.010μH to 1mH	Molded Diallyl Phthalate (DAP) Solder Fillet, Interlock Substrate Easily handled by automatic equipment	Yes
PK	.160	.125	.130	.010μH to 1mH	Molded Epoxy Case, Solder Fillet Interlock Substrate Easily handled by automatic equipment	Yes
PW	.180	.140	.065 or .095	.010μH to 1mH	Conformal Coating Bonding Pad Completes Connection	Yes

Leaded Microwave Inductor Selection Table

	Series	Length	Width	Height	Inductance	NOTES	QPL
FIXED	M	.004-.170	.024	.024	6.3nH to 684nH	Bonded, Self-Leaded Air Core High Frequency Choke, Constructed of 47AWG Copper Wire, Insulated	In Process
	MG	.004-.170	.024	.024	6.3nH to 684nH	Bonded, Self-Leaded Air Core High Frequency Choke, Constructed of 47AWG Gold Wire, Insulated	In Process
	S	.200	.100	.100	5nH to 330nH	Epoxy Conformal Coating Self-Leaded Tinned Air Core High Frequency Choke	In Process

Spiral Chip Inductor Selection Table

	Series	Length	Width	Height	Inductance	NOTES	QPL
FIXED	MC	.100 or .160	.095 or .125	.045 or .060	10nH to 700nH	Chip Mounted Coil	In Process
	SP	.045 or 050	.045 or .075	.010	3nH to 160nH	Quartz and 99.6% Alumina Substrate Materials. 3 1/2, 4 1/2, 5 1/2, 8 1/2, turns available on .045" X .045" or .050" X .075", 11 1/2, 18 1/2, 22 1/2 turns only on .050" X .075" values above 50nH available on .050" X .075".	No

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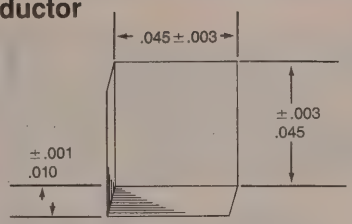
PICONICS MICROWAVE COMPONENTS
SP, M, MG AND MC SERIES

SP Series Spiral Chip Inductor

This style inductor may be used where low inductance values are required and gold wire bonding is the method for making interconnections. When used as an r.f. choke, attach center pad to r.f. and outside pad to power supply. Custom designs available. Other ceramic materials having various dielectric constants are available.



DIMENSIONS IN INCHES

NOTES:
(1) Self-resonant frequency may be increased by mounting inductor on an insulating stand-off. These stand-offs can be provided by Piconics.
(2) Inductors to 25 turns in this geometry are available on special order.
(3) Attachment is generally made using non-conductive epoxy such as EPO-TEK H-61 or EPO-TEK H-20.
(4) Thermosonic wire bonding using1 mil gold wire is recommended for lead attachment to this style inductor. Gold ribbon may also be used.
(5) Resonances shown in the tables are the lower self resonances encountered. Typical values are higher.
(6) Measurements are very dependent on fixturing and frequency.
(7) Quartz typically gives high SRF and Q's than ceramic due to lower Dielectric Constant.
(8) Bonding are typically .005" in diameter.
(9) Other thicknesses, values, sizes available on request.

SP Series on Quartz

Part No.	Turns (2)	@200MHz Inductance (L)nH(6)	Q Min (7)	Series Resonance Min GHz(1-5-7)	Parallel Resonance Min GHz(5)	DCR MAX OHM
SP3P5-Q	3 1/2	7	3.5	17	9	2.5
SP4P5-Q	4 1/2	11	3.4	15	9	4
SP5P5-Q	5 1/2	16	3.2	11	7	6
SP8P5-Q	8 1/2	45	2.8	8	5	20
SP11P5-Q	11 1/2	80	2.5	3.5	3.5	28

SP Series on Ceramic

Part No.	Turns (2)	@200MHz Inductance (L)nH(6)	Q Min (7)	Series Resonance Min GHz(5)	Parallel Resonance Min GHz(5)	DCR MAX OHM
SP3P5-A	3 1/2	7	3.5	13	8	2.5
SP4P5-A	4 1/2	11	3.4	12	7	4
SP5P5-A	5 1/2	16	3.2	9	5	6
SP8P5-A	8 1/2	45	2.8	6	3.5	20
SP11P5-A	11 1/2	80	2.5	3	2.5	28

Piconics' M and MG series are microminiature broadband air core chokes with high self-resonant frequencies, suitable for microwave applications. Piconics' M and MG series chokes provide inductance values from 10nH to 700nH, operating frequencies from 100MHz and self-resonant frequencies from 1GHz to 28GHz.

Piconics' M and MG series chokes are available from 2 to 100 turns for standard models. Special models can also be provided. Applications includes oscillators, mixers, switches, stripline devices, broadband modulators, power supplies, filters and frequency multipliers.

M Series

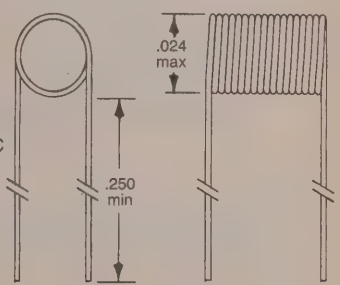
PHYSICAL CHARACTERISTICS
- Air Core
- Self-Leaded
- Solder Strippable Leads (SS) AWG 47 Copper
- Recommended operating and storage Temperature Range: -55°C to +125°C

OPTIONS AVAILABLE
- Axial Leads
- Tinned Leads (We recommend pre-timing of leads prior to circuit insertion)
- Gold Plated Leads. M xxx 47GP
- Gold Coils. See MG Series Data Sheet
- Higher temperature class insulation available upon request

MG Series

PHYSICAL CHARACTERISTICS
- Air Core
- Self-Leaded
- Recommended operating and storage Temperature Range:-55°C to +125°C
- AWG 47 Gold

OPTIONS AVAILABLE
- Axial Leads



M SERIES - ELECTRICAL CHARACTERISTICS

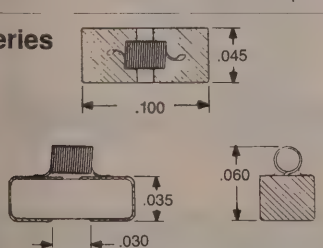
Piconics' Part Number	Length Nom. Inches	L nH±10%	Test Freq. MHz	Q Min	SRF Min GHz	DC Res Ohms Max	Idc Max MA
M2T47SS	.004	10.4	200	36	28	0.20	100
M3T47SS	.005	14.1	200	34	25	0.23	100
M5T47SS	.010	24	200	32	15	0.29	100
M8T47SS	.014	39	100	24	14	0.38	100
M10T47SS	.017	50	100	24	13	0.46	100
M15T47SS	.026	80	100	24	11	0.61	100
M20T47SS	.034	116	100	24	8	0.76	100
M25T47SS	.043	146	25	17	6	0.91	100
M30T47SS	.050	178	25	17	6	1.1	100
M35T47SS	.060	213	25	17	5	1.3	100
M40T47SS	.068	240	25	17	4	1.4	100
M45T47SS	.077	282	25	17	3	1.6	100
M50T47SS	.085	320	25	17	3	1.8	100
M55T47SS	.095	343	25	17	2	1.9	100
M60T47SS	.102	388	25	17	2	2.0	100
M65T47SS	.112	415	25	17	2	2.2	100
M70T47SS	.120	450	25	17	1	2.3	100
M75T47SS	.128	485	25	17	1	2.5	100
M80T47SS	.136	530	25	17	1	2.7	100
M85T47SS	.145	565	25	17	1	2.9	100
M90T47SS	.153	615	25	17	1	3.0	100
M95T47SS	.162	651	25	17	1	3.2	100
M100T47SS	.170	700	25	17	1	3.4	100

MG SERIES - ELECTRICAL CHARACTERISTICS

Piconics' Part Number	Length Nom. Inches	L nH±10%	Test Freq. MHz	Q Min	SRF Min GHz	DC Res Ohms Max	Idc Max MA
MG2T47SS	.004	11	200	32	28	.30	100
MG3T47SS	.005	15	200	30	25	.33	100
MG5T47SS	.010	25	200	28	15	.41	100
MG8T47SS	.014	41	100	23	14	.55	100
MG10T47SS	.017	53	100	23	13	.63	100
MG15T47SS	.026	86	100	23	11	.97	100
MG20T47SS	.034	130	100	23	8	1.2	100
MG25T47SS	.043	159	25	15	6	1.5	100
MG30T47SS	.050	195	25	15	6	1.7	100
MG35T47SS	.060	234	25	15	5	1.9	100
MG40T47SS	.068	272	25	15	4	2.1	100
MG45T47SS	.077	305	25	15	3	2.4	100
MG50T47SS	.085	346	25	15	3	2.6	100
MG55T47SS	.095	387	25	15	2	2.8	100
MG60T47SS	.102	428	25	15	2	3.0	100
MG65T47SS	.112	470	25	15	2	3.3	100
MG70T47SS	.120	510	25	15	1	3.5	100
MG75T47SS	.128	550	25	15	1	3.7	100
MG80T47SS	.136	592	25	15	1	3.9	100
MG85T47SS	.145	633	25	15	1	4.1	100
MG90T47SS	.153	670	25	15	1	4.3	100
MG95T47SS	.162	710	25	15	1	4.5	100
MG100T47SS	.170	760	25	15	1	4.7	100

The number of turns required are counted between the leads.
NOTE: Electrical characteristics are measured at a point on the leads .100" from the body of the coil.

MC Series



FEATURES -
- Minimum Height
- Surface Mountable
- East of Handling

ABSOLUTE MAXIMUM RATINGS
- Operating Temperature range: 55°C to +125°C
- Storage Temperature range: -55°C to +125°C
- Temperature rise (at 90°C): 35°C
- Maximum Operating Temperature: 125°C
- DC MA MAX: 100

PHYSICAL CHARACTERISTICS
* Air Core
- Alumina Substrate Base
- Gold Plated Contacts over Nickel
* Weight: 0.1 gram maximum

OPTIONS AVAILABLE
* Optional wire sizes available.
* Tinned terminations available.

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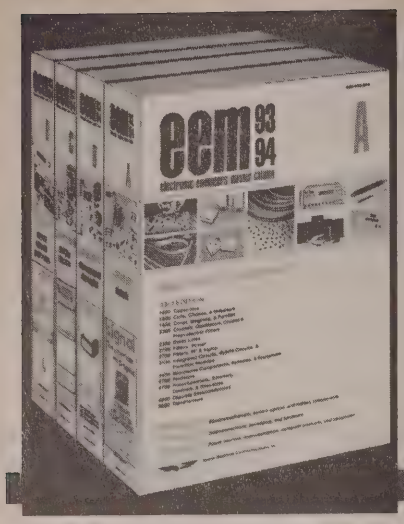

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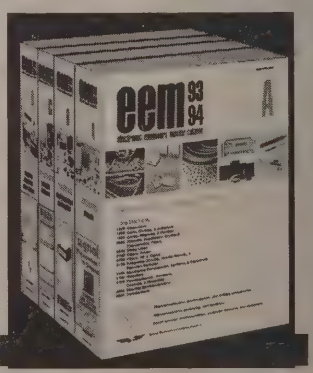

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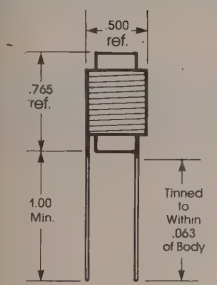
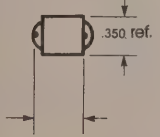
Economy High Current Inductors

Optional Base Mounting and Shielded Construction

SPE 100-SERIES

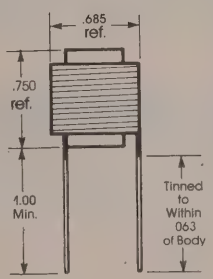




PART NO.	L µHY	DC AMPS	NOM DCR	NOM LEAD DIA.
SPE-100	1.5	12	.003	.064
SPE-101	2	10	.004	.057
SPE-102	3	8.5	.005	.051
SPE-103	3.5	7.0	.006	.045
SPE-104	4.2	5.5	.007	.040
SPE-105	10	4.3	.010	.036
SPE-106	20	4.3	.017	.036
SPE-107	28	3.4	.024	.032
SPE-108	34	2.6	.031	.029
SPE-109	50	2.1	.046	.050
SPE-110	100	2.1	.069	.050
SPE-111	125	1.7	.090	.045
SPE-112	160	1.35	.120	.040
SPE-113	250	1.0	.189	.035
SPE-114	350	1.0	.235	.035
SPE-115	500	.850	.392	.032
SPE-116	600	.670	.453	.030
SPE-117	750	.530	.641	.025
SPE-118	1000	.420	.890	.025
SPE-119	0.9	13	.003 max.	.064

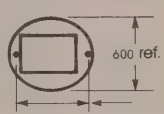
Nominal lead spacing is .410; however, due to lead length, lead spacing is variable.

SPE 200-SERIES

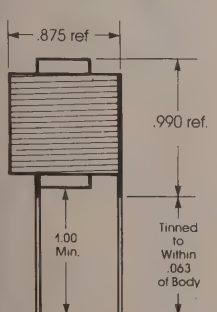


PART NO.	L µHY	DC AMPS	NOM DCR	NOM LEAD DIA.
SPE-200	27	5.5	.020	.040
SPE-201	33	5.5	.022	.040
SPE-202	39	5.5	.025	.040
SPE-203	47	5.0	.030	.040
SPE-204	56	4.8	.036	.036
SPE-205	68	4.4	.040	.036
SPE-206	82	4.0	.052	.032
SPE-207	100	3.8	.061	.032
SPE-208	120	3.5	.066	.032
SPE-209	150	3.0	.075	.032
SPE-210	180	2.8	.100	.029
SPE-211	220	2.35	.110	.029
SPE-212	270	2.0	.150	.026

Nominal lead spacing is .600; however, due to lead length, lead spacing is variable.



SPE 300-SERIES



	PART NO.	L µHY	DC AMPS	NOM DCR	NOM LEAD DIA.
*	SPE-300	47	9.0	.019	.057
†	SPE-301	56	8.0	.024	.050
	SPE-302	68	6.0	.031	.045
†	SPE-303	82	6.0	.034	.045
†	SPE-304	100	6.0	.039	.045
	SPE-305	120	5.0	.048	.040
	SPE-306	150	5.0	.054	.040
	SPE-307	180	4.3	.072	.036
	SPE-308	220	4.3	.081	.036
†	SPE-309	270	4.3	.091	.036
	SPE-310	330	3.4	.120	.032
	SPE-311	390	3.4	.134	.032
*	SPE-312	470	3.4	.153	.032
	SPE-313	560	2.7	.196	.028
	SPE-314	680	2.5	.228	.028
	SPE-315	820	2.5	.300	.050
	SPE-316	1000	2.0	.332	.050
†	SPE-317	1200	2.0	.383	.050
	SPE-318	1500	1.5	.510	.045

* option C not available
† option C available only without option A

NOTE: Options B and D not available on SPE-300 series units.

Nominal lead spacing is .700; however, due to lead length, lead spacing is variable.

OPTIONS AVAILABLE — A-B-C-D-E-O OPTION TABLE

A. Plastic dip coating.
B. Mounted on 94 V-0 base, 3 terminals (2 used). Base dia. .780 max.
C. Shield can supplied with unit.
D. Mounted on 94 V-0 base and shield can supplied with unit.
E. For high voltage applications.
O. No options. Plain self leads as shown.

Note: Shield can will reduce "L" up to a maximum of 15% on the 100 and 200 series and 30% on the 300 series of the specified value depending upon which series is being evaluated.

Ordering Information Example:

SPE-300-A
Family — Part Identification — Option Identification

Base Mount Option

Shield Can Option

Base Option - B
- Base diameter .780 max.
- 3 terminals on .640 dia. circle @ 90°
- .050 standoffs above board
- Base height above board .190 max.

Aluminum Shield Can Option - C for EMI Suppression.
- Can height above board 1.07 max.
- Can diameter .900 max.
- Can lug mounting .895± .010 btn centers
- Can lugs .016 TK x .060 wide
- Can standoff above board .030

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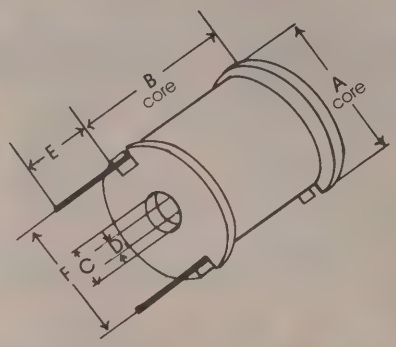
Ferrite Power Inductors

Drum Core Type



Standard component ferrite core power inductors rated up to 12 amps DC for switch mode power supplies and other applications. Leads are tinned to within .063" of the core.

SPB-100 SERIES (2 μ HY-800 μ HY)

PART NO.	INDUCTANCE	DC AMPS	NOM DCR	LEAD SIZE	DIMENSIONS
SPB-100	2 μ HY	12.0	.005	14 gauge	A .550 ref.
SPB-101	3 μ HY	10.0	.007	15 gauge	B .788 ref.
SPB-102	4 μ HY	8.5	.010	16 gauge	C .187 ref.
SPB-103	8 μ HY	7.0	.012	17 gauge	D .126 ref.
SPB-104	18 μ HY	7.0	.013	17 gauge	E .6875/.8125
SPB-105	22 μ HY	5.5	.016	18 gauge	F SPB-100 — 107 .510 ref.
SPB-106	30 μ HY	4.3	.021	19 gauge	SPB-108 — 118 .560 ref.
SPB-107	37 μ HY	3.4	.032	20 gauge	
SPB-108	50 μ HY	2.6	.042	20 gauge	Mounts using a non-metallic #4 screw
SPB-109	80 μ HY	2.6	.059	20 gauge	
SPB-110	100 μ HY	2.1	.080	20 gauge	
SPB-111	135 μ HY	2.1	.093	20 gauge	
SPB-112	160 μ HY	1.7	.126	20 gauge	
SPB-113	220 μ HY	1.7	.154	20 gauge	
SPB-114	300 μ HY	1.7	.183	20 gauge	
SPB-115	380 μ HY	1.35	.252	20 gauge	
SPB-116	450 μ HY	1.35	.286	20 gauge	
SPB-117	600 μ HY	1.07	.406	20 gauge	
SPB-118	800 μ HY	1.07	.470	20 gauge	

SPB-200 SERIES (4 μ HY-1.8 MHY)

PART NO.	INDUCTANCE	DC AMPS	NOM DCR	LEAD SIZE	DIMENSIONS
SPB-200	4 μ HY	12.0	.006	14 gauge	A .710 ref.
SPB-201	5 μ HY	10.0	.008	15 gauge	B .866 ref.
SPB-202	20 μ HY	8.5	.013	16 gauge	C .187 ref.
SPB-203	30 μ HY	7.0	.019	17 gauge	D .126 ref.
SPB-204	40 μ HY	5.5	.025	18 gauge	E .6875/.8125
SPB-205	75 μ HY	4.3	.042	19 gauge	F SPB-200 — 207 .625 ref.
SPB-206	120 μ HY	4.3	.053	19 gauge	SPB-208 — 215 .700 ref.
SPB-207	150 μ HY	3.4	.072	20 gauge	
SPB-208	200 μ HY	2.6	.105	20 gauge	Mounts using a non-metallic #4 screw
SPB-209	300 μ HY	2.1	.158	20 gauge	
SPB-210	400 μ HY	2.1	.181	20 gauge	
SPB-211	600 μ HY	1.7	.272	20 gauge	
SPB-212	800 μ HY	1.7	.322	20 gauge	
SPB-213	950 μ HY	1.35	.433	20 gauge	
SPB-214	1.5 MH	1.07	.683	20 gauge	
SPB-215	1.8 MH	1.07	.760	20 gauge	

SPB-300 SERIES (40 μ HY-2.5 MHY)

PART NO.	INDUCTANCE	DC AMPS	NOM DCR	LEAD SIZE	DIMENSIONS
SPB-300	40 μ HY	12.0	.013	14 gauge	A .945 ref.
SPB-301	60 μ HY	10.0	.019	15 gauge	B .946 ref.
SPB-302	80 μ HY	10.0	.022	15 gauge	C .187 ref.
SPB-303	120 μ HY	8.5	.032	16 gauge	D .126 ref.
SPB-304	150 μ HY	8.5	.038	16 gauge	E .6875/.8125
SPB-305	175 μ HY	7.0	.046	17 gauge	F SPB-300 — 313 .775 ref.
SPB-306	200 μ HY	7.0	.049	17 gauge	SPB-314 — 318 .940 ref.
SPB-307	300 μ HY	5.5	.073	18 gauge	
SPB-308	400 μ HY	5.5	.086	18 gauge	Mounts using a non-metallic #4 screw
SPB-309	475 μ HY	4.3	.110	19 gauge	
SPB-310	550 μ HY	4.3	.120	20 gauge	
SPB-311	700 μ HY	3.4	.165	20 gauge	
SPB-312	825 μ HY	3.4	.183	20 gauge	
SPB-313	900 μ HY	3.4	.195	20 gauge	
SPB-314	1.2 MHY	2.6	.281	20 gauge	
SPB-315	1.5 MHY	2.6	.323	20 gauge	
SPB-316	1.7 MHY	2.6	.343	20 gauge	
SPB-317	2.0 MHY	2.1	.440	20 gauge	
SPB-318	2.5 MHY	2.1	.525	20 gauge	

SPB-400 SERIES (100 μ HY-3.0 MHY)

PART NO.	INDUCTANCE	DC AMPS	NOM DCR	LEAD SIZE	DIMENSIONS
SPB-400	100 μ HY	12.0	.022	14 gauge	A 1.380 ref.
SPB-401	150 μ HY	10.0	.034	15 gauge	B .985 ref.
SPB-402	200 μ HY	10.0	.038	15 gauge	D .180-.285
SPB-403	300 μ HY	8.5	.056	16 gauge	E .6875/.8125
SPB-404	375 μ HY	8.5	.065	16 gauge	F 1.14 ref.
SPB-405	450 μ HY	8.5	.070	16 gauge	
SPB-406	500 μ HY	7.0	.089	17 gauge	Mounts using a non-metallic #8 screw
SPB-407	600 μ HY	7.0	.098	17 gauge	
SPB-408	700 μ HY	5.5	.130	18 gauge	
SPB-409	850 μ HY	5.5	.145	18 gauge	
SPB-410	1.0 MHY	5.5	.166	18 gauge	
SPB-411	1.3 MHY	4.3	.218	19 gauge	
SPB-412	1.6 MHY	4.3	.250	20 gauge	
SPB-413	2.0 MHY	3.4	.340	20 gauge	
SPB-414	3.0 MHY	3.4	.433	20 gauge	

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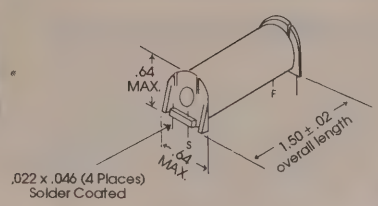
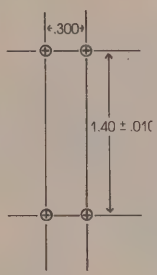
Ferrite Power Inductors

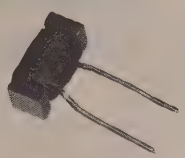
Slug Core PC Mounting

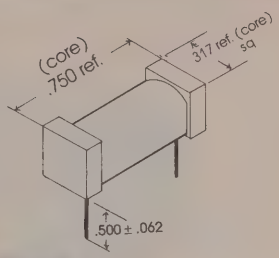


SPS-100 SERIES (110 μ HY-100 mH)			
PART NO.	INDUCTANCE	DC AMPS	NOM DCR
SPS-100	110 μ HY	4.9	.055
SPS-101	140 μ HY	4.3	.075
SPS-102	300 μ HY	3.0	.143
SPS-103	420 μ HY	2.5	.210
SPS-104	600 mH	2.1	.310
SPS-105	1.0 mH	1.6	.500
SPS-106	1.3 mH	1.35	.700
SPS-107	1.9 mH	1.2	.900
SPS-108	3.0 mH	.96	1.40
SPS-109	5.0 mH	.75	2.35
SPS-110	8.0 mH	.59	3.70
SPS-111	10.0 mH	.52	5.20
SPS-112	18.0 mH	.39	8.70
SPS-113	28.0 mH	.31	13.7
SPS-114	45.0 mH	.25	22.0
SPS-115	60.0 mH	.21	31.0
SPS-116	100.0 mH	.16	52.0

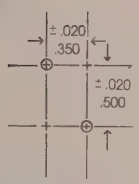


Bobbin Core





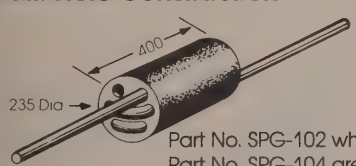
SPS-200 SERIES (1.5 μ HY-1.0 mH)				
PART NO.	INDUCTANCE	DC AMPS	NOM DCR	LEAD SIZE
SPS-200	1.5 μ HY	12.0	.003	.065
SPS-201	2.0 μ HY	10.0	.004	.057
SPS-202	3.0 μ HY	8.5	.005	.051
SPS-203	3.5 μ HY	7.0	.006	.045
SPS-204	4.2 μ HY	5.5	.007	.040
SPS-205	10.0 μ HY	4.3	.011	.036
SPS-206	20.0 μ HY	4.3	.017	.036
SPS-207	28.0 μ HY	3.4	.024	.032
SPS-208	34.0 μ HY	2.6	.031	.032
SPS-209	50.0 μ HY	2.1	.046	.032
SPS-210	100.0 μ HY	2.1	.069	.032
SPS-211	125.0 μ HY	1.7	.090	.032
SPS-212	160.0 μ HY	1.35	.124	.032
SPS-213	250.0 μ HY	1.0	.189	.032
SPS-214	350.0 μ HY	1.0	.235	.032
SPS-215	500.0 μ HY	.85	.392	.032
SPS-216	600.0 μ HY	.67	.453	.032
SPS-217	750.0 μ HY	.53	.641	.032
SPS-218	1.0 mH	.42	.890	.032



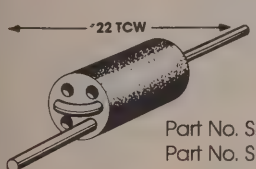
P.C. Board Layout

Wide Band Shield Bead Ferrite Chokes

Multi-Hole Construction



Part No. SPG-102 white
Part No. SPG-104 green



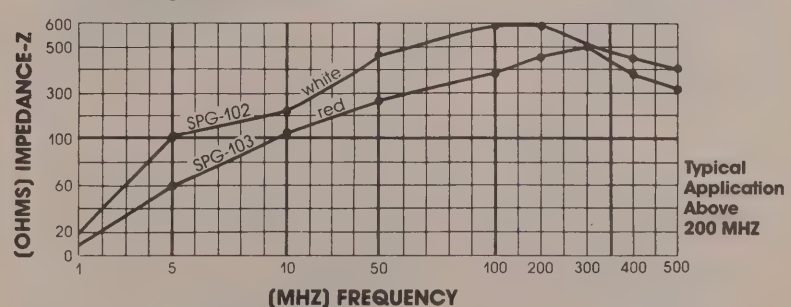
Part No. SPG-103 red
Part No. SPG-105 yellow

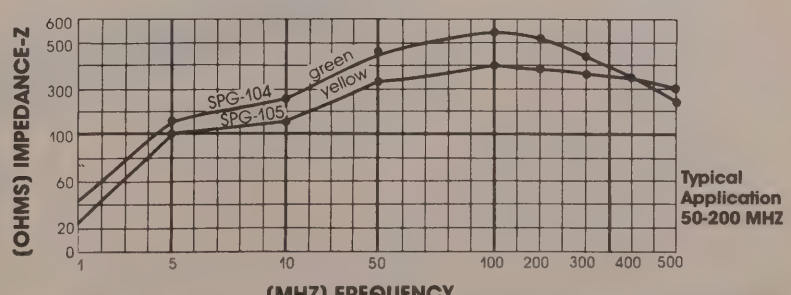
Impedances from 10 to 600 OHMS are available over frequency ranges from 1 MHZ to 500 MHZ

Prem offers a complete line of shield bead chokes for use in attenuating EMI and other unwanted signals in a circuit without contributing to power losses at lower frequencies or DC.

IMPEDANCE versus FREQUENCY

(Typical Readings)





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CRT Display Products

Adjustable Linearity Coil

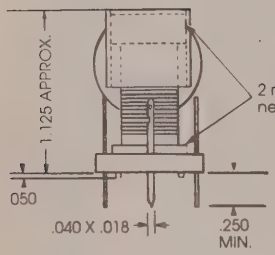
Variability ranges for CRT display terminal applications

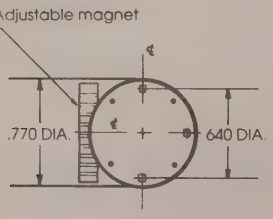
New magnetically-biased linearity coil is fingertip adjustable to compensate for standard manufactured material tolerances and other components. Typical units can be adjusted to cover ranges indicated on graph.

Custom design service available for your specific pc board application.

Typical Space Requirement: .8 diameter by 1.25 high

Meets all Flammability Requirements of U.L. 94V-2 or better

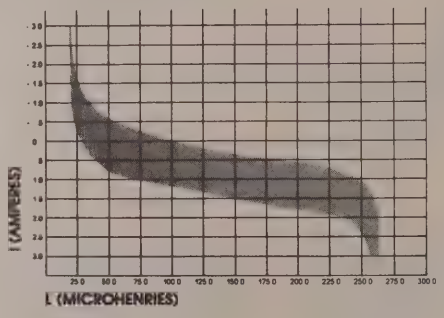




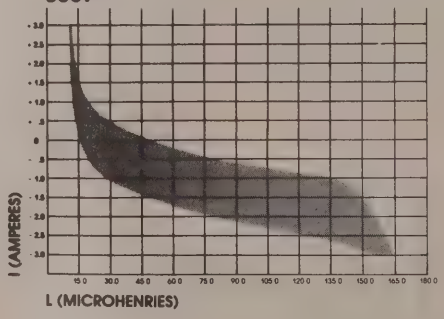
Three .050/.060 holes @ 90° on .640 pin circle

Adjustable Ranges

3508



3509



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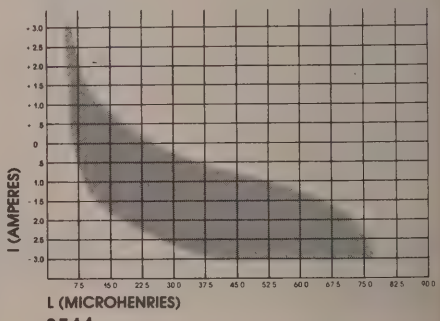

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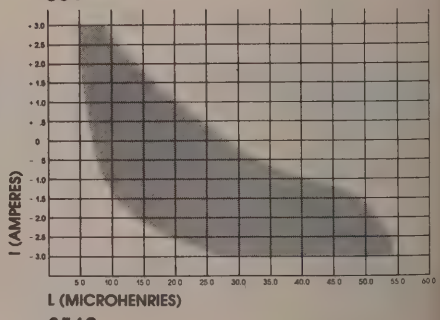

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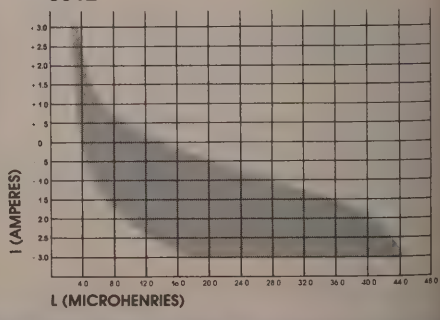

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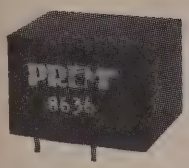
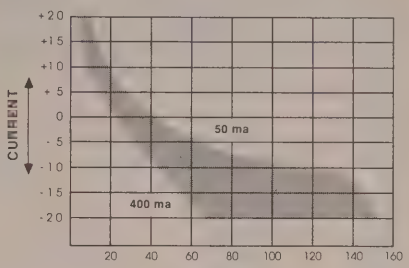
CRT Display Products

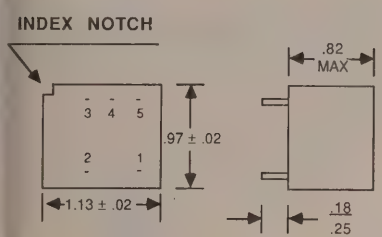


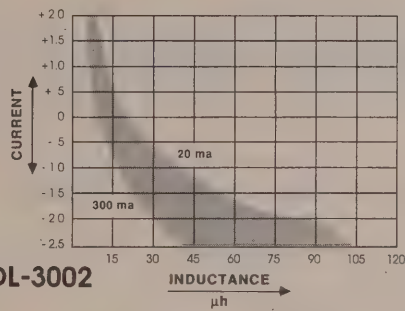
Electronically Adjustable Dynamic Linearity Coils

Specifically designed for multi-scan rate monitors utilizing frequencies to 90kHz

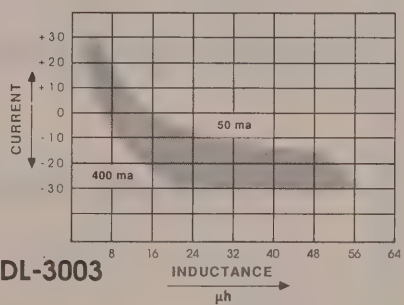


SDL-3001

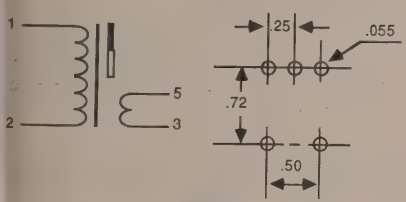




SDL-3002



SDL-3003

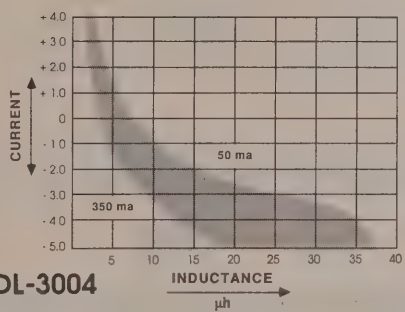


FUNCTION WINDING (TERM 1 & 2)

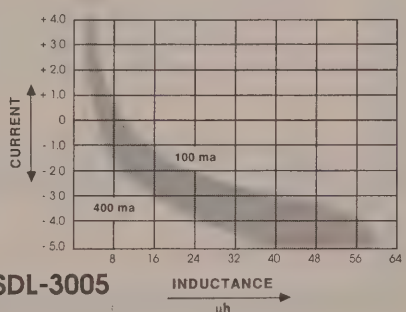
WITH A NEGATIVE CURRENT APPLIED TO TERMINAL #1, INDUCTANCE WILL INCREASE (AS SHOWN BY GRAPHS).

CONTROL WINDING (TERM 3 & 5)

APPLY A POSITIVE DC CURRENT TO TERMINAL #3 FOR BIAS ADJUSTMENT (REQUIRED DC CURRENT — 0 TO 400 MA) DC RESISTANCE ≅ 4.0 OHMS.



SDL-3004



SDL-3005

Custom Designed CRT Display Magnetics

Prem Magnetics custom designs fixed linearity coils, variable linearity coils, pincushion coils, width coils, horizontal drive and oscillator coils for use in CRT display applications. Prem's engineers have vast experience in designing and manufacturing economical magnetic devices for display circuits.

- Pin Cushion Coils
- Width Coils
- Horizontal Driver Transformers
- Variable Linearity Coils
- Horizontal Oscillators
- Dynamic Linearity Coils
- Parabolic Variable Linearity Coils

Custom design service available for your specific application.

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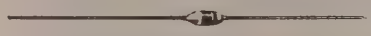
RCD inductors...the low cost of high quality.
Now at prices starting below $.05 each!

Inductor Chokes: 0.05μH to 100mH

AL02–Microminiature!
Ultra-miniature conformal coated inductors are the smallest in the industry, only ⅛" long! 0.1μH to 470μH, 5% and 10% tolerance.



AL03–Low Cost!
Miniature conformal coated inductor choke (¼" long). Available from 0.1μH to 1000μH in 5%, 10%, 20% tolerance.

AL05–Delivery from Stock!
Conformal coated inductors offer performance similar to molded types at half the cost. Available from 0.1μH to 2200μH in 5%, 10%, 20% tolerance. Body size is .135" dia. x .35" long.

P0206–Miniature Molded
Molded construction offers performance per MIL-C-15305 at low cost due to automated production. Available from 0.1μH to 1000μH in 3%, 5%, 10%, 20% tolerance. Body size is .095" dia. x .250" long.

P0410–MIL Grade
Molded inductor per MIL-C-15305 offer excellent stabilty. Available from 0.15μH to 1000μH, in 3%, 5%, 10%, 20% tolerance. Body is .155" dia. x .375" long.

R0608, R0908, R1014–Radial Lead
Radial design enables significant space savings. Available from 1μH to 100mH, 5% and 10%. R0608 is .220" dia. x .300" high, R0908 is .335 x .320, R1014 is .400 x .550.

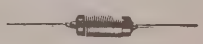
Shielded Inductor Chokes: 0.1μH to 120mH

PFC0410–Economy
Conformal coated construction offers shielded performance equivalent to molded parts at a reduced cost. Wide inductance range from 0.1μH to 10mH, in tolerances of 5%-20%. Body size is .177" dia. x .440".

PF0410–Molded
Molded shielded construction per MIL-C-15305 offers excellent performance, wide inductance range from 0.22μH to 10mH, in tolerances of 5%-20%. Body size is .162" dia. x .410" long.

RS1014–Radial Lead
Shielded inductor in a radial lead version offers significant space savings. Wide inductance range from 10μH to 120mH, in tolerances of 5%-10%. Body size is .400" dia. x .55" high.

High Current Filter Chokes: 1 Amp to 20 Amp



CA–Axial Lead
High-current power chokes are available with 1A-5A ratings, in values 5μH to 680μH, 10% tol. Available with shrink tube insulation.

CH–Radial Lead
High-current power chokes offer space savings in 3A-20A ratings, 5μH to 270μH, 10% tol. Available with shrink tube insulation.

CV–Vertical Mount
High-current power chokes require minimal PCB space due to vertical design. 1A-5A, 5μH to 680μH, 10% tol.

Surface Mount, Shielded and Unshielded: .003μH to 1000μH
(High current SM models available, consult factory)

CI–World's Smallest!
Available in 3 sizes (0603, 0805, 1008), in values .003μH to 10μH, 5% and 10%. Available on Tape & Reel.

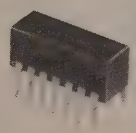
MCI–Molded
Molded chip inductors offer superior performance, 0.1μH to 1000μH, 5%-20%. Available in 1210 or 1812 size.

MSI–Molded Shielded
Shielded chip inductors minimize magnetic coupling, 1μH to 1000μH, 5%-20%. Available in 1210 or 1812 size.

Custom Magnetics

Toroids

Transformers



Lan Networks

Variable RF Coils

Refer to EEM section 2350 for RCD delay lines, and to section 4700 for RCD resistors, networks, and hybrids.

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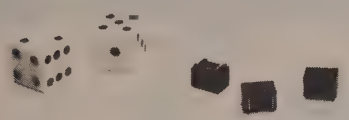
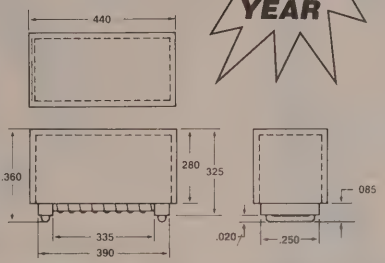
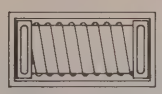
RL1500
Surface Mount Inductors

1994 OUR 39th YEAR





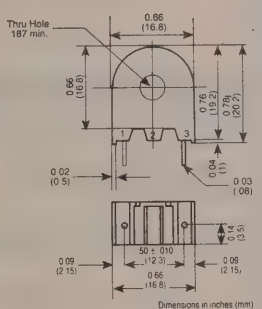
The RL-1500 Series offers over 45 standard high Q inductive values covering a range of 1.0uH to 680uH with rated currents of up to 1.8 Amps AC. They are ideal for surface mount assembly using vapor phase or infrared soldering. This series uses a nonconductive high volume resistivity, low loss ferrite material.



Recommended surface mount pad geometry—.050 x .225—2 places.

INDUCTANCE	Q METER FREQUENCY
1.0uH – 10uH	7.90 MHz
12uH –100uH	2.50 MHz
120uH – 1000uH	790 kHz
1200uH – 6800uH	250 kHz

RL3410/RL3420/RL3430
Current Sensors



FEATURES:

- Molded Aperture for Primary Wire(s)
- Frequency Range Up to 100kHz
- Meets VDE Specifications
- PC Board Mounting

NOTES:

- Maximum operating temperature: 105°C.
- Maximum ratings are with a 1 turn primary and specified secondary terminating resistance.
- Amp/microsecond (A/usec) rating of primary equals Volt/microsecond (V/usec) rating of secondary when the secondary is terminated with its specified resistance. (Note: A/usec is equal to the product of a square wave pulse current, in Amps, multiplied by the current pulse width in microseconds.)
- Inductor scale factor is: Vout = 1 Volt/Amp when the specified terminating resistance is used.

Renco Part No.	Sensing Range (Amps)	Frequecny Response* (kHz)	Secondary Turns	Secondary Inducatnce mH (Min.)	Secondary Inductance Test Voltage @ 15.75kHz	Secondary DCR Ohms (Max.)	Secondary Terminating Resistance Ohms** (Nom.)	Primary Unipolar Amp usec. Rating (Max.)	Primary Bipolar Amp usec. Rating (Max.)	1 Turn Primary Peak Sense Current (Amps)
RL-3410	2-10	5-25	50	5.0	0.5	0.7	50	150	300	20
RL-3420	2-14	5-50	100	20.0	1.0	1.40	100	300	600	20
RL-3430	1-35	1-100	200	80.0	2.0	4.50	200	600	1200	20

RL3435/RL4435
Low Cost Toroids

FEATURES:

- Low cost
- Rugged construction
- Single layer design
- Operating temperature: –55°C to +125°C
- Meets UL 94V0 specifications

ELECTRICAL CHARACTERISTICS AT 25°C

Renco Part # Without Clip Mount Package	REFERENCE OPERATING VALUES			DESIGN CONTROL VALUES					Clip Mount Package	Renco Part # With Clip Mount Package
	Inductance Typical (uH)(1)	Idc (Amps)	ETop (V-uSec)	Inductance No D.C. + 20 (uH) – 12%	DCR (Ohms) Max.	Coil Size Code	Lead Dia. (In. + .003)	Min. Energ Storage (uJ)(2)		
RL-3435-20-2.0	20	2.0	52	32.8	.06	H	.020	40	N/A	N/A
RL-3435-25-2.5	25	2.5	30	20.7	.04	A	.020	75	CM1	RL-4435-25-2.5
RL-3435-50-2.5	50	2.5	50	45.7	.07	B	.020	150	CM2	RL-4435-50-2.5
RL-3435-100-2.5	100	2.5	90	94.1	.10	C	.020	300	CM3	RL-4435-100-2.5
RL-3435-35-2.5	35	2.5	55	28.4	.04	B	.025	110	CM2	RL-4435-35-2.5
RL-3435-70-3.0	70	3.0	85	61.0	.05	C	.025	300	CM3	RL-4435-70-3.0
RL-3435-145-3.0	145	3.0	140	141.8	.08	D	.025	650	CM4	RL-4435-145-3.0
RL-3435-285-3.0	285	3.0	300	264.1	.14	E	.025	1275	CM5	RL-4435-285-3.0
RL-3435-450-3.0	450	3.0	425	436.3	.20	F	.025	2000	N/A	N/A
RL-3435-100-3.5	100	3.5	130	90.7	.04	D	.032	600	CM4	RL-4435-100-3.5
RL-3435-165-4.0	165	4.0	240	152.0	.07	E	.032	1300	CM5	RL-4435-165-4.0
RL-3435-270-4.0	270	4.0	350	263.9	.10	F	.032	2150	N/A	N/A
RL-3435-40-4.0	40	4.0	70	37.9	.03	C	.032	300	CM3	RL-4435-40-4.0
RL-3435-12-5.0	12	5.0	44	20.3	.03	G	.032	150	N/A	N/A
RL-3435-100-5.0	100	5.0	200	90.7	.04	E	.042	1250	CM5	RL-4435-100-5.0
RL-3435-170-5.0	170	5.0	300	159.7	.05	F	.042	2100	N/A	N/A
RL-3435-55-5.0	55	5.0	100	54.9	.02	D	.042	650	CM4	RL-4435-55-55.0
RL-3435-95-7.0	95	7.0	225	96.0	.03	F	.051	2300	N/A	N/A
RL-3435-55-7.0	55	7.0	150	49.1	.02	E	.051	1300	CM5	RL-4435-55-7.0
RL-3435-55-10.0	55	10.0	175	55.9	.02	F	.064	2750	N/A	N/A

1. I_{dc} and ET_{pp} values show point of typical inducatnce. 2. LI^2 rating is the ability of the inductor to store energy.

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Surface Mount Technology

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- Open frame SMT Platforms and encapsulated SMT Modules allow standard and custom Renco chokes, inductors and transformers to be used in surface mount assemblies.
- SMT Modules and SMT Platforms with multiple inductors can be provided.
- Ideal for automated assembly.
- Open frame SMT Platforms can be supplied with conformal or open construction components.
- All terminals including gull wing, J hook, and butt joint available.
- Fully compatible with infrared and vapor phase reflow soldering.
- Flexible SMT Module and SMT Platform configurations.

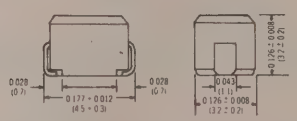
Chipductor Surface Mount Inductors

The RL-2525 CHIPDUCTOR Series offers over thirty-five standard values of miniature inductors that are designed specifically for compact assemblies requiring surface mount components. The RL-2525 can be supplied on reels for automated assemblies or in bulk packaging.

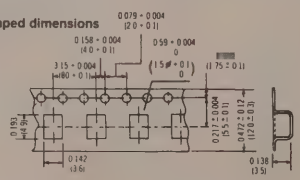
SPECIFICATIONS:
Nominal Inductance: 0.22 to 220.0 uH
Inductive Tolerance: +10% to +20%
Q: 40 to 50 Min.
DC Resistance: 0.10 to 9.8 Ohms
Maximum DC Current: 70 to 710 mA

Operating Temperature: −25°C to +85°C
Standard Packaging: 500 per reel or bulk packaging.

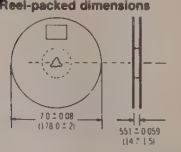
MECHANICAL DIMENSIONS



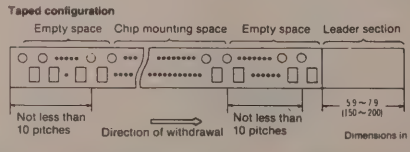
Taped dimensions



Reel-packed dimensions



Taped configuration



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Custom Toroids At Standard Prices

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Due to our high speed winding equipment, use of robotics and high efficiency production techniques Renco Electronics can now offer CUSTOM WOUND TOROID COILS AT STANDARD PRICES.

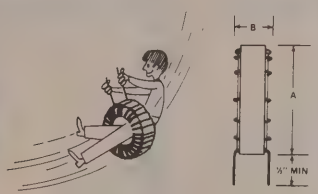
Renco can wind toroids with 8 gauge to 50 gauge wire on any size toroid core made of:
• Ferrite • Powdered Iron • Mollypermalloy • Tape Wound • Steel

Your toroid coils can be supplied any way you want, such as:
• Encapsulated • Epoxy Coated • Hermetically Sealed
• Vacuum Varnish Impregnated • Taped

Swingductor™ RL1386 /RL1518

185 values each version

(unmounted) (mounted, shown)



Designed for applications requiring a known inductance change with changing current loads (as in power supplies). Although similar in appearance to conventional toroids, the special core material allows a "controlled saturation," so that a specific inductance value is repeatable at a specific current. The core material is effective up to 1 MHz. As a result of toroidal design, the Swingductor™ produces a closed magnetic field, resulting in low EMI. All are supplied with pretinned leads for easy PC board installation.

DIM. (IN)	"A" (MAX. DIA.)	"B" (MAX. WIDTH)
RL1386-1	1.10	0.500
RL1386-2	1.45	0.874
RL1386-3	1.80	0.900
RL1386-4	2.00	1.100
RL1386-5	2.60	1.500

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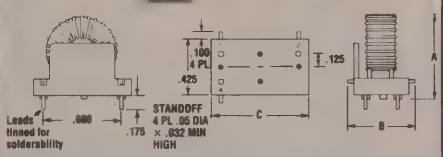
Magnetic Amplifier Toroids RL1661

A rugged series of low cost saturable mag-amp reactors uses low loss material allowing operation from 20kHz to over 100kHz. Simplifies control circuit design in switching power supplies. Increases power density by reducing component requirements. Especially useful in multiple output power supplies where outputs are tightly controlled.

Part Number	Dimensions A Max	B Max	C Max
RL-1661-1	.85 (21.59)	.65 (16.51)	.825 (20.96)
RL-1661-2	1.00 (25.40)	.65 (16.51)	.825 (20.96)
RL-1661-3	1.25 (31.75)	.65 (16.51)	1.150 (29.21)
RL-1661-4	.90 (22.86)	.55 (13.97)	.825 (20.96)
RL-1661-5	1.05 (26.67)	.55 (13.97)	.825 (20.96)
RL-1661-6	1.30 (33.02)	.55 (13.97)	1.150 (29.21)

Dimensions in inches (mm)



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If your specs do not exactly match any of our standards — give us a call and we'll make up a free custom sample in our special prototype and sampling laboratory. So unless you need something exceptionally complex, we'll ship your sample within 10 days.

Gary Dertinger

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Common Mode Chokes RL1328/1329

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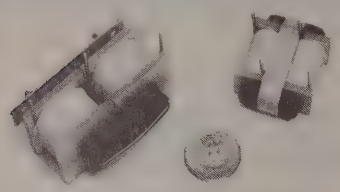
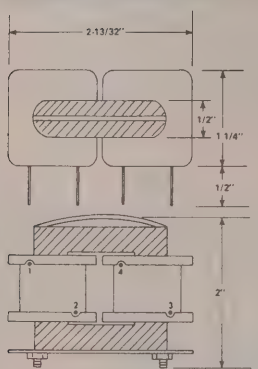
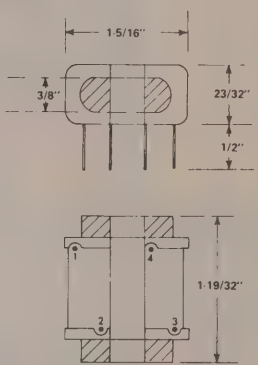


Placed at the inputs of electrical equipment, these chokes help meet U.S. and international requirements for safety and EMI. These low priced Common Mode Chokes are available in a wide range of standard inductances, with current ratings to 35 Amps.



Series RL1328: (120 values)
Inductance: 47.0 to 39000.0 μH
Max DCR: 0.002 to 0.555 Ohms
Max leakage inductance:
4.0 to 3080.0 μH
Max interwinding capacitance:
2.0 to 9.4 pF
Hipot winding to winding and winding to core: 5000 VAC
Suggested rated current:
3 to 35 AC Amps



Series RL1329: (86 values)
Inductance: 6.8 to 22000.0 μH
Max DCR: 0.0028 to 0.555 Ohms
Max leakage inductance:
1.5 to 1430.0 μH
Max interwinding capacitance:
1.0 to 10.7 pF
Hipot winding to winding and winding to core: 5000 VAC
Suggested rated current:
2 to 22 AC Amps

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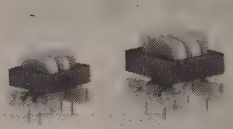
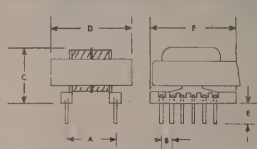
Common Mode Chokes RL1361-1/RL1361-2

Placed at the inputs of electrical equipment, these chokes help meet U.S. and international requirements for safety and EMI. Low-priced, they're available in a wide range of inductances and current ratings from 100mA to 5.5Amps. PC mounting. Low profile. Varnish impregnated. MTL Used Class B 130°C. MIL spec and encapsulation available.

STYLE NUMBER	TYPICAL DIMENSIONS						TERMINAL	
	A	B	C	D	E	F	SIZE	NO.
RL-1361-1	.515	.200	.622	.750	.175	.850	.025 SQ.	8
RL-1361-2	.630	.200	.797	.850	.175	1.100	.025 SQ.	10



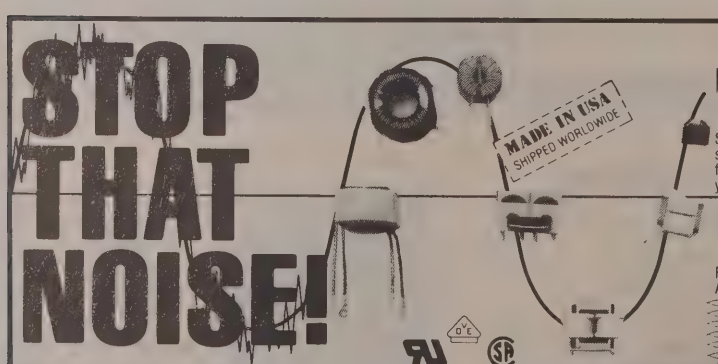
RL1361-1 RL1361-2



UL RECOGNIZED

DVE designs

STOP THAT NOISE!



PRECISELY THE BEST HIGH DENSITY COMMON MODE CHOKES (Standard and Custom)

Stop electrical line noise and EMI! We give you the greatest selection of the smallest size, highest current/volume density Common Mode Chokes. Choose from almost 300 standard catalog models. If our standard models don't meet your needs, we'll make what you need.

Fast delivery!

Our Low Cost Common Mode Chokes feature:

- **Low Leakage**
- **Low Interwinding Capacitance**
- **Low R_{DC}**
- **Balanced to within 1%**
- **High Dielectric Strength**
- **High SRF**

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High Current Filter Inductors RL-2226/2227

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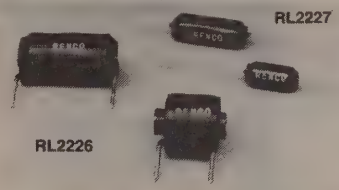
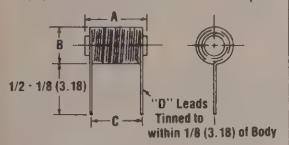
High performance, compact, low cost filter inductors available with radial or axial leads. High current capability makes them suitable for switching power supplies, filter networks, SCR and triac control circuits. Outer windings insulated and protected with PVC sleeve.

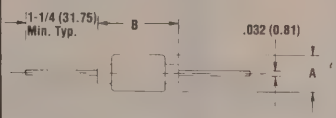


Series RL-2226: (24 values)
Inductance: 5 to 250uH
Max DCR: 0.010 to 0.090 Ohms
Max rated current: 3 to 15 Amps
Incremental current: 3 to 20 Amps



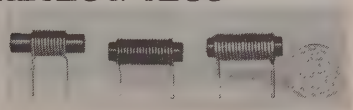
Dimensions RL-2226:
A (Max) 0.875 to 1.625
B (Max) 0.625 to 1.000
C (±.062) 0.500 to 1.125
D (±.005) .042 to .082

Series RL-2227: (20 values)
Inductance: 5 to 1000uH
Max DCR: 0.015 to 0.600 Ohms
Max rated current: 1 to 5 Amps

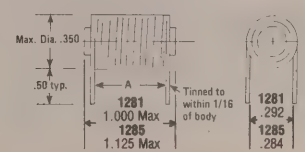


Dimensions RL-2227:
A (Max) .475 to .700
B (Max) .800 to 1.300

Low Cost Chokes RL1281/1285



Heavy duty, general purpose inductors use ferrite cores and offer a wide range of inductance values. Their compact size and pretinned leads make them easy to use in printed circuit boards.



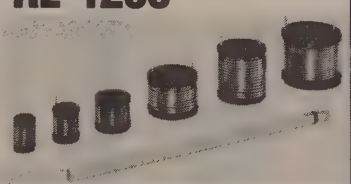
Series RL1281: (23 values)
Max current: 4 Amps
Inductance (±15%)*: 0.22 to 12.50 μH
Max DCR: 0.003 to 0.025 Ohms
Dimension "A": 0.187 to 0.875

Series RL1285: (19 values)
Max current: 6 Amps
Inductance (±15%)*: 0.22 to 10.20 μH
Max DCR: 0.002 to 0.015 Ohms
Dimension "A": 0.125 to 0.883

*Measured at 1 KHz

Power Line Chokes RL-1256

Available in 406 standard values. High saturation flux density material makes these coils ideal wherever high current choke values in a small physical size are needed.



Series RL-1256-1: (34 values)
Inductance: 1.0 to 560.0 μH
Max DCR: 0.003 to 0.696 Ohms
Saturation current: 87.0 to 2.9 DC Amps
Suggested Rated current: 9.0 to 0.8 AC Amps
Dimension "E": 0.406 to 0.550

Series RL-1256-2: (41 values)
Inductance: 1.0 to 2200 μH
Max DCR: 0.003 to 1.54 Ohms
Saturation current: 108.0 to 2.90 DC Amps
Suggested Rated current: 11.4 to 0.8 AC Amps
Dimension "E": 0.590 to 0.671

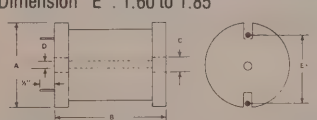
Series RL-1256-3: (45 values)
Inductance: 1.0 to 4700.0 μH
Max DCR: 0.003 to 1.86 Ohms
Saturation current: 116.0 to 1.7 DC Amps
Suggested Rated current: 21.0 to 1.0 AC Amps
Dimension "E": 0.750 to 0.800

Series RL-1256-4: (48 values)
Inductance: 1.8 to 15000.0 μH
Max DCR: 0.002 to 3.39 Ohms
Saturation current: 150.0 to 1.5 DC Amps
Suggested Rated current: 27.0 to 1.3 AC Amps
Dimension "E": 1.11 to 1.87

Series RL-1256-5: (48 values)
Inductance: 1.8 to 15000.0 μH
Max DCR: 0.002 to 2.17 Ohms
Saturation current: 155.0 to 1.5 DC Amps
Suggested Rated current: 35.0 to 2.0 AC Amps
Dimension "E": 1.11 to 1.28

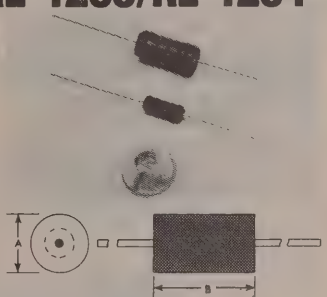
Series RL-1256-6: (49 values)
Inductance: 4.7 to 47000.0 μH
Max DCR: 0.002 to 6.19 Ohms
Saturation current: 149.9 to 1.2 DC Amps
Suggested Rated current: 35.0 to 1.4 AC Amps
Dimension "E": 1.31 to 1.53

Series RL-1256-7: (50 values) NEW SIZE
Inductance: 5.6 to 68000.0 μH
Max DCR: .0018 to 5.220 Ohms
Saturation current: 200.0 to 1.5 DC Amps
Suggested Rated current: 45.0 to 2.0 AC Amps
Dimension "E": 1.60 to 1.85



DIM (IN)	A	B	C	D
RL-1256-1	0.660	0.84	0.195	Clearance
RL-1256-2	0.825	0.84	0.195	Hole For
RL-1256-3	1.1	0.84	0.195	4/40 Screw
RL-1256-4	1.6	1.03	0.290	Clearance
RL-1256-5	1.6	1.45	0.290	Hole For
RL-1256-6	2.0	1.50	0.320	8/32 Screw
RL-1256-7	2.4	1.50	0.425	With Washer

Power Line Chokes RL-1283/RL-1284



Series RL1283: (54 values)
Inductance: 3.9 to 100000.0 μH
Max DCR: 0.007 to 89.7 Ohms
Saturation current: 15.5 to 0.081 DC Amps
Suggested rated current: 4.0 to 0.065 AC Amps

Series RL1284: (45 values)
Inductance: 3.9 to 18000.0 μH
Max DCR: 0.008 to 48.3 Ohms
Saturation current: 7.3 to 0.091 DC Amps
Suggested rated current: 1.28 to 0.039 AC Amps

DIM. **RL-1283 (A)** 0.453 max. **(B)** 0.900 max
(IN) **RL-1284 (A)** 0.260 max. **(B)** 0.650 max

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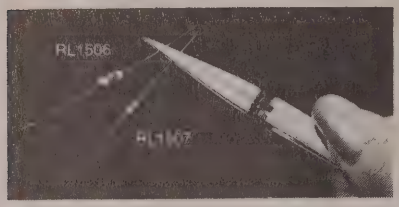
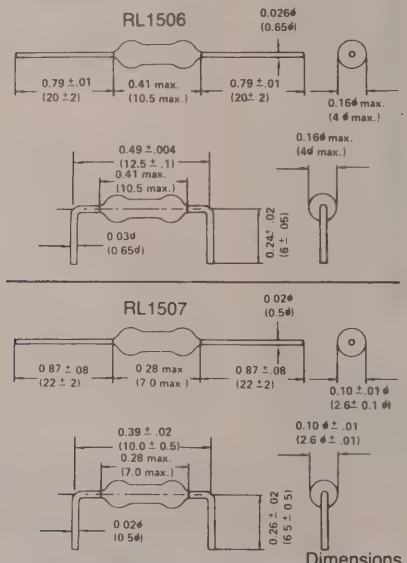
Mini Inductor RL1506
Sub Mini Inductor RL1507

1994 OUR 39th YEAR



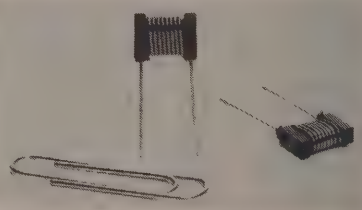
These rugged coils exhibit high Q and very low distributed capacity, all concentrated into an amazingly small package. Ideal where weight, space, Hi Q, and auto insertion are involved. Temperature range −25° to +85°C. Coils identified with industry standard color code.

OUTER DIMENSIONS Dimensions of Single Product
Temperature Range: −25°C to +85°C



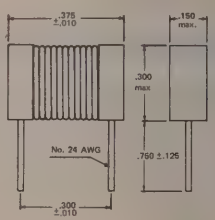
Dimensions in inches (mm)

Flat Coils RL1160 (45 values)

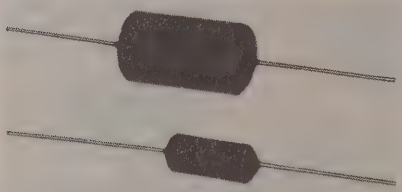


Unique flat coil configuration ideally suited to high density PCBs. Twice the inductance and Q values than axial lead inductors occupying the same space. Wide range of inductance and Q values for use at radio as well as audio frequencies.

Inductance:
1.0 to 4700.0 μH
Frequency:
7.9 MHz to 250.0 KHz
Min Q: 37.0 to 63.0
Max DCR:
0.010 to 29.9 Ohms
Saturation current:
7.0 to 0.11 DC Amps
Suggested rated current: 2.25 to 0.027 AC Amps



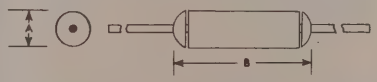
Shielded Inductors RL1123/RL1124



Low cost, miniature shielded coils, extremely useful in compact audio filters, tone control circuits, amplifiers, and wherever high inductance coils are needed. Excellent, low cost alternatives to fixed pot cores.

Series RL1123: (96 values)
Inductance: 1.0 μH to 47.0 H
Max DCR: 0.0066 to 5170.0 Ohms
Suggested rated current: 1.5 to 0.0054 AC Amps

Series RL1124: (80 values)
Inductance: 1.0 μH to 4.7 H
Max DCR: 0.011 to 1700.0 Ohms
Suggested rated current: 0.707 to 0.0054 AC Amps



		RL1123	RL1124
DIM. (IN)	A	.500 max.	.260 max.
	B	.950 max.	.700 max.

WEIGHT: RL1123 . . . 15 gm max. approx
RL1124 . . . 5 gm max. approx.
LEADS: No. 20 tinned copper 1-1/4" long min.

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Making custom coils is not just an accommodation for an occasional customer. Custom coils have always been a major part of Renco's business. We have over 35 years experience in making custom designed inductors and transformers.

As for pot core assemblies, we've manufactured millions since 1955, and are thoroughly experienced with all standard cores and hardware, including Ferroxcube, Siemens, TDK, Magnetics Inc., Indiana General, etc. We stock all the popular bobbins, including printed circuit types.

Let us assist you in your upcoming designs. Our fully independent sample and prototype department can usually ship a prototype within 10 days.

Send us your specifications and designs for your pot cores, coils, inductors, or transformers, and we'll respond promptly with very competitive prices. We have a reputation for keeping our delivery promises.

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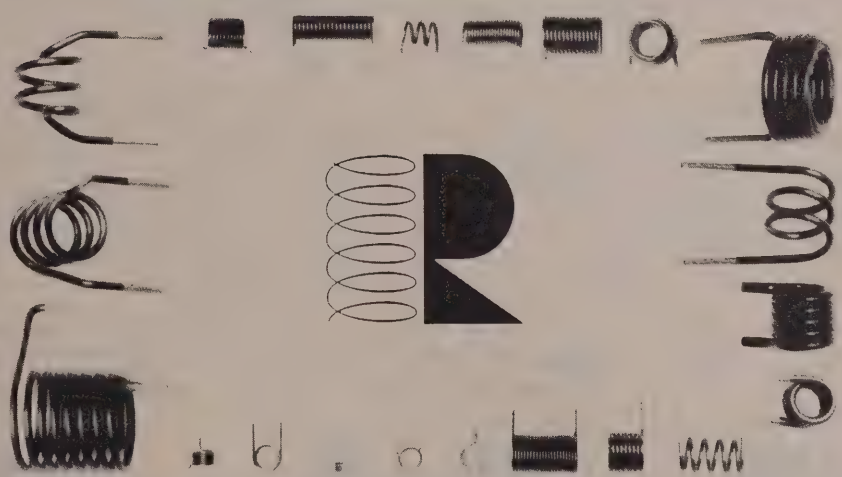
Air Core Inductors



Low cost, self-supporting, air core inductors for use in a wide range of high frequency application wound to your specifications.

APPLICATIONS

- Satellite Communication Systems
- Microwave Equipment
- Television Circuits
- AM/FM Radio Receivers/Transmitters
- Test Equipment
- Band Pass Filters

SPECIFICATIONS

- Frequency: Up to 1000 MHz
- Current: Up to 50 Amps*
- Operating Temperatures: Up to 220°C

MECHANICAL

- Windings: Clockwise
  Counter Clockwise
  Variable Pitch and Length
- Wire Gauge: #8 to #32
- Leads: Pretinned
  Formed Leads
  Terminals*
- Coil Length: To Customer Specification

*Depending on wire gauge.

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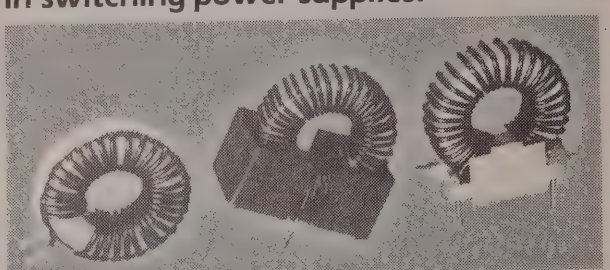
Inductors for Power Supply and EMI/RFI Filter Applications

"CI" Inductors are designed primarily for applications such as energy storage in switching power supplies.



Typical DC Resistance in Ohms

	Current Rating in Amps				
	.5	1	2	3	5
CIE Series	.05 - .12	.02 - .08	.01 - .02	.002 - .005	.001 - .002
CIL Series	.09 - .23	.04 - .10	.02 - .04	.006 - .010	.001 - .004
CIR Series	.22 - .73	.12 - .22	.04 - .08	.02 - .03	.006 - .012
CIT Series	.50 - .92	.18 - .32	.10 - .12	.05 - .06	.015 - .031

Build Your Own Standard Part Number

To build your own part number, specify the series, inductance, current rating and case style. To optimize the inductance, size and current carrying capability, choose your part number from within the range of part numbers on the graphs below.

Example: CIL 35 U E U

- CIL — Series
- 35 — Inductance (a point is represented as 'R')
- U — Inductance Unit: U = Micro Henry, M = Milli Henry
- E — Current Rating: C = .5 amp, D = 1 amp, E = 2 amps, F = 3 amps, G = 5 amps
- U — Case Style (See options below)

Lead Diameter Dimensions			
Current Rating	Style U & K	Style T Series CIL, CIR & CIT	Style T Series CIE
.5	.020	.050	.040
1	.025	.050	.040
2	.032	.050	.040
3	.040	.050	.040
5	.050	.050	.050

CIE Series

Induct. in µH	Current Rating in Amps				
	.5	1	2	3	5
1	*	*	*	CIE1UFX	CIE1UGX
2	*	*	*	CIE2UFX	CIE2UGX
6	*	*	CIE6UEX	CIE6UFX	**
20	*	CIE20UDX	CIE20UEX	**	**
40	CIE40UCX	CIE40UDX	CIE40UEX	**	**
80	CIE80UCX	CIE80UDX	**	**	**
150	CIE150UCX	**	**	**	**

*Call factory **See CIL series

CIL Series

Induct. in µH	Current Rating in Amps				
	.5	1	2	3	5
2	*	*	*	*	CIL2UGX
8	*	*	*	CIL8UFX	CIL8UGX
20	*	*	CIL20UEX	CIL20UFX	**
50	*	CIL50UDX	CIL50UEX	**	**
100	CIL100UCX	CIL100UDX	CIL100UEX	**	**
300	CIL300UCX	CIL300UDX	**	**	**
500	CIL500UCX	**	**	**	**

*See CIE series **See CIR series

CIR Series

Induct.	Current Rating in Amps				
	.5	1	2	3	5
15µH	*	*	*	*	CIR15UGX
50µH	*	*	*	CIR50UFX	CIR50UGX
100µH	*	*	CIR100UEX	CIR100UFX	**
300µH	*	CIR300UDX	CIR300UEX	**	**
500µH	CIR500UCX	CIR500UDX	CIR500UEX	**	**
4.7mH	CIR4R7MCX	**	**	**	**

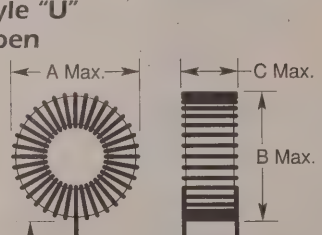
*See CIL series **See CIT series

CIT Series

Induct.	Current Rating in Amps				
	.5	1	2	3	5
50µH	*	*	*	*	CIT50UGX
200µH	*	*	*	CIT200UFX	CIT200UGX
350µH	*	*	CIT350UEX	CIT350UFX	**
1mH	*	CIT1MDX	CIT1MEX	**	**
1.5mH	*	CIT1R5MDX	**	**	**
5mH	CIT5MCX	**	**	**	**

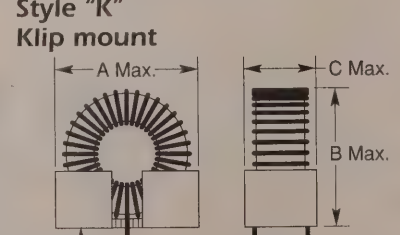
*See CIR series **Call factory

Style "U" Open



Size	CIE	CIL	CIR	CIT
A	.650	.900	1.500	1.800
B	.650	.900	1.500	1.800
C	.325	.425	.625	.750
D	.187	.187	.187	.187
E	.250	.300	.600	.750

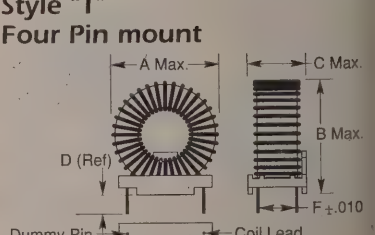
Style "K" Klip mount



Size	CIE	CIL	CIR
A	.687	.900	1.500
B	.700	.950	1.550
C	.500	.500	.750
D	.187	.187	.187
E	.300	.300	.500

Style K not available for 5 amp or CIT coils

Style "T" Four Pin mount



Size	CIE	CIL	CIR	CIT
A	.765	.900	1.500	1.750
B	.825	1.075	1.560	1.860
C	.440	.650	.650	.850
D	.187	.187	.187	.187
E	.600	.800	.800	.900
F	.250	.400	.400	.600

Note: Inductance tolerance is ± 20%; Dimensions are in inches.

Custom inductors and transformers are standard at Standex Electron
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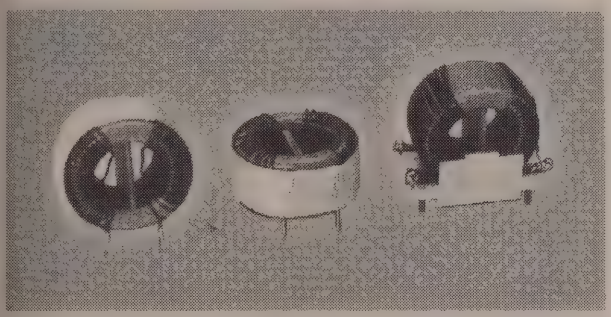
Common Mode Chokes for EMI/RFI Filter Applications

"CM" Chokes are designed primarily for Common Mode noise on A.C. lines.



Typical DC Resistance in Ohms

	Current Rating in Amps				
	.5	1	3	5	10
CME Series	.030 - .049	.012 - .039	.006 - .014	.004 - .006	.003
CMM Series	032 - .070	.012 - .047	.007 - 015	.005 - .009	.003
CMP Series	.090 - .110	.040	.016 - .026	.007 - .010	.005
CMT Series	.100 - .140	060 - .090	.030 - .050	.010 - .020	.010

Build Your Own Standard Part Number

To build your own part number, specify the series, inductance, current rating and case style. To optimize the inductance, size and current carrying capability, choose your part number from within the range of part numbers on the graphs below.

Example: CMM 400 U F U

- CMM — Series
- 400 — Inductance (a 'point' is represented as 'R')
- U — Inductance Unit: U = Micro Henry, M = Milli Henry
- F — Current Rating: B = .25 amp, C = .5 amp, D = 1 amp, F = 3 amps, G = 5 amps, H = 10 amps
- U — Case Style (See options below)

Lead Diameter Dimensions				
Current Rating	Style U & H Series CMM, CMP & CMT	Style U & H Series CME	Style T Series CME & CMM	Style T Series CMP & CMT
.25	.016	–	–	.050
.5	020	016	040	050
1	.025	.025	.040	.050
3	032	025	.040	.050
5	.040	.032	.040	.050
10	.050	.040	.040/.050	.050

CME Series

Induct. (Per Winding)	Current Rating in Amps				
	.5	1	3	5	10
100µH	*	*	CME100UFX	CME100UGX	CME100UHX
220µH	*	*	CME220UFX	CME220UGX	**
330µH	*	CME330UDX	CME330UFX	**	**
470µH	CME470UCX	CME470UDX	CME470UFX	**	**
680µH	CME680UCX	CME680UDX	**	**	**
1mh	CME1MCX	CME1MDX	**	**	**

*Call factory **See CMM series

CMM Series

Induct. (Per Winding)	Current Rating in Amps				
	.5	1	3	5	10
250µH	*	CMM250UDX	CMM250UFX	CMM250UGX	CMM250UHX
500µH	*	CMM500UDX	CMM500UFX	CMM500UGX	**
750µH	CMM750UCX	CMM750UDX	CMM750UFX	CMM750UGX	**
1mH	CMM1MCX	CMM1MDX	CMM1MFX	**	**
2.5mH	CMM2R5MCX	CMM2R5MDX	**	**	**
3.6mH	CMM3R6MCX	**	**	**	**

*See CME series **See CMP series

CMP Series

Induct. (Per Winding)	Current Rating in Amps					
	.25	.5	1	3	5	10
500µH	*	*	*	*	CMP500UGX	CMP500UHX
1mh	*	*	*	CMP1MFX	CMP1MGX	**
2.5mH	*	*	CMP2R5MDX	CMP2R5MFX	**	**
5mH	CMP5MBX	CMP5MCX	**	**	**	**
7.5mH	CMP7R5MBX	CMP7R5MCX	**	**	**	**
10mH	CMP10MBX	**	**	**	**	**

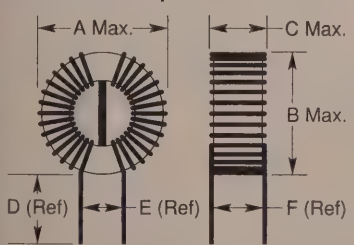
*See CMM series **See CMT series

CMT Series

Induct. (Per Winding)	Current Rating in Amps					
	.25	.5	1	3	5	10
1mh	*	*	*	*	CMT1MGX	CMT1MHX
2.5mH	*	*	*	CMT2R5MFX	CMT2R5MGX	CMT2R5MHX
5mH	*	CMT5MCX	CMT5MDX	CMT5MFX	**	**
7.5mH	*	CMT7R5MCX	CMT7R5MDX	CMT7R5MFX	**	**
10mH	CMT10MBX	CMT10MCX	CMT10MDX	**	**	**
25mH	CMT25MBX	**	**	**	**	**

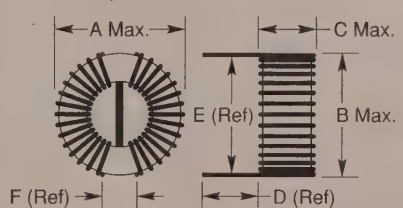
*See CMP series **Call factory

Style "U" Open (Vertical P.C. Board Mount)



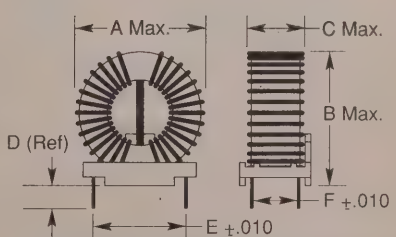
Size	CME	CMM	CMP	CMT
A	700	1.100	1 500	1.750
B	700	1.100	1.500	1.750
C	.400	.450	.675	.700
D	187	.187	187	.187
E	300	.360	.400	.400
F	.400	.400	.600	.600

Style "H" Open (Horizontal P.C. Board Mount)



Size	CME	CMM	CMP	CMT
A	700	1.100	1.500	1.750
B	700	1 100	1.500	1 750
C	.400	.450	.675	.700
D	.187	.187	187	.187
E	.600	1.000	1.000	1.600
F	.300	.300	.400	.400

Style "T" Four Pin Mount with Header



Size	CME	CMM	CMP	CMT
A	765	1 100	1 500	1 750
B	875	1 275	1 560	1 800
C	440	440	.650	850
D	.187	.187	187	187
E	.600	.600	800	900
F	.250	.250	.400	600

Note: Inductance tolerance is ± 20%; Dimensions are in inches

Custom inductors and transformers are standard at Standex Electronics. Please call or write with any questions or requirement you may have.

Standex Electronics

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Standex Fixed Inductors

Series 166 & 168 Surface Mount Inductors

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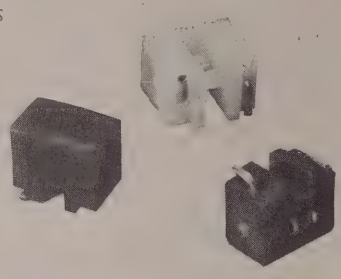
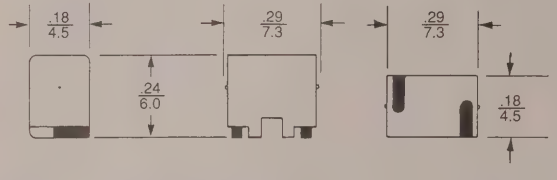
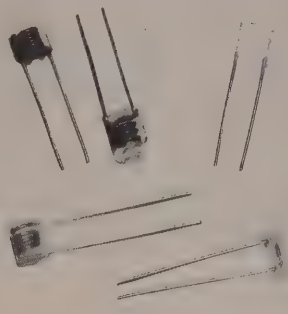
- Higher "Q" than other surface mount Inductors
- Very tight inductance tolerances
- May be packaged "Tape & Reel" or bulk
- Samples available "Off the Shelf"

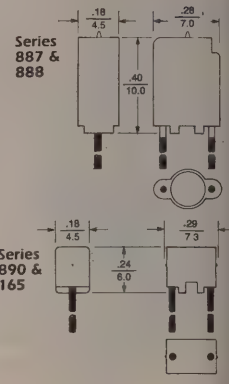




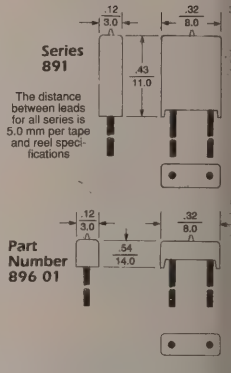
Series	Inductance Range	Q	Test Freq
166	9nH to 13nH (4 values)	155-170	270
168	16nH to 84nH (6 values)	105-130	100 to 150 MHz

Series 887, 888, 890, 891 & 896 Supplied "Tape and Reel" or "Fan Fold" for Automatic Insertion





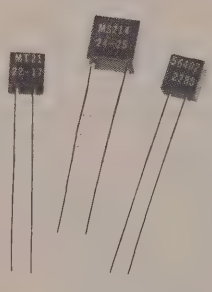
Series	Inductance Range	Q	Test Freq
887	15nH to 115nH (10 values)	100 to 105	100 to 150 MHz
888	15nH to 35nH (4 values)	100 to 115	100 to 150 MHz
165	9nH to 13nH (4 values)	155 to 170	270 MHz
890	16nH to 84nH (6 values)	105 to 130	100 to 150 MHz
891	9.5nH to 17.1nH (8 values)	155 to 180	270 MHz
896	P.C. Board Jumper		

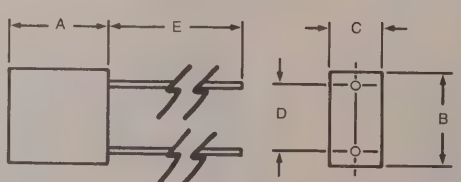


Series MT Toroidal Inductors Ref. Mil. Spec. Series MS21422, MS21423 & MS21424

	MT2122 &23	MT2124
A	.215/5.46	.285/7.24
B	.20/5.1	.27/6.9
C	.10/2.5	.15/3.8
D	.10/2.5	.20/5.1
E	1.0/25.4	1.0/25.4
Leads	#24	#22

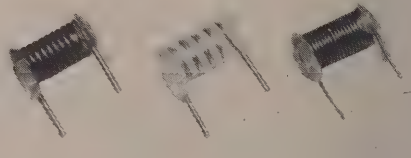
inches/millimeters

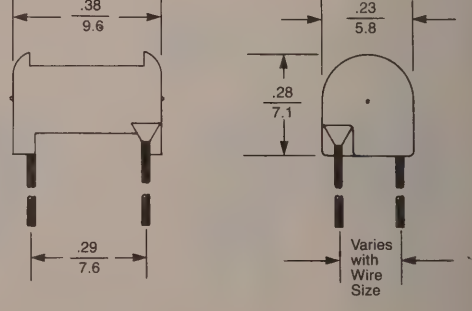




Series	Inductance Range	Q	Max Current
MT2123	.01µH to 1.0µH (25 values)	60 to 80	700 to 3000mA
MT2122	.10µH to 10µH (25 values)	55 to 70	280 to 2200 mA
MT2124	10µH to 1000µH (25 values)	45 to 80	110 to 550 mA

Series LM2





Inductance Range		Q	
No Core	With Core	No Core	With Core
.026µH to .660µH ±5% (26 valves)	.69µH to 1.74µH ±10% (9 values)	80 to 100	40 to 55

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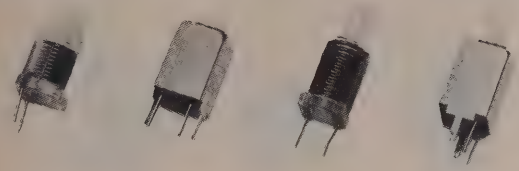
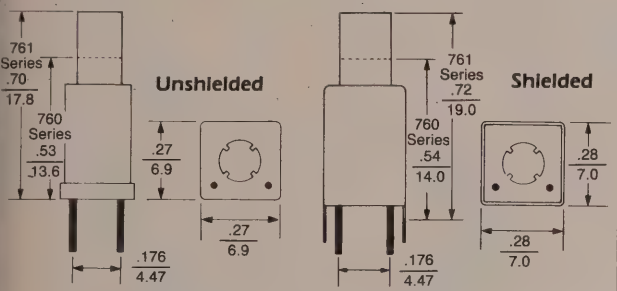
Standex 7mm & 10mm Molded Variable Inductors

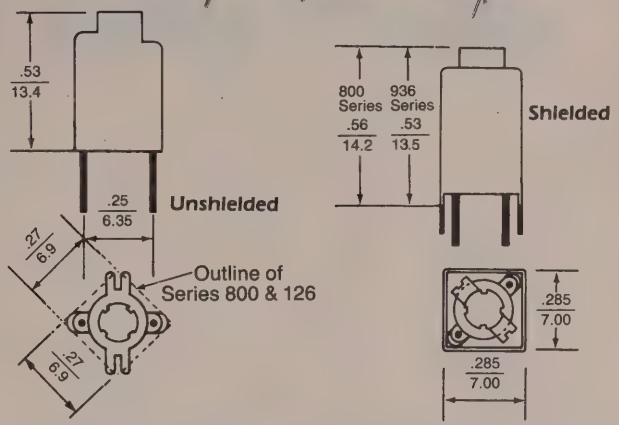
Series 760 and 761 — 7mm Coils





Series	Unshielded Inductance Range	Unshielded Q	Shielded Inductance Range	Shielded Q	Core
760	.064µH to .874µH	70 to 93	.059µH to .433µH	54 to 74	6-32
761	.062µH to .414µH	108 to 128	.056µH to .209µH	66 to 75	6-32

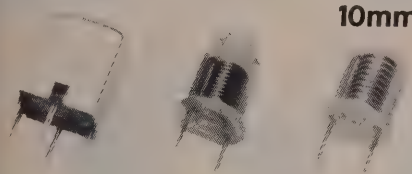
Series 800, 936 and 126 — 7mm Coils

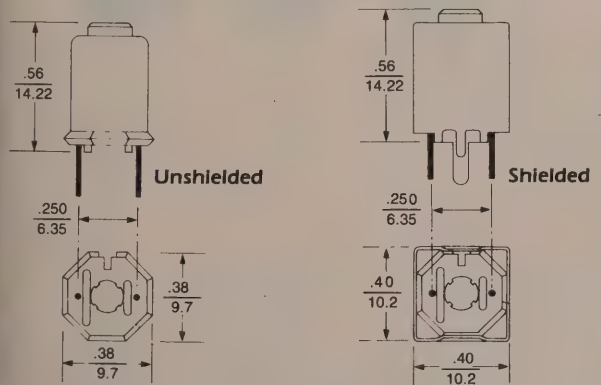


Series	Unshielded Inductance Range	Unshielded Q	Shielded Inductance Range	Shielded Q	Core
800	.069µH to .70µH	86 to 106	.063µH to .385µH	61 to 73	6-32
936 & 126	.051µH to .400µH	97 to 132	.048µH to .207µH	69 to 77	6-32

Series 936 & 126 are tapable

Series 925 and 926 — 7mm Coils with 10mm Shield Cans

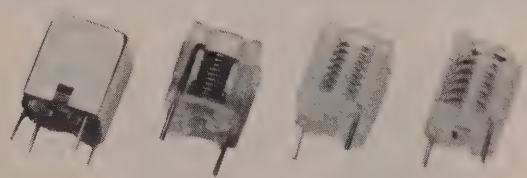


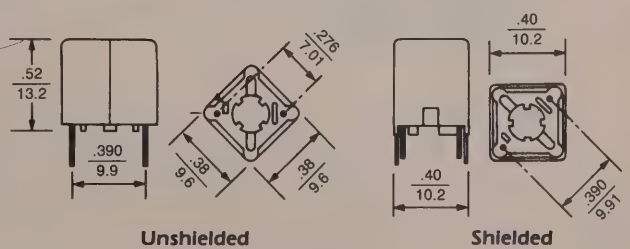


Series	Unshielded Inductance Range	Unshielded Q	Shielded Inductance Range	Shielded Q	Core
925	.069µH to .920µH	77 to 100	.067µH to .700µH	68 to 90	6-32
926	.052µH to .440µH	98 to 132	.051µH to .334µH	90 to 110	6-32

Series 926 is tapable

Series 957, 956 and 910 — 10mm Coils





Series	Unshielded Inductance Range	Unshielded Q	Shielded Inductance Range	Shielded Q	Core
910	.057µH to .268µH	111 to 158	.053µH to .172µH	86 to 101	10-32
956	.059µH to .380µH	107 to 159	.055µH to .234µH	87 to 102	10-32
957	.086µH to .885µH	97 to 123	.077µH to .501µH	68 to 90	10-32

Series 910 is tapable

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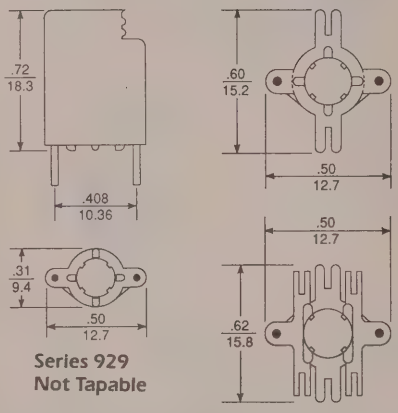
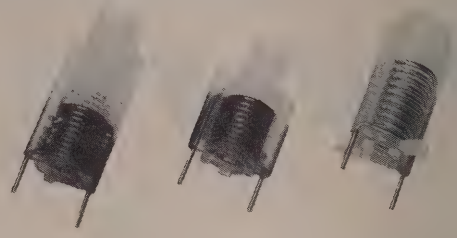
Standex Molded Variable Inductors

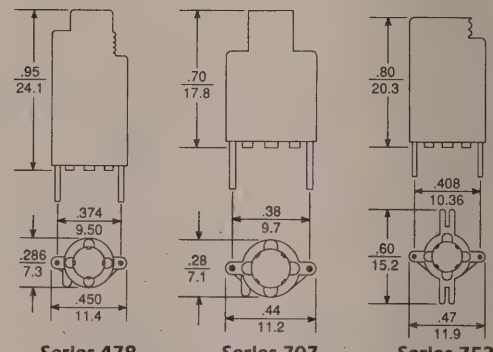
Series 928, 929, & 138



Inductance Range	Q	Core
.043µH to .419µH	90 to 160	10-32

Series 478, 707 & 752

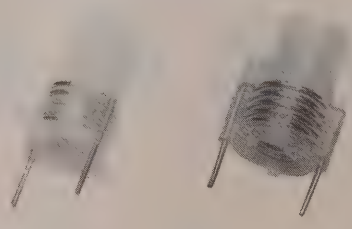


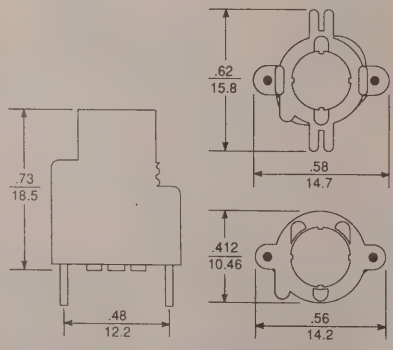


Series	Inductance Range	Q	Core
478	.38µH to 1.94µH	75 to 166	10-32
707	.042µH to 1.0µH	84 to 137	10-32
752	.042µH to .86µH	86 to 163	10-32

Series 752 is tapable

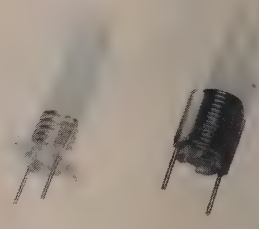
Series 308, 932, 408 & 933

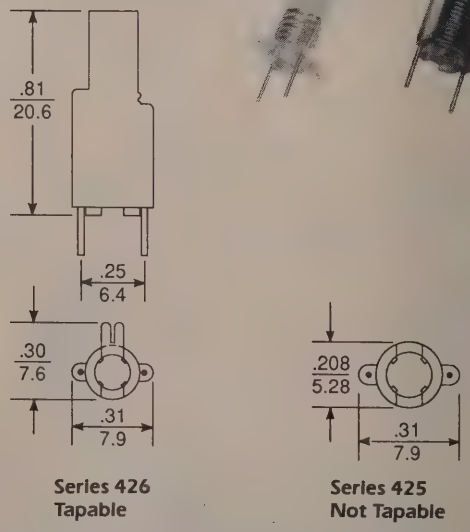




Series	Inductance Range	Q	Core
308 & 408	.046µH to .480µH	113 to 214	10-32
932 & 933	.045µH to .610µH	108 to 217	1/4" x 28

Series 426 & 425





Series	Inductance Range	Q	Core
425	.054µH to 1.18µH	71 to 119	6-32
426	.0216µH to .4568µH	62 to 190	6-32

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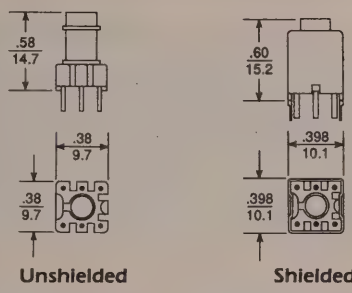
Standex Variable Inductors

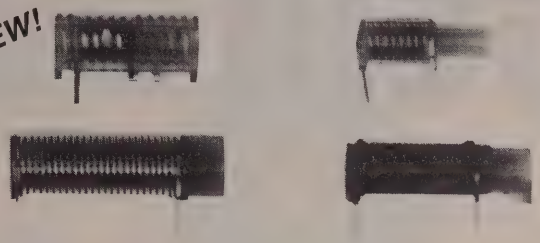
Series 950



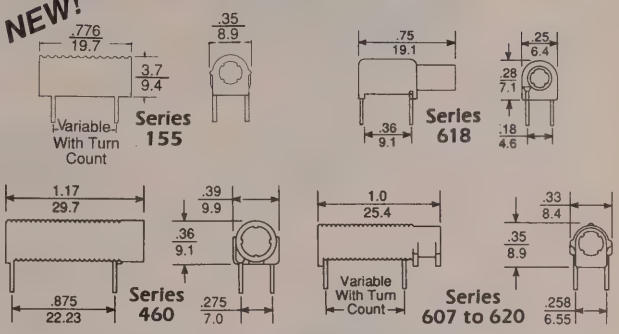
Unshielded		Shielded		
Inductance Range	Q	Inductance Range	Q	Core
1.12µH to 7.40µH	63 to 71	.97µH to 5.75µH	45 to 54	10-32

Series 618, 607 to 620, 460, and 155

NEW!

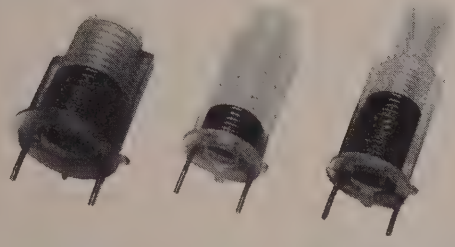


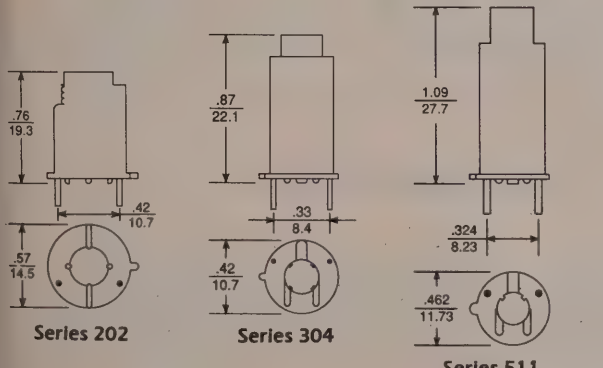
NEW!



Series	Inductance Range	Q	Core
618	.023µH to .991µH	51 to 180	6-32
607-620	.138µH to 1.475µH	135 to 183	10-32
460	1.52µH to 3.45µH	95 to 125	¼ x 28
155	.043µH to .194µH	94 to 140	10-32

Series 202, 304, & 511



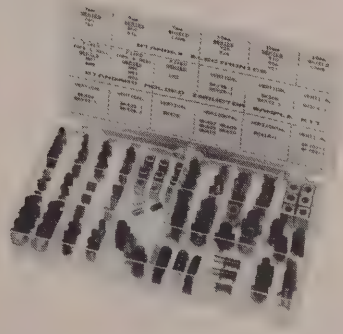


Series	Inductance Range	Q	Core
202	.050µH to 1.46µH	70 to 195	¼ x 28
304	.080µH to 1.60µH	80 to 180	10-32
511	.080µH to 1.80µH	80 to 180	10-32

Sample Kits

For Molded Fixed & Variable RF Coils

$49.00 each



"Standard" kit (pictured) contains a few pieces of most series offered in Standex's catalog of inductors. Approximately 80 coils total.

"7mm" kit contains 3 pieces each of most turn counts of series 760, 761, 800, and 936. Approximately 75 coils total.

"10mm" kit contains 3 pieces each of most turn counts of series 910, 956, and 957. Approximately 75 coils total.

"LM2" kit contains 3 pieces each of series LM2 coils turn count 1½ through 20½. Approximately 60 coils total.

"Tape & Reel" kit contains 5 pieces each of most turn counts available of series 887, 888, 890, 891, & 896. Approximately 145 coils total.

Call, fax or write us for any samples, standard or custom sample kits that you may require.

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eem MINIGLOSSARY

BASIC ASCII CODE

				b7	0	0	0	0	1	1	1	1
				b6	0	0	1	1	0	0	1	1
				b5	0	1	0	1	0	1	0	1
b4	b3	b2	b1		0	1	2	3	4	5	6	7
0	0	0	0	0	NUL	DLE	SP	0	@	P	`	p
0	0	0	1	1	SOH	DC1	!	1	A	Q	a	q
0	0	1	0	2	STX	DC2	"	2	B	R	b	r
0	0	1	1	3	ETX	DC3	#	3	C	S	c	s
0	1	0	0	4	EOT	DC4	$	4	D	T	d	t
0	1	0	1	5	ENQ	NAK	%	5	E	U	e	u
0	1	1	0	6	ACK	SYN	&	6	F	V	f	v
0	1	1	1	7	BEL	ETB	'	7	G	W	g	w
1	0	0	0	8	BS	CAN	(	8	H	X	h	x
1	0	0	1	9	HT	EM	)	9	I	Y	i	y
1	0	1	0	10	LF	SUB	*	:	J	Z	j	z
1	0	1	1	11	VT	ESC	+	;	K	[	k	{
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1	1	0	1	13	CR	GS	-	=	M	]	m	}
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Control Character Representations

NUL	Null
SOH	Start of Heading (CC)
STX	Start of Text (CC)
ETX	End of Text (CC)
EOT	End of Transmission (CC)
ENQ	Enquiry (CC)
ACK	Acknowledge (CC)
BEL	Bell
BS	Backspace (FE)
HT	Horizontal Tabulation (FE)
LF	Line Feed (FE)
VT	Vertical Tabulation (FE)
FF	Form Feed (FE)
CR	Carriage Return (FE)
SO	Shift Out
SI	Shift In
DLE	Data Link Escape (CC)
DC1	Device Control 1
DC2	Device Control 2
DC3	Device Control 3
DC4	Device Control 4
NAK	Negative Acknowledge (CC)
SYN	Synchronous Idle (CC)
ETB	End of Transmission Block (CC)
CAN	Cancel
EM	End of Medium
SUB	Substitute
ESC	Escape
FS	File Separator (IS)
GS	Group Separator (IS)
RS	Record Separator (IS)
US	Unit Separator (IS)
DEL	Delete

(CC) Communication Control
(FE) Format Effector
(IS) Information Separator

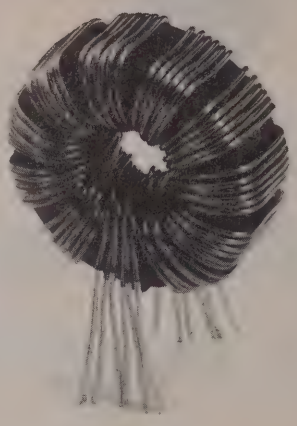
Special Graphic Characters

SP	Space
!	Exclamation Point
|	Logical OR
"	Quotation Marks
#	Number Sign
$	Dollar Sign
%	Percent
&	Ampersand
'	Apostrophe
(	Opening Parenthesis
)	Closing Parenthesis
*	Asterisk
+	Plus
,	Comma
-	Hyphen (Minus)
.	Period (Decimal Point)
/	Slant
:	Colon
;	Semicolon
<	Less Than
=	Equals
>	Greater Than
?	Question Mark
@	Commercial At
[	Opening Bracket
\	Reverse Slant
]	Closing Bracket
^	Circumflex
¬	Logical NOT
_	Underline
`	Grave Accent
{	Opening Brace
¦	Vertical Line (This graphic is stylized to distinguish it from Logical OR)
}	Closing Brace
~	Tilde

TAMURA INDUCTORS FOR SWITCH-MODE POWER REGULATOR. CONTROL & ENERGY STORAGE CIRCUITS.

LINEAR INDUCTANCE TO 300kHz. SMOOTHING AND ENERGY STORAGE COILS

MODEL NO.	AMPS DC	"L" µH @ 20kHz		DCR (Ω)	DIMENSIONS (mm)			PRICE (qty)		
		RATED DC	0 DC		OD	HT	DIA	1-9	10-24	25-99
RS1-1	2	150	215	0.010	24	14	0.6	$7.00	$6.30	$5.90
RS1-2	3	100	160	0.060	24	14	0.8	7.10	6.40	6.00
RS1-3	5	30	45	0.025	24	14	1.0	6.20	5.60	5.30
RS2-1	3	200	325	0.105	29	15	0.8	10.20	9.20	8.70
RS2-2	5	100	190	0.055	29	15	1.0	9.50	8.60	8.10
RS2-3	7	30	45	0.020	29	15	1.3	8.70	7.80	7.40
RS3-1	3	250	400	0.145	31	17	0.8	12.20	11.00	10.40
RS3-2	5	150	280	0.085	33	18	1.0	11.70	10.50	9.90
RS3-3	7	75	135	0.035	33	19	1.3	11.40	10.30	9.70



LINEAR INDUCTANCE TO 100kHz. SMOOTHING AND ENERGY STORAGE COILS

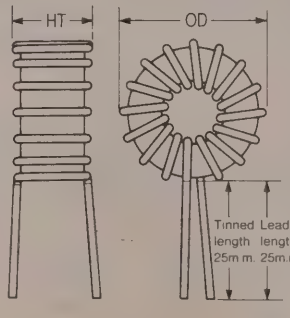
MODEL NO.	AMPS DC	"L" (µH) @ 1kHz	DCR (Ω)	DIMENSIONS (mm)			PRICE (qty)		
				OD	HT	DIAxL[1]	1-9	10-24	25-99
SKC-101	5-10	30	0.009	32	18	1.3x1	$10.70	$9.60	$9.10
SKC-102	5-10	50	0.011	32	18	1.3x1	11.70	10.50	9.90
SKC-103	5-10	100	0.017	32	18	1.3x1	13.50	12.20	11.50
SKC-104	5-10	150	0.023	32	18	1.3x1	14.70	13.20	12.50
SKC-105	5-10	200	0.024	37	20	1.3x1	15.40	13.90	13.10
SKC-106	5-7.5	400	0.048	37	20	1.3x2	20.10	18.10	17.10
SKC-107	5-7.5	600	0.056	44	26	1.3x2	22.70	20.40	19.30
SKC-108	5-7.5	800	0.044	54	25	1.3x2	27.80	25.00	23.60
SKC-109	5-6	1200	0.081	55	26	1.3x3	31.90	28.70	27.10
SKC-110	5-6	1800	0.099	55	26	1.3x3	35.00	31.50	29.80
SKC-201	10-15	30	0.005	32	18	1.3x2	13.80	12.40	11.70
SKC-202	10-15	50	0.007	37	20	1.3x2	15.40	13.90	13.10
SKC-203	10-15	100	0.012	37	20	1.3x2	20.10	18.10	17.10
SKC-204	10-15	150	0.014	44	26	1.3x2	22.70	20.40	19.30
SKC-205	10-15	200	0.011	54	25	1.3x2	27.80	25.00	23.60
SKC-206	10-12	400	0.024	55	26	1.3x4	33.30	30.00	28.30
SKC-207	10-12	600	0.032	56	27	1.3x4	39.40	35.50	33.50
SKC-208	10-12	800	0.032	56	33	1.3x4	44.90	40.40	38.20
SKC-301	15-25	30	0.004	37	20	1.3x3	17.30	15.60	14.70
SKC-302	15-25	50	0.006	39	21	1.3x3	20.70	18.60	17.60
SKC-303	15-25	100	0.006	54	25	1.3x3	28.50	25.70	24.20
SKC-304	15-20	150	0.009	55	26	1.3x3	31.90	28.70	27.10
SKC-305	15-20	200	0.011	55	26	1.3x3	35.00	31.50	29.80
SKC-306	15-20	400	0.016	56	33	1.3x6	46.10	41.50	39.20
SKC-401	20-30	30	0.004	41	23	1.3x4	22.70	20.40	19.30
SKC-402	20-30	50	0.005	46	25	1.3x4	24.80	22.30	21.10
SKC-403	20-28	100	0.006	55	26	1.3x4	33.30	30.00	28.30
SKC-404	20-25	150	0.008	56	27	1.3x4	39.40	35.50	33.50
SKC-405	20-25	200	0.008	56	33	1.3x4	44.90	40.40	38.20
SKC-501	25-35	30	0.003	45	24	1.3x5	24.50	22.10	20.80
SKC-502	25-35	50	0.003	55	26	1.3x5	31.80	28.60	27.00
SKC-503	25-35	100	0.004	55	33	1.3x5	40.90	36.80	34.80
SKC-504	25-30	150	0.006	57	34	1.3x5	46.70	42.00	39.70
SKC-601	30-40	30	0.002	54	25	1.3x6	30.30	27.30	25.80
SKC-602	30-40	50	0.003	55	26	1.3x6	35.10	31.60	29.80
SKC-603	30-35	100	0.004	56	33	1.3x6	46.10	41.50	39.20
SKC-801	40-50	30	0.002	55	33	1.3x8	40.00	36.00	34.00
SKC-802	40-50	50	0.002	54	34	1.3x8	48.00	43.20	40.80

NOTE 1: Wire diameter (DIA) by number of leads (L) in parallel.

DIMENSIONS

VARIABLE INDUCTANCE TO 100kH. SMOOTHING AND ENERGY STORAGE COILS

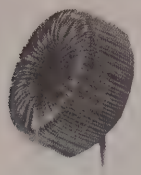
MODEL NO.	AMPS DC	"L" µH @ 1kHz		DCR (Ω)	DIMENSIONS (mm)			PRICE (qty)		
		RATED DC	0 DC		OD	HT	DIAxL[2]	1-9	10-24	25-99
SKL-103	5	100	450	0.017	32	18	1.3x1	$13.60	$12.20	$11.60
SKL-105	5	200	1000	0.025	32	18	1.3x1	15.20	13.70	12.90
SKL-203	10	100	500	0.011	43	23	1.3x2	20.50	18.50	17.40
SKL-205	10	200	1000	0.015	54	29	1.3x2	27.00	24.30	22.90
SKL-303	15	100	500	0.008	55	26	1.3x3	30.50	27.50	25.90
SKL-305	15	200	1000	0.011	56	27	1.3x3	35.30	31.80	30.00
SKL-403	20	100	500	0.008	55	26	1.3x4	34.70	31.20	29.50
SKL-404	20	150	750	0.009	56	27	1.3x4	37.90	34.10	32.20
SKL-502	25	50	250	0.006	55	26	1.3x5	32.60	29.30	27.70
SKL-503	25	100	600	0.007	57	34	1.3x5	42.90	38.60	36.50



NOTE 2: Wire diameter (DIA) by number of leads (L) in parallel.

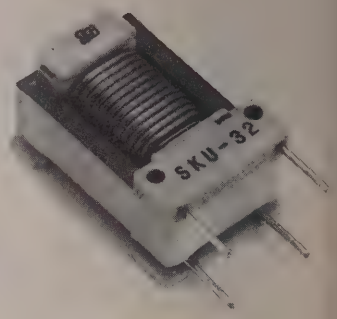
CONTACT TAMURA for ORDERING, STOCK, OEM PRICING, DETAILED DATA SHEETS or YOUR CUSTOM REQUIREMENTS by FAX: 909/676-9482 or CALL: (909) 699-1270.

TAMURA INDUCTORS FOR SWITCH-MODE POWER REGULATOR. CONTROL & ENERGY STORAGE CIRCUITS.



EN, SKU INDUCTOR FEATURES*

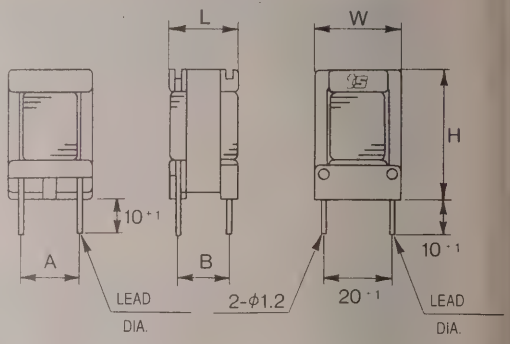
- Rated Current: Specified at 55˚C temperature rise.
- Direct Current Resistance (DCR): Maximum values.
- Operating Temperature: -25˚C to +60˚C.



POWER INDUCTORS FOR ENERGY STORING AND SMOOTHING CIRCUITS TO 100kHz.

MODEL NO.	AMPS DC	"L" mH @ 1kHz 0A DC	DCR (Ω)	DIMENSIONS (mm) LEAD DIA	"A"	PRICE (qty) 1-9	10-24	25-99
SKU-071	5.0	0.20	0.037	1.10	16	$8.60	$7.70	$7.30
SKU-072	4.0	0.45	0.082	0.95	16	8.80	7.90	7.50
SKU-073	3.0	0.55	0.090	0.85	16	8.60	7.70	7.30
SKU-074	2.0	1.30	0.220	0.70	16	8.80	7.90	7.50
SKU-075	1.0	4.00	0.600	0.55	16	8.90	8.00	7.60
SKU-076	0.5	8.50	1.200	0.45	16	9.30	8.40	7.90
SKU-11P	10.0	0.065	0.012	1.60	16	8.60	7.70	7.30
SKU-12P	5.0	0.30	0.056	1.10	16	8.80	7.90	7.50
SKU-13P	2.5	1.00	0.170	0.80	16	8.80	7.90	7.50
SKU-14P	1.5	2.50	0.370	0.65	16	8.90	8.00	7.60
SKU-15P	1.0	5.00	0.750	0.55	16	9.30	8.40	7.90
SKU-16P	0.5	10.00	1.600	0.45	16	9.70	8.70	8.20
SKU-31P	10.0	0.12	0.013	1.60	16	12.00	10.80	10.20
SKU-32P	8.0	0.16	0.019	1.40	16	12.00	10.80	10.20
SKU-33P	7.0	0.20	0.024	1.30	16	11.80	10.60	10.00
SKU-34P	5.0	0.60	0.063	1.10	16	12.00	10.80	10.20
SKU-35P	4.0	0.85	0.090	0.95	16	12.00	10.80	10.20
SKU-36P	3.0	1.70	0.175	0.85	16	12.20	11.00	10.40

DIMENSIONS



HIGH FREQUENCY POWER INDUCTORS FOR ENERGY STORAGE CIRCUITS TO 300kHz.

MODEL NO.	AMPS DC	"L" µH @ 20kHz RATED DC	0 DC	DCR (Ω)	DIMENSIONS (mm) LEAD DIA	"A"	PRICE (qty) 1-9	10-24	25-99
EN4-1	5.0	150	210	0.060	1.10	13	$9.70	$9.20	$8.20
EN4-2	4.0	200	280	0.095	0.95	13	9.90	9.40	8.40
EN4-3	3.0	280	360	0.130	0.85	13	10.10	9.60	8.60
EN4-4	2.0	850	1200	0.360	0.70	13	10.20	9.70	8.70
EN4-5	1.0	2600	3400	0.960	0.55	13	10.50	10.00	8.90
EN4-6	0.5	4500	5000	1.630	0.45	13	10.70	10.20	9.10
EN5-1	10.0	100	130	0.030	1.60	18	12.90	12.30	11.00
EN5-2	8.0	150	180	0.040	1.40	18	12.70	12.10	10.80
EN5-3	7.0	200	240	0.050	1.30	18	12.60	12.00	10.70
EN5-4	5.0	500	650	0.120	1.10	17	12.90	12.30	11.00
EN5-5	3.0	1000	1200	0.250	0.85	15	12.60	12.00	10.70
EN6-1	15.0	75	80	0.015	2.00	21	20.90	19.90	17.80
EN6-2	13.0	150	175	0.025	1.80	21	17.50	16.60	14.90
EN6-3	10.0	200	230	0.035	1.60	20	17.10	16.20	14.50
EN6-4	7.0	350	380	0.650	1.30	18	16.80	16.00	14.30
EN6-5	5.0	900	1200	0.170	1.10	17	17.30	16.40	14.70

EN, SKU DIMENSIONS

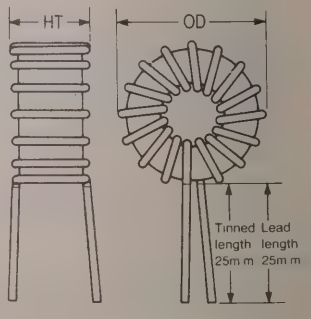
SERIES PREFIX	DIMENSIONS (mm max) H	W	L	B
EN-4	32.0	28.0	18.0	13.0
EN-5	38.0	38.0	27.0	19.0
EN-6	43.0	43.0	30.0	23.0
SKU-07	29.5	25.0	17.0	12.0
SKU-10	38.5	25.0	15.0	10.0
SKU-30	38.5	25.0	20.0	15.0

NORMAL MODE NOISE FILTERING TOROIDAL COILS

MODEL NO.	AMPS DC[1]	"L" µH @ 1kHz 1ma	DCR (Ω)	DIMENSIONS (mm) OD	HT	DIA	PRICE (qty) 1-9	10-24	25-99	100 up
SKP1-30	2	30	0.039	16.0	8.0	0.6	$2.30	$2.10	$2.00	$1.80
SKP1-40	2	55	0.050	16.0	8.0	0.6	2.30	2.10	2.00	1.80
SKP1-50	2	80	0.061	16.0	8.5	0.6	2.50	2.30	2.10	2.00
SKP2-30	2	50	0.051	16.0	11.0	0.6	2.50	2.30	2.10	2.00
SKP2-40	2	90	0.066	16.0	11.0	0.6	2.50	2.30	2.10	2.00
SKP2-50	2	130	0.082	16.0	11.5	0.6	2.60	2.30	2.20	2.10
SKP3-30	3	40	0.028	21.0	11.0	0.8	2.60	2.30	2.20	2.10
SKP3-40	3	80	0.037	21.0	11.0	0.8	2.70	2.40	2.30	2.20
SKP3-50	3	120	0.045	21.5	11.5	0.8	3.00	2.70	2.50	2.40
SKP4-40	5	65	0.023	25.0	12.0	1.0	3.40	3.10	2.90	2.70
SKP4-50	5	100	0.028	26.0	12.0	1.0	3.70	3.30	3.10	3.00
SKP5-40	5	100	0.033	27.5	14.0	1.0	4.30	3.90	3.70	3.40
SKP5-50	5	150	0.041	28.0	15.0	1.0	4.70	4.20	4.00	3.80

Note 1: SKP series "L" with DC amp rating is approximately 50% value shown.

DIMENSIONS



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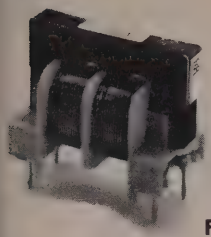
TAMURA COMMON MODE COILS FOR AC LINE & EMI/RFI FILTERING, 0.1 to 50MHz.



FEATURES

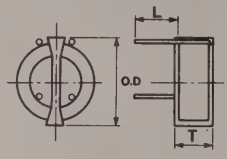
- Rated Voltage: 250VAC, 50/60 Hz.
- Rated Current: Spec'd at max. temp. rise.
- Insulation Resistance: 100 Megohms, 500VDC.
- Direct Current Resistance (DCR): Spec'd per line, input to output.
- Dielectric Voltage: 1.5kVAC (line to gnd); 2.0kVAC, CMF Series.
- Temperature Rise: ≤30˚C, CMT; ≤55˚C, CMF.
- Operating Temperature: -25˚C to +85˚C, CMT; -25˚ C to +60 ˚C, CMF.
- Creepage Distance: 3.2mm min., CMF series.

COMMON MODE NOISE FILTERING COILS

MODEL NO.	INDUCTANCE		DCR	DIA	PRICE (qty)		
	AMPS	mH min	(Ω)	mm	1-9	10-24	25-99
CMT-01102	1.0	2	0.25	0.4	$5.00	$4.50	$4.30
CMT-01104	1.0	4	0.35	0.4	5.70	5.10	4.80
CMT-01202	2.0	2	0.15	0.55	5.10	4.60	4.30
CMT-01301	3.0	1	0.10	0.7	4.70	4.20	4.00
CMT-02105	1.0	5	0.40	0.4	5.80	5.20	4.90
CMT-02107	1.0	7	0.50	0.4	6.00	5.40	5.10
CMT-02203	2.0	3	0.20	0.55	5.50	5.00	4.70
CMT-02302	3.0	2	0.10	0.7	5.10	4.60	4.30
CMT-03110	1.0	10	0.55	0.4	7.70	6.90	6.50
CMT-03305	3.0	5	0.15	0.7	7.20	6.50	6.10
CMT-03502	5.0	2	0.04	0.95	7.00	6.30	5.90
CMT-03801	8.0	1	0.02	1.2	6.70	6.00	5.70
CMF-0470	0.15	47	7.0	0.7	2.50	2.30	2.10
CMF-0330	0.2	33	6.0	0.7	2.50	2.30	2.10
CMF-0220	0.3	22	4.5	0.7	2.50	2.30	2.10
CMF-0100	0.45	10	3.0	0.7	2.50	2.30	2.10
CMF-0056	0.55	5.6	1.0	0.7	2.50	2.30	2.10
CMF-0033	0.8	3.3	0.7	0.7	2.50	2.30	2.10
CMF-6470	0.45	47	3.0	0.7	2.80	2.50	2.40
CMF-6330	0.5	33	2.5	0.7	2.80	2.50	2.40
CMF-6220	0.65	22	2.0	0.7	2.80	2.50	2.40
CMF-6100	0.9	10	0.6	0.7	2.80	2.50	2.40
CMF-6056	1.0	5.6	0.4	0.7	2.80	2.50	2.40
CMF-6033	2.0	3.3	0.3	0.7	2.80	2.50	2.40
CMF-8470	0.5	47	4.0	0.8	3.00	2.70	2.50
CMF-8330	0.85	33	3.0	0.8	3.00	2.70	2.50
CMF-8220	0.8	22	2.0	0.8	3.00	2.70	2.50
CMF-8100	1.0	10	0.7	0.8	3.00	2.70	2.50
CMF-8056	1.5	5.6	0.4	0.8	3.00	2.70	2.50
CMF-8033	2.0	3.3	0.3	0.8	3.00	2.70	2.50
CMF-2470	1.0	47	2.0	1.0	3.70	3.30	3.10
CMF-2330	1.2	33	0.8	1.0	3.70	3.30	3.10
CMF-2220	1.4	22	0.6	1.0	3.70	3.30	3.10
CMF-2100	2.2	10	0.3	1.0	3.70	3.30	3.10
CMF-2056	2.7	5.6	0.25	1.0	3.70	3.30	3.10
CMF-2033	4.0	3.3	0.08	1.0	3.70	3.30	3.10

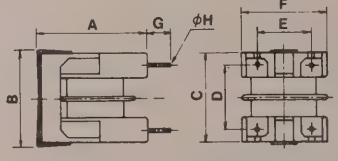
CMT SERIES (dim. mm)

SERIES PREFIX	O.D.	T	L±3mm
CMT-01	28	12.5	20
CMT-02	28	14.5	20
CMT-03	32	22	20



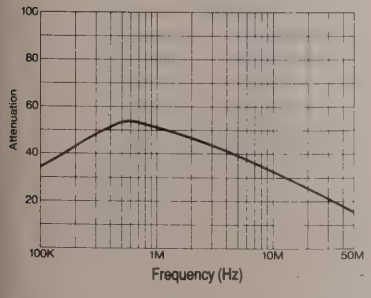
CMF SERIES (dim. mm)

SERIES PREFIX	A	B	C±1	D±1	E±.4	F±1	G±.4
CMF-0	20.5	17.5	18.0	12.5	10.0	16	4
CMF-6	28.0	22.5	18.0	12.5	10.0	18	4
CMF-8	31.0	24.0	22.0	16.0	10.0	20	4
CMF-2	33.5	38.5	37.0	30.0	12.5	21	4

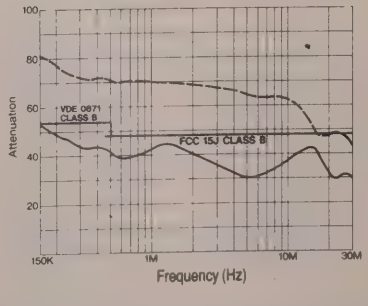


TYPICAL PERFORMANCE CHARACTERISTICS

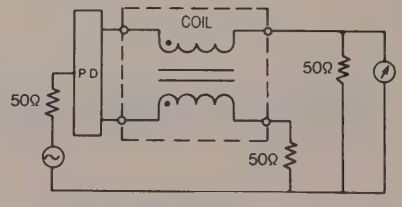
STATIC CHARACTERISTIC CMT-02105 IN CIRCUIT 1



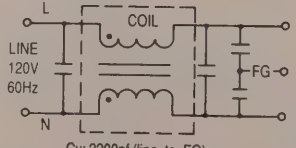
DYNAMIC CHARACTERISTIC CMT-02105 IN CIRCUIT 2



CIRCUIT 1



CIRCUIT 2



Switching Power Supply

Cy: 2200pf (line–to–FG)
Cx: 0.1µf (line–to–line)

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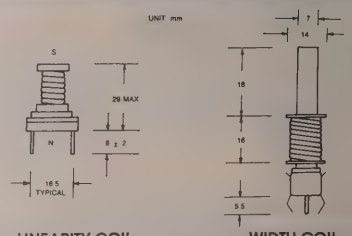
TMP INC.
1701 E. Edinger Avenue, F1, Santa Ana, CA 92705 U.S.A.
PHONE: (714) 558-8028 • FAX: (714) 972-9658

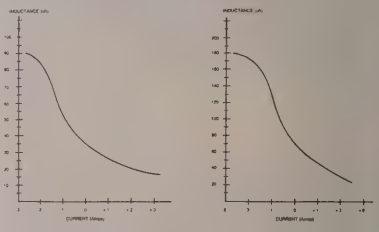
E119952 (S)

LINEARITY/WIDTH COIL
FOR VIDEO DISPLAY



LINEARITY COIL WIDTH COIL

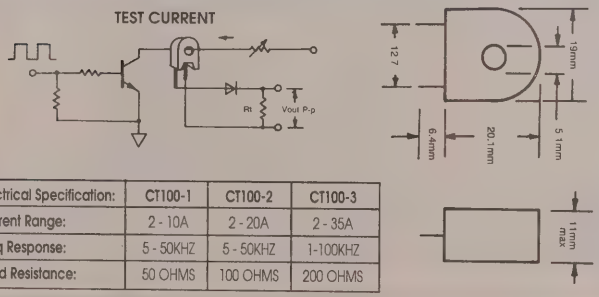
INDUCTANCE VS CURRENT CURVES FOR LINEARITY COIL



ELECTRICAL SPECIFICATION FOR WIDTH COIL

Inductance:	8μH ~38μH
D.C.R.:	0.05 OHM
Turns:	36-1/2 (for REF)
Torsion:	0.6 KG/CM

CURRENT SENSOR



Electrical Specification:	CT100-1	CT100-2	CT100-3
Current Range:	2 - 10A	2 - 20A	2 - 35A
Freq Response:	5 - 50KHZ	5 - 50KHZ	1-100KHZ
Load Resistance:	50 OHMS	100 OHMS	200 OHMS

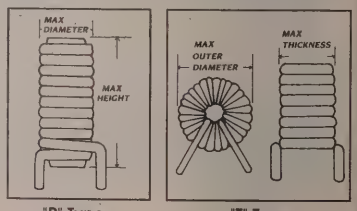
OUTPUT POWER CHOKE

FEATURES

Inductance: 5-600 MicroH (R Type) 20-100 MicroH (T Type)

Current Range:
2, 3, 5 & 10 AMPERE (R Type)
2, 3 & 5 AMPERE (T Type)

Temperature Rising:
Less than 40°C at full rated current



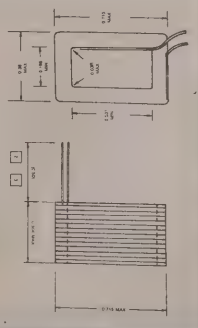
"R" Type "T" Type

Part No.	Current Rating (A)	D.C.R. (milli-ohm)	20 KHZ Inductance (μH)	Wire Size (mm)	MAX Outer Diameter (mm)	MAX Thickness (mm)
"T" TYPE POWER CHOKE						
TPC-02026	2	45	26	0.6	17	9
TPC-02125	2	95	125	0.6	17	12
TPC-03040	3	35	40	0.8	22	12
TPC-03110	3	55	110	0.8	22	12
TPC-05064	5	30	64	1.0	26	13
TPC-05100	5	40	100	1.0	26	13
"R" TYPE POWER CHOKE						
RPC-03005	3	18	5	0.8	12.7	17.0
RPC-03100	3	60	100	0.8	12.7	26.5
RPC-05025	5	20	25	1.0	12.7	23.0
RPC-05400	5	110	400	1.0	25.0	21.5
RPC-10100	10	32	100	1.30	28.0	21.5
RPC-10300	10	52	300	1.30	35.6	25.5

VOICE COIL
FOR HARD DISK DRIVES AND RF APPLICATIONS

PERFECT WINDING

- Coil-wound by auto-winding machine with polyurethane/enameled self bonding wire coated thermal epoxy.
- Wire size from AWG43 (0.01ø) to AWG25 (0.5ø) with temperature rating from 120°C to 180°C.
- Accurate turns with D.C.R. controlled within 3%.
- Fully cured-no deformation and out-gasing.
- Ultrasonically clean-no loose particles for contamination.
- Packing with tooled PVC-tray.
- Special shapes and sizes available, designed to your specifications.



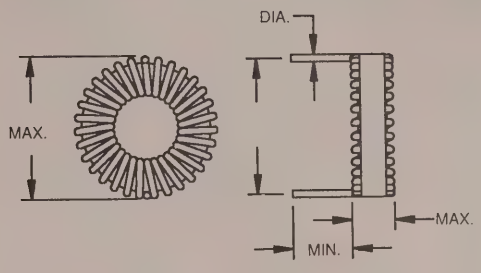
SEE OUR TRANSFORMERS IN VOLUME A PAGE 2580; AND LIGHTING BALLASTS IN VOLUME B PAGE 1199.

SWITCH MODE POWER INDUCTORS

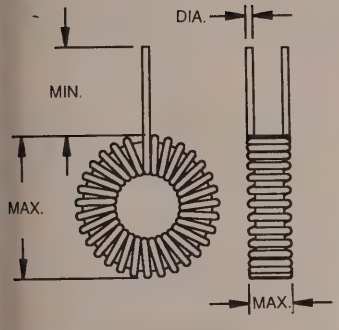
TOROTEL PRODUCTS INCORPORATED 13402 SOUTH 71 HIGHWAY GRANDVIEW, MO 64030 (816) 761-6314 FAX (816) 763-2278

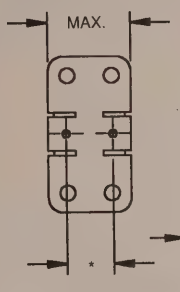
- Twenty-three standard series
- Eleven different mechanical configurations
- Ten different core materials
- Over eleven hundred individual part numbers, address size, cost, energy storage capability and core loss

STYLE A

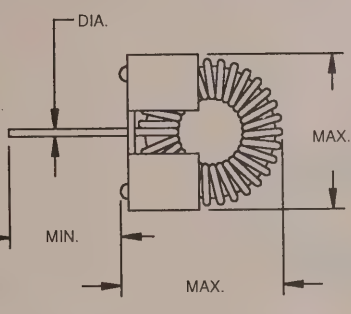


STYLE D





STYLE G



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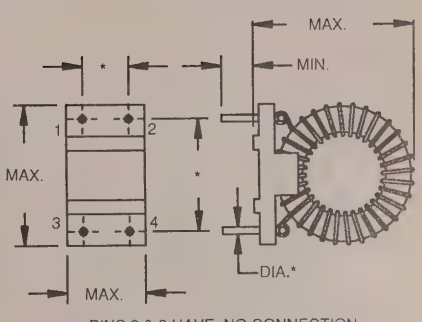
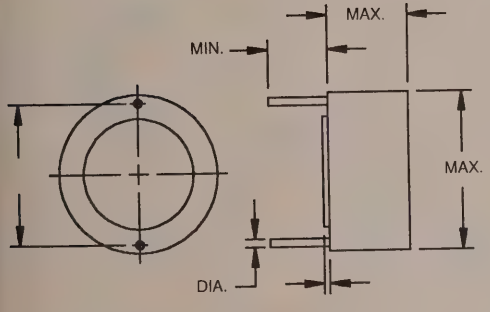
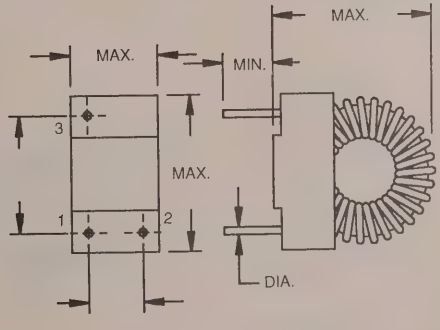


PINS 2 & 3 HAVE NO CONNECTION

STYLE BA, BB

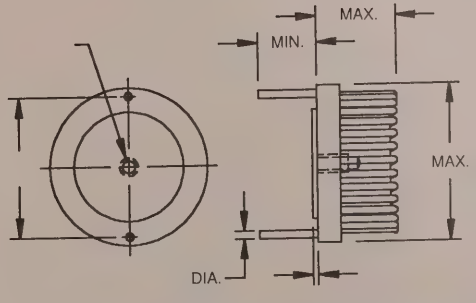


STYLE E



PIN 3 HAS NO CONNECTION

STYLE CA, CB



STYLE	DESCRIPTION
BA	WITH FOOT
BB	WITHOUT FOOT

Styles F and G are not available in all sizes.

*This dimension to be established by factory
Dimensions are in inches

STYLE	DESCRIPTION
CA	WITH FOOT
CB	WITHOUT FOOT

TOROTEL STANDARD CONFIGURATIONS
(Custom Styles Are Also Available)

CURRENT SENSE INDUCTORS

TOROTEL PRODUCTS INCORPORATED 13402 SOUTH 71 HIGHWAY GRANDVIEW, MO 64030 (816) 761-6314 FAX (816) 763-2278

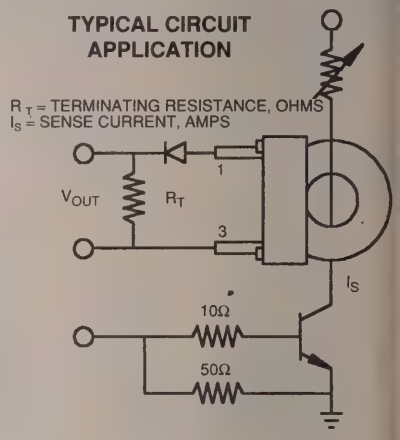
PART NUMBER	TURNS	INDUCTANCE (mH)	TEST LEVEL (V) †	DCR (Ω)	R_T (Ω)	FIG.
*1C30	30	1.8	0.015	0.3	30	1
*1C50	50	5	0.025	0.7	50	1
*1C100	100	20	0.050	1.4	100	1
*1C200	200	80	0.100	4.5	200	1
*1C400	400	320	0.200	10.0	400	1
*1C600	600	1080	0.300	20.0	600	1
*2C30	30CT	1.8	0.015	0.3	30	2
*2C50	50CT	5	0.025	0.7	50	2
*2C100	100CT	20	0.050	1.4	100	2
*2C200	200CT	80	0.100	4.5	200	2
*2C400	400CT	320	0.200	10.0	400	2
*2C600	600CT	1080	0.300	20.0	600	2

† Test frequency is 1 khz.

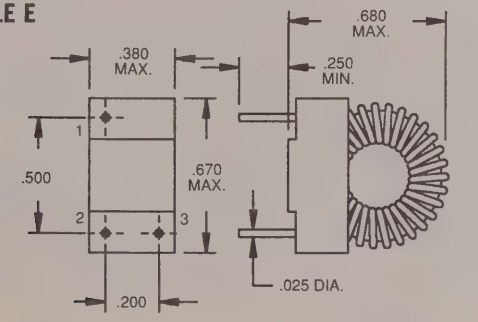
Current transformers are used to sense a current in a conductor and provide a voltage which is proportional to that current, while providing high voltage isolation. These current transformers are suitable for switch mode power supply applications and are rated for 130°C operating temperature and 2500V dielectric withstanding voltage. Center tap models are also available.

FIG. 1 FIG. 2

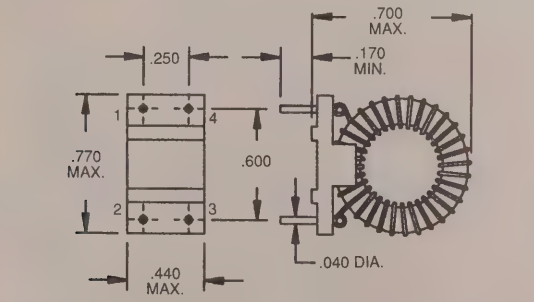
TYPICAL CIRCUIT APPLICATION



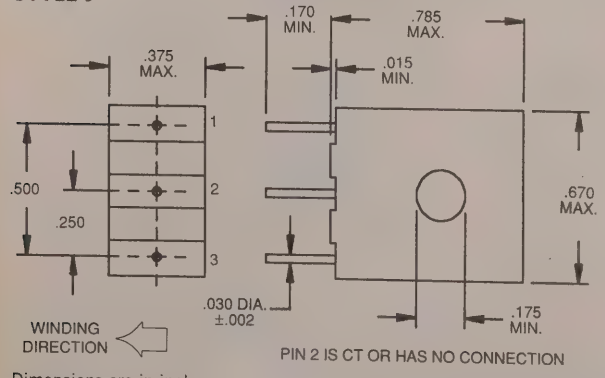
STYLE E



STYLE F

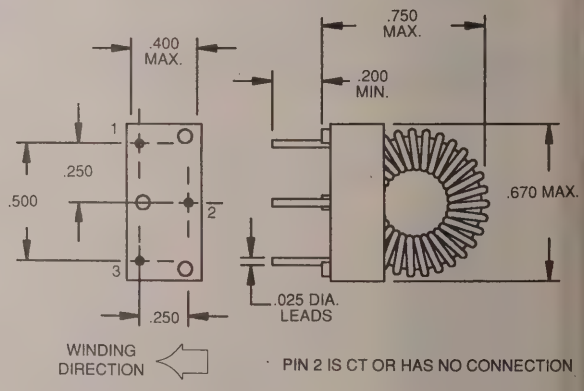


STYLE J

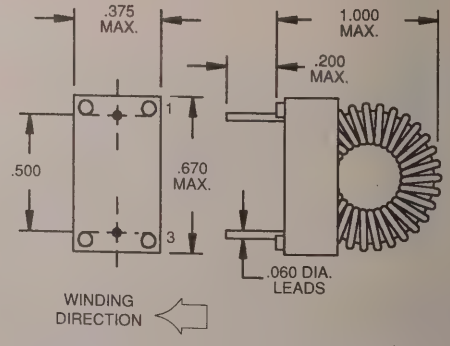


Dimensions are in inches

STYLE K



STYLE L



PART NUMBER ORDERING INFORMATION

* Add style prefix (from this page) to part number

EXAMPLE: E 1 C 30

STYLE

SCHEMATIC

TURNS

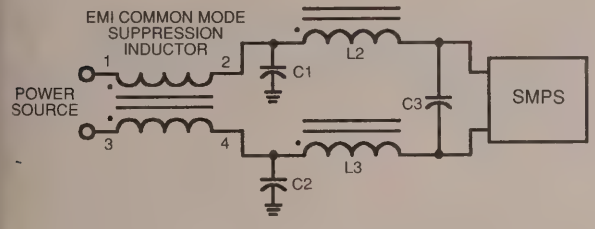
SIZE

COMMON MODE INDUCTORS

TOROTEL PRODUCTS INCORPORATED 13402 SOUTH 71 HIGHWAY GRANDVIEW, MO 64030 (816) 761-6314 FAX (816) 763-2278

FOR EMI/RFI APPLICATIONS

- Maximum operating temperature: 130°C. (ambient + temperature rise)
- Dielectric strength: 1500 Vrms
- Winding balance: ±1%

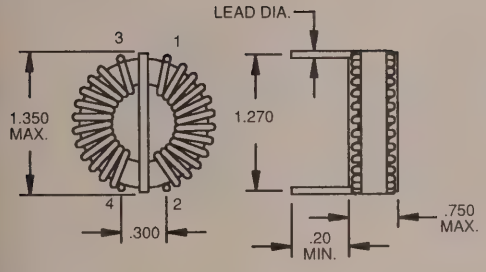


PART NUMBER	"L"† (mH)	DCI‡ (Amps)	DCR† (Ω) max.	LEAKAGE INDUCTANCE (μH)	TEST** LEVEL (VRMS)	LEAD DIA.
*32K2	2.0	7.5	.02	25	0.08	0.047
*32K4	4.0	5.2	.04	45	0.20	0.036
*32K8	8.0	3.2	.12	90	0.50	0.032
*32K16	16.0	2.6	.16	180	1.00	0.032

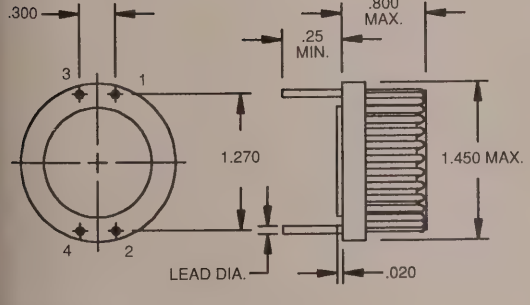
† Inductance and DCR values shown are for each winding. Other inductances are available.
‡ DCI is for 40°C temperature rise.
** Test level is at 1 KHZ.

A typical circuit for the elimination of noise is shown to the left. The filter contains two stages, one for common mode noise (L1, C1 and C2) and one for conducted noise (L2, L3 and C3).

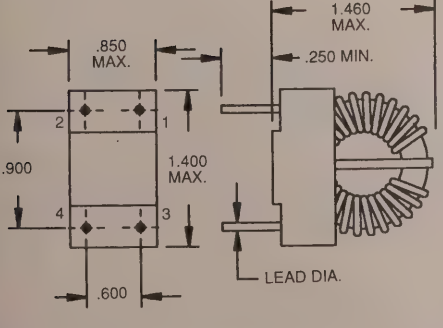
STYLE A



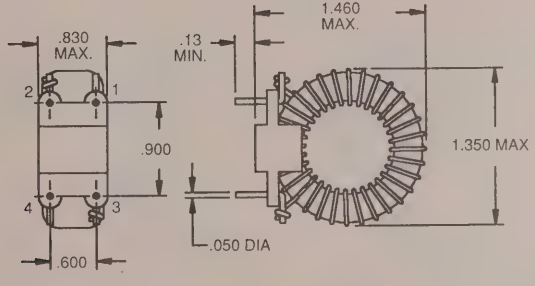
STYLE C



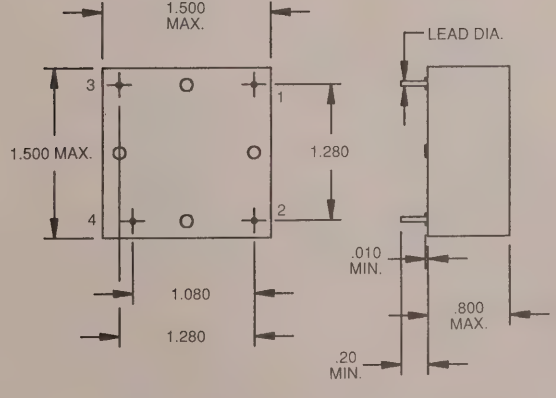
STYLE E



STYLE F



STYLE H



PART NUMBER ORDERING INFORMATION

* Add style prefix (from this page) to part number

EXAMPLE: A 32 K 2

STYLE — A

CORE TYPE — 32

SIZE — K

INDUCTANCE (milihenrys) — 2

Dimensions are in inches

For LEAD DIA. see table above.

COMMON MODE INDUCTORS

TOROTEL PRODUCTS INCORPORATED 13402 SOUTH 71 HIGHWAY GRANDVIEW, MO 64030 (816) 761-6314 FAX (816) 763-2278

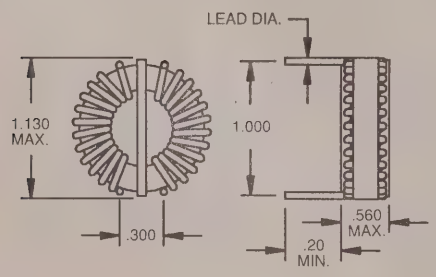
PART NUMBER	"L"† (mH)	DCI‡ (Amps)	DCR† (Ω) max.	LEAKAGE INDUCTANCE (μH)	TEST** LEVEL (VRMS)	LEAD DIA.
*31G1	1.0	6.0	0.02	12	0.08	0.036
*31G3	3.0	3.5	0.06	35	0.20	0.032
*31G10	10.0	1.8	0.24	130	0.50	0.032

† Inductance and DCR values shown are for each winding.
Other inductances are available.
‡ DCI is for 40°C temperature rise.
** Test level is at 1 KHZ.

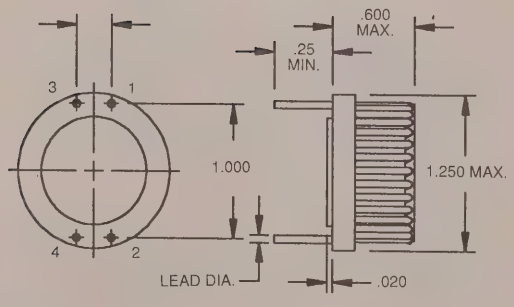
- Maximum operating temperature: 130°C. (ambient + temperature rise)
- Dielectric strength: 1500 Vrms
- Winding balance: ±1%

Common Mode Inductors are most often used to eliminate line transmitted noise, such as that caused by transistors, SCR's, etc., in switch mode regulated power supplies. Interference caused by multiple equipment on a common power line can be minimized by the "split-winding" design, thus reducing the inherent conducted noise to an acceptable level. See toroid common mode filtering circuit on facing page. Special note should be made of the phasing dots.

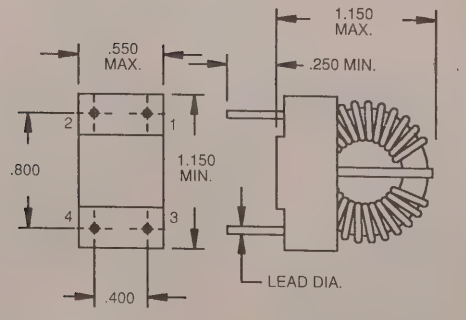
STYLE A



STYLE C



STYLE E



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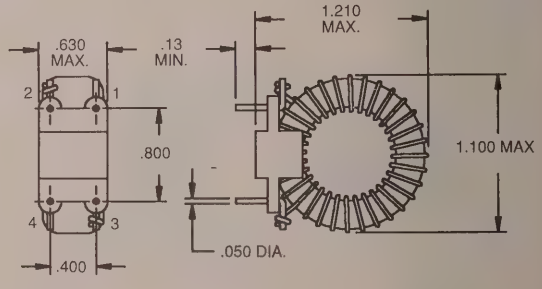
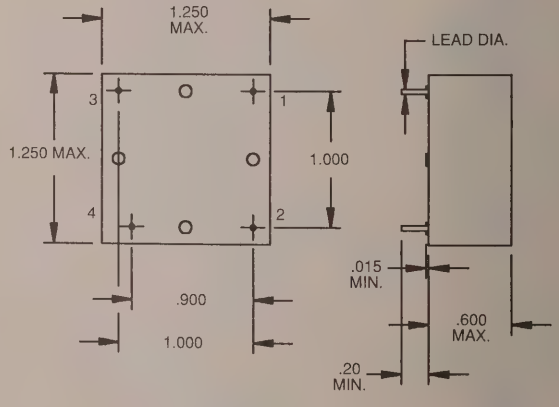


STYLE H



PART NUMBER ORDERING INFORMATION

* Add style prefix (from this page) to part number

EXAMPLE: A 31 G 1

STYLE — A

CORE TYPE — 31

SIZE — G

INDUCTANCE (milihenrys) — 1

Dimensions are in inches.

For LEAD DIA. see table above.

COMMON MODE INDUCTORS

TOROTEL PRODUCTS INCORPORATED 13402 SOUTH 71 HIGHWAY GRANDVIEW, MO 64030 (816) 761-6314 FAX (816) 763-2278

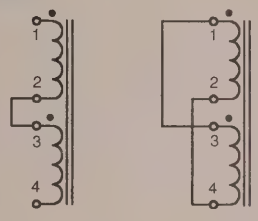
- **Ideally suited as switching regulator and coupled inductors, common mode chokes, or in other power filtering applications.**
- **The temperature rise is less than 30°C when measured at an ambient temperature of 100°C, 0.1 v rms, 10 khz, and at rated DC current as shown in the Tables below.**
- **A large selection of sizes provides maximum performance for minimum size.**
- **Each unit is magnetically shielded.**
- **Units QPL'D to MIL-T-27/356 are also available.**

All inductors have split windings for versatility. They can be connected in series, parallel or individually for balanced filtering applications.

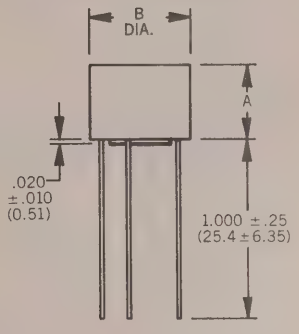
The ratings in the tables below are for a series-aided connection of both windings. The inductance of a parallel connection of these windings will result in 25% of the inductance at twice the rated current. The DCR will be 25% of the series connection.

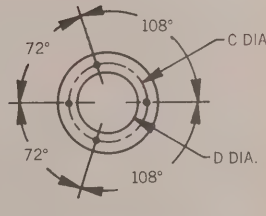
CASE	A MAX.	B MAX.	C ±.010	D ±.010	INSERT	TERMINAL ARRANGEMENT	LEAD DIA.
1	.280 (7.11)	.410 (10.41)	.260 (6.6)	.160 (4.06)	—	A	.012
2	.340 (8.63)	.500 (12.7)	.350 (8.89)	.250 (6.35)	—	A	.012
3	.415 (10.54)	.630 (16.0)	.440 (11.17)	.340 (8.64)	—	A	.016
4	.500 (12.70)	.800 (20.32)	.560 (14.22)	.460 (11.68)	—	B	.016
5	.635 (16.12)	.950 (24.13)	.670 (17.0)	.570 (14.48)	.138-32 UNC-2B	B	.020

Dimensions are in inches (mm)

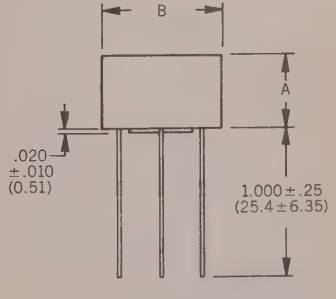


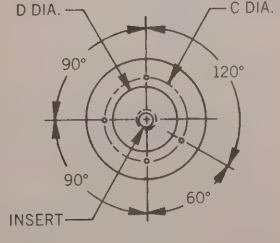
TERMINAL ARRANGEMENT A





TERMINAL ARRANGEMENT B





PART NUMBER	SERIES CONNECTED INDUCTANCE (mH)*	SERIES CONNECTED CURRENT (DC Amps)	SERIES CONNECTED DCR (Ω)	CASE
PK-01	20.0	0.06	54.00	1
PK-02	20.0	0.10	29.00	2
PK-03	20.0	0.14	20.00	3
PK-04	20.0	0.22	12.40	4
PK-05	20.0	0.29	10.20	5
PK-06	15.0	0.07	40.50	1
PK-07	15.0	0.12	22.00	2
PK-08	15.0	0.16	15.00	3
PK-09	15.0	0.25	9.30	4
PK-10	15.0	0.33	7.70	5
PK-11	10.0	0.08	27.00	1
PK-12	10.0	0.14	14.60	2
PK-13	10.0	0.20	10.00	3
PK-14	10.0	0.31	6.20	4
PK-15	10.0	0.40	5.10	5
PK-16	7.5	0.10	20.30	1
PK-17	7.5	0.17	11.00	2
PK-18	7.5	0.24	7.50	3
PK-19	7.5	0.38	4.70	4
PK-20	7.5	0.49	3.80	5
PK-21	5.0	0.12	13.50	1
PK-22	5.0	0.21	7.30	2
PK-23	5.0	0.30	5.00	3
PK-24	5.0	0.47	3.10	4
PK-25	5.0	0.60	2.60	5
PK-26	3.0	0.16	8.10	1
PK-27	3.0	0.27	4.40	2
PK-28	3.0	0.38	3.00	3
PK-29	3.0	0.60	1.90	4
PK-30	3.0	0.78	1.50	5

* Inductance is measured at 0.1 Vrms/10KHZ

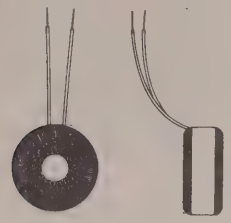
PART NUMBER	SERIES CONNECTED INDUCTANCE (mH)*	SERIES CONNECTED CURRENT (DC Amps)	SERIES CONNECTED DCR (Ω)	CASE
PK-31	2.00	0.19	5.40	1
PK-32	2.00	0.33	2.90	2
PK-33	2.00	0.47	2.00	3
PK-34	2.00	0.74	1.30	4
PK-35	2.00	0.95	1.00	5
PK-36	1.00	0.27	2.70	1
PK-37	1.00	0.47	1.50	2
PK-38	1.00	0.66	1.00	3
PK-39	1.00	1.00	0.62	4
PK-40	1.00	1.30	0.50	5
PK-41	0.75	0.31	2.00	1
PK-42	0.75	0.54	1.00	2
PK-43	0.75	0.76	0.75	3
PK-44	0.75	1.20	0.47	4
PK-45	0.75	1.60	0.38	5
PK-46	0.50	0.38	1.30	1
PK-47	0.50	0.66	0.66	2
PK-48	0.50	0.93	0.50	3
PK-49	0.50	1.47	0.31	4
PK-50	0.50	1.90	0.25	5
PK-51	0.25	0.53	0.66	1
PK-52	0.25	0.93	0.33	2
PK-53	0.25	1.30	0.25	3
PK-54	0.25	2.08	0.16	4
PK-55	0.25	2.70	0.13	5
PK-56	0.10	0.78	0.30	1
PK-57	0.10	1.35	0.17	2
PK-58	0.10	1.95	0.11	3
PK-59	0.10	3.08	0.07	4
PK-60	0.10	3.88	0.06	5
PK-61	0.04	1.18	0.14	1
PK-62	0.04	2.03	0.07	2
PK-63	0.04	2.68	0.06	3

TOROTEL PRODUCTS INCORPORATED 13402 SOUTH 71 HIGHWAY GRANDVIEW, MO 64030 (816) 761-6314 FAX (816) 763-2278

INDUCTORS

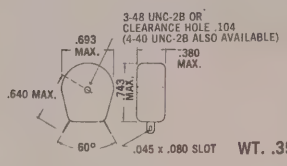
CASE STYLES AVAILABLE

UNCASED



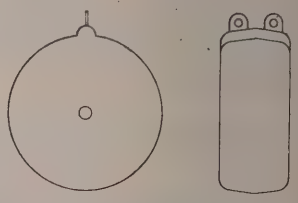
STYLE 1

COMPRESSION MOLDED



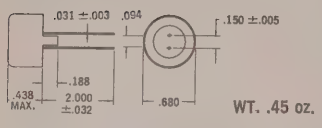
WT. .35 oz.

STYLE 2



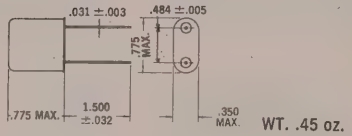
STYLE 3

METAL CASED



WT. .45 oz.

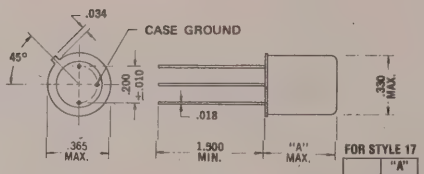
STYLE 4



WT. .45 oz.

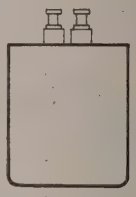
STYLE 5

STYLE 6

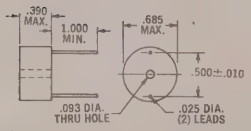


FOR STYLE 17	
	"A"
TG	.390
TH	.350

STYLE 17

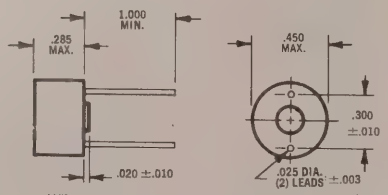


STYLE 7



WT. .35 oz.

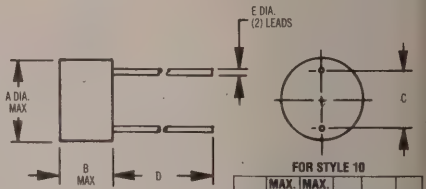
STYLE 8



WT. .08 oz.

P	PF
NO FOOT	WITH FOOT

STYLE 9

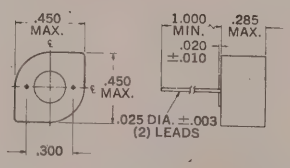


FOR STYLE 10					
CASE	MAX. A	MAX. B	C	D	E
TE	.250	.343	.200	1.625	.020
TJ	.250	.343	.100	1.625	.020
P65	.360	.300	.200	1.000	.025

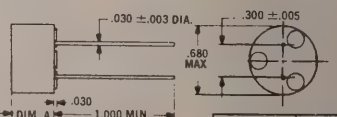
STYLE 10

TYPE PREFIX TABLE		
THREADED	THRU HOLE	STYLE
PS	PSC	NO FOOT
PF	PFC	WITH FOOT

STYLE 11



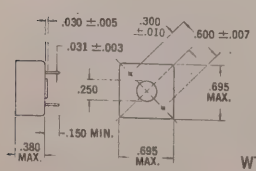
STYLE 12



WT. .35 oz.

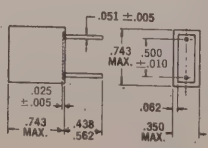
DIM. A		STYLE
.435	.390	
PS	PST	FEET
PW	PWT	NO FEET

STYLE 13



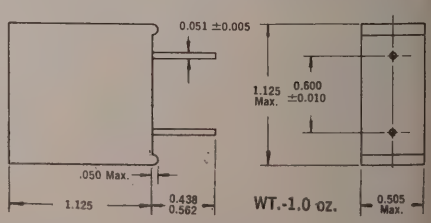
WT. .35 oz.

STYLE 14



WT. .35 oz.

STYLE 15



WT.-1.0 oz.

STYLE 16

TOROTEL PRODUCTS INCORPORATED 13402 SOUTH 71 HIGHWAY GRANDVIEW, MO 64030 (816) 761-6314 FAX (816) 763-2278

INDUCTORS

FAX THIS PAGE OR CALL CATALOG DATA DEPARTMENT, FOR CATALOG DATA SHEETS ON OVER 1762 STANDARD INDUCTANCE VALUES AND TYPES

YOUR NAME _____ POSITION _____

COMPANY _____

ADDRESS _____

_____

PHONE _____

FAX _____

CHECK BOX TO REQUEST FAXED DATA SHEET OR CHECK HERE FOR ENTIRE CATALOG MAILING. ☐

See Transformer Section 5600 for 201 Standard Audio & 736 Standard Power Transformers

Series	Approx. Size	Inductance Range Min.	Max.	Approx.. Ohms/mh	Case Styles* Available	Check Box
TE	.26 x .34	0.1MH	220MH	8.9	10	
TJ	.26 x .34	0.1MH	220MH	8.9	10	
65	.36 x .30	1mH	120mH	0.93	10	
TH	.365 x .35	10µH	1mH	50	17	
TG	.365 x .35	1mH	500mH	3.24	17	
29	.45 x .29	0.05mH	10mH	19.1	6,9,12	
13	.45 x .29	.5mH	100mH	2.8	6,9,12	
03	.45 x .29	1mH	250mH	1.5	6,9,12	
82	.45 x .29	1mH	250mH	1.23	6,9,12	
72	.45 x .29	1.25mH	350mH	0.95	6,9,12	
52	.45 x .29	2mH	500mH	0.65	6,9,12	
53	.65 x .33	.05mH	15mH	10.1	1,2,4,5,6,8,13,14,15	
51	.65 x .33	1mH	500mH	1.2	1,2,4,5,6,8,13,14,15	
50	.65 x .33	1mH	3H	0.6	1,2,4,5,6,8,13,14,15	
55	.65 x .33	1.2mH	3H	0.47	1,2,4,5,6,8,13,14,15	
56	.65 x .33	1.5mH	3.6H	0.34	1,2,4,5,6,8,13,14,15	
57	.65 x .33	2mH	5H	0.22	1,2,4,5,6,8,13,14,15	
68	.86 x .40	.075mH	17.5mH	5.02	1,7,11	
89	.86 x .40	1.5mH	600mH	0.67	1,7,11	
90	.86 x .40	3mH	6H	0.38	1,7,11	
91	.86 x .40	3mH	6H	0.28	1,7,11	
92	.86 x .40	3.6mH	7.2H	0.2	1,7,11	
93	.86 x .40	5mH	10H	0.16	1,7,11	
74	.98 x .42	.1mH	20mH	3.08	1,3,7,11,16	
48	.98 x .42	2mH	600mH	0.42	1,3,7,11,16	
06	.98 x .42	5mH	7.2H	0.21	1,3,7,11,16	
24	.98 x .42	6mH	8.5H	0.15	1,3,7,11,16	
23	.98 x .42	7.2mH	10H	0.13	1,3,7,11,16	
21	.98 x .42	10mH	15H	0.08	1,3,7,11,16	
59	1.15 x .52	3mH	3.6H	0.31	1,11	
10	1.15 x .52	5mH	8.6H	0.13	1,11	
08	1.15 x .52	7.2mH	10H	0.12	1,11	
07	1.15 x .52	10mH	12H	0.09	1,11	
05	1.15 x .52	15mH	20H	0.07	1,11	
94	1.27 x .63	5mH	860mH	0.21	1,3,7,11	
30	1.27 x .63	5mH	17.5H	0.11	1,3,7,11	
28	1,27 x .63	7.2mH	20H	0.09	1,3,7,11	
27	1.27 x .63	8.6mH	24H	0.07	1,3,7,11	
25	1.27 x .63	12mH	36H	0.04	1,3,7,11	
84	1.57 x .70	5mH	20H	0.08	1,3,7	
54	1.84 x .86	17.5mH	40H	0.05	1,3,7	
15	2.43 x 1.03	100mH	60H	0.03	1,7	

*Custom Case sizes available

VERNITRON
CORPORATION

Transformers, Power Inductors, DC-DC Converters, SCR/Audio/Switch Mode and Surface Mount Magnetics.

AIE MAGNETICS DIVISION
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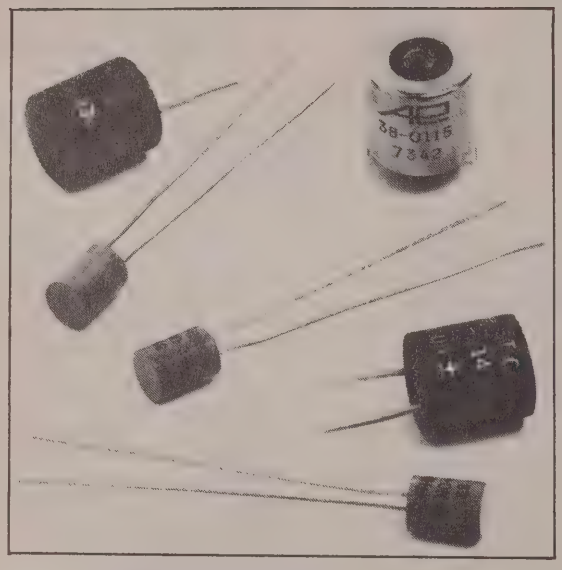
INDUCTORS



Switching Regulator Inductors
AIE Magnetics manufactures a line of inductors for DC-DC converters, lower current outputs or switching power supplies. These inductors have been designed to operate with switching regulators, available from several semiconductor manufacturers, which operate in the 30-500 Khz range.

TYPICAL APPLICATIONS
- *BOOST CONVERTERS*
- *BUCK CONVERTERS*
- *BUCK-BOOST CONVERTERS*

FEATURES
- *REQUIRE MINIMAL CIRCUIT BOARD SPACE*
- *SHIELDED FROM RADIATING NOISE*
- *SEALED TO WITHSTAND ALL BOARD CLEANING PROCESSES*

Fixed Inductors...Micro-Miniature and Miniature
AIE Magnetics fixed inductors offer the optimum in design efficiency and provide the highest inductances per unit of volume. These inductors provide your design solution in two distinct areas: (1) Small DC currents with non-critical temperature coefficient of inductance and (2) where DC current is a design factor and where a low temperature coefficient of inductance is desired.

TYPICAL APPLICATIONS
- *DECOUPLING NETWORKS*
- *FILTER CHOKES*
- *PEAKING AND COMPENSATING CIRCUITS*
- *TONE COLOR FILTERS*
- *OSCILLATORS*
- *TONE DECODING*

FEATURES
- *MICRO-MINIATURE & MINIATURE SIZES*
- *LOW TEMPERATURE COEFFICIENT OF INDUCTANCE*
- *ENCAPSULATED*
- *MIL-C-15303 FEATURES*
- *SOLDERABLE LEADS*
- *WELDABLE LEADS (Optional)*

Variable Inductors...Miniature
AIE Magnetics variable inductors are typical of our miniaturization efforts for high Q's and high inductances in a minimum of space. These printed circuit mount, shielded inductors offer top tuning for easy access. If your packaging demands dictate side tuning, we can modify our Series 38 for this purpose.

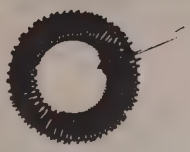
TYPICAL APPLICATIONS
- *HIGH Q TUNED CIRCUITS*
- *FILTER NETWORKS*
- *TANK CIRCUITS*
- *BLOCKING*
- *DECOUPLING*
- *PULSE WIDTH CONTROL*
- *CONTROL OF RL OR LC CONSTANT*

FEATURES
- *MINIATURE SIZE*
- *TEMPERATURE STABILITY*
- *20 KHZ TO 100 MHZ*
- *PRINTED CIRCUIT MOUNTING*
- *± 20% MINIMUM TUNING RANGE*
- *L'S FROM .10 MICROHENRIES TO 22 MILLIHENRIES*

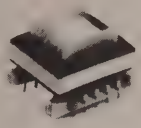
■ Inductors ■ Chokes ■ Coils

QUICK DELIVERY AT COMPETITIVE PRICES

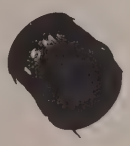
■ **Toroidal Inductors--**
Designed specifically for:
Switching Power Supplies
High Current Filters



■ **"EE" Core Transformers--**
Core configurations, size range, and ferrite mix provide one of the most cost effective designs available.



■ **Ferrite Drum Cores--**
Designed for:
High Current Applications
Power Line Chokes

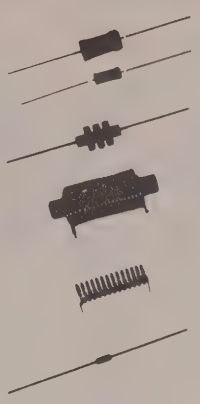


■ **Pot Core Assemblies--**
High degree of repeatability, high Q's, stable inductance, and tunability

Wilco has the answers to your inductor needs.

Choose from a complete line of over 20 standard inductor types, each with superior production quantity deliveries - or call with your specifications for custom inductors and be assured of reliable performance, modified to your requirements in only 72 hours!

For immediate action, call: (317) 293-9300, or write today. Ask for a FREE copy of our latest catalog!



■ **High Current Ferrite Bobbin Chokes--**
A wide range of inductances in a small package.

■ **Multi-Pi--**
High L and High Q

■ **Hash Chokes--**
Power Line Filters

■ **Air Coils--**
High Frequency Applications

■ **Single Layer Wound--**
Varnish or Conformal Coated

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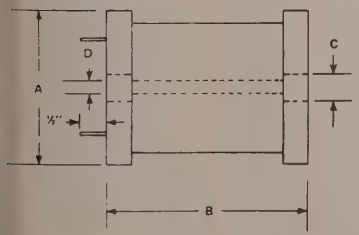
"DC" SERIES • POWER LINE INDUCTORS

The use of high saturation flux density ferrite drum cores make these inductors ideal for use in switching power supply applications.

MAXIMUM PHYSICAL DIMENSIONS:				
	A	B	C	D
DC1	.660	.840	.195	Clearance Hole For 4/40 Screw
DC2	.825	.840	.195	
DC3	1.1	.840	.195	

Typical Applications Are:

- Power Supplies
- Switching Regulators
- SCR and Triac Controls
- RFI Suppression
- Filters

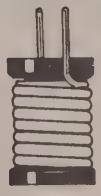


NOTES:

- Saturation current lowers inductance 5%.
- Inductance ±10% measured at 1 KHz.
- Leads for PC mounting tinned to within 1/16" of body.
- Non-listed values available on request.
- Coils finished with sleeving (Polyolefin shrink tube).
- Center hole for mechanical mounting.
- RDC measured @ 20°C.
- Values below 10uH ±20%.

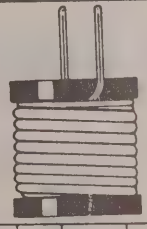
DC1

WILCO Part#	Inductance at O DC (μH)	Max. DCR (Ohms)	Saturation Current (DC Amps)	Rated Current (AC Amps)
DC1-10G	1.0	.003	87.0	9.0
DC1-12G	1.2	.003	66.0	9.0
DC1-15G	1.5	.004	56.0	9.0
DC1-18G	1.8	.004	56.0	9.0
DC1-22G	2.2	.005	47.0	9.0
DC1-27G	2.7	.005	47.0	9.0
DC1-33G	3.3	.005	40.0	9.0
DC1-39G	3.9	.006	36.0	9.0
DC1-47G	4.7	.007	32.0	9.0
DC1-56G	5.6	.007	29.0	9.0
DC1-68G	6.8	.008	26.0	9.0
DC1-82G	8.2	.009	24.5	9.0
DC1-100	10.0	.010	21.2	9.0
DC1-120	12.0	.011	19.0	9.0
DC1-150	15.0	.015	17.5	7.2
DC1-180	18.0	.016	16.5	7.2
DC1-220	22.0	.020	15.8	5.5
DC1-270	27.0	.030	14.4	4.5
DC1-330	33.0	.040	13.2	4.0
DC1-390	39.0	.046	11.8	4.0
DC1-470	47.0	.062	11.0	2.8
DC1-560	56.0	.069	10.0	2.8
DC1-680	68.0	.077	8.9	2.8
DC1-820	82.0	.083	8.2	2.8
DC1-101	100.0	.095	7.5	2.8
DC1-121	120.0	.127	5.8	2.0
DC1-151	150.0	.181	5.6	1.6
DC1-181	180.0	.217	5.1	1.6
DC1-221	220.0	.240	4.3	1.6
DC1-271	270.0	.300	4.1	1.6
DC1-331	330.0	.336	3.8	1.3
DC1-391	390.0	.460	3.3	1.0
DC1-471	470.0	.636	3.2	0.8
DC1-561	560.0	.696	2.9	0.8



DC2

WILCO Part#	Inductance at O DC (μH)	Max. DCR (Ohms)	Saturation Current (DC Amps)	Rated Current (AC Amps)
DC2-10G	1.0	.003	108.0	11.4
DC2-12G	1.2	.003	108.0	11.4
DC2-15G	1.5	.003	83.0	11.4
DC2-18G	1.8	.003	68.0	11.4
DC2-22G	2.2	.004	68.0	11.4
DC2-27G	2.7	.005	58.0	11.4
DC2-33G	3.3	.005	58.0	11.4
DC2-39G	3.9	.005	50.0	11.4
DC2-47G	4.7	.005	50.0	11.4
DC2-56G	5.6	.006	44.0	11.4
DC2-68G	6.8	.007	39.0	11.4
DC2-82G	8.2	.007	36.0	11.4
DC2-100	10.0	.009	30.0	11.4
DC2-120	12.0	.009	27.0	11.4
DC2-150	15.0	.013	25.0	9.4
DC2-180	18.0	.018	22.0	7.2
DC2-220	22.0	.019	21.0	7.2
DC2-270	27.0	.026	20.5	5.5
DC2-330	33.0	.029	18.6	5.5
DC2-390	39.0	.030	17.0	5.5
DC2-470	47.0	.035	15.1	5.5
DC2-560	56.0	.039	13.6	5.5
DC2-680	68.0	.053	12.7	4.8
DC2-820	82.0	.060	11.3	4.8
DC2-101	100.0	.080	10.4	4.0
DC2-121	120.0	.090	9.4	4.0
DC2-151	150.0	.980	8.6	4.0
DC2-181	180.0	.110	7.8	4.0
DC2-221	220.0	.150	7.0	2.8
DC2-271	270.0	.213	6.3	2.0
DC2-331	330.0	.305	5.2	1.6
DC2-391	390.0	.320	4.9	1.6
DC2-471	470.0	.355	4.5	1.6
DC2-561	560.0	.388	4.1	1.6
DC2-681	680.0	.430	3.7	1.6
DC2-821	820.0	.590	3.4	1.3
DC2-102	1000.0	.818	3.1	1.0
DC2-122	1200.0	1.14	2.7	0.8
DC2-152	1500.0	1.26	2.4	0.8
DC2-182	1800.0	1.39	2.2	0.8
DC2-222	2200.0	1.54	2.0	0.8

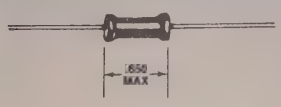


DC3

WILCO Part#	Inductance at O DC (μH)	Max. DCR (Ohms)	Saturation Current (DC Amps)	Rated Current (AC Amps)
DC3-10G	1.0	.003	116.0	21.0
DC3-12G	1.2	.003	116.0	21.0
DC3-15G	1.5	.003	116.0	21.0
DC3-18G	1.8	.003	90.0	21.0
DC3-22G	2.2	.003	90.0	21.0
DC3-27G	2.7	.003	74.0	21.0
DC3-33G	3.3	.003	74.0	21.0
DC3-39G	3.9	.003	62.0	21.0
DC3-47G	4.7	.003	54.0	21.0
DC3-56G	5.6	.003	54.0	21.0
DC3-68G	6.8	.004	47.0	21.0
DC3-82G	8.2	.004	42.0	21.0
DC3-100	10.0	.006	38.0	17.0
DC3-120	12.0	.008	35.0	13.5
DC3-150	15.0	.009	32.0	13.5
DC3-180	18.0	.010	29.0	13.5
DC3-220	22.0	.011	25.0	13.5
DC3-270	27.0	.012	23.0	13.5
DC3-330	33.0	.017	20.0	13.5
DC3-390	39.0	.022	19.0	11.4
DC3-470	47.0	.024	19.1	9.0
DC3-560	56.0	.026	17.5	9.0
DC3-680	68.0	.029	15.8	9.0
DC3-820	82.0	.032	14.0	9.0
DC3-101	100.0	.034	13.2	9.0
DC3-121	120.0	.046	12.1	7.2
DC3-151	150.0	.064	10.8	5.5
DC3-181	180.0	.072	9.7	5.5
DC3-221	220.0	.080	8.7	5.5
DC3-271	270.0	.110	7.9	4.5
DC3-331	330.0	.122	7.1	4.5
DC3-391	390.0	.169	6.7	4.0
DC3-471	470.0	.187	6.0	4.0
DC3-561	560.0	.205	5.5	4.0
DC3-681	680.0	.256	5.0	2.8
DC3-821	820.0	.288	4.5	2.8
DC3-102	1000.0	.426	4.1	2.0
DC3-122	1200.0	.462	3.7	2.0
DC3-152	1500.0	.518	3.4	2.0
DC3-182	1800.0	.705	2.8	1.6
DC3-222	2200.0	1.02	2.5	1.3
DC3-272	2700.0	1.14	2.3	1.3
DC3-332	3300.0	1.27	2.0	1.3
DC3-392	3900.0	1.67	1.8	1.0
DC3-472	4700.0	1.86	1.7	1.0

"SFB" SERIES • SMALL FERRITE Bobbin Coils

- Leads No. 20 Tinned Copper 1.5" long
- Coils Finished with Polyolifin Shrink Tube
- Nonstandard Values Available
- Saturation Current Lowers Inductance 5%



WILCO PART #	L uh ±15%	R.D.C. OHMS MAX.	Saturation Current (DC AMPS)	I AMPS Suggested Rating	DIA. NOM.	TEST FREQ.
SFB 39G	3 9	019	7 3	1 28	260	1 kHz
SFB 47G	4 7	022	6 3	1 28	260	1 kHz
SFB 56G	5 6	024	5 6	1 28	260	1 kHz
SFB 68G	6 8	026	5 3	1 28	260	1 kHz
SFB 82G	8 2	028	4 5	1 28	260	1 kHz
SFB 100	10	033	4 1	1 28	260	1 kHz
SFB 120	12	037	3 6	1 28	260	1 kHz
SFB 150	15	040	3 3	1 28	260	1 kHz
SFB 180	18	044	3 0	1 28	260	1 kHz
SFB 220	22	050	2 7	1 28	260	1 kHz
SFB 270	27	058	2 5	1 28	260	1 kHz
SFB 330	33	075	2 2	1 008	260	1 kHz
SFB 390	39	094	2 0	804	260	1 kHz
SFB 470	47	109	1 8	804	260	1 kHz
SFB 560	56	140	1 7	804	260	1 kHz
SFB 680	68	131	1 5	804	260	1 kHz
SFB 820	82	152	1 4	804	260	1 kHz
SFB 101	100	208	1.2	632	260	1 kHz
SFB 121	120	283	1 1	508	260	1 kHz
SFB 151	150	340	1 0	508	260	1 kHz
SFB 181	180	362	95	508	260	1 kHz
SFB 221	220	430	86	508	260	1 kHz
SFB 271	270	557	77	400	260	1 kHz

WILCO PART #	L uh ±15%	R.D.C. OHMS MAX	Saturation Current (DC AMPS)	I AMPS Suggested Rating	DIA. NOM.	TEST FREQ.
SFB 331	330	665	70	400	260	1 kHz
SFB 391	390	712	64	400	260	1 kHz
SFB 471	470	1 15	59	315	260	1 kHz
SFB 561	560	1 27	54	315	260	1 kHz
SFB 681	680	1 61	.49	.250	260	1 kHz
SFB 821	820	1.96	.44	.200	260	1 kHz
SFB 102	1000	2.30	.40	.200	260	1 kHz
SFB 122	1200	2.65	.35	.200	260	1 kHz
SFB 152	1500	3.45	.33	.158	260	1 kHz
SFB 182	1800	4.03	.29	.158	260	1 kHz
SFB 222	2200	4.48	.27	.158	260	1 kHz
SFB 272	2700	5.40	.24	.125	260	1 kHz
SFB 332	3300	6.56	.22	.125	260	1 kHz
SFB 392	3900	8.63	.20	.100	260	1 kHz
SFB 472	4700	9.66	.18	.100	260	1 kHz
SFB 562	5600	13.9	.166	.082	260	1 kHz
SFB 682	6800	16.3	.151	.082	260	1 kHz
SFB 822	8200	20.8	.138	.065	260	1 kHz
SFB 103	10000	26.4	.125	.050	260	1 kHz
SFB 123	12000	29.9	.114	.050	260	1 kHz
SFB 153	15000	42.5	.098	.039	260	1 kHz
SFB 183	18000	48 3	.091	.039	260	1 kHz

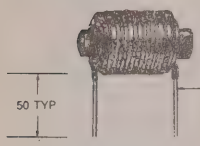
"LFB" SERIES • LARGE FERRITE Bobbin Coils

- Leads No. 20 Tinned Copper 1.5" long
- Coils Finished with Polyolifin Shrink Tube
- Nonstandard Values Available
- Saturation Current Lowers Inductance 5%

WILCO PART #	L uh ±15%	R.D.C. OHMS MAX	Saturation Current (DC AMPS)	I AMPS Suggested Rating	DIA. NOM.	TEST FREQ.
LFB 39G	3 9	007	15 5	4 0	450	1 kHz
LFB 47G	4 7	008	13 9	4 0	450	1 kHz
LFB 56G	5 6	009	12 6	4 0	450	1 kHz
LFB 68G	6 8	011	11 5	4 0	450	1 kHz
LFB 82G	8 2	013	9 89	4 0	450	1 kHz
LFB 100	10	017	8 70	4 0	450	1 kHz
LFB 120	12	019	8 21	4 0	450	1 kHz
LFB 150	15	022	7 34	4 0	450	1 kHz
LFB 180	18	023	6 64	4 0	450	1 kHz
LFB 220	22	026	6 07	4 0	450	1 kHz
LFB 270	27	027	5 36	4 0	450	1 kHz
LFB 330	33	032	4 82	4 0	450	1 kHz
LFB 390	39	033	4 36	4 0	450	1 kHz
LFB 470	47	035	3 98	4 0	450	1 kHz
LFB 560	56	037	3 66	3 2	450	1 kHz
LFB 680	68	047	3 31	2 5	450	1 kHz
LFB 820	82	060	3 10	2 0	450	1 kHz
LFB 101	100	080	2 79	1 6	450	1 kHz
LFB 121	120	090	2 54	1 6	450	1 kHz
LFB 151	150	.107	2 22	1 6	450	1 kHz
LFB 181	180	.123	1 98	1 6	450	1 kHz
LFB 221	220	.150	1 89	1 6	450	1 kHz
LFB 271	270	162	1 63	1 6	450	1 kHz
LFB 331	330	183	1 51	1 6	450	1 kHz
LFB 391	390	212	1 39	1 6	450	1 kHz
LFB 471	470	281	1 24	1 2	450	1 kHz
LFB 561	560	380	1 17	1 0	450	1 kHz

WILCO PART #	L (µH) ±15%	R.D.C. OHMS MAX.	Saturation Current (DC AMPS)	I AMPS Suggested Rating	DIA NOM	TEST FREQ.
LFB 681	680	420	1 05	1 0	450	1 kHz
LFB 821	820	548	97	0 8	450	1 kHz
LFB 102	1000	655	87	0 8	450	1 kHz
LFB 122	1200	884	79	0 6	450	1 kHz
LFB 152	1500	1 04	70	0 6	450	1 kHz
LFB 182	1800	1 18	64	0 6	450	1 kHz
LFB 222	2200	1 56	58	0 5	450	1 kHz
LFB 272	2700	2 06	53	0 4	450	1 kHz
LFB 332	3300	2.53	47	0 4	450	1 kHz
LFB 392	3900	2 75	43	0 4	450	1 kHz
LFB 472	4700	3.19	39	0.4	450	1 kHz
LFB 562	5600	3 92	359	315	450	1 kHz
LFB 682	6800	5 69	322	250	450	1 kHz
LFB 822	8200	6 32	293	250	450	1 kHz
LFB 103	10000	7 30	266	250	450	1 kHz
LFB 123	12000	9 21	241	200	450	1 kHz
LFB 153	15000	10 5	214	200	450	1 kHz
LFB 183	18000	14 8	198	158	450	1 kHz
LFB 223	22000	21 8	180	125	450	1 kHz
LFB 273	27000	22 7	162	125	450	1 kHz
LFB 333	33000	25 7	146	125	450	1 kHz
LFB 393	39000	31 8	135	100	450	1 kHz
LFB 473	47000	36 1	122	100	450	1 kHz
LFB 563	56000	40 9	112	100	450	1 kHz
LFB 683	68000	57 3	101	082	450	1 kHz
LFB 823	82000	79 3	090	065	450	1 kHz
LFB 104	100000	89 7	081	065	450	1 kHz

"HCS" SERIES



RADIAL LEAD HASH CHOKES
WOUND ON .250 x 1.00
FERRITE RODS

WILCO Part #	L uh	R.D.C. Ohms Max	Rated Current Suggested Max (amps)	Lead Spacing Typ	Lead Dia. Nom	Body Dia. Max
HCS 100	10	016	10 00	260	050	590
HCS 200	20	017	11 00	560	050	590
HCS 300	30	021	11 00	610	050	590
HCS 500	50	043	7 00	625	039	550
HCS 101	100	086	5 00	750	030	550
HCS 151	150	107	5 00	565	030	600
HCS 201	200	140	4 00	620	030	600
HCS 251	250	184	4 00	750	030	600

"HCL" SERIES

RADIAL LEAD HASH CHOKES
WOUND ON .250 x 1.50
FERRITE RODS

WILCO Part #	L uh	R.D.C. Ohms Max	Rated Current Suggested Max (amps)	Lead Spacing Typ	Lead Dia Nom	Body Dia Max
HCL 101	100	061	8 00	1 143	050	590
HCL 201	200	110	6 00	1 103	039	550
HCL 301	300	140	5 00	1 145	030	550
HCL 401	400	167	4 00	775	030	600
HCL 501	500	192	4 00	880	030	600
HCL 601	600	237	4 00	1 080	030	600
HCL 701	700	257	4 00	1 115	030	600
HCL 801	800	291	4 00	1 285	030	600

L = ± 15% @ 1KHz Measured with zero D.C. current

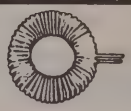
OPTIONS AVAILABLE:

- Intermediate values
- Shrink tube sleeving
- Formed leads
- Tight "L" tolerances

Compact size and pretinned leads for fast & easy PCB insertion in:

- Filters for switching regulators
- SCR/TRIAC control circuits
- Power supplies
- Hash filters
- RF circuits

"ITS" SERIES • SMALL TOROIDAL INDUCTORS



• ACTUAL SIZE •

- The Toroidal core design produces a closed magnetic field resulting in low EMI.

TYPICAL APPLICATIONS:

- Switching Power Supplies
- Output Chokes
- Hash Filters
- EMI/RFI Filtering

WILCO PART NUMBER	L UH ±15%	MAX RDC (OHMS)	RATED DC AMPS	OD (NOM)	ID (NOM)	H (NOM)	LEAD LENGTH (NOM)
ITS10G	1	.004	10	.58	.25	.262	.5
ITS12G	1.2	.004	10	.58	.25	.262	.5
ITS15G	1.5	.005	10	.58	.25	.262	.5
ITS18G	1.8	.005	10	.58	.25	.262	.5
ITS22G	2.2	.007	10	.58	.25	.262	.5
ITS27G	2.7	.007	10	.58	.25	.262	.5
ITS33G	3.3	.008	10	.58	.25	.262	.5
ITS39G	3.9	.009	10	.58	.25	.262	.5
ITS47G	4.7	.01	10	.60	.22	.28	.5
ITS56G	5.6	.011	9	.60	.22	.28	.5
ITS68G	6.8	.012	9	.60	.22	.28	.5
ITS82G	8.2	.013	9	60	.22	.28	.5
ITS100	10	014	9	60	.22	.28	.5
ITS120	12	.018	8	.60	.22	.28	.5
ITS150	15	.02	8	.60	.22	.28	.5
ITS180	18	.025	7	.60	.22	.28	.5
ITS220	22	.029	7	.60	.22	.28	.5
ITS270	27	.035	5.5	.60	.22	.28	.5
ITS330	33	04	5.5	.60	22	.28	.5
ITS390	39	.06	5.5	.60	22	.28	.5
ITS470	47	.095	5	.60	22	.28	.5
ITS560	56	.120	5	.56	.23	.24	.5
ITS680	68	.125	4	.56	23	.24	.5
ITS820	82	.200	3.5	.56	.23	.24	.5
ITS101	100	.223	3.5	.56	23	.24	.5
ITS121	120	.331	3	.56	23	.24	.5
ITS151	150	.402	3	.56	23	.24	.5
ITS181	180	.479	3	.56	23	.24	.5
ITS221	220	.583	2	.56	.23	.24	.5
ITS271	270	.632	2	.56	23	.24	.5
ITS331	330	.652	1.5	.56	.23	.24	.5
ITS391	390	.731	1.5	.56	23	.24	.5
ITS471	470	.872	1.5	.56	23	.24	.5
ITS561	560	.984	1.5	.56	23	.24	.5
ITS681	680	1.01	1	.56	.23	.24	.5
ITS821	820	1.22	1	.56	.23	.24	.5
ITS102	1000	1.59	1	.56	.23	.24	.5

- Inductance measured@ 1khz with zero DC current
- Toroids are self leaded for PCB insertion

Options Available: • Intermediate Values • Custom Mounts • Encapsulation

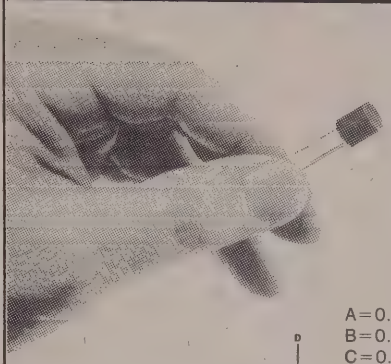
WILCO CORPORATION

6451 SAGUARO COURT 317-293-9300 INDIANAPOLIS, IN 46268

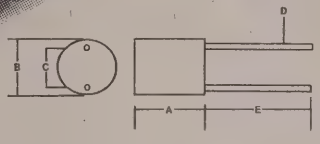
FAX 317 / 293-9462

Part #	Inductance	Rdc. Max.	Idc (Amps)
MC102	1 mH	3.1 ohms	.132 A
MC122	1.2 mH	4.0 ohms	.132 A
MC152	1.5 mH	6.1 ohms	.083 A
MC182	1.8 mH	6.4 ohms	.083 A
MC222	2.2 mH	6.8 ohms	.083 A
MC272	2.7 mH	7.7 ohms	.083 A
MC332	3.3 mH	9.0 ohms	.053 A
MC472	4.7 mH	16 ohms	.053 A
MC562	5.6 mH	18 ohms	.053 A
MC682	6.8 mH	19 ohms	.053 A
MC822	8.2 mH	21 ohms	.053 A
MC103	10 mH	25 ohms	.041 A
MC123	12 mH	33 ohms	.041 A
MC153	15 mH	37 ohms	.041 A
MC183	18 mH	40 ohms	.041 A
MC223	22 mH	56 ohms	.032 A
MC273	27 mH	62 ohms	.032 A
MC333	33 mH	70 ohms	.032 A
MC473	47 mH	99 ohms	.032 A
MC563	56 mH	135 ohms	.021 A
MC683	68 mH	150 ohms	.021 A
MC823	82 mH	212 ohms	.021 A
MC104	100 mH	235 ohms	.021 A

"MC" SERIES
MINITURIZED ENCAPSULATED INDUCTOR



- **Miniaturized Encapsulated Inductors.**
- **Great for Noise, Spike and Filtering Applications in Power Supplies, Switching Regulators, and Amplifiers.**
- **Extreme Resistance to Mechanical Shock.**



A=0.40 inches (10.16mm) max.
B=0.37 inches (9.398mm) max.
C=0.20 inches (5.08mm) max.
D=0.0203 inches (.51562mm) nom.
E=1.2 inches (30.48mm) min.
Core Material=Ferrite
Cup Material=Glass Fibre Diallyl Phthallate
Fill=Epoxy Resin+Polyamide Hardner

NOTES:
- Inductance measured at 50 mVRMS 1 kHz
- Inductance is +/-10% @ 1 kHz
- Ambient Temperature -55 degrees C to 100 degrees C
- Nonstandard values available
- Magnetic shield available

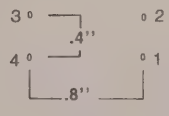
WILCO PART NUMBER	L UH ±15%	MAX RDC (OHMS)	I MAX (AMPS)	0% Saturation (DC AMPS)	10% Saturation (DC AMPS)	50% Saturation (DC AMPS)
TBM100	10	.019	4.64	1.47	5.16	16.68
TBM120	12	.02	4.64	1.36	4.42	14.33
TBM150	15	.02	4.64	1.19	3.87	12.51
TBM180	18	.021	4.64	1.12	3.64	11.77
TBM220	22	.021	4.64	1	3.44	11.12
TBM270	27	.023	4.84	0.91	3.1	10.01
TBM330	33	.023	4.64	0.83	2.69	8.7
TBM390	38	.023	4.64	0.76	2.48	8.01
TBM470	47	.026	4.64	0.68	2.29	7.41
TBM560	56	.028	4.64	0.64	2.06	6.67
TBM680	68	.035	4.64	0.56	1.82	5.89
TBM820	82	.038	3.68	0.52	1.72	5.56
TBM101	100	.041	3.68	0.48	1.55	5
TBM121	120	.045	3.68	0.43	1.38	4.45
TBM151	150	.058	3.68	0.38	1.26	4.08
TBM181	180	.071	2.93	0.35	1.15	3.71
TBM221	220	.078	2.93	0.32	1.05	3.38
TBM271	270	.083	2.93	0.28	0.94	3.03
TBM331	330	.115	2.32	0.26	0.85	2.74
TBM391	390	.170	1.83	0.24	0.78	2.53
TBM471	470	.175	1.83	0.22	0.7	2.25
TBM561	560	.283	1.15	0.2	0.65	2.11
TBM681	680	.401	1.15	0.28	0.6	1.92
TBM821	820	.410	0.92	0.26	0.51	1.65
TBM102	1000	.513	0.92	0.25	0.47	1.53
TBM122	1200	.595	0.92	0.14	0.43	1.39
TBM152	1500	.899	0.72	0.12	0.39	1.25
TBM182	1800	1.04	0.72	0.11	0.35	1.14
TBM222	2200	1.12	0.72	0.1	0.32	1.03
TBM272	2700	1.67	0.58	0.09	0.29	0.93
TBM332	3300	1.93	0.58	0.08	0.26	0.84
TBM392	3900	2.12	0.58	0.08	0.24	0.78
TBM472	4700	2.23	0.45	0.07	0.22	0.71
TBM562	5600	2.67	0.45	0.06	0.2	0.65
TBM682	6800	3.45	0.36	0.06	0.18	0.59
TBM822	8200	5.37	0.29	0.05	0.17	0.54
TBM103	10000	6.11	0.29	0.05	0.15	0.48

TBM PCB MOUNT TOROIDS

- **Vertical base mounted toroids provide greater mechanical stability and easy PCB installation**
- **Typical applications are switching power supplies, filters, output chokes, EMI/RFI filtering**
- **The torodial configuration provides a closed magnetic field resulting in low EMI**

Height=1.22'' Max
Length=1.2'' Max
Width=.65'' Max
Polyurethane Coated
Marked: WILCO+PART#
Pin Connections are 1+3
No Pin Connections on 2+4

Pin Layout



Top View

NOTES:
- **Inductance measured at 1 Khz 0 amps DC**
- **Inductance is ± 15% @ 1 Khz 0 amps DC**
- **Nonstandard values available**
- **Operating temperature is -55 degrees C to 100 degrees C**
- **Saturation currents shown indicate the max drop in L at that current**

WILCO CORPORATION
6451 SAGUARO COURT 317-293-9300 INDIANAPOLIS, IN 46268
FAX 317-293-9462

"ML" SERIES MINIATURE LAYER Choke Coils

All choke coils in this series are wound on .095x¼ size forms. Leads are of No.21 tinned wire. Values from .68 uh to 5.6 uh are wound on phenolic forms. Values from 6.8 uh to 33 uh are wound on iron core forms. Tolerances are ± 15% for ML10S through ML82S: ± 10% from ML10G through ML270. All units are impregnated with thermosetting varnish and are EIA color coded.

• ¼ WATT RESISTOR SIZE CHOKES •

WILCO PART # ML Series	L uh	Q NOM.	S.R.F. NOM. (MHz)	R.D.C. OHMs NOM.	I (MA) MAX.	DIA. NOM.	TEST FREQ. (MHz)
ML 10S	.10	45	750+	.06	1824	.107	25
ML 12S	.12	47	"	.07	1824	.109	"
ML 15S	.15	48	712	.08	1824	.111	"
ML 18S	.18	44	607	.09	1379	.107	"
ML 22S	.22	46	541	.09	1490	.111	"
ML 27S	.27	44	475	.13	1154	.107	"
ML 33S	.33	44	428	.14	1054	.107	"
ML 39S	.39	45	410	.16	975	.107	"
ML 47S	.47	43	387	.21	912	.107	"
ML 56S	.56	44	365	.24	1012	.111	"
ML 68S	.68	46.9	308	.25	942	.109	"
ML 82S	.82	45.6	279	.32	816	.109	"
ML 10G	1.0	30.3	253	.33	635	.106	7.9
ML 12G	1.2	30.1	234	.42	563	"	"
ML 15G	1.5	31.3	208	.58	479	.104	"
ML 18G	1.8	31.0	187	.68	443	"	"
ML 22G	2.2	32.1	169	1.17	337	.102	"
ML 27G	2.7	32.3	153	1.42	306	"	"
ML 33G	3.3	33.3	137	2.68	223	.100	"
ML 39G	3.9	34.4	126	2.92	214	"	"
ML 47G	4.7	33.5	114	3.44	197	"	"
ML 56G	5.6	32.1	106	3.92	184	"	"
ML 68G	6.8	42.7	54.0	.43	557	.104	"
ML 82G	8.2	40.8	49.6	.56	488	"	"
ML 100	10	39.1	46.6	.72	430	"	"
ML 120	12	62.5	40.3	1.18	336	.102	2.5
ML 150	15	64.5	36.5	1.43	300	"	"
ML 220	22	63.2	29.2	3.11	207	.100	"
ML 270	27	64.8	27.0	3.54	194	"	"

"MP" SERIES • MULTI-PI Choke Coils

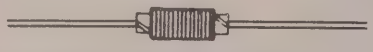
These Coils use 3-Pi Universal windings to insure low distributed capacity and High "Q".

WILCO PART NO.	L±5% uH	Q (MIN)	TEST FREQ. MHz	S.R.F. MIN. MHz	RDC OHMS (MAX)	I MA (MAX)	COIL DIA.	CORE LENGTH	CORE MATERIAL
MP101	100	49	.79	11	5.4	160	.41	.75	Phenolic
MP151	150	53	.79	8.8	6.5	160	.41	.75	Phenolic
MP241	240	56	.79	7.2	8.5	160	.44	.75	Phenolic
MP391	390	57	.79	5.6	11	160	.5	.75	Phenolic
MP551	550	58	.79	4.8	13	160	.5	.75	Phenolic
MP621	620	59	.79	4.5	15	160	.53	.75	Phenolic
MP751	750	56	.79	4	16	160	.53	.75	Phenolic
MP102	1000	83	.25	2.6	8.6	160	.47	.875	Powdered Iron
MP152	1500	82	.25	2.1	11	160	.47	.875	Powdered Iron
MP242	2400	80	.25	1.7	15	160	.53	.875	Powdered Iron
MP392	3900	73	.25	1.4	20	160	.56	.875	Powdered Iron
MP552	5500	69	.25	1.1	25	160	.59	.875	Powdered Iron
MP622	6200	89	.25	1	37	100	.53	.875	Powdered Iron
MP822	8200	83	.25	.94	46	100	.56	.875	Powdered Iron
MP103	10000	108	.079	.71	31	100	.53	.875	Ferrite
MP253	25000	102	.079	.47	82	65	.53	.875	Ferrite
MP503	50000	113	.079	.33	127	65	.63	.875	Ferrite

Leads: 1.5 inch. AWG 20 TCW
Coils finished with Thermosetting Varnish

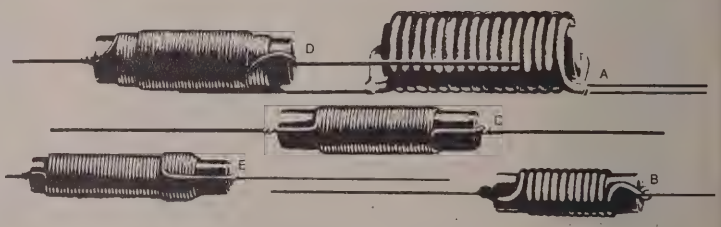
"W" SERIES Single Layer Solenoid Type Choke Coils

All choke coils in this series are wound on .156x⅛ size forms. Leads are of No. 20 tinned wire. Values from 1 uh to 18 uh are wound on phenolic forms. Values from 22 uh to 100 uh are wound on iron core forms. Tolerances are ± 20% for W10G through W22G: ± 10% from W27G through W101. All units are impregnated with thermosetting varnish and are EIA color coded.



WILCO PART #	L uh	Q NOM.	S.R.F. NOM. (MHz)	R.D.C. OHMs NOM.	COLOR CODE	I (MA) MAX	DIA NOM.	TEST FREQ (MHz)
W 10 G	1.0	45	238	.11	Br Blk Gld	1965	.179	7 90
W 12 G	1.2	45	218	.12	Br Rd Gld	1882	.179	"
W 15 G	1.5	45	200	.14	Br Gr Gld	1742	.179	"
W 18 G	1.8	45	180	.24	Br Gry Gld	1330	.175	"
W 22 G	2.2	45	165	.26	Rd Rd Gld	1278	.175	"
W 27 G	2.7	45	149	.34	Rd Vi Gld	1118	.175	"
W 33 G	3.3	45	136	.52	Or Or Gld	904	.172	"
W 39 G	3.9	45	127	.61	Or Wh Gld	835	.172	"
W 47 G	4.7	50	114	80	Yel Vi Gld	729	170	"
W 56 G	5.6	50	104	1.15	Gr Blu Gld	608	170	"
W 68 G	6.8	50	94.8	1.35	Blu Gry Gld	561	.169	"
W 82 G	8.2	50	86.1	1.75	Gry Rd Gld	493	.168	"
W 100	10	50	78.5	2.50	Br Blk Blk	412	.167	"
W 120	12	30	71.6	2.90	Br Rd Blk	383	166	2.50
W 150	15	30	63.9	5.10	Br Gr Blk	288	.165	"
W 180	18	30	57.5	6.60	Br Gry Blk	254	.164	"
W 220	22	85	36.1	1.10	Rd Rd Blk	622	.170	"
W 270	27	80	33 2	1 22	Rd Vi Blk	590	.169	"
W 330	33	80	30.6	1.38	Or Or Blk	555	.169	"
W 390	39	90	26.6	2 04	Or Wh Blk	456	.167	"
W 470	47	90	24.9	2.32	Yel Vi Blk	428	.167	"
W 560	56	90	23 6	2 50	Grn Blu Blk	412	.167	"
W 680	68	90	21.6	3.00	Blu Gry Blk	376	.166	"
W 820	82	100	19 0	4 70	Gry Rd Blk	300	165	"
W 101	100	100	17.8	5 40	Br Blk Br	280	165	"

"LF" SERIES • HIGH CURRENT HASH CHOKES



WILCO Part #	Inductance ± 20% (µH)	DC Resistance Max. (Ω)	DC Current Max. (Amps)	Coil Diameter	Lead Wire Size	Lead Lengths Min.	Body Length Min.	Refer To Figure	Core Material
MEASURED ON Q-METER AT 7.9 MHz									
LF 335G	3.35	.01	20	.6	12 AWG	1.25	1.25	A	IRON
LF 49G	4.9	.016	15	.6	14 AWG	1.25	1.25	A	IRON
LF 88G	8.8	.021	10	.56	16 AWG	1.25	1.25	A	IRON
LF 40G	4	.012	8	.38	20 AWG	1.25	1.00	B	FERRITE
MEASURED ON 1KHz BRIDGE									
LF 400	40	.082	3	.31	20 AWG	1.25	1.25	C	FERRITE
LF 680	68	.054	5	.56	20 AWG	1.25	1.25	D	"
LF 101	100	.216	2	.38	20 AWG	1.25	1.25	E	"
LF 125	125	.08	3.5	.5	20 AWG	1.25	1.25	D	"
LF 251	250	.17	2.5	.44	20 AWG	1.25	1.25	D	"
LF 501	500	.26	2	.56	20 AWG	1.25	1.25	D	"
LF 102	1000	.55	1	.5	20 AWG	1.25	1.25	D	"

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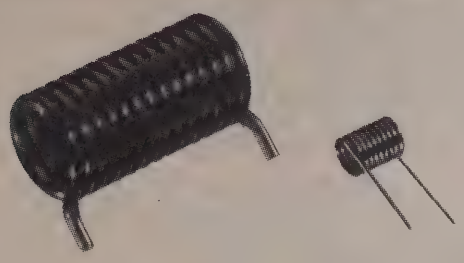
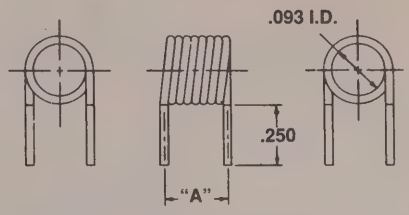
"AC" SERIES • AIR COILS



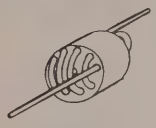
1. LEADS STRIPPED .250 TYP.
2. 26 AWG – LEFT HAND WIND



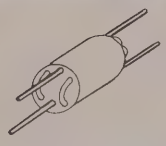
WILCO PART NO.	No. Of Turns	"A" Dim.	Wire	Electrical Data
AC 0952	2½	.051	26 Gauge, SPN, Green	L = 22 nh
AC 0953	3½	.068	26 Gauge, SPN, Green	L = 34 nh
AC 0954	4½	.085	26 Gauge, SPN, Green	L = 43 nh
AC 0955	5½	.102	26 Gauge, SPN, Green	L = 51 nh
AC 0956	6½	.119	26 Gauge, SPN, Green	L = 64 nh
AC 0957	7½	.136	26 Gauge, SPN, Green	L = 77 nh
AC 0958	8½	.153	26 Gauge, SPN, Green	L = 92 nh
AC 0959	9½	.170	26 Gauge, SPN, Green	L = 99 nh
AC 0960	10½	.187	26 Gauge, SPN, Green	L = 118 nh

FB SERIES • WIDE - BAND CHOKES

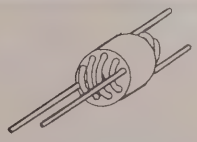
- Ferrite beads also known as wide-band chokes, low and high pass filters or band reject filters
- Used to suppress a selected frequency or band of frequencies
- Reduce signal noise



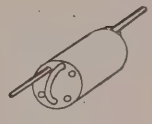
4.5 Turns



2 x 1.5 Turns

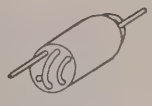


2 x 2.5 Turns



1.5 Turns

2 Turns



2.5 Turns

3 Turns

WILCO PART NO.	Length (Inches) MAX	Diameter (Inches) MAX	Turns	Wire (TCW)	Impedance @ 50 MHz	Impedance @ 100 MHz	Lead Length (Inches) MIN
FB1111	.43	.26	1.5	24 AWG	400	470	1.25
FB1112	.43	.26	2.0	24 AWG	650	600	1.25
FB1113	.43	.26	2.5	24 AWG	850	725	1.25
FB1114	.43	.26	3.0	24 AWG	1000	750	1.25
FB1115	.43	.42	4.5	22 AWG		670	1.25
FB1116	.43	.26	2X1.5	24 AWG		450	1.25
FB1117	.43	.42	2X2.5	22 AWG		650	1.25

WILCO CORPORATION

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FAX 317 / 293-9462

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TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 93/94 EDITION OF EEM

AC Power Supplies, Product Selection Guide **D•2221**

Batteries, Product Selection Guide **D•1419**

Cabinets, Enclosures, Racks & Chassis, Product Selection Guide **C•1003**

Capacitors, Product Selection Guide **A•1003**

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For Power supply output filters
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High inductance
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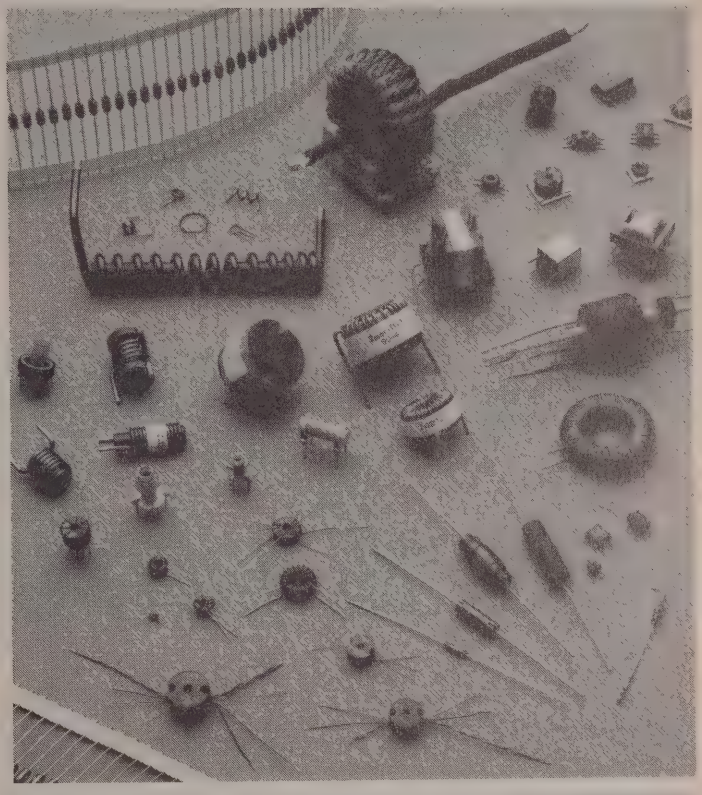
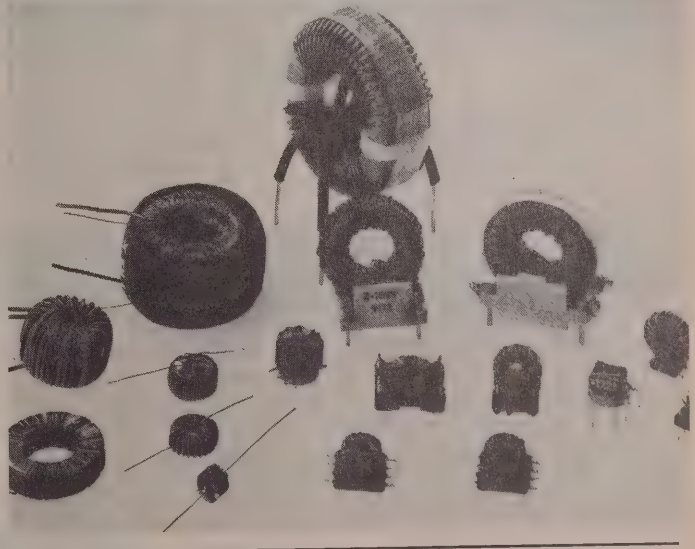
Surface Mount Coils, Chokes and Inductors





• SEE SECTION 5600 FOR TRANSFORMERS.

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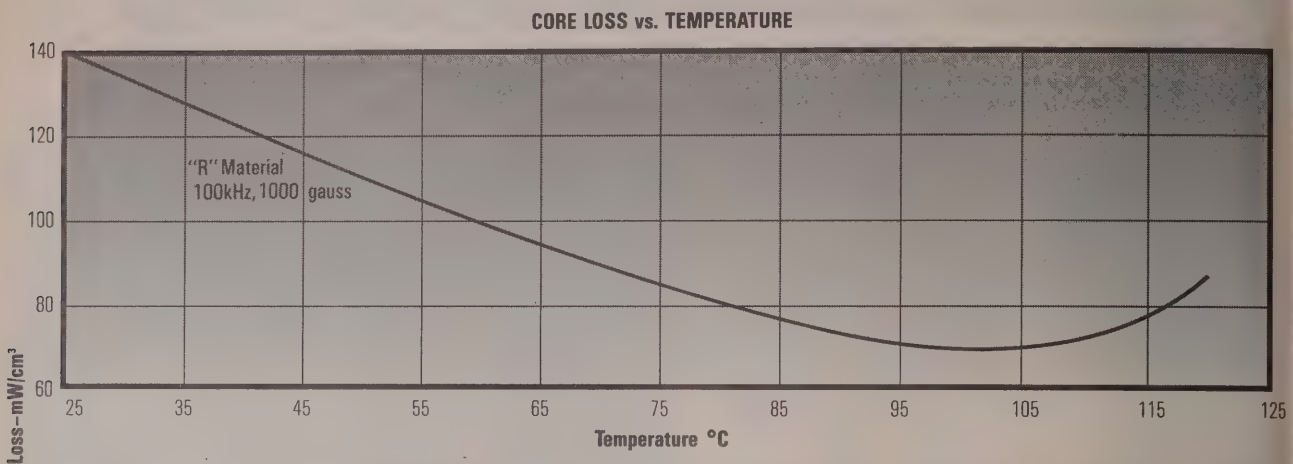

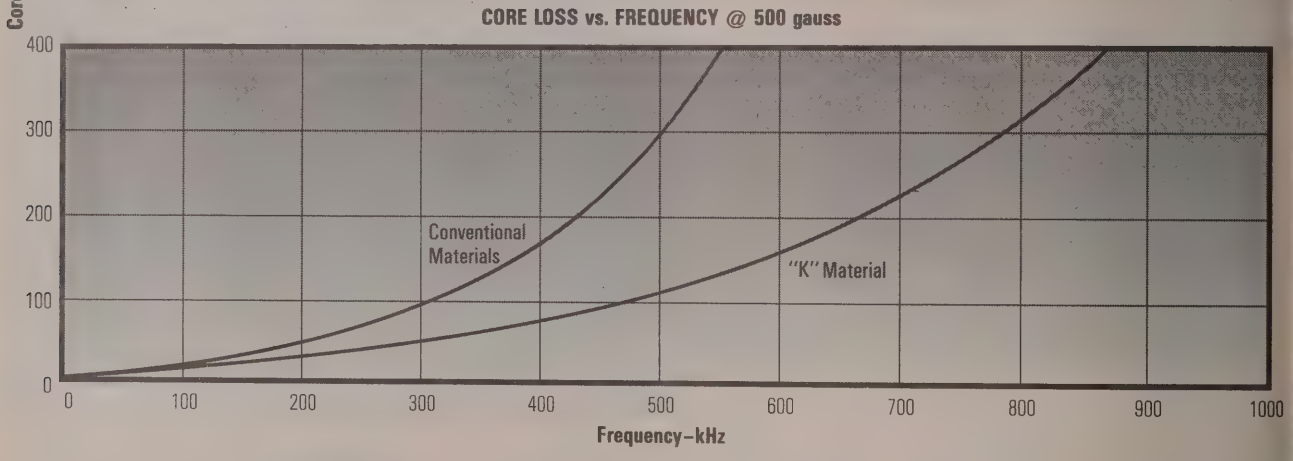

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CORES, MAGNETS & FERRITES

TAPE CORES

Manufacturer	Starting EEM Page No.	Common Mode Noise Filters	Converters	Current Transformers	Electronic Transformers	EMI/RFI Filters	High Frequency Counters	Inductors – High Q Filters	In-Line Filters	Inverters	Magnetic Amplifiers	Noise Filters	Power Factor Correction	Pulse Transformers	Regulators	Saturating Transformers	Static Magnetic Devices	Switching Regulators
Magnetics/Spang	A•1322	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√

BOBBIN CORES

Manufacturer	Starting EEM Page No.	Common Mode Noise Filters	Converters	Current Transformers	Electronic Transformers	EMI/RFI Filters	High Frequency Counters	Inductors – High Q Filters	In-Line Filters	Inverters	Magnetic Amplifiers	Noise Filters	Power Factor Correction	Pulse Transformers	Regulators	Saturating Transformers	Static Magnetic Devices	Switching Regulators
Magnetics/Spang	A•1322	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√

CUT CORES

Manufacturer	Starting EEM Page No.	Common Mode Noise Filters	Converters	Current Transformers	Electronic Transformers	EMI/RFI Filters	High Frequency Counters	Inductors – High Q Filters	In-Line Filters	Inverters	Magnetic Amplifiers	Noise Filters	Power Factor Correction	Pulse Transformers	Regulators	Saturating Transformers	Static Magnetic Devices	Switching Regulators
Magnetics/Spang	A•1322	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√

MOLYPERMALLOY POWDER CORES

Manufacturer	Starting EEM Page No.	Common Mode Noise Filters	Converters	Current Transformers	Electronic Transformers	EMI/RFI Filters	High Frequency Counters	Inductors – High Q Filters	In-Line Filters	Inverters	Magnetic Amplifiers	Noise Filters	Power Factor Correction	Pulse Transformers	Regulators	Saturating Transformers	Static Magnetic Devices	Switching Regulators
Magnetics/Spang	A•1322	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√

FERRITE CORES

Manufacturer	Starting EEM Page No.	Common Mode Noise Filters	Converters	Current Transformers	Electronic Transformers	EMI/RFI Filters	High Frequency Counters	Inductors – High Q Filters	In-Line Filters	Inverters	Magnetic Amplifiers	Noise Filters	Power Factor Correction	Pulse Transformers	Regulators	Saturating Transformers	Static Magnetic Devices	Switching Regulators
Advanced Component Industries	A•1318	√		√		√	√	√				√					√	
Magnetics/Spang	A•1322	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√

MAGNETS

Manufacturer	Starting EEM Page No.	Type			
		Alnico	Ceramic	Sm Co	Nd fe
A-L-L Magnetics/ The Magnet Source	A•1319	√	√	√	√
Jobmaster Magnetics	A•1320	√	√	√	√
Magnetic Component Engineering	A•1321	√	√	√	√
Magnetics/Spang	A•1322	√	√	√	√
Master Magnetics	A•1319	√	√	√	√
Miami Magnetic Co.	A•1319	√	√	√	√

KASCHKE KG

ADVANCED COMPONENTS INDUSTRIES, INC.

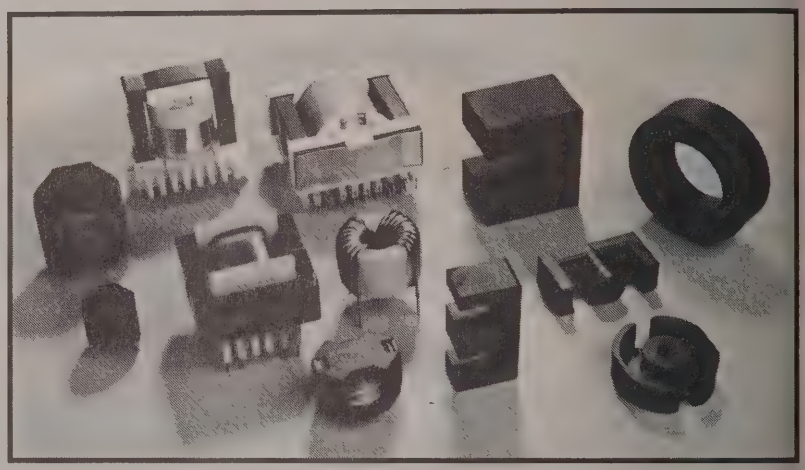
1308 Sartori Ave., Suite 105 · Torrance, CA 90501

(310) 328-0060 · Fax: (310) 328-0062

Kamafer (Kaschke-Germany) is a world wide active manufacturer of custom made and off the shelf ferrite and inductive products.

A: Ferrite-Division

As one of the leading European Ferrite-manufacturer, we produce nickel-zinc and manganise-zinc soft ferrites in all shapes and sizes.



We are specialised in:
- power-ferrites
- high permeability-ferrites
- ferrites for EMI-applications
- ferrites for HF-welding

Material Characteristics:

	K 14	K 40	K 250	K 800	K 700	K 2004	K 2006	K 4000	K 6000	K 10000
Initial permeability µi	14	40	250	800	700	2000	2100	4000	6000	10000
Bs mT at Hs/Am^{-1}	360 10000	470 10000	340 2000	370 2000	420 1000	425 800	450 800	380 800	370 800	350 800
Curie temperature °C	≥335	≥335	≥335	≥135	≥330	≥200	≥200	≥130	≥125	≥130

B: Inductive components division

Products:
Toroidal power inductors, power transformers, high current filter-chokes, power-chokes, tunable RF-coils, balun-coils, IFT'S, surface mount inductive components.

Components designed for:
switching power supplies, EMi/RFi-filters, télecommunications circuits, automotive circuits.

Engineering:
Our highly qualified engineering team guarantees fast and proficient reaction to all kinds of customer requests and designs.

Pricing:
Domestic and off-shore facilities provide competitive prices on both high and low volume orders.

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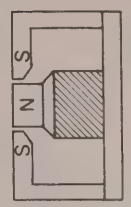
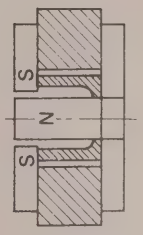
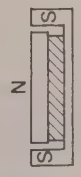
Free Magnet Properties Wall Chart

CA 800-262-4638 • US 800-525-3536 • FL 800-222-7846

Original MMPA class	BHmax* (MGOe)	\ Br \ (Gk)	\ Hc \ (Oe)	\ Hci \ (Oe)	Service TempMax	Density g / cc	% Loss Br/ °C	Optimum Configuration
Alnico 1ic	1.4	\ 7.2	\ 470	\ 480	450 \ 840	6.9	-.03	
Alnico 2ic	1.7	\ 7.5	\ 560	\ 580	450 \ 840	7.1	-.03	
Alnico 2is	1.5	\ 7.1	\ 550	\ 570	450 \ 840	6.8	-.03	
Alnico 3ic	1.35	\ 7.0	\ 480	\ 500	450 \ 840	6.9	-.03	
Alnico 5ac	5.5	\ 12.8	\ 640	\ 640	525 \ 975	7.3	-.02	
Alnico 5as	3.9	\ 10.9	\ 620	\ 630	525 \ 975	6.9	-.02	
Alnico 5dgac	6.5	\ 13.3	\ 670	\ 670	525 \ 975	7.3	-.02	
Alnico 5-7ac	7.5	\ 13.5	\ 740	\ 740	525 \ 975	7.3	-.02	
Alnico 6ac	3.9	\ 10.5	\ 780	\ 800	525 \ 975	7.3	-.02	
Alnico 6as	2.9	\ 9.4	\ 790	\ 820	525 \ 975	6.9	-.02	
Alnico 8ac	5.3	\ 8.2	\ 1650	\ 1860	550 \ 102	7.3	-.025	
Alnico 8as	4.0	\ 7.4	\ 1500	\ 1690	550 \ 102	7.0	-.025	
Alnico 8hcac	5.0	\ 7.2	\ 1900	\ 2170	550 \ 102	7.3	-.025	
Alnico 8hcas	4.5	\ 6.7	\ 1800	\ 2020	550 \ 102	7.0	-.025	
Alnico 9ac	9.0	\ 10.6	\ 1500	\ 1500	550 \ 102	7.3	-.025	
Ceramic 1	1.05	\ 2.3	\ 1860	\ 3250	800 \	4.9	-.2	
Ceramic 5	3.4	\ 3.8	\ 2400	\ 2500	800 \	4.9	-.2	
Ceramic 7	2.75	\ 3.4	\ 3400	\ 3250	800 \	4.9	-.2	
Ceramic 8A	3.5	\ 3.85	\ 2950	\ 3050	800 \	4.9	-.2	
Ceramic 8B	3.4	\ 3.8	\ 3400	\ 3900	800 \	4.9	-.2	
Ceramic 8C	4.0	\ 4.1	\ 2800	\ 2900	800 \	4.9	-.2	
SmCo 5/16	5.0	\ 4.7	\ 4500	\ 16000	250 \ 482	8.2	-.043	
SmCo 16/18	16.	\ 8.3	\ 7500	\ 18000	250 \ 482	8.2	-.043	
SmCo18/20	18.	\ 8.7	\ 8000	\ 20000	250 \ 482	8.2	-.043	
SmCo 22/15	22.	\ 9.5	\ 9000	\ 15000	250 \ 482	8.2	-.043	
SmCo 24/18	24.	\ 10.2	\ 9200	\ 18000	300 \ 572	8.4	-.03	
SmCo 26/11	26.	\ 10.5	\ 9000	\ 11000	300 \ 572	8.4	-.03	
SmCo 28/7	28.	\ 10.9	\ 6500	\ 7000	300 \ 572	8.4	-.03	
NdFeB27/11	27.	\ 10.8	\ 9300	\ 11000	80 \ 176	7.4	-.10	
NdFeB30/18	30.	\ 11.0	\ 10000	\ 18000	80 \ 176	7.4	-.10	
NdFeB33/11	33.	\ 11.8	\ 10800	\ 11000	80 \ 176	7.4	-.10	
NdFeB35/14	35.	\ 12.3	\ 11300	\ 14000	80 \ 176	7.4	-.10	
NdFeB40/9	40.	\ 13.0	\ 8500	\ 9000	80 \ 176	7.4	-.10	







*B = Flux Density H = Intensity Br = Residual Induction Hc = Coercive Force Hci = Intrinsic Hc

Free complete 30 pg. DoD, MMPA & MDFA Magnet STD-0100-90 (Visa $10 shp/hnd). Free magnet samples & Literature.

(G/CC x .036127292 = LB/CIN) (C x 9/5 + 32 = F) (Weight = Dnst x Area)

Manufacturers of Alloys: Alnico, Ceramic, NdFeB, SmCo, Flexible, Rare earth

Magnet Assemblies: All types; Line Card available upon request.

Magnets: Lab, Permanent, Superconducting, MIL, etc.

Meters: Flux, Gauss \ Magnetizers

Consult Local Factory for Your Specific Magnetic Properties Application.

A-L-L Magnetics Inc.
930 S. Placentia Ave.
Placentia, CA 92670
Phone: 714-632-1754
In: CA 800-262-4638
Fax: 714-632-1757

Master Magnetics Inc.
607 S. Gilbert St.
Castle Rock, CO 80104
Phone: 303-688-3966
In: US 800-525-3536
Fax: 303-688-5303

Miami Magnet Co. Inc.
6073-C26 N.W. 167th St.
Miami, FL 33015
Phone: 305-823-0641
In: US 800-222-7846
Fax: 305-823-1603

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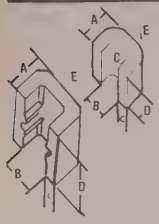
JOBMASTER MAGNETS

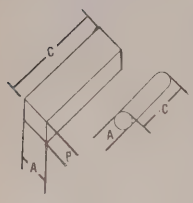
STOCK JOBMASTER MAGNETS



POWER MAGNET

Cat No	A mm	A ins	B mm	B ins	C mm	C ins	D mm	D ins	E mm	E ins	Weight gr	Weight oz
811	19	¾	14.2	9/16	7.9	5/16	19	¾	4	5/32	71	2½
812	25.4	1	19	¾	9.5	⅜	25.4	1	4.7	3/16	142	5
813	28.6	1⅛	22.2	⅞	11.1	7/16	28.6	1⅛	4.7	3/16	226	8
814	35	1⅜	35	1⅜	11	7/16	44.5	1¾	8	5/16	368	13
815	41	1⅝	41	1⅝	14.3	9/16	57	2¼	8	5/16	709	25
816	54	2⅛	47.6	1⅞	16	⅝	82.5	3¼	9.5	⅜	1446	51

Hole centres 814 31 75 mm 1¼" 815 38 mm 1½" 816 43 mm 1 11/16"

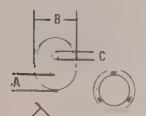


BAR MAGNET

Cat No	A mm	A ins	B mm	B ins	C mm	C ins	WEIGHT gr	WEIGHT oz
805	6	¼ diameter			20	13/16	4	.15
806	8	5/16 diameter			25	1	8	.30
807	10	⅜ diameter			30	1 3/16	16	.58
844	10	⅜	5	3/16	20	13/16	11	.38
845	12.5	½	5	3/16	40	1 9/16	21	.75
846	15	⅝	5	3/16	60	2⅜	56	2
842	15	⅜	10	⅜	50	2	70	2½
843	15	⅝	10	⅜	75	3	100	3½

POT MAGNET

Cat No	A mm	A ins	B mm	B ins	C	WEIGHT gr	WEIGHT oz
831	15.8	⅝	17.5	11/16	Tapped Hole	28	1
832	19.0	¾	20.6	13/16	OBA/6 SI	47	1¾
833	25.4	1	27	1 1/16	or 10 NF	100	3½
834	30.1	1 3/16	35	1⅜		198	7



SHALLOW POT MAGNET

Cat No	A mm	A ins	B mm	B ins	C mm	C ins	WEIGHT gr	WEIGHT oz
826	8	5/16	19	¾	3.5	9/64	14	½
827	9.5	⅜	28.6	1⅛	4.7	3/16	50	1¾
828	11.1	7/16	38	1½	4.7	3/16	100	3½

POWER MAGNET

Cat No	A mm	A ins	B mm	B ins	C mm	C ins	D mm	D ins	Weight gr	Weight oz
802	25.4	1	6.35	¼	7.9	5/16	7.9	5/16	28.3	1

RARE EARTH MAGNETS

Permanent Magnet Material

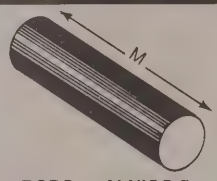
Jobmax 18 — Samarium Cobalt	Diameter	Thickness
Stock sizes	0.071"	0.157"
	0.098"	0.157"
	0.125"	0.125"
	0.187"	0.187"
	0.197"	0.059"
	0.250"	0.250"
	0.312"	0.062"
	0.375"	0.125"
	0.375"	0.250"
	0.375"	0.500"
	0.500"	0.187"
	0.500"	0.375"
	0.730"	0.300"

Jobmax 27 — Neodymium Iron Boron	Diameter	Thickness
Stock sizes	0.118"	0.059"
	0.197"	0.059"
	0.250"	0.125"
	0.330"	0.125"
	0.375"	0.062"
	0.375"	0.125"
	0.375"	0.100"
	0.394"	0.059"
	0.500"	0.125"
	0.500"	0.250"
	0.750"	0.187"
	1.000"	0.187"

Jobmax 35 is also available in many sizes.

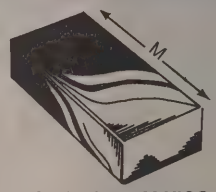
Cut blocks available in most sizes. Call for details.

JOBMASTER CAST ALNICO 5 MAGNETS



RODS — ALNICO 5

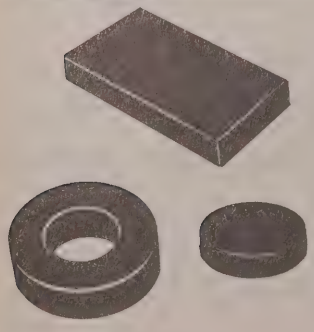
Dimensions in inches A	Dimensions in inches C
.125	4
.187	5
.250	6
.375	6
.500	6
.625	6
.750	6
.875	6
1.000	6



BARS, single — ALNICO 5

Dimensions in inches A	B	C
.125	.250	6
.250	.250	6
.250	.500	6
.500	.500	6
.500	.750	6
.500	1.000	6
.750	.750	6
1.000	1.000	6

CERAMIC MAGNETS



available in most sizes

Ceramic magnets are Barium Ferrite permanent magnets. They are extremely resistant to demagnetization (they lose approximately 4% of their strength every 100 years!) and are relatively inexpensive. They are extremely resistant to solvents and corrosive agents.

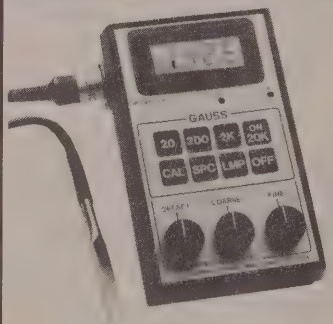
There are several grades of ceramic magnets:

Grade 1 Ceramic are unoriented and inexpensive. These magnets are usually magnetized conventionally but can be ordered multipole.

Grade 5 Ceramic are oriented. They are usually magnetized conventionally. The energy product is very close to that of Alnico 5, a fine magnetic alloy.

Grade 8 Ceramic is also oriented. It is even more resistant to demagnetization than Grade 5 Ceramic.

MICROPOWER GAUSSMETER



- Probes for every application available at low cost
- July 1992 price: $353.00

MODEL GM1A

- 0.25% ± 1 digit accuracy all ranges
- Automatic low battery warning, 100 hrs. life, 9V battery
- No reference magnets required... precalibrated probes
- Cal function for special or custom probes
- Calibrated analog output 200mV Full scale
- Front panel calibration and set-up
- Touch keyboard controls
- Display lighting
- Incremental/expanded scale operation. Null out up to ± 4 kG
- Militesia version available, at no extra cost
- Easy zeroing with three well balanced controls
- 3 ft. cable
- Rugged ABS case
- Duracell battery included

MANY OF OUR MAGNETS, MAGNETIC PRODUCTS AND SERVICES ARE NOT LISTED ABOVE. PLEASE CALL FOR INFORMATION.

JOBMASTER MAINTAINS AN EXTENSIVE STOCK OF MAGNETS, ELECTROMAGNETS, AND RELATED COMPONENTS. CALL OR WRITE FOR CATALOG.

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JOBMASTER CORPORATION

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In Canada call 416-897-1380
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Randallstown, Maryland 21133
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MAGNETS

NEODYMIUM IRON BORON • SAMARIUM COBALT
CERAMICS • ALNICOS • MOLDED/BONDED RARE EARTHS
ELECTROMAGNETS • MAGNETIC ASSEMBLIES

Complete design facilities.
We will take you from prototypes to high volume production quantities.

We specialize in custom shapes and sizes that require ultra high precision machining. Thickness to .009" and diameters to .018" with tolerances to ±.0001". Call or fax us with your requirements for an IMMEDIATE quotation.

MATERIAL PROPERTIES

Material	Maximum Energy Product	Br Gauss (Range)	Hc Oersteds (Range)	Hci Oersteds (Range)
SmCo 1 - 5	16 - 22	8300 - 9500	7500 - 9000	15000 - 2000
SmCo 2 - 17	22 - 30	9600 - 10900	8400 - 9200	7000 - 12000
NdFeB XX	27 - 46	10400 - 13900	9600 - 13000	12000 - 1500
NdFeB XXH	30 - 41	11200 - 13200	10200 - 12200	17000+
NdFeB XXSH	30 - 33	11200 - 11700	10700 - 11100	20000+
SmCo - PB	4 - 9	Up to 6600	5000	6000+
NdFeB - PB	4 - 9	Up to 6700	4700	8000+
ALNICO	2 - 8	6700 - 13500	480 - 1900	480 - 2000
CERAMICS	1 - 4	2300 - 4100	1860 - 3400	3050 - 3900

MCE

MAGNETIC COMPONENT ENGINEERING, INC.
213 North Cedar Avenue, Inglewood, California 90301

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FOR HIGH TECH APPLICATIONS

MAGNETICS®
Division of Spang & Company

THE BROADEST RANGE OF MAGNETIC CORES FROM A SINGLE SOURCE

Ferrites
Ferrites are ceramic structures made from high purity oxides of manganese, zinc, and iron. They are pressed, fired, and machined to meet requirements. They can be used over a wide frequency range, having a high electrical resistivity and low eddy current losses, for low level and power applications.

Powder Cores
Molypermalloy powder (MPP) cores are a distributive air gap type and have many outstanding characteristics-high resistivity, low hysteresis and eddy current losses and excellent inductance stability under both dc and ac conditions. MPP, High Flux, and Kool Mμ® cores are excellent for uni-directional drive applications such as pulse or fly back transformers.

Tape Wound Cores
Tape wound cores are made from high permeability magnetic strip alloys (.0005" to .014" thick) of nickel-iron (80% or 50% Ni), silicon-iron, cobalt-iron, and amorphous metals.

Bobbin Cores
Bobbin cores are miniature tape cores made from ultra-thin (.000125" to .001" thick) nickel-iron strip (80% Ni or 50% Ni) wound on non-magnetic stainless steel bobbins. Covered with protective caps and epoxy coated, bobbin cores are made as small as .050" in ID and widths of .032".

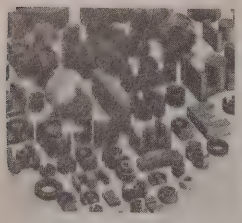
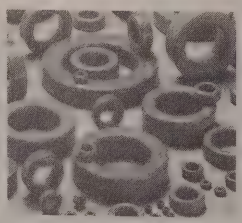
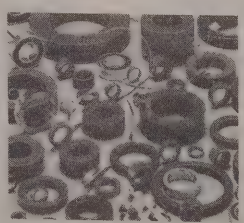
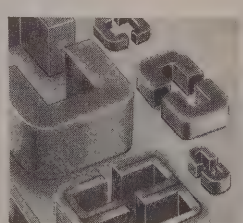
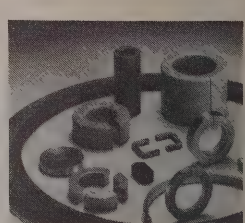
Cut Cores (nickel-iron, cobalt-iron, amorphous)
These cores are ideal for applications where low core loss is needed and core saturation is undesirable.

Core Material Considerations

Please Call or Fax Us for our Complete catalog

	Flux Density	Initial Perm.	Frequency* Range	Max. op. Temp.	Core Losses	Core Cost	Winding Cost	Temp. Stability	Mounting Flexibility
Ferrite Toroids MAGNETICS®									
J Mat'l	4300	5000	to > MHz	100°C	lowest	low	high	fair	fair
W Mat'l	4300	10,000							
H Mat'l	4200	15,000							
Ferrite Shapes									
K Mat'l	4600	1500	to 2MHz	125°C		depends upon geometry			
P Mat'l	5000	2300	to 200kHz	125°C	(1)				
F Mat'l	5100	2700	to 100kHz	125°C	(2)				
F Mat'l	4700	3000	to 100kHz	125°C	(3)				
MPP Cores	7000	14-550	< 1MHz	200°C	low	high	high	good	fair
50 Ni-50 Fe Powder Cores	15,000	60-200	< 1MHz	200°C	low	high	high	good	fair
KOOL Mμ® Powder Cores	11,000	60-125	< 1MHz	200°C	low	low	high	good	fair
Ni/Fe Tape Cores Ni/Fe Bobbin Cores	7,000 to 15,000	to 100,000	to 100kHZ	200°C	low to medium	high	high	good	fair
Amorphous Tape Cores (iron-base)	16,000	10,000	to 500kHz	150°C	low	high	high	good	fair
Amorphous Tape Cores (cobalt-base)	5,000	to 100,000	to 500kHz	100°C	low	high	high	good	fair
Si-Fe Tape Cores	16,000	4000	<1000Hz	300°C	highest	medium	high	good	fair
Ni-Fe Cut Cores	15,000	15,000	to 100kHz	150°C	medium	high	low	good	fair

*Frequency depends on adjusting operating flux density to levels that keep core losses to acceptable limits.
(1) Core losses decrease up to 100°C
(2) Core losses decrease up to 70°C, remain low to 100°C
(3) Low core losses at lower temperatures

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CRYSTALS

Manufacturer	Starting EEM Page No.	Crystal Blanks	Microprocessor	Quartz	Quartz (Watches)	Crystal Holders
Abracon Corp.	A•1330		√§		√§	
Anderson Electronics Inc.	A•1333	√*	√	√§*		
Bliley Electric Co.	A•1340	√	√	√		√
Bomar Crystal	A•1346		√			
Champion Technologies	A•1347		√§	√	√	
Colorado Crystal Corp.	A•1348			√		
Comclock	A•1349		√	√		
Cõnnor Winfield	A•1350	√	√§	√§		
CTS Corp./ Frequency Controls Business	A•1358	√*	√§*	√§*		
Dale Electronics	A•1379			√		
Ecliptek Corp.	A•1383		√	√		
Epson America	A•1388		√§	√§	√§	
Fox Electronics	A•1397		√§	√§	√§	
Hybrids International	A•1406		√§	√§*	√§	√§
HY-Q International	A•1408		√§	√§		
International Crystal Manufacturing Co.	A•1409		√	√		√
McCoy Electronics	A•1412	√§*	√§*	√§*		
Micro Crystal Div.	A•1420		√§*	√§*	√	
Monitor Products Co.	A•1424		√§	√§	√§	
M-Tron Industries	A•1431	√*	√§*			
Musashino Corp.	A•1437	√§	√§	√§	√§	√§
NDK America	A•1440	√	√§	√	√	
Pletronics, Inc.	A•1449		√§			
Q-Tech Corp.	A•1456			√§		
Reeves-Hoffman	A•1464	√				
RXD Inc.	A•1470		√§	√§	√	
Saronix	A•1474		√§	√§	√§	
Seiko Instruments	A•1480		√§	√§	√§	
Standard Crystal	A•1481	√	√§		√	√§
Statek Corp.	A•1482		√	√		
Toyocom USA Inc.	A•1484	√	√	√	√	
TTE Frequency Devices	A•1496	√§	√§	√§	√	√

* MIL Spec. § Surface Mount.

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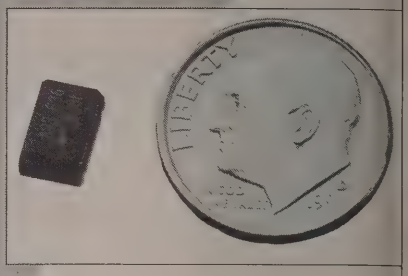

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SM-994 1.7MM LOW POWER, LOW PROFILE, 5V MICRO-MINIATURE SMD CLOCK OSCILLATOR UNDER DEVELOPMENT

SM-38 ULTRA-MINIATURE SMD TYPE REFLOW SOLDERABLE CRYSTAL

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CRYSTAL FILTERS

Manufacturer	Starting EEM Page No.	Active	AF	IF	UHF/ VHF	RF	Micro-wave	LC	Comb	Single Side-band	Vesti-gial Side-band	Band pass	Low pass	High pass	Notch (Band Elim.)	Linear Phase	Equal-izer	Hybrid	Other
Fox Electronics	A•1397				√	√						√							
Frequency Electronics	A•1402	√*	√*	√*	√*	√*	√*	√*	√*		√*	√*	√*	√*	√*		√*	√*	
HY-Q International	A•1408			√				√		√	√	√							
McCoy Electronics	A•1412		√*	√*		√§*		√*		√§*		√§*	√§*	√§*	√§*	√§*	√§*	√§*	
Murata Erie/ North America	A•1432																		Piezo ceramic filters.
Musashino Corp.	A•1437	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	
NDK America	A•1440			√	√	√				√		√	√	√		√			SAW filters.
Toyocom USA Inc.	A•1484	√				√§						√§			√§				

* MIL Spec. § Surface Mount.

TIME & FREQUENCY INSTRUMENTATION

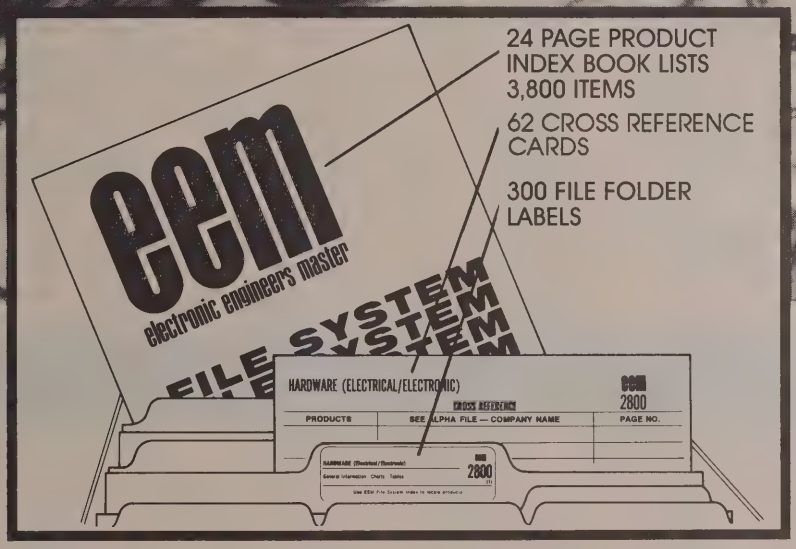
Manufacturer	Starting EEM Page No.	Standards	Clocks	Distribution Amplifier	Systems	Test Sets	Other
Ball Corp./ Efratom Div.	A•1339	√*	√*	√*			
Continental Microwave Technology	A•1357				√		
CTS Corp./ Frequency Controls Business	A•1358	√	√				
Epson America	A•1388		√				
Fox Electronics	A•1397		√§				
Frequency Electronics	A•1402	√*	√*	√*	√*	√*	
FTS/Austron	A•1405	√	√	√	√	√	
Hybrids International	A•1406		√§*				
Monitor Products Co.	A•1424	√	√				
Murata Erie North America	A•1432						Piezoelectric & ceramic resonators.
Musashino Corp.	A•1437	√	√	√	√	√	
NDK America	A•1440	√					
Q-Tech Corp.	A•1456		√§*				
Raltron Electronics	A•1460	√§*	√§				
Vectron Laboratories Inc.	A•1502	√					

* MIL Spec. § Surface Mount

OSCILLATORS

Manufacturer	Starting EEM Page No.	AF	LF	RF	Micro-wave	Sinu-soidal	Square Wave	Pulse	UHF/ VHF	Crys-tal Con-trol Mod-ule	Tun-ing Fork Con-trol	Oven-ized	Volt-age Con-trol VCXO	Temp. Com-pen-sated TCXO	Volt-age Con-trol/ Temp. Comp.	Clock	LC	RC	Other
Abracon Corp.	A•1330					√§	√§			√§	√§					√§			
Anderson Electronics Inc.	A•1333									√§*						√§*			
AT & T Microelectronics	A•1334			√§	√§	√	√§		√§	√§			√§			√§			Timing Recovery Units, SAW Filters.
AVX Corp.	A•1336	√	√	√		√	√	√								√			
Ball Corp./ Efrafrom Div.	A•1339								√*			√*			√*	√*			Rubidium - Mil Spec.
Bliley Electric Co.	A•1340											√	√	√	√	√			
Champion Technologies	A•1347									√§			√§	√		√§			
Comclock	A•1349						√§			√§						√§			Tri-State oscillators
Connor Winfield	A•1350			√§*	√§	√§*	√§*			√§*		√*	√§*	√§*	√§*	√§*	√§*	√§*	
Continental Microwave Technology	A•1357			√§*	√§*				√§*	√§*									
CTS Corp./ Frequency Business Controls	A•1358	√§*	√§*	√§*	√§*	√§*	√§*		√§*	√§*		√§*	√§*	√§*	√	√§*			
Dale Electronics	A•1379	√		√		√	√			√						√			
Ecliptek Corp.	A•1383	√	√	√			√	√								√			
Epson America	A•1388						√§									√§			
Fox Electronics	A•1397			√§		√§	√§			√§	√§	√	√	√	√	√§			Programmable Frequency Synthesizer
Frequency Electronics	A•1402									√*		√*	√*	√*	√*	√*			
FTS/Austron	A•1405			√		√	√					√	√						
Hybrids International	A•1406			√§*		√§*	√§*	√§*		√§*	√§*		√§*	√§*	√§*	√§*			
HY-Q International	A•1408									√			√	√	√	√§			
International Crystal Manufacturing Co.	A•1409		√	√		√	√			√			√	√	√				
Isotemp Research	A•1410									√		√	√	√	√				Crystal ovens.
McCoy Electronics	A•1412			√§*		√§*	√§*		√§*	√§*		√*	√§*	√§*	√§*	√§*			Component ovens.
MF Electronics	A•1419															√§			
Micro Crystal Div.	A•1420						√§*				√§*	√*	√*						
Monitor Products Co.	A•1424				√	√*	√§*	√§*		√§*		√*	√§*	√*	√*	√§*			
M-Tron	A•1431			√§*			√§*			√§*			√			√§*			
Murata Erie North America	A•1432		√	√	√§	√	√	√	√	√		√	√	√	√	√			DRO, DCXO.
Musashino Corp.	A•1437	√§	√§	√§	√§	√§	√§	√§	√§	√§	√§	√§	√§	√§	√§	√§	√§	√§	
NDK America	A•1440			√		√	√		√	√		√	√	√§	√	√§			
Oscillatek	A•1442			√§*	√§*	√§	√§*		√§*			√§	√§	√§*	√§	√§•			
Pletronics, Inc.	A•1449						√§									√§			
Q-Tech Corp.	A•1456		√§*	√§*		√§*	√§*		√§	√§*			√§*			√§*			
Raltron Electronics	A•1460									√			√	√	√	√§*			
Reeves-Hoffman	A•1464						√*			√*		√*	√*	√*	√*	√*			
RXD Inc.	A•1470						√§		√	√§		√	√	√		√			
Saronix	A•1474						√§			√§	√§		√§			√§			
Seiko Instruments	A•1480						√§							√					
Standard Crystal	A•1481		√				√			√	√		√						
Statek Corp.	A•1482						√				√								
Toyocom USA Inc.	A•1484			√		√	√§					√	√	√	√	√			
TTE Frequency Devices	A•1496					√§	√§						√	√§	√§				
Vectron Laboratories Inc.	A•1502			√§*	√§*	√§*	√§*		√§*	√§*		√§*	√§*	√§*	√§*	√§*			Clock recovery; Data retiming module.
Wenzel Associates	A•1510	√	√	√		√	√									√			
Xsis Electronics	A•1511						√§*			√§*						√§*			

* MIL Spec. § Surface Mount.



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ABRACON OSCILLATOR REFERENCE GUIDE

SERIES TYPE	FREQUENCY RANGE	OVERALL FREQ. STABILITY	OPERATING TEMP RANGE	INPUT VOLTAGE Vcc	INPUT CURRENT	SYMMETRY	TR+TF max	LOGIC "1" LEVEL	LOGIC "0" LEVEL	PACKAGE TYPE
ACO(V) (HCMOS/TTL)	500KHz-110MHz	±0.01% (100ppm)	0 to 70°C	+5Vdc±10% or +3.3V(V)	10-60mA	40/60% max (45/55 typ)	6-10ns max	2.4v TTL 4.5v HCMOS	0.4v TTL 0.5v HCMOS	14 pin thru hole
ACH(V) (HCMOS/TTL)	500KHz-110MHz	±0.01% (100ppm)	0 to 70°C	+5Vdc±10% or+3.3V(V)	10-60mA	40/60% max (45/55 typ)	6-10ns max	2.4v TTL 4.5v HCMOS	0.4v TTL 0.5v HCMOS	8 pin thru hole
ACM (CMOS/TTL)	1MHz-70MHz	±0.01% (100ppm)	0 to 70°C	+5Vdc±5%	10mA max.	40/60% max (45/55 typ)	15ns max	2.4Vdc min TTL -0.5Vdc CMOS	0.4v TTL 0.5v HCMOS	3 pin in line thru hole
ACE (ECL)	20MHz-200MHz	±0.01% (100ppm)	0 to 70°C	-5.2V±5%	140mA max	40/60% @ 1/2Vp-p	<4ns	-1.0V min	-1.6V max	14 pin thru hole
ACS (HCMOS/TTL)	625KHz-70MHz	±0.01% (100ppm)	0 to 70°C	+5Vdc±10%	20-25mA max	40/60% max (45/55 typ)	8ns max	2.4v TTL 4.5v HCMOS	0.4v TTL 0.5v HCMOS	surface mount
ASM (HCMOS/TTL)	1.5MHz-70MHz	±0.01% (100ppm)	0 to 70°C	+5Vdc±5%	23-35mA	40/60% max (45/55 typ)	5ns max	2.4v TTL 4.5v HCMOS	0.4v TTL 0.5v HCMOS	surface mount
ASL/ASV (HCMOS/TTL)	1.8432MHz-70MHz	±0.01% (100ppm)	-10 to 70°C	+5Vdc±5% +3.3V(V)	20-60mA	40/60% max (45/55 typ)	10ns max	2.4v TTL 4.5v HCMOS	0.4v TTL 0.5v HCMOS	surface mount
ASO (HCMOS/TTL)	1.8432MHz-70MHz	±0.01% (100ppm)	-10 to 70°C	+5Vdc±5%	20-60mA	40/60% max (45/55 typ)	10ns max	2.4v TTL 4.5v HCMOS	0.4v TTL 0.5v HCMOS	surface mount

ABRACON QUARTZ CRYSTAL REFERENCE GUIDE

SERIES TYPE	FREQUENCY RANGE	FREQUENCY TOLERANCE	STANDARD STABILITY OVER OPERATING	STANDARD LOAD CAPACITANCE	SHUNT CAPACITANCE	DRIVE LEVEL	PACKAGE TYPE
AB	1-250MHz	±50ppm@25°C	±100ppm; 0-70°C	18pf (series)	7pf max.	1mW max.	HC49/U
ABL	1-70MHz	±50ppm@25°C	±100ppm; 0-70°C	18pf (series)	7pf max.	1mW max.	HC49/US low profile
ABLS	1-70MHz	±50ppm@25°C	±100ppm; 0-70°C	18pf (series)	7pf max.	1mW max.	HC49/US surface mount
ABU	1-160MHz	±50ppm@25°C	±100ppm; 0-70°C	18pf (series)	7pf max.	1mW max.	UM1 package
ABSM	1-70MHz	±50ppm@25°C	±100ppm; 0-70°C	18pf (series)	7pf max.	1mW max.	surface mount
ABMM	14-66MHz	±50ppm@25°C	±100ppm; 0-70°C	16pf (series)	7pf max.	0.1mW max.	1.30mm ht. surface mount
ABMC	3.5-50MHz	±50ppm@25°C	±100ppm; 0-70°C	16pf (series)	7pf max.	1mW max.	2.5mm ht. surface mount
AB308	3.5-64MHz	±30ppm@25°C	±5ppm; 0-70°C	18pf (series)	7pf max.	1.0µW max.	3x8mm watch crystal
AB26T	32.768KHz	±20ppm@25°C	±0.035ppm; -10-100°C	12.5pf (standard)	1.7pf max.	1.0µW max.	2x6mm watch crystal
AB38T	32.768KHz	±20ppm@25°C	±0.035ppm; -10-60°C	12.5pf (standard)	0.085pf typ.	1.0µW max.	3x8mm
ABS25	24KHz-200KHz	±20ppm@25°C	±0.035ppm; -10-60°C	12.5pf (standard)	1.1pf typ.	1.0µW max.	low frequency surface mount
ABS35	32.768KHz	±20ppm@25°C	±0.035ppm; -10-60°C	12.5pf (standard)	1.7pf max.	1.0µW max.	SMD watch crystal

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25ppm	R
10ppm	Y
45/55 Symmetry	S
47.5/52.5 Symmetry	T
Enable/Disable	A
Extended Temp., -40°C to +85°C	L

Example part numbers:

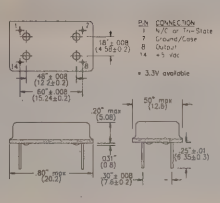
ACO 10.000MHz-**C** = 50ppm
ACO 10.000MHz-**CS** = 50ppm, 45/55 symmetry

ACH 10.000MHz-R = 25ppm
ACH 10.000MHz-RSA = 25ppm 45/55 symmetry tri-state

ACM 10.000MHz-C = 50ppm

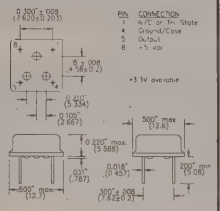
Additional options available
Call for Abracon Product Catalog

ACO



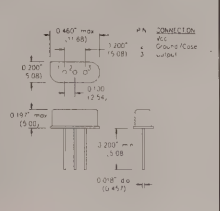
FULL SIZE

ACH



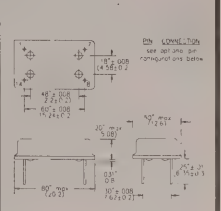
HALF SIZE

ACM



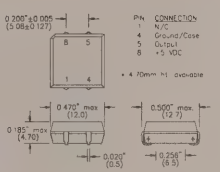
MINIATURE

ACE



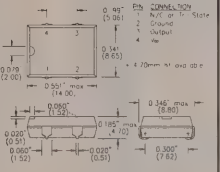
ECL FULL SIZE

ACS



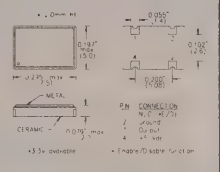
PLASTIC SMD J-LEAD

ASM



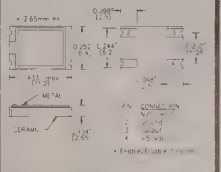
PLASTIC SMD J-LEAD

ASL/ASV



CERAMIC SMD

ASO



CERAMIC SMD

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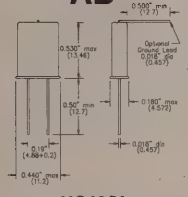
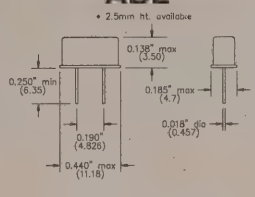
AB



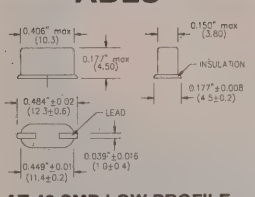
HC49/U

ABL



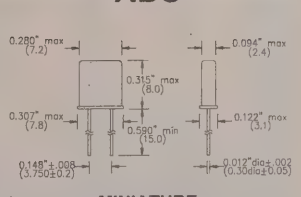
AT-49 LOW PROFILE

ABLS



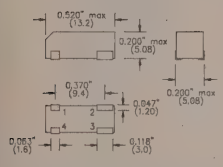
AT-49 SMD LOW PROFILE

ABU



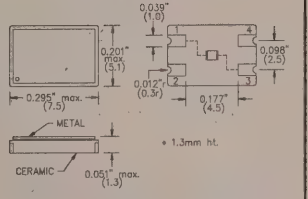
MINIATURE

ABSM



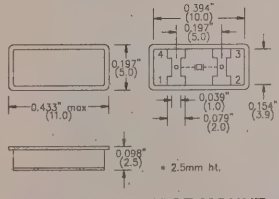
PLASTIC SURFACE MOUNT

ABMM



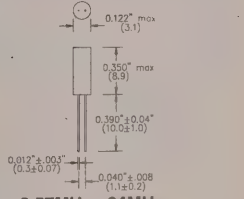
CERAMIC SURFACE MOUNT

ABMC



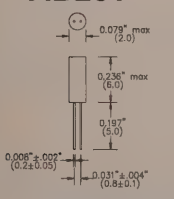
CERAMIC SURFACE MOUNT

AB308



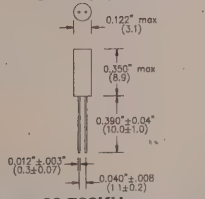
3.57MHz - 64MHz

AB26T



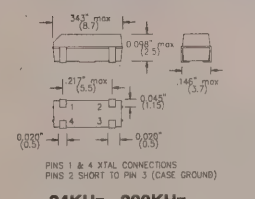
32.768KHz

AB38T



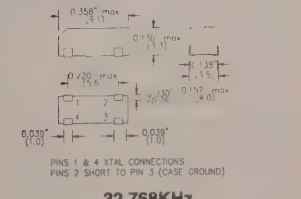
32.768KHz

ABS25



24KHz - 200KHz

ABS35



32.768KHz

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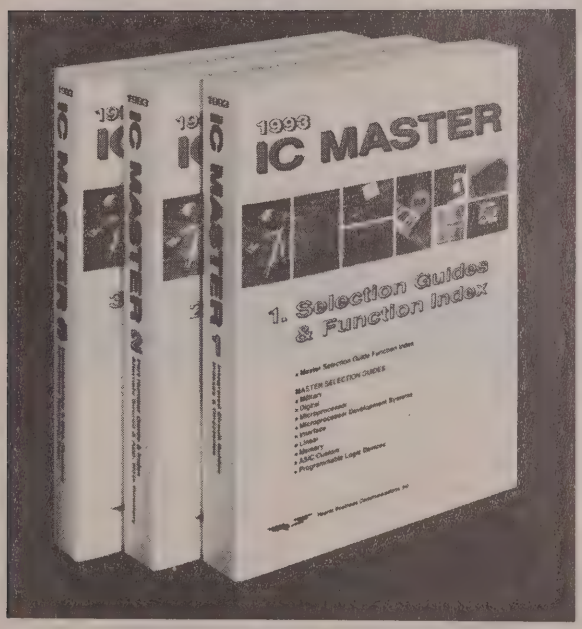

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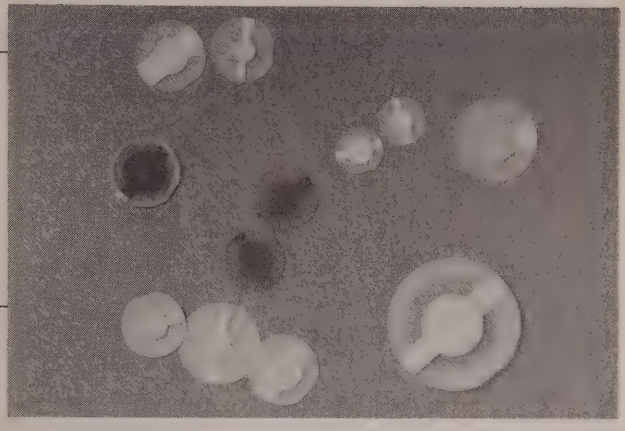

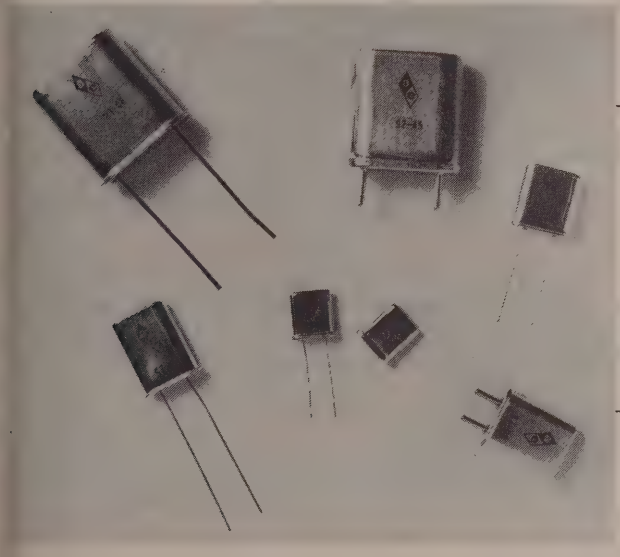

CRYSTALS:
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- TTL, TTL Enable, TRI-State, HCMOS, CMOS, ECL
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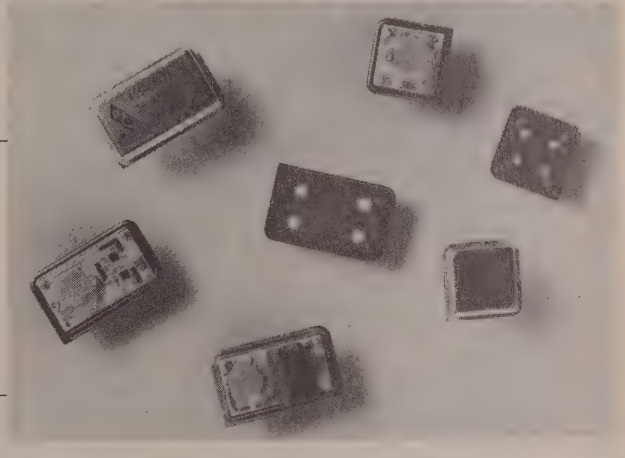

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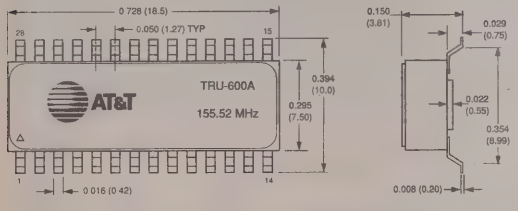
TRU600
- Miniature, Ceramic 28-Lead Surface-Mount Package
- 100K ECL Inputs and Outputs
- SONET Compatible
- Low Power Consumption

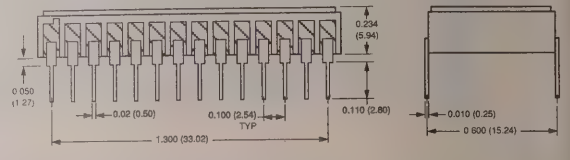
TRU200
- Ceramic 28-Pin DIP Package
- 100K ECL Inputs and Outputs
- SONET Compatible

TRU050
- Ceramic 16-Pin DIP Package
- TTL Compatible Output
- Superior Jitter Performance

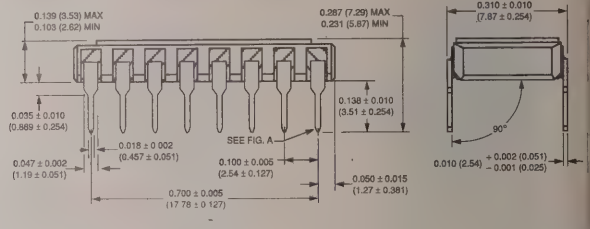
TRU600 Package
Dimensions are in inches and (millimeters).



TRU200 Through-Hole Package
Dimensions are in inches and (millimeters).



TRU050 Through-Hole Package
Dimensions are in inches and (millimeters).



Model	TRU600	TRU200	TRU050
Data Rate Range	155.520 MHz to 622.080 MHz	44 MHz to 315 MHz	up to 52 MHz
Power Consumption	325 mW	325 mW	250 mW
Jitter Generation	10 ps rms	10 ps rms	<1 ns (pp typical)
Operating Temperature	–40 °C to +85 °C	–40 °C to +85 °C	–40 °C to +85 °C

Electrical Specifications

Parameter	Symbol	Min	Max	Unit
Supply Voltage				
TRU050	V_{DD}	4.5	5.5	V
TRU200	V_{CC}–V_{EE}	4.5	5.5	V
TRU600	V_{CC}	4.5	5.5	V
Supply Current				
TRU050	I_{DD}	25	60	mA
TRU200G	I_{CC}	50	75	mA
TRU600	I_{CC}	50	75	mA

For additional information, contact your AT&T Account Manager or the following:
❑ AT&T Microelectronics, Dept. AL-500404200, 555 Union Blvd., Allentown, PA 18103 **1-800-372-2447** (In Canada, **1-800-553-2448**)

AT&T Microelectronics

FREQUENCY CONTROL PRODUCTS

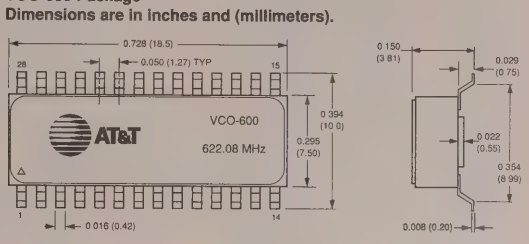
Voltage Controlled SAW Oscillator VCO-600

Features:

- Low-Profile, Ceramic 28-Lead Surface-Mount Package
- 10K ECL Logic Levels with Fast Transition Times
- Low Phase Jitter

Model	VCO600
Frequency Range	155 MHz to 1.1 GHz
Operating Temperature	–40 °C to +85 °C
Storage Temperature	–55 °C to +125 °C
Frequency Stability	±100 ppm
Pull Range	±1500 ppm

VCO-600 Package
Dimensions are in inches and (millimeters).



Electrical Specifications

Parameter	Symbol	Min	Max	Unit
Supply Voltage	V_{EE}	–4.5	–5.5	V
Supply Current	I_{EE}	36	48	mA
Symmetry	SYM	45	55	%
Transition Times				
Rise Time	tR	0.10	0.35	ns
Fall Time	tF	0.10	0.35	ns

Crystal Oscillators

Features:

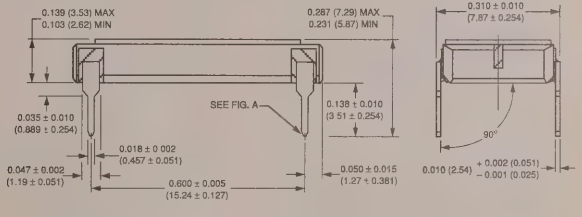
R-Type

- Low-Profile, Ceramic 14-Pin DIP Package
- TTL or CMOS Selectable
- 3-State Output
- VCXO or Fixed Frequency

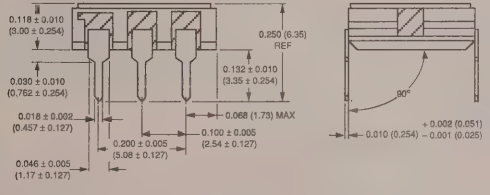
S-Type

- Miniature, Ceramic 6-Pin Surface-Mount or DIP Package
- TTL or CMOS Selectable
- 3-State Output
- VCXO or Fixed Frequency

14-Pin, Ceramic DIP
Dimensions are in inches and (millimeters).



6-Pin, Ceramic DIP
Dimensions are in inches and (millimeters).



Model	R- and S-Types
Frequency Range	up to 52 MHz
Operating Temperature	–40 °C to +85 °C
Storage Temperature	–55 °C to +125 °C
Frequency Stability	to ±50 ppm

Electrical Specifications: R- and S-Types

Parameter	Symbol	Min	Max	Unit
Supply Voltage	V_{DD}	4.5	5.5	V
Supply Current	I_{DD}	12	32	mA
Symmetry				
≤40 MHz	SYM	45	55	%
≥40 MHz	SYM	40	60	%
Transition Times				
Rise Time	tR	1.0	5.0	ns
Fall Time	tF	1.0	5.0	ns

For additional information, contact your AT&T Account Manager or the following:
❑ AT&T Microelectronics, Dept. AL-500404200, 555 Union Blvd., Allentown, PA 18103 **1-800-372-2447** (In Canada, **1-800-553-2448**)

Clock Oscillators

AVX CORPORATION
A KYOCERA GROUP COMPANY

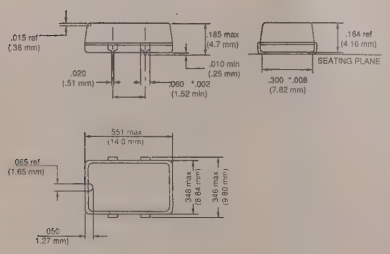
How to Order:

SMT – TTL Compatible	AMO – HC* – TS* – Frequency
SMT – HCMOS/CMOS	AMO – HC* – CS* – Frequency
8 Pin – TTL Compatible	KHO – HC* – TS* – Frequency
8 Pin – HCMOS/CMOS	KHO – HC* – CS* – Frequency
8 Pin – Advanced CMOS	KHO – AC* – CS* – Frequency
8 Pin – Low Power	KHO – CS* – ** – Frequency
14 Pin – Low Cost TTL	KXO – 01 – Frequency
14 Pin – Low Cost TTL Compatible	KXO – CT1 – TS – Frequency
14 Pin – TTL Compatible	KXO – HC* – TS* – Frequency
14 Pin – HCMOS/CMOS	KXO – HC* – CS* – Frequency
14 Pin – Advanced CMOS	KXO – AC* – CS* – Frequency
14 Pin – ECL – Quartz	KXO – EH* – *** – Frequency
14 Pin – ECL – Saw Resonator	KSO – EL* – * – Frequency
14 Pin – Intel 80386	386 – HC* – CS* – Frequency
14 Pin – Motorola MC68040/030	K68EC – Frequency

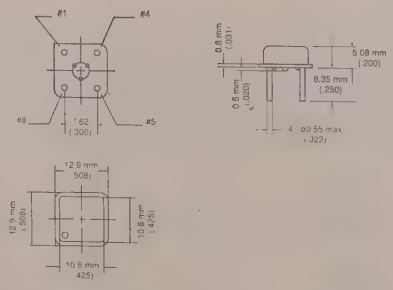
Series	Output Frequency (MHz)	Fan Out	Output Level VOH Min	Output Level VOL Max	Features
TTL Compatible					
KXO—01	4 ≈ 50	10 TTL	2.4	0.4	Cost Performance
KXO—CT1	1 ≈ 50	10 TTL	2.4	0.4	Low Cost with Fast Rise/Fall Times
KXO—HC*—T (KHO—HC*—T)	1 ≈ 80	10 TTL	2.4	0.4	Versatile Drive Capabilities
AMO—HC*—T	1.5 ≈ 72	10 TTL	2.4	0.4	Surface Mount—J Leaded
CMOS/HCMOS					
KXO—HC*—C (KHO—HC*—C)	1 ≈ 80	50pF	0.9 VDD	0.1 VDD	Versatile Drive Capabilities
KXO—AC*—C (KHO—AC*—C)	72 ≈ 135	15pF	0.9 VDD	0.1 VDD	Advanced CMOS
KHO—CS	0.5 ≈ 32	1 TTL	0.9 VDD	0.1 VDD	Low Power Consumption
AMO—HC*—C	1.5 ≈ 72	50pF	0.9 VDD	0.1 VDD	Surface Mount—J Leaded
ECL Compatible					
KXO—EH (Negative Supply)	50 ≈ 135	ECL (10KH)	-1.02	-1.63	Quartz Controlled
KXO—EH (Positive Supply)	50 ≈ 135	ECL (10KH)	+3.98	+3.40	Quartz Controlled
KSO—EL	135 ≈ 400	ECL (100K)	+3.98	+3.41	Saw Resonator Controlled
Special					
386—HC	24, 32, 40 & 50	80 ≈ 150pF	0.9 VDD	0.1 VDD	Intel 80386
K68—EC	40, 50, 66.6667 & 80	10 TTL	2.4	0.4	Motorola MC68040/030 Families

Dimensions:

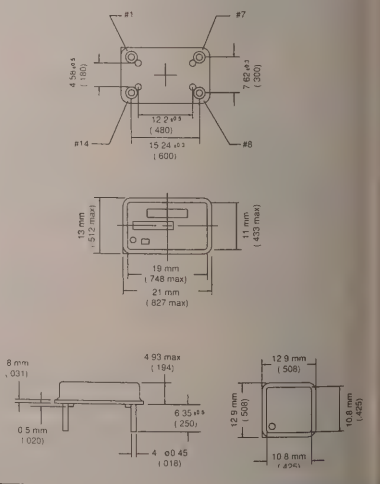
AMO Series



KHO Series



KXO Series



KHz Band Ceramic Resonators KBR–B, BK, F, Y Series

AVX CORPORATION
A KYOCERA GROUP COMPANY

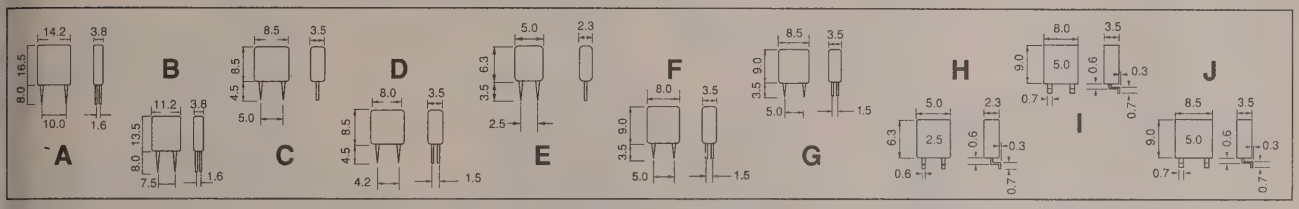
Part Numbering System:

KBR	–	455	BK	TS
①		②	③	④

① Type
② Oscillation Frequency
③ Resonator Type
④ Lead Style – Blank – Standard
TS – Single in–line
TL – Formed Lead

Specifications

	Frequency Range	Type	Figure	Frequency Tol.	Temp. Stability	Op. Temp. Range
LEADED	190-249kHz	B	A	±0.5%	±0.3% (-20°C to +80°C)	-20°C to +80°C
	250-379kHz		B			
	380-430kHz	BK	G			
	431-439kHz	B	C			
	440-525kHz	BK	F			
	526-539kHz	B	D			
	540-655kHz	BK	F			
	656-680kHz	B	D			
	795-815kHz	F	E			
	960-1020kHz					
SMT	380-430kHz	Y	J	±0.5%	±0.3% (-20°C+80°C)	-20°C to + 80°C
	440-525kHz		I			
	600-655kHz					
	795-815kHz		H			
	960-1020kHz					



MHz Band Ceramic Resonators KBR–M, MS, MSA, MY, MKS, PBRC–A, PBRC–B Series

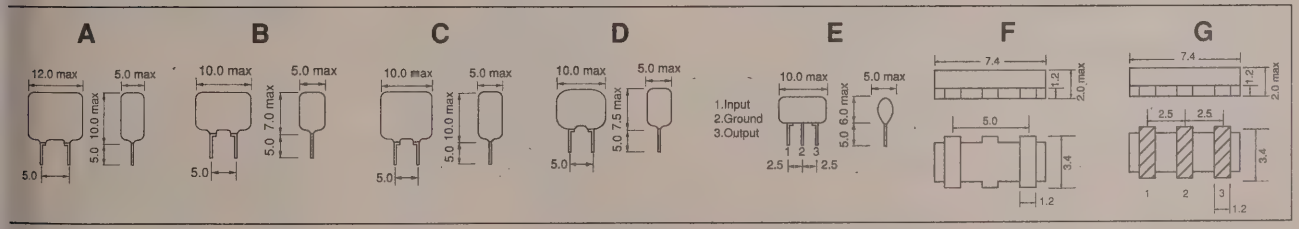
Part Numbering System:

KBR	–	4.00	MSA	TR
①		②	③	④

① Type
② Oscillation Frequency
③ Resonator Type
④ Packaging – TR – T&R (for Leaded)
TF – Ammo Pack
R – T&R (for SMT)

Specifications

	Feature	Type	Figure	Freq. Range	Freq. Tol.	Freq. Stability	Op. Temp.
LEADED		MS	A	2.0-3.5MHz	±0.5%	±0.3% (-20°C to +80°C)	-20°C to +80°C
		MSA	D	3.58-6.0MHz			
		M	C	6.1-7.9MHz		±0.5% (-20°C to +80°C)	
			B	8.0-12.0MHz			
		MY	C	12.1-20.0MHz		±0.3% (-20°C to +80°C)	
	Built-In Caps	MKS	E	3.58-6.0MHz	±0.5%	±0.5% (-20°C to +80°C)	
SMT		PBRC-A	F	2.0-8.0MHz	±0.5%	±0.3% (-20°C to +80°C)	-20°C to + 80°C
	Built-In Caps	PBRC-B	G	2.0-20.0MHz	±0.5%	±0.3% (-20°C to +80°C)	



SAW Resonators KAR Series

Part Numbering System:

KAR	–	91	CS
①		②	③

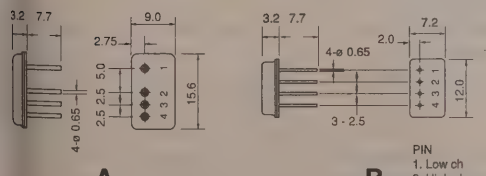
① Type
② Oscillation Frequency
③ Resonator Type – CS, CT– Sml. pkg.
CB, CD – Std.pkg.

Specifications

	Channel*	Res. Freq. (MHz)**	Res. Loss (dB)	Parallel Cap. (pF)	Temp. Stability -10°C–+60°C(ppm/°C)	Dimension
KAR-55CD	U- 2	55.24 ±0.08	5.0 Max.	3.8 ±1	±8	Figure A
	3	61.24 ±0.08		3.9 ±1		
KAR-83CB	U- 5	77.24 ±0.08	4.0 <ax.	4.5 ±1	±7	
	6	83.24 ±0.08		4.2 ±1		
KAR-55CB	W- 3	55.24 ±0.08	5.0 Max.	4.3 ±1	±8	
	4	62.24 ±0.08		3.7 ±1		
KAR-86CB	A- 3	86.24 ±0.08	3.0 Max.	4.2 ±1	±5	
	4	95.24 ±0.08		4.0 ±1		
KAR-77CB	O- 3	77.24 ±0.08	4.0 Max.	4.5 ±1	±7	
	4	85.24 ±0.08		4.2 ±1		
KAR-85CB	O- 4	85.25 ±0.08	3.0 Max.	4.2 ±1	±5	
	5	93.24 ±0.08		4.0 ±1		

KAR-61CT	U- 3	61.24 ±0.08	5.0 Max.	4.4 ±1	±8	Figure B
	4	67.24 ±0.08		4.2 ±1		
KAR-77CS	O- 3	77.24 ±0.08	4.5 Max.	3.1 ±1	±8	
	4	85.24 ±0.08		2.8 ±1		
KAR-91CS	J- 1	91.24 ±0.08	3.2 Max	3.6 ±1	±5	
	2	97.24 ±0.08		3.5 ±1		
KAR-211CS	U- 13	211.24 ±0.15	2.0 Max.	3.0 ±1	±8	

*J – Japan, U – USA, W – W. Germany, A – Australia, O – East Europe
** Other frequencies available on request



COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A
A/D acrylonitrile butadiene-styrene
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AFC audio frequency control
AFT automatic filter test
ALGOL algorithmic language
AM a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
ASIC application specific IC
ATE automatic test equipment
ATG automatic test generation
AWG American wire gauge

B
BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility syste

C
CAD computer-aided design
CAE computer-aided engineering
CAM computer-aided manufacture
CAMAC computer-automated measurement and control
CAPP computer-aided process planning
CAT computer-aided test
CATV cable television or community antenna television
CCC (leaded) ceramic chip carriers
CCD computer-controlled display
CERMET ceramic metal element
CIE computer-integrated engineering
CIM computer-integrated manufacturing
CLCC ceramic leadless chip carriers
CMOS complementary metal-oxide semiconductor
Comm. communications
CPS characters per second
CPU central processing unit

D
D/A digital to analog
DAC digital to analog converter
DBMS data base management system
DC direct current
DFT design for testability
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DRAM dynamic RAM
DTL diode transistor logic

E
EDA electronic design automation
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EIA Electronic Industries Association
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM erasable programmable ROM
ESR equivalent series resistance

F
FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G
GaAsFET gallium arsenide FET
CMIP commn management information protocol
GPIB general purpose interface bus
GPS global positioning system

H
HF high frequency (3 to 30 MHz)
HIPOT test, measurement, and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I
IAB Internet Activities Board
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared
ISDN integrated services digital network
ISO International Standards Organization

J
JEDEC Joint Electronic Device Engineering Council
JFET junction FET
JMOS junction MOS

K
kHz kilohertz (10^3 hertz)
KSR keyboard send /receive

L
LAN local area network
LC (filters) inductance/capacitance
LCC leaded chip carrier
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M
MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
µF microfarad
MHz megahertz
MIC microwave IC
MIPS million instructions per second
MIB microcomputer interface board
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor FET
MOSIGT metal oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N
NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM national instrumentation module
NOR not OR
NTC negative temperature coefficient

O
OCR optical character reader
OEM original equipment manufacturer
OR a logical operator
OSI open systems interconnection

P
PAL programmable array logic
PC printed circuit
PCB printed circuit board
PCM pulse code modulation
PCS plastic clad silica
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLCC plastic leaded chip carrier
PLL phased lock loop
PPI plan position indicator
PROM programmable ROM
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q
QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R
RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S
SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon-controlled switch
SDA source & detector assemblies
SGMP simple gateway monitoring protocol
SIDAC bidirectional voltage-triggered switch
SIMM single in-line memory module
SIP single in-line package
SMD surface mount device
SMT surface mount technology
SNMP simpole network management protocol
SO small outline
SOIC small outline IC
SOT small outline transistor
SSI small scale integration
SSR solid-state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T
TC temperature coefficient
TCE thermal coefficient of expansion
TXCO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U
UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

V
VAC volts (of) alternating current
VAN value-added network
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency (30 kHz to 300 MHz)
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W
WPS word processing software

Y
YIG yttrium iron garnet

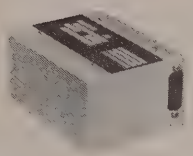
Z
ZIF zero insertion force

Ball Efratom Division

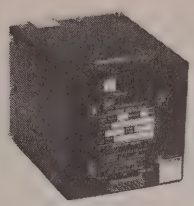
time and frequency systems

EMXO/ECXO
Sub-Mini Crystal Osc.

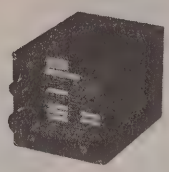
FRK
Com'l. Rb. Osc.



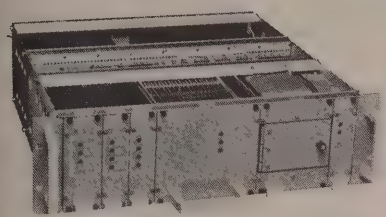
FRS-N & C
Mini Com'l Rb Osc.



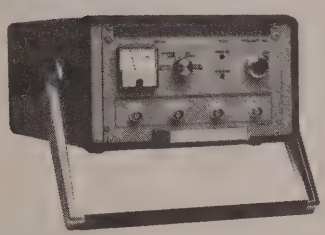
M-100
Mil Rb. Osc.



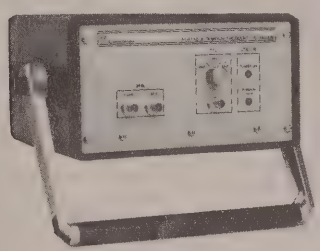
M-3000
Mini Mil Rb. Osc



MODEL MFS
MODULAR FREQUENCY SYSTEM



MODEL MRT
RUBIDIUM FREQUENCY STANDARD



MODEL PRFS
Portable Rb Freq. Std.

EFRATOM is the recognized world leader in rubidium atomic precision time and frequency systems for military/aerospace and commercial applications. Utilizing state-of-the-art atomic oscillator technology, EFRATOM has conceived and developed a family of time and frequency references for radio navigation, geophysical survey positioning systems, satellite tracking and control, communication systems employing PCM and spread spectrum techniques and standard time and interval generation and transfer.

EFRATOM's Model M-3000 is a miniature military atomic oscillator measuring just 3.25 in × 3.25 in × 4.5 in (83 mm × 83 mm × 114 mm), yet this instrument has excellent long term stability and fast warm-up performance. Model M-100 and M-3000 rubidium oscillators are radiation hardened and offer unparalled performance in the toughest of airborne and ground environments.

EFRATOM also offers modular frequency components, Model MFS in a 19 inch rack, permitting the user to configure unique time and frequency systems for his application. The MFS is also available with GPS disciplining of a Rb oscillator as an alternate to the cesium standard and to provide UTC time.

EFRATOM has also entered into quartz technology with a line of very high end crystal oscillators achieving state of the art specifications in terms of low power, small size, and fast warm-up all at super OCXO performance.

Model PRFS (Portable Rubidium Frequency Std) employs a rugged, compact design consisitng of the Model FRS-C rubidium oscillator, buffer amplifier and regulated power supply. The PRFS is available as a portable instrument for laboratory or field use.

MODEL	FRS-N	FRK-H	MRT-H	M-100	M-3000	PRFS	EMXO
Output Frequency	5 or 10 MHz sine 10MHz TTL	5 or 10 MHz sine	2ea10; 5; 1; 01.MHz sine	5/10MHz	5/10MHz	10&5MHz sine 10,5 or 1MhzTTL	10/10.23MHz Sine/TTL
Aging/Mo.	5E-11	1E-11	1E-11	6E-11/Opt1E-11	3E-11	5E-11	< 5E-10/Day
Short Term (100s)	5E-12	1E-12	1E-12	3E-12	4E-12	1E-11	5E-12(1s)
Phase Noise (1HzBW) SSB	–110dBc (100Hz)	–120dBc @ 100 Hz –145dBc @ 1KHz		–120dBc @ 100Hz –135dBc @ 1KHz	–140 dBc @ 100Hz –150dBc @ –1KHz	–110dBc @ 100Hz –130dBc @ 1KHz	–120dBc @ 10Hz –155dBc @ 10KHz
		Low Noise Option –155 dBc (100Hz)					
Warm-Up at 25°C	6 min/1E-9	< 10 Min. for 2E-10*			< 6 Min to 5E-10	6 Min/1E-9	4 Min to 1E-8
Operations Temperature	–55°C to +65°C Baseplate	–25°C to +65°C Baseplate	–10°C to +50°C Ambient	–55°C to +65°C Baseplate +75°C Option	–55°C to +80°C Baseplate	0°C to +50°C Ambient	–55°C to 95°C Ambient
Power at 25°C	12W	22VDC to 32VDC/13W	110/220 VAC/50W	22.5 to 32 VDC/18W	22 to 32 VDC/15W	115/220 VAC/25W	≤ 0.375W(TTL)
Dimensions	2 x 3 x 4 inches	3.9 x 3.9 x 4.4 inches	6 x 10 x 15 inches	~ 4 x 4 x 4.8 inches	3.25 x 3.25 x 4.5 inches	6 x 10 x 11 inches	1.3 x 1.3 x 1.3 inches
Weight	1.2 lbs	2.9 lbs	35 lbs	< 4 lbs	< 2.3 lbs	15 lbs	< 40 gms

*5 min warm-up available on M-100

Ball Efratom Division, 3 Parker; Irvine, CA 92718/Telephone 714/770-5000/Telex 68-5635/Fax 714-770-2463
Ball Efratom Elektronik GmbH, Fichtenstr 25/8011 Hofolding/Germany/Telephone 08104-9040/Telex 529701/Fax 08104-9918
Ball Efratom Corp., Ltd. P.O. Box 325/Bromley/Kent/England BR1 2WX/Telephone 081-3131078/Fax 081-2906948

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2545 W. GRANDVIEW BOULEVARD
P.O. BOX 3428
ERIE, PENNSYLVANIA 16508

BLILEY CRYSTAL OSCILLATORS

Oven Controlled (OCXO)

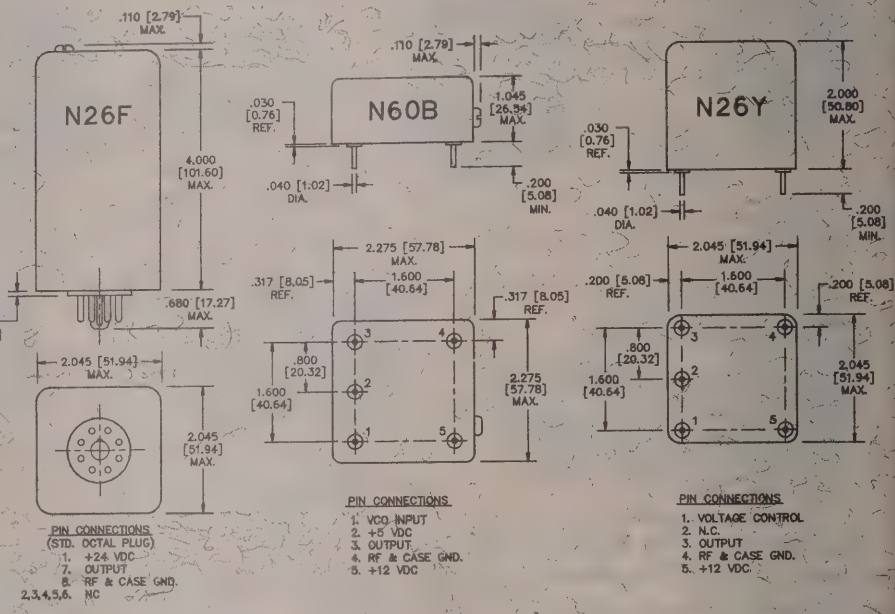
SPECIAL FEATURES

N26F: Excellent phase noise, frequency stability, and aging.

N60B: Excellent frequency stability, good phase noise, low power consumption.

N26Y: Excellent frequency stability, low power consumption and good phase noise.

(See chart for complete specs)



Type	N26F	N60B	N26Y
Frequency — Standard — Optional	10 MHz 5 MHz to 10 MHz	10 MHz 5 MHz to 15 MHz	10 MHz 5 MHz to 10 MHz
Frequency Stability	$\pm 5 \times 10^{-9}$ 0°C to +50°C $\pm 1 \times 10^{-8}$ –20°C to +70°C	$\pm 5 \times 10^{-9}$ 0°C to +50°C $\pm 1 \times 10^{-8}$ –20°C to +70°C	$\pm 2.5 \times 10^{-9}$ 0°C to +70°C
Aging	5×10^{-10}/day	5×10^{-10}/day	5×10^{-10}/day
Frequency Adjustment	Mechanical Electrical available	Mechanical	Electrical
Output	Sine Wave +7 dBm minimum with 50 ohm load	Sine Wave 0 dBm minimum with 50 ohm load	Sine Wave 0 dBm minimum with 50 ohm load
Single Sideband Phase Noise	10 Hz –130 dBc/Hz 100 Hz –150 dBc/Hz 1,000 Hz –155 dBc/Hz 10,000 Hz –160 dBc/Hz Noise floor –165 dBc/Hz	10 Hz –120 dBc/Hz 100 Hz –145 dBc/Hz 1,000 Hz –145 dBc/Hz 10,000 Hz –150 dBc/Hz Noise floor –155 dBc/Hz	100 Hz –145 dBc/Hz 1,000 Hz –150 dBc/Hz Noise floor –150 dBc/Hz
Power Supply	+24Vdc ± 10% fixed value between +12Vdc and +28Vdc optional 6 watts maximum at turn on 3 watts at 25°C	+15Vdc ± 10% fixed value between +12Vdc and +28Vdc optional 6 watts maximum at turn on 1.5 watts at 25°C	+12Vdc ± 10% 6 watts maximum at turn on 2 watts at 25°C
Size (Maximum Dimensions LWH)	2.045" × 2.045" × 4.000"	2.275" × 2.275" × 1.045"	2.045" × 2.045" × 2.000"
Mounting	Octal plug	Terminals/Pins	Terminals/Pins

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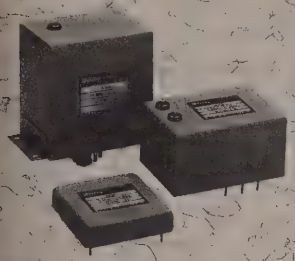

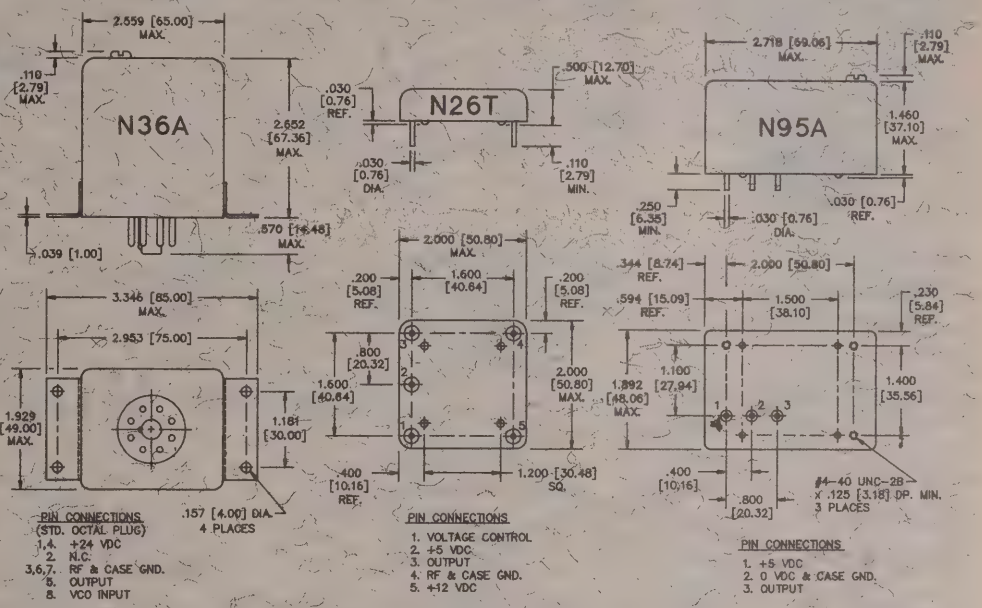

SPECIAL FEATURES

N36A: Superior aging and frequency stability in a compact case.

N26T: Low Profile package, voltage control for phase locking applications, low power consumption.

N95A: +5Vdc power supply, low power consumption, small case.

(See chart for complete specs)

Type	N36A	N26T	N95A
Frequency — **Standard** — **Optional**	32.768 MHz 15 MHz to 40 MHz	12.352 MHz 5 MHz to 15 MHz	10 MHz 5 MHz to 10 MHz
Frequency Stability	$\pm 1 \times 10^{-8}$ 0°C to +55°C $\pm 2 \times 10^{-8}$ –30°C to +65°C	$\pm 1.8 \times 10^{-7}$ 0°C to +65°C $\pm 3.5 \times 10^{-7}$ –40°C to +85°C	$\pm 2 \times 10^{-8}$ 0°C to +65°C
Aging	1.5×10^{-10}/day 5×10^{-8}/year	5×10^{-9}/day 5×10^{-6}/15 years	1×10^{-9}/day
Frequency Adjustment	Mechanical & Electrical Fine Tune	Electrical	Mechanical
Output	Sine Wave 0 dBm with 50 ohm load	HCMOS	Sine Wave +1 dBm with 100 ohm load
Short Term Stability (Allan Variance)	1×10^{-11}/sec.	2×10^{-10}/0.1 sec. 1×10^{-10}/1 sec. 1×10^{-10}/10 sec.	1×10^{-10}/sec.
Power Supply	+24Vdc ± 10% 6 watts maximum at turn on 2.5 watts at 25°C	+12Vdc ± 10% 4.75 watts maximum at turn on 1.6 watts at 25°C +5Vdc ± 5%	+5Vdc ± 10% 3.2 watts maximum at turn on 1.5 watts at 25°C
Size (Maximum Dimensions LWH)	2.559" × 1.929" × 2.652"	2.000" × 2.000" × 0.500"	2.718" × 1.892" × 1.460"
Mounting	Octal plug or brackets	Terminals/Pins	Inserts

Bliley

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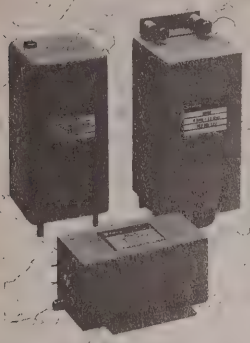
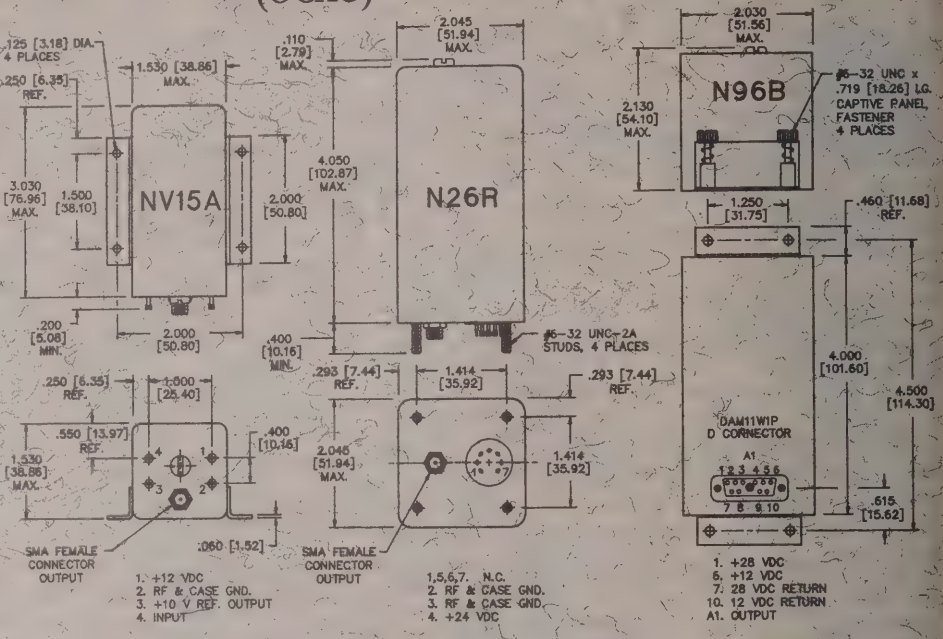
BLILEY CRYSTAL OSCILLATORS

Oven Controlled (OCXO)





SPECIAL FEATURES

NV15A: Small case, good frequency stability and phase noise.

N26R: High frequencies, good phase noise, +13 dBm output.

N96B: Superior frequency stability, fast warm-up, good aging.

(See chart for complete specs)

Type	NV15A	N26R	N96B
Frequency — Standard — Optional	10 MHz 5 MHz to 10 MHz	50 MHz 25 MHz to 50 MHz	9 MHz 9 MHz to 12 MHz
Frequency Stability	$\pm 1 \times 10^{-8}$ 0°C to +50°C	$\pm 5 \times 10^{-8}$ 0°C to +50°C	$\pm 5 \times 10^{-9}$ –55°C to +80°C
Aging	5×10^{-10}/day after 30 days	1×10^{-8}/day 1×10^{-6}/year	1×10^{-9}/day
Frequency Adjustment	Mechanical adjustment sufficient for 5 to 10 years aging Electrical Fine Tune standard		
Output	Sine Wave +13 dBm with 50 ohm load	Sine Wave +13 dBm with 50 ohm load	Sine Wave 1V rms with 91 ohm load
Single Sideband Phase Noise	10 Hz –125 dBc/Hz 100 Hz –145 dBc/Hz 1,000 Hz –150 dBc/Hz 100 KHz –150 dBc/Hz	10 Hz –90 dBc/Hz 100 Hz –120 dBc/Hz 1,000 Hz –135 dBc/Hz 10 KHz –145 dBc/Hz 100 KHz –150 dBc/Hz	
Power Supply	+12Vdc ± 10% 5 watts maximum at turn on 2.5 watts at 25°C fixed value between +12Vdc and +28Vdc optional	+24Vdc ± 10% 6 watts maximum at turn on 2 watts at 25°C fixed value between +15Vdc and +28Vdc optional	+28Vdc ± 10% 30 watts maximum at turn on 5 watts at 25°C
Size (Maximum Dimensions LWH)	3.030" x 1.530" x 1.530"	2.045" x 2.045" x 4.050"	4.000" x 2.030" x 2.130"
Mounting	Brackets/Flange	Studs	Brackets

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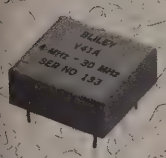
BLILEY CRYSTAL OSCILLATORS

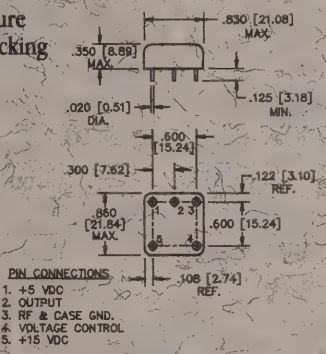
Voltage Controlled
(VCXO)

Bliley Voltage Controlled Crystal Oscillators combine inherent crystal stability and voltage controlled frequency deviation in a single solid state device.

Bliley Type V41A is a miniature VCXO designed for phase locking applications with standard TTL output.

V41A

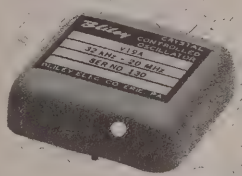


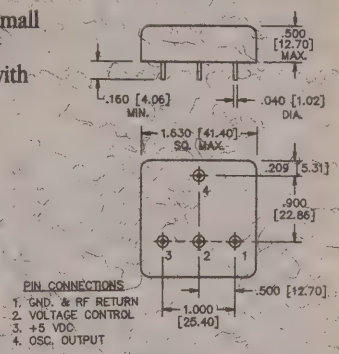


Type	V41A
Frequency Range	4 MHz to 30 MHz
Frequency Stability	+.0015%
Operating Temp. Range	0°C to +70°C
Frequency Deviation	± .004% minimum
Linearity	± 20% maximum
Modulation Voltage	+1V to +9V
Transfer Function	Positive
Output	TTL compatible
Supply Voltage	+5Vdc ± 5%, 15Vdc ± 5%
Mounting	Five 0.020" terminals
Size	0.860" × 0.830" × 0.350", maximum dimensions

Type V19A is a low cost, small size VCXO, ideal for many Phase Lock applications with TTL output.

V19A





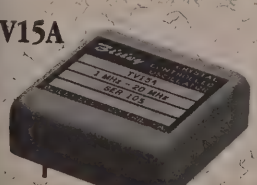
Type	V19A
Frequency Range	32 KHz to 20 MHz
Frequency Stability	± .0015%
Operating Temp. Range	0°C to +70°C
Frequency Deviation	± .004% minimum
Linearity	± 20% maximum
Modulation Voltage	+1V to +4V
Transfer Function	Positive
Output	TTL compatible
Supply Voltage	+5Vdc ± 5%
Mounting	PC boards mount using 4 terminals
Size	1.630" × 1.630" × 0.500", max. dim.
Options	High Speed CMOS Output

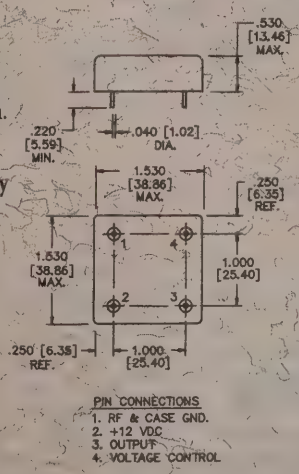
Temperature Compensated Voltage Controlled
(TCVCXO)

Bliley TCVCXO's consolidate many of the advantages of temperature compensation and voltage control in a single design.

Type TV15A is a small size TCVCXO offering good frequency stability and voltage control for phase locking applications.

TV15A



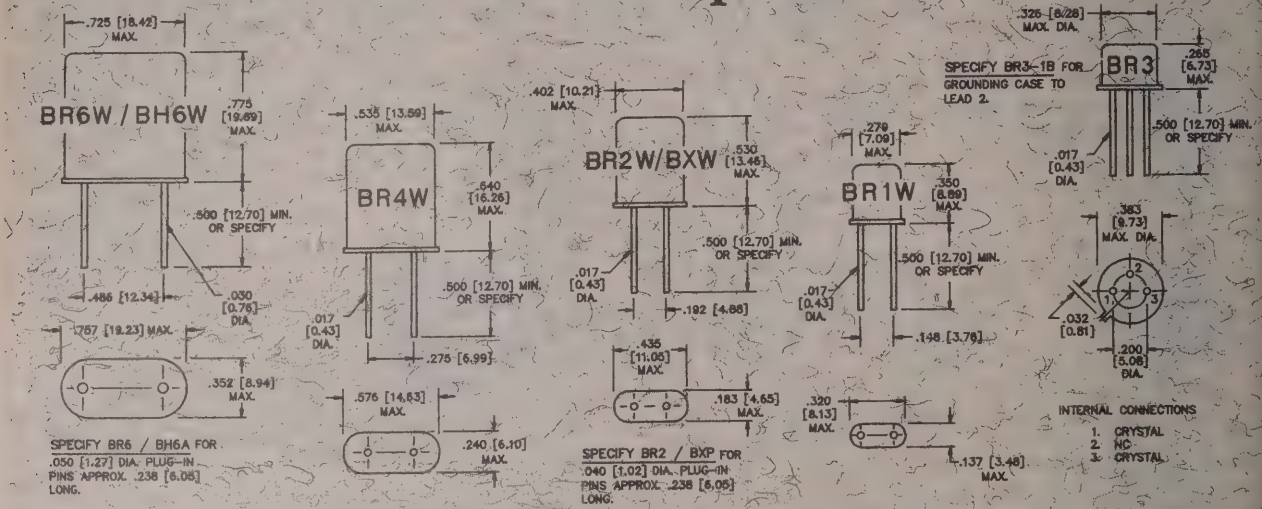


Type	TV15A
Frequency Range 1 MHz to 20 MHz	**Output** TTL
Frequency Stability ± 1 × 10^{-6} at any control voltage	**Aging** 1 × 10^{-6}/year typical
Operating Temp. Range 0°C to +60°C	**Supply Voltages** +5Vdc ± 5% & +12Vdc ± 5% req.
Electrical Frequency Control a. Control Voltage: 0 to +10V b. Range: ± 10 ppm to ± 15 ppm c. Input Impedance: 2K ohms minimum	**Size** 1.530" × 1.530" × 0.530", max. dim.
	Options • High Speed CMOS (HCMOS) • Sine Wave output & higher frequencies with a larger case size • Other supply voltages • Other case sizes

For further information call (814) 838-3571
or TWX 510-696-6886 • FAX 814-833-2712
BLILEY ELECTRIC COMPANY
2545 W. GRANDVIEW BOULEVARD
P.O. BOX 3428
ERIE, PENNSYLVANIA 16508

BLILEY CRYSTALS

General Purpose and Mil-Spec



Holder options include Mil-Spec. resistance-weld seal (BR Series) or solder seal (BH & BX Series).

Bliley Type	BR6W	BR6	BH6W	BH6A	BR4W	BR2W	BR2	BXW	BXP	BR1W	BR3
Mil-H-10056 Holder Designation	HC-51/U	HC-48/U	HC-33/U	HC-6/U	HC-46/U Size	HC-49/U	HC-50/U	HC-18/U	HC-25/U	HC-52/U	HC-35/U Size
Vibration	10G from 10 to 2000 Hz										
Shock	100G for 11 ms										

Internally ruggedized designs are available for higher level shock and vibration.

Bliley Type	Frequency Range (MHz)	Crystal Cut-AT (Mode)	Max. Series Res. (Ω)	Freq. Tol. (%) vs Temp. Range (°C) (Includes Calibration at +25°C)				Aging (PPM)		Typical Drive Level (mW)
				0 to +50	0 to +75	–40 to +70	–55 to +105	1st Mo.	Next 12 Mos.	
BR6/BH6	1 — 2	FUNDAMENTAL	400	± .0015	± .002	± .0025	± .003	3	3	5
BR6/BH6 & BR4W	2 — 3		200							
	3 — 4		100							
BR6/BH6 BR4W & BR2/BX	4 — 7		60							
	7 — 10		30							
	10 — 20		25							
	20 — 90	3 RD	40							2
BR1W	10 — 30	FUND.	25							5
	30 — 90	3 RD	40							
BR2/BX & BR1W	60 — 100	5 TH	60							2
	100 — 200	7 TH	100							
BR3	7 —10	FUND.	40							0.5
	10 — 25		25							
	25 — 75	3 RD	40							
	75 — 150	5 TH	60							
	150 — 200	7 TH	125							

Bliley
first name in frequency control

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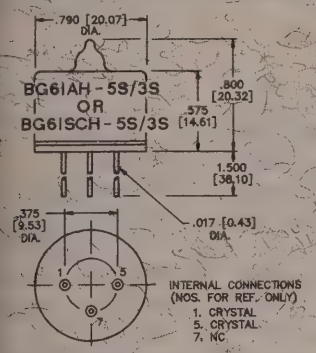
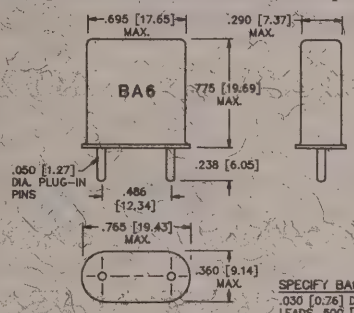
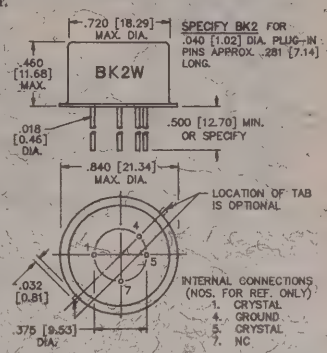


BG61AH-5S/3S OR BG61SCH-5S/3S
(GLASS ENCLOSURES)



BA6/BA6W



(COLDWELD SEALED METAL ENCLOSURES) BK2/BK2W

	Bliley Type	Frequency Range (MHz)	Overtone	Max. Series Res. (Ω)	Ave. Q (10^6)	Freq. Tol. at TP (± in PPM)	Aging* per Week	Typical Drive Level (μW)
AT cut	BG61AH-5S	5	5	140	2.5	1	7×10^{-10}	0.5
	BG61AH-3S	3.8 – 6	3	50	1.5	4	2×10^{-9}	25
	BA6/BA6W & BK2/BK2W	3.8 – 7 7 – 11 11 – 15	3 3 3	50 35 25	1.5 0.6 0.4	5 5 5	1×10^{-8} 1×10^{-8} 1×10^{-8}	25 25 25
SC cut	BG61SCH-5S	5	5	350	2.5	0.5	7×10^{-10}	0.5
	BG61SCH-3S	5 10	3 3	110 65	2.2 1.2	1.5 1.5	2×10^{-9} 2×10^{-9}	25 25
	BA6/BA6W & BK2/BK2W	5 10	3 3	120 70	2.0 1.0	1.5 1.5	1×10^{-8} 1×10^{-8}	25 25

*Aging – After 30 days operation Turning Point – AT Available at any temp. in the range of +45° to +90°C, standard tolerance ± 5°C; optional ± 3°C & ± 4°C
– SC Available at any temp. in the range of +50°C to +80°C, standard tolerance ± 5°C

Doubly Rotated Cut Crystals

The SC cut leads the family of doubly rotated cut crystals in warmup, phase noise, G sensitivity, and aging characteristics when compared to the AT cut. FC and IT cut crystal performance approaches that of the SC cut. As the graphs indicate, frequency temperature behavior differs which can be advantageous in certain applications.

Typical Characteristics for Third Overtone Crystal Cuts

Doubly rotated cut crystals are offered in fundamental, 3rd and 5th overtones over a wide frequency spectrum. Many holder configurations are available.

Cut	Frequency (MHz)	Res. (ohms)	C_0 (pF)	C_1 (fF)	Q ($\times 10^6$)
AT	5.0	35	3.3	0.44	2.1
FC	5.0	45	3.2	0.30	2.4
IT	5.0	60	3.2	0.20	2.6
SC	5.0	90	3.1	0.15	2.4
AT	10.0	20	5.5	0.92	0.8
FC	10.0	25	5.2	0.51	1.2
IT	10.0	35	5.1	0.35	1.3
SC	10.0	50	5.0	0.24	1.3

Bliley
first name in | frequency control

BOMAR CRYSTAL COMPANY
201 Blackford Avenue • Middlesex, New Jersey 08846
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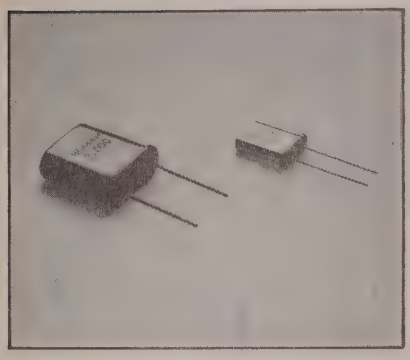


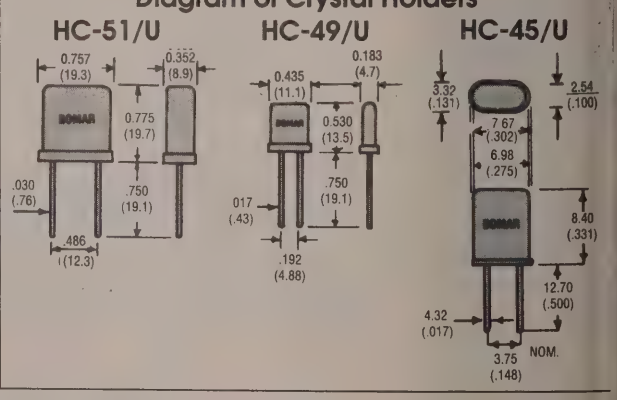
Bomar can provide AT Cut Crystals from 1 MHz to 100 MHz. The AT Cut operates on the fundamental and all odd overtones. This cut maintains the lowest of all temperature coefficients, supplies an extremely high Q, plus it offers an economical cost which makes it the standard for most oscillators such as temperature controlled as well as non-controlled types, and in filter applications. The frequency may be multiplied up or down as needed.

Product applications are in mobile, portable and base station communications, radio transceiver filters, computer modems, satellite frequency converters, and in any field where truly clean, drift-free reception is required.

GENERAL CRYSTAL SPECIFICATIONS

FREQUENCY RANGE (MHZ)	MODE	HOLDER
1.0000 - 2.9999	Fund.	HC-51/U HC-48/U
2.8800 - 23.9999	Fund.	HC-49/U HC-50/U
24.0000 - 65.0000	3rd. OT	HC-49/U HC-50/U
65.0000 - 100.0000	5th. OT	HC-49/U HC-50/U

Diagram of Crystal Holders



Sealing Method : Resistance Weld. Optional 3rd lead and vinyl sleeve.

Calibration Tolerance: ± 30PPM @ 25°C

Freq. Stability vs. Temp. Range: ± 30 PPM from -20°C to +70°C

Please advise if other specifications are required.

CALL TOLL-FREE

FOR PROMPT QUOTATIONS ON YOUR CRYSTAL REQUIREMENTS

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Champion Oscillators

VCXOs (TTL/CMOS)

DIP PACKAGE	Freq. Range	Stability	Deviation Sensitivity	Options
K1523BA	2 - 55 MHz	±0.0025%	±50 ppm/V min	3
K1524AA	3 - 35 MHz	±0.005%	±150 ppm/V min	3
K1525 Series	2 - 33 MHz	±0.0025%	±50 ppm/V min	3*
SURFACE MOUNT				
K1526 Series	2 - 33 MHz	±0.0025%	±50 ppm/V min	3*

(*Standard control voltage +0.5V to +4.5V. Custom deviation, sensitivity & control voltage available)

TCXOs

DIP PACKAGE	Freq. Range	Output	Stability	Operating Temp.
K1519 Series	10 - 26 MHz	Sinewave	±0.0005%	-30°C to +70°C
K1602 Series	12 - 25 MHz	Sinewave	±0.0002%	-40°C to +85°C
K1602T Series	3 - 25 MHz	TTL/CMOS	±0.0002%	-40°C to +85°C

DATA CLOCKS

DIP PACKAGE	Freq. Range	Symmetry	Logic	Stability	Options
K11041	40 - 70 MHz	47.5/52.5%	TTL/CMOS	±0.01%	3
K1300	70 - 125 MHz	40/60%	TTL/CMOS	±0.01%	1,2
K1100BA	1 - 100 MHz	40/60%	TTL/CMOS	±0.01%	1,2,8
RASCO PLUS	1.25 - 50 MHz	40/60%	TTL/CMOS	±0.01%	1,2,3,4
SURFACE MOUNT					
MSO_E	1.5 - 40 MHz	40/60%	TTL/CMOS	±0.01%	2
HALF-DIP PACKAGE					
K500 Series	1 - 70 MHz	40/60%	TTL/CMOS	±0.01%	1,2,8
TIGHT STABILITY					
K1144BM	1.75 - 35 MHz	40/60%	TTL/CMOS	±0.0020%	1,4
K1144AM	35.1 - 60 MHz	40/60%	TTL	±0.0025%	1
ECL COMPATIBLE					
K1149 Series	40 - 220 MHz	40/60%	ECL	±0.01%	1,5,6,7
PROGRAMMABLE					
K2100AC	5 - 135 MHz	40/60%	TTL	±0.01%	

DUAL BAUD RATE GENERATOR

K1135 Series	(50 - 19,200 Baud)	±0.01%

Options: 1. Tighter Stability 2. Tighter Symmetry 3. Extended Temperature Range 4. Enable/Disable 5.Various Pinouts 6. Complementary Output 7. Internal Pull-Downs 8. Tri-State Operation
Note: 0.01% = 100 ppm, 0.005% = 50 ppm, etc

One-Stop Product Line, Leading Edge Technology

... and Non-Stop Service

Fast Delivery — best lead times in the industry

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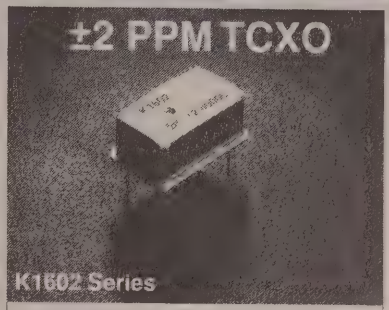
NEW PRODUCTS

±2 PPM TCXO



K1602 Series

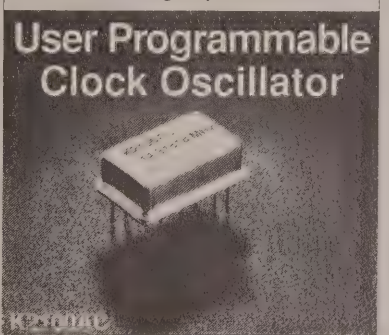
- 10 to 26 MHz
- –40°C to +85°C
- ±2 ppm stability
- All metal DIP package
- Sinewave, TTL, CMOS output available

Improved VCXO
In DIP or Surface Mount

K1525 Series K1526 Series

- 2 to 33 MHz
- Accepts faster modulation rates
- Wider deviation available
- Control voltage options available

User Programmable Clock Oscillator



- Serially programmable output, 5 to 135 MHz
- TTL Compatible Waveform
- Typical Jitter Less Than 100 pS
- Independently programmable dual outputs for both Video and Memory Clock applications
- Standard reference crystal frequency 14.31818 MHz

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- Low Perturbation TCXO Crystals
- On Time Delivery
- Quick Response to Inquiries
- Engineering and Technical Assistance
- Outstanding Customer Support
- Short Lead Time on Established Products
- All Popular Glass and Metal Packages
- Low G Sensitivity Crystals
- Custom Designs

PRODUCT LINE:

Frequency: 1.0 to 250.0 Mhz
Overtone: Fundamental, 3rd, 5th, 7th & 9th
Cuts: AT, BT, AC and SC and other doubly rotated cuts.
Holders: Glass, Coldweld, Resistance Weld & Solder Seal

Some Representative Precision Crystal Designs...

PARAMETER		CCSC-303001	CCSC-303003	CCSC-505010	CCAT-303159	CCAT-505083
Frequency	MHz	5.000	10.000	10.000	10.000	10.000
Cut		SC	SC	SC	AT	AT
Vibration Mode		3rd	3rd	5th	3rd	5th
Holder		HC-27/U	HC-27/U	HC-27/U	HC-27/U	HC-27/U
Load Capacitance	pF	22	22	22	22	22
Co Nominal	pF	3.6	5.2	3.3	5.0	3.6
C_1 Nominal	fF	0.18	.30	.045	1.4	.22
L Nominal	mH	5600	840	5700	185	1100
R Nominal	Ohms	85	55	290	15	60
Q Nominal	(millions)	2.0	1.0	1.3	0.900	1.25
Q Minimum	(millions)	—	—	1.2	—	1.1
*Trimability	(ppm/pF)	0.15	.21	.035	0.7	0.2
Inflection Temperature	°C	+98	+95	+95	+25	+25
Turning Point Range	°C	+30 to +95	+30 to +95	+30 to +95	+60 to +90	+60 to +90
Turning Point Tolerance	°C	±5	±5	±5	±5	±5
Max Slope for LTP from +75°C to Inflection Temperature	($°C^{-1}$)	$\pm 8 \times 10^{-8}$	$\pm 8 \times 10^{-8}$	$\pm 8 \times 10^{-8}$	—	—
Calibration at TPt	(ppm)	±1.5	±1.5	±1.5	±4	±1.5
Max T.C. ±1°C from LTP of +82°C	($°C^{-1}$)	$\pm 4 \times 10^{-9}$	$\pm 4 \times 10^{-9}$	$\pm 4 \times 10^{-9}$	—	—
"C" Mode Inharmonics	(Resistance Ratio)	2:1	2:1	2:1	—	—
"B" Mode (Freq. above "C")		10%	10%	10%	—	—
Drive Level (Recommended Maximum)	uW	10	10	10	10	10

*Trimability: $\frac{df}{dC_1}\Big|_{22pF}$ (ppm/pF)

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When you need clock oscillators in a hurry think of Comclok

Half Size and Surface Mount also Available

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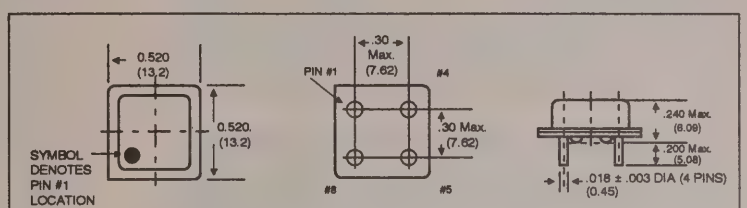
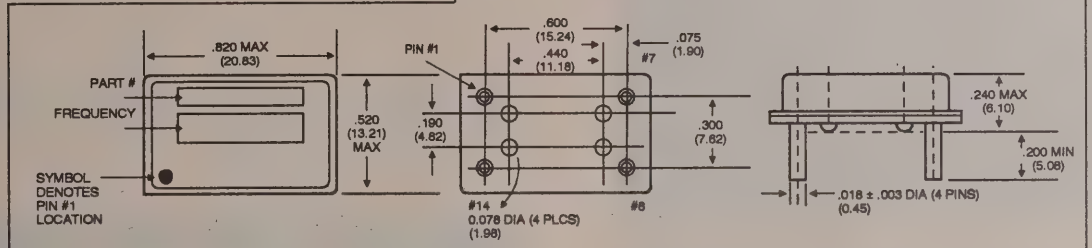
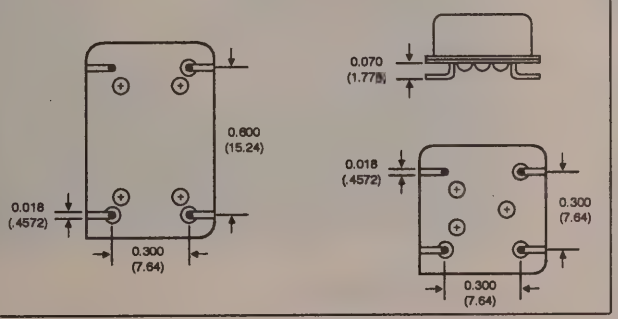
Frequency Range: 10 MHz – 50 MHz*

TTL Clock Oscillators
Frequency Range : 250 KHz – 70.0 MHz

TRI-STATE
Frequency Range : 10 MHz – 50 MHz*







STANDARD FEATURES:
- 0.800" (L) X 0.500" (W) X 0.240" (H)* Full Size
- 0.500" (L) X 0.500" (W) X 0.240" (H)* Half Size
- High Reliability
- Resistance Welded
- Dual Inline Spacing

OPTIONS:
- Surface Mount (gull wing)
- Extended Temperature Ranges
- 45 / 55 Symmetry
- 100 ppm
- 50 ppm
- 25 ppm
- 15 ppm
- 10 ppm

* (50.0 – 70.0 MHz under development)

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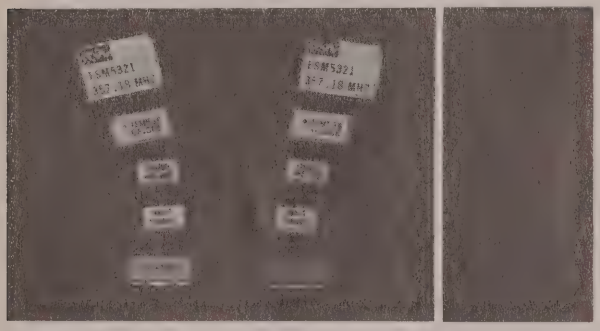
- ➜ VCXO SMD oscillators
- ➜ 3V logic clocks
- ➜ Oscillator for Hi Frequency clock drivers
- ➜ Wide application DCXO

NEW SMD CLOCK OSCILLATORS



Ceramic SMD Crystal Unit — NEW PRODUCT!

Model	XM-1		
Frequency Range*	16 MHz to 100 MHz		
Frequency Stability	± 50 ppm ; 70°C to +60°C		
Accuracy @ 25°C	50 ppm		
Short Cap	7 pf max.		
16 to 32 M	Fundamental	40Ω ESR	16 or 32 pf CL
28 to 84 M	3rd OT	60Ω ESR	Series CL
84 to 100 M	5th OT	780Ω ESR	Series CL

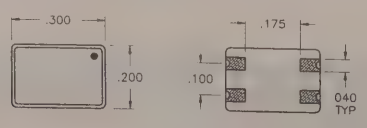
Model	XL-1		
Frequency Range*	10 M to 100 M		
Frequency Stability	± 50 ppm ; 70°C to +60°C		
Accuracy @ 25°C	50 ppm		
Short Cap	7 pf max.		
16 to 32 M	Fundamental	40Ω ESR	16 or 32 pf CL
28 to 84 M	3rd OT	60Ω ESR	Series CL
84 to 100 M	5th OT	780Ω ESR	Series CL

Package Outline 1(XM-1) Pin 1: Input Pin 2: Ground Pin 3: Output Pin 4: Ground

Height of XM-1 is 1.5 mm. Height of XL-1 is 1.7 mm. Several package footprints are available for XL-1. Package Outline 1 only represents footprint for XM-1, however, length and width dimensions are identical for either model.

Other SMD crystal models are available at frequencies lower than 10 MHz. Also, many standard frequencies are available.
*Please call for details.

Package Outline 1: Ceramic Surface Mount Crystal



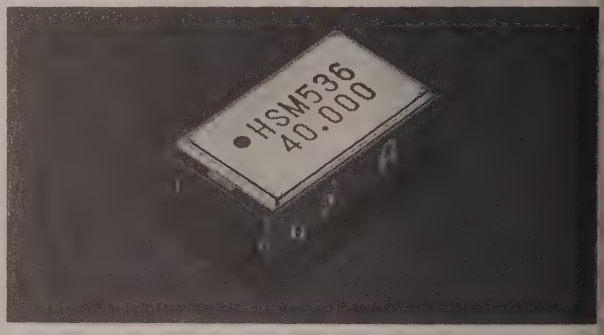
HCMOS Ceramic SMD Clock — NEW PRODUCT!

Model	HSM93	HSM933
Frequency Range*	1.8432 MHz to 70 MHz	
Frequency Stability	± 100 ppm ; 0°C to +70°C	
Drive Io	50 pf	
Symmetry	50 / 50 ± 10%	
Rise / Fall Time	7 nS max.	
Supply Voltage	+5 Vdc ± 5%	3.3 Vdc ± 5%
Supply Current	70 mA max.	

Model	HSM536
Frequency Range*	1.8432 MHz to 100 MHz
Frequency Stability	± 100 ppm ; 0°C to +70°C
Drive Io	50 pf
Symmetry	50 / 50 ± 10%
Rise / Fall Time	7 nS max.
Supply Voltage	+5 Vdc ± 5%
Supply Current	70 mA max.

Package Outline 2 (HSM93) Pin 1: Enable / Disable Pin 2: ground
Package Outline 3 (HSM536) Pin 3: Output Pin 4: Vdd (+5 Vdc)

*Many standard frequencies are available. Please call for details.



Soldering

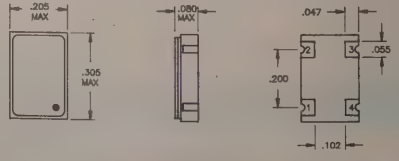
General Conditions
260°C for 10 seconds maximum

Solderability
(EIAJ-RCX-0102/101 Condition 1a)

- Flux: MIL-F-14256 (WW Rosin = 25%, isopropyl alcohol = 75%)
- Solder: QQS571 (Sn = 63%, Pb = 37%)
- Solder bath temperature: 235°C ±5°C
- Depth of immersion: Up to electrical terminal.
- Immersing time: Within .2 seconds ± 0.5 seconds into solder bath.

After performing the above procedures, a newly soldered coverage shall be greater than 90%.

Package Outline 2: Ceramic Surface Mount Oscillator



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VCXO SMD

Model	VSH51	VSH52	VSH53	VSH54
Frequency Range	100 KHz to 30 MHz			
Temperature Range	0°C to +70°C			
Frequency Stability	± 25 ppm	± 50 ppm	± 100 ppm	± 20 ppm
Output Waveform	HCMOS Squarewave			
Output Voltage*	Voh = 4.5 minimum Vol = .40 maximum			
Duty Cycle	45/55 typ; ± 10% maximum			
Rise / Fall Time	6 ns maximum			
Supply Voltage	+ 5 VDC ± 10%			
Control Voltage*	.5 V to 4.5 V			
Deviation*	± 100 ppm			
Center Frequency	2.5 Vdc ± .5 Vdc			
Monotonic Linearity	less than ± 20%			
Input Impedence	1/2 50K ohms at 1/4 10 KHz			
Modulation Bandwidth	1/4 15 KHz			
Package Outline 4	Pin 2: Control Voltage Pin 7: Output		Pin 4: Ground Pin 9: +5 Vdc	

*Additional options available

High Frequency

Model	VSA51	VSA52	VSA53	VSA54
Frequency Range	30 MHz to 60 MHz			
Temperature Range	0°C to +70°C			
Frequency Stability	± 25 ppm	± 50 ppm	± 100 ppm	± 20 ppm
Output Waveform	CMOS Squarewave; TTL Compatible			
Output Voltage*	Voh = 4.4 minimum Vol = .44 maximum			
Duty Cycle	45/55 typ; ± 10% maximum			
Rise / Fall Time	3 ns maximum			
Supply Voltage	+ 5 VDC ± 10%			
Control Voltage*	.5 V to 4.5 V			
Deviation*	± 100 ppm			
Center Frequency	2.5 Vdc ± .5 Vdc			
Monotonic Linearity	less than ± 20%			
Input Impedence	1/2 50K ohms at 1/4 10 KHz			
Modulation Bandwidth	1/4 15 KHz			
Package Outline 4	Pin 2: Control Voltage Pin 7: Output		Pin 4: Ground Pin 9: +5 Vdc	

*Additional options available

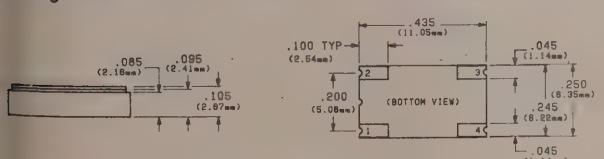
Environmental Characteristics

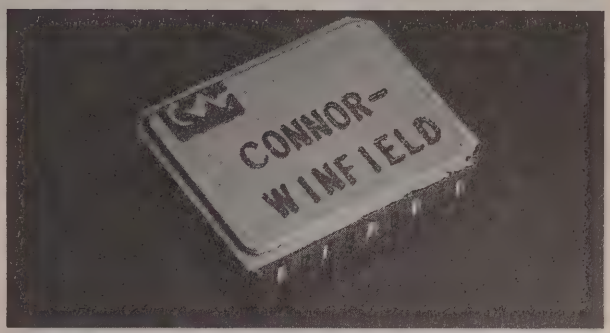
Temperature Cycle
The specimen shall meet electrical characteristics after tested 5 cycles of -55°C to +125°C per MIL-STD-883C method 1010.6 test condition B.

Hermetical
No bubbles appear in Flourinert (FC-43) at 125°C ± 5°C, for 30 minutes.

Solvent Resistance
Marking will withstand immersion in Isopropyl Alcohol or Trichloroethylene.

Package Outline 3: Ceramic Surface Mount Oscillator





ECL SMD

Model	ESM51	ESM52	ESM53	ESM63
Frequency Range	24 MHz to 360 MHz			
Temperature Range	0°C to +70°C		-40°C to +85°C	
Frequency Stability	± 25 ppm	± 50 ppm	± 100 ppm	± 100 ppm
Output Waveform	ECL Squarewave (100K or 10K)			
Output Voltage*	Voh = -1.04 minimum Vol = -1.90 maximum			
Duty Cycle	48/52 typ; ± 5% maximum			
Rise / Fall Time	1.5 ns typ; 2 ns maximum			
Package Outline 4	Pin 4: Vee	Pin 7: Output	Pin 9: Vcc	

Please Note: Output is terminated into 50 ohms to Vtt.
Vtt = -2 Vdc referenced to Vcc
* For supply voltage options 1 or 2.

Supply Voltage Options (add corresponding number to base model)
1: -5.2 Vdc (10K equivalent)
2: -4.5 Vdc (100K equivalent)
3: +5 Vdc Output Voltage (Voh) = 3.96 Minimum
(Vol) = 3.40 Maximum

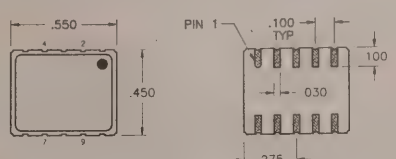
Additional Options (add corresponding number to base model)
1: Complementary Output on Pin 6
2: Enable/Disable on Pin 2, Enable = Vcc; Disable Vee
3: Enable/Disable on Pin 2, Complementary output on Pin 6

ACMOS SMD

Model	ASM51	ASM52	ASM53	ASM63
Frequency Range	14 MHz to 150 MHz			
Frequency Stability	± 25 ppm	± 50 ppm	± 100 ppm	± 100 ppm
Output Waveform	CMOS Squarewave; TTL Compatible			
Load	50 pf, 24 mA output current			
Rise / Fall Time	3 ns; 48/52 typical duty cycle			
Supply Voltage	+5 Vdc ±10%; 100 mA max current			
Package Outline 4	Pin 2: Enable/Disable or N/C Pin 7: Output		Pin 4: GND Pin 9: (+)	

Options (add to base model number)
R: Enable/Disable Tristate
A: 3 Volt Logic

Package Outline 4: Ceramic Surface Mount Oscillator



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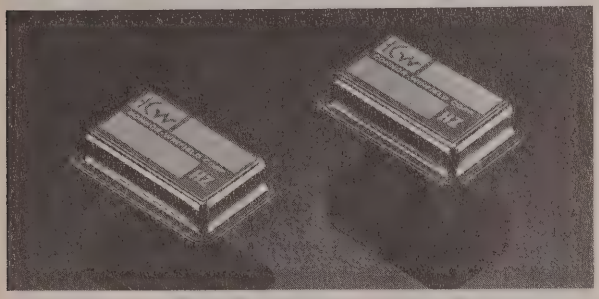
NEW PRODUCTS FOR 1993/94



Clock Driver Oscillator and Module For Pentium

Connor-Winfield Corporation now has available a clock oscillator specifically designed to drive minimum skew clock drivers for clock generation applications operating at high frequencies. This new oscillator was originally designed to provide the clock input to drive the Pentium microprocessor. Connor-Winfield's model UPA53 is available with frequencies from 25 MHz to 100 MHz and can be used to provide the input for clock drivers available from Motorola, National, and many others that are designed specifically for operation with the Pentium microprocessor.

In addition, Connor-Winfield is also offering a complete module packaged in an all metal, hermetically sealed 14-pin DIP. This module combines the clock driver and the oscillator into one package providing up to 9 outputs. The module provides a symmetrical output current drive of up to 24 mA and a maximum output skew of 600 ps and is also available for extended temperature range applications.

Please call for additional details!

Digitally Compensated Crystal Oscillators

Connor-Winfield announces a new line of digitally compensated crystal oscillators. Housed in a 24-pin hermetically sealed DIP, this new oscillator design can provide extremely tight frequency versus temperature in a variety of logic types and frequency ranges.

Whether you need a frequency standard of 10 MHz or a telecomm frequency of 155.52 MHz, Connor-Winfield can provide you with stabilities as tight as .2 ppm over extended temperature ranges. In addition, ECL outputs or CMOS outputs are available as standards. Voltage control capability can also be provided in CMOS or ECL logic. Because of the modular design approach, virtually any oscillator circuit we make can be incorporated into this package providing superior stability characteristics.

If you have an application, please give us a call!

New TCXO Models Available

Due to customer demand, Connor-Winfield has designed several TCXO's for second sourcing of our competitor's products. A recent addition is a 14-pin double DIP with external frequency adjustment. Stabilities are available to +/- 1 ppm. Call for details!

Hybrid Clock Oscillators

HCMOS General Specifications

Wave Form	HCMOS logic Squarewave
Supply Voltage	5 Vdc ± 10%
Supply Current (@ 25°C)	25 mA max. (typ. 1 Hz to 20 MHz 7mA)
Output Load	CMOS: Capacitance load = 50 pf max.
Output Driving Ability	TTL Equivalent: 2 TTL gates LSTTL Equivalent: 10 LSTTL gates ALS: 20 ALS gates Fast: 6 fast gates S & AS: 2 S & AS gates
Symmetry	50 / 50 ± 10% (typ. 52 / 48%)
Voltage "0" Level	0.5 V max. 10% VDD
Voltage "1" Level	4.5 V min. 90% VDD
Rise / Fall Time	10 nS max. (typ. 6 nS) at CL = 15 pf

14-pin DIP

Model	HC13R8	HC14R8	HC15R8
Frequency Range	4 MHz to 50 MHz		
Temperature Range	0°C to +70°C		
Frequency Stability	± 25 ppm	± 50 ppm	± 100 ppm

Package Outline 6 — Pin 1: N/C; Pin 7: Case Ground; Pin 8: Output; Pin 14: +5 Vdc

Tri-State Gating Models

8-pin DIP*	S51R	S52R	S53R
14-pin DIP**	HC13R8R	HC14R8R	HC15R8R
Frequency Range	1.8432 MHz to 70 MHz		
Temperature Range	0°C to +70°C		
Frequency Stability	± 25 ppm	± 50 ppm	± 100 ppm

*Package Outline 5 — Pin 1: N/C; Pin 4: Case Ground; Pin 5: Output; Pin 8: +5 Vdc

**Package Outline 6 — Pin 1: Enable / Disable; Pin 7: Case Ground; Pin 8: Output; Pin 14: +5 Vdc

Enable / Disable — Pin 1: Input; Low Level: .8 V max.; High Level: 2.2 V min; Open. Pin 8: Output; High Impedence (disable); Active (enable); Active (enable)

3 Volt Logic Clock

Model	A53AA	A53RA
Frequency Range	10 M to 150 M	
Temperature Range	0°C to +70°C	
Frequency Stability	± 10 ppm	± 100 ppm

Package Outline 5 — Pin 1: N/C or E/D; Pin 4: Case Ground; Pin 5: Output; Pin 8: +5 Vdc

Other Available HCMOS Models

Type Description	Frequency Range	Model	Package Outline
Independent Dual Frequency	1.8432 MHz to 50 MHz	S53DF	6
Tight Symmetry 47.5 / 52.5 max.	1 MHz to 70 MHz	MPH53*	6
Low Frequency, 14-pin	1 Hz to1 KHz	HC15R6	6
Custom Frequency, 14-pin	1 KHz to 70 MHz	HC15R5	4
Custom Frequency, 8-pin	250 Hz to 70 MHz	H53	5
Tight Tolerance, ±10 ppm	50 KHz to 50 MHz	H10C	6

*Also available with Tri-state Gating Function

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Hybrid Clock Oscillators

Frequency Tolerance / Temperature Range Options

Designator:	14-pin models	8-pin* models	Option	
	13	51	± 25 ppm;	0°C to +70°C
	14	52	± 50 ppm;	0°C to +70°C
Standard →	***15***	***53***	***± 100 ppm;***	***0°C to +70°C***
	16	63	± 100 ppm;	-40°C to +85°C
	17	73	± 100 ppm;	-55°C to +125°C

*Also designator for Dual Frequency, High Frequency Sinewave, and Advanced CMOS models.

TTL General Specifications

Output Load	1 to 10 TTL gates, Squarewave
Symmetry	50 / 50 ± 10%
Supply Voltage	5 Vdc ± 5%
Supply Current	85 mA max. (30 to 50 mA typ.)
Logic "0" Level	1Hz to 80 MHz +.4V max.
Logic "1" Level	1 Hz to 80 MHz 2.4V min.
Rise / Fall Time	1 Hz to 8.999 MHz 15 ns 9 MHz to 31.999 MHz 10 ns 32 MHz to 80 MHz 7 ns

TTL 14-pin DIP

Model	S13R8	S14R8	S15R8
Frequency Range	1 MHz to 80 MHz		
Temperature Range	0°C to +70°C		
Frequency Stability	± 25 ppm	± 50 ppm	± 100 ppm
Package Outline 6	Pin 1: N/C Pin 8: Output	Pin 7: Case Ground Pin 14: +5 Vdc	

Other Available TTL Models:

Model Description	Frequency Range	Model	Package Outline
Low Frequency, 14-pin	1 Hz to 250 KHz	S15R7	6
Custom Frequency, 14-pin	250 KHz to 50 MHz	S15R6	6
Tight Tolerance, ± 10 ppm	50 Khz to 50 MHz	S10C	6

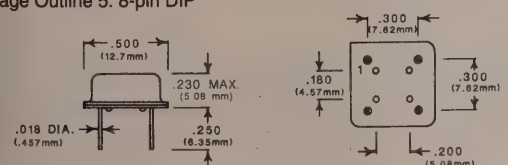
Immediate delivery on Hybrid Clock Oscillators at these stock frequencies:

HCMOS and TTL clocks at these frequencies are available for immediate delivery:

1 MHz	1.024 MHz	1.2288 MHz	1.8432 MHz
2 MHz	2.048 MHz	2.457MHz	3 MHz
3.6864 MHz	4 MHz	4.096 MHz	4.9152 MHz
5 MHz	6 MHz	8 MHz	8.064 MHz
8.192 MHz	10 MHz	11 MHz	11.0592 MHz
12 MHz	12.288 MHz	12.5 MHz	14.31818 MHz
15.36 MHz	16 MHz	16.384 MHz	18.0 MHz
19.968 MHz	20 MHz	24 MHz	25 MHz
25.175 MHz	28.322 MHz	30 MHz	32 MHz
33.333 MHz	36 MHz	40 MHz	40.96 MHz
44.736 MHz	44.9 MHz	48 MHz	50 MHz
60 MHz	64 MHz	65 MHz	66 MHz
66.666 MHz	70 MHz	80 MHz	100 MHz

Many other frequencies are available in 2 to 3 week lead times.
If you don't see what you need, please call!

Package Outline 5: 8-pin DIP



High Frequency Clocks

ACMOS Squarewave General Specifications

Output		Advanced CMOS Logic Squarewave
Supply Voltage		+5 Vdc ± 10%
Output Voltage	Voh Vol Io	3.7 V min. .44 V max. 24 mA max.
Symmetry		50 / 50 ± 5% (52 / 48 typ.)
Rt / Ft		3nS max. (15 pf load)
Supply Current		20 mA @ 16 MHz ; 100 mA @ 150 MHz

ACMOS Models

14-pin DIP*	AC51	AC52	AC53
8-pin DIP**	A51	A52	A53
Frequency Range	24 MHz to 150 MHz		
Temperature Range	0°C to +70°C		
Frequency Stability	± 25 ppm	± 50 ppm	±100 ppm
*Package Outline 6 or 7	Pin 1: N/C Pin 8: Output	Pin 7: Case Ground Pin 14: +5 Vdc	
**Package Outline 5	Pin 1: N/C Pin 5: Output	Pin 4: Case Ground Pin 8: +5 Vdc	

Special Function ACMOS Models

Tri-state Gating	AC51R	AC52R	AC53R
Tight Symmetry*	MPA51	MPA52	MPA53
Frequency Range	24 MHz to 150 MHz		
Temperature Range	0°C to +70°C		
Frequency Stability	± 25 ppm	± 50 ppm	±100 ppm
Package Outline 6	Pin 1: Enable / Disable Pin 7: Case Ground	Pin 8: Output Pin 14: +5 Vdc	

*Symmetry better than 2% max. (typ. 1%).
Also available with Tri-state Gating: Add "R" to model number.

Tri-state Gating Function Description

Input Pin	Output Pin
Low Level: .8 V max.	High Impedence (disable)
High Level: 2.2 V min.	Active (enable)
Open	Active (enable)

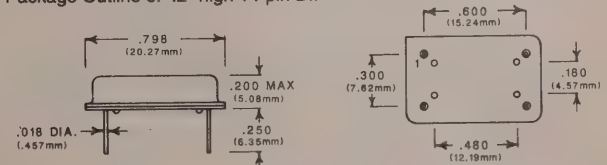
CMOS Low Current 4000 Series

Wave Form	CMOS logic Squarewave
Supply Voltage	+5 Vdc to +15 Vdc inclusive
Output Load	1 Hz to < 4 MHz CL = 40 pf @ +5 to 15 Vdc
Supply Current	3 to 20 mA (3 mA @ 5 Vdc and 20 mA @15 Vdc)
"L" Suffix Option	2 mA max. @ 5 Vdc ; 15 mA max. @ 15 Vdc
Symmetry	1 Hz to 3 MHz 50 / 50 ± 2%

CMOS Models

Model Description	Frequency Range	Model	Package Outline
Low Frequency	1 Hz to 200 Hz	C15R6**	6
High Frequency	201 Hz to 4 MHz	C15R5**	6
Reduced Size	250 Hz to 4 MHz	C53	5

Package Outline 6: .2" high 14-pin DIP



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High Frequency Hybrid Oscillators

ECL Squarewave General Specifications

Output	10K ECL	100K ECL
Supply Voltage	-5.2 V	-4.5 V
Output Voh Voltage Vol	-1.04 V min., -.95 V typ., -.85 V max. -1.90 V min., -1.80 V typ., -1.60 V max.	
Symmetry Rt / Ft	50 / 50 ± 10% 2 nS max.	
Supply Current	75 mA max. (55 mA typ.)	

Standard Model	**ECLB-1**	**ECLB-2**	**E15R8**
Frequency Range	10 MHz to 500 MHz		30MHz to 200 MHz
Temperature Range	0°C to +70°C		
Frequency Stability	± 100 ppm		
Output	10K ECL	100K ECL	10K ECL
Supply Voltage	-5.2 V	-4.5 V	-5.2 V

Package Outline 7 Pin 1: Internally Connected Pin 7: Vee (-)
Pin 8: Output Pin 14: Vcc (Case Ground)

Standard Options:
Stability Options
- *A ± 50 ppm Stability over temperature range
- D ± 100 ppm Stability (-40°C to +85°C)
- E ± 25 ppm Stability (0°C to +70°C)
- F ± 10 ppm Stability (0°C to +50°C)

Output Options
- *Q Pin 1: Complementary Output
- G Pin 1: Enable / Disable: Enable to Low Level (Vil) Disable to High Level (Vih)

Pin Connect Options
- *P Pin 1: Internally Connected Pin 7: Vee (Case Ground) Pin 8: Output Pin 14: Vcc

*Options available on E15R8 Low Cost model to 170 MHz

ECL 8-pin DIP NEW PRODUCT!

Model	**E531***	
Frequency Range	24 to 180 MHz	
Temperature Range	0°C to +70°C	
Frequency Stability	± 100 ppm	
*Output	-1 10K ECL	-2 100K ECL
Supply Voltage	-5.2 V	-4.5 V

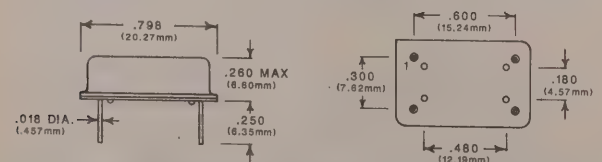
Package Outline 5 Pin 1: Vee Pin 4: Vee (Case ground)
Pin 5: Output Pin 8: Vcc
Pin 1 Options: Comp. out, enable/disable, or N.C.

High Frequency ECL NEW PRODUCT!

Model	**ED01-353**	**ED02-353**
Frequency Range	200 MHz to 600 MHz	
Temperature Range	0°C to +70°C	
Frequency Stability	± 100 ppm	
Output	10K ECL	100K ECL
Supply Voltage	-5.2 V	-4.5 V

Package Outline 8 Pins 1 and 8: Vee Pin 9: Output
Pin 10: Complementary Output Pin 16: Vcc (Case Ground)

Package Outline 7: .26" High Cap, 14-pin DIP



Call or write for more information on Connor-Winfield's line of High Frequency DIPs

Sinewave Low Frequency

Model	**DPS1**	**DPS3**	**DPS2**	**DPS4**
Fixed Frequencies	1 KHz to 75 KHz		100 Hz to 100 KHz	
Frequency Tolerance	± .01%	± .005%	± .01%	± .005%
Output, 10K Load T.H.D. ≤ 5%	1 Vrms min. DC coupled		1.5 Vrms min. @ 8 Vdc 3.0 Vrms min. @15 Vdc DC coupled	
Supply Voltage	5 Vdc ± 10%		+8 to +15 Vdc (must specify) ± 10%	
Supply Current	50 mA max.		35 mA max.	

Package Outline 7 Temperature range: 25°C to + 75°C Output wave: Sinewave.
Option: Adding "D" option to end of model number calls out ≤ 1% T.H.D.

High Frequency

Model**	**SW53**
Frequency Range	100 KHz to 150 MHz
Output*	10 dBm
Load*	50 ohm; Output AC coupled
Supply Voltage	5 Vdc ± 10%
Supply Current	50 mA max.; 25 mA typ.

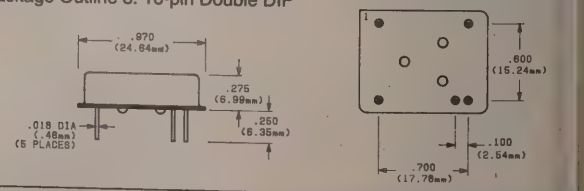
Package Outline 6 Pin 7: Ground Pin 8: Output Pin 14: +5V
Distortion (THD): ≤ 5% *Output voltage dependent upon frequency and fixed load. Consult factory for details.

High Frequency Sinewave NEW PRODUCT!

Model	**SD01-353**
Frequency Range	24 MHz to 500 MHz
Temperature Range	0°C to +70°C
Frequency Stability	± 100 ppm
Output	Sinewave, AC Coupled
Output Load	50 Ohm
Output Amplitude	0 dBm ± 3 dBm @ 5V, 10 dBm ± 3 dBm @ 12V
Distortion	-25 dBm max., -35 dBm typ.
Supply Voltage	+5 Vdc ± 5%
Supply Current	70 mA max. (30 mA typ.)

Package Outline 8 Pin 1: No Connection Pin 8: Case Ground
Pin 9: Output Pin 16: Vcc

Package Outline 8: 16-pin Double DIP



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6

VCXOs / VCOs / TCXOs

High Frequency VCXO — NEW PRODUCT!

Model	HV51	HV52	HV53	HV55
Frequency Range	100 KHz to 90 MHz			
Temperature Range	0°C to +70°C			
Frequency Stability	± 25 ppm	± 50 ppm	± 100 ppm	± 10 ppm
Output	ACMOS Squarewave			
Drive Io Symmetry Rise / Fall Time	AC Series 24 mA 50 / 50 ± 5% (52 / 48 typ.) 6 nS (2 nS typ.)			
Deviation	± 10 ppm to ± 100 ppm (depending upon frequency) .5 V to 5 Vdc (positive transfer function)			
Supply Voltage	+5 Vdc ± 5%			
Supply Current	70 mA max.			
Package Outline 6 or 7	Pin 1: Control Voltage Input (Fo = 2 to 3 V) Pin 7: Case Ground Pin 8: Output Pin 14: +5 Vdc			

VCXOs Designed For Telecommunication Applications

ACMOS VCXO High Frequency/Tight Stability

Model	HV54-150	HV64-150
Frequency Range	10 MHz to 70 MHz	
Stability	± 20 ppm	
Temperature Range	0°C to +70°C	-40°C to +85°C
Deviation	Standard: ± 75 ppm (positive transfer function)	
Package	14-pin DIP (Package Outline 6 or 7)	
Pin 1: Control Voltage Pin 4: Ground	Pin 8: Output Pin 14: +5 Vdc	

ECL VCXO 14-pin DIP

Model	EV54-160-31	EV64-160-31
Frequency Range	20 MHz to 60 MHz	
Stability	± 20 ppm	
Temperature Range	0°C to +70°C	-40C° to +85°C
Deviation	Standard: ± 75 ppm (positive transfer function)	
Package	14-pin DIP (Package Outline 6 or 7)	
Pin 1: Control Voltage Pin 4: Ground	Pin 8: Output Pin 14: +5 Vdc	

ECL VCXO High Frequency

Model	EDV54-80-11	EDV64-80-11
Frequencies	60 MHz to 200 MHz	
Stability	± 20 ppm	
Temperature	0°C to +70°C	-40°C to +85°C
Deviation	Standard: ± 75 ppm (positive transfer function)	
Package	16-pin Double DIP (Package Outline 8)	
Options	Q: Complementary output (Pin 15) G: Enable / Disable (Pin 15)	
Pin 1: Control Voltage Pin 10: Complementary output	Pin 8: Vee Pin 16: Vcc (case)	Pin 9: Output

Fixed Frequency Clocks
Special fixed frequency clocks are now available for use in Telecommunication applications. ECL, TTL, or HCMOS clocks can be provided with the following stability/temperature range options:
± 20ppm 0°C to + 70°C
± 20ppm -40°C to +85°C
Call for further details.

DIP VCO 14-pin DIP

TTL Models	PL14R1	PL14R2	PL14R3
Fixed Frequencies	100 KHz to 80 MHz (please specify center frequency)		
Frequency Stability	± 1%	± 1%	± 2%
Temperature Range	0°C to +70°C		
Deviation from F (nominal)	± 2% min. ± 4% max.	± 10% min. ± 15% max.	± 20% min. ± 30% max.

ACMOS Models	AV53R1	AV53R2
Fixed Frequencies	10 MHz to 170 MHz (please specify center frequency)	
Frequency Stability	± 1%	
Temperature Range	0°C to +70°C	
Deviation from F (nominal)	± 2% min. ± 4% max.	± 10% min. ± 15% max.

SPECIFICATIONS COMMON TO BOTH MODEL SERIES:

Control Voltage	0 V min. to +5 V max. F (nominal) at +2 to +3 V Positive transfer characteristic
Supply Voltage Symmetry Supply current	5 Vdc ±10% 50 / 50 ±10% 85 mA max.
Package Outline 6	*Pin 1: Control voltage

HCMOS TCXO 14-pin DIP

Model	HTV1	HTV2	HTV3	HTV4
Frequency Range	100 KHz to 50 MHz			
Temperature Range	+20° to +40°C	0° to +50°C	0° to +70°C	-30° to +70°C
Frequency Stability	± .5 ppm	± 1 ppm	± 2.5 ppm	± 5 ppm
Output	HCMOS Squarewave			
Drive Io Symmetry Rise /Fall Time	4 mA 50 / 50 ± 10% 6 nS			
Frequency Trim Range	±10 ppm min. / .5 V to 4.5 V			
Supply Voltage	± 5 Vdc ± 1%			
Supply Current	25 mA max., 10 mA typ.			
Package Outline 7	Pin 1: Control Voltage Input (Fo = 2 to 3 V) Pin 7: Case Ground Pin 8: Output Pin 14: +5 Vdc			

DIP TCXO ± 5 ppm

Model	H10BV	HV56
Frequency Range	100 KHz to 35 MHz	12 MHz to 75 MHz
Temperature Range	0°C to +70°C	
Frequency Stability	± 5 ppm	
Output	HCMOS Squarewave	
Drive Io Symmetry Rise / Fall Time	4 mA 50 / 50 ± 10% 6 nS	
Frequency Adjust.	± 10 ppm min., .5 Vdc to 4.5 Vdc	
Supply Voltage	+5 Vdc ± 5%	
Supply Current	30 mA max. (20 mA typ.)	
Package Outline 7	Pin 1: Control Voltage Input (Fo = 2 to 3 V) Pin 7: Case Ground Pin 8: Output Pin 14: +5 Vdc	

Engineering Notes on Connor-Winfield's TCXO Series
The above TCXO models require a stable DC voltage on Pin 1. Fo is set at a Pin 1 voltage of 2.5 Vdc nominal. For accurate frequency adjustment, use a potentiometer between Pins 14 and 7 with a wiper to Pin 1.

MINIGLOSSARY
BASIC
EBCDIC CODE

Bit Positions 4, 5, 6, 7	Second Hexadecimal Digit	Digit Punches	00				01				10				11				Bit Positions 0, 1
			00	01	10	11	00	01	10	11	00	01	10	11	00	01	10	11	Bit Positions 2, 3
			0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	First Hexadecimal Digit
			12				12	12		12	12	12		12	12				Zone Punches
				11				11	11	11		11	11	11		11			
					0		0		0	0	0		0	0			0		
			9	9	9	9	9	9	9	9									Digit Punches
			①	②	③	④	⑤	⑥	⑦	⑧					⑨	⑩	⑪	⑫	
0000	0	8-1	NUL	DLE	DS		SP	&	-									0	8-1
0001	1	1	SOH	DC1	SOS				⑬		a	j			A	J	⑭	1	1
0010	2	2	STX	DC2	FS	SYN					b	k	s		B	K	S	2	2
0011	3	3	ETX	TM							c	l	t		C	L	T	3	3
0100	4	4	PF	RES	BYP	PN					d	m	u		D	M	U	4	4
0101	5	5	HT	NL	LF	RS					e	n	v		E	N	V	5	5
0110	6	6	LC	BS	ETB	UC					f	o	w		F	O	W	6	6
0111	7	7	DEL	IL	ESC	EOT					g	p	x		G	P	X	7	7
1000	8	8		CAN							h	q	y		H	Q	Y	8	8
1001	9	8-1		EM							;	r	z		I	R	Z	9	9
1010	A	8-2	SMM	CC	SM		¢	!	⑮	:									8-2
1011	B	8-3	VT	CU1	CU2	CU3	.	$	,	#									8-3
1100	C	8-4	FF	IFS		DC4	<	*	%	@									8-4
1101	D	8-5	CR	IGS	ENQ	NAK	(	)	_	'									8-5
1110	E	8-6	SO	IRS	ACK		+	;	>	=									8-6
1111	F	8-7	SI	IUS	BEL	SUB	I	¬	?	"									8-7
			12				12				12	12		12	12	12		12	Zone Punches
				11				11				11	11	11		11	11	11	
					0				0		0		0	0	0		0	0	
			9	9	9	9									9	9	9	9	

Card Hole Patterns

①	12-0-9-8-1	⑤	No-Punches	⑨	12-0
②	12-11-9-8-1	⑥	12	⑩	11-0
③	11-0-9-8-1	⑦	11	⑪	0-8-2
④	12-11-0-9-8-1	⑧	12-11-0	⑫	0
				⑬	0-1
				⑭	11-0-9-1
				⑮	12-11

Control Character Representations

ACK	Acknowledge	EOT	End of Transmission	PF	Punch Off
BEL	Bell	ESC	Escape	PN	Punch On
BS	Backspace	ETB	End of Transmission Block	RES	Restore
BYP	Bypass	ETX	End of Text	RS	Reader Stop
CAN	Cancel	FF	Form Feed	SI	Shift In
CC	Cursar Control	FS	Field Separator	SM	Set Mode
CR	Carriage Return	HT	Horizontal Tab	SMM	Start of Manual Message
CU1	Customer Use 1	IFS	Interchange File Separator	SO	Shift Out
CU2	Customer Use 2	IGS	Interchange Group Separator	SOH	Start of Heading
CU3	Customer Use 3	IL	Idle	SOS	Start of Significance
DC1	Device Control 1	IRS	Interchange Record Separator	SP	Space
DC2	Device Control 2	IUS	Interchange Unit Separator	STX	Start of Text
DC4	Device Control 4	LC	Lower Case	SUB	Substitute
DEL	Delete	LF	Line Feed	SYN	Synchronous Idle
DLE	Data Link Escape	NAK	Negative Acknowledge	TM	Tape Mark
DS	Digit Select	NL	New Line	UC	Upper Case
EM	End of Medium	NUL	Null	VT	Vertical Tab
ENQ	Enquiry				

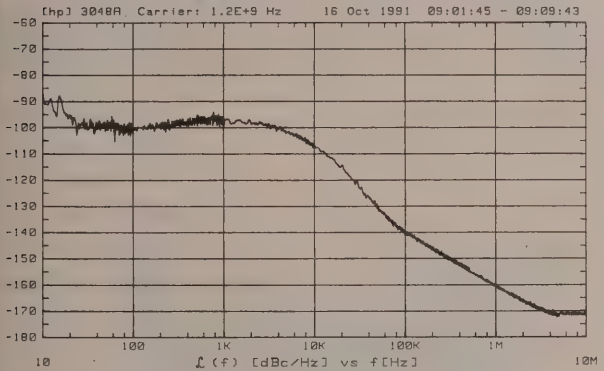
Special Graphic Characters

¢	Cent Sign
.	Period, Decimal Point
<	Less-than Sign
(	Left Parenthesis
+	Plus Sign
|	Logical OR
&	Ampersand
!	Exclamation Point
$	Dollar Sign
*	Asterisk
)	Right Parenthesis
;	Semicolon
¬	Logical NOT
-	Minus Sign, Hyphen
/	Slash
,	Comma
%	Percent
_	Underscore
>	Greater-than Sign
?	Question Mark
:	Colon
#	Number Sign
@	At Sign
'	Prime, Apostrophe
=	Equal Sign
"	Quotation Mark

SYNTHESIZERS, OSCILLATORS AND RF SUBSYSTEMS

For MLS, Ground to Air Communications, Radar and SatCom Applications

PHASE LOCKED OSCILLATORS



S-SERIES SYNTHESIZERS

FEATURES:

- High performance
- Small, low profile 1U high package
- Low phase noise
- Phase error-free
- Extremely low microphonics
- Excellent spectral purity
- Competitively priced

APPLICATIONS:

- Satellite Communications
- Digital Radio

SPECIFICATIONS:

Frequency Range:	600 MHz to 13 GHz
Tuning Bandwidth:	600 MHz
Frequency Stepsize:	125 KHz
Power Output:	13 dBm nominal
Output Phase Noise at 5 GHz: (with External Reference to specification shown)	
(Internal Reference Optional)	–68 dBc/Hz @10 Hz –68 dBc/Hz @100 Hz –80 dBc/Hz @1Kz –85 dBc/Hz @10 Kz –108 dBc/Hz @100 Kz –130 dBc/Hz @1 MHz
External Reference required:	5 / 10 Mhz –125 dBc/Hz @ 10 Hz –140 dBc/Hz @ 100 Hz –150 dBc/Hz @ > 1 Kz
Spurious (In Band):	–60 dB @ > 400 Hz & < 1 Mhz offset –70 dBc > 1Mhz offset
Harmonics:	–50 dBc
D.C. Supplies:	To be specified between + 15 v and + 24 v, + 5 v ± 0.25 v
Temperature Range:	0 to 60°C (Operating Case Temp.)
Programming Control:	Parallel BCD, TTL / CMOS
Alarm:	TTL "0" for alarm
Connectors:	RF= SMA-F, DC/Logic/Alarm=IDC

Many optional specifications are available.
Please contact the factory for details.

SPECIFICATIONS:

"L5" SERIES PHASE LOCKED TO A 5 MHz INPUT									
MODEL NO.		FREQUENCY (MHz)	OUTPUT POWER (dBm)		SPURIOUS (dBc)	SPURIOUS LINE RELATED (dBc)	HARMONICS (dBc)	PHASE NOISE (dBc)	
								1 KHz	10 KHz
MCRO	0960-L5	960	+13	+20	-90	-50	-25	-100	-110
MCRO	1200-L5	1200	+13	+20	-90	-50	-25	-98	-108
MCRO	2000-L5	2000	+13	+20	-90	-50	-25	-93	-103

"L100" SERIES PHASE LOCKED TO A 100 MHz NOMINAL INPUT									
MCRO	0900-L100	900	+13	+20	-90	-50	-25	-105	-115
MCRO	1200-L100	1200	+13	+20	-90	-50	-25	-103	-113
MCRO	2000-L100	2000	+13	+20	-90	-50	-25	-98	-108

Other phase locked oscillators up to 24 GHz are available. Please consult our technical sales staff.

CONTINENTAL

MICROWAVE TECHNOLOGY INC.

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UNITED KINGDOM: TEL: 0582 491149 • FAX: 0582 581873

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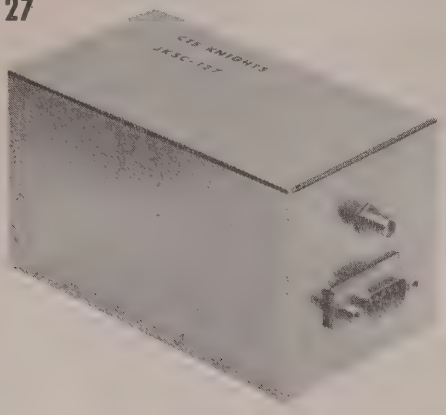
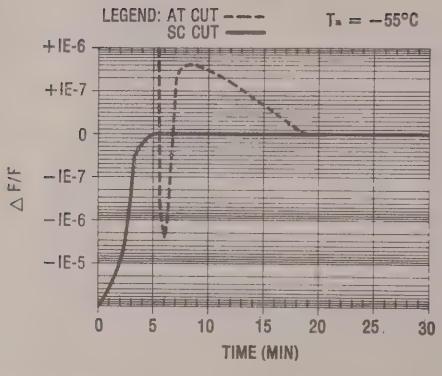
OVENIZED CRYSTAL OSCILLATORS FAST WARM-UP-SC CUT OVENIZED OSCILLATOR

JKSC-127



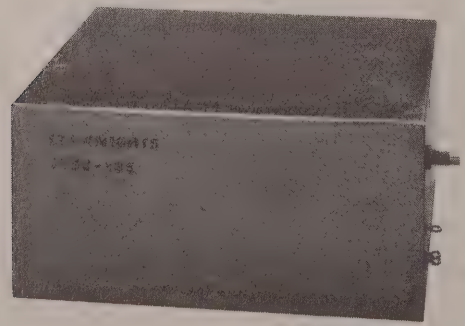


SPECIFICATIONS

FREQUENCY ..... 10.0 MHz or 10.230 MHz
INPUT VOLTAGE ..... +28 VDC ±5% oven
+15 VDC ±5% oscillator
INPUT CURRENT ..... Oven @ turn-on 1.2 amps maximum
@ -25°C 125 mA typical
@ -55°C 240 mA typical
Oscillator 20 mA maximum
FREQUENCY STABILITY:
vs. Temperature ..... ±5 x 10^{-9} from -55°C to +71°C
vs. Time ±5 x 10^{-12} RMS/sec
±5 x 10^{-10}/day at shipment
±3 x 10^{-8}/year
WARM-UP ..... @ -55°C <5 x 10^{-9} in 7 minutes
@ -32°C <5 x 10^{-9} in 5 minutes
@ +25°C <5 x 10^{-9} in 3 minutes
PHASE NOISE (1 HzBW) ..... @ 10 Hz offset - 120 dbc
@ 100 Hz offset - 140 dbc
@ 1 KHz offset -150 dbc
@ 100 KHz offset - 150 dbc
RF OUTPUT ..... +5 db minimum into 50 ohms
FREQUENCY ADJUSTMENT ..... Coarse (mechanical) ±5 x 10^{-7} minimum
Fine (electrical) ±5 x 10^{-8} minimum for ±5 VDC
SIZE ..... 2.5" x 4.5" x 2.5" H. 63.5mm x 114.3mm x 63.5mm
Modifications of the JKSC-127 available.

OVENIZED CRYSTAL OSCILLATORS ULTRA STABLE-SC CUT DOUBLE OVEN OSCILLATOR

JKSC-135



SPECIFICATIONS

FREQUENCY ..... 5.0 MHz
INPUT VOLTAGE ..... +15 VDC
INPUT POWER ..... 7 Watts maximum at turn on
2.5 Watts @ 25°C
FREQUENCY STABILITY:
vs. Temperature ..... <1 x 10^{-9} peak to peak
-25°C to +60°C
vs. Time ..... 8 x 10^{-12} RMS/100 sec.
±5 x 10^{-10}/day
±2 x 10^{-8}/year
OUTPUT ..... Sine, 1V RMS into 50 ohms
SIZE ..... 5.0" X 2.38" X 3.20"H. 127mm x 60.45mm x 81.28mm

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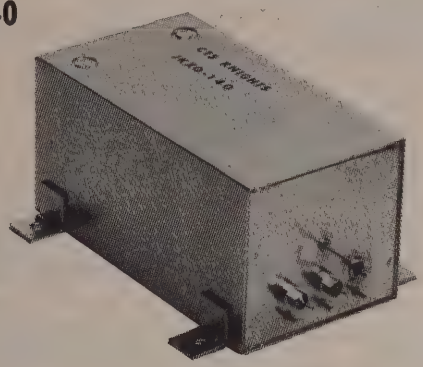
OVENIZED CRYSTAL OSCILLATORS TELECOMMUNICATIONS - OVENIZED OSCILLATOR WITH STANDARD TELECOMMUNICATION FREQUENCIES

JKXO-140



SPECIFICATIONS

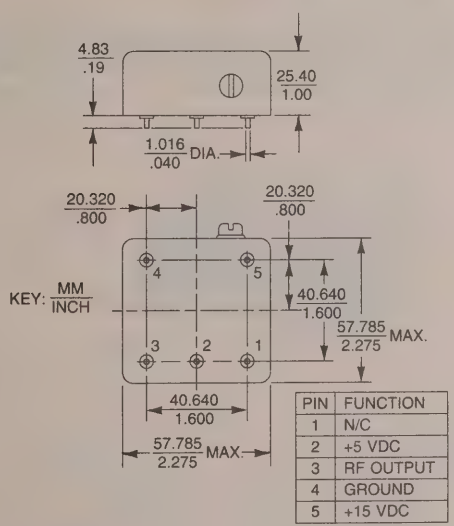
CENTER FREQUENCIES (MHz) 5.0, 5.12, 6.176, 10.0, 10.24, 12.352
INPUT VOLTAGE .....+24 VDC
INPUT POWER.....8 Watts maximum @ turn-on
3.5 Watts stabilized @ +25°C

FREQUENCY STABILITY:
vs. Temperature.....3×10^{-10}/15°C (0°C to +55°C)
vs. Time $\pm 3 \times 10^{-10}$/day after 30 days
$\pm 2 \times 10^{-8}$/year
$\pm 5 \times 10^{-10}$/20 years

OUTPUT.....2 TTL loads
ELECTRICAL ADJUSTMENT.....$\pm 5 \times 10^{-8}$ minimum for ±5 VDC
SIZE.....2.30" x 4.50" x 2.10" H. 58.42 x 114.3 x 53.34

OVENIZED CRYSTAL OSCILLATORS SMALL SIZE- LOW POWER CONSUMPTION OVENIZED OSCILLATOR

JKXO-141



PIN	FUNCTION
1	N/C
2	+5 VDC
3	RF OUTPUT
4	GROUND
5	+15 VDC

FREQUENCY		5.0 MHz*		
OUTPUT LEVEL		TTL with fanout of 10 LSTTL loads		
FREQUENCY ADJUSTMENT		Sufficient for 20 Yrs. aging		
OPERATING TEMPERATURE RANGE		0°C to +60°C		
FREQUENCY STABILITY VS.		JKXO-141-1	JKXO-141-2	JKXO-141-3
TEMPERATURE	(0°C -60°C)	8×10^{-8}	3×10^{-8}	3×10^{-9}
	Any 15°C Change	—	6×10^{-9}	1.4×10^{-9}
AGING	Per Day	1×10^{-8}	3×10^{-9}	5×10^{-10}
	Per Year	1.5×10^{-6}	5×10^{-7}	1.5×10^{-7}
	Per 20 Years	3×10^{-6}	1×10^{-6}	5×10^{-7}
SUPPLY VOLTAGE		5×10^{-9}/%	5×10^{-10}/%	5×10^{-11}/%
WARM UP	20 minutes	1×10^{-7}	1×10^{-7}	1×10^{-7}
	8 Hours	—	—	1×10^{-9}
INPUT POWER		+5Vdc +5%	@ 50ma MAX	
		+15Vdc +5%	@ 500ma MAX (Cold Start)	
			@ 150ma Hot (35°C) Typ.	
SIZE		2.25" X 2.25" X 1" H		
RELIABILITY		Better than 250,000 Hrs MTBF		
VIBRATION/SHOCK		2 G, 10-500 Hz/30 G, 11ms		

*Consult factory for other frequencies and options

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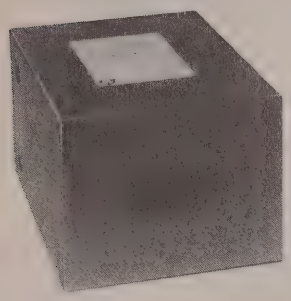
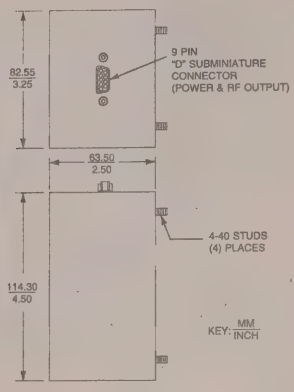
OVENIZED CRYSTAL OSCILLATORS STRATUM II - SC CUT DOUBLE OVEN OSCILLATOR

JKSC-142





SPECIFICATIONS

OUTPUT FREQUENCY: ..... 5.0 MHz*
DC INPUT REQUIREMENTS: ..... +15VDC and +5VDC (±5% regulated to ±1%)
INPUT POWER REQUIREMENTS (TYPICAL):

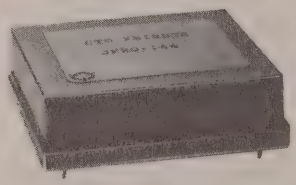
	+15VDC	+5VDC
@ turn-on	9 watts	0.18 watts
@ +35°C	3watts	0.18 watts

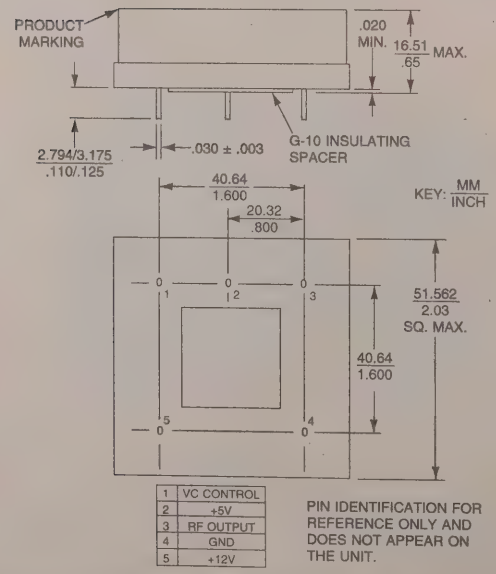
OPERATING TEMPERATURE RANGE: ..... 0°C to +60°C
RF OUTPUT CHARACTERISTICS: ..... Square wave
10 LS TTL Loads
Duty Cycle 45/55 to 55/45
WARM UP (+25°C): ..... Less than $+1 \times 10^{-7}$ in 25 minutes from frequency at one hour on
STABILITY: ..... $\pm 1 \times 10^{-7}$ for 20 years without adjustment
(After stabilization): ..... $\pm 1 \times 10^{-10}$ per day with any 15°C ambient temperature change and a 0.3% input voltage change.
INPUT/OUTPUT CONNECTOR: ..... 9 pin "D" sub-miniature
MTBF: ..... greater than 250,000 hours
SIZE: ..... 4.50" x 3.25" x 2.5" H.

* Consult factory for other frequencies and options

OVENIZED CRYSTAL OSCILLATORS STRATUM III - LOW PROFILE OCVCXO

JKXO-144





1	VC CONTROL
2	+5V
3	RF OUTPUT
4	GND
5	+12V

PIN IDENTIFICATION FOR REFERENCE ONLY AND DOES NOT APPEAR ON THE UNIT.

SPECIFICATIONS

FREQUENCY RANGE ..... 10 to 25 MHz standard*
INPUT VOLTAGE ..... +12.0 VDC ±5% oven
+5.0 VDC ±5% oscillator
INPUT POWER ..... 12V - 5W maximum at turn on
2 W maximum at room temperature
5V - 75 mW maximum

FREQUENCY STABILITY:
vs. Temperature ..... $\pm 1 \times 10^{-7}$ -40°C to +85°C
$\pm 3 \times 10^{-8}$ 0°C to 65°C
vs. Time ..... $\pm 5 \times 10^{-9}$/day at time of shipment
$\pm 1 \times 10^{-6}$/10 years
vs. Supply ..... $\pm 1 \times 10^{-8}$/day for ±5% voltage change, oven or oscillator

OUTPUT ..... HCMOS
DEVIATION ..... ±10 PPM minimum, ±15 PPM maximum
CONTROL VOLTAGE ..... ±3.0 VDC
LINEARITY ..... ≤10% Best straight line
SHOCK ..... 100Gs, 6 ms
VIBRATION ..... 10 Gs, 10-500 Hz

* Other frequencies available upon request

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OVENIZED CRYSTAL OSCILLATORS TRACK AND HOLD OSCILLATOR

JKXO-137

Track Mode: The oscillator output frequency will track an externally supplied reference frequency to within $\pm 1 \times 10^{-8}$ accuracy for 20 years of operation.

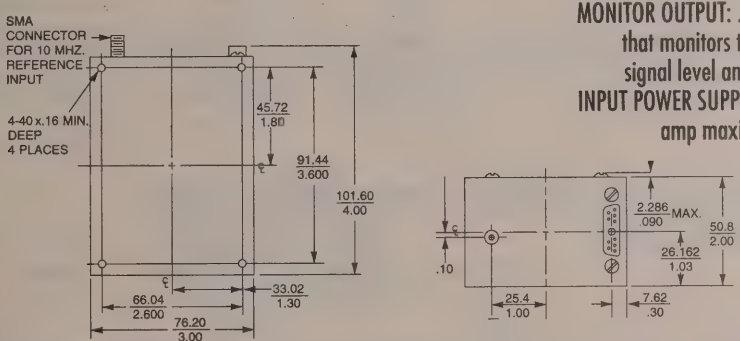
SPECIFICATIONS

OUTPUT FREQUENCY: ..... 10 MHz.
OPERATING TEMPERATURE RANGE: ..... 0°C to 60°C.
RF OUTPUT: ..... Square wave, 0.8 volt maximum "0" level, +3.5 volt minimum "1" level when driving 50 ohms to ground.
SPURIOUS OUTPUTS: ..... -60dbc maximum
OUTPUT SYMMETRY: ..... 40% to 60% duty cycle (50% nominal)
WARM-UP TIME TO ACQUIRE TRACKING: ..... 20 minutes maximum

Hold Mode Operation: The oscillator will hold its frequency setting after switching to hold mode as long as power is not interrupted. The oscillator will remain within the following accuracy for 2 months due to aging, temperature and input voltage variations. (External reference frequency within $\pm 10^{-8}$ of 10 MHz at switch over, and will be removed after switch over.)

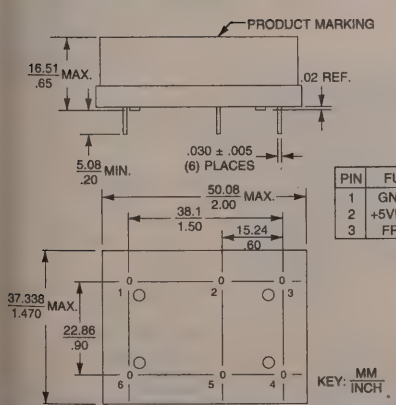
SPECIFICATIONS

STABILITY: ..... $10 \text{ MHz} \pm 10 \times 10^{-8}$/2 months (After 1 hour)
SHORT TERM STABILITY.
ALLEN VARIANCE: ..... 1×10^{-10} RMS maximum for 1 second gate times.
SINGLE SIDEBAND PHASE NOISE (1 HZ BW): ..... -70 dbc at 1 Hz offset;
..... -100 dbc at 100 Hz offset;
..... -130 dbc at 1 KHz offset
MONITOR OUTPUT: ..... The oscillator has a self test circuit that monitors the oven temperature, internal reference voltage, output signal level and phase lock. The output levels are HC logic compatible.
INPUT POWER SUPPLY: ..... + 19VDC to + 30VDC (24 VDC nominal) with 1 amp maximum at turn on and 0.5 amp maximum at steady state.



OVENIZED CRYSTAL OSCILLATORS STRATUM III AND SONET–LOW PROFILE OCVCXO

JKXO-150



PIN	FUNCTION	PIN	FUNCTION
1	GND (OVEN)	4	GND (OSC)
2	+5VDC (OVEN)	5	+5VDC (OVEN)
3	FREQ. OUT	6	VOLT CONTROL

SPECIFICATIONS

FREQUENCY RANGE: ..... 25.0-75.0 Mhz Standard
INPUT VOLTAGE: ..... +5.0 VDC ±5%
INPUT POWER: ..... 3 W Maximum at turn on + 1W typical at room temperature
FREQUENCY STABILITY:
Vs. Temperature ..... ±0.37 PPM 0° C to 70° C
Vs. Time ..... $\pm 5 \times 10^{-9}$ +/ Day After 30
OUTPUT:
Level: ..... 0 dbm to +5 dbm into 50 ohms
Harmonics ..... -30 dbc max
Nonharmonics ..... -60 dbc max
DEVIATION ..... ±10.0 PPM minimum
SLOPE 2PPM/Volt
CONTROL VOLTAGE: ..... 0 to ±10 VDC
LINEARITY: ..... ±5% Monotonic
SHORT TERM STABILITY ..... $<5 \times 10^{-10}$ Allan Variance for 1 sec.
SHOCK ..... 100 Gs. 6 ms.
VIBRATION ..... 10 Gs. 10-500 Hz

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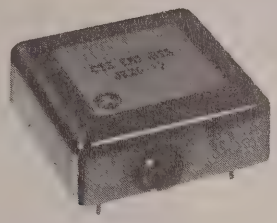
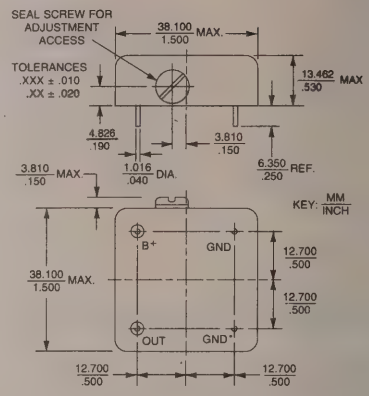
TEMPERATURE COMPENSATED CRYSTAL OSCILLATORS & TCVCXO'S

RUGGED -LOW PROFILE TCXO & TCVCXO

JKXO-12
JKVXO-12



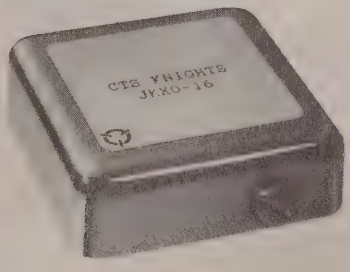


MODEL	FREQUENCY RANGE	SUPPLY VOLTAGE OPTIONS (VDC)	STABILITY WITH TEMPERATURE	VCXO DEVIATION OPTIONS	MAX. AGING 1st YR.	OUTPUT OPTIONS
JKXO-12A	3 to 30 MHz	12-20	±2 ppm, -55 to +85°C	NONE	1 ppm	Sine Wave, TTL, HCMOS, CMOS (Below 10 MHz)
JKXO-12B	3 to 30 MHz	12-20	±1 ppm, -40 to +75°C	NONE	1 ppm	
JKXO-12C	3 to 50 MHz	12-20	±0.5 ppm, 0 to +70°C	NONE	1 ppm	
JKVXO-12A	8 to 30 MHz	9-20	±10 ppm, 0 to +70°C	±100 ppm, ±5V Input	1 ppm	TTL
JKVXO-12B	30 to 50 MHz	12-20	±5ppm,0 to +70°C	±15 ppm, ±3V Input	1 ppm	Sine Wave
JKVXO-12C	8 to 35 MHz	12-20	±2 ppm, 0 to +70°C	±40 ppm, ±3V Input	1 ppm	Sine, TTL

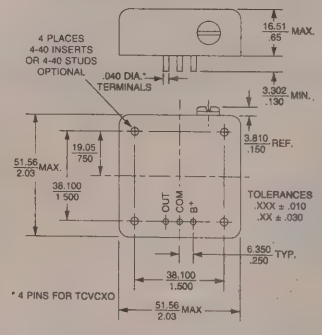
TEMPERATURE COMPENSATED CRYSTAL OSCILLATORS & TCVCXO'S

VERSATILE - WIDE FREQUENCY RANGE TCXO & TCVCXO

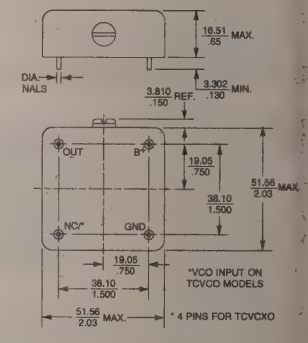
JKXO-16
JKVXO-16



STANDARD PACKAGE



OPTIONAL PACKAGE



MODEL	FREQUENCY RANGE	SUPPLY VOLTAGE OPTIONS (VDC)	STABILITY WITH TEMPERATURE	VCXO DEVIATION OPTIONS	MAX. AGING 1st YR.	OUTPUT OPTIONS
JKXO-16A	1 Hz to 30 MHz	12-28	±1 ppm, -40 to +75°C	NONE	1 ppm	Sine (Above 500 KHz) ECL, TTL, HCMOS CMOS (Below 10 MHz)
JKXO-16B	1 Hz to 30 MHz	12-28	±1 ppm, -55 to +85°C	NONE	1 ppm	
JKXO-16C	1 Hz to 30 MHz	12-28	±2 ppm, -40 to +75°C	NONE	1 ppm	
JKXO-16D	30 to 100 MHz	15-28	±2 ppm, -20 to +70°C	NONE	1 ppm	
JKXO-16E	1 KHz to 30 MHz	5	±2 ppm, -20 to +70°C	NONE	1 ppm	
JKVXO-16A	1 KHz to 30 MHz	5-20	±10 ppm, 0 to +70°C	±40 ppm, 0 to 5 VDC	1 ppm	TTL, ECL, HCMOS CMOS (Below 10 MHz) Sine (Above 500 KHz)
JKVXO-16B	1 KHz to 30 MHz	9-20	±20 ppm, -20 to +70°C	±100 ppm, ±5V Input	1 ppm	
JKVXO-16C	1 MHz to 30 MHz	5	±30 ppm, -55 to +85°C	±100 ppm, 0 to 5V Input	1 ppm	
JKVXO-16D	30 MHz to 150 MHz	12-20	±5 ppm, 0 to +50°C	±15 ppm, ±5V Input	1 ppm	Sine, ECL

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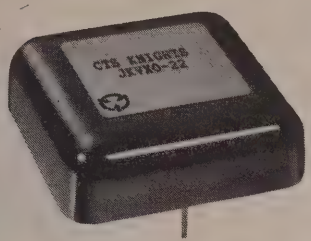
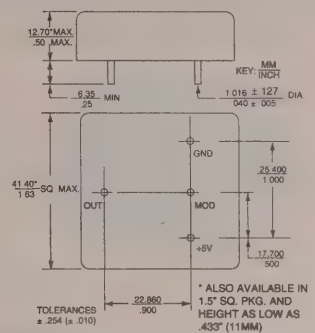
STRATUM IV - LOW PROFILE TCXO & TCVCXO

JKVXO-22



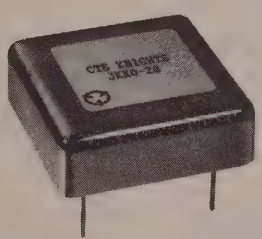


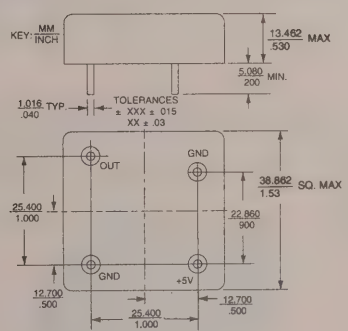
MODEL	*FREQUENCY RANGE	SUPPLY VOLTAGE OPTIONS (VDC)	STABILITY WITH TEMPERATURE	VCXO DEVIATION OPTIONS	MAX. AGING 1st YR.	OUTPUT OPTIONS
JKVXO-22A	1 MHz to 30 MHz	5	±10 ppm, 0 to +50°C	±40 ppm, 0 to +5 VDC	2 ppm	TTL, CMOS
JKVXO-22B	30 MHz to 50 MHz	5	±5 ppm, 0 to +50°C	±12 ppm, 0 to +5 VDC	1 ppm	TTL, HCMOS, ECL
JKVXO-22C	1 MHz to 30 MHz	5	±15 ppm, -20 to +70°C	±100 ppm, 0 to +5 VDC	2 ppm	TTL, ECL, (-5V Supply Req.) HCMOS

TEMPERATURE COMPENSATED CRYSTAL OSCILLATORS & TCVCXO'S

ECONOMICAL - LONG TERM STABILITY TCXO

JKXO-28 (TCXO)





MODEL	FREQUENCY RANGE	SUPPLY VOLTAGE OPTIONS (VDC)	STABILITY WITH TEMPERATURE	VCXO DEVIATION OPTIONS	MAX. AGING 1st YR.	OUTPUT OPTIONS
JKXO-28	8 MHz to 20 MHz	5	±1 ppm, 0 to +70°C	NONE	.75 ppm	TTL or HCMOS

TEMPERATURE COMPENSATED CRYSTAL OSCILLATORS & TCVCXO'S

STRATUM IV - GENERAL PURPOSE PLL VCXO

JKVXO-100

SPECIFICATIONS

FREQUENCY RANGE.....10 to 35 MHz
Custom frequencies to 65.536 MHz
CENTER FREQUENCY AT ROOM TEMPERATURE.....±10 ppm at time of shipment
PULLABILITY.....±200 ppm minimum
TEMP. STABILITY.....0°C to +60°C ±40 ppm
OSCILLATOR INPUT.....+12 VDC ±10% @ 10 mA max.
+5 VDC ±10% @ 25 mA max.
OUTPUT.....TTL (5 loads)

Size: 21.844" max x 17.878" max x 8.89" max (H)

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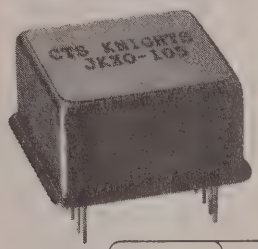
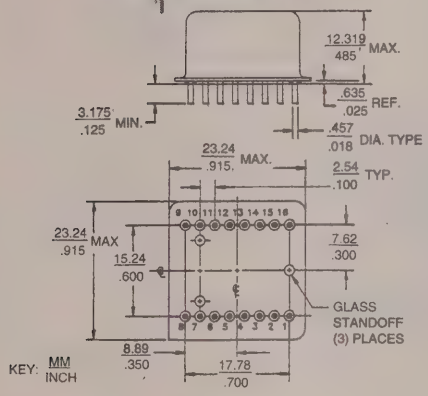
TEMPERATURE COMPENSATED CRYSTAL OSCILLATORS & TCVCXO'S

STRATUM III - SUBMINIATURE TCVCXO

JKXO-105





SPECIFICATIONS

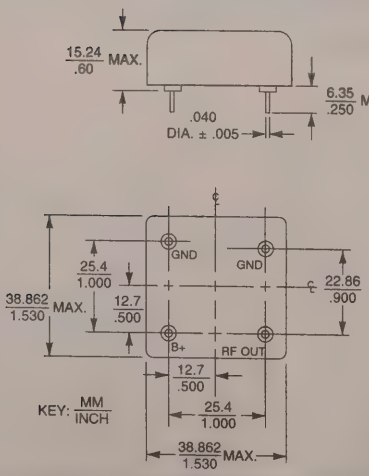
FREQUENCY RANGE	12.0-25.0 MHz
FREQUENCY STABILITY	±0.3 x 10^{-6} (0°C to +60°C)
AGING	±1.0 x 10^{-6} /1st yr. maximum
	±2.0 x 10^{-6}/10 yrs. maximum
PHASE NOISE	10 Hz -75 dBc/Hz Typical
	100 Hz -104 dBc/Hz Typical
	1 KHz -132 dBc/Hz Typical
	100 KHz -152 dBc/Hz Typical
OPERATING TEMPERATURE	0°C to +60°C (Standard)
NON-OPERATING	-40°C to +85°C
INPUT VOLTAGE	+5.0 VDC ±5.0%
WAVEFORM	TTL compatible
LOAD	2 TTL standard
SYMMETRY	40/60%
LOGIC 1	+2.4 V minimum
LOGIC 0	+0.4 V maximum
Tr & Tf	10nSEC maximum (0.4 to 2.4V)
CURRENT	20 mA maximum
FREQUENCY ADJUSTMENT	Electrical
PACKAGE	0.915" Sq. x 0.485" max.

Please contact factory for other Frequency, Stability, Temperature Range, or other performance requirements.
Data herein subject to change without prior notice.

TEMPERATURE COMPENSATED CRYSTAL OSCILLATORS & TCVCXO'S

LOW AGING TCXO - ±1.0 PPM, ALL CONDITIONS FOR 10 YEARS

JKXO-110



SPECIFICATIONS

FREQUENCY RANGE	2.5-20 MHz
STANDARD FREQUENCIES	10.0 MHz
	15.0 MHz
	20.0 MHz
FREQUENCY STABILITY	±0.3 ppm
AGING	±0.7 ppm/10 years
ABSOLUTE ACCURACY	±1.0 ppm/10 years
PHASE NOISE	10 Hz -105 dBc/Hz Typical
	100 Hz -138 dBc/Hz Typical
	1 KHz -155 dBc/Hz Typical
	100 KHz -159 dBc/Hz Typical
OPERATING TEMPERATURE	0°C to +50°C (Standard)
NON-OPERATING	-40°C to +85°C
INPUT VOLTAGE	+12.0 VDC ±5.0%
	or +15.0 VDC ±5.0%
WAVEFORM	HCMOS
LOAD	50pF maximum
SYMMETRY	50/50 ±5%
LOGIC 1	+4.0 V minimum
LOGIC 0	+0.1 V maximum
Tr & Tf	<10ns at 50pF load
	<4ns at 10pF load
CURRENT	25 mA maximum
FREQUENCY ADJUSTMENT	None required
PACKAGE	1.53" x 1.53" x .6" max.

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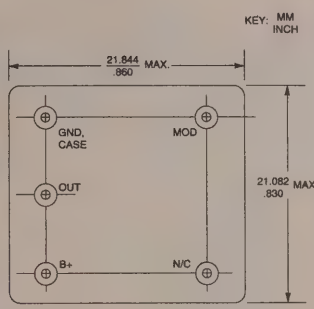
TEMPERATURE COMPENSATED CRYSTAL OSCILLATORS & TCVCXO'S
STRATUM IV - SUBMINIATURE .25 CU. IN. VCXO

JKVXO-112



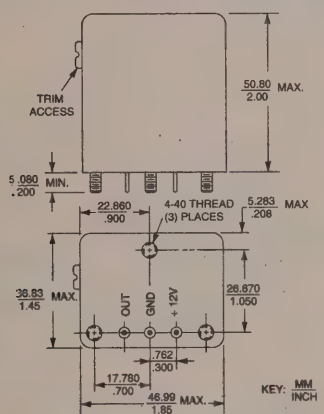
SPECIFICATIONS

FREQUENCY RANGE.....2-35 MHz
FREQUENCY DEVIATION.....±40 to ±90 ppm
FREQUENCY VS. TEMPERATURE.....±15 ppm, 0°C to +70°C
OUTPUT.....TTL or HCMOS
INPUT.....5 VDC ±5%
MODULATION INPUT VOLTAGE OPTIONS.....-1) 0 VDC to +10 VDC, centered at 5 VDC
-2) 0 VDC to +5 VDC, centered at 2 VDC

Size: 21.844" max x 17.878" max x 8.89" max (H)

TEMPERATURE COMPENSATED CRYSTAL OSCILLATORS & TCVCXO'S
HIGH RELIABILITY- HIGH STABILITY - WIDE TEMPERATURE RANGE TCXO

JKXO-200

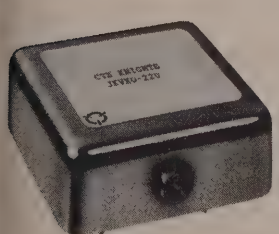


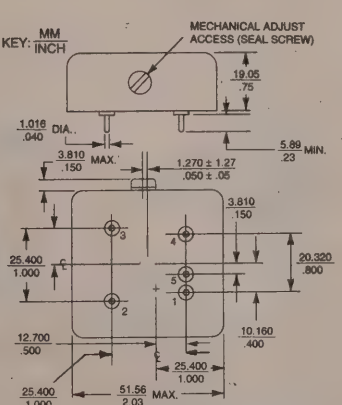
SPECIFICATIONS

FREQUENCY VS. TEMP. -55°C TO +85°C INCLUDING HYSTERESIS.....$\pm 5 \times 10^{-7}$
1°C/MIN TEMP. SLEW -55°C TO +85°C INCLUDING TRIM ADJUST EFFECT..$\pm 7 \times 10^{-7}$
STABILITY VS. TIME.....$\pm 3 \times 10^{-7}$ 1st yr.
$\pm 8 \times 10^{-7}$/5 yrs.
STABILITY VS. VOLTAGE (12V ±1V).....$\pm 5 \times 10^{-9}$
OUTPUT LEVEL: 50Ω LOAD.....50 mV RMS
1000ΩLOAD.....150 mV RMS
WARM UP TO WITHIN $\pm 5 \times 10^{-8}$.....10 seconds max.
INPUT POWER AT +12V.....50 mW max.

TEMPERATURE COMPENSATED CRYSTAL OSCILLATORS & TCVCXO'S
STRATUM III - HIGH STABILITY TCVCXO

JKVXO-220





TOLERANCE	
.XX	.XXX
± 76 MM	±.381 MM
±.03	± 0.15

PIN	FUNCTION
1	OUT
2	Vcc
3	⌀ VOLTS, CASE
4	VCXO INPUT
5	RF RETURN, CASE

SPECIFICATIONS

FREQUENCY RANGE:.....1 MHz to 25 MHz
EXCELLENT LONG TERM AGING:.....<4 ppm in 20 years
OPERATING RANGE:.....0 to +50°C or 0 to 70°C
$\pm 3 \times 10^{-7}$ ΔF VS. TEMP. AT ANY DEVIATION VOLTAGE SETTING.
DEVIATION:.....±10 to ±15 ppm for 0 to +10V input, centered at +5 VDC.
TTL OR HCMOS OUTPUT
AVAILABLE WITH OR WITHOUT TRIM ACCESS PORT.
+12V SUPPLY (OTHER VOLTAGES AVAILABLE).

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CRYSTAL OSCILLATORS VCXO 14 PIN DIP TTL VCXO - CUSTOM FREQUENCIES TO 90 MHZ

VX0-55 SERIES

ELECTRICAL SPECIFICATIONS

SPECIFICATIONS	MODEL	FREQUENCY RANGE	SYMBOL	MINIMUM	TYPICAL	MAXIMUM	UNITS
Operating Voltage	A, B	1 MHz to 25 MHz	Vcc	4.50	5.00	5.50	V
Maximum Supply Voltage			Vcc Max.			7.00	
Supply Current	A	12.25 MHz to 25 MHz	Icc		18	25	mA
	B	3.0625 MHz to <12.25 MHz			30	60	
		1 MHz to <3.0625 MHz			45	75	
Output Voltage-HI	A, B	1 MHz to 25 MHz	Voh	2.40	3.60		V
Output Voltage-LO			Vol		0.25	0.40	
Rise & Fall Time	A, B	3.0625 MHz to 25 MHz	Ir, If		3	5	nS
(measured between 0.5V to 2.4V)		1 MHz to <3.0625 MHz			8	18	
Duty Cycle	A, B	12.25 MHz to 25 MHz		40	50	60	%
(measured @ 1.5V)		1 MHz to <12.25 MHz		45	50	55	
Control Voltage	A, B	1 MHz to 25 MHz	Vc	0.0	2.5	5.0	V
Start-up Time	A, B	1 MHz to 25 MHz	Is		5	15	mS
Control Voltage Input Impedance	A, B	1 MHz to 25 MHz		100K			Ω
Fanout	A, B	1 MHz to 25 MHz	Fo	1		10	TTL loads
Linearity	A, B	1 MHz to 25 MHz		-25	±10	+25	%

Consult factory for other deviations

PIN CONNECTIONS
Pin 1: Frequency control voltage
Pin 7: Ground/case
Pin 8: Output
Pin 14: +5 VDC

Package height may vary
Consult factory for HCMOS models
See Figure B for standard package
See Figure A for Surface mount Package

ORDERING INFORMATION

OUTPUT FREQUENCY

VXO-55 ☐ ☐ ☐ ☐ ☐ • ☐

☐ S = Surface mount gullwing, Fig. A
Blank - thru-hole

Frequency and Model	Code
12.25 to 25.0 MHz Basic oscillator	GA
1 MHz to <12.25 MHz Basic oscillator with dividers	GB

Frequency Deviation*	Code
±120 ppm min.	I

* Positive Slope

Frequency Tolerance Vc = 2.50V	Code
±01% (100 ppm)	.2
±005% (50 ppm)	3

Operating Temperature Range	Code
0°C to 70°C	C
-40°C to 85°C	I

CRYSTAL OSCILLATORS

ECL ECLIPS/100E - CUSTOM FREQUENCIES FROM 250.1 TO 750 MHZ, 14 PIN PACKAGE SEE FIGURE C

EXO 75 SERIES

Complimentary output standard
Temperature stability: +/-200 ppm
Operating temperature: 0 to 70°C

PARAMETER	UNITS	SYMBOL	MINIMUM	TYP	MAXIMUM	CONDITION #
Operating Voltage	V	Vcc				
Max. Oper. Voltage	V	Vcc max.	4.75	5.0	5.25	
Supply Current	nA	Icc		90	130	Full Load
Start-Up Time	nSec	Ts		4	10	Full Load
Output Voltage, HI	V	Voh	3.98		4.26	Full Load
Output Voltage, LO	V	Vol	3.05		3.40	Full Load
Rise and Fall Time	nS	Tr & Tf		0.5	1.0	20-80%
Symmetry	%	Sys	40	50	60	@ 50% level
Load	Ohms	Ω			50	TO Vcc-2V

Note: Stability includes 25°C accuracy, temperature stability, frequency vs. supply voltage, load and environmental changes and 1st year aging.

PIN CONNECTIONS

Pins	Function
Pin 1	Vcc (+5V)
Pin 2, 6, 9, 13	Case/Ckt Gnd)
Pin 7, 8	Output
Pin 14	N/C (*)

No External Connection Allowed.

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CRYSTAL OSCILLATORS ECL100K-CUSTOM FREQUENCIES FROM 25 TO 250 MHZ, 14 PIN PACKAGE SEE FIGURE D

EXO 65G SERIES

ELECTRICAL CHARACTERISTICS (INTO 50Ω TO -2.0 VDC LOAD)

SPECIFICATIONS	UNITS	SYMBOL	MINIMUM	TYPICAL	MAXIMUM	TEST CONDITIONS
Operating Voltage	V	Vee	-5.7	-4.5	-4.2	
Min. Oper. Voltage	V	Vee min.	-7.0			
Supply Current	mA	Iee			100	
Start-up Time	mS	Ts			10	
Output Voltage-HI	V	Voh	-1.02		-.87	0 to 70°C
			-1.08		-.87	-40 to 85°C
Output Voltage-LO	V	Vol	-1.83		-1.62	0 to 70°C
			-1.83		-1.56	-40 to 85°C
Duty Cycle (up time)	%	Sym	40		60	Measured at 50% of waveform
Rise and Fall Time	nS	Rs, Fl		1.5	2.5	Measure from 20% to 80% of waveform
Output Load						50 Ohms to -2.0V

Positive supply voltage available
Complimentary designs available

PIN CONNECTIONS

PIN	EXO65GO	EXO65G1	EXO65G7	EXO65G14	EXO65G0C	EXO65G7C	EXO65G14C
1	N/C	Case	N/C	N/C	Output	Output	Output
7	-Vee	-Vee	Gnd/Case	-Vee	-Vee	Gnd/Case	-Vee
8	Output	Output	Output	Output	Output	Output	Output
14	Gnd	Gnd	-Vee	Gnd/Case	Gnd	-Vee	Gnd/Case

Consult factory for availability.

ORDERING INFORMATION

EXO-65G [ ] [ ] [ ] [ ] • [ ] OUTPUT FREQUENCY

S= Surface Mount, Figure E
Blank = Thru-hole

Case Ground	Code
Isolated Case	0
Pin 1 Case	I
Pin 7 Case	7
Pin 14 Case	14

Frequency Tol (note 2)	Code
±.01% (100 ppm)	2
±.005% (50 ppm)	3

Operating Temperature Range	Code
0°C to +85°C	C
-40°C to +85°C 25 to 130 MHz only	I

CRYSTAL OSCILLATORS ECL10KH - FREQUENCIES FROM 25 TO 250 MHZ, 14 PIN PACKAGE SEE FIGURE D

EXO 55G SERIES

ELECTRICAL CHARACTERISTICS (INTO 50Ω TO -2.0 VDC LOAD)

SPECIFICATIONS	UNITS	SYMBOL	MINIMUM	TYPICAL	MAXIMUM	TEST CONDITIONS
Operating Voltage	V	Vee	-5.46	-5.20	-4.94	
Min. Oper. Voltage	V	Vee min.	-7.0			
Supply Current	mA	Iee			100	
Start-up Time	mS	Ts			10	
Output Voltage-HI	V	Voh	-1.02		-.74	0 to 70°C
			-1.06		-.65	-40 to 85°C
Output Voltage-LO	V	Vol	-1.95		-1.60	0 to 70°C
			-1.95		-1.57	-40 to 85°C
Duty Cycle (up time)	%	Sym	40		60	Measured at 50% of waveform
Rise and Fall Time	nS	Rs, Fl		1.5	2.5	Measure from 20% to 80% of waveform
Output Load						50 Ohms to -2.0V

Positive supply voltage available
Complimentary designs available

PIN CONNECTIONS

PIN	EXO55GO	EXO65G1	EXO65G7	EXO65G14	EXO650C	EXO65G7C	EXO65G14C
1	*N/C	Case	*N/C	*N/C	Output	Output	Output
7	-Vee	-Vee	Bnd/Case	-Vee	-Vee	Gnd/Case	-Vee
8	Output	Output	Output	Output	Output	Output	Output
14	Gnd	Gnd	-Vee	Gnd/Case	Gnd	-Vee	Gnd/Case

* No Internal Connection

ORDERING INFORMATION

EXO-55G [ ] [ ] [ ] [ ] • [ ] OUTPUT FREQUENCY

S= Surface Mount, Figure E
Blank = Thru-hole

Case Ground	Code
Isolated Case	0
Pin 1 Case	I
Pin 7 Case	7
Pin 14 Case	14

Frequency Tol (note 2)	Code
±.01% (100 ppm)	2
±.005% (50 ppm)	3

Operating Temperature Range	Code
0°C to +85°C	C
-40°C to +85°C	I

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CRYSTAL OSCILLATORS
ACMOS/TTL COMPATIBLE - DRIVES 50Ω TRANSMISSION LINE, 80 MHz TO 135 MHz, 14 PIN PACKAGE

CXO GTS SERIES

Consult factory for frequencies above 135 MHz

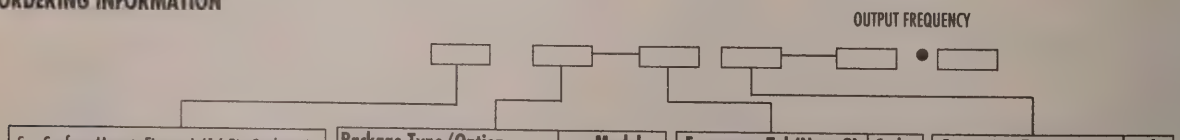
PARAMETER	UNITS	SYMBOL	FREQUENCY RANGE	TEMP. RANGE	MINIMUM	TYPICAL	MAXIMUM	CONDITION
Operating Voltage Max. Oper. Voltage	V	Vcc Vcc max.	80.0 MHz to 135.0 MHz	0 to 85°C	4.5	5	5.5 7	50 ohm transmission line
Supply Current	mA	Icc	80.0 MHz to 135.0 MHz	0 to 85°C		75	100	50 ohm transmission line
Start-Up Time	mS	Ts	80.0 MHz to 135.0 MHz	0 to 85°C		5	10	50 ohm transmission line
Output Voltage - HI	V	Voh	80.0 MHz to 135.0 MHz	0 to 85°C	4.6 2.4			VDD=5V, Ioh=-50,µA VDD=5V, Ioh=-16mA
Output Voltage - LO	V	Vol	80.0 MHz to 135.0 MHz	0 to 85°C			0.4 0.4	VDD=5V, Ioh=-50,µA VDD=5V, Ioh=-16mA
Rise and Fall Time	nS	Tr & Tf	80.0 MHz to 135.0 MHz	0 to 85°C		.8	1.5	50 ohm transmission line
Duty Cycle (up time)	%	Sym	80.0 MHz to 135.0 MHz	0 to 85°C	40	50	60	50% Vcc
			80.0 MHz to 135.0 MHz	0 to 85°C	45	50	55	1.4V
Fanout Output Load		Fo	80.0 MHz to 135.0 MHz	0 to 85°C				50 ohm transmission line
Enable Voltage - HI Enable Voltage - LO	V V	Vih Vil	80.0 MHz to 135.0 MHz	0 to 85°C		2.0	Vcc + .5V 0.8	
High Z Current	mA	Iz	80.0 MHz to 135.0 MHz	0 to 85°C			0.05	TRI-STATED

PIN CONNECTIONS

PINS	Function
14 Pin	
Pin 1	Enable
Pin 7	Case/CKT GND
Pin 8	Output
Pin 14	Vcc (+5V)

Enable Truth Table		Osc. Output
Pin 1	Low	High Impedance
Pin 1	High	Functioning
Pin 1	Floating	Functioning

ORDERING INFORMATION



S = Surface Mount, Figure A (14 Pin Package)
Blank = Thru-hole, Figure B (14 Pin Package)

Package Type/Option	Model
14 Pin DIP/STD Output	CXO-65GTS
14 Pin DIP/Tristate Output	CXO-63GTS

Frequency Tol (Note 2)	Code
±01% (100 ppm)	2
±005% (50 ppm)	3

Operating Temp. Range	Code
0°C to +70°C	C
0°C to +85°C	I

Consult Factory for Availability of 8 PIN Package.

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CRYSTAL OSCILLATORS STRATUM IV - TELECOMMUNICATIONS FREQUENCIES 16.384 MHZ, 44.736 MHZ, 49.408 MHZ, 51.84 MHZ, 89.472 MHZ, 14 PIN DIP PACKAGE SEE FIGURE B

CX063HT SERIES

Consult factory for custom frequencies. HCMOS/TTL compatible, stability =/- 32ppm for 20 years. Temperature range; -40° to 85°C.

CXO HG-SERIES SPECIFICATION SUMMARY

PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNITS
Supply Voltage	Vcc	Operating	4.5	5.0	5.5	V
		Absolute Maximum			7.0	
Supply Current	Icc	16.0 -> 25 MHz		15	25	
		> 25 -> 50 MHz		30	40	mA
		>50 -> 70 MHz		40	60	
		>70 -> 89.472		45	85	
Output Load		16.0 -> 50 MHz			50	pF
		> 50 -> 70 MHz			30	
		> 70 -> 89.472			15	
		6.0 -> 89.472 MHz**			10	TTL
Output Voltage	Voh	CMOS Load	Vcc -.4			V
		TTL Load **	Vcc -.6			
	Vol				0.4	
Output Current	Ioh	Voh = 3.9V			-16	mA
	Iol	Vol = 0.4V			16	
Symmetry		16.0 - 89.472 MHz	40		60	%
Rise & Fall Time	Tr/Tf	16.0 -> 25 MHz		5	8	nS
		> 25 - 70 MHz		3	5	
		> 70 -> 89.472 MHz		2	3	
Output Short-Circuit Current	Ios	1 min maximum duration			50	mA
Enable Input V	Vih		2.0			V
	Vil				0.8	
Enable Input Load	Cin				10	pF
Tristate Leakage	Iz	Vil = 0.8V			0.05	mA

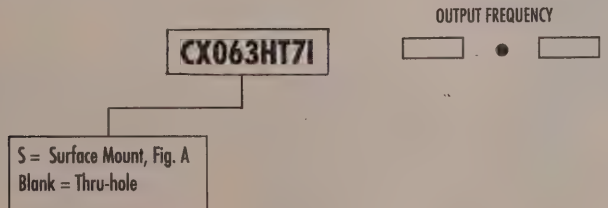
Unless otherwise specified all test conditions are under max rated TTL and/or CMOS load
** For TTL application above 25 MHz add "s" suffix to model designation

TEST CONDITIONS

SEE FANOUT FOR	CMOS	OR	TTL
Symmetry	50% of waveform		1.5V Level
Load	50 pF (unless noted)		10 TTL loads
Rise & Fall Time	10 to 90% of waveform		.5V to 2.4V

All parameters are met with MAXIMUM FANOUT LOAD UNLESS NOTED

ORDERING INFORMATION



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CRYSTAL OSCILLATORS
3.3 VOLT INPUT - CMOS OUTPUT, LOW POWER CONSUMPTION, 8 TO 50 MHZ, 8 PIN DIP PACKAGE

CXO 23/25 LV SERIES
3.3/5V SWITCHABLE 30.1 TO 50 MHZ

SPECIFICATION	UNITS	SYMBOL	FREQUENCY RANGE	TEMP. RANGE	MINIMUM	TYPICAL	MAXIMUM
Operating Voltage	V	Vcc	8.0 MHz to 30.0 MHz	0 to 70°C	2.7	3.3	3.6
			30.1 MHz to 50.0 MHz (1)		3.0	3.3	3.6
Max. Oper. Voltage	V	Vcc max.	8.0 MHz to 50.0 MHz				7
Supply Current	mA	Icc	8.0 MHz to 30.0 MHz			10	13
(OSC Enabled)			30.1 MHz to 50.0 MHz			15	20
Supply Current	mA	Icc	8.0 MHz to 30.0 MHz (2)			0.5	1
(OSC Disabled)			30.1 MHz to 50.0 MHz			3.0	5
Start-Up Time	mS	Ts	8.0 MHz to 30.0 MHz			3	5
			30.1 MHz to 50.0 MHz			6	10
Output Voltage - HI	V	Voh	8.0 MHz to 50.0 MHz		Vcc-.4V		
Output Voltage - LO	V	Vol	8.0 MHz to 50.0 MHz				0.4
Duty Cycle (up time)	%	Sym	8.0 MHz to 50.0 MHz		40	50	60
Rise & Fall Time	nS	Tr/Tf	8.0 MHz to 30.0 MHz			8	12
			30.1 MHz to 50.0 MHz			5	8
Fanout Output Load	pF	Fo	8.0 MHz to 50.0 MHz				15 pF
Enable Input Load	pF	Fi					15 pF
Enable Voltage - HI	V	Vih	8.0 MHz to 50.0 MHz (2)		.7 Vcc		
Enable Voltage - LO	V	Vil					.2 Vcc

TRISTATE/ENABLE TRUTH TABLE

CONTROL INPUT	OUTPUT
OPEN or HIGH	OSC. OUTPUT
LOW	HIGH Z or LOGIC 1 (2)

TEST CONDITIONS

	CMOS (15 pF)
Symmetry	50% of Vcc
Load	15 pF
Rise & Fall Time	20% to 80% of Vcc

(1) 3.3/5.0 V Switchable
(2) 8.0-30.0 MHz: Output latched to logic 1 when disabled
30.1-50 MHz: Output is high impedance when disabled
All parameters are met with MAXIMUM FANOUT LOAD unless noted

ORDERING INFORMATION

OUTPUT FREQUENCY

S= Surface Mount, Figure G
Blank = Thru-hole, Figure F

Package Type/Option	Model
8 to 30 MHz	
8 Pin DIP/STD Output	CXO-25LV
8 Pin DIP/STD Output w/Enable	CXO-25LVE
30.1 to 50 MHz	
8 Pin DIP/Tristate Output	CXO-23LV

Frequency Tol (Note 2)	Code
+/- .01% (100 ppm)	2

Operating Temp. Range	Code
0°C to +70°C	C

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400 Reimann Ave., Sandwich, IL 60548 815-786-8411 FAX: 815-786-3600

CRYSTAL OSCILLATORS HCMOS - DRIVE 95Ω TRANSMISSION LINE, 1 MHZ TO 105.561 MHZ

CXO HG SERIES - HCMOS/TTL COMPATIBLE, CONSULT FACTORY FOR HIGHER FREQUENCIES

CXO HG-SERIES SPECIFICATION SUMMARY

PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNITS
Supply Voltage	Vcc	Operating	4.5	5.0	5.5	V
		Absolute Maximum			7.0	
Supply Current	Icc	1.0 -> 7.0 MHz		5	12	
		>7.0 -> 25 MHz		15	25	
		>25 -> 50 MHz		30	40	mA
		>50 -> 70 MHz		40	60	
		> 70 -> 105.561 MHz		45	85	
Output Load		1.0 -> 50 MHz			50	pF
		> 50 -> 70 MHz			30	
		> 70 -> 105.561 MHz**			15	
		1.0 -> 105.561 MHz**			10	TTL
Output Voltage	Voh	CMOS Load	Vcc -.4			
		TTL Load **	Vcc -.6			V
	Vol				0.4	
Output Current	Ioh	Voh = 3.9V			-16	mA
	Iol	Vol = 0.4V			16	
Symmetry		1.0 ->50 MHz**	45		55	%
		> 50 -> 70 MHz**	40		60	
		> 70 -> 105.561 MHz	45		55	
Rise & Fall Time	Tr/Tf	1.0 -> 25 MHz		5	8	nS
		> 25 - 70 MHz		3	5	
		> 70 -> 105.561 MHz		2	3	
Output Short-Circuit Current	Ios	1 min maximum duration			50	mA
Enable Input V	Vih		2.0			V
	Vil				0.8	
Enable Input Load	Cin				10	pF
Tristate Leakage	Iz	Vil = 0.8V			0.05	mA

Unless otherwise specified all test conditions are under max rated TTL and/or CMOS load
** For TTL application above 25 MHz add "s" suffix to model designation

TRISTATE/ENABLE TRUTH TABLE

CONTROL INPUT	OUTPUT
OPEN or HIGH	OSC. OUTPUT
LOW	HIGH Z or LOGIC 1

TEST CONDITIONS

SEE FANOUT PG 3 FOR	CMOS	OR	TTL
Symmetry	50% of waveform		1.5V Level
Load	50 pF (unless noted)		10 TTL loads
Rise & Fall Time	10 to 90% of waveform		.5V to 2.4V

All parameters are met with MAXIMUM FANOUT LOAD UNLESS NOTED

ORDERING INFORMATION

OUTPUT FREQUENCY

S = Surface Mount, Figure E or G
Blank = Thru-hole, Figure D or F

Package Type/Option	Model
14 Pin DIP/STD Output	CXO-65HG
14 Pin DIP/STD Output w/Enable	CXO-65HGE
14 Pin DIP/Tristate Output	CXO-63HG
8 Pin DIP/STD Output	CXO-25HG
8 Pin DIP/STD Output w/Enable	CXO-25HGE
8 Pin DIP/Tristate Output	CXO-23HG

Frequency Tol	Code
+/- .01% (100 ppm)	2
+/- .005% (50 ppm)	3
+/- .0025% (25 ppm) (0°C to 70°C only)	5

Operating Temp. Range	Code
0°C to +70°C	C
-40°C to +85°C*	I

* -20 to 85C≥70 MHz

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CRYSTAL OSCILLATORS ECONOMICAL - CMOS/10TTL COMPATIBLE, 1 TO 80 MHZ

MXO 45 SERIES

Operating temperature: 0 to 70 °C
Drives 50 pF load

ORDERING INFORMATION

Package Type/Option	Model	
14 Pin/DIP/STD Output	MXO-45	Figure D
14 Pin/DIP/TRISTATE Output	MXO-45T	Figure D
8 Pin DIP/STD Output	MXO-45HS	Figure F
8 Pin DIP/TRISTATE Output	MXO-45HST	Figure F

ELECTRICAL CHARACTERISTICS (OVER 0° TO 70°C TEMPERATURE RANGE)

FREQUENCY RANGE.....1.000 MHz to 80.000 MHz
FREQUENCY STABILITY.....±01% (100 ppm)
OPERATING TEMPERATURE.....0° to 70°C
STORAGE TEMPERATURE.....-55° to +125°C
SUPPLY VOLTAGE.....5.0 Volts (DC) ±10 %
SUPPLY CURRENT.....30 mA Max (1-30 MHz), 50 mA Max (30.1-80 MHz)
DUTY CYCLE (SYMMETRY).....40%/60%
RISE & FALL TIME.....5nS max 1-80 MHz (TTL)
10nS max 1-30 MHz (CMOS)
5nS max 30.1-80 MHz (CMOS)
OUTPUT LEVEL.....TTL: VOL = +.4V max, VOH = +2.4 min
CMOS: VOL = +.5V max, VOH = Vdd-.5V min
OUTPUT LOAD.....1 to 10 TTL Gate: 50 pF max (CMOS) 1-50 MHz
30 pF max (CMOS) 30.1-80 MHz
START UP TIME.....15 Msec.
Inclusive of 25°C tolerance, operating temperature range, input voltage change, load change, first year of aging, shock, and vibration

CRYSTAL OSCILLATORS TRUE TTL 14 PIN DIP SEE FIGURE D

MXO 53/55L SERIES

Frequency range: MXO 55L 2.4576 to 70 MHz
Frequency range: MXO 53L 15 to 50 MHz

ELECTRICAL CHARACTERISTICS

SPECIFICATIONS	MODEL	FREQUENCY RANGE	SYMBOL	MINIMUM	TYPICAL	MAXIMUM	UNITS
Operating Voltage		2.4576 to 70 MHz	V_{CC}	4.50	5.00	5.50	V
Maximum Supply Voltage	A, B		V_{CC} Max.			7.00	
Supply Current	A	4.9152 to 25 MHz	I_{CC}		20	35	mA
		>25 to 70 MHz			33	65	
	B	2.4576 to <4.9152 MHz			30	50	
Output Voltage-HI	A, B	2.4576 to 70 MHz	V_{OH}	2.40	3.60		V
Output Voltage-LO			V_{OL}		0.30	0.40	
Rise & Fall Time (measured between 0.5V & 2.4V)	A	4.9152 to 25 MHz	t_R & t_F		3	5	nS
		>25 to 70 MHz			2	4	
	B	2.4576 to <4.9152 MHz			3	5	
Start-up Time	A, B	2.4576 to 11 MHz	t_S		8	15	mS
	A	>11 to 25 MHz			2	5	
	A	>25 to 70 MHz			8	15	
Duty Cycle (Uptime) (measured @ 1.5V)	A	4.9152 to 70 MHz		40	50	60	
	B	2.4576 to <4.9152 MHz		45	50	55	
Enable Input Load Factor	AE	4.9152 to 70 MHz	FI			2	TTL Loads
Fanout (per output)	A, B	2.4576 to 25.0 MHz	F_O			10	TTL
		>25.0 MHz				5	Gates

ORDERING INFORMATION

Package Type/Option	Model
14 Pin DIP/STD Output	MXO-55L
14 Pin DIP/TRISTATE Output	MXO-53L

Frequency Range	Code
4.9152 MHz to 70 MHz Basic Oscillator (No enable)	GA
4.9152 MHz to 32 MHz Basic Osc. with enable (Note)	GAE
2.4576 MHz to >4.9152 MHz Basic Osc. with Dividers	GB

Frequency Tol	Code
± .01% (100 ppm)	2
± .005% (50 ppm)	3
± .05% (500 ppm)	4

Operating Temp. Range	Code
0°C to +70°C	C

Note: PIN 1 must not be left floating.

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ENGINEERING DATA MECHANICAL/ENVIRONMENTAL CAPABILITIES

Mechanical Enclosures - CTS Frequency Controls uses flux-free sealing techniques (resistance weld and cold weld) for improved cleanliness, superior hermeticity, and long term reliability. CTS manufactures crystals in 21 standard packages. One half-inch hold-down wire (for mechanical support and/or grounding case are available on the oval packages.

ENCLOSURE vs FREQUENCY (MHz)

ENCLOSURE	FUNDAMENTAL FREQ.	3RD O.T.	5TH O.T.	7TH O.T.	9TH O.T.	
	1.0 1.8 2.4 6.0 10.0 20.0 30.0	10.0 18.0 30.0 60.0 75.0	50 80 130	75 100 150 180	150 175 200 225	600 MHZ
HC-48, 51, 36, 47						
HC-40						
HC-49, 50, 42, 43 R3W-SM,DIP, DIP-SM						
HC-37						
HC-46, R5W						
HC-35, HC-45 (SIM) R2W-SM						
ATS, ATS-SM						
3X8MM TUBULAR						
ATP-SM						
INVERTED MESA R2W, HC-35/U			Fundamental	3rd O.T.		

HOLDER STYLE (SEE OUTLINE DRAWINGS)

Sealing Method	Mode	25°C Calibration	Stability Over Temp.	Temperature Range	Load
R = Resistance weld K = Cold weld	1 = Fundamental 3 = 3rd O.T. 5 = 5th O.T. 7 = 7th O.T. 9 = 9th O.T.	0 = +/-5 ppm 1 = +/-10 ppm 2 = +/-20 ppm 3 = +/-30 ppm 4 = +/-40 ppm 5 = +/-50 ppm 6 = +/-100 ppm	0 = +/-5 ppm 1 = +/-10 ppm 2 = +/-20 ppm 3 = +/-30 ppm 4 = +/-40 ppm 5 = +/-50 ppm 6 = +/-100 ppm	A = 0 to 70°C B = -40 to 85°C C = -55 to 105°C D = special*	00 = Series 10 thru 99 for load

A = R3/K3	F = R3W-SM	M = HC-40/U	V = ATS
B = R3W/K3W	G = R2W-SM	S = R5W	W = ATS-SM
C = R17/K17	H =1/2 X 1/2 DIP	T = RTO-5/KTO-5	Z = 3MM X 8MM
D = R17W/K17W	J = 1/2 X 1/2 SMX	Y = R3W (.450" HIGH)	
E = R2W	L = TO-8	X = R3W (.380" HIGH)	

***SPECIAL** – TO BE SPECIFIED ON P.O.

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PRECISION QUARTZ CRYSTAL RESONATORS

Description: CTS High Stability Precision Resonators are used where specific tight parameter control is required. These crystals are used in communication, instrumentation, and military applications where specialized performance, documentation, or testing demands extra attention. These crystals are either calibrated at room temperature, or at elevated temperature for ovenized oscillator applications.

ELECTRICAL PERFORMANCE

A. Q-VALUE $\left(\frac{1}{2\pi C_1 F_s R_s}\right)$	Normal	Custom Designs	Optimum Designs
Fund. 1-50 MHz	75K	200K	750K
3rd O.T. 5-30	100K	200K	750K
3rd 30-85	60K	100K	125K
5th, 7th, 9th 50-200	40K	75K	100K

B. FREQUENCY TOLERANCE			
Calibration Tolerance	±15 ppm	±5 ppm	±3 ppm @ T.P.
Temperature Tolerance (Freq. Dev. from 25°C reading)			
0 + 50°C	±6 ppm	±3 ppm	±2 ppm
-40°C +85°C	±20 ppm	±15 ppm	±11 ppm
-55° +105°C	±30 ppm	±24 ppm	±20 ppm
T.P. @ 85°C (Ovenized Application)	±5°C	±3°C	±2°C

C. AGING			
@ Room Temp.	≤1 ppm/yr	≤1/2 ppm/yr	—
@ Turning Point (Ovenized Application)	≤1 ppm/yr	≤1/2 ppm/yr	≤2 x 10^{-7} /yr ≤1 x 10^{-9} /day

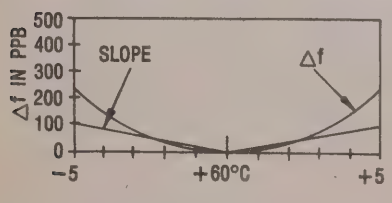
D. INHARMONIC MODES (SPURS)			
	6 db (min) (2:1 R ratio)	15 db (min)	30 db (min) (Funds)

Note: Multiple Parameters may conflict

ENVIRONMENTAL PERFORMANCE (MIL-STD 202F)

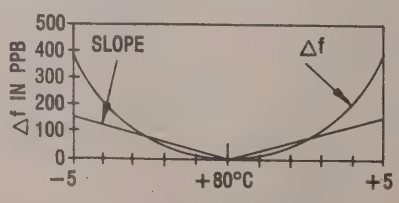
	Typical	Custom Designs	Optimum Designs
Mech. Shock 213B	100g/6 msec	1000g/1 msec	10,000g/5 msec
Vibration 204D	10g; 10-500 Hz	20g; 20-2000 Hz	50g; 20-5000 Hz
Hermeticity (≤1 x 10^{-8} cc/sec/atm)	All Designs	All Designs	All Designs

CRYSTAL FREQUENCY STABILITY NEAR TURNING POINT- OVENIZED APPLICATIONS



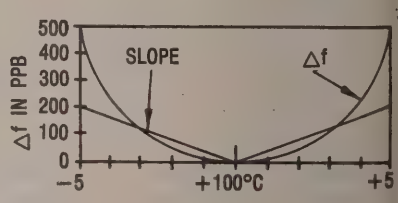
$\frac{\Delta f}{f} = (9.6\ PPB/°C^2) \times \Delta T^2$

SLOPE = (19 PPB/°C) x ΔT



$\frac{\Delta f}{f} = (15.6\ PPB/°C^2) \times \Delta T^2$

SLOPE = (31 PPB/°C) x ΔT



$\frac{\Delta f}{f} = (21.6\ PPB/°C^2) \times \Delta T^2$

SLOPE = (43 PPB/°C) x ΔT

Military Crystals

CTS Frequency Controls test lab is government approved for qualification testing to military specification MIL-C-3098G, and includes equipment for environmental testing such as humidity, shock, vibration and aging.

Production test equipment conforms to maintenance and periodic re-calibration required by U.S. Government calibration system requirements in MIL-C-45662A.

CTS Frequency Controls is QPL Approved on a variety of part numbers, phone factory for details.

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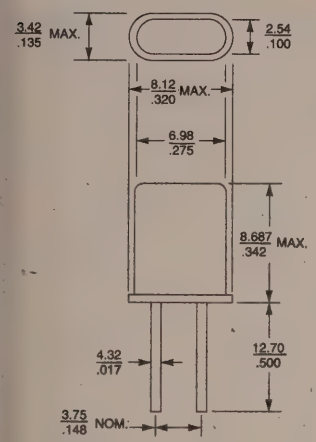
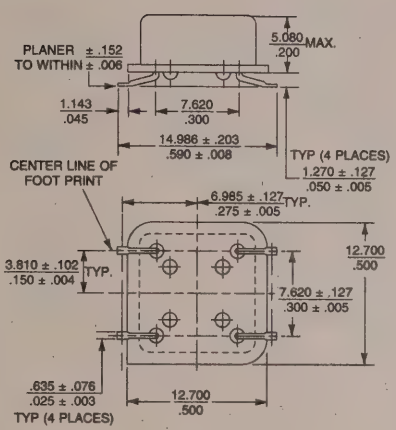
KNIGHTS CRYSTALS AND OSCILLATORS
400 Reimann Ave., Sandwich, IL 60548 815-786-8411 FAX: 815-786-3600

CRYSTAL ENCLOSURES

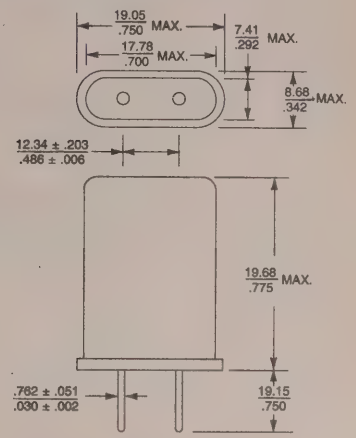
R-2W



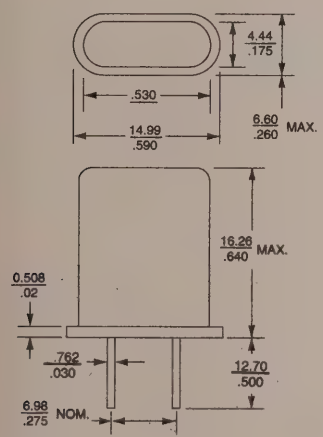
DIP-SM



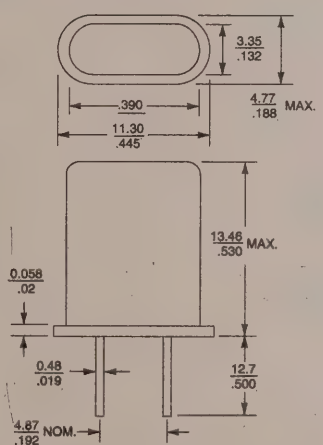
RESISTANCE WELD R17W (HC-51/U)



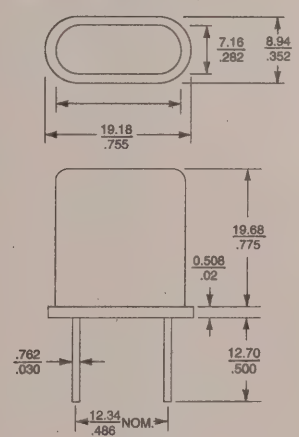
R5W



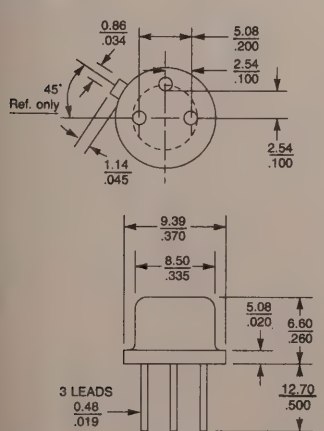
COLDWELD K3W (HC-43/U)



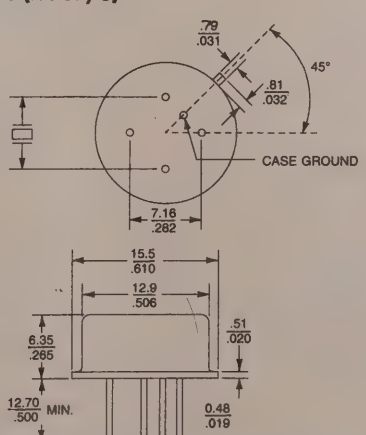
COLDWELD K17W (HC-47/U)



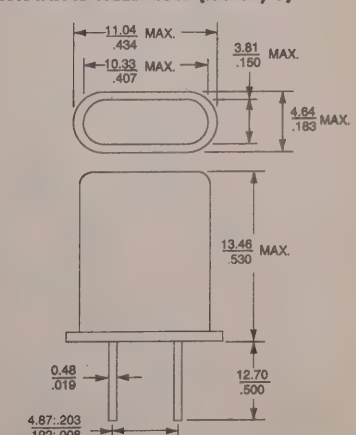
RESISTANCE WELD TO5 (HC-35/U)



TO-8 (HC-37/U)



RESISTANCE WELD R3W (HC-49/U)



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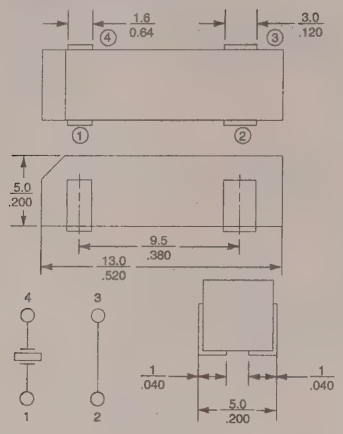
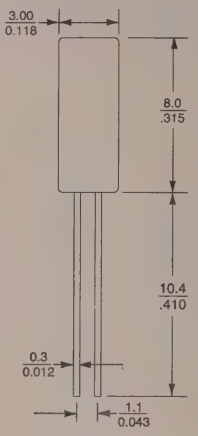
CRYSTAL ENCLOSURES

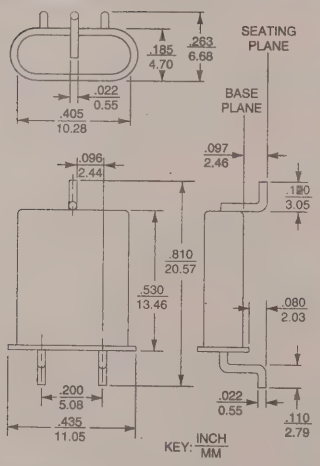
ATP-SM



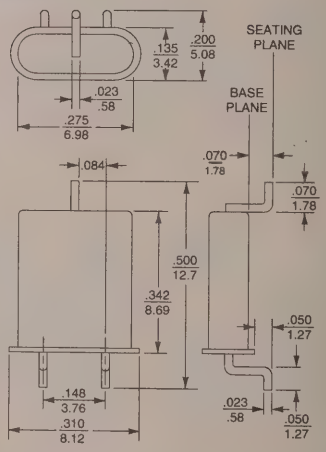
"ATP STRIP" CRYSTAL RESONATORS



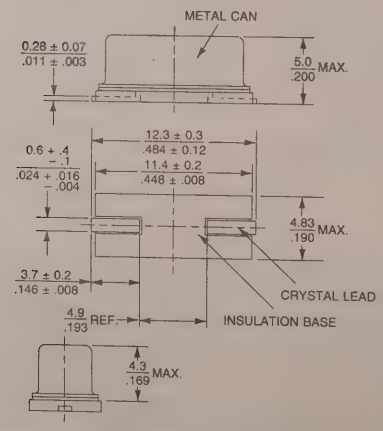
R3WSM



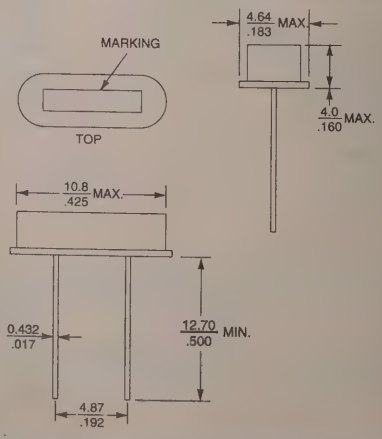
R2WSM



ATS-SM



ATS



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CLOCKS

FIGURE A

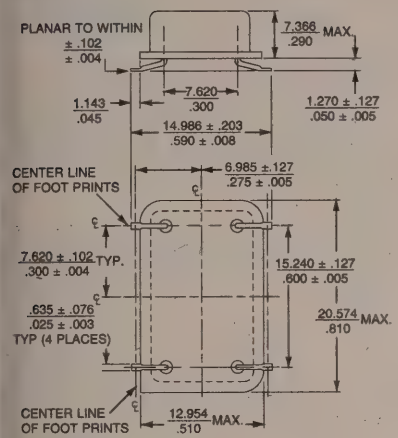


FIGURE E

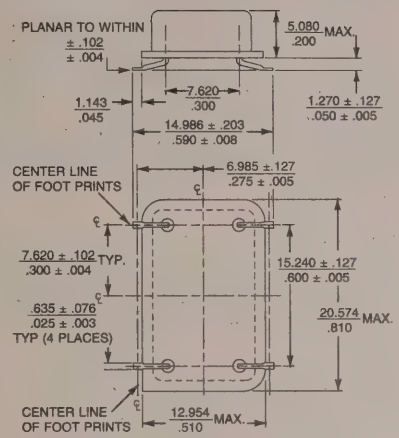


FIGURE C

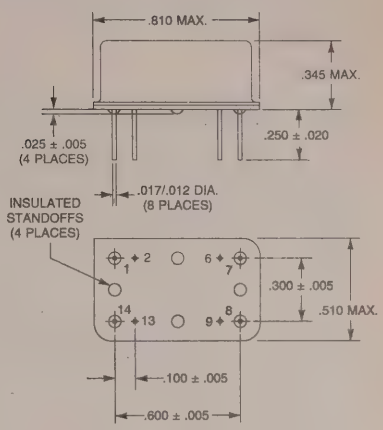


FIGURE D

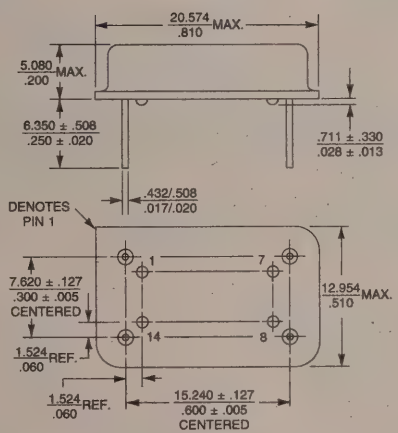


FIGURE B

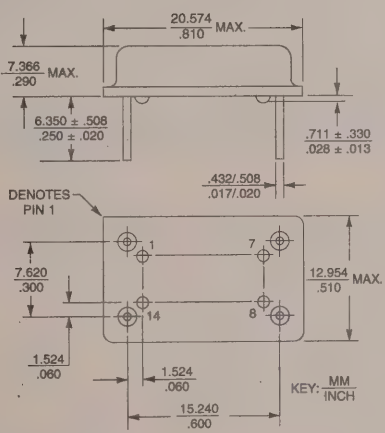


FIGURE G

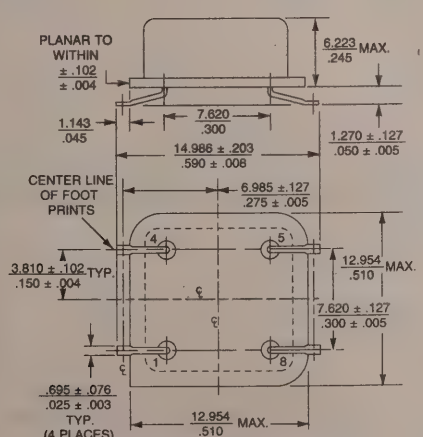
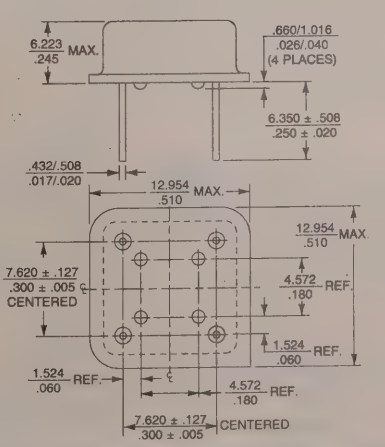


FIGURE F



MINIGLOSSARY CAPACITORS

Anode: One of two plates or conductors. In polarized capacitors, the anode should be connected to the positive conductor in the circuit.

Capacitive Reactance: The opposition (in ohms) of capacitance to the flow of alternating current, equal to the reciprocal of the product of the angular frequency (2π times frequency in Hertz) of the current times the capacitance in farads.

Cathode: One of two plates or conductors. In electrostatic capacitors the cathode is metallic. In electrolytic capacitors the cathode is a liquid, gel or other conductive material which is in intimate contact with a metallic cathodic connection.

Dielectric Constant: The ratio of the capacitance of a capacitor with some material other than air between the capacitor plates to the capacitance of the same capacitor with air between the plates. For example, the dielectric constants of air, Teflon®, polystyrene and ruby mica are 1, 2.1, 2.6 and 5.4, respectively.

Electrolytic: A capacitor with one metallic conductor (generally the anode) and with a liquid or semiconductor cathode. Nonpolarized electrolytic capacitors generally have two equal anodes as well as the liquid cathode. These anodes operate alternately as anode and cathodic connection as alternating current is applied.

Electrostatic: One of two general classes of capacitors in which two or more discrete metallic conductors are present and separated by an insulating dielectric material. Examples include: mica, ceramic, film, and paper types.

Farad: The basic unit of measure in capacitors. A capacitor charged to one volt with a charge of one coulomb (one ampere flowing for one second) has a capacitance of one farad. Capacitors are generally rated at portions of a farad (microfarads or picofarads).

1 farad (F) = 1,000,000 microfarads (μF) 1 microfarad (μF) = 1,000,000 picofarads (pF)

Impedance: All capacitors exhibit impedance. It is a function of capacitor type and internal construction. This can be particularly important in certain applications such as filters for switching power supplies. Capacitors used in these applications often have special multiple tab construction to shorten current paths and to reduce internal resistance.

Leakage Current: Expressed as dcl for electrolytic capacitors, a measure of the intrinsic losses in a charged capacitor. Generally speaking, the lower the dcl, the higher quality the capacitor.

Power Factor: A measure of the overall efficiency of a capacitor. Power factor ratings take all internal losses into consideration in a complex formula. This parameter of certain capacitors is often very important in AC applications such as motor-start and/or motor-run capacitors

Rated Voltage: The rated working voltage of a capacitor. Generally expressed in DC Volts (Vdcw). This is the voltage at which a capacitor may be safely operated at 25°C continuously within its overall parameters.

Ripple Current: The total amount of alternating and direct current that may be applied to an electrolytic capacitor under stated conditions. In general, the higher the ripple current applied, the shorter the operating life of the capacitor will be. Application of significantly higher than rated ripple currents can shorten the capacitor life dramatically and may even cause catastrophic failure (explosion).

Surge Voltage: The momentary surge voltage which may be applied for a stated length of time without doing permanent damage to the unit.

Temperature: Capacitors are generally rated at 25°C at sea level under specific humidity conditions. Operating temperature ranges are also given, along with derating (reliability) curves for operation at temperatures other than 25°C.

Temperature Coefficient: Expressed as TC in ppm (parts per million) or in percent (%) from the norm of 25°C. This is seldom a straight line and may vary widely for certain types. Most capacitors have positive TC in that the capacitance increases as temperature increases. Some types, however, have negative TC in that the capacitance decreases as temperature increases.

Ceramic Capacitor Codes
(Capacitance Given In pF)

Color	Digit	Multiplier	Tolerance			Temperature Coefficient ppm°C	Significant Figure	Multiplier
			Class 1					
			10pF or less	Over 10pF	Class 2			
Black	0	1	±2.0pF	±20%	±20%	0	0.0	–1
Brown	1	10	±0.1pF	±1%		–33		–10
Red	2	100		±2%		–75	1.0	–100
Orange	3	1000		±3%		–150	1.5	–1000
Yellow	4	10000			+100% –0%	–220	2.0	–10000
Green	5		±0.5pF	±5%	±5%	–330	3.3	+1
Blue	6					–470	4.7	+10
Violet	7					–750	7.5	+100
Gray	8	0.01	±0.25pF		+80% –20%	+150 to –1500		+1000
White	9	0.1	±1.0pF	±10%	±10%	+100 to –750		+10000
Silver								
Gold								

MODELS XOSM-52B and XOSM-52BE Clock Oscillators

Hybrid Crystal, Surface Mount

240 Hz to 72 MHz (-52B), 500 KHz to 40 MHz (-52BE)

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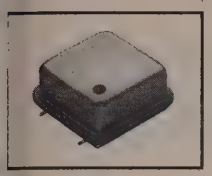


FEATURES

- HCMOS, CMOS, NMOS, TTL, LS-TTL, S-TTL compatible
- Enabled tri-state output optional
- Hermetically sealed package

ELECTRICAL SPECIFICATIONS

Operating Temperature Range: 0°C to + 70°C.

Frequency Stability: (Inclusive of calibration tolerance at 25°C temperature change, input voltage change, load change, aging, shock and vibration): ± .01% (± 100PPM).

Input Voltage (Vdd): + 5.0 ± 0.5 VDC.

Input Current: 5 to 50 mA typical (see table).

Rise Time: 4nS typical (CMOS levels), 2nS typical (TTL levels).

Fall Time: 4nS typical (CMOS levels), 2nS typical (TTL levels).

Logic '0' Level: 0.1 Vdd maximum CMOS, 0.4 V maximum TTL.

Logic '1' Level: 0.9 Vdd minimum CMOS, 2.4 V minimum TTL.

Logic '0' Sink Current: 16 mA minimum.

Logic '1' Source Current: 0.4 mA minimum.

Output Waveform: Squarewave, HCMOS, CMOS, NMOS, TTL, LS-TTL, S-TTL compatible, waveform symmetry. (0.5 Vdd CMOS or 1.4 V TTL levels): 50 ± 10%.

Output Load: 50 pF HCMOS or 1-10 TTL loads.

Enable Input Voltage: 3.5 V minimum.

Disable Input Voltage: 0.8 V maximum.

Enable Input Current: 10 µA maximum.

Disable Input Current: 300 µA maximum.

MECHANICAL SPECIFICATIONS

Hermetically Sealed Package: Leak rate less than 2 x 10^{-8} atmosphere cc/sec. of helium.

Marking Ink: Epoxy, solvent resistant.

Solvent Resistance: Isopropyl alcohol, trichloroethane, Freon TMC.

Terminal Solderability: Per MIL-STD-202, Method 208C.

ENVIRONMENTAL SPECIFICATIONS

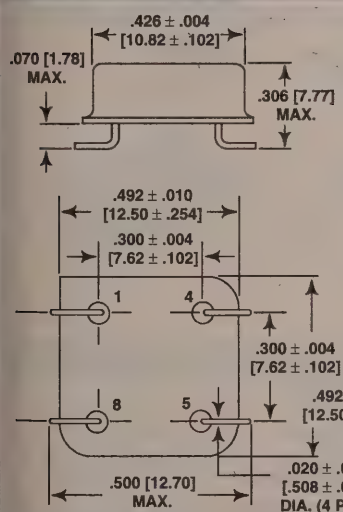
Temperature Cycle: - 55°C to + 85°C, 3 cycles.

Shock: 1000 G's 0.35 millisecond, 1/2 sine wave, 3 shocks each plane.

Vibration: .06 D.A., 10-55 Hz, 35 G, 55-2000 Hz.

Humidity: 85% relative humidity at 85°C, 240 hours.

DIMENSIONAL CONFIGURATIONS [Numbers in brackets indicate millimeters]

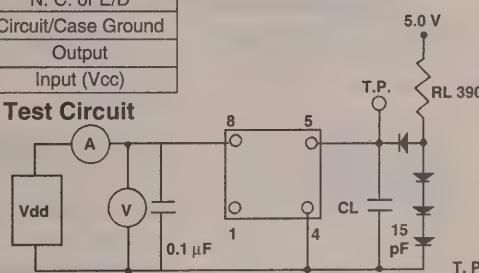


IDD CHARACTERISTICS @ 5 VDC		
IDD (TYP.) IN mA, 15 pf, LOAD		
FREQ. MHz	XOSM-52B	XOSM-52BE
1	10	10
4	6	10
16	13	14
40	23	20
60	40	—

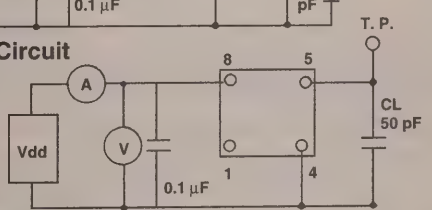
PIN	CONNECTION
1	N. C. or E/D
4	Circuit/Case Ground
5	Output
8	Input (Vcc)

Pin 1 identified by square corner/dot.
CAUTION: Unit can be damaged if plugged in backwards.

TTL Test Circuit



CMOS Test Circuit



CL - To include probe and fixture capacitance.

PART MARKING

— Model
— Frequency
— Pin identifier
— Dale

HOW TO ORDER

XOSM-52	B	E	10
MODEL	FREQ. ACCURACY	ENABLE/DISABLE	FREQ./MHz
	A = ± .005% B = (± .01% Std. tol.)	E = With function BLANK = #1 Pin open	

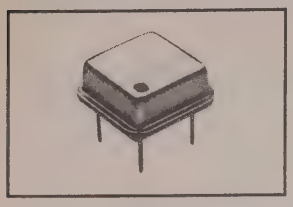
Contact factory for other models, logic families, stabilities and temperature ranges.

DALE ELECTRONICS, INC., 1155 W. 23rd Street, Tempe, AZ 85282-1883 • Phone (602) 967-7874 • Fax 602-829-9314

MODELS XO-52B, XO-52BD, XO-52BE Clock Oscillators

Hybrid Crystal, 240 Hz to 110 MHz (-52B)
1.0 MHz to 70 MHz (-52BD), 1.0 MHz to 110 MHz (-52BE)

A COMPANY OF VISHAY DALE®



FEATURES

- HCMOS, CMOS, NMOS, TTL, LS-TTL, S-TTL compatible
- Enabled output optional
- Hermetically sealed package

ELECTRICAL SPECIFICATIONS

Operating Temperature Range: 0°C to + 70°C.

Frequency Stability: (Inclusive of calibration tolerance at + 25°C temperature change, input voltage change, load change, aging, shock and vibration): ± .01% (± 100PPM).

Input Voltage (Vdd): + 5.0 ± 0.5 VDC.

Input Current: 5 to 50 mA typical.

Rise Time: 4nS typical (CMOS levels), 2nS typical (TTL levels).

Fall Time: 4nS typical (CMOS levels), 2nS typical (TTL levels).

Logic '0' Level: 0.5 V maximum CMOS, 0.4 V maximum TTL (Vdd = 5 V).

Logic '1' Level: 4.5 V minimum CMOS, 2.4 V minimum TTL (Vdd = 5 V).

Logic '0' Sink Current: 16 mA minimum.

Logic '1' Source Current: 0.4 mA minimum.

Output Waveform Symmetry: 60/40 standard. 55/45 available.

Output Load: 50 pF HCMOS or 1-10 TTL loads.

Enable Input Voltage: 3.5 V minimum.

Disable Input Voltage: 0.5 V maximum.

Enable Input Current: 10 µA maximum.

Disable Input Current: 300 µA maximum.

MODELS XO-54B, XO-54BD, XO-54BE Clock Oscillators

Hybrid Crystal, 240 Hz to 110 MHz (-54B)
1.0 MHz to 70 MHz (-54BD), 1.0 MHz to 110 MHz (-54BE)

A COMPANY OF VISHAY DALE®

FEATURES

- HCMOS, CMOS, NMOS, TTL, LS-TTL, S-TTL compatible
- Enabled output optional
- Hermetically sealed package

ELECTRICAL SPECIFICATIONS

Operating Temperature Range: 0°C to + 70°C.

Frequency Stability: (Inclusive of calibration tolerance at + 25°C temperature change, input voltage change, load change, aging, shock and vibration): ± .01% (± 100PPM).

Input Voltage (Vdd): + 5.0 ± 0.5 VDC.

Input Current: 5 to 50 mA typical.

Rise Time: 4nS typical (CMOS levels), 2nS typical (TTL levels).

Fall Time: 4nS typical (CMOS levels), 2nS typical (TTL levels).

Logic '0' Level: 0.5 V maximum CMOS, 0.4 V maximum TTL (Vdd = 5 V).

Logic '1' Level: 4.5 V minimum CMOS, 2.4 V minimum TTL (Vdd = 5 V).

Logic '0' Sink Current: 16 mA minimum.

Logic '1' Source Current: 0.4 mA minimum.

Output Waveform Symmetry: 60/40 standard. 55/45 available.

Output Load: 50 pF HCMOS or 1-10 TTL loads.

Enable Input Voltage: 3.5 V minimum.

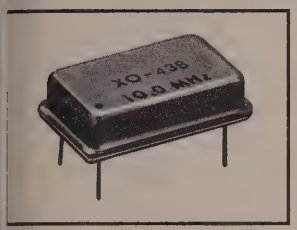
Disable Input Voltage: 0.5 V maximum.

Enable Input Current: 10 µA maximum.

Disable Input Current: 300 µA maximum.

MODEL XO-43B
Clock Oscillators
Hybrid Crystal, Resistance Welded Metal Package
Low Profile, 250 KHz to 60 MHz

A COMPANY OF VISHAY DALE®



FEATURES
- Able to withstand flow soldering
- Wide range of standard frequencies available from stock
- Hermetically sealed package
- Low profile .225" [5.72] maximum seating height
- Metal Case - corrosion resistant and grounded for EMI shielding
- Glass standoffs for spacing from mounting surface

STANDARD ELECTRICAL SPECIFICATIONS

FREQUENCY RANGE	INPUT CURRENT (mA)	WAVEFORM SYMMETRY AT 1.4 VDC	TTL OUTPUT RISE & FALL TIME (From Zero to One Level)	"ZERO" LEVEL SINKING 16 mA	"ONE" LEVEL SOURCING 0.4 mA
250 KHz to 3.999 MHz	65 max.	55/45	15 nS max.	0.4 volts max.	2.4 volts min.
4.0 MHz to 24.999 MHz	40 max.	60/40*	10 nS max.	0.4 volts max.	2.4 volts min.
25.0 MHz to 60.0 MHz	50 max.	60/40*	6 nS max.	0.4 volts max.	2.4 volts min.

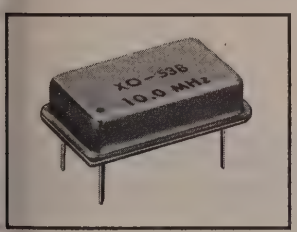
* 55/45 Available

ELECTRICAL SPECIFICATIONS
Input Voltage: + 5 VDC ± 0.5 V.
Frequency Range: 250 KHz to 60 MHz.
Operating Temperature Range: 0°C to + 70°C.
TTL Compatible: Will drive 1-10 TTL Gates.

ENVIRONMENTAL SPECIFICATIONS
Temperature Cycle: - 55°C to + 85°C, 3 cycles.
Shock: 1000 G's 0.35 millisecond, 1/2 sine wave, 3 shocks each plane.
Vibration: .06 D.A., 10-55 Hz, 35 G, 55-2000 Hz.
Humidity: 85% relative humidity at + 85°C, 240 hours.

MODEL XO-53B
Clock Oscillators
Hybrid Crystal, Resistance Welded Metal Package
Low Profile, 250 KHz to 60 MHz

A COMPANY OF VISHAY DALE®



FEATURES
- Able to withstand flow soldering
- Wide range of standard frequencies available from stock
- Hermetically sealed package
- Low profile .225" [5.72] maximum seating height
- Metal Case - corrosion resistant and grounded for EMI shielding
- Glass standoffs for spacing from mounting surface

STANDARD ELECTRICAL SPECIFICATIONS

FREQUENCY RANGE	INPUT CURRENT (mA)	WAVEFORM SYMMETRY AT 1.4 VDC	TTL OUTPUT RISE & FALL TIME (From Zero to One Level)	"ZERO" LEVEL SINKING 16 mA	"ONE" LEVEL SOURCING 0.4 mA
250 KHz to 3.999 MHz	90 max.	60/40	15 nS max.	0.4 volts max.	2.4 volts min.
4.0 MHz to 8.999 MHz	40 max.	60/40	15 nS max.	0.4 volts max.	2.4 volts min.
9.0 MHz to 24.999 MHz	40 max.	60/40	10 nS max.	0.4 volts max.	2.4 volts min.
25.0 MHz to 31.999 MHz	70 max.	60/40	10 nS max.	0.5 volts max.	2.4 volts min.
32.0 MHz to 60.0 MHz	70 max.	60/40	6 nS max.	0.5 volts max.	2.4 volts min.

ELECTRICAL SPECIFICATIONS
Input Voltage: + 5 VDC ± 0.5 V.
Frequency Range: 250 KHz to 60 MHz.
Frequency Stability: ± .01% (± 100PPM).
Operating Temperature Range: 0°C to + 70°C.
TTL Compatible: Will drive 1-10 TTL Gates.

ENVIRONMENTAL SPECIFICATIONS
Temperature Cycle: - 55°C to + 85°C, 3 cycles.
Shock: 1000 G's 0.35 millisecond, 1/2 sine wave, 3 shocks each plane.
Vibration: .06 D.A., 10-55 Hz, 35 G, 55-2000 Hz.
Humidity: 85% relative humidity at + 85°C, 240 hours.

DALE ELECTRONICS, INC., 1155 W. 23rd Street, Tempe, AZ 85282-1883 • Phone (602) 967-7874 • Fax 602-829-9314

MINIGLOSSARY
BASIC CAPACITOR FORMULAS

I. Capacitance (farads)

English: $C = \frac{.224\,K\,A}{t_D}$

Metric: $C = \frac{.0884\,K\,A}{t_D}$

II. Energy stored in capacitors (Joules, watt-sec)

$E = \frac{1}{2}\,CV^2$

III. Linear charge of a capacitor (Amperes)

$I = C\frac{dV}{dt}$

IV. Total Impedance of a capacitor (ohms)

$Z = \sqrt{R_s^2 + (X_C - X_L)^2}$

Where Rs = ESR

V. Capacitive Reactance (ohms)

$X_C = \frac{1}{2\pi fC}$

VI. Inductive Reactance (ohms)

$X_L = 2\pi fL$

VII. Phase Angles:

Ideal Capacitors: Current leads voltage 90°
Ideal Inductors: Current lags voltage 90°
Ideal Resistors: Current in phase with voltage

VIII. Dissipation Factor

$DF = \tan\delta \text{ (loss angle)} = \frac{ESR}{X_c} = (2\pi fC)\,(ESR)$

IX. Power Factor

PF = Sine δ (loss angle) = Cos φ (phase angle)
PF = DF (when less than 10%)

X. Quality Factor (dimensionless)

$Q = \text{Cotan } \delta \text{ (loss angle)} = \frac{1}{DF}$

XI. Equivalent Series Resistance (ohms)

$ESR = (DF)\,(Xc) = (DF)\,(\frac{1}{2}\pi fC)$

XII. Power Loss (watts)

Power loss $= (2\pi fCV^2)\,(DF)$

XIII. KVA (Kilowatts)

$KVA = 2\pi fCV^2 \times 10^{-3}$

XIV. Temperature Characteristic (ppm/°C)

$TC = \frac{Ct - C_{25}}{C_{25}\,(T_t - 25)} \times 10^6$

XV. Cap Drift (%)

$C.D. = \frac{C_1 - C_2}{C_1} \times 100$

XVI. Reliability of Ceramic Capacitors

$\frac{L_o}{L_t} = \left[\frac{V_t}{V_o}\right]^x \quad \left[\frac{T_t}{T_o}\right]^\tau$

XVII. Capacitors in Series (current the same)

Any number: $\frac{1}{C_T} = \frac{1}{C_1} + \frac{1}{C_2} \cdots + \frac{1}{C_N}$

Two: $C_T = \frac{C_1\,C_2}{C_1 + C_2}$

XVIII. Capacitors in Parallel (voltage the same)

$C_T = C_1 + C_2 \cdots + C_N$

XIX. Aging Rate

A.R. = % Δ C/decade of time

XX. Decibels

$db = 20 \log \frac{V_1}{V_2}$

Metric prefixes:

Pico	X 10^{-12}
Nano	X 10^{-9}
Micro	X 10^{-6}
Milli	X 10^{-3}
Deci	X 10^{-1}
Deca	X 10
Kilo	X 10^3
Mega	X 10^6
Giga	X 10^9
Tera	X 10^{12}

Symbols:

K	=	Dielectric Constant
A	=	Area of electrode overlap
t_D	=	Dielectric thickness
V	=	Voltage (volts)
t	=	time (hours)
R_S	=	Series Resistance (ohms)
f	=	frequency (Hertz)
L	=	Inductance (henries)
δ	=	Loss angle
ø	=	Phase angle
x+y	=	Exponent effect of voltage and temperature
L_O	=	Operating life (hours)
L_t	=	Test life (hours)
V_t	=	Test voltage (volts)
V_o	=	Operating voltage (volts)
T_t	=	Test temperature (°C)
T_o	=	Operating temperature (°C)

ECLIPTEK CORPORATION
3545-B Cadillac Avenue • Costa Mesa • California 92626-1401
Phone: 714/433-1200 • Fax: 714/433-1234

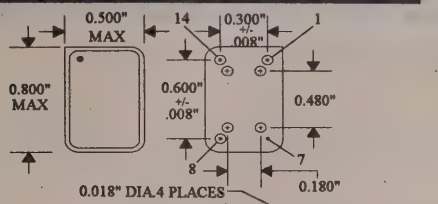
HCMOS/TTL CRYSTAL OSCILLATOR

EC1100 Series • Drives HCMOS & TTL
EC1100HS Series • Drives HCMOS & TTL • 1/2 Size

The EC1100 Series and the EC1100HS Series of HCMOS clocks from Ecliptek not only provides you with the highest quality crystal timing source available, but also gives you the flexibility of stocking one part to meet both your HCMOS and TTL compatibility needs.

Available options include tri-state, tight symmetry, extended temperature range, tight frequency stabilities, custom lead lengths, and gull-wing formation for surface mounting.

DIMENSIONS • EC1100 SERIES

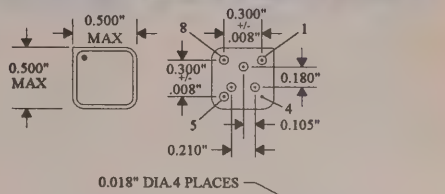


PIN	CONNECTION
1	NC or Tri-State
2	GND
3	Output
4	VDD

METRIC CONVERSION

0.551" = 14.00mm	0.386" = 9.800mm	0.348" = 8.840mm
0.300" = 7.620mm	0.200" = 5.080mm	0.164" = 4.160mm
0.065" = 1.650mm	0.060" = 1.520mm	0.050" + 1.270mm
0.020" = 0.510mm	0.015" = 0.380mm	0.008" = 0.203mm

DIMENSIONS • EC1100HS SERIES



PIN	CONNECTION
1	NC or Tri-State
2	GND/CASE
3	Output
4	+VDD

*lower height 0.200"/5.08mm available

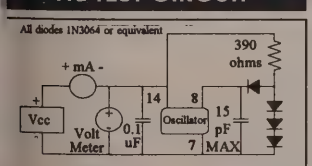
METRIC CONVERSION

0.800" = 20.32mm	0.600" = 15.24mm	0.500" = 12.70mm
0.480" = 12.19mm	0.300" = 7.620mm	0.200" = 5.080mm
0.180" = 4.572mm	0.031" = 0.787mm	0.018" = 0.457mm
0.008" = 0.203mm		

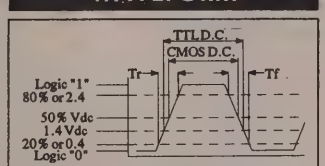
STANDARD SPECIFICATIONS	DRIVES HCMOS AND TTL —FULL SIZE • EC1100 SERIES	DRIVES HCMOS AND TTL—HALF SIZE • EC1100HS SERIES
Frequency Range	500 KHz to 100 MHz (Contact Factory For Other Frequencies)	500 KHz to 100 MHz (Contact Factory For Other Frequencies)
Operating Temp. Range	0°C to + 70°C	0°C to +70°C
Storage Temp. Range	-55°C to +125°C	-55°C to +125°C
Supply Voltage (Vcc)	+5.0Vdc +/-10%	5 Vdc +/-10%
Supply Current	15mA Max below 5.0 MHz, 20mA Max below 24.0 MHz, 30 mA Max 24.0 MHz and above	20mA Max below 24.0 Mhz, 35mA Max 24.0 MHz and above
Frequency Tolerance/Stability	+/-100ppm Maximum (Inclusive of temp, voltage, load, aging)	+/-100 ppm Maximum (Inclusive of temp, voltage, load, aging)
Symmetry	40/60% Max (45/55% Typ.)	40/60% Max (45/55% Typ.)
Voh (Logic "1")	2.4 Vdc Min. w/TTL Load, Vcc-0.5 Vdc Min. w/HCMOS Load	2.4 Vdc Min. w/TTL Load, Vcc-0.5 Vdc Min. w/HCMOS Load
Vol (Logic "0")	0.4Vdc Max. w/TTL Load, 0.5 Vdc Max. w/HCMOS Load	0.4 Vdc Max. w/TTL Load, 0.5 Vdc Max. w/HCMOS Load
Rise/Fall Time	6 nSec. Max 0.4V to 2.4V w/TTL, 4 nSec. Max 20% to 80% of waveform w/HCMOS	6 nSec Max 0.4V to 2.4V w/TTL, 4 nSec. Max 20% to 80% of waveform w/HCMOS
Load Drive Capability	up to 10 TTL Loads or up to 10/HCMOS Loads	up to 10 TTL Loads or up to 10 HCMOS Loads
	EC1100 SERIES	**EC1100HS SERIES**
Shock	MIL-STD-883C, Method 2002, Condition B	MIL-STD-883C, Method 2002, Condition B
Vibration	MIL-STD-883C, Method 2007, Condition A	MIL-STD-883C, Method 2007, Condition A
Seal Integrity	MIL-STD-883C, Method 1014, Conditions A2 and C (< 5 x 10-8 ATM cc/sec)	MIL-STD-883C, Method 1014, Conditions A2 and C (< 5 x 10-8 ATM c/sec)
Solderability	MIL-STD-883C, Method 2003	MIL-STD-883C, Method 2003
Marketing	MIL-STD-202F, Method 215	MIL-STD-202F, Method 215

EC1100 SERIES

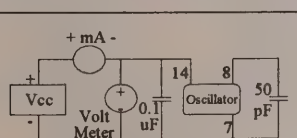
TTL TEST CIRCUIT



WAVEFORM



HCMOS TEST CIRCUIT



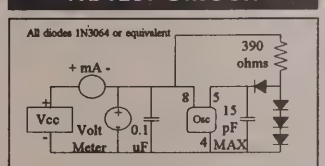
PART NUMBERING GUIDE

E C 11 00 ET T TS G - 64.000MHz — Frequency

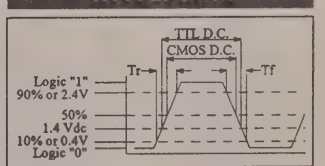
- OUTPUT TYPE: C = HCMOS / TTL Compatible
- FREQUENCY STABILITY: 00 = 100 ppm; 45 = 50 ppm; 25 = 25 ppm; 20 = 20 ppm
- OPERATING TEMP.: Blank = 0°C to +70°C; ET = -40°C to +85°C
- SYMMETRY: Blank = 40 / 60 Symmetry @ 50% and 1.4V; T = 45 / 55 @ 50% thru 70 MHz and @ 1.4 V thru 50 MHz; R = 47.5/52.5 @ 50% thru 50 MHz
- PIN 1 CONNECTION: Blank = No Connection; TS = Tri-State Enable High
- OPTIONS: Blank = None; G = Gull-winged SMD Leads

EC1100HS SERIES

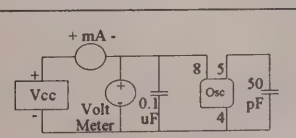
TTL TEST CIRCUIT



WAVEFORM



HCMOS TEST CIRCUIT



PART NUMBERING GUIDE *

E C 11 00 HS ET T TS G - 64.000MHz — Frequency

- OUTPUT TYPE: C = HCMOS / TTL Compatible
- FREQUENCY STABILITY: 00 = 100 ppm; 45 = 50 ppm; 25 = 25 ppm; 20 = 20 ppm
- PACKAGE: HS = Half Size
- OPERATING TEMP.: Blank = 0°C to +70°C; ET = -40°C to +85°C
- SYMMETRY: Blank = 40 / 60 Symmetry @ 50% and 1.4V; T = 45 / 55 @ 50% thru 70 MHz and @ 1.4 V thru 50 MHz; R = 47.5/52.5 @ 50% thru 50 MHz
- PIN 1 CONNECTION: Blank = No Connection; TS = Tri-State Enable High
- OPTIONS: G = Gull-winged SMD Leads

* If the part number (excluding frequency) exceedes 10 characters, a custom part number will be assigned.

3545-B Cadillac Avenue • Costa Mesa • California 92626-1401
Phone: 714/433-1200 • Fax: 714/433-1234

ECLIPTEK CORPORATION

SURFACE MOUNT

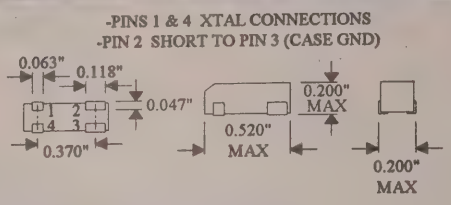
ECSM Series • Plastic Surface Mount
EC2SM Series • Resistance Welded HC-49/UP Surface Mount

MICROPROCESSOR CRYSTALS

ECLIPTEK offers manufacturers of microprocessor based equipment a complete selection of high quality surface mountable crystals from 3.579545MHz to 48 MHz with the EC2SM series and from 3.579545MHz to 70.000MHz with the ECSM Series.

Available options include series resonant, custom parallel load capacitances and tight stabilities

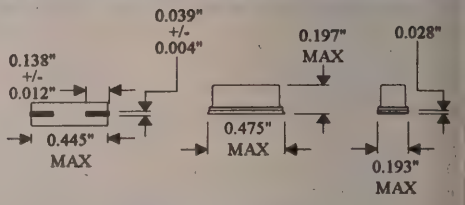
DIMENSIONS • ECSM SERIES



METRIC CONVERSION

0.520" = 13.10mm	0.118" = 3.000mm
0.370" = 9.400mm	0.063" = 1.600mm
0.200" = 5.091mm	0.047" = 1.200mm

DIMENSIONS • EC2SM SERIES



METRIC CONVERSION

0.475" = 12.00mm	0.193" = 4.902mm	0.028" = 0.700mm
0.445" = 11.300mm	0.138" = 3.500mm	0.012" = 0.300mm
0.197" = 5.000mm	0.039" = 1.000mm	0.004" = 0.100mm

STANDARD SPECIFICATIONS	Plastic Surface Mount • ECSM SERIES	Resistance Welded HC-49/UP Surface Mount • EC2SM SERIES
Holder — Nominal Frequency	3.579545 MHz to 70 Mhz	3.579545 MHz to 48 Mhz *
Frequency Accuracy/Stability	+/-50ppm at 25°C, +/-100ppm 0°C to +70°C*	+/-50ppm at 25°C, +/-100ppm 0°C to +70°C*
Shunt Capacitance (C_0)	7 pF	7 pF*
Load Capacitance (C_L)	18 pF (Custom C_L and Series Resonant Available)	18 pF (Custom C_L and Series Resonant Available)*
Operating Temperature Range	0°C to +70°C	0°C to +70°C*
Insulation Resistance	500 Megaohms Minimum at 100 Vdc	500 Megaohms Minimum at 100 Vdc*
Mode of Operation	fundamental below 30 MHz, 3rd overtone above	fundamental below 24 MHz, 3rd overtone above*
Drive Level	1mWatt Maximum, correlation at 100 uWatts	1mWatt Maximum, correlation at 100 uWatts
Shock	MIL-STD-883C, Method 2002, Condition B	MIL-STD-883C, Method 2002, Condition B
Vibration	MIL-STD-883C, Method 2007, Condition A	MIL-STD-883C, Method 2007, Condition A
Seal Integrity	MIL-STD-883C, Method 1014, Conditions C & A2	MIL-STD-883C, Method 1014, Conditions C & A2

*Please Contact Factory For Non-Standard Requirements.

COMMON PART NUMBERS • ECSM SERIES

PART NUMBER	FREQ MHz	Rs
ECSM036	3.579545	200
ECSM037	3.6864	200
ECSM040	4.000	200
ECSM049	4.9152	200
ECSM060	6.000	120
ECSM072	7.15909	120
ECSM080	8.000	90
ECSM098	9.8304	80
ECSM100	10.000	70
ECSM111	11.0592	70
ECSM121	12.000393	70
ECSM143	14.31818	70
ECSM147	14.7456	70
ECSM160	16.000	50
ECSM164	16.384	50
ECSM184	18.432	50
ECSM197	19.6608	50
ECSM200	20.000	50
ECSM240F*	24.000	50
ECSM246	24.576	50
ECSM300F*	30.000	50
ECSM400	40.000	80
ECSM480	48.000	100
ECSM600	60.000	100
ECSM700	70.000	100

*Available as Fundamental or 3rd Overtone.

COMMON PART NUMBERS • EC2SM SERIES

PART NUMBER	FREQ MHz	Rs
EC2SM036	3.579545	200
EC2SM037	3.6864	200
EC2SM040	4.000	200
EC2SM049	4.9152	200
EC2SM060	6.000	120
EC2SM072	7.15909	120
EC2SM074	7.3728	120
EC2SM080	8.000	90
EC2SM082	8.192	90
EC2SM098	9.8304	80
EC2SM100	10.000	70
EC2SM111	11.0592	70
EC2SM120	12.000	70
EC2SM123	12.288	70
EC2SM143	14.31818	70
EC2SM147	14.7456	70
EC2SM160	16.000	50
EC2SM164	16.384	50
EC2SM184	18.432	50
EC2SM197	19.6608	50
EC2SM200	20.000	50
EC2SM240F*	24.000	50
EC2SM320F*	32.000	50
EC2SM400F*	40.000	50
EC2SM480	48.000	80

*Available as Fundamental or 3rd Overtone.

PART NUMBERING GUIDE *

ECSM 270 S - 27.000MHz T

- PACKAGE: Plastic Encapsulated Surface Mount AT-Strip
- FREQUENCY CODE
- LOAD CAPACITANCE: Blank =Standard 18pF; S = series resonant; XX=XXpF Custom
- FREQUENCY in MHz
- OPTIONS: Blank = None; T = Tape and Reel

* = Parts will be marked with "ES" followed by three digit freq. code and load capacitance designator

PART NUMBERING GUIDE *

EC2SM 270 S - 27.000MHz T

- PACKAGE: Surface Mountable HC-49/UP
- FREQUENCY CODE
- LOAD CAPACITANCE: Blank =Standard 18pF; S = series resonant; XX=XXpF Custom
- FREQUENCY in MHz
- OPTIONS: Blank = None; T = Tape and Reel

* = Parts will be marked with "E1" followed by three digit freq. code and load capacitance designator

ECLIPTEK CORPORATION
3545-B Cadillac Avenue • Costa Mesa • California 92626-1401
Phone: 714/433-1200 • Fax: 714/433-1234

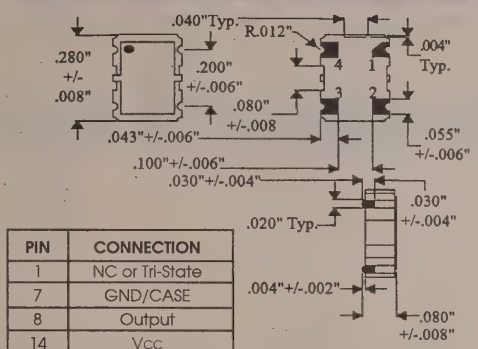
SURFACE MOUNT

EC1100SC Series • Ceramic Surface Mount
EC1100SJ Series • J-Lead Plastic Surface Mount
HCMOS/TTL CRYSTAL OSCILLATORS

ECLIPTEKS' EC1100SJ Series and EC1100SC Series of HCMOS/TTL clocks provide you with the highest quality crystal timing source available while giving you the flexibility of stocking one part to meet both your HCMOS and TTL compatibility needs. Available options include tri-state, tight symmetry, extended temperature range.

The EC1100SJ Series of HCMOS/TTL Compatible oscillators from Ecliptek provides you with the highest quality crystal timing source available. Utilizing state-of-the-art transfer molding technology, these oscillators employ an 'AT' cut crystal in a hermetically sealed metal can, which is then encapsulated in the plastic package. A built-in bypass capacitor is designed into the circuitry, minimizing EMI. Manufactured with an optimized leadframe, four 'J' leads provide exceptional stress relief when mounted on printed circuit boards, and are consistent with common industry solder pad geometries. Options include tri-state, extended temperature ranges, and tape-and-reel.

DIMENSIONS • EC1100SC SERIES

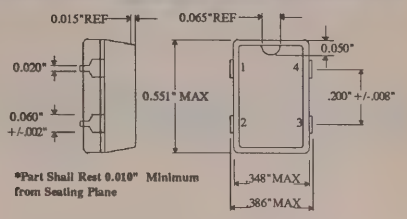


PIN	CONNECTION
1	NC or Tri-State
7	GND/CASE
8	Output
14	Vcc

METRIC CONVERSION

0.800" = 20.32mm	0.600" = 15.24mm	0.500" = 12.70mm
0.480" = 12.19mm	0.300" = 7.620mm	0.200" = 5.080mm
0.180" = 4.572mm	0.031" = 0.787mm	0.018" = 0.457mm
0.008" = 0.203mm		

DIMENSIONS • EC1100SJ SERIES



PIN	CONNECTION
1	NC or Tri-State
4	GND/CASE
5	Output
8	+5 Vdc

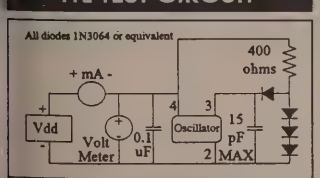
METRIC CONVERSION

0.500" = 12.70mm	0.300" = 7.620mm	0.220" = 5.588mm
0.210" = 5.334mm	0.200" = 5.080mm	0.180" = 4.572mm
0.105 = 2.667mm	0.031" = 0.787mm	0.018" = 0.457mm
0.008" = 0.203mm		

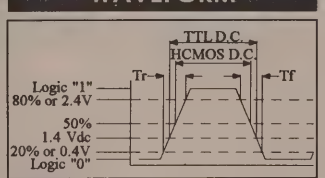
STANDARD SPECIFICATIONS	CERAMIC SURFACE MOUNT • EC1100SC SERIES	J-LEAD PLASTIC SURFACE MOUNT • EC1100SJ SERIES
Frequency Range	1.5 MHz to 50.0 MHz (contact factory for other frequencies)	1.5 MHz to 70.0 MHz (contact factory for other frequencies)
Operating Temp. Range	-10°C to + 70°C	-10°C to +70°C
Storage Temp. Range	-55°C to +125°C	-55°C to +125°C
Input Voltage (V_{DD})	5.0 Vdc +/-10%	+5.0Vdc +/-10% operating, +7.0V Max., -0.3V Min.
Tri-State Input Voltage (V_{IH} and V_{IL})	+2.2V_{IH} Min. to enable output, +0.8 V_{IL} to disable output	+2.0V_{IH} Min. to enable output, +0.8 V_{IL} to disable output
Input Current (Output Enabled)	Please Contact Factory	25mA Max. below 30.0MHz, 35mA Max. 30.0MHz and above
Input Current (Output Disabled)	Please Contact Factory	15mA Max. below 30.0MHz, 20mA Max. 30.0MHz and above
Supply Current	50mA Max.	Please see "Input Current (Output Enabled)"
Frequency Tolerance/Stability	+/-100ppm Max. (Inclusive of voltage, load, temp.) Aging +/-5ppm/year	+/-100ppm Max. (Inclusive of voltage, load, temp.) Aging +/-5ppm/year
Symmetry	40/60%	45/55% @ 50%, 40/60% @ 1.4 Vdc 1.5MHz to 50.0MHz
Voh (Logic "1")	2.4 Vdc Min. w/TTL Load, V_{DD}-0.4Vdc Min. w/50pF Load	2.4 Vdc Min. w/TTL Load, V_{DD}-0.4 Vdc Min. w/50pF Load
Vol (Logic "0")	0.4Vdc Min. w/TTL Load, 0.4Vdc w/50pF Load	0.4 Vdc Min. w/TTL Load, 0.4 Vdc Max. w/50pF Load
Rise/Fall Time	5nS Max. 0.4V to 2.4V w/TTL, 7nS Max 10% to 90% of waveform w/50pF.	5 nS Max 0.4V to 2.4V w/TTL, 7 nSec. Max 10% to 90% of waveform w/50pF Load
Load Drive Capability	Up to 10 TTL Loads or up to 50pF Load (HCMOS)	Up to 10 TTL Loads or up to 50pF Load (HCMOS)
Start up/Enable Time	Please Contact Factory	Start up in 10mS Max Below 30MHz, 15mS 30Mhz and Above. Enable in 100ns Max

EC1100SJ SERIES

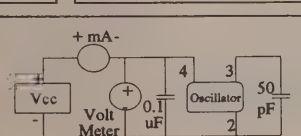
TTL TEST CIRCUIT



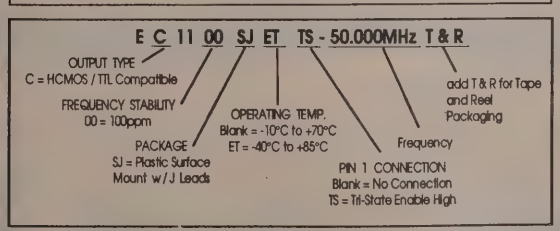
WAVEFORM



HCMOS TEST CIRCUIT

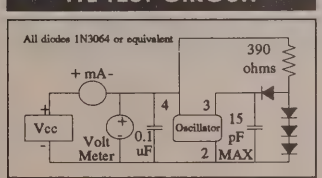


PART NUMBERING GUIDE

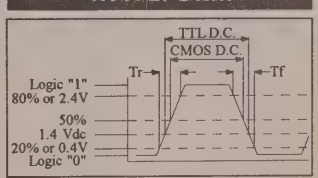

E C 11 00 SJ ET TS - 50.000MHz T & R
OUTPUT TYPE
C = HCMOS / TTL Compatible
FREQUENCY STABILITY
00 = 100ppm
PACKAGE
SJ = Plastic Surface Mount w/ J Leads
OPERATING TEMP.
Blank = -10°C to +70°C
ET = -40°C to +85°C
PIN 1 CONNECTION
Blank = No Connection
TS = Tri-State Enable High
Frequency
add T & R for Tape and Reel Packaging

EC1100SC SERIES

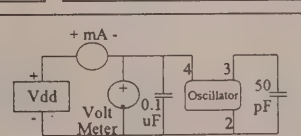
TTL TEST CIRCUIT



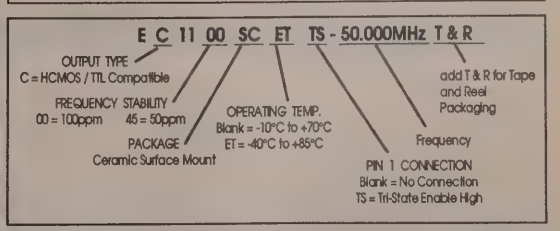
WAVEFORM



HCMOS TEST CIRCUIT



PART NUMBERING GUIDE


E C 11 00 SC ET TS - 50.000MHz T & R
OUTPUT TYPE
C = HCMOS / TTL Compatible
FREQUENCY STABILITY
00 = 100ppm
45 = 50ppm
PACKAGE
Ceramic Surface Mount
OPERATING TEMP.
Blank = -10°C to +70°C
ET = -40°C to +85°C
PIN 1 CONNECTION
Blank = No Connection
TS = Tri-State Enable High
Frequency
add T & R for Tape and Reel Packaging

3545-B Cadillac Avenue • Costa Mesa • California 92626-1401
Phone: 714/433-1200 • Fax: 714/433-1234

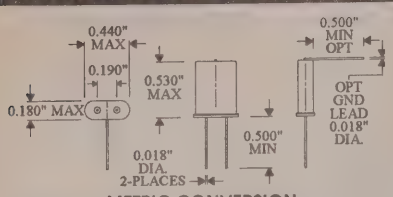
ECLIPTEK CORPORATION

MICROPROCESSOR CRYSTAL

EC Series • Resistance Welded HC-49/US Package
EC2 Series • Low Profile Resistance Welded HC-49/US Package
EC38 Series • 3mm x 8mm Cylindrical

Ecliptek offers manufacturers of microprocessor based equipment a complete selection of high quality crystals from 3.579545 MHz to 70 MHz with the EC2 Series and the very small tubular EC38 Series. The EC Series offers a selection from 1 MHz to 200 MHz. Available options for the EC2 Series include ground lead, insulator tab, special lead lengths, series resonant and custom parallel load capacitances: while the EC38 Series options include series resonant, custom parallel load capacitances and tight stabilities. The EC Series options include vinyl sleeving, ground lead, insulator tab, special lead lengths and formations, series resonant and custom parallel load capabilities.

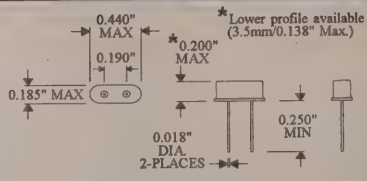
DIMENSIONS • EC SERIES



METRIC CONVERSION

0.440" = 11.18mm	0.250" = 6.350mm
0.200" = 5.091mm	0.190" = 4.826mm
0.185" = 4.700mm	0.018" = 0.457mm

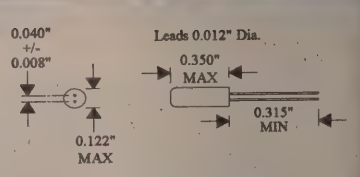
DIMENSIONS • EC2 SERIES



METRIC CONVERSION

0.530" = 13.46mm	0.500" = 12.70mm
0.440" = 11.18mm	0.190" = 4.826mm
0.180" = 4.572mm	0.018" = 0.457mm

DIMENSIONS • EC38 SERIES



METRIC CONVERSION

0.350" = 8.900mm	0.315" = 8.000mm
0.122" = 3.100mm	0.040" = 1.016mm
0.012" = 0.305mm	0.008" = 0.203mm

STANDARD SPECIFICATIONS	EC SERIES	EC2 SERIES	EC38 SERIES
Nominal Frequency	1 MHz to 200 Mhz *	3.579545 MHz to 70 Mhz *	3.579545 MHz to 70 Mhz*
Frequency Tolerance/Stability	+/-50ppm at 25°C, +/-100ppm 0°C to +70°C*	+/-50 ppm at 25°C, +/-100 ppm over 0°C to +70°C*	+/-50 ppm at 25°C, +/-100 ppm 0°C to +70°C*
Shunt Capacitance (C_0)	7 pF *	7 pF *	7 pF *
Load Capacitance (C_L)	18 pF *	18 pF *	18 pF *
Operating Temperature Range	0°C to +70°C*	0°C to +70°C*	0°C to +70°C*
Insulation Resistance	500 Megaohms Minimum at 100 Vdc	500 Megaohms Minimum at 100 Vdc	500 Megaohms Minimum of 100 Vdc
Mode of Operation (AT-Cut)	Fund < 24 MHz, 3rd < 72 MHz *	Fundamental below 24 MHz, 3rd overtone above*	Fund < 30 MHz, 3rd above*
Drive Level	2 mWatts Maximum, correlation at 100 uWatts*	1 mWatt Maximum, corralation at 100 uWatts*	1 mWatt Maximum, correlation at 100 uWatts*
Shock	MIL-STD-883C, Method 2002, Condition B	MIL-STD-883C, Method 2002, Condition B	MIL-STD-883C, Method 2002, Condition B
Vibration	MIL-STD-883C, Method 2007, Condition A	MIL-STD-883C, Method 2007, Condition A	MIL-STD-883C, Method 2007, Condition A
Seal Integrity	MIL-STD-883C, Method 1014, Conditions C & A2	MIL-STD-883C, Method 1014, Conditions C & A2	MIL-STD-883C, Method 1014, Conditions C & A2

*Please Contact Factory For Non-Standard Requirements.

COMMON PART NUMBERS • EC SERIES

PART NUMBER	FREQ MHz	Rs
EC010	1.00	2000
EC018	1.8432	650
EC025	2.3576	350
EC036	3.579545	180
EC040	4.000	120
EC072	7.15909	40
EC098	9.8304	30
EC120	12.000	25
EC160	16.000	25
EC197	19.6608	25
EC200	20.000	25
EC240F*	24.000	25
EC246F*	24.576	25
EC295	29.4912	25
EC300F*	30.000	25
EC360	36.000	25
EC500	50.000	25

COMMON PART NUMBERS • EC2 SERIES

PART NUMBER	FREQ MHz	Rs
EC2036	3.579545	200
EC2040	4.000	200
EC2060	6.000	120
EC2072	7.15909	120
EC2080	8.000	90
EC2098	9.8304	80
EC2100	10.000	70
EC2111	11.0592	70
EC2120	12.000	70
EC2143	14.31818	70
EC2160	16.000	50
EC2184	18.432	50
EC2197	19.6608	50
EC2200	20.000	50
EC2240F*	24.000	50
EC2320F*	32.000	50
EC2400F*	40.000	50

COMMON PART NUMBERS • EC38 SERIES

PART NUMBER	FREQ MHz	Rs
EC38036	3.579545	200
EC38040	4.000	200
EC38060	6.000	120
EC38072	7.15909	120
EC38080	8.000	90
EC38098	9.8304	80
EC38100	10.000	70
EC38111	11.0592	70
EC38120	12.000	70
EC38143	14.31818	70
EC38160	16.000	50
EC38184	18.432	50
EC38197	19.6608	50
EC38200	20.000	50
EC38240F	24.000	50
EC38320F	32.000	100
EC38400	40.000	100

* = Fundamental # = Third Overtone

PART NUMBERING GUIDE *

EC 240 S - 24.000MHz LI

- EC: PACKAGE HC-49/U
- 240: FREQUENCY CODE
- S: LOAD CAPACITANCE Blank =Standard 18pF; S = series resonant; XX=XXpF Custom
- 24.000MHz: FREQUENCY in MHz
- LI: OPTIONS Add Consecutive Letters For All Desired Options L = Gnd Lead; I = Insulator Tab; T&R = Tape and Reel; Blank = None

PART NUMBERING GUIDE *

EC2 240 S - 24.000MHz T & R

- EC2: PACKAGE HC-49/US (Low Profile)
- 240: FREQUENCY CODE
- S: LOAD CAPACITANCE Blank =Standard 18pF; S = series resonant; XX=XXpF Custom
- 24.000MHz: FREQUENCY in MHz
- T & R: OPTIONS Add Consecutive Letters For All Desired Options L = Gnd Lead; I = Insulator Tab; T&R = Tape and Reel; Blank = None

* = Parts will be marked with "E2" followed by 3 digit frequency code and load capacitance designator

PART NUMBERING GUIDE *

EC38 240 S - 24.000MHz T & R

- EC38: PACKAGE 3mm X 8mm cylindrical
- 240: FREQUENCY CODE
- S: LOAD CAPACITANCE Blank =Standard 18pF; S = series resonant; XX=XXpF Custom
- 24.000MHz: FREQUENCY in MHz
- T & R: OPTIONS T&R = Tape and Reel; Blank = None

* = Parts will be marked with "E8" followed by 3 digit frequency code and load capacitance designator

ECLIPTEK CORPORATION
3545-B Cadillac Avenue • Costa Mesa • California 92626-1401
Phone: 714/433-1200 • Fax: 714/433-1234

CRYSTAL OSCILLATORS

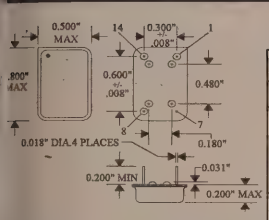
E1100 Series • ECL Logic • Full Size
ELF1100 Series • Low Power HCMOS/TTL • Full Size
EMO Series • Drives HCMOS/TTL • Miniature Size

The E1100 Series of ECL clocks from Ecliptek provide you with the highest quality crystal timing source available. Many popular pin configurations are offered as standard options. Other options include tight symmetry, extended temperature range, tight frequency stabilities, complementary outputs, enable/disable, custom lead lengths, and gull-wing formation for surface mounting.

The ELF1100 Series of low frequency HCMOS clocks from Ecliptek not only provides you with the highest quality crystal timing source available, but also gives you the capability of stocking one part to meet both your HCMOS and TTL compatibility needs. Available options include tight symmetry, extended temperature range, tight frequency stabilities, custom lead lengths, and gull-wing formation for surface mounting.

The EMO Series of HCMOS clocks from Ecliptek not only provides you with the highest quality crystal timing source in the smallest package we have available, but also gives you the capability of stocking one part to meet both your HCMOS and TTL compatibility needs. Available options to this miniature oscillator include a 50 ppm stability and custom lead lengths.

DIMENSIONS • E1100 SERIES

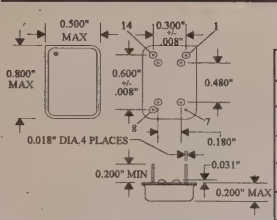


PIN	CONNECTION
1	SEE OPTIONS BELOW
7	
8	
14	

METRIC CONVERSION

0.800" = 20.32mm
0.600" = 15.24mm
0.500" = 12.70mm
0.480" = 12.19mm
0.300" = 7.620mm
0.200" = 5.080mm
0.180" = 4.572mm
0.031' = 0.787mm
0.018" = 0.457mm
0.008" = 0.203MM

DIMENSIONS • ELF1100 SERIES

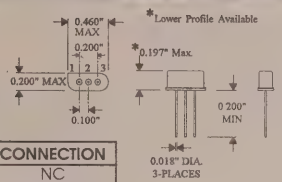


PIN	CONNECTION
1	NC
7	GND/CASE
8	Output
14	Vcc

METRIC CONVERSION

0.800" = 20.32mm
0.600" = 15.24mm
0.500" = 12.70mm
0.480" = 12.19mm
0.300" = 7.620mm
0.200" = 5.080mm
0.180" = 4.572mm
0.031' = 0.787mm
0.018" = 0.457mm
0.008" = 0.203MM

DIMENSIONS • EMO SERIES



PIN	CONNECTION
1	NC
7	GND/CASE
8	Output
14	Vcc

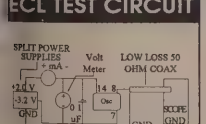
METRIC CONVERSION

0.460" = 11.68MM	0.200" = 5.080mm
0.197" = 5.000mm	0.100' = 2.540mm
0.018" = 0.457mm	

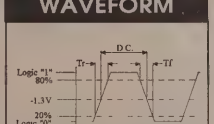
GENERAL SPECIFICATIONS	E1100 SERIES	ELF1100 SERIES	EMO SERIES
Frequency Range	20 MHz to 200.0 MHz (Higher Frequencies under development)	32.768 KHz (Contact Factory For Other Frequencies)	1.0 MHz to 25.0 MHz (Contact Factory For Other Frequencies)
Operating Temperature Range	0°C to +70°C	0°C to +70°C, temp. stability over +10°C to +50°C	-10°C to +70°C
Storage Temperature Range	0°C to +70°C	-30°C to +80°C	-40°C to +100°C
Supply Voltage	-5.2 Vdc +/-5% (+/-5Vdc +/-5% for AC pin configuration)	4.0 Vdc to 5.5 Vdc	5 Vdc +/-5%
Supply Current	140mA Max.	200uA Max. @ 5.5 Vdc	10 mA Max.
Frequency Tolerance/Stability	+/-100 ppm Maximum (Inclusive of temp, voltage, load, aging)	+/-100 ppm Maximum (Inclusive of temp, voltage, load, aging)	+/-100 ppm Maximum (Inclusive of temp, voltage, load, aging)
Symmetry	40/60% Max. @ 50% Level	40/60% Max.	40/60% Max. (45%/55% Typ.)
Voh (Logic "1")	-1.0V Min., -0.70 V Max	2.4 Vdc Min. w/TTL Load, Vcc-0.5 Vdc Min. w/HCMOS Load	2.4 Vdc Min. w/TTL Load, Vcc -0.5 Vdc Min. w/HCMOS Load
Vol (Logic "0")	-1.9V Min., -1.6V Max.	0.4 Vdc Max. w/TTL Load, 0.5 Vdc Max. w/HCMOS Load	0.4 Vdc Max. w/TTL Load, 0.5 Vdc Max. w/HCMOS Load
Rise/Fall Time	2nSec Max OVER 20% to 80%	1uSec Max 0.4V to 2.4V w/TTL, 1 uSec Max 20% to 80% of waveform w/HCMOS	6 nSec Max 0.4V to 2.4V w/TTL, 15ns Max 20% to 80% of waveform w/HCMOS
Load Drive Capacity	50 ohms to -2.0Vdc	up to 1 TTL Load or up to 1 HCMOS Load	up to 2 TTL Loads or up to 2 HCMOS Loads

EC1100 SERIES

ECL TEST CIRCUIT



WAVEFORM



PIN CONFIGURATION

PIN	AA	AB	AC	AM
1	GND/CASE	NC	NC	NC
7	-5.2V	-5.2	GND/CASE	GND/CASE
8	OUT	OUT	OUT	OUT
14	GND	GND/CASE	+5.0V	-5.2V

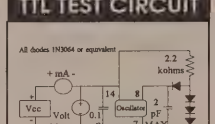
PART NUMBERING GUIDE

E 11 00 AC ET T C G - 64.000MHz — Frequency

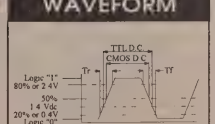
- OUTPUT TYPE: ECL
- FREQUENCY STABILITY: 00 = 100 ppm; 45 = 50 ppm; 25 = 25 ppm
- PIN CONNECTION: AA, AB, AC, AM per above
- OPERATING TEMP.: Blank = 0°C to +70°C; ET = -40°C to +85°C
- SYMMETRY: Blank = 40/60 @ 50%; T = 45/55 @ 50%; R = 47.5/52.5 @ 50%
- PIN 1 CONNECTION: Blank = No Connection; EH = Enable High; EL = Enable Low; C = Complimentary output
- OPTIONS: G= Gull-winged SMD leads; Blank = none

ELF1100 SERIES

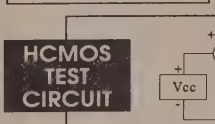
TTL TEST CIRCUIT



WAVEFORM



HCMOS TEST CIRCUIT



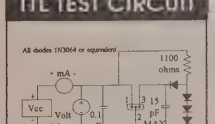
PART NUMBERING GUIDE

E LF 11 00 T G - 32.768kHz — Frequency

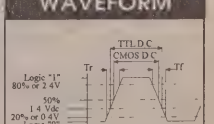
- OUTPUT TYPE: LF = Low Frequency HCMOS/TTL Compatible
- FREQUENCY STABILITY: 00 = 100 ppm; 30 = 30 ppm
- SYMMETRY: Blank = 40/60 @ 50%; T = 45/55 @ 50%; R = 47.5/52.5 @ 50%
- OPTIONS: Blank = none; G= Gull-winged SMD leads

EMO SERIES

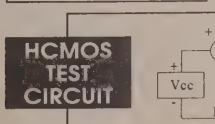
TTL TEST CIRCUIT



WAVEFORM



HCMOS TEST CIRCUIT



PART NUMBERING GUIDE

EMO 100 - 20.000MHz

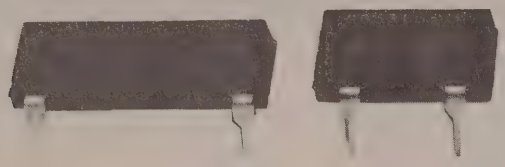
- TYPE/PACKAGE: EMO = HC-49/U Short Oscillator Package with CMOS/TTL Compatible Output
- FREQUENCY STABILITY: 00 = 100 ppm; 45 = 50 ppm
- Frequency in MHz

* Marking on parts will consist of EMO1 for EMO100 and EMO2 for EMO45 followed by a special three digit frequency code

PLASTIC DIP OSCILLATORS

EPSON

SG-51K-14 PIN DIP
SG-531P-8 PIN DIP



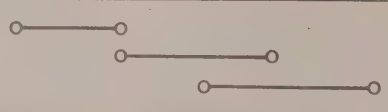
FEATURES

- Low Cost
- Auto Insertable Plastic DIP
- Replaces Metal Can Type
- Available with Tristate Output
- 5ns Rise-Fall Time (TYP)

SPECIFICATIONS

Frequency Range		1.025 MHz - 66.667 MHz
Frequency Stability	5v±0.5v (−10°C~+70°C)	C=±100 PPM, B=±50 PPM
Temperature Range	Operating Storage	−10°C~+70°C −55°C~125°C
Input Voltage		5v±0.5v
Current Consumption		35mA MAX, TYP 10mA (12 MHz)
Output (−10°C~+70°C)	Duty Rise & Fall Time Output Load Start Up Time "O" Level "I" Level	40/60 MAX, TYP 45/55 @½V_{DD} or 1.4V LEVEL 8nsec MAX, TYP 5nsec 10TTL Gate/50pF CMOS 10msec MAX, TYP 0.5msec +0.4 V MAX (16 mA) V_{DD}−0.4V MIN (−400μA)
Aging	@25°C, V_{DD}=5V	±5 PPM MAX, TYP±1 PPM

FREQUENCY LIST

Frequency / Model	2.5MHz 25MHz 30MHz 50 MHz 66.667MHz
K, P T, PT YH, PH	

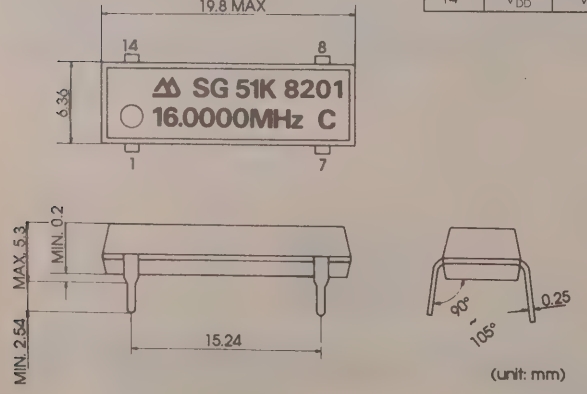
FUNCTION LIST

Model SG-51/531	Terminal	Load Condition		Output Control Function
	DIP 4PIN	C-MOS	TTL-10	OE Function
SG-51K/531	○	○	○	
SG-51/531P	○	○	○	○
SG-51/531PH	○	○		○
SG-51KT	○		○	
SG-51YH	○	○		
SG-51/531PT	○		○	○

DIMENSIONS

SG-51K/P

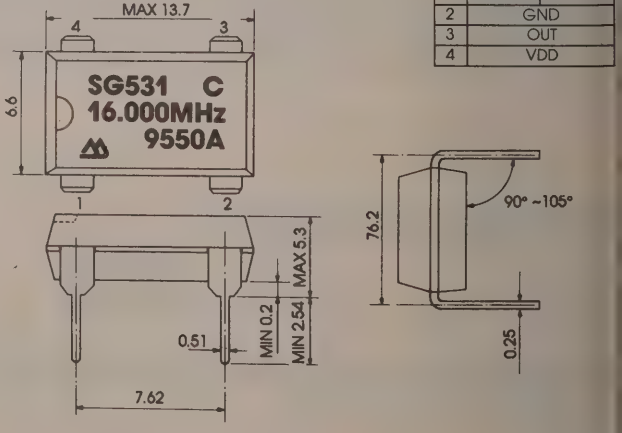
No.	PIN OUT	
1	NC	OE
7	GND	GND
8	OUT	OUT
14	V_{DD}	V_{DD}



(unit: mm)

SG-531

PIN	CONNECTION	
1	NC SC-531 SG-531T SG-531YH	OE SG-531P SG-531PT SG-531PH
2	GND	
3	OUT	
4	VDD	



(Unit: MM)

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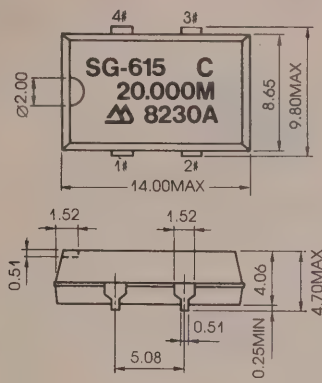
SMD CRYSTAL OSCILLATOR

EPSON

SG-615 OSCILLATOR



NO.	PIN CONNECTION
1#	NC (OE)
2#	GND
3#	OUT
4#	V_{DD}

( ) indicates P type

Specifications (characteristics)

Item		Symbol	SG-615/615P	SG-615T/615PT	SG-615PTJ	Remark
			Specification			
Output frequency range		fo	1.0250MHz to 26.0000MHz *2	26.0001MHz to 36.0000MHz	36.0001MHz to 66.6667MHz	
Power source voltage	MAX. supply voltage	V_{DD}-GND	−0.3V to + 7.0V	−0.3V to +7.0V	−0.3V to +7.0V	
	Operating voltage	V_{DD}	5.0V±0.5V	5.0V±0.5V	5.0V±0.5V	
Temperature range	Storage temperature	T_{STG}	−55°C to +125°C	−55°C to +125°C	−55°C to +125°C	Stored without Tape & Reel
	Operating temperature	T_{OPR}	−10°C to +70°C (−40°C to +85°C)			−40°C to +85°C : custom order
Soldering condition (lead part)		T_{SOL}	Under 260°C within 10sec.×2 times or under 230°C within 3min.			
frequency stability		Δf/fo	B:±50ppm C:±100ppm	B:±50ppm C:±100ppm	(B:±50ppm) C:±100ppm	−10°C to +70°C B-type is possible, please consult us.
Current consumption		Iop	25mA MAX.	35mA MAX.	35mA MAX.	No load condition
Duty		Tw/T	40% to 60% * (45% to 55% *1)	40% to 60% ** (45% to 55% *1)	40% to 60% ** (45% to 55% *1)	* : 1.4V or 1/2V_{DD} level **: 1.4V level
Output voltage		V_{OH}	V_{DD}-0.4V MIN.	V_{DD}-0.4V MIN.	2.4V MIN.	I_{OH}=−400μA
		V_{OL}	0.4V MAX. *	0.4V MAX. *	0.5V MAX. **	*:I_{OL}=16mA **:I_{OL}=8mA
Output load condition(Fan out)	TTL	N	10TTL MAX.	10TTL(30pF) MAX.	5TTL(15pF) MAX.	
	C-MOS	CL	50pF MAX.			
Output enable/standby input voltage		V_{IH}	2.0V MIN.	2.0V MIN.	3.5V MIN.	
		V_{IL}	0.8V MAX.	0.8V MAX.	1.5V MAX.	
Output disable current		I_{OE}	12mA MAX.	20mA MAX.	28mA MAX.	OE terminal = GND
Output rise time		t_{TLH}	8nsec. MAX. *	10nsec. MAX. *	5nsec. MAX.	* : Refer to output waveform chart (page 9)
Output fall time		t_{THL}	8nsec. MAX. *	8nsec. MAX. *	5nsec. MAX.	

Item		Symbol	SG-615PH/615YH	
			Specification	Remark
Output frequency range		fo	26.0001MHz to 66.6667MHz	
Power source voltage	MAX. supply voltage	V_{DD}-GND	−0.3V to +7.0V	
	Operating voltage	V_{DD}	5.0V±0.5V *3	
Temperature range	Storage temperature	T_{STG}	−55°C to + 125°C	Stored without tape & Reel
	Operating temperature	T_{OPR}	−10°C to +70°C (−40°C to +85°C)	−40°C to + 85°C : custom order
Soldering condition (lead part)		T_{SOL}	Under 260°C within 10sec.×2 times or under 230°C within 3 min.	
Frequency stability		Δf/fo	(B: ±50ppm) C: ±100ppm	−10°C to +70°C
Current consumption		Iop	35mA MAX.	No load condition. Up to 45MHz : 21mA MAX.
Duty		Tw/T	40% to 60%	1/2 V_{DD} level
Output voltage		V_{OH}	V_{DD}−0.4V MIN.	I_{OH}=−4mA
		V_{OL}	0.4V MAX.	I_{OL}= 4mA
Output load condition(Fan out)	TTL	N		
	C-MOS	CL	50pF MAX.	
Output enable/standby input voltage		V_{IH}	2.0V MIN.	
		V_{IL}	0.8V MAX.	
Output disable current		I_{OE}	20mA MAX.	OE terminal=GND
Output rise time		t_{TLH}	7nsec. MAX. *3	Refer to output waveform chart (page 9)
Output fall time		t_{THL}	7nsec. MAX. *3	Over 45MHz : 5ns

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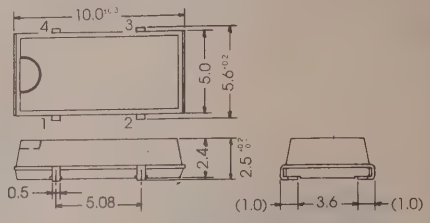
SMD CRYSTAL OSCILLATOR

EPSON

SG-636 OSCILLATOR

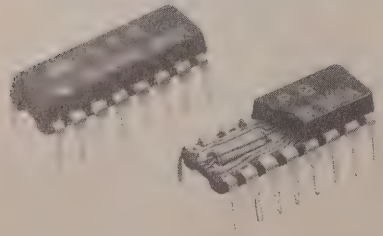


NO.	PIN TERMINAL
1	OE
2	GND
3	OUT
4	V_{DD}

SPECIFICATIONS (Characteristics)

Item		Symbol	Specifications	Remarks
Output frequency range		fo	2.2168MHZ~40.000MHz	
Power source voltage	Max. supply voltage	V_{DD}-GND	−0.5V TO +7.0V	
	Operating voltage	V_{DD}	5.0V ± 0.5V	
Temperature range	Storage temperature	T_{STG}	−55°C to +100°C	Stored without Tape and Reel
	Operating temperature	T_{OPR}	−10°C to +70°C	
Soldering condition		T_{SOL}	Under 260°C within 10 sec×2 or under 230°C within 3 min.	
Frequency stability		Δf/fo	C:±100ppm	−10°C~+70°C
Current consumption		I_{OP}	16mA MAX.	No load condition
Duty		T_W/T	40% to 60% (45% to 55% *)	1/2 V_{DD} level
Output voltage		V_{OH}	V_{DD} −0.4V MIN.	I_{OH} = −2mA
		V_{OL}	0.4V MAX.	I_{OL} = −2mA
Output load condition		N	5 pcs. MAX.	LSTTL load
		CL	15pF MAX.	C-MOS load
Output enable voltage		V_{IH}	2.0V MIN.	
		V_{IL}	0.8V MAX.	
Output disable current		I_{OE}	12mA MAX.	
Output rise time		t_{TLH}	7nsec MAX.	C-MOS load: 20% V_{DD} ---80% V_{DD}
Output fall time		t_{THL}	7nsec MAX.	C-MOS load: 80% V_{DD} ---20% V_{DD}
Oscillation start time		t_{OSC}	10msec MAX.	More than for 1m sec until V_{DD} = 0V–4.5V. Time at 4.5V to be 0 sec.
Aging		fa	± 5ppm/year MAX.	Ta = 25°C, V_{DD} = 5V, first year
Shock resistance		S.R.	±20ppm MAX.	Drop test of 3 times on a hard board from 75cm height or excitation test with 3000G 0.3ms 1/2 sine wave in 3 directions

PROGRAMMABLE STANDARD PULSE GENERATOR SPG 8600 SERIES

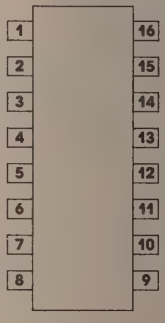


SPG 8600 Series high precision, time-base frequency generators contain a miniature quartz crystal element integrated with a CMOS monolithic chip. They provide low power consumption, high quality and low cost for a broad range of OEM applications.

TERMINAL CONNECTIONS

No.	Pin Out	No.	Pin Out
1	NC	16	V_{DD}
2	CTL_3	15	NC
3	CTL_2	14	RESET
4	CTL_1	13	NC (CSEL)
5	CTL_6	12	NC (EXC)
6	CTL_5	11	FOUT
7	CTL_4	10	TEST
8	V_{SS}	9	OUT

NC: Not connected.



SPECIFICATIONS

UNIT	RANGE
8640AN	600 KHz to 0.0005 Hz
8640BN	1 MHz to 1/120 Hz
8650A	60 KHz to 0.0005 Hz
8650B	60 KHz to 1/1200 Hz
8650E	32.768 KHz to 0.00027 Hz
8651A	1 MHz to 0.0005 Hz
8651B	100 KHz to 1/1200 Hz
8651E	32.768 KHz to 0.00027 Hz

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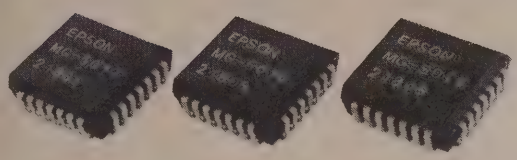
PHASE LOCKED LOOP (PLL) OSCILLATOR

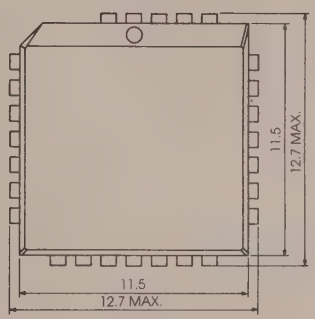
EPSON

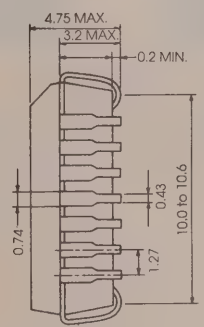
MG-5000 SERIES
MG-6000 SERIES



FEATURES:
- 28 Pin PLCC
- Built-in Crystal
- Built-in Loop Filters
- Surface Mountable
- MG-5010 – 2 Simultaneous Outputs
- MG-6010 – 6 Simultaneous Outputs
- Customs Available

External Dimensions (Unit: mm)





SPECIFICATIONS (characteristics)
Absolute Maximum Rating

Item	Symbol	Rating	Unit
Supply voltage	AV_{DD} DV_{DD}	–0.5 to +7.0	V
Input/Output voltage	$V_{I/O}$	DV_{DD}+0.5 to DV_{SS}–0.5	V
Storage temperature	T_{STG}	–40 to +100	°C
Soldering condition	T_{SOL}	Twice at under 260°C within 10 sec. or under 230°C within 3 min.	

Operating Range

Item	Symbol	Rating MIN	Rating TYP	Rating MAX	Unit	Remarks
Operating voltage	AV_{DD} DV_{DD}	4.5	5.0	5.5	V	
Operating temperature	TOPR	0		70	°C	AV_{DD}, DV_{DD} 4.5 to 5.5V
Output load condition	CL			25	pF	Capacitance load

Frequency Characteristics

Item	Symbol	Specification	Remarks
Frequency stability	Δfa	±100 ppm	–10 to +70°C
Aging	fa	±5 ppm/Y	Ta=25°C, AV_{DD}·DV_{DD}=5V first year

MG5010
Output frequency (nominal frequency)
Video Clock (VCLK)

VCLK OUTPUT (MHz)	VS_3	VS_2	VS_1	VS_0
14.31818	0	0	0	0
65.32670	0	0	0	1
External clock output	0	0	1	0
36.24289	0	0	1	1
25.28054	0	1	0	0
28.41264	0	1	0	1
23.93821	0	1	1	0
39.82244	0	1	1	1
44.74431	1	0	0	0
50.56107	1	0	0	1
16.33167	1	0	1	0
32.66335	1	0	1	1
56.82528	1	1	0	0
19.91122	1	1	0	1
41.61221	1	1	1	0
79.64488	1	1	1	1

Memory Clock (MCLK)

VCLK OUTPUT (MHz)	MS_1	MS_0
33.11079	0	0
35.79545	0	1
43.84943	1	0
49.21874	1	1

MG-6010:
Output frequency (nominal frequency)

Pin Name	Pin No.	Output frequency	Note
1.84MHz	1	1.844008MHz	
16 MHz	10	16.002672 MHz	
24 MHz	9	23.714486 MHz	
32 MHz	11	32.005344 MHz	
REFCLK	19	14.318180 MHz	
CPUCLK	24	32.215905 MHz 39.992158 MHz 50.113630 MHz	Select the output frequency with "SCLK0" and "SCLK1"

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CRYSTALS

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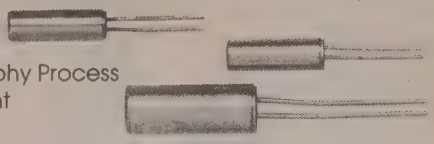
C-TYPE



FEATURES

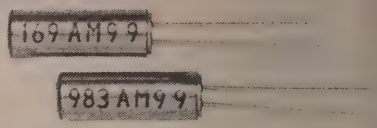
- Photolithography Process
- Shock Resistant

C2-TYPE

Item	Frequency Unit	*30KHz~ 99KHz	100KHz~ 163KHz
Frequency Tolerance (25°C)	ppm	±100	
Series Resistance	KΩ	32~15	12~8
Motional Capacitance	fF	2.1~0.9	0.9~0.6
Shunt Capacitance	pF	1.0~0.8	0.9~0.6
Drive Level	μW	MAX 1.0	
Turn over Temperature	°C	25±5	
Temperature Coefficient	ppm/°C²	MAX –0.04	
Aging (25°C)	ppm/Year	MAX ±5	

*Below 30KHz is available on request

CA-301



FEATURES

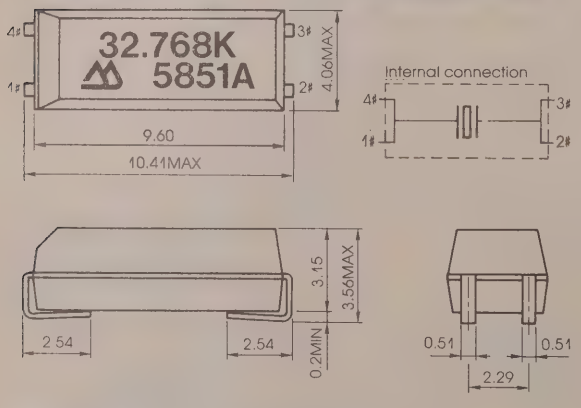
- At Strip Cyrstal
- Shock Resistant

CA-301

Item	Unit	Specification	Remarks
Frequency	MHz	4~25 25~66.667MHz	Fundamental 3rd overtone
Load Capacitance	pF	Standard grade 18pF	Load capacitances is available on request
Frequency Tolerance	ppm	±30	25°C ±3
Temperature Characteristics	ppm	±30	–20°C~+70°C
Series Resistance	Ω	It depends on the below-mentioned list	–20°C~+70°C
Shunt Capacitance	pF	MAX.5	
Aging	ppm/Year	±5	@25°C
Shock Resistance	ppm	±10	75cm×3 times drop onto a hard wooden board.
Operating Temperature	°C	–20°C~+70°C	
Storage Temperature	°C	–40°C~+85°C	
Drive Level	μW	100μW	

SMD CRYSTALS

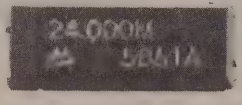
MC-405-CRYSTAL

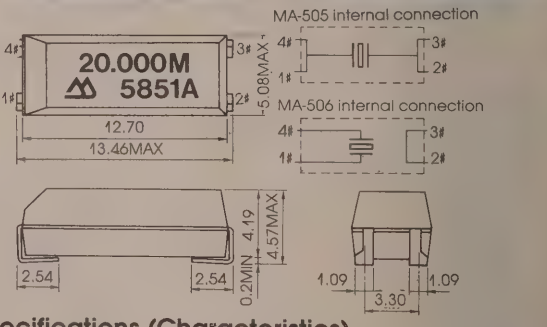


Specifications (Characteristics)

Item		Symbol	Specifications			Remarks
Nominal frequency		f	32.768KHz	Over 20KHz Under 99KHz	Over 100KHz Under 163KHz	Please consult us
Temperature range	Storage temp.	T_{STG}	–55°C~+125°C			Stored w/o Tape & Reel
	Operating temp.	T_{OPR}	–40°C~+85°C			
Maximum drive level		GL	1.0μW MAX.			
Soldering condition		T_{SOL}	Two times at under 260°C within 10 sec. or under 230°C within 3 min.			
Frequency tolerance (standard)		Δf/f	±20ppm or ±50ppm	±100ppm		Ta=25°C

MA-505/506-CRYSTAL





Specifications (Characteristics)

Item		Symbol	Specifications	Remarks
Nominal Frequency Range		f	4.0MHz~26.0MHz	Fundamental mode *1
			26.0MHz~66.667MHz	3rd overtone mode
Temperature range	Storage temperature	T_{STG}	–55°C~+125°C,	Stored as naked product after unpacking
	Operating temp	T_{OPR}	–20°C~+70°C	
Drive level	Maximum drive level	GL	2mW MAX.	Only crystal oscillation is guaranteed
	Recommended level	DL	10μW~100μW TYP.	
Soldering condition		T_{SOL}	Two times at less than 260°C within 10 sec. or under 230°C within 3 min.	
Frequency tolerance (standard)		Δ/f	±50ppm	Ta=25°C, DL=100μW
Frequency temperature characteristics			Below: 5.3MHz: ±50ppm	–20°C~+70°C, DL=100μW
			Over 5.5MHz:±30ppm	–20°C~+70°C, DL=100μW
Load capacitance		CL	Fundamental: 10pF~∞, Overtone: 5pF~∞	According to customer's requirements

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MINIATURE SMD CRYSTALS

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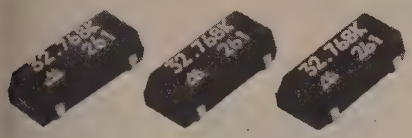
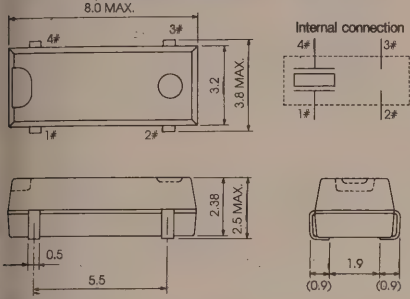
MC-306 CRYSTAL



External Dimensions (Unit : mm)

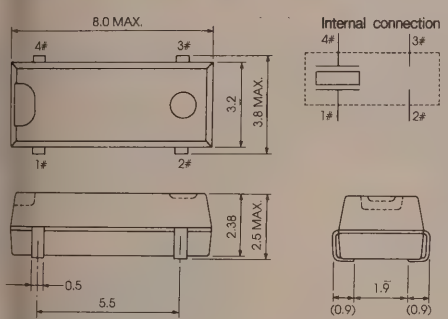


Specifications (Characteristics)

Item		Symbol	Specifications		Remarks
Nominal Frequency		f	32.768kHz	20.000 to 165.000kHz *	*Please consult us except for 32.768kHz
Temperature range	Storage temperature	T_{STG}	−55°C to +125°C		
	Operating temperature	T_{OPR}	−40°C to +85°C		
Maximum drive level		GL	1.0μW MAX.		
Soldering condition		T_{SOL}	Twice at under 260°C within 10 sec. or under 230°C within 3 min.		
Frequency tolerance (standard)		Δf/f	±50ppm or ±20ppm	±100ppm	Ta=25°C, DL=1.0μW
Peak temperature (frequency)		θT	25°C±5°C	25°C TYP.	
Temperature coefficient (frequency)		α	−0.04ppm/°C² MAX.		
Load capacitance		CL	3pF to ∞		As specified
Series resistance		R_1	50kΩ	50kΩ to 8kΩ	
Motion capacitance		C_1	1.8fF	2.1fF to 0.6fF	
Shunt capacitance		C_0	0.9pF TYP.	1.0pF to 0.6pF	
Isolation resistance		IR	100MΩ MIN.		
Aging		fa	±3ppm/Y MAX.	±5ppm/Y MAX.	Ta=25°C ±3°C, first year
Shock resistance		S.R.	±5ppm MAX.		Drop test of 3 times on a hard board from 75cm height or excitation test with 3000G×0.3ms×1/2 sine wave×3 directions.

MA-306 CRYSTAL

External Dimensions (Unit : mm)

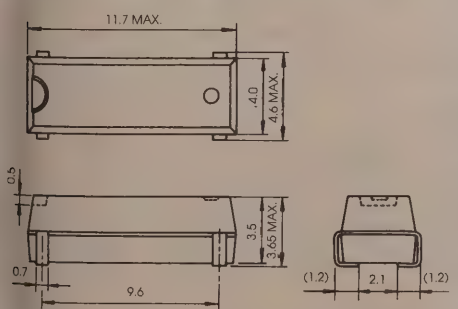


Specifications (Characteristics)

Item		Symbol	Specifications	Remarks
Nominal Frequency		f	17.73MHz to 40.00MHz	Fundamental mode
Temperature range	Storage temperature	T_{STG}	−55°C to +100°C	Stored as naked product after unpacking
	Operating temperature	T_{OPR}	−20°C to +70°C	
Drive level	Maximum drive level	GL	2mW MAX.	Only crystal oscillation is guaranteed
	Recommended drive level	DL	10μW to 100μW	
Soldering condition		T_{SOL}	Twice at under 260°C within 10 sec. or under 230°C within 3 min.	
Frequency tolerance (standard)		Δf/f	±50ppm	Ta=25°C
Frequency temperature characteristics (standard)			±30ppm	−20°C to +70°C, 25°C standard
Load capacitance		CL	10pF to ∞	As specified
Series resistance		R_1	60kΩ	
Shunt capacitance		C_0	5pF MAX.	
Isolation resistance		IR	500MΩ MIN.	
Aging		fa	±5ppm/Y MAX.	Ta=25°C, first year
Shock resistance		S.R.	±10ppm MAX.	Drop test of 3 times on a hard board from 75cm height or excitation test with 3000G×0.3ms×1/2 sine wave×3 directions.

MA-406 CRYSTAL

External Dimensions (Unit : mm)



Specifications (Characteristics)

Item		Symbol	Specifications	Remarks
Nominal Frequency		f	4.0MHz to 30.00MHz 26.0MHz to 64.0MHz	Fundamental mode *1
Temperature range	Storage temperature	T_{STG}	−55°C to +125°C	Stored as naked product after unpacking
	Operating temperature	T_{OPR}	−20°C to +70°C	
Drive level	Maximum drive level	GL	2mW MAX.	Only crystal oscillation is guaranteed
	Recommended drive level	DL	10μW to 100μW	
Soldering condition		T_{SOL}	Twice at under 260°C within 10 sec. or under 230°C within 3 min.	
Frequency tolerance (standard)		Δf/f	±50ppm	Ta=25°C ±3°C *2
Frequency temperature characteristics (standard)			±30ppm	20°C to +70°C, 25°C standard
Load capacitance		CL	10pF to ∞	As specified
Series resistance		R_1	60kΩ	
Shunt capacitance		C_0	5pF MAX.	
Isolation resistance		IR	500MΩ MIN.	
Aging		fa	±5ppm/Y MAX.	Ta=25°C, first year
Shock resistance		S.R.	±10ppm MAX.	Drop test of 3 times on a hard board from 75cm height or excitation test with 3000G×0.3ms×1/2 sine wave×3 directions.

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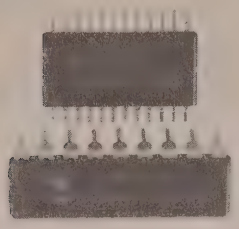
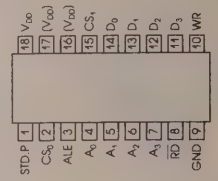
CMOS REAL TIME CLOCK MODULES

EPSON

REAL TIME CLOCK MODULE RTC-72421/72423



TERMINAL CONNECTIONS



SPECIFICATIONS — Operating Range

Item	Symbol	Conditions	Value	Unit
Power Supply	V_{DD}	—	4.5 ~ 5.5	V
Data-holding	V_{DH}	—	2.0 ~ 5.5	V
Crystal Frequency	f_0	Ta = 25°C	32.768	kHz
Operating Temp	T_{OPR}	—	−10 ~ +70	°C

Note) Data-holding voltage guarantees clock operations, though it does not guarantee operations outside the IC and data input/output.

Frequency Characteristics

Item		Conditions	MAX. Value	Unit
Frequency Tolerance	A	Ta = 25°C	±10	ppm
	B	V_{DD} = 5V	±50	
Frequency Temp. Characteristics		(−10 ~ +70°C at 25°C = 0ppm)	+10/−120	ppm
Aging		V_{DD} = 5V Ta = 25°C First year	±5	ppm/year

Electrical Characteristics

Item	Symbol	Conditions	MIN.	TYP.	MAX.	UNIT	Terminal
H. Input Voltage	V_{IH1}	—	2.2	—	—	V	All inputs except CS_1
L. Input Voltage	V_{IL1}	—	—	—	0.8		
Input Leak 1	I_{LK1}	$V_I = V_{DD}$/0V	—	—	1/−1	μA	Inputs except D_0 ~ D_3
Input Leak 2	I_{LK2}		—	—	10/−10		D_0 ~ D_3
L. Output Voltage 1	V_{OL1}	I_{OL} = 2.5mA	—	—	0.4	V	D_0 ~ D_3
H. Output Voltage	V_{OH}	I_{OH} = −400μA	2.4	—	—		
L. Output Voltage 2	V_{OL2}	I_{OL} = 2.5mA	—	—	0.4	V	STD.P
Off Leak Current	I_{OFFLK}	$V_I = V_{DD}$/0V	—	—	10	μA	
Input Capacitance 1	C_{I1}	Input freq. 1MHz	—	10	—	pF	Inputs except D_0 ~ D_3
Input Capacitance 2	C_{I2}		—	20	—		D_0 ~ D_3, STD.P
Current Consumption 1	I_{DD1}	CS_1 = 0V, V_{DD} = 5V	—	—	10	μA	V_{DD}
Current Consumption 2	I_{DD2}	CS_1 = 0V, V_{DD} = 2V	—	—	5		
H. Input Voltage 2	V_{IH2}	V_{DD} = 2 ~ 5.5V	$\frac{4}{5} V_{DD}$	—	—	V	CS_1
L. Input Voltage 2	V_{IL2}		—	—	$\frac{1}{5} V_{DD}$		

(V_{DD} = 5V ± 0.5V, Ta = −10 ~ 70°C)

Note • This device is made with C-MOS circuitry. Please take precautions to prevent damage due to static discharge.
• We recommend placing a 0.1μF capacitor and a 1 to 10μF capacitor next to RTC-72421 to protect against power line ripple. And start-up time of input voltage is greater than 1msec.
• Standard ultrasonic cleaning can be used on the RTC-72421, but please exercise caution in choosing a cleaning solution as the RTC-72421 could be damaged.

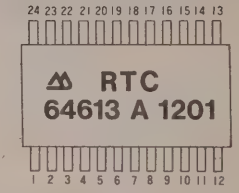
FEATURES

- **The built-in quartz oscillator makes regulation unnecessary and allows for easy design.**
- Direct bus-compatibility (120 nano second access time).
- ALE INPUT terminal available for 8048, 8051, and 8085 series.
- Incorporates built-in Time (hour, minute, second), and Date (year, month, week, day) counters.
- 12hr/24hr clock switchover function and automatic leap year setting.
- Interrupt masking.
- 30 seconds error adjustment function.
- READ, WRITE, HOLD, STOP, RESET, and CHIP SELECT INPUTS.
- The C-MOS IC boasts low current consumption and features a backup function.
- 18 pin dual in line package.
- Pin and function are compatible with the SMC 5242C.

8-bit REAL TIME CLOCK MODULE RTC-64611/64613

- Built-in quartz crystal allows adjustment-free and efficient operation
- 8-bit data bus and high speed access. (85nsec. MAX.)
- Provided with the same interface as of S RAM and battery backup function
- Interruption of alarm of sec.—day and day of week and carry interruption
- Reference signal selectable in a range of 1Hz–64Hz (binary)
- Leap year automatically adjustable. (Gregorian calendar)
- With 1Hz ouput terminal
- provided with START/STOP 30 sec. ADJUST function
- RTC-64613: Almost same mounting method as of universal type SMD IC

TERMINAL CONNECTION



(NC) is to be same level of V_{DD}
Do not connect NC terminals to any external terminals.

1. GND
2. H-START STOP
3. IRQ
4. 1Hz
5. A_3
6. A_2
7. A_1
8. A_0
9. I/O_1
10. I/O_2
11. I/O_3
12. GND
13. I/O_4
14. I/O_5
15. I/O_6
16. I/O_7
17. I/O_8
18. CS
19. OE
20. WE
21. NC
22. (NC)
23. (NC)
24. V_{DD}

4-bit MULTIFUNCTIONAL REAL TIME CLOCK MODULE RTC-63421/63421M/63423

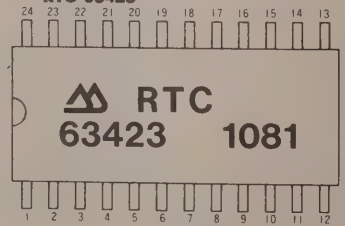
- Built-in quartz crystal allows adjustment-free and efficient operation
- Alarm interruption of sec.—month and day of week possible
- Provided with microcomputer compatible bus interface
- Standard signal output selectable in a range of 10min. to 1024Hz
- Either sec.-hour and day of week or sec.-year and day of week is selectable
- Reference area of time/alarm register is settable. Provided with RAM bits (marked on "*" which is shown resister table)
- Provided with START/STOP 30 sec. adjusting function
- Almost the same mounting method (RTC-63423) as of universal type SMD IC

Model	Applicable CPU
RTC-63421	Intel bus system
RTC-63421M	Motorola bus system
RTC-63423	Motel bus system

RTC-63421/63421M

1. INTERRUPT
2. $\overline{CS_0}$
3. ALE
4. A_0
5. A_1
6. A_2
7. A_3
8. (E)RD
9. GND
10. WR(R/W*)
11. D_3
12. D_2
13. D_1
14. D_0
15. CS_1
16. (NC)
17. (NC)
18. V_{DD}

RTC-63423



(NC) is to be same level of V_{DD} *=63421M
Do not connect NC terminals to any external terminals.

1. INTERRUPT
2. CS_0
3. ALARM
4. ALE
5. A_0
6. 30secAJS
7. A_1
8. 68/80
9. A_2
10. A_3
11. (E)RD
12. GND
13. WR(R/W)
14. D_3
15. D_2
16. D_1
17. 1Hz
18. D_0
19. CS_1
20. STOP/START
21. NC
22. (NC)
23. (NC)
24. V_{DD}

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CMOS REAL TIME CLOCK MODULES

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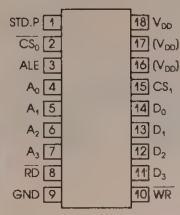
REAL TIME CLOCK MODULE 62421/62423



FEATURES

- **The built-in quartz oscillator makes regulation unnecessary and allows for easy design**
- Direct bus-compatibility (120 nano second access time).
- ALE INPUT terminal available for 8048, 8051, and 8085 series.
- Incorporates built-in Time (hour, minute, second), and Date (year month, week, day) counters.
- 11 hr/24 hr clock switchover function and automatic leap year setting.
- Interrupt masking.
- 30 seconds error adjustment function.
- READ, WRITE, HOLD, STOP, RESET, and CHIP SELECT INPUTS.
- The C-MOS IC boasts low current consumption and features a backup function.
- 18 pin dual in line package.
- Pin and function are compatible with the OK1-6242/62×42

SPECIFICATIONS–Operating Range

Item	Symbol	Conditions	Value	Unit
Power Supply	V_{DD}	–	4.5~5.5	V
Data-holding	V_{DH}	–	2.0~5.5	V
Crystal Frequency	fo	Ta=25°C	32.768	kHz
Operating Temp.	T_{OPR}	–	–10~+70	°C

Note) Data-holding voltage guarantees clock operations, though it does not guarantee operations outside the IC and data input/output.

Frequency Characteristics

Item		Conditions	MAX. Value	Unit
Frequency	A	Ta=25°C	±10	ppm
Tolerance	B	V_{DD}=5V	±50	
Frequency Temp. Characteristics		(–1.0~+70°C at 25°C=0ppm	+10/–120	ppm
Aging		V_{DD}=5V Ta=25°C First Year	±5	ppm/year

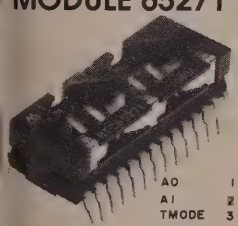
Electrical Characteristics

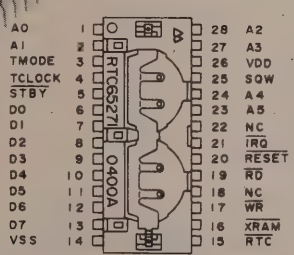
Item	Symbol	Conditions		MIN	TYP	MAX	UNIT	Terminal
H. Input Voltage	V_{IH1}	–		2.2	–	–		All Input except CS_1
L. Input Voltage	V_{IL1}	–		–		0.8		
Input Leak 1	I_{LK1}	V_I=V_{DD}/OV		–	–	1/-1	μA	Inputs except Do~D3
Input Leak 2	I_{LK2}			–	–	10/-10		Do~D3
L Output Voltage 1	V_{OL1}	I_{OL}=2.5mA		–	–	0.4	V	Do~D3
H. Output Voltage	V_{OH}	I_{OH}=400μA		2.4	–	–		
L. Output Voltage 2	V_{OL2}	I_{OL}=2.5mA		–	–	0.4	V	STD-P
Off Leak Current	I_{OFFLK}	V_I=V_{DD}/OV		–	–	10	μA	
Input Capacitance 1	C_1	Input freq. 1MHz		–	5	–	pF	Inputs except Do~D3
Input Capacitance 2	C_2			–	5	–		Do~D3, STD.P
Current Consumption 1	I_{DD1}	CS_1=0V	V_{DD} =5V	–	–	30	μA	V_{DD}
Current Consumption 2	I_{DD2}		V_{DD} =2V	–	–	10		
H.Input Voltage 2	V_{IH2}	V_{DD}=2–5.5V		4/5V_{DD}	–	–	V	CS_1
L.Input Voltage 2	V_{IL2}			–	–	1/5V_{DD}		

Note) • This device is made with C-MOS circuitry. Please take precautions to prevent damage due to static discharge.
• We recommend placing a 0.1μF capacitor and a 1 to 10μF capacitor next to RTC-72421 to protect against power line ripple. And start-up time of input voltage is greater than 1msec.
• Standard ultrasonic cleaning can be used on the RTC-62421, but please exercise caution in choosing a cleaning solution as the RTC-72421 could be damaged.

(V_{DD}=5V±0.5V, Ta=–10~70°C

REAL TIME CLOCK MODULE 65271





FEATURES

- A built-in crystal resonator makes the product efficient and adjustment-free.
- A builtin power supply switching circuit makes it possible to provide automatic power supply backup toboth the RTC and extended RAM.
- Extended RAM: 4K-bytes of built-in SRAM
  Page register: 1 byte
  Configuration: 32 bytes × 128 pages
- The real-time clock block consists of:
  Indirect register: 1 byte
  Clock, alarm, calendar: 10 bytes
  Control register: 4 bytes
  User RAM: 50 bytes
- Adoption of a nonmultiplex bus makes direct connection with the CPU bus of an 80286 • 80386 or later CPU possible.
- The package is a 28-pin DIP IC with a battery holder that makes batery replacement possible.

Operating Conditions

Item	Symbol	MIN	TYP	MAX	Unit	Remarks
Supply voltage	VDD	4.5	5.0	5.5	V	Between VDD and VSS
Operating temperature	TOPR	-10	--	+70	°C	

Electrical Characteristics

Item	Symbol	Conditions	MAX	Unit
Frequency tolerance	Δf/fo	Ta-25°C VDD=5.0V	5±20	ppm
Aging	fa	Ta=25°C, VDD = 5.0V, first year	±5	ppm/y
Temperature characteristics	top	VDD = 5.0V, TQ = –10 to 70°C	+10 -120	ppm
Voltage characteristics	fv	VDD = 3V, TA=stable	±5	ppm

Characteristic	Symbol	Test Conditions	MIN	TYP	MAX	Unit
Input voltage (high level)	V_{IH}		2.2		VDD+0.3	V
Input voltage (iow level)	V_{IL}		–0.3		0.8	V
Input leak current	I_L	RESET, RD, WR, RTC, XRAM, DO-D7 AO-A5			±1	μA
Output voltage (high level)	V_{OH}	V_{DD} - 5.0V I_{LOAD} = 4.0 mA V_{DD} - 5.0V	2.4			V
Output voltage (low level)	V_{OL}	I_{LOAD} = 4.0 mA			0.4	V
Power supply current	I_{DD}	Outputs unloaded			15	mA
Current when using batter backup	I_{BAT}	Ta=25°C		0.5	1 0	μA
Input current	I_{STBY}	STBY=V_{SS}			2	μA

AT/XT COMPATIBLE

Product	Package Type	Extended Alarm	Battery Holder
RTC6581	DIP	Not Available	Integral
RTC6583	SOP	Not Available	Absence
RTC6587	PLCC	Not Available	Absence
RTC6591	DIP	Available	Integral
RTC6593	SOP	Available	Absence
RTC6597	PLCC	Available	Absence

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PRODUCT SELECTION GUIDES

TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 93/94 EDITION OF EEM

AC Power Supplies, Product Selection Guide	D•2221
Batteries, Product Selection Guide	D•1419
Cabinets, Enclosures, Racks & Chassis, Product Selection Guide	C•1003
Capacitors, Product Selection Guide	A•1003
Coils, Chokes, Inductors, Product Selection Guide	A•1179
Connectors, Terminals & Sockets, Product Selection Guide	C•1139
Cores, Magnets & Ferrites	A•1317
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide	A•1326
DC-DC Converters	D•2049
DC Power Supplies, Product Selection Guide	D•1488
Delay Lines, Product Selection Guide	A•1513
Discrete Semiconductors, Product Selection Guide	A•2130
Displays, Readouts, & CRTs, Product Selection Guide	B•1017
Fans, Blowers, Cooling Equipment, & Heat Exchangers, Product Selection Guide	C•1557
Fiber Optics, Product Selection Guide	B•1200
Filters, Power, Product Selection Guide	A•1584
Filters, Signal, Product Selection Guide	A•1617
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Interconnection Systems, Product Selection Guide	C•1670
Keyboards & Keypads, Product Selection Guide	B•1818
Lamps, Lights, & Indicators, Product Selection Guide	B•1131
Microwave Components, Product Selection Guide	A•1719
Military Qualified Products List	B•1002
Motors, Drives, & Rotating Components, Product Selection Guide	B•1231
Oscilloscopes, Product Selection Guide	D•1402
Panel Hardware, Product Selection Guide	C•1522
Panel Meters, Analog & Digital, Product Selection Guide	D•1336
Potentiometers, Trimmers, Controls, & Rheostats, Product Selection Guide	A•2053
Power Supplies, AC, Product Selection Guide	D•2221
Power Supplies, DC, Product Selection Guide	D•1488
Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide	B•1341
Relays, Product Selection Guide	B•1401
Resistors, Product Selection Guide	A•1859
Solenoids, Product Selection Guide	B•1626
Switches, Product Selection Guide	B•1658
Thermal Components, Product Selection Guide	B•1857
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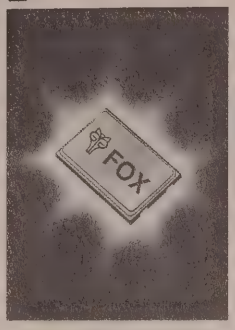
FOX SURFACE MOUNT CRYSTALS

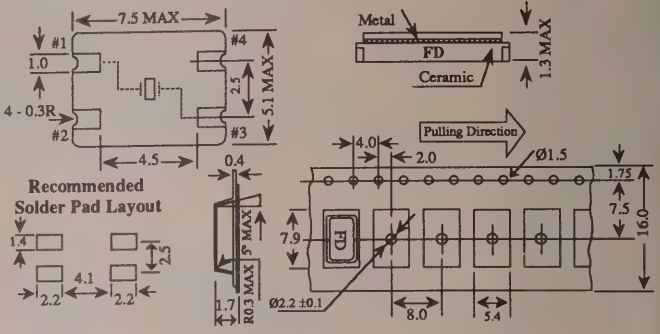


The FD, our smallest SMD Crystal, features 1.3 mm height.

Freq. Range	14 - 100 MHz
Freq. Tolerance	±50PPM @ 25°C
Freq. Stability	±50PPM
Temp. Range	-10°C to +60°C

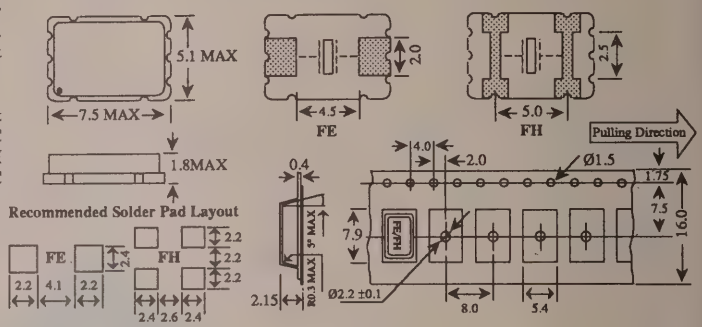
Pin Connections

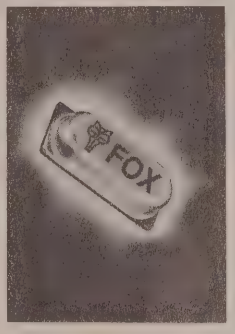
#1 Crystal	#4 GND (Case)
#2 GND (Case)	#3 Crystal



The FE/FH Series offers a low cost epoxy sealed package with a 1.8 mm height and two different land patterns.

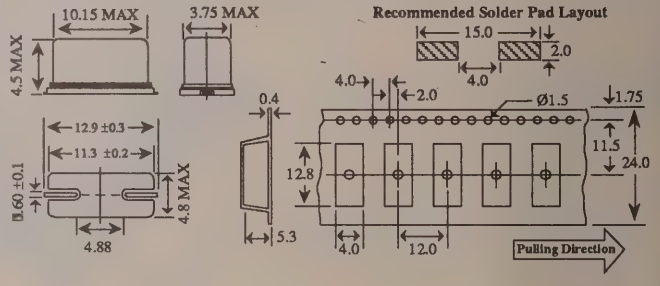
Freq. Range	10 - 100 MHz
Freq. Tolerance	±50PPM @ 25°C
Freq. Stability	±50PPM
Temp. Range	-10°C to +60°C





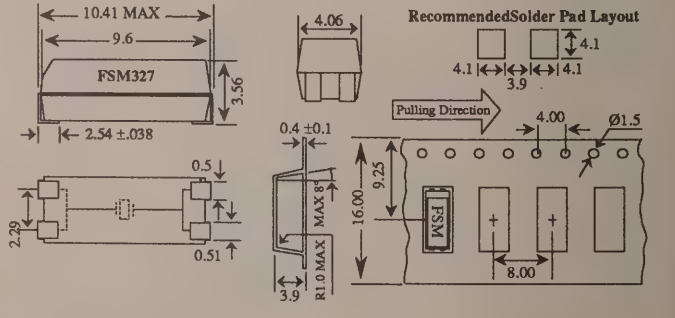
The HC49SD "AT Strip" Crystal provides a low profile, wide frequency range, and a miniature solder pad layout contained in a metal can.

Freq. Range	3.2 - 70 MHz
Freq. Tolerance	±30PPM @ 25°C
Freq. Stability	±50PPM
Temp. Range	0°C to +70°C



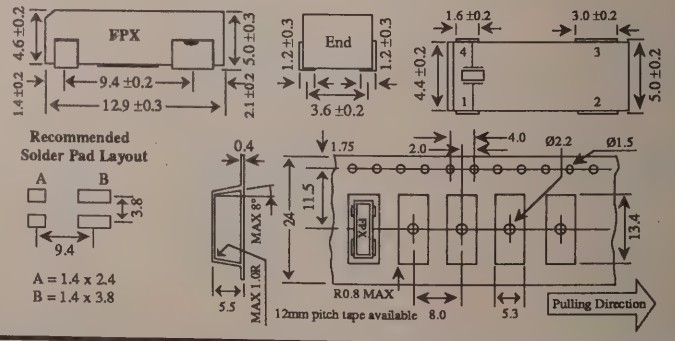
The FSM327 is our SMD Watch Crystal encased in a thermoplastic package built to withstand high temperature soldering techniques.

Frequency	32.768 kHz
Freq. Tolerance	±20PPM @ 25°C
Temp. Range	-40°C to +85°C
Load Capacitance	12.5 pF (std)



The FPX Crystal features a 5 mm profile and is a cost saving design.

Freq. Range	3.579545 - 70 MHz
Freq. Tolerance	±50PPM @ 25°C
Freq. Stability	±100PPM
Temp. Range	-10°C to +70°C
(Select Freq.)	-40°C to +85°C



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SURFACE MOUNT OSCILLATORS

F4000 - 3.3 Volt

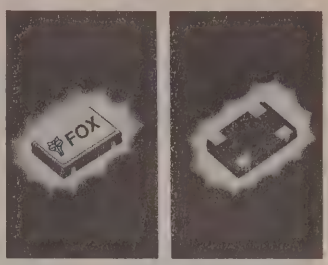
The F4000 is our new low-voltage oscillator. Among the many benefits of a 3.3V system are an increase in battery life, reduced heat generation and improved EMI, packaged with the low profile necessary for today's advanced portable PC and instrumentation designs.

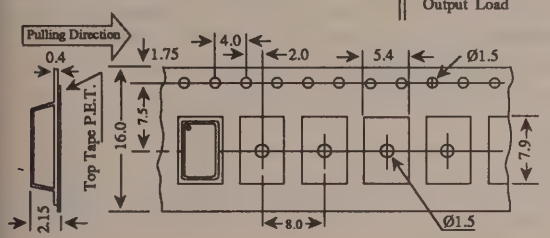
Frequency Range	1.8432 ~ 50.000 MHz
Frequency Stability	±100PPM
Operating Temperature	-10°C to +70°C
Input Current	
1.8432 ~ 32.000 MHz	12.0 mA MAX
32.000+ ~ 50.000 MHz	16.5 mA MAX
Symmetry	45/55% MAX
Rise/Fall Time	7 ns MAX
Output Load - HCMOS	15 pF

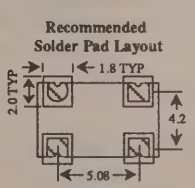
F3345/F3355 - 5 Volt

The F3345/F3340 & F3355/F3350 are ceramic oscillators, perfect for applications such as miniature computers and peripherals, telecommunication devices and instrumentation. Featuring tri-state enable/disable, high capacitive load option, and low EMI.

	F3345	F3355
Frequency Range	1.8432 ~ 67 MHz	1.8432 ~ 50 MHz
Frequency Stability	±100PPM (F3345) ±50PPM (F3340)	±100PPM (F3355) ±50PPM (F3350)
Operating Temperature	-10°C to +70°C	-10°C to +70°C
Input Current		
1.8432 ~ 25 MHz	25 mA MAX	20mA MAX
25 ~ 50 MHz	45 mA MAX	35mA MAX
50 ~ 67 MHz	60 mA MAX	------
Symmetry @ 2.5 VDC	45/55% MAX	45/55% MAX
Rise/Fall Time	7 ns MAX	10 ns MAX
Output Load	10 TTL or 50 pF	10 LS-TTL or 15 pF

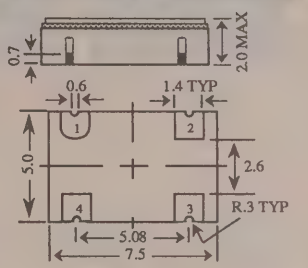






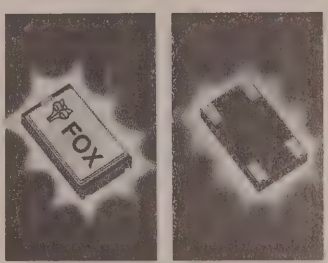
F4000
Pin Connections
#1 E/D #3 OUTPUT
#2 GND #4 3.3VDC

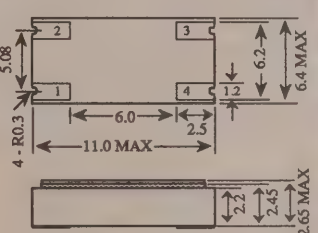
F3345/F3355
Pin Connections
#1 E/D #3 OUTPUT
#2 GND #4 5VDC



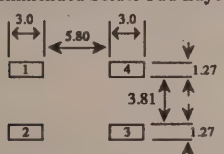
The F3160 / F3170 & F3165 / F3175 are ceramic oscillators which can drive both HCMOS and TTL loads in high density applications. Features include tri-state enable/disable, industry compatible pinout, and low noise.

	F3160	F3165
Frequency Range	1.8432 - 100 MHz	1.8432 - 50 MHz
Frequency Stability	±100PPM (F3160) ±50PPM (F3170)	±100PPM (F3165) ±50PPM (F3175)
Operating Temperature	-10°C to +70°C	-10°C to +70°C
Input Current		
1.8432 ~ 25 MHz	25 mA MAX	20 mA MAX
25 ~ 50 MHz	45 mA MAX	35 mA MAX
50 ~ 70 MHz	70 mA MAX	-----
70 ~ 100 MHz	80 mA MAX	-----
Symmetry @ 2.5 VDC	40/60% MAX	45/55% MAX
Rise/Fall Time		
1.8432 ~ 70 MHz	7 ns MAX	10 ns MAX
70+ ~ 100 MHz	3ns MAX	-----
Output Load		
1.8432 ~ 70 MHz	10 TTL	10 LSTTL
1.8432 ~ 100 MHz	50 pF	15 pF

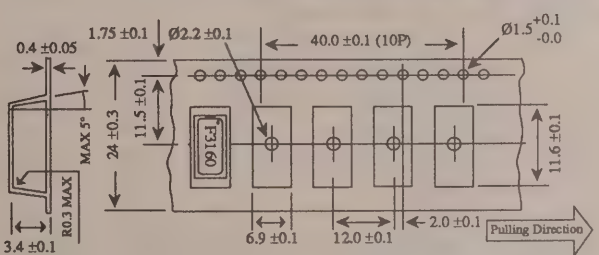




Recommended Solder Pad Layout

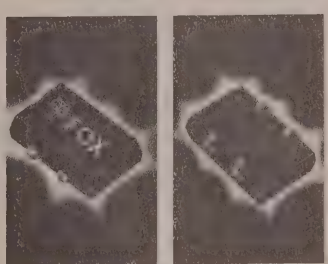


Pin Connections
#1 E/D #3 Output
#2 GND #4 +5 VDC

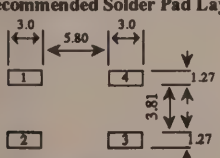


The FSO Series Oscillator is compatible with both TTL and HCMOS technologies. Features include extended temperature range, 5000 G shock resistance, and tri-state enable/disable option. Enable option FSO-2, FSO-2T, and FSO-2H.

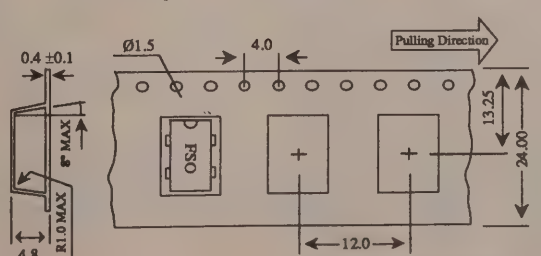
	FSO / FSO-2	FSO-T/FSO-2T	FSO-H	FSO-2H
Frequency Range	1.025 - 26 MHz	26 - 36 MHz	30 - 55 MHz	26 - 66.667 MHz
Frequency Stability				
-10°C to +70°C	±100PPM	±100PPM	±100PPM	±100PPM
-40°C to +85°C	±200PPM	±200PPM		
Input Current				
No Load	23 mA MAX	35 mA MAX	35 mA MAX	35 mA MAX
Disabled (-2, -2T, -2H only)	12 mA MAX	20 mA MAX	--------	20 mA MAX
Symmetry	40/60% MAX	40/60% MAX	40/60% MAX	40/60% MAX
Rise/Fall Time	8 ns MAX	10 ns MAX	7 ns MAX	7 ns MAX
Output Load	10 TTL or 50 pF	10 TTL or 30 pF	10 LS-TTL or 50 pF	50 pF

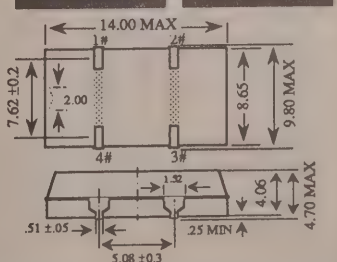


Recommended Solder Pad Layout



Pin Connections
#1 E/D or N.C. #3 Output
#2 GND #4 +5 VDC





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PROGRAMMABLE CRYSTAL OSCILLATORS

F6053A

F6151

F6053A FREQ. RANGE .360kHz ~ 120MHz
F6151 FREQ. RANGE .320kHz ~ 115MHz

Tri-State - Low Power - High Speed CMOS Technology
No External Components Necessary
Surface Mount in Development

Fox Programmable Oscillators offer convenience with space & power savings for applications such as Computers and Peripherals, Graphic Board Dot Clocks, R.F. Designs, and Variable Frequency Environments

Fox Electronics is now offering two models of synthesizers with built in quartz crystals. The F6151 has two programmable outputs from .320 - 115 MHz. Three other outputs are available from the CLKA/2, CLKA/4 and FREF pins. The F6053A has a single output with a frequency range of .360 - 120 MHz.

Some RF applications for the devices include:

1. Adjustable reference frequency for prototyping & testing.
2. Low cost sweep generator for scanners & etc.
3. Frequency hopping - agile carrier for secure communication applications.
4. Power conservation for portable systems on standby.
5. Systems that require multiple frequency standards for international sales.

Other applications using the programmable oscillators are:

1. Hard disk drives - to vary frequency according to the radius of the drive to allow storage of up to one-third more data.
2. Laptop computer - to slow the oscillator speed to produce less power consumption, or speed it up to produce higher performance.
3. Graphic board dot clocks - to allow dynamic synchronization of different monitors or display resolutions.
4. On-board test strategies - to skew a system's desired frequency (eg ±10%) in worst case evaluations.

The hybrid's output is based on a phase-locked loop oscillator input derived from an internal 14.31818 MHz reference clock. The output is programmed via two wire serial inputs, and can be set to the reference frequency during frequency change so that the output signal will transfer, glitch-free, from the old frequency to the new one. Setting time between frequency transitions is less than 10ms

The F6053A/F6151 oscillator's programmable 3-state output operation supports "wired-OR" connections between external clock lines. Output frequencies are limited by the particular target output, but are generally within 0.1% of the desired frequency. With a well-regulated input voltage, the voltage-controlled oscillator (VCO) quickly locks onto the reference frequency, and produces an output oscillation almost as stable as the input reference with respect to time and temperature.

Short term stability (a.k.a. jitter) is measured by how the VCO keeps pace or slows down to maintain lock with the reference frequency. Testing on a range of mother boards and graphics cards has shown the jitter rate to be acceptable for normal operation, even in those boards and cards designed for single frequency operation. Jitter is less that 500 ps.

Reasonably priced evaluation kits are available now. Typical test hardware needed includes a 5VDC source, an IBM compatible PC with 3.5" floppy drive & VGA monitor, and an oscilloscope. Our kits include a test board, oscillator, software & data sheets containing all the timing diagrams and programming examples needed for firmware engineering. Call now to order your kit. **Kit with 1 oscillator $25.00**
Kit with 2 oscillators $35.00

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FOX CRYSTALS

FC -- Surface Mount 10 - 70MHz

FD -- Surface Mount 14 - 100MHz

FE /FH -- Surface Mount 10 - 100MHz

FSM-327 -- Surface Mount 32.768kHz

FPX -- Surface Mount 3.579545 - 70MHz

HC49S -- 3.2 - 70MHz - SM Option HC49SD

HC49U -- 1.5 - 175MHz - SM Option HC49U-W

NC26 -- Tuning Fork 32.768kHz

NC26S -- Tuning Fork 20kHz to 163kHz

NC38 -- Tuning Fork 32.768kHz

FX-3 -- 3.2 - 70MHz

HC80 -- 1 - 1.048576MHz, 3.579545 - 200MHz

HC51U -- 245kHz - 4.8MHz

FOX OSCILLATORS

F1100H -- TTL 1.8432 - 80MHz 14 Pin Dip Metal Package

F1100HT -- TTL Tri-State 70 - 110MHz 14 Pin Dip Metal Package

F1100E -- TTL 1.0 - 100MHz 14 Pin Dip Metal Package

F3000 / F3020 -- HCMOS / TTL Tri-State
Enable/Disable 10 TTL/50 pF Load 1.8432 -110MHz
14 Pin Dip Metal Package & Half Size 8 Pin Dip Metal Package

F3240/F3260 -- HCMOS/TTL 1.8432 - 67MHz
3 Pin "AT" Strip - Miniature Size

F3160/F3170 -- HCMOS/TTL 1.8432 - 100MHz SMT Ceramic Pkg
F3165//F3175 -- HCMOS/TTL 1.8432 - 50MHz SMT Ceramic Pkg

F3345/F3340 -- HCMOS/TTL 1.8432 - 67MHz SMT Ceramic Pkg
F3355/F3350 -- HCMOS/TTL 1.8432 - 50MHz SMT Ceramic Pkg

NEW F4000 -- 3.3 Volt Low Power
1.8432 - 50MHz SMT Ceramic Package

FSO -- HCMOS /TTL Tri-State 1.025 - 66.667MHz
Surface Mount Plastic Package

P5C -- HCMOS & TTL 1.025 - 66.667MHz
4 & 14 Pin Dip Plastic Package Tri-State E/D Option

H5C -- HCMOS .50 - 90MHz
Half Size 8 Pin Dip Metal Package

H5C-2 -- HCMOS/TTL Tri-State 1.8432 - 70MHz
Half Size 8 Pin Dip Metal Package
'1' Enable / '0' Disable Option

F5C -- HCMOS 4 - 50MHz 14 Pin Dip Metal Package

F5C-2 -- HCMOS/TTL Tri-State '1' Enable / '0' Disable
14 Pin Dip Metal Package 1.8432 - 70MHz

F5C-7 -- HCMOS Independent Dual Frequency
14 Pin Dip Metal Package Output 1: 12 - 32Mhz 2: 8.0 - 50MHz

F5L -- ECL 30 - 200MHz 14 Pin Dip Metal Package

VCXO-B -- Voltage Controlled 1 - 24MHz & 44.736MHz
14 Pin Dip Metal Package

TCXO -- Temperature Compensated 5 - 60 MHz

NEW F6053A / F6151 Programmable Oscillator
.320 - 120MHz

Fast Fox
Quality Quick

LET FAST FOX HELP YOU WITH YOUR "RUSH" REQUIREMENTS

Delivery: From 3 to 15 working days
Frequencies: 3-27MHz Fundamental Crystals
30 - 60MHz 3rd Overtone Crystals
F1100E 4-25MHz Oscillators
F1100H 4-70MHz Oscillators
H5C-2 1.8432-50MHz Oscillators
F5C-2 1.8432-50MHz Oscillators
F3020 1.8432-70MHz Oscillators *
F3000 1.8432-70MHz Oscillators *
Quantity: Call for pricing & delivery confirmation
* Select frequencies betwen 60 ~ 70MHz

FOX STANDARD CRYSTALS

FREQUENCY	*CL*	*49U / PART#*	*49S / PART#*	*FPX / PART#*
1.000 MHz	SERIES	FOX010S	----	----
1.8432 MHz	13 pF	FOX018S	----	----
2.000 MHz	20 pF	FOX020S	----	----
2.097152 MHz	20 pF	FOX021S	----	----
2.4576 MHz	32 pF	FOX024S	----	----
3.000 MHz	32 pF	FOX030S	----	----
3.2768 MHz	18 pF	FOX032S	----	----
3.579545 MHz	18 pF	FOX036S	FOXS/036S	FPX036S
3.6864 MHz	SERIES	FOX0368S	FOXS/0368S	FPX0368S
3.6864 MHz	20 pF	FOX0368-20	FOXS/0368-20	FPX0368S-20
4.000 MHz	SERIES	FOX040A	FOXS/040A	FPX040A
4.000 MHz	20 pF	FOX040	FOXS/040	FPX040
4.032 MHz	22 pF	FOX0432	----	FPX0432
4.194304 MHz	12 pF	FOX041	FOXS/041	FPX041
4.433619 MHz	20 pF	FOX0443	FOXS/0443	FPX0443
4.9152 MHz	SERIES	FOX049	FOXS/049	FPX049
4.9152 MHz	20 pF	FOX049-20	FOXS/049-20	FPX049-20
5.000 MHz	20 pF	FOX05A	FOXS/05A	FPX05A
5.0688 MHz	SERIES	FOX050	FOXS/050	FPX050
5.185 MHz	20 pF	----	----	FPX051
6.000 MHz	SERIES	FOX060	FOXS/060	FPX060
6.000 MHz	20 pF	FOX060-20	FOXS/060-20	FPX060-20
6.144 MHz	30 pF	FOX061	FOXS/061	FPX061
6.144 MHz	20 pF	FOX061-20	----	----
6.5536 MHz	20 pF	----	----	FPX065
7.3728 MHz	SERIES	FOX073	FOXS/073	FPX073
7.3728 MHz	20 pF	FOX073-20	FOXS/073-20	FPX073-20
8.000 MHz	SERIES	FOX080	FOXS/080	FPX080
8.000 MHz	20 pF	FOX080-20	FOXS/080-20	FPX080-20
8.192 MHz	SERIES	FOX081	FOXS/081	----
8.192 MHz	20 pF	FOX081-20	FOXS/081-20	----
9.600 MHz	SERIES	FOX096	----	----
9.8304 MHz	SERIES	FOX098	FOXS/098	----
9.8304 MHz	20 pF	FOX098-20	FOXS/098-20	----
10.000 MHz	SERIES	FOX100	FOXS/100	FPX100
10.000 MHz	20 pF	FOX100-20	FOXS/100-20	FPX100-20
10.738635 MHz	SERIES	----	----	FPX107
10.738635 MHz	20 pF	----	----	FPX107-20
11.000 MHz	SERIES	FOX111	FOXS/111	FPX111
11.000 MHz	20 pF	FOX111-20	FOXS/111-20	FPX111-20
11.0592 MHz	SERIES	FOX115	FOXS/115	FPX115
11.0592 MHz	20 pF	FOX115-20	FOXS/115-20	FPX115-20
12.000 MHz	SERIES	FOX120	FOXS/120	FPX120
12.000 MHz	20 pF	FOX120-20	FOXS/120-20	FPX120-20
12.288 MHz	SERIES	FOX128	FOXS/128	FPX128
12.288 MHz	20 pF	FOX128-20	FOXS/128-20	FPX128-20
14.31818 MHz	SERIES	FOX143	FOXS/143	FPX143
14.31818 MHz	20 pF	FOX143-20	FOXS/143-20	FPX143-20
14.7456 MHz	SERIES	FOX147	FOXS/147	FPX147
14.7456 MHz	20 pF	FOX147-20	FOXS/147-20	FPX147-20
15.000 MHz	SERIES	FOX150	----	FPX150
15.000 MHz	20 pF	----	----	FPX150-20
16.000 MHz	SERIES	FOX160	FOXS/160	FPX160
16.000 MHz	20 pF	FOX160-20	FOXS/160-20	FPX160-20
18.000 MHz	SERIES	FOX180	----	FPX180
18.000 MHz	20 pF	----	----	FPX180-20
18.432 MHz	SERIES	FOX184	FOXS/184	FPX184
18.432 MHz	20 pF	FOX184-20	FOXS/184-20	FPX184-20
19.6608 MHz	SERIES	FOX196	FOXS/196	FPX196
19.6608 MHz	20 pF	FOX196-20	FOXS/196-20	FPX196-20
20.000 MHz	SERIES	FOX200	FOXS/200	FPX200
20.000 MHz	20 pF	FOX200-20	FOXS/200-20	FPX200-20
22.1184 MHz	SERIES	FOX221	FOXS/221	FPX221
22.1184 MHz	20 pF	----	FOXS/221-20	FPX221-20
24.000 MHz	SERIES	FOX240F	FOXS/240F	FPX240F
24.000 MHz	20 pF	FOX240F-20	FOXS/240F-20	FPX240F-20
24.000 MHz *	SERIES	FOX240	----	----
32.000 MHz *	SERIES	FOX320	----	----
32.000 MHz *	20 pF	FOX320-20	----	----
100.000 MHz **	SERIES	FOX1000	----	----

* 3rd overtone ** 5th overtone

2/2/93

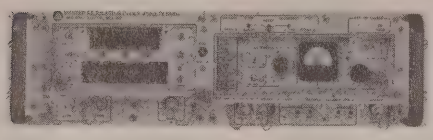
Frequency Electronics

From the basic quartz crystal, to complete time and frequency systems.

Timekeeper for Outer Space... Ask anyone who knows anything about this nation's deep space probe and satellite programs to mention any 10. Our instruments or equipment are aboard at least 8.

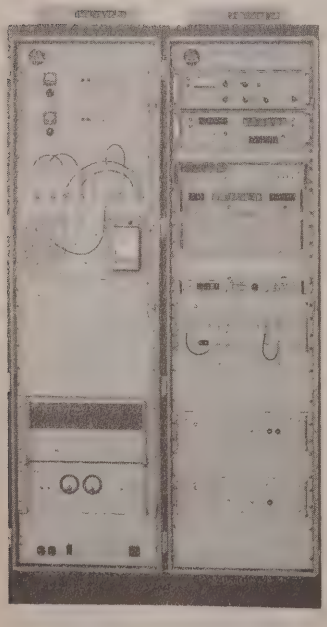
Hybridized Cesium Beam Primary Frequency Standard

Model FE-5440A, Option FH
Military Nomenclature (0-1824A/U)



High Reliability, Militarized Cesium Beam Frequency Standards for aerospace, shipboard, laboratory and mobile applications.

Systems Capability



Communication Time and Frequency Standards
Model FE-5054A
(CTFS)

Frequency Distribution Systems

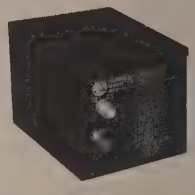
Models FE-798A/FE-799A

A militarized, high reliability RF distribution system for satellite ground stations, and shipboard, mobile, and laboratory applications.

Rubidium Standard

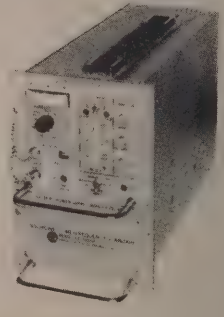
- MIL-E-5400, Class II
- Fast Warm-up
- MIL-SPEC Power
- Low g Sensitivity

Model FE-5600A



Instruments

Disciplined Time Frequency Standard
Model FE-1050A
(AN/URQ-23)



Low Noise, High Isolation Signal Distribution Systems
Model FE-7913A
Model FE-7914A

FREQUENCY ELECTRONICS, INC.
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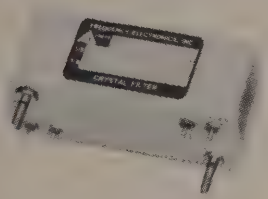
516-794-4500 • FAX: 516-794-4340

Frequency Electronics

Quartz Oscillators — Rubidium Standards Cesium Standards Complete Systems

Crystal Filters And Discriminators



Class S & B Custom Hybrid Capability

Multiple Technologies - DC to 22 GHz

Thick Film - DC to 2.5 GHz
Thin Film - 100 MHz to 22 GHz
Microwave, RF, Power,
Analog, Digital
MIL-M-38510 Level "S"
or Level "B"

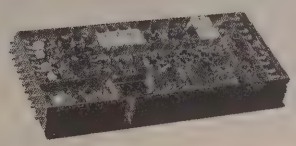
MCXO

Microcomputer Compensated Crystal Oscillator

1.5″ x 2.7″ x 0.7″

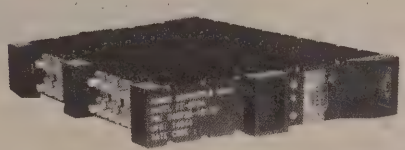
- Power as low as 20 mW
- Stability to 3 x 10^{-8}
- Operating Temp. −55°C to +85°C

Satellite Frequency Generation And Distribution Equipment



Frequency synthesis, processing, and distribution of low noise reference signals have been applied to the development of high reliability hardware for satellite applications. Precision oscillators and distribution equipment configured as redundant assemblies are presently being used on a wide variety of space programs. FEI's high reliability hybrid techniques result in light weight and low power consumption.

DC/DC Converter

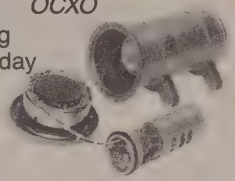


- S Level
- 1 W-100W Output Power
- Multiple Output Capability
- Custom Designs

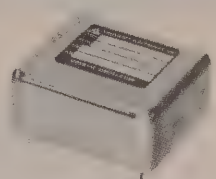
High Reliability Crystal Oscillators

OCXO

Daily Aging
<1 x 10^{-11}/day

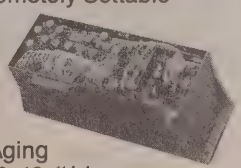


TCXO and TCVCXO



Temperature Compensated/
Voltage Controlled
Crystal Oscillators

Space Application
High Stability
Remotely Settable



Daily Aging
< 2 to 3x10^{-11}/day

Fast Warm-Up
Miniature OCXO

- Warm-up to stabilized frequency of 1x10^{-7} in < 1 min. (−55°C to +85°C)
- Low steady state power: 1.8W @ −55°C
- Small size: 3″ x 1″ x 1″

INSTRUMENTS
Disciplined Time Frequency Standards
High Stability Frequency Standards
Digital Phase Comparators
Frequency Error Analyzers
Distribution Amplifiers
Passive Combiners • Digital Clocks
Microwave Frequency Multipliers

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Ovenized Voltage Controlled Crystal Oscillators
Temperature Compensated Voltage Controlled Crystal Oscillators
Non-Ovenized Crystal Oscillators
Precision Low Power Oscillators

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Band Reject Crystal Filters
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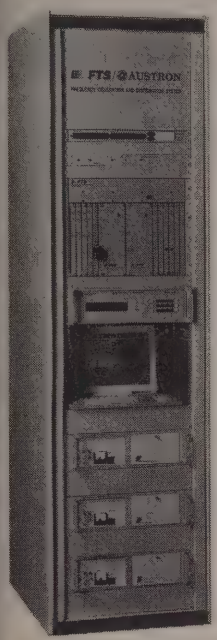
SYSTEMS



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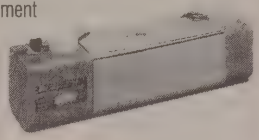
- Metrology Laboratories
- Range Timing Systems

NEW REPLACEMENT TUBES

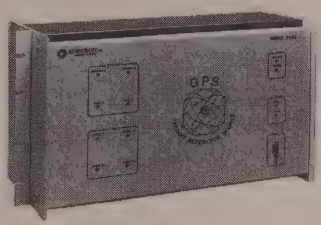
Replacement tubes are now available for most major Cesium Beam Tube manufacturers such as HP, NEC, and FEI.

- Meets or exceeds original specifications of existing equipment
- No mechanical modifications to existing equipment
- 8-year extended tube warranty
- Low cost



PRIMARY REFERENCE SOURCES

FTS/AUSTRON offers the widest PRS Product Line in the industry. Choose between Loran, GPS, or Cesium based references, all are designed and manufactured entirely at FTS and AUSTRON.



- Crystal oscillators or Rubidium
- Single and Multi-station tracking units available
- GPS based models can be upgraded to include Loran
- Loran based models can be upgraded to include GPS
- RS-232 Remote Interface
- Cesium models offer 8-year tube warranty
- Many options and configurations to choose from

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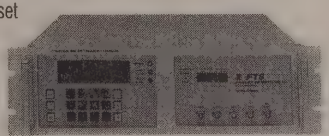
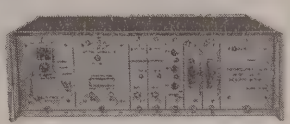
Cesium, Rubidium, or Crystal Frequency Sources are available to meet the most demanding requirements for precision time and frequency, such as the FTS 4065 MASTER CESIUM AND TIME STANDARD shown below.

- Accuracy of $\pm 5 \times 10^{-12}$ over full temperature range of 0 to 50°C
- Ideal for networks and computer based systems
- Programmable phase/frequency offset
- RS-232 Remote Interface
- Fully automated



SIGNAL GENERATION AND DISTRIBUTION



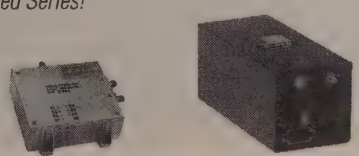
- Variety of frequencies
- Special low noise designs
- Sine and TTL RS-232 outputs
- DS0, DS1, and DS3 telecommunication clock signals

TIMECODE

AUSTRON has a complete line of instruments from basic generators and readers to full complement tape search and control units. Available for bench, panel, rack or portable. All standard IRIG, XR3 and NASA codes are available.

OSCILLATORS

FTS manufactures a wide variety of precision, ovenized crystal oscillators qualified for commercial, military and space aplications. *Ask about the 9300 and 9400 Space Qualified Series!*



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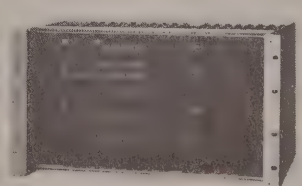
- Test Set independent
- Covers T1E1, all data circuits, two and four wire VF circuits
- Microsoft® Windows™ interface



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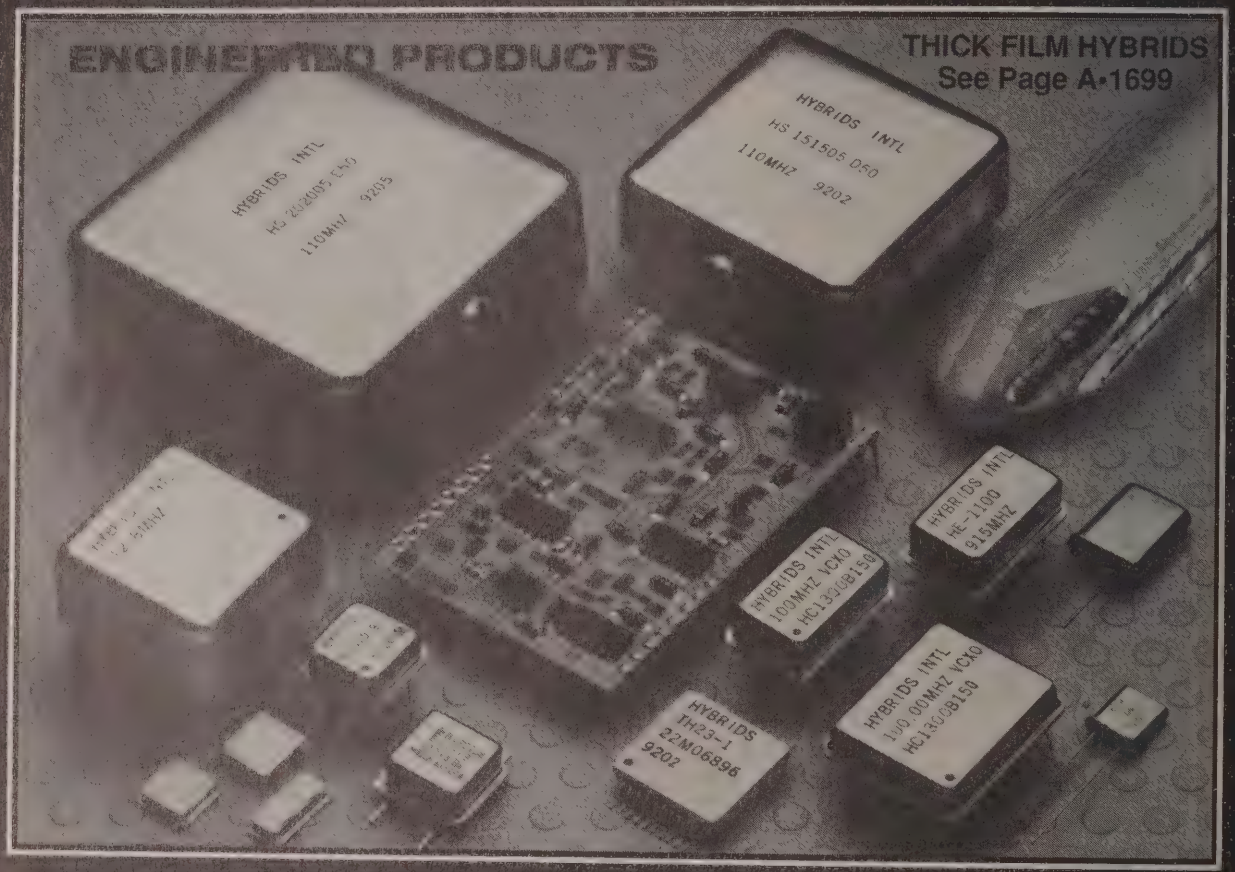

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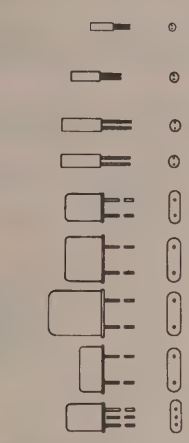
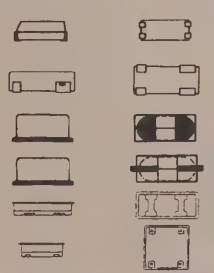
145STF, X CUT, D = 1.5, L = 5.0 mm	32.768 KHz, ±20 ppm at 25°C, CL=12.5 pF, 50K ohms, (AVAILABLE - 200 KHz)
26STF, X CUT, D = 2.0, L = 6.0 mm	25-760 KHz, ±20 ppm at 25°C, CL=12.5 pF, 50K ohms, (AVAILABLE - AT CUT 14.2 - 17.7 MHz)
38STF, X CUT, D = 3.0, L = 8.0 mm	25-760 KHz, ±20 ppm at 25°C, CL=12.5 pF, 30K ohms
39M, AT CUT, D = 3.0, L = 9.0 mm	3.5-25 MHz, ±30 ppm at 25°C, ±50 ppm (-20 to 70°C) (AVAILABLE 3RD OT 25-64 MHz)
HC-45/UM-1, AT CUT, L=7.8, W=3.1, H=8.0 mm	1.0-200 MHz, ±30 ppm at 25°C, ±50 ppm (-20 to 70°C)
HC-49/u-M, AT CUT, L=11.2, W=4.8, H=7.7 mm	3.5-75 MHz, ±30 ppm at 25°C, ±50 ppm (-20 to 70°C)
HC-49/u, AT CUT, L=11.2, W=4.8, H=13.5 mm	1.0-200 MHz, ±30 ppm at 25°C, ±50 ppm (-20 to 70°C)
HC-49/U-4H, AT CUT, L=11.2, W=4.8, H=3.5 mm	3.27-25 MHz, ±30 ppm at 25°C, ±50 ppm (-20 to 70°C)
MONOLITHIC CRYSTAL FILTERS HC-49/u, 45/UM-1	10.7, 21.4, 36, 45, 55, 58, 70, 90 MHz



CUSTOMER SERVICE — SURFACE MOUNT — ENGINEERING EXCELLENCE

32SMX, X CUT, L=10.41, W=4.01, H=3.56 mm	32.768 KHz, ±100 ppm, CL=12.5 pf, 50K ohms
86SMX, AT CUT, L=13.1, W=5.0, H=5.0 mm	3.57-25 MHz, ±30 ppm at 25°C, ±50 ppm (-20 - +70°C) (HIGHER FREQ. AVAILABLE 3RD OT)
49USMX(4H-SB), AT CUT, L=11.6, W=5.7, H=4.5 mm	3.57-25 MHz, ±30 ppm at 25°C, ±50 ppm (-20 - +70°C) (HIGHER FREQ. AVAILABLE 3RD OT)
49USMX(4L-LB), AT CUT, L=11.4, W=5.7, H=4.0 mm	3.57-25 MHz, ±30 ppm at 25°C, ±50 ppm (-20 - +70°C) (HIGHER FREG. AVAILABLE 3RD OT)
53SMX, AT CUT, L=10.7, W=4.7, H=2.5 mm	3.50-25 MHz, ±30 ppm at 25°C, ±100 ppm (-20 - +70°C)
83SMX, AT CUT, L=7.7, W=7.7, H=2.3 mm	4.0-175 MHz, ±30 ppm at 25°C, ±50 ppm (-20 - +70°C)



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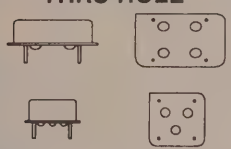
THRU-HOLE

HT/C/E11XX-F FULL SIZE L=20.8, W=11.0, H=5 mm
LOW PROFILE AVAILABLE SEATED H=4.5 mm
14 PIN DIP METAL PACKAGE

HT/C/E11XX-H HALF SIZE L=13.2, W=13.2, H=5 mm
8 PIN DIP METAL PACKAGE



LOW POWER CMOS	.1 Hz to 2 MHz
STANDARD CMOS	.1 Hz to 12 MHz
HIGH SPEED HCMOS	.1 Hz to 120 MHz
TTL	.1 Hz to 120 MHz
ECL	.20 MHz to 650 MHz
ECL HALF SIZE	.20 MHz to 150 MHz
INDEPENDENT DUAL	.1 Hz to 120 MHz (F/S ONLY)

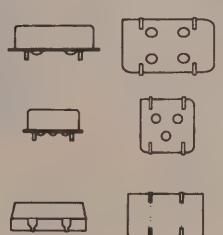
TRI-STATE, ENABLE/DISABLE - REF. HIGH OR LOW

DISCIPLINED QUALITY — SURFACE MOUNT — COST EFFECTIVE

HT/C/E11XX-F FULL SIZE GULL WING L=20.8, W=11.0, H=5.0 mm 14 PIN DIP METAL PACKAGE

HT/C/E11XX-H HALF SIZE GULL WING L=13.2, W=13.2, H=5.0 mm 8 PIN DIP METAL PACKAGE

HT/C11XX-SJ L=14.0, W=9.80, H=4.70 mm
SURFACE MOUNT PLASTIC PACKAGE



LOW POWER CMOS	.1 Hz to 2 MHz
STANDARD CMOS	.1 Hz to 12 MHz
HIGH SPEED HCMOS	.1 Hz to 120 MHz
TTL	.1 Hz to 120 MHz
ECL	.20 MHz to 650 MHz
ECL HALF SIZE	.20 MHz to 150 MHz
INDEPENDENT DUAL	.1 Hz to 120 MHz (F/S ONLY)

TRI-STATE, ENABLE/DISABLE - REF. HIGH OR LOW

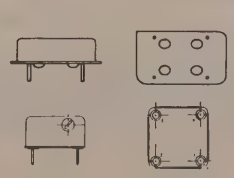
TTL 1.5 MHz to 36 MHz
HCMOS 1.5 MHz to 55 MHz
TRI-STATE, ENABLE/DISABLE - REF. HIGH OR LOW

JUST IN TIME DELIVERY — TCXO-VCXO — ADVANCED TECHNOLOGY

HT/C13XX-FULL SIZE VCXO L=20.8, W=11.0, H=5.0 mm
(GULL WING AVAILABLE)

HT/14XX-FULL SIZE TCXO L=20.8, W=11.0, H=5.0 mm
(GULL WING AVAILABLE)

HT/HC/HEI"XI":SQUARE SIZE TCXO L=25.4, W=25.4, H=12.7 mm



TTL OR HCMOS, 1-40 MHz. DEVIATION (50: ±50 ppm) (100: ±100 ppm) (150: ±150 ppm)

TTL OR HCMOS, 1-40 MHz ±10 ppm (0 - 70°C) to ±1 ppm (0 to 50°C)

TTL, HCMOS OR ECL, 500 Hz to 40 MHz, ±1 ppm w/5V, ±2 ppm w/10V, ±5 ppm w/12V

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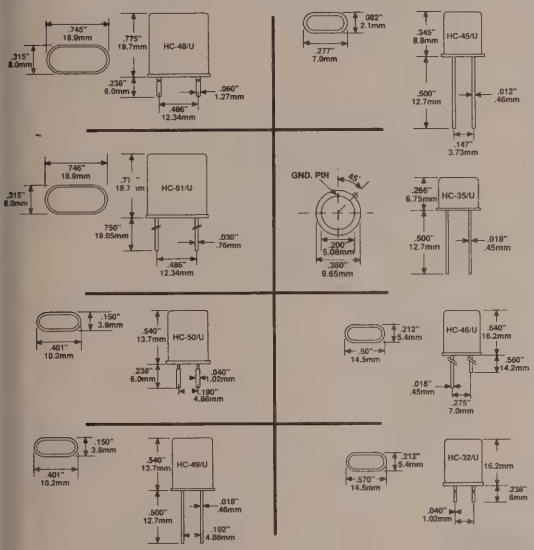
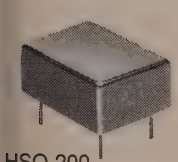


HOLDER TYPE			FREQUENCY RANGE
RESISTANCE WELD	COLD WELD	SOLDER SEAL	
HC 48/U	HC 36/U	HC 6/U	150 KC-200 MHZ
HC 51/U	HC 47/U	HC 33/U	150 KC-200 MHZ
HC 50/U	HC 42/U	HC 25/U	3.5 MHZ-200 MHZ
HC 49/U	HC 43/U	HC 18/U	3.5 MHZ-200 MHZ
HC 52/U	—	—	7.5 MHZ-200 MHZ
HC 35/U	—	—	7.5 MHZ-200 MHZ
HC 46/U	—	—	7.5 MHZ-200 MHZ
HC 32/U	—	—	7.5 MHZ-200 MHZ
		HC 13/U	70 KC-150 KC

Frequency Stabilities at Temp. Range of -30 +70°C
From 5 PPM (±.0005%) 50 PPM (±.05%)

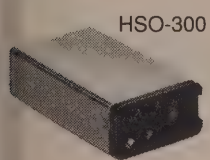
Custom Oscillators – TCXO,VCXO,TCVCXO

250 KC – 200 MHz Single Unit Orders, Large Quantities



HSO-200

HSO-300



These oscillators have option of phase lock loop or AC modulation

ICM OSCILLATOR	FREQUENCY RANGE (MHZ)	TEMP.† TOLERANCE (PPM)	INPUT VOLTAGE (VDC)	INPUT CURRRENT (MA)	OUTPUT TYPE	OUTPUT LEVEL
OE 7	3-200	±5-±10	7-30	30 Max.	Sinewave	.5 VRMS
OE 20	3-20	±2-±5	12-15	25 Max.	Sinewave	.5 VRMS
OE 40	10-20	±1.5-±20	9.5	5 Max.	*	*
OE 50	14-20	±5, ±10	7.5	2 Max.	*	*
HSO-100	10-125	±5-±20	5.0	40 Max.	Sinewave TTL,HCMOS	3 dbm min
HSO-200	4-120	±1-±2.0	5.0-30	20 Max.	Sinewave	6 dbm min
HSO-300	4-125	±1-±2.0	5.0-30	20 Max.	Sinewave	7 dbm min

* Depends on output stage † Operating temp. range: -20°C – +60°C

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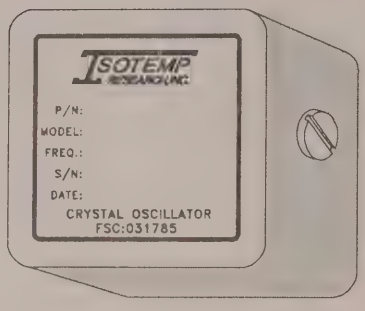
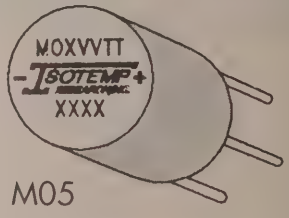
P O Box 26330. 10 N Lee • Oklahoma City, OK 73126-0330 • Phone (405) 236-3741
FAX (405) 235-1904 • **Toll Free 1-800-725-1426 • 24 Hr Toll Free FAX 1-800-322-9426**

FREQUENCY CONTROL PRODUCTS

•CRYSTAL OSCILLATORS
•CRYSTAL OVENS



1 MHz TO 100 MHz
VCXO'S
TCXO'S
OCXO'S



M05
M18
M43
MC49
CRYSTAL OVENS

FEATURES INCLUDE:

- INTERNAL SMD CONSTRUCTION
- LOW PROFILE
- TIGHT STABILITIES
- SINE OR SQUARE WAVES
- PHASE LOCKING INPUTS

MANY OPTIONS AVAILABLE - CALL US WITH YOUR REQUIREMENTS

ISOTEMP RESEARCH, INC.

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CRYSTAL OSCILLATORS

Many configurations available with Printed Circuit Board or other mechanical mounts. AT-Cut and S-C Cut resonators are used to provide a wide range of cost and performance options. All new designs use surface mount technology to reduce cost, improve quality and performance. A few popular models are listed below. Call or FAX our Sales Engineers for technical assistance.

MODEL SERIES	SIZE (INCHES) L x W x H	FREQUENCY RANGE	FEATURES
VCXO 105	1.50 x 1.50 x 0.50	1 MHz to 50 MHz	Custom tuning features
TCXO 35	2.00 x 2.00 x 0.75	1 KHz to 100 MHz	Versatility
TCXO 50	1.80 x 1.20 x 0.60	100 KHz to 20 MHz	Low cost
TCXO 74	1.50 x 1.50 x 0.50	100 KHz to 50 MHz	Popular size, many options
TCXO 130	1.40 x 0.92 x 0.53	4 MHz to 20 MHz	Small package, low power
OCXO 33	2.00 x 2.00 x 1.00	1 KHz to 100 MHz	Small size, PCB mount
OCXO 36	2.00 x 2.00 x 4.00	1 KHz to 100 MHz	Most versatile
OCXO 82	2.00 x 2.00 x 0.75	1 KHz to 50 MHz	Low profile
OCXO 91	2.00 x 2.80 x 1.50	3 MHz to 50 MHz	High performance, PCB mount
OCXO 107	4.00 x 2.72 x 2.35	1 MHz to 50 MHz	Specials

OVENS

Ovens for stabilizing quartz crystals and semiconductors. High gain proportional circuits operate from -30°C to +85°C. Your choice of input voltages and set point temperatures. Adjustable models available. Call or FAX for free application note and engineering assistance.

MODEL	DESCRIPTION	CRYSTAL HOLDERS
M05	PCB mount over crystal	TO-5, HC35/7, TO-39
M18	PCB mount over crystal	TO-18, TO-72
M43	PCB mount over crystal	HC-18/U, HC-25/U, HC-42/U, HC-49/U, HC-50/U
MC49	Slide on mount with connecting wire leads	HC-18/U, HC-25/U, HC-42/U, HC-49/U, HC-50/U

ORDERING INFORMATION: Model Number plus VVTT
where VV = Voltage VDC
TT = Set Point Temperature °C

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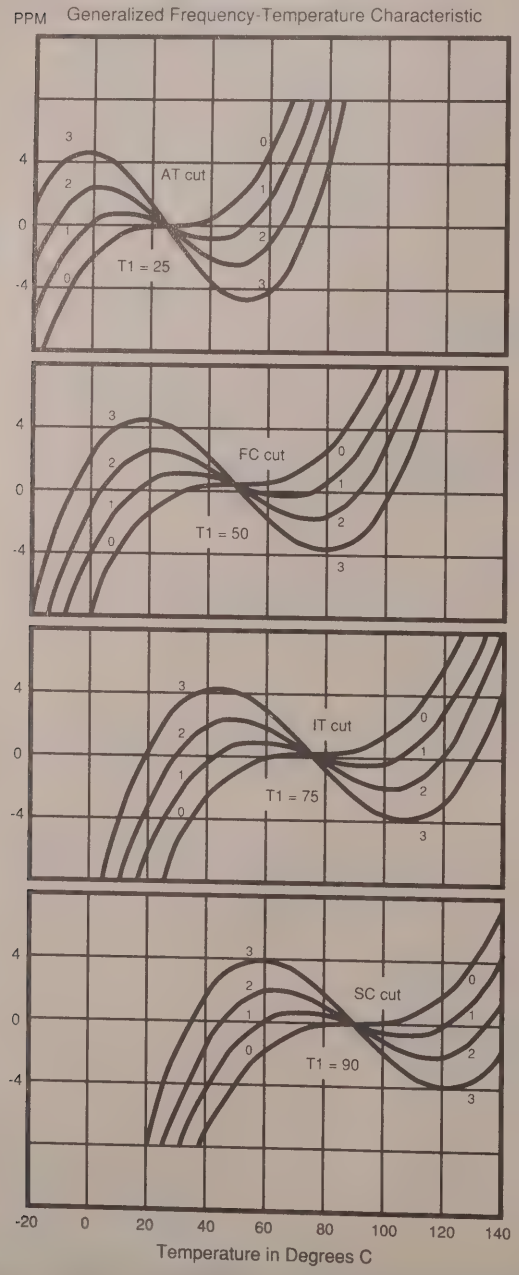
OAK FREQUENCY CONTROL GROUP

Oak Frequency Control Group (OFCG) manufactures quartz resonators from 800 KHz to 360 MHz, fundamental to 11th overtones, in a complete range of holder styles.

With two manufacturing facilities, OFCG Crystal, leads the industry in the design and manufacture of low phase noise and microphonics, low aging rate and high frequency fundamental crystals.

DOUBLY ROTATED AT (DRAT) CRYSTAL CUTS



Oak Frequency Control Group has established a design and manufacture capability for a range of doubly rotated resonators such as FC, IT, and SC resonators.

Frequency-temperature curves of DRAT resonators are very similar to those of AT-cut. The most significant difference is that where AT has an inflection temperature (T) in the area of 25°C to 30°C depending on design and frequency, the inflection temperature will be in the area of 45°C to 55°C for FC, 70°C to 80°C for IT, and 85°C to 95°C for SC. Curves of DRAT resonators are flatter than corresponding AT cuts.

The temperature stability advantage is valid only for higher temperatures where DRAT resonators can show up to 10 times improvement in stability compared to AT resonators. For wide temperature ranges which include temperatures below O°C, better stability can be attained with AT-cut resonators.

The main advantages of these resonators, in particular the SC (Stress Compensated) type are:

- Improved frequency-temperature stability for ovenized applications with operating temperatures in the 60°C to 80°C temperature range.
- Reduced amplitude frequency effect which allows higher drive levels and improved signal to noise ratio.
- Superior thermal transient characteristics resulting in improved short term stability and faster warm up times in oven operation.
- Improved ageing characteristics
- Improved vibration sensitivity
- Higher Co/C1 ratio resulting in reduced sensitivity to circuit component changes.

-Higher Q Factor - 10-15% higher than AT-cut.

For your specific requirements please contact our engineering staff.

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DRAT resonators are the right choice for oven controlled crystal oscillators (OXCO). Development of DRAT resonators has significantly improved achievable OXCO characteristics. Presence of the very strong B mode (8-10% above the main mode frequency) somewhat complicates oscillator design. More complex processes, lower yields and lower motional capacitance causing tighter tolerance requirements contribute to higher costs of DRAT cuts.

Typical Parameters of Doubly Rotated Cuts

F (MHz)	MODE	HOLDER	CUT	Rs (0)	Co (pF)	C1 (F1) (Ff)	Co/C1	Q
4,000	FUND	HC-36	SC	10	5.0	3.7	1350	1,000,000
5,000	FUND	HC-36	FC	80	4.5	15.0	630	500,000
6,300	FUND	HC-49	FC	10	2.8	5.0	560	500,000
7,100	FUND	HC-37	IT	20	3.0	3.4	880	300,000
7,100	FUND	HC-37	SC	15	2.8	2.4	1170	600,000
13,400	FUND	HC-35	FC	15	3.8	11.0	350	70,000
17,000	FUND	HC-35	FC	10	3.8	11.0	350	85,000
24,000	FUND	HC-35	SC	10	3.5	5.0	700	130,000
24,000	FUND	HC-35	IT	10	3.7	7.0	530	100,000
5,000	3rd O/T	HC-40	SC	50	2.8	0.22	12700	1,800,000
10,000	3rd O/T	HC-37	SC	65	3.5	0.22	15900	1,100,000
10,000	3rd O/T	HC-40	SC	40	5.3	0.32	16500	1,200,000
10,230	3rd O/T	HC-37	IT	60	3.2	0.24	3300	1,000,000
10,400	3rd O/T	HC-37	SC	35	4.2	0.55	7700	500,000
24,000	3rd O/T	HC-35	SC	40	3.5	0.50	7000	300,000
30,000	3rd O/T	HC-35	SC	40	3.4	0.43	7900	300,000
40,000	3rd O/T	HC-35	SC	45	3.5	0.50	7000	200,000
50,000	3rd O/T	HC-35	SC	30	3.4	0.50	6800	200,000
50,000	3rd O/T	HC-37	SC	30	3.5	0.50	7000	200,000
54,000	3rd O/T	HC-43	SC	30	2.9	0.45	6600	200,000
80,000	3rd O/T	HC-35	SC	45	2.8	0.40	7000	100,000
100,000	3rd O/T	HC-35	SC	40	3.3	0.40	8200	100,000
50,000	5th O/T	HC-35	SC	70	3.5	0.22	15300	200,000
80,000	5th O/T	HC-35	SC	60	3.5	0.20	17500	120,000
90,000	5th O/T	HC-35	SC	70	3.8	0.24	15900	110,000
100,000	5th O/T	HC-35	SC	80	3.8	0.18	21000	120,000
120,000	5th O/T	HC-35	SC	80	3.7	0.17	21800	100,000
143,000	5th O/T	HC-35	SC	75	4.6	0.18	25500	80,000

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THICK FILM HYBRID CLOCK OSCILLATORS

- MIL-O-55310 QPL Product
- DIP, Chip Carrier, TO Type, and custom designed enclosures offered
- TTL, ECL, CMOS, HCMOS, ACMOS
- Industrial to Aerospace Hi Rel application

ECL OUTPUT

Model	Frequency	Package	Complementary Output
069	30 MHz - 130 MHz	14 Lead Flatpack	Yes
082	30 MHz - 130 MHz	32 Pad LCC	Yes
769	30 MHz - 130 MHz	14 pin DIP	Yes
770	30 MHz - 130 MHz	4 pin DIP	No
771	30 MHz - 130 MHz	14 pin DIP	No

TTL OUTPUT

Model	Frequency	Package	QPL Equivalent
061	65 KHz - 65 MHz	20 Lead Flatpack	55310/21
065	12 MHz - 80 MHz	20 Lead Flatpack	N/A
066	750 KHz - 65 MHz	14 Lead Flatpack	N/A
068	12 MHz - 24 MHz	20 Lead Flatpack	N/A
070	40 KHz - 60 MHz	40 Pad LCC	55310/19
071	750 KHz - 60 MHz	40 Pad LCC	N/A
072	750 KHz - 30 MHz	32 Pad LCC	N/A
073	20 MHz - 50 MHz	44 Pad LCC	N/A
085	40 KHz - 60 MHz	44 Pad LCC	55310/20
095	12 MHz - 30 MHz	16 Lead Flatpack	N/A
708	245 Hz - 60 MHz	8 Pin TO-8	55310/10
717	32 KHz - 65 MHz	8 Pin TO-5	55310/09
720	8 KHz - 65 MHz	4 Pin 1/2 DIP	N/A
724	1 Hz - 65 MHz	4 Pin DIP	N/A
726	250 KHz - 24 MHz	14 Pin DIP	55310/17
741	1 Hz - 65 MHz	14 Pin DIP	55310/16

CMOS - HCMOS - ACMOS OUTPUT

Model	Frequency	Output	Package	QPL Equivalent
063	1 KHz - 70 MHz	ACMOS	12 Lead Flatpack	N/A
075	65 KHz - 65 MHz	HCMOS	40 Pad LCC	N/A
077	65 KHz - 65 MHz	HCMOS	44 Pad LCC	N/A
091	65 KHz - 65 MHz	HCMOS	20 Lead Flatpack	N/A
094	65 KHz - 65 MHz	HCMOS	16 Lead Flatpack	N/A
712	65 KHz - 65 MHz	HCMOS	8 Pin TO-5	55310/12
721	250 KHz - 65 MHz	ACMOS	4 Pin 1/2 DIP	N/A
728	65 KHz - 65 MHz	HCMOS	4 Pin DIP	55310/26
745	1 Hz - 15 MHz	CMOS	14 Pin DIP	55310/18
748	250 Hz - 65 MHz	HCMOS	14 Pin DIP	55310/26

MIL-O-55310 OSCILLATORS

M55310/XX	Frequency	Output	Package
/08	50 Hz - 50 MHz	TTL	14 Pin DIP
/09	400 KHz - 60 MHz	TTL	TO-5
/10	1 KHz - 60 MHz	TTL	TO-8
/11	50 KHz - 10 MHz	CMOS	14 Pin DIP
/12	50 KHz - 10 MHz	CMOS	TO-5
/14	0.1 Hz - 25 MHz	TTL	14 Pin DIP
/15	0.01 Hz - 10 MHz	CMOS	14 Pin DIP
/16	0.1 Hz - 60 MHz	TTL	14 Pin DIP
/17	250 KHz - 50 MHz	TTL	14 Pin DIP
/18	0.01 Hz - 15 MHz	CMOS	14 Pin DIP
/19	1 MHz - 60 MHz	TTL	40-LCC
/20	1 MHz - 60 MHz	TTL	44-LCC
/21*	1 MHz - 60 MHz	TTL	20-FP
/25	25 MHz - 175 MHz	ECL	14 Pin DIP
/26*	100 KHz - 65 MHz	CMOS	4 Pin DIP 14 Pin DIP 4 Pin DIP

*QPL Approval Pending

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HOW TO SPECIFY CLOCK OSCILLATORS

Output Frequency

MHz
KHz
Hz

□□□□ – □ □ □ @ □□ • □□□□□□

Series Number

Temperature Stability Code

1: -55° to +125°C ±50 ppm
2: -55° to +125°C ±100 ppm
3: -55° to +105°C ±40 ppm
4: -55° to +105°C ±80 ppm
5: -20° to +70°C ±25 ppm
6: -20° to +70°C ±50 ppm
7: 0° to +70°C ±10 ppm
8: 0° to +70°C ±25 ppm
9: -40° to +85°C ±30 ppm
0: -40° to +85°C ±70 ppm

Screening Requirements

X: McCoy Verification
100% Room Temperature Testing Key Parameters
AQL Temperature Testing Key Parameters
100% Leak Testing
B: MIL-O-55310, Class B

Accuracy at +25°C

A = ±15 ppm
B = ±25 ppm
C = ±10 ppm
X = Overall stability included in temperature stability code. Only available with 2, 4, 6 & 0 temperature stability codes.

Example
741-1AB @ 10.000000 MHz
This is a series 741, 14 Pin DIP Oscillator, with an output frequency of 10.000000 MHz temperature stability of ±50 ppm over -55°C to ±125°C. Initial accuracy of ±15 ppm and tested to Class B of MIL-O-55310.

McCoy Electronics has QPL status on MIL-O-55310/8, MIL-O-55310/10, MIL-O-53310/14, MIL-O-55310/16, MIL-O-55310/17, MIL-O-53310/18, MIL-O-55310/19, and MIL-O-55310/20. Call factory for more information.

SINEWAVE OUTPUT TCXO

Series	185L	185	545L	545	385L	385	930	355
Key Features	VHF Applications		VHF Applications SMA Output		VHF Applications Smallest Size		Small 24 Pin DIP High Stability	Low Cost
Frequency	3MHz-75MHz	75MHz-150MHz	3MHz-75MHz	75MHz-150MHz	3MHz-75MHz	75MHz-150MHz	10MHz-75MHz	3MHz-25MHz
Output Level	+5dBm/50 Ω				+5dBm/50 Ω			1Vp.p/1K Ω
Supply	+15VDC±5%				+15VDC±5%		+12VDC±5%	+5VDC±5%
Temperature Stability	Options	Options	Options	Options	Options	Options	Options	Options
-20°C to +70°C	±.5 ppm ±1 ppm ±2 ppm ±3 ppm ±5 ppm	– ±1 ppm ±2 ppm ±3 ppm ±5 ppm	±.5 ppm ±1 ppm ±2 ppm ±3 ppm ±5 ppm	– ±1 ppm ±2 ppm ±3 ppm ±5 ppm	±.5 ppm ±1 ppm ±2 ppm ±3 ppm ±5 ppm	– ±1 ppm ±2 ppm ±3 ppm ±5 ppm	±.5 ppm (<30MHz) ±1 ppm ±2 ppm ±3 ppm ±5 ppm	– ±1 ppm ±2 ppm ±3 ppm –
-40°C to +85°C	±1 ppm ±2 ppm ±3 ppm ±5 ppm	±2 ppm ±3 ppm ±4 ppm ±5 ppm	±1 ppm ±2 ppm ±3 ppm ±5 ppm	±2 ppm ±3 ppm ±4 ppm ±5 ppm	±1 ppm ±2 ppm ±3 ppm ±5 ppm	±2 ppm ±3 ppm ±4 ppm ±5 ppm	±1 ppm (<30MHz) ±2 ppm ±3 ppm ±5 ppm	±1 ppm ±2 ppm ±3 ppm –
-55°C to +85°C	±1 ppm ±2 ppm ±3 ppm ±5 ppm	±2.5 ppm ±3 ppm ±4 ppm ±5 ppm	±1 ppm ±2 ppm ±3 ppm ±5 ppm	±2.5 ppm ±3 ppm ±4 ppm ±5 ppm	±1 ppm ±2 ppm ±3 ppm ±5 ppm	±2.5 ppm ±3 ppm ±4 ppm ±5 ppm	±1 ppm (<30MHz) ±2 ppm (<30MHz) ±3 ppm ±5 ppm	– – – –
Aging	≤1ppm/year	≤2ppm/year	≤1ppm/year	≤2ppm/year	≤1ppm/year	≤2ppm/year	≤1ppm/year	
Frequency Adjustment	Mechanical: ±5 ppm min.				Mechanical: ±5 ppm min.		External Potentiometer: ±5 ppm min.	Mechanical ±5 ppm min.
Package (L x W x H)	2" x 2" x .5"		2" x 2" x .78" SMA Connector Output		1.5" x 1.5" x .5"		1.4" x .81" x .375"	1.5" x 1" x .520"

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SQUAREWAVE OUTPUT TCXO

Series	100	101	103	103M	200	356	544	934
Key Features	Compact 24 Pin DIP		Small 16 Pin DIP	Designed for MIL Applications	Popular Package	Low Cost	Low Phase Noise in inch square package	Economical 4 Pin DIP Clock Replacement
Frequency	200KHz-25MHz		5MHz-25MHz	10MHz-50MHz	200KHz-25MHz	3MHz-25MHz		10MHz-20MHz
Output	HCMOS/TTL		TTL		HCMOS/TTL			TTL
Supply	+5VDC±5%	+12VDC±5%	+5VDC±5%	+5VDC±5% +15VDC±5%	+12VDC±5% +5VDC±5%	+5VDC±5%		+5VDC±2%
Temperature Stability	Options	Options	Options	Options	Options	Options	Options	Options
-20°C to +70°C	±1 ppm ±2 ppm ±3 ppm –	±1 ppm ±2 ppm ±3 ppm –	±1 ppm ±2 ppm ±3 ppm ±5 ppm	±1 ppm ±2 ppm ±3 ppm ±5 ppm	±1 ppm ±2 ppm ±3 ppm –	±1 ppm ±2 ppm ±3 ppm –	±1 ppm ±2 ppm ±3 ppm ±5 ppm	±5 ppm (-30°C to +70°C) – –
-40°C to +85°C	±2 ppm ±3 ppm ±5 ppm –	±1 ppm ±2 ppm ±3 ppm ±5 ppm	±2 ppm ±3 ppm ±4 ppm ±5 ppm	±2 ppm ±3 ppm ±4 ppm ±5 ppm	±1 ppm ±2 ppm ±3 ppm ±5 ppm	±1 ppm ±2 ppm ±3 ppm –	±1 ppm ±2 ppm ±3 ppm ±5 ppm	– – – –
-55°C to +85°C	±2 ppm ±3 ppm ±5 ppm –	±1 ppm ±2 ppm ±3 ppm ±5 ppm	±3 ppm ±4 ppm ±5 ppm –	±3 ppm ±4 ppm ±5 ppm –	±1 ppm ±2 ppm ±3 ppm ±5 ppm	– – – –	±1 ppm ±2 ppm ±3 ppm ±5 ppm	– – – –
Aging	≤2 ppm/year					≤1 ppm/year		
Frequency Adjustment	External Potentiometer: ±3 ppm min.		External Potentiometer: ±5 ppm min.		Mechanical: ±3 ppm min.	Mechanical ±5 ppm min.		Voltage Control Feature ±4ppm min. 0-5V
Package (L x W x H)	1.4" x .81" x .375"		.985" x .81" x .375"		1.5" x 1.5" x .5"	1.5" x 1" x .520"	1" x 1" x .5"	.82" x .525" x .395"

GOOD STABILITY OCXO

Series	579	599	816	850
Key Features	Smallest OCXO		Ovenized with Voltage Control	Low Phase Noise VHF application
Frequency	3MHz-20MHz		10MHz-30MHz	20MHz-100MHz
Output	TTL	Sine	TTL	Sine
Supply	+12VDC±5%		+15VDC±5%, +5VDC±10%	+12VDC±5%
Input Power	≤5 Watts @ turn-on ≤1.2 Watts @ +25°C		≤9 Watts @ turn-on ≤2 Watts @ +25°C	≤10 Watts @ turn-on ≤2 Watts @ +25°C
Temperature Stability –20°C to +70°C –55°C to +75°C	±.1 ppm ±.15 ppm		±.15 ppm ±.3 ppm	±.05 ppm ±.1 ppm
Aging	<.5 ppm/year		<1.0 ppm/year	<1.0 ppm/year
Frequency Adjustment	Mechanical: ±4 ppm min.		Mechanical: ±5 ppm min. Electrical: ±15 ppm min., 0-10V	Mechanical: ±5 ppm min.
Package (L x W x H)	1.5" x 1.5" x .6"		2.275" x 2.275" x 1.000"	2.0" x 2.0" x 1.0"
Crystal Type	AT Cut			SC Cut

BEST STABILITY

Series	834	840	841
Key Features	Super Low Aging High Stability	Low Aging Superior Stability	
Frequency	3MHz-7MHz	7MHz-20MHz	
Output	Sine		TTL
Supply	+12VDC±5%	+15VDC±5%	
Input Power	≤10 Watts @ turn-on ≤3 Watts @ +25°C		
Temperature Stability –20°C to +70°C –55°C to +85°C	$\pm 3 \times 10^{-9}$ $\pm 6 \times 10^{-9}$		
Aging	<.03 ppm/year	<.1 ppm/year	
Frequency Adjustment	Electrical: ±.1 ppm min., 0-8V	Mechanical ±.1 ppm min.	
Package (L x W x H)	3.0" x 3.0" x .1.35"	2.0" x 2.0" x 1.0"	
Crystal Type	SC Cut		

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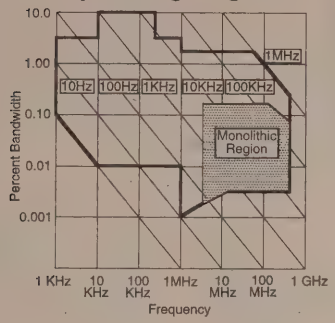
CRYSTAL FILTERS

Operating Regions



Best Operating Regions

This chart gives the regions where crystal filters can be built. The "Discrete Filter" region shows where filters can be built using individual crystals, capacitors, coils, transformers, and resistors. The "Monolithic" region defines where filters, that employ two or more resonators per individual crystal unit (plus some other discrete components), can be manufactured.

The difficulty increases as the edge of the chart is approached and some filter types cannot be realized at or near the edge of the chart. Filters which fall in the two colored regions will be the most producible and all approximation types can be realized within these regions.

Bandpass

Bandpass filters will pass a band of frequencies and attenuate other bands of frequencies both above and below the passband. Single sideband filters are bandpass designs but they form such an important sub-set that they are often given their own classification.

Band Reject

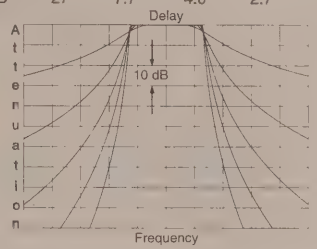
Band reject filters attenuate a specified band of frequencies while passing a broad range of frequencies adjacent to the rejected band.

Discriminators are similar to filters except they produce an output DC voltage which is proportional to the input frequency.

Shape Factors and Practical Limits

Theoretical Shape Factors (60/3 dB) for Monotonic Responses

Number of Poles	2	3	4	5	6	8	10
Filter Type							
Butterworth	32	10.0	5.6	4.0	3.2	2.4	2.0
Chebyshev 0.1 dB	29	8.5	4.4	3.0	2.3	1.7	1.4
Chebyshev 0.5 dB	27	7.7	4.0	2.7	2.2	1.6	1.4



Practical Shape Factors (60/3 dB) for Monotonic Response

Number of Poles	2	3	4	5	6	8	10
Filter Type							
Butterworth	32	10.0	5.8	4.2	3.3	2.5	2.2
Chebyshev 0.1 dB	30	9.0	4.7	3.1	2.4	1.8	1.5
Chebyshev 0.5 dB	29	8.0	4.2	2.8	2.3	1.7	1.5

Practical Limits

	Typical	Best	
Shape Factor	1.5–30	1.075	
Passband Flatness	1.0	0.10	dB
Narrowest Bandwidth	0.01	.001	%
Widest Bandwidth	2.5	10	%
Maximum Attenuation	90	100	dB
Phase Linearity	±5	±2	°
Phase Matching	±5 (Quad)	±3 (All)	°
Temperature Range	-20 to +70	-45 to +105	°C
Shock	15	1500	g's
Vibration	10g Sine 10-2000 Hz	45+ Grms Random	
Aging	<10ppM (10 years)	5ppM (15 years)	

* **Amplitude and Delay Compensation**
* **Phase and Amplitude Matching**
* **Hi-Rel Capability**
* **Standard I.F. and Custom Designs Available**

Approximation Types

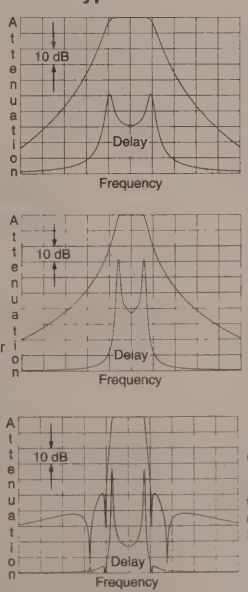
Depending upon the required specifications, an approximation type will be chosen to meet those requirements. The following are the most common types used.

Types used for control of attenuation only

Butterworth–Produces a very smooth, flat passband with a fair rate of roll-off. This approximation produces easily realized networks.

Chebyshev–The response is similar to the Butterworth but with ripple within the passband and an improved roll-off rate. Networks obtained by this approximation are the most easily realized.

Cauer or Elliptic Function–The pass-band ripple is similar to the Chebyshev but with greatly improved stopband selectivity due to the addition of finite attenuation peaks. The network complexity is increased over the Butterworth or Chebyshev but it still yields practical realizations over nearly the entire operating region. All of the responses shown here are for six pole networks with identical design band widths.



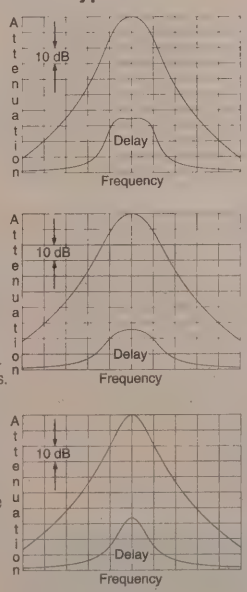
Approximation Types

Types used for phase and delay control

Bessel or Linear Phase–This approximation is the Butterworth of delay control. It produces filters with a flat delay around center frequency. The more poles used, the wider the flat region extends. The roll-off rate is poor. There are some realization restrictions and so these designs cannot be obtained over the entire operating region.

Gaussian–Very similar to the Bessel except that the delay has a slight "bump" at center frequency and the rate of roll-off is slower. Because of the delay response, the ringing characteristics are better than the Bessel. Realization restrictions also apply to these filters.

Synchronously Tuned–These filters have the same advantages and disadvantages as the Bessel and Gaussian except that the ringing response is the best of all design types and the roll-off is even slower than the Gaussian. As with the other two types, some realization restrictions apply. Responses shown are for 6 pole networks with identical 3 dB design bandwidths.



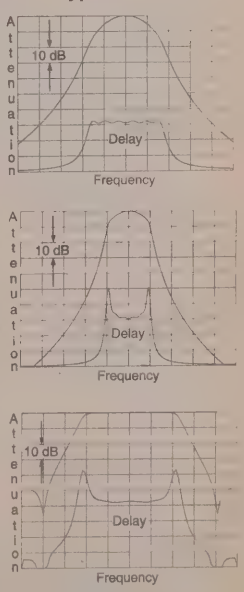
Approximation Types

Compromise types

Chebyshev Phase Error–In this approximation the Chebyshev approximating technique is applied to the phase (delay) over the passband region. It produces the bell shaped amplitude response similar to a Gaussian or Bessel design and an equiripple phase and delay response. The selectivity is better than the Bessel or Gaussian.

Gaussian to 6 (or 12) dB– These filters have passband response that follows the Gaussian shape and, at either the 6 or 12 dB point, the response changes and follows the Butterworth characteristic. The phase, or delay, response is somewhat improved over a strict Butterworth and the attenuation is better than the pure Gaussian and so it is a true compromise type of approximation. As with all of the filters where there is an attempt to control the phase response, the realization becomes more difficult and so its operating region is slightly restricted.

Custom Ringing Response–Sometimes it is necessary to obtain both good ringing response and good attenuation at the same time. In these instances a custom ringing response filter can be synthesized. Because both phase and attenuation must be controlled, these filters require more components and are somewhat larger and more costly than other types.



MINIGLOSSARY
BASIC
EBCDIC CODE

Bit Positions 4, 5, 6, 7	Second Hexadecimal Digit	Digit Punches	00				01				10				11				
			00	01	10	11	00	01	10	11	00	01	10	11	00	01	10	11	Bit Positions 0, 1
			00	01	10	11	00	01	10	11	00	01	10	11	00	01	10	11	Bit Positions 2, 3
			0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	First Hexadecimal Digit
			12				12	12		12	12	12		12	12				Zone Punches
				11				11	11	11		11	11	11		11			
					0		0		0	0	0		0	0			0		
			9	9	9	9	9	9	9	9									Digit Punches
			①	②	③	④	⑤	⑥	⑦	⑧					⑨	⑩	⑪	⑫	
0000	0	8-1	NUL	DLE	DS		SP	&	-									0	8-1
0001	1	1	SOH	DC1	SOS				⑬		a	j			A	J	⑭	1	1
0010	2	2	STX	DC2	FS	SYN					b	k	s		B	K	S	2	2
0011	3	3	ETX	TM							c	l	t		C	L	T	3	3
0100	4	4	PF	RES	BYP	PN					d	m	u		D	M	U	4	4
0101	5	5	HT	NL	LF	RS					e	n	v		E	N	V	5	5
0110	6	6	LC	BS	ETB	UC					f	o	w		F	O	W	6	6
0111	7	7	DEL	IL	ESC	EOT					g	p	x		G	P	X	7	7
1000	8	8		CAN							h	q	y		H	Q	Y	8	8
1001	9	8-1		EM							;	r	z	`	I	R	Z	9	9
1010	A	8-2	SMM	CC	SM		¢	!	⑮	:									8-2
1011	B	8-3	VT	CU1	CU2	CU3	.	$	,	#									8-3
1100	C	8-4	FF	IFS		DC4	<	*	%	@									8-4
1101	D	8-5	CR	IGS	ENQ	NAK	(	)	_	'									8-5
1110	E	8-6	SO	IRS	ACK		+	;	>	=									8-6
1111	F	8-7	SI	IUS	BEL	SUB	I	¬	?	"									8-7
			12				12				12	12		12	12	12		12	Zone Punches
				11				11				11	11	11		11	11	11	
					0				0		0		0	0	0		0	0	
			9	9	9	9									9	9	9	9	

Card Hole Patterns

①	12-0-9-8-1	⑤	No-Punches	⑨	12-0
②	12-11-9-8-1	⑥	12	⑩	11-0
③	11-0-9-8-1	⑦	11	⑪	0-8-2
④	12-11-0-9-8-1	⑧	12-11-0	⑫	0
				⑬	0-1
				⑭	11-0-9-1
				⑮	12-11

Control Character Representations

ACK	Acknowledge
BEL	Bell
BS	Backspace
BYP	Bypass
CAN	Cancel
CC	Cursar Control
CR	Carriage Return
CU1	Customer Use 1
CU2	Customer Use 2
CU3	Customer Use 3
DC1	Device Control 1
DC2	Device Control 2
DC4	Device Control 4
DEL	Delete
DLE	Data Link Escape
DS	Digit Select
EM	End of Medium
ENQ	Enquiry
EOT	End of Transmission
ESC	Escape
ETB	End of Transmission Block
ETX	End of Text
FF	Form Feed
FS	Field Separator
HT	Horizontal Tab
IFS	Interchange File Separator
IGS	Interchange Group Separator
IL	Idle
IRS	Interchange Record Separator
IUS	Interchange Unit Separator
LC	Lower Case
LF	Line Feed
NAK	Negative Acknowledge
NL	New Line
NUL	Null
PF	Punch Off
PN	Punch On
RES	Restore
RS	Reader Stop
SI	Shift In
SM	Set Mode
SMM	Start of Manual Message
SO	Shift Out
SOH	Start of Heading
SOS	Start of Significance
SP	Space
STX	Start of Text
SUB	Substitute
SYN	Synchronous Idle
TM	Tape Mark
UC	Upper Case
VT	Vertical Tab

Special Graphic Characters

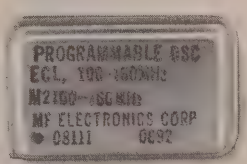
¢	Cent Sign
.	Period, Decimal Point
<	Less-than Sign
(	Left Parenthesis
+	Plus Sign
!	Logical OR
&	Ampersand
!	Exclamation Point
$	Dollar Sign
*	Asterisk
)	Right Parenthesis
;	Semicolon
¬	Logical NOT
-	Minus Sign, Hyphen
/	Slash
,	Comma
%	Percent
_	Underscore
>	Greater-than Sign
?	Question Mark
:	Colon
#	Number Sign
@	At Sign
'	Prime, Apostrophe
=	Equal Sign
"	Quotation Mark

Check out the broadest range of crystal oscillators in the industry.

- ☑ ECL families with fixed frequencies up to 400 MHz in full size, and up to 200 MHz in half size.
- ☑ User-programmable oscillators up to 200 MHz.
- ☑ HCMOS/TTL families from 1 kHz to 125 MHz in full size *and* half size.
- ☑ Voltage-controlled crystal oscillators covering 1 MHz to 67 MHz.

Big performance in a tiny package

☑ Check out our new microminiature-size surface-mount models – they can drive full-size loads (50 pF or 10 TTL) over 1.8 MHz through 66.7 MHz.



Need help finding the right oscillator for your application? No problem. Our customer-oriented staff stands ready to help you get the oscillators you need right now. Available in three of the most popular packages. Whatever your application. And we back all our products with quality engineering *and* sales support you'll find second to none. To find out more, call or write: MF Electronics Corp., 10 Commerce Drive, New Rochelle, NY 10801; (914) 576-6570; FAX: (914) 576-6204. **1-800-331-1236.**

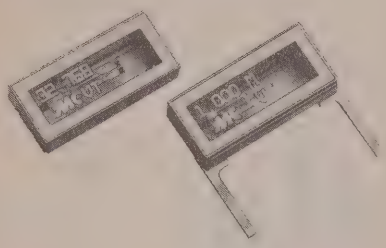
MF Electronics

COMPONENTS THAT SET THE PACE

Micro Crystal a Division of SMH
702 W. Algonquin Road • Arlington Heights, IL 60005
Phone (708) 806-1485 Fax (708) 593-5062

Miniature Resonators, Frequency Range: 10k-2.0 MHz-SMD

CX1 Quartz Crystal



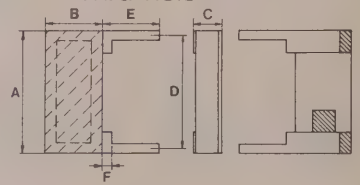
FEATURES:
- Ceramic package height 1.6 mm
- SMD-version in tape and reel
- MIL temperature range
- High stability
- Low aging
- Low power consumption
- High shock resistance

VERSIONS:
CX1V: For Pierce oscillators.
CX1H: For series oscillators.
CX1V-O: For thru-hole mounting.
CX1V-T: For surface mounting at (SMD) max. 260°/20 s.

SPECIFICATIONS:
Typical Frequency Adjustment:
±30ppm to ±10,000ppm
(Tighter tolerances available on request)
Operating Temperature Ranges:
Industrial: –40° to 85°C
Military: –55° to 125°C
Shock Resistance:
5000g/0.3ms (1/2 Sine)
Aging: ±3ppm maximum first year

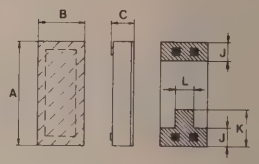
DIMENSIONS:

Thru-hole



Dim.	Inches	mm
A	0.32	8.1
B	0.15	3.8
C	0.08	2.0
D	0.30	7.6
E	0.15	3.8
F	0.03	0.7
Leads	0.01	0.3
	x0.02	x0.4

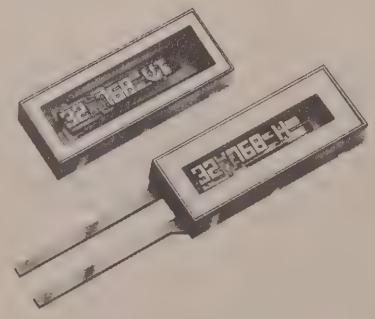
SMD



Dim.	Inches	mm
A	0.32	8.1
B	0.15	3.8
C	0.07	1.6
J	0.04	1.1
K	0.11	2.7
L	0.06	1.5

Miniature Resonators, Frequency Range: 18kHz-1.0 MHz-SMD

CX2 Quartz Crystal
18 kHz-1.0 MHz



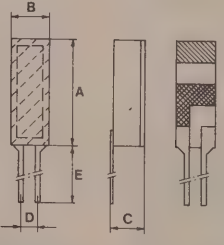
FEATURES:
- Ceramic package height 1.5 mm
- SMD-version in tape and reel
- MIL temperature range
- High stability
- Low aging
- Low power consumption
- High shock resistance

VERSIONS:
CX2V: For Pierce oscillators.
CX2H: For series oscillators.
CX2V-O: For thru-hole mounting.
CX2V-T: For surface mounting at (SMD) max. 260°/20 s.

SPECIFICATIONS:
Typical Frequency Adjustment:
±30ppm to ±10,000ppm
(Tighter tolerances available on request)
Operating Temperature Ranges:
Industrial: –40° to 85°C
Military: –55° to 125°C
Shock Resistance:
5000g/0.3ms (1/2 Sine)
Aging: ±3ppm maximum first year

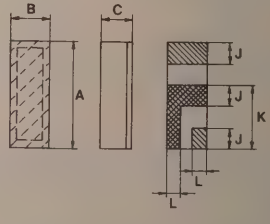
DIMENSIONS:

Thru-hole



Dim.	Inches	mm
A	0.27	6.7
B	0.10	2.5
C	0.08	1.9
D	0.05	1.27
E	0.22	5.6
Leads	0.006	0.14
	x0.014	x0.33

SMD



Dim.	Inches	mm
A	0.27	6.7
B	0.10	2.5
C	0.06	1.5
J	0.04	1.1
K	0.15	3.8
L	0.03	0.8

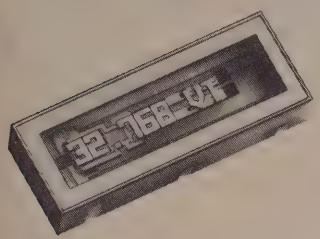
Micro Crystal a Division of SMH

702 W. Algonquin Road • Arlington Heights, IL 60005

Phone (708) 806-1485 Fax (708) 593-5062

Miniature Resonators, Frequency Range: 18k-1.0 MHz-SMD

CX3 Quartz Crystal
18 kHz-1.0 MHz



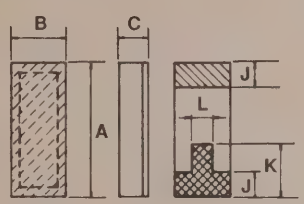
FEATURES:
- Ceramic package height 1.5 mm
- SMD-package in tape and reel
- MIL temperature range
- High stability
- Low aging
- Low power consumption
- High shock & vibration resistance

VERSIONS:

Glass IId	Ceramic IId	
CX3	CC3:	Standard version
CX3V	CC3V:	For Pierce oscillators
CX3H	CC3H:	For series oscillators
CX3V-T	CC3V-T:	For surface mounting
CX3H-T	CC3H-T:	at max 260°C/20s

SPECIFICATIONS:
Typical Frequency Adjustment:
±30ppm to ±10,000ppm
(Tighter tolerances available on request)
Operating Temperature Ranges:
Industrial: –40° to 85°C
Military: –55° to 125°C
Shock Resistance:
5000g/0.3ms (1/2 Sine)
Vibration Resistance:
20g/10-2000Hz
Aging: ±3ppm maximum first year

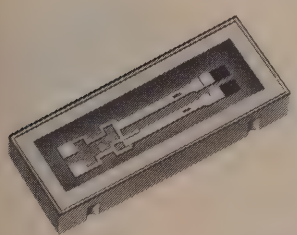
DIMENSIONS:



Dim.	Inches	mm
A	0.27	6.7
B	0.10	2.5
C	0.06	1.5
J	0.05	1.3
K	0.10	2.5
L	0.03	0.8

Miniature Resonators, Frequency Range: 18kHz-1.0 MHz-SMD

CX4 Quartz Crystal
18 kHz-1.0 MHz



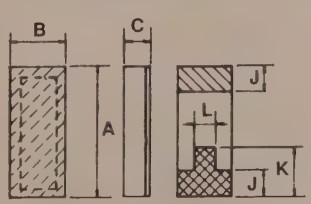
FEATURES:
- Ultra Miniature Ceramic package height 1.1 mm
- SMD-package in tape and reel
- MIL temperature range
- High stability
- Low aging
- Low power consumption
- High shock & vibration resistance

VERSIONS:

Glass IId	Ceramic IId	
CX4	CC4:	Standard version
CX4V	CC4V:	For Pierce oscillators
CX4H	CC4H:	For series oscillators

SPECIFICATIONS:
Typical Frequency Adjustment:
±30ppm to ±10,000ppm
(Tighter tolerances available on request)
Operating Temperature Ranges:
Industrial: –40° to 85°C
Military: –55° to 125°C
Shock Resistance:
5000g/0.3ms (1/2 Sine)
Vibration Resistance:
20g/10-2000Hz
Aging: ±3ppm maximum first year

DIMENSIONS:



Dim.	Inches	mm
A	0.20	5.0
B	0.08	1.9
C	0.04	1.1
J	0.04	0.9
K	0.06	1.5
L	0.02	0.5

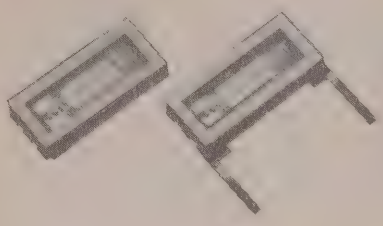
Micro Crystal a Division of SMH

702 W. Algonquin Road • Arlington Heights, IL 60005

Phone (708) 806-1485 Fax (708) 593-5062

AT Strip Resonators, Frequency Range: 8-25 MHz-SMD

CXAT Quartz Crystal

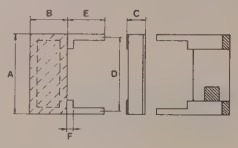


FEATURES:

- Miniature hermetically sealed ceramic package
- Package height 1.6mm
- High stability
- SMD-version in tape and reel
- Low aging
- Low power consumption
- High shock resistance

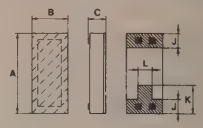
DIMENSIONS

Thru-hole



Dim.	Inches	mm
A	0.32	8.1
B	0.15	3.8
C	0.08	2.0
D	0.30	7.6
E	0.15	3.8
F	0.03	0.7
Leads	0.01	0.3
	x 0.02	x 0.4

SMD



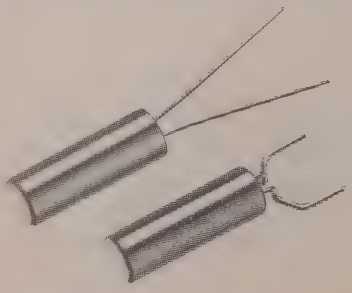
Dim.	Inches	mm
A	0.32	8.1
B	0.15	3.8
C	0.07	1.6
J	0.04	1.1
K	0.11	2.7
L	0.06	1.5

SPECIFICATIONS

Typical Frequency Adjustment:
±50ppm to ±10,000ppm
(Tighter tolerances available)
Operating Temperature Ranges:
Industrial: –40° to 85°C
Military: –55° to 125°C
Shock Resistance:
5000g/0.3ms (1/2 Sine)
Aging: ±3ppm maximum first year

Quartz Crystal Resonators, Frequency Range: 10-200 kHz-SMD

MX1 Tuning Fork

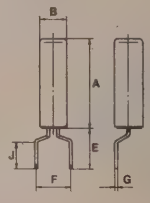


FEATURES:

- Small metal package 2×6mm
- Economical
- SMD-version in tape and reel
- High stability
- Low aging
- Low power consumption
- High shock resistance

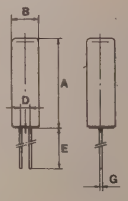
DIMENSIONS:

SMD



Dim.	Inches	mm
A*	0.24	6.1
B	0.08	2.0
E	0.12	3.0
F	0.10	2.54
G	0.01	0.2
J	0.08	2.0
on request:		
E	0.07	1.9
F	0.05	1.27
J	0.04	1.0

Thru-hole



Dim.	Inches	mm
A*	0.24	6.1
B	0.08	2.0
D	0.03	0.7
E	0.28	7.0
G	0.01	0.2

* 10 – 20 kHz A = 0.30"/7.5 mm
21 – 28 kHz A = 0.26"/6.5 mm

SPECIFICATIONS:

Typical Frequency Adjustment:
±30ppm (Tighter tolerances available on request)
Operating Temperature Range:
Industrial: –40° to 85°C
Military: –55° to 125°C
Shock Resistance:
5000g/0.3ms (1/2 Sine)
Aging: ±5ppm maximum first year

VERSIONS:

MX1V: For Pierce oscillators.
MX1H: For series oscillators.
MX1-O: For thru-hole mounting.
MX1-T: For surface mounting at max. 260°/20 s.

Micro Crystal a Division of SMH

702 W. Algonquin Road • Arlington Heights, IL 60005

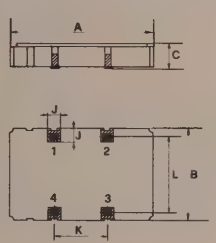
Phone (708) 806-1485 Fax (708) 593-5062

Clock Oscillator, Frequency Range: 0.1-50 MHz MCSO Series

FEATURES:
- Surface mountable ceramic package
- Available in Tape and Reel or in sticks
- Excellent temperature and shock stability

SPECIFICATIONS:
- Frequency Stability (Overall): ±100ppm
- Operating Temp. Ranges: Standard: 0° to 70°C Industrial: –40° to 85°C Military: –55° to 125°C
- Supply Voltage: 5 Vdc ± 10%
- Shock Resistance: 5000g/0,3ms (1/2 Sine)*
- Vibration Resistance: 20g/10 to 2000 Hz*

MCSO DIMENSIONS AND PINOUT

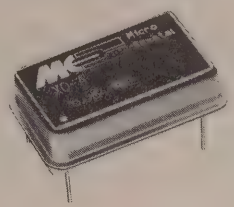


PINOUT

1	N.C./OPTION: Tristate
2	GND
3	OUTPUT
4	Vcc

Dim.	Inches	mm
A	0.55	14.1
B	0.36	9.1
C	0.10	2.4
K	0.20	5.1
L	0.29	7.3
J	0.05	1.3

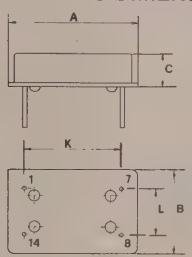
Clock Oscillator, Frequency Range: 0.1-45 MHz XO Series



FEATURES:
- Custom specifications
- HC-MOS technology
- Extremely wide temp. range

SPECIFICATIONS:
- Frequency Stability (Overall): ±100ppm
- Operating Temp. Ranges: Standard: 0° to 70°C Industrial: –40° to 85°C Military: –55° to 125°C
- Supply Voltage: 5 Vdc ± 10%
- Shock Resistance: 5000g/0,3ms (1/2 Sine)*
- Vibration Resistance: 20g/10 to 2000 Hz*

XO DIMENSIONS AND PINOUT



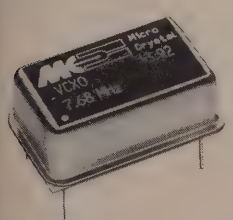
PINOUT

1	N.C./OPTION: Tristate
7	GND
8	OUTPUT
14	Vcc

Dim.	Inches	mm
A	0.80	20.3
B	0.52	13.2
C	0.20	5.1 (7.6 mm)
K	0.60	15.2
L	0.30	7.6

* Subject to confirmation for custom frequencies

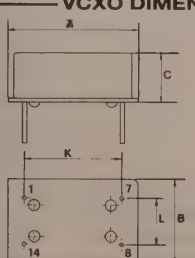
Voltage Controlled Oscillator Frequency Range: 0.5-45 MHz VCXO Series



FEATURES:
- Good linearity
- Tight thermal stability
- Excellent consistency

SPECIFICATIONS:
- Frequency Stability (Overall): ±20ppm (typ.)
- Operating Temp. Ranges: –40° to 85°C
- Supply Voltage: 5 Vdc ± 10%
- Shock Resistance: 5000g/0,3ms (1/2 Sine)*
- Vibration Resistance: 20g/10 to 2000 Hz*

VCXO DIMENSIONS AND PINOUT



PINOUT

1	Voltage control
7	GND
8	OUTPUT
14	Vcc

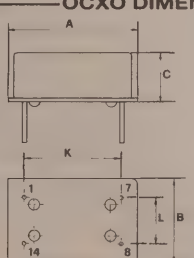
Dim.	Inches	mm
A	0.80	20.3
B	0.52	13.2
C	0.30	7.6
K	0.60	15.2
L	0.30	7.6

Oven Controlled Oscillator Frequency Range: 0.01-24 MHz OCXO Series

FEATURES:
- Extremely small dimensions
- Very fast warm up
- Low power consumption

SPECIFICATIONS:
- Frequency Stability (Overall): ±0.2ppm (typ.)
- Operating Temp. Range: –20° to 70°C –40° to 85°C
- Supply Voltage: 12 Vdc ± 0.5V
- Shock Resistance: 2000g/0,3ms (1/2 Sine)
- Vibration Resistance: 20g/10 to 2000 Hz

OCXO DIMENSIONS AND PINOUT



PINOUT

1	voltage/resistance cont.
7	GND
8	OUTPUT
14	Vcc

Dim.	Inches	mm
A	0.80	20.3
B	0.52	13.2
C	0.30	7.6
K	0.60	15.2
L	0.30	7.6

CRYSTALS

TCXO'S, VCXO'S, OCXO'S, HI-REL OSC., DIP OSC.

MONITOR PRODUCTS COMPANY, INC.

FAX # (619) 434-0255 PHONE # (619) 433-4510

- Over 200 Standard TCXO Designs
- 65 Years of Frequency Control Engineering Excellence
- Custom Designs Are Our Specialty
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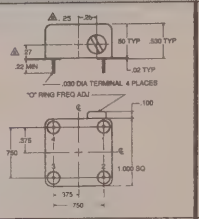
- Full Hybrid Manufacturing Capability Class 100,000 Clean Room
- Telecommunications & Military Approved Designs
- 30 Years of Koldweld Hi-Rel Crystal Design
- USA Manufacturing Insures Long Term Availability
- MIL-I-45208 & ISO 9000 Quality Systems
- TCXO's Are Our Specialty

HIGH PERFORMANCE, SIZE REDUCED TCXO UNITS

Phase Lock Applications – Stabilities To ±1.0 ppm – Smallest TCXO's

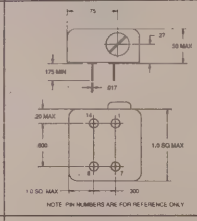
7311
- 3.2 - 25 MHz
- ± 2 ppm
- -40°C to 85°C
- +5 VDC
- HCMOS Output
- 1.0 x 1.0 x 0.5 Inches
- 50 pf max. load
- Internal Trim

- Low Power Consumption
- Excellent Short Term Stability
- Low Aging Rate
- "O" Ring Seal



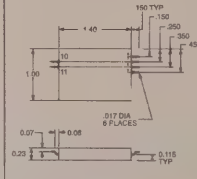
7315
- 4 - 25 MHz
- ± 2 ppm
- -40°C to 85°C
- + 5VDC
- HCMOS Output
- Mechanical Trim
- 1.0 x 1.0 x 0.5 Inches
- 14 PIN DIP Configuration

- "O" Ring Seal
- Wide Operating Temperature
- 1 PPM/Year Aging



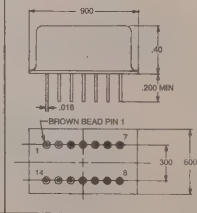
7279
- 10.0 - 25 MHz
- ± 2.8 ppm
- -20°C to 75°C
- +15 VDC
- HCMOS Output
- External Trim
- 1.0 x 1.40 x 0.23 Inches
- 0.23 Max. Seating Height

- Surface Mounting
- Low Phase Noise
- Low Current Drain
- Hybrid Construction
- Hi-Rel Koldweld Crystal



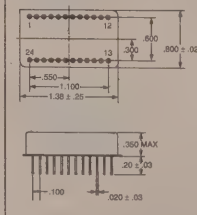
7285
- 500 KHz to 20 MHz
- ± 1 ppm
- -40°C to 60°C
- +12 to 15 VDC
- HCMOS Output
- Electrical Trim
- 0.9 x 0.6 x 0.4 Inches
- 14 PIN DIP Package
- Tight Tolerance

- Hermetically Sealed
- Through Hole or "J" Leads
- < 1 ppm Aging Per Year
- Shock to 1,000 G's



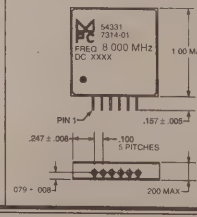
7298
- 4 - 25 MHz
- ± 1 ppm
- -35°C to 85°C
- 8.5 To 16 VDC
- TTL Output
- Electrical Trim
- 1.38 x 0.8 x 0.35 Inches
- 24 PIN DIP Package
- Low Profile 0.350 Inches

- Full 10 TTL Driving Capability
- Excellent Short Term Stability
- Hermetically Sealed
- Gold Leads For Socket Application



7314
- 8.0 - 25 MHz
- ± 1 ppm
- -32°C to 65°C
- + 5 VDC Input
- Clipped Sine Out
- External Trim
- 1 x 1 x 0.2 inch
- Lowest Height In The Industry

- Surface Mount Configuration
- Only 5 mA Current Consumption
- ±1 ppm Aging Per Year

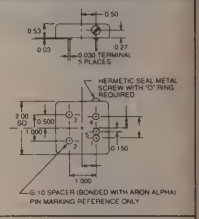


SPECIALIZED APPLICATION TEMPERATURE COMPENSATED CRYSTAL OSCILLATORS

Phase Noise to -150 DBC @ 1KHz - Stabilities to ±0.1 ppm - Low Power

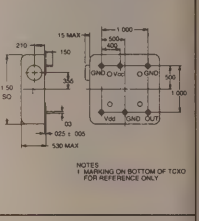
7253
- 3 - 4 MHz
- ±0.1 ppm
- 0°C to 50°C
- + 5 and 15VDC
- CMOS Output
- Mechanical Trim
- 2 x 2 x .5 Inches
- Tightest Tolerance TCXO

- Industry Standard Package
- Excellent Long Term Aging
- "O" Ring Sealed Package
- Insulating Spacers, Standard
- One Week Delivery



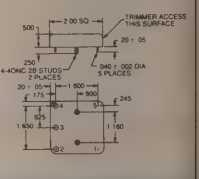
7290
- 3 - 8 MHz
- ±2.5 ppm
- -55°C to 85°C
- +5 and +10 VDC
- HCMOS Output
- Mechanical Trim
- 1.5 x 1.5 x .5 Inches
- Wide Temperature Operating Range

- 1 ppm Aging Per Year
- 4 Point Mount KTO-8 Crystal
- High Vibration & Shock
- 50MW Power Consumption



7307
- 10.00000 MHz
- ± 2 ppm
- -40°C to 85°C
- +12 VDC
- Sinewave Output
- Trim (Option)
- 2 x 2 x .5 Inches
- 0.5 Inch Max. Seating Height

- Phase Noise to -150 DBC @ 1 KHz
- 4 Point Mount KTO-8 Crystal
- High Vibration & Shock
- 50 Ohm Loading
- Phase Lock Application

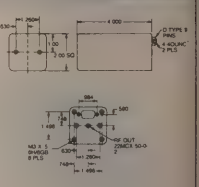


HIGH STABILITY OVEN CONTROLLED FREQUENCY STANDARDS

PHASE NOISE TO -170 DBC @ 1KHz • STABILITIES TO ± 1 • 10E-9 • LOW POWER

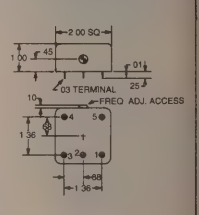
1224
- 5.0000 MHz
- ±2 x 10E-9
- ±1 x 10E-9 Option
- -150 DBC @ 1 KHz
- -170 DBC Option
- Low Current, 300 mA
- High Stability

- -10°C to 60°C Temperature Range
- Excellent Long Term Aging
- Digital Oven Monitoring
- 2 x 2 x 4 Inch
- External Freq. Control



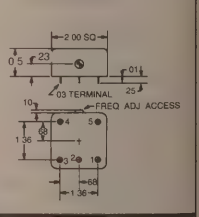
1225
- 2 to 10 MHz
- ±5 x 10E-9
- HCMOS Output
- -150 DBC @ 1KHz
- -170 DBC Option
- Low Current 215 mA
- 2 x 2 x 1 Inch
- High Stability
- -10°C to 60°C Temperature Range

- Excellent Long Term Aging
- Digital Oven Monitoring
- Low Power Consumption 1.6W Nom.
- Internal Mechanical Trimmer



1233
- 2 to 10 MHz
- ±5 x 10E-9
- HCMOS Output
- -150 DBC @ 1 KHz
- -170 DBC Option
- Low Current Drain
- 2 x 2 x 0.5 Inch
- High Stability
- Lowest Profile Available

- Only 1/2 Inch Seating Height
- -10°C to 60°C
- Excellent Long Term Stability
- Digital Oven Monitoring
- Internal Mechanical Trim



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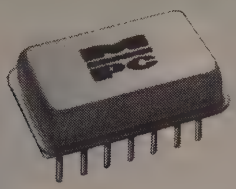
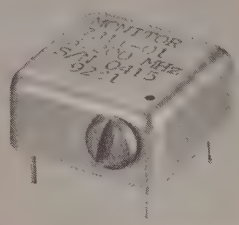


7285 14 PIN TCXO

7298 24 PIN TCXO



7311-01 1.0x1.0x0.5 INCH TCXO

BASIC TEMPERATURE COMPENSATED CRYSTAL OSCILLATORS

*Frequency Range	Frequency Stability	Temperature Range °C	**Output Waveform	Size LxWxH in.	Input Voltage	MPC Part Number
500 KHz-5.0 MHz	±5 ppm	-40 to 85	CMOS	1.6 x 1.6 x 0.5	10-12 VDC	7157
1.0 to 10.0 MHz	±2 ppm	-55 to 70	CMOS	2.0 x 2.0 x 0.82	8 VDC	7114
1.0 to 1.0 MHz	±1 ppm	-30 to 85	CMOS	2.0 x 2.0 x 0.53	10-12 VDC	7143
2 to 20 MHz	±1.0 ppm	-55 to 85	TTL/CMOS	1.5 x 1.5 x 0.32	15 VDC	7277
2 to 75 MHz	±1.0 ppm	-55 to 90	HCMOS	1.5 x 1.5 x 0.53	10/5 VDC	7290
5 to 24 MHz	±1.0 ppm	-40 to 85	HCMOS	1.25 x 1.25 x 0.5	12 VDC	7217
500 KHz-20 MHz	±1.0 ppm	-40 to 60	HCMOS	0.9 x 0.6 x 0.4	12-15 VDC	7285
10 to 50.0 MHz	±5 ppm	-40 to 85	TTL	2.0 x 2.0 x 0.75	10-15 VDC	7204
30 to 70.0 MHz	±0.5 ppm	0 to 50	SINEWAVE	2.0 x 2.0 x 0.75	12-15 VDC	7216

VOLTAGE CONTROLLED OSCILLATORS, VCXO'S

Frequency Range 0-70°C	Frequency Stability	Frequency Pullability	**Output Waveform	Size LxWxH in.	Input Voltage	MPC Part Number
4 to 24.9 MHz	±25 ppm	±200 ppm min.	HCMOS	.815 x .515 x .285	+5 VDC	6701
25 to 70 MHz	±25 ppm	±50 ppm min.	HCMOS	.815 x .515 x .285	+5 VDC	6702
25 to 70 MHz	±20 ppm	±50 ppm min.	HCMOS	.815 x .515 x .285	+5 VDC	6703

LOWEST COST COMMERCIAL/INDUSTRIAL TEMPERATURE COMPENSATED CRYSTAL OSCILLATORS

*Frequency Range	Frequency Stability	Temperature Range °C	**Output Waveform	Size LxWxH in.	Input Voltage	MPC Part Number
5.0 to 20 MHz	±0.5 ppm	-15 to 35	TTL	1.0 x 0.6 x 0.33	5 VDC ±5%	7400A1A1
5.0 to 20 MHz	±1.0 ppm	0 to 50	TTL	1.0 x 0.6 x 0.33	5 VDC ±5%	7400B2A1
5.0 to 20 MHz	±2.0 ppm	-10 to 60	TTL	1.0 x 0.6 x 0.33	5 VDC ±5%	7400D4A1
1.0 to 20 MHz	±1.0 ppm	0 to 50	TTL	1.5 x 1.5 x 0.50	5 VDC ±5%	7401B2A2
1.0 to 20 MHz	±1.0 ppm	-10 to 60	TTL	1.5 x 1.5 x 0.50	5 VDC ±5%	7401B4A2
1.0 to 20 MHz	±2.0 ppm	-20 to 70	TTL	1.5 x 1.5 x 0.50	5 VDC ±5%	7401D7A2

*Consult Factory for Available Standard Frequencies **Other Outputs Available: CMOS and Sinewave

HI-REL MIL-0-55310 CLOCK OSCILLATORS***

Frequency Range	Frequency Stability	Temperature Range °C	Output Waveform	Size LxWxH in.	Input Voltage	MPC Part Number
1 Hz to 100 MHz	±50 ppm	-55 to 125	TTL	.815 x .515 x .2	5 VDC	5600
1 Hz to 100 MHz	±50 ppm	-55 to 125	HCMOS	.815 x .515 x .2	5 VDC	6600
1.5 Hz to 66 MHz	±100 ppm	-55 to 125	HCMOS	0.27 x 0.19 x .09	5 VDC	SM-990

NOTE: P/N 5600, and 6600 are 14 pin dip oscillators. SM-990 is a ceramic surface mount oscillator.
***Built to conform to specifications of MIL-0-55310

MONITOR PRODUCTS COMPANY, INC.
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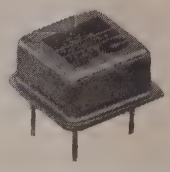
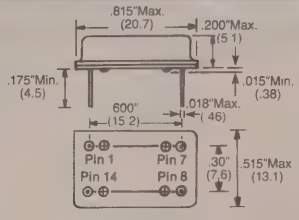
Environmental Protection

Low Cost
Proven Reliability
Special Outputs



*Inquire for a list of selected oscillators under $1.00.

970 FULL SIZE OSCILLATORS

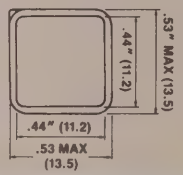


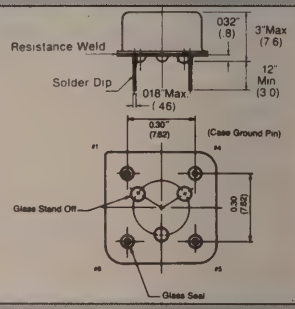
PIN CONNECTION

#1: N.C. OR ENABLE/DISABLE
#7: GND
#8: OUTPUT
#14: +5V_{DC}

Dimensions in inches and (mm)

975 HALF SIZE OSCILLATORS

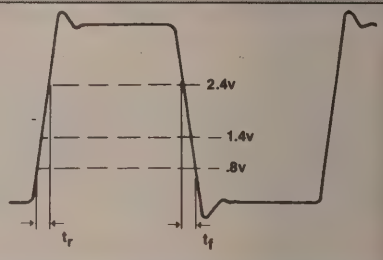




TTL CLOCK OSCILLATORS TO 120 MHZ

2 PRODUCT FAMILIES
1 MHz - 120 MHz
COMMONLY USED FOR MICROPROCESSOR CLOCK SIGNAL APPLICATIONS

TTL 970T FULL SIZE 14 PIN
TTL 975T HALF SIZE 8 PIN

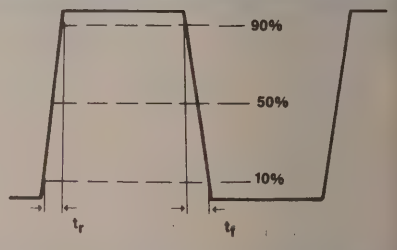


TYPICAL OUTPUT WAVE SHAPE

CMOS/HCMOS CLOCK OSCILLATORS TO 120 MHZ

7 PRODUCT FAMILIES
1 MHz - 120 MHz
DUAL OUTPUTS & TRISTATE AVAILABLE
COMMONLY USED IN LOW CURRENT AND HIGH DENSITY APPLICATIONS

HCMOS 970H FULL SIZE
HCMOS 975H HALF SIZE
970HD DUAL OUTPUT
970HHT ENABLE/DISABLE
970HHTX HEAVY LOAD TRISTATE
975 HHT TRISTATE HIGH ENABLE
975HHTX HEAVY LOAD TRISTATE

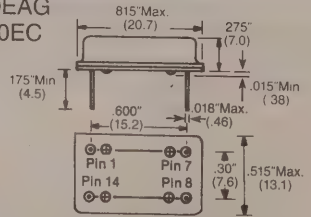


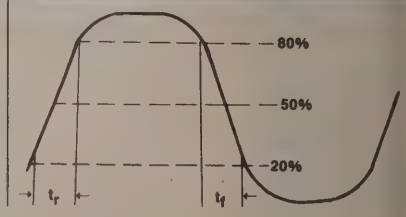
TYPICAL OUTPUT WAVE SHAPE

ECL CLOCK OSCILLATORS TO 200 MHZ**

2 PRODUCT FAMILIES
30 MHz - 200 MHz
COMMONLY USED IN HIGH SPEED GRAPHICS APPLICATIONS

970EAG
970EC





**Inquire for a list of selected ECL Clock Oscillators under $8.00.

ECL 970E TYPICAL OUTPUT WAVE SHAPE

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MONITOR Products

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FAX: (619) 434-0255
EASTERN PHONE: (904) 725-4384
FAX: (904) 725-4584

$2 MILLION INVENTORY TO SERVE OUR CUSTOMERS

Standard Operating Temperature Range: 0°C to 70°C (Other temperature ranges available)
Storage Temperature Range: -55°C to +125°C
Standard Tolerance: ±100 ppm @ 25°C (Other tolerances available)
AQL: 0.65 Standard (MIL-STD-105)

Product Family	Frequency Range	Standard Tolerance	Output Symmetry	TR and TF (Max)	"0" Level (Max)	"1" Level (Min)	Input Voltage Current (Max)	Output Load
970T (TTL)	1 MHz-120 MHz	±100 ppm (.01%) ±50 ppm typ.	50/50 ±10% ±5% Avail.	15nS 1 - 3.5MHz 10nS 3.5 - 20MHz 6nS 20 - 100MHz	+0.4V	+2.4V	5V ±10% 70mA1-3.19 MHz 30mA3.2-24.9MHz 50mA25-80 MHz	10 TTL Gates
975T (1/2 Size)	1 MHz-120 MHz	±100 ppm (.01%)	50/50 ±10% ±5% Avail.	10nS Max.	+0.4V	+2.4V	5V ±10% 50mA Max.	5 TTL Gates
970H (High Speed CMOS)	1 MHz-120 MHz	±100 ppm (.01%)	50/50 ±5%	10nS Max.	+0.5V	+4.5V	5V ±10% 20mA Max.	CMOS CL 20 pf
975H (1/2 Size)	1 MHz-120 MHz	±100 ppm (.01%)	50/50 ±5%	10nS Max.	+0.5V	+4.5V	5V ±10% 15mA Max.	CMOS 20 pf
970HD (Independent Dual Output HCMOS)	3.5 MHz-70 MHz	±100 ppm (.01%)	50/50 ±5%	10nS Max.	+0.5V	+4.5V	+5V ±10% 30mA Max.	CMOS 20 pf
970HHT (Tristate High Enable CMOS Input)	1.0 MHz-105.561 MHz	±100 ppm (.01%)	50/50 ±5% to 70 MHz 40/60 ±5% above 70 MHz	10nS Max.	+0.5V	+4.5V	50mA Max.	CMOS 20 pf or 10 LSTTL Compatible Gates to 50 MHz
970HHTX (Heavy Load Tristate)	3.5 MHz-70 MHz	±100 ppm (.01%)	50/50 ±5%	10nS Max.	+0.5V	+4.5V	5V ±10% 50mA Max.	CMOS 50 pf or 10 TTL Compatible Gates to 50 MHz
975HHT (Tristate High Enable CMOS Input)	1.0 MHz-100.0 MHz	±100 ppm (.01%)	50/50 ±5%	10nS Max.	+0.5V	+4.5V	5V ±10% 50mA Max.	CMOS 20 pf or 10 TTL Compatible Gates to 50 MHz
975HHTX (Heavy Load Tristate)	3.5 MHz-70 MHz	±100 ppm (.01%)	50/50 ±5%	10nS Max.	+0.5V	+4.5V	5V ±10% 50mA Max.	CMOS 50 pf or 10 TTL Compatible
970EAG (ECL)	30 MHz-200 MHz	±100 ppm (.01%)	50/50 ±10%	2nS Max.	+3.2V	+4.0V.	+5V ±10% 60mA Max.	330 ohms
970EC (ECL)	30 MHz-200 MHz	±100 ppm (.01%)	50/50 ±10%	2nS Max.	-1.60V	-1.00V	-5.2V ±10% 60mA Max.	50 ohms
SM-990 (Surface Mount HCMOS Tristate)	1.8 MHz-50.0 MHz	±100 ppm (.01%)	50/50 ±5%	10nS	+0.5V	+4.5V	5V ±10% 20mA1.5-19MHz 35mA20-50.0MHz	50 pf
SM-991 (Low Power Surface Mount HCMOS Tristate)	1.8 MHz-66.666 MHz	±100 ppm (.01%)	50/50 ±5%	10nS	+0.5V	+4.5V	5V ±10% 10mA1.8-29MHz 15mA30-39MHz 30mA40-66MHz	15 pf
SM-992 (3VDC Surface Mount HCMOS Tristate)	1.8 MHz-34 MHz	±100 ppm (.01%)	50/50 ±5%	10nS	+10% of Vcc Max.	80% of Vcc Min.	+3VDC ±0.3V 2mA1.8432MHz 5mA34.000MHz	15 pf
SM-993 (Low Profile Surface Mount HCMOS Tristate)	1.8 MHz-50.0 MHz	±100 ppm (.01%)	50/50 ±5%	10nS	0.5V	+4.5V	5VDC ±0.5V 35mA1.8-50.0MHz	50 pf
SM-994 (Low Profile, Low Power Surface Mount HCMOS Tristate)	1.8 MHz-66.666 MHz	±100 ppm (.01%)	50/50 ±5%	10nS	0.5V	+4.5V	+5VDC ±1.8V 10mA1.8-29MHz 15mA30-34MHz 30mA35-66MHz	15 pf

TCXO'S, VCXO'S, OCXO'S, HI-REL OSC., DIP OSC. CRYSTALS

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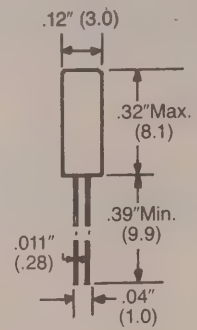
CRYSTALS

TCXO'S, VCXO'S, OCXO'S, HI-REL OSC., DIP OSC.

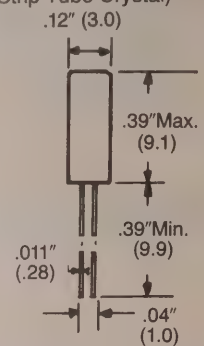
$2 MILLION INVENTORY TO SERVE OUR CUSTOMERS

SELECTED CRYSTALS AVAILABLE FOR 28 CENTS

MM-38
(Watch Crystal)

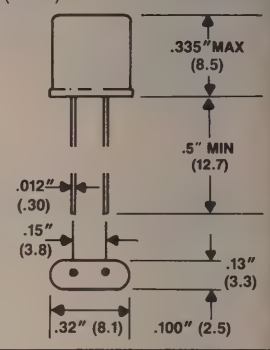


MM-39
(AT Strip Tube Crystal)

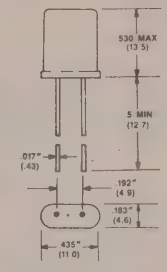


MM-80
(UM1)

Dimensions in inches and (mm)

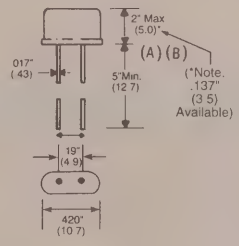


MM-18/49*
(HC-18/49)

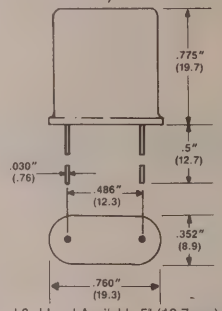


Optional 3rd Lead Available.5" (12.7mm) MIN
*Resistance Welded

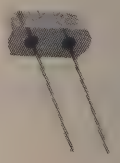
MS-49
(HC-49/S)



MM-33/MM-51*
(HC-33/HC-51)



Optional 3rd Lead Available.5" (12.7mm) MIN
*Resistance Welded



MICROPROCESSOR CRYSTALS

MPC Part #	Frequency Range	Stability	ESR OHMS (Max)	Drive Level (Max)	Shunt Capitance (Max)
MM-38	23.0 KHz-120.0 KHz	±50 ppm -10°C to 60°C	40K OHMS	1 µW	1.1 pf
MM-39	3.579 MHz-25.0 MHz	±50 ppm -10°C to 60°C	3.5 MHz 200 OHMS 25 MHz 50 OHMS	100 µW	7.0 pf
MM-18/49	1.0 MHz-24.0 MHz[2] (Fundamental) 24.0 -170.0 MHz (Overtone)	±50 ppm[1] -20°C to 70°C	1.0 MHz 3000 OHMS 3.579-12.0 MHz 100 OHMS 12.0-70.0 MHz 40 OHMS 70.0-170.0 MHz 130 OHMS	1.0 mw	7.0 pf
MM-80 (Standard Gold Leads)	3.5 MHz-30.0 MHz (Fundamental) 30.0 MHz-140.0 MHz (Overtone)	±50 ppm -20°C to 70°C	3.5-3.999 MHz 300 OHMS 4.0-7.99 MHz 200 OHMS 8.0-9.999 MHz 90 OHMS 10.0-25.0 MHz 40 OHMS 25.0-59.999 MHz 60 OHMS 60.0-129.999 MHz 90 OHMS 130.0-140.0 MHz 150 OHMS	100 µW	7.0 pf
MM-33/51	245 KHz-4.0 MHz	±50 ppm[1] -10°C to 60°C	245 KHz-1.0 MHz 200 OHMS 1.0-1.8432MHz 800 OHMS 1.8432-2.0 MHz 500 OHMS 2.0-3.0 MHz 400 OHMS 3.0-4.0 MHz 100 OHMS	2.0 mw	7.0 pf
MS-49	3.579MHz-50.0 MHz	±50 ppm -20°C to 70°C	3.5-6.00 MHz 150 OHMS 6.01-8.00 MHz 80 OHMS 8.01-10.00 MHz 80 OHMS 10.01-27.9 MHz 60 OHMS 28.0-45.0 MHz 40 OHMS 28.0-50.0 MHz 100 OHMS* *3rd Overtone	1.0 mW	7.0 pf

Load Capacitance: Specify [1]Below 2 MHz stability tolerance is ± 100 ppm [2]Frequency range over 3 MHz are all AT Cut–See MM38 for lower frequencies

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MONITOR PRODUCTS SURFACE MOUNT CRYSTALS & CLOCK OSCILLATORS

SURFACE MOUNT CLOCK OSCILLATORS

NEW SM-990 FAMILY OF MICRO-MINIATURE CERAMIC AND SEAM WELD CLOCK OSCILLATORS

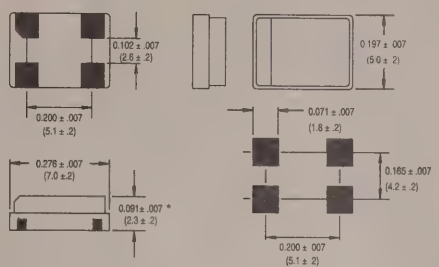
SM-990
- General Purpose Use
- 1.8 to 50.0 MHz
- Ceramic Package
- Glass Hermetic Seal
- Stability .01% (.005% Optional)
- HCMOS/TTL Compatible
- 45/55 Symmetry
- Tristate Enable Disable
- MTBF = 524K Hours
- 5NS Typical R/F time
- 8 to 35 MA Typical Input Current
- 50 pf Load

SM-991
- Low Power 5 Volt
- 1.8 to 66.666 MHz
- Ceramic/Glass Package
- Stability .01% (.005% Optional)
- HCMOS/LSTTL Compatible
- MTBF = 524K Hours
- 5NS Typical R/F time
- 15 PF Load
- 6 to 15 MA Typical Input Current
- Tristate Enable Disable

SM-992
- 3 Volt Low Power
- 1.8 to 34.0 MHz
- Ceramic/Glass Package
- Stability .01% (.005% Optional)
- MTBF = 524K Hours
- 0 to 70°C Operating Temperature Range
- Vibration/ Shock per MIL STD 202F
- Tristate Enable Disable
- 15 pf Load

SM-993
- 1.7mm Height
- 1.8 to 50.0 MHz
- Seam Weld Package
- Stability .01% (.005% Optional)
- HCMOS/TTL Compatible
- 45/55 Symmetry
- Tristate Enable Disable
- 5NS Typical R/F time
- 35 MA Typical Input Current
- 50 pf Load

SM-994
- 1.7mm Height
- 1.8 to 66.666 MHz
- Seam Weld Package
- Stability .01% (.005% Optional)
- HCMOS/LSTTL Compatible
- 45/55 Symmetry
- Tristate Enable Disable
- 5NS Typical R/F time
- 6-15 MA Typical Input Current
- 15 pf Load



*Au lead plg: 1.0 micro meters M min.; 2.5 micro meters M max.

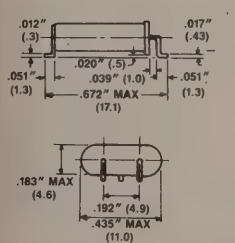
*SM-993 & SM-994 0.07" (1.7mm)

Surface Mount Oscillators available in all output formats. Not all options available in all product families. Check family datasheet or call factory.

SURFACE MOUNT CRYSTALS

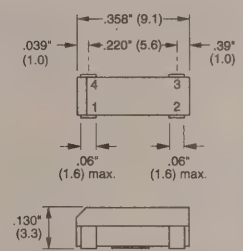
Dimensions in inches and (mm)

SM-49

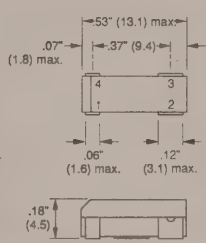


SMS-49
Tape & Reel Available

SM-38
Tape & Reel Standard



SM-55
Tape & Reel Standard



SURFACE MOUNT CRYSTAL CHARACTERISTICS

MPC Part #	Frequency Range	Stability	ESR OHMS (Max.)	Drive Level (Max.)	Shunt Capacitance (Max.)
SM-49*	1.0 MHz-150.0 MHz	±50 ppm -20°C to 70°C	1.0 MHz 3000 OHMS 1.8432 MHz 800 OHMS 2.00-2.457 MHz 500 OHMS 2.4576-2.999 MHz 300 OHMS 3.00-3.5 MHz 200 OHMS 3.51-4.43 MHz 100 OHMS 4.44-4.9152 MHz 70 OHMS 4.92-5.58 MHz 55 OHMS 5.59-5.99 MHz 45 OHMS 6.09-7.9MHz 40 OHMS 8.0-9.83 MHz 35 OHMS 9.8304-13.5 MHz 30 OHMS 13.6-17.99 MHz 25 OHMS 18.0-24.00 MHz 20 OHMS 20.0-70.00 MHz* 40 OHMS 70.0-130.00 MHz** 100 OHMS 120.0-170.00 MHz*** 130 OHMS	1.0 mW	7.0 pf
SMS-49	3.57 MHz-50.0 MHz	±50 ppm -20°C to 70°C	3.57-6.0 MHz 150 OHMS 6.01-10.0 MHz 80 OHMS 10.01-27.9 MHz 60 OHMS 28.0-45.0 MHz 40 OHMS 28.0-50.0 MHz 100 OHMS	1.0 mW	7.0 pf
SM-38	32.768 KHz	±50 ppm -10°C to 60°C	40K OHMS	100 mW	.85 (typical)
SM-55	3.5 MHz-50.0 MHz	±100 ppm -10°C to 70°C	3.5 MHz 200 OHMS 10.0 MHz 60 OHMS 25.0 MHz 50 OHMS 50.0 MHz 100 OHMS	100 µW	7.0 pf

*3rd, **5th, ***7th Overtone

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TCXO'S, VCXO'S, OCXO'S, HI-REL OSC., DIP OSC. CRYSTALS

eem MINIGLOSSARY

BASIC ASCII CODE

				b7	0	0	0	0	1	1	1	1
				b6	0	0	1	1	0	0	1	1
				b5	0	1	0	1	0	1	0	1
b4	b3	b2	b1		0	1	2	3	4	5	6	7
0	0	0	0	0	NUL	DLE	SP	0	@	P	`	p
0	0	0	1	1	SOH	DC1	!	1	A	Q	a	q
0	0	1	0	2	STX	DC2	"	2	B	R	b	r
0	0	1	1	3	ETX	DC3	#	3	C	S	c	s
0	1	0	0	4	EOT	DC4	$	4	D	T	d	t
0	1	0	1	5	ENQ	NAK	%	5	E	U	e	u
0	1	1	0	6	ACK	SYN	&	6	F	V	f	v
0	1	1	1	7	BEL	ETB	'	7	G	W	g	w
1	0	0	0	8	BS	CAN	(	8	H	X	h	x
1	0	0	1	9	HT	EM	)	9	I	Y	i	y
1	0	1	0	10	LF	SUB	*	:	J	Z	j	z
1	0	1	1	11	VT	ESC	+	;	K	[	k	{
1	1	0	0	12	FF	FS	,	<	L	\	l	|
1	1	0	1	13	CR	GS	-	=	M	]	m	}
1	1	1	0	14	SO	RS	.	>	N	^	n	~
1	1	1	1	15	SI	US	/	?	O	_	o	DEL

Control Character Representations

NUL	Null
SOH	Start of Heading (CC)
STX	Start of Text (CC)
ETX	End of Text (CC)
EOT	End of Transmission (CC)
ENQ	Enquiry (CC)
ACK	Acknowledge (CC)
BEL	Bell
BS	Backspace (FE)
HT	Horizontal Tabulation (FE)
LF	Line Feed (FE)
VT	Vertical Tabulation (FE)
FF	Form Feed (FE)
CR	Carriage Return (FE)
SO	Shift Out
SI	Shift In
DLE	Data Link Escape (CC)
DC1	Device Control 1
DC2	Device Control 2
DC3	Device Control 3
DC4	Device Control 4
NAK	Negative Acknowledge (CC)
SYN	Synchronous Idle (CC)
ETB	End of Transmission Block (CC)
CAN	Cancel
EM	End of Medium
SUB	Substitute
ESC	Escape
FS	File Separator (IS)
GS	Group Separator (IS)
RS	Record Separator (IS)
US	Unit Separator (IS)
DEL	Delete

(CC) Communication Control
(FE) Format Effector
(IS) Information Separator

Special Graphic Characters

SP	Space	<	Less Than
!	Exclamation Point	=	Equals
¦	Logical OR	>	Greater Than
"	Quotation Marks	?	Question Mark
#	Number Sign	@	Commercial At
$	Dollar Sign	[	Opening Bracket
%	Percent	\	Reverse Slant
&	Ampersand	]	Closing Bracket
'	Apostrophe	^	Circumflex
(	Opening Parenthesis	¬	Logical NOT
)	Closing Parenthesis	—	Underline
*	Asterisk	`	Grave Accent
+	Plus	{	Opening Brace
,	Comma	¦	Vertical Line (This graphic is stylized to distinguish it from Logical OR)
-	Hyphen (Minus)		
.	Period (Decimal Point)		
/	Slant	}	Closing Brace
:	Colon	~	Tilde
;	Semicolon		

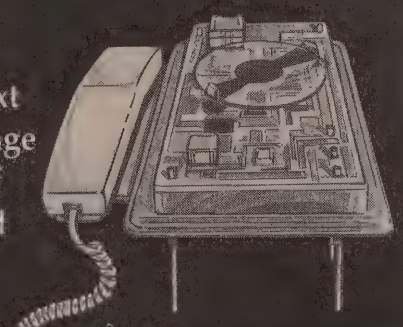
Design Dilemma?

You can spend a couple hours looking through these pages,

or

call the M-tron DESIGN LINE at 1-800-762-8800 and get help fast!

Let M-tron provide the best solution to your next crystal/oscillator challenge with our wide variety of high-quality custom and off-the-shelf products.



We'll evaluate your needs, give technical assistance and deliver on time, all at a competitive price. *Satisfaction guaranteed.*

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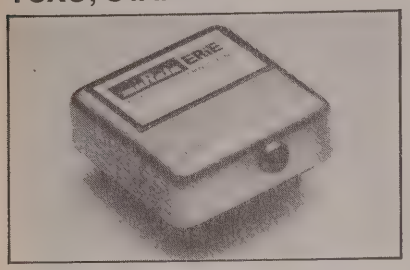
crystal oscillators

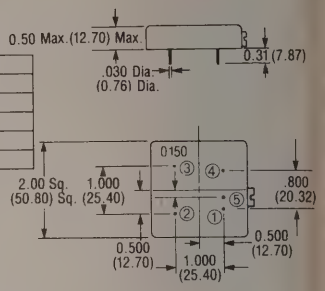
TCXO, STANDARD



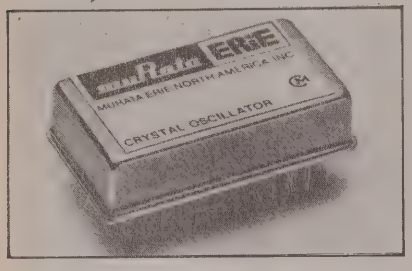
SPECIFICATIONS

MODEL	TC2140-□□
Features	High stability Very low aging
Frequency Range	6MHz to 20Mhz
Frequency Stability vs. Temperature Range	±0.25ppm 0°C to +50°C
Input Voltage & Current	+12VDC @ 15mA Max.
Output type	TTL
Aging Rate	0.2ppm/Yr.
Frequency Adjustment	Mechanical 10 Yr. Range Minimum

PIN	FUNCTION
1	Output
2	B+
3	Ground
4	N/C
5	Ground



TCXO, MINIATURE



SPECIFICATIONS

MODEL	TC2100-□□	TC2110-□□
Features	Requires only 0.35 cu. In., Direct Replacement for K1516 Series	Low cost, +5VDC operation
Frequency Range	6MHz to 24MHz	5MHz to 25 MHz
Frequency Stability Vs. Temperature Range	±2ppm, −40°C to +85°C	±1ppm, −20°C to +70°C
Input Voltage & Current	+10VDC @ 5mA Max.	±5VDC @ 20mA Max.
Output Type	Sine, 1Vp-p, 1KΩ LOAD (Harmonics < −20dBc)	"HC" CMOS
Aging Rate	1ppm/YR.	1ppm/YR.
Frequency Adjustment	Electrical Via Ext. Pot. or control voltage; 5 Yr. Range Minimum	Mechanical 10 Yr. Range Minimum
Figure	1	2

PIN	FUNCTION
1	Ground
2	RF Output
3	+VDC
7	Frequency Adj. V ref
8	N/C
12	N/C
14	Frequency Adj. Input

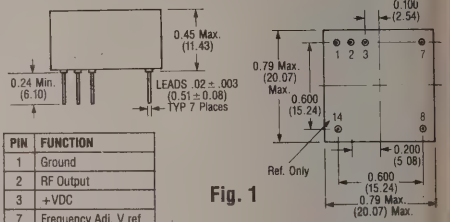
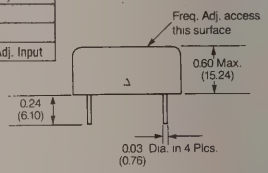


Fig. 1



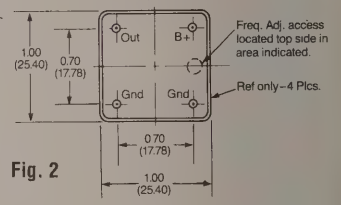
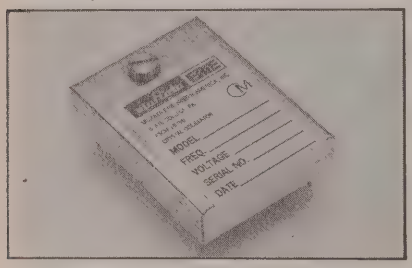


Fig. 2

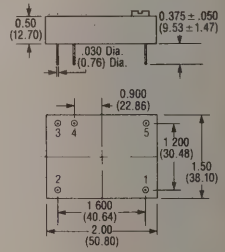
TCXO, HIGH FREQUENCY



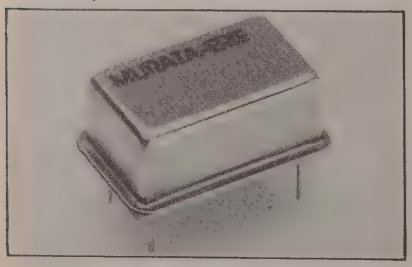
SPECIFICATIONS

MODEL	TC2170-□□	TC2180-□□
Features	Small Package Internal freq. multiplier for better stability with fundamental crystal.	Very small package for UHF TCXO
Frequency Range	24MHz to 120MHz	120MHz to 500MHz
Frequency Stability Vs. Temperature Range	±1ppm, −40°C to +70°C	±5ppm, −40°C to +70°C
Input Voltage & Current	+7.5VDC @ 40mA Max.	+7.5VDC @ 45MA Max.
Output Type	+3dBm, 50Ω LOAD (Harmonics & Subharmonics < −30dBc)	+3dBm, 50Ω LOAD (Harmonics & Subharmonics < −30dBc)
Aging Rate	1ppm/YR.	2ppm/YR.
Frequency Adjustment	Mechanical; 5 Yr. Range Minimum	Mechanical; 5 Yr. Range Minimum

PIN	FUNCTION
1	B+
2	Ground
3	Output
4	Ground
5	Ground



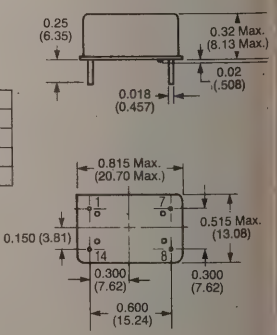
VCXO, MINIATURE HYBRID



SPECIFICATIONS

MODEL	VH2340HE
Features	High frequency fundamental crystal
Frequency Range	15MHz to 60MHz
Input Voltage & Current	−5.2 VDC @ 35mA Typ.
Output Type	ECL "10KH"
Control Voltage and Freq. vs. Voltage Slope	0V to −5.0V Negative
AFC Input Impedance	10KΩ Min.
Linearity	±20%
Deviation	±10ppm
Temp. Stability	±25ppm
Temp. Range	0°C to 70°C

PIN	FUNCTION
1	Voltage Control Input
7	V_{ee} (−5.2V)
8	Output
14	Case & Circuit Ground



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crystal oscillators

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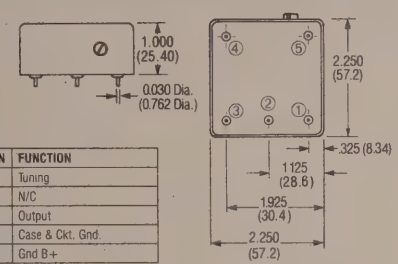
OCXO, HIGH STABILITY

SPECIFICATIONS

MODEL	OC2500ET	OC2520EK	OC2530EJ
Features	Low Profile Oven	"SC" or "IT" Cut Crystal For Fast Warm-Up Low Phase Noise	VHF Frequency
Frequency Range	1MHz to 20MHz	5MHz to 15MHz	50MHz to 400MHz
Input Voltage and Power	15VDC 1.5W @ 25°C Typ. 4W Max. @ Turn-On	+15VDC 3W @ 25°C Typ. 15W Max. @ Turn-On	+15VDC 3.0W @ 25°C Typ. 9W Max. @ Turn-On
Output Type	TTL	+7 dBm into 50Ω	+3 dBm into 50Ω
Electronic Freq. Control and Freq. vs. Voltage Slope	±2.0ppm min. for 0±5v Negative	$\pm 2\times10^{-7}$ for 0±5v Negative	±3ppm Mechanical
Temperature Stability	$\pm 1\times10^{-7}$ −20°C to +70°C	$\pm 5\times10^{-9}$ −40°C to +75°C	$\pm 1\times10^{-7}$ −20°C to +70°C
Aging	2×10^{-9}/DAY	5×10^{-10}/DAY	1×10^{-8}/DAY
Package	2.25×2.25×1.00	2.0×2.0×4.0	2.0×2.0×4.0
Figure	1	2	2



PIN	FUNCTION
1	Tuning
2	N/C
3	Output
4	Case & Ckt. Gnd.
5	Gnd B+

Fig. 1

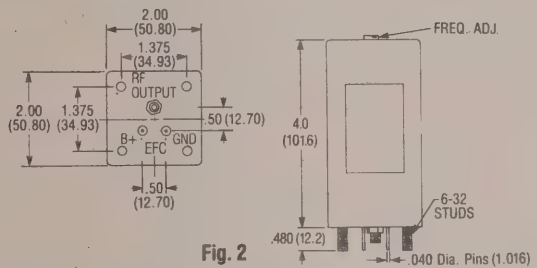
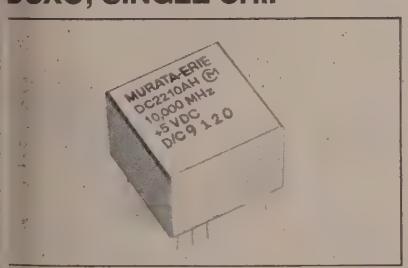


Fig. 2

OCXO, SINGLE CHIP



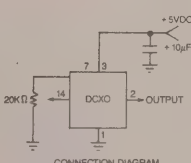
SPECIFICATIONS—MODEL DC221□□□

- Only one active device gives high reliability
- Low parts count for smallest size and best price
- Better stability than any other low cost TXCO

Frequency Range: 6MHz to 25MHz
Output: "H" ("HC" CMOS)
Spurious: −60dBc
Input Voltage: A Std. (+5VDC)
Input Current: 20mA Typ.
Frequency Adjustment: To offset at least 10 Yrs. Aging

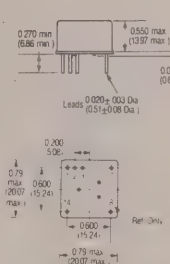
Frequency Stability: (△f/f) vs.:
Temperature: See Table
Input Voltage: $\pm 5\times10^{-8}$/%
Load Variation: $\pm 1\times10^{-8}$/%
Time: 1ppm/Yr. Typ.
Time After Turn-On: $\pm 1\times10^{-7}$ within 5 sec.

MODEL NO.	Temp. Range	Max. Freq. Error
DC2210	−40°C to +85°C	±5 x 10^{-7}
DC2212	0°C to +70°C	±2.5 x 10^{-7}

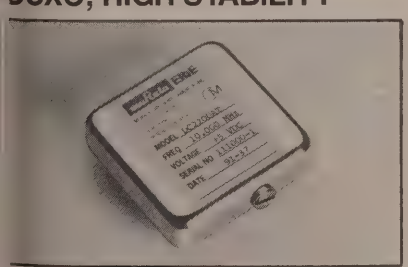


CONNECTION DIAGRAM

PIN	FUNCTION
1	Ground
2	RF Output
3	+VDC
7	Frequency Adj. V Ref
8	N/C
14	Freq. Adj. Input



OCXO, HIGH STABILITY



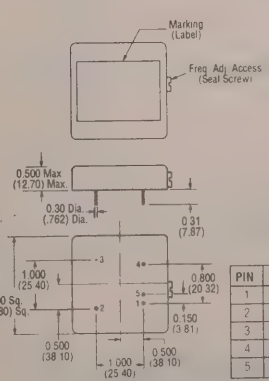
SPECIFICATIONS—MODEL DC220□□□

- Single +5VDC supply, low power consumption
- High stability yet low cost- best price/performance ratio available
- Low profile package- 2.0x2.0x0.5"H

Frequency Range: 100kHz to 22MHz
Output: T Std. (TTL); C, J optional
Output Symmetry: 50/50±5%
Spurious: −60dBc
Input Voltage: A Std. (+5VDC)
Input Current: 22mA Typ.
Mechanical Frequency Adjustment: To offset at least 10 Yrs. Aging

Frequency Stability: (Δf/f) vs.:
Temperature: See Table
Input Voltage: ± 1 x 10^{-6}/%
Load Variation: ± 1 x 10^{-6}/%
Time: ± 2 x 10^{-7}/Yr. Typ.
Time After Turn-On: ± 1 x 10^{-7} within 5 sec.

MODEL NO.	Temp. Range	Max. Freq. Error
DC2200	−40°C to +85°C	±3 x 10^{-7}
DC2202	0°C to +70°C	±1 x 10^{-7}



PIN	FUNCTION
1	Output
2	N/C
3	Ground
4	+5VDC
5	Ground

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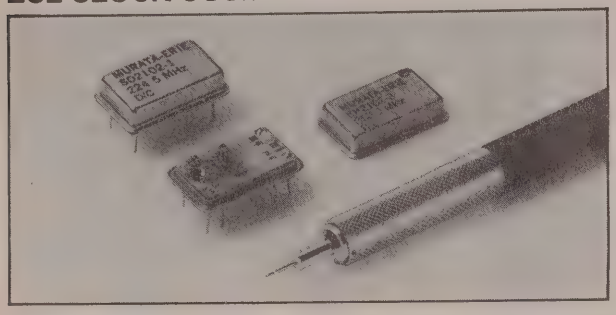
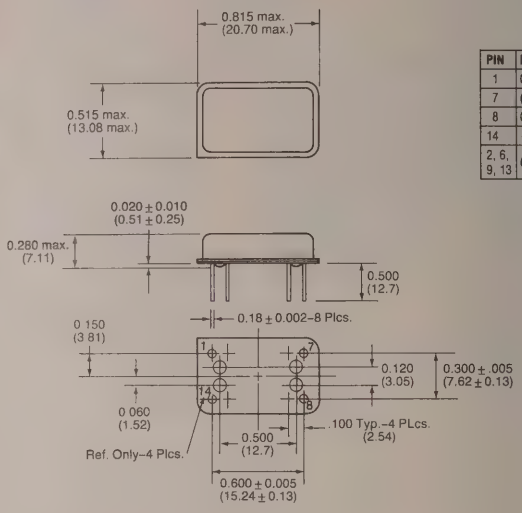
ECL CLOCK OSCILLATOR



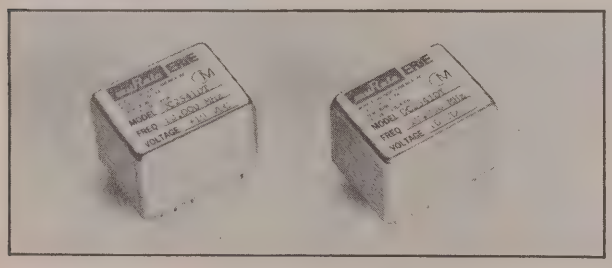


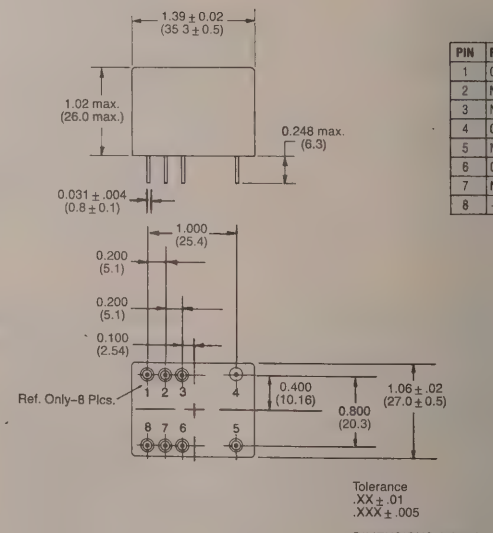
PIN	FUNCTION
1	Output Compliment
7	(Ground) VEE
8	Output
14	+5 VCC
2, 6, 9, 13	GND

SPECIFICATIONS

MODEL	SH2128□□-1
Features	Saw oscillator High frequency Small package High performance
Frequency Range	200MHz to 500MHz
Frequency Stability vs. Temperature Range	±250ppm max. 0°C to +70°C
Input Voltage & Current	+5VDC @ 120mA max. (-5.2VDC)
Output Type	ECL "100K"
Duty Cycle	50/50±10%
Rise & Fall Times	1.0nS max.
Load	50 OHMs to −2V
Aging Rate	±5ppm/Yr. typ.
Storage Temperature Range	−20°C to +80°C

OCXO MINIATURE





PIN	FUNCTION
1	Output
2	N/C
3	N/C
4	Ground
5	N/C
6	Control Voltage
7	N/C
8	+12V

SPECIFICATIONS

MODEL	OC2545 DT	OC2541 DT
Features	Low cost High stability Low phase noise Small package	Very low cost for High stability "SC" cut osc. Low phase noise Small package
Frequency Range	5MHz to 20MHz	5MHz to 20MHz
Input Voltage and Power	+12VDC@250mA max. (90mA Typ.)	+12VDC@250mA max. (90mA Typ.)
Output Type	TTL 50/50 duty cycle	TTL 50/50 duty cycle
Electronic Freq. Control: Freq. vs. Voltage	±4ppm min., 0 to +6VDC	±1ppm min., 0 to +10VDC
Temperature Stability	±0.05ppm Typ., 0°C to +50°C	±0.01ppm Typ., 0°C to +50°C
Aging	0.3ppm/Yr.	0.15ppm/Yr.
Package	1.39″ x 1.06″ x 1.00″	1.39″ x 1.06″ x 1.00″

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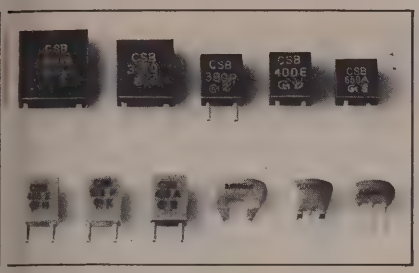
piezoelectric ceramic resonators

muRata ERiE®
MURATA ERIE NORTH AMERICA

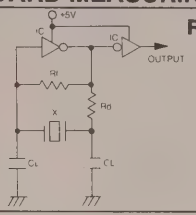


Murata Erie's ceramic resonators are widely used in clock oscillators for microprocessors, replacing quartz crystals at substantially reduced cost, and in many other applications.

Features of ceramic resonators include low cost, good stability, small size and rugged construction, and a wide frequency range.

STANDARD MEASURING CIRCUIT

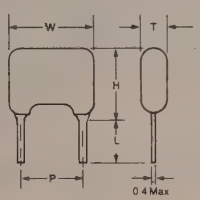
RCA CD4069



SPECIFICATIONS

TYPE	CSA TYPE	CSB TYPE	CST TYPE
Frequency Range	1.26 to 32 MHz	190 to 1250 KHz	1.8 to 25.99 MHz
Frequency Tolerance	±0.5%	±0.5%	±0.5%
Temperature Stability (-20°C to +80°C)	±0.5%	±0.3%	±0.3%
Time Stability (10 years)	±0.3%	±0.3%	±0.3%

CSA TYPE*



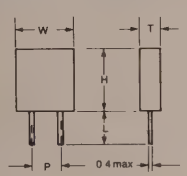
Unit: mm

Dimensions mm	MK	MG	MTZ	MXZ
	1.26 to 1.799 MHz	1.8 to 6.30 MHz	6.31 to 13.0 MHz	13.01 to 32.0 MHz
W	10.0	10.0 (12.0)**	10.0	10.0
H	10.0	7.5 (12.0)	10.0	10.0
T	5.0	5.0 (5.0)	5.0	5.0
P	5.0	5.0 (5.0)	(5.0)	5.0
L	5.0	5.0 (5.0)	5.0	5.0
Capacitance				
CL_1	30pF			
CL_2	30pF			

**Dimensions in parentheses ( ) for Freq. Range 2.0 to 2.75 MHz

CSB TYPE*

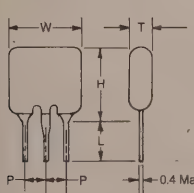
D : Offset
J : In-Line



Unit: mm

Dimensions mm	D	D	J	J	J	J
	190 to 249 KHz	250 to 374 KHz	375 to 429 KHz	430 to 519 KHz	520 to 699 KHz	700 to 1250 KHz
W	13.5	10.8	8.0	7.5	7.5	5.0
H	14.5	12.2	9.0	8.5	7.2	6.0
T	3.8	3.8	3.3	3.3	2.8	2.2
P	10.1	7.7	5.0	5.0	5.0	2.5
L	9.0	6.7	3.5	3.5	3.5	3.5
Capacitance						
CL_1	330pF	220pF	120pF	100pF	100pF	100pF
CL_2	470pF	470pF	470pF	100pF	100pF	100pF

CST TYPE*

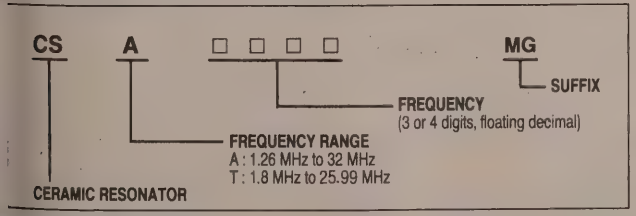


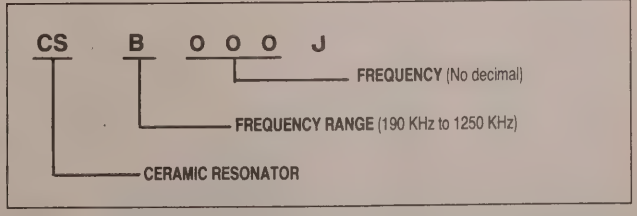
Dimensions mm	MG	MTW	MGW	MXW
	1.80 to 2.44 MHz	6.31 to 13.0 MHz	2.45 to 6.30 MHz	13.01- 25.99
W	10.0	10.0	10.0	10.0
H	10.0	10.0	5.0	10.0
T	5.0	5.0	5.0	5.0
P	2.5	2.5	2.5	2.5
L	5.0	5.0	5.0	5.0

CL_1 and CL_2 (loading capacitors) built-in.

For additional information, please refer to Catalog #63-06

PART NUMBERING SYSTEM





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ceramic filters

Emitter Bypass Filters

Model	Center Frequency (KHz)	3dB Bandwidth (KHz)	Ripple (dB) max.	Selectivity (dB) min.	Termination Impedance (ohms) max.
BFU455K	455 ±2	8 (±2KHz)	—	8 @-9KHz 12 @ +9KHz	30 (15)

TV Sound Filters

Model	Nominal Frequency (MHz)	3dB Bandwidth (KHz) min.	20dB Bandwidth (KHz) max.	Spurious Response (dB) min.	Insertion Loss (dB) max.	Input/Output Impedance (ohms)
SFE 4.5MBF	4.5	±60	530KHz	30dB min. (3.5-4.5MHz) 20dB min. (4.5-5.3MHz)	6	1000

Ceramic Filters For Digital Communications

Model	Nominal Center Frequency (KHz)	6dB Bandwidth (KHz) min.	Stopband Attenuation (dB) min. (f_o ±100KHz)	Ripple (dB) max.	Selectivity (dB) min.	6DT 20μ/Sec. Bandwidth (KHz)	Insertion Loss (dB) min.	Input/Output Impedance (ohms)	Operating Temperature Range	Withstanding Voltage
SFP450D	450	±10	27	450 ±7 2	40 @ ±20KHz	—	4	1.5K	−20°C to +80°C	50V DC
SFP450F	450	±6	27	450 ±4 1.5	40 @ ±12.5KHz	—	6	2K		
SFR450D	450	±10	25	—	50 @ ±20KHz	—	5	2K		
SFR450F	450	±6	25	—	50 @ ±12.5KHz	—	4	1.5K		
SFG450D	450	±10	23	—	40 @ ±25KHz	±9	7	1.5K		
SFG450F	450	±6	23	—	40 @ ±17.5KHz	±6	9	2K		
SFH450D	450	±10	35	—	50 @ ±25KHz	±8	8	1.5K		
SFH450F	450	±6	35	—	50 @ ±17.5KHz	±5	10	2K		

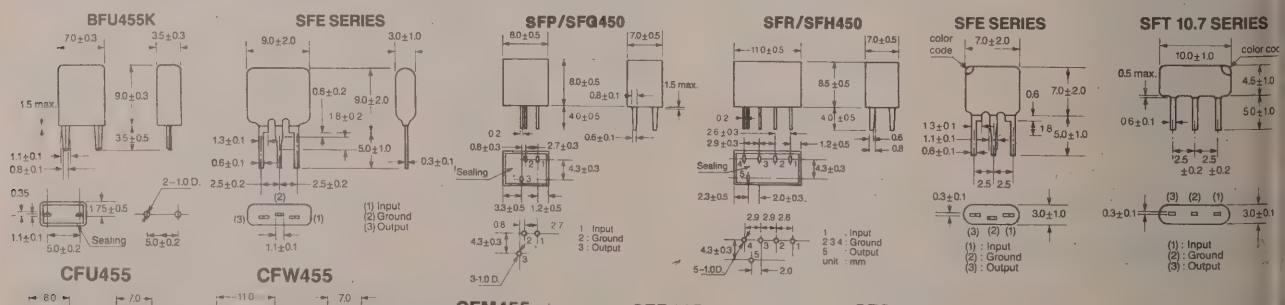
Ceramic Filters For FM Radios

Model	Center Frequency (MHz, ±30KHz)	3dB Bandwidth (KHz) min.	20dB Bandwidth (KHz) max.	40dB Bandwidth (KHz) max.	Ripple (dB) max.	Spurious Response (8-12MHz) (dB) min.	Insertion Loss (dB) max.	Input/Output Impedance (ohms)	Operating Temperature Range	Withstanding Voltage
SFE 10.7MA5-A	A:10 7 (Red)	280 ±50	650	—	1.0	30	6	330	−20°C to +80°C	50V DC
SFE 10.7MS2-A		230 ±50	570	—	1.0	40	6			
SFE 10.7MS3-A		180 ±40	520	—	1.0	40	7			
SFE 10.7MJA10-A		150 ±40	380	—	1.0	38	10			
SFT 10.7MS3-A		180 ±40	—	550	0.5	(9-12 MHz) 50	7.5			
SFT 10.7MA5-A	Z:10.7±90KHz	280 ±50	—	700	0.5	(9-12 MHz) 50	6.0			

Multi-Element For High Selectivity Ladder Filters

Model	Center Frequency (KHz)	6dB Bandwidth (KHz) min.	Bandwidth (KHz) min.	Spurious Response (dB) min.	Insertion Loss (db) max.	Input/Output Impedance (ohms)	Operating Temperature Range	Withstanding Voltage
CFU455E2	455 ±2	±15	±30	27	4	1500	−20°C to +80°C	50V DC
CFU455E2	455 ±1.5	±7.5	±15	27	6	1500		
CFU455H2	455 ±1.0	±3	±9	25	6	2000		
CFW455B	455 ±2	±15	±30	35	4	1500		
CFW455E	455 ±2	±7.5	±15	35	6	1500		
CFW455H	455 ±2	±3	±9	35	6	2000		
CFM455A	455 ±2	±17.5	±30	50	3	1000		
CFM455E	455 ±2	±8	±16	45	5	1500		
CFM455H	455 ±2	±3	±7.5	45	6	2000		
CFR455A	455 ±2	±17.5	±30	60	4	1000		
CFR455E	455 ±2	±8	±16	55	6	1500		
CFR455H	455 ±2	±3	±7.5	55	7	2000		
CFS455A	455 ±2	±17.5	±30	70	4	1500		
CFS455E	455 ±2	±8	±15	70	6	1500		
CFS455H	455 ±2	±3	±7.5	70	7	2000		

ATT'N dB: CFU/40, CFW/50, CFM/60, CFR/60, CFS/70



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MUSASHINO Corporation

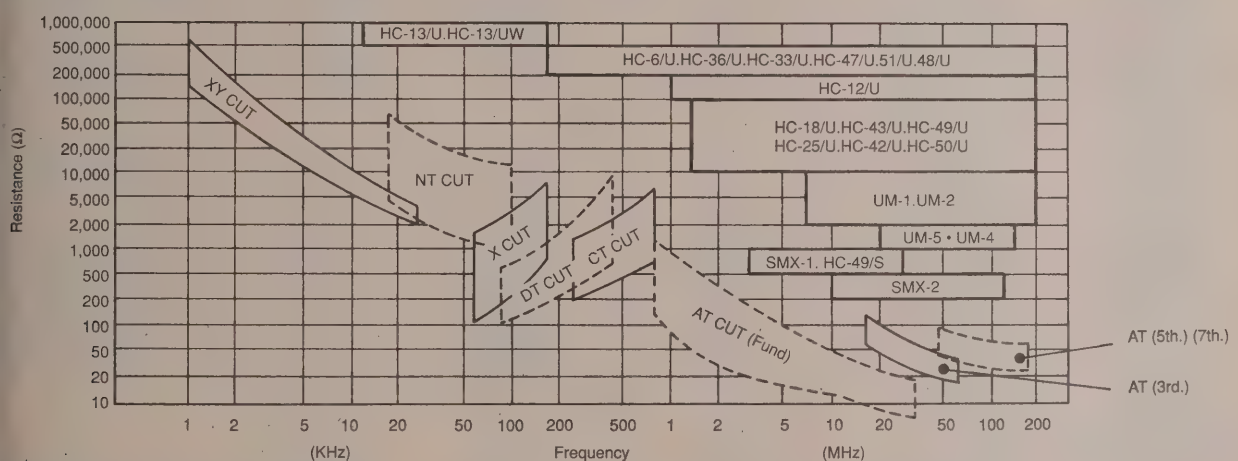
CRYSTAL
CRYSTAL FILTERS
CRYSTAL OSCILLATORS

Mode of Vibration and Orientation Angle

Orientation Angle	Frequency Range	Mode of Vibration	Frequency Formula*
AT Fundamental	800KHz~ 30MHz	Thickness-shear	1670/t (KHz-mm)
AT Overtone	10MHz~250MHz		1670Xn/t n=3, 5, 7
BT Fundamental	2MHz~ 35MHz		2560/t
CT	250KHz~ 1.1MHz	Face-shear	3080/ℓ
DT	60KHz~500KHz		2070/ℓ
SL	300KHz~ 1.1MHz		460/ℓ
X	350KHz~ 20MHz	Thickness-extensional	2970/t
Y	500KHz~ 25MHz	Thickness-shear	1980/t

* n: Overtone order t: Thickness ℓ: Length

Frequency Range vs. Equivalent Resistance & Holder



Ordering Formulas for Crystals

(1) Holder	(_____)
(2) Nominal frequency	(___MHz)
(3) Mode of vibration	(F, O ⌴)
(4) Frequency tolerance (at 25±2°C)	(±__x10^{-6})
(5) Load capacitance (CL)	(__pF)
(6) Frequency stability in operating temperature range (relative to 25°C)	(±__x10^{-6})
(7) Operating temperature range	(−__°C~+__°C)
(8) Equivalent series resistance (R_1 max.)	(__Ω)
(9) Parallel capacitance (C_O)	(__pF)
(10) Marking	
(11) Others	

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MUSASHINO Corporation

Crystal Units

For Microprocessor

Model: HC-51/U, HC-49/U, UM-1

Frequency (MHz)	Parts No.	Max. E. S. R. (Ω max.)
HC-51/U		
1.000000	SMA01-30	700
1.843200	SMA02-30	600
2.000000	SMA03-30	500
2.097152	SMA04-30	500
2.457600	SMA05-30	400
3.579545	SMA06-30	120
HC-49/U		
1.000000	SMB01-30	3000
1.843200	SMB02-30	700
2.000000	SMB03-30	500
2.097152	SMB04-30	500
2.457600	SMB05-30	400
3.000000	SMB06-30	200
3.276800	SMB07-30	180
3.330000	SMB08-30	180
3.579545	SMB09-30	180
3.600000	SMB10-30	180
3.686400	SMB11-30	160
3.932160	SMB12-30	120
4.000000	SMB13-30	100
4.194304	SMB14-30	100
4.433619	SMB15-30	80
4.915200	SMB16-30	70
5.000000	SMB17-30	70
5.068800	SMB18-30	70
5.185000	SMB19-30	70
5.714300	SMB20-30	60
5.990400	SMB21-30	60
6.000000	SMB22-30	50
6.144000	SMB23-30	50
6.400000	SMB24-30	50
6.553600	SMB25-30	50
7.000000	SMB26-30	40
7.159090	SMB27-30	40
7.372800	SMB28-30	40
8.000000	SMB29-30	35
9.216000	SMB30-30	35
9.830400	SMB31-30	35
10.000000	SMB32-30	30
10.738635	SMB33-30	30
11.000000	SMB34-30	30
11.059200	SMB35-30	30
12.000000	SMB36-30	30

Frequency (MHz)	Parts No.	Max. E. S. R. (Ω max.)
HC-49/U		
12.288000	SMB37-30	30
13.516800	SMB38-30	25
14.318180	SMB39-30	25
14.745600	SMB40-30	25
15.000000	SMB41-30	25
16.000000	SMB42-30	25
16.384000	SMB43-30	25
17.360000	SMB44-30	25
18.000000	SMB45-30	20
18.432000	SMB46-30	20
19.354000	SMB47-30	20
19.660800	SMB48-30	20
20.000000	SMB49-30	20
22.118400	SMB50-30	20
23.400000	SMB51-30	20
24.000000	SMB52-30	20
24.576000	SMB53-30	40
25.000000	SMB54-30	40
27.000000	SMB55-30	40
30.000000	SMB56-30	40
32.000000	SMB57-30	40
36.000000	SMB58-30	40
40.000000	SMB59-30	40
48.000000	SMB60-30	40
UM-1		
6.000000	SMC01-30	120
8.000000	SMC02-30	80
10.000000	SMC03-30	60
12.000000	SMC04-30	40
12.500000	SMC05-30	40
14.318180	SMC06-30	30
14.400000	SMC07-30	30
15.000000	SMC08-30	30
16.000000	SMC09-30	30
18.000000	SMC10-30	30
18.432000	SMC11-30	30
19.354000	SMC12-30	30
19.660800	SMC13-30	30
20.000000	SMC14-30	30
22.118400	SMC15-30	30
24.000000	SMC16-30	30
25.000000	SMC17-30	30

(For any other frequency in the range of 3 to 48 MHz please contact us.)

S M *A *B *C **0 1** — **3 0**

Holder | Code No. | Load capacitance

*A HC-51/U
*B HC-49/U
*C UM-1

Basic Specification				
	Frequency tolerance :	±50 x 10^{-6} (25 ± 2°C)	Load capacitance:	30pF
	Frequency stability:	±50 x 10^{-6}	Drive level:	1mW
	Operating temp. range:	-20 ~ +70°C	Frequency aging:	±50 x 10^{-6}/year

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MUSASHINO Corporation

Crystal Oscillators

Item \ Model	MCO3000A C-MOS	MCO6000A MCO6000B HS C-MOS	MCO7000A MCO7000B C-MOS	MCO8000 Tr	ECO2000 ECL 10K
Frequency Range	0.05~20.0MHz	3.0~25.0MHz	1.0~70.0MHz	0.25~70.0MHz	60.0~150.0MHz
Frequency Stability	±100ppm or ±50ppm				
Operating Temp. Range	0°C~+70°C				
Storage Temp. Range	-40°C~+100°C				
Input Voltage	V_{DD}: +5V±0.5V		V_{DD}: +5V±0.3V	V_{DD}: +5V±0.5V	V_{EE}: -5.2V±0.14V
Input Current (T = 25°C)	6mA V_{DD}: 5.0V	20mA V_{DD}: 5.0V	1~20MHz 5mA~11mA 20~70MHz 15mA~35mA (max.) 40mA	0.25~2.9MHz 45mA 3.0~70MHz 30mA V_{DD}: 5.0V	60mA V_{EE}: -5.2V
Output Load	1 LS TTL or C-MOS COMP.	10LS TTL or C-MOS COMP.	10 TTL or C-MOS COMP.	10 TTL	ECL COMP.
Output Level	L: 10% V_{DD}	H: 90% V_{DD}	VoL: max. 0.4V VoH: min. 4.5V	0.25~31.9; L: 0.4V H: 2.4V 32.0~70.0; L: 0.5V H: 2.4V	H: -0.7~-1.02V L: -1.95~-1.0V
Duty (T = 25°C)	40%~60% V_{DD}/2		40%~60% V_{DD}/2 40%~60% 1.4V	40%~60% 1.4V	40%~60% 50%
Rise & Fall Time (T = 25°C)	0.05~1.99MHz 50 ns 2.00~20.0MHz 25ns	6ns	0.5V/4.5V 5ns 0.4V/2.4V 3.5ns	0.25~2.9MHz 15ns 3.0~9.9MHz 10ns 10.0~31.9MHz 7ns 32.0~70.0MHz 5ns	60.0-99.9MHz 3.5ns 100.0-150.0MHz 2.5ns (20%~80% point)
Measurement Circuit	CL = 15pF		10TTL, CL = 15pF	RL=320Ω CL = 15pF	RL = 50Ω
3 State Output	x		OPTION (MCO7000AT) 7000B-Enable/high	x	
Dimension	A	MCO6000A: A MCO6000B: B	MCO7000A: A MCO7000B: B	A	C

Crystal Filters

- **MCF 10.7MHz Series**
- **MCF 21.4MHz Series**
- **MCF with Transformers**
- **Block Crystal Filters**
- **Linear Phase Crystal Filter**
- **MCF 45MHz Overtone Series**
- **MCF 45MHz Fundamental Series**
- **MCF 58.1125MHz Overtone Series**
- **MCF 70.00MHz Overtone Series**
- **Miniature Package UM-5 • UM-4**
- **For Mobile Telephone System**

Ordering Formulas For Crystal Filters

(1) Nominal frequency (___MHz)
(2) Pass band width (±___KHz min. at ___dB)
(3) Stop band width (±___KHz max. at ___dB)
(4) Insertion loss (___dB max.)
(5) Ripple (___dB max.)
(6) Attenuation guaranteed (___dB min. ± ___~___KHz)
(7) Terminating impedance (___Ω //___pF)
(8) Operating temperature range (–___°C~+___°C)
(9) Dimension, Marking

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NDK AMERICA, INC.

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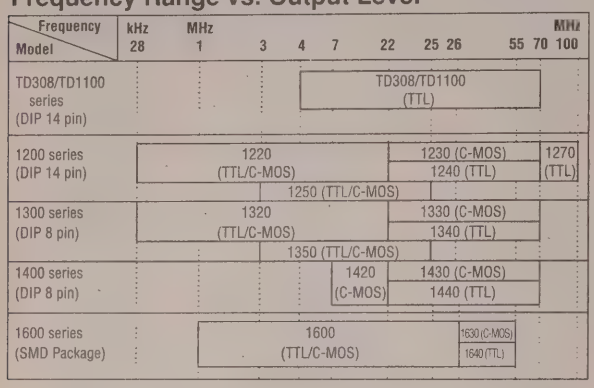
CRYSTAL CLOCK OSCILLATORS

In addition to products listed below, NDK America offers Crystal Oscillators in models SPXO, TCXO, VCXO and OCXO, as well as Filters, Saw Devices and Crystals. *Please call for complete catalog.*

Frequency Range vs. Output Level



TD308/TD1100 Series

Model / Feature	TD308/ TD1100
Output Level	TTL
Frequency Range	3.9 ~ 70MHz
Frequency Stability	See Table 1
Operating Temp. Range (°C)	
Current Typical	20 ~ 30mA
Consumption Max	50mA
$V_{OL}^{MAX}/V_{OH}^{MIN}$	See Table 2
T_r^{MAX}/T_f^{MAX}	See Table 3
Duty Cycle (%)	40 ~ 60
Fanout (gate)	10
Stand-by Function	No
Dual Output Option	No

Table 1

Model	Frequency Stability (x 10-6)	Oper. Temp. Range (°C)
TD308C	+100	-20 ~ +70
T1308CB	+500	-20 ~ +70
TD308CC	+1000	-20 ~ +70
TD308CD	+50	0 ~ +70

Table 2

Frequency Range	V_{OL}	V_{OH}
<40MHz	$0.4V^{MAX}$	$2.4V^{MIN}$
≥40MHz	$0.5V^{MAX}$	$2.4V^{MAX}$

Table 3

Frequency Range	Tr	Tf
~ 8MHz	15ns	15ns
8 ~ 22MHz	10ns	10ns
22 ~ 30MHz	7ns	7ns
30 ~ 70MHz	5ns	5ns

1200/1300/1400 Series

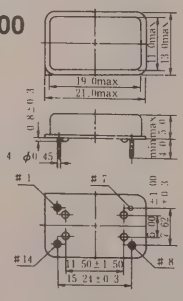
Model / Feature	1220 (1221 ~ 1229) 1320 (1321 ~ 1329)	1230 (1230 ~ 1239) 1330 (1330 ~ 1339)	1240 1240 ~ 1249) 1340 (1340 ~ 1349)	1250 (1251 ~ 1259) 1350 (1351 ~ 1359)	1270 (1271 ~ 1272) -	- 1420 (1429)	- 1430 (1431 ~ 1437)	- 1440 (1441 ~ 1447)
Output Level	C-MOS TTL	C-MOS -	- TTL	C-MOS TTL	- TTL	C-MOS -	C-MOS -	- TTL
Frequency Range	28kHz ~ 22MHz	22 ~ 70MHz	22 ~ 70MHz	3 ~ 25MHz	70 ~ 100MHz	7 ~ 22MHz	22 ~ 70MHz	22 ~ 70MHz
Frequency Stability	±50, ±100, ±500, ±1000 x 10^{-6} ±200 x 10^{-6} in only 1270 series, ±50 x 10^{-6} except 1400 series							
Operating Temp. Range (°C)	0 ~ + 70°C, -10 ~ +70°C, -20 ~ +70°C Freq. stab. ±50 x 10^{-6}, 0 ~ +70°C only							
Current Typical	5mA	13 ~ 22mA	13 ~ 22mA	11mA	25 ~ 35mA	10 ~ 30mA	40 ~ 80mA	35 ~ 80mA
Consumption Max	10mA	25 ~ 40mA	25 ~ 40mA	25mA	50mA	40mA	50 ~ 85mA	45 ~ 85mA
$V_{OL}^{MAX}/V_{OH}^{MIN}$	0.4/V_{DD} -0.5V	0.5V/V_{DD} -0.5V	0.4V/2.4V or 0.5/2.4V	0.4V/V_{DD} -0.5V	0.5/2.4V	0.5V/V_{DD} -0.5V	0.5V/V_{DD} -0.5V	0.4/2.4V
T_r^{MAX}/T_f^{MAX}	10/10ns	5/5ns	5/5ns	7/7ns	5/5ns	6/6ns	6/6ns	3.5/3.5ns
Duty Cycle (%)	45 ~ 55 or 40 ~ 60 for 1129, 1329	40 ~ 60	40 ~ 60	45 ~ 55 at 1/2V_{DD} or 40 ~ 60 at 1.4V	40 ~ 60	45 ~ 55	45 ~ 55	40 ~ 60
Fanout (gate)	2 or C_L=15pF	C_L=15pF	5	5 or C_L=15pF	(As or F) 5	C_L=150pF$_{MAX}$	C_L=150pF$_{MAX}$	10
Stand-by Function	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Dual Output Option	1229, 1329	No	No	No	No	No	No	No

Note 1: Consumption in 1420 and 1430 series is value at CL = 50pF

1600 Series

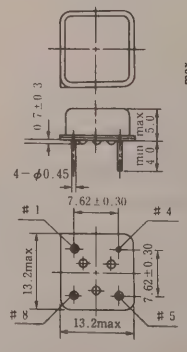
Model / Feature	- 1620 (1629)	- 1630 (1631 ~ 1634)	- 1640 (1641 ~ 1644)
Output Level	C-MOS TTL	C-MOS -	- TTL
Frequency Range	1 ~ 26MHz	26 ~ 55MHz	26 ~ 55MHz
Frequency Stability	±100, ±200	±100, ±200	±100, ±200
Operating Temp Range (°C)	-20 ~ +70	-20 ~ +70	-20 +70
Current Typical	5 ~ 15mA	18 ~ 25mA	18 ~ 25mA
Consumption Max	10 ~ 20mA	25 ~ 35mA	25 ~ 35mA
$V_{OL}^{MAX}/V_{OH}^{MIN}$	0.5V/V_{DD} 0.5V or 0.4/2.4V	0.5V/V_{DD} 0.5V	0.4/2.4V
T_f^{MAX}/T_f^{MAX}	5/5ns	5/5ns	5/5ns
Duty Cycle (%)	45 ~ 55 at 1/2V_{DD} or 40 ~ 60 at 1.4V	45 ~ 55	40 ~ 60
Fanout (gate)	10 or C_L=15 (max50) pF	C_L=15 (max50) pF	10
Stand-by Function	Yes	Yes	Yes
Dual Output Option	No	No	No

TD308/TD1100 1200 Series



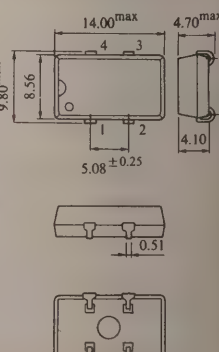
PIN	Connection TD308/TD1100 Series
#1	NC
#7	Ground to Case
#8	OUTPUT
#14	+5 VDC
PIN	1200 Series
#1	NC or Stand-by or Output (Dual's)
#7	Ground or Case
#8	OUTPUT
#14	+5 VDC

1300-1400 Series



PIN	Connection
#1	NC or Stand-by or Output (Dual's)
#4	Ground or Case
#5	OUTPUT
#8	+5 VDC

1600 Series



NO	Connection
#1	STAND BY
#2	GND
#3	OUTPUT
#4	V_{DD}

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CRYSTALS

CP12A

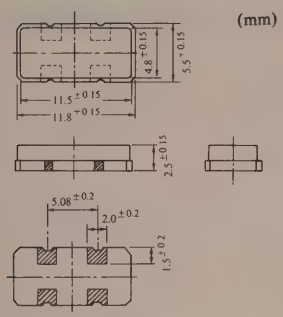
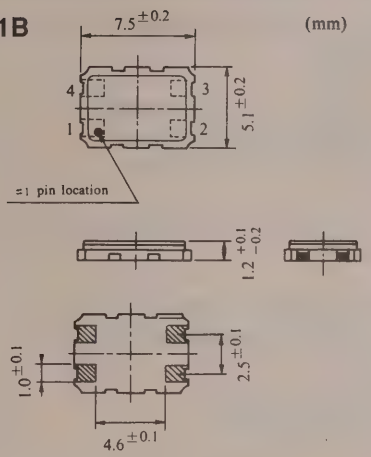


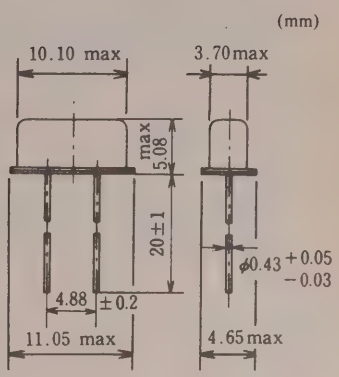
Table 1 Equivalent Series Resistance

Frequency Range (MHz)	Equivalent Series Resistance (Ω)	
	-10°C ~+ 70°C	-40°C ~ + 125°C
3.5 ~ 4.0	150max	200max
4.0 ~ 8.0	120	180
8.0 ~ 12.0	80	120
12.0 ~ 25.0	50	80

CP21B



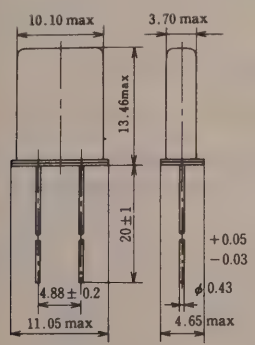
AT-51



Item \ Standard Spec. Code	1	2	3	1	2	3
Holder	CP12A			CP21B		
Frequency Range	3.5MHz ~ 25MHz			16MHz ~ 110MHz		
Overtone Mode	Fundamental			Fundamental	3rd overtone	5th overtone
Frequency Tolerance (25 ± 3°C)	±50 x 10^{-6}	±100 x 10^{-6}	±100 x 10^{-6}	±50 x 10^{-6}	±10 x 10^{-6}	±10 x 10^{-6}
Temperature Characteristics (in reference to 25°C)	±50 x 10^{-6}	±100 x 10^{-6}	±150 x 10^{-6}	±50 x 10^{-6}	±5 x 10^{-6}	±15 x 10^{-6}
Operating Temperature Range	-10 ~ 70°C		-40 ~ +125°C	-10 ~ 60°C	-10 ~ +50°C	-30 ~ +85°C
Equivalent Series Resistance	*See table 1			40 Ω max	60 Ω max	80 Ω max
Drive Level	100μW			10μW		
Standard Load Capacitance	12pF			To be defined after circuit investigation		
Operable Temperature Range	-40 ~ +125°C			-30 ~ +85°C		

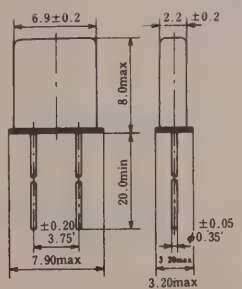
Holder	AT-51
Frequency Range	3.2 ~ 54.2MHz
Overtone Mode	Fundamental, 3rd overtone
Frequency Tolerance (25 ± 3°C)	±20/50 x 10^{-6}
Temperature Characteristics (in reference to 25°C)	±30/50 x 10^{-6}
Operating Temperature Range	-10 ~ 60°C
Drive Level	50μW
Vibration	10 ~ 55Hz; overall amplitude 1.5mm
Shock	Three times random drops onto a hard wooden board from the height of 75 cm.

NR-18



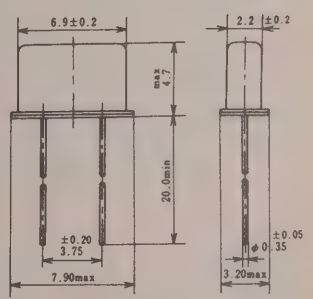
Holder	NR-18
Frequency Range	2 ~ 132 MHz
Overtone Mode	Fundamental, 3rd OT, 5th OT
Frequency Tolerance (25 ± 3°C)	±10/50 x 10^{-6}
Temperature Characteristics (in reference to 25°C)	±5/50 x 10^{-6}
Operating Temperature Range	-10 ~ 60°C

NR-2B



Holder	NR-2B
Frequency Range	1 ~ 100 MHz
Overtone Mode	Fundamental, 3rd OT, 5th OT
Frequency Tolerance (25 ± 3°C)	±10 x 10^{-6}
Temperature Characteristics (in reference to 25°C)	±5 x 10^{-6}
Operating Temperature Range	-10 ~ 60°C

NR-2D



Holder	NR-2D
Frequency Range	12.8 ~ 110 MHz
Overtone Mode	Fundamental, 3rd OT, 5th OT
Frequency Tolerance (25 ± 3°C)	±10 x 10^{-6}
Temperature Characteristics (in reference to 25°C)	+5 x 10^{-6}
Operating Temperature Range	-10 ~ 60°C

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Since 1979, Oscillatek has been a steadily growing supplier of precision crystal oscillators. Oscillatek has always been guided by three principles:

1. **Excellence in Customer Service**
2. **Engineering Leadership**
3. **Quality Products**

In addition to a broad assortment of standard products we can design custom products to your specifications. Oscillatek's product line features:

HYBRID CLOCK OSCILLATORS
MIL-O-55310 CLOCK OSCILLATORS
VCXO's
TCXO's & TCVCXO's
OCXO's & OVCXO's

HYBRID OSCILLATOR ORDER INFORMATION

Output Options:			Input:
TD	= TTL	DC to 120 MHz	+5.0 VDC
HC	= HCMOS	DC to 50 MHz	+5.0 VDC
AC	= CMOS AC	DC to 120 MHz	+5.0 VDC
EH	= ECL 10KH	10 to 380 MHz	-5.2 VDC

Stability vs. Temperature Options:			Accuracy at +25°C
A15	= ±10 PPM	0° to +50°C	±15 PPM
B15	= ±10 PPM	0° to +70°C	±15 PPM
BB5	= ±25 PPM	0° to +70°C	±15 PPM
B55	= ±50 PPM	0° to +70°C	Included
B14	= ±100 PPM	0° to +70°C	Included
DB5	= ±25 PPM	-40° to +85°C	±15 PPM
D55	= ±50 PPM	-40° to +85°C	Included
D14	= ±100 PPM	-40° to +85°C	Included
G55	= ±50 PPM	-55° to +125°C	±15 PPM
G14	= ±100 PPM	-55° to +125°C	Included

Enable Options*:

0 = No Enable Function
Pin 1 = No connect

1 = Enable Option
Logic "1" on Pin 1 = Enable
Logic "0" on Pin 1 = Disable
Tri-state output when disabled

*14/4 Pin & Half-size Packages

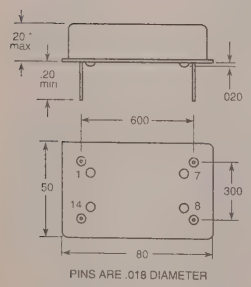
Screening Options:

C = Commercial
S = Class "B" per MIL-O-55310

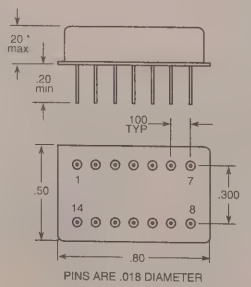
Storage Temperature

-55°C to +125°C

14/4 Pin DIP Packages



B3 Package
B2 w/o standoffs



B0 Package
B1 w/o standoffs

Typical Specifications:

Duty Cycle: < 1 MHz 48/52 to 52/48
< 8 MHz 45/55 to 55/45
> 8 MHz 40/60 to 60/40

Typical Aging: <5.0 PPM/year at +25°C

Seal: <1.0 x 10^{-8} cc/second

Typical P/N:

HC B3 A 0 G14 S 10.000 MHz

- Frequency
- Screening
- Stability
- Enable
- Predetermined
- Package
- Output

S = Class "B"
B14 = See above
0 = No enable
B3 = See outline dwg
HC = HCMOS

PINOUTS TTL/CMOS
Pin 1 = NC*
Pin 7 = Gnd, Case
Pin 8 = Output
Pin 14 = +5.0 V

PINOUTS ECL
Pin 1 = NC*
Pin 7 = -5.2V
Pin 8 = Output
Pin 14 = Gnd, Case

*Optional Enable

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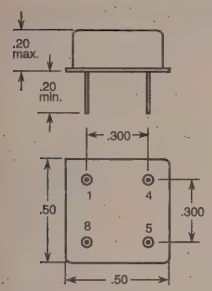
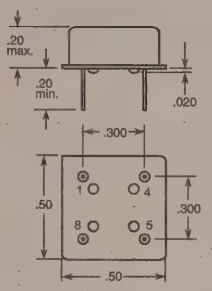
Half-Size DIP Packages



A0 Package



A1 Package

Frequency: **TC** = TTL LS DC to 100 MHz; **AC** = CMOS AC DC to 100 MHz; **TD** = TTL DC to 40 MHz

Duty Cycle: <12 MHz 45/55 to 55/45; >12 MHz 40/60 to 60/40

Typical Aging: <5.0 PPM/year at +25°C

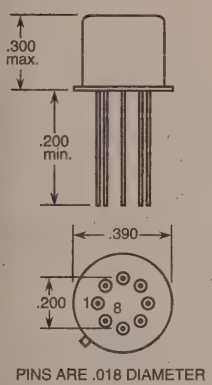
Seal: <1.0 x 10^{-8} cc/second

Pinouts:
Pin 1 = NC*
Pin 5 = Output
Pin 7 = Gnd, Case
Pin 8 = +5.0V
*Optional enable

Typical P/N:
AC A0 A 0 G55 S 80.000 MHz

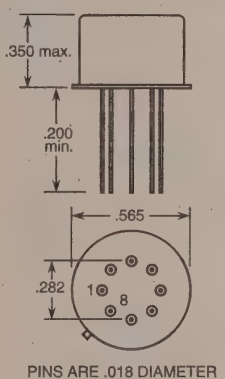
- Screening — **S** = See opposite page
- Stability — **G55** = See opposite page
- Enable — **0** = See opposite page
- Predetermined
- Package — **A0** = See outline dwg
- Output — **AC** = See above

T0-5



H0 Package

T0-8



J0 Package

Frequency: **TC** = TTL LS DC to 60 MHz; **AC** = CMOS AC DC to 80 MHz; **TD** = TTL DC to 40 MHz

Duty Cycle: <12 MHz 45/55 to 55/45; >12 MHz 40/60 to 60/40

Typical Aging: <5.0 PPM/year at +25°C

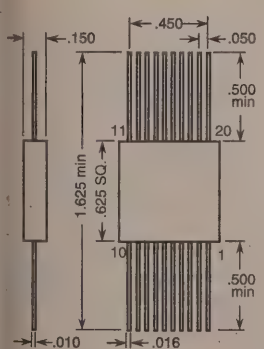
Seal: <1.0 x 10^{-8} cc/second

Pinouts: Pin 4 = Gnd, Case; Pin 5 = Output; Pin 8 = +5.0V

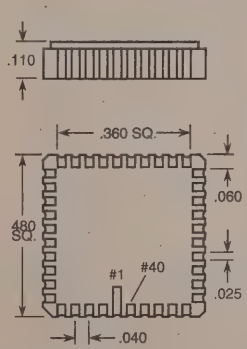
Typical P/N:
TD H0 A0 G55 S 40.000 MHz

- Screening — **S** = See opposite page
- Stability — **G55** = See opposite page
- Predetermined
- Package — **H0** = See outline dwg
- Output — **TD** = See above

Surface Mount Packages



M0 Flatpack



K0 LCC

BOTTOM VIEWS

Frequency: **TC** = TTL LS DC to 70 MHz; **HC** = HCMOS DC to 60 MHz; **TD** = TTL DC to 40 MHz

Duty Cycle: <12 MHz 45/55 to 55/45; >12 MHz 40/60 to 60/40

Typical Aging: <5.0 PPM/year at +25°C

Seal: <1.0 x 10^{-8} cc/second

Pinouts:

K0 LCC	**M0** Flatpack
Pin 4 & 10 = +5.0V	Pin 1 = Output
Pin 31 & 37 = Gnd, Case	Pin 10 = Gnd, Case
Pin 39 = Output	Pin 20 = +5.0V

Typical P/N:
HC K0 A0 G14 S 60.000 MHz

- Screening — **S** = See opposite page
- Stability — **G14** = See opposite page
- Predetermined
- Package — **K0** = See outline dwg
- Output — **HC** = See above

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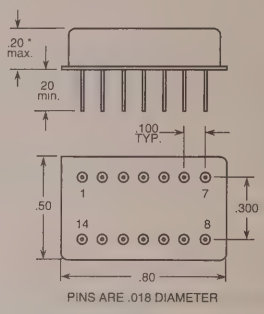
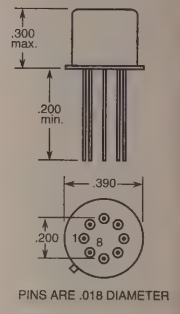
Oscillatek is an approved source of MIL-O-55310 hybrid oscillators.

Oscillatek is currently qualified to the following:

Type	Output	Package
M55310/09	TTL	TO-5
M55310/14	TTL	14 pin DIP
M55310/16	TTL	14 pin DIP
M55310/17	TTL	14 pin DIP



M55310/14
M55310/16
M55310/17



M55310/09

QPL Part Numbering

M55310/___-B___A – Frequency

- A=-55°C to +125°C
- Freq. Tolerance (±50 or ±100 PPM)
- B= Class "B" screening
- Type

Type	Frequency Range	Freq. Tolerance ppm		Pinouts			
		±50	±100	+5V	Gnd	Out	Gate
09	400 KHz - 9 MHz	01	05	8	4	5	na
09	9 MHz - 25 MHz	11	15	8	4	5	na
09	25 MHz - 30 MHz	21	25	8	4	5	na
14	0.1 Hz - 1 KHz	01	na	4	7	5	na
14	1 KHz - 150 KHz	02	na	4	7	5	na
14	150 KHz - 300 KHz	03	na	4	7	5	na
14	300 KHz - 600 KHz	04	na	4	7	5	na
14	600 KHz - 2.5 MHz	05	na	4	7	5	na
14	2.5 MHz - 5.0 MHz	06	na	4	7	5	na
14	5.0 MHz - 10 MHz	07	na	4	7	5	na
14	10 MHz - 15 MHz	08	na	4	7	5	na
14	15 MHz - 25 MHz	09	na	4	7	5	na
16	0.1 Hz - 250 Hz	01	04	14	7	8	na
16	250 Hz - 150 KHz	11	14	14	7	8	na
16	159 KHz - 5.0 MHz	21	24	14	7	8	na
16	4.0 MHz - 20 MHz	31	34	14	7	8	na
16	20 MHz - 60 MHz	41	44	14	7	8	na
17	250 KHz - 5 MHz	01	04	14	7	8	pin 9
17	4.0 MHz - 20 MHz	11	14	14	7	8	pin 9
17	20 MHz - 50 MHz	21	24	14	7	8	pin 9

The above table is a summary of the -55° to +125°C options offered by Oscillatek. Other temperature ranges and stabilities may be available. Stability tolerance is based on the +23°C calibration tolerance of ±15 PPM for ±50 PPM vs. Temperature.

Oscillatek provides QPL parts with 100% Class "B" screening:

1 Internal Visual
2 Stabilization Bake
3 Temperature Cycling
4 Constant Acceleration
5 Seal Test
6 Electrical Test at +23°C
7 168 Hour Burn-in load
8 Electrical Test vs Temperature

Consult factory for test details and current DESC specifications

The current issue of the appropriate military slash sheet should be consulted for further information on QPL products. Data on the current issue of the slash sheet may supercede data on this page.

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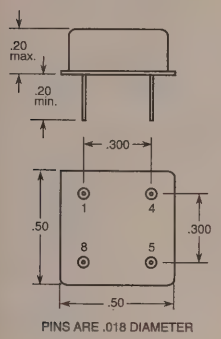
Half-Size DIP VCXO



PINS ARE .018 DIAMETER

A2 Package

Output Options:

TD = TTL	1 to 24 MHz
HC = HCMOS	1 to 24 MHz

Stability Options:

CODE	DEVIATION	STABILITY VS. TEMP.	
1A15	±30 PPM	±10 PPM	0° to +50°C
3BB5	±50 PPM	±25 PPM	0° to +70°C
5B55	±100 PPM	±50 PPM	0° to +70°C

Screening Options:

C = Standard Commercial
S = Class "B" per MIL-O-55310

Typical P/N: HC A2 F 5BB5 C 12.228 MHz
F is predetermined

Typical Specifications:

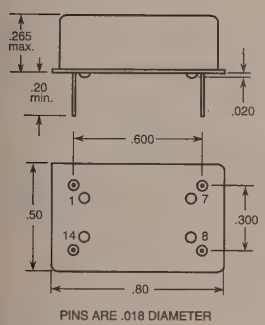
Symmetry <12 MHz: 45/55 to 55/45
Symmetry >12 MHz: 40/60 to 60/40

Linearity: <20%
Slope: Positive

Control Voltage: 0 to supply
Impedance: >50 kΩ
Mod. Bandwidth: >1 KHz

Pin 1 = Tune 0 to +5V
Pin 4 = Gnd, Case
Pin 5 = Output
Pin 8 = +5.0 VDC

14 Pin DIP VCXO



PINS ARE .018 DIAMETER

B5 Package

Output Options:

TD = TTL	1 to 70 MHz
AC = CMOS AC	1 to 70 MHz

Stability Options:

CODE	DEVIATION	STABILITY VS. TEMP.	
5A45	±100 PPM	±40 PPM	0° to +50°C
3B55	±100 PPM	±50 PPM	0° to +70°C
6B75	±150 PPM	±70 PPM	0° to +70°C

Screening Options:

C = Standard Commercial
S = Class "B" per MIL-O-55310

Typical P/N: AC B5 F 3B55 C 51.84 MHz
F is predetermined

Typical Specifications:

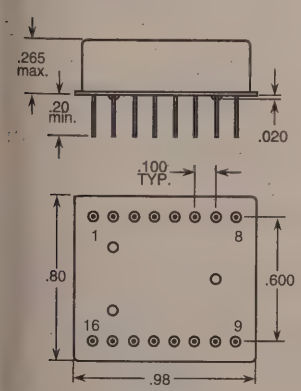
Symmetry <12 MHz: 45/55 to 55/45
Symmetry >12 MHz: 40/60 to 60/40

Linearity: <20%
Slope: Positive

Control Voltage: 0 to supply
Impedance: >50 kΩ
Mod. Bandwidth: >1 KHz

Pin 1 = Tune 0 to +5V
Pin 7 = Gnd, Case
Pin 8 = Output
Pin 14 = +5.0 VDC

16 Pin Doublewide DIP VCXO



PINS ARE .018 DIAMETER

F3 Package

Output Options:

TD = TTL	.01 to 120 MHz
AC = CMOS AC	.01 to 120 MHz
EC = ECL 10KH	5 to 160 MHz
EP = ECL 10KH	160 to 250 MHz

Stability Options:

CODE	DEVIATION	STABILITY VS. TEMP.	
5B25	±100 PPM	±20 PPM	0° to +70°C
6B35	±150 PPM	±30 PPM	0° to +70°C
7B65	±200 PPM	±60 PPM	0° to +70°C
7D85	±200 PPM	±80 PPM	-40° to +85°C

Screening Options:

C = Standard Commercial
S = Class "B" per MIL-O-55310

Typical P/N: EC F3 F 5B25 C 155.52 MHz
F is predetermined

Typical Specifications:

Symmetry <12 MHz: 45/55 to 55/45
Symmetry >12 MHz: 40/60 to 60/40

Linearity: <20%
Slope: Negative

Control Voltage: 0 to supply
Impedance: >50 kΩ
Mod. Bandwidth: >1 KHz

	Pinouts TD AC	Pinouts EC EP
Pin 5 =	Output	No Connect
Pin 6 =	Tune 0 to +5V	Tune
Pin 8 =	Gnd, Case	Supply
Pin 9 =	No Connect	Output
Pin 16 =	+5.0 VDC	Gnd, Case

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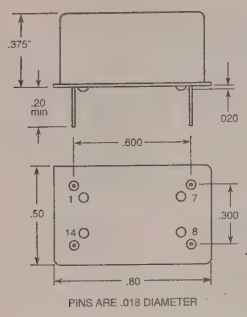
14/4 Pin TCXO



B8 Package

Output Options:

TC	= LS TTL	= 1.0 to	90 MHz
AC	= CMOS AC	= 1.0 to	90 MHz
HC	= HCMOS	= 10 to	50 MHz

Stability Options:

A16	= ±1.0 PPM	0° to +50°C	1 to 24 MHz
AB6	= ±2.5 PPM	0° to +50°C	1 to 70 MHz
A56	= ±5.0 PPM	0° to +50°C	1 to 90 MHz
D15	= ±10.0 PPM	-40° to +85°C	1 to 70 MHz

Screening Options:

C = Standard Commercial
S = Class "B" per MIL-O-55310

Typical P/N: HC B8 GO A16 C 24.000 MHz
GO is predetermined

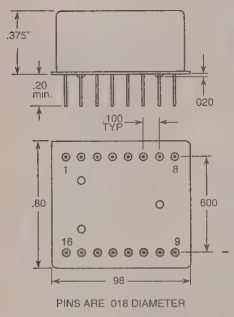
Pinouts:

Pin 1	=	Tune 0 to +5V
Pin 7	=	Ground
Pin 8	=	Output
Pin 14	=	+5.0 VDC

General Specifications:

Supply Voltage:	+5.0 VDC ±5%
Voltage Stability:	<1.0 PPM for ±5%
Trim Range:	>15 PPM
Tuning Voltage:	0 to +5.0 VDC
Seal:	<1 x 10^{-8} cc/second

16 Pin Doublewide DIP TCXO



F4 Package

Output Options:

TC	= LS TTL	= 1.0 to	70 MHz
AC	= CMOS AC	= 1.0 to	70 MHz
HC	= HCMOS	= 1.0 to	50 MHz

Stability Options:

B57	= ±0.5 PPM	0° to +70°C	1 to 24 MHz
B16	= ±1.0 PPM	0° to +70°C	1 to 50 MHz
D16	= ±1.0 PPM	-40° to +85°C	1 to 24 MHz
DB6	= ±2.5 PPM	-40° to +85°C	1 to 50 MHz

Screening Options:

C = Standard Commercial
S = Class "B" per MIL-O-55310

Typical P/N: TC F4 GO D16 S 6.4000 MHz
GO is predetermined

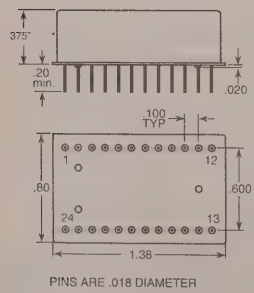
Pinouts

Pin 6	=	Tune 0 to +5V
Pin 8	=	Ground
Pin 9	=	Output
Pin 16	=	+5.0 VDC

General Specifications:

Supply Voltage:	+5.0 VDC ±5%
Voltage Stability:	<1.0 PPM for ±5%
Trim Range:	>10 PPM
Tuning Voltage:	0 to +5.0 VDC
Aging:	< 2 PPM per year <10 PPM per 10 yrs
Seal:	<1 x 10^{-8} cc/second

24 Pin Doublewide DIP TCXO



G2 Package

Output Options:

TC	= LS TTL	= 1.0 to	90 MHz
AC	= CMOS AC	= 1.0 to	90 MHz
HC	= HCMOS	= 1.0 to	50 MHz

Stability Options

B57	= ±0.5 PPM	0° to +70°C	1 to 24 MHz
B16	= ±1.0 PPM	0° to +70°C	1 to 50 MHz
BB6	= ±2.5 PPM	0° to +70°C	1 to 90 MHz
D16	= ±1.0 PPM	-40° to +85°C	1 to 26 MHz
EB6	= ±2.5 PPM	-55° to +85°C	1 to 26 MHz

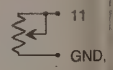
Screening Options:

C = Standard Commercial
S = Class "B" per MIL-O-55310

Typical P/N: TC G2 GO A16 C 90.000 MHz
GO is predetermined

Pinouts

Pin 1	=	Gnd, Case
Pin 3	=	Output
Pin 11	=	Resistor Tune
Pin 12 to 17	=	Gnd, Case
Pin 23	=	Gnd, Case
Pin 24	=	+5.0 VDC



General Specifications:

Supply Voltage:	+5.0 VDC ±5%
Voltage Stability:	<0.25 PPM for ±5%
Trim Range:	>5 PPM
Tuning Voltage:	0 to +5.0 VDC
Tuning Resistor:	20KΩ Pot.11 to Gnd
Aging:	<1 PPM per year <5 PPM per 10 yrs
Seal:	<1 x 10^{-8} cc/second

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OSCILLATEK
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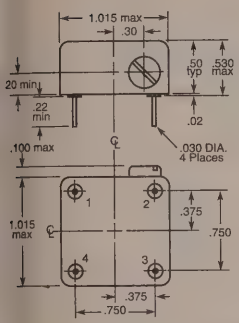
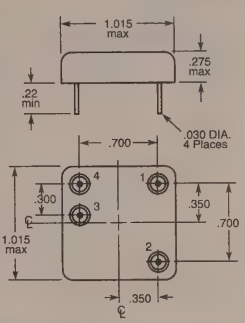
Solder Seal TCXO Small Package (1.0 " SQ.)



P1 Package



P2 Package

Output Options:

			Input:
TC = LS TTL	=	.01 to 30 MHz	+5.0V
HC = HCMOS	=	.01 to 40 MHz	+5.0V
RB = +4 dBm 50Ω	=	4 to 40 MHz	+12.0V

Stability Options

A17 = ±0.1 PPM	0° to +50°C	1 to 16 MHz
A16 = ±1.0 PPM	0° to +50°C	1 to 40 MHz
B16 = ±1.0 PPM	0° to +70°C	1 to 40 MHz
BB6 = ±2.5 PPM	0° to +70°C	1 to 40 MHz
D57 = ±0.5 PPM	-40° to +85°C	1 to 16 MHz
D16 = ±1.0 PPM	-40° to +85°C	1 to 24 MHz

Typical P/N: HC P2 HO D16 S 12.800 MHz

HO is predetermined

Screening Options:

C= Commercial
S= Class "B" per MIL-O-55310

P2 Package

Pin 1 = Output
Pin 2 = Tune
Pin 3 = Gnd, Case
Pin 4 = Supply

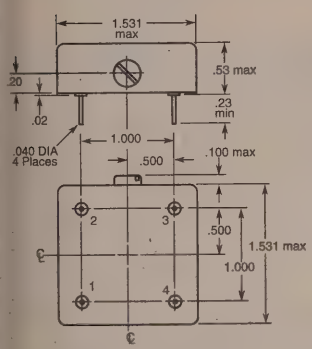
P1 Package

Pin 1 = Output
Pin 2 = Gnd, Case
Pin 3 = Gnd, Case*
Pin 4 = Supply

*Optional VCO

Note: Not all stabilities are available in all output options. Oscillatek does not recommend wave soldering, IR reflow or other elevated temperature processing without consulting the factory.

Solder Seal TCXO Mid-Size Package



R1 Package

Output Options:

			Input:
TD = TTL	=	.01 to 50 MHz	+5.0V
HC = HCMOS	=	.01 to 60 MHz	+5.0V
RB = +4 dBm 50Ω	=	.01 to 110 MHz	+12.0V
EH = ECL 10 KH	=	.01 to 220 MHz	-5.2V

Stability Options

A17 = ±0.1 PPM	0° to +50°C	.01 to 16 MHz
A16 = ±1.0 PPM	0° to +50°C	.01 to 220 MHz
B16 = ±1.0 PPM	0° to +70°C	.01 to 150 MHz
BB6 = ±2.5 PPM	0° to +70°C	.01 to 220 MHz
D57 = ±0.5 PPM	-40° to +85°C	.01 to 16 MHz
D16 = ±1.0 PPM	-40° to +85°C	.01 to 60 MHz
FB6 = ±2.5 PPM	-55° to +105°C	.01 to 16 MHz

Typical P/N: EH R1 HO B16 C 120.00 MHz

HO is predetermined

Screening Options:

C= Commercial
S= Class "B" per MIL-O-55310

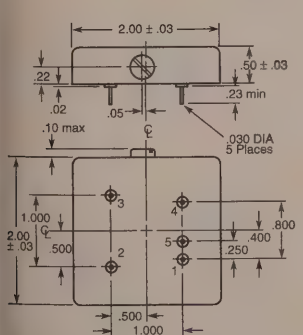
Pinouts

	TD HC RB	EH
Pin 1 =	Output	Out
Pin 2 =	Supply	Gnd
Pin 3 =	Gnd, Case	Vee
Pin 4 =	Gnd, Case*	NC*

*Optional electrical tune

Note: Not all stabilities are available in all output options. Oscillatek does not recommend wave soldering, IR reflow or other elevated temperature processing without consulting the factory.

Solder Seal TCXO Large Package



S6 Package

Output Options:

			Input:
TD = TTL	=	.01 to 50 MHz	+5.0V
HC = HCMOS	=	.01 to 60 MHz	+5.0V
AC = CMOS AC	=	.01 to 125 MHz	+5.0V
RB = +4 dBm 50Ω	=	.01 to 225 MHz	+12.0V
EH = ECL 10 KH	=	.01 to 225 MHz	-5.2V

Stability Options

A17 = ±0.1 PPM	0° to +50°C	.01 to 48 MHz
A16 = ±1.0 PPM	0° to +50°C	.01 to 225 MHz
BB7 = ±0.25 PPM	0° to +70°C	.01 to 48 MHz
B16 = ±1.0 PPM	0° to +70°C	.01 to 225 MHz
D57 = ±0.5 PPM	-40° to +85°C	.01 to 48 MHz
D16 = ±1.0 PPM	-40° to +85°C	.01 to 90 MHz
FB6 = ±2.5 PPM	-55° to +105°C	.01 to 48 MHz
FB6 = ±5.0 PPM	-55° to +125°C	.01 to 48 MHz

Typical P/N: RB S6 H2 B16 C 70.00 MHz

H2 is predetermined

Screening Options:

C= Commercial
S= Class "B" per MIL-O-55310

Pinouts

	TD HC AC RB	EH
Pin 1 =	Output	Out
Pin 2 =	Supply	Gnd
Pin 3 =	Gnd, Case	Vee
Pin 4 =	Gnd, Case	Gnd*
Pin 5 =	Gnd, Case*	Gnd

*Optional electrical tune

Note: Not all stabilities are available in all output options. Oscillatek does not recommend wave soldering, IR reflow or other elevated temperature processing without consulting the factory.

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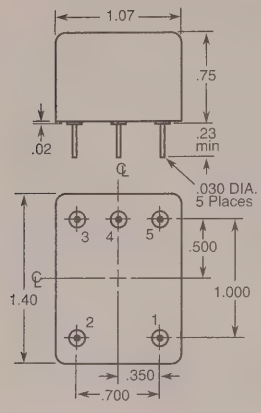
Solder Seal OCXO Small Package



RD Package

Output Options:

TD = TTL	=	DC to 50 MHz
HC = HCMOS	=	DC to 50 MHz
RC = +7 dBm 50Ω	=	DC to 50 MHz

Stability Options

A18	=	±1 x 10^{-8}	0° to +50°C
B28	=	±2 x 10^{-8}	0° to +70°C
D27	=	±2 x 10^{-7}	-40° to +85°C
S38	=	±5 x 10^{-8}	-40° to +85°C

Screening Options:

C = Standard Commercial
S = Class "B" per MIL-O-55310

Typical P/N:

HC RD K1 A 4 D27 C 10.000 MHz
Screening
Stability
Aging
Supply
Predetermined
Package
Output

Supply Options:

A	= +5.0 VDC	3 Watts
B	= +12.0 VDC	3 Watts
C	= +15.0 VDC	3 Watts
D	= +24.0 VDC	3 Watts

Aging Options:

2	= 1 x 10^{-8}/day	2 x 10^{-6}/year
3	= 5 x 10^{-9}/day	1 x 10^{-6}/year
4	= 3 x 10^{-9}/day	5 x 10^{-7}/year
5	= 1 x 10^{-9}/day	2 x 10^{-7}/year

Phase Noise (10 MHz Sinewave)

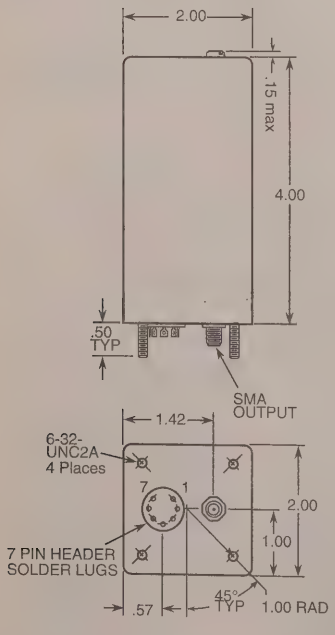
At	10 Hz	= -100 dBc
	100 Hz	= -127 dBc
	1.0 KHz	= -148 dBc
	>10.0 KHz	= -155 dBc

Pinouts:

Pin 1 = Output
Pin 2 = Gnd, Case
Pin 3 = VCO Input*
Pin 4 = VCO Reference*
Pin 5 = Supply

*When specified

High Stability HF OCXO



V1 Package

Output Options:

RC = +7 dBm 50Ω
RE = +13 dBm 50Ω

Stability Options

A50	=	±5 x 10^{-10}	0° to +50°C
A30	=	±3 x 10^{-10}	0° to +50°C
B70	=	±7 x 10^{-10}	0° to +70°C
C29	=	±2 x 10^{-9}	-20° to +70°C
C19	=	±1 x 10^{-9}	-20° to +70°C
S29	=	±2 x 10^{-9}	-40° to +70°C

Screening Options:

C = Standard Commercial
S = Class "B" per MIL-O-55310

Supply Options:

B	= +12.0 VDC	12 Watts
C	= +15.0 VDC	12 Watts
D	= +24.0 VDC	12 Watts

Aging Options:

6	= 5 x 10^{-10}/day	1 x 10^{-7}/year
7	= 3 x 10^{-10}/day	5 x 10^{-8}/year
8	= 1 x 10^{-10}/day	2 x 10^{-8}/year
9	= 7 x 10^{-11}/day	1 x 10^{-8}/year

Phase Noise (5 MHz)

At	10 Hz	= -120 dBc
	100 Hz	= -140 dBc
	1.0 KHz	= -155 dBc
	>10.0 KHz	= -157 dBc

Typical P/N:

RC V1 M1 C 7 C29 C
Screening
Stability
Aging
Supply
Predetermined
Package
Output

Frequency Options:

1 MHz 5 MHz 10 MHz
20 MHz 50 MHz 100 MHz

Pinouts:

Pin 1 = Supply
Pin 2 = Gnd, Case
Pin 3 = No connect
Pin 4 = Supply
Pin 5 = VCO Reference*
Pin 6 = VCO Input*
Pin 7 = VCO Return*

*When specified

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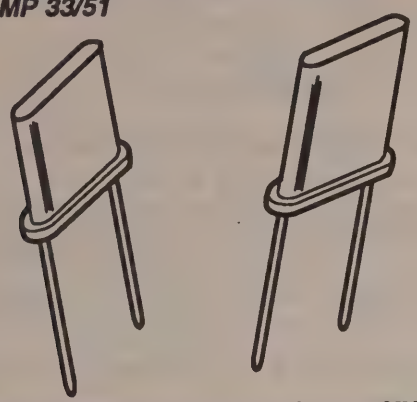
Pletronics

MICROPROCESSOR CRYSTALS

STANDARD MIRCROPROCESSOR CRYSTALS MP49, MP 33/51



- **Standard Frequencies from 1 MHz to 48 MHz.**
- **Custom Frequencies from 1MHz to 200 MHz.**
- **Standard Packages: HC-33: Solder Seal, HC-49, HC-51: Resistance Weld.**
- **Standard frequencies available from stock.**

STANDARD SPECIFICATIONS:	HC-49	HC-33/51
Frequency Range:	1 to 200 MHz	1 to 4 MHz
Calibration Tolerance:	± 0.005% (50ppm) at 25° C	
Overall Frequency Stability:	±0.01% (100ppm) from 0°C to 70°C	
Operating Temperature:	0°C to 70°C	
Shunt Capacitance:	7pF Maximum	
Load Capacitance:	See Standard Frequency Table	
Effective Series Resistance:	See Standard Frequency Table	
Drive Level:	1 to 2mW	
Sealing Method:		
HC-33	Solder	
HC-49/51	Resistance Weld	

STANDARD FREQUENCIES: HC-49 PACKAGE

Part No.	Freq. (MHz)	C_L	MAX. ESR (Ω)
MP49-13	1.8432	13pF	550
MP49-32*	2.4576	32pF	300
MP49-18	3.579545	18pF	150
MP49-30	3.6000	30pF	150
MP49-20	3.6864	20pF	150
SRMP49**	4.000	Series	80
MP49-20	4.000	20pF	100
MP49-12	4.194304	12pF	100
MP49-20	4.433619	20pF	100
SRMP49	4.91520	Series	70
SRMP49	5.000	Series	70
SRMP49	5.0688	Series	50
MP49-18	5.1850	18pF	60
SRMP49	5.7143	Series	50
SRMP49	6.000	Series	75
MP49-30	6.144	30pF	75
MP49-20	6.4000	20pF	60
MP49-20	6.5536	20pF	50
SRMP49	7.3728	Series	50
SRMP49	8.000	Series	45
SRMP49	9.8304	Series	45
SRMP49	10.000	Series	35
SRMP49	11.000	Series	35
SRMP49	11.0592	Series	35
SRMP49	12.000	Series	35
SRMP49	13.5168	Series	35
SRMP49	14.31818	Series	35
SRMP49	14.7456	Series	35
SRMP49	15.000	Series	35
SRMP49	16.000	Series	35
SRMP49	18.000	Series	35
SRMP49	18.432	Series	35
MP49-20	18.8696	20pF	35
SRMP49	19.6608	Series	35
SRMP49	20.000	Series	35
SRMP49	22.1184	Series	35
SRMP49	24.000	Series	35
SRMP49	36.000	Series	40
SRMP49	48.000	Series	40

* Dashed numbers (e.g. -32) indicate load capacitance in picoFarade (e.g. -32pF)
** Model numbers without dashed numbers indicate series resonance.

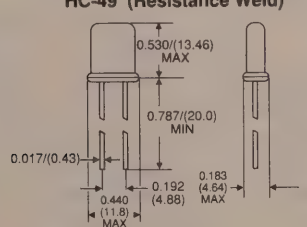
STANDARD FREQUENCIES: HC-33/51* PACKAGE

Part No.	Freq. (MHz)	C_L	MAX. ESR (Ω)
MP33-13**	1.000	13PF	750
MP33-13	1.8432	13pF	540
MP33-20	2.000	20pF	300
MP33-20	2.097152	20pF	300
MP33-32	2.4576	32pF	250
MP33-16	3.579545	16pF	100

* For crystals in HC-51 packages, MP33 becomes MP51 in part numbers.
** Dashed numbers (e.g.-13) indicate load capacitance in picofarade (e.g. -13pF)

DIMENSIONS HC-49

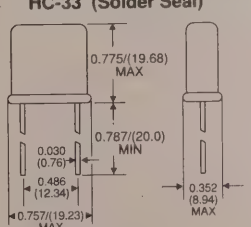
HC-49 (Resistance Weld)



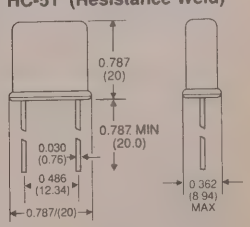
Inches (Millimeters)

DIMENSIONS HC-33/51

HC-33 (Solder Seal)



HC-51 (Resistance Weld)



Inches (Millimeters)

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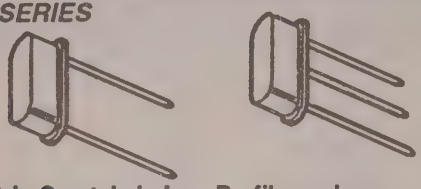
Pletronics

MICROPROCESSOR CRYSTALS

LOW PROFILE MICROPROCESSOR CRYSTALS
LP49 SERIES



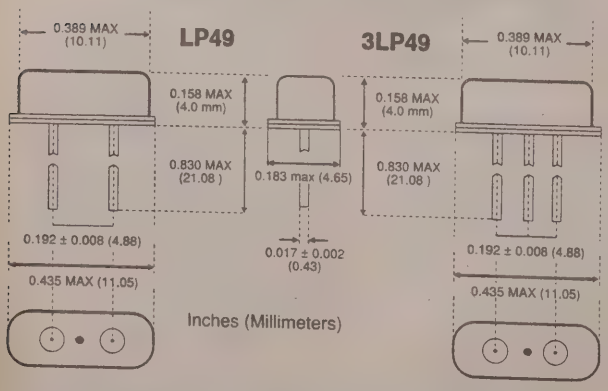
- **AT-Strip Crystals in Low Profile package: Standard: 3.5mm high, LP49 Series.**
- **Available with Three Leads (3LP40 Series): Middle Lead Case Ground.**
- **Lead Spacing same as HC-49.**
- **Frequency Range: 3.5 MHz to 25 MHz**
- **Standard frequencies available from stock.**

STANDARD SPECIFICATIONS:

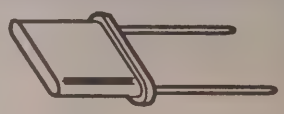
Frequency Range:	3.5 MHz to 25 MHz (Fundamental Mode)
Calibration Tolerance:	± 0.005% (50ppm) at 25° C
Overall Frequency Stability:	±0.01% (100ppm) from 0°C to 70°C
Operating Temperature:	0°C to 70°C
Shunt Capacitance:	1.50 to 3.50 pF
Load Capacitance:	See Standard Frequency Table
Effective Series Resistance:	See Standard Frequency Table
Drive Level:	1 mW below 4 MHz, 2 mW 4 MHz and up
Sealing Method:	Resistance Weld

STANDARD FREQUENCIES: (MHz)

3.579545(18pF)	5.068800	12.000000
3.686400(20pF)	6.000000	14.318180
4.000000(20pF)	6.144000(30pF)	15.000000
4.194304(12pF)	8.000000	16.000000
4.915200	10.000000	18.000000
5.000000(20pF)	11.059200	20.000000
		24.000000



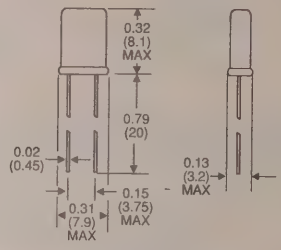
MINIATURE MICROPROCESSOR CRYSTALS
UM-1



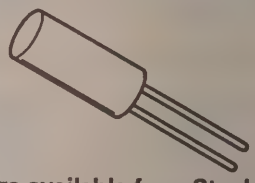
- **Miniature Crystals Housed in UM-1 Package.**
- **Frequencies from 4 MHz to 160 MHz.**

STANDARD SPECIFICATIONS:

Frequency Range:	4 MHz to 160 MHz
Calibration Tolerance:	± 0.005% (50ppm) at 25° C
Overall Frequency Stability:	±0.01% (100ppm) from 0°C to 70°C
Operating Temperature:	0°C to 70°C
Shunt Capacitance:	7 pF
Drive Level:	1 mW
Sealing Method:	Resistance Weld



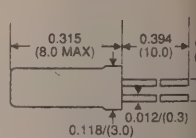
WATCH CRYSTALS
WX-32.768 kHz



- **Tuning Fork Crystal.**
- **Miniature Sizes.**
- **Standard 3mm x 8mm Size available from Stock.**

STANDARD SPECIFICATIONS:

Size: Standard:	3mm x 8mm ± 0.2mm
Optional:	2mm x 6mm ± 0.2mm
Optional:	1.5mm x 5mm ± 0.2mm
Frequency Range:	32.768 kHz
Calibration Tolerance:	± 0.002% (20ppm) at 25° C
Operating Temperature:	-10°C to 60°C
Turnover Temperature:	23° C ± 5° C
Drive Level:	1 mW
Shunt Capacitance:	1.7 pF
Load Capacitance:	12.5 pF
Equivalent Series Resistance:	25 kOhms
Quality Factor:	80,000 Typical
Aging:	1ppm Typical 1st year at 25° C
Sealing Method:	Cold Weld



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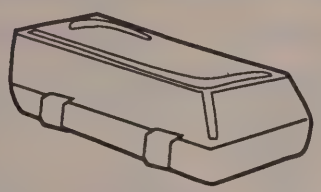
Pletronics

PLASTIC SURFACE MOUNT

SM20 SERIES WATCH CRYSTALS

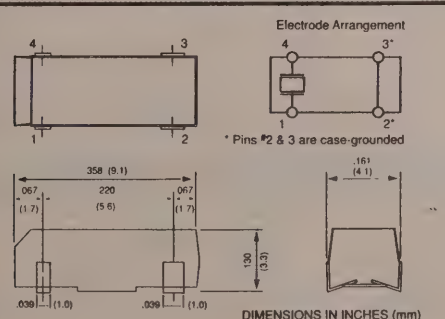


- **Lower Power Consumption – 1 microWatt Typical**
- **Heat-Resistant Hermetically Sealed Crystals Permit High-Temperature Reflow Soldering**
- **Ideal For High Density Circuit Boards**
- **Automatic Mounting From Tape & Reel**

STANDARD SPECIFICATIONS:

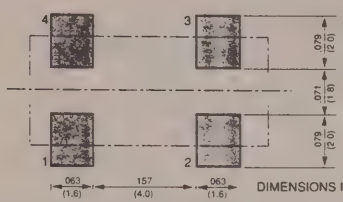
Frequency Range:	32.768 kHz
Temperature Range:	
Storage Temp.:	-40°C ~ + 85°C
Operating temp.:	-40°C ~ + 80°C
Turnover temp.:	25°C +/- 5°C
Calibration Tolerance:	± 0.003% (30ppm) at 25° C
Overall Frequency Stability:	-10°C + 60°C ±0.005% (50ppm)
Equivalent Series Resistance:	50kΩ maximum
Load Capacitance:	12.5pF typical
Motional Capacitance:	0.003pF typical
Shunt Capacitance:	1.35pF typical
Drive Level:	1μW typical
Insulation Resistance	500MΩ min.(DC 100v ± 15v)
Aging (1st year)	± 5ppm max. (25°C ± 3°C)
Leak Rate	1 x 10^{-7} mbar ℓ/sec. max.
Shock Resistance:	± 5ppm maximum after 3 drops on a hard board from 75cm height

DIMENSIONS



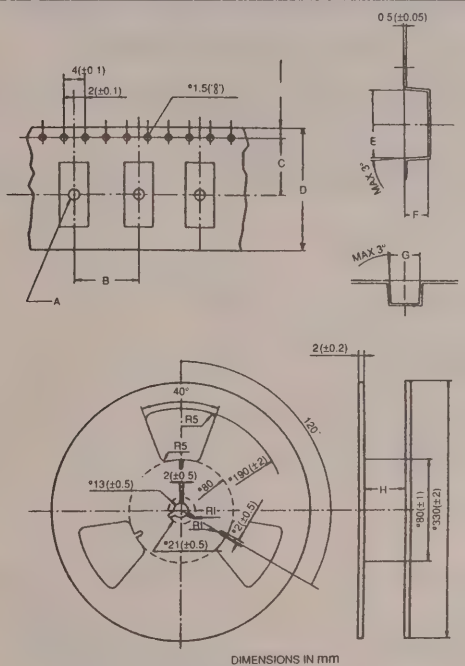
DIMENSIONS IN INCHES (mm)

RECOMMENDED LAND PATTERN



DIMENSIONS IN INCHES (mm)

SHIPPING TAPE & REEL



DIMENSIONS IN mm

TAPE & REEL DIMENSIONS (mm)

SERIES	TAPE							REEL
	A	B	C	D	E	F	G	H
SM39	2.2 ±0.1	12 ±0.1	11.5 ±0.1	24 ±0.3	13.1 ±0.1	4.7 ±0.1	5.5 ±0.1	24.2
	(Conforms to EIAJRC-10098 TE2412M)							
SM20	1.6 ±0.1	8 ±0.1	7.5 ±0.1	16 ±0.3	9.4 ±0.1	3.5 ±0.1	4.3 ±0.1	17.5
	(Conforms to EIAJRC-10098 TE1608M)							
	Parts per reel: 1,000							

RECOMMENDED SOLDER REFLOW PROFILE

(See SM39)

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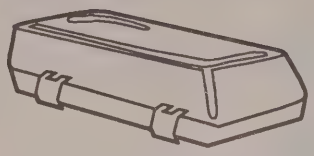
PLASTIC SURFACE MOUNT CRYSTALS

SM39 SERIES



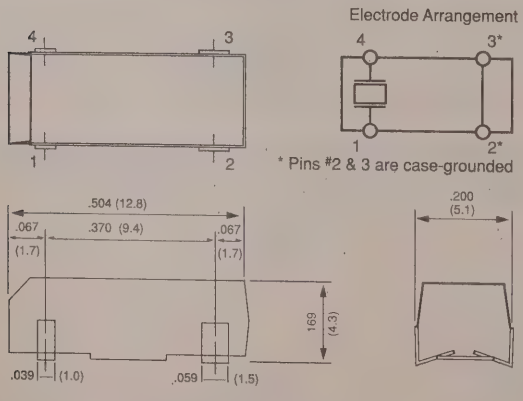
- **AT-Strip Crystals in Thermoplastic Package**
- **Ideal For High Density Circuit Boards**
- **Heat-Resistant Hermetically Sealed Crystals Permit High-Temperature Reflow Soldering**
- **Automatic Mounting From Tape & Reel**
- **Meets Standard Commercial Shock, Vibration & Aging Requirements**

STANDARD SPECIFICATIONS

Frequency Range:	3.579545MHz–30.000MHz*
Calibrations Tolerance:	± 0.005% (50ppm) at 25° C
Overall Frequency Stability:	±0.01% (100ppm)** from 0°C to 70°C
Temperature Range:	
Operating temp.:	0°C to 70°C
Storage temp.:	-40°C to 85°C
Equivalent Series Resistance:	(See Frequency Table Below)
Shunt Capacitance:	7.0pF Maximum
Drive Level:	200µW (<4MHz) 50µW (≥4MHz & <10MHz) 500µW (≥10MHz)
Insulation Resistance:	500MΩ minimum (DC 100V ±15V)
Leak Rate:	1 x 10-7 mbar. ℓ/sec. maximum
Shock Resistance:	± 5ppm maximum after 3 drops on a hard board from 75cm height

*Higher frequencies under development–contact factory.
**Tighter tolerance also available–contact factory

DIMENSIONS



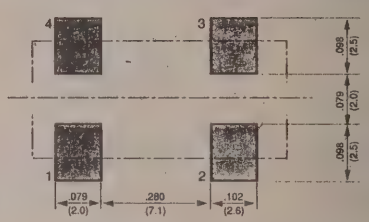
DIMENSIONS IN INCHES (mm)

STANDARD FREQUENCIES

Part No.	Freq. (MHz)	C_L	MAX. ESR (Ω)
SM39-18*	3.579545	18pF	200
SM39-20	3.686400	20pF	200
SM39-SR**	3.686400	Series	200
SM39-20	4.000000	20pF	200
SM39-SR	4.000000	Series	150
SM39-SR	4.915200	Series	150
SM39-30	6.144000	30pF	100
SM39-SR	7.372800	Series	100
SM39-SR	8.000000	Series	100
SM39-SR	10.000000	Series	100
SM39-20	11.059200	20pF	50
SM39-SR	11.059200	Series	50
SM39-SR	12.000000	Series	50
SM39-SR	14.318180	Series	50
SM39-SR	14.745600	Series	50
SM39-SR	16.000000	Series	50
SM39-SR	18.432000	Series	50
SM39-SR	19.660800	Series	50
SM39-SR	20.000000	Series	50
SM39-SR	24.000000	Series	50

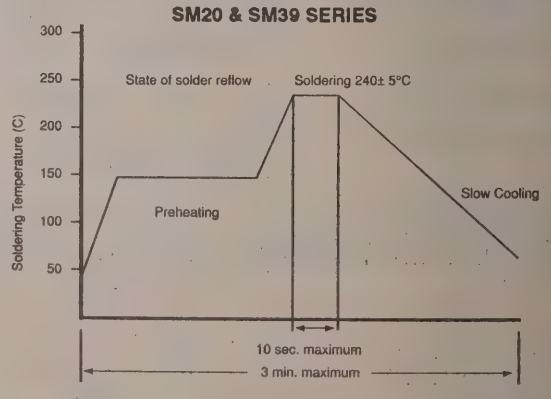
* Dashed number (e.g. *18) indicates Load Capacitance in picofarads
** SR indicates Series resonance.

RECOMMENDED LAND PATTERN



DIMENSIONS IN INCHES (mm)

RECOMMENDED SOLDER REFLOW PROFILE



SHIPPING TAPE & REEL

(See SM20)

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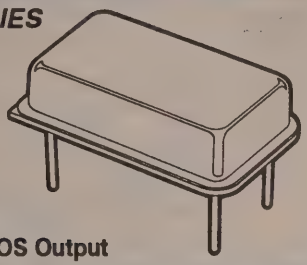
CLOCK OSCILLATORS

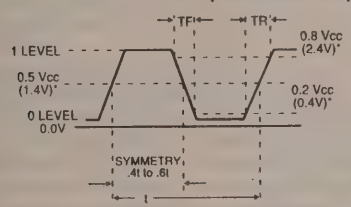
STANDARD CLOCK OSCILLATOR
P1100-HC SERIES



- High-Speed CMOS Output
- TTL-Compatible: Drives up to 10 Standard TTL Loads.
- Available in a Wide Range of Frequencies.
- Standard Frequencies Available from Stock.

STANDARD SPECIFICATIONS:

Frequency Range:	250Hz to 100 MHz
Operating Temperature Range:	0°C to 70°C
Overall Frequency Stability:	±0.01% (100ppm) Standard; 50ppm to 1000ppm also available.
Input Voltage (Vcc):	5Vdc ± 10%
Input Current:	10mA to 60mA without load. (Varies with frequency and load)



* Voltage levels in ( ) refer to TTL levels.

Test Load: 50 pF (HC Device); 10-TTL +20 pF (TTL Device)
Output Symmetry: 60/40 to 40/60 (55/45 to 45/55 Typical)
Rise & Fall Times: 6nS Maximum with 10TTL Load
Logic Level "1": 4.5 V Min. (HC Device); 2.4 V Min. (TTL Device)
Logic Level "0": 0.5 V Max. (HC Device); 0.4 V Max. (TTL Device)
Sealing Method: Resistance Weld
Leads: Nickel Plated; Solder Dipped

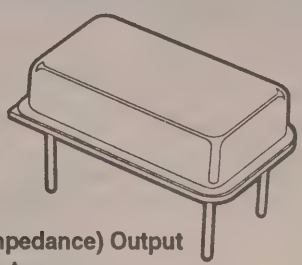
Pin	Connection
1	N/C
7	Case Ground
8	Output
14	Input (Vcc)

Model	Frequency Stability 0°C to 70°C
P1145-HC	±0.005% (50ppm)
P1100-HC	±0.01% (100ppm)
P1114-HC	±0.5% (500ppm)
P1115-HC	±0.1% (1000ppm)

STANDARD FREQUENCIES (MHz)

1.000000	6.144000	18.432000	40.000000
1.843200	7.372800	19.660800	44.900000
2.000000	8.000000	20.000000	48.000000
2.457600	9.600000	24.000000	50.000000
3.579545	10.000000	25.000000	50.350000
3.686400	11.059200	25.175000	60.000000
4.000000	12.000000	28.322000	64.000000
4.915200	14.318180	30.000000	66.000000
5.000000	15.000000	32.000000	66.667000
5.068800	16.000000	33.333000	
6.000000	16.257000	36.000000	

TRI-STATE CLOCK OSCILLATOR
P1100-3S SERIES

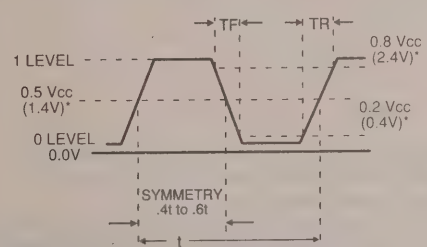


- "True" Tri-State (High Impedance) Output
- High Speed CMOS Output
- TTL-Compatible: Drives up to 10 Standard TTL Loads.
- Enable/Disable Input is HC-, HCT, and TTL-Compatible.
- Standard Frequencies Available from Stock.

STANDARD SPECIFICATIONS:

Frequency Range:	500kHz to 100 MHz
Operating Temperature Range:	0°C to 70°C
Overall Frequency Stability:	±0.01% (100ppm) Standard; 50ppm to 1000ppm also available.
Input Voltage (Vcc):	5Vdc ±10%
Input Current:	10mA to 60mA without load. (Varies with frequency and load)

Requirement for Enable/Disable Input at pin #1: Enable State Logic (Logic "1"): 0.6 x Vcc minimum (Vih), 10µA maximum (Iih); Disable State(Logic"0"):0.4 volt maximum (Vil), 150µA maximum(Iih)
Output at pin #8, Corresponding to each Input State: Enable State: Normal Output: Disable state: High-impedance Output



* Voltage levels in ( ) refer to TTL levels.

Test Load: 50 pF (HC Device); 10-TTL +20 pF (TTL Device)
Output Symmetry: 60/40 to 40/60 (55/45 to 45/55 Typical)
Rise & Fall Times: 6nS Maximum with 10TTL Load
Logic Level "1": 4.5 V Min. (HC Device); 2.4 V Min. (TTL Device)
Logic Level "0": 0.5 V Max. (HC Device); 0.4 V Max. (TTL Device)
Sealing Method: Resistance Weld
Leads: Nickel Plated; Solder Dipped

Pin	Connection
1	Enable/Disable Input
7	Case Ground
8	Output
14	Input (Vcc)

Model	Frequency Stability
P1145-3S	±0.005% (50ppm)
P1100-3S	±0.01% (100ppm)
P1114-3S	±0.05% (500ppm)
P1115-3S	±0.1% (1000ppm)

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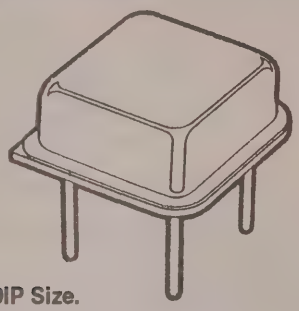
MINI-DIP CLOCK OSCILLATORS

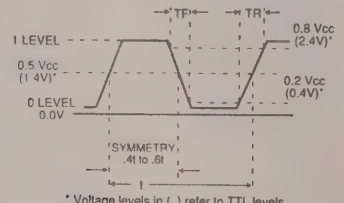
MINI-DIP CLOCK OSCILLATOR
SQ2200 SERIES



- Space-Saving Mini-DIP Size.
- High-Speed CMOS Output.
- TTL-Compatible: Drivers up to 10 Standard TTL Loads.
- Available in a Wide Range of Frequencies.
- Standard Frequencies Available from Stock.

STANDARD SPECIFICATIONS:

Frequency Range:	250Hz to 100 MHz
Operating Temperature Range: Overall	0°C to 70°C
Frequency Stability:	±0.01% (100ppm) Standard; 50ppm to 1000ppm also available.
Input Voltage (Vcc):	5Vdc ± 10%
Input Current:	10mA to 60mA without load. (Varies with frequency and load)



* Voltage levels in ( ) refer to TTL levels.

Test Load: 50 pF (HC Device); 10-TTL +20 pF (TTL Device)
Output Symmetry: 60/40 to 40/60 (55/45 to 45/55 Typical)
Rise & Fall Times: 6nS Maximum with 10TTL Load
Logic Level "1": 4.5 V Min. (HC Deivce); 2.4 V Min. (TTL Device)
Logic Level "0": 0.5 V Max. (HC Device); 0.4 V Max. (TTL Device)
Sealing Method: Resistance Weid
Leads: Nickel Plated; Solder Dipped

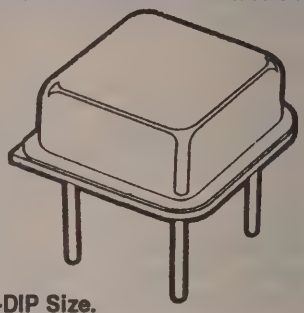
Pin	Connection
1	N/C
4	Case Ground
5	Output
8	Input (Vcc)

Model	Frequency Stability 0°C to 70°C
SQ2245	±0.005% (50ppm)
SQ2200	±0.01% (100ppm)
SQ2214	±0.5% (500ppm)
SQ2215	±0.1% (1000ppm)

STANDARD FREQUENCIES (MHz)

1.843200	14.318180	25.000000	40.000000
3.686400	16.000000	25.175000	48.000000
4.000000	16.257000	28.322000	50.000000
8.000000	18.432000	30.000000	64.000000
10.000000	20.000000	32.000000	
12.000000	24.000000	36.000000	

MINI-DIP TRI STATE CLOCK OSCILLATOR
SQ3300 SERIES

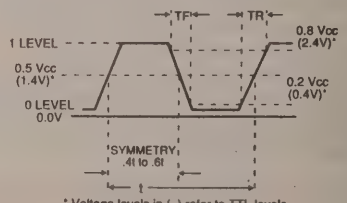


- Space-Saving Mini-DIP Size.
- "True" Tri-State (High Impedance Output)
- High Speed CMOS Output
- TTL-Compatible: Drives up to 10 Standard TTL Loads.
- Enable/Disable Input is HC-, HCT, and TTL-Compatible.
- Available in a Wide Range of Frequencies.

STANDARD SPECIFICATIONS:

Frequency Range:	500kHz to 100 MHz
Operating Temperature Range: Overall	0°C to 70°C
Frequency Stability:	±0.01% (100ppm) Standard; 50ppm to 1000ppm also available.
Input Voltage (Vcc):	5Vdc ±10%
Input Current:	10mA to 60mA without load. (Varies with frequency and load)

Requirement for Enable/Disable Input at pin #1: Enable State Logic (Logic "1"): 0.6 x Vcc minimum (Vih), 10µA maximum (Iih); Disable State(Logic"0"):0.4 volt maximum (Vil), 150µA maximum(Iih)
Output at pin #8, Corresponding to each Input State: Enable State: Normal Output: Disable state: High-impedance Output



* Voltage levels in ( ) refer to TTL levels.

Test Load: 50 pF (HC Device); 10-TTL +20 pF (TTL Device)
Output Symmetry: 60/40 to 40/60 (55/45 to 45/55 Typical)
Rise & Fall Times: 6nS Maximum with 10TTL Load
Logic Level "1": 4.5 V Min. (HC Deivce); 2.4 V Min. (TTL Device)
Logic Level "0": 0.5 V Max. (HC Device); 0.4 V Max. (TTL Device)
Sealing Method: Resistance Weid
Leads: Nickel Plated; Solder Dipped

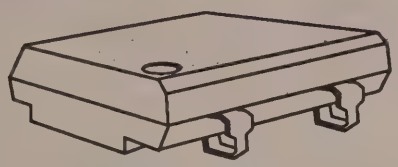
Pin	Connection
1	Enable/Disable Input
4	Case Ground
5	Output
8	Input (Vcc)

Model	Frequency Stability 0°C to 70°C
SQ3345	±0.005% (50ppm)
SQ3300	±0.01% (100ppm)
SQ3314	±0.05% (500ppm)
SQ3315	±0.1% (1000ppm)

Pletronics

SURFACE MOUNT CLOCK

SM 1100 SERIES



- **Frequencies from 1MHz to 120 MHz.**
- **HCMOS/ACMOS output; also 10-TTL compatible.**
- **Proprietary structure of the intermal crystal makes the oscillator extremely rugged.**
- **Tri-state output standard in all units.**
- **Controlled rise and fall times (slowed for low frequency ranges) and other noise-suppressing design features incorporated into a custom I.C. minimize EMI/RFI emissions and waveform distortion.**
- **ESD-protected Input/Output**
- **Short-circuit protected output.**

STANDARD SPECIFICATIONS:

Frequency Range:	1MHz to 120 MHz.
Operating Temperature Range:	0°C to +70°C (-40°C to +85°C optional)
Storage:	-55°C to +125°C
Assembly:	260°C for 30 seconds maximum

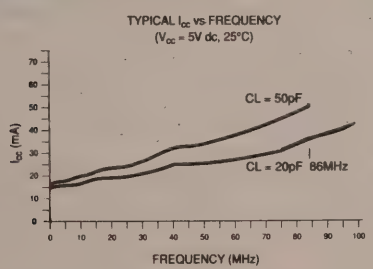
Overall Frequency Stability: (inclusive of all parameters)

Model	Frequency Stability 0°C to 70°C
SM1144	±0.0025%(25ppm)
SM1145	±0.0050%(50ppm)
SM1100	±0.0100%(100ppm)
SM1114	±0.0500%(500ppm)

(-40°C to +85°C frequency stability optional)

Start-up time: 1mS maximum

Input: Input Voltage (Vcc); 5Vdc ± 10% Standard (4 to 6 Vdc available, 7 Vdc absolute maximum); Input Current (Icc) See following graph.



Output : Test Load: 10-TTL load when tested as TTL device; 50 pF load when tested as CMOS device. (TTL test load used in factory test unless specified otherwise by customers.)

Sink and Source Current: 25 mA maximum

Symmetry: 40/60% to 60/40% when measured either at the TTL level (1.4V) or the CMOS level (50% Vcc); 45/55% to 55/45% optional.

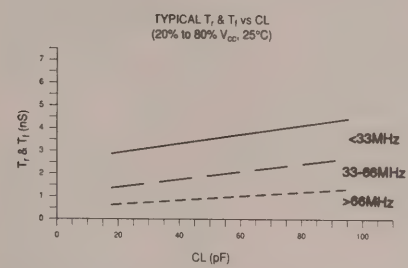
Pin Connections

Pin SM1100J	Connection
1	Enable/Disable Input
2	Ground
3	Output
4	Vin (Vcc)

Rise and Fall Time (T_r & T_f) With Test Load:

		<33 MHz	33-36MHz	>66MHz
CMOS (from 20% to 80% Vcc)	typical	3.5nS	2nS	1nS
	maximum	7nS	4nS	2nS
TTL (from 0.4V to 2.5V)	typical	2nS	1nS	0.5nS
	maximum	4nS	2nS	1nS

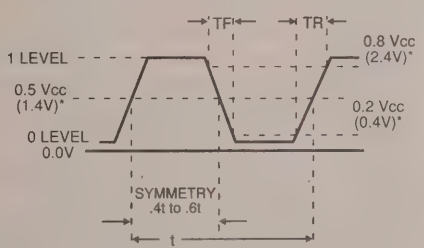
Rise and Fall Time (T_r & T_f) versus Capacitive Load: See following graph



Logic Levels with 25 mA Sink/Source Current:

	logic "1"	logic "0"
CMOS:	90% Vcc min.	10% Vcc max.
TTL:	2.5 V min.	0.4 V max.

Waveform:



* Voltage levels in ( ) refer to TTL levels.

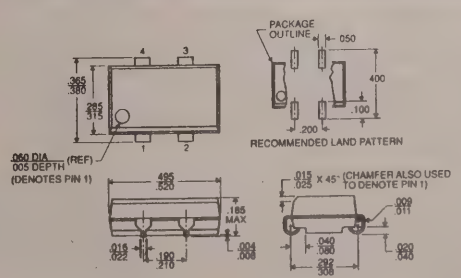
Tri-state Input/Output: Enable/Disable[1]: Enable State (logic "1")[1]: 2.4 V minimum[3] (Vih); 10 µA maximum (Iih). Disable State (logic "0"): 0.4 V maximum[3] (Vil); 300 µA maximum (Iil)

1. Each oscillator unit supplied with 15-50 kohm input pull-up resistor.
2. Logic "0" Enable State available by special order.
3. Pin #1 also has TTL thresholds, making them compatible with CMOS logic levels.

Output: When pin#1 is open (no connection): Normal Output
When pin#1 is at logic "1" (2.4 V minimum); Normal Output
When pin#1 is at logic "0" (0.4 V maximum): High-Impedance Output[4]

4. Each oscillator unit supplied with 30-70 kohm output pull-up resistor.

PHYSICAL DIMENSIONS (INCHES):



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Q-Tech Corporation
10150 W. Jefferson Blvd., Culver City, CA 90232, USA
(310) 836-7900 • Telex: 69-6140 • FAX (310) 836-2157

Quality Hybrid Crystal Clock Oscillators

LOGIC FAMILIES: TTL, CMOS, HCMOS, ACMOS, ECL and SINE

TTL

SPECIFICATION	FREQUENCY RANGE	SYMBOL	MIN	TYP	MAX	UNIT
Operating Voltage	All	V_{CC}	4.5	5.0	5.5 *7.0	Volt (V)
Supply Current	50 MHz-120 MHz	I_{CC}		40		milliAmpere (mA)
	27 MHz to 50 MHz			25		
	6.5 MHz to 27 MHz			12		
	.01Hz to 6.5 MHz			20		
Output Voltage -High	All	V_{OH}	2.4	3.8		Volt (V)
Output Voltage -Low	All	V_{OL}		0.3	0.4	
Rise/Fall Times (measured btw .8V & 2.0V)	5 MHz to 80 MHz	t_r/t_f		3	5	nanosecond (ns)
	Less than 5 MHz			8	10	
Start-Up Time	27.5 MHz to 100 MHz	t_s		10		millisecond (ms)
	16 MHz to 27.5 MHz			2		
	10 MHz to 16 MHz			5		
	Less than 10 MHz			15		
**Duty Cycle or Symmetry	27 MHz to 80 MHz	N/A	40	50	60	percent %
	6.5 MHz to 27 MHz		40	50	60	
	With divider(s)		45	50	55	
	Less than 5 MHz		45	50	55	
Load	27 MHz to 65 MHz	N/A		6		TTL loads
	Less than 27 MHz			10		TTL loads
Stability vs. Supply Voltage	All	N/A		$\pm 1x10^{-6}$	$\pm 2x10^{-6}$	$\Delta F/\Delta V$ for $\Delta V = \pm 10\%$
Stability vs. Load	All	N/A			$\pm 1x10^{-6}$	$\Delta F/\Delta$ Load for Δ Load $= \pm 20\%$
Aging & Stability	All	N/A		± 5	± 10	PPM/Year
Screening	Full MIL Temperature Range: −55°C to +125°C with special option to +200°C if required					
Package	**Available in all Q-Tech packages**					

* Absolute maximum operating voltage. ** For tighter tolerance, or special waveform, consult the factory.

CMOS, HCMOS, ACMOS & "Z" DRIVERS

Q-Tech "C" type clock oscillators are compatible with the **high voltage, 4000 series CMOS** logic family. Frequencies from .01 Hz to 15 MHz and voltages from 5 volts to 15 volts are available.
Q-Tech's **"HC/AC"** clock oscillators match the **High Speed CMOS** logic family. These HC/AC clocks produce rail-to-rail CMOS logic levels at frequencies to over 100 MHz. These units can drive one TTL load or high capacitance CMOS and NMOS loads.
Options available in the HC/AC line include provisions for **special symmetry** option, a **low current** option for battery operation when the output frequency is below to 100 KHz, and optional 10 TTL drive capability. Although normally run at 5.0 volts like TTL, HC clocks can operate down to 2.5 volts, with some restrictions on maximum frequency.
Extra outputs, gates, special digital functions and automatic testing provisions can often be included at low cost.

SPECIFICATION	STD CMOS	HC/AC
Frequency Range	.01 Hz to 15 MHz (Max. frequency depends on voltage)	.01 Hz to 120 MHz
Supply Voltage	*5 to 15 volts	*2.5 to 5.0 Volts
Supply Current	2-4 mA typical at 5 V and 6 MHz	6 mA typical @ 10 MHz
Load	10 CMOS/MOS loads typical (depends on frequency)	±2 mA drive typical. Can drive 1 TTL load, excellent for high capacitance loads ***
Rise/Fall Times (t_r and t_f)	<100 ns @ 5 V (depends on load)	6 ns typical @ 6 MHz. 10 ns max.
Logic Level "1"	V_{CC} −0.1 V min.	V_{CC} −0.1 min.
Logic Level "0"	0.0 +0.1 V max.	0.0 +0.1 V max.
Aging & Stability	Same as TTL	Same as TTL
Symmetry	60/40 4 MHz to 15 MHz 50/50 below 4 MHz	60/40 STD **48/52 available up to 25 MHz.
Screening	Full MIL Temperature Range −55°C to +125°C	
Package	**Available in all Q-Tech packages**	

Notes: *Special supply voltage. Ultra low current for battery operation available.
**Special tightened symmetry or arbitrary specified symmetry available.
***Higher drive capabilities available.

ECL

The ECL logic family is characterized by **very high speed** (clocks available to 200 MHz.) Q-Tech ECL clocks are available in 10K, 10KH, 100K, 300K and ECLinPS for compatibility with most ECL systems.
ECL components typically use a negative Vcc of − 5.2 Volts D.C., referenced to ground pin. For example, the Q-Tech QT48 package, built as an ECL clock, would use − 5.2 Volts on pin 7 ("Vcc") and ground on pin 14. Other pin configurations are also available.
ECL oscillators (QT6E1 and QT41E1 series) are available with quick delivery on standard frequencies. For more information, request our brochure.

Available Features/Options:

1. Full Military Temperature range
2. Surface Mount packages
3. Low cost commercial ECL Version
4. A.C. coupled output for r.f. applications
5. Custom clocks with gates, complementary outputs, etc.
6. Positive Vcc.
7. Custom load requirements.
8. Voltage controlled

SPECIFICATION	ECL
**Frequency Range	1 MHz to 200 MHz
Supply Voltage	− 5.2 V std for 10K and 10 KH output
	− 4.5 V std for 100K output
Supply Current	30 mA typical
Load	Std ECL
Rise/Fall Times (t_r and T_f)	Std 10K, 100K, and 10 KH
Levels	STD 10K, 100K and 10 KH
Aging & Stability	Same as TTL
Symmetry	60/40 (max), 55/45 (typical)
Screening	Full MIL Temperature range: − 55° to + 125°C
Package	**Available in all Q-Tech standard packages except QT1, QT3 and QT14**

** For higher frequency, refer to UHF and VHF sources in our catalog.

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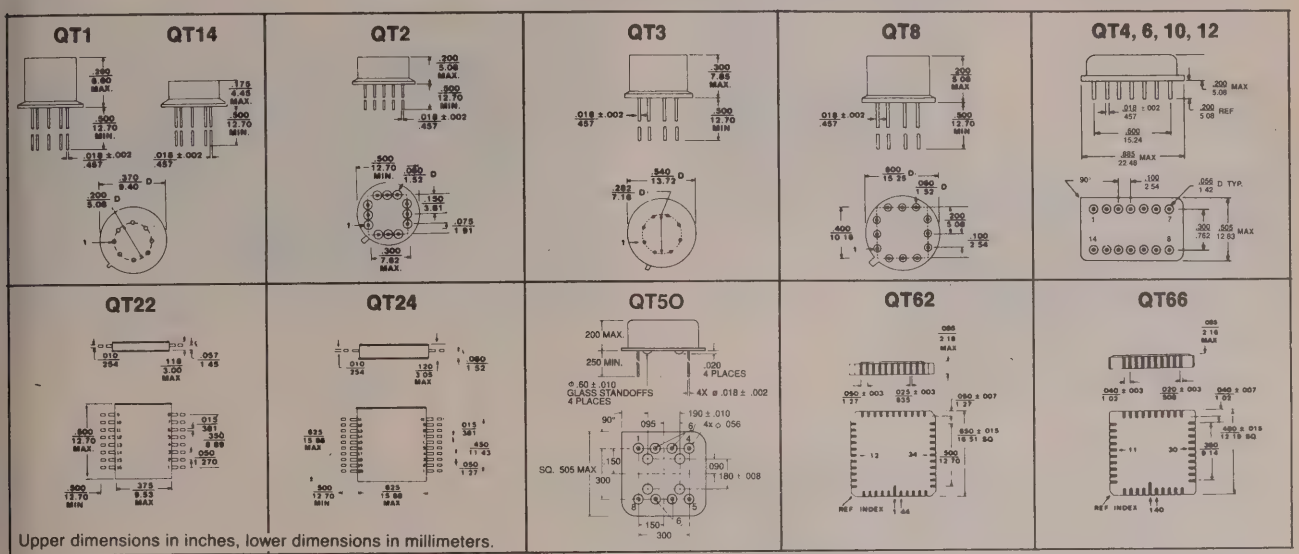
10150 W. Jefferson Blvd., Culver City, CA 90232, USA
(310) 836-7900 • Telex: 69-6140 • FAX (310) 836-2157

QPL: Mil-O-55310/08 Thru /20 Inclusive; And /26

QUALITY HYBRID CRYSTAL CLOCK OSCILLATORS DRAWING OUTLINES



Upper dimensions in inches, lower dimensions in millimeters.

	LOGIC FAMILY	TTL	CMOS		HCMOS/ACMOS	ECL
	INPUT VOLTAGE	5.0V	5.0V - 10.0V	10.0V - 15.0V	5.0V	−5.2V

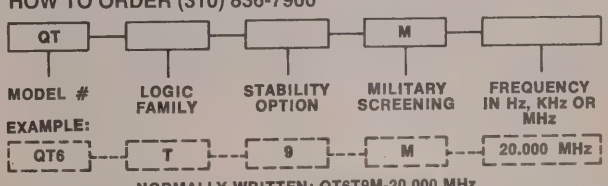
MODEL #	PCKG.	PIN CONNECTIONS VCC/VDD	GND/CASE	OUT	EQUIVALENT MIL-O-P/N M 55310/XX	FREQUENCY RANGE				
QT1	TO 5	8	4/4	5	/09 = TTL & /12 = CMOS	400 Hz - 60 MHz	1.5 KHz - 8.5 MHz	1.5 KHz - 15 MHz	400 Hz - 60 MHz	8 MHz - 80 MHz
QT14	TO 5	8	4/4	5	N/A					
QT2	TO 8	12	6/6	5	N/A	1 Hz - 80 MHz	1 Hz - 8.5 MHz	1 Hz - 15 MHz	.01 Hz - 80 MHz	1 MHz - 200 MHz
QT3	TO 8	8	4/4	5	/10 = TTL & /13 = CMOS	1.5 KHz - 30 MHz			.01 Hz - 30 MHz	4 - 80 MHz
QT4	DIP	4	7/7	5	/14 = TTL / 25 = ELC	0.1 Hz	0.01 Hz	0.01 Hz	.03 Hz	1 MHz
QT6	DIP	14	7/7	8	/ 16 & 17 = TTL & / 18 & / 26 = CMOS / 25 = ECL					
QT10	DIP	14	8/2	1	/08 = TTL & /11 & /15 = CMOS					
QT12	DIP	14	7/7	4	N/A	100 MHz	8.5 MHz	15 MHz	100 MHz	200 MHz
QT22	FP	8	9/9	10	N/A	1.5 KHz - 100 MHz	1 Hz 8.5 MHz	1 Hz 15 MHz		
QT24	FP	13	10/10	11	/21 = TTL	1 Hz - 100 MHz				
QT50	DIP	8	4	5	N/A	400 Hz - 64 MHz	1.5KHz - 8.5 MHz	1.5 KHz - 15 MHz	400 Hz - 64 MHz	4 MHz - 80 MHz
QT62	LCC	6, 12	34, 40	42	/20 = TTL	1.5 KHz - 100 MHz	1 Hz 8.5 MHz	1Hz 15 MHz	.03 Hz 100 MHz	1 MHz 200 MHz
QT66	LCC	4, 10	31,37	39	/19 = TTL					

FREQUENCY STABILITY VS TEMPERATURE**

OPTION CODE	±%	±PPM	TEMPERATURE
1	.01	100	0°C — +70°C
4	.005	50	
2	.005	50	0°C — +50°C
*3	.0005	5	
5	.0025	25	–20°C — +70°C
6	.005	50	–55°C — +105°C
9	.005	50	–55°C — +125°C
10	.01	100	
11	.005	50	–40°C — +85°C
8	TO CUSTOMER SPECIAL REQUIREMENTS		

* Requires external tuning capacitor.
** All units operate from −55°C to +125°C. Tolerance unspecified outside of temperature limits.

HOW TO ORDER (310) 836-7900



NORMALLY WRITTEN: QT6T9M-20.000 MHz

There are three ways to order a Q-Tech Clock Oscillator:

1. By ordering a Q-Tech standard part number such as: **QT6 T 9 M-20 MHz.**
2. By ordering a MIL-O-55310 part number such as **M55310/16-B31 A-20 MHz.**
3. By ordering a special custom requirement unit (whether the product is governed by a customer source control document or is a Q-Tech special design), a special part number **MCM XXXX** will be assigned to the product designating **Microelectronic Custom (Oscillator) Module,** which will also assure you of **confidentiality** regarding the **proprietary nature** of your design.

SPECIAL OPTIONS AVAILABLE

- Gated Outputs
- Multiple Frequency Outputs
- Tri-State Outputs
- Fine Frequency Adjustment
- Precise Programmed Outputs
- Quick Start-Up Time
- Sinewave Output
- Special Symmetry
- Logic: TTL, CMOS, HCMOS, ACMOS, ECL, 'Z' Drivers and Sine
- 200°C Operation
- Very Low Power Consumption
- Special Package Configurations
- Special Pin Configurations

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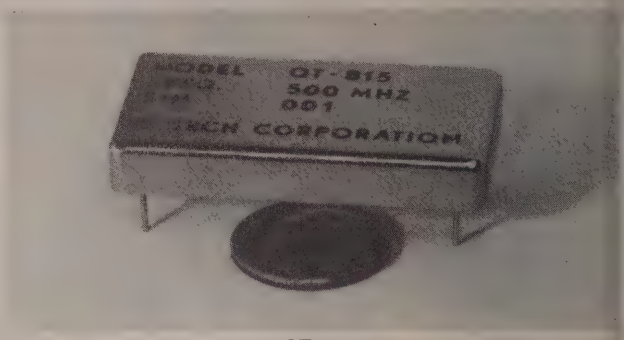
Crystal Controlled Sinewave Sources

ULTRA-SMALL HF AND VHF SOURCES

QT-815

This tiny unit (less than 0.4 cu. in.) is the smallest member of Q-Tech's line of HF/VHF sources. Q-Tech's QT-815 is available in the frequency range from 4 MHz to 500 MHz. With a package size of just 1.66 inches x .875 inches x .275 inches, the QT-815 is **one half the size of completing units** with no compromise in specifications. Features include low noise, crystal stability, +7 dBm output, and low DC current.



QT-815
1.66 in. x .875 in. x .27 in.
4 TO 500 MHz
ULTRA-SMALL SOURCE

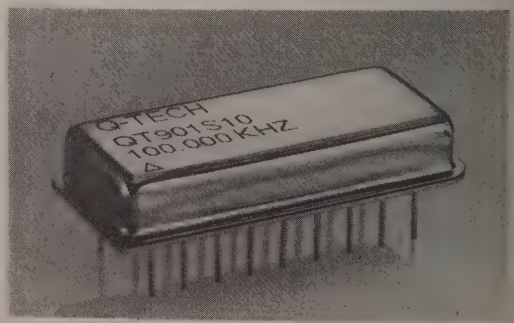
QT-815 Features

FREQUENCY	**4 MHZ to 500 MHZ**	
OUTPUT		
Level	+7 dBm STANDARD (>0.7 Vrms/50 ohms)	
Harmonics	–20 dBc (dB below carrier)	
Subharmonics/	–40 dBc	
Spurious	(–70 dBc for specific bands around carrier)	
Phase Noise	Offset From Carrier	Phase Noise
	100 Hz	–115 dBc/Hz
(Typical	1 kHz	–135 dBc/Hz
at	10 kHz	–150 dBc/Hz
100 MHz)	50 kHz	–155 dBc/Hz
STABILITY		
25°C	±10 PPM	
Temperature	–20°C to +70°C ±25 PPM	
Aging	5 PPM 1st year, 3 PPM/year, thereafter	
SUPPLY		
Voltage	12 or 15 Vdc, ±10% (any supply in 12-24 volt range, optional)	
Current	<20 mA	
MECHANICAL		
Size	0.875 in. x 1.66 in. x 0.275 in.	
Mounting	PCB Mount	

Other Models, Options:

QT-825: Package size 1.5 in. x 1.5 in. x .5 in.
QT-875: +30 dBm output (1 Watt) Package is 2 in. x 3 in. x .5 in.
QT-901: 10 Hz to 1 MHz
QT-906: 1 MHz to 72 MHz, .88" x .5" x 2" package, 0 dBm (7 dBm optional)
Temperature/ Stability + 50 ppm from –55 degrees C. to + 125 degrees C
Connections: PC board mount: BNC, SMA optional output connectors

Additional packages and options are available.
For full details, please request bulletin QT800.



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Other Q-Tech Products

VXCO'S

Q-Tech ***Voltage Controlled Crystal Oscillators*** can be ***"frequency shifted"*** or ***"controlled"*** with an external voltage source. Q-Tech VCXO's, often used for frequency synthesis, clock recovery and other phase lock loop applications, are available in DIP packages (full size and half size / see package outlines) as well as custom packages. Minimum deviation (pulling) is ±100 ppm for a control voltage range of 0 to 5 volts. VCXO's requiring a wider pull range, improved linearity, ECL or sinewave output are also available. Integrating the VCXO, the loop filter and the phase detector into one small package can reduce cost, space and system noise. A variety of complete phase locked loops in a single package are now available utilizing either VCO or VGXO. For more details, please request our brochure.

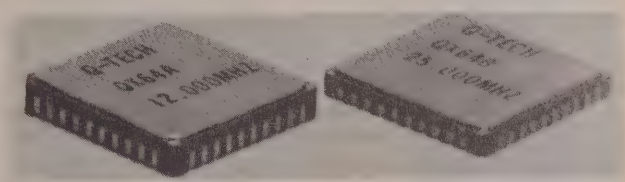
ECL CLOCK OSCILLATORS

In addition to its complete line of ECL Clock Oscillators, Q-Tech now offers another version of unscreened and fast delivery ECL in 2 standard DIPS: ***QT6E1*** (14 pin DIP) and the ***QT41E1*** (4 pin DIP) ***series.*** These units operate at –5.2 Volts with a frequency range of 1 MHz to 200 MHz. For more details please request our brochure.

ECL Clock Oscillators

SURFACE MOUNT CRYSTALS

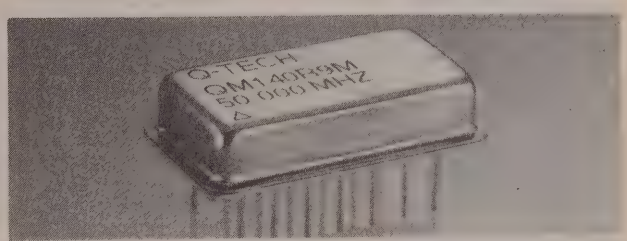
Q-Tech is introducing its new line of Surface Mount Crystals: the ***QX64A*** (85 mils thick) and ***QX64B*** (65 mils thick) ***series*** with a frequency range of 5 MHz to 125 MHz. These surface mount crystals can withstand full military environmental testings. They are hermetically sealed in a 40 pad LCC with any pin configuration at no extra charge. They are also available in swept quartz for ***radiation hardened applications.*** For more details please request our brochure.



Surface Mount Crystals

MICROPROCESSOR CLOCK DRIVERS - THE QM SERIES

Q-Tech Corporation has developed a family of microprocessor clock generators/drivers for various types of micorprocessors ranging from 8 bit to the State-of-the-Art 32 bit and beyond. Versions are available with either commercial or full MIL-spec designs. For full details, please request our brochure.



The QM140R module meets the clock requirements of Motorola 68040.

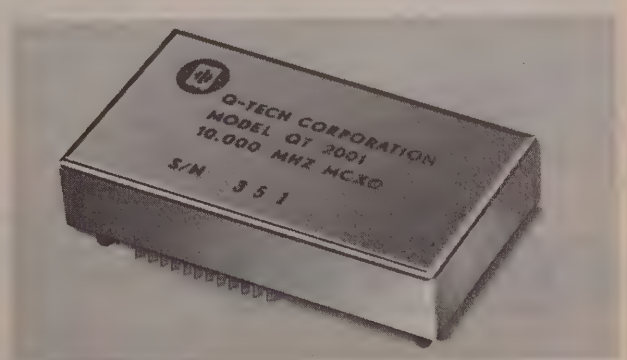
M C X O

Microprocessor Compensated Crystal Oscillator

A new approach to low power high stability design, Q-TECH'S MCXO breaks the 30 year, 1 ppm frequency stability barrier for compensated crystal oscillators.

- ± 3 x 10^{-8} stability from -55°C to +85°C **(without an oven!)**
- 75 milliwatts maximum power input
- 10 second initialization
- Designed-in spectral purity; 10 MHz output
- Package Dimensions: 3.125" x 1.75" x .7"
- Custom packages available

For full details, please request our MCXO bulletin.

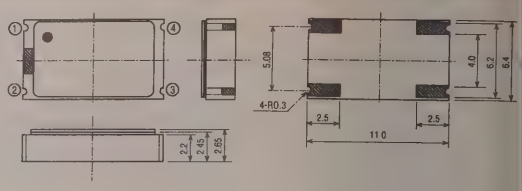


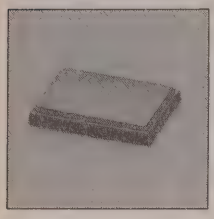
SMD Oscillators

RALTRON

New C02810 C02910 Families

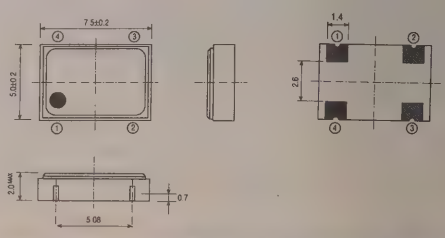
Surface Mount Clock Oscillators
Frequency Range: 1.8432 MHz - 70.000 MHz
Enable/Disable Function Available
Dimensions: 11mm x 6.4mm x 2.65mm (High)
Driving Ability:
10 LS-TTL (15pf mos) C02810
10 N-TTL (15pf mos) C02910
Compatible with EPSON SG615 Family





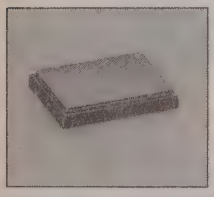
C04810 C04910 Families

Ultra Thin Surface Mount Clock Oscillator
Frequency Range: 1.8432 MHz - 67.000 MHz
Enable/Disable Function Available
Dimensions: 7.5mm x 5mm x 2mm (High)
Driving Ability:
10 LS-TTL (15pf mos) C04810
10 N-TTL (15pf mos) C04910
Smallest and Thinnest SMD Clock Oscillator in the World.



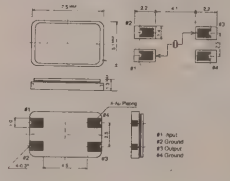
SMD Crystals

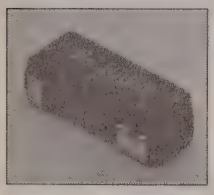
RALTRON



New H-13 Families

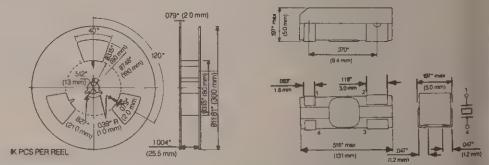
Ultra Thin Surface Mount Crystal Unit
Frequency Range: 16.000 MHz - 100.000 MHz
Dimensions: 7.5mm x 5.1mm x 1.3mm (High)
Fundamental, Third, and Fifth Overtones
+/-50PPM at Room Temp,
+/-50PPM from -10/+60°C

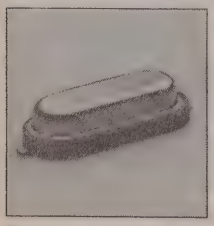




TT-SMD Families

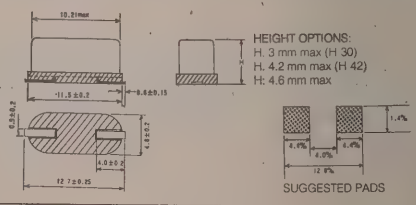
Plastic Package Surface Mount Crystal Unit
Frequency Range: 3.500 MHz - 50.000 MHz
Dimensions: 13.1mm x 5mm x 5mm (High)
Fundamental and Third Overtone
+/-50PPM at Room Temp,
+/-100 PPM from -10/+70°C





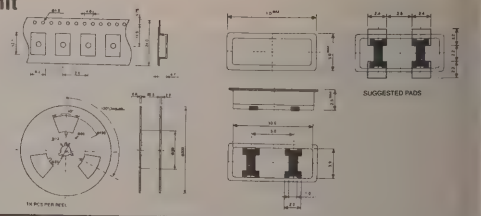
HC-49 Short Family (3 mm HEIGHT)

HC-49 Short Surface Mount Crystal Unit
Frequency Range: 3.000 MHz - 50.000 MHz
Dimensions: 12.7mm x 8.3mm x 3mm (High)
Fundamental and Third Overtone
+/-50PPM at Room Temp,
+/-50PPM typ. (+/-100PPM max)
from -10/+60°C



T-25 Family

T-25 Ceramic Package Surface Mount Crystal Unit
Frequency Range: 3.000 MHz - 50.000 MHz
Dimensions: 11mm x 5mm x 2.5mm (High)
Fundamental and Third Overtone
+/-50PPM at Room Temp,
+/-100PPM from -10/+60°C



RALTRON

RALTRON ELECTRONICS CORP. 2315 NW 107th AVENUE, MIAMI, FLORIDA 33172 U.S.A.
FAX (305) 594-3973, TELEX 441588 RALSEN, (305) 593-6033

Raltron is one of the fastest growing manufacturers of a complete line of frequency management components, including crystal units, oscillators, filters and ceramic resonators.

Standard Voltage Controlled Crystal Oscillators

RALTRON

VCXO - VC 7000 Series

Frequency Range:
500 kHz to 150 MHz

Frequency Stability:
+/- 50 PPM
+/- 25 PPM

Operating Temperature Range:
0° to +70° C

Output Waveform:
Square (tr and tf 10 nsec max)

Output Level:
TTL: Voh = 2.5 VDC min
Vol = 0.5 VDC max
HCMOS: Voh = 90% Vdd
Vol = 10% Vdd

Output Drive:
TTL: 1 to 10 TTL loads
HCMOS: 15 pf typ. (10 LSTTL max)

Supply Voltage:
5 VDC +/- 5%

Supply Current:
35 mA max typ

Nominal Control Voltage:
+2.5 VDC

Control Voltage Range:
0.5 to 4.5 VDC

Linearity:
+/- 10% max (monotonic)

Slope:
positive

Deviation Sensitivity:

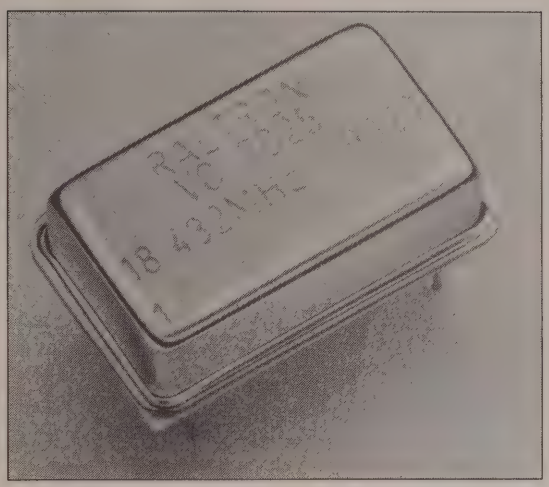
up to 29.999 MHz	up to +/- 100 PPM/V
30 to 59.999 MHz	up to +/- 50 PPM/V
60 to 150 MHz	up to +/- 25 PPM/V

Modulation Frequency:
3 dB >10 kHz

Input Impedance:
>20 kohms

Aging:
+/- 1 PPM/year typ.

Mechanical:
see attached outline

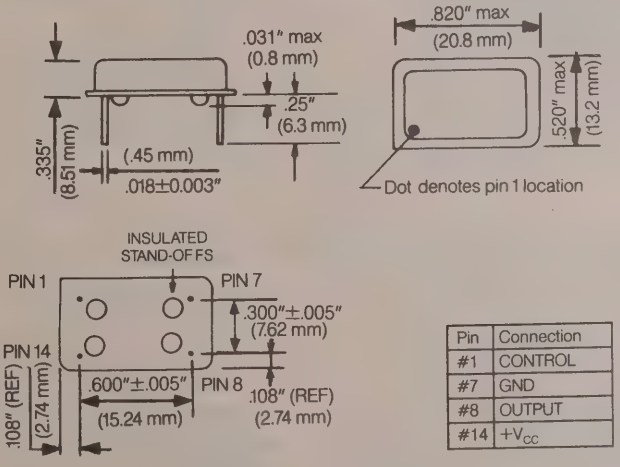


Raltron manufactures a complete line of the highest quality VCXO's to both standard and custom specifications. Call us today with your standard and custom VCXO needs.

Family	Frequency Stability	Frequency in MHz	Deviation*
VC7I-TTL up to 30 MHz	25 or 50 PPM	(NOM. CONTROL VOLT.)	H, L or V
VC72-HCMOS up to 30 MHz	25 or 50 PPM	(NOM. CONTROL VOLT.)	H, L or V
VC73-HCMOS 30 to 150 MHz	25 or 50 PPM	(NOM. CONTROL VOLT.)	V only

* DEVIATION: H=100PPM/V; L=50 PPM/V; V= 25PPM/V

NOTE: OTHER OPTIONS AVAILABLE UPON REQUEST. PLEASE CONSULT FACTORY WITH SPECIFICS.



Pin	Connection
#1	CONTROL
#7	GND
#8	OUTPUT
#14	$+V_{CC}$

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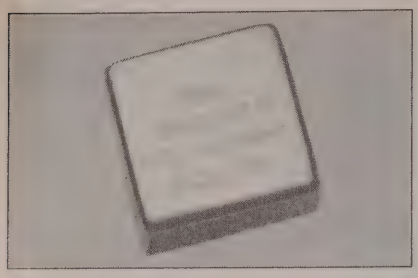
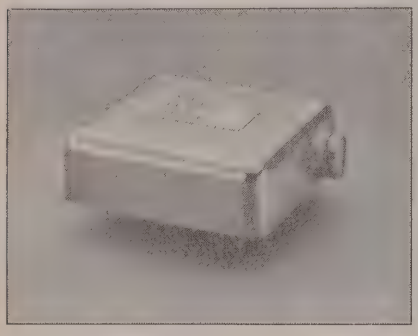
Crystal Oscillators—TCXO

RALTRON



TCXO **New, Low Priced Temperature Compensated Crystal Oscillator**

Frequency Range: 1MHz to 40 MHz
Frequency Stability:
0°to + 50° C: ±0.6 ppm
-20° C to 70° C: ±0.8 ppm
-40° C to 85° C: ±1.0 ppm
Output Options: HCMOS, CMOS, Clipped Sinewave
Supply Voltage: Standard: 5VDC; Options: +12VDC or +15VDC
Size: 0.8" x 0.8" x 0.4"
Aging: ±1.0 ppm per year



TCXO **Temperature Compensated Crystal Oscillator**

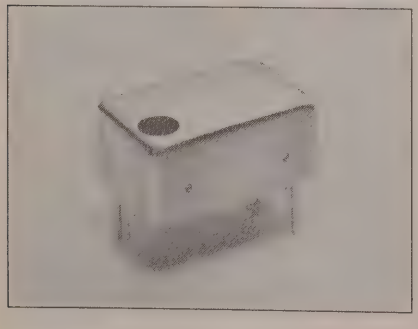
Frequency Range: 1 MHz to 60 MHz
Frequency Stability vs. Temperature Options:*
0°C to +50°C: ±0.3 ppm
-20°C to +70°C: ±0.5 ppm
-40°C to +85°C: ±1.0 ppm
Output Options: HCMOS, CMOS or Clipped Sinewave
Supply Voltage: Standard: +5 VDC; Options: +12VDC or +15VDC
Size: 1.5" Square X 0.5"
Aging: ±1 ppm per year
Frequency Adjust: Screwdriver slot

*Not all options available at all frequencies/temperature ranges.

VCTCXO **Voltage Controlled Temperature Compensated Crystal Oscillator**

Frequency Range: 1 MHz to 25 MHz
Frequency Stability vs. Temperature Options:*
0°C to +50°C: ±0.5 ppm
-20°C to +70°C: ±1.0 ppm
-40°C to +85°C: ±2.0 ppm
Output options: HCMOS, CMOS or Clipped Sinewave
Supply Voltage: Standard: +5VDC; Options: +12VDC or +15VDC
Control Voltage:
Slope: Positive, ±20% linearity
Modulation Input Range: 0 Volts to +5 Volts
Deviation Range: ±10 ppm min
Size: 1.5" Square X 0.5"
Aging: ±1 ppm per year

*Not all options available at all frequencies/temperature ranges.



TCXO **Temperature Compensated Crystal Oscillator**

Frequency Range: 10 MHz to 20 MHz
Frequency Stability:
-10° C to +70° C: ±2.0 ppm
-20° C to +70° C: ±2.0 ppm
-30° C to +75° C: ±2.5 ppm
Supply Voltage: 5V ±0.3VDC
Supply Current: 5 mA max
Size: .736" x .480" x .342"
Aging: ±1 ppm per year

Note: Other options available on request. Please consult factory with specifics.

RALTRON

RALTRON ELECTRONICS CORP. 2315 NW 107th AVENUE, MIAMI, FLORIDA 33172 U.S.A.
FAX (305) 594-3973, TELEX 441588 RALSEN, (305) 593-6033

Raltron is one of the fastest growing manufacturers of a complete line of frequency management components, including crystal units, oscillators, filters and ceramic resonators.

PRODUCT SELECTION GUIDES

TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 93/94 EDITION OF EEM

AC Power Supplies, Product Selection Guide **D•2221**

Batteries, Product Selection Guide **D•1419**

Cabinets, Enclosures, Racks & Chassis, Product Selection Guide **C•1003**

Capacitors, Product Selection Guide **A•1003**

Coils, Chokes, Inductors, Product Selection Guide **A•1179**

Connectors, Terminals & Sockets, Product Selection Guide **C•1139**

Cores, Magnets & Ferrites **A•1317**

Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide **A•1326**

DC-DC Converters **D•2049**

DC Power Supplies, Product Selection Guide **D•1488**

Delay Lines, Product Selection Guide **A•1513**

Discrete Semiconductors, Product Selection Guide **A•2130**

Displays, Readouts, & CRTs, Product Selection Guide **B•1017**

Fans, Blowers, Cooling Equipment, & Heat Exchangers, Product Selection Guide **C•1557**

Fiber Optics, Product Selection Guide **B•1200**

Filters, Power, Product Selection Guide **A•1584**

Filters, Signal, Product Selection Guide **A•1617**

Instruments, Test & Measuring, Product Selection Guide **D•1215**

Interconnection Systems, Product Selection Guide **C•1670**

Keyboards & Keypads, Product Selection Guide **B•1818**

Lamps, Lights, & Indicators, Product Selection Guide **B•1131**

Microwave Components, Product Selection Guide **A•1719**

Military Qualified Products List **B•1002**

Motors, Drives, & Rotating Components, Product Selection Guide **B•1231**

Oscilloscopes, Product Selection Guide **D•1402**

Panel Hardware, Product Selection Guide **C•1522**

Panel Meters, Analog & Digital, Product Selection Guide **D•1336**

Potentiometers, Trimmers, Controls, & Rheostats, Product Selection Guide **A•2053**

Power Supplies, AC, Product Selection Guide **D•2221**

Power Supplies, DC, Product Selection Guide **D•1488**

Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide **B•1341**

Relays, Product Selection Guide **B•1401**

Resistors, Product Selection Guide **A•1859**

Solenoids, Product Selection Guide **B•1626**

Switches, Product Selection Guide **B•1658**

Thermal Components, Product Selection Guide **B•1857**

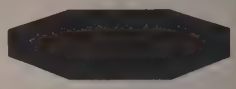
Transducers & Encoders, Product Selection Guide **B•1911**

Transformers, Product Selection Guide **A•2229**

Wire & Cable, Product Selection Guide **C•1701**

REEVES-HOFFMAN

DIVISION DYNAMICS CORPORATION OF AMERICA



QUARTZ CRYSTALS

CRYSTAL PRODUCT LINE CAPABILITY SUMMARY

The following is a brief overview of the packaged and crystal blanks manufactured by Reeves-Hoffman Division, the smart choice for low frequency crystals as well as standard and precision AT's up to 250 MHz. We have 50 years of experience and we welcome the opportunity to quote your requirements. Please contact us with your specifications for a prompt quotation.

LOW FREQUENCY CRYSTALS (1 KHz to 1 MHz)

FREQUENCY RANGE	HOLDER	TEMP. RANGE	STABILITY	RESISTANCE
1 KHz to 15 KHz	A	–40°C to +95°C	200 ppm	1250 ohms
15 KHz to 100 KHz	A	–40°C to +95°C	100 ppm	50K to 90K ohms
100 KHz to 200 KHz	A	–40°C to +95°C	150 ppm	5000 ohms
200 KHz to 450 KHz	B	–40°C to +95°C	100 ppm	2K to 5K ohms
450 KHz to 1 MHz	C	–40°C to +95°C	75 ppm	1K to 2K ohms

DEFINITION OF HOLDER TYPES

A	B		C	
HC-13	HC-6	HC-47	HC-18	HC-43
HC-34	HC-33	HC-48	HC-25	HC-49
	HC-36	HC-51	HC-42	HC-50

HIGH FREQUENCY FUNDAMENTAL CRYSTALS OSCILLATOR APPLICATIONS

FREQUENCY RANGE MHZ.	MODE	CAL @ 25 DEG. C ± PPM	MAXIMUM Rs OHMS	TYP. Cm fF	TYP. Co. pF.	TYP. AGING 25 DEG. C
30.000 - 34.999	FUND.	10	15	18	4.0	±5 PPM
35.000 - 39.999	FUND.	15	15	15	3.5	±5 PPM
40.000 - 49.999	FUND.	20	25	15	3.3	±5 PPM
50.000 - 69.999	FUND.	20	20	15	3.4	±7 PPM
70.000 - 79.999	FUND.	20	20	8	2.0	±8 PPM
80.000 - 90.000	FUND.	25	25	8	1.8	±8 PPM

MINIATURE SIZE - Available in HC-45 resist-weld and TO-5 cold-weld packages.

HIGH FREQUENCY FUNDAMENTAL CRYSTALS WIDE BANDWIDTH FILTER APPLICATIONS

FREQUENCY RANGE MHZ.	MODE	CAL @ 25 DEG. C ± PPM	MAXIMUM Rs OHMS	TYP. Cm fF	SPURIOUS SUPR.	CLEAN AREA KHZ.	TYP. AGING 25 DEG. C
30.000 - 34.999	FUND.	10	35	3.5	-35 dB	100	±5 PPM
35.000 - 39.999	FUND.	15	40	3.5	-35 dB	100	±5 PPM
40.000 - 49.999	FUND.	20	40	3.0	-30 dB	150	±5 PPM
50.000 - 59.999	FUND.	20	50	2.5	-30 dB	180	±7 PPM
60.000 - 69.999	FUND.	20	50	2.2	-25 dB	210	±7 PPM
70.000 - 79.999	FUND.	20	55	2.0	-25 dB	225	±8 PPM
80.000 - 90.000	FUND.	30	60	2.0	-25 dB	300	±8 PPM

MINIATURE SIZE - Available in HC-45 resist-weld and TO-5 cold-weld packages.

ETHERNET CRYSTALS

Reeves-Hoffman Division offers a low cost 20 MHz crystal for Ethernet applications. The part number for this device is 04-20423-312.

CRYSTAL BLANKS

- Finished Blank Frequency Range: 8 to 200 MHz
  Fundamental Range: 8 to 75 MHz
  3rd, 5th, 9th Overtone: 8 to 200 MHz
- Square or round unfinished blanks also available.

For further information or catalog, contact your Reeves-Hoffman representative or
Reeves-Hoffman Division, Dynamics Corporation of America • 400 W. North Street, Carlisle, PA 17013 USA • Phone 717-243-5929 • FAX 717-243-0079

REEVES-HOFFMAN

DIVISION DYNAMICS CORPORATION OF AMERICA

OSCILLATORS

DUAL IN LINE CLOCK OSCILLATORS

CMOS OUTPUT: 1 TO 120 MHz

Reeves-Hoffman CMos oscillators utilize a custom ASIC design to provide the highest possible reliability through reduced parts count and improved process controls. These oscillators are TTL and CMos compatible for improved versatility. The high output drive capability provides improved symmetry control. Tristate output control is standard for use with automated test systems and in frequency switching applications.

MODEL TYPE	FREQ. RANGE	STABILITY*	TEMP. RANGE	LOAD	INPUT VOLTAGE	INPUT CURRENT	PACKAGE
122BA	**1 to 70 MHz**	±100 PPM	0 to 70 C	50 PF	5V, ±5%	40 ma (max)	14 Pin DIP (Pkg A)
222BA	**1 to 70 MHz**	±100 PPM	0 to 70 C	50 PF	5V, ±5%	40 ma (max)	8 Pin DIP (Pkg H)
03-32787-XXX	**25 to 120 MHz**	±50 PPM	0 to 70 C	35 PF	5V, ±5%	80 ma (max)	14 Pin DIP (Pkg A)

*Stability includes calibration tolerance, frequency stability vs. temperature, supply voltage and load changes, and first year aging

TTL OUTPUT: 1 TO 115 MHZ

Reeves-Hoffman TTL oscillators utilize a highly reliable transistor oscillator circuit to provide a true TTL output. The proprietary oscillator configuration also provides controlled rise and fall times for logic applications that are EMI sensitive.

MODEL TYPE	FREQ. RANGE	STABILITY	TEMP. RANGE	LOAD	INPUT VOLTAGE	INPUT CURRENT	PACKAGE
03-02181-XXX	**1 to 115 MHzV**	±100 PPM*	0 to 85 C	5 TTL	5V, ±5%	75 ma (max)	14 PIN DIP (Pkg A)
03-32295-XXX	**6 to 60 MHz**	±3 PPM	0 to 60 C	3 TTL	5V, ±5%	40 ma (max)	14 PIN DIP (Pkg A)

* Stability includes calibration tolerance, frequency stability vs. temperature, supply voltage and load changes, and first year aging

ECL OUTPUT: 4 TO 200 MHZ

Reeves-Hoffman ECL oscillators utilize a proprietary circuit design to provide improved output performance with the best possible reliability. These oscillators are 10KH ECL compatible and options for +5 volt operation are available for improved versatility. The 3108 also provides an output disable control for use with automated test systems.

MODEL TYPE	FREQ. RANGE	STABILITY*	TEMP. RANGE	LOAD	INPUT VOLTAGE	INPUT CURRENT	PACKAGE
03-02144-XXX	**4 to 200 MHz**	±50 PPM	0 to 85 C	50 ohm /-2v	-5.2V, ±5%	70 ma (max)	14 PIN DIP (Pkg A)
03-03108-XXX ENABLE/DISABLE	**4 to 125 MHz**	±50 PPM	0 to 70 C	50 ohm /-2v	-5.2V, ±5%	70 ma (max)	14 PIN DIP (Pkg B)

* Stability includes calibration tolerance, frequency stability vs. temperature, supply voltage and load changes, and first year aging

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REEVES-HOFFMAN
DIVISION DYNAMICS CORPORATION OF AMERICA

OSCILLATORS

TEMPERATURE COMPENSATED CRYSTAL OSCILLATORS

14 PIN DIL PACKAGE**: 6 TO 60 MHz

Packaged in an all metal hermetically sealed case, these oscillators provide good long term stability with improved temperature stability. They are ideal for any application requiring moderate stability in a small package. Available with either TTL or CMos output, other options include external frequency adjust.

MODEL TYPE	FREQ. RANGE	STABILITY	TEMP. RANGE	OUTPUT	INPUT VOLTAGE	INPUT CURRENT	AGING
32295	6 to 60 MHz	±3 PPM	-10 to 60 C	TTL	5V, ±5%	40 ma (max)	1 PPM / yr
255AA	6 to 60 MHz	±3 PPM	-10 to 60 C	CMOS	5V, ±5%	40 ma (max)	1 PPM / yr
255BA	6 to 60 MHz	±12 PPM	-10 to 85 C	CMOS	5V, ±5%	40 ma (max)	1 PPM / yr

** See package style A for outline dimensions

DISCRETE PACKAGES: 1 TO 160 MHZ

Reeves-Hoffman TCXO's use a variety of compensation techniques to provide a wide range of options and sizes. These oscillators provide excellent performance at the most economical cost. In house control over the most critical operations and extensive use of process controls insures a high quality product on-time. Available with either TTL or CMos output, other options include Tristate output and electrical frequency adjust.

MODEL TYPE	FREQ. RANGE	STABILITY	TEMP. RANGE	OUTPUT	INPUT VOLTAGE	INPUT CURRENT	PACKAGE TYPE**	AGING (1ST YR)
2155A	3.2 to 16 MHz	±1 PPM	0 to 55 C	TTL	5V, ±5%	10 ma (max)	C	1 PPM
2155C	3.2 to 16 MHz	±5 PPM	-20 to 70 C	TTL	5V, ±5%	10 ma (max)	C	1 PPM
2155D	3.2 to 16 MHz	±12 PPM	-40 to 85 C	TTL	5V, ±5%	10 ma (max)	C	1 PPM
3115A	4 to 20 MHz	±0.2 PPM	0 to 50 C	TTL	5V, ±5%	25 ma (max)	E	1 PPM
3115B	4 to 20 MHz	±1 PPM	-40 to 85 C	TTL	5V, ±5%	25 ma (max)	E	1 PPM
3184A	3.2 to 16 MHz	±0.5 PPM	0 to 70 C	TTL	5V, ±5%	35ma (max)	F	1 PPM
455AA	10 to 155 MHz	±1 PPM	0 to 70 C	ECL	-5.2V, ±5%	85 ma (max)	D	1 PPM
3201A	10 to 160 MHz	±1 PPM	-30 to 70 C	SINE	5V, 12V or 15V	35 ma (max)	G	1 PPM

** See package styles for outline dimensions

For further information or catalog, contact your Reeves-Hoffman representative or
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REEVES-HOFFMAN
DIVISION DYNAMICS CORPORATION OF AMERICA

OSCILLATORS

VOLTAGE CONTROLLED CRYSTAL OSCILLATORS

14 PIN DIL PACKAGE**: 1.5 TO 80 MHz

Reeves-Hoffman dual in line Voltage controlled oscillators are designed for use in communication and instrumentation applications. Proprietary crystal designs and the use of high frequency fundamental mode crystals provide the right combination of stability and pullibility. They are ideal for use in Phase Lock Loop circuitry. Surface mount designs are also available.

MODEL TYPE	FREQ. RANGE	STABILITY*	TEMP. RANGE	OUTPUT	FREQUENCY DEVIATION	INPUT VOLTAGE	INPUT CURRENT
322AB	**1.5 to 60 MHz**	±20 PPM	0 to 70 C	TTL / CMOS	±75 PPM, MIN .5 to 4.5 V	5V, ±5%	40 ma (max)
322DC	**1.5 to 80 MHz**	±25 PPM	-40 to 85 C	TTL / CMOS	±100 PPM, MIN .5 to 4.5 V	5V, ±5%	60 ma (max)
322BD	**1.5 to 80 MHz**	±50 PPM	0 to 70 C	TTL / CMOS	±200 PPM, MIN .5 to 4.5 V	5V, ±5%	60 ma (max)

*Stability includes calibration tolerance, frequency stability vs. temperature, supply voltage and load changes, and first year aging
** See package style A for outline dimensions

24 PIN DIL PACKAGE***: 80 TO 160 MHZ

The Reeves-Hoffman 344 series of Voltage controlled oscillators was designed to meet the specific needs of telecommunications systems. The use of high frequency crystals and high performance designs provide low phase jitter making them ideal for SONET applications.

MODEL TYPE	FREQ. RANGE	STABILITY*	TEMP. RANGE	OUTPUT	FREQUENCY DEVIATION	INPUT VOLTAGE	INPUT CURRENT
344CC	**80 to 160 MHz**	±30 PPM	0 to 70 C	ECL	±100 PPM, MIN .5 to 4.5 V	-5.2 V, ±5%	75 ma (max)
344BC	**80 to 160 MHz**	±50 PPM	0 to 70 C	ECL	±100 PPM, MIN .5 to 4.5 V	-5.2 V, ±5%	75 ma (max)

* Stability includes calibration tolerance, frequency stability vs. temperature, supply voltage and load changes, and first year aging
*** See package style H for outline dimensions

DISCRETE PACKAGES: 1 TO 30 MHZ

Reeves-Hoffman Voltage controlled oscillators can be optimized to support a variety of applications and designed to meet the specific needs of almost any system. The following are two examples of this dynamic capability. Challenge us with your VCXO requirement.

MODEL TYPE	FREQ. RANGE	STABILITY	TEMP. RANGE	OUTPUT	FREQUENCY DEVIATION	INPUT VOLTAGE	PACKAGE TYPE*
355AB	**1.0 to 20 MHz**	±20 PPM	0 to 70 C	TTL / CMOS	±1000 PPM, MIN .5 to 9.5 V	12 V, ±5%	F
366AB	**5 to 30 MHz**	±5 PPM	0 to 50 C	TTL / CMOS	±50 PPM, MIN .5 to 4.5 V	5 V, ±5%	F

* See package styles for outline dimensions

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REEVES-HOFFMAN
DIVISION DYNAMICS CORPORATION OF AMERICA

OSCILLATORS

OVEN CONTROLLED CRYSTAL OSCILLATORS

THE 100 SERIES

The 100 Series of ovenized oscillators provides excellent performance at an economical price. The oven's innovative thermal/mechanical design is the key. This design is an excellent choice for use in GPS, Communications and Instrumentation applications.

	MODEL 100	MODEL 101	MODEL 102	MODEL 103	MODEL 104
FREQUENCY RANGE	4.0 MHZ TO 10.5 MHZ	9.0 MHz TO 15.0 MHz	9.0 MHz TO 15.0 MHz	9.0 MHz TO 15.0 MHz	9.0 MHZ TO 15.0 MHZ
OUTPUT TYPE	TTL/CMOS	TTL/CMOS	Sinewave: +5 ohm (±2 db)	TTL/CMOS	Sinewave: +3 dbm (±1.5 db)
DIMENSIONS (max.)	1.42 in. X 1.01 in. X 0.75 in.*	1.42 in. X 1.01 in. X 0.75 in.*	1.42 in. X 1.01 in. X 0.75 in.*	1.5 in. X 1.5 in. X 0.625 in.	2.0 in. X 2.0 in. X 1.75 in.
TEMP. STABILITY: -40° to + 60°C 0° to + 60°C	 ±5 X 10^{-3} (OPT. EA) ±2 X 10^{-3} (OPT. FA)	See chart below	See chart below	 ±5.0 x 10^{-3} (OPT. CB) ±2.5 x 10^{-3} (OPT. DB)	See chart below
POWER: TURN-ON	1.2 WATTS max. (cutback after 2 mins.)	7.6 WATTS max.	7.6 WATTS max.	6.0 WATTS	8.0 WATTS
STEADY STATE	250 mW max. @ -40°C	0.75 WATT max @ 25°C	0.75 WATT max @ 25°C	1.2 WATTS @ 25°C	1.0 WATT @ 25°C
INPUT VOLTAGE	+5 VDC to -12 VDC	+5 VDC and +12 VDC	+5 VDC and +12 VDC	+5 VDC	+12 VDC
PHASE NOISE: OFFSET dBc / Hz (TYP.)	10Hz 100Hz 1KHz 10KHz -90 -130 -140 -140	10Hz 100Hz 1KHz 10KHz -110 -140 -152 -160	10Hz 100Hz 1KHz 10KHz -110 -140 -152 -160	10Hz 100Hz 1KHz 10KHz 95 130 140 145	10Hz 100Hz 1KHz 10KHz 120 143 155 160
AGING PER YEAR	5 X 10^{-7}	See chart below	See chart below	3 X 10^{-7}	See chart below
TRIM RANGE	±5 X 10^{-6} min. (internal trim)	Ext. (Sufficient for 5 years)	Ext. (Sufficient for 5 years)	Int. (Sufficient for 5 years)	Int. (Sufficient for 5 years)

* See package style I for outline dimensions

TEMPERATURE STABILITY OPTION CHART FOR 101 AND 102 MODEL OCXO'S

TEMP. RANGE			
-40° to +70°C	±1.0x10^{-7} (OPT. AA)	±5.0x10^{-8} (OPT. AB)	±2.0x10^{-8} (OPT. AC)
-30° to +70°C	±1.0x10^{-7} (OPT. BA)	±5.0x10^{-8} (OPT. BB)	±2.0x10^{-8} (OPT. BC)
0° to +70°C	±7.0x10^{-8} (OPT. CA)	±3.5x10^{-8} (OPT. CB)	±1.5x10^{-8} (OPT. CC)
+10° to +50°C	±5.0x10^{-8} (OPT. DA)	±2.5x10^{-8} (OPT. DB)	±1.0x10^{-8} (OPT. DC)
AGING PER YEAR	7x10^{-7}	±5x10^{-7}	3x10^{-7}

TEMPERATURE STABILITY OPTION CHART FOR 104 MODEL OCXO'S

TEMP. RANGE			
-40° to +70°C	±5.0x10^{-8} (OPT. AA)	±2.0x10^{-8} (OPT. AB)	±1.6 x10^{-8} (OPT. AC)
-30° to +70°C	±5.0x10^{-8} (OPT. BA)	±2.0x10^{-8} (OPT. BB)	±1.5 x10^{-8} (OPT. BC)
0° to +70°C	±3.5 x10^{-8} (OPT. CA)	±1.5x10^{-8} (OPT. CB)	±1.0 x10^{-8} (OPT. CC)
+10° to +50°C	±2.5 x10^{-8} (OPT. DA)	±1.0 x10^{-8} (OPT. DB)	±5.0x10^{-8} (OPT. DC)
AGING PER YEAR	3 x10^{-7}	±2 x10^{-7}	1 x10^{-7}

TELECOMMUNICATIONS STRATUM 3 AND 3E APPLICATIONS

The new STRATOSC 3 and STRATOSC 3E Series of Oscillators provide the ultimate in stability and performance for Stratum 3 and 3E applications. Innovative Electrical and Mechanical design coupled with surface mount manufacturing methods produce highly reliable, cost effective components for all applications. Optimal performance for the frequency range specified above is achieved using 3rd Overtone precision resonators manufactured under Clean Room conditions using proprietary cleaning processes. STRATOSC Series oscillator performance is available in other frequency ranges, using multiplication techniques and in different enclosures.

	STRATOSC 3	STRATOSC 3E
FREQUENCY RANGE (MHz)	5 to 15	
TEMPERATURE STABILITY 0° C TO +70° C	± .3 PPM	± 7 x 10^{-9}
OUTPUT TYPE	5-TTL Loads. Duty Cycle ±5% Level 0.4V to +3.0V Min.	
SHORT TERM AGING (24 Hrs)	± 1 x 10^{-3}	± 2 x 10^{-3}
VOLTAGE STABILITY (± 5%)	± 3 x 10^{-3}	± 1 x 10^{-3}
HOLDOVER (24 Hours)	± 0.37 PPM	± 1 x 10^{-3}
ACCURACY FOR 20 YEARS	± 4.6 PPM	± 1 PPM
WANDER (TDEV)	Better than Bellcore TA-NWT-001244 requirements.	
ELECTRICAL TRIM (Minimum)	± 5 PPM	± 1 PPM
SUPPLY VOLTAGE	+12 VDC ± 5%	
TURN-ON POWER (Watts)	5.0 Maximum	
STEADY STATE POWER (Watts)	1.0 Maximum @ +25°C	
MECHANICAL SIZE	1.5" x 1.5" x 1.0" Nominal	

For further information or catalog, contact your Reeves-Hoffman representative or
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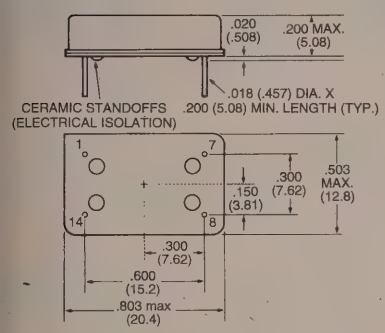
REEVES-HOFFMAN

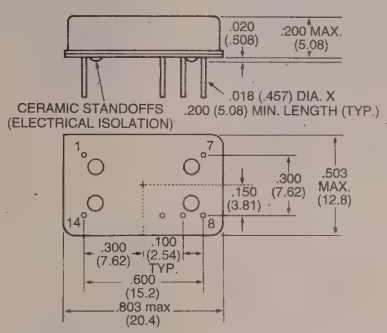
DIVISION DYNAMICS CORPORATION OF AMERICA

OSCILLATORS

PACKAGE A



PACKAGE B



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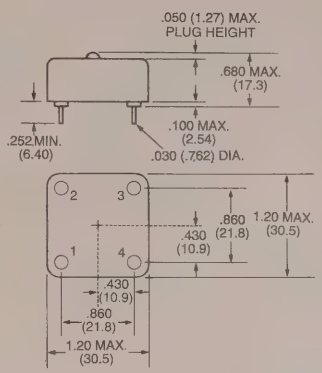

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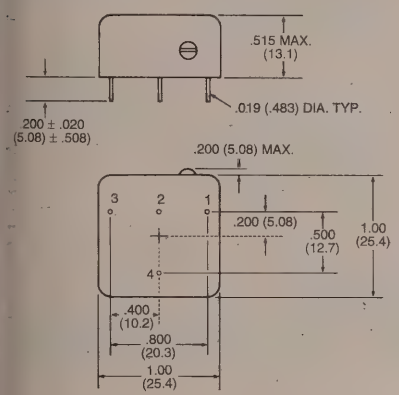
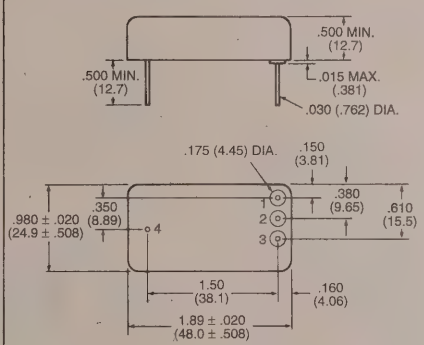


PACKAGE E



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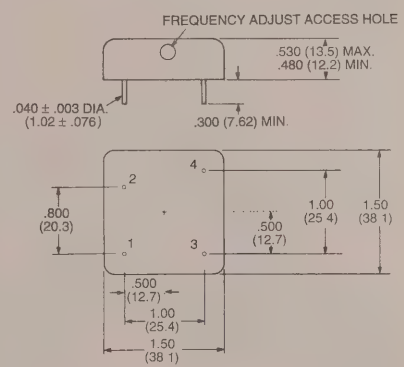
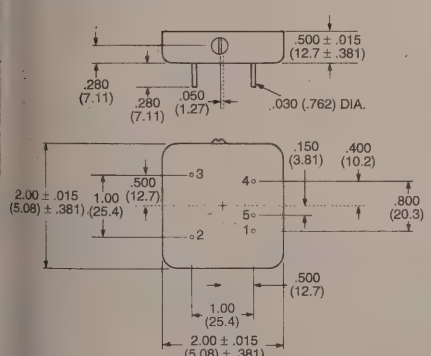
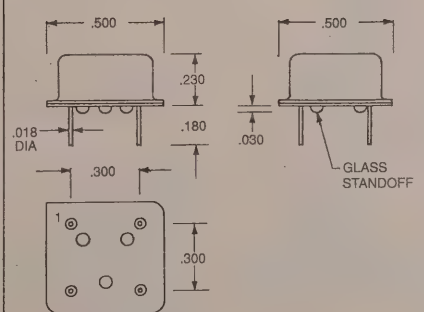


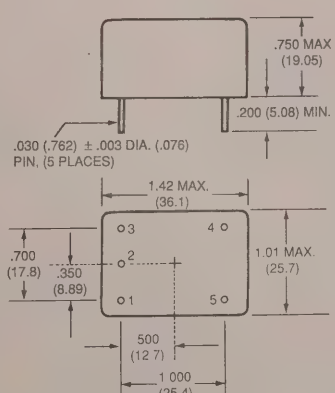
PACKAGE G



PACKAGE H



PACKAGE I



NOTE: Pin numbers are for reference only.

For further information or catalog, contact your Reeves-Hoffman representative or
Reeves-Hoffman Division, Dynamics Corporation of America • 400 W. North Street, Carlisle, PA 17013 USA • Phone 717-243-5929 • FAX 717-243-0079

RXD
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RXD CLOCK OSCILLATOR
PART NUMBERING SYSTEM

Oscillator Model	ID CD.
3-Lead	3L
TTL	T
SMT	SMT
HCMOS	HSC
Half Size	H
High Frequency	HF
Dual Output	D
Tristate	R
Enable/Disable Tristate	
Enable/Disable TTL/HSC Compatible	RC
ECL Dual	3E
Single	4E
Oven Controlled Clock Oscillator	OCX
Temperature Controlled Oscillator	TCX
Voltage Controlled Clock Oscillator	VCX
Monolithic Filter	MF

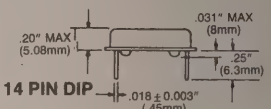
Stability Requirement	ID CD.
± 0.0025% (25 ppm)	0
± 0.005% (50 ppm)	1
± 0.01% (100 ppm)	2
± 0.05% (500 ppm)	3
± 0.1% (1000 ppm)	4
Other	7

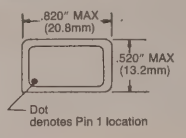
Operating Temp. Range	ID CD.
	Std.
0°C to 70°C	No. Code
-40°C to +85°C	A
Other	B

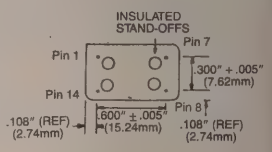
Symmetry	ID CD.
	Std.
60/40	No. Code
55/45	5
Other	6

EXAMPLE: RXD 40.000 MHz
High Speed CMOS 40.000 - Part # is: HSC 2

HSC2 & HFHSC2
HIGH SPEED CMOS CLOCK OSCILLATOR



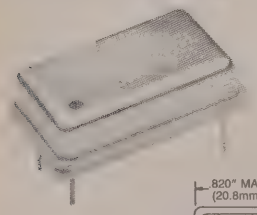


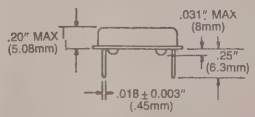


SPECIFICATIONS

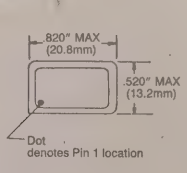
Model	HSC2	HFHSC2
Frequency Range	500kHz-70MHz	70MHz-100MHz
Frequency Stability	±0.01% (100ppm) Std.	
Operating Temperature Range	0°C to +70°C	
Storage Temperature Range	-55°C to +125°C	
Input Voltage	+5.0 VDC ± 0.5V	
Input Current	500kHz-20.000 MHz 20mA 20.001MHz-35.000MHz 30mA 35.001MHz-70.000MHz 40mA	
Output: Load	15pf Typical	15pf Max.
Symmetry	40/60% Max @ 1/2VDD	
Voltage "0" Level	±0.5 V (10% VDD) Max.	
"1" Level	+4.5V (90% VDO) Max.	0.5V VCC
Rise/Fall Time	500kHz-10.000MHz 15 ns	5 ns
	10.001MHz-25MHz 10 ns	
	25.001-70.000MHz 6 ns	

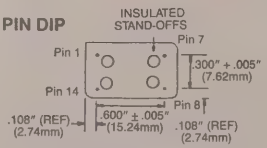
T2 & HFT2 TTL CLOCK OSCILLATOR





14 PIN DIP



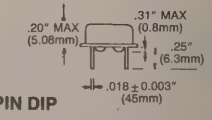


PIN 1—N.C.
PIN 7—CASE GND
PIN 8—OUTPUT
PIN 14— + VDD

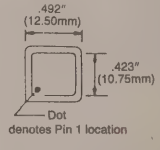
SPECIFICATIONS

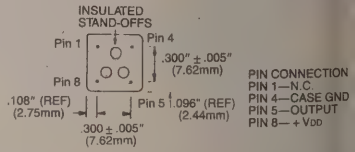
Model	T2	HFT2
Frequency Range	500kHz-75MHz	70MHz-100MHz
Frequency Stability	±0.01% (100ppm) Std.	
Operating Temperature	0°C to 70°C	
Storage Temperature	-55°C to 125°C	
Input Voltage	5VDC ± 10%	
Input Current (Max)	500kHz-25 MHz 30mA 25.1MHz-70MHz 70mA	40mA
Output: Load	1-10TTL Gates	2TTL Max.
Symmetry	40/60% Max @ 1.4VDC	
Voltage "0" Level	500kHz-25MHz +0.4V Max. 25.1 MHz-75MHz +0.5V Max.	0.5 V Max.
"1" Level	+2.4V min.	
Rise/Fall Time	500kHz-25MHz 10ns 25.1MHz-75MHz 6 ns	5 ns
Start Up Time (max)	500kHz-25MHz 5 ns 25.1MHz-75MHz 10 ns	10 ns
Shock	1000G's, 0.35mS, 1/2 Sine Wave 3 shocks each plane	1000G's, 0.5mS, 1/2 Sine Wave 3 shocks each plane
Vibration	10-82Hz, 1.52mmD.A., 82-2000Hz, 20G's Duration TIme 12 hours.	
Leak	<2x10-8 Atmos. CC/Sec of Helium	<5x10-8 Atmos. CC/Sec of Helium

HT2 & HHFT2
HALF SIZE TTL CLOCK OSCILLATOR



14 PIN DIP





SPECIFICATIONS

Model	HT2	HHFT2
Frequency Range	500kHz-75MHz	70MHz-100MHz
Frequency Stability	±0.01% (100ppm) Std.	
Operating Temperature	0°C to +70°C	
Storage Temperature	-55°C to +125°C	
Input Voltage	5VDC ± 10%	
Input Current (Max)	500kHz-25 MHz 30mA 25.1MHz-70MHz 70mA	40mA
Output: Load	1-10TTL Gates	2TTL Max.
Symmetry	40/60% Max @ 1.4VDC	
Voltage "0" Level	500kHz-25MHz +0.4V Max. 25.1 MHz-75MHz +0.5V Max.	0.5 V
"1" Level	+2.4V min.	
Rise/Fall Time	500kHz-25MHz 10 ns 25.1MHz-75MHz 6 ns	5 ns

Note: Inclusive of calibration tolerance at 25°C, Operating Temperature Range, Supply Voltage Change, Load Change, Shock, Vibration and Aging. All Specifications subject to change without notice.

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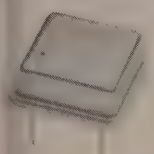
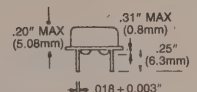
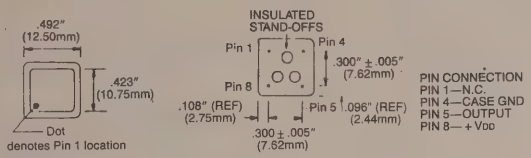
HHSC2 & HHFHSC2

HALF SIZE HIGH SPEED CMOS CLOCK OSCILLATOR





14 PIN DIP

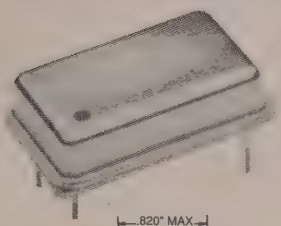


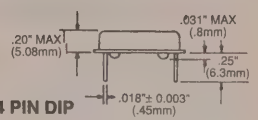
SPECIFICATIONS

Model	HHSC2	HHFHSC2
Frequency Range	500kHz-70MHz	70MHz-100MHz
Frequency Stability	±0.01% (100ppm) Std.	
Operating Temperature	0°C to +70°C	
Storage Temperature	-55°C to +125°C	
Input Voltage	5.0V ± 0.5V	
Input Current	500kHz-19.999 MHz 20mA 20.000MHz-34.999MHz 30 mA 35.000MHZ-70.000MHZ 40 mA	60mA Max.
Output: Load	15pf Typical	15pf Max.
Symmetry	40/60% Max @ 1/2VDD	
Voltage "0" Level	0.5 V (10% VDD) Max..	0.5 V Max.
"1" Level	+4.5V (90% VDD) Min.	0.5V Max. VCC
Rise/Fall Time	500kHz-10.000MHz 15 ns 10.01MHz-25MHz 10 ns 25.01-70.000MHz 6 ns	5 ns 0.5VCC-0.5VDC

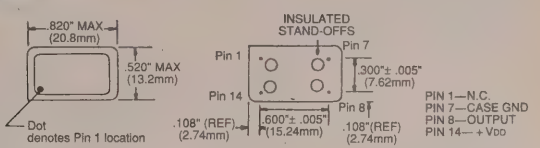
HSCR2 & HFHSCR2

HIGH SPEED CMOS TRISTATE ENABLE/DISABLE CLOCK OSCILLATOR





14 PIN DIP

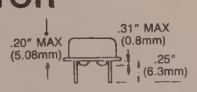


SPECIFICATIONS

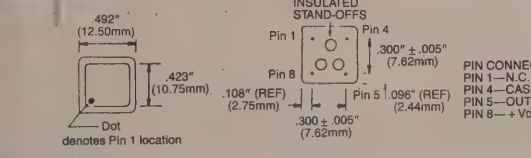
Frequency Range	3.5MHz-70MHz	70MHZ-100MHz
Frequency Stability	0.01% (±100ppm) Std.	
Operating Temperature Range	0°C to + 70°C	
Storage Temperature Range	-55°C to + 125°C	
Input Voltage	5V ± 0.5V	
Input Current	60mA Max.	
Rise/Fall Time	8 ns Max. 3.5MHz-40MHz 6 ns Max. 40.01MHz-100MHz	
Enable/Disable Phase Delay Time	100 ns Max.	
Output: Load	CMOS 3.5MHz-40.00MHz 150pf Max. 40.01MHz-50.00MHz 80pf Max 50.01MHz-70.00MHz 50pf Max 70.01MHz-100MHz 15pf Max	
Symmetry	40/60% Max @ 1/2VCC	
Voltage "0" Level	0.5 V Max	
"1" Level	0.5V Min. VCC	

HHSCR2 & HHFHSCR2

HALF SIZE HIGH SPEED CMOS TRISTATE ENABLE/DISABLE CLOCK OSCILLATOR



14 PIN DIP



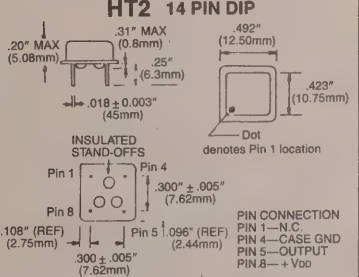
SPECIFICATIONS

Frequency Range	3.5MHz-70MHz	70MHz-100MHz
Frequency Stability	0.01 (±100ppm) Std.	
Operating Temperature Range	0°C to +70°C	
Storage Temperature Range	-55°C to +125°C	
Input Voltage	5V ± 0.5V	
Input Current	60mA Max.	
Rise/Fall Time	8 ns Max. 3.5MHz-40MHz 6 ns Max. 40.01MHz-100MHz	
Enable/Disable Phase Delay Time	100 ns Max.	
Output: Load	CMOS 3.5 MHz-40.00MHz 150pf Max. 40.01MHz-50.00MHz 80pf Max 50.01MHz-70.00MHz 50pf Max.	
Symmetry	40/60% Max @ 1/2VCC	
Voltage "0" Level	0.5V Max	
"1" Level	0.5V VCC	

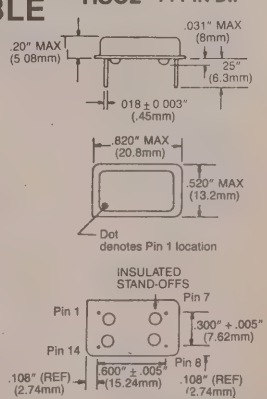
THSC2 & HTHSC2

TTL/HCMOS COMPATIBLE FULL & HALF SIZE CLOCK OSCILLATOR

HT2 14 PIN DIP



HSC2 14 PIN DIP



SPECIFICATIONS

Frequency Range	500kHz to 70MHz
Frequency Stability	± 0.01% (100ppm) Std.
Operating Temperature	0°C to +70°C
Storage Temperature	-65°C to +150°C
Input Voltage	+5.0VDC +10%
Input Current	500kHz-20MHz 20mA 20.1MHz-70MHz 30mA
Output: Load	1-10TTL Gates or 15pf (Typical)
Symmetry	60/40% (+1/2VDD)
Voltage "0" Level	+0.5 V (10% VDD) Max.
"1" Level	+4.5V (90%VDD) Min.
Rise/Fall Time	500kHz-10MHz 15 ns 10.1MHz-25MHz 10 ns 25.1MHz-70MHz 6 ns

Note: Inclusive of calibration tolerance at 25°C, Operating Temperature Range, Supply Voltage Change, Load Change, Shock, Vibration and Aging. All Specifications subject to change without notice.

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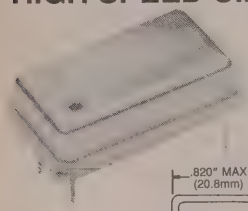
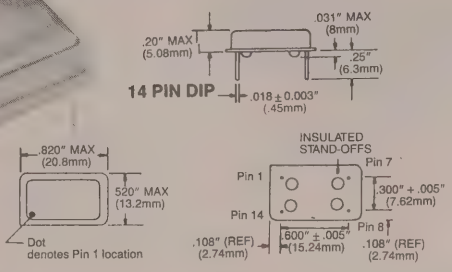
RC2

TRISTATE ENABLE/DISABLE CLOCK OSCILLATOR HIGH SPEED CMOS/TTL



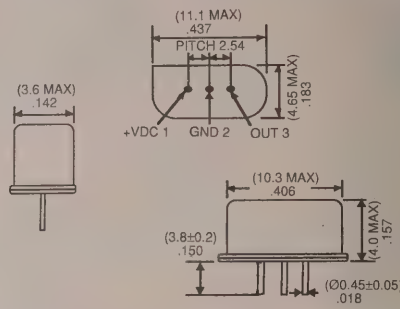


SPECIFICATIONS

	CMOS	TTL
Frequency Range	3.5MHz-70MHz	
Frequency Stability	0.01 (±100ppm) Std.	
Operating Temperature Range	0°C to +70°C	
Storage Temperature Range	-55°C to +125°C	
Input Voltage	5V ± 0.5V	
Input Current	60mA Max.	
Rise/Fall Time	6 ns	
Enable/Disable Phase Delay Time	100 ns Max.	
Output: Load	3.5-50MHz 50pf Max. 50.1-70MHz 30pf Max.	3.5-50MHz 10TTL Max.
Symmetry	40/60% 1/2VCC	40/60% 1.4V
Voltage "0" Level	0.5V Max	0.4V Max
"1" Level	0.5V VCC	2.4V Min

3LT2 & 3LHSC2

THREE LEAD LOW PROFILE TTL & HCMOS CLOCK OSCILLATOR

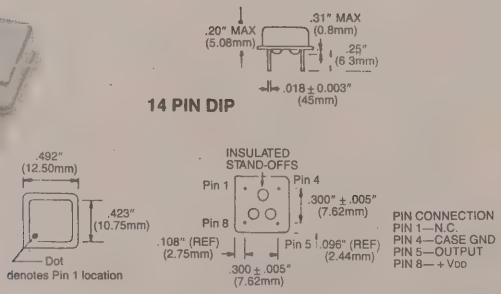


SPECIFICATIONS

	3LT2	3LHSC2
Frequency Range	3.5MHz-50MHz	
Frequency Stability	±0.01 (±100ppm) Std.	
Operating Temperature Range	-0°C to +70°C	
Storage Temperature Range	-50°C to +125°C	
Input Voltage	5V ± 0.5V	
Input Current	3.5MHz-29.999MHz 15mA Max. 30.000MHz-50.000MHz 30mA Max	
Rise/Fall Time	10 ns Max.	3.5MHz-8.999MHz 15 ns Max 9.0MHz-39.999MHz 10 ns Max 40.0MHz-50.000MHz 8 ns Max
Output: Load	1-10TTL	15pf
Symmetry	40/60%	
Voltage "0" Level	0.4V Max	0.5V Max
"1" Level	2.4V Min.	0.5V Min

HRC2

HALF SIZE TRISTATE HIGH SPEED CMOS/TTL ENABLE/DISABLE CLOCK OSCILLATOR

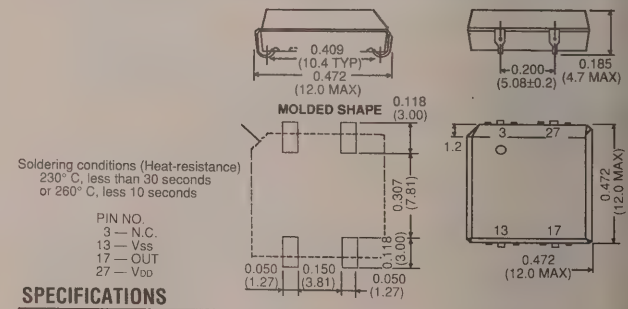


SPECIFICATIONS

	CMOS	TTL
Frequency Range	3.5MHz-70MHz	
Frequency Stability	0.01 (±100ppm) Std.	
Operating Temperature Range	0°C to + 70°C	
Storage Temperature Range	-55°C to + 125°C	
Input Voltage	5V ± 0.5V	
Input Current	60mA Max.	
Rise/Fall Time	6 ns	
Enable/Disable Phase Delay Time	100 ns Max.	
Output: Load	3.5-50MHz 50pf Max. 50.1-70MHz 30pf Max.	3.5-50MHz 10TTL Max.
Symmetry	40/60% 1/2VCC	40/60% 1.4V
Voltage "0" Level	0.5V Max.	0.4V Max.
"1" Level	0.5V VCC	2.4V Min.

SMT2

TTL SURFACE MOUNT CLOCK OSCILLATOR (TTL/CMOS COMPATIBLE)



SPECIFICATIONS

	CMOS	TTL
Frequency Range	625kHz-70.0MHz	
Frequency Stability	±0.01 (±100ppm) Std.	
Operating Temperature Range	-10°C to +70°C	
Storage Temperature Range	-55°C to +125°C	
Supply Voltage	+5.0V DC ± 0.5V	
Input Current	625kHz-29.999MHz 20mA Max 30.000MHz-70.000MHz 25mA Max	
Rise/Fall Time	8 ns	
Output: Load	TTL/CMOS compatible CMOS load 50pf 625kHz-29.999MHz	1-10TTL Gates 25.000MHz-70 MHz
Symmetry	40/60% @ 1.4VDC	
Voltage "0" Level	+0.5V Max (10%VDD)	±0.4V Max
"1" Level	+4.5V Max (90%VDD)	+2.4V Min

Note: Inclusive of calibration tolerance at 25°C, Operating Temperature Range, Supply Voltage Change, Load Change, Shock, Vibration and Aging. All Specifications subject to change without notice.

RXD
P.O. Box 1494 • 806 Custer Avenue • Norfolk, NE 68701
WATS 1-800-228-8108 • Phone 402-379-0112 • Fax 402-379-3074

MICROPROCESSOR CRYSTAL
PART NUMBERING SYSTEM

Model
MP49
MP35
MP35L
MP494
MP494L
UM1
AT39
AT310
WC26
WC38
SMD
SMDWC
SMD88
SMX

ID #	(CL) Load Capacitance
10	10pf
12	12pf
16	16pf
*	18pf
20	20pf
30	30pf
32	32pf
S	Series
*	Standard CL is not designated on crystal

ID #	Tolerances-PPM Freq.	Stab.
0	±10	±10
6	±25	±25
*	±25	±35
*	±30	±50
4	±50	±50
2	±50	±100
1	±100	±100
*	Standard tolerances are not designated on MP49 & MP494	

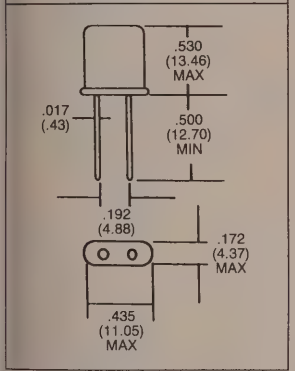
ID #	Temperature Range
*	-10°C to +60°C
A	0°C to +70°C
D	-10°C to +70°C
*	-20°C to +70°C
E	-40°C to +85°C
*	Standard temperature is not designated on MP49 & MP494

ID #	Options
C	Cut Lead
G	Ground/3rd Lead
I	Insulator/Spacer
R	Tape & Reel
V	Vinyl Sleeve
P	Special Packaging (Date Code, Bar Code, Anti-Static Bags, etc.)
X	Non-standard Tolerances, Temperatures, Load Capacitance

ID #	Mode
*	Fundamental
3	3rd OT
5	5th OT
7	7th OT
*	Funda-mental is not designated on crystal

SAMPLE
MP49104AV3 - where specifics for every option are selected.
MP49V - where load capacitance, tolerances, temperature & mode are standard.

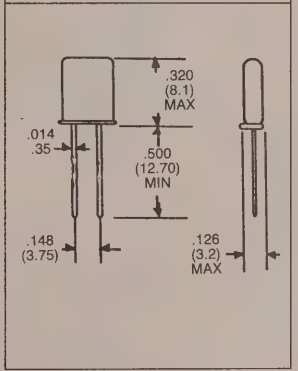
HC-49/U



FREQ.	MX OHMS
1.000	3000
1.8432	600
2.000	450
2.4576	250
3.2768	150
3.579-3.6864	120
4.00-4.194304	100
4.9152	75
5.000-5.9904	50
6.000-8.000	40
9.8304	35
10.000-12.000	30
13.5168-16.000	25
18.000-25.000	20

SPECIFICATIONS: 1.8 - 25.0
Calibration Tolerance: ± 25ppm at 25°C
Stability Tolerance: ±35ppm -20 to +75°C
Shunt Capacitance: 7pf

UM1

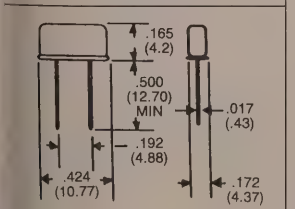


FREQ.	MX OHMS	MODE
3.5-3.99	300	F
4.0-4.49	250	F
4.5-4.99	200	F
5.0-5.99	180	F
6.0-6.99	150	F
7.0-7.99	120	F
8.0-8.99	100	F
9.0-9.99	70	F
10.0-12.99	50	F
13.0-30.0	40	F
31.0-39.99	60	3
40.0-60.0	50	3
61.0-90.00	50	3
50.0-70.0	130	5
70.0-150.0	120	5
70-180.0	180	7

SPECIFICATIONS:
Calibration Tolerance: ± 20ppm at 25°C
Stability Tolerance: ±50ppm -10 to +60°C
Shunt Capacitance: 7pf

LOW PROFILE

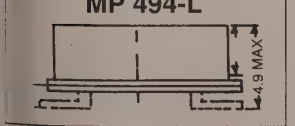
MP 494



FREQ.	MX OHMS
3.2768-3.500	200
3.57954-3.999	170
4.00-5.999	150
6.00-6.999	120
7.00-9.999	90
10.00-15.999	70
16.00-19.999	50
20.000-23.999	40
24.00-33.000	45

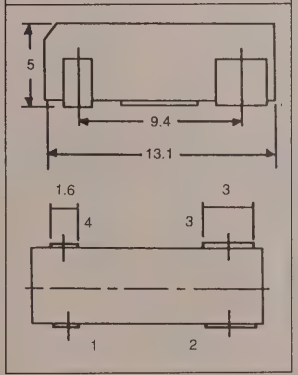
SPECIFICATIONS:
Calibration Tolerance:
± 30ppm at 25°C
Stability Tolerance:
±50ppm at -10 TO +60°C
Shunt Capacitance: 7pf

MP 494-L



SURFACE MOUNT

SMD



FREQ.	MX OHMS
3.50-3.999	200
4.00-4.999	150
5.00-5.999	120
6.00-6.999	100
7.00-8.999	80
9.00-12.999	60
13.00-25.00	50

SPECIFICATIONS:
Calibration Tolerance:
± 50ppm at 25°C
Stability Tolerance:
±100ppm at -10 to +70°C
Shunt Capacitance: 7pf

SaRonix

Quartz Crystals and Oscillators

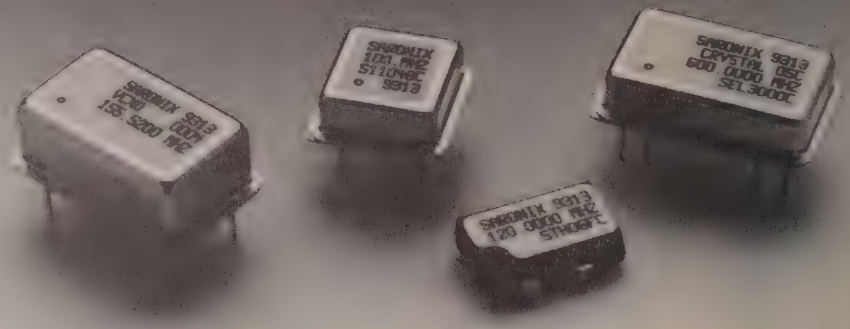
The Company:
Headquartered in Palo Alto, California, SaRonix is a leading, well-established U. S. supplier of quartz crystal and crystal oscillator products to the electronics industry.

The Products:
A very broad range of crystals and oscillators — from traditional components — to SMT packages — to advanced proprietary technology with oscillators up to 600 MHz.

Quality:
SaRonix practices total quality management and is currently pursuing ISO 9000 qualification at each of its manufacturing facilities.

Service:
SaRonix supports its customers world-wide with engineering, sales and manufacturing in the U.S., Asia and Europe.

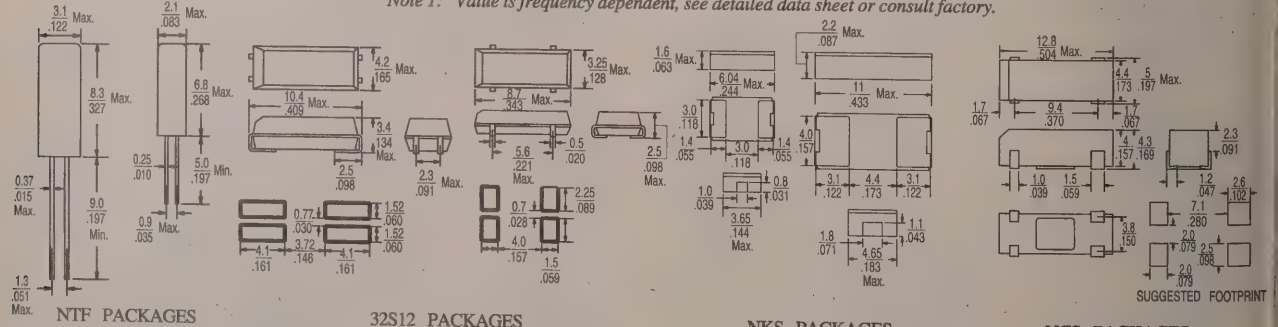
Quick-turn Premium 3-day and 10-day delivery available on many products.



Tubular and SMT Crystals

Series		NTF Tubular	32S12	NKS	NCS
KEY FEATURES		*real time frequency tight tolerance low cost*	*real time frequency SMT 32.768kHz*	*SMT low profile small ceramic package*	*SMT small molded package*
Frequency Range		32.768kHz	32.768kHz	3.5 - 40MHz	3.5 - 40MHz
Frequency Tolerance @ 25°C	± ppm	20	20	50	30 or 50
Frequency Stability:					
Over Operating Temp Range	± ppm	—	—	50	30 or 50
Turnover Temperature	°C	25 ± 5	25 ± 5	—	—
Temp Characteristics - K	ppm / °C²	–.038 typ	–.038 typ	—	—
Load Capacitance - Cl	pF	9.5 to 15 typ	12.5	16 to Series	16 to Series
Series resistance - Rs	Ω	30k typ	50k max	30 to 150	50 to 2200
Motional Capacitance - C1	pF	.003 typ	.003 typ	Note 1	Note 1
Shunt Capacitance - Co	pF	1.5 typ	1.5 typ	5 max	7 max
Drive Level - Pd	µW	10 max	1 max	50 max	Note 1
Temperature Range:					
Operating	°C	–10 to +60	–20 to +70	–20 to +70	–20 to +70
Storage	°C	–55 to +125	–30 to +80	–40 to +85	–40 to +85
Aging first year	ppm	10 max	10 max	5 max	5 max

Note 1: Value is frequency dependent, see detailed data sheet or consult factory.



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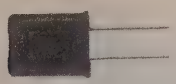
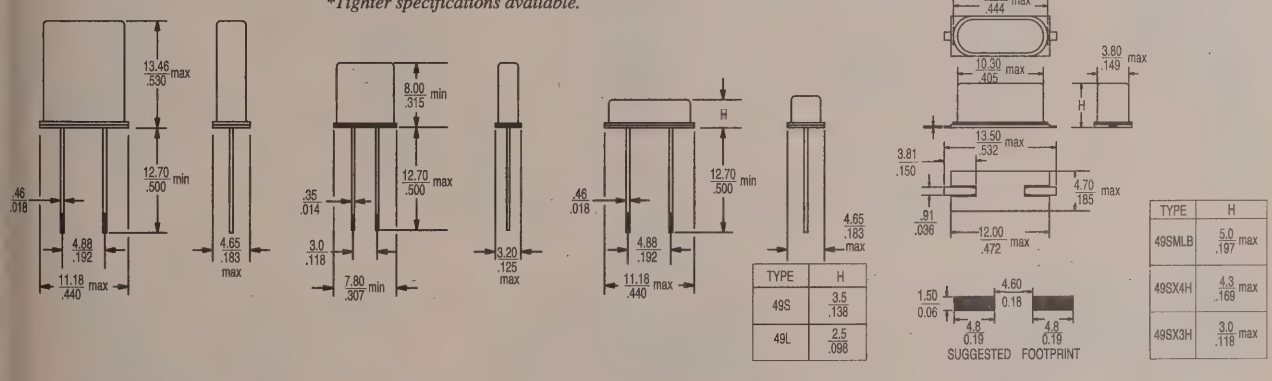
SaRonix

Quartz Crystals



Series		HC49/U	HC45/U (or UM-1)	49S/49SMLB
KEY FEATURES		*very popular AT cut standard holder large open stock*	*miniature holder*	*very low profile SMT version available*
Frequency Range	**MHz**	**1 - 200**	**6 - 200**	**3.5 - 50**
Frequency Tolerance @ 25°C	**± ppm**	**30***	**30***	**50***
Frequency Stability:				
Over Operating Temp Range	**± ppm**	**50***	**50***	**100***
Load Capacitance - Cl	**pF**	**6 to Series**	**10 to Series**	**10 to Series**
Series Resistance - Rs	**Ω**	**Note 1**	**Note 1**	**Note 1**
Motional Capacitance - C1	**pF**	**Note 1**	**Note 1**	**Note 1**
Shunt Capacitance - Co	**pF**	**7 max**	**7 max**	**7 max**
Drive Level - Pd	**mW**	**2.0 max**	**2.0 max**	**0.5 max**
Temperature Range:				
Operating	**°C**	**–20 to +70**	**–20 to +70**	**–20 to +70**
Storage	**°C**	**–55 to +125**	**–55 to +125**	**–55 to +125**
Aging First Year	**ppm**	**< 5**	**< 3**	**< 5**

Note 1: Value is frequency dependent, see detailed data sheet or consult factory.
**Tighter specifications available.*



STANDARD HC49/U HC45/U 49 S 49SMLB

The following selection chart lists AT-cut quartz crystals available from stock for most common microprocessor applications.

Freq. MHz	Part No.	Freq. MHz	Part No.	Freq. MHz	Part No.	Freq. MHz	Part No.	Freq. MHz	Part No.	Freq. MHz	Part No.	Freq. MHz	Part No.
HC49/U												**HC45/U (res. weld)**	
1.000000	NMP010A	3.600000	NYP036-30	5.990400	NMP059	10.000000	NYP100-20	16.000000	NYP160-20	23.400000	NMP234	6.000000	45N060
1.843200	NYP018A-13	3.686400	NYP037-20	6.000000	NMP060	10.000000	NMP100	16.000000	NMP160	24.000000	NYP240-20	8.000000	45N080
1.843200	NMP018A	3.686400	NMP037	6.144000	NYP061-30	10.738635	NYP107-32	16.384000	NMP163	24.000000	NMP240	10.000000	45N100
2.000000	NYP020A-20	3.932160	NYP039-12	6.400000	NYP064-20	11.000000	NMP110	17.360000	NMP173	24.576000	NYP245-18	12.000000	45N120
2.000000	NMP020A	3.932160	NMP039	6.553600	NMP065	11.059200	NYP111-20	18.000000	NMP180	25.000000	NMP250	12.500000	45N125
2.097152	NYP021A-20	4.000000	NYP040-20	7.000000	NMP070	11.059200	NMP111	18.432000	NYP184-20	27.000000	NMP270	14.318180	45N143
2.457600	NYP024A-20	4.000000	NMP040	7.159090	NYP071-20	12.000000	NYP120-20	18.432000	NMP184	28.636360	NYP286-32	14.400000	45N144
2.457600	NMP024A	4.096000	NYP0409-20	7.372800	NYP0073-20	12.000000	NMP120	19.354000	NYP193-20	30.000000	NYP300-20	15.000000	45N150
3.000000	NYP030A-30	4.194304	NYP041-12	7.372800	NMP073	12.288000	NYP122-20	19.354000	NMP193	30.000000	NMP300	16.000000	45N160
3.000000	NMP030A	4.433619	NYP044-20	8.000000	NYP080-18	12.288000	NMP122	19.660800	NYP196-20	32.000000	NMP320	18.000000	45N180
3.276800	NYP032A-15	4.915200	NMP049	8.000000	NMP080	13.516800	NMP135	19.660800	NMP196	36.000000	NMP360	18.432000	45N184
3.276800	NMP032A	5.000000	NYP050-20	8.192000	NYP081-20	14.318180	NYP143-32	20.000000	NYP200-20	40.000000	NMP400	19.354000	45N193
3.330000	NMP033A	5.068800	NMP051	9.216000	NMP092	14.318180	NMP143	20.000000	NMP200	48.000000	NMP480	19.660800	45N196
3.579545	NYP035A-18	5.185000	NYP052-20	9.830400	NYP098-20	14.745600	NMP147	22.118400	NMP221			20.000000	45N200
3.579545	NMP035A	5.714300	NMP057	9.830400	NMP098	15.000000	NMP150					22.118400	45N221
												24.000000	45N240
												25.000000	45N250

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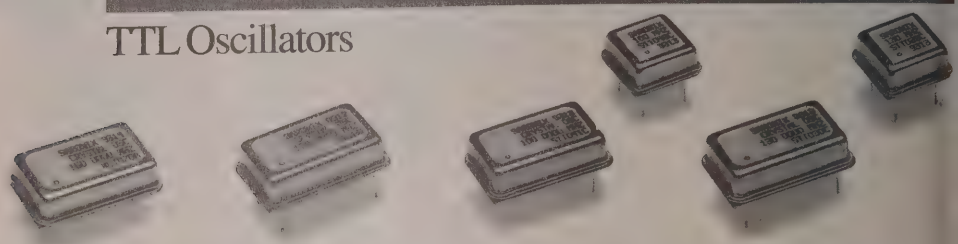
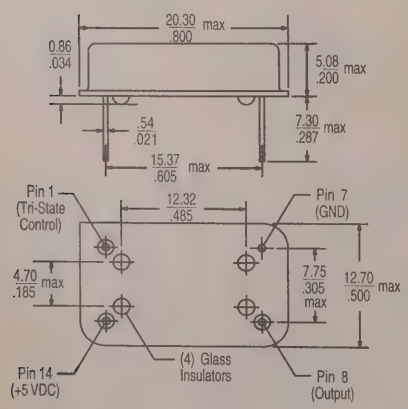
SaRonix

TTL Oscillators

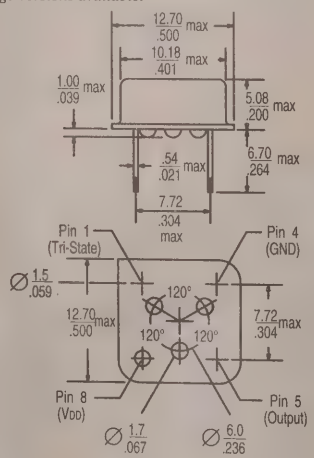


Series Logic		NCT/NTT TTL	S1100 TTL	STT TTL	S11041/S11048 TTL
KEY FEATURES		*true TTL device*	*true TTL device replaces other mfrs. 1100 Series oscillators*	*low current precise rise and fall times drives high speed TTL microprocessors*	*low current precise symmetry drives high speed NMOS processors*
Frequency Range	MHz	.25 - 80	.25 - 110	.25 - 132	40 - 100
Frequency Stability	± ppm	25, 50 or 100	25, 50 or 100	25, 50 or 100	25, 50 or 100
Temperature Range:					
Operating	°C	0 to +70*	0 to +70*	0 to +70*	0 to +70*
Storage	°C	–55 to +125	–55 to +125	–55 to +125	–55 to +125
Supply Voltage	VDC	5 ± 5%	5 ± 5%	5 ± 10%	5 ± 5%
Supply Current:					
typ	mA	Note 1	Note 1	25	
max	mA	100	50	75	50
Tri-state		optional	—	standard feature	standard feature
Output:		TTL	TTL	TTL	TTL
Symmetry @ 1.5V	%	50 ± 10	50 ± 10 or ± 5	50 ± 10 or ± 5	50 ± 2.5
Rise Time 0.5 - 2.4 V	ns	3 to 8 max	4 to 8 max	2 to 4 max	1.7 max
Fall Time 0.5 - 2.4 V	ns	3 to 8 max	4 to 8 max	2 to 4 max	1.7 max
Logic 0	V	0.5 max	0.5 max	0.5 max	0.5 max
Logic 1	V	2.4 min	2.4 min	2.4 min	2.5 min, 3.9 max
Load		10 TTL	5 TTL	50 mA sink & source	10 TTL or 50 Ω
Package type		A	A	A, B or C	A, B or C

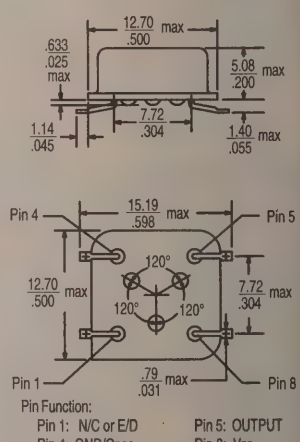
Note 1: Value is frequency dependent, see detailed data sheet or consult factory.
**Extended temperature range versions available.*



PACKAGE A (FULL SIZE)



PACKAGE B (HALF SIZE)



PACKAGE C
(HALF SIZE - GULL WING)

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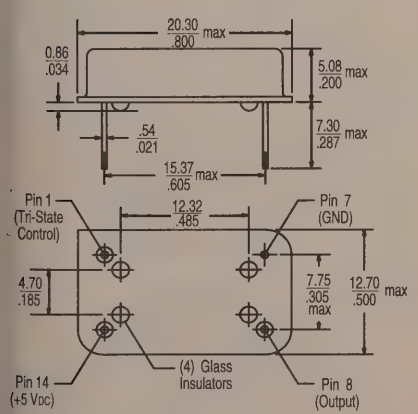
SaRonix

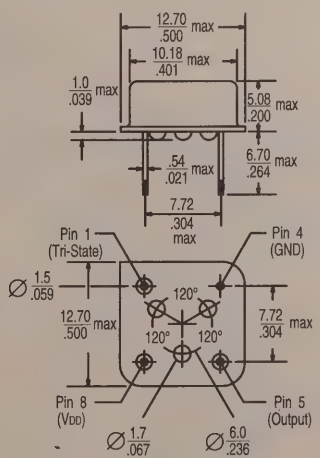
CMOS Oscillators

Series Logic		NCC CMOS	NCC CMOS	NTL CMOS	STH HCMOS	STA ACMOS
KEY FEATURES		*extremely low power real time clock*	*low power*	*very low power*	*RISC and CISC Clock*	*high drive ACMOS reduced EMI*
Frequency Range	**MHz**	**32.768kHz**	**.0625 - 24**	**4 - 10**	**.25 - 132**	**.25 - 132**
Frequency Stability	**± ppm**	**10 or 25**	**50 or 100**	**20, 50 or 100**	**25, 50 or 100**	**25, 50 or 100**
Temperature Range:						
Operating	**°C**	**–20 to +70***	**–20 to +70***	**0 to +70***	**0 to +70***	**0 to +70***
Storage	**°C**	**–30 to +85**	**–30 to +85**	**–55 to +125**	**–55 to +125**	**–55 to +125**
Supply Voltage	**VDC**	**3 to 7**	**5 ± 10%**	**5 ± 10%**	**5 ± 10%**	**5 ± 10%**
Supply Current:						
typ		**20 µA**	**Note 1**	**0.25 mA per MHz**	**25 mA**	**25 mA**
max		**30 µA**			**65 mA**	**65 mA**
Tri-state		**standard feature**	**—**	**standard feature**	**standard feature**	**standard feature**
Output:		**CMOS**	**CMOS**	**CMOS**	**HCMOS**	**ACMOS**
Symmetry @ 50% VDD	**%**	**50 ± 5**	**50 ± 10**	**50 ± 10**	**50 ± 10 or ± 5**	**50 ± 10 or ± 5**
Rise/Fall Time 20-80% VDD	**ns**	**30 typ, 40 max**	**40 typ, 60 max**	**10 max**	**Note 1**	**Note 1**
Logic 0	**V**	**.3 max**	**.5 max**	**10% VDD max**	**10% VDD max**	**10% VDD max**
Logic 1	**V**	**VDD–0.3 min**	**VDD–0.5 min**	**90% VDD min**	**90% VDD min**	**90% VDD min**
Load max		**15 pF, 200kΩ**	**15 pF, 200kΩ**	**2 CMOS**	**50 pF max**	**50 pF max**
Package type		**A, B or C**	**A, B or C**	**A**	**A, B or C**	**A, B or C**

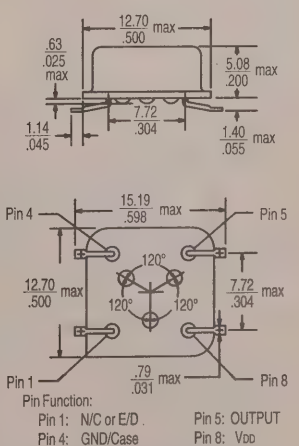
Note 1: Value is frequency dependent, see detailed data sheet or consult factory.
**Extended temperature range versions available.*



PACKAGE A (FULL SIZE)



PACKAGE B (HALF SIZE)



PACKAGE C
(HALF SIZE - GULL WING)

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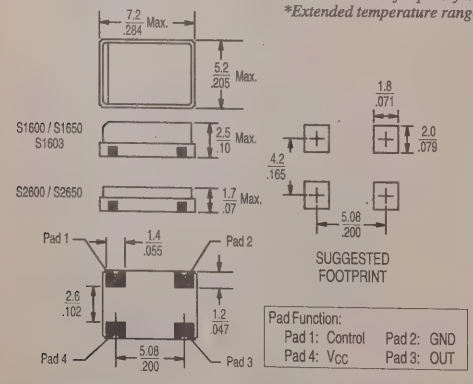
SaRonix

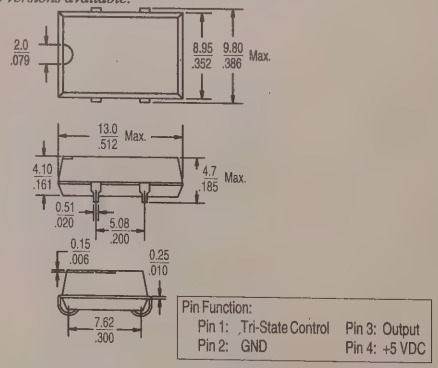
CMOS/TTL Oscillators

Series Logic		S1600/S2600 HCMOS/TTL	S1603 HCMOS	NTH/NTT Type H HCMOS/TTL	STA/STH/STT Type F ACMOS/TTL	NRH/NRT HCMOS/TTL
KEY FEATURES		*miniature ceramic SMT S2600: 1.7mm high heavy load version*	*3V operation miniature ceramic SMT*	*molded SMT package*	*high frequency SMT drives HCMOS and NMOS MPU's*	*reduced EMI drives HCMOS and TTL*
Frequency Range	MHz	1.5 - 66	1.5 - 48	1 - 70	70 - 130	24 - 70
Frequency Stability	± ppm	50 or 100	100	100	50, 100 or 500	25, 50 or 100
Temperature Range:						
Operating	°C	0 to +70*	0 to +70*	0 to +70*	0 to +70*	0 to +70*
Storage	°C	–55 to +125	–55 to +125	–55 to +125	–55 to +125	–55 to +125
Supply Voltage	VDC	5 ± 10%	3 ± 10%	5 ± 10%	5 ± 10%	5 ± 10%
Supply Current:						
typ	mA	Note 1	Note 1	10	45	20
max	mA	35	8	35	65	60
Tri-state		standard feature	standard feature	standard feature	standard feature	standard feature
Output:		HCMOS	HCMOS	HCMOS	ACMOS	HCMOS (NRH)
Symmetry @ 50% VDD	%	50 ± 5	50 ± 5	50 ± 10	50 ± 5 or ±10	50 ± 5
Rise/Fall Time 20-80% VDD	ns	10 max	10 max	8 max	4 max	2 typ, 8 max
Logic 0	V	10% VDD max	10% VDD max	10% VDD max	10% VDD	10% VDD max
Logic 1	V	90% VDD min	90% VDD min	90% VDD min	90% VDD	90% VDD min
Load max		S1600/2600: 15pF max	50pF max	50pF max to 50MHz	50pF // 500 Ω max	30 to 50pF
Load max		S1650/2650: 50pF < 50MHz		30pF > 50MHz		
Load max		S1650/2650: 30pF > 50MHz				
Output:		TTL		TTL	TTL	TTL (NRT)
Symmetry @ 1.5 VDD	%	50 ± 5		50 ± 10	50 ± 5 or ± 10	50 ± 5
Rise/Fall Time 0.5-2.5 VDD	ns	5 max		8 max	2 max	1 typ, 3 max
Logic 0	V	0.5 V max		0.5 V max	0.5 V max	0.5 max
Logic 1	V	2.5 min		2.5 V min	2.5 V min	2.5 min
Load		5 TTL		10 TTL	50 mA sink & source	10 TTL
Package type		SMD ceramic	SMD ceramic	H	F	A, B or C

Note 1: Value is frequency dependent, see detailed data sheet or consult factory.
**Extended temperature range versions available.*



PACKAGE SMD CERAMIC



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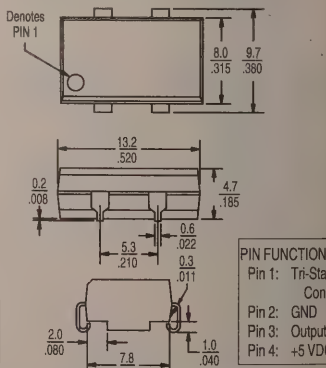

PACKAGE TYPE F

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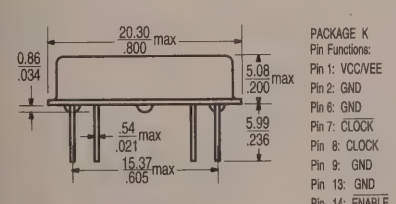
SaRonix

ECL Oscillators and VCXOs

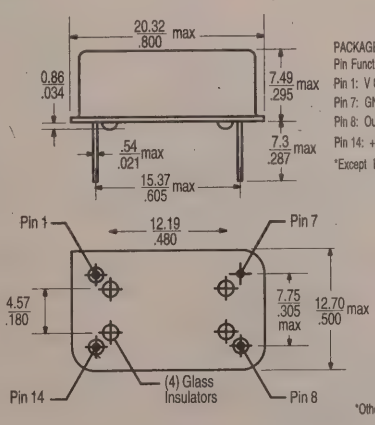
Logic Series		S1149 ECL	SEL3400/3500 ECL	SEL3000/3100 ECL	S1500 VCXO HCMOS/TTL	S1550 VCXO ECL
KEY FEATURES		*interchangeable with K1149 Series*	*output disable/wired-or or complementary output 4 pin DIL*	*AT crystal performance to 600MHz complementary output 8 pin DIL*	*HCMOS/TTL compatible pullability to ± 350ppm*	*10KH/10KE compatible pullability to ± 350ppm*
Frequency Range	MHz	5 - 140	70 - 400	70 - 600	1.5 - 100	70 - 622.08
Frequency Stability	±ppm	100	50 or 100	100 or 200	25 or 50	50
Temperature Range:						
Operating	°C	0 to +70*	0 to +70*	0 to +70*	0 to +70*	0 to +70*
Storage	°C	–55 to +125	–55 to +125	–55 to +125	–55 to +125	–55 to +125
Supply Voltage:	VDC	+5.0 ± 5% or –5.2 ± 5%	+5.0 nom (4.75 to 5.5) or –5.2 nom (–4.75 to –5.5)	+5.0 nom (4.75 to 5.5) or –5.2 nom (–4.75 to –5.5)	5 ± 10%	+5.0 ± 5% or –5.2 ± 5%
Supply Current:						
typ	mA	40	70	70	15 at 12MHz	
max	mA	60	100	100	50 at 100MHz	100
Tri-state		not applicable	disable/wired-or optional	disable/wired-or	optional	disable/wired-or optional
Output:		ECL	10KH or 10KE	10 KH or 10KE	HCMOS TTL	10KE compatible
Symmetry @ 50% VDD	%	50 ± 5 @ VBB	50 ± 5 @ crossing /VBB	50 ± 5 @ crossing	50 ± 5	50 ± 10 @ VBB
Symmetry @ 1.5V	%				50 ± 5	
Rise/Fall Time 20-80% VDD	ns	1.5 typ	1.0typ10KH,.225typ10KE	1.0typ10KH,.225typ10KE		0.350 typ
Rise/Fall Time 10-90% VCC	ns				8 max	
Rise/Fall Time 0.4 to 2.4V	ns	1.5 typ			8 max	
Logic 0	V	–1.8 typ	–1.8 or +3.2 typ	–1.8 or +3.2 typ	0.5 max 0.5 max	–1.8 or +3.2 typ
Logic 1	V	–0.8 typ	–0.8 or +4.2 typ	–0.8 or +4.2 typ	VCC–0.5Vmin 2.8 min	–0.8 or +4.2 typ
Load max		510 Ω to VEE	50 Ω to VCC -2V	50 Ω to VCC – 2V	25pF 10TTL	50 Ω to VCC – 2V
Jitter				4ps typ		
Package type		A	A	K	D	D or E

**Extended temperature range versions available*

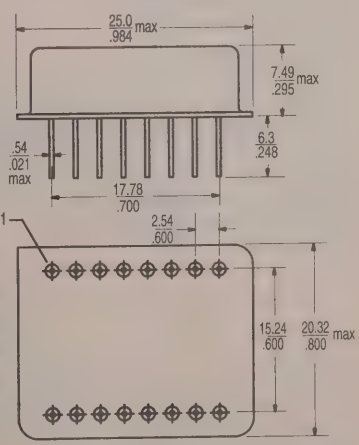
All specifications are subject to change without notice.



PACKAGE K



PACKAGE D



PACKAGE E

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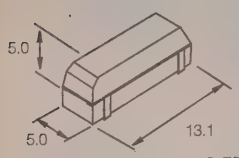
SII
Seiko Instruments

SURFACE MOUNT CRYSTALS

Seiko Instruments supplies a full range of surface mount crystals to meet your design needs. Our surface mount line covers frequencies from 24KHz to 60MHz. Offering one of the most extensive SM crystal lines in the industry.

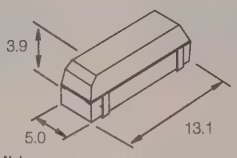
Surface Mount Plastic Mold (SP Series)

SPA1

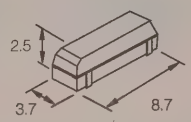


3.57 ~ 25MHz

SPA2

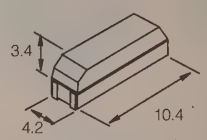


SPA3



20 ~ 60MHz

SPT1



24 ~ 200KHz

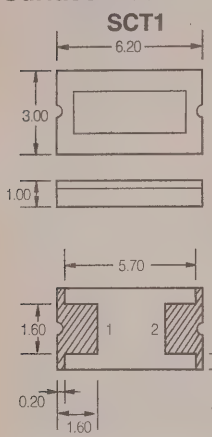
SPT2

24 ~ 200KHz

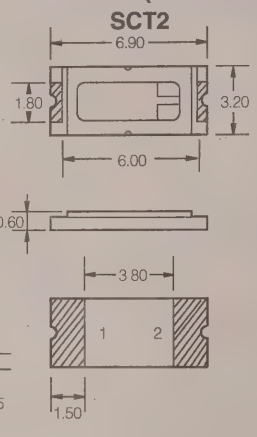
Unit: mm

Surface Mount Ceramic Mold (SC Series)

SCT1

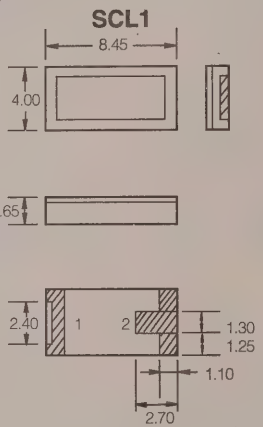


SCT2



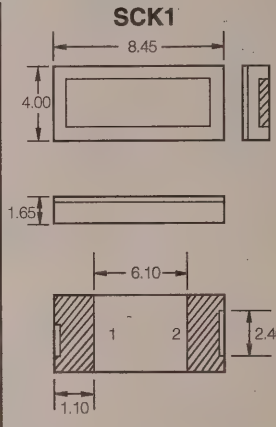
32 ~ 200KHz

SCL1



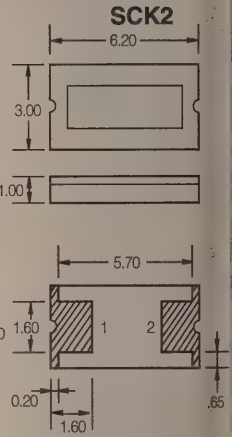
0.5 ~ 1.536MHz

SCK1



1.536 ~ 2.4575MHz

SCK2



2.4576 ~ 4.9152MHz

Unit :mm

TIGHT TOLERANCE/WIDE TEMPERATURE

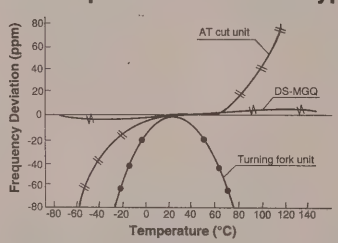
MGQ SERIES

Standard Specifications

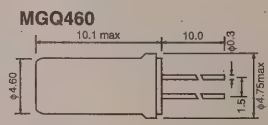
- ❑ *Frequency Range:* 1.0MHz to 3.2MHz
- ❑ *Frequency Temperature Stability:* Down to ± 2.5ppm
- ❑ *Operating Temperature:* -30°C to +70°C
- ❑ *Series Resistance:* 35Ω to 120Ω Typical*
- ❑ *Aging:* ± 2ppm (1st year)
- ❑ Extremely Shock Resistant

*Frequency Dependent

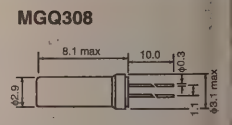
Comparison with Other Types



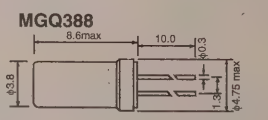
MGQ460



MGQ308

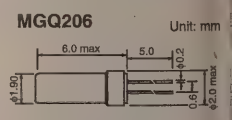


MGQ388



MGQ206

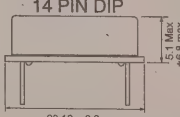
Unit: mm



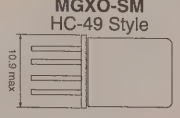
MGXO SERIES OSCILLATORS

- ❑ *14-Pin DIP Compatible*
- ❑ *TCX0 Specs/Low Power*
- ❑ *Extremely Shock Resistant*
- ❑ *Frequency can be electrically adjusted (PEAC).*

MGXO-51
***MGXO-68**
14 PIN DIP



MGXO-SM
HC-49 Style



Standard Specifications

Items	AA	A	B	C	D	E
Oscillation Frequency	0.5Hz-3.2MHz					
Frequency Stability (at room temperature)	± 0.5ppm	± 2ppm	± 3ppm	± 5ppm	± 10ppm	± 20ppm
Frequency Temperature Stability (-20°C ~ + 70°C)	± 2.5ppm	± 5ppm	± 10ppm	± 25ppm	± 50ppm	± 100 ppm
Aging (first year)	± 1ppm	± 3ppm				
Power Supply Voltage	DC 5.0V ± 5%					
Current Consumption	1mA Max.					
Output Waveform	Square wave duty ratio 50% ±10%					
Rise and Fall Time	Max. 100ns					
Operating Temperature Range	-20°C ~ +70°C					

SII
Seiko Instruments
Seiko Instruments USA Inc.
Electronic Components Division
2990 W. Lomita Blvd., Torrance, CA 90505
Telephone: (310) 517-7833
Fax: (310) 517-7792

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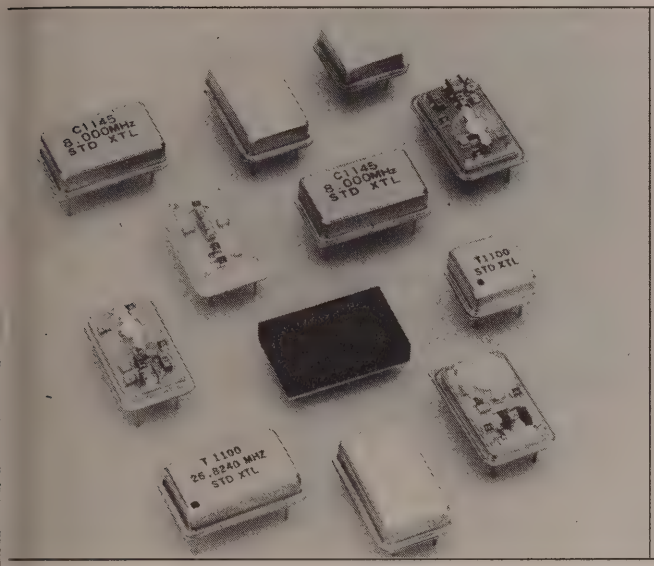
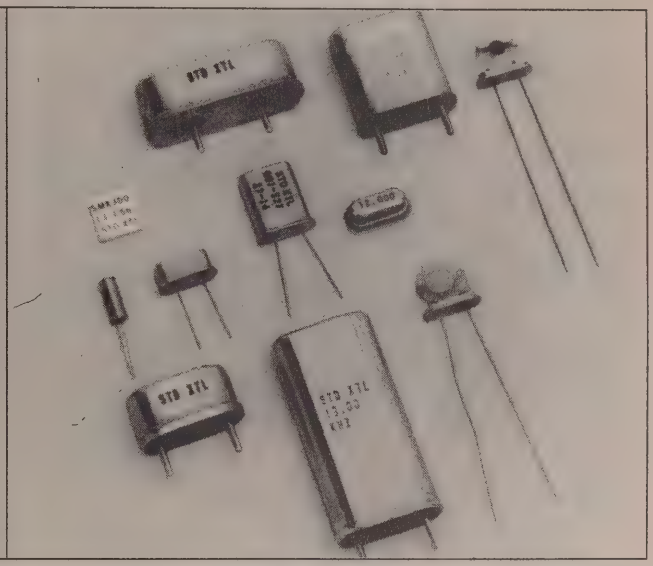
STANDARD CRYSTAL

The Crystal and Oscillator Specialist.





OSCILLATORS - .001HZ TO 200 MHZ

- ECL
- VCXO
- Fast TTL (70-110MHZ)
- Low Power
- TTL/Compatable
- HCMOS

8 Pin DIP (1/2 size) and 14 Pin DIP (Full size)

QUARTZ CRYSTALS

- Over 200k Crystals in Stock At All Times
- µP To Custom Requirements
- Unmounted Crystal Blanks
- Ceramic Surface Mount Package

FULL MANUFACTURING CAPABILITY
STANDARD CRYSTAL QUALITY SYSTEM

- Statical Process Control
- Bar Coded WIP/ Inventory System
- Automatic Test Equipment

FAST DELIVERY AVAILABLE : 24 HOURS TO 1 WEEK

STANDARD CRYSTAL CORPORATION

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Miniature Quartz Crystals–Leaded and Surface Mount (10kHz-50MHz)

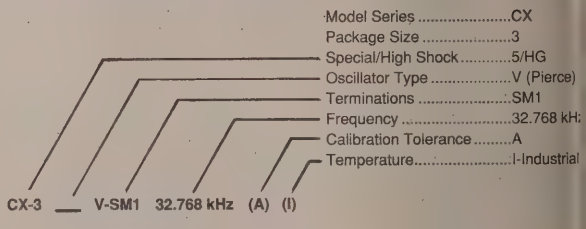
Crystal Selection Guide

MODEL	PACKAGE	TERMINATIONS	MAXIMUM TEMP °C (10 sec.)	FREQUENCY/ RANGE	CRYSTAL CALIBRATION TOLERANCE AT 25°C	OPERATING & STORAGE TEMP
CX Miniature quartz crystal in a rectangular hermetically sealed ceramic package **H** Designates series operation **V** Intended for a Pierce oscillator **HG** High shock version capable of surviving greater than 10,000 G's	**-1** Statek miniature ceramic package	**-03** (side lead) **-01** (no lead)—gold **-SM1** **-SM2** **-SM3**	210 210 260 260 260	10 kHz to 2 Mhz (Tuning Fork/Extensional) 8 MHz to 50 MHz (At Cut-Fundamental) >50MHz upon request	10-74.9 kHz (Tuning Fork) **A** ± 0.003% **B** ± 0.01% **C** ± 0.1% 75-169 kHz **A** ± 0.005% **B** ± 0.01% **C** ± 0.1% 170-249 kHz **A** ± 0.01% **B** ± 0.02% **C** ± 0.2% 250-600 kHz **A** ± 0.02% **B** ± 0.05% **C** ± 0.5% 530 kHz-2MHz (Extensional Mode) **A** ± .05% **B** ± 0.1% **C** ± 1.0% 8 MHz-50 MHz (At Cut-Fundamental) **A** ± 0.01% **B** ± 0.1% **C** ± 1.0% Tighter Tolerances Available	**I:** Industrial Range –40°C to +85°C **M:** Military Range –55°C to +125°C
	-2 smaller package with multiple lead-out options	**-01** (no lead)—gold **-02** (end leads) **-03** (side corner leads) **-04** (side center leads) **SM** surface mount	210 210 210 210 260	18 kHz to 600 kHz (Tuning Fork) 800 kHz to 1.35 MHz (Extensional Mode) 11 MHz to 40 MHz (At Cut-Fundamental) >40 MHz upon request		
	-3 Surface mount low-profile package	**-01** (no lead)—gold **-SM1** **-SM2** **-SM3**	210 260 260 260			
	-4 SMALLEST surface mount package	**-01** (no lead)—gold **-SM1** **-SM2** **-SM3**	210 260 260 260	32.768 kHz 30 kHz to 100 kHz >30 MHz available upon request		
SX Miniature quartz crystal within a TO-5 can **R** Designates series operation **V** Intended for a Pierce oscillator	**-1** rugged three-pin hermetically sealed TO-5 package	3 leads		10 kHz to 2 MHz (Tuning Fork/Extensional) 8 MHz to 50 MHz (At Cut-Fundamental) >50 MHz available upon request	10-24.9 kHz **A** ± 0.01% **B** ± 0.03% 25-49.9 kHz **A** ± 0.01% **B** ± 0.03% 50-149.9 kHz **A** ± 0.02% **B** ± 0.05% 150-600 kHz **A** ± 0.02% **B** ± 0.05% 530 kHz-2 MHz **A** ± 0.05% **B** ± 0.1% 8 MHz-50 MHz **A** ± 0.010% **B** ± 0.1% **C** ± 1.0%	
TS Quartz crystal for temperature sensing applications Stable high accuracy thermal sensor	CX-1 CX-2 CX-3 All types available	Same as CX-1, CX-2, CX-3 listed above		262.144 kHz 300 kHz Other frequencies available upon request	Linear Coefficient 34.5ppm/°C Thermal Parameters for 262.144 kHz Other frequencies available upon request	–55°C to +125°C

Surface Mount Termination Guide

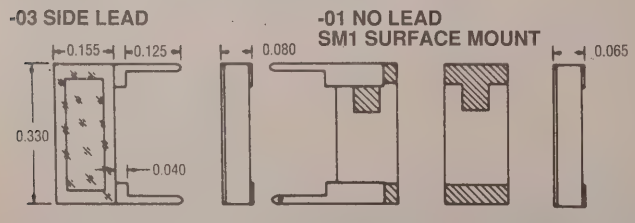
Designation	Termination	Recommended Application
SM1	Gold Plated	Vapor Phase or Infrared Solder Reflow, or Conductive Epoxy
SM2 **(Add 0.002)**	Ni Sn Plated	Vapor Phase or Infrared Solder Reflow, or Wave Solder
SM3 **(Add 0.005)**	Ni Sn Plated Solder Dipped	Vapor Phase or Infrared Solder Reflow, or Wave Solder

Crystal Part Numbering System

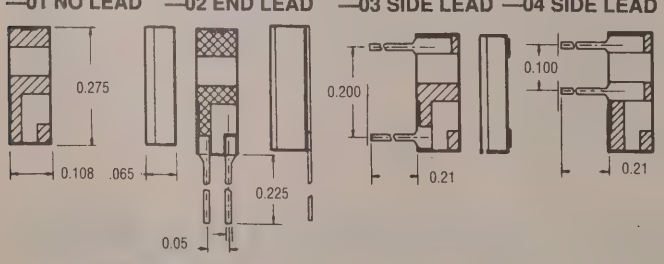


Crystal Packaging Details

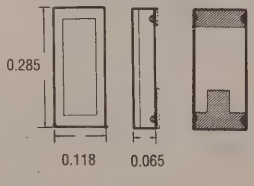
CX-1



CX-2

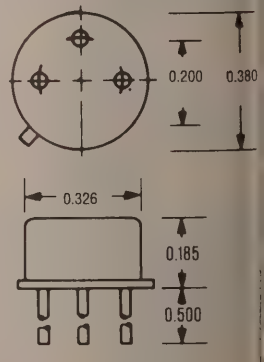


CX-3



CX-4

TO-5



STATEK
A Technicorp Company
512 N. Main ▪ Orange, California 92668 ▪ Telephone (714) 639-7810 ▪ Telex 67 8394 ▪ FAX (714) 997-1256

Miniature Quartz Crystal Oscillators (0.001Hz–40MHz)

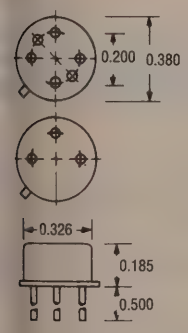
Oscillator Selection Guide —Frequency stability determined by Crystal Selection Guide

MODEL	PACKAGE	DESCRIPTION	FEATURES	FREQUENCY	CALIBRATION TOLERANCE (25°C)
SQXO-2 SQXO-2 SM	TO-5 24-pad LCC	Hermetically sealed, Hybrid crystal oscillator	TTL/CMOS compatible 5 volt operation Low profile package	10 kHZ to 50 MHz	**A** ± 0.01% **B** ± 0.03%
LXO	4-pin DIP	High accuracy, Low frequency, Hermetically sealed, Hybrid crystal oscillator	CMOS compatible High frequency stability Low power Current consumption typical 10µA at 32.768 kHz (2 vdc) Low Aging: 1 ppm/yr typical Wide supply voltage range (2-7 vdc)	10 kHz to 2.1 MHz 32.768 kHz	32.768 kHz **A** ± 0.001% **B** ± 0.0025% **C** ± 0.01% Other frequencies **A** ± 0.01% **B** ± 0.03% **C** ± 0.1%
LXO-2	4-pin DIP	Low frequency Hermetically sealed, Multi-function Hybrid crystal oscillator	Same as standard LXO plus: Enable, disable, tristate TTL/CMOS compatible Fast rise/fall time: 10N sec typ	10 kHz to 2.1 MHz	32.768 kHz **A** ± 0.001% **B** ± 0.0025% **C** ± 0.01% Other frequencies **A** ± 0.01% **B** ± 0.03% **C** ± 0.1%
LXO-AT	4-pin DIP	High frequency, Hermetically sealed, Multi-function, Hybrid crystal oscillator	TTL/CMOS compatible 5 volts operation Enable, disable, tristate	500 kHz to 50 MHz	**A** ± 0.01% **B** ± 0.03%
LQXO-1, 2 LQXO-4 LQXO-1F, 2F	6-pin TO-5 3-pin TO-5 14-lead flat pack	Hermetically sealed, Hybrid crystal oscillator	Miniature packaging **-1** 5 vdc **-2** 12 vdc **-4** 5 vdc Current consumption typical 15µA at 32.768 kHz (2 vdc)	10 kHz to 2.1 MHz	10 kHz to 50 kHz **A** ± 0.01% **B** ± 0.03% 50 kHz to 2.1MHz **A** ± 0.02% **B** ± 0.05%
DQXO-1, 2, 3 DQXO-1F, 2F DQXO-3 SM	**-1** 6-pin TO-5 **-2** 6-pin TO-5 **-3** 3-pin TO-5 14-lead flat pack 24-pad LCC	Hermetically sealed. Hybrid crystal oscillator and frequency divider	Very low frequency **-1** 5 vdc **-2** 12 vdc **-3** 5 vdc or 12 vdc Multiple outputs available -3 SM: -55 to + 125°C	Crystal frequency and divided output -1 0.001 Hz - 1Hz -2 0.001 Hz - 1Hz Single output -3 0.01 Hz - 10 kHz	**A** ± 0.01% **B** ± 0.03% Stability: ±0.02% -40 to +85°C
PXO	16-lead DIP	Frequency-selectable dual-output crystal oscillator	Programmable to 57 frequencies 0.7µA typical at 5v	0.002 Hz to 2.1 MHz	32.768 kHz **A** ± 0.001% 600 kHz to 2.1 MHz **A** ± 0.01%
REAL TIME CLOCK	16-lead DIP	Combination real-time clock and crystal oscillator	Current consumption <30µA Supply voltage: 3 to 5.5 vdc	Crystal frequency: 32.768 kHz	**A** ± 0.005%
CXO	Ceramic surface mount	Hermetically sealed, Hybrid crystal oscillator	Ultra-miniature, low profile package TTL/CMOS compatible 5 volts operation	2-40 MHz Other frequencies available	**A** ± 0.01% **B** ± 0.03%

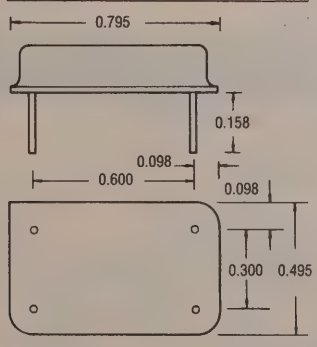
Oscillator Packaging Details

Note: Dimensions are in inches

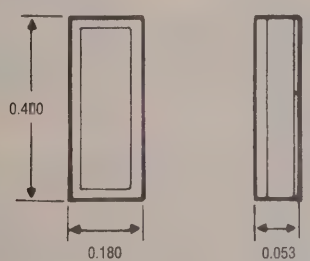
TO-5



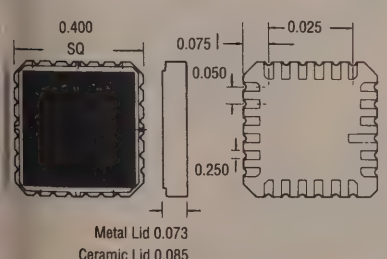
4 pin DIP



CXO

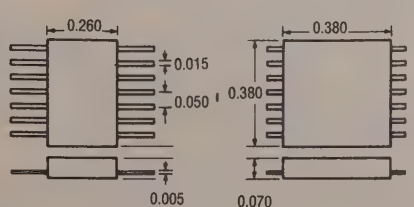


24-pad LCC

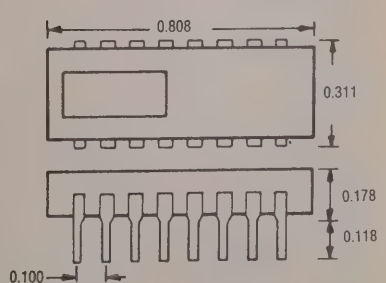


Metal Lid 0.073
Ceramic Lid 0.085

14 lead flat pack



PXO 16 Pin DIP



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For over 50 years, TOYOCOM has been dedicated to the design and manufacture of electronic equipment and components. Strict quality control — from the materials to the final product — has contributed to our crystal products' world-wide reputation.

TOYOCOM's broad product lines — from cultured quartz crystal to finished components — have proven to be valuable in serving the high performance needs today's technology demands. We offer a wide selection of standard parts as well as custom designs to meet your application. Call today.

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Product	Item	Application
Cultured Quartz	Raw, Pre-dimensioned	Electrical, Optical
Crystal Blank	Round, Square, AT-strip	Crystal resonator
Crystal Unit	Hermetically sealed, SMD	Communication, Microprocessor, Instrumentation
Crystal Filter	Monolithic, Linear phase	Communication, Instrumentation
Crystal Oscillator	Clock, PXO, TCXO, VCXO, TCVCXO, OCXO, Digital TCXO	Communication, Clock, Instrumentation
Saw Device	Resonator, Filter	Communication, VCR, CATV, Security system
Optical Component	Wave length plate, Isolator Low pass filter	Optical disk, AV, OA, Communication, Measurement equipment

TOYOCOM

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TOYOCOM U.S.A., INC. **1-800-TOYOCOM**

TOYOCOM

SMD QUARTZ PRODUCTS

Crystal Unit

Surface Mountable Crystal Unit

for first local oscillator for pager, reference oscillator for pager, second local oscillator for handheld portable telephones, etc.

Features

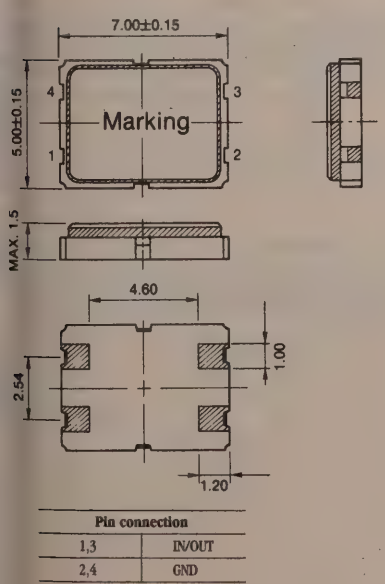
- High reliable ultra-miniaturized size low profile unit
- Excellent shock-proof characteristics (10,000G min.)
- High reliable LCC package
- Available to Surface Mount Technology and IR-reflow process

Specifications

HOLDER	TSX-1	TSX-2	TSX-3
Size (mm)	7.0 x 5.0 x 1.5	7.8 x 3.4 x 1.2	11.0 x 5.0 x 2.5
Frequency range	12.8 to 150 MHz	12.8 to 30 MHz	3.6 to 50 MHz
Mode of vibration	Fundamental, 3rd, 5th	Fundamental	Fundamental, 3rd
Frequency tolerance (at 25°C ± 3°C)		±10 ppm	
Load capacitance (C_L)	Series, 20 pF, 30 pF, etc.		
Frequency stability in operating temperature range	to be discussed ex. ±4 ppm (0 to 50°C)		
Drive level	10 μW		
Resonance resistance (Rr)	Fundamental; 40Ω max., 3rd; 50Ω max., 5th; 80Ω max.		
Aging	±1 ppm/year		

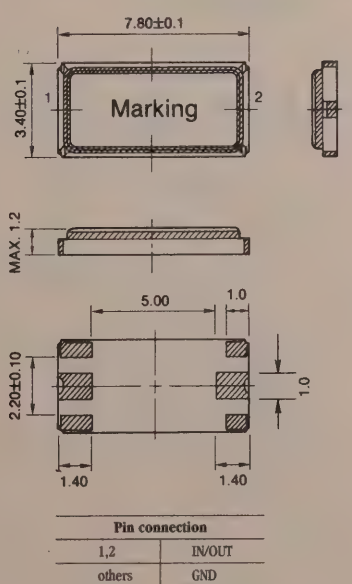
OUTLINE DRAWING (Size in mm)

TSX-1



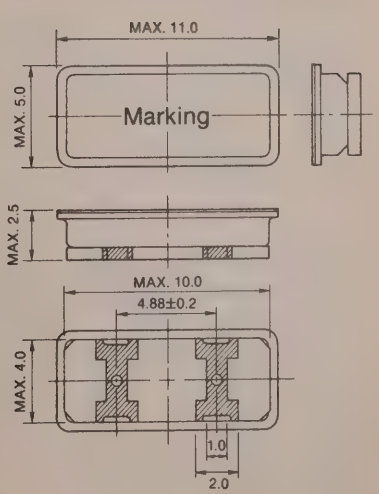
Pin connection	
1,3	IN/OUT
2,4	GND

TSX-2



Pin connection	
1,2	IN/OUT
others	GND

TSX-3



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TOYOCOM U.S.A., INC. 1-800-TOYOCOM

TOYOCOM

SMD QUARTZ PRODUCTS

Clock Oscillator & Crystal Unit

Surface Mountable Clock Oscillator

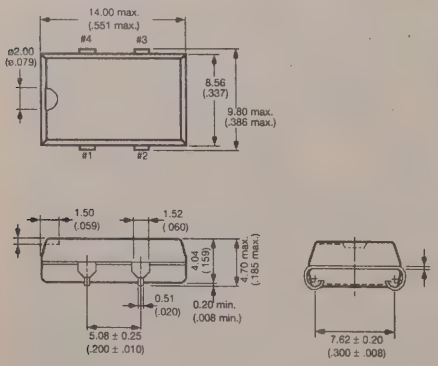
MODEL	TCO-711JT	TCO-711JTC
Output	TTL Logic	CMOS Logic
Frequency range	1.5 to 70MHz	1.5 to 70MHz
Frequency stability	±100ppm	
Operating temperature	0° to +70°C	
Input voltage	±5.0VDC ±10%	
Input current	10mA max. (1.5 to 10MHz) 15mA max. (10+ to 26MHz) 35mA max. (26+ to 50MHz) 50mA max. (50+ to 70MHz)	CL = 15pF 8mA max. (1.5 to 10MHz) 15mA max. (10+ to 26MHz) 35mA max. (26+ to 50MHz) 50mA max. (50+ to 70MHz)
Rise/Fall time	5ns max. (1.5 to 70MHz)	6ns max. (CL = 15pF) 12ns max. (CL = 50pF)
Fan out	1 to 10 gates, 1.6mA/gate	$\|I_{OH}\| = I_{OL}$ = 4mA min.
Remarks	R Reflow — 260°C for 20 seconds max. Tri State — Pin #1H (open) = Fo output, pin #1L (Gnd) = High Z	

Surface Mountable Crystal Unit

MODEL	HC-49/USMD-B	TQC-10G SERIES
Frequency range	3.5 to 36MHz	3.5 to 40MHz
Frequency tolerance	±50ppm (at +25°C)	N/A
Frequency stability	±100ppm (0° to +70°C, inclusive of frequency tolerance at +25°C)	±100ppm (0° to +70°C, inclusive of frequency tolerance at +25°C)
Load capacitance	16.0 ±0.2pF, 10.0 ±0.2pF (32MHz)	
Remarks	Shunt capacitance 5pF max., Drive level 0.5 ±0.1mW	

OUTLINE DRAWINGS

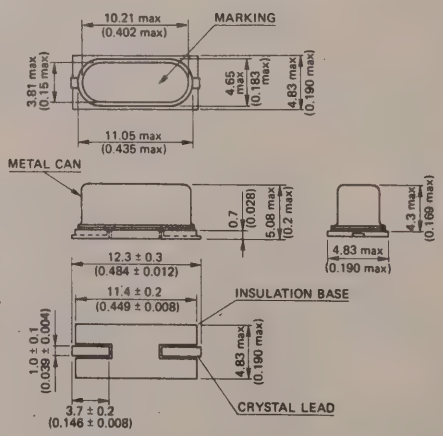
TCO-711J Series



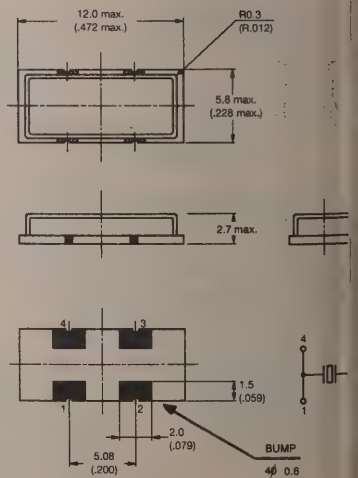
Lead	Connection
#1	*N.C. or Control
#2	GND
#3	OUTPUT
#4	+ VDC

*DO NOT use as a tie-point on N.C. models

HC-49/USMD-B



TQC-6G Series



Size: mm (inch)

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TOYOCOM U.S.A., INC. **1-800-TOYOCOM**

TOYOCOM

CRYSTAL OSCILLATOR

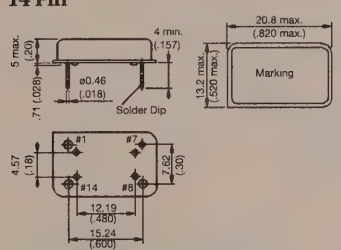
TTL Clock Oscillator TCO-700 Series

TTL

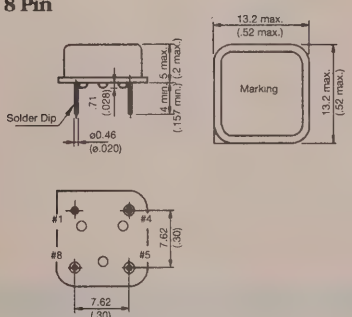
MODEL	TCO-711A	TCO-711S4	TCO-711TH	TCO-711STH
Output level	TTL Logic		Tri-state, TTL Logic	
Package	14 pin	8 pin	14 pin	8 pin
Frequency range	0.15 to 100MHz	1.25 to 70MHz	1.25 to 70MHz	1.25 to 70MHz
Frequency stability	±100ppm (see note 1 for other standards)			
Symmetry	40 to 60%			
Input current/ Frequency	~10MHz 10mA	~26MHz 15mA	~50MHz 35mA	~70MHz 50mA
Rise/Fall time	1.25MHz to 70MHz, 5ns max.			
Fan out	1 to 10 gates (0.15 to 60MHz) 1 to 5 gate (60 to 100MHz)	1 to 10 gates 1.6mA/gate	1 to 10 gates 1.6mA/gate	1 to 10 gates 1.6mA/gate
Remarks	—	—	Tri-state	
			#1 L (GND) H (Open)	#8 Z (High Impedance) F_o

OUTLINE DRAWINGS

14 Pin



8 Pin



Pin Connection

Pin	TCO-711A	TCO-711TH
1	N.C.	Control
7	Case GND	Case GND
8	Output	Output
14	5.0 VDC	5.0 VDC

Pin Connection

Pin	TCO-711S4	TCO-711STH
1	N.C.	Control
4	Case GND	Case GND
5	Output	Output
8	5.0 VDC	5.0 VDC

Standard Specifications

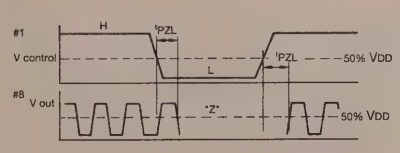
Frequency stability	see table 1
Operating temperature	0° to 70°C
Storage temperature	−55° to + 125°C
Input voltage	+5V ± 10%
Symmetry	40 to 60% at 1.4V

Note 1

Model	Frequency Stability*	
TCO-711	± 0.01%	(± 100 ppm)
TCO-744	± 0.0025%	(± 25 ppm)
TCO-745	± 0.005%	(± 50 ppm)

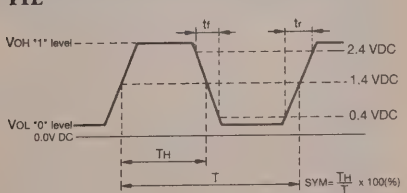
*Inclusive of calibration tolerance @25°C operating temperature, input voltage change, load change, aging, shock and vibration.

DISABLE/ENABLE



WAVE FORM

TTL



Size: mm (inch)

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TOYOCOM U.S.A., INC. **1-800-TOYOCOM**

TOYOCOM

CRYSTAL OSCILLATOR

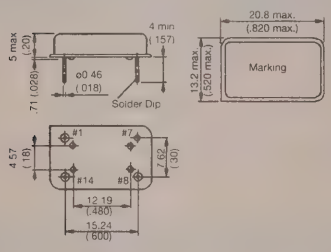
CMOS Clock Oscillator
TCO-700 Series

CMOS

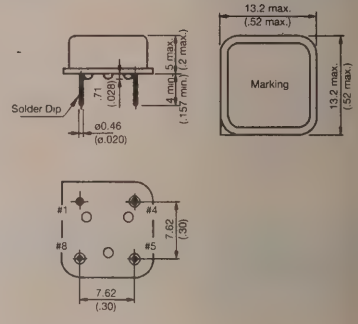
MODEL	TCO-711HC	TCO-711SHC	TCO-711THC	TCO-711STHC
Output level	CMOS logic		Tri-state, CMOS logic	
Package	14 pin	8 pin	14 pin	8 pin
Frequency range	1.25 to 70MHz	1.25 to 70MHz	1.25 to 70MHz	1.25 to 70MHz
Frequency stability	±100ppm (see note 1 for other standards)			
Input current/ Frequency	~10MHz 8mA	~26MHz 15mA	~50MHz 35mA	~70MHz 50mA
Rise/Fall time	10ns	8ns	7ns	5ns
Fan out	$\|I_{OH}\| = I_{OL}$ = 4mA min.			
Remarks	—	—	Tri-state	
			#1 L (GND) H (Open)	#8 or #5 Z (High Impedance) F_O

OUTLINE DRAWINGS

14 Pin



8 Pin



Pin Connection

Pin	TCO-711HC	TCO-711THC
1	N.C.	Control
7	Case GND	Case GND
8	Output	Output
14	5.0 VDC	5.0 VDC

Pin Connection

Pin	TCO-711SHC	TCO-711STHC
1	N.C.	Control
4	Case GND	Case GND
5	Output	Output
8	5.0 VDC	5.0 VDC

Standard Specifications

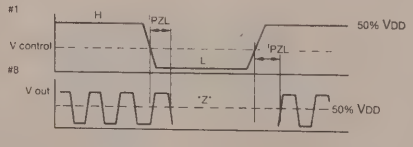
Frequency stability	see table 1
Operating temperature	0° to 70°C
Storage temperature	–55° to + 125°C
Input voltage	+5V ± 10%
Symmetry	40 to 60% at 50% VDD

Note 1

Model	Frequency Stability*	
TCO-711	± 0.01%	(± 100 ppm)
TCO-744	± 0.0025%	(± 25 ppm)
TCO-745	± 0.005%	(± 50 ppm)

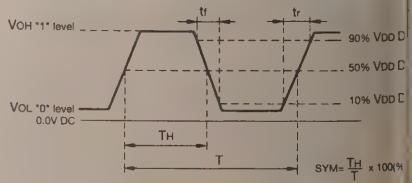
*Inclusive of calibration tolerance @25°C operating temperature, input voltage change, load change, aging, shock and vibration.

DISABLE/ENABLE



WAVE FORM

CMOS



Size: mm (inch)

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TOYOCOM U.S.A., INC. **1-800-TOYOCOM**

TOYOCOM

CRYSTAL OSCILLATOR

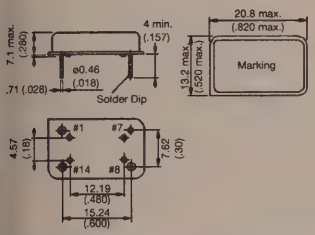
ECL, Tight Stability Clock Oscillator
TCO-700 Series

ECL & Tight Stability

MODEL	TCO-711F4	TCO-711G4	TCO-706AB	TCO-706AC
Output level	10K ECL		CMOS logic	
Package	14 pin (HT. 10 to 90MHz, 5.0mm max; 90 to 125MHz 7.11 mm max.)		14 pin	
Frequency range	40 to 125MHz		1.25 to 25MHz	
Frequency stability	±100ppm		± 5ppm over Temperature ± 1ppm vs. Input Voltage ± 2ppm/year vs. Aging	
Input voltage	-5.46 to -4.94VDC	+4.94 to +5.46VDC	5.0V ± 5%	
Remarks	High level -0.960 to -0.810V Low level -1.850 to -1.650V	High level +4.24 to +4.39VDC Low level +3.35 to +3.55VDC	Frequency adjustment by internal trimmer. ±3ppm min.	Frequency tolerance (at +25°C) ± 2ppm

OUTLINE DRAWING

14 Pin

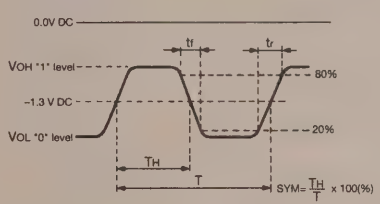


Pin Connection

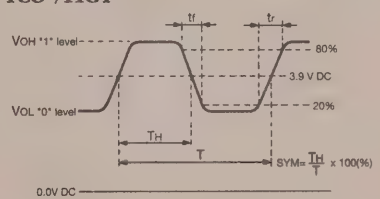
Pin	TCO-711F	TCO-711G4	TCO-706AB TCO-706AC
1	N.C.	Case GND	N.C.
7	-5.2 V.	V_{EE}	Case GND
8	Output	Output	Output
14	Case GND	V_{CC}	5.0 VDC

OUTPUT WAVEFORM

TCO-711F4

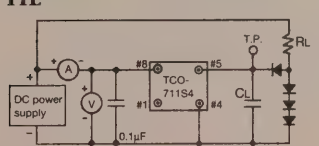


TCO-711G4

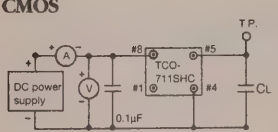


TEST CIRCUIT DIAGRAM

TTL



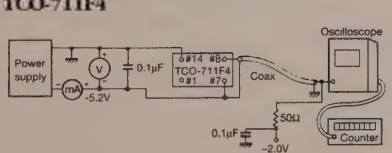
CMOS



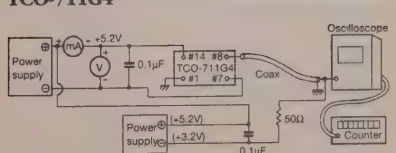
Standard Specifications

Frequency stability	see table 1
Operating temperature	0° to 70°C
Storage temperature	-25° to +85°C
Input voltage	+5V ± 10%
Symmetry	40 to 60% at 1.4V or 50% VDD

TCO-711F4



TCO-711G4



Size: mm (inch)

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TOYOCOM U.S.A., INC. **1-800-TOYOCOM**

TOYOCOM VOLTAGE CONTROLLED CRYSTAL OSCILLATOR

VCXO
TCO-700 Series

VCXO

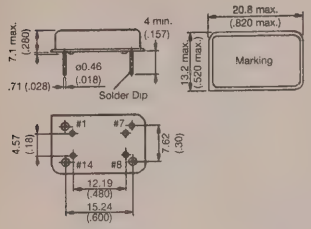
MODEL	TCO-745VC	TCO-745V	TCO-711VC	TCO-711V
Output level	CMOS logic	TTL logic	CMOS logic	TTL logic
Package	14 pin		14 pin	
Frequency range	1.25 to 25MHz		1.25 to 33MHz	
Frequency stability	± 50ppm including calibration temp. voltage at 2.5VDC		± 100ppm including calibration temp. voltage at 2.5VDC	
Frequency deviations vs. control voltage	± 150ppm at 2.5VDC ± 2.5V		± 200ppm at 2.5VDC ± 2.5VDC	
Control voltage	0 to 5.0VDC		0 to 5.0VDC	
Fan out	IOH - IOL = 2mA	1 to 10 gate	IOH - IOL = 2mA	1 to 10 gate

VCXO

MODEL	TCO-730C1	TCO-208C
Output level	TTL compatible	TTL compatible
Package	14 pin with height of 0.335 inch	see outline drawing
Frequency range	12 to 20MHz	1 to 25MHz
Frequency stability	±30ppm/-20~70°C ±1ppm/+5V ±5% ±3ppm/yr.	±30ppm/0~50°C ±5ppm/+5V ±5% ±3ppm/yr.
Supply current	16mA max.	25mA
Control voltage	+2.5 ±2V ±50ppm min.	+2.5 ±2.5V ±200ppm min.
Fan out	1 to 2 gate	1 to 2 gate

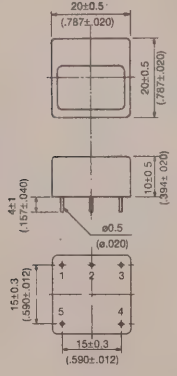
OUTLINE DRAWINGS

14 Pin



Note: Height of TCO -730C1 is 0.335 inches.

TCO-208C

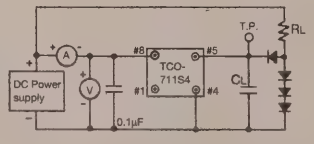


Pin Connection

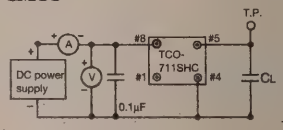
Pin	TCO-745VC, V 711VC, V	TCO-730C1	Pin	TCO-208C, 215K1
1	Control	Control	1	+V$_{CC}$
7	Case GND	Case GND	2	Output
8	Output	Output	3	GND
14	5.0VDC	5.0VDC	4	Control
			5	GND

TEST CIRCUIT DIAGRAM

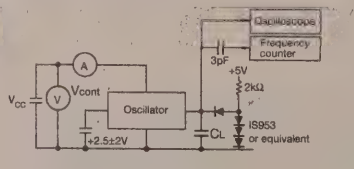
TTL



CMOS



TCO-730C1, -208C, -215K1



CL: Total fixture and probe capacitance = 15pF max.

Standard Specifications

Frequency stability	see table 1
Operating temperature	0° to 70°C
Storage temperature	-25° to +85°C
Input voltage	+5V ± 10%
Symmetry	40 to 60% at 1.4V or 50% VDD

Size: mm (inch)

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TOYOCOM U.S.A., INC. **1-800-TOYOCOM**

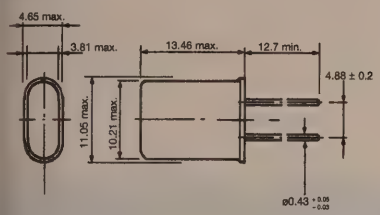
TOYOCOM

CRYSTAL UNITS

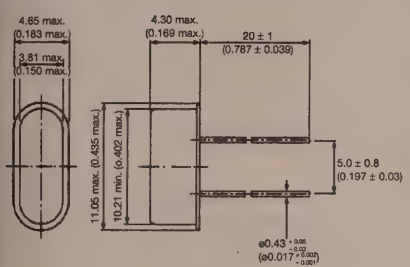
Microprocessor and Miniature Package Units

OUTLINE DRAWINGS

HC-49/U-10



HC-49/U-70

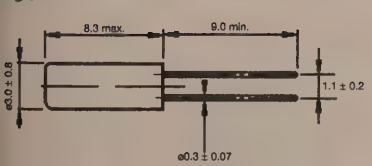


TYPE	STANDARD	TOC-100A-7C	LOW PROFILE
Frequency range	1.8432 to 60MHz	32.768KHz	3.0 to 60MHz
Frequency tolerance	±50ppm (at + 25℃)	±20ppm (at + 25℃)	±50ppm (at + 25℃)
Load capacitance	12, 16, 32pF	12 ± 0.2pF	16 ± 0.2pF
Resonant resistance	25~650Ω max.	30KΩ max.	50~180Ω max.
Operating temperature	0° to +70℃		
Shunt capacity	7pF max.	1.6 ± 0.4pF	5pF max.
Package (Resistance weld)	HC-49/U-10	RV-38	HC-49/U-70

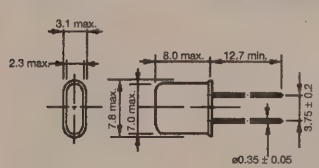
For Professional Use

TYPE	UM-1 UM-4 UM-5	UM-1 WITH METAL JACKET	UM-4S WITH METAL JACKET
Frequency range	30 to 175MHz	10 to 200MHz	12 to 200MHz
Frequency tolerance (at +25℃)	±5, ±10, ±15ppm	±10, ±15, ±20, ±30ppm	±10, ±15, ±20, ±30ppm
Frequency stability	as tight to ±3ppm (-10° to +50℃). ±7.5ppm (-20° to +70℃)	as tight to ±3ppm (-10° to +60℃). ±15ppm (-30° to +80℃)	as tight to ±4ppm (0° to +55℃). ±20ppm (-30° to +85℃)
Aging/year	±1ppm, ±2ppm, ±4ppm		
Load capacitance	Series, 20pF, 30pF		
Drive level	2μW	0.5, 1, 2m W	0.5, 1, 2m W
Application	Pager	Surface mount technology	

RV-38

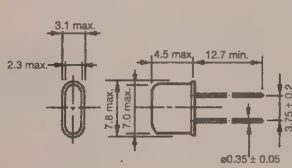


UM-1

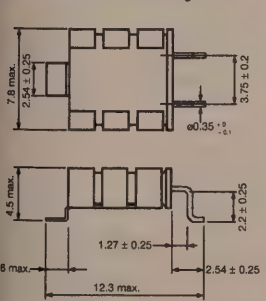


mm	inch
0.05	.002
0.2	.008
0.35	.014
2.3	.091
3.1	.122
3.75	.148
4.5	.177
5.8	.228
7.0	.276
7.8	.307
12.7	.500

UM-4

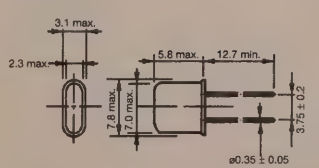


UM-1 SMD with Metal Jacket

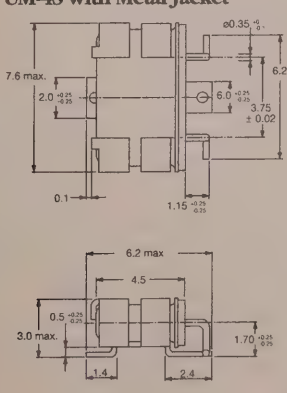


mm	inch
0.1	.004
0.2	.008
0.25	.01
0.35	.014
1.27	.05
1.76	.069
2.2	.081
2.54	.100
3.75	.148
4.5	.177
7.8	.307
12.3	.484

UM-5



UM-4S with Metal Jacket



Size: mm (inch)

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TOYOCOM U.S.A., INC. **1-800-TOYOCOM**

TOYOCOM NEW CRYSTAL OSCILLATORS

Digitally Compensated TCXO SMD TCXO

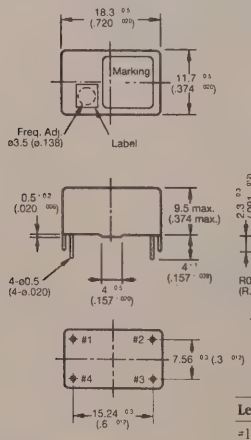
Toyocom's Digitally Compensated TCXO delivers unexcelled value in crystal oscillators. Features such as compact design and excellent frequency stability over a wide temperature range allow use as a reference oscillator for fixed or portable equipment. In addition, Toyocom now has a very small (ICC) surface mount type TCXO available.

TCXO & SMD

MODEL	DTCXO TCO-109A	SURFACE MOUNTABLE TYPE TCO-935A
Standard frequency	12.8MHz, 15.36MHz, 14.4MHz	12.8MHz, 15.36MHz, 14.4MHz, 16.8MHz
Supply voltage	DC + 5V ± 10%	DC + 5V ± 5%
Current drain	5mA max.	2mA max.
Output level	1V p-p min./clipped sinewave (DC-cut)	1V p-p min./clipped sinewave (DC-cut)
Load	20KΩ/5pF ± 10%	20KΩ/5pF ± 10%
Frequency stability		
vs. Temperature	± 1.0ppm/-30° to +80°C	± 2.5ppm/-30° to +75°C
vs. Supply voltage	± 0.2ppm/DC +5V ± 10%	± 0.3ppm/DC +5V ± 5%
vs. Load	± 0.2ppm/20KΩ/5pF ± 10%	± 0.3ppm/20KΩ/5pF ± 10%
Aging	± 1.0ppm/year	± 1.0ppm/year
Frequency adjustment	± 3.0ppm min. by internal trimmer	± 3.0ppm min. by internal trimmer

OUTLINE DRAWINGS

TCO-109A

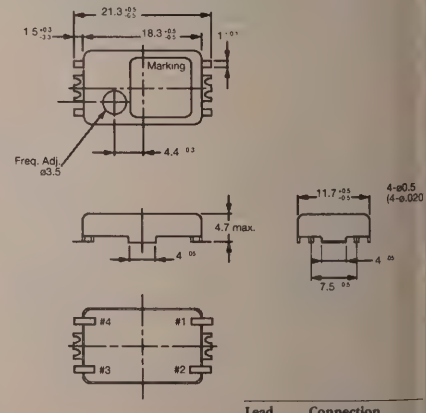


Lead	Connection
#1	N.C.
#2	Common & Case
#3	Output
#4	+ Vcc

(Material)
Case: Silver-Nickel
Pin: Silver-Nickel

Size: mm (inch)

TCO-935A



Lead	Connection
#1	Common & Case
#2	Output
#3	+ Vcc
#4	N.C.

(Material)
Case: Silver-Nickel
Pin: Solder Coated PBR-1/2H

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TOYOCOM U.S.A., INC. **1-800-TOYOCOM**

TOYOCOM

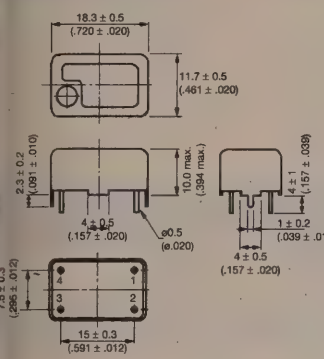
CRYSTAL OSCILLATOR

TCXO & OCXO

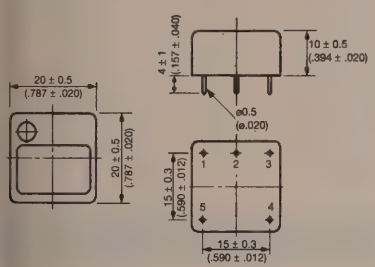
TCXO

OUTLINE DRAWINGS

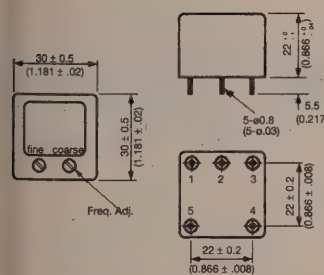
TCO-909Z, TCO-919A



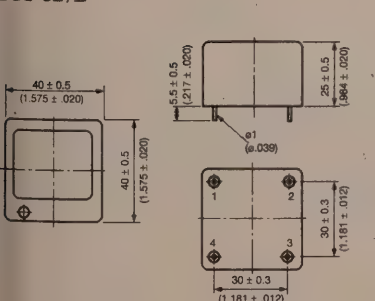
TCO-519L



TCO-635A, A1



TCO-627B

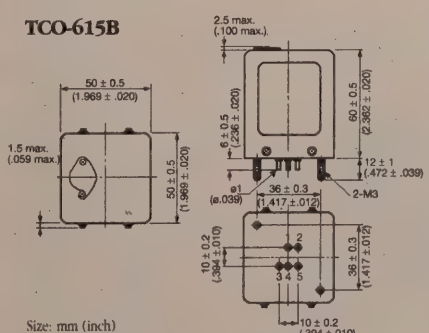


MODEL	TCO-909Z	TCO-919A	TCO-519L
Standard frequency	12.8MHz, 15.36MHz	12.8MHz	12.8MHz, 15.36MHz
Available frequency	10 to 24MHz	12 to 17MHz	10 to 24MHz
Frequency stability vs. Temperature vs. Supply voltage Aging	±2.5ppm/-30° to +75°C ±0.3ppm/+5V ±5% ±1ppm/year	±2.5ppm/-30° to +75°C ±0.3ppm/+5V ±5% ±1ppm/year	±1ppm/-20° to +70°C ±0.2ppm/+5V ±5% ±1ppm/year
Supply voltage	+5V ±5%	+5V ±5%	+5V ±5%
Supply current	2mA max.	2mA max.	2mA max.
Output	1V p-p min. Clipped Sinewave (DC-Cut)	1V p-p min. Clipped Sinewave (DC-Cut)	1V p-p min. Clipped Sinewave (DC-Cut)
Operating temperature	–40° to +85°C	–35° to +80°C	–30° to +80°C
Frequency adjustment	±3ppm min. by internal trimmer	±3ppm min. by internal trimmer	±3ppm min. by internal trimmer
Audio modulation	—	Deviation: ±8ppm min. Distortion: 3% max. Input voltage: 2V p-p Modulation range: 1Hz to 3KHz Response slope: Negative	—

OCXO

MODEL	TCO-635A	TCO-635A1	TCO-627B	TCO-615B
Standard frequency	10MHz	10MHz	5MHz, 6.4MHz or 10MHz	5MHz
Available frequency	—	5 to 25MHz	4 to 10MHz	—
Frequency stability vs. Temperature vs. Supply voltage Aging per day Aging per year Warm up at +25°C	±1 x 10^{-7}/-20° to +70°C ±3 x 10^{-8}/+12V ±10% ±2 x 10^{-8} ±2 x 10^{-7} ±5 x 10^{-8} (5 minutes)		±5 x 10^{-8}/-10° to +60°C ±3 x 10^{-8}/+12V ±10% ±2 x 10^{-8} ±1 x 10^{-7} ±5 x 10^{-8} (10 minutes)	±5 x 10^{-9}/-10° to +60°C ±1 x 10^{-9}/+12V ±5% ±5 x 10^{-10} ±2 x 10^{-8} ±5 x 10^{-8} (30 minutes)
Supply voltage	+12V ±10%			
Supply current Warm up Steady at +25°C	150mA max. 70mA max.		330mA max. 120mA max.	500mA max. 300mA max.
Output	Sinewave +8 ±2dBm/50Ω	TTL compatible, Fanout 2		
Frequency adjustment	±1 x 10^{-6} min.		±5 x 10^{-7} min.	±1 x 10^{-7} min.

TCO-615B



Size: mm (inch)

Pin Connection

Pin	TCO-909Z	TCO-919A	TCO-519L	TCO-635A,A1	TCO-627B	TCO-615B
1	Common & Case		+$\overline{V}_{cc}$	NC	NC	Output
2	Output		Output	NC	Output	+V_{cc}
3	+$\overline{V}_{cc}$		Common & Case	Common & Case	+$\overline{V}_{cc}$	NC
4	—	Control	Common & Case	Output	Common & Case	NC
5	—	—	Common & Case	+$\overline{V}_{cc}$	—	Common & Case

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Toyocom HCM Filter (Monolithic Crystal Filter) features compact design, high reliability and excellent intermodulation characteristics for use in a wide range of applications. Nominal frequency ranges from 10 to over 100MHz with 2 to 8 poles.

TOYOCOM

CRYSTAL FILTER

HCM Filter, Miniature Package & VHF Series

Miniature Package

Type	Center frequency (MHz)	No. of pole	Passband (dB)	Passband (kHz)	Stopband (dB)	Stopband (kHz)	Max. ripple (dB)	Max. loss (dB)	Guaranteed attenuation (dB)	Guaranteed attenuation (kHz)	Terminating impedance Zt (Ω/pF)	Case
21J1D3	21.4	2	3	±10	13	±30	1.0	1.5	35	+350 to +1000	1.8k/1.0	UM-5
21J1B3	21.4	2	3	±7.5	15	±25	1.0	1.5	60	–300 to –1000	1.5k/2.5	UM-5
21M1B3	21.7	2	3	±7.5	15	±25	1.0	1.5			1.5k/2.5	UM-5
TQF-602A	26 to 50	2	3	±10	10	±30	1.0	2.0	35 60	+910 –910	1.5k/2.5 ±2	UM-5

Operating temperature range: –30° to +80°C

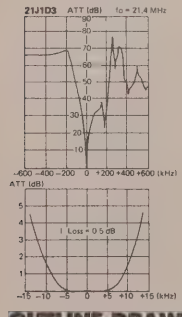
VHF 45MHz Fundamental Series

Type	No. of pole	Passband (dB)	Passband (kHz)	Stopband (dB)	Stopband (kHz)	Max. ripple (dB)	Max. loss (dB)	Guaranteed attenuation (dB)	Guaranteed attenuation (kHz)	Terminating impedance Zt (Ω//pF)	Coupling impedance Zc (pF)	Case
45E1FF	2	3	±3.75	10	±12.5	1.0	2.0	65	– 910	200//4	—	UM-1
45E2FF	4	3	±3.75	30	±12.5	1.0	4.0	90	±910	350//6.5	18	(UM-1) x 2
45E3FF	6	3	±3.75	50	±12.5	2.0	6.0	80	±910	350//5	—	H-1
45E4FF	8	3	±3.75	70	±12.5	2.0	7.0	80	±910	350//5	—	H-1
45E1BF	2	3	±7.5	15	±25	1.0	2.0	65	– 910	650//3	—	UM-1
45E2BF	4	3	±7.5	30	±25	1.0	3.0	90	±910	650//3	9	(UM-1) x 2
45E3BF	6	3	±7.5	60	±25	2.0	5.0	80	±910	650//1.5	—	H-1
45E4BF	8	3	±7.5	80	±25	2.0	6.0	80	±910	650//1.5	—	H-1
45E1AF	2	3	±15	10	±50	1.0	2.0	65	– 910	1100//-0.9	—	UM-1
45E2AF	4	3	±15	30	±50	1.0	3.0	80	±910	1200//0.7	3.5	(UM-1) x 2

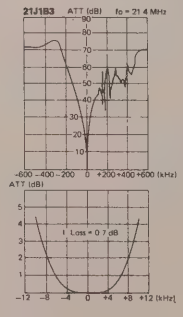
Operating temperature range: –30° to +80°C

ELECTRICAL DATA

21J1D3



21J1B3



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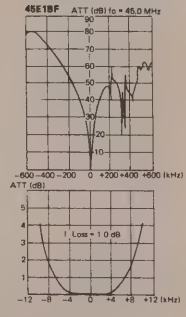

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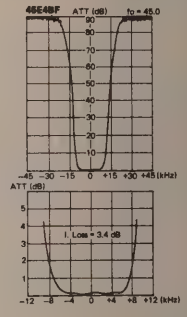
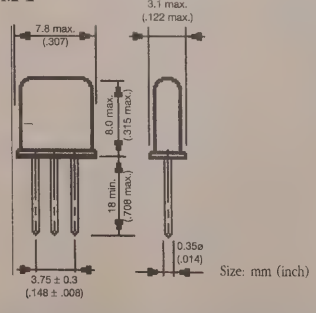


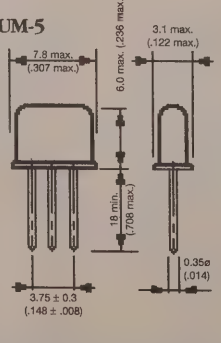
OUTLINE DRAWINGS

UM-1

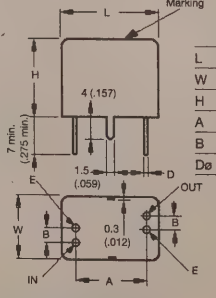


Size: mm (inch)

UM-5

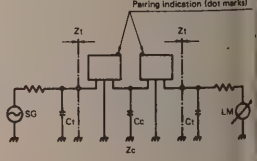


H-1



	(mm)	(in)
L	11.0	.433
W	8.5	.335
H	11.5	.452
A	7.4	.291
B	2.0	.078
Dø	0.35	.012

4-Pole



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TOYOCOM

SAW DEVICE

Filter & Resonator

Surface Acoustic Wave Filter

MODEL	TQS-624	TQS-417A	TQS-729
Nominal frequency	80 to 95MHz	135 to 175MHz	836.5MHz
Passband at 3dB	fo ± 15KHz min.	fo ± 4MHz min.	fo ± 25MHz min.
Loss	3dB max.	5dB max. including ripple	4.0dB max.
Ripple in band	1.5dB max.	—	1.0 dB max.
Stopband	70dB min. at fo -910KHz	50dB min. at fo -42.8MHz	20 dB min. at 869MHz
Attenuation	60dB min.	40dB min.	30 dB min.
Termination	900Ω/–2pF	500Ω / -7pF	50Ω
Operating temperature	-30° to +70°C	-10° to +50°C	–30 ~ + 70°C
Package	SS-13072	F-11 or SS-972A	SS-541

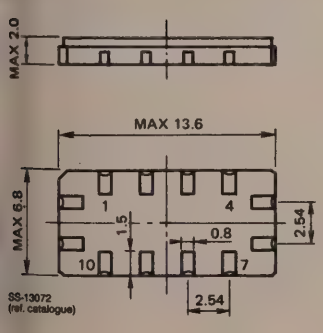
Surface Acoustic Wave Resonator

MODEL	TQS-301□-5R	TQS-302□-5R	TQS-303□-5R	TQS-304□-5R	TQS-305□-5R	TQS-306□-5R	TQS-307□-5R	TQS-308□-5R	TQS-309□-5R	TQS-310□-5R
Frequency (MHz)	303.875	310	471.25	591.25	567	668	674	680	704	710
Freq. tolerance at 25°C(kHz)	± 250	± 250	± 150	± 200	± 200	± 200	± 200	± 200	± 200	± 200
Insertion loss (dB)	18	18	12	12	12	12	12	12	12	12
Input, Output capacitance (pF)	1.4 ± 0.5	1.4 ± 0.5	2.3 ± 0.6	2.0 ± 0.6	2.0 ± 0.6	1.9 ± 0.6	1.9 ± 0.6	1.9 ± 0.6	1.9 ± 0.6	1.9 ± 0.6
Insertion phase shift	180° or 0° at F_c									
Turnover temp.	45° ± 30°C									
Operating temp. range	0° to +60°C									
Storage temp. range	-40° to +85°C									
Package	TO-39/2P3L									

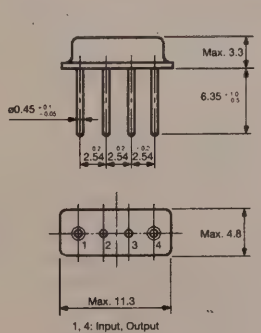
*Note: Please specify insertion phase shift with following Type Number (180°C to TQS-3XXA-5R, 0° to TQS-3XXB-5R)
*Note 2: Other frequencies and specifications of our SAW Resonator TQS-300 Series ranging from 200 to 1000 MHz are available upon request.

OUTLINE DRAWINGS †: Consult TOYOCOM to obtain detailed Outline Drawing for Package SS-541.

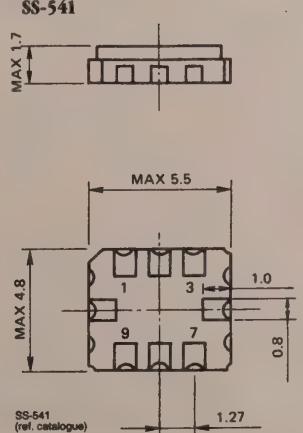
SS-13072



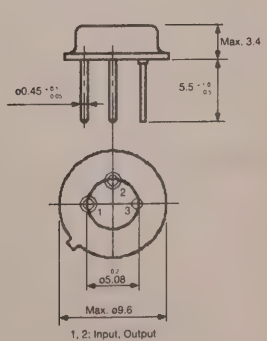
F-11



SS-541



TO-39/2P3L



Size: mm (inch)

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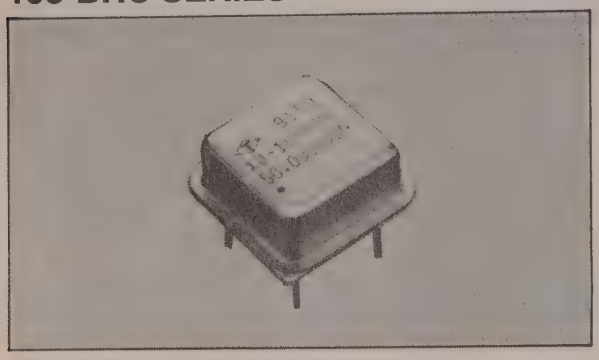
TAITIEN

CRYSTAL CLOCK OSCILLATORS

105-BHC SERIES



Features

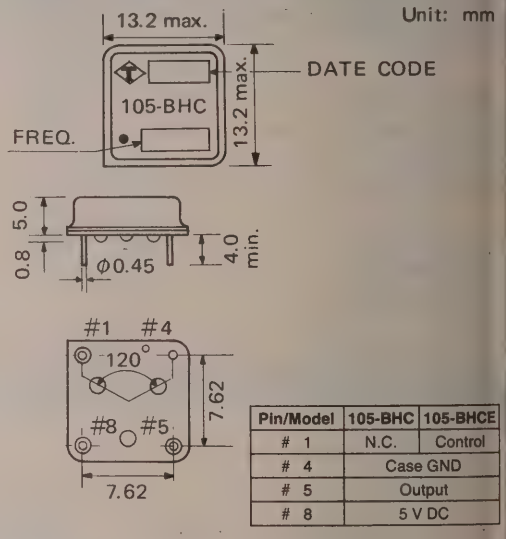
- Compatible with 8-pin dual in line
- HCMOS circuit, half size, space saving
- Hermetically sealed metal case and high reliability
- Case ground for minimizing RF radiation
- Tight symmetry (45 to 55%) available
- Tri-state output option available (Suffix E)

Model		105-BHC	105-BHCE	BHT-BHTE
Frequency range		1.0 to 80 MHz		
Frequency stability*		± 0.01% , ±0.005%, ±0.0025%		
Operating temperature range		0 to 70°C		
Storage temperature range		– 55 to 125°C		
Input voltage		5.0V DC ±10%		
Input current		15 mA max. (1 to 20 MHz) 50 mA max. (20 to 80 MHz)		
Output	Symmetry: SYM	40 to 60% (at 50% VDD)		at 1.4V
	Rise/Fall time: tr, tf	10 ns max. (1 to 20 MHz) 8 ns max. (20 to 80 MHz)		8 ns max. 6 ns max.
	Fanout	10 TTL		

truth table of control pin of tri-state series	pin 1	out put
	L (OPEN) H	Hi Z Active

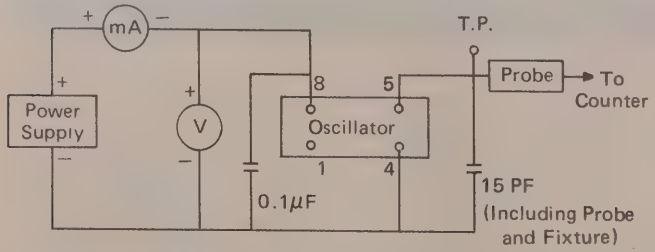
* Inclusive of calibration tolerance at 25°C, operating temperature, input voltage change, load change, aging, shock and vibration

Outline drawing

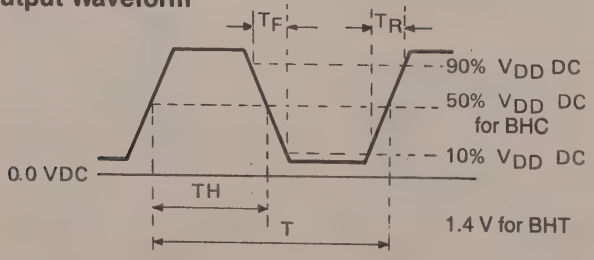


Pin/Model	105-BHC	105-BHCE
# 1	N.C.	Control
# 4	Case GND	
# 5	Output	
# 8	5 V DC	

Test circuit



Output Waveform



Test Conditions

Environmental:

Temperature cycle: – 40 to + 85°C, 100 cycles, 2 hrs. max. each

Shock: 500 G's 1 msec, ½ since wave, 3 shocks each plane

Vibration: 10–55 Hz, .060″ D.A., 55 Hz–2000 Hz 35 G's, duration time–12 hours

Humidity: 85% Relative humidity, @ + 40°C, 250 hours

Mechanical:

Gross leak test: All units 100% leak tested in de-ionized water. (760mmHg→200mmHg)

Fine leak test: Mass spectrometer leak rate less than 5 × 10^–7 atm. cc/sec. of helium

Seal strength: 2 lbs. max. force perpendicular to top and bottom

Bend test: Pins will withstand maximum bend of 90° reference to base for 2 bends.

Marking ink: Heat cured epoxy

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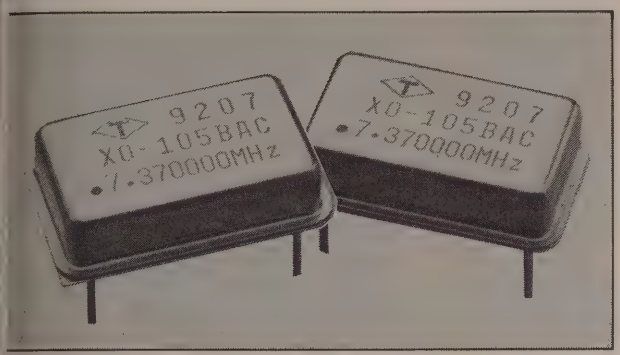
TAITIEN

CRYSTAL CLOCK OSCILLATORS

105-BAC/105-BIC/105-BBC SERIES



Features

- Compatible with 14-pin dual in line
- HCMOS circuit TTL/CMOS compatible for BIC
- Hermetically sealed metal case and high reliability
- Case ground for minimizing RF radiation
- Tight symmetry (45 to 55%) available for 105-BAC, & 105-BIC, very tight symmetry (49 to 51%) for 105-BBC Series
- Tri-state output option available (Suffix E) for 105-BAC/BAT Series

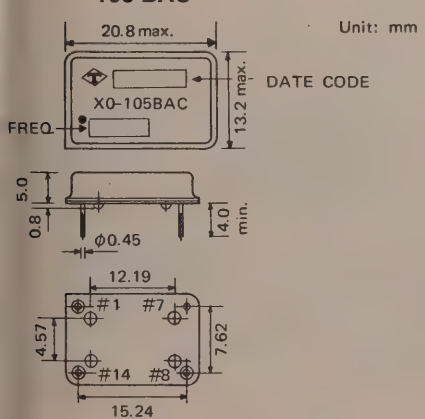
Model		105-BAC	105-BACE	BAT/BATE	105-BIC	105-BBC
Frequency range		1.0 to 80 MHz			8866 MHz	1.0 KHz81.0 MHz
Frequency stability*		± 0.01% , ±0.005%, ±0.0025%			± 0.01% , ±0.005%, ±0.0025%	± 0.01% , ±0.005%, ±0.0025%
Operating temperature range		0 to 70°C			0 to 70°C	0 to 70°C
Storage temperature range		– 55 to 125°C			– 55 to 125°C	– 55 to 125°C
Input voltage		5.0V DC ±10%			5.0V DC ±10%	5.0V DC ±10%
Input current		**15 mA max. (1 to 20 MHz) 50 mA max. (20 to 80 MHz)**			**20 mA max. (8 to 20 MHz) 50 mA max. (20 to 66 MHz)**	**10 mA max.**
Output	Symmetry: SYM	40 to 60% (at 50% VDD)		at 1.4V	40 to 60% (at 50% VDD)	51 to 49% (at 50% VDD)
	Rise/Fall time: tr, tf	10 ns max. (1 to 20 MHz) 8 ns max. (20 to 80 MHz)		8 ns max. 6 ns max.	10 ns max. (8 to 20 MHz) 8 ns max. (20 to 66 MHz)	10 ns max.
	Fanout	10 TTL			10 LSTTL	10 LSTTL

truth table of control pin of tri-state series	pin 1	out put
	L (OPEN) H	Hi Z Active

* Inclusive of calibration tolerance at 25°C, operating temperature, input voltage change, load change, aging, shock and vibration

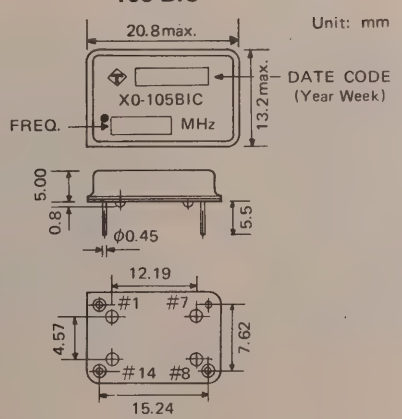
Outline drawing

105 BAC



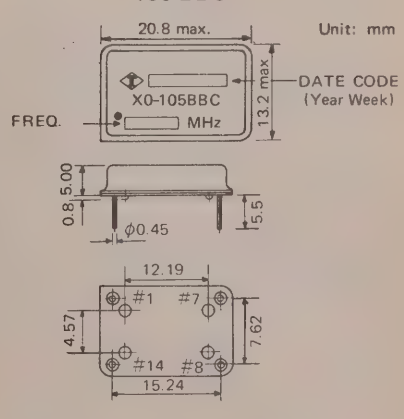
MODEL / PIN	105-BAC	105-BACE
# 1	N.C.	CONTROL
# 7	CASE GND	
# 8	OUTPUT	
# 14	5V DC	

105 BIC



PIN NO.	
# 1	N.C.
# 7	CASE GND
# 8	OUTPUT
# 14	+5V DC

105 BBC



PIN NO.	
# 1	N.C.
# 7	CASE GND
# 8	OUTPUT
# 14	+5V DC

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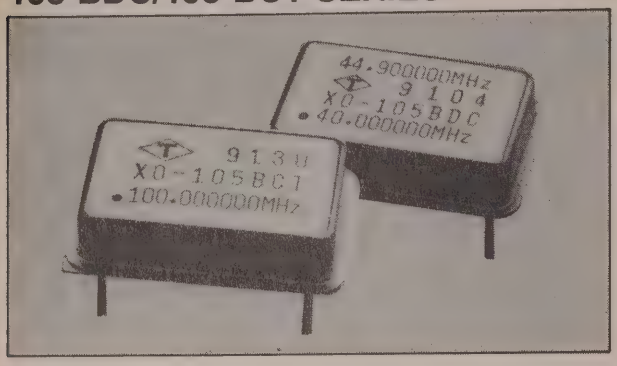
TAITIEN

CRYSTAL CLOCK OSCILLATORS

105-BDC/105-BCT SERIES



Features
- Compatible with 14-pin dual in line
- Hermetically sealed metal case and high reliability
- Case ground for minimizing RF radiation

105-BDC
- Dual outputs, space saving
- HCMOS circuit, TTL/CMOS compatible
- Tight symmetry (45 to 55%) available

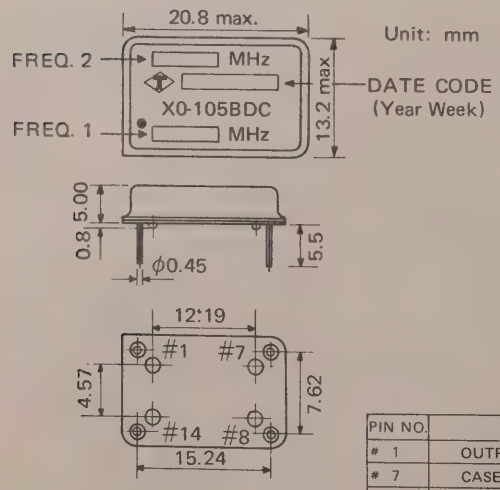
105-BCT
- Frequency Range 50–100 MHz
- Fast TTL Circuit, Direct drive TTL circuit
- 40/60 only

Model		105-BDC	105BCT
Frequency range		8 to 50MHz	50 to 100MHz
Frequency stability*		±0.01%, ±0.005%	±0.01% (±100PPM)
Operating temperature range		0 to 70°C	0 to 70°C
Storage temperature range		−55° to +125°C	−55° to +125°C
Input voltage		5.0V DC ±10%	5.0V DC ±10%
Input current		30mA max. [Both output (8 to 20MHz)] 45mA max. [one output (8 to 20MHz), the other output (20 to 50MHz)] 60mA max. [Both output (20 to 50MHz)]	50mA max. (50 to 70MHz) 90mA max. (70 to 100MHz)
Output	Symmetry: SYM	40 to 60% (at 50% VDD)	40 to 60% @ 1.4V
	Rise/Fall time: tr,tf	10ns max. (8 to 20MHz) 8ns max. (20 to 50 MHz)	4ns max. (50 to 70MHz) 3ns max. (70 to 100MHz)
	Fanout	10 LSTTL	10 TTL

*Inclusive of calibration tolerance at 25°C, operating temperature, input voltage change, load change, aging, shock and vibration.

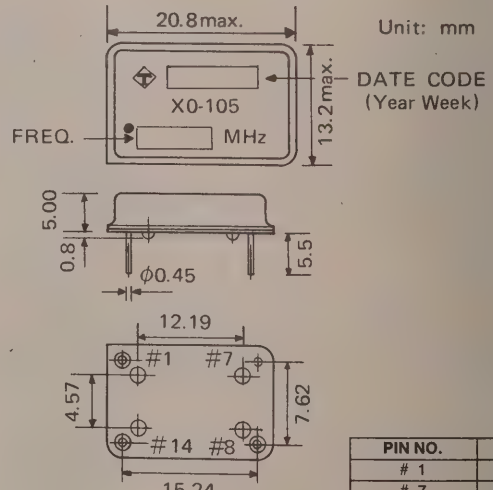
Outline drawing

105BDC



PIN NO.	
# 1	OUTPUT 1
# 7	CASE GND
# 8	OUTPUT 2
#14	+5V DC

105BCT



PIN NO.	
# 1	OUTPUT 1
# 7	CASE GND
# 8	OUTPUT 2
#14	+5V DC

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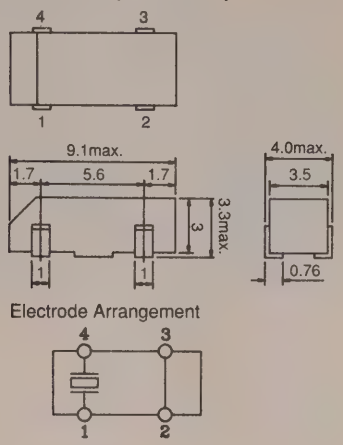
TAITIEN

QUARTZ CRYSTAL UNIT

CM200 (SMD TYPE)

Standard Specifications:
(Preliminary)
- Holder type CM200
- Normal frequency 32.768 KHz
- Frequency tolerance ±30 ppm (at 25°C)
- Turnover temperature 25°C ± 4°C
- Parabolic curvature constant −0.034 ± 0.006 ppm/°C²
- Equivalent series resistance 50 KΩ max.
- Load capacitance 12.5 pF max.
- Shunt capacitance 2.0 pF max.
- Drive level 1 μW typ.
- Operating temp. range −10°C ~ +60°C
- Insulation resistance 500MΩ min. at DC 100V ± 15V

Dimensions (Unit: mm)



CM309 (SMD TYPE)

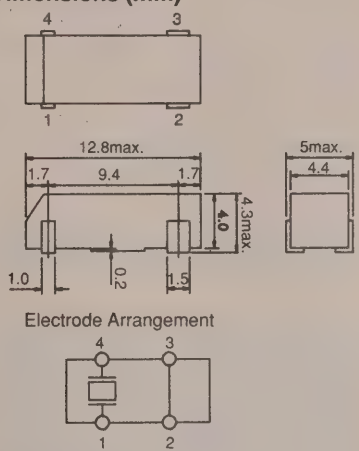
Standard Specifications:
(Preliminary)
- Frequency range 3.579545 ~ 20.0 MHz
- Mode of vibration AT-cut Thickness-shear Fundamental
- Equivalent series resistance See Table 1
- Drive level 50μW→500μW
- Load capacitance 16pF, 30pF

- Frequency tolerance ±50ppm
- Frequency stability ±50ppm.... −10°C ~ +60°C
- Operating temp. range −10°C ~ +60°C
- Shunt capacitance (C0) 7.0 pF max
- Insulation resistance 500MΩ min at DC 100V ±15V

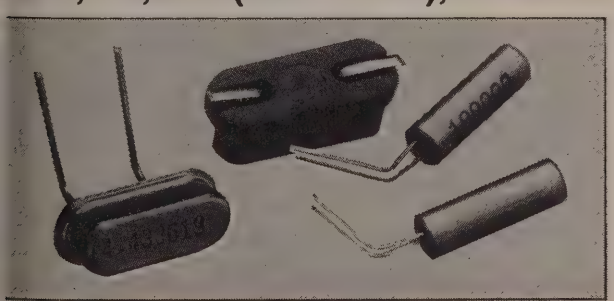
Equivalent Series Resistance (E.S.R.)
Table 1

Type / Frequency	Mode	E.S.R.
3.5 MHZ	F	200Ω Max
4.0 MHZ	F	150Ω
6.0 MHZ	F	100Ω
8.0 MHZ	F	80Ω
10.0 MHZ	F	50Ω
16.0 MHZ	F	50Ω
20.0 MHZ	F	50Ω

Dimensions (mm)

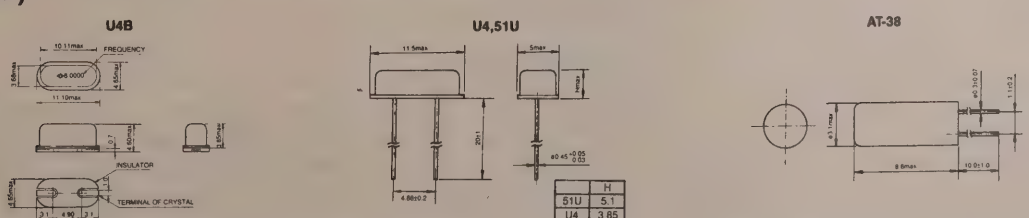


51U, U4, U4B(SMD TYPE), AT-38



Standard Specifications
- Frequency range: 51U, U4, 3.5 ~ 40MHz AT-38 3.57 ~ 25MHz
- Mode of vibration 3.5 ~ 25MHZ: AT-cut Thickness-shear 25 ~ 40MHz: BT-cut Thickness-shear Fundamental
- Drive level: 20μW→5mW
- Load capacitance Series resonance: 16pF, 20pF, 30pF, 32pF
- Frequency tolerance: ±30ppm, ±50ppm, ±100ppm.
- Frequency stability: ±100ppm.... −20°C to 70°C
- Operating temp. range: −10 ~ +60°C
- Storage temp. range: −30 ~ +80°C

Dimensions (mm)



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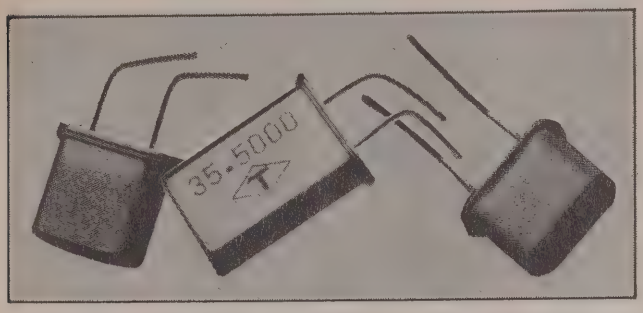
TAITIEN

QUARTZ CRYSTAL
TUNING FORK CRYSTAL

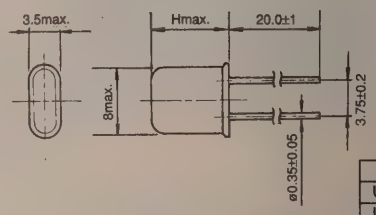
QUARTZ CRYSTAL UNITS UM-1(UM-5), 49U, SMD type.



- Temperature stability ±50ppm–20 ~ =70°C (±30ppm ±20 ±10)
- Aging ±5ppm/Year
  F: Fundamental
  3 RD: Third overtone
  5 TH: Fifth overtone

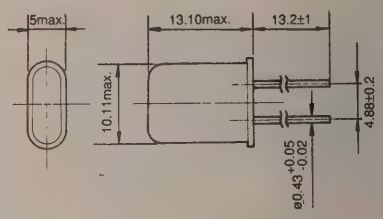
Dimensions (mm)

UM-1(UM-5)



	H
UM-1	8.0
UM-5	6.0

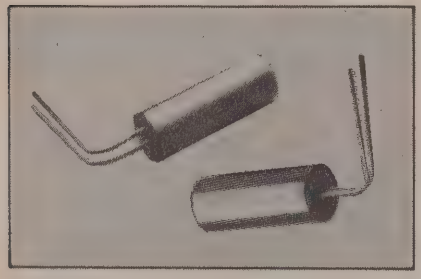
49U

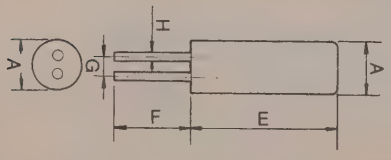


Standard Specifications:

- 6.4M ~125 MHZ (UM-1)
- 16M ~125 MHZ (UM-5)
- Frequency range 1.000 MHZ to 125.000 MHZ (49v)
- Mode of vibration
  AT-cut, Thickness-shear BT-cut, Thickness-shear Fund, 3rd, 5th.
- Drive level 10 μW–5mW
- Load capacitance
  Series resonance, 16pF, 20pF, 30pF, 32pF.
- Frequency tolerance
  ±10ppm, ±20ppm, ±30ppm, ±50ppm, ±100ppm
- Shunt Capacitance 7pF max

TUNING FORK CRYSTAL TC-2 × 6, TC-3 × 8, TC-3 × 10





Standard Specifications:

TYPE	TC-2 × 6	TC-3 × 8	TC-3 × 10	
Nominal Frequency	32.768KHz	30KHz ~ 80KHz	25KHz ~ 30KHz	80KHz–130KHz
Frequency Tolerance	±20 ±30 ±50 ±100 PPM			
Load Capacitance	*12.5pF (Typical)			
Drive Level	1μW max.			
Series Resistance	40KΩ max.		70KΩ max.	40KΩ max.
Q-Factor	60K (Typical)			
Turnover Temperature	25°C ± 5°C			
Parabolic Curvature Constant	– 0.042ppm/°C²/max.			
Shunt Capacitance	1.6 (Typical)		1.9 (Typical)	1.4 (Typical)
Capacitance Ratio (C_o/C_1)	Refer to Fig. 3			
Operating Temp. Range	– 10 ~ + 60°C			
Storage Temp. Range	– 30 ~ + 70°C			
Shock Resistance	± 3ppm max. Natural Drop 3 Times On the Hard Board from the Height of 75cm			
Insulation Resistance	500MΩmin./DC100V			
Dimensions	Refer to Drawing			

*AVAILABLE UPON REQUEST

Dimensions (mm)

Type	A	A'	E	F	G	H
TC-2 × 6	2.0	2.1 max.	6.0 max.	5.0 min.	0.7 ± 0.2	ϕ0.28 ± 0.05
TC-3 × 8	3.0	3.1 max.	8.2 max.	10 ± 1	1.1 ± 0.2	ϕ0.35 ± 0.07
TC-3 × 10	3.0	3.1 max.	10.0 max.	10 ± 1	1.1 ± 0.2	ϕ0.35 ± 0.07

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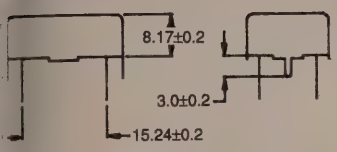
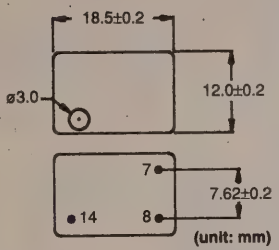
TAITIEN

TCXO

SERIES E

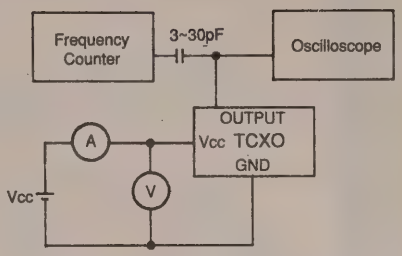
Dimensions





- Low power consumption
- Small size and low price

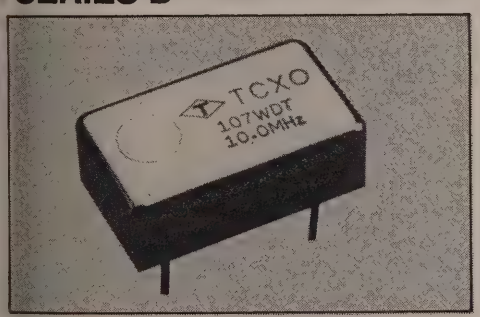
Pin connection
7. GND
8. Output
14. Vcc



Electrical Specifications

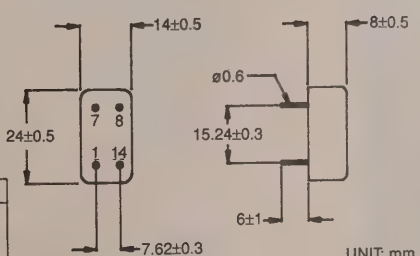
Model	057WET 057WEP	107CET 107CEP	207EET 207EEP	307GET 307GEP	307FET 307FEP
Output frequency	1MHz-20MHz				
Frequency stability vs. Temperature	±0.5ppm (0~55°C)	±1ppm (−10°C~+60°C)	±2ppm (−20°C~+70°C)	±3ppm (−30°C~+70°C)	±3ppm (−40°C~+80°C)
vs. Aging	<1ppm/year				
vs. Supply voltage	±0.25ppm/DC+5V±5%				
Power supply	DC+5V				
Output level	TTL/Clipped sine wave (1Vp–p min., 20KΩ//15pF)				
Dissipation current	TTL: 1MHz~15MHz 15mA max. 15MHz~20MHz 20mA max. Clipped sine wave: 2mA max.				
Operable temperature range	−10°C~+65°C	−20°C~+70°C	−30°C~+80°C	−40°C~+80°C	−45°C~+85°C
Frequency adjustment	±3ppm min. by internal trimmer				

SERIES D



- Low power consumption
- Small size and low price
- For portable equipment, frequency control marine radio system, communication application

Dimensions



Pin connection
1. GND (earth)
2. Output
3. Vcc (+5v)

Electrical Specifications

Model	TC-057 AD	TC-107WD	TC-207CD	TC-507ED
Output frequency	5MHz~20MHz			
Frequency stability vs. Temperature	±0.5ppm (+15°C~+35°C)	±1ppm (0°C~+55°C)	±2ppm (−10°C~+60°C)	±5ppm (−20°C~+70°C)
vs. Aging	±1ppm/year			
vs. Supply voltage	±0.4ppm/+5VDC±5%			
Power supply	DC+5V±5%			
Output level	TTL compatible			
Dissipation current	20 mA max.			
Operating temperature range	+5°C~+45°C	−10°C~+65°C	−20°C~+70°C	−30°C~+80°C
Frequency adjustment	±5ppm min. by means of internal trimmer			

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Clock Oscillators

TTL

	DIP, FLATPACK & SURFACE MOUNT		LCC
Series	**CO-401:** 4 Pin DIP **CO-402:** 14 Pin DIP ● **CO-406:** Surface Mount **CO-407:** Flatpack	**CO-238**	**CO-408**
Frequency	16 kHz-100 MHz	16 kHz-70 MHz	1 MHz-60 MHz
Output	Drives 10 TTL loads (above 50 MHz, CO-238 drives 2 Schottky loads).		
Supply	5 Vdc ±5% at 30-90 mA depending upon frequency.		
Accuracy (at 25°C)	**CO-40☐ A:** ±50 ppm **CO-40☐ C:** ±25 ppm **CO-40☐ D:** ±15 ppm **CO-40☐ B:** ±10 ppm ***CO-40☐ E:** ±1 ppm ☐ for 4 pin DIP 2 for 14 pin DIP 6 for surface mount 7 for flatpack *Set to ± 1 ppm via external capacitor (≤60 MHz only)	**CO-238A:** ±50 ppm **CO-238C:** ±25 ppm **CO-238D:** ±15 ppm **CO-238B:** ±10 ppm ***CO-238E:** ±1 ppm **Tuning adjust settable to ±1 ppm; available 16 kHz-30 MHz	**CO-408A:** ±50 ppm **CO-408C:** ±25 ppm
Temperature Stability	**STANDARD:** 0°C to +70°C: ±25 ppm Option **1:** -55°C to +85°C: ±50 ppm Option **2:** -55°C to +125°C: ±50 ppm Option **3:** 0°C to +50°C: ±3 ppm (only in CO-238) Option **5:** 0°C to +50°C: ±5 ppm Option **8:** 0°C to +50°C: ±10 ppm Option **7:** -55°C to +125°C: ±100 ppm ***Option **9:** -55°C to +200°C: ±300 ppm (only in CO-401/2/6/7 in 4-20 MHz range) ***Specified stability includes initial accuracy: do not specify A, B, C, D, or E		
Aging Rate (typical after 30 days)	3 ppm first year 2 ppm/year thereafter	5 ppm first year 3 ppm/year thereafter Opt "Y": 1 ppm/year	3 ppm first year 2 ppm/year thereafter
Size	†CO-401: 0.5" x 0.8" x 0.2" CO-402: 0.5" x 0.8" x 0.2" CO-406: 0.5" x 0.8" x 0.25 ††CO-407: 0.6" x 0.8" x 0.17" †CO-401 Series available with insulated standoffs; height increases to 0.23" ††0.12" opt. to 20 MHz	0.5" x 0.8" x 0.35"	0.48" x 0.48" x 0.085"
Case	Resistance welded metal case	Epoxy Case	Sealed ceramic leadless chip carrier

● Available as QPL to MIL-O-55310 /18 & /19

Improved accuracy/stability available on some models. (e.g. f_0 ± 7 ppm 0/50°C; f_0 ± 10 ppm 0/70°C) Improvement over wider temp ranges also available. Please contact factory

CMOS/HCMOS

	CMOS (5V)	CMOS (8-15V)	HCMOS (5V)	HCMOS LCC
Series	**CO-421:** 4 Pin DIP **CO-422:** 14 Pin DIP ● **CO-426:** Surface Mount **CO-427:** Flatpack	**CO-411:** 4 Pin DIP **CO-412:** 14 Pin DIP ● **CO-416:** Surface Mount **CO-417:** Flatpack	**CO-441:** 4 Pin DIP ● **CO-442:** 14 Pin DIP ● **CO-446:** Surface Mount **CO-447:** Flatpack	**CO-448**
Frequency	1 Hz-8 MHz	1 Hz-15 MHz	1 Hz-175 MHz	12.5 MHz-50 MHz
Output	Standard CMOS	Standard CMOS	HCMOS/ACMOS	HCMOS
Supply	5 Vdc ±5%	8-15 Vdc	5 Vdc ±5% (3 Vdc opt. to 20 MHZ)	5 Vdc ±5%
Accuracy (at 25°C)	**CO-42☐ A:**±50 ppm **CO-42☐ C:** ±25 ppm **CO-42☐ D:**± 15 ppm **CO-42☐ B:**± 10 ppm ***CO-42☐ E:** ±1 ppm	**CO-41☐ A:**±50 ppm **CO-41☐ C:**±25 ppm **CO-41☐ D:**±15 ppm **CO-41☐ B:**±10 ppm ***CO-41☐ E:** ±1 ppm	**CO-44☐ A:**±50 ppm **CO-44☐ C:**±25 ppm **CO-44☐ D:**±15 ppm **CO-44☐ B:**±10 ppm ***CO-44☐ E:** ±1 ppm	**CO-448A:** ±50 PPM **CO-448C:** ±25 PPM
	☐ for 4 pin DIP 2 for 14 pin DIP 6 for surface mount 7 for flatpack *Settable to ± 1 ppm via external capacitor (≤60 MHz only)			
Temperature Stability	**STANDARD:** 0°C to +70°C: ±25 ppm Option **1:** -55°C to +85°C: ±50 ppm Option **2:** -55°C to +125°C: ±50 ppm Option **6:** 0°C to +50°C: ±5 ppm Option **8:** 0°C to +50°C: ±10 ppm Option **7:** -55°C to +125°C: ±100 ppm *Option **9:** -55°C to +200°C: ±300 ppm (only to 20 MHz; N/A in CO-448) *Specified stability includes initial accuracy: do not specify A, B, C, D, or E			
Aging Rate (typical after 30 days)	**CO-440 Series** ●Tri-state available 4 MHz to 175 MHz 3 ppm first year 2 ppm/year thereafter			
Size	†CO-411/421/441: 0.5" x 0.8" x 0.2" CO-412/422/442: 0.5" x 0.8" x 0.2" CO-416/426/446: 0.5" x 0.8" x 0.25 ††CO-417/427/447: 0.6" x 0.8" x 0.17" †4 Pin DIP series available with insulated standoffs; height increases to 0.23" ††0.12" opt. to 20 MHz		CO-446 ●1/2 DIP Available 0.5 x 0.5 x 0.23"	0.48" x 0.48" x 0.085"
Case	Resistance Welded Metal Case			Sealed ceramic leadless chip carrier

● Available as QPL to MIL-O-55310 /18 & /19

Improved accuracy/stability available on some models. (e.g. f_0 ± 7 ppm 0/50°C; f_0 ± 10 ppm 0/70°C) Improvement over wider temp ranges also available. Please contact factory

Sinewave Oscillators

	50 Hz to 4 MHz	4 MHz to 500 MHz			500.1 MHz to 2.6 GHz	
Series	*Low Frequency* **CO-281**	*Basic Line* **CO-233 (H, F, FW)**	*Reduced Size Line* **CO-285W** (SMA) **CO-285P** (pcb mt.)	*Miniature Hybrid* **CO-484** (DIP) **CO-487** (Flatpack)	*Reduced Size Line* **CO-286W** (SMA) **CO-286P** (pcb mt.)	*Very High Freq.* **CO-287W**
Frequency	50 Hz to 4 MHz	4 MHz to 500 MHz	4 MHz to 500 MHz	4 MHz to 500 MHz	500.1 MHz to 1.3 GHz	1.31 GHz to 2.6 GHz
Output	Std - 1 Vrms/1 kΩ Opt - 0 dBm/50Ω to + 20 dBm/50Ω	Standard - > 0.5 Vrms/50Ω (+ 7 dBm) Option R: > 1 Vrms/50Ω (+ 13 dBm) High level option: 1 watt (+ 30 dBm) available in 2" x 3" x ¾" package Model CO-284W			Standard: > 0.5 Vrms/50Ω (+ 7 dBm) Option R: > 1.0 Vrms/50Ω (+ 13dBm) High output opt. +20 dBm/50Ω to 1.3 GHz (in 2" x 3" x ¾" pkg.)	
Supply	+ 15 Vdc - 5%	+ 15 Vdc - 5% (Any supply in 12-24 Vdc range optional; supply less than 15 Vdc subject to reduced output level)			+ 15 Vdc - 5%	
Accuracy (at 25°C)	Standard: - 10 ppm *Option T: - 1 ppm	Standard: - 10 ppm *Option T: - 1 ppm	Standard: - 10 ppm *Option T: - 1 ppm	**CO-484A:** - 50 ppm **CO-484C:** - 25 ppm **CO-484D:** - 15 ppm **CO-484B:** - 10 ppm	Standard: - 10 ppm *Option T: - 1 ppm *Tuning adjust settable to - 1 ppm	
	*Tuning adjustment settable to - 1 ppm					
Temperature Stability	**Standard:** 0°C to +70°C: - 25 ppm Option 1: 55°C to +85°C: - 50 ppm Option 2: -55°C to +125°C: - 50 ppm (not available in CO-284W CO-287W) Option 3: 0°C to +50°C: - 3 ppm (not available in CO-284W CO-484, CO-487 CO-287W) Option 4: 0°C to +50°C: - 1 ppm (only in CO-281) Option 5: 0°C to +50°C: - 5 ppm Option 6: 0°C to +50°C 10 ppm For higher stability see sections describing Vectron TCXOs and oven-controlled types					
Aging Rate (after 30 days)	Standard: 5 ppm first year, 3 ppm per year thereafter Option Y: 2 ppm first year 1 ppm per year thereafter			3 ppm first year 2 ppm per year thereafter	Standard: 5 ppm first year, 3 ppm per year thereafter Option Y: 2 ppm first year, 1 ppm per year thereafter	
Phase Noise (typical 4-100 MHz)	Offset from Carrier: Standard: *Option L1: **Option L2 100 Hz -100 dBc/Hz -115 dBc/Hz -120 dBc/Hz 1 kHz -125 dBc/Hz -140 dBc/Hz -145 dBc/Hz 10 kHz -140 dBc/Hz -150 dBc/Hz -160 dBc/Hz 50 kHz -145 dBc/Hz -155 dBc/Hz -160 dBc/Hz				Noise degrades by 6 dB per octave above 100 MHz *L1 Option is not available in CO-281 CO-484, CO-487 CO-284W **L2 Option is available only in CO-233FW and is limited to 200 MHz; above 100 MHz, output of CO-233FW/L2 is restricted to + 7 dBm	
Size	2" x 2" x ¾" 2" x 2" x ½" optional	CO-233, CO-233H 1½" x 1½" x ⅝" CO-233F, CO-233FW 2" x 2" x ¾"	1" x 1.6" x 0.5"	**CO-484** 0.8" x 1.0" x 0.20" **CO-487** 1" x 1" x 0.17"	**CO-286W** (P): 1" x 2" x 0.6" High output opt: 2" x 3" x ¾"	2" x 2 ½" x ½"
Configuration	pins for pcb mount Option "W" SMA connector Option "U" SMC connector Option "X" BNC connector	**CO-233** (4-149 MHz) pcb mount **CO-233H** (150-300 MHz) pcb mount **CO-233FW** (4-500 MHz)SMA connector pins and studs on base **CO-233F** (4-500 MHz) pcb mount	**CO-285W** pins on base SMA on side **CO-285P** pcb mount 7 pins on base	**CO-484** 16 pin double DIP **CO-487** 16 pin flatpack	**CO-286W** SMA on 1" x 0.6" side pins on base **CO-286P** pcb mount without SMA High output opt: SMA and pins on 2" x ¾" side studs on base	SMA on side pins on base

To order Vectron Crystal Oscillators or for Engineering Assistance...call (203) 853-4433

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The Crystal Oscillator Company
VECTRON LABORATORIES, INC.
166 Glover Avenue, P.O. Box 5160, Norwalk, CT 06856-5160
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Available as QPL to MIL-0-55310/25B

ECL

CO-439 / CO-459
• ½ DIP available
0.5" x 0.5" x 0.23"

NEW!

CO-434 (200-300 MHz) and CO-454 (200-625 MHz) available in 1" x 1" x 0.17" flatpack

	10K, 10KH, MECLIII		100K ECL, ECLinPS	
Series	**CO-431:** 4 Pin DIP **CO-432:** 14 Pin DIP● **CO-434:** 16 Pin Double DIP **CO-436:** Surface Mount **CO-437:** Flatpack	**CO-233ME** **CO-233MEH**	**CO-451:** 4 Pin DIP **CO-452:** 14 Pin DIP **CO-454:** 16 Pin Double DIP **CO-456:** Surface Mount **CO-457:** Flatpack	**CO-233KEQ**
Frequency	**CO-434:** 200.1 MHz to 300 MHz **Other models:** 5.0 MHz to 200 MHz		**CO-454:** 200.1 MHz to 625 MHz **CO-233KEQ:** 150.0 MHz to 700 MHz **Other Models:** 5.0 MHz to 200 MHz	
Output	Output taken directly from 10K, 10KH or MECLIII gate, depending on frequency. Complementary outputs optional (Standard in CO-434)		≤400 MHz: 100K ECL >400 MHz: ECLinPS Complementary outputs standard in CO-454, optional in CO-452 and CO-457	≤400 MHz: from 100K gate >400 MHz: from ECLinPS gate complementary outputs
Supply	−5.2V ±5%: <40 mA from 5 to 110 MHz <60 mA above110 MHz		Standard: −4.5V ±5% at <60 mA Option **F**: −5.2V ±5% at <70 mA	
Accuracy (at 25°C)	**CO-43□ A:** ±50 ppm **CO-43□ C:** ±25 ppm **CO-43□ D:** ±15 ppm **CO-43□ B:** ±10 ppm ***CO-43□ E:** ± 1 ppm	5-149.9 MHz models **CO-233ME:** ±10 ppm ***CO-233MET:** ±1 ppm	**CO-45□ A:** ±50 ppm **CO-45□ C:** ±25 ppm **CO-45□ D:** ±15 ppm **CO-45□ B:** ±10 ppm **CO-45□ E:** ± 1 ppm*	**CO-233KEQ:** ±10 ppm ***CO-233KEQT:** ±1 ppm *Tuning adjustment settable to ±1 ppm with ±5 ppm nominal range: available to 500 MHz.
	*E= set to ±1 ppm via external capacitor (≤60 MHZ only) T= set to ±1 ppm via internal capacitor			
	1 4 pin DIP 2 14 pin DIP 4 double DIP 6 surface mount	150-200 MHz models: **CO-233MEHA:** ±50 ppm **CO-233MEHB:** ±10 ppm	1 4 pin DIP 2 14 pin DIP 4 double DIP 6 surface mount 7 flatpack	
Temperature Stability	**STANDARD:** 0°C to +70°C: ±25 ppm Option 1: −55°C to +85°C: ±50 ppm Option 2: −55°C to +125°C: ±50 ppm Option 3: 0°C to +50°C: ±3 ppm Option 5: 0°C to +50°C: ±5 ppm Option 6: 0°C to +50°C: ±10 ppm Option 7: −55°C to +125°C: ±100 ppm		(Only available in Model CO-233ME and CO-233KEQ)	
	−1, −2, −7 restricted to −30/+85°C above 110 MHz in CO-233ME.			
Aging Rate (typical after 30 days)	3 ppm first year 2 ppm/year thereafter	5 ppm first year 3 ppm/year thereafter Opt. "Y": 1 ppm/year	3 ppm first year 2 ppm/year thereafter	5 ppm first year 3 ppm/year thereafter Opt. "Y": 1 ppm/year
Size	#CO-431: 0.5" x 0.8" x 0.2" CO-432: 0.5" x 0.8" x 0.2" CO-434: 0.8" x 1.0" x 0.2" CO-436: 0.5" x 0.8" x 0.25" CO-437: 0.6" x 0.8" x 0.17"	1.5" x 1.5" x 0.625" CO-233ME: 4 pin base CO-233MEH: 5 pin base	#CO-451: 0.5" x 0.8" x 0.2" CO-452: 0.5" x 0.8" x 0.2" CO-454: 0.8" x 1.0" x 0.2" CO-456: 0.5" x 0.8" x 0.25" CO-457: 0.6" x 0.8" x 0.17"	1.5" x 1.5" x 0.5"
Case	Resistance welded metal case #CO-431 available with insulated standoffs, increases height to 0.23"	Metal case "C" option: meets gross leak test	Resistance welded metal case #CO-451 available with insulated standoffs; increases height to 0.23"	Metal case "C" option: meets gross leak test

•Available as MIL-0-55310 25B

Improved accuracy/stability available on some models (e.g. ±.7 ppm 0/50°C). Improvement over wider temp ranges also possible. Please contact factory.

VCOs Non-Crystal Oscillators

NEW!

OPTION
• VC-373 available in flatpack (Model CO-377)

Series	VC-381	VC-371	VC-373
Center Frequency	10 Hz to 500 kHz	500 kHz to 500 MHz	1 MHz to 100 MHz
Deviation	±10%; wider and narrower deviation optional to a full octave (limited to 300 MHz in VC-371 and 82 MHz in VC-373)		
Control Voltage	±5V (higher and lower sensitivity optional)		0 to +5V (±5V optional)
Linearity	±1%	±10% standard (±3% and ±1% optional with limited deviation)	±10%
Transfer Function	Positive	Negative	Positive for 0 to 5V Negative for ±5V
Accuracy (25°C)	±0.5% (tuning adjust optional, settable to ±0.1%)		N/A
Temperature Stability	**Standard:** 0/ +50°C: ±1.5% Option **1:** −20/ +70°C: ± 3% Option **2:** −55/ +85°C: ± 6%	**Standard:** 0/ +50°C: ±1% Option **1:** −20/ +70°C: ±2% Option **2:** −55/ +85°C: ±4% *Option **3:** 0/ +50°C: ±0.3% *Option **4:** −20/ +70°C: ±0.5% *Only for deviation ≤±10% Improved stability with oven	**Std:** 0/ + 50°C: ±2% ±1% Opt **1:** −20/ + 70°C: ±3% ±2% Opt **2:** −55/ + 85°C: ±5% ±4% Opt **3:** −55/ +125°C: ±6% ±5% *unipolar control voltage-standard **bipolar control voltage-optional
Output Level	>1 Vrms into 1kΩ (TTL and CMOS optional)	>0.5 Vrms into 50Ω (TTL, CMOS, ECL optional)	TTL (HCMOS/ACMOS optional to 100 MHz)
Supply Voltage	15 Vdc ±5% (12-28 Vdc optional) +5 Vdc required for TTL; −5.2 Vdc required for ECL		5 Vdc ±5%
Size	2" x 2" x ¾" (51 x 51 x 19 mm), reduced height optional		0.5" x 0.8" x 0.2"
Configuration	Pins on base for pc board mounting Option "**W**": SMA, pins and mounting studs on base Option "**SW**": SMA on side, pins on base (size is 2" x 2⅛" x ¾")		4 pin DIP (Surface mount and flatpack pkg's available)

NEW!

CO-374W/P
•Now available to 1 GHz in a 1" x 1.5" x 0.5" pcb mounting package

Clock TCXOs

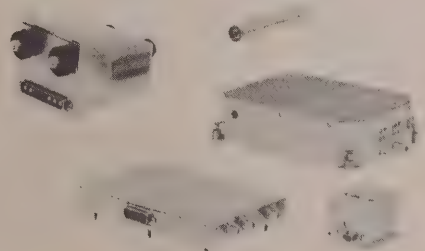
TTL CMOS

	Lowest Price	Smallest size: DIP pin configuration	
Frequency	12kHz-20 MHz	32 kHz-20 MHz	300 Hz-15 MHz
Temperature Stability (Temp. Range A) + 15°C to + 35°C:	**CO-231A57:** ±5 x 10^{-7}	**CO-532A57:** ±5 x 10^{-7}	**CO-236A57:** ±5 x 10^{-7}
(Temp. Range **B**) 0°C to + 50°C:	**CO-231B16:** ±1 x 10^{-6}	**CO-532B16:** ±1 x 10^{-6}	**CO-236B16:** ±1 x 10^{-6}
(Temp. Range **C**) 0°C to + 70°C:	**CO-231C36:** ±3 x 10^{-6}	**CO-532C36:** ±3 x 10^{-6}	**CO-236C36:** ±3 x 10^{-6}
(Temp. Range **D**) −20°C to + 70°C:	**CO-231D56:** ±5 x 10^{-6}	**CO-532D56:** ±5 x 10^{-6}	**CO-236D56:** ±5 x 10^{-6}
(Temp. Range **E**) −40°C to + 75°C:	**CO-231E15:** ±1 x 10^{-5}	**CO-532E15:** ±1 x 10^{-5}	**CO-236E15:** ±1 x 10^{-5}
(Temp. Range **F**) −55°C to + 85°C:	**CO-231F25:** ±2 x 10^{-5}	**CO-532F25:** ±2 x 10^{-5}	**CO-236F25:** ±2 x 10^{-5}
Aging Rate	1 x 10^{-6} per year		
Output	TTL compatible (drives 10 TTL loads)		CMOS compatible
Supply	+5 Vdc ± 5%		+12 Vdc ± 5% (9-15 Vdc optional)
Current	4-20 MHz: <30 mA <4 MHz: 40-80 mA	8-20 MHz: <30 mA <8 MHz: 40-80 mA	3-10 mA depending upon frequency
Frequency Adjustment	settable to 1 x 10^{-6}		
Size	1⅛" x 1⅛" x ½" (38 x 38 x 13 mm) pcb mount housed in metal can with epoxy base	1" x 1" x 0.38" (26 x 26 x 10 mm) DIP compatible pin configuration metal can with metalized base	1⅛" x 1⅛" x ½" (38 x 38 x 13 mm) pcb mount housed in metal can with epoxy base

Custom Products

Vectron offers the broadest available line of standard product crystal oscillators. With these products as a base, Vectron has produced special crystal oscillators in virtually every conceivable package, some of which are pictured below. Further, Vectron has engineered and produced a variety of crystal oscillator based sub-systems; photos of some of these are also shown below. We welcome the opportunity to design and construct custom crystal oscillator related products for your specific needs.

See the last two pages for other new products!



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VECTRON
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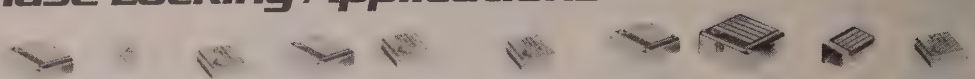
Telephone: (203) 853-4433 Fax (203) 849-1423

VCXOs Voltage Controlled Crystal Oscillators for Phase Locking Applications



	TTL		HCMOS/ACMOS	ECL		SINEWAVE			
Configuration	PC board mount	low profile hybrid DIP	low profile hybrid DIP	low profile hybrid DIP Std. ECL	low profile hybrid DIP 100K ECL	PC board mount		rf output connector	low profile hybrid DIP
Series	(a) CO-231V (b) CO-231VH	CO-401V CO-402V	CO-441V CO-442V	CO-434V	CO-454V	(a) CO-233V (b) CO-233VH	(a) CO-233VF (b) CO-286VP	(a) CO-233VFW (b) CO-286VW	(a) CO-484V (b) CO-487V
Center Frequency	(a) 32 kHz-25 MHz (b) 25.1-70 MHz	32 kHz-20 MHz	32 kHz-70 MHz	8-200 MHz	8-200 MHz	(a) 8-149.9 MHz (b) 150-200 MHz	(a) 8-400 MHz (b) 400.1-1200 MHz	(a) 8-400 MHz (b) 400.1-1200 MHz	8-200 MHz
Supply Voltage (± 5%)	+ 5 Vdc		+ 5 Vdc	–5.2 Vdc	–4. 5/–5.2 Vdc	+ 15 Vdc (+12 Vdc to + 24 Vdc optional)			

Deviation/ Stability Alternatives

Code	Temperature Range	Temperature Stability	Minimum Deviation
G	0/ + 50°C	± 10 ppm	± 30 ppm
A	0/ + 50°C	± 20 ppm	± 50 ppm
B	0/ + 50°C	± 35 ppm	± 100 ppm
C*	0/ + 50°C	± 35 ppm	± 200 ppm
D	0/ + 70°C	± 20 ppm	± 40 ppm
E	0/ + 70°C	± 40 ppm	± 100 ppm
F*	0/ + 70°C	± 40 ppm	± 200 ppm

Code	Temperature Range	Temperature Stability	Minimum Deviation
G	–20/ + 70°C	± 30 ppm	± 60 ppm
H	–20/ + 70°C	± 40 ppm	± 100 ppm
I*	–20/ + 70°C	± 40 ppm	± 200 ppm
J	–40/ + 85°C	± 40 ppm	± 60 ppm
K	–40/ + 85°C	± 50 ppm	± 100 ppm
L*	–40/ + 85°C	± 50 ppm	± 200 ppm
M	–55/ + 85°C	± 50 ppm	± 100 ppm
N*	–55/ + 85°C	± 50 ppm	± 200 ppm

NOTE: Surface Mount and Flatpack Packages are available for most models. Please contact factory for assistance

*The following notes apply to options C, F, I, L and N (± 200 ppm deviation)
- They are only available at frequencies up to 25 MHz (75 MHz for ECL & Sinewave Models)
- Linearity of ± 10% is standard
- Model CO-231V which is normally packaged in a 1.5" x 1.5" x 0.5" metal can with epoxy base, requires a metal base which increases height to 5/8"; pin diameter is then .030"

Contact factory for wider deviation requirements

Control Voltage	0 to 5 V; positive transfer function (lowest frequency at 0 V) *Bipolar control optional (±3 V to ±10 V, 625 kHz to 70 MHz)	0 to 5 V; positive transfer function (lowest frequency at 0 V) *Bipolar control optional (±3 V to ±10 V)	0 to –5 V (lowest frequency at 0 V) *Bipolar control optional (± 3 V to ± 10 V)	0 to + 6 V positive transfer function (lowest frequency at 0V) * ± 3 V to ±10 V optional except for CO-286V			
Linearity	*With bipolar control voltage option, transfer function is negative, linearity is ±10% and an additional + 12 V to + 24 V supply is required for ECL models			± 20% (± 10% optional); ± 10% is standard with bipolar control voltage and with deviation/stability options C, F, I, L and N			
Mechanical Tuning Options	"T"	N/A	N/A	N/A	"T"	"T"	"T"	N/A
	"T" indicates that a mechanical tuning option is available; add "T" to model number			"T" indicates that a mechanical tuning option is available; add "T" to model number			
Size	(a) CO-231V 1⅛" x 1⅛" x ½" (b) CO-231VH 1⅛" x 1⅛" x ½"	0.5" x 0.8" x 0.2" CO-401V: 4 pin CO-402V: 14 pin	0.5" x 0.8" x 0.2" CO-441V: 4 pin CO-442V: 14 pin	0.8" x 0.98" x 0.2" 16 pin double DIP	1½" x 1½" x ½" CO-233V & VH differ in pin configuration	(a) 2" x 2" x ¾" (b) 1" x 2" x 0.6"	(a) 2" x 2" x ¾" (b) 1" x 2" x 0.6"	(a) 16 pin double DIP 0.8" x 0.98" x 0.2" (b) Flatpack 1.0" x 1.0" x 0.17"

Wide Deviation Linear VCXOs

	BASIC VCXOs		TEMPERATURE COMPENSATED (TC/VCXOS)		OVEN CONTROLLED (OC/VCXOs)	
Series	CO-271	CO-275, CO-275H	CO-351	CO-352	CO-272	CO-276
Center Frequency	to 23 MHz	23.1 600 MHz	to 20 MHz	20.1-500 MHz	to 23 MHz	23.1-500 MHz
Deviation	± .001% to ± .25%. Model Codes for ± .01%, ± .03%, ± .1%, and ± .25% are shown in the stability section below (for deviation exceeding ± 0.25% consider a Vectron non-crystal VCO or custom VCXO)					
Control Voltage	± 5 volts (higher or lower sensitivity, or unipolar control, available); Negative transfer function					
Linearity	"H": ± 5% (smooth monotonic characteristic with no discontinuities) "A": ± 3% "B": ± 1%					

Stability (at f_0)

	(Temperature Range B) 0°C to + 50°C		(Temperature Range D) –20°C to + 70°C		(Temperature Range F) –55°C to + 85°C		(Temperature Range B) 0°C to + 50°C		(Temperature Range D) –20°C to + 70°C		(Temperature Range F) –55°C to + 85°C		(Temperature Range B) 0°C to + 50°C		(Temperature Range D) –20°C to + 70°C		(Temperature Range F) –55°C to + 85°C	
	Code	Stability	Code	Stability	Code	Stability	Code	Stability	Code	Stability	Code	Stability	Code	Stability	Code	Stability	Code	Stability
± .01% deviation (G)	GB35 GB15	± .003% ± .001%	GD55 GD35	± .005% ± .003%	GF55	± .005%	GB36 GB57	± .0003% ± .00005%	GD56 GD16	± .0005% ± .0001%	GF25 GF56	± .002% ± .0005%	GB37	± .00003%	GD57	± .00005%	GF16	± .0001%
± .03% deviation (H)	HB55 HB25	± .005% ± .002%	HD14 HD55	± .01% ± .005%	HF14	± 01%	HB15 HB56	± .001% ± .0005%	HD15 HD56	± .001% ± .0005%	HF55 HF25	± .005% ± .002%	HB16	± 0001%	HD26	± .0002%	HF56	± .0005%
± .1% deviation (L)	LB14 LB35	± .01% ± .003%	LD24 LD14	± .02% ± .01%	LF34	± .03%	LB25 LB15	± .002% ± .001%	LD55 LD25	± .005% ± .002%	LF14 LF55	± .01% ± .005%	LB36	± .0003%	LD56	± .0005%	LF15	± .001%
± .25% deviation (K)	KB34 KB14	± .03% ± .01%	KD54 KD34	± .05% ± .03%	KF13	± .1%	KB14 KB35	± .01% ± .003%	KD24 KD14	± .02% ± .01%	KF34 KF24	± .03% ± 02%	—		—		—	

Output Level	Sinewave is standard (3.5-600 MHz; TTL optional (3.5-100 MHz); ECL optional (20-200 MHz); lower frequency sine/TTL, and CMOS/HCMOS available on special order.							
Supply Voltage	15 Vdc ± 5% standard; 12-28 Vdc optional. + 5 Vdc required for TTL; – 5.2 Vdc required for ECL					24 Vdc standard; 12-28 Vdc optional. + 5 Vdc required for TTL – 5.2 Vdc required for ECL		
Frequency Adjust	Screwdriver adjustment permits setting center frequency; range is approximately 10% of deviation, but no less than ± .001%							
Size	2" x 2" x ¾" (51 x 51 x 19 mm) 2" x 2¼" x ¾" for SW option	2" x 3" x ¾" (51 x 77 x 19 mm) (reduced size available)	2" x 2" x ¾" (51 x 51 x 19 mm) 2" x 2¼" x ¾" for SW option	2" x 3" x ¾" (51 x 77 x 19 mm)	2" x 2" x 4" (51 x 51 x 102 mm)	2" x 2" x 4" (51 x 51 x 102 mm)		
Configuration Options	pins for pc board mounting (rf output connector option recommended above 200 MHz) "W": SMA, pins and mounting studs on base "SW": SMA on side, pins on base (studs optional on CO-271SW, Std on CO-275SW) (SMC connector available)		pins for pcb mount "W": SMA, pins and mounting studs on base "SW": SMA on side, pins on base (studs optional) (SMC connector available)	pins for pcb mount and studs (rf output connector option recommended above 200 MHz) "SW": SMA on side, pins and studs on base (SMC connector available)	octal plug-in, studs "W": SMA, solder header, studs "U": SMC, solder header, studs "X": BNC, solder header, studs	SMC, solder header, studs "W": SMA, solder header, studs "X": BNC, solder header, studs		

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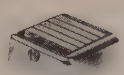
TCXOs Temperature Compensated Crystal Oscillators

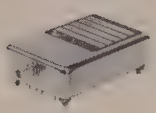
Basic TCXOs

•CO-566 series mini TCXO 0.8" x 1.4" x 0.2" see last page

NEW!



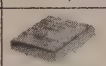
NEW!



•CO-590 series MCXO available with ±5 x 10^{-8} stability

	50 Hz to 20 MHz		20.1 MHz to 140 MHz	140 MHz to 420 MHz	420 MHz to 630 MHz	630 MHz to 1 GHz
	CO-251 SERIES Moderate Stability	**CO-252 SERIES** High Stability	**CO-254 SERIES**	**CO-255 SERIES**	**CO-256 SERIES**	**CO-856 SERIES**
Temperature Stability (Temp. Range A) + 15°C to +35°C	**CO-251A57:** ± 5 x 10^{-7} **CO-251A27:** ± 2 x 10^{-7}	**CO-252A17:** ± 1 x 10^{-7} **CO-252A58:** ± 5 x 10^{-8}	**CO-254A57:** ± 5 x 10^{-7} **CO-254A17:** ± 1 x 10^{-7}	**CO-255A57:** ± 5 x 10^{-7} **CO-255A17:** ± 1 x 10^{-7}	**CO-256A57:** ± 5 x 10^{-7} **CO-256A17:** ± 1 x 10^{-7}	**CO-856A57:** ± 5 x 10^{-7} **CO-856A17:** ± 1 x 10^{-7}
(Temp. Range B) + 0°C to +50°C	**CO-251B16:** ± 1 x 10^{-6}	**CO-252B16:** ± 1 x 10^{-6} **CO-252B27:** ± 2 x 10^{-7} **CO-252B17:** ± 1 x 10^{-7}	**CO-254B16:** ± 1 x 10^{-6} **CO-254B57:** ± 5 x 10^{-7} **CO-254B27:** ± 2 x 10^{-7}	**CO-255B16:** ± 1 x 10^{-6} **CO-255B57:** ± 5 x 10^{-7} **CO-255B27:** ± 2 x 10^{-7}	**CO-256B16:** ± 1 x 10^{-6} **CO-256B57:** ± 5 x 10^{-7} **CO-256B27:** ± 2 x 10^{-7}	**CO-856B16:** ± 1 x 10^{-6} **CO-856B57:** ± 5 x 10^{-7}
(Temp. Range C) 0°C to +70°C	**CO-251C36:** ± 3 x 10^{-6}	**CO-252C16:** ± 1 x 10^{-6} **CO-252C57:** ± 5 x 10^{-7} **CO-252C37:** ± 3 x 10^{-7}	**CO-254C36:** ± 3 x 10^{-6} **CO-254C16:** ± 1 x 10^{-6} **CO-254C37:** ± 3 x10^{-7}	**CO-255C36:** ± 3 x 10^{-6} **CO-255C16:** ± 1 x 10^{-6} **CO-255C37:** ± 3 x 10^{-7}	**CO-256C36:** ± 3 x 10^{-6} **CO-256C16:** ± 1 x 10^{-6} **CO-256C37:** ± 3 x 10^{-7}	**CO-856C36:** ±3 x 10^{-6} **CO-856C16:** ±1 x 10^{-6}
(Temp. Range D) –20°C to +70°C	**CO-251D56:** ± 5 x 10^{-6}	**CO-252D16:** ± 1 x 10^{-6} **CO-252D57:** ± 5 x 10^{-7}	**CO-254D56:** ± 5 x 10^{-6} **CO-254D16:** ± 1 x 10^{-6} **CO-254D57:** ± 5 x 10^{-7}	**CO-255D56:** ± 5 x 10^{-6} **CO-255D16:** ± 1 x 10^{-6} **CO-255D57:** ± 5 x 10^{-7}	**CO-256D56:** ± 5 x 10^{-6} **CO-256D16:** ± 1 x 10^{-6} **CO-256D57:** ± 5 x 10^{-7}	**CO-856D56:** ±5 x 10^{-6} **CO-856D16:** ±1 x 10^{-6}
(Temp. Range E) –40°C to +75°C	**CO-251E15:** ± 1 x 10^{-5}	**CO-252E56:** ± 5 x 10^{-6} **CO-252E26:** ± 2 x 10^{-6} **CO-252E16:** ± 1 x 10^{-6}	**CO-254E56:** ± 5 x 10^{-6} **CO-254E26:** ± 2 x 10^{-6} **CO-254E16:** ± 1 x 10^{-6}	**CO-255E56:** ± 5 x 10^{-6} **CO-255E26:** ± 2 x 10^{-6} **CO-255E16:** ± 1 x 10^{-6}	**CO-256E56:** ± 5 x 10^{-6} **CO-256E26:** ± 2 x 10^{-6} **CO-256E16:** ± 1 x 10^{-6}	**CO-856E56:** ±5 x 10^{-6} **CO-856E26:** ±2 x 10^{-6}
(Temp. Range F) –55°C to +85°C	**CO-251F25:** ± 2 x 10^{-5}	**CO-252F56:** ± 5 x 10^{-6} **CO-252F26:** ± 2 x 10^{-6} **CO-252F16:** ± 1 x 10^{-6}	**CO-254F56:** ± 5 x 10^{-6} **CO-254F26:** ± 2 x 10^{-6} **CO-254F16:** ± 1 x 10^{-6}	**CO-255F56:** ± 5 x 10^{-6} **CO-255F26:** ± 2 x 10^{-6} **CO-255F16:** ± 1 x 10^{-6}	**CO-256F56:** ± 5 x 10^{-6} **CO-256F26:** ± 2 x 10^{-6} **CO-256F16:** ± 1 x 10^{-6}	**CO-856F56:** ±5 x 10^{-6}
(Temp. Range G) –55°C to +105°C		**CO-252G56:** ± 5 x 10^{-6}	**CO-254D56:** ± 5 x 10^{-6}	**CO-255G56:** ± 5 x 10^{-6}	**CO-256G56:** ± 5 x 10^{-6}	
(Temp. Range H) –55°C to +125°C		**CO-252H15:** ± 1 x 10^{-5}	**CO-254H15:** ± 1 x 10^{-5}	**CO-255H15:** ± 1 x 10^{-5}	**CO-256H15:** ± 1 x 10^{-5}	
Output Level & Frequency	TTL: 50 Hz-20MHz CMOS: 50 Hz-15 MHz Sine: 1 MHz-20 MHz HCMOS: 40 kHz-20 MHz (CO-252)		Sine: 20 MHz-140 MHz TTL: 20 MHz-100 MHz ECL: 20 MHz-140 MHz HCMOS: 20 MHz- 50 MHz	Sine: 140 MHz-420 MHz ECL: 140 MHz-420 MHz	Sine: 420 MHz-630 MHz	Sine: 630 MHz-1GHz
Supply	Any supply voltage in 5-24 Vdc range; current as low as 3 mA for some models			Any supply voltage in 12-24 Vdc range		
Frequency Adjustment	Screwdriver adjustment, settable to 1 x 10^{-7}. Electronic tuning (TC/VCXO) capability optional except in CO-856					
Aging Rate	5 x 10^{-7} to 1 x 10^{-6} per year		1 x 10^{-6}/year	1 x 10^{-6}/year		
Size	2" x 2" x 3/4" (51 x 51 x 19 mm) 1/2" height and smaller size available			2" x 3" x 3/4" (51 x 76 x 19 mm)	2" x 4" x 3/4" (51 x 102 x 19 mm)	1.75" x 3.75" x 0.75" (45 x 95 x 19 mm)

Size Reduced TCXOs

	Hybrid Design		Other small TCXOs	
	CO-258 *Lowest profile 0.32" (8.2 mm) height*	**CO-259** *0.4" (10.2 mm) height with mechanical tuning*	**CO-257** *Least expensive type among Vectron's size reduced Series*	**CO-253** *24 pin DIP resistance welded package*
Output level & Frequency	 TTL: 20 kHz to 70 MHz HCMOS: 40 kHz to 50 MHz CMOS: 400 Hz to 15 MHz ECL: 5 MHz to 70 MHz		*TTL/HCMOS: 315 kHz to 50 MHz + 7 dBm sine: 5 MHz to 140 MHz *Drives 3 TTL loads, 10 LSTTL loads or HCMOS (output from HCMOS gate)	*TTL/HCMOS: 315 kHz to 50 MHz sine: 5 MHz to 140 MHz
Temperature Stability (Temp. Range A) + 15°C to + 35°C	**CO-258A37:** ± 3 x 10^{-7} **CO-258A17:** ± 1 x 10^{-7}	**CO-259A37:** ± 3 x 10^{-7} **CO-259A17:** ± 1 x 10^{-7}	**CO-257A37:** ± 3 x 10^{-7} **CO-257A17:** ± 1 x 10^{-7}	**CO-253A37:** ± 3 x 10^{-7} **CO-253A17:** ± 1 x 10^{-7}
(Temp. Range B) 0°C to + 50°C	**CO-258B57:** ± 5 x 10^{-7} **CO-258B27:** ± 2 x 10^{-7}	**CO-259B57:** ± 5 x 10^{-7} **CO-259B27:** ± 2 x 10^{-7}	**CO-257B57:** ± 5 x 10^{-7} **CO-257B27:** ± 2 x 10^{-7}	**CO-253B57:** ± 5 x 10^{-7} **CO-253B27:** ± 2 x 10^{-7}
(Temp. Range C) 0°C to + 70°C	**CO-258C57:** ± 5 x 10^{-7} **CO-258C37:** ± 3 x 10^{-7}	**CO-259C57:** ± 5 x 10^{-7} **CO-259C37:** ± 3 x 10^{-7}	**CO-257C57:** ± 5 x 10^{-7} **CO-257C37:** ± 3 x 10^{-7}	**CO-253C57:** ± 5 x 10^{-7} **CO-253C37:** ± 3 x 10^{-7}
(Temp. Range D) –20°C to + 70°C	**CO-258D36:** ± 3 x 10^{-6} **CO-258D16:** ± 1 x 10^{-6} ***CO-258D57:** ± 5 x 10^{-7}	**CO-259D36:** ± 3 x 10^{-6} **CO-259D16:** ± 1 x 10^{-6} ***CO-259D57:** ± 5 x 10^{-7}	**CO-257D36:** ± 3 x 10^{-6} **CO-257D16:** ± 1 x 10^{-6} ***CO-257D57:** ± 5 x 10^{-7}	**CO-253D36:** ± 3 x 10^{-6} **CO-253D16:** ± 1 x 10^{-6} ***CO-253D57:** ± 5 x 10^{-7}
(Temp. Range E) –40°C to + 75°C	**CO-258E56:** ± 5 x 10^{-6} **CO-258E26:** ± 2 x 10^{-6} **CO-258E16:** ± 1 x 10^{-6}	**CO-259E56:** ± 5 x 10^{-6} **CO-259E26:** ± 2 x 10^{-6} **CO-259E16:** ± 1 x 10^{-6}	**CO-257E56:** ± 5 x 10^{-6} **CO-257E26:** ± 2 x 10^{-6} **CO-257E16:** ± 1 x 10^{-6}	**CO-253E56:** ± 5 x 10^{-6} **CO-253E26:** ± 2 x 10^{-6} **CO-253E16:** ± 1 x 10^{-6}
(Temp. Range F) –55°C to + 85°C	**CO-258F56:** ± 5 x 10^{-6} **CO-258F26:** ± 2 x 10^{-6} ***CO-258F16:** ± 1 x 10^{-6}	**CO-259F56:** ± 5 x 10^{-6} **CO-259F26:** ± 2 x 10^{-6} ***CO-259F16:** ± 1 x 10^{-6}	**CO-257F56:** ± 5 x 10^{-6} **CO-257F26:** ± 2 x 10^{-6} ***CO-257F16:** ± 1 x 10^{-6}	**CO-253F56:** ± 5 x 10^{-6} **CO-253F26:** ± 2 x 10^{-6} ***CO-253F16:** ± 1 x 10^{-6}
(Temp. Range G) –55°C to + 105°C	**CO-258G56:** ± 5 x 10^{-6} ***CO-258G36:** ± 3 x 10^{-6}	**CO-259G56:** ± 5 x 10^{-6} ***CO-259G36:** ± 3 x 10^{-6}	**CO-257G56:** ± 5 x 10^{-6} ***CO-257G36:** ± 3 x 10^{-6}	**CO-253G56:** ± 5 x 10^{-6} ***CO-253G36:** ± 3 x 10^{-6}
(Temp. Range H) –55°C to + 125°C	**CO-258H15:** ± 1 x 10^{-5} *Asterisked models not available above 12 MHz	**CO-259H15:** ± 1 x 10^{-5}	**CO-257H15:** ± 1 x 10^{-5} *Asterisked model not available above 12 MHz	**CO-253H15:** ± 1 x 10^{-5}
Aging Rate	1 x 10^{-6} per year	1 x 10^{-6} per year	1 x 10^{-6} per year	1 x 10^{-6} per year
Supply Voltage	TTL & HCMOS: 10-15V and 5V (single 5V optional in CO-259) CMOS: 10-15V; ECL: 10-15V and –5.2V		5V for TTL/HCMOS 12-15V for sine	10-24V and 5V single 5V supply optional
Frequency Adjustment	Voltage control	Mechanical (VCXO opt.)	Mechanical (VCXO opt.)	External potentiometer
Size	1.5" x 1.5" x 0.32" (38 x 38 x 8.2 mm)	1.5" x 2.0" x 0.4" (38 x 51 x 10.2 mm)	1.5" x 1.5" x 0.5" (38 x 38 x 12.7 mm)	0.8" x 1.4" x 0.39" (21 x 36 x 9.9 mm)

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High Frequency OCXOs

Oven Controlled Crystal Oscillators (<1 MHz to 25 MHz)

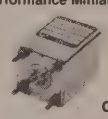
Basic OCXOs

* Low Phase Noise Option

	HIGH STABILITY (to 5 x 10^{-10}/day)			ULTRA STABLE (to 1 x 10^{-10}/day)	
	Most economical CO-211 SERIES	Higher stability and output CO-200 SERIES	Superior temperature stability CO-244 SERIES	CO-206 SERIES	Size reduced; best stability CO-706 SERIES
Frequency	<1 MHz to 25 MHz with 1, 2, 4, 5 and 10 MHz standard			5 MHz standard (other frequencies available to 75 MHz)	
Temperature Stability (Temp. Range A) +15/ +35°C	CO-21□A: AT: ±3 x 10^{-8}; SC: ±2 x 10^{-8} CO-21*□A: AT: ±5 x 10^{-9}; SC: ±3 x 10^{-9}	CO-20□□A: AT: ±3 x 10^{-8}; SC: ±3 x 10^{-9} CO-20*□□A: AT: ±1 x 10^{-9}; SC: ±5 x 10^{-10}	CO-24□A: AT: ±5 x 10^{-10}; SC: ±3 x 10^{-10}	CO-20□A39-V: ±3 x 10^{-9} CO-20*□A516-V: ±5 x 10^{-10}	CO-70□A19-V: ±1 x 10^{-9} CO-70*□A316-V: ±3 x 10^{-10}
(Temp. Range B) 0/ +50°C	CO-21□B: ±5 x 10^{-8}; ±3 x 10^{-8} CO-21*□B: ±1 x 10^{-8}; ±5 x 10^{-9}	CO-20□□B: ±5 x 10^{-9}; ±5 x 10^{-9} CO-20*□□B: ±3 x 10^{-9}; ±2 x 10^{-9}	CO-24□B: ±1 x 10^{-9}; ±5 x 10^{-10}	CO-20□B59-V: ±5 x 10^{-9} CO-20*□B19-V: ±1 x 10^{-9}	CO-70□B29-V: ±2 x 10^{-9} CO-70*□B510-V: ±5 x 10^{-10}
(Temp. Range D) –20/ +70°C	CO-21□D: ±1 x 10^{-7}; ±5 x 10^{-8} CO-21*□D: ±3 x 10^{-8}; ±1 x 10^{-8}	CO-20□□D: ±1 x 10^{-8}; ±1 x 10^{-8} CO-20*□□D: ±5 x 10^{-9}; ±3 x 10^{-9}	CO-24□D: ±3 x 10^{-8}; ±2 x 10^{-8}	CO-20□D18-V: ±1 x 10^{-8} CO-20*□D39-V: ±3 x 10^{-9}	CO-70□D59-V: ±5 x 10^{-9} CO-70*□D29-V: ±2 x 10^{-9}
(Temp. Range G) –55/ +75°C	CO-21□G: ±2 x 10^{-7}; ±1 x 10^{-7} CO-21*□G: ±5 x 10^{-8}; ±3 x 10^{-8}	CO-20□□G: ±3 x 10^{-8}; ±3 x 10^{-8} CO-20*□□G: —; ±2 x 10^{-8}	CO-24□G: ±1 x 10^{-8}; ±5 x 10^{-9}	CO-20□G38-V: ±3 x 10^{-8} CO-20*□G18-V: ±1 x 10^{-8}	CO-70□G28-V: ±2 x 10^{-8} CO-70*□G59-V: ±5 x 10^{-9}
Aging	4: 1 x 10^{-8}/day; 5: 5 x 10^{-9}/day; 6: 3 x 10^{-9}/day; 7: 1 x 10^{-9}/day; *8S: 5 x 10^{-10}/day. Temp. Stability e.g. 38=±3 x 10^{-8}; 59=±5 x 10^{-9}	1: 1 x 10^{-8}/day; 2: 5 x 10^{-9}/day; 3: 3 x 10^{-9}/day; 4: 1 x 10^{-9}/day; *5S: 5 x 10^{-10}/day. Temp. Stability e.g. 19=±1 x 10^{-9}; 510=±5 x 10^{-10}	4: 1 x 10^{-8}/day; *5S: 5 x 10^{-10}/day. Temp. Stability e.g. 39=±3 x 10^{-9}; 310=±3 x 10^{-10}	6: 3 x 10^{-10}/day; 4 x 10^{-8}/year; *7: 1 x 10^{-10}/day; 2 x 10^{-8}/year	6: 3 x 10^{-10}/day; 4 x 10^{-8}/year; *7: 1 x 10^{-10}/day; 2 x 10^{-8}/year
	*8S & 5S types use SC cut crystals for 5 x 10^{-10}/day, 1 x 10^{-8}/year aging (5 x 10^{-8}/year optional at some frequencies). When using this aging option, also use the "SC" column temperature stabilities.			*1 x 10^{-10}/day models available in 4-6.25 MHz range and multiples of 4-6.25 MHz	
Output Level	Standard: >1 Vrms into 500Ω Optional: 0 dBm or +7 dBm/50Ω TTL or HCMOS	Standard: >1 Vrms into 50Ω Optional: TTL, HCMOS, or ECL	Standard: >1 Vrms into 500Ω Optional: 0 dBm to +13 dBm/50Ω TTL, HCMOS or ECL	Standard: >1 Vrms/50Ω Optional: TTL, HCMOS	Standard: >0.5 Vrms/50Ω Optional: +13 dBm/50Ω TTL, HCMOS
Supply Voltage (± 5%)	24 Vdc standard (Operation from any voltage in 5-28 Vdc range optional on most models).			24 Vdc standard (Operation from any voltage in 15-28 Vdc range optional)	15 Vdc standard
Input Power	<6 watts at turn-on (–20/+70°C); <3 watts stabilized (25°C) reduced power drain available			<6 watts at turn-on (–20/+70°C) <3 watts stabilized (25°C)	
Frequency Adjustment	Screwdriver adjustment settable to 1 x 10^{-8} nominal. Electronic tuning (VCXO) option "V"			Screwdriver adjustment and electronic tuning	
Size	2" x 2" x 3" (51 x 51 x 76 mm)	2" x 2" x 4" (51 x 51 x 102 mm)	2¼" x 2¼" x 4¼" (57 x 57 x 110 mm)	2¼" x 2¼" x 4¼" (57 x 57 x 110 mm)	2" x 2" x 2⅞" (3¼" above 12.5 MHz)
Base	Octal plug, solder header or rf connector with solder header			Same options as CO-244	Solder header, SMA optional
Phase Noise (typical) with sine output in 4-12 MHz range for "High Stability" Series and in 4-6 MHz range for "Ultra-Stable" Series	Offset from Carrier: Standard / Low Noise Option L1 / *Ultra Low Noise Option L2 100 Hz: –130 dBc/Hz / –135 dBc/Hz / –145 dBc/Hz 1 kHz: –140 dBc/Hz / –145 dBc/Hz / –160 dBc/Hz 10 kHz: –143 dBc/Hz / –148 dBc/Hz / –165 dBc/Hz 50 kHz: –145 dBc/Hz / –150 dBc/Hz / –165 dBc/Hz (Figures shown are with AT crystals. Phase noise is somewhat improved with SC crystals.) *Output level with L2 option is +10 dBm minimum for all models; SMA output connector is standard			Offset from Carrier: Standard / *Ultra Low Noise Option L2 10 Hz: –115 dBc/Hz / –135 dBc/Hz 100 Hz: –140 dBc/Hz / –155 dBc/Hz 1 kHz: –145 dBc/Hz / –165 dBc/Hz 10 kHz: –148 dBc/Hz / –168 dBc/Hz 50 kHz: –150 dBc/Hz / –168 dBc/Hz *L2 option restricted to +10 dBm output.	

Size Reduced OCXOs

Low Profile PC Board Mount OCXOs



Premium Performance Miniature OCXOs

* Low Phase Noise Option

	CO-711 SERIES (AT Cut Crystal)	CO-718S SERIES (SC/IT Cut Crystal)	CO-700 SERIES (AT Cut Crystal)	CO-705S SERIES (SC/IT Cut Crystal)
Frequency	1-25 MHz with 5 MHz and 10MHz standard (available to 32 kHz with logic output)			
Temperature Stability (Temp. Range A) +15°C to + 35°C	CO-71□A38: ± 3 x 10^{-8} CO-71□A58: ± 5 x 10^{-8}	CO-718SA28: ± 2 x 10^{-8} CO-718SA39: ± 3 x 10^{-9}	CO-70□A50: ± 5 x 10^{-8} CO-70□A19: ± 1 x 10^{-8}	CO-705SA39: ±3 x 10^{-9} CO-705SA510: ±5 x 10^{-10}
(Temp. Range B) 0°C to + 50°C	CO-71□B56: ± 5 x 10^{-8} CO-71□B18: ± 1 x 10^{-8}	CO-718SB38: ± 3 x 10^{-8} CO-718SB56: ± 5 x 10^{-8}	CO-70□B18: ± 1 x 10^{-8} CO-70□B29: ± 2 x 10^{-8}	CO-705SB59: ±5 x 10^{-9} CO-705SB18: ±1 x 10^{-8}
(Temp. Range D) –20°C to + 70°C	CO-71□D17: ± 1 x 10^{-7} CO-71□D38: ± 3 x 10^{-8}	CO-718SD56: ± 5 x 10^{-8} CO-718SD16: ± 1 x 10^{-8}	CO-70□D38: ±3 x 10^{-8} CO-70□D59: ±5 x 10^{-9}	CO-705SD18: ±1 x 10^{-8} CO-705SD39: ±3 x 10^{-9}
(Temp. Range G) –55°C to + 75°C	*CO-71□G27: ± 2 x 10^{-7} *CO-71□G58: ± 5 x 10^{-8}	CO-718SG17: ± 1 x 10^{-7} *CO-718SG38: ± 3 x 10^{-8}	CO-70□G58: ±5 x 10^{-8} CO-70□G18: ±1 x 10^{-8}	CO-705SG28: ±2 x 10^{-8} CO-705SG59: ±5 x 10^{-9}
(Temp. Range F) –55°C to + 85°C	* with L2 option consult factory	*CO-718SF27: ± 2 x 10^{-7} *CO-718SF58: ± 5 x 10^{-8}		CO-705SF38: ±3 x 10^{-8} CO-705SF18: ±1 x 10^{-8}
Aging	4: 1 x 10^{-8}/day (2 x 10^{-8}/year); 5: 5 x 10^{-9}/day (1.5 x 10^{-8}/year); 6: 3 x 10^{-9}/day (1 x 10^{-8}/year); 7: 1 x 10^{-9}/day(3 x 10^{-9}/year)	5 x 10^{-10}/day (1 x 10^{-7}/year) (5 x 10^{-8}/year optional at some frequencies)	1: 1 x 10^{-8}/day (2 x 10^{-8}/year); 2: 5 x 10^{-9}/day (1.5 x 10^{-8}/year); 3: 3 x 10^{-9}/day (1 x 10^{-8}/year); 4: 1 x 10^{-9}/day (3 x 10^{-9}/year)	5 x 10^{-10}/day (1 x 10^{-7}/year) (5 x 10^{-8}/year optional at some frequencies)
Restabilization at 25°C (freq relative to that 2 hrs. after turn-on, following 24 hrs. off)	1 x 10^{-7}: 9 minutes; 3 x 10^{-8}: 12 minutes; 1 x 10^{-8}: 30 minutes	Standard / 6W Turn-on 1 x 10^{-7}: 7 minutes / 4 minutes 3 x 10^{-8}: 10 minutes / 7 minutes 1 x 10^{-8}: 15 minutes / 10 minutes	1 x 10^{-7}: 10 minutes; 3 x 10^{-8}: 15 minutes; 1 x 10^{-8}: 30 minutes	Standard / 15W Turn-on 1 x 10^{-7}: 9 minutes / 3 minutes 3 x 10^{-8}: 12 minutes / 4 minutes 1 x 10^{-8}: 15 minutes / 5 minutes
Output Level	Standard: >0.5 Vrms/50Ω (+7 dBm); >1 Vrms/ 50Ω (+13 dBm) with L2 option HCMOS/TTL optional		>1 Vrms/ 50Ω (+13 dBm) HCMOS/TTL optional	
Supply Voltage (±5%)	+15 Vdc standard (12-24 Vdc optional); +5 Vdc supply with HCMOS/TTL output available			
Input Power	<3.5 Watts at turn-on		<5 Watts at turn-on	
Frequency Adjustment	Screwdriver adjustment settable to 1 x 10^{-8}. Option "V": Voltage tuning			
Size	2" x 2" x 1" (1¼" also available), pins for pcb mounting		1.5" x 1.5" x 2", solder header and studs; SMA output optional	
Phase Noise (with sinewave output 4-12 MHz)	Offset: Standard / Option L2 10 Hz: –105 dBc/Hz / –120 dBc/Hz 100 Hz: –135 dBc/Hz / –145 dBc/Hz 1 kHz: –145 dBc/Hz / –160 dBc/Hz 10 kHz: –148 dBc/Hz / –165 dBc/Hz 50 kHz: –150 dBc/Hz / –165 dBc/Hz	Offset: Standard / Option L2 10 Hz: –115 dBc/Hz / –130 dBc/Hz 100 Hz: –140 dBc/Hz / –155 dBc/Hz 1 kHz: –145 dBc/Hz / –163 dBc/Hz 10 kHz: –148 dBc/Hz / –166 dBc/Hz 50 kHz: –150 dBc/Hz / –168 dBc/Hz	Offset: Standard / Option L2 10 Hz: –105 dBc/Hz / –120 dBc/Hz 100 Hz: –135 dBc/Hz / –145 dBc/Hz 1 kHz: –145 dBc/Hz / –160 dBc/Hz 10 kHz: –148 dBc/Hz / –165 dBc/Hz 50 kHz: –150 dBc/Hz / –165 dBc/Hz	Offset: Standard / Option L2 10 Hz: –115 dBc/Hz / –130 dBc/Hz 100 Hz: –140 dBc/Hz / –155 dBc/Hz 1 kHz: –145 dBc/Hz / –163 dBc/Hz 10 kHz: –148 dBc/Hz / –166 dBc/Hz 50 kHz: –150 dBc/Hz / –168 dBc/Hz

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VHF OCXOs Oven Controlled Crystal Oscillators (25-400 MHz)

Basic Series

✱ Low Phase Noise Option

	Most Economical CO-229 SERIES	Highest Frequency, Lowest Noise CO-224 SERIES	Highest Stability CO-225 SERIES	CO-225S SERIES
Frequency	25 MHz to 200 MHz	25 MHz to 400 MHz	25 MHz to 200 MHz	
Temperature Stability (Temp. Range A) +15°C to +35°C	**CO-229 A38:** ± 3 x 10^{-8} **CO-229 A59:** ± 5 x 10^{-8}	**CO-224 A38:** ± 3 x 10^{-8} **CO-224 A59:** ± 5 x 10^{-8}	**CO-225 A18:** ± 1 x 10^{-8} **CO-225 A19:** ± 1 x 10^{-8}	**CO-225 SA18:** ±1 x 10^{-8} **CO-225 SA19:** ±1 x 10^{-8}
(Temp. Range B) 0°C to +50°C	**CO-229 B58:** ± 5 x 10^{-8} **CO-229 B18:** ± 1 x 10^{-8}	**CO-224 B58:** ± 5 x 10^{-8} **CO-224 B18:** ± 1 x 10^{-8}	**CO-225 B58:** ± 5 x 10^{-8} **CO-225 B18:** ± 1 x 10^{-8} **CO-225 B39:** ± 3 x 10^{-9}	**CO-225 SB58:** ±5 x 10^{-8} **CO-225 SB18:** ±1 x 10^{-8} **CO-225 SB29:** ±2 x 10^{-9}
(Temp. Range D) −20°C to +70°C	**CO-229 D17:** ± 1 x 10^{-7} **CO-229 D38:** ± 3 x 10^{-8}	**CO-224 D17:** ± 1 x 10^{-7} **CO-224 D38:** ± 3 x 10^{-8}	**CO-225 D38:** ±3 x 10^{-8} **CO-225 D18:** ±1 x 10^{-8} **CO-225 D59:** ±5 x 10^{-9}	**CO-225 SD38:** ~3 x 10^{-8} **CO-225 SD18:** ±1 x 10^{-8} **CO-225 SD39:** ±3 x 10^{-9}
(Temp. Range G) −55°C to +75°C	**CO-229 G27:** ± 2 x 10^{-7} **CO-229 G58:** ± 5 x 10^{-8}	**CO-224 G27:** ± 2 x 10^{-7} **CO-224 G58:** ± 5 x 10^{-8}	**CO-225 G17:** ±1 x 10^{-7} **CO-225 G38:** ±3 x 10^{-8}	**CO-225 SG17:** ±1 x 10^{-7} **CO-225 SG28:** ±2 x 10^{-8}
(Temp. Range F) −55°C to +85°C				**CO-225 SF38:** ±3 x 10^{-8}
Aging	Standard: 1 x 10^{-8}/day, 2 x 10^{-6}/year Optional: 5 x 10^{-9}/day, 1 x 10^{-6}/year Option "**S**": 2 x 10^{-9}/day, 5 x 10^{-7}/year	Standard: 1 x 10^{-8}/day, 2 x 10^{-6}/year Optional: 5 x 10^{-9}/day, 1 x 10^{-6}/year Option "**S**": 2 x 10^{-9}/day, 5 x 10^{-7}/year	1 x 10^{-9}/day, 3 x 10^{-7}/year 1 x 10^{-10}/day to 75 MHz available in CO-207 and CO-707 series.	5 x 10^{-10}/day, 1 x 10^{-7}/year
Output Level	Standard: >0.5 Vrms into 50Ω (+ 7 dBm) Optional: TTL to 100 MHz	Standard: >1 Vrms into 50Ω (+ 13 dBm) Optional: ECL (to 200 MHz)	Standard: >0.5 Vrms into 50Ω (+ 7 dBm) Optional: +13 dBm ("**R**"), TTL, ECL	
Supply Voltage (±5%)	24 Vdc standard. Operation from any specified voltage in 12-28 Vdc range optional			
Input Power	<6 Watts at turn-on(−20/ + 70°C); <3 Watts stabilized (25°C)			
Frequency Adjustment	Screwdriver adjust. settable to <1 x 10^{-6} nominal. Electronic tuning (VCXO) option "**V**"			
Size	2" x 2" x 3" (51 x 51 x 77 mm)	2" x 2" x 4" (51 x 51 x 102 mm)	2" x 2" x 4" (51 x 51 x102 mm)	
Base	SMC output, solder header and 4 studs; SMA or BNC optional			
✱ **Phase noise** typical, with sine output in 75-125 MHz range	Offset from Carrier: 100 Hz, 1 kHz, 10 kHz, 50 kHz Standard: −120 dBc/Hz, −135 dBc/Hz, −140 dBc/Hz, −145 dBc/Hz Ultra-low noise option not available	Offset from Carrier: 100 Hz, 1 kHz, 10 kHz, 50 kHz Standard: −120 dBc/Hz, −135 dBc/Hz, −140 dBc/Hz, −145 dBc/Hz *Ultra Low Noise Option **L2**: −130 dBc/Hz, −145 dBc/Hz, −155 dBc/Hz, −157dBc/Hz *L2 option is restricted to + 10 dBm (+7 dBm above 300 MHz)	Offset from Carrier: 100 Hz, 1 kHz, 10 kHz, 50 kHz Standard: −105 dBc/Hz, −115 dBc/Hz, −120 dBc/Hz, −125 dBc/Hz *Ultra Low Noise Option **L2**: −120 dBc/Hz, −135 dBc/Hz, −140 dBc/Hz, −140 dBc/Hz *L2 option is available to 125 MHz; contact factory for further improvement.	

Size Reduced VHF OCXOs (25-200 MHz)

✱ Low Phase Noise Option

	Lowest Noise CO-724 SERIES (AT Cut Crystal)	Lowest Noise CO-724S SERIES (SC/IT Cut Crystal)	Highest Stability CO-725 SERIES (AT Cut Crystal)	Highest Stability CO-725S SERIES (SC/IT Cut Crystal)
Frequency	25-140 MHz range		25-200 MHz range	
Temperature Stability (Temp. Range A) +15°C to + 35°C	**CO-724A38:** ± 3 x 10^{-8} ***CO-724A18:** ± 1 x 10^{-8}	**CO-724SA18:** ± 1 x 10^{-8} ***CO-724SA39:** ± 3 x 10^{-9}	**CO-725A38:** ± 3 x 10^{-8} **CO-725A59:** ± 5 x 10^{-8}	**CO-725SA18:** ±1 x 10^{-8} **CO-725SA39:** ±3 x 10^{-9}
(Temp. Range B) +0°C to + 50°C	**CO-724B58:** ± 5 x 10^{-8} ***CO-724B28:** ± 2 x 10^{-8}	**CO-724SB28:** ± 2 x 10^{-8} ***CO-724SB59:** ± 5 x 10^{-9}	**CO-725B58:** ± 5 x 10^{-8} **CO-725B18:** ± 1 x 10^{-8}	**CO-725SB28:** ±2 x 10^{-8} **CO-725SB59:** ±5 x 10^{-9}
(Temp. Range D) -20°C to + 70°C	**CO-724D17:** ± 1 x 10^{-7} ***CO-724D58:** ± 5 x 10^{-8}	**CO-724SD58:** ± 5 x 10^{-8} ***CO-724SD18:** ± 1 x 10^{-8}	**CO-725D17:** ±1 x 10^{-7} **CO-725D38:** ±3 x 10^{-8}	**CO-725SD58:** ±5 x 10^{-8} **CO-725SD18:** ±1 x 10^{-8}
(Temp. Range G) −55°C to + 75°C	**CO-724G37:** ± 3 x 10^{-7} ***CO-724G17:** ± 1 x 10^{-7}	**CO-724SG17:** ± 1 x 10^{-7} ***CO-724SG38:** ± 3 x 10^{-8}	***CO-725G37:** ±3 x 10^{-7} ***CO-725G58:** ±5 x 10^{-8}	**CO-725SG17:** ±1 x 10^{-7} ***CO-725SG38:** ±3 x 10^{-8}
(Temp. Range F) −55°C to + 85°C	*with L2 option, consult factory	**CO-724SF27:** ± 2 x 10^{-7} ***CO-724SF58:** ± 5 x 10^{-8}	*with L2 option, consult factory	***CO-725SF27:** ±2 x 10^{-7} ***CO-725SF58:** ±5 x 10^{-8}
Aging	Standard: 1 x 10^{-8}/day, (2 x 10^{-6}/year) Optional: 5 x 10^{-9}/day, (1 x 10^{-6}/year)	2 x 10^{-8}/day(5 x 10^{-7}/year)	1 x 10^{-9}/day, (3 x 10^{-7}/year) For 1 x 10^{-10}/day to 75 MHz, see CO-207 and CO-707 series	5 x 10^{-10}/day (1 x 10^{-7}/year)
Output Level	Standard: >0.5 Vrms/50Ω (+ 7 dBm) + 10dBm optional Optional: HCMOS, TTL (to 70 MHz)		Standard: >0.5 Vrms/50Ω (+ 7 dBm) Optional: >1 Vrms/50Ω (+13 dBm) option "**R**" to 125 MHz	
Supply Voltage (±5%)	+ 15 Vdc standard. Operation from any specified voltage in 12-24 Vdc range optional			
Input Power	<4 Watts at turn-on −20/ + 70°C			
Frequency Adjustment	Multi-turn screwdriver adjust. settable to <1 x 10^{-6} Electronic tuning option "**V**".			
Size	2" x 2" x 1" (51 x 51 x 25.4 mm). Reduced ht. available		2" x 2" x 1 1/4" (51 x 51 x 32 mm)	
Base	Pins for pcb mounting. Option "**W**" for SMA connector and terminals on side, studs on base			
✱ **Phase noise** typical, with sine output in 75-125 MHz range	Offset from Carrier: 100 Hz, 1 kHz, 10 kHz, 50 kHz Standard: −115 dBc/Hz, −130 dBc/Hz, −140 dBc/Hz, −145 dBc/Hz Ultra Low Noise Option (**L2**): −130 dBc/Hz, −145 dBc/Hz, −155 dBc/Hz, −157 dBc/Hz		Offset from Carrier: 100 Hz, 1 kHz, 10 kHz, 50 kHz Standard: −105 dBc/Hz, −115 dBc/Hz, −120 dBc/Hz, −125 dBc/Hz Ultra Low Noise Option (L2): −120 dBc/Hz, −135 dBc/Hz, −140 dBc/Hz, −140 dBc/Hz	

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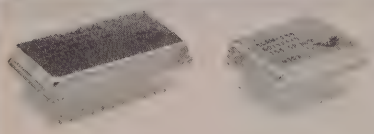
Sonet Clock Recovery Module SCRM-155

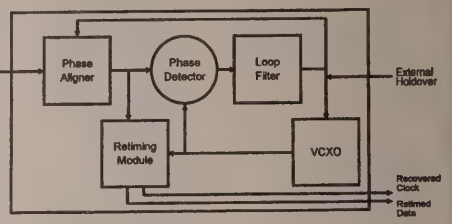


- **Clock Recovery and Data Retiming *(with VCXO)***
- ***Meets CCITT Type A or B*-Interfaces with either type**
- **Holdover Feature offers ±20 ppm clock accuracy with no data input**
- **Acquires Lock Quickly (40 bit periods)**
- **Eliminates Pattern (systematic) Jitter**

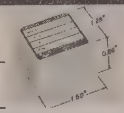
OPTIONS
- Expanded temperature range of -40°C to +85°C
- Built-in optical receiver

The Vectron SCRM-155 Sonet Clock Recovery Module recovers clock and data from an incoming NRZ PCM data stream. It regenerates the original incoming data stream through the use of an optimally timed decision circuit. The internal VCXO in the SCRM-155 allows the user, without the need of an additional crystal oscillator, to set the clock frequency with an external control voltage (holdover). Compatible with both CCITT Type A and Type B interfaces.

CHARACTERSTIC	CONDITION	SPECIFICATION
Clock Rate		155.52 MHz
Acquisition Time	Input Density = 50%	40 bit period (260 nanosec)
Phase Drift due to input data	20 non-transitions	<0.002 UI
	80 non-transitions	<0.006 UI
Jitter Tolerance (Exceeds requirements of T1 x 3/92-005R1)	10 Hz	>40 UI
	300 Hz	>10 UI
	6.5 kHz	>2 UI
	65 kHz	>2 UI
Jitter Transfer Peaking		0 dBm
Bandwidth		15.5 kHz typical
Residual Jitter	Input Density = 50%	<2° rms
	2^7-1 PRB Sequence	<2° rms
	2^{23}-1 PRB Sequence	<2° rms
Free Running Temperature Stability	0 to +70°C	±20 PPM
Tuning Range	0 to -5V (ECL)	≥±50 PPM
	0 to +5V (PECL)	≥±50 PPM
Signal levels		10 KH ECL/PECL compatible, differential input, complementary output
Supply		-5.2 Vdc ±5% at 85 mA (ECL) +5.0 Vdc ±5% at 85 mA (PECL)
Size		24 pin Double DIP 0.8" x 1.4" x 0.2" (20.3 x 36 x 5.1 mm) or 16 pin Double Dip 0.8" x 1.0" x 0.2" (20.3 x 25.4 x 5.1 mm)



Miniature PC Board Mount OCXOs (32 kHz-50MHz)



		CO-734 SERIES (AT Cut Crystal)		CO-738S SERIES (SC/IT Cut Crystal)	
FREQUENCY		5 MHz and 10 MHz standard. Other frequencies available in 4-50 MHz range with sine output and in 32 kHz-17 MHz range with logic output. See Series CO-724 for 50-140 MHz and CO-725 for 50-200 MHz.			
STABILITY	**Temperature** (Temp Range A) +15°C to +35°C	**CO-734A38:** ±3 x 10^{-8}	**CO-734A59:** ±5 x 10^{-9}	**CO-738SA19:** ±1 x 10^{-9}	**CO-738SA510:** ±5 x 10^{-10}
	(Temp Range B) 0°C to +50°C	**CO-734B58:** ±5 x 10^{-8}	**CO-734B18:** ±1 x 10^{-8}	**CO-738SB18:** ±1 x 10^{-8}	**CO-738SB19:** ±1 x 10^{-9}
	(Temp Range D) -20°C to +70°C	**CO-734D17:** ±1 x 10^{-7}	**CO-734D38:** ±3 x 10^{-8}	**CO-738SD18:** ±1 x 10^{-8}	**CO-738SD59:** ±5 x 10^{-9}
	(Temp Range E) -40°C to +75°C	**CO-734E38:** ±3 x 10^{-8}	**CO-734E59:** ±5 x 10^{-9}	**CO-738SE58:** ±5 x 10^{-8}	**CO-738SE18:** ±1 x 10^{-8}
	Aging Rate	**Standard:** 1 x 10^{-9}/day (2 x 10^{-6}/year) CO-737: 1 x 10^{-9}/day (3 x 10^{-7}/year) Optional: 5 x 10^{-10}/day (1.5 x 10^{-7}/year)		5 x 10^{-10}/day (1 x 10^{-7}/year) 4 to 32 MHz only 5 x 10^{-8}/year optional at some frequencies	
	Supply	5 x 10^{-9} per percent		1 x 10^{-9} per percent	
	Short Term (Allan Variance)	5 x 10^{-11} per second		5 x 10^{-12} per second	
	Warm-up (Restabilization) (frequency relative to that two hours after turn-on following 24 hours off time at +25°C)	1 x 10^{-6}: 5 minutes 1 x 10^{-7}: 7 minutes 3 x 10^{-8}: 10 minutes 1 x 10^{-8}: 30 minutes		1 x 10^{-6}: 2 minutes 1 x 10^{-7}: 2.5 minutes 3 x 10^{-8}: 3 minutes 1 x 10^{-8}: 4 minutes	
OUTPUT / SUPPLY	**Output**	Output: Standard: >0.5Vrms into 50Ω(+7dBm); Option "R": >1.0Vrms into 50Ω(+13dBm); Option "J": **HCMOS/TTL. Supply: +15Vdc; +15Vdc; *+15Vdc and +5Vdc. *Any voltage in 12-24 Vdc range optional; supply below 15 Vdc results in reduced ouput level. **Drives 3 TTL loads, 10 LSTTL loads or HCMOS; ouput is from HCMOS gate			
	Harmonics (Sinewave Output)	20 dB below deisred output. If internal multiplication is used, generally above 12 MHz, subharmonics are also -20 dBc. Harmonic and subharmonic attenuation can be improved on special order.			
	Input Power	6 watts at turn-on; less than 2 watts stabilized at +25°C. Higher power required for temperature beyond -20 to +70°C and lower power needed for 0 to 50°C.			
PHASE NOISE	**(Sinewave Output 4-12 MHz)**	Offset / Phase Noise: 10 Hz -100 dBc/ Hz; 100 Hz -135 dBc/ Hz; 1 kHz -145 dBc/ Hz; 10 kHz -150 dBc/ Hz; 50 kHz -150 dBc/ Hz		Offset / Phase Noise: 10 Hz -120 dBc/ Hz; 100 Hz -140 dBc/ Hz; 1 kHz -145 dBc/ Hz; 10 kHz -150 dBc/ Hz; 50 kHz -150 dBc/ Hz	
FREQUENCY ADJUST	Tuning via external potentiometer	10 ppm minimum range for 0 to 6V control		5 x 10^{-7} for 0 to 6V control	
MECHANICAL PACKAGE		1.5" x 1.25" x 0.86" (38 x 32 x 22 mm) Pins for PC board mounting			

OPTIONS
- 0.75" height
- 0.65" height
- European CO-08 pkg.

Contact factory with your specifications

To order Vectron Crystal Oscillators or for Engineering Assistance...fax (203) 849-1423

VECTRON
The Crystal Oscillator Company
VECTRON LABORATORIES, INC.
166 Glover Avenue, P.O. Box 5160, Norwalk, CT 06856-5160
Telephone: (203) 853-4433 Fax (203) 849-1423

Other New Products

• ½ DIP Clock Series

- ❑ **Size**: 0.5" x 0.5" x 0.23"
- ❑ **Frequency**: to 100 MHz
- ❑ **Output / Input**
  - **CO-449**: HCMOS/ACMOS; +5 Vdc
  - **CO-439**: 10K/10KH ECL; -5.2 Vdc
  - **CO-459**: 100K ECL; -4.5 Vdc
- ❑ **Package:** 4 pin resistance welded (surface mount optional)

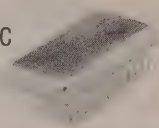
• CO-445V Series Mini VCXO (Hybrid)

- ❑ **Size**: 0.8" x 1.0" x 0.39"; 16 pin Double DIP
- ❑ **Frequency**: 10 MHz to 40 MHz
- ❑ **Deviation**: ±.01% to ±.05%
- ❑ **Stability**: ±40 ppm over 0°C to +70°C at Vc of +2.5 V, including 20 years aging
- ❑ **Output**: HCMOS/ACMOS; Input: +5 Vdc

• CO-454V High Frequency VCXO

- ❑ **Size**: 0.8" x 1.4" x 0.2", 24 pin Double DIP
- ❑ **Frequency**: 622.08 MHz
- ❑ **Output**: ECLinPS; Input: -4.5 Vdc or -5.2 Vdc
- ❑ **Deviation**: up to ±100 ppm

• CO-566 Series Mini TCXO (Hybrid)



- ❑ **Size**: 0.8" x 1.4" x 0.2"; 24 pin Double DIP
- ❑ **Frequency**: 315 kHz to 20 MHz
- ❑ **Stability**: $\pm 5 \times 10^{-7}$ over 0°C to +70°C
  $\pm 2 \times 10^{-6}$ over -55°C to +85°C
- ❑ **Output**: HCMOS; Input: +5 Vdc
- ❑ **Frequency Adjust:** Settable to 1×10^{-7}

• CO-590 Series MCXO

- ❑ **Frequency**: 5 or 10 MHz
- ❑ **Stability**: $\pm 5 \times 10^{-8}$ over -20°C to +70°C
- ❑ **Aging**: 3×10^{-7}/year
- ❑ **Frequency Adjust**: Settable to 1×10^{-8}
- ❑ **Output**: HCMOS; Input: +5 Vdc
- ❑ **Size**: 2" x 2" x 0.5"

• CO-740 Series Mini OCXO

- ❑ **Size**: 2" x 2" x 0.5" (PCB Mounted)
- ❑ **Frequency**: 5 MHz to 20 MHz
- ❑ **Stability**: $\pm 1 \times 10^{-8}$ over 0°C to +50°C
- ❑ **Aging**: 1×10^{-7}/year, better aging available
- ❑ **Output**: +7 dBm (50Ω); Input: +15 Vdc

Vectron's Commitment

Vectron is and will remain, a world-class supplier to our global market and will apply innovative, forward-looking, ethical principles in complying with the requirements of that market. We are totally committed to recognizing the needs of our customer and responding to those needs with superior quality, service, responsiveness and specification compliance.

All of our employees are dedicated to these principles with total customer satisfaction as their constant goal.

To ensure continued improvement, our SPC program is being extended company wide and will directly aid our intent to achieve ISO 9000 status. Our ***Total Quality Management*** philosophy is key to our future, as is our program on Total Cycle Time Reduction, both of which are calculated to dramatically reduce internal costs and reduce the time-to-market of new products.

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The Crystal Oscillator Company

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166 Glover Avenue, P.O. Box 5160, Norwalk, CT 06856-5160
Telephone: (203) 853-4433 Fax (203) 849-1423

WENZEL ASSOCIATES, INC.
Crystal Oscillators & Standards

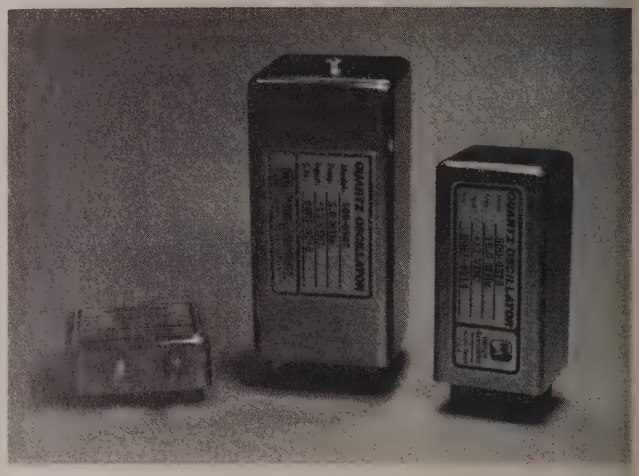
Capabilities

Wenzel Associates manufactures high performance crystal oscillators from 1 to 500 MHz for test equipment, military radar, navigation and communication systems, and the telecommunications industry.

Unprecedented noise performance is available in OEM oscillators as well as in rack mounted phase noise reference standards.

Fast deliveries are available on standard and custom requirements and special low cost oscillators are available where minimal packaging is acceptable for high volume and VSAT applications.

High reliability screening may be requested on several oscillator configurations per MIL-O-55310 built under our quality system based on MIL-I-45208.



Standards

Rack mounted frequency standards may be specified with aging rates of $1x10^{-10}$ per day and outputs at 1, 5, 10 and 100 MHz. Please ask about special frequencies. Multiple output configurations are very often requested and are generally limited only by connector space. Our new ultra-low noise frequency standard provides noise floors better than -176 dBc for both 5 and 100 MHz outputs and provides an excellent reference for critical phase noise measurements.

1 to 12.5 MHz Oscillators

	Package	Max Temp Range	Max Temp Stability	Typical Temp 0-50°C	Best 5 MHZ Phase Noise 10 100 1K 10 KHz	Best 10 MHZ Phase Noise 10 100 1K 10 KHz	Best Aging per day	Power at 25°C	Crystal
STREAMLINE Low Profile High Performance	2 x 2 x 1"	-54 to +75°C	1×10^{-9}/°C 2×10^{-10}/°C	$\pm 5 \times 10^{-8}$ $\pm 1 \times 10^{-8}$	-115 -155 -165 -165 -135 -160 -165 -168	-110 -155 -165 -165 -130 -155 -165 -168	1×10^{-9} 1×10^{-10}	2.0 W	AT-Cut SC-Cut
TIMEKEEPER Standard High Performance	2 x 2 x 4"	-54 to +75°C	5×10^{-10}/°C 1×10^{-10}/°C	$\pm 2 \times 10^{-8}$ $\pm 5 \times 10^{-9}$	-115 -155 -165 -165 -135 -160 -168 -168	-110 -150 -165 -165 -130 -155 -165 -168	1×10^{-9} 1×10^{-10}	1.5 W	AT-Cut SC-Cut
SMALL FRY Low Power High Performance	1.5 x 1.5 x 3"	-54 to +75°C	2×10^{-10}/°C 2×10^{-11}/°C	$\pm 1 \times 10^{-8}$ $\pm 5 \times 10^{-9}$	-120 -155 -165 -165 -142 -160 -168 -168	-115 -150 -165 -165 -132 -155 -165 -168	1×10^{-9} 1×10^{-10}	1.0 W	AT-Cut
ULTRA-LOW NOISE Superb Noise Performance	1.8 x 3.0 x 1"	-54 to +75°C	5×10^{-10}/°C	$\pm 5 \times 10^{-9}$	-148 -170 -174 -178	-140 -162 -168 -172	1×10^{-10}	2.5 W	SC-Cut

12.5 to 130 MHz Oscillators

	Package	Max Temp Range	Max Temp Stability	Typical Temp 0-50°C	Best 50 MHZ Phase Noise 10 100 1K 10 KHz	Best 100 MHZ Phase Noise 10 100 1K 10 KHz	Best Aging per year	Power at 25°C	Crystal
L.O. SERIES Tiny Low Phase Noise	1.5 x 1.5 x .5"	-54 to +75°C	.05 PPM/°C .02 PPM/°C	±5PPM ±2PPM	-95 -125 -145 -160 -105 -135 -150 -165	-90 -120 -145 -160 -100 -130 -150 -165	1×10^{-6} 5×10^{-7}	1.8 W	AT-Cut SC-Cut
SPRINTER Miniature Low Phase Noise	2 x 2 x .75"	-54 to +75°C	1×10^{-9}/°C 1×10^{-9}/°C	$\pm 5 \times 10^{-7}$ $\pm 5 \times 10^{-8}$	-95 -125 -145 -165 -105 -135 -150 -165	-90 -120 -145 -165 -100 -130 -150 -165	1×10^{-8} 5×10^{-7}	2.0 W	AT-Cut SC-Cut
TIMEKEEPER Multiplied High Performance	2 x 2 x 4"	-54 to +75°C	2×10^{-10}/°C 5×10^{-11}/°C	$\pm 1 \times 10^{-8}$ $\pm 2 \times 10^{-9}$	-105 -135 -145 -150 -118 -140 -148 -148	-90 -130 -145 -150 -110 -135 -148 -148	1×10^{-7} 1×10^{-8}	2.5 W	AT-Cut SC-Cut
PHASE LOCKED SOURCE	4 x 4 x 2.2" 5 x 6 x 2.2"	-54 to +75°C	5×10^{-11}/°C 1×10^{-10}/°C	$\pm 2 \times 10^{-9}$ $\pm 5 \times 10^{-9}$	-118 -140 -160 -165 -126 -148 -160 -176	-110 -140 -150 -165 -118 -145 -158 -174	1×10^{-8} 1×10^{-8}	3.5 W	SC-Cut SC-Cut
ULTRA-LOW NOISE Superb Noise Performance	1.8 x 3.0 x 1"	-54 to +75°C	1×10^{-9}/°C	$\pm 5 \times 10^{-8}$	-105 -135 -160 -176	-100 -130 -158 -174	5×10^{-7}	2.5 W	SC-Cut

WENZEL ASSOCIATES, INC. 1005 La Posada Dr. • Austin, Texas 78752 • Tel: 512-450-1400 • Fax: 512-450-1490

The QPL Source for Hybrid Oscillators M55310/8, 11, 14, 15, 16, 17, 18, 19

XSIS has earned the reputation among OEM's as the Industry's most reliable supplier of advanced-design microcircuit crystal oscillators. Superior designs and consistent high-quality workmanship make the XSIS oscillators virtually failure-free. Overall quality and the industry's best on-time quoted delivery make XSIS the supplier of choice for hi-rel hybrid oscillators.

All oscillators manufactured by XSIS are tested for all electrical parameters over the operating temperature range. 100% screening tests include fine and gross leak, constant acceleration, automatic temperature cycling and electrical tests plus 160-hour power-on burn in. When required, other testing may include PIND test, destructive and non-destructive bond pull test and die shear test. These tests are also performed in-house on a continuous sampling basis to insure consistent quality.

Environmental tests performed in-house include shock and vibration, salt spray, moisture resistance and 8-hour steam aging. Temperature, humidity, airborne particulate levels and electrostatic discharge (ESD) conditions are monitored and controlled in our expanded engineering, production assembly and test areas.

XSIS Electronics, Inc. is an OEM certified supplier and our only product is the superior hybrid crystal oscillator. As a QPL source, all XSIS microcircuit oscillators are manufactured to the electrical and mechanical parameters of MIL-O-55310, workmanship standards are in accordance with MIL-H-38534, the product assurance program plan is in accordance with MIL-STD-790E, and the quality system is as required by MIL-I-45208B.

XSIS **is** excellence in hybrid oscillators.

4 and 14 pin DIP

TTL	100 Series	60.0 Hz to 70.0 MHz
CMOS	200 Series	1.5 Hz to 12.0 MHz
ECL	300 Series	10.0 MHz to 200.0 MHz
HCMOS	200A Series	1.5 Hz to 65.0 MHz

LCC (0.480"sq.)

TTL	XE10 Series	400 KHz to 65 MHz

- Calibration accuracy: ±15 ppm @ +25°C
- Freq. stability vs. temperature ±50 ppm over -55°C to +125°C
- Frequency aging @ +25°C ±5 ppm per year
- Lowered input current
- Unique, rugged design for high shock and vibration environs
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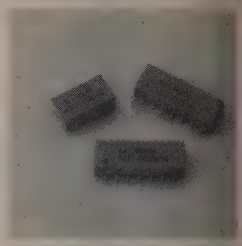
DELAY LINES



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When you need delay lines, miniature or micro fuses, magnetic products, or custom thick film hybrids...come to bel, the company who has been supplying the world with electronic components since 1949.

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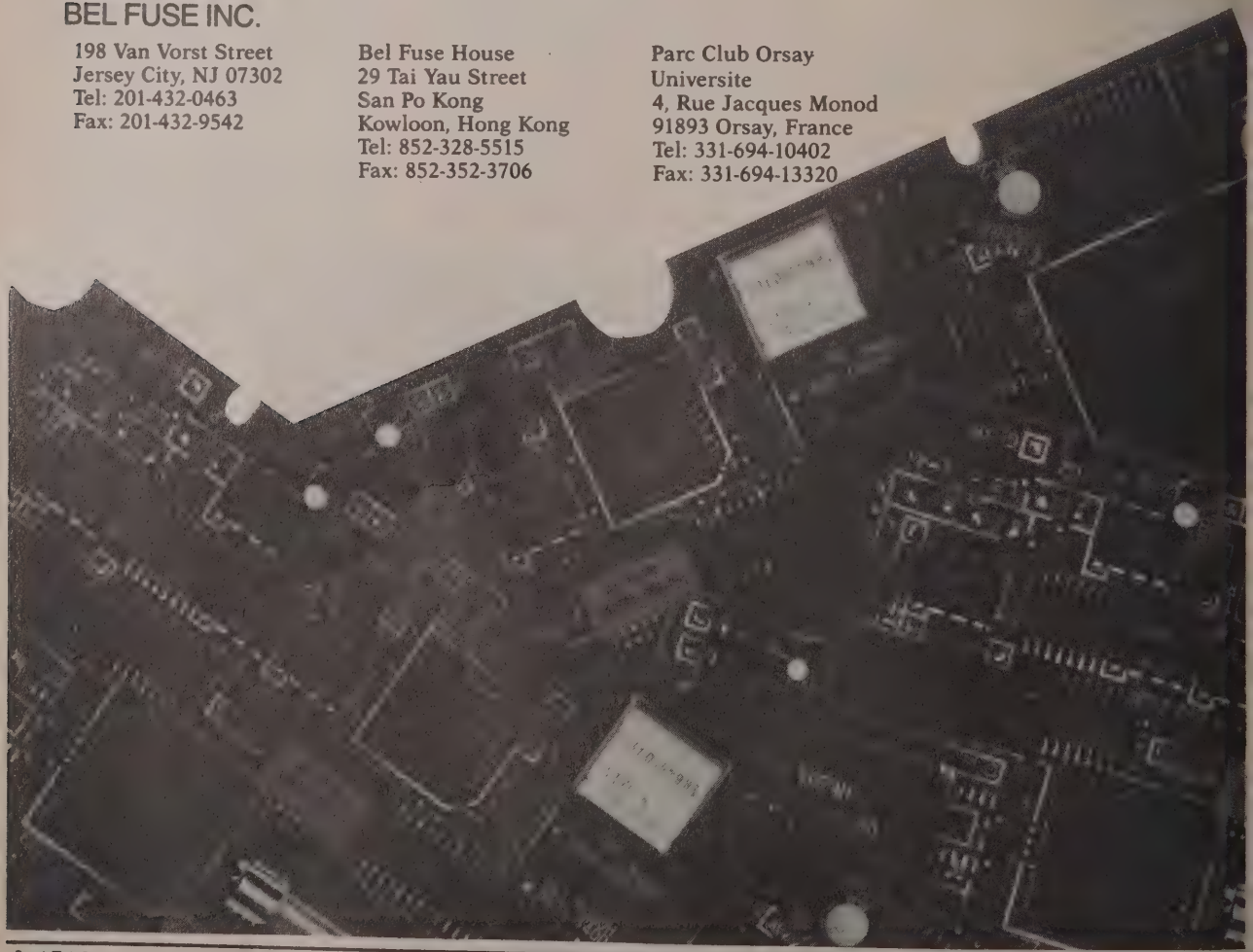


DELAY LINES

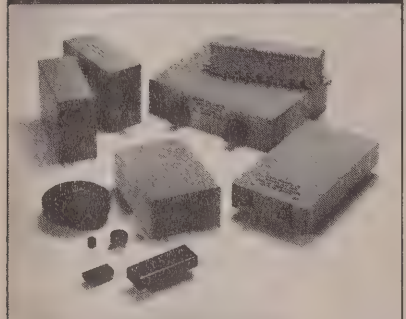
Manufacturer	Starting EEM Page No.	Passive				Digital		Video	Glass & Quartz	Other Types
		Distributed Constant		Lumped Constant						
		Fixed	Variable	Fixed	Variable	Tapped	Program-mable			
Allen Avionics	A•1514	√§*	√§*	√§*	√§*	√§*	√§*	√§*	√*	Miniature, TO5 package
Bel Fuse Inc.	A•1515	√§	√§	√§	√§		√§			
Dallas Semiconductor	A•1525					√§	√§			
Data Delay Devices	A•1528	√§*	√§*	√§*	√§*	√§*	√§*	√§*		All silicon delay lines
Elmec Technology of America	A•1546	√§		√§	√		√			
ESC Electronics Corp.	A•1552			√§*		√§*	√§*	√§*		
JBM Electronics, Inc.	A•1567	√*	√*	√*		√*	√*			Military hermetic sealed, autoinsertable.
Kappa Technologies Inc.	A•1568		√*	√§*	√*	√§*	√§*	√*		
Murata Erie North America	A•1571	√§								
PCA Electronics	A•1572					√§				
Polara Engineering	A•1576	√§*		√§*		√§*	√§*	√		
RCD Components	A•1577	√§*		√§*		√§*	√§*			
Rhombus Industries	A•1579			√§*		√§*	√§*	√§*		
Technitrol Inc.	A•1580			√§*		√§*	√§			

* MIL Spec. § Surface Mount.

ALLEN AVIONICS, INC.

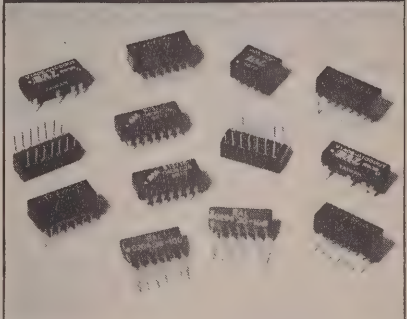
The world's most complete source of:
Video Delay Lines • General Purpose Delay Lines
Video Filters • LC Filters from 20Hz to 3GHz
Video Hum Eliminators & Isolation Transformers
Digital Delay Lines and Video Instrumentation.

GENERAL PURPOSE DELAY LINES



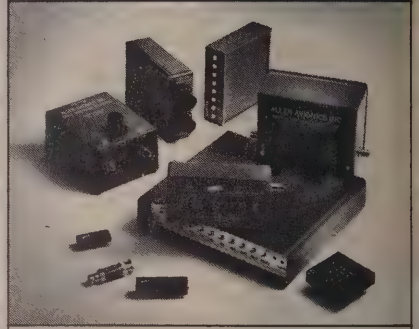
- Audio
- RF
- Lumped & Distributed
- Spiradel
- Fixed
- Variable
- Tapped
- Dual-In-Line
- Programmable
- Miniature & TO5 Package
- Radio Paging
- High Frequency
- Custom Designs
- Military
- Surface Mount

DIGITAL DELAY LINES



- TTL
- DTL
- ECL
- Fixed
- Variable
- Programmable
- Ultra-High-Speed
- Surface Mount
- Delay Trimmers

VIDEO DELAY LINES



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- Rack Mountable
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- Infinitely Variable
- Programmable
- 30 MHz Delay Lines for HDTV
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DIGITAL DELAY LINE SERIES A447 5 TAP

TECHNICAL INFORMATION

TEST CONDITIONS

Pulse Voltage	3.2 Volts
Rise Time	3.0 Nsec (10%-90%)
Pulse Width	1.2 x Total Delay
Pulse Period	4 x Pulse Width
Supply Current, I_{CCL}	60.0 Milliamps typical
Supply Voltage, Vcc	5.0 Volts
Ambient Temperature	25°C

PERFORMANCE CHARACTERISTICS

Delay Tolerance From Input To Tap
±2 Nsec or 5% whichever is greater
Delay Tolerance From Tap To Tap
±2 Nsec or 7% whichever is greater
Performance Characteristics apply at above listed Test Conditions.

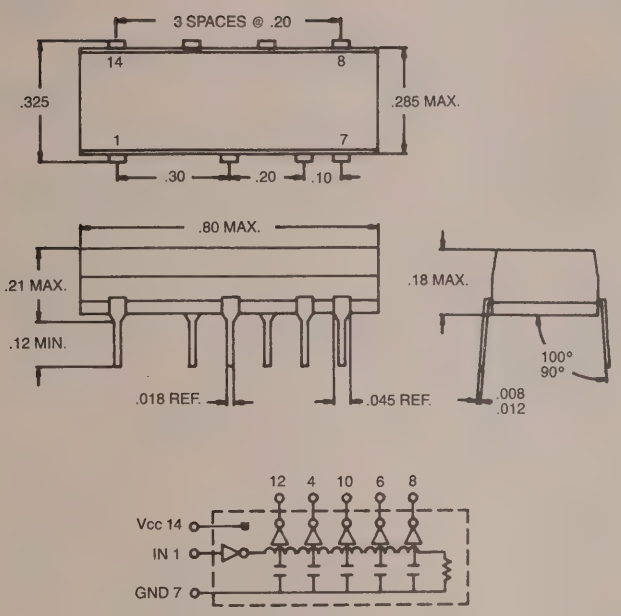
ELECTRICAL CHARACTERISTICS

Supply Voltage, Vcc
4.75 to 5.25 Volts
Logic 1 Input Current
50 Microamp max.
Logic 0 Input Current
−2 Milliamp max.
Logic 1 Output Voltage
2.7 Volts min.
Logic 0 Output Voltage
0.5 Volts max.
Operating Temperature Range
0°C To 70°C
Temperature Coefficient Of Total Delay
500PPM/°C Typical
Minimum Input Pulse Width
40% Of Total Delay
Maximum Duty Cycle
50%

DRIVE CAPABILITIES

10 TTL Loads/Tap max.
20 TTL Loads/Unit max.

—Compatible with TTL and DTL circuits
—Other delays and tolerances upon request



Part Number	Total Delay 1, 3	Delay/Tap 1, 3	Rise Time 2, 3
A447-0025-02	25NS	5NS	4NS
A447-0030-02	30NS	6NS	4NS
A447-0040-02	40NS	8NS	4NS
A447-0050-02	50NS	10NS	4NS
A447-0060-02	60NS	12NS	4NS
A447-0070-02	70NS	14NS	4NS
A447-0080-02	80NS	16NS	4NS
A447-0090-02	90NS	18NS	4NS
A447-0100-02	100NS	20NS	4NS
A447-0125-02	125NS	25NS	4NS
A447-0150-02	150NS	30NS	4NS
A447-0200-02	200NS	40NS	4NS
A447-0250-02	250NS	50NS	4NS
A447-0300-02	300NS	60NS	4NS
A447-0400-02	400NS	80NS	4NS
A447-0450-02	450NS	90NS	4NS
A447-0500-02	500NS	100NS	5NS

1 Delays measured at 1.5 Volts level on Leading Edge only.
2 Rise Times measured from .75 Volts to 2.4 Volts.
3 Measured with no loads on taps.

Specifications Subject To Change Without Notice

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DIGITAL DELAY LINE SERIES A447 10 TAP

TECHNICAL INFORMATION

TEST CONDITIONS

Pulse Voltage	3.2 Volts
Rise Time	3.0 Nsec (10%-90%)
Pulse Width	1.2 × Total Delay
Pulse Period	4 × Pulse Width
Supply Current, I_{CCL}	120.0 Milliamps typical
Supply Voltage, V_{CC}	5.0 Volts
Ambient Temperature	25°C

PERFORMANCE CHARACTERISTICS

Delay Tolerance From Input To Tap
± 2 Nsec or 5% whichever is greater
Delay Tolerance From Tap To Tap
± 2 Nsec or 7% whichever is greater
Performance Characteristics apply at above listed Test Conditions.

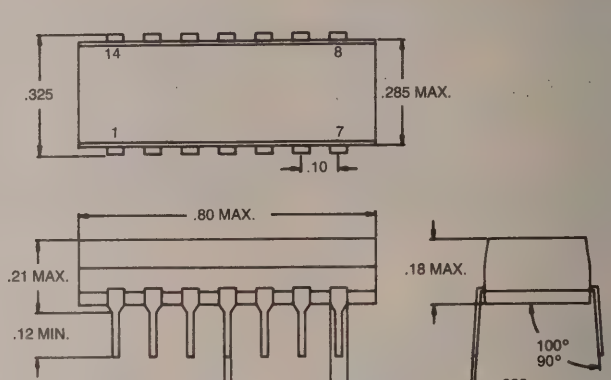
ELECTRICAL CHARACTERISTICS

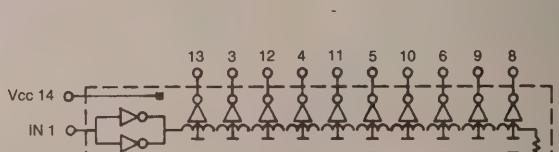
Supply Voltage, V_{CC}
4.75 to 5.25 Volts
Logic 1 Input Current
100 Microamp max.
Logic 0 Input Current
– 4 Milliamp max.
Logic 1 Output Voltage
2.7 Volts min.
Logic 0 Output Voltage
0.5 Volts max.
Operating Temperature Range
0°C To 70°C
Temperature Coefficient Of Total Delay
500PPM/°C Typical
Minimum Input Pulse Width
40% Of Total Delay
Maximum Duty Cycle
50%

DRIVE CAPABILITIES

10 TTL Loads/Tap max.
20 TTL Loads/Unit max.

—Compatible with TTL and DTL circuits
—Other delays and tolerances upon request





Part Number	Total Delay 1, 3	Delay/Tap 1, 3	Rise Time 2, 3
A447-0050-10	50NS	5NS	4NS
A447-0100-10	100NS	10NS	4NS
A447-0150-10	150NS	15NS	4NS
A447-0200-10	200NS	20NS	4NS
A447-0250-10	250NS	25NS	4NS
A447-0300-10	300NS	30NS	4NS
A447-0350-10	350NS	35NS	4NS
A447-0400-10	400NS	40NS	4NS
A447-0500-10	500NS	50NS	5NS

1 Delays measured at 1.5 Volts level on Leading Edge only.
2 Rise Times measured from .75 Volts to 2.4 Volts.
3 Measured with no loads on taps.

Specifications Subject To Change Without Notice

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DIGITAL DELAY LINE SERIES A447 CONTROLLED LEADING & TRAILING EDGE DELAY MODULE 5 TAP

TECHNICAL INFORMATION

TEST CONDITIONS

Pulse Voltage	3.2 Volts
Rise Time	3.0 Nsec (10%-90%)
Pulse Width	1.2 × Total Delay
Pulse Period	4 × Pulse Width
Supply Current, I_{CCL}	60.0 Milliamps typical
Supply Voltage, V_{CC}	5.0 Volts
Ambient Temperature	25°C

PERFORMANCE CHARACTERISTICS

Delay Tolerance From Input To Tap
±2 Nsec or 5% whichever is greater
Delay Tolerance From Tap To Tap
±2 Nsec or 7% whichever is greater
Performance Characteristics apply at above listed Test Conditions.

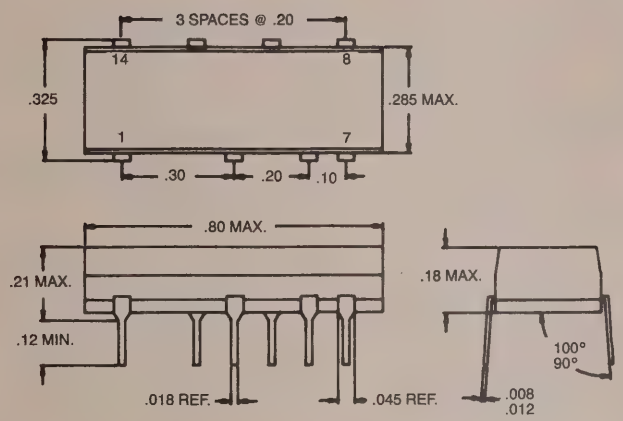
ELECTRICAL CHARACTERISTICS

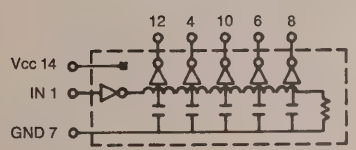
Supply Voltage, Vcc
4.75 to 5.25 Volts
Logic 1 Input Current
50 Microamp max.
Logic 0 Input Current
−2 Milliamp max.
Logic 1 Output Voltage
2.7 Volts min.
Logic 0 Output Voltage
0.5 Volts max.
Operating Temperature Range
0°C To 70°C
Temperature Coefficient Of Total Delay
500PPM/°C Typical
Minimum Input Pulse Width
20% Of Total Delay
Maximum Duty Cycle
50%

DRIVE CAPABILITIES

10 TTL Loads/Tap max.
20 TTL Loads/Unit max.

—Compatible with TTL and DTL circuits
—Other delays and tolerances upon request





Part Number	Total Delay 1, 3	Delay/Tap 1, 3	Rise Time/Fall Time 2, 3
A447-0025-A1	25NS	5NS	4NS
A447-0030-A1	30NS	6NS	4NS
A447-0040-A1	40NS	8NS	4NS
A447-0050-A1	50NS	10NS	4NS
A447-0060-A1	60NS	12NS	4NS
A447-0070-A1	70NS	14NS	4NS
A447-0080-A1	80NS	16NS	4NS
A447-0090-A1	90NS	18NS	4NS
A447-0100-A1	100NS	20NS	4NS
A447-0125-A1	125NS	25NS	4NS
A447-0150-A1	150NS	30NS	4NS
A447-0200-A1	200NS	40NS	4NS
A447-0250-A1	250NS	50NS	4NS
A447-0300-A1	300NS	60NS	4NS
A447-0400-A1	400NS	80NS	4NS
A447-0450-A1	450NS	90NS	4NS
A447-0500-A1	500NS	100NS	5NS

1 Delays measured at 1.5 Volts level on Leading and Trailing Edge.
2 Rise and Fall Times measured from .75 Volts to 2.4 Volts.
3 Measured with 1 STTL (15 PF) load per tap.

Specifications Subject To Change Without Notice

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DIGITAL DELAY LINE SERIES A447 TRIPLE OUTPUT MODULE

TECHNICAL INFORMATION

TEST CONDITIONS

Pulse Voltage	3.2 Volts
Rise Time	3.0 Nsec (10%-90%)
Pulse Width	1.2 × Total Delay
Pulse Period	4 × Pulse Width
Supply Current, I_{CCL}	Constant "0" in 115 mA max Constant "1" in 90 mA max.
Supply Voltage, Vcc	5.0 Volts
Ambient Temperature	25°C

PERFORMANCE CHARACTERISTICS

Delay Tolerance From Input To Output
As Specified In Table
Performance Characteristics apply at above listed Test Conditions.

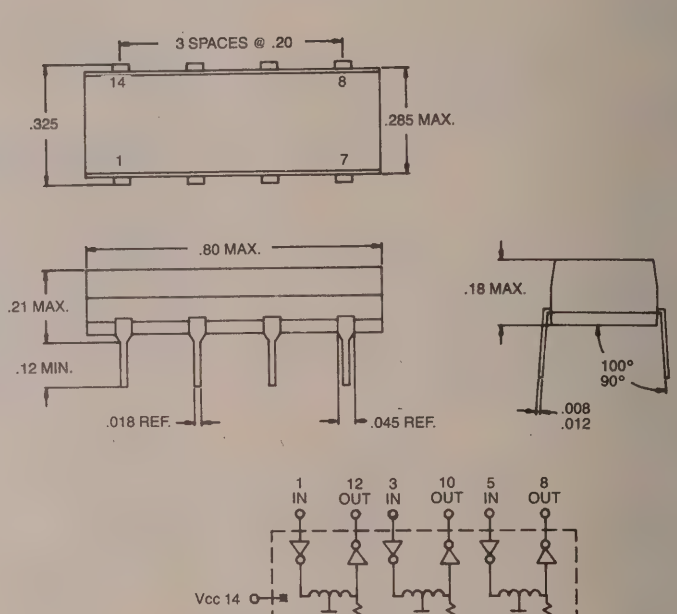
ELECTRICAL CHARACTERISTICS

Supply Voltage, Vcc
4.75 to 5.25 Volts
Logic 1 Input Current
50 Microamp max.
Logic 0 Input Current
– 2 Milliamp max.
Logic 1 Output Voltage
2.7 Volts min.
Logic 0 Output Voltage
0.5 Volts max.
Operating Temperature Range
0°C To 70°C
Temperature Coefficient of Total Delay
1200PPM/°C Typical
Minimum Input Pulse Width
100% of Total Delay
Maximum Duty Cycle
50%

DRIVE CAPABILITIES

10 TTL Loads/Output max.
20 TTL Loads/Unit max.

—Compatible with TTL and DTL circuits
—Other delays and tolerances upon request



Part Number	Total Delay 1, 3	Rise Time 2, 3
A447-0010-A3	10 NS ± 1.5 NS	3 NS
A447-0020-A3	20 NS ± 1.5 NS	3 NS
A447-0030-A3	30 NS ± 2.0 NS	3 NS
A447-0040-A3	40 NS ± 2.0 NS	3 NS
A447-0050-A3	50 NS ± 2.5 NS	3 NS
A447-0060-A3	60 NS ± 3.0 NS	4 NS
A447-0070-A3	70 NS ± 3.5 NS	4 NS
A447-0080-A3	80 NS ± 4.0 NS	4 NS
A447-0090-A3	90 NS ± 4.0 NS	4 NS
A447-0100-A3	100 NS ± 5.0 NS	4 NS

1 Delays measured at 1.5 Volt Leading Edge only.
2 Rise Times measured from .75 Volts to 2.4 Volts.
3 Measured with 1 STTL load (15PF) on each output.

Specifications Subject To Change Without Notice

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DIGITAL DELAY LINE SERIES A463 8 PINS 5 TAP

TECHNICAL INFORMATION

TEST CONDITIONS

Pulse Voltage	3.2 Volts
Rise Time	3.0 Nsec (10%-90%)
Pulse Width	1.2 x Total Delay
Pulse Period	4 x Pulse Width
Supply Current, I_{CCL}	60.0 Milliamps typical
Supply Voltage, Vcc	5.0 Volts
Ambient Temperature	25°C

PERFORMANCE CHARACTERISTICS

Delay Tolerance From Input To Tap
± 2 Nsec or 5% whichever is greater
Delay Tolerance From Tap To Tap
± 2 Nsec or 7% whichever is greater
Performance Characteristics apply at above listed Test Conditions.

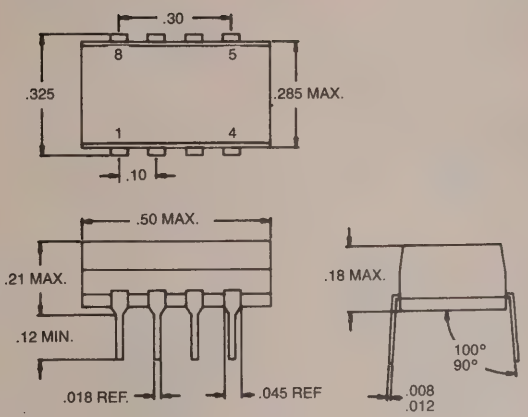
ELECTRICAL CHARACTERISTICS

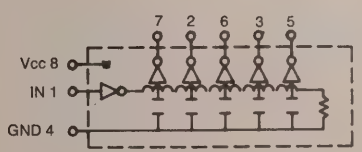
Supply Voltage, Vcc
4.75 to 5.25 Volts
Logic 1 Input Current
50 Microamp max.
Logic 0 Input Current
– 2 Milliamp max.
Logic 1 Output Voltage
2.7 Volts min.
Logic 0 Output Voltage
0.5 Volts max.
Operating Temperature Range
0°C To 70°C
Temperature Coefficient Of Total Delay
500PPM/°C Typical
Minimum Input Pulse Width
40% Of Total Delay
Maximum Duty Cycle
50%

DRIVE CAPABILITIES

10 TTL Loads/Tap max.
20 TTL Loads/Unit max.

—Compatible with TTL and DTL circuits.
—Other delays and tolerances upon request





Part Number	Total Delay 1, 3	Delay/Tap 1, 3	Rise Time 2, 3
A463-0025-02	25NS	5NS	4NS
A463-0030-02	30NS	6NS	4NS
A463-0040-02	40NS	8NS	4NS
A463-0050-02	50NS	10NS	4NS
A463-0060-02	60NS	12NS	4NS
A463-0070-02	70NS	14NS	4NS
A463-0080-02	80NS	16NS	4NS
A463-0090-02	90NS	18NS	4NS
A463-0100-02	100NS	20NS	4NS
A463-0125-02	125NS	25NS	4NS
A463-0150-02	150NS	30NS	4NS
A463-0200-02	200NS	40NS	4NS
A463-0250-02	250NS	50NS	4NS

1 Delays measured at 1.5 Volts level on Leading Edge only.
2 Rise Times measured from .75 Volts to 2.4 Volts.
3 Measured with no loads on taps.

Specifications Subject To Change Without Notice

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SMD DIGITAL DELAY LINE 5 TAP SERIES S423

TECHNICAL INFORMATION

TEST CONDITIONS

Pulse Voltage	3.2 Volts
Rise Time	3.0 Nsec (10%-90%)
Pulse Width	1.2 × Total Delay
Pulse Period	4 × Pulse Width
Supply Current, I_{CCL}	60.0 Milliamps typical
Supply Voltage, Vcc	5.0 Volts
Ambient Temperature	25°C

PERFORMANCE CHARACTERISTICS

Delay Tolerance From Input To Tap
±2 Nsec or 5% whichever is greater
Delay Tolerance From Tap To Tap
±2 Nsec or 7% whichever is greater
Performance Characteristics apply at above listed Test Conditions.

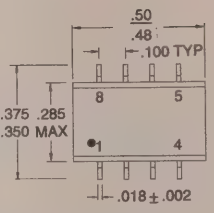
ELECTRICAL CHARACTERISTICS

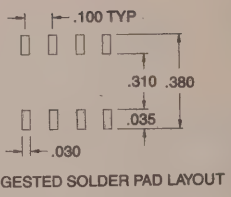
Supply Voltage, Vcc
4.75 to 5.25 Volts
Logic 1 Input Current
50 Microamp max.
Logic 0 Input Current
−2 Milliamp max.
Logic 1 Output Voltage
2.7 Volts min.
Logic 0 Output Voltage
0.5 Volts max.
Operating Temperature Range
0°C To 70°C
Temperature Coefficient Of Total Delay
500PPM/°C Typical
Minimum Input Pulse Width
40% Of Total Delay
Maximum Duty Cycle
50%

DRIVE CAPABILITIES

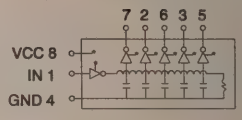
10 TTL Loads/Tap max.
20 TTL Loads/Unit max.

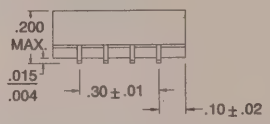
—Compatible with TTL and DTL circuits
—Other delays and tolerances upon request

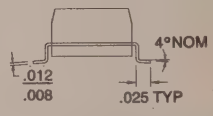




SUGGESTED SOLDER PAD LAYOUT





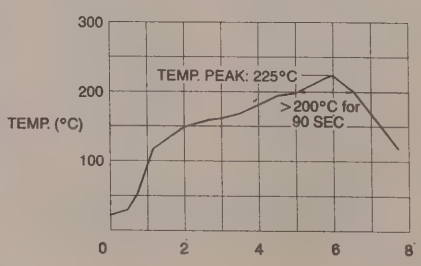


Part Number	Total Delay 1, 3	Delay/Tap 1, 3	Rise Time 2, 3
S423-0025-02	25NS	5NS	4NS
S423-0030-02	30NS	6NS	4NS
S423-0040-02	40NS	8NS	4NS
S423-0050-02	50NS	10NS	4NS
S423-0060-02	60NS	12NS	4NS
S423-0070-02	70NS	14NS	4NS
S423-0080-02	80NS	16NS	4NS
S423-0090-02	90NS	18NS	4NS
S423-0100-02	100NS	20NS	4NS
S423-0125-02	125NS	25NS	4NS
S423-0150-02	150NS	30NS	4NS
S423-0200-02	200NS	40NS	4NS
S423-0250-02	250NS	50NS	4NS

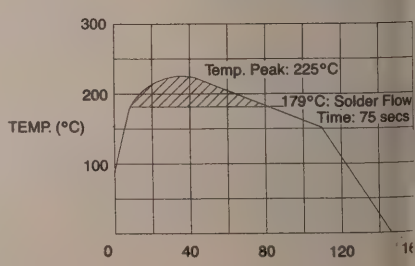
1 Delays measured at 1.5 Volts level on Leading Edge only.
2 Rise Times measured from .75 Volts to 2.4 Volts.
3 Measured with no loads on taps.

SOLDERING TEMPERATURE PROFILE

INFRA RED



VAPOR PHASE



Specifications Subject To Change Without Notice

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LUMPED CONSTANT DELAY LINES SINGLE IN-LINE SERIES 0401

TECHNICAL INFORMATION

TEST CONDITIONS

Pulse Width	3 × Total Delay
Pulse Period	4 × Pulse Width
Rise Time	2.0 NSec (10%-90%)
Pulse Voltage	1 Volt
Ambient Temperature	20°C

PERFORMANCE CHARACTERISTICS

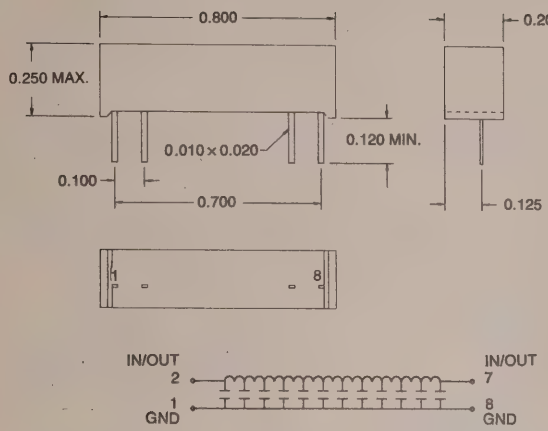
Distortion	10% max.
Rise Time (True)	See Table

Performance Characteristics apply at above listed Test Conditions.

ELECTRICAL CHARACTERISTICS

Operating Temperature Range
– 55°C To 125°C
Temperature Coefficient
100PPM/°C Typical
Dielectric Withstanding Voltage
50 Volt

—Compatible with TTL and ECL circuits
—Other delays and impedances upon request



Time Delay (ns)	Tolerance (Max.) (ns)	Max. * Rise Time (ns)	DCR (Ohms) (Max.)	Impedance Ohms (Zo) ± 10%	Part Number
0.0	+0.25	1.0	1.0	100	0401-1403-01
0.5	±0.25	1.0	1.0	100	0401-1403-02
1.0	±0.25	1.0	1.0	100	0401-1403-03
1.5	±0.25	1.0	1.0	100	0401-1403-04
2.0	±0.25	1.0	1.0	100	0401-1403-05
2.5	+0.25	1.0	1.0	100	0401-1403-06
3.0	±0.25	1.0	1.0	100	0401-1403-07
3.5	±0.25	1.0	1.0	100	0401-1403-08
4.0	±0.25	1.0	1.0	100	0401-1403-09
4.5	±0.25	1.0	1.0	100	0401-1403-10
5.0	+0.25	1.1	1.0	100	0401-1403-11
5.5	±0.25	1.2	1.0	100	0401-1403-12
6.0	±0.25	1.3	1.0	100	0401-1403-13
6.5	±0.25	1.4	1.0	100	0401-1403-14
7.0	±0.25	1.5	1.0	100	0401-1403-15
7.5	+0.25	1.6	1.0	100	0401-1403-16
8.0	±0.25	1.7	1.0	100	0401-1403-17
8.5	±0.25	1.8	1.0	100	0401-1403-18
9.0	±0.25	1.9	1.0	100	0401-1403-19
9.5	±0.25	2.0	1.0	100	0401-1403-20
10.0	±0.25	2.0	1.0	100	0401-1403-21
11.0	±0.25	2.2	2.0	100	0401-1403-23
12.0	±0.25	2.3	2.0	100	0401-1403-25
13.0	±0.25	2.5	2.0	100	0401-1403-27
14.0	±0.25	2.6	2.0	100	0401-1403-29
15.0	±0.25	2.8	2.0	100	0401-1403-31
16.0	±0.25	3.0	2.5	100	0401-1403-33
17.0	±0.25	3.2	2.5	100	0401-1403-35
18.0	±0.25	3.4	2.5	100	0401-1403-37
19.0	±0.25	3.6	2.5	100	0401-1403-39
20.0	±0.50	3.8	2.5	100	0401-1403-40
25.0	±0.50	4.5	4.0	100	0401-1403-46
30.0	±0.50	5.5	4.5	100	0401-1403-51
35.0	±0.50	6.4	5.5	100	0401-1403-56
40.0	±0.50	7.4	6.0	100	0401-1403-61

*Rise Time measured from 10% to 90% of the pulse (True)

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LUMPED CONSTANT DELAY LINE 0432 PICOLINE AND 0402 SERIES

TECHNICAL INFORMATION

TEST CONDITIONS

Pulse Width	3.0 x Total Delay, 5.0 Nsec min.
Pulse Period	4 x Pulse Width
Rise Time	1.0 NSec (10%-90%)
Pulse Voltage	1 Volt
Ambient Temperature	25°C

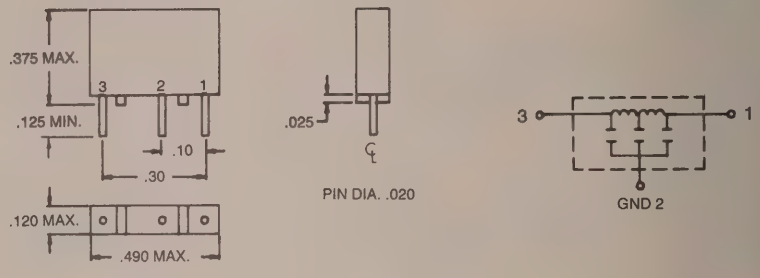
PERFORMANCE CHARACTERISTICS

Distortion 10% max.
Performance Characteristics apply at above listed Test Conditions.

ELECTRICAL CHARACTERISTICS

Operating Temperature Range
– 55°C To 125°C
Temperature Coefficient Of Total Delay
100PPM/°C Typical
Dielectic Withstanding Voltage
50 Volt DC
Operation
Bidirectional

—Compatible with TTL and ECL circuits
—Other delays and impedances upon request
—Gold coated pins for excellent conductivity for time delays of 100 to 1000 PS.



Part Number	Time Delay	*Rise Time	DCR Max (OHMS)	$Z_0 \pm 10\%$ (OHMS)
0432-0100-55	100 ± 50 PS	0.9 NS	0.20	55
0432-0200-55	200 ± 50 PS	0.9 NS	0.20	55
0432-0300-55	300 ± 50 PS	0.9 NS	0.20	55
0432-0400-55	400 ± 50 PS	1.0 NS	0.20	55
0432-0500-55	500 ± 50 PS	1.0 NS	0.22	55
0432-0600-55	600 ± 60 PS	1.1 NS	0.24	55
0432-0700-55	700 ± 70 PS	1.2 NS	0.26	55
0432-0800-55	800 ± 80 PS	1.3 NS	0.28	55
0432-0900-55	900 ± 90 PS	1.4 NS	0.30	55
0432-1000-55	1000 ± 100 PS	1.5 NS	0.30	55

*Rise time measured from 20% to 80% of the pulse.

Part Number 55 OHMS ± 10%	Part Number 93 OHMS ± 10%	Time Delay	*Rise Time	DCR Max (OHMS)
0402-0001-55	0402-0001-93	1 ± .2NS	1.6NS	0.20
0402-0002-55	0402-0002-93	2 ± .2NS	1.6NS	0.25
0402-0003-55	0402-0003-93	3 ± .2NS	1.7NS	0.37
0402-0004-55	0402-0004-93	4 ± .2NS	1.7NS	0.50
0402-0005-55	0402-0005-93	5 ± .25NS	1.8NS	0.62
0402-0006-55	0402-0006-93	6 ± .3NS	2.0NS	0.75
0402-0007-55	0402-0007-93	7 ± .3NS	2.2NS	0.80
0402-0008-55	0402-0008-93	8 ± .3NS	2.4NS	0.85
0402-0009-55	0402-0009-93	9 ± .3NS	2.6NS	0.90
0402-0010-55	0402-0010-93	10 ± .3NS	2.8NS	0.95

*Rise Time measured from 20% to 80% of the pulse.

Specifications Subject To Change Without Notice

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SQUARE WAVE GENERATOR SERIES A457 TTL COMPATIBLE

TECHNICAL INFORMATION

TEST CONDITIONS

Pulse Voltage	3.2 Volts
Rise/Fall Time	3.0 Nsec (10%-90%)
Supply Current	60.0 Milliamps max.
Supply Voltage, Vcc	5.0 Volts ±5%
Ambient Temperature	25°C

PERFORMANCE CHARACTERISTICS

Output Frequency Tolerance
±2%
Performance Characteristics apply at above listed Test Conditions.

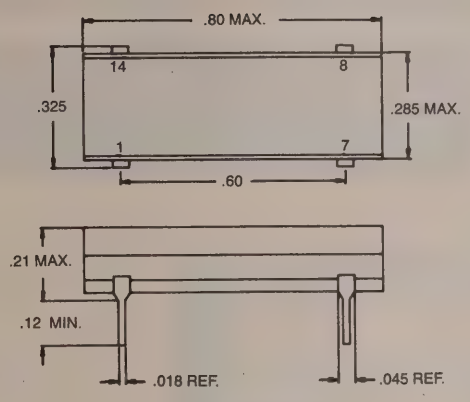
ELECTRICAL CHARACTERISTICS

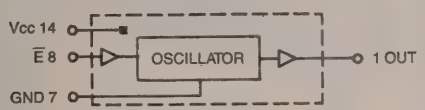
Supply Voltage, Vcc
4.75 to 5.25 Volts
Logic 1 Input Voltage
2.0 Volts min.
Logic 0 Input Voltage
0.8 Volts max.
Logic 1 Output Voltage
2.7 Volts min.
Logic 0 Output Voltage
0.5 Volts max.
Operating Temperature Range
0°C To 70°C
Temperature Coefficient Of Output Frequency
500PPM/°C Typical

DRIVE CAPABILITIES

10 TTL Loads max.

—Compatible with TTL and DTL circuits
—Output wave train is synchronized with random gating signal
—Enable input "high" will result in a constant "high" at output
—First output "low" appears one half cycle after input goes "low"
—Other frequencies upon request

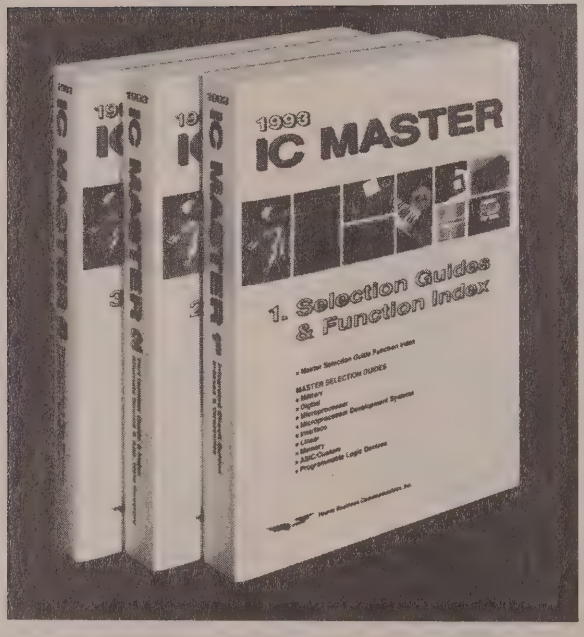




Part Number	Output Frequency
A457-0002-01	2 MHz
A457-0003-01	3 MHz
A457-0004-01	4 MHz
A457-0005-01	5 MHz
A457-0006-01	6 MHz
A457-0007-01	7 MHz
A457-0008-01	8 MHz
A457-0009-01	9 MHz
A457-0010-01	10 MHz
A457-0011-01	11 MHz
A457-0012-01	12 MHz
A457-0013-01	13 MHz
A457-0014-01	14 MHz
A457-0015-01	15 MHz
A457-0020-01	20 MHz
A457-0025-01	25 MHz
A457-0030-01	30 MHz
A457-0035-01	35 MHz
A457-0040-01	40 MHz
A457-0045-01	45 MHz
A457-0050-01	50 MHz

Specifications Subject To Change Without Notice

SSSSOPER
TTIME
SSSAVER!



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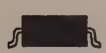
IC MASTER
Published annually in February,

All–Silicon Active Delay Lines

8–Pin DIP
14–Pin DIP
16–Pin DIP
(300 mil)

8–Pin GULLWING
14–Pin GULLWING
16–Pin GULLWING

16–Pin SOIC
(300 mil)



8–Pin SOIC
(150 mil)

ALSO AVAILABLE IN DIE FORM

- Reliability of monolithic IC
- All–silicon time delays
- Leading and trailing edge accuracy
- Auto–insertable, low profile
- Tape and reel available
- Vapor phase, IR and wave solderable
- TTL/CMOS–compatible
- Custom delays available

Specification temp. 0° to 70°C ■ Operating temp. –40°C to +85°C ■ Storage temp. –55°C to +125°C ■ Soldering temp. 260°C for 10 sec.

DS1000 **5–Tap Silicon Delay Line**	• Delay tolerance 2 ns or ±5% • 5 taps equally spaced • Leading and trailing edge accuracy • Custom delays available • Extended temperature range available • Tighter tolerances available	14–Pin DIP 14–Pin DIP Sheared NC 8–Pin DIP 14–Pin GULLWING 8–Pin GULLWING 16–Pin SOIC 8–Pin SOIC (150 mil)	DS1000–XXX DS1000K–XXX DS1000M–XXX DS1000G–XXX DS1000H–XXX DS1000S–XXX DS1000Z–XXX	XXX=25 to 500 ns XXX=25 to 500 ns XXX=25 to 500 ns XXX=25 to 500 ns XXX=25 to 500 ns XXX=25 to 500 ns XXX=25 to 500 ns
DS1003 **4–Tap Silicon Delay Line for RISC Applications**	• 4 delayed clock phases • Support of 50% duty cycle clocks • Leading and trailing edge–controlled • Tap–to–tap tolerance ±0.5 ns • CMOS–compatible output • Vapor phase, IR and wave solderable • Custom values available	14–Pin DIP 14–Pin DIP 8–Pin DIP 8–Pin DIP 8–Pin DIP 8–Pin GULLWING 8–Pin GULLWING 8–Pin GULLWING 8–Pin GULLWING 8–Pin GULLWING	DS1003–16 DS1003–20 DS1003M–25 DS1003M–33 DS1003M–40 DS1003H–16 DS1003H–20 DS1003H–25 DS1003H–33 DS1003H–40	16=RISC – 16 20=RISC – 20 25=RISC – 25 33=RISC – 33 40=RISC – 40 16=RISC – 16 20=RISC – 20 25=RISC – 25 33=RISC – 33 40=RISC – 40
DS1004 **5–Tap High Speed Tight Tolerance Silicon Delay Line**	• 5 taps with controlled tap–to–tap delays of 2, 3, 4, or 5 ns • Preserves input signal symmetry • Leading and trailing edge–controlled accuracy • Input to tap 1 output 5 ns	8–Pin DIP 8–Pin SOIC	DS1004M–00X* DS1004Z–00X*	X=2, 3, 4, 5 ns Tap–to–Tap X=2, 3, 4, 5 ns Tap–to–Tap
DS1005 **5–Tap Silicon Delay Line Voltage Compensated**	• Delay tolerance ±2 ns or ±3% • 5 taps equally spaced • Leading and trailing edge accuracy • Custom delays available • Extended temperature range available • Tighter tolerances available	14–Pin DIP 14–Pin DIP Sheared NC 8–Pin DIP 14–Pin GULLWING 8–Pin GULLWING 16–Pin SOIC	DS1005–XXX DS1005K–XXX DS1005M–XXX DS1005G–XXX DS1005H–XXX DS1005S–XXX	XXX=60 to 250 ns XXX=60 to 250 ns XXX=60 to 250 ns XXX=60 to 250 ns XXX=60 to 250 ns XXX=60 to 250 ns

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CUSTOM DELAYS

LPP LATE PACKAGE PROGRAMMING

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FAX (214) 450–3715

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Seven Years' Experience Making Silicon Delay Lines

8–Pin DIP
14–Pin DIP
16–Pin DIP
(300 mil)

8–Pin GULLWING
14–Pin GULLWING
16–Pin GULLWING

ALSO AVAILABLE IN DIE FORM

16–Pin SOIC
(300 mil)

8–Pin SOIC
(150 mil)

- Reliability of monolithic IC
- All–silicon time delays
- Leading and trailing edge accuracy
- Auto–insertable, low profile
- Tape and reel available
- Vapor phase, IR and wave solderable
- TTL/CMOS–compatible
- Custom delays available

Specification temp. 0° to 70°C ■ Operating temp. –40°C to +85°C ■ Storage temp. –55°C to +125°C ■ Soldering temp. 260°C for 10 sec.				
DS1007 **7–In–1 Silicon Delay Line**	• 7 independent buffered delays • Delay tolerance ±2 ns • 4 delays can be custom set from 3 ns to 10 ns • 3 delays can be custom set from 9 ns to 40 ns • Tighter tolerances available	16–Pin DIP 16–Pin GULLWING 16–Pin SOIC	DS1007–XXX DS1007G–XXX DS1007S–XXX	XXX=3 to 40 ns XXX=3 to 40 ns XXX=3 to 40 ns
DS1010 **10–Tap Silicon Delay Line**	• 10 taps equally spaced • Delay tolerance 2 ns or ±5% • Leading and trailing edge accuracy • Custom delays available • Extended temperature range available • Tighter tolerances available	14–Pin DIP 14–Pin GULLWING 16–Pin SOIC	DS1010–XXX DS1010G–XXX DS1010S–XXX	XXX=50 to 1000 ns XXX=50 to 1000 ns XXX=50 to 1000 ns
DS1012 **2–In–1 Sub–Miniature Silicon Delay Line with Logic**	• Two independent buffered delays per input • Option of timed AND, NAND, OR, NOR, XOR, XNOR, HALF–XOR, and HALF X–NOR outputs • Option of complemented outputs • Low power • Custom delays or logic options available	8–Pin DIP 8–Pin GULLWING 8–Pin SOIC (150 mil)	DS1012M–XXX DS1012H–XXX DS1012Z–XXX	XXX=3 to 60 ns XXX=3 to 60 ns XXX=3 to 60 ns
DS1012–DXX **Pulse Doubler**	• Wide range of frequencies • Fixed–width pulse for any input transition • Doubles specific frequencies • Low–power	8–Pin DIP 8–Pin GULLWING 8–Pin SOIC (150 mil)	DS1012M–DXX DS1012H–DXX DS1012Z–DXX	DXX=16 to 50 MHz DXX=16 to 50 MHz DXX=16 to 50 MHz

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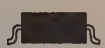
All–Silicon Timing Solutions

8–Pin DIP
14–Pin DIP
16–Pin DIP
(300 mil)

8–Pin GULLWING
14–Pin GULLWING
16–Pin GULLWING

16–Pin SOIC
(300 mil)



8–Pin SOIC
(150 mil)

ALSO AVAILABLE IN DIE FORM

- Reliability of monolithic IC
- All–silicon time delays
- Leading and trailing edge accuracy
- Auto–insertable, low profile
- Tape and reel available
- Vapor phase, IR and wave solderable
- TTL/CMOS–compatible
- Custom delays available

Specification temp. 0° to 70°C ■ Operating temp. –40°C to +85°C ■ Storage temp. –55°C to +125°C ■ Soldering temp. 260°C for 10 sec.

DS1013 **3–In–1 Silicon Delay Line Voltage–Compensated**	• Three independent buffered delays • Delay tolerance ±2 ns or 3% • Leading and trailing edge accuracy • Custom delays available • Extended temperature range available • Tighter tolerances available	14–Pin DIP 8–Pin DIP 14–Pin GULLWING 8–Pin GULLWING 16–Pin SOIC	DS1013–XXX DS1013M–XXX DS1013G–XXX DS1013H–XXX DS1013S–XXX	XXX=15 to 100 ns XXX=15 to 100 ns XXX=15 to 100 ns XXX=15 to 100 ns XXX=15 to 100 ns
DS1020 **8–Bit Programmable Silicon Delay Line**	• 0.25, 0.5, 1 and 2 ns steps • 256 increments • Programmable using 3–wire serial port • Programmable using 8–bit parallel port • 10 ns minimum delay	16–Pin DIP 16–Pin GULLWING 16–Pin SOIC	DS1020–XXX DS1020G–XXX DS1020S–XXX	XXX: 025=0.25 ns 050=0.50 ns 100=1.00 ns 200=2.00 ns
DS1040 **Programmable Pulse Generator**	• Rising edge–triggered • 5 evenly spaced pulse widths • Parallel programmable • Maximum pulse widths from 25 ns to 500 ns • Inverted and non–inverted outputs	8–Pin DIP 8–Pin GULLWING 8–Pin SOIC	DS1040M–XXX DS1040H–XXX DS1040Z–XXX	XXX=15 to 500 ns XXX=15 to 500 ns XXX=15 to 500 ns
DS1045 **4–Bit Dual Programmable Delay Line**	• Dual programmable outputs from a single source • 16 programmable steps for each output • Programmable using parallel 8–bit port • Temperature–compensated	16–Pin DIP 16–Pin SOIC	DS1045–XXX* DS1045S–XXX*	–3=3 ns per step –4=4 ns per step –5=5 ns per step

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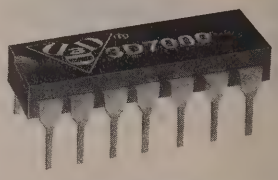
data delay devices

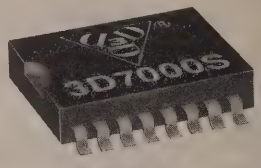
New Dimensions in Delay Line Techniques

All Silicon Delay Line

5 & 10 Taps (Standard Pin-Out)

NEW

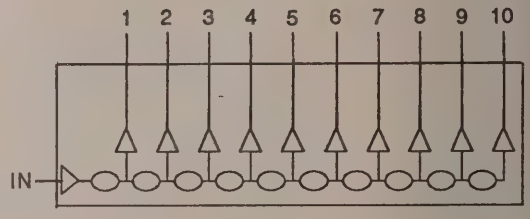




FEATURES

- High operating frequency (100 MHz).
- Very low ground-bounce noise.
- Voltage & temperature compensated.
- Auto-insertable.
- TTL/CMOS compatible, Low power CMOS.
- Vapor phase, IR and wave solderable.

OUTPUTS



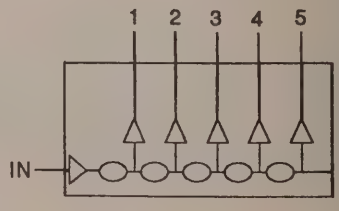
SPECIFICATIONS

- **Standard 14 pin DIP & 16 pin SOIC.**
- **Leading & trailing edge accuracy.**
- **Delay tolerance:** ± 5% or ± 2 ns, whichever is greater (others on request).
- **Custom delays available:** Any increment from 5 to 50 ns not listed.
- **Minimum input pulse width:** 20% of total delay.
- **Delay time vs. Vcc:** 1.5 ns or 2% for 5 Vdc ± 5%.
- **Temperature coefficient of delay:** ±1 ns or ± 3%, whichever is greater (0 to 70°C). (Others on request.)

TABLE

Part Number	Part Number	Delay/Tap (ns)	Max Operating Freq (MHz)
3D7010-50	3D7005-25	5	67
3D7010-60	3D7005-30	6	55
3D7010-80	3D7005-40	8	41
3D7010-90	3D7005-45	9	37
3D7010-100	3D7005-50	10	33
3D7010-150	3D7005-75	15	22
3D7010-200	3D7005-100	20	16
3D7010-250	3D7005-125	25	15
3D7010-300	3D7005-150	30	11
3D7010-400	3D7005-200	40	8
3D7010-450	3D7005-225	45	7
3D7010-500	3D7005-250	50	6

OUTPUTS

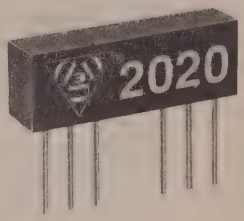


DATA DELAY DEVICES ■ 3 Mt. Prospect Avenue, Clifton, New Jersey 07013 ■ (201) 773-2299 ■ FAX (201) 773-9672

data delay devices *New Dimensions in Delay Line Techniques*

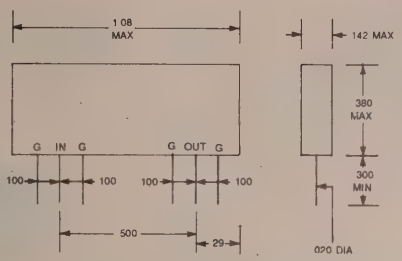
PICO Seconds Delay Lines

NEW



Specifications:

- **Delay range:** 100 ps to 1750 ps.
- **Delay tolerance:** 2% or 10 ps.
- **Frequency response:** Greater than 350 MHZ.
- **Ripple in pass-band:** Approximately .2 db.
- **Temperature range:** –65 to +125°C.
- **Temperature coefficient:** <100 PPM/°C.
- **Dielectric breakdown:** >500 V.
- **Meets or exceeds MIL-D-23859C.**
- **Epoxy encapsulated.**

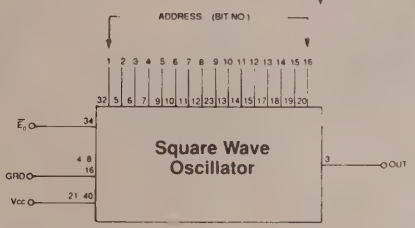


16 BIT Programmable Gated-Oscillator

NEW

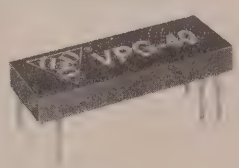
Specifications:

- **Period variation:** monotonic in one direction.
- **Duty cycle:** 50%.
- **Period tolerance:** ±5%.
- **Inherent period** = period increment.
- **Power dissipation:** 1.1 W max.
- **Supply voltage:** 4.75 to 5.25 Vdc.
- **Operating temperature:** 0-70°C.
- **Temperature coefficient:** 100 PPM/° C.
- **Inherent delay (T_{DO})** = 12 ns.



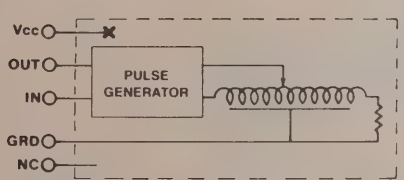
Variable Pulse Generator

NEW



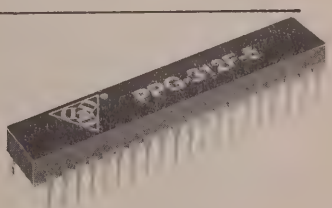
Specifications:

- **Screwdriver adjustment.**
- **Inherent pulse-width (PW_0):** 15 ns typ.
- **Trigger-inherent delay (TD_0):** 6 ns typ.
- **Pulse-width resolution:** .12 ns.
- **Output rise-time:** 2 ns typ.
- **Temperature coefficient:** 100 PPM/°C.
- **Temperature range:** 0°C to 70°C standard. (–55°C to +125°C on request)
- **Supply voltage:** 5.0 Vdc ± 5%.
- **Power dissipation:** 300 mw max.



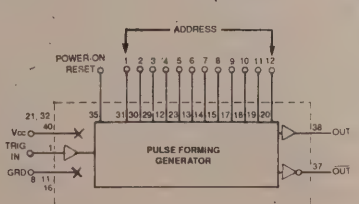
12 BIT Programmable Pulse Generator

NEW



Specifications:

- **Trigger inherent delay:** 13 ns typ.
- **Inherent pulse-width:** 19 ns typ.
- **Pulse-width variation:** monotonic in one direction.
- **Programmed pulse-width tolerance:** ±2% or 2 ns whichever is greater.
- **Supply voltage (Vcc):** 5 Vdc.
- **Operating temperature:** 0° C to 70° C.
- **Temperature coefficient:** 100 PPM/° C.
- **Supply current: Icc:** 200 ma.
- **Pulse-width increments:** 0.5 ns to 50 ns.



data delay devices

New Dimensions in Delay Line Techniques

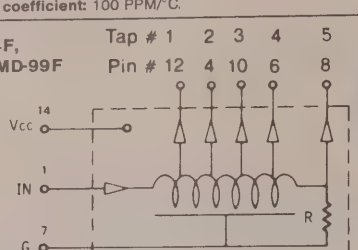
ACTIVE DELAY LINES (FAST-TTL LOGIC)

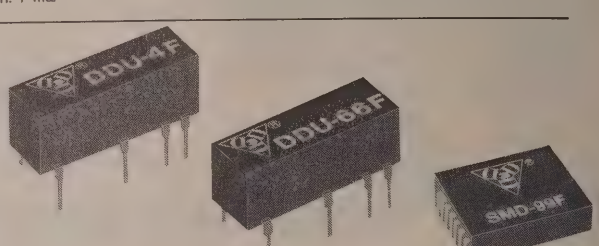
5 Equal Taps

Specifications:

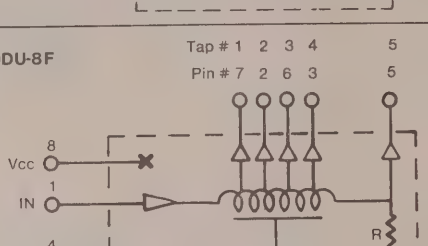
- **Outputs:** 5, equally spaced.
- **Delay Tolerance:** see table.
- **Rise time:** 2 NS typically.
- **Minimum pulse width:** 20% of total delay for DDU-4F.
  40% of total delay for rest.
- **Temperature range:** 0°C to + 70°C.
- **Temperature coefficient:** 100 PPM/°C.
- **Input signal requirement:** TTL logic.
- **Output fan-out:** TTL Schottky load.
- **Supply voltage:** 4.75 to 5.25 Vdc.
- **Supply current:**
  I_{CCL}: 32 ma.
  I_{CCH}: 7 ma.

Series DDU-4F,
DDU-66F-, SMD-99F

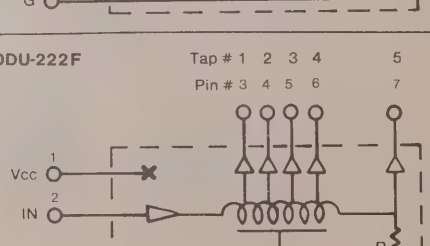


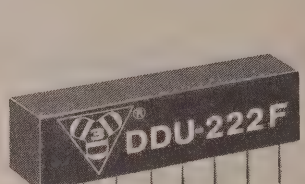


Series DDU-8F



Series DDU-222F





Part Numbers					Total Delay
DDU-4F-5004	DDU-8F-5004	DDU-66F-4	SMD-99F-5004	DDU-222F-4	4
DDU-4F-5006	DDU-8F-5006	DDU-66F-6	SMD-99F-5006	DDU-222F-6	6
DDU-4F-5008	DDU-8F-5008	DDU-66F-8	SMD-99F-5008	DDU-222F-8	8
DDU-4F-5010	DDU-8F-5010	DDU-66F-10	SMD-99F-5010	DDU-222F-10	10
DDU-4F-5012	DDU-8F-5012	DDU-66F-12	SMD-99F-5012	DDU-222F-12	12
DDU-4F-5016	DDU-8F-5016	DDU-66F-16	SMD-99F-5016	DDU-222F-16	16
DDU-4F-5020	DDU-8F-5020	DDU-66F-20	SMD-99F-5020	DDU-222F-20	20
DDU-4F-5025	DDU-8F-5025	DDU-66F-25	SMD-99F-5025	DDU-222F-25	25
DDU-4F-5030	DDU-8F-5030	DDU-66F-30	SMD-99F-5030	DDU-222F-30	30
DDU-4F-5035	DDU-8F-5035	DDU-66F-35	SMD-99F-5035	DDU-222F-35	35
DDU-4F-5040	DDU-8F-5040	DDU-66F-40	SMD-99F-5040	DDU-222F-40	40
DDU-4F-5045	DDU-8F-5045	DDU-66F-45	SMD-99F-5045	DDU-222F-45	45
DDU-4F-5050	DDU-8F-5050	DDU-66F-50	SMD-99F-5050	DDU-222F-50	50
DDU-4F-5060	DDU-8F-5060	DDU-66F-60	SMD-99F-5060	DDU-222F-60	60
DDU-4F-5075	DDU-8F-5075	DDU-66F-75	SMD-99F-5075	DDU-222F-75	75
DDU-4F-5100	DDU-8F-5100	DDU-66F-100	SMD-99F-5100	DDU-222F-100	100
DDU-4F-5125	DDU-8F-5125	DDU-66F-125	SMD-99F-5125	DDU-222F-125	125
DDU-4F-5150	DDU-8F-5150	DDU-66F-150	SMD-99F-5150	DDU-222F-150	150
DDU-4F-5175	DDU-8F-5175	DDU-66F-175	SMD-99F-5175	DDU-222F-175	175
DDU-4F-5200	DDU-8F-5200	DDU-66F-200	SMD-99F-5200	DDU-222F-200	200
DDU-4F-5250	DDU-8F-5250	DDU-66F-250	SMD-99F-5250	DDU-222F-250	250
DDU-4F-5300					300
DDU-4F-5350					350
DDU-4F-5400					400
DDU-4F-5450					450
DDU-4F-5500					500

data delay devices

New Dimensions in Delay Line Techniques

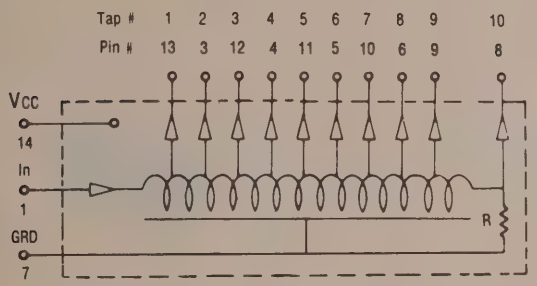
ACTIVE DELAY LINES (FAST-TTL LOGIC)

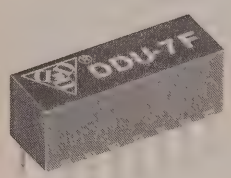
10 Taps

Specifications:

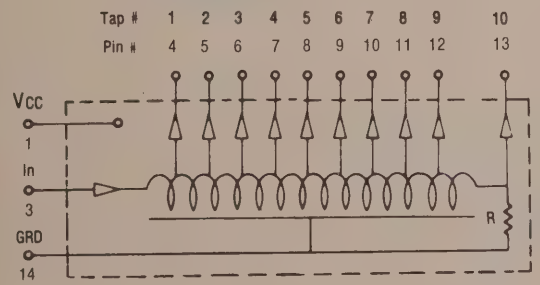
- **No. Taps:** 10 equally spaced taps
- **Total Delay Tolerance:** ± 5% or better, or 2 NS whichever is greater
- **Rise time:** 2 NS typically
- **Temperature coefficient:** 100 PPM/° C
- **Temperature range:** 0° to + 70° C
- **Minimum pulse-width:** 20% of total delay
- **input signal requirement:** TTL logic
- **Output fan-out:** TTL Schottky load
- **Supply voltage:** 4.75 to 5.25 V
- **Supply Current:**
  I_{CCL}: 50 ma.
  I_{CCH}: 15 ma.

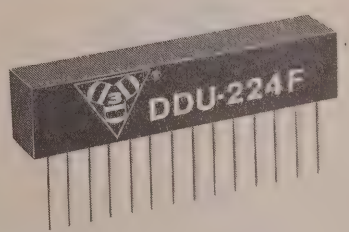
Series DDU-7F





Series DDU-224F





Part Numbers		Tap Delay	Total Delay
DDU-7F-10	DDU-224F-10	1	9
DDU-7F-20	DDU-224F-20	2	18
DDU-7F-25	DDU-224F-25	2.5	22.5
DDU-7F-50	DDU-224F-50	5	45
DDU-7F-100	DDU-224F-100	10	100
DDU-7F-150	DDU-224F-150	15	150
DDU-7F-200	DDU-224F-200	20	200
DDU-7F-250	DDU-224F-250	25	250
DDU-7F-300	DDU-224F-300	30	300
DDU-7F-400	DDU-224F-400	40	400
DDU-7F-500	DDU-224F-500	50	500

data delay devices

New Dimensions in Delay Line Techniques

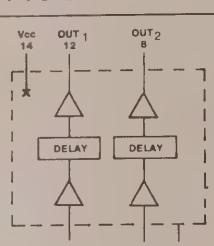
ACTIVE DELAY LINES (FAST-TTL LOGIC)

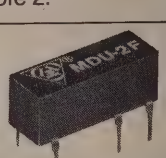
Multiple Delay Lines

Specifications:

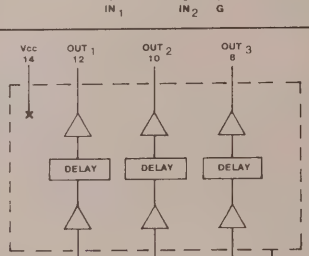
- **Delay Tolerance:** ±5% or 2 NS whichever is greater.
- **Rise-time:** 2 NS typically.
- **Temperature coefficient:** 100 PPM/°C.
- **Temperature range:** 0° to + 70°C.
- **Input signal requirement:** TTL logic.
- **Input pulse width:** Min. 100% of total delay.
- **Input rep. rate** = min. 3 × pulse width.
- **Output fan-out:** TTL loads.
- **Supply voltage:** 5Vdc ± 5%.
- **Supply current:** see Table 2.

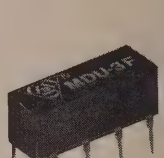
Series MDU-2F
Series MDU-28F





Series MDU-3F





Series MDU-4F

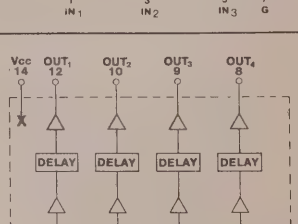


Table 1

Part Numbers				
MDU-28F	MDU-2F	MDU-3F	MDU-4F	Delay Per Line (ns)
MDU-28F-5	MDU-2F-5	MDU-3F-5	MDU-4F-5	.5
MDU-28F-6	MDU-2F-6	MDU-3F-6	MDU-4F-6	6
MDU-28F-8	MDU-2F-8	MDU-3F-8	MDU-4F-8	8
MDU-28F-10	MDU-2F-10	MDU-3F-10	MDU-4F-10	10
MDU-28F-12	MDU-2F-12	MDU-3F-12	MDU-4F-12	12
MDU-28F-15	MDU-2F-15	MDU-3F-15	MDU-4F-15	15
MDU-28F-16	MDU-2F-16	MDU-3F-16	MDU-4F-16	16
MDU-28F-20	MDU-2F-20	MDU-3F-20	MDU-4F-20	20
MDU-28F-25	MDU-2F-25	MDU-3F-25	MDU-4F-25	25
MDU-28F-30	MDU-2F-30	MDU-3F-30	MDU-4F-30	30
MDU-28F-35	MDU-2F-35	MDU-3F-35	MDU-4F-35	35
MDU-28F-40	MDU-2F-40	MDU-3F40	MDU-4F-40	40
MDU-28F-45	MDU-2F-45	MDU-3F-45	MDU-4F-45	45
MDU-28F-50	MDU-2F-50	MDU-3F-50	MDU-4F-50	50
MDU-28F-60	MDU-2F-60	MDU-3F-60	MDU-4F-60	60
MDU-28F-75	MDU-2F-75	MDU-3F-75	MDU-4F-75	75
MDU-28F-100	MDU-2F-100	MDU-3F100	MDU-4F-100	100
MDU-28F-125	MDU-2F-125			125
MDU-28F-150	MDU-2F-150			150
MDU-28F-175	MDU-2F-175			175
MDU-28F-200	MDU-2F-200			200
MDU-28F-250	MDU-2F-250			250

Series	I_{CCH}	I_{CCL}
MDU-28F	12 MA	54 MA
MDU-2F	12 MA	54 MA
MDU-3F	14 MA	74 MA
MDU-4F	24 MA	110 MA

data delay devices

New Dimensions in Delay Line Techniques

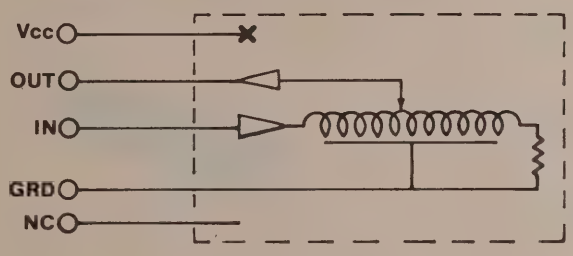
ACTIVE DELAY LINES (FAST-TTL LOGIC)

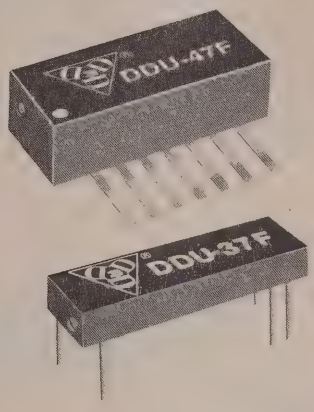
Trimmer Delay

Specifications:

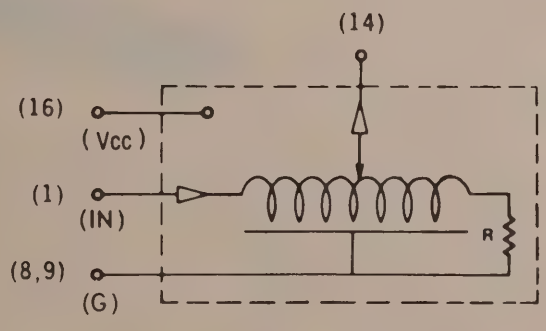
- **Input signal requirement:** TTL logic.
- **Output fan-out:** TTL Schottky load.
- **Inherent delay:** 10 NS typ.
- **Delay resolution:** .12 NS.
- **Output rise-time:** 4 NS typ.
- **Temperature coefficient:** 100 PPM/°C.
- **Temperature range:** 0°C to 70°C standard. (−55°C to +125°C on request)
- **Supply voltage:** 5.0 Vdc ± 5%.
- **Power dissipation:** 230 MW max.

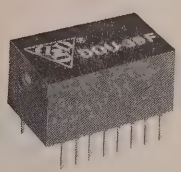
Series DDU-37F, Series DDU-47F





Series DDU-39F





Part No.	Min. Delay Variation (NS)
DDU-37F-25	15
DDU-37F-30	20
DDU-37F-40	30
DDU-37F-50	40
DDU-37F-60	50
DDU-37F-70	60
DDU-37F-80	70
DDU-37F-100	90
DDU-37F-120	100
DDU-37F-150	140
DDU-37F-200	180

Part No.	Inherent Delay Typ.	Adjustment Range Typ.
DDU-39F	7 ns	7 ns to 25 ns
DDU-47F	5 ns	5 ns to 25 ns

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New Dimensions in Delay Line Techniques

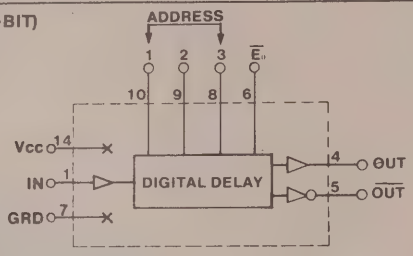
ACTIVE DELAY LINES (FAST-TTL LOGIC)

Digitally Programmable (3 - 8 BIT)

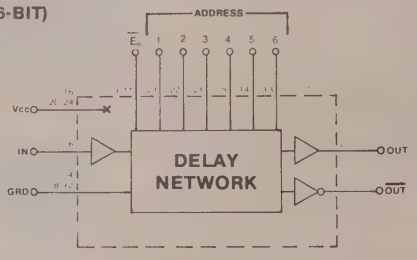
Specifications:

- **Input signal requirement:** TTL logic
- **Propagation delay:** Address to output = 7 NStyp. Enable to output = 6 NS typ.
- **Output fan-out:** TTL Schottky load
- **Delay variation:** Monotonic in one direction
- **Programmed delay tolerance:** ± 5% or 1 NS whichever is greater
- **Operating temperature:** 0-70°C
- **Temperature coefficient:** 100 PPM/°C
- **Supply current:** see Table 2
- **Supply voltage:** 4.75 to 5.25 Vdc

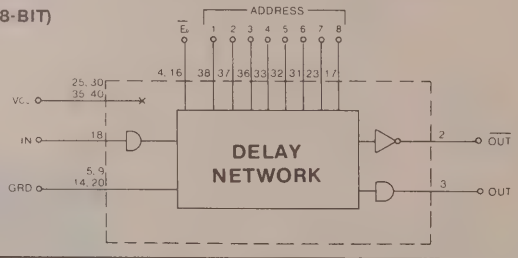
Series PDU-13F (3-BIT)



Series PDU-16F (6-BIT)



Series PDU-18F (8-BIT)



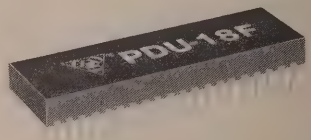


TABLE 1

Part Numbers						
PDU-13F	PDU-14F	PDU-15F	PDU-16F	PDU-17F	PDU-18F	Delay Increment
PDU-13F-.5	PDU-14F-.5	PDU-15F-0.5	PDU-16F-0.5	PDU-17F-.5	PDU-18F-.5	5 NS
PDU-13F-1	PDU-14F-1	PDU-15F-1	PDU-16F-1	PDU-17F-1	PDU-18F-1	1 NS
PDU-13F-2	PDU-14F-2	PDU-15F-2	PDU-16F-2	PDU-17F-2	PDU-18F-2	2 NS
PDU-13F-3	PDU-14F-3	PDU-15F-3	PDU-16F-3	PDU-17F-3	PDU-18F-3	3 NS
PDU-13F-4	PDU-14F-4	PDU-15F-4	PDU-16F-4	PDU-17F-4	PDU-18F-4	4 NS
PDU-13F-5	PDU-14F-5	PDU-15F-5	PDU-16F-5	PDU-17F-5	PDU-18F-5	5.NS
PDU-13F-6	PDU-14F-6	PDU-15F-6	PDU-16F-6	PDU-17F-6	PDU-18F-6	6 NS
PDU-13F-7	PDU-14F-7	PDU-15F-7	PDU-16F-7	PDU-17F-7	PDU-18F-7	7 NS
PFU-13F-8	PDU-14F-8	PDU-15F-8	PDU-16F-8	PDU-17F-8	PDU-18F-8	8 NS
PDU-13F-9	PDU-14F-9	PDU-15F-9	PDU-16F-9	PDU-17F-9	PDU-18F-9	9 NS
PDU-13F-10	PDU-14F-10	PDU-15F-10	PDU-16F-10	PDU-17F-10	PDU-18F-10	10 NS
PDU-13F-12	PDU-14F-12	PDU-15F-12				12 NS
PDU-13F-15	PDU-14F-15	PDU-15F-15				15 NS
PDU-13F-20	PDU-14F-20	PDU-15F-20				20 NS
PDU-13F-25	PDU-14F-25					25 NS
PDU-13F-30	PDU-14F-30					30 NS
PDU-13F-35	PDU-14F-35					35 NS
PDU-13F-40	PDU-14F-40					40 NS
PDU-13F-45	PDU-14F-45					45 NS
PDU-13F-50	PDU-14F-50					50 NS
	PDU-14F-60					60 NS
	PDU-14F-80					80 NS
	PDU-14F-100					100 NS

TABLE 2

Series No.	ICCH (MA)	ICCL (MA)	TDO (NS)
PDU-13F	20	45	4
PDU-14F	30	74	9
PDU-15F	30	74	13
PDU-16F	30	74	13
PDU-17F	68	86	14
PDU-18F	65	130	14

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New Dimensions in Delay Line Techniques

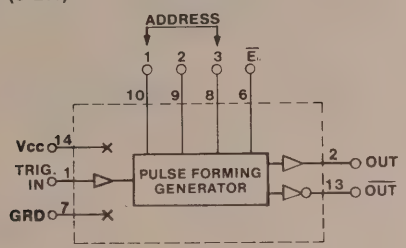
ACTIVE PULSE-WIDTH GENERATORS (FAST-TTL LOGIC)

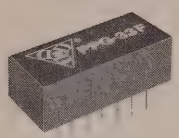
Programmable (3 - 8BITS)

Specifications:

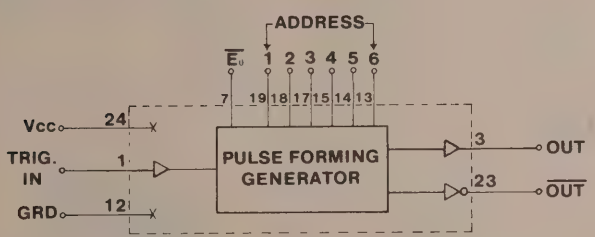
- **Input signal requirement:** TTL rising-edge.
- **Output fan-out:** TTL Schottky loads.
- **Trigger inherent delay:** 6 NS Typ.
- **Inherent pulse-width:** 11 NS Typ.
- **Pulse-width variation:** monotonic in one direction.
- **Programmed pulse-width tolerance:** ± 5% or 1 NS whichever is greater.
- **Propagation delay:**
  Address to output = 7 ns Typ.
  Enable to output = 6 ns Typ.
- **Min. PRR** = PW_{OUT} + 10 ns min.
- **Min. down-time** = 1 × programmed PW.
- **Supply voltage:** 5 Vdc.
- **Operating temperature:** 0°C to 70°C.
- **Temperature coefficient:** 100 PPM/°C.
- **Power dissipation:** see Table 2.

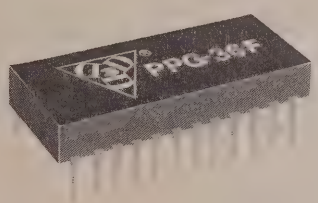
Series PPG-33F (3-BIT)





Series PPG-36F (6-BIT)





Series PPG-38F (8-BIT)

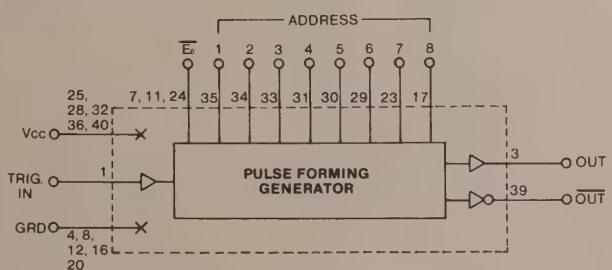


Table 1

Part Numbers			Incremental Pulse-Width
PPG-33F-.5	PPG-36F-.5	PPG-38F-.5	.5 NS
PPG-33F-1	PPG-36F-1	PPG-38F-1	1 NS
PPG-33F-2	PPG-36F-2	PPG-38F-2	2 NS
PPG-33F-3	PPG-36F-3	PPG-38F-3	3 NS
PPG-33F-4	PPG-36F-4	PPG-38F-4	4 NS
PPG-33F-5	PPG-36F-5	PPG-38F-5	5 NS
PPG-33F-6	PPG-36F-6	PPG-38F-6	6 NS
PPG-33F-7	PPG-36F-7	PPG-38F-7	7 NS
PPG-33F-8	PPG-36F-8	PPG-38F-8	8 NS
PPG-33F-9	PPG-36F-9	PPG-38F-9	9 NS
PPG-33F-10	PPG-36F-10	PPG-38F-10	10 NS
PPG-33F-15			15 NS
PPG-33F-20			20 NS
PPG-33F-40			40 NS
PPG-33F-50			50 NS

Table 2

Part Numbers	I_{CCL} (MA)	I_{CCH} (MA)
PPG-33F	41	20
PPG-36F	72	27
PPG-38F	150	42

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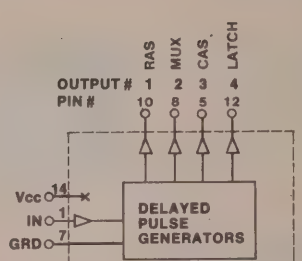
New Dimensions in Delay Line Techniques

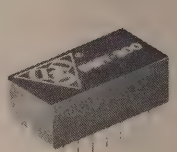
ACTIVE MODULES

Dram Timer (Schottky-TTL Logic)
Series DMT-300

Specifications:

- **Input requirement:** TTL logic, rising-edge triggered.
- **Input pulse width:** 4 NS min.
- **Max. rep. rate of (MREQ) =** TE of latch strobe.
- **Output fan-out:** TTL Schottky load.
- **Time delay tolerance:** ± 5% or 2 NS whichever is greater.
- **Supply voltage (Vcc):** 5 Vdc ± 5%.
- **Operating temperature:**) C to 70 C.
- **Temperature Coefficient:** 100 PPM/ C.
- **Power dissipation:** 740 MW max.





Part No.	Output 1 (RAS) LE	Output 1 (RAS) TE	Output 2 (MUX control) LE	Output 2 (MUX control) TE	Output 3 (CAS) LE	Output 3 (CAS) TE	Output 4 (Latch Strobe) LE	Output 4 (Latch Strobe) TE
DMT-301-1	15	190	40	190	65	190	140	190
DMT-301-2	15	165	40	165	65	165	115	215
DMT-301-3	15	190	40	190	65	190	190	240
DMT-301-4	15	215	40	215	65	215	165	265
DMT-301-5	15	265	40	265	115	265	215	315
DMT-301-6	15	215	40	215	65	215	165	335
DMT-301-7	15	165	30	165	50	165	115	265
DMT-301-8	15	135	30	135	50	135	85	235
DMT-301-9	15	275	40	275	65	275	220	370
DMT-302-1	15	265	65	265	90	265	215	315
DMT-302-2	15	290	75	290	115	290	240	340
DMT-303-1	25	300	75	300	125	300	250	350

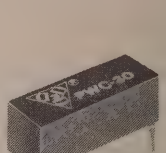
Pulse Width Controller (Fast-TTL Logic)
Series PWC-30

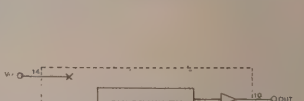
Specifications:

- **Input signal:** TTL.
- **Output fan-out:** 10 TTL loads.
- **Trigger inherent delay:** 5 NS typ.
- **Pulse-width tolerance** = 5% or 2 NS (others on request)
- **Min. PRR** = 1.1 × PW
- **Supply voltage:** 5 Vdc.
- **Supply current:**
  - ICCL: 32 ma.
  - ICCH: 7 ma.
- **Operating temperature:** 0 C to 70 C (−55 to 125 C on request).*
- **Temperature coefficient:** 100 PPM/ C.
- **Output rise-time:** 2 NS typ.

*DIL package used.

Part No.	Pulse Width
PWC-30-5	5 NS
PWC-30-10	10 NS
PWC-30-15	15 NS
PWC-30-20	20 NS
PWC-30-30	30 NS
PWC-30-40	40 NS
PWC-30-50	50 NS
PWC-30-60	60 NS
PWC-30-75	75 NS
PWC-30-100	100 NS
PWC-30-125	125 NS
PWC-30-150	150 NS
PWC-30-175	175 NS
PWC-30-200	200 NS
PWC-30-250	250 NS
PWC-30-300	300 NS
PWC-30-350	350 NS
PWC-30-400	400 NS
PWC-30-500	500 NS

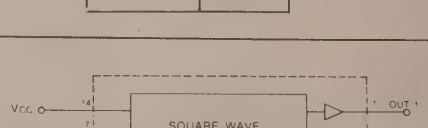




Gated-Oscillator (Fast-TTL Logic)
Series DLO-31F

Specifications:

- **Frequencies:** See table; others on request.
- **Tolerance:** ± 2%.
- **Temperature coefficient:** 100 PPM/ C.
- **Operating temperature:** 0 - 70 C.
- **Supply voltage:** 4.75 to 5.25 Vdc.
- **Supply current:** 40 ma.
- **Storage temperature:** −55 C to 125 C.
- **Enable signal:** TTL logic.
- **Output fan-out:** TTL Schottky load.
- **Inherent delay:** 4 NS typ.



Part Number	Frequency	Part Number	Frequency
DLO-31F-2	2 MHz	DLO-31F-10	10 MHz
DLO-31F-2.5	2.5 MHz	DLO-31F-11	11 MHz
DLO-31F-3	3 MHz	DLO-31F-12	12 MHz
DLO-31F-3.5	3.5 MHz	DLO-31F-13	13 MHz
DLO-31F-4	4 MHz	DLO-31F-14	14 MHz
DLO-31F-4.5	4.5 MHz	DLO-31F-15	15 MHz
DLO-31F-5	5 MHz	DLO-31F-20	20 MHz
DLO-31F-5.5	5.5 MHz	DLO-31F-25	25 MHz
DLO-31F-6	6 MHz	DLO-31F-30	30 MHz
DLO-31F-7	7 MHz	DLO-31F-35	35 MHz
DLO-31F-8	8 MHz	DLO-31F-40	40 MHz
DLO-31F-9	9 MHz		

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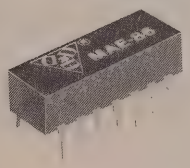
data delay devices — *New Dimensions in Delay Line Techniques*

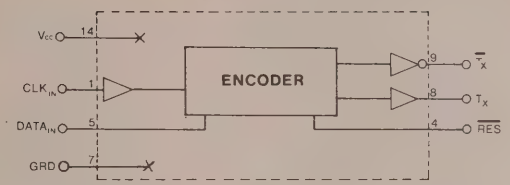
ACTIVE MODULES (SCHOTTKY-TTL LOGIC)

Manchester Encoder
Series MAE-86

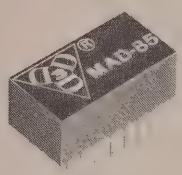


Specifications:

- **Input signal requirement:** TTL logic.
- **Output fan-out:** TTL Schottky load.
- **Operating temperature:** 0° to 70°C.
- **Temperature coefficient:** 100 PPM/°C.
- **Supply voltage V_{CC}:** 5 Vdc ± 5%.
- **Power dissipation:** 300 MW max.
- **CLK_{IN} =** 1 X operating data rates (15 NS min. PW).
- **Data rates up to 30 MB/S.**



Manchester Decoder
Series MAD-85

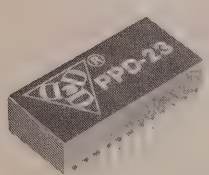


Specifications:

- **Input signal requirement:** TTL logic.
- **Output fan-out:** TTL Schottky load.
- **Operating temperature:** 0°C to 70°C.
- **Temperature coefficient:** 100 PPM/° C.
- **Supply voltage V_{CC}:** 5Vdc ± 5%.
- **Power dissipation:** 740 MW max.

Part No.	Operating Data Rates	Part No.	Operating Data Rates	Part No.	Operating Data Rates
MAD-85-1	1 MB/S	MAD-85-10	10 MB/S	MAD-85-18	18 MB/S
MAD-85-2	2 MB/S	MAD-85-11	11 MB/S	MAD-85-19	19 MB/S
MAD-85-3	3 MB/S	MAD-85-12	12 MB/S	MAD-85-20	20 MB/S
MAD-85-4	4 MB/S	MAD-85-13	13 MB/S	MAD-85-21	21 MB/S
MAD-85-5	5 MB/S	MAD-85-14	14 MB/S	MAD-85-22	22 MB/S
MAD-85-6	6 MB/S	MAD-85-15	15 MB/S	MAD-85-23	23 MB/S
MAD-85-7	7 MB/S	MAD-85-16	16 MB/S	MAD-85-24	24 MB/S
MAD-85-8	8 MB/S	MAD-85-17	17 MB/S	MAD-85-25	25 MB/S
MAD-85-9	9 MB/S				

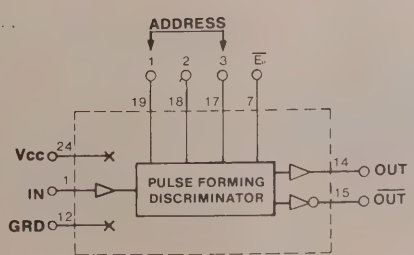
Programmable Pulse Discriminator
Series PPD-23



Specifications:

- **Input requirement:** TTL logic.
- **Inherent pulse width:** 5 NS typ.
- **Supply voltage:** 5 Vdc ± 5%.
- **Operating temperatures:** 0°C to 70°C.
- **Temperature coefficient:** 100 PPM/°C.
- **Power dissipation:** 850 MW max.

Part Number	Incremental Pulse Width Per Step	Total Programmed Pulse Width
PPD-23-1	1 NS ± .4NS	7 NS
PPD-23-2	2 NS ± .4NS	14 NS
PPD-23-3	3 NS ± .5NS	21 NS
PPD-23-5	5 NS ± .6NS	35 NS
PPD-23-10	10 NS ± 1.0 NS	70 NS
PPD-23-15	15 NS ± 1.3 NS	105 NS
PPD-23-20	20 NS ± 1.5 NS	140 NS
PPD-23-40	40 NS ± 2.0 NS	280 NS
PPD-23-50	50 NS ± 2.5 NS	350 NS



data delay devices

New Dimensions in Delay Line Techniques

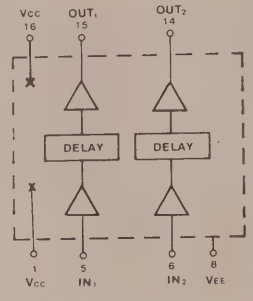
ACTIVE DELAY LINES (ECL-LOGIC)

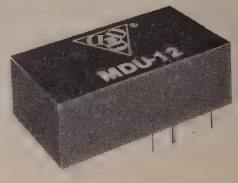
Multiple Delay Lines
Series MDU-12, MDU-13 (10KH ECL)

Specifications:

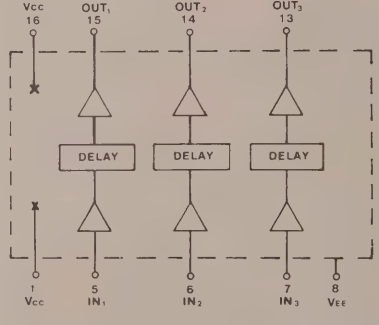
- **Total Delay Tolerance:** ± 5% or better, or 1 NS whichever is greater.
- **Rise-time:** 2 NS typical.
- **Logic 1 voltage:** −.96V
- **Logic 1 current:** .26 MA
- **Logic 0 current:** .5μA
- **Logic 0 voltage:** −1.65V
- **Supply voltage:** −5.2V
- **Operating Temperature:** −30°C to 85°C
- **Temperature Coefficient:** 100 PPM/°C

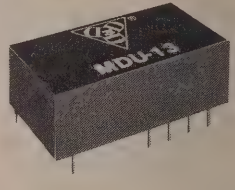
Part No.	Delay Per Line (NS)
MDU-12-5	5
MDU-12-10	10
MDU-12-15	15
MDU-12-20	20
MDU-12-25	25
MDU-12-30	30
MDU-12-35	35
MDU-12-40	40
MDU-12-45	45
MDU-12-50	50
MDU-12-60	60
MDU-12-75	75
MDU-12-100	100
MDU-12-125	125
MDU-12-150	150
MDU-12-200	200
MDU-12-250	250





Part No.	Delay Per Line (NS)
MDU-13-5	5
MDU-13-10	10
MDU-13-15	15
MDU-13-20	20
MDU-13-25	25
MDU-13-30	30
MDU-13-35	35
MDU-13-40	40
MDU-13-45	45
MDU-13-50	50



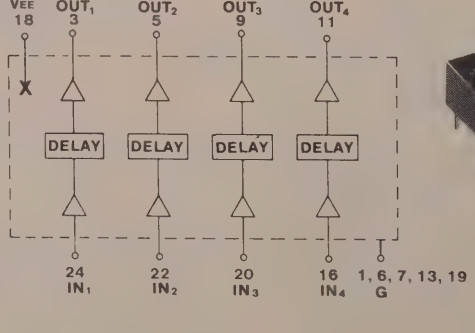


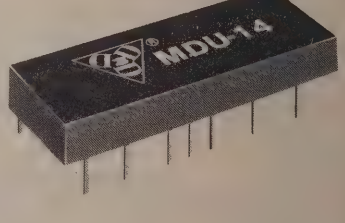
Series: MDU-14 (100K ECL)

Specifications:

- **Total delay tolerance:** ±5% or 1 NS whichever is greater.
- **Rise time:** 1 NS typ.
- **Input pulse width:** 40% of total delay.
- **Input pulse voltage:** .8V p-p (−.9V to −1.7V).
- **Logic 1 input voltage:** −1.16V min.
- **Logic 0 input voltage:** −1.47V max.
- **Logic 1 output voltage:** −1.02V min.
- **Logic 0 output voltage:** −1.62V max.
- **Supply voltage (Vee):** −5V.
- **Operating Temperature:** 0°C to + 85°C.
- **Temperature Coefficient:** 100 PPM/°C.
- **Fan-out capabilities:** 70 ECL

Part No.	Delay Per Line (NS)
MDU-14-2	2
MDU-14-2.5	2.5
MDU-14-3	3
MDU-14-4	4
MDU-14-5	5
MDU-14-6	6
MDU-14-7	7
MDU-14-8	8
MDU-14-9	9
MDU-14-10	10
MDU-14-12.5	12.5
MDU-14-15	15
MDU-14-20	20
MDU-14-25	25





data delay devices

New Dimensions in Delay Line Techniques

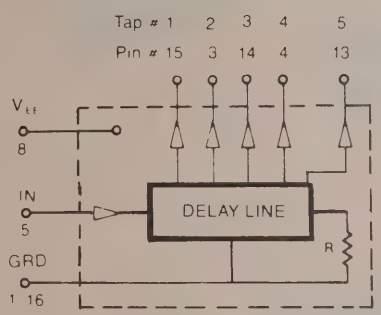
ACTIVE DELAY LINES (ECL-LOGIC)

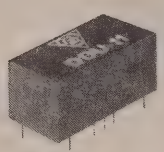
Multi Taps

Specifications:

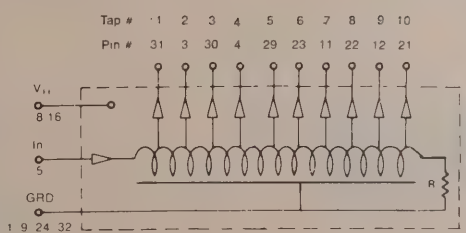
- **Total Delay Tolerance:** ± 5% or better, or 2 NS whichever is greater.
- **No. Taps:** 5 - 10
- **Rise-Time:** 2 NS typical
- **Supply Voltage:** −5.2V
- **Operating Temperature:** −30°C to 85°C
- **Temperature Coefficient:** 100 PPM/°C
- **Family Type:** 10K ECL (DDU-11 & 12)
  100K ECL (DDU-18)

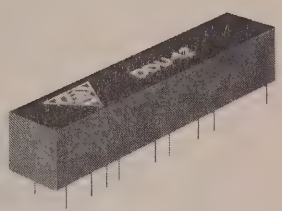
Part No.	Total Delay NS	Tap Delay NS
DDU-11-5	4	1
DDU-11-10	8	2
DDU-11-20	16	4
DDU-11-25	20	5
DDU-11-50	50	10
DDU-11-75	75	15
DDU-11-100	100	20
DDU-11-150	150	30
DDU-11-200	200	40
DDU-11-250	250	50
DDU-11-300	300	60
DDU-11-400	400	80
DDU-11-500	500	100



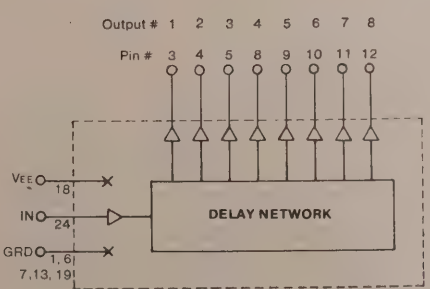


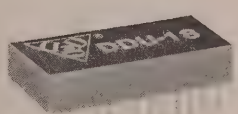
Part No.	Total Delay NS	Delay Tap NS
DDU-12-10	9	1
DDU-12-20	18	2
DDU-12-25	22.5	2.5
DDU-12-40	36	4
DDU-12-50	45	5
DDU-12-75	75	7.5
DDU-12-100	100	10
DDU-12-150	150	15
DDU-12-200	200	20
DDU-12-250	250	25
DDU-12-300	300	30
DDU-12-400	400	40
DDU-12-500	500	50
DDU-12-750	750	75
DDU-12-1000	1000	100
DDU-12-1500	1500	150





Part No.	Delay Increment NS	Total Delay NS
DDU-18-4	.5	3.5
DDU-18-8	1	7.0
DDU-18-12	1.5	10.5
DDU-18-16	2	16
DDU-18-20	2.5	20
DDU-18-24	3	24
DDU-18-32	4	32
DDU-18-40	5	40
DDU-18-48	6	48
DDU-18-56	7	56
DDU-18-64	8	64
DDU-18-72	9	72
DDU-18-80	10	80
DDU-18-100	12.5	100
DDU-18-120	15	120
DDU-18-160	20	160
DDU-18-200	25	200





data delay devices

New Dimensions in Delay Line Techniques

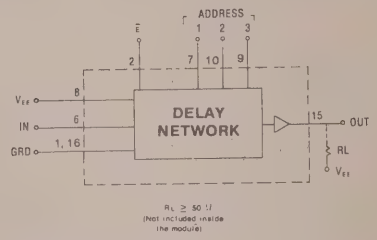
ACTIVE DELAY LINES (10KH-ECL LOGIC)

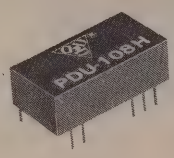
Programmable Delay Lines (3-8 BIT)

Specifications:

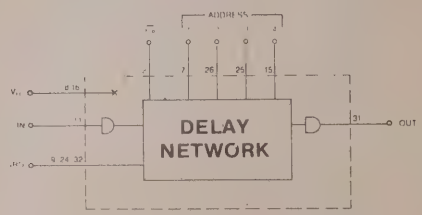
- **Input signal requirement:** ECL logic
- **Output fan-out:** ECL loads
- **Delay variation:** Monotonic in one direction
- **Programmed delay tolerance:** ±5% or 1 NS whichever is greater
- **Inherent delay:** see Table 2
- **Propagation delay:**
  Address to output = 3.6 NS typ
  Enable to output = 1.7 NS typ
- **Power dissipation:** see Table 2
- **Supply voltage:** −5Vdc ± 5%
- **Operating Temperature:** 0-70°C
- **Temperature Coefficient:** 100 PPM/°C

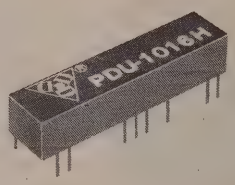
Series PDU-108H



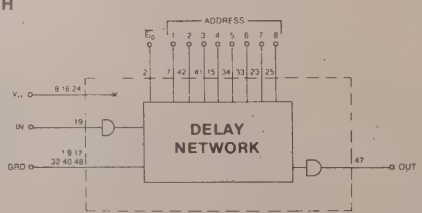


Series PDU-1016H





Series PDU-10256H



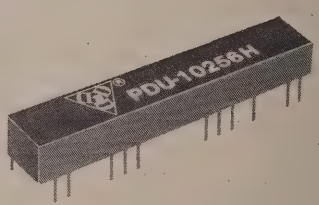


Table 1

Part Numbers			Delay Increment
PDU-108H-.5	PDU-1016H-.5	PDU-10256H-.5	.5 NS
PDU-108H-1	PDU-1016H-1	PDU-10256H-1	1 NS
PDU-108H-2	PDU-1016H-2	PDU-10256H-2	2 NS
PDU-108H-3	PDU-1016H-3	PDU-10256H-3	3 NS
PDU-108H-4	PDU-1016H-4	PDU-10256H-4	4 NS
PDU-108H-5	PDU-1016H-5	PDU-10256H-5	5 NS
PDU-108H-6	PDU-1016H-6	PDU-10256H-6	6 NS
PDU-108H-7	PDU-1016H-7	PDU-10256H-7	7 NS
PDU-108H-8	PDU-1016H-8	PDU-10256H-8	8 NS
PDU-108H-9	PDU-1016H-9	PDU-10256H-9	9 NS
PDU-108H-10	PDU-1016H-10	PDU-10256H-10	10 NS
PDU-108H-12	PDU-1016H-12		12 NS
PDU-108H-15	PDU-1016H-15		15 NS
PDU-108H-20	PDU-1016H-20		20 NS
PDU-108H-25	PDU-1016H-25		25 NS
PDU-108H-30	PDU-1016H-30		30 NS
PDU-108H-35	PDU-1016H-35		35 NS
PDU-108H-40	PDU-1016H-40		40 NS
PDU-108H-45	PDU-1016H-45		45 NS
PDU-108H-50	PDU-1016H-50		50 NS
	PDU-1016H-60		60 NS
	PDU-1016H-80		80 NS
	PDU-1016H-100		100 NS

Table 2

Series	Power Dissipation	Inherent Delay
PDU-108H	290 MW	2.8 NS
PDU-1016H	615 MW	5.5 NS
PDU-1032H	615 MW	5.5 NS
PDU-1064H	925 MW	12 NS
PDU-10256H	925 MW	12 NS

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New Dimensions in Delay Line Techniques

ACTIVE DELAY LINES (H-CMOS)

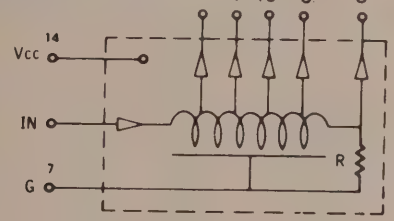
5 Taps

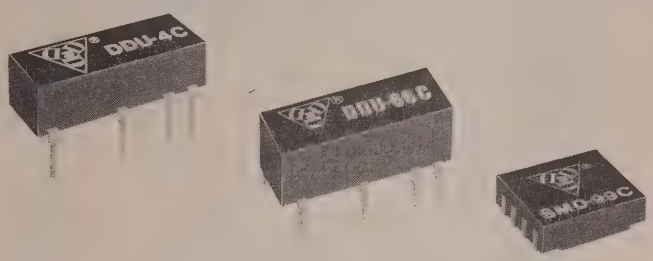
Specifications:

- **No. Taps:** 5 equally spaced taps.
- **Total delay tolerance:** 5% or 2 NS whichever is greater.
- **Rise-time:** 8 NS typ.
- **Temperature coefficient:** 300 PPM/°C.
- **Temperature range:** 0°C to + 70°C.
- **Supply voltage:** 5 Vdc ± 5%.
- **Logic 1 input:** 3.2V.
- **Logic 0 input:** .9V.
- **Logic 1 output:** 4.5V.
- **Logic 0 output:** 0.1V.
- **Input current:** 1 μa max.
- **Supply current:**
  I_{CCH} = 5 MA
  I_{CCL} = 20 μa
- **Fan-out:** 10 LSTTL loads min.

Series DDU-4C, DDU-66C, SMD-99C

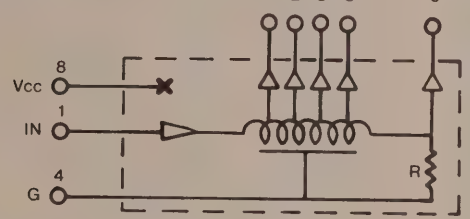
Tap # 1 2 3 4 5
Pin # 12 4 10 6 8

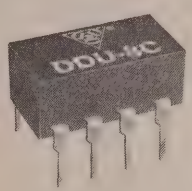




Series DDU-8C

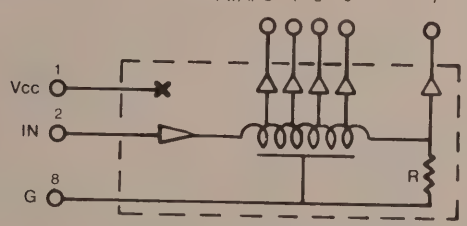
Tap # 1 2 3 4 5
Pin # 7 2 6 3 5





Series DDU-222C

Tap # 1 2 3 4 5
Pin # 3 4 5 6 7



Part Numbers					Total Delay (NS)
DDU-8C-5050	DDU-4C-5050	DDU-66C-50	SMD-99C-5050	DDU-222C-50	50
DDU-8C-5060	DDU-4C-5060	DDU-66C-60	SMD-99C-5060	DDU-222C-60	60
DDU-8C-5075	DDU-4C-5075	DDU-66C-75	SMD-99C-5075	DDU-222C-75	75
DDU-8C-5100	DDU-4C-5100	DDU-66C-100	SMD-99C-5100	DDU-222C-100	100
DDU-8C-5125	DDU-4C-5125	DDU-66C-125	SMD-99C-5125	DDU-222C-125	125
DDU-8C-5150	DDU-4C-5150	DDU-66C-150	SMD-99C-5150	DDU-222C-150	150
DDU-8C-5175	DDU-4C-5175	DDU-66C-175	SMD-99C-5175	DDU-222C-175	175
DDU-8C-5200	DDU-4C-5200	DDU-66C-200	SMD-99C-5200	DDU-222C-200	200
DDU-8C-5250	DDU-4C-5250	DDU-66C-250	SMD-99C-5250	DDU-222C-250	250

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New Dimensions in Delay Line Techniques

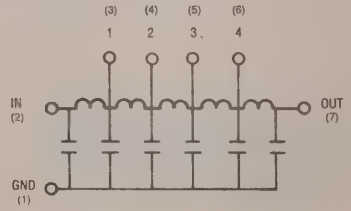
PASSIVE DELAY LINES (SIP-TYPE)

Series 1505

Specifications:

- **5 Equal taps**
- **Meets or exceeds:** MIL-D-23859C
- **Operating temperature range:** −55°C to + 125°C
- **Storage temperature range:** −55 C to + 125 C
- **Temperature coefficient:** 100 PPM/°C
- **Dielectric breakdown:** 50 Vdc.
- **Epoxy encapsulated**
- **Maximum distortion @ output:** 10%

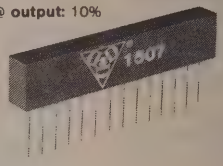
Part No.	Total Delay (NS)	Imp. Ω
1505-A	5	50
1505-10A	10	50
1505-20A	20	50
1505-30A	30	50
1505-40A	40	50
1505-50A	50	50
1505-60A	60	50
1505-70A	70	50
1505-80A	80	50
1505-90A	90	50
1505-100A	100	50
1505-5B	5	100
1505-10B	10	100
1505-20B	20	100
1505-30B	30	100
1505-40B	40	100
1505-50B	50	100
1505-60B	60	100
1505-75B	75	100
1505-100B	100	100
1505-30C	30	200
1505-50C	50	200
1505-60C	60	200
1505-100C	100	200
1505-50G	50	500
1505-100G	100	500
1505-200G	200	500
1505-300G	300	500



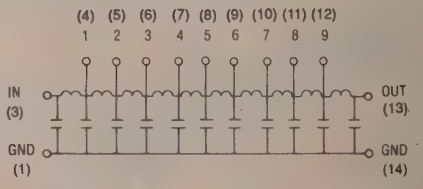
Series 1507

Specifications:

- **10 Equal taps**
- **Meets or exceeds:** MIL-D-23859C
- **Operating temperature range:** −55 C to +125°C
- **Storage temperature range:** −55 C to + 125 C
- **Temperature coefficient:** 100 PPM/ C
- **Dielectric breakdown:** 50 Vdc
- **Epoxy encapsulated**
- **Maximum distortion @ output:** 10%



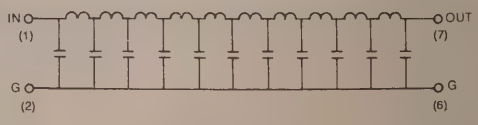
Part No.	Total Delay (NS)	Imp. Ω
1507-20A	20	50
1507-40A	40	50
1507-50A	50	50
1507-100A	100	50
1507-150A	150	50
1507-200A	200	50
1507-20B	20	100
1507-50B	50	100
1507-100B	100	100
1507-200B	200	100
1507-250B	250	100
1507-20C	20	200
1507-50C	50	200
1507-100C	100	200
1507-200C	200	200
1507-50G	50	500
1507-100G	100	500
1507-200G	200	500
1507-300G	300	500
1507-500G	500	500



Series 1514

Specifications:

- **Meets or exceeds:** MIL-D-23859C.
- **Operating temperature:** −55 C to + 125 C.
- **Storage temperature:** −55 C to + 125 C.
- **Temperature coefficient:** 100 PPM/ C.
- **Dielectric breakdown:** 50 Vdc.
- **Epoxy encapsulated.**
- **Distortion @ output:** 10% max.
- **Rise-time:** 1 NS or 20% of TD (whichever is greater).
- **Delay tolerance:** 5% or 1 NS whichever is greater.



Part No.	Delay (ns)	Imp. Ω	Part No.	Delay (ns)	Imp.	Part No.	Delay (ns)	Imp. Ω	Part No.	Delay (ns)	Imp. Ω
1514-2.5A	2.5	50	1514-3.5Y	3.5	75	1514-5B	5	100	1514-50D	50	250
1514-5A	5	50	1514-7.5Y	7.5	75	1514-10B	10	100	1514-70D	70	250
1514-10A	10	50	1514-15Y	15	75	1514-20B	20	100	1514-120D	120	250
1514-15A	15	50	1514-22.5Y	22.5	75	1514-30B	30	100	1514-130D	130	250
1514-20A	20	50	1514-30Y	30	75	1514-40B	40	100	1514-150D	150	250
1514-25A	25	50	1514-37.5Y	37.5	75	1514-50B	50	100	1514-170D	170	250
1514-30A	30	50	1514-45Y	45	75	1514-60B	60	100	1514-270D	270	250
1514-40A	40	50	1514-60Y	60	75	1514-80B	80	100			
1514-50A	50	50	1514-75Y	75	75	1514-100B	100	100	1514-70E	70	300
1514-60A	60	50	1514-90Y	90	75	1514-120B	120	100	1514-140E	140	300
1514-70A	70	50	1514-105Y	105	75	1514-140B	140	100			
1514-80A	80	50	1514-120Y	120	75	1514-150B	150	100	1514-45G	45	500
1514-90A	90	50	1514-135Y	135	75				1514-50G	50	500
1514-100A	100	50	1514-150Y	150	75				1514-80G	80	500
									1514-100G	100	500
									1514-190G	190	500

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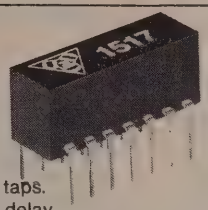
New Dimensions in Delay Line Techniques

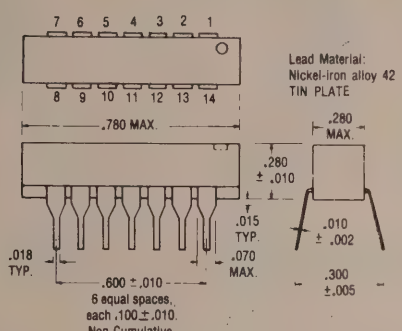
DIP-TAPPED DELAY LINES

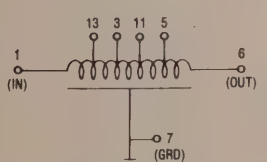
SERIES 1517
5 Taps



Specifications

- **Delay accuracy:** ± 5% (others on request).
- **No. taps:** 5 Equally spaced taps.
- **Taps accuracy:** ± 5% of tap delay.
- **Impedance tolerance:** ± 10%.(others on request).
- **Rise-Time:** 30% of time delay.
- **Withstanding voltage:** 50 Vdc. Min.
- **Temperature coefficient:** 100 PPM/°C.
- **Environment:** Meets or exceeds MIL-D-23859C.

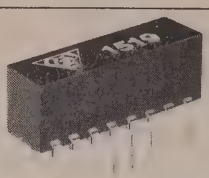




TAPS - CONNECTION

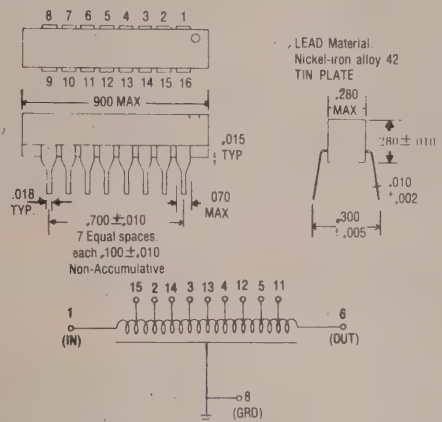
Part No.	Total Delay (NS)	Imp. (Ω)	Rdc. (Ω)	Part No.	Total Delay (NS)	Imp. (Ω)	Rdc. (Ω)
1517-10A	10	50	0.6	1517-150D	150	250	8.5
1517-15A	15	50	0.6	1517-15E	15	300	2.5
1517-20A	20	50	0.7	1517-30E	30	300	3.0
1517-30A	30	50	0.7	1517-50E	50	300	4.0
1517-40A	40	50	0.9	1517-60E	60	300	4.0
1517-5B	5	100	0.5	1517-75E	75	300	4.5
1517-10B	10	100	0.7	1517-90E	90	300	5.5
1517-15B	15	100	0.7	1517-120E	120	300	8.0
1517-20B	20	100	0.9	1517-130E	130	300	9.0
1517-25B	25	100	1.0	1517-180E	180	300	11.0
1517-30B	30	100	1.5	1517-220E	220	300	13.0
1517-40B	40	100	1.8	1517-20F	20	400	4.5
1517-50B	50	100	2.0	1517-40F	40	400	5.0
1517-60B	60	100	2.0	1517-60F	60	400	5.0
1517-75B	75	100	2.5	1517-80F	80	400	8.0
1517-10C	10	200	1.5	1517-100F	100	400	9.0
1517-20C	20	200	2.0	1517-120F	120	400	10.0
1517-30C	30	200	2.5	1517-160F	160	400	13.0
1517-40C	40	200	3.0	1517-180F	180	400	14.0
1517-50C	50	200	3.0	1517-240F	240	400	19.0
1517-60C	60	200	3.5	1517-300F	300	400	23.0
1517-80C	80	200	3.5	1517-25G	25	500	3.0
1517-90C	90	200	5.0	1517-50G	50	500	5.0
1517-120C	120	200	5.0	1517-75G	75	500	8.0
1517-150C	150	200	8.0	1517-100G	100	500	15.0
1517-25D	25	250	2.5	1517-125G	125	500	9.0
1517-37D	37	250	3.0	1517-150G	150	500	13.0
1517-50D	50	250	3.5	1517-200G	200	500	21.0
1517-60D	60	250	4.0	1517-225G	225	500	23.0
1517-75D	75	250	4.0	1517-300G	300	500	29.0
1517-100D	100	250	5.0				

SERIES 1519
10 Taps



Specifications

- **Delay Accuracy:** ± 5% (others on request)
- **No. taps:** 10 Equally spaced taps.
- **Taps accuracy:** ± 5% of tap delay.
- **Impedance tolerance:** ± 10% (others on request).
- **Rise-Time:** 20% of time delay.
- **Withstanding voltage:** 50 Vdc. Min.
- **Temperature coefficient:** 100 PPM/°C.
- **Environment:** Meets or exceeds MIL-D-23859C.



Part No.	Total Delay (NS)	Imp. (Ω)	Rdc. (Ω)	Part No.	Total Delay (NS)	Imp. (Ω)	Rdc. (Ω)
1519-20A	20	50	1.0	1519-200D	200	250	10.0
1519-25A	25	50	1.0	1519-225D	225	250	11.0
1519-30A	30	50	1.2	1519-300D	300	250	17.0
1519-40A	40	50	1.5	1519-375D	375	250	20.0
1519-45A	45	50	1.5	1519-500D	500	250	24.0
1519-50A	50	50	1.5	1519-30E	30	300	5.0
1519-60A	60	50	1.5	1519-60E	60	300	6.0
1519-75A	75	50	1.8	1519-90E	90	300	7.0
1519-100A	100	50	2.0	1519-120E	120	300	8.0
1519-10B	10	100	1.0	1519-150E	150	300	9.0
1519-20B	20	100	1.5	1519-180E	180	300	11.0
1519-30B	30	100	1.5	1519-240E	240	300	16.0
1519-40B	40	100	1.8	1519-270E	270	300	18.0
1519-50B	50	100	2.0	1519-360E	360	300	21.0
1519-60B	60	100	3.0	1519-450E	450	300	25.0
1519-80B	80	100	3.5	1519-600E	600	300	40.0
1519-90B	90	100	3.5	1519-40F	40	400	8.5
1519-100B	100	100	4.0	1519-80F	80	400	9.0
1519-120B	120	100	4.0	1519-120F	120	400	9.0
1519-150B	150	100	5.0	1519-160F	160	400	16.0
1519-200B	200	100	6.0	1519-200F	200	400	18.0
1519-250B	250	100	7.0	1519-240F	240	400	20.0
1519-20C	20	200	3.0	1519-320F	320	400	26.0
1519-40C	40	200	4.0	1519-360F	360	400	28.0
1519-60C	60	200	4.5	1519-480F	480	400	38.0
1519-80C	80	200	5.5	1519-600F	600	400	45.0
1519-100C	100	200	6.0	1519-800F	800	400	40.0
1519-120C	120	200	6.5	1519-50G	50	500	6.0
1519-160C	160	200	7.0	1519-100G	100	500	10.0
1519-180C	180	200	8.5	1519-150G	150	500	16.0
1519-200C	200	200	9.0	1519-200G	200	500	30.0
1519-240C	240	200	9.5	1519-250G	250	500	18.0
1519-300C	300	200	16.0	1519-300G	300	500	26.0
1519-400C	400	200	16.0	1519-400G	400	500	42.0
1519-50D	50	250	5.5	1519-450G	450	500	45.0
1519-75D	75	250	6.0	1519-500G	500	500	55.0
1519-100D	100	250	7.0	1519-600G	600	500	58.0
1519-125D	125	250	8.0	1519-750G	750	500	50.0
1519-150D	150	250	8.5	1519-1000G	1000	500	65.0

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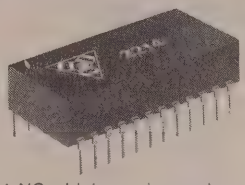
New Dimensions in Delay Line Techniques

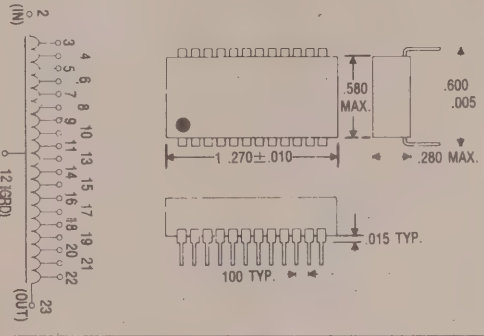
DIP-TAPPED DELAY LINES

SERIES 2214
20 Taps



Specifications

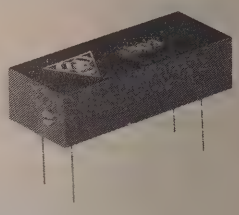
- **20 Equally spaced taps.**
- **Td/Tr = 10/1.**
- **Delay tolerance:** ± 5% or 1 NS whichever is greater.
- **Tap tolerance:** ± 5% or 1 NS whichever is greater.
- **Temperature coefficient:** 100 PPM/°C.
- **Temperature range:** -55°C to +125°C.
- **Dielectric breakdown:** 50 Vdc.
- **Meets or exceeds MIL-D-23859C.**
- **Epoxy encapsulated.**



Part No.	Imp. (Ω)	Total Delay (NS)	Tap Increment (NS)	Rdc (Ω)
2214-50A	50	50	2.5	3.2
2214-60A	50	60	3.0	3.6
2214-80A	50	80	4.0	5.0
2214-100A	50	100	5.0	6.0
2214-150A	50	150	7.5	6.0
2214-200A	50	200	10.0	7.0
2214-50B	100	50	2.5	6.0
2214-60B	100	60	3.0	6.0
2214-80B	100	80	4.0	6.5
2214-100B	100	100	5.0	7.0
2214-150B	100	150	7.5	8.0
2214-200B	100	200	10.0	8.5
2214-300B	100	300	15.0	11.0
2214-400B	100	400	20.0	12.0
2214-40C	200	40	2.0	7.0
2214-80C	200	80	4.0	8.0
2214-120C	200	120	6.0	10.0
2214-200C	200	200	10.0	13.0
2214-300C	200	300	15.0	12.0
2214-400C	200	400	20.0	15.0
2214-500C	200	500	25.0	17.0
2214-600C	200	600	30.0	23.0
2214-800C	200	800	40.0	38.0
2214-50D	250	50	2.5	7.0
2214-100D	250	100	5.0	10.0
2214-150D	250	150	7.5	12.0
2214-200D	250	200	10.0	22.0
2214-250D	250	250	12.5	21.0
2214-300D	250	300	15.0	23.0
2214-400D	250	400	20.0	26.0
2214-500D	250	500	25.0	30.0
2214-600D	250	600	30.0	37.0
2214-800D	250	800	40.0	41.0
2214-1000D	250	1000	50.0	47.0
2214-200G	500	200	10.0	20.0
2214-300G	500	300	15.0	37.0
2214-400G	500	400	20.0	40.0
2214-500G	500	500	25.0	45.0
2214-600G	500	600	30.0	52.0
2214-800G	500	800	40.0	80.0
2214-1000G	500	1000	50.0	100.0
2214-1200G	500	1200	60.0	110.0
2214-1500G	500	1500	75.0	130.0
2214-2000G	500	2000	100.0	156.0

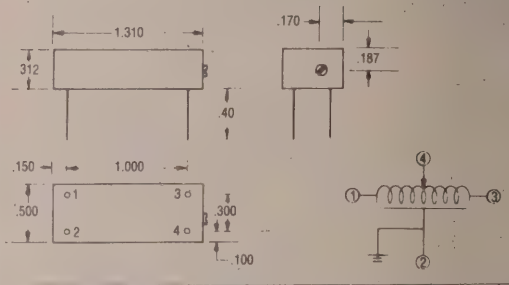
CONTINUOUSLY VARIABLE DELAY LINES

SERIES 1503



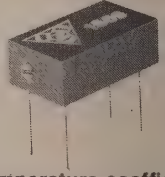
Specifications

- **Continuously variable delay.**
- **Multi-turn adjusting screw** (40 turns approx.).
- **Temperature coefficient:** 100 PPM/°C.
- **Rise-time:** 20% of time delay.
- **Flat leads** (.020 x .010).
- **Withstanding voltage:** 50 Vdc.
- **Resolution:** .12 NS approx.



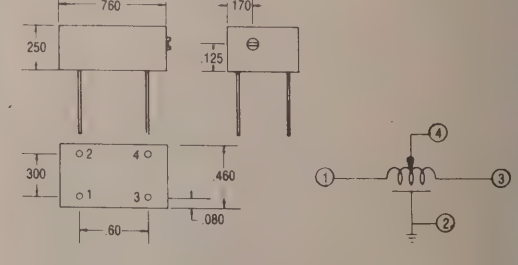
Part No.	Td (NS)	Imp. (Ω)	Rdc (Ω)	Part No.	Td (NS)	Imp. (Ω)	Rdc (Ω)
1503-15A	15	50	.7	1503-100B	100	100	6.0
1503-25A	25	50	.8	1503-120B	120	100	8.0
1503-30A	30	50	1.0	1503-160B	160	100	10.0
1503-40A	40	50	1.5	1503-200B	200	100	14.0
1503-50A	50	50	1.7	1503-30C	30	200	4.0
1503-60A	60	50	2.0	1503-60C	60	200	8.0
1503-80A	80	50	3.0	1503-100C	100	200	14.0
1503-100A	100	50	3.5	1503-20D	20	250	5.0
1503-15B	15	100	1.0	1503-20E	20	300	5.0
1503-30B	30	100	2.0	1503-30F	30	350	8.0
1503-50B	50	100	3.0	1503-25G	25	400	8.0
1503-60B	60	100	4.0	1503-40H	40	500	12.0
1503-80B	80	100	5.0				

SERIES 1509



Specifications

- **Low cost unit.**
- **Fits standard DIP sockets.**
- **Continuously variable.**
- **20 Turns approx.**
- **Resolution — .15 NS.**
- **Withstanding voltage — 100 Vdc.**
- **Temperature coefficient — 200 PPM/°C.**
- **Flat leads (.020 x .010).**



Part No.	Td (NS)	Impedance (Ω)	TR (NS)	Rdc (Ω)
1509-05B	5	100	3	.4
1509-20C	20	200	8	1.0
1509-30F	30	400	10	7.0
1509-40H	40	500	15	13.0

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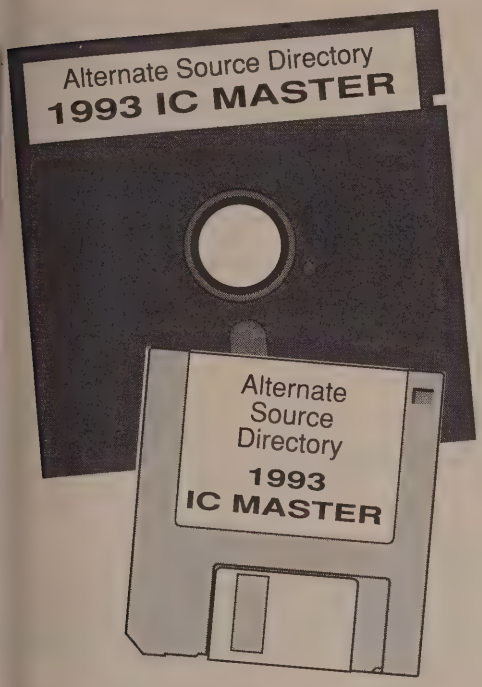
Hearst Engineering Software

ICMASD

Alternate Source Directory



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Published annually in March

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ELMEC®

High-Speed Delay Lines

CDA TYPE

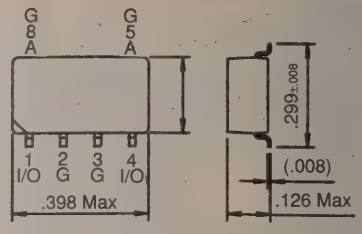
Fixed-Value Passive Delay Line

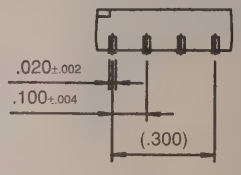
- **Surface-mount Package**
- **ECL or FAST TTL interfaced**
- **Digital or analog circuit applications**

Electrical Characteristics

- Waveform distortion (overshoot/preshoot): ±20% Max.
- Insulation resistance: DC50V, 100MΩ Min.
- Dielectric strength: DC 50V, 1 minute
- Operating temperature range: -10°C ~ +80°C
- Storage temperature range: -40°C ~ +120°C

Package Dimensions





Unit: inch

Standard Ratings

50Ω Type (characteristic impedance: 50Ω ± 10%)

CDA P/N	Time Delay	Rise Time * (Max.)	Bandwidth (Min.)	Td Temp. Coefficient
0005	50ps ± 25ps	200ps	1 GHz	0 ~ 150 ppm/°C
0105	100ps ± 50ps			
0205	200ps ± 50ps			
0305	300ps ± 50ps			
0405	400ps ± 50ps			
0505	500ps ± 50ps			
0605	600ps ± 50ps			
0705	700ps ± 50ps			
0805	800ps ± 50ps			
0905	900ps ± 50ps			
1005	1.0ns ± 50ps			
1105	1.1ns ± 50ps	300ps	900 MHz	
1205	1.2ns ± 50ps			
1305	1.3ns ± 50ps			
1505	1.5ns ± 50ps	500ps	700 MHz	
2005	2.0ns ± 0.2ns	550ps	600 MHz	
2505	2.5ns ± 0.2ns	600ps	500 MHz	
3005	3.0ns ± 0.2ns			
3505	3.5ns ± 0.25ns			
4005	4.0ns ± 0.3ns			
4505	4.5ns ± 0.3ns	675ps	440 MHz	
5005	5.0ns ± 0.3ns	750ps	400 MHz	
5505	5.5ns ± 0.3ns	825ps	360 MHz	-400±200 ppm/°C**
6005	6.0ns ± 0.3ns	900ps	330 MHz	
6505	6.5ns ± 0.4ns	975ps	300 MHz	
7005	7.0ns ± 0.4ns	1.1ns	285 MHz	
7505	7.5ns ± 0.4ns	1.2ns	250 MHz	
8005	8.0ns ± 0.4ns			
8505	8.5ns ± 0.5ns	1.3ns	235 MHz	
9005	9.0ns ± 0.5ns	1.4ns	220 MHz	
9505	9.5ns ± 0.5ns	1.5ns	200 MHz	
10005	10.0ns ± 0.5ns			
10505	10.5ns ± 0.6ns	1.6ns	190 MHz	
11005	11.0ns ± 0.6ns	1.7ns	180 MHz	
11505	11.5ns ± 0.6ns	1.8ns	165 MHz	
12005	12.0ns ± 0.6ns			
12505	12.5ns ± 0.7ns	1.9ns	160 MHz	
13005	13.0ns ± 0.7ns	2.0ns	150 MHz	
13505	13.5ns ± 0.7ns	2.1ns	140 MHz	
14005	14.0ns ± 0.7ns			
14505	14.5ns ± 0.8ns	2.2ns	135 MHz	
15005	15.0ns ± 0.8ns	2.3ns	130 MHz	
16005	16.0ns ± 0.8ns	2.4ns	125 MHz	
17005	17.0ns ± 0.8ns	2.6ns	115 MHz	
18005	18.0ns ± 0.9ns	2.8ns	110 MHz	
19005	19.0ns ± 1.0ns	3.0ns	105 MHz	
20005	20.0ns ± 1.0ns	3.2ns	100 MHz	

Standard Ratings

100Ω Type (characteristic impedance: 100Ω ±10%)

CDA P/N	Time Delay	Rise Time * (Max.)	Bandwidth (Min.)	Td Temp. Coefficient
0010	50ps ± 25ps	200ps	1 GHz	0 ~ 150 ppm/°C
0510	500ps ± 100ps			
1010	1.0ns ± 0.1ns	300ps	900 MHz	
1510	1.5ns ± 0.15ns	500ps	700 MHz	
2010	2.0ns ± 0.2ns	550ps	600 MHz	
2510	2.5ns ± 0.2ns	600ps	500 MHz	
3010	3.0ns ± 0.2ns			
3510	3.5ns ± 0.25ns			
4010	4.0ns ± 0.3ns	650ps	450 MHz	
4510	4.5ns ± 0.3ns	700ps	400 MHz	
5010	5.0ns ± 0.3ns	800ps	360 MHz	
5510	5.5ns ± 0.3ns	880ps	325 MHz	
6010	6.0ns ± 0.3ns	960ps	300 MHz	
6510	6.5ns ± 0.4ns	1.0ns	275 MHz	
7010	7.0ns ± 0.4ns	1.1ns	255 MHz	
7510	7.5ns ± 0.4ns	1.2ns	240 MHz	
8010	8.0ns ± 0.4ns	1.3ns	225 MHz	
8510	8.5ns ± 0.5ns	1.4ns	210 MHz	
9010	9.0ns ± 0.5ns	1.5ns	190 MHz	
9510	9.5ns ± 0.5ns			
10010	10.0ns ± 0.5ns	1.6ns	180 MHz	
10510	10.5ns ± 0.6ns	1.7ns	170 MHz	- 400 ± 200 ppm/°C**
11010	11.0ns ± 0.6ns	1.8ns	160 MHz	
11510	11.5ns ± 0.6ns	1.9ns	150 MHz	
12010	12.0ns ± 0.6ns			
12510	12.5ns ± 0.7ns	2.0ns	140 MHz	
13010	13.0ns ± 0.7ns	2.1ns	135 MHz	
13510	13.5ns ± 0.7ns	2.2ns	130 MHz	
14010	14.0ns ± 0.7ns	2.3ns	125 MHz	
14510	14.5ns ± 0.8ns			
15010	15.0ns ± 0.8ns	2.4ns	120 MHz	
16010	16.0ns ± 0.8ns	2.6ns	110 MHz	
17010	17.0ns ± 0.9ns	2.7ns	105 MHz	
18010	18.0ns ± 0.9ns	2.9ns	100 MHz	
19010	19.0ns ± 1.0ns	3.1ns	95 MHz	
20010	20.0ns ± 1.0ns	3.2ns	90 MHz	

* Measured between the 20% and 80% points of the rising edge of the output waveform.
** 0 ~ 150ppm/°C is also available for certain parts.

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ELMEC®

High-Speed Delay Lines

FDC/FDD Type

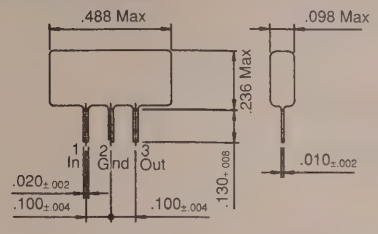
Fixed-Value Passive Delay Line

- **SIP Package**
- **ECL or Fast TTL interfaced**
- **Digital or analog circuit applications**

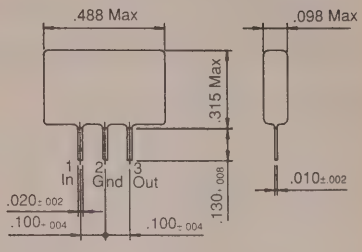
Electrical Characteristics

- Waveform distortion (overshoot/preshoot): ±20% Max.
- Insulation resistance: DC50V, 100MΩ Min.
- Dielectric strength: DC 50V, 1 minute
- Operating temperature range: -40°C ~ +85°C
- Storage temperature range: -40°C ~ +120°C
- Delay time temperature coefficient:
  ±100ppm/°C (FDC*)
  -400±200ppm/°C (FDD)

Package Dimensions



FDC



FDD

Unit: inch

Standard Ratings

FDC P/N	Time Delay	Rise Time ** (Max.)	Bandwidth (Min.)	Impedance
00505	50ps ± 25ps	150ps	2.5 GHz	50Ω
0105	100ps ± 50ps			
01505	150ps ± 50ps		2.0 GHz	
0205	200ps ± 50ps			
02505	250ps ± 50ps			
0305	300ps ± 50ps			
03505	350ps ± 50ps			
0405	400ps ± 50ps			
04505	450ps ± 50ps	200ps	1.5 GHz	
0505	500ps ± 50ps			
05505	550ps ± 25ps			
0605	600ps ± 50ps			
0705	700ps ± 50ps			
0805	800ps ± 50ps		1.0 GHz	
0905	900ps ± 50ps			
1005	1.0ns ± 50ps			
1105	1.1ns ± 50ps	250ps	900 MHz	
1205	1.2ns ± 50ps			
1305	1.3ns ± 50ps			
1405	1.4ns ± 50ps			
1505	1.5ns ± 50ps			
1605	1.6ns ± 50ps	300ps	800 MHz	
1705	1.7ns ± 50ps			
1805	1.8ns ± 50ps			
1905	1.9ns ± 50ps			
2005	2.0ns ± 50ps			
2505	2.5ns ± 0.20ns	500ps	700 MHz	
3005	3.0ns ± 0.20ns			
3505	3.5ns ± 0.25ns	600ps	600 MHz	
4005	4.0ns ± 0.30ns	700ps		
4505	4.5ns ± 0.30ns			
5005	5.0ns ± 0.30ns			
0510	0.5ns ± 0.10ns	300ps	1.5 GHz	100Ω
1010	1.0ns ± 0.10ns		1.0 GHz	
1510	1.5ns ± 0.15ns	400ps	900 MHz	
2010	2.0ns ± 0.20ns		800 MHz	
2510	2.5ns ± 0.20ns	500ps	700 MHz	
3010	3.0ns ± 0.20ns			
3510	3.5ns ± 0.25ns	600ps	600 MHz	
4010	4.0ns ± 0.30ns	700ps		
4510	4.5ns ± 0.30ns			
5010	5.0ns ± 0.30ns			

FDD P/N	Time Delay	Rise Time ** (Max.)	Bandwidth (Min.)	Impedance
5505	5.5ns ± 0.3ns	800ps	400 MHz	50Ω
6005	6.0ns ± 0.3ns	900ps	350 MHz	
6505	6.5ns ± 0.4ns			
7005	7.0ns ± 0.4ns	1.0ns	330MHz	
7505	7.5ns ± 0.4ns			
8005	8.0ns ± 0.4ns	1.1ns		
8505	8.5ns ± 0.5ns	1.2ns	300 MHz	
9005	9.0ns ± 0.5ns	1.3ns		
9505	9.5ns ± 0.5ns		250 MHz	
10005	10.0ns ± 0.5ns	1.4ns	200 MHz	
10505	10.5ns ± 0.6ns			
11005	11.0ns ± 0.6ns			
11505	11.5ns ± 0.6ns	1.5ns	170 MHz	
12005	12.0ns ± 0.6ns			
12505	12.5ns ± 0.7ns	1.6ns	150 MHz	
13005	13.0ns ± 0.7ns			
13505	13.5ns ± 0.7ns	1.7ns		
14005	14.0ns ± 0.7ns			
14505	14.5ns ± 0.8ns	1.8ns		
15005	15.0ns ± 0.8ns			
5510	5.5ns ± 0.3ns	800ps	400 MHz	100Ω
6010	6.0ns ± 0.3ns	900ps	350 MHz	
6510	6.5ns ± 0.4ns			
7010	7.0ns ± 0.4ns	1.0ns	330 MHz	
7510	7.5ns ± 0.4ns			
8010	8.0ns ± 0.4ns	1.1ns		
8510	8.5ns ± 0.5ns	1.2ns	300 MHz	
9010	9.0ns ± 0.5ns	1.3ns		
9510	9.5ns ± 0.5ns		250 MHz	
10010	10.0ns ± 0.5ns	1.4ns		

*Except for FDC 4505,5000 which is -400 ± 200ppm/°C.
** Measured between the 20% and 80% points of the rising edge of the output waveform.

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ELMEC®

High-Speed Delay Lines

VDA Type
Variable-Range Active Delay Line

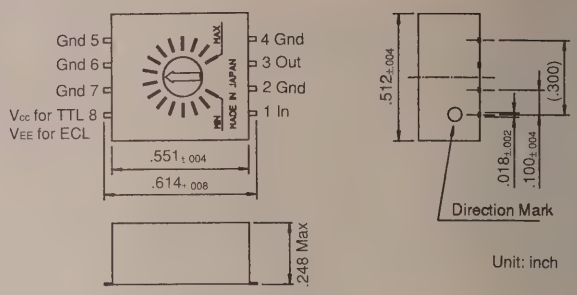
- **Surface-mount Package**
- **Fast TTL interfaced**
- **(CMOS and ECL 10 KH versions under development.)**
- **Digital or analog circuit applications**

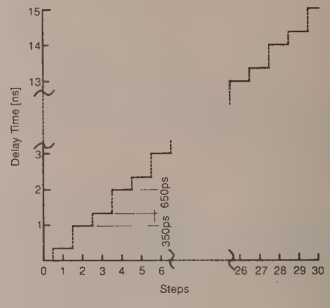
Electrical Characteristics
- Incremental steps: 31
- Output rise time: Within Fast TTL Spec.
- Inherent delay: 4ns ± 1ns
- Vcc voltage: 4.5V ~5.5V
- Operating temperature range: -40°C ~+85°C
- Storage temperature range: -40°C ~ +120°C
- Delay time temperature coefficient: Equiv. to Fast TTL (Internal delay elements: within ±100ppm/°C)

STANDARD RATINGS

VDA P/N	Max. Td (±5%)	Td Increments	Accuracy of Td Increments	Max. Frequency for Guaranteed Step Accuracy	Max. Frequency for Signal Pass-through
TS-15	15 ns	1ns steps	±0.5ns (or ±5%)	66MHz	80MHz
TS-30	30ns	2ns steps	±1ns (or ±5%)	33MHz	60MHz

Package Dimensions





QDB/QDD Type
Voltage Control Variable-Range Passive Delay Line

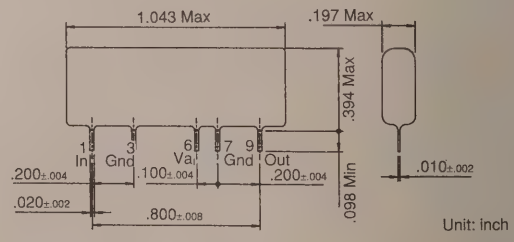
- **SIP Package**
- **ECL interfaced**
- **Digital or analog circuit applications**

Electrical Characteristics
- Control voltage range: 1.3V + Vbias (Delay Max.) ~ 11.3V + Vbias (Delay Min.) Vbias: signal line DC bias voltage
- Impedance: 45Ω ~68Ω
- Waveform distortion (overshoot/preshoot): ±20% max.
- Operating temperature range: -10°C ~+80°C
- Storage temperature range: -40°C ~ +120°C

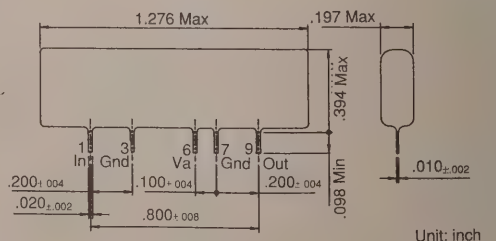
STANDARD RATINGS

P/N	Variable Delay Range	Inherent Delay Time	Rise Time	Bandwidth (-3db)
QDB1005	1.0ns±0.1ns	3.0ns ~3.5ns	1.0ns Max.	300MHz Min.
QDD1305	1.3ns ± 0.1ns	4.3ns ~4.8ns	1.2ns Max.	250MHz Min.

Package Dimensions



QDB



QDD

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ELMEC®

High-Speed Delay Lines

VDJ1010 Type

Variable-Range Passive Delay Line

- **DIP Package**
- **ECL100K interfaced**
- **Digital or analog circuit applications**

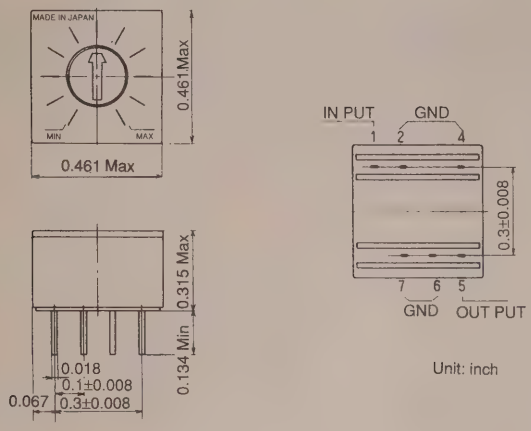
Electrical Characteristics

- DC Max. voltage: DC 2.5V Max. (constant)
- Bandwidth (-3dB): 1 GHz min.
- Waveform distortion (overshoot/preshoot): ±20% Max.
- Inherent delay: 230 ps max. at the minimum point within the variable range
- Operating temperature range: -40°C ~+85°C
- Storage temperature range: -40°C ~ +120°C
- Delay time temperature coefficient: ±100ppm/°C

Standard Ratings

Td Variable Range (±10%)	No. of Steps	Step Resolution	Rise Time (20% - 80%)	Input Impedance (±10%)	Output Impedance (±10%)
0 ~1.0ns	30 steps	33 ps	300 ps max.	50Ω	100Ω

Package Dimensions



Unit: inch

VDK/VDS Type

Variable-Range Passive Delay Line

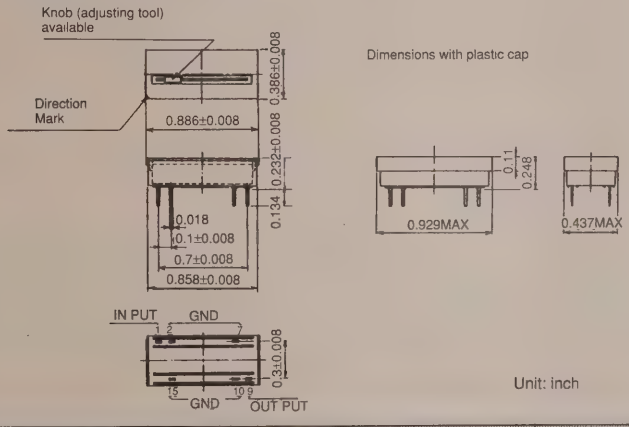
- **16-Pin DIP equivalent package**
- **Digital or analog circuit applications**

Electrical Characteristics

- Waveform distortion (overshoot/preshoot): ±20% Max.
- Inherent delay: 220ps max. at the minimum point within the variable range (VDK) 450ps max. at the minimum point within the variable range (VDS)
- Operating temperature range: -10°C ~+80°C
- Storage temperature range: -40°C ~ +120°C
- Bandwidth (-3dB): 800MHz Min.

Standard Ratings

Package Dimensions



Unit: inch

VDK P/N	Td Variable Range (+20% - 0%)	Step Resolution	Rise Time (20% - 80%) Max.	Input Impedance (±10%)	Output Impedance (±10%)	Logic Family Interface
0510	0 - 0.5ns	12.5ps	300ps	50Ω	100Ω	ECL 100K
2010	0 - 2.0ns	50ps	300ps	50 Ω	100 Ω	ECL 100K
0515	0 - 0.5ns	12.5ps	300ps	75 Ω	150 Ω	CML
2015	0 - 2.0ns	50ps	300ps	75 Ω	150 Ω	CML

VDS P/N	Td Variable Range (±20% -0%)	* Step Resolution		Rise Time (max.)		Input Impedance (±10%)	Output Impedance (±10%)	DC Max Voltage (Max.)	Logic Family Interface	Temperature Coefficient
		1.75%	3.25%							
5010	0 - 5ns	88ps	163ps	–	0.8ns**	50 Ω	100 Ω	2.5V	ECL 10KH	±100ppm/°C
1110	0 - 10ns	175ps	325ps	–	1.3ns**	50 Ω	100 Ω	2.5V	ECL 10KH	±100ppm/°C
2110	0 - 20ns	350ps	650ps	–	2.3ns**	50 Ω	100 Ω	2.5V	ECL 10K	-400±200ppm/°C
5020	0 - 5ns	88ps	163ps	–	2.0ns***	100 Ω	200 Ω	4.5V	TTL FAST	±100ppm/°C
1120	0 - 10ns	175ps	325ps	–	2.5ns***	100 Ω	200 Ω	4.5V	TTL FAST	±100ppm/°C
2120	0 - 20ns	350ps	650ps	–	3.5ns***	100 Ω	200 Ω	4.5V	TTL FAST	-400±200ppm/°C

* VDS has alternate step increments of 1.75% and 3.25%.

**VDS measured at 20% ~ 80%
***VDS measured at 10% ~ 90%

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ELMEC®

High-Speed Delay Lines

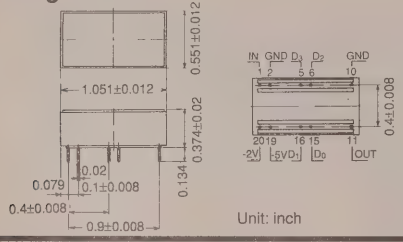
PDH 4-Bit Type
Programmable Active Delay Line

- **DIP Package**
- **ECL10KH interfaced**
- **Digital circuit applications**

Electrical Characteristics

- Max. frequency for guaranteed step accuracy: 80 MHz *
- No. of programmable steps: 16
- Supply voltage: -4.5V ~-5.7V
  -2V ± 5%
- Inherent delay: 4.5ns max.
- Output rise time: ECL10KH compatible
- Power consumption: -2V: 40mA (typical)
  -5V: 85mA (typical)
- Delay time temperature coefficient: ± 100ppm/°C
- Operating temperature range: -10°C ~ +60°C
- Storage temperature range: -40°C ~ +120°C

Package Dimensions



Unit: inch

Standard Ratings Logic 1: ECL (H) Level Logic 0: ECL (L) Level

Step	Address				PDH P/N					
	D_0	D_1	D_2	D_3	4050	4100	4125	4250	4500	4102
0	0	0	0	0	0 (ps)	0 (ps)	0 (ps)	0 (ps)	0 (ns)	0(ns)
1	1	0	0	0	50	100	125	250	0.5	1
2	0	1	0	0	100	200	250	500	1.0	2
3	1	1	0	0	150	300	375	750	1.5	3
4	0	0	1	0	200	400	500	1000	2.0	4
5	1	0	1	0	250	500	625	1250	2.5	5
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
13	1	0	1	1	650	1300	1625	3250	6.5	13
14	0	1	1	1	700	1400	1750	3500	7.0	14
15	1	1	1	1	750±5%	1500±5%	1875±5%	3750±5%	7.5±5%	15±5%
Step accuracy; ± 1/2 LSB up to 80 MHz					50ps±25ps	100ps±50ps	125ps±62.5ps	250ps±125ps	0.5ns±0.25ns	1ns±0.5ns

*Can be used at higher frequencies, but with broader tolerance range. For reference: ±1LSB at 150 MHz.

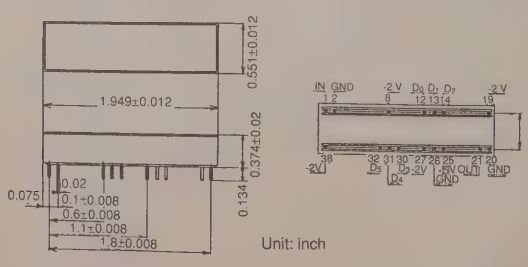
PDH 6-Bit Type
Programmable Active Delay Line

- **DIP Package**
- **ECL10KH interfaced**
- **Digital circuit applications**

ELECTRICAL CHARACTERISTICS

- Max. frequency for guaranteed step accuracy: 80 MHz *
- No. of programmable steps: 64
- Supply voltage: -4.5V ~-5.7V
  -2V ± 5%
- Inherent delay: 7ns max.
- Output rise time: ECL10KH compatible
- Power consumption: -2V: 90mA (typical)
  -5V: 120mA (typical)
- Delay time temperature coefficient: ± 100ppm/°C
- Operating temperature range: -10°C ~ +60°C
- Storage temperature range: -40°C ~ +120°C

Package Dimensions



Unit: inch

Standard Ratings Logic 1: ECL (H) Level Logic 0: ECL (L) Level

Step	Address						PDH P/N				
	D_0	D_1	D_2	D_3	D_4	D_5	6050	6100	6125	6200	6500
0	0	0	0	0	0	0	0 (ps)	0 (ps)	0 (ps)	0 (ns)	0 (ns)
1	1	0	0	0	0	0	50	100	125	0.2	0.5
2	0	1	0	0	0	0	100	200	250	0.4	1.0
3	1	1	0	0	0	0	150	300	375	0.6	1.5
4	0	0	1	0	0	0	200	400	500	0.8	2.0
5	1	0	1	0	0	0	250	500	625	1.0	2.5
6	0	1	1	0	0	0	300	600	750	1.2	3.0
7	1	1	1	0	0	0	350	700	875	1.4	3.5
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
61	1	0	1	1	1	1	3050	6100	7625	12.2	30.5
62	0	1	1	1	1	1	3100	6200	7750	12.4	31.0
63	1	1	1	1	1	1	3150±5%	6300±5%	7875±5%	12.6±5%	31.5±5%
Step accuracy; ± 1/2 LSB up to 80 MHz							50ps±25ps	100ps±50ps	125ps±62.5ps	0.2ns±0.1ns	0.5ns±0.25ns

*Can be used at higher frequencies, but with broader tolerance range. For reference: ±1LSB at 150 MHz.

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High-Speed Delay Lines

PDL 6-Bit Type

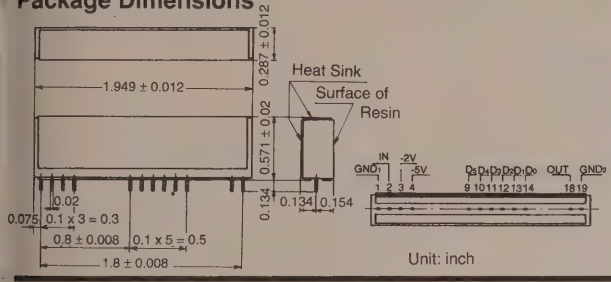
Programmable Active Delay Line

- **SIP Package**
- **ECL10KH interfaced**
- **Digital circuit applications**

Electrical Characteristics

- Max. frequency for guaranteed step accuracy: 80 MHz *
- No. of programmable steps: 64
- Supply voltage: -4.5V ~-5.7V
  -2V ± 5%
- Inherent delay: 7ns max.
- Output rise time: ECL10KH compatible
- Power consumption: -2V: 90mA (typical)
  -5V: 120mA (typical)
- Delay time temperature coefficient: ± 100ppm/°C
- Operating temperature range: -10°C ~ +60°C
- Storage temperature range: -40°C ~ +120°C

Package Dimensions



Unit: inch

Standard Ratings Logic 1: ECL (H) Level Logic 0: ECL (L) Level

Step	Address						PDL P/N			
	D_0	D_1	D_2	D_3	D_4	D_5	6050	6100	6125	6500
0	0	0	0	0	0	0	0 (ps)	0 (ps)	0 (ps)	0 (ps)
1	1	0	0	0	0	0	50	100	125	0.5
2	0	1	0	0	0	0	100	200	250	1.0
3	1	1	0	0	0	0	150	300	375	1.5
4	0	0	1	0	0	0	200	400	500	2.0
5	1	0	1	0	0	0	250	500	625	2.5
6	0	1	1	0	0	0	300	600	750	3.0
7	1	1	1	0	0	0	350	700	875	3.5
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
61	1	0	1	1	1	1	3050	6100	7625	30.5
62	0	1	1	1	1	1	3100	6200	7750	31.0
63	1	1	1	1	1	1	3150±5%	6300±5%	7875±5%	31.5±5%
Step accuracy; ± 1/2 LSB up to 80 MHz							50ps±25ps	100ps±50ps	125ps±62.5ps	0.5ps±0.25ns

*Can be used at higher frequencies, but with broader tolerance range. For reference: ±1LSB at 150 MHz.

PDE 6-Bit Type

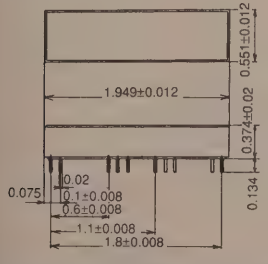
Programmable Active Delay Line

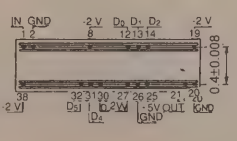
- **DIP Package**
- **ECL100K interfaced**
- **Digital circuit applications**

Electrical Characteristics

- Max. frequency for guaranteed step accuracy: 100 MHz *
- No. of programmable steps: 64
- Supply voltage: -4.2V ~-5.2V
  -2V ± 5%
- Inherent delay: 6ns ± 1ns
- Output rise time: ECL100K compatible
- Power consumption: -2V: 90mA (typical)
  -5V: 170mA (typical)
- Delay time temperature coefficient: ± 100ppm/°C
- Operating temperature range: -10°C ~ +60°C
- Storage temperature range: -40°C ~ +120°C

Package Dimensions





Unit: inch

Standard Ratings Logic 1: ECL (H) Level Logic 0: ECL (L) Level

Step	Address						PDE P/N				
	D_0	D_1	D_2	D_3	D_4	D_5	6050	6100	6125	6250	6500
0	0	0	0	0	0	0	0 (ps)	0 (ps)	0 (ps)	0 (ns)	0 (ns)
1	1	0	0	0	0	0	50	100	125	0.25	0.5
2	0	1	0	0	0	0	100	200	250	0.50	1.0
3	1	1	0	0	0	0	150	300	375	0.75	1.5
4	0	0	1	0	0	0	200	400	500	1.00	2.0
5	1	0	1	0	0	0	250	500	625	1.25	2.5
6	0	1	1	0	0	0	300	600	750	1.50	3.0
7	1	1	1	0	0	0	350	700	875	1.75	3.5
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
61	1	0	1	1	1	1	3050	6100	7625	15.25	30.5
62	0	1	1	1	1	1	3100	6200	7750	15.50	31.0
63	1	1	1	1	1	1	3150±5%	6300±5%	7875±5%	15.75±5%	31.5±5%
Step accuracy; ± 1/2 LSB up to 100 MHz							50ps±25ps	100ps±50ps	125ps±62.5ps	0.25ns±0.125ns	0.5ns±0.25ns

*Can be used at higher frequencies, but with broader tolerance range. For reference: ±1LSB at 150 MHz

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ESC

DELAY LINES

ESC DELAY LINES – SINCE 1953

THE FOLLOWING PAGES REPRESENT A MINIMUM VARIETY OF ESC'S CURRENTLY AVAILABLE DELAY LINES

Most ESC DELAY LINES are available for MIL applications!

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(D) Denotes availability in Auto-Insertable DIP package
(C) Denotes availability for high temperature, MIL applications

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ESC

DELAY LINES

SERIES SIL–7 –Single-in-line 5 taps/SERIES SIL-14 –Single-in-line 10 taps

COMMON SPECIFICATIONS

- Output Time Delay Tolerance:
  ±5% for 20ns and above
  ±10% or .25ns whichever is greater, for 10ns and less
- Distortion: ±10% at output
- Attenuation: 0.5db max
- Temperature Coefficient: 100 ppm/°C max
- Operating Temperature Range: –55°C to +125°C
- Dielectric Strength: 50 VDC
- Size: SIL-7: .80L × .20W × .25H
  SIL-14: 1.50L × .20W × .25H

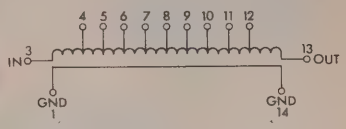
SERIES SIL-7

7 PIN

TD (ns)	Rise Time max (ns)	No. of Taps	TD/Tap (ns)	Atten. max %	MODEL NO.	
					50Ω ± 10%	100Ω ± 10%
1	1.5	none	—	2.0	SLA-1	SLB-1
2	1.5	none	—	2.0	SLA-2	SLB-2
3	1.5	none	—	2.0	SLA-3	SLB-3
4	2.0	none	—	2.0	SLA-4	SLB-4
5	2.0	5	1.0 ± 0.3	2.0	SLA-5	SLB-5
10	3.0	5	2.0 ± 0.4	2.0	SLA-10	SLB-10
20	6.0	5	4.0 ± 0.5	2.0	SLA-20	SLB-20
30	9.0	5	6.0 ± 1.0	2.0	SLA-30	SLB-30
40	12.0	5	8.0 ± 1.0	2.0	SLA-40	SLB-40
50	15.0	5	10.0 ± 1.0	2.5	SLA-50	SLB-50
60	18.0	5	12.0 ± 1.5	3.0	—	SLB-60
70	22.0	5	14.0 ± 1.5	4.0	—	SLB-70
80	25.0	5	16.0 ± 1.5	4.5	—	SLB-80
90	28.0	5	18.0 ± 2.0	4.5	—	SLB-90
100	30.0	5	20.0 ± 2.0	5.0	—	SLB-100

SERIES SIL-14

14 PIN



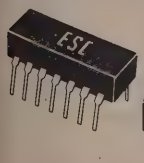
TD (ns)	Rise Time max (ns)	TD/Tap (ns)	Atten. max %	MODEL NO.	
				50Ω ± 10%	100Ω ± 10%
10	2.0	1.0 ± 0.5	2.5	SLA14-10	—
20	4.0	2.0 ± 0.5	2.5	SLA14-20	SLB14-20
25	5.0	2.5 ± 1.0	2.5	SLA14-25	SLB14-25
30	6.0	3.0 ± 1.0	2.5	SLA14-30	SLB14-30
40	8.0	4.0 ± 1.0	2.5	SLA14-40	SLB14-40
50	10.0	5.0 ± 1.0	3.0	SLA14-50	SLA14-50
60	12.0	6.0 ± 1.0	3.5	SLA14-60	SLB14-60
70	14.0	7.0 ± 1.0	3.5	SLA14-70	SLB14-70
75	15.0	7.5 ± 1.0	4.0	SLA14-75	SLB14-75
80	16.0	8.0 ± 1.0	4.5	SLA14-80	SLB14-80
90	18.0	9.0 ± 1.0	4.5	SLA14-90	SLB14-90
100	20.0	10.0 ± 1.0	4.5	SLA14-100	SLB14-100
150	30.0	15.0 ± 2.0	8.0	—	SLB14-150
200	40.0	20.0 ± 2.0	10.0	—	SLB14-200

SERIES DIP-14 –10 Taps/SERIES DIP-G14 –Surface Mounting G Leads
SERIES DIP-16 –Extended Delay 10 Taps/SERIES DIP-G16 –Surface Mounting G Leads

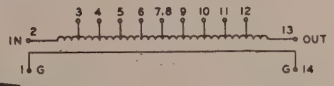
COMMON SPECIFICATIONS

- Operating Temperature: –55°C to +125°C
- Temperature Coefficient: 100 ppm/°C max
- Attenuation: 1dB max
- Distortion (at max delay): ±10% max
- Dielectric Strength: 50VDC
- Size: DIP14: .785L × .285W × .250H
  DIP16: .890L × .285W × .280H

SERIES DIP-14/SERIES DIP-G14

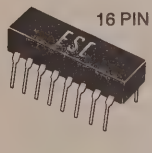


14 PIN DIP

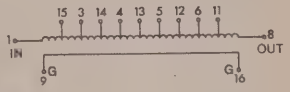


Time Delay (nsec) ± 5%	Rise Time (nsec)	No. of Taps	Delay per Tap (nsec) non-cumulative	IMPEDANCE ± 10% → 50	75	100	200
				MODEL NO.			
10 ± 5%	2.0	10	1.0 ± .5	5P10	7P10	1P10	—
20	4.0	10	2.0 ± .5	5P20	7P20	1P20	2P20
30	6.0	10	3.0 ± 1	5P30	7P30	1P30	2P30
40	7.0	10	4.0 ± 1	5P40	7P40	1P40	2P40
50	8.0	10	5.0 ± 1	5P50	7P50	1P50	2P50
100	6.0	10	10.0 ± 1.5	5P100	7P100	1P100	2P100
150	25.0	10	15.0 ± 1.5	5P150	7P150	1P150	2P150
200	35.0	10	20.0 ± 2	5P200	7P200	1P200	2P200
250	42.0	10	25.0 ± 2.5	5P250	7P250	1P250	2P250
300	50.0	10	30.0 ± 3.0	5P300	7P300	1P300	2P300

SERIES DIP-16/SERIES DIP-G16



16 PIN DIP



Time Delay (ns) ± 5%	Rise Time (ns)	No. of Taps	Delay per Tap (ns) ± 2ns or 5% (whichever is greater)	IMPEDANCE ± 10% → 100	200	300	500
				MODEL NO.			
250	45	10	25	1N25	2N25	3N25	5N25
300	55	10	30	1N30	2N30	3N30	5N30
350	65	10	35	1N35	2N35	3N35	5N35
400	70	10	40	1N40	2N40	3N40	5N40
450	80	10	45	1N45	2N45	3N45	5N45
500	90	10	50	1N50	2N50	3N50	5N50
600	110	10	60	1N60	2N60	3N60	5N60
800	145	10	80	1N80	2N80	3N80	5N80
1000	180	10	100	1N100	2N100	3N100	5N100

Intermediate Delay Values Available Upon Request.

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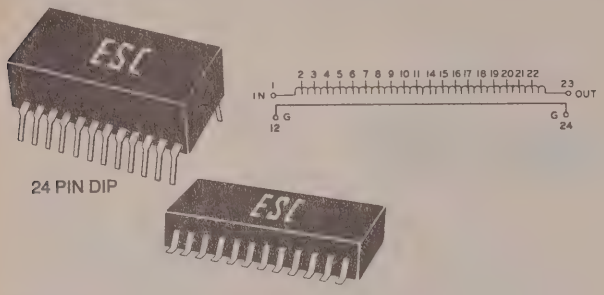
ESC

DELAY LINES

SERIES DIP-24 –to 2000 Nsec 20 taps/SERIES DIP-G24 –Surface Mounting G Leads

SPECIFICATIONS:

- Operating Temperature: –55°C to +125°C
- Temperature Coefficient: 100 ppm/°C max
- Attenuation: 1 dB max
- Distortion: 10% max
- Dielectric Strength: 50 VDC
- Size: 1.3L × .580W × .300H

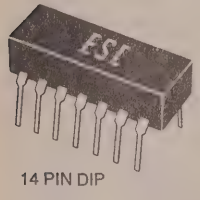


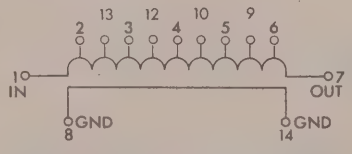
For Gull Wing Surface Mount Package add letter G following 1st 3 digits. Example: 124-5 converts to 124G-5.

IMPEDANCE ±10% (OHMS) →			100	200	500
Time Delay ±5%	Rise Time (nsec) Max	Delay per Tap ±% or 1nsec WIG	MODEL NO.		
200	17	10.0	124-2	224-2	524-2
250	21	12.5	124-2.5	224-2.5	524-2.5
400	34	20.0	124-4	224-4	524-4
500	42	25.0	124-5	224-5	524-5
600	50	30.0	124-6	224-6	524-6
750	63	37.5	124-7.5	224-7.5	524-7.5
800	67	40.0	124-8	224-8	524-8
1000	84	50.0	124-10	224-10	524-10
1200	110	60.0	124-12	224-12	524-12
1500	125	75.0	124-15	224-15	524-15
2000	170	100.0	—	224-20	524-20

SERIES MIL-23 –low profile

- Total Time Delay Tolerance: ±2 ns Below 40 ns Delay
  ±5% Above 40 ns Delay
- No. of Taps: 10 Equally Spaced
- Temperature Coefficient: 100 ppm/°C max.
- Operating Temp. Range: –55°C to +125°C
- Distortion at max delay: ±10% max.
- Attenuation: 10% max.
- Dielectric Strength: 50 VDC
- Size: 14 Pin, .750L × .300W × .187H





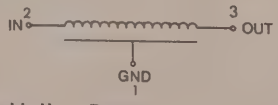
Total Td ns	Rise Time max(ns)	IMPEDANCE ±10%		
		50Ω	100Ω	200Ω
10	3	A002	B102	—
15	4	A003	B103	—
20	5.5	A004	B104	—
25	6	A005	B105	—
30	6.5	A006	B106	—
35	7	A007	B107	—
40	8	A008	B108	C208

Total Td ns	Rise Time max(ns)	IMPEDANCE ±10%		
		50Ω	100Ω	200Ω
45	9	A009	B109	C209
50	10	A010	B110	C210
60	12	A012	B112	C212
80	16	A016	B116	C216
100	20	A020	B120	C220
120	24	A022	B122	C222
140	28	A024	B124	C224
150	30	A025	B125	C225
160	32	A026	B126	—
180	36	A028	B128	—
200	40	A030	B130	—
220	45	—	B132	—
240	50	—	B134	—
250	50	—	B135	—
260	55	—	B136	—
280	60	—	B138	—
300	60	—	B140	—
330	70	—	B143	—

SERIES SAT/SERIES SBT –miniature singles

SPECIFICATIONS:

- Delay Tolerance: ±.25ns
- Operating Temperature: –55°C to +125°C
- Attenuation: 0.25 db max
- Dielectric Strength: 50 VDC
- Temp. Coefficient: 100 ppm/°C
- Band Width: 200 MHz (–3dB)
- Size: .56L × .25W × .20H



Intermediate Delay Values Available Upon Request.

Miniature trimming delay lines in increments of 0.5 ns for your fine "tweeking."

Td(ns)	Impedance ±10%	
	50Ω	100Ω
1.0	SAT-10	SBT-10
1.5	SAT-15	SBT-15
2.0	SAT-20	SBT-20
2.5	SAT-25	SBT-25
3.0	SAT-30	SBT-30
3.5	SAT-35	SBT-35
4.0	SAT-40	SBT-40
4.5	SAT-45	SBT-45
5.0	SAT-50	SBT-50

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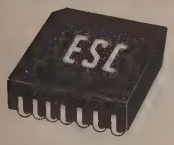
ESC DELAY LINES

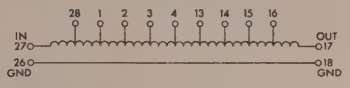
SERIES JSA/SERIES JSB –low profile, 10 taps, surface mounting, J leads

SPECIFICATIONS:

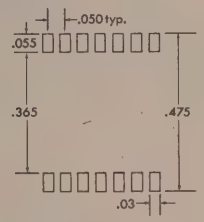
- Operating Temperature: – 55°C to + 125°C
- Temperature Coefficient: 100 ppm/°C max
- Terminals: Electro tin plated, Alloy 42 .020w x .010 th.
- Distortion (at max delay): ± 10% max
- Dielectric Strength; 50 VDC



10 TAPS



Size: 450L × .450W × .175H



Suggested PC Board Solder Pads

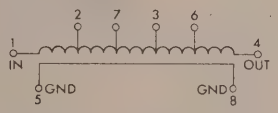
Time Delay (ns) ± 2ns or 5%	Rise Time (ns)	Attenuation (db) max	Delay per Tap (ns)	IMPEDANCE ± 10%	
				100Ω Model No.	200Ω Model No.
25	5	3%	2.5 ± 0.5	JSA25	JSB25
30	6	3%	3.0 ± 0.5	JSA30	JSB30
35	7	3%	3.5 ± 0.5	JSA35	JSB35
40	8	3%	4.0 ± 0.5	JSA40	JSB40
45	9	3%	4.5 ± 0.5	JSA45	JSB45
50	10	3%	5.0 ± 1.0	JSA50	JSB50
60	12	5%	6.0 ± 1.0	JSA60	JSB60
75	15	5%	7.5 ± 1.0	JSA75	JSB75
100	20	5%	10.0 ± 2.0	JSA100	JSB100
125	25	8%	12.5 ± 2.0	JSA125	JSB125
150	30	8%	15.0 ± 2.0	JSA150	JSB150
175	35	10%	17.5 ± 2.0	JSA175	JSB175
200	40	12%	20.0 ± 2.0	JSA200	JSB200
250	50	12%	25.0 ± 2.0	JSA250	JSB250

SERIES 8A/SERIES 8B –machine insertable, DIP, delay lines, 8 pin package, 5 taps

SPECIFICATIONS:

- Delay Tolerance: ± 1ns or ± 5% whichever is greater
- Distortion (at max delay): ± 10% max
- Attenuation: 0.5dB max
- Dielectric Strength: 50VDC
- Temperature Coefficient: 100ppm/°C max
- Operating Temperature Range: – 55°C to + 125°C
- Terminals: HTD alloy 42. 020w x .010th.

8 PIN



Size: .500L × .285W × .250H

Delay (ns)	Delay per Tap (ns)	Rise Time (ns) max	IMPEDANCE ± 10% 50Ω	100Ω
5	1	2	8A05	8B05
10	2	3	8A10	8B10
15	3	5	8A15	8B15
20	4	7	8A20	8B20
25	5	8	8A25	8B25
30	6	10	8A30	8B30
35	7	12	8A35	8B35
40	8	13	8A40	8B40
50	10	17	8A50	8B50

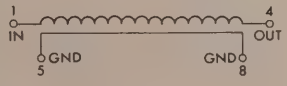
Total Time Delay Tolerance: ± 1ns or ± 5%, whichever is greater.

SERIES 8GSA/SERIES 8GSB –low profile, 8 pin, package surface mounting G leads

SPECIFICATIONS

- Band Width: 200MHz (– 3dB)
- Delay Tolerance: ± .25ns
- Attenuation: 0.25dB max
- Dielectric Strength: 50VDC
- Operating Temperature: – 55°C to + 125°C
- Temp. Coefficient: 100ppm/°C max
- Terminals: Electro tin plated alloy 42

4 PIN



Size: 500L x .285W x .250H

Delay (ns) ± .25ns	Impedance 50Ω	100Ω
1.0	8GSA-10	8GSB-10
1.5	8GSA-15	8GSB-15
2.0	8GSA-20	8GSB-20
2.5	8GSA-25	8GSB-25
3.0	8GSA-30	8GSB-30
3.5	8GSA-35	8GSB-35
4.0	8GSA-40	8GSB-40
4.5	8GSA-45	8GSB-45
5.0	8GSA-50	8GSB-50

Intermediate Delay Values Available Upon Request.

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ESC

DELAY LINES

DIGITAL DELAY LINES

COMMON SPECIFICATIONS:

	14 Series	14L Series
Supply voltage	5V ±5%	5V ±5%
Supply current	70mA max	25mA max
Rise & Fall Time	4ns max	6ns max
Operating Temp.	0 to 70°C	0 to 70°C
Size	.8 × .4 × .28	.8 × .4 × .28
Delay tolerance: ±5% or 2ns, whichever is greater		

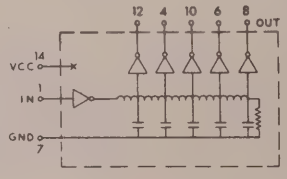
ESC can also supply these devices with ceramic IC's that have been screened to MIL-STD-833 for −55°C to +125°C operation. Case size will be .82L × .40W × .36H. When ordering add letter "C" after fourth digit in part number.
Example: 14LP10 converts to 14LPC10.
14T100 converts to 14TC100.
All items above available in the low profile auto-insertable package. Contact Plant.

SERIES 14T –digital
TTL, 5-taps

TTL, DTL

Model No.	Delay (ns)	Delay/ Tap (ns)
14T25	25	5
14T30	30	6
14T35	35	7
14T40	40	8
14T45	45	9
14T50	50	10
14T75	75	15
14T100	100	20
14T150	150	30
14T200	200	40
14T250	250	50
14T300	300	60
14T500	500	100
14T750	750	150
14T1000	1000	200

14 PIN



SERIES 14LT –low power
Shottky, 5taps

Low power schottky

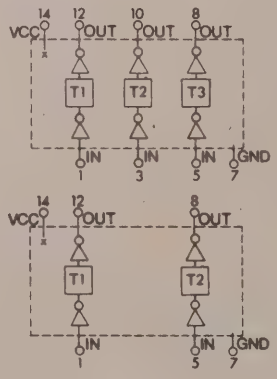
Model No.	Delay (ns)	Delay/ Tap (ns)
14LT50	50	10
14LT75	75	15
14LT100	100	20
14LT150	150	30
14LT200	200	40
14LT250	250	50
14LT300	300	60
14LT500	500	100

SERIES 14P/SERIES 14D–
digital, TTL, triplets and dual

TTL, DTL

Model No.		*Delay
14P Series	14D Series	(ns)
14P5	14D5	5
14P10	14D10	10
14P15	14D15	15
14P20	14D20	20
14P25	14D25	25
14P50	14D50	50
14P75	14D75	75
14P100	14D100	100

*Per Line



SERIES 14LP/SERIES 14LD–
low power schottky triplets and dual

Low power schottky

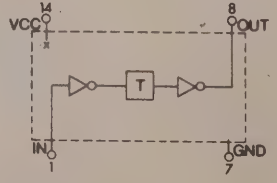
Model No.		*Delay
14LP Series	14LD Series	(ns)
14LP5	14LD5	5
14LP10	14LD10	10
14LP15	14LD15	15
14LP20	14LD20	20
14LP25	14LD25	25
14LP50	14LD50	50
14LP75	14LD75	75
14LP100	14LD100	100

*Per Line

SERIES 14G/SERIES 14LG–
digital, TTL, single output

Model No.	Delay
14G5	5
14G10	10
14G20	20
14G25	25
14G50	50
14G75	75
14G100	100
14G150	150
14G200	200
14G500	500
14G750	750
14G1000	1000

Intermediate Delay Values Available Upon Request.



SERIES 14LG –low power
schottky single output

Model No.	Delay
14LG10	10
14LG20	20
14LG25	25
14LG50	50
14LG75	75
14LG100	100
14LG150	150
14LG200	200
14LG300	300
14LG500	500

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ESC

DELAY LINES

MACHINE INSERTABLE LOW PROFILE DIP DIGITAL DELAY LINES

COMMON SPECIFICATIONS:

- Supply Voltage: 5.0VDC ± 5%
- Delay Tolerance: ± 2ns or ± 5% WIG
- Rise Time: 4ns max
- Minimum Pulse Width: 20% of total delay (10 taps)
  40% of total delay (5 taps)
- Maximum Duty Cycle: 50%
- Operating Temp. Range: 0°C to + 70°C
- Temp. Coeff. of Delay: 1.0ns + 500ppm/°C
- Terminals: HTD alloy 42. 020w x .010th.

The auto-insertable versions of the single output 14G Series and the triplet 14P Series are available as 14GD & 14PD respectively.

DC PARAMETERS		LIMITS Min.	LIMITS Max.
V_{oh}	V_{cc} = min, I_{oh} = 1.0 mA	2.5V	—
V_{ol}	V_{cc} = min, I_{ol} = 20 mA	—	0.5V
I_{ih}	V_{cc} = max, V_{ih} = 2.7V	—	50 µA
I_{il}	V_{cc} = max, V_{il} = 0.5V	– 2.0 mA	—

COMMON TEST CONDITIONS

- Vcc = 5.0VDC, Temp. 25° ± 5°C
- Time delay measured at the 1.5V level
- Rise time measured from .75V to 2.4V
- All outputs loaded with 15pf
- Input Test Pulse: Pulse voltage: 3.0V
  Pulse rise time: 2 ns
  Pulse width: 1.2 × max Td
  Pulse spacing: 5 × max Td

The low-low profile series is available as above (14TDL) and in the single output 14GDL Series only.

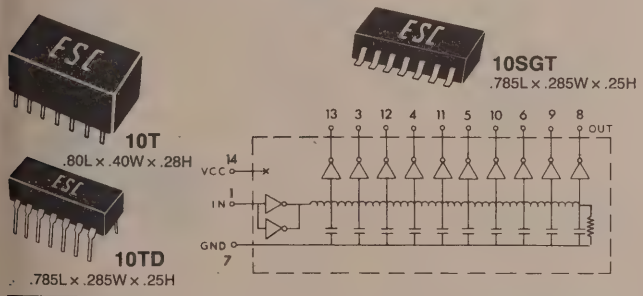
DC PARAMETERS		LIMITS Min.	LIMITS Max.
I_i	V_{cc} = max, V_i = 5.5V	—	1.0 mA
V_i	V_{cc} = min, I_{in} = – 18 madc	– 1.2Vdc	—
I_{cc}	V_{cc} = max, outputs low	Series 10T Series 10TD Series 10SGT Series 14TD Series 14TDL	140 mA 140 mA 140 mA 70 mA 70 mA

SERIES 10T/SERIES 10TD –digital TTL compatible 10 taps, 14 pin, package
SERIES 10SGT –surface mounting G lead

Also available in Low Power Schottky-Series 10LT, 10LTD, or 10LSGT

ESC can also supply the 10T Series with ceramic IC's that have been screened to MIL-STD-883 for – 55°C to + 125°C operation.

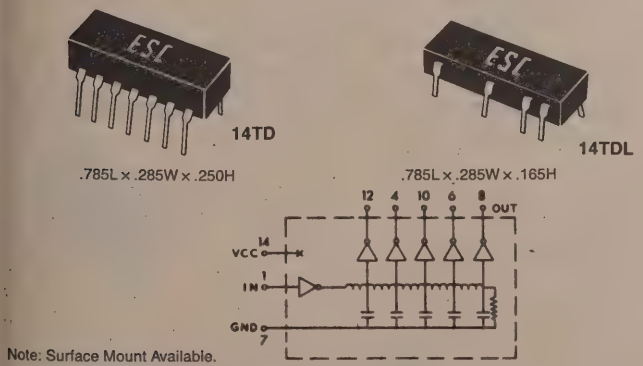
The height will increase to .32 inches. When specifying, add letter "C" after "T". Example: 10T50 converts to 10TC50.



Model Nos. Series 10T	Series 10TD	Series 10SGT	Delay (ns)	Delay/ Tap (ns)
10T50	10TD50	10SGT50	50	5
10T60	10TD60	10SGT60	60	6
10T70	10TD70	10SGT70	70	7
10T80	10TD80	10SGT80	80	8
10T90	10TD90	10SGT90	90	9
10T100	10TD100	10SGT100	100	10
10T200	10TD200	10SGT200	200	20
10T250	10TD250	10SGT250	250	25
10T300	10TD300	10SGT300	300	30
10T350	10TD350	10SGT350	350	35
10T400	10TD400	10SGT400	400	40
10T450	10TD450	10SGT450	450	45
10T500	10TD500	10SGT500	500	50
10T750	10TD750	10SGT750	750	75
10T1000	10TD1000	10SGT1000	1000	100

For variations in delay from above listing, modify part number by changing delay.
Example: 375ns, 10SGT series becomes 10SGT375

SERIES 14TD –TTL/DTL compatible, 5 taps, 14 pin package, low profile
SERIES 14TDL –low-low profile



Note: Surface Mount Available.

Intermediate Delay Values Available Upon Request.

Model Nos. Series 14TD	Series 14TDL	Delay (ns)	Delay/ Tap (ns)
14TD25	14TDL25	25	5
14TD30	14TDL30	30	6
14TD35	14TDL35	35	7
14TD40	14TDL40	40	8
14TD45	14TDL45	45	9
14TD50	14TDL50	50	10
14TD75	14TDL75	75	15
14TD100	14TDL100	100	20
14TD150	14TDL150	150	30
14TD200	14TDL200	200	40
14TD250	14TDL250	250	50
14TD300	14TDL300	300	60
14TD500	14TDL500	500	100
14TD750	N/A	750	150
14TD1000	N/A	1000	200

For variations in delay from above listing, modify part number by changing delay.
Example: 400ns, 14TDL Series becomes 14TDL400

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ESC

DELAY LINES

LOW PROFILE MILITARY APPLICATIONS

COMMON SPECIFICATIONS:

- Supply Voltage (Vcc): 5.0VDC ± 5%
- Delay Tolerance: ± 2ns or ± 5% wig
- Rise Time: 4ns max
- Minimum Pulse Width: JSMTC Series: 40% of Td
  10TCL Series: 20% of Td
- Maximum Duty Cycle: 50%
- Operating Temp. Range: − 55°C to + 125°C
- Temp. coeff. of delay: 1.0ns + 500ppm/°C
- Terminals: .020w x .010th HTD alloy 42

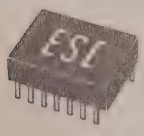
DC PARAMETERS		LIMITS MIN.	LIMITS MAX.
V_{oh}	V_{cc} = min I_{oh} = 1.0 mA	2.5V	—
V_{ol}	V_{cc} = min I_{ol} = 20 mA	—	0.5V
I_{ih}	V_{cc} = max V_{in} = 2.7V	—	50 µA
I_{il}	V_{cc} = max V_{il} = 0.5V	− 2.0 mA	—

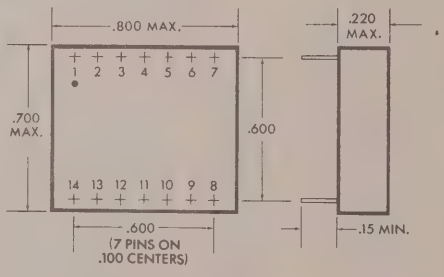
COMMON TEST CONDITIONS

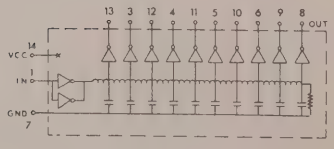
- Temperature: 25° ± 5°C, V_{cc} = 5.0VDC
- Input pulse width: 1.2 times the total delay time
- Pulse spacing: 5 times the total delay time
- Input rise time: 2ns; input pulse amplitude 3.0VDC
- All outputs loaded with 15pf
- Time delays measured at the 1.5 volts on the leading edges
- Rise time measured from .75 to 2.4V

DC PARAMETERS		LIMITS MIN.	LIMITS MAX.
I_i	V_{cc} = max V_i = 5.5V	—	1.0 mA
V_i	V_{cc} = min I_{in} = − 18 madc	− 1.2Vdc	—
I_{cc}	V_{cc} = max outputs low	JSMTC Series 10TCL Series	70mA 140mA

SERIES 10TCL –TTL digital, 10 taps



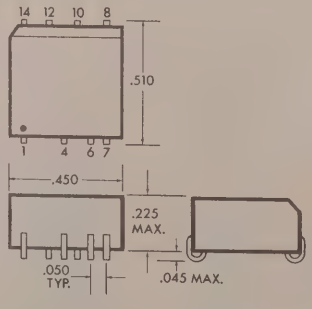


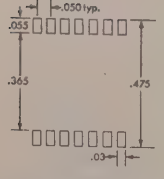


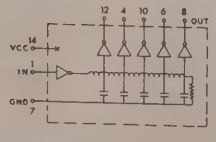
MODEL NOS.	DELAY (ns)	DELAY/TAP (ns)
10TCL50	50	5
10TCL60	60	6
10TCL70	70	7
10TCL80	80	8
10TCL90	90	9
10TCL100	100	10
10TCL200	200	20
10TCL250	250	25
10TCL300	300	30
10TCL350	350	35
10TCL400	400	40
10TCL450	450	45
10TCL500	500	50

SERIES JSMTC –5 taps, surface mounting

5 TAPS







MODEL NOS.	DELAY (ns)	DELAY/TAP Tap (ns)
JSMTC25	25	5
JSMTC50	50	10
JSMTC75	75	15
JSMTC100	100	20
JSMTC125	125	25
JSMTC150	150	30
JSMTC200	200	40
JSMTC250	250	50

Intermediate Delay Values Available Upon Request.

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NEW JERSEY 07650 ● (201) 947-0400 ● TWX: 710-991-9780 ● FAX: 201-947-0406

ESC

DELAY LINES

HIGH PERFORMANCE DIGITAL DELAY LINES—DELAY TOLERANCE CONTROLLED AT LEADING AND TRAILING EDGES

COMMON SPECIFICATIONS:

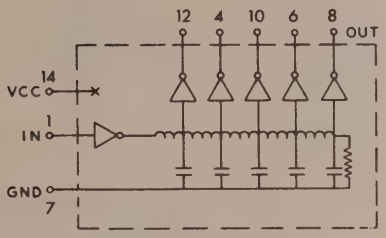
	14HT 14HTD	14HLT
Supply Voltage	5 ± 5%	5V ± 5%
Supply Current	70mA Max	25mA Max
Rise & Fall Time	4ns Max	6ns Max
Operating Temp.	0 to 70°C	0 to 70°C
Delay Tolerance	± 5% or 2ns*	± 5% or 3ns*
Min. Pulse Width: 20% of TD		
Max Duty Cycle: 50%		
Temp. Coeff. of Delay: 1.0ns + 500ppm/°C		
Operating Temperature: 0 to 70°C		

*Whichever is greater

ESC can supply the 14HT and 14HLT series with ceramic IC's that have been screened to MIL-STD-883 for −55°C to +125°C operation. Case size will be .82L × .40W × .36H. When ordering add suffix "C" (14HTC, 14HLTC.)

SERIES 14HT –high performance TTL compatible, 5 taps

14 PIN

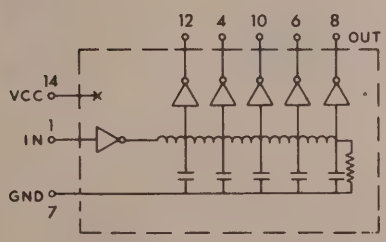


Size: .80L × .40W × .28H

MODEL NO.	DELAY (ns)	DELAY/ Tap (ns)
14HT25	25	5
14HT30	30	6
14HT35	35	7
14HT40	40	8
14HT45	45	9
14HT50	50	10
14HT75	75	15
14HT100	100	20
14HT150	150	30
14HT200	200	40
14HT250	250	50
14HT300	300	60
14HT500	500	100
14HT750	750	150
14HT1000	1000	200

SERIES 14HTD –low profile, DIP package, TTL compatible, 5 taps

14 PIN

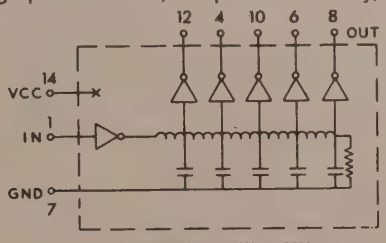


Size: .785L × .285W × .25H

MODEL NO.	DELAY (ns)	DELAY/ Tap (ns)
14HTD25	25	5
14HTD30	30	6
14HTD35	35	7
14HTD40	40	8
14HTD45	45	9
14HTD50	50	10
14HTD75	75	15
14HTD100	100	20
14HTD150	150	30
14HTD200	200	40
14HTD250	250	50
14HTD300	300	60
14HTD500	500	100
14HTD750	750	150
14HTD1000	1000	200

SERIES 14HLT –high performance, low power Schottky, 5 taps

14 PIN



Size: .80L × .40W × .28H

MODEL NO.	DELAY (ns)	DELAY/ Tap (ns)
14HLT50	50	10
14HLT75	75	15
14HLT100	100	20
14HLT150	150	30
14HLT200	200	40
14HLT250	250	50
14HLT300	300	60
14HLT500	500	100

Available as Machine Insertable SERIES 14HLTD

Intermediate Delay Values Available Upon Request.

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NEW JERSEY 07650 ● (201) 947-0400 ● TWX: 710-991-9780 ● FAX: 201-947-0406

ESC

DELAY LINES

LOW PROFILE DIGITAL DELAY LINES FOR MILITARY APPLICATIONS

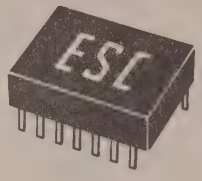
COMMON SPECIFICATIONS:

	9 Series	9L Series
Supply Voltage	5.0 VDC ± 5%	5.0 VDC ± 5%
Supply Current	70mA Max	25mA Max
Rise & Fall Time	4.0 ns Max	6ns Max
Operating Temp.	−55°C to +125°C	−55°C to +125°C
Size * *	.80L × .50W × .165H	
Delay Tolerance	± 5% or 2 ns whichever is greater	

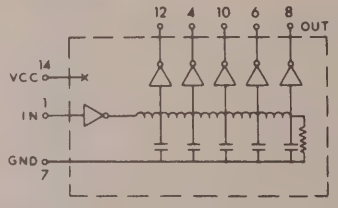
* * Height of 9P, 9LP is .200

These devices are supplied with ceramic IC's that have been screened to MIL-STD-883 for −55°C to +125°C operation.

SERIES 9T –TTL compatible, 5 taps



14 PIN



MODEL NO.	DELAY (ns)	DELAY/ TAP (ns)
9T25	25	5
9T30	30	6
9T35	35	7
9T40	40	8
9T45	45	9
9T50	50	10
9T75	75	15
9T100	100	20
9T150	150	30
9T200	200	40

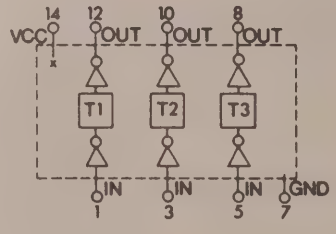
SERIES 9LT –low power schottky, 5 taps

MODEL NO.	DELAY (ns)	DELAY/ TAP (ns)
9TL50	50	10
9TL75	75	15
9TL100	100	20
9TL150	150	30
9TL200	200	40

SERIES 9P –TTL compatible triplets

MODEL NO.	DELAY * PER LINE (ns)
9P5	5
9P10	10
9P15	15
9P20	20
9P25	25
9P50	50

*Per Line



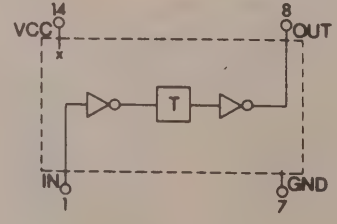
SERIES 9LP –low power schottky triplets

MODEL NO.	DELAY * PER LINE (ns)
9LP10	10
9LP15	15
9LP20	20
9LP25	25
9LP50	50

*Per Line

SERIES 9G –TTL compatible single output

MODEL NO.	DELAY PER LINE (ns)
9G5	5
9G10	10
9G20	20
9G25	25
9G50	50
9G100	100
9G200	200



SERIES 9LG –low power schottky single output

MODEL NO.	DELAY PER LINE (ns)
9LG10	10
9LG20	20
9LG25	25
9LG50	50
9LG100	100
9LG200	200

Intermediate Delay Values Available Upon Request.

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ESC

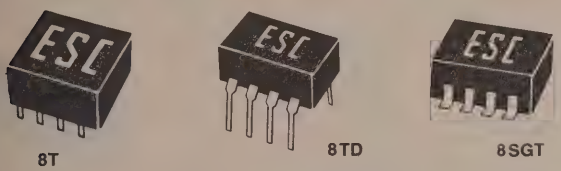
DELAY LINES

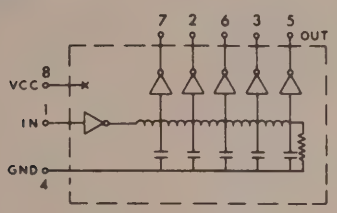
SERIES 8T/SERIES 8TD –digital, TTL compatible, 5 taps, 8 pin package, dual-in-line or auto insertable
SERIES 8SGT –surface mounting G leads

SPECIFICATIONS:

- Supply voltage: 5.0VDC ± 5%
- Delay tolerances: ± 2ns or ± 5% whichever is greater
- Rise Time: 4ns Max
- Minimum Pulse Width: 40% of total delay
- Maximum Duty Cycle: 50%
- Operating temp. range: 0°C to + 70°C
- Temp. Coeff. of delay: 1.0ns + 500ppm/°C
- Terminals: Electro tinplated alloy 42 .020w × .010th

Note: 1–All packages can be supplied in the single-output type as Series 8G, 8GD or 8SGG or dual-output types as Series 8D,8DD or 8SGD.
*2–For – 55°C to 125°C operation specify Series 8TC.





8T Size: .50L × .40W × .25H
8TD Size: .50L × .28W × .25H
8SGT Size: .50L × .28W × .25H

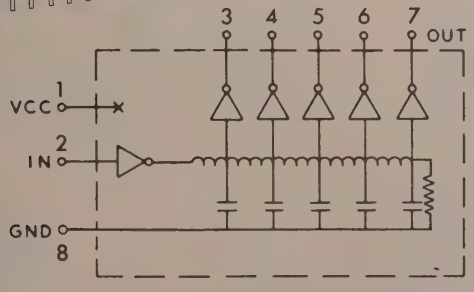
MODEL NOS.			DELAY	DELAY/
SERIES 8T	SERIES 8TD	SERIES 8SGT	(ns)	TAPS (ns)
8T25	8TD25	8SGT25	25	5
8T30	8TD30	8SGT30	30	6
8T40	8TD40	8SGT40	40	8
8T50	8TD50	8SGT50	50	10
8T75	8TD75	8SGT75	75	15
8T100	8TD100	8SGT100	100	20
8T200	8TD200	8SGT200	200	40
8T250	8TD250	8SGT250	250	50
8T300	8TD300	8SGT300	300	60
8T400	8TD400	8SGT400	400	80
8T500	8TD500	8SGT500	500	100

For variations in delay from above listing, modify part number by changing delay.
Example: 350ns, 8T Series becomes 8T350

SERIES 5T –digital TTL compatible, 5 taps

SPECIFICATIONS:

- Supply voltage: 5V ± 5%
- Logic 1 input current: 50µA max.
- Logic 0 input current: 2 mA max.
- Logic 1 voltage out: 2.4V min.
- Logic 0 voltage out: 0.5V max.
- Operating temperature: 0 to + 70°C
- Fan-out capabilities max: 10 TTL loads/tap, 20 TTL loads/unit
- Delay tolerances: ± 2 ns or ± 5% whichever is greater
- Rise Time: 4 ns max



Size: .81L × .18W × .34H

MODEL NO.	TD (ns)	TD/TAP (ns)
5T25	25	5
5T30	30	6
5T35	35	7
5T40	40	8
5T45	45	9
5T50	50	10
5T75	75	15
5T100	100	20
5T150	150	30
5T200	200	40
5T250	250	50
5T300	300	60
5T350	350	70
5T400	400	80

Also available as a single output Series 5G

Intermediate Delay Values Available Upon Request.

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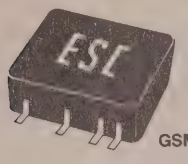
ESC

DELAY LINES

SERIES GSMT –surface mounting, TTL compatible, 5 taps, G leads
SERIES JSMT –surface mounting, TTL compatible, 5 taps, J leads

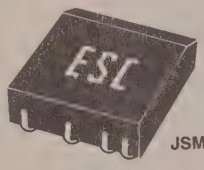
SPECIFICATIONS:

- Supply voltage (Vcc): 5.0VDC ± 5%
- Delay tolerance: ± 2 or ± 5% whichever is greater
- Rise Time: 4ns max
- Minimum Pulse Width: 40% of total delay
- Maximum Duty Cycle: 50%
- Operating temp. range: 0 to + 70°C
- Temp. coeff. of delay: 1.0ns + 500ppm/°C
- Terminals: .020w × .010th.

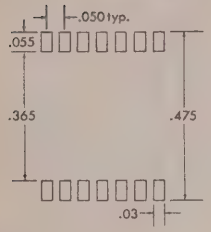


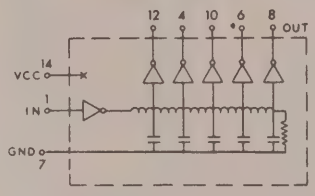
GSMT

14 PIN



JSMT





Size: GSMT .450L × .370W × .175H
JSMT .450L × .450W × .175H

Suggested PC Board Solder Pads

TEST CONDITIONS:

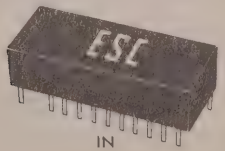
- Temperature: 25° ± 5°C, V_{cc} = 5.0VDC
- Input pulse width: 1.2 times the total delay time
- Pulse spacing: 5 times the total delay time
- Input rise time: 2ns; input pulse amplitude 3.0VDC
- All outputs loaded with 15pf
- Time delays measured at the 1.5 volts level on the leading edges
- Rise time measured from .75 to 2.4V

MODEL NOS.		TOTAL	DELAY/
G STYLE	J STYLE	DELAY (ns)	TAP (ns)
GSMT25	JSMT25	25	5
GSMT30	JSMT30	30	6
GSMT45	JSMT45	45	9
GSMT50	JSMT50	50	10
GSMT75	JSMT75	75	15
GSMT100	JSMT100	100	20
GSMT125	JSMT125	125	25
GSMT150	JSMT150	150	30
GSMT200	JSMT200	200	40
GSMT250	JSMT250	250	50

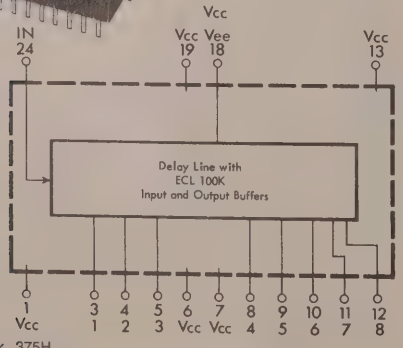
SERIES 24ECL –ECL "100K" compatible, 8 taps

SPECIFICATIONS:

- 100K ECL Input and Output
- Operating Temp.: 0°C to + 85°C
- Storage Temp: – 55°C to + 125°C
- Vee: – 4.5VDC ± 5%
- Logic 1 Output: – 1.025 min.
- Logic 0 Output: – 1.620 max.



24 PIN



Size: 1.3L × .50W × .375H

Intermediate Delay Values Available Upon Request.

TEST CONDITIONS:

- Pulse Width: 2 × total Td
- Pulse Spacing: 5 × total Td
- Pulse Amplitude: (– 1.475 max to – 1.165 min)
- Vee: – 4.5VDC
- Vcc: 0VDC
- Temperature: + 25°C

Outputs connected to external 50 ohms pulldown resistor to – 2.0V

Model No.	Total Delay (ns)	Delay/ Tap (ns)	Delay Tolerances*
24ECL8	10	**1	± .5ns or ± 5%
24ECL16	17	**2	± .5ns or ± 5%
24ECL24	24	3	± 1.0ns or ± 5%
24ECL32	32	4	± 1.5ns or ± 5%
24ECL40	40	5	
24ECL48	48	6	
24ECL56	56	7	
24ECL64	64	8	
24ECL72	72	9	
24ECL80	80	10	
24ECL160	160	20	
24ECL200	200	25	

*Whichever is greater
**First tap is 3.0 nsec.

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ESC

DELAY LINES

HIGH SPEED CMOS DIGITAL DELAY LINES

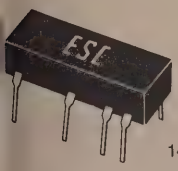
This series of digital hybrid delay lines are contained in a 14 Pin DIP package using High Speed CMOS series circuits.

SERIES 14CMOS –5 tap, 14 pin package

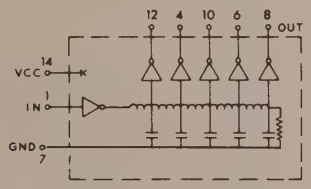
SPECIFICATIONS:

- Supply voltage: 5.0VDC ± 5%
- Delay tolerances: ± 2ns or ± 5% whichever is greater
- Rise Time: 3ns max
- Minimum Pulse Width: 40% of total delay
- Maximum Duty Cycle: 50%
- Operating temp. range: 0°C to + 70°C
- Temp. coeff. of delay: 1.0ns + 500ppm/°C
- Terminals: HTD alloy 42. 020w x .010th

**Also available for – 55°C to + 125°C operation. The dimensions will change to .82L × .40W × .36H.



14 PIN



Size: .785L × .285W × .250H

DC PARAMETERS		LIMITS	
		Min.	Max.
Voh	Vcc = min Ioh = 4.0mA	4.0V	—
Vol	Vcc = min Iol = 4.0mA	—	.3V
Vih	Vcc = min-max	2.0V	—
Vil	Vcc = min-max	—	.8V
IL	Vcc = max	—	+ / – 1.0µA
Icc	Vcc = max outputs low	—	15mA
max load	Vcc = max Voh = 4.0V	10 LSTTL Loads	

TEST CONDITIONS:

- V_{cc} = 5.0VDC, Temp. 25° ± 5°C
- Time delay measured at the 1.5V level
- Rise time measured from .75V to 2.4V
- All outputs loaded with 15pf
- Input Test Pulse: Pulse voltage: 3.0V
  Pulse rise time: 2 ns
  Pulse width 1.2 × max Td
  Pulse spacing: 5 × max Td

MODEL NO.	DELAY (ns)	DELAY/ TAP (ns)
14CMTD32	32	*5
14CMTD36	36	*6
14CMTD40	40	*7
14CMTD44	44	*8
14CMTD48	48	*9
14CMTD52	52	*10
14CMTD60	60	12
14CMTD75	75	15
14CMTD100	100	20
14CMTD125	125	25
14CMTD150	150	30
14CMTD175	175	35
14CMTD200	200	40
14CMTD250	250	50
14CMTD300	300	60
14CMTD350	350	70
14CMTD400	400	80
14CMTD420	420	84
14CMTD440	440	88
14CMTD450	450	90
14CMTD500	500	100

*Residual Delay first tap-12ns.

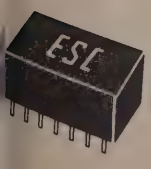
FAST TTL LOGIC DELAY LINES

SERIES 14FT –fast, TTL compatible, 14 pin package, 5 taps

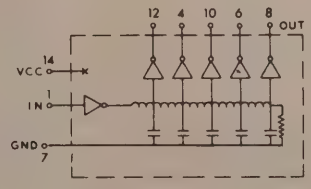
For variations in delay from above listing, modify part number by changing delay. Example: 400ns, 14FT series becomes 14FT400.

SPECIFICATIONS:

- Supply voltage: 5.0VDC ± 5%
- Delay tolerances: ± 2ns or ± 5% whichever is greater
- Rise Time: 3ns max
- Minimum Pulse Width: 40% of total delay
- Maximum Duty Cycle: 50%
- Operating temp. range: 0°C to + 70°C
- Temp. coeff. of delay: 1.0ns + 500ppm/°C
- Terminals: Electro tin plated alloy 42 .020w × .010th



14 PIN



Size: .80L × .40W × .28H

Intermediate Delay Values Available Upon Request.

TEST CONDITIONS:

- V_{cc} = 5.0VDC, Temp. 25° ± 5°C
- Time delay measured at the 1.5V level
- Rise time measured from .75V to 2.4V
- All outputs loaded with 15pf
- Input Test Pulse: Pulse voltage: 3.0V
  Pulse rise time: 2 ns
  Pulse width 1.2 × max Td
  Pulse spacing: 5 × max Td

MODEL NO.	DELAY (ns)	DELAY/ TAP (ns)
14FT25	25	5
14FT30	30	6
14FT35	35	7
14FT40	40	8
14FT45	45	9
14FT50	50	10
14FT75	75	15
14FT100	100	20
14FT150	150	30
14FT200	200	40
14FT250	250	50
14FT300	300	60
14FT500	500	100

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ESC

DELAY LINES

ECL "10,000" DIGITAL DELAY LINES — 16 PIN DIL

SPECIFICATIONS:

- Cumulative delay tolerances: ±1ns or ±5% whichever is greater
- Log 1 (output): –.96V
- Logic 0 (output): –1.65V max
- Logic 1 (input): –.98V min
- Logic 0 (input): –1.63V max
- Output rise time: 3ns max
- Supply voltage: –5.2V ± 5%
- Supply current: EC series: 65mA max, EG series: 70mA, ED series: 100mA, EP series:140mA
- *Operating temperature: 0°C to +70°C
- Delay temp. coefficient: 1.0ns +500ppm/°C
- Terminals: Electro tin plated alloy 42 .020w × .010th

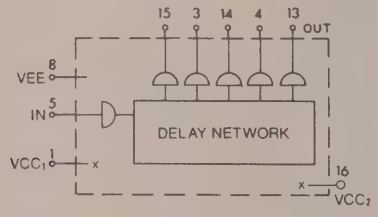
*Available for –55°C to +125°C operation with dimensions increased to .360 high × .820 long. Specify 16ECC, 16EPC, 16EDC, or 16EPC when ordering.

TEST CONDITIONS:

- Temp. = 25°C Vee = –5.2VDC Vcc = GND
- **Input Amplitude: 1.0V (–.75V to –1.75V)
- Pulse Width: 3 × max Td
- Pulse Spacing: 5 × max Td
- Time delays measured at the –1.3V level
- Output terminals connected through an external pulldown resistor of 100Ω to –2VDC.

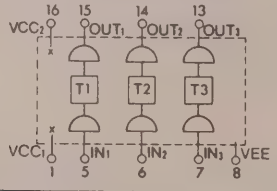
**Input pulse is provided by standard open emitter ECL 10,000 gate.

SERIES 16EC –ECL compatible, 5 taps



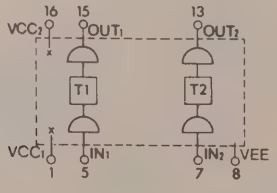
MODEL NO.	DELAY (ns)	DELAY/TAP (ns)
16EC10	10	2
16EC15	15	3
16EC20	20	4
16EC25	25	5
16EC30	30	6
16EC40	40	8
16EC50	50	10
16EC60	60	12
16EC80	80	16
16EC100	100	20

SERIES 16EP –ECL compatible, triplets



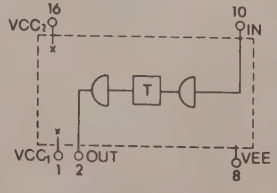
MODEL NO.	DELAY PER LINE (ns)
16EP5	5
16EP10	10
16EP15	15
16EP20	20
16EP25	25
16EP50	50

SERIES 16ED –ECL compatible, dual



MODEL NO.	DELAY PER LINE (ns)
16ED5	5
16ED10	10
16ED15	15
16ED20	20
16ED25	25
16ED50	50
16ED60	60
16ED80	80
16ED100	100

SERIES 16EG –ECL compatible, single output



MODEL NO.	DELAY (ns)
16EG5	5
16EG10	10
16EG15	15
16EG20	20
16EG25	25
16EG50	50
16EG75	75
16EG100	100

Intermediate Delay Values Available Upon Request.

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ESC

DELAY LINES

SERIES PTT3/SERIES PTT4/SERIES PTT6 –TTL compatible programmable delay lines

This series of programmable hybrid delay lines utilize TTL Schottky circuits. The PTT's are offered in 3, 4 & 6 Bit Series.

SPECIFICATIONS:

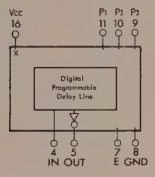
- Logic 1 (output): 2.4 min
- Logic 0 (output): .50 VDC max
- Operating Temp. Range: 0°C to + 70°C*
- Storage Temp. Range: – 55°C to + 125°C

*For – 55°C to + 125°C operation – Contact Plant

TEST CONDITIONS:

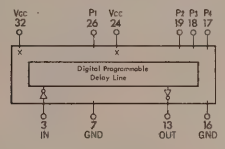
- Vcc = 5 VDC Temp. = 25°C
- Input Pulse Width: 3 × max Td
- Input Rise Time: 2ns max
- Input Pulse Spacing: 5 × max Td
- Td measured at 1.5 V level
- Output loaded with 15pf

3 BIT



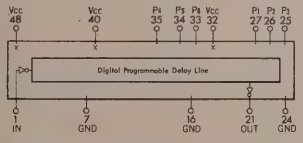
Model No.	Zero Step Delay (ns)	Maximum Delay (ns) (nom)	Delay per step (ns)
PTT3-1	7 ± 2	14	1 ± .5
PTT3-2		21	2 ± .5
PTT3-3		28	3 ± .6
PTT3-4		35	4 ± .8
PTT3-5		42	5 ± 1
PTT3-6		49	6 ± 1
PTT3-7		56	7 ± 1
PTT3-8		63	8 ± 1
PTT3-9		70	9 ± 1
PTT3-10		77	10 ± 1

4 BIT



Model No.	Zero Step Delay (ns)	Maximum Delay (ns) (nom)	Delay per step (ns)
PTT4-1	15 ± 2	30	1 ± .5
PTT4-2		45	2 ± .5
PTT4-3		60	3 ± .6
PTT4-4		75	4 ± .8
PTT4-5		90	5 ± 1
PTT4-6		105	6 ± 1
PTT4-7		120	7 ± 1
PTT4-8		135	8 ± 1
PTT4-9		150	9 ± 1
PTT4-10		165	10 ± 1

6 BIT



Model No.	Zero Step Delay (ns)	Maximum Delay (ns) (nom)	Delay per step (ns)
PTT6-1	20 ± 2	83	1 ± .5
PTT6-2		146	2 ± .5
PTT6-3		209	3 ± .6
PTT6-4		272	4 ± .8
PTT6-5		335	5 ± 1

SERIES PEC3/SERIES PEC4/SERIES PEC6 –ECL compatible programmable delay lines

This series of programmable hybrid delay lines utilize ECL 10,000 Series IC's. The PEC's are offered in 3, 4 & 6 Bit Series.

SPECIFICATIONS:

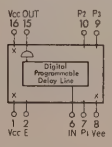
- Logic 1 (output): – .96 V min
- Logic 0 (output): – 1.65 V max
- Operating Temp. Range: – 0°C to + 70°C
- Storage Temp. Range: – 55°C to + 125°C

Also available for – 55°C to + 125°C operation as Series PECC3, PECC4 and PECC6.

TEST CONDITIONS:

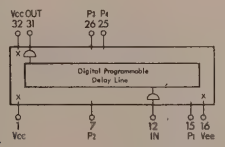
- Input Pulse Width: 3 × max delay time
- Input Pulse Spacing: 5 × delay time
- Input Rise Time: 2 ns max
- Input Pulse Voltage: 1.0 V (– .75 V to – 1.75 V)
- Vee: – 5.2 VDC
- Output connected to – 2 VDC through 100 ohms.
- Time delays measured at – 1.3 Volt Level.

3 BIT



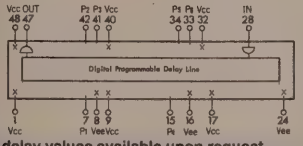
Model No.	Zero Step Delay (ns)	Maximum Delay (ns) (nom)	Delay per step (ns)
PEC3-1	3 ± 2	10	1 ± .5
PEC3-2		17	2 ± .5
PEC3-3		24	3 ± .6
PEC3-4		31	4 ± .8
PEC3-5		38	5 ± 1

4 BIT



Model No.	Zero Step Delay (ns)	Maximum Delay (ns) (nom)	Delay per step (ns)
PEC4-1	10 ± 2	25	1 ± .5
PEC4-2		40	2 ± .5
PEC4-3		55	3 ± .6
PEC4-4		70	4 ± .8
PEC4-5		85	5 ± 1

6 BIT


Vcc OUT P2 P3 Vcc P4 P3 Vcc IN
48 47 42 41 40 34 33 32 28
Digital Programmable Delay Line
1 7 8 9 15 16 17 24
Vcc P1 Vee Vcc P4 Vee Vcc Vee

Model No.	Zero Step Delay (ns)	Maximum Delay (ns) (nom)	Delay per step (ns)
PEC6-1	20 ± 2	71	1 ± .5
PEC6-2		134	2 ± .5
PEC6-3		197	3 ± .6
PEC6-4		260	4 ± .8
PEC6-5		323	5 ± 1

Intermediate delay values available upon request.

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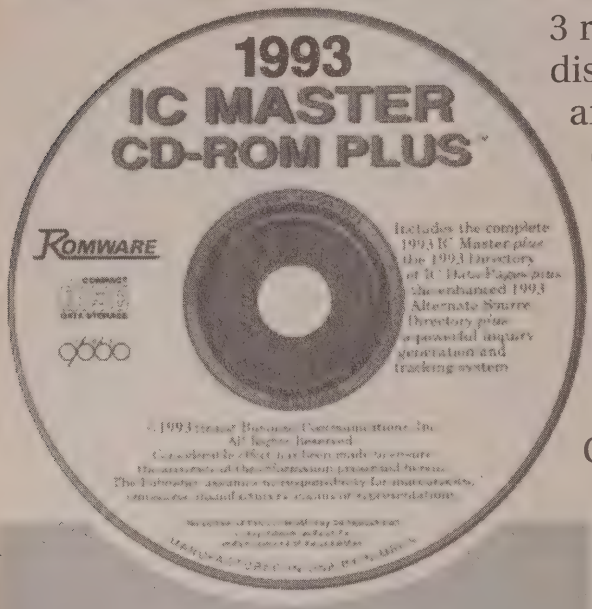

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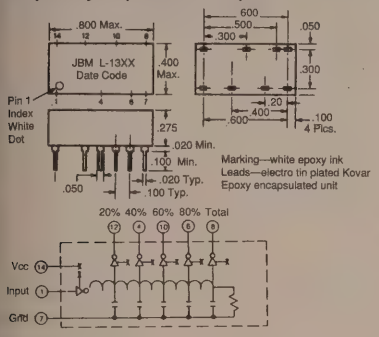
jbm Active and Passive Delay Lines

Delay Range 25 thru 1000 nsec
STYLE L-13 (14-pin outline)
5 equally-spaced taps



Operating Temp . . . . . 0°C to +70°C
Storage Temp . . . . . –55°C to +125°C
(All lines internally terminated)
I_{IH} Logic "1" Input Current . . . 50µA Max.
I_{LH} Logic "0" Input Current . . –2mA Max.
V_{OH} Logic "1" Voltage Out . . . 2.7V Min.
V_{OL} Logic "0" Voltage Out . . 0.5V Max.

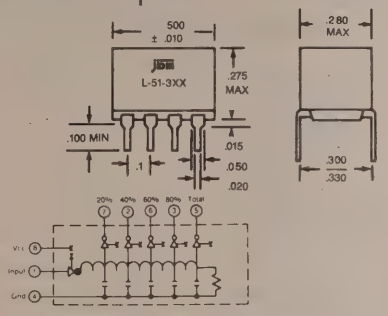
DRIVE CAPABILITIES (TTL LOADS)

Logic "0" 10 Loads/Tap Max.
20 Loads/Unit Max.

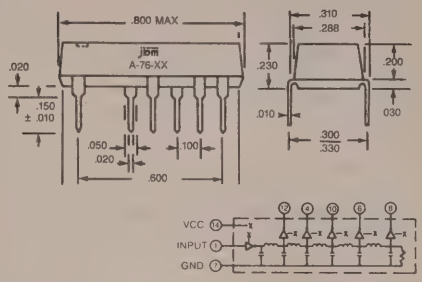
Logic "1" 20 Loads/Unit Max.

Voltage Range: 4.75V to 5.25V
Supply Current: 75mA Max.

L-51-300 Series (8-pin)
25 thru 500n
Mini 5 Tap



A-76 SERIES (14-pin) DIP
5 Tap Autoinsertable



Mini DIP 8 PIN Part No.	Delay Times In Nanoseconds Cumulative Delays TAP 1	TAP 2	TAP 3	TAP 4	TAP 5	Auto Ins. 14 PIN Part No.	L-13-XX TAP/TAP ±3 nS/10%
L-51-301	5 ± 2	10 ± 2	15 ± 2	20 ± 2	25 ± 2	A-76-81	L-13-50
L-51-302	6 ± 2	12 ± 2	18 ± 2	24 ± 2	30 ± 2	A-76-82	L-13-51
L-51-303	7 ± 2	14 ± 2	21 ± 2	28 ± 2	35 ± 2	A-76-83	L-13-52
L-51-304	8 ± 2	16 ± 2	24 ± 2	32 ± 2	40 ± 2	A-76-84	L-13-53
L-51-305	9 ± 2	18 ± 2	27 ± 2	36 ± 2	45 ± 2	A-76-85	L-13-54
L-51-306	10 ± 2	20 ± 2.5	30 ± 2.5	40 ± 2.5	50 ± 2.5	A-76-86	L-13-55
L-51-307	12 ± 2.5	24 ± 2.5	36 ± 2.5	48 ± 2.5	60 ± 3	A-76-87	L-13-193
L-51-308	15 ± 2.5	30 ± 2.5	45 ± 2.5	60 ± 3	75 ± 3.5	A-76-88	L-13-56
L-51-309	20 ± 2.5	40 ± 2.5	60 ± 3	80 ± 4	100 ± 5	A-76-89	L-13-57
L-51-310	25 ± 3	50 ± 3	75 ± 3.5	100 ± 5	125 ± 6	A-76-90	L-13-191
L-51-311	30 ± 3	60 ± 3	90 ± 4	120 ± 6	150 ± 7	A-76-91	L-13-58
L-51-312	40 ± 3	80 ± 4	120 ± 6	160 ± 8	200 ± 10	A-76-92	L-13-59
L-51-313	50 ± 3	100 ± 5	150 ± 7	200 ± 10	250 ± 12	A-76-93	L-13-60
L-51-314	60 ± 4	120 ± 6	180 ± 9	240 ± 12	300 ± 15	A-76-94	L-13-250
L-51-315	70 ± 4	140 ± 7	210 ± 10	280 ± 14	350 ± 17	A-76-95	L-13-251
L-51-316	80 ± 4	160 ± 8	240 ± 12	320 ± 16	400 ± 20	A-76-96	L-13-252
L-51-317	90 ± 5	180 ± 9	270 ± 13	360 ± 18	450 ± 22	A-76-97	L-13-253
L-51-318	100 ± 5	200 ± 10	300 ± 15	400 ± 20	500 ± 25	A-76-98	L-13-254

TTL BUFFERED SURFACE MOUNT DC COMM.

8 Pin Mini 5 Tap	S-51-2XX	280 HIGH
14 Pin STD 5 Tap	S-76-2XX	250 HIGH
14 Pin STD 10 Tap	S-31-2XX	285 HIGH
8 Pin Mini 3 DLS	S-79-5XX	280 HIGH
14 Pin STD 3 DLS	S-79-4XX	250 HIGH
8 Pin Mini Single	S-78-5XX	280 HIGH
14 Pin STDSingle	S-78-4XX	250 HIGH

TRADITIONAL TTL BUFFERED DELAY LINES

14 Pin Outline 5 Tap	L-13-XX	275 HIGH
14 Pin Outline Untapped	L-35-XX	275 HIGH
14 Pin DIP Multiple	L-49-XX	275 HIGH

TRADITIONAL TTL BUFFERED DELAY LINES

14 Pin Outline 5 Tap	L-13-XX	275 HIGH
14 Pin Outline Untapped	L-35-XX	275 HIGH
14 Pin DIP Multiple	L-49-XX	275 HIGH

AUTO INSERTABLE TTL BUFFERED DL-COMM.

8 Pin Mini 5 Tap	L-51-3XX	275 HIGH
14 Pin STD 5 Tap	A-76-XX	230 HIGH
14 Pin STD 10 Tap	A-31-3XX	270 HIGH
8 Pin Mini 3 DLS	L-79-6XX	275 HIGH
14 Pin STD 3 DLS	A-79-7XX	230 HIGH
8 Pin Mini Single	L-78-6XX	275 HIGH
14 Pin STD Single	A-78-7XX	230 HIGH

SPECIAL ACTIVES

8 Pin TTL SIP 5 Tap	L-77-1XX	340 HIGH
14 Pin CMOS 5 Tap	L-16-XX	275 HIGH
16 Pin TTL 3 Bit Programmable	L-65-1XX	275 HIGH
16 Pin ECL 3 Bit Programmale	L-66-1XX	275 HIGH
16 Pin ECL 3 DLS	L-82-3XX	275 HIGH
16 Pin ECL 5 Tap	L-82-XX	275 HIGH
24 Pin 100K ECL 8 Tap	L-82-5XX	375 HIGH
14 Pin TTL 10 Tap	L-31-XX	275 HIGH

Active Delay Lines – JBM also offers the following delay lines. Please contact factory for full line catalog.

PASSIVE DELAY LINES

7 Pin SIP Passive 5 Tap & Untapped	L-52-XXX	275 HIGH
14 Pin SIP Passive 10 Tap	L-26-XX	270 HIGH
14 Pin Auto Insertable STD Passive 10 Tap	A-73-1XX	200 HIGH
14 Pin Surface Mount STD 10 Tap	S-73-2XX	220 HIGH
14 Pin 10 Tap/10:1 Ratio Passive-Cantilever	L-33-XXX	300 HIGH

MILITARY HI-RELIABILITY

14 Pin DIL Hermetic Sealed TTL 5 Tap	L-87-5XX	260 HIGH
14 Pin Thin Surface Mount TTL 5 Tap	S-13-7XX	150 HIGH
16 Pin DIL TTL 3 Bit Programmable	D-65-1XX	360 HIGH
16 Pin DIL ECL 3 Bit Programmable	D-66-1XX	360 HIGH
14 Pin DIL TTL 5 Tap	L-13-8XX	325 HIGH
14 Pin DIL TTL Low 5 Tap	L-28-5XX	260 HIGH
14 Pin DIL TTL Thin 5 Tap	L-13-9XX	165 HIGH
14 Pin DIL Hermetic Sealed TTL 10 Tap	L-87-XX	315 HIGH
14 Pin DIL STD TTL 10 Tap	L-31-8XX	315 HIGH
14 Pin Surface Mount Low TTL 10 Tap	S-31-2XX	160 HIGH
14 Pin DIL Hermetic Sealed TTL 3 DLS	L-87-3XX	260 HIGH
14 Pin Low DIL TTL 3 DLS	L-15-4XX	260 HIGH
14 Pin DIL STD TTL 3 DLS	L-15-8XX	325 HIGH
14 Pin DIP Passive MIL-D-23859/23C	L-71-XXX	187 HIGH

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KAPPA® TECHNOLOGIES INC.

Selection Guide

DIGITAL DELAY LINES - Logic Family Availability

Function	Device	ACMOS	ECL10K	ECL100K	FTTL	STTL
1-TAP OUTPUTS						
Single, Fixed	10/54/74K01	•	•		•	•
Single, Controlled TPLH and TPHL	54/74K101				•	•
Single, Precision Delay Control	54/74K201	•			•	•
Dual, Fixed	54/74K02					•
Dual, Controlled TPLH and TPHL	54/74K102				•	•
Dual, Precision Delay Control	54/74K202	•			•	•
Triple, Fixed	10/54/74K03	•	•		•	•
Triple,Controlled TPLH and TPHL	54/74K103				•	•
Triple, Precision Delay Control	54/74K203	•			•	•
Quad, Fixed	10/100/54/74K04	•	•	•	•	•
Hex, Fixed	54/74K06	•			•	•
2-TAP OUTPUTS						
Single, Fixed	10/54/74K12	•	•		•	•
Dual, Fixed	10/54/74K22	•	•		•	•
5-TAP OUTPUTS						
Single, Fixed	10/54/74K05	•	•		•	•
Single, Controlled TPLH and TPHL	54/74K105				•	•
Single, Precision Delay Control	54/74K205	•			•	•
8-TAP OUTPUTS						
Single, Fixed	100K08			•		
10-TAP OUTPUTS						
Single, Fixed	10/54/74K10	•	•		•	•
Single, Controlled TPLH and TPHL	54/74K110				•	•
Single, Precision Delay Control	54/74K210	•			•	•
PROGRAMMABLE						
3-bit, 8-step with enable	10/54/74K33	•	•		•	•
4-bit, 16-step with enable	10/54/74K34	•	•		•	•
6-bit, 64-step with enable	10/54/74K36	•	•		•	•
8-bit, 256-step with enable	10/54/74K38	•	•		•	•
PULSE GENERATORS						
Single, Fixed with enable	54/74K41	•			•	•
3-bit, 8-step programmable with enable	54/74K53	•			•	•
4-bit, 16-step programmable with enable	54/74K54	•			•	•
6-bit, 64-step programmable with enable	54/74K56	•			•	•
8-bit, 256-step programmable with enable	54/74K58	•			•	•
SQUARE-WAVE GENERATORS						
Single, Fixed with enable	54/74K46	•			•	•
3-bit, 8-step programmable with enable	54/74K63	•			•	•
4-bit, 16-step programmable with enable	54/74K64	•			•	•
6-bit, 64-step programmable with enable	54/74K66	•			•	•
8-bit, 256-step programmable with enable	54/74K68	•			•	•
TIMING CORRECTION MODULES						
R3000A μP, Fixed	74K84	•			•	
DELAY TRIMMERS						
Single, Variable	10/54/74K91	•	•		•	•

ANALOG DELAY LINES - Type Selection

Function	Kappa Series Number			
	Dual-In-Line	Single-In-Line	Gull-Wing Surface Mount	
			50-mil pitch	100-mil pitch
1-Tap Output, Single, Fixed	DP04C (4-pin)	SP04C (4-pin)/SP08C (8-pin)	N/A	SMP04C (4-pin)
5-Tap Output, Single, Fixed	DP08C (8-pin)	SP07C (7-pin)	N/A	SMP08C (8-pin)
10-Tap Output, Single, Fixed	DP14C (14-pin)	SP14C (14-pin)	SOP14C (14-pin)	SMP14C (14-pin)
20-Tap Output, Single, Fixed	DP24C (24-pin)	N/A	N/A	SMP24C (24-pin)
Video Broadcast - 75Ω	VB75	N/A	N/A	N/A
Biomedical and Video Broadcast	DV24 (24-pin), DV28 (28-pin)	N/A	N/A	N/A
Continuously Variable	HV28	N/A	N/A	N/A

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KAPPA® TECHNOLOGIES INC.

Custom Miniature & Precision Delay Lines

Optimization of Most Critical Parameters as Required.

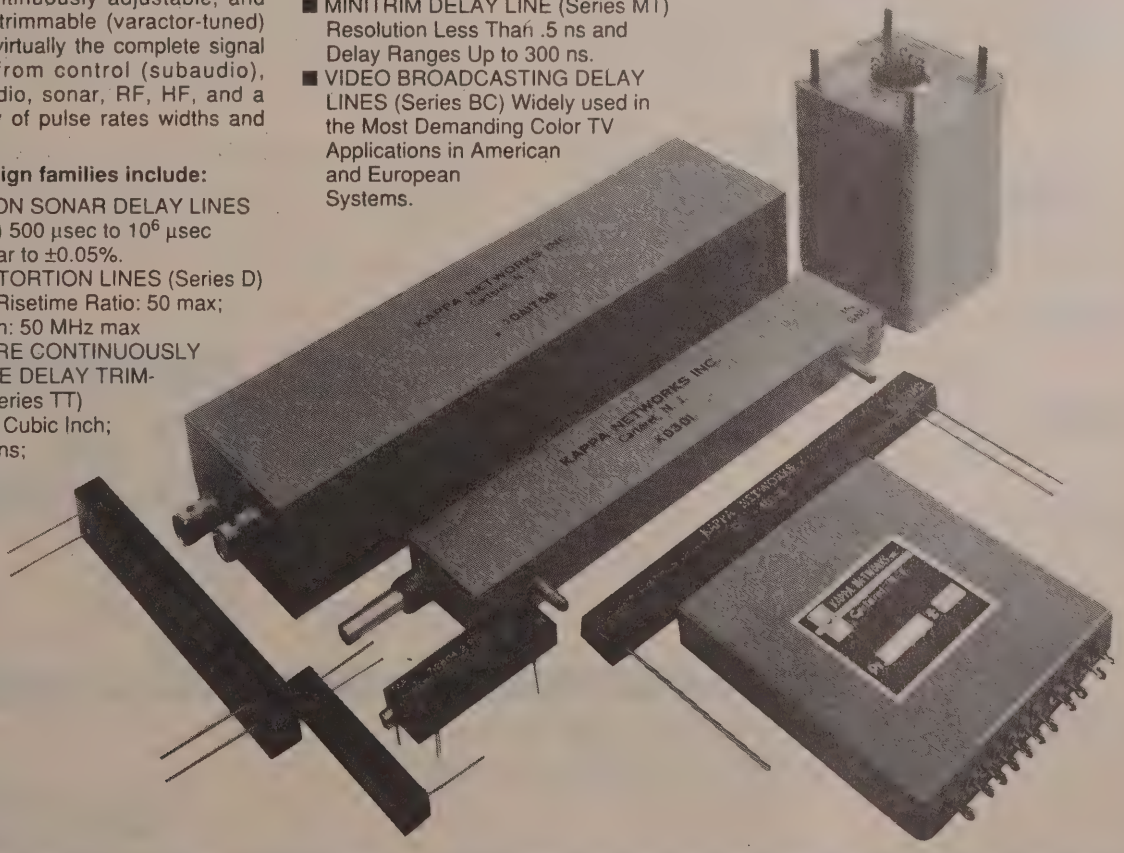
Description	Precision Audio/Sonar	Video Broadcast	Low Distortion	Std. Dist. Constant	Super η	Continuous Variable	Std. Lumped Constant	Mini® Trim	Tiny® Trim
SERIES NUMBER	A	BC	D	DC	H	K	LC	MT	TT
Delay Range (in microseconds)	500 to 10^6	.05 to 10	up to 100	up to 3	.5 to 500	up to .5	.05 to 10^6	up to .25	up to .12
Standard Delay Tolerances (±%)	1	2	1	5	5	+10/-0	5	+10/-0	+10/-0
Impedance Range (in ohms)	500 to 10K	75	100 to 1K	300 to 2K	50 to 2K	100 to 1K	100 to 20K	50 to 1K	300 to 500
Standard Impedance Tolerances (±%)	5	2	5	10	5	10	5	10	10
Delay Resolution	N/A	N/A	N/A	N/A	N/A	> of .1% or 1ns	N/A	.25 ns	.25 ns
Delay-to-Risetime Ratio (max)	N/A	N/A	50	11	150	8	. 200	7	4
Delay Linearity (±%)	.05 to .25	.025 to 1	.25	N/A	1	N/A	.5	N/A	N/A
Bandwidth (max)	70 KHz	20 MHz	50 MHz	30 MHz	10 MHz	25 MHz	250 MHz	100 MHz	70 MHz
Attenuation (in dB)	A.S.	A.S.	A.S.	•	A.S.	•	A.S.	<.5 dB	<25 dB
Distortion (±%)	N/A	A.S.	1 to 2	•	10	15	10	15	15
Dielectric Strength (VDC)	100	100	100	100 or A.S.	100 or A.S.	100 or A.S.	A.S.	100	100
Operating Temp. Range (°C)	-55/+85 A.S.	-55/+125	-55/+125	-55/+125	-55/+125	-55/+125	-55/+125	-55/+125	-55/+125
Delay Stability vs. Temperature (ppm/°C)	50	50	50	200	50	50 or 200	50	200	200

Abbreviations: A.S. = As Specified; N/A = Not Applicable; • = See Data Sheet

Over the past two decades, **Kappa** has optimized, packaged, and critically tested literally thousands of specific variations of several hundred different passive and hybrid delay lines: fixed tapped, continuously adjustable, and electrically trimmable (varactor-tuned) lines; over virtually the complete signal spectrum from control (subaudio), through audio, sonar, RF, HF, and a wide variety of pulse rates widths and duty cycles.

Typical design families include:

- PRECISION SONAR DELAY LINES (Series A) 500 µsec to 10^6 µsec ±1%; linear to ±0.05%.
- LOW DISTORTION LINES (Series D) Delay-to-Risetime Ratio: 50 max; Bandwidth: 50 MHz max
- MINIATURE CONTINUOUSLY VARIABLE DELAY TRIMMERS (Series TT) SIZE: 1/4 Cubic Inch; up to120 ns; resolution ≤0.25 ns.
- SUPER-η™ DELAY LINES (Series H) Embody New Design Principle Providing the Highest Efficiency yet Obtainable in Lumped-Constant Delay Lines.
- MINITRIM DELAY LINE (Series MT) Resolution Less Than .5 ns and Delay Ranges Up to 300 ns.
- VIDEO BROADCASTING DELAY LINES (Series BC) Widely used in the Most Demanding Color TV Applications in American and European Systems.
- TRANSPONDER/TACAN/DME (Series C) Designed to Meet the Requirements of MIL-D-23859 and to Withstand the Most Rigorous Military Environments.



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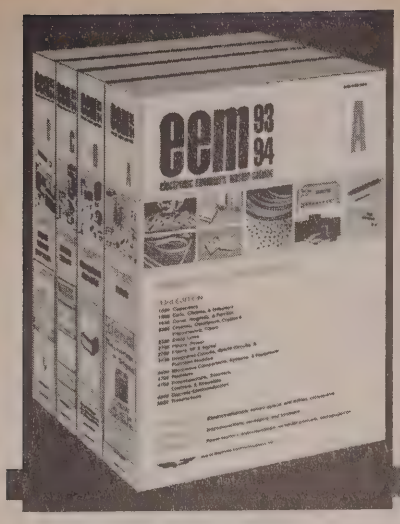

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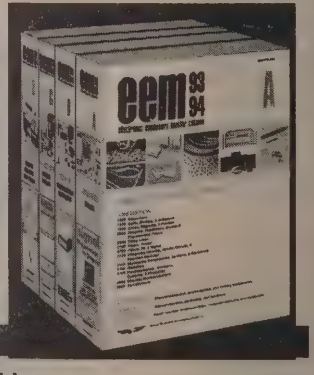

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delay line
chip monolithic, 200MHz to 2GHz

muRata ERiE®
MURATA ERIE NORTH AMERICA

This delay line is developed by applying chip multilayer and via hole technology. It consists of copper line and temperature compensated dielectric and incorporates metal shields. LD series are very small and provides excellent signal matching.

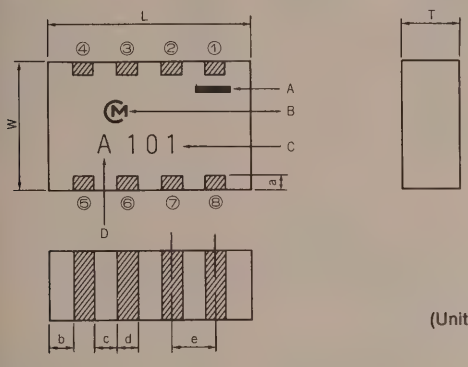
FEATURES

- High stability at high frequency 200MHz to 2 GHz
- This product is small, thin, light and highly reliable and utilizes multilayer construction.
- Metal shield is built into the chip
- Reflow soldering ability is standard.
- Supplied on tape and bulk.

APPLICATIONS

- Optical interface equipment.
- Fiber optic tele-communications.
- High speed super computers.
- Work station displays and CPU's
- Test and measurement equipment.

DIMENSIONS



(Unit : mm)

CODE	LDH36	LDH46 TYP
L	6.3±0.3	10.0±0.3
W	5.0±0.3	6.3±0.3
T	2.5max	4.0max
a	0.4±0.3	0.4±0.3
b	0.64min	0.49min
c	0.3min	1.3min
d	0.6min	0.8min
e	1.27±0.2	2.54±0.2

TERMINAL

PIN No.	NAME	PIN No.	NAME
1	IN / OUT	5	IN / OUT
2	GND	6	GND
3	GND	7	GND
4	GND	8	GND

ELECTRICAL CHARACTER TABLE — LDH36 TYPE

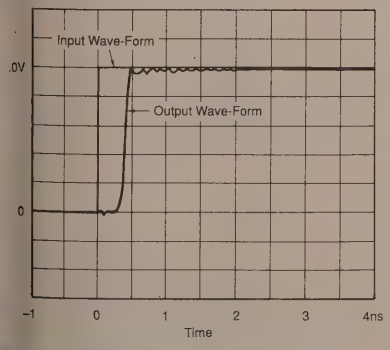
Part Numbers	Delay Time (DT) (ns)	*Impedance	Rising Time	D.C. Resistance (Ω) MAX)	Insulation Resistance	Rated Power	Operating Temperature Range
LDH36-01A101AB	0.1±0.05	50Ω±10%	0.1nS max	0.2	100MΩ min	1/4W	–25 to +85°C
LDH36-01A201AB	0.2±0.05			0.4			
LDH36-01A301AB	0.3±0.05		0.15nS max	0.6			
LDH36-01A401AB	0.4±0.05			0.8			
LDH36-01A501AB	0.5±0.05			1.0			
LDH36-01A601BB	0.6±0.1			1.2			
LDH36-01A701BB	0.7±0.1		0.2nS max	1.4			
LDH36-01A801BB	0.8±0.1			1.6			
LDH36-01A901BB	0.9±0.1			1.8			
LDH36-01A102BB	1.0±0.1			2.0			

ELECTRICAL CHARACTER TABLE — LDH46 TYPE

Part Numbers	Delay Time (DT) (ns)	*Impedance	Rising Time	D.C. Resistance (Ω) MAX)	Insulation Resistance	Rated Power	Operating Temperature Range
LDH46-01A152BA	1.5±0.1	50Ω±10%	0.3nS max	3.0	100MΩ min	1/4W	–25 to +85°C
LDH46-01A202BA	2.0±0.1		0.4nS max	4.0			
LDH46-01A252BA	2.5±0.1			5.0			
LDH46-01A302BA	3.0±0.1			6.0			
LDH46-01A402BA	4.0±0.1			8.0			
LDH46-01A502BA	5.0±0.1			10.0			
LDH46-01A602CA	6.0±0.2		0.25 x DT max	12.0			
LDH46-01A702CA	7.0±0.2			14.0			
LDH46-01A802CA	8.0±0.2			16.0			
LDH46-01A902CA	9.0±0.2			18.0			
LDH46-01A103CA	10.0±0.2			20.0			

PULSE RESPONSE

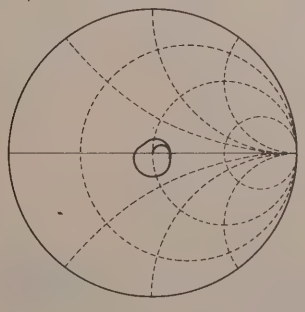
Test sample: LDH36-01A401A



IMPEDANCE

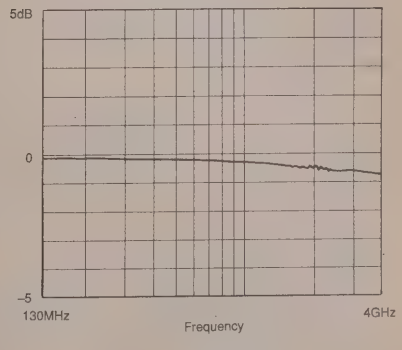
Frequency Range: 130MHz to 4GHz (Smith Chart)

Test sample: LDH36-01A401A



INSERTION LOSS

Test sample: LDH36-01A401AB



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14 Pin DIP 10 Tap TTL Compatible Active Delay Lines

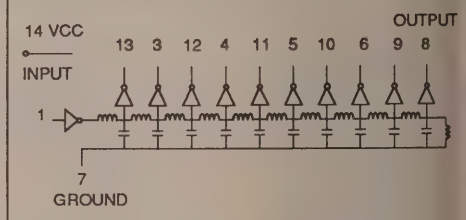
TAP DELAYS ±5% or ±2 nS	TOTAL DELAYS ±5% or ±2 nS	PART NUMBER	TAP DELAYS ±5% or ±2 nS	TOTAL DELAYS ±5% or ±2 nS	PART NUMBER
5	50	EP8301	44	440	EP8322
6	60	EP8311	45	450	EP8309
7.5	75	EP8317	47	470	EP8323
10	100	EP8302	50	500	EP8310
12.5	125	EP8319	55	550	EP8330
15	150	EP8303	60	600	EP8324
17.5	175	EP8320	65	650	EP8331
20	200	EP8304	70	700	EP8325
22.5	225	EP8321	75	750	EP8329
25	250	EP8305	80	800	EP8326
30	300	EP8306	85	850	EP8332
35	350	EP8307	90	900	EP8327
40	400	EP8308	95	950	EP8333
42	420	EP8318	100	1000	EP8328

Delay times referenced from input to leading edges at 25°C, 5.0V, with no load.

DC Electrical Characteristics

	Parameter	Test Conditions	Min	Max	Unit
V_{OH}	High-Level Output Voltage	V_{CC} = min. V_{IL} = max. I_{OH} = max	2.7		V
V_{OL}	Low-Level Output Voltage	V_{CC} = min. V_{IH} = min. I_{OL} = max		0.5	V
V_{IK}	Input Clamp Voltage	V_{CC} = min. I_I = I_{IK}		-1.2V	V
I_{IH}	High-Level Input Current	V_{CC} = max. V_{IN} = 2.7V		50	µA
		V_{CC} = max. V_{IN} = 5.25V		1.0	mA
I_{IL}	Low-Level Input Current	V_{CC} = max. V_{IN} = 0.5V		-2	mA
I_{OS}	Short Circuit Output Current	V_{CC} = max. V_{OUT} = 0. (One output at a time)	-40	-100	mA
I_{CCH}	High-Level Supply Current	V_{CC} = max. V_{IN} = OPEN		150	mA
I_{CCL}	Low-Level Supply Current	V_{CC} = max. V_{IN} = 0		150	mA
T_{RO}	Output Rise Time	Td ≤ 500 nS (0.75 to 2.4 Volts)		4	nS
		Td > 500 nS		5	nS
N_H	Fanout High-Level Output	V_{CC} = max. V_{OH} = 2.7V		20 TTL LOAD	
N_L	Fanout Low-Level Output	V_{CC} = max. V_{OL} = 0.5V		10 TTL LOAD	

Schematic



Recommended Operating Conditions

		Min	Max	Unit
V_{CC}	Supply Voltage	4.75	5.25	V
V_{IH}	High-Level Input Voltage	2.0		V
V_{IL}	Low-Level Input Voltage		0.8	V
I_{IK}	Input Clamp Current		-18	mA
I_{OH}	High-Level Output Current		-1.0	mA
I_{OL}	Low-Level Output Current		20	mA
P_W*	Pulse Width of Total Delay	40		%
d*	Duty Cycle		40	%
T_A	Operating Free-Air Temperature	0	+70	°C

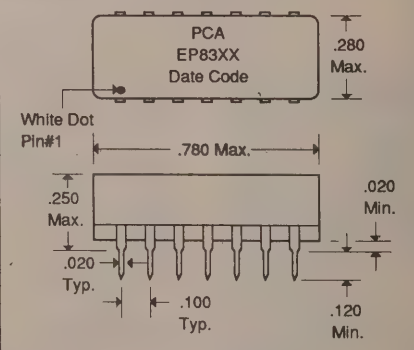
**These two values are inter-dependent.*

Input Pulse Test Conditions @ 25° C

			Unit
E_{IN}	Pulse Input Voltage	3.2	Volts
P_W	Pulse Width % of Total Delay	110	%
T_{RI}	Pulse Rise Time (0.75 - 2.4 Volts)	2.0	nS
P_{RR}	Pulse Repetition Rate @ Td ≤ 200 nS	1.0	MHz
	Pulse Repetition Rate @ Td > 200 nS	100	KHz
V_{CC}	Supply Voltage	5.0	Volts

EP83XX 10/92

Package Dimensions



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TEL: (818) 892-0761
FAX: (818) 894-5791

14 Pin DIP and SMD 5 Tap Low-Profile TTL Compatible Active Delay Lines

Compatible with standard auto-insertable equipment and can be used in either infrared or vapor phase process.

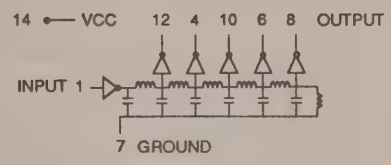
Delays are ±5% or ±2 nS Tap	Total	DIP Part Number	SMD Part Number	Delays are ±5% or ±2 nS Tap	Total	DIP Part Number	SMD Part Number
5, 10, 15, 20	25	EP8200-HL	EPA073HL-25	40, 80, 120, 160	200	EP8204-HL	EPA073HL-200
6, 12, 18, 24	30	EP8213-HL	EPA073HL-30	45, 90, 135, 180	225	EP8221-HL	EPA073HL-225
7, 14, 21, 28	35	EP8214-HL	EPA073HL-35	50, 100, 150, 200	250	EP8205-HL	EPA073HL-250
8, 16, 24, 32	40	EP8215-HL	EPA073HL-40	60, 120, 180, 240	300	EP8206-HL	EPA073HL-300
9, 18, 27, 36	45	EP8216-HL	EPA073HL-45	70, 140, 210, 280	350	EP8207-HL	EPA073HL-350
10, 20, 30, 40	50	EP8201-HL	EPA073HL-50	80, 160, 240, 320	400	EP8208-HL	EPA073HL-400
12, 24, 36, 48	60	EP8211-HL	EPA073HL-60	84, 168, 252, 336	420	EP8218-HL	EPA073HL-420
15, 30, 45, 60	75	EP8217-HL	EPA073HL-75	88, 176, 264, 352	440	EP8222-HL	EPA073HL-440
20, 40, 60, 80	100	EP8202-HL	EPA073HL-100	90, 180, 270, 360	450	EP8209-HL	EPA073HL-450
25, 50, 75, 100	125	EP8219-HL	EPA073HL-125	84, 188, 282, 376	470	EP8223-HL	EPA073HL-470
30, 60, 90, 120	150	EP8203-HL	EPA073HL-150	100, 200, 300, 400	500	EP8210-HL	EPA073HL-500
35, 70, 105, 140	175	EP8220-HL	EPA073HL-175				

Delay times referenced from input to leading edges at 25°C, 5.0V, with no load.

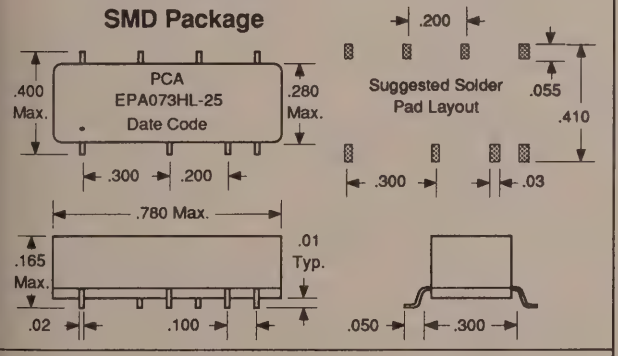
DC Electrical Characteristics

	Parameter	Test Conditions	Min	Max	Unit
V_{OH}	High-Level Output Voltage	V_{CC} = min. V_{IL} = max. I_{OH} = max	2.7		V
V_{OL}	Low-Level Output Voltage	V_{CC} = min. V_{IH} = min. I_{OL} = max		0.5	V
V_{IK}	Input Clamp Voltage	V_{CC} = min. I_I = I_{IK}		-1.2	V
I_{IH}	High-Level Input Current	V_{CC} = max. V_{IN} = 2.7V		50	µA
		V_{CC} = max. V_{IN} = 5.25V		1.0	mA
I_{IL}	Low-Level Input Current	V_{CC} = max. V_{IN} = 0.5V		-2	mA
I_{OS}	Short Circuit Output Current	V_{CC} = max. V_{OUT} = 0. (One output at a time)	-40	-100	mA
I_{CCH}	High-Level Supply Current	V_{CC} = max. V_{IN} = OPEN		75	mA
I_{CCL}	Low-Level Supply Current	V_{CC} = max. V_{IN} = 0		75	mA
T_{RO}	Output Rise Time	Td ≤ 500 nS (0.75 to 2.4 Volts)		4	nS
		Td > 500 nS		5	nS
N_H	Fanout High-Level Output	V_{CC} = max. V_{OH} = 2.7V		20 TTL LOAD	
N_L	Fanout Low-Level Output	V_{CC} = max. V_{OL} = 0.5V		10 TTL LOAD	

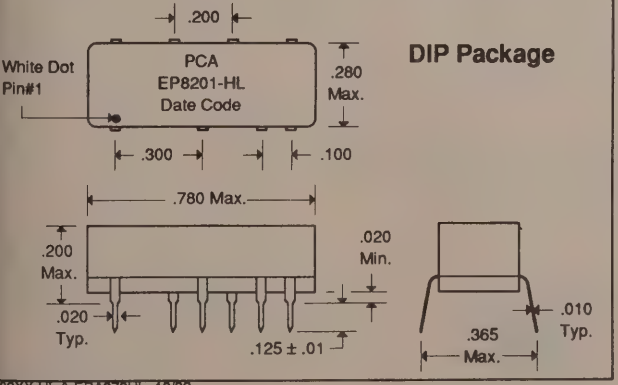
Schematic



SMD Package



DIP Package



EP82XX-HL & EPA073HL 10/92

Recommended Operating Conditions

		Min	Max	Unit
V_{CC}	Supply Voltage	4.75	5.25	V
V_{IH}	High-Level Input Voltage	2.0		V
V_{IL}	Low-Level Input Voltage		0.8	V
I_{IK}	Input Clamp Current		-18	mA
I_{OH}	High-Level Output Current		-1.0	mA
I_{OL}	Low-Level Output Current		20	mA
P_W*	Pulse Width of Total Delay	40		%
d*	Duty Cycle		40	%
T_A	Operating Free-Air Temperature	0	+70	°C

**These two values are inter-dependent.*

Input Pulse Test Conditions @ 25° C

			Unit
E_{IN}	Pulse Input Voltage	3.2	Volts
P_W	Pulse Width % of Total Delay	110	%
T_{RI}	Pulse Rise Time (0.75 - 2.4 Volts)	2.0	nS
P_{RR}	Pulse Repetition Rate @ Td ≤ 200 nS	1.0	MHz
	Pulse Repetition Rate @ Td > 200 nS	100	KHz
V_{CC}	Supply Voltage	5.0	Volts

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16799 SCHOENBORN ST.
NORTH HILLS, CA 91343
TEL: (818) 892-0761
FAX: (818) 894-5791

14 Pin DIP and SMD 5 Tap TTL Compatible Active Delay Lines

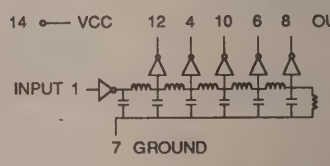
Delays are ±5% or ±2 nS Tap	Total	DIP Part Number	SMD Part Number
5, 10, 15, 20	25	EP8200	EPA073-25
6, 12, 18, 24	30	EP8213	EPA073-30
7, 14, 21, 28	35	EP8214	EPA073-35
8, 16, 24, 32	40	EP8215	EPA073-40
9, 18, 27, 36	45	EP8216	EPA073-45
10, 20, 30, 40	50	EP8201	EPA073-50
12, 24, 36, 48	60	EP8211	EPA073-60
15, 30, 45, 60	75	EP8217	EPA073-75
20, 40, 60, 80	100	EP8202	EPA073-100
25, 50, 75, 100	125	EP8219	EPA073-125
30, 60, 90, 120	150	EP8203	EPA073-150
35, 70, 105, 140	175	EP8220	EPA073-175
40, 80, 120, 160	200	EP8204	EPA073-200
45, 90, 135, 180	225	EP8221	EPA073-225
50, 100, 150, 200	250	EP8205	EPA073-250
60, 120, 180, 240	300	EP8206	EPA073-300
70, 140, 210, 280	350	EP8207	EPA073-350
80, 160, 240, 320	400	EP8208	EPA073-400
84, 168, 252, 336	420	EP8218	EPA073-420
88, 176, 264, 352	440	EP8222	EPA073-440
90, 180, 270, 360	450	EP8209	EPA073-450
94, 188, 282, 376	470	EP8223	EPA073-470
100, 200, 300, 400	500	EP8210	EPA073-500
110, 220, 330, 440	550	EP8230	EPA073-550
120, 240, 360, 480	600	EP8224	EPA073-600
130, 260, 390, 520	650	EP8231	EPA073-650
140, 280, 420, 560	700	EP8225	EPA073-700
150, 300, 450, 600	750	EP8229	EPA073-750
160, 320, 480, 640	800	EP8226	EPA073-800
170, 340, 510, 680	850	EP8232	EPA073-850
180, 360, 540, 720	900	EP8227	EPA073-900
190, 380, 570, 760	950	EP8233	EPA073-950
200, 400, 600, 800	1000	EP8228	EPA073-1000

Delay times referenced from input to leading edges at 25°C, 5.0V, with no load.

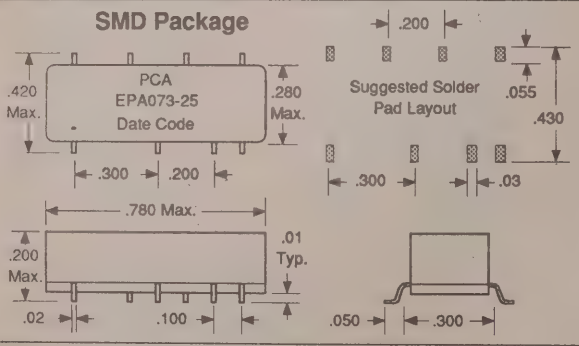
DC Electrical Characteristics

	Parameter	Test Conditions	Min	Max	Unit
V_{OH}	High-Level Output Voltage	V_{CC} = min. V_{IL} = max. I_{OH} = max	2.7		V
V_{OL}	Low-Level Output Voltage	V_{CC} = min. V_{IH} = min. I_{OL} = max		0.5	V
V_{IK}	Input Clamp Voltage	V_{CC} = min. I_I = I_{IK}		-1.2	V
I_{IH}	High-Level Input Current	V_{CC} = max. V_{IN} = 2.7V		50	µA
		V_{CC} = max. V_{IN} = 5.25V		1.0	mA
I_{IL}	Low-Level Input Current	V_{CC} = max. V_{IN} = 0.5V		-2	mA
I_{OS}	Short Circuit Output Current	V_{CC} = max. V_{OUT} = 0. (One output at a time)	-40	-100	mA
I_{CCH}	High-Level Supply Current	V_{CC} = max. V_{IN} = OPEN		75	mA
I_{CCL}	Low-Level Supply Current	V_{CC} = max. V_{IN} = 0		75	mA
T_{RO}	Output Rise Time	Td ≤ 500 nS (0.75 to 2.4 Volts)		4	nS
		Td > 500 nS		5	nS
N_H	Fanout High-Level Output	V_{CC} = max. V_{OH} = 2.7V		20 TTL LOAD	
N_L	Fanout Low-Level Output	V_{CC} = max. V_{OL} = 0.5V		10 TTL LOAD	

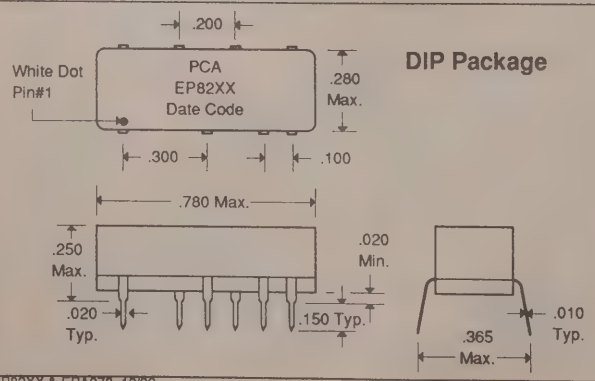
Schematic



SMD Package



DIP Package



EP82XX & EPA073 10/92

Recommended Operating Conditions

		Min	Max	Unit
V_{CC}	Supply Voltage	4.75	5.25	V
V_{IH}	High-Level Input Voltage	2.0		V
V_{IL}	Low-Level Input Voltage		0.8	V
I_{IK}	Input Clamp Current		-18	mA
I_{OH}	High-Level Output Current		-1.0	mA
I_{OL}	Low-Level Output Current		20	mA
P_W*	Pulse Width of Total Delay	40		%
d*	Duty Cycle		40	%
T_A	Operating Free-Air Temperature	0	+70	°C

**These two values are inter-dependent.*

Input Pulse Test Conditions @ 25° C

			Unit
E_{IN}	Pulse Input Voltage	3.2	Volts
P_W	Pulse Width % of Total Delay	110	%
T_{RI}	Pulse Rise Time (0.75 - 2.4 Volts)	2.0	nS
P_{RR}	Pulse Repetition Rate @ Td ≤ 200 nS	1.0	MHz
	Pulse Repetition Rate @ Td > 200 nS	100	KHz
V_{CC}	Supply Voltage	5.0	Volts

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TEL: (818) 892-0761
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14 Pin DIP 5 Tap Low Power TTL Compatible Active Delay Lines

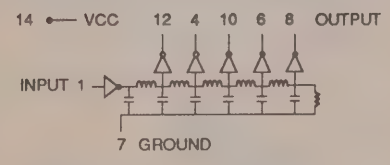
TAP DELAYS ±5% or 2 nS	TOTAL DELAYS ±5% or 2 nS	PART NUMBER	TAP DELAYS ±5% or 2 nS	TOTAL DELAYS ±5% or 2 nS	PART NUMBER
10, 20, 30, 40	50	EP8270	30, 60, 90, 120	150	EP8282
11, 22, 33, 44	55	EP8271	35, 70, 105, 140	175	EP8283
12, 24, 36, 48	60	EP8272	40, 80, 120, 160	200	EP8284
13, 26, 39, 52	65	EP8273	45, 90, 135, 180	225	EP8285
14, 28, 42, 56	70	EP8274	50, 100, 150, 200	250	EP8286
15, 30, 45, 60	75	EP8275	55, 110, 165, 220	275	EP8287
16, 32, 48, 64	80	EP8276	60, 120, 180, 240	300	EP8288
17, 34, 51, 68	85	EP8277	70, 140, 210, 280	350	EP8289
18, 36, 54, 72	90	EP8278	80, 160, 240, 320	400	EP8290
19, 38, 57, 76	95	EP8279	90, 180, 270, 360	450	EP8291
20, 40, 60, 80	100	EP8280	100, 200, 300, 400	500	EP8292
25, 50, 75, 100	125	EP8281			

Delay times referenced from input to leading edges at 25°C, 5.0V, with no load.

DC Electrical Characteristics

Parameter		Test Conditions	Min	Max	Unit
V_{OH}	High-Level Output Voltage	V_{CC} = min. V_{IL} = max. I_{OH} = max	2.7		V
V_{OL}	Low-Level Output Voltage	V_{CC} = min. V_{IH} = min. I_{OL} = max		0.5	V
V_{IK}	Input Clamp Voltage	V_{CC} = min. I_I = I_{IK}		-1.5	V
I_{IH}	High-Level Input Current	V_{CC} = max. V_{IN} = 2.7V		20	µA
		V_{CC} = max. V_{IN} = 5.25V		0.1	mA
I_{IL}	Low-Level Input Current	V_{CC} = max. V_{IN} = 0.5V		-0.36	mA
I_{OS}	Short Circuit Output Current	V_{CC} = max. V_{OUT} = 0. (One output at a time)	-5	-42	mA
I_{CCH}	High-Level Supply Current	V_{CC} = max. V_{IN} = OPEN		30	mA
I_{CCL}	Low-Level Supply Current	V_{CC} = max. V_{IN} = 0		30	mA
T_{RO}	Output Rise Time	Td ≤ 500 nS (0.75 to 2.4 Volts)		8	nS
N_H	Fanout High-Level Output	V_{CC} = max. V_{OH} = 2.7V	20 TTL LOAD		
N_L	Fanout Low-Level Output	V_{CC} = max. V_{OL} = 0.5V	20LS TTL LOAD		

Schematic



Recommended Operating Conditions

		Min	Max	Unit
V_{CC}	Supply Voltage	4.75	5.25	V
V_{IH}	High-Level Input Voltage	2.0		V
V_{IL}	Low-Level Input Voltage		0.8	V
I_{IK}	Input Clamp Current		-18	mA
I_{OH}	High-Level Output Current		-0.4	mA
I_{OL}	Low-Level Output Current		8	mA
P_W*	Pulse Width of Total Delay	40		%
d*	Duty Cycle		40	%
T_A	Operating Free-Air Temperature	0	+70	°C

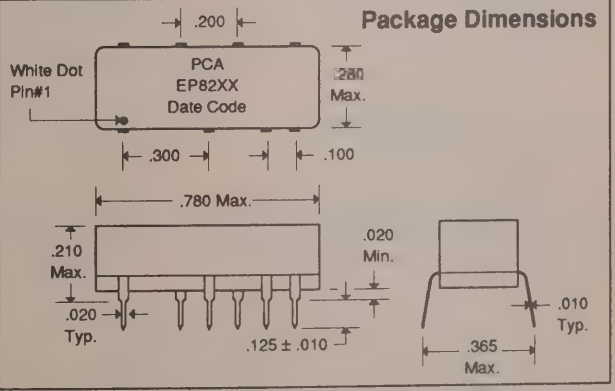
**These two values are inter-dependent.*

Input Pulse Test Conditions

			Unit
E_{IN}	Pulse Input Voltage	3.2	Volts
P_W	Pulse Width % of Total Delay	110	%
T_{RI}	Pulse Rise Time (0.75 - 2.4 Volts)	2.0	nS
P_{RR}	Pulse Repetition Rate @ Td ≤ 200 nS	1.0	MHz
	Pulse Repetition Rate @ Td > 200 nS	100	KHz
V_{CC}	Supply Voltage	5.0	Volts

EP8270 to EP8292 10/92

Package Dimensions



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Passive DIP Delay Lines

- Complete range of delay times
- 14-30 pin versions
- Various pinouts
- Miniature and low profile styles
- High performance types

Passive SIP Delay Lines

- 7-14 pin versions
- 5- and 10-tap styles
- Short-delay trimmers

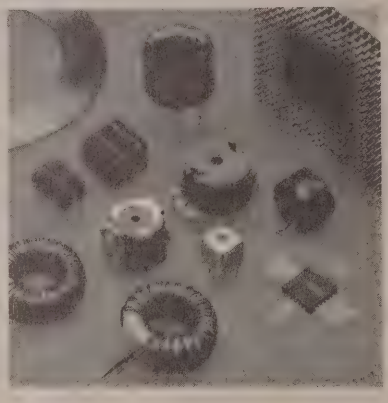
Passive Distributed Delay lines

- Very low distortion
- Fast rise-time versions
- 200-1000 ohms impedance

Active Delay Lines

- DIP, SIP, and mini-DIP packages
- TTL and ECL types
- Programmables
- 8-24 pin versions
- 5- and 10-tap styles
- Very high reliability models
- Surface mount varieties
- Hermetically sealed versions
- MIL spec models

MAGNETIC COMPONENTS



Inductors

- IF-RF inductors
- Filtering inductors
- Linear and Toroidal
- Inductances from 0.1-10 μH
- Frequencies to 100 MHz
- Q to 100
- MIL spec models

Pulse Transformers

- Data communications interfaces
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- SCR triggering
- Balanced-to-unbalanced line conversion
- Low profile packages
- Miniature packages
- Surface mount styles
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Polara has a strong capability in the design of special components for unusual applications. This may mean achieving a difficult delay time, operating frequency, or pulse envelope. At other times the need is for small size or special shape to fit compact packaging requirements.

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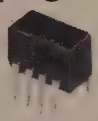
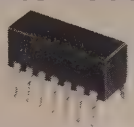
Active (Digital) Delay Lines–4nS to 2000nSec

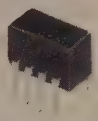


Series A01–Single Delay
Designed to meet MIL-D-23859 utilizing a molded DIP case, in 8-pin or 14-pin package sizes, standard delay times range from 10nS to 500nS. Available in Surface Mount version.

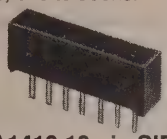


Series A02–Dual Delay, 8 pin
Series A03–Triple Delay, 14 pin
Series A04-Quad Delay, 14 pin
Single DIP package contains 2, 3, or 4 isolated delays, 5ns to 500ns.

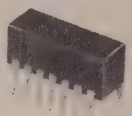
Series A1405 14-pin DIP, 5-Tap
Designed to meet MIL-D-23859, in encapsulated and molded versions. Wide range of delay times from 4nS to 1000nS.



Series A0805 8 pin DIP, 5-Tap
Miniature 5-tap delay line is available in a wide range of values from 4nS to 500nS.



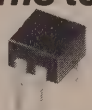
Series SA1410 10 pin SIP, 10-Tap
Series SA0805 8 pin SIP, 5-Tap
Space-saving SIP package offers a range of delay times from 4nS to 500nS.



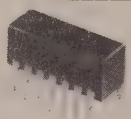
Series A1410 14-pin DIP, 10-Tap
Features 10 uniform taps in a 14-pin package, in a wide range of delay times from 5nS to 1000nS.

Passive (Analog) Delay Lines–0.1nS to 2000nSec

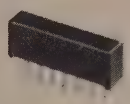
Series S01–Single Delay SIP
Lumped constant design per MIL-D-23859 offers a delay range of 1nS to 10nS in a 3.5 or 8-pin SIP. 100Ω impedance is standard, 50Ω & 200Ω available.



Series P01–Single Delay DIP
Available in standard 8-pin or 14-pin DIP package sizes, or new ultra miniature 4-pin DIP. Delay times range from 100pS to 100nS. Impedance values of 50Ω-500Ω. Available in surface mount version.



Series P0805 8-pin DIP, 5-Tap
Series P1410 14-pin DIP, 10-Tap
Features uniform taps in an 8 or 14-pin DIP (standard or low-profile). Values range from 10nS to 1000nS, impedances of 50Ω to 500Ω, and 4 standard pin-out configurations.



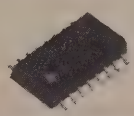
Series SP05 7-pin SIP, 5-Tap
Features 5 uniform taps in a molded 7-pin SIP case. Delay times range from 1nS to 100nS, in 50Ω and 100Ω impedance values.

Series SP10 14-pin SIP, 10-Tap
Designed to meet applicable portions of MIL-D-23859 in delay times ranging from 10nS to 250nS, impedance values of 50Ω to 200Ω.

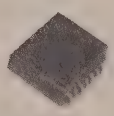
Series P2420 24-pin DIP, 20-Tap
Features 20 uniform taps in a standard 24-pin molded DIP package. Delay times range from 1nS to 1000nS, in 50Ω to 200Ω impedance values. 3 standard pin-out configurations.

Surface Mount Delay Lines–0.1nS to 1000nSec

SMP01 Chip, Single Delay Passive
Miniature delay line chip is the first of its kind in the industry, offering very small time adjustments in ECL circuits. Value range from 0.1nS to 1nS in 50Ω and 75Ω impedance values. Available on plastic Tape & Reel.

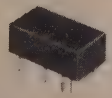


P0805AG 8-pin, 5-Tap, Passive
SMP1405 14-pin, 5-Tap, Passive
SMP1410 14-pin, 10-Tap, Passive
SMP1610 16-pin, 10-Tap, Passive
Small outline (.050" pin spacing) or standard (.100" pin spacing), 5 to 1000ns, in 3 standard pin-out configurations. Available on Tape & Reel.

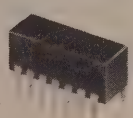


SMA0805 8-pin, 5-Tap, Active
SMA1405 14-pin, 5-Tap, Active
SMA1410 14-pin, 10-Tap, Active
Small outline (.050" pin spacing) or standard (.100" pin spacing), 2.5ns to 1000ns. Available on Tape & Reel.

Custom Delay Lines



Programmable



10K & 100K ECL

Hi-Speed CMOS

Refer to EEM section 2350 for RCD delay lines, and to section 4700 for RCD resistors, networks, and hybrids.

RCD Components Inc. ***Resistors • Coils • Delay Lines***
520 E. Industrial Park Dr., Manchester, N.H. 03109 USA TEL (603) 669-0054 FAX (603) 669-5455

eem SYMBOLS USED BY INTERNATIONAL REGULATORY AGENCIES

These symbols appear on many electrical/electronic components distributed in the world market. They indicate that a country's standard-setting agency has approved the design of the component and/or a testing agency has approved the performance of the component in meeting the standard. This page lists only those countries that have a *symbol* to represent their authority.

Argentina (IRAM) Instituto Argentino de Racionalization de Materiales

Australia (SAA) Standards Association of Australia

Austria (ÖVE) Öesterreichischer Verband für Elektrotechnik

Belgium (CEB) Comité Electrotechnique Belge

ABNT **Brazil (ABNT)** Associação Brasileira de Normas Teonicas

Canada (CSA) Canadian Standards Association

Czechoslovakia Urad pro Normalizaci a Mereni (Office for Standards and Measurements)

Denmark (DEK) Dansk Elektroteknisk Komite (Danish Electrotechnical Committee)

Egypt (EOS) Egyptian Organization for Standardization and Quality Control

Finland (SETI) Electrical Inspectorate

France (UTE) Union Technique de l'Électricité

TGL **Germany, Democratic Republic of (East) (ASMW)** Amt für Standardi-sierung Messwesen und Warenprufung (Office for Standardization, Metrology and Quality Control)

Germany, Federal Republic of (West) (DKE) Deutsche Electrotechnische Kommission im DIN und VDE (German Electrotechnical Commission of DIN and VDE)

ELOT **Greece (ELOT)** The Hellenic Organization of Standardization

Hong Kong Hong Kong Standards & Testing Centre

Hungary (MSZH) Magyar Szabvanyugi Hivatal (Hungarian Office for Standardization)

India (ISI) Indian Standards Institute "Manak Bhavan"

Indonesia Badan Kerjasama Standardisasi LIPI-YDNI (LIPI-YDNI Joint Standardization Committee)

Iran Institute of Standards and Industrial Research of Iran

Ireland (IIRS) Institute for Industrial Research and Standards

SII **Israel (SII)** Standards Institution of Israel

Italy (CEI) Comitato Elettrotecnico Italiano (Italian Electrotechnical Committee)

Japan (JISC) Japanese Industrial Standards Committee Agency of Industrial Science and Technology

Korea, Republic of (South) Industrial Advance Administration

Mexico (DGN) Dirección General de Normas Secretaria de Patrimonio y Fomento Industrial Puente de Tecamachalco

Netherlands (NEC) Nederlands Elektrotechnisch Comite

SANZ **New Zealand (SANZ)** Standards Association of New Zealand

Norway (NEK) Norsk Elektroteknisk Komite (Norwegian Electrotechnical Committee)

Pakistan Pakistan Standards Institution

Poland Polski Komitet Normalizacji Miar i Jakosci (Polish Committee for Standardization, Measures and Quality Control)

Portugal (CEP) Comissão Electrotécnica Portuguesa

STAS **Romania** Institutul Roman de Standardizare (Romanian Standards Institute)

Singapore Singapore Institute of Standards and Industrial Research

South Africa (SABS) South African Bureau of Standards

Spain (IRANOR) Instituto Nacional de Racionalización y Normalización

Sweden (SEK) Svenska Elektriska Kommissionen (Swedish Electrotechnical Commission)

Switzerland (SEV) Schweizerischer Elektrotechnischer Verein Postfach

Turkey (TSE) Turk Standardlari Enstitusu (Turkish Standards Institution)

United Kingdom (BSI) British Standards Institution

United States Underwriters Laboratories Inc. Recognized Component Mark

United States Underwriters Laboratories Inc.

Venezuela CODELECTRA en Conjunto con COVENIN Avda. Ppal.

Yugoslavia Federal Institute of Standardization

Rhombus Industries Inc.

Delay Lines & Pulse Transformers

Passive and Digital Delay Lines

Since 1970, Rhombus Industries has been supplying quality components for Commercial and Military designs. Whether the application is a low distortion passive device in a Medical Ultrasound System, or a high frequency/high precision RISC timing module our experience and technical abilities will provide the component to match your requirement. Our factory in Southern California has complete process capabilities to expedite the design cycle and provide timely support in critical situations. Because we provide extensive engineering services and prompt sample turnaround (free of charge), Rhombus has been able to address the most demanding requirements for our wide range of customers. Please call one of our applications engineers to discuss the details of your requirement.

Contact the factory, or your local representative or distributor to request detailed literature and samples.

Commercial and Military Delay Line Products

Passive Delay Lines

Fast Rise Times
Low Distortion
Variety of Configurations

Wide Range of Impedances:
50 / 75 / 100 / 200 Ohm

10 Tap 14 Pin DIP/SMD
5 Tap 8 Pin DIP/SMD
20 Tap 24 Pin DIP

5 Tap 7 Pin SIP
10 Tap 14 Pin SIP
16 Tap 19 Pin SIP

Single Delay 8 Pin SIP
Single Delay 3 Pin SIP

Digital Delay Lines

TTL, FAST, AC/ACT
ECL 10K, 10KH, 100K

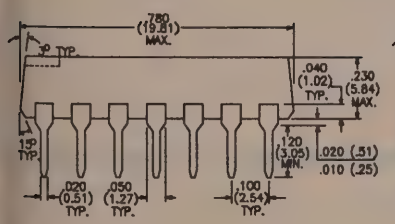
Available as 8 or 14 Pin DIP/SMD:
5 Equal Taps
10 Equal Taps (14 Pin)
Single, Dual, Triple,
or Quad (14 Pin)
Pulse Width Generators

Available as 8 Pin SIP:
5 Equal Taps
Single or Dual

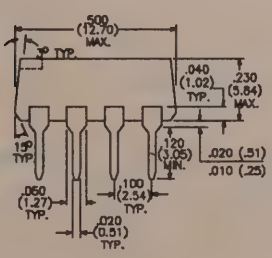
Also Programmables,
Pulse Width Discriminators
& Custom Gated Logic Delays

Standard Transfer-molded Packages Physical Dimensions: inches (mm)

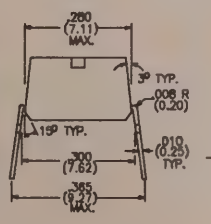
14 Pin



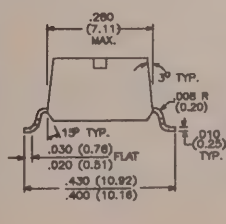
8 Pin



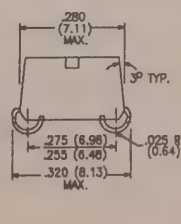
DIP



Gullwing SMD



J-Bend SMD



For Information on Rhombus Industries' Transformer Products refer to Section 5600

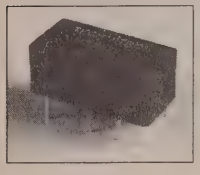
Rhombus Industries Inc. • 15801 Chemical Lane, Huntington Beach, CA 92649-1595 • (714) 898-0960 • FAX: (714) 896-0971

Technitrol

1952 East Allegheny Avenue, Philadelphia, PA 19134 USA • 215-426-9105 • Fax 215-426-2836

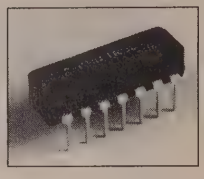
HIGH-RELIABILITY DELAY LINES

QPL Military Series



5-Tap Active QPL Delay Lines

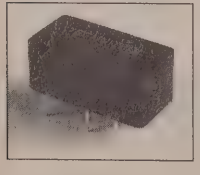
- Qualified to Mil-D-83532.
- Standard total delay values ranging from 25 to 500 nanoseconds, and tap delay values from 5 to 100 nanoseconds.
- Part numbers M83532/02A001A through M83532/02A029A available upon request.
- Schottky TTL Logic.
- QPL JAN I.C.'s (in accordance with Mil-M-38510) incorporated in all active delay lines.



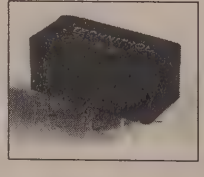
10-Tap Passive QPL Delay Lines

- Qualified to Mil-D-83531.
- Standard total delay values ranging from 10 to 100 nanoseconds, and tap delay values from 1 to 10 nanoseconds.
- Part numbers M83531/01-001 through M83531/01-425 available upon request.
- Standard impedance 100 ohms, other values available.

High-Performance Active Series



5-Tap FAST Delay Lines FSTDL Series



5-Tap TTL Delay Lines TTLDL Series

- Standard total delay values ranging from 25 to 500 nanoseconds and tap delay values from 5 to 100 nanoseconds.
- Tight tolerance designs available.
- Designed for leading edge timing. Trailing edge timing available.
- Transfer molded packaging for highest reliability.
- For custom designs—contact factory.

FAST FAX

Just photocopy this EEM page, circle the component you would like to learn more about and "FAX ME."

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Title _____

Company _____

Fax _____

Phone _____

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Made in the U.S.A.

Contact factory for Catalog 1001

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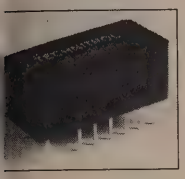
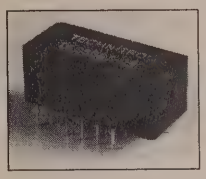
HIGH-SPEED DELAY LINES

RISC R3000 Products



RISC Delay Module

- For R3000 cache memory timing applications.
- Five input frequencies from 32 to 80 MHz available.
- Advanced CMOS, FAST, or Schottky TTL compatible inputs.
- Precise tap to tap delays.
- Custom designs available upon request.



RISC Clock Oscillator Module

- Combines clock oscillator and delay line functions in one package.
- Need only supply V_{CC} to generate four-phase clock edges.
- Outputs similar to those of RISC delay module.
- Five frequency options available.

PICO-DELAY Series

- High speed delay lines with outputs ranging from 100 to 3000 picoseconds (ps). Custom delay values available upon request.
- Tight tolerances of only ± 25 ps for delays from 100 to 2000 ps and ± 40ps for delays from 2100 to 3000 ps.
- Miniature package available for delays from 100 to 500 ps.
- Standard impedance is 50 ohms. Non-standard impedances available upon request.
- Typical distortion: ±10% maximum.
- Temperature range of –55 to +125°C.

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ade in the U.S.A.

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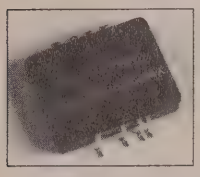
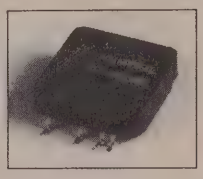
ACTIVE SURFACE-MOUNT DELAY LINES

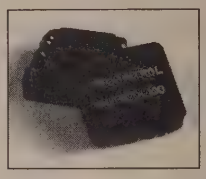
TTL Surface-Mount 5-tap Series



Low Profile Gull-Wing
GCTTLDL Series (1/8" Height)



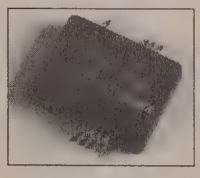
Gull-Wing—1/2" Square
GBTTLDL Series



J-Lead—1/2" Square
BJTTLDL Series

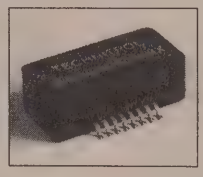
- Designed for vapor phase reflow soldering at 215°C.
- Standard total delay values ranging from 25 to 200 nanoseconds and tap delay values from 5 to 40 nanoseconds.
- Supports Schottky TTL, FAST and FACT logics.
- Transfer-molded packaging—for highest reliability.
- Designed for leading edge timing. Trailing edge timing available.
- For custom designs—contact factory.

Surface-Mount Programmable Series



TTL Logic
Low Profile Gull-Wing
(1/8" Height)
GCTTLPG Series

- Designed for vapor phase reflow soldering at 215°C.
- Schottky TTL logic.
- 3-bit binary programming gives 7 equal step delays.
- Available in 11 step delays from 1 to 15 ns.
- Low inherent delay. Input to output = 6.0 ± 1.5 ns.



ECL Logic
Gull-Wing
GECLPG Series

- Designed for vapor phase reflow soldering at 215°C.
- 10k ECL logic.
- 3-bit binary programming gives 7 equal step delays.
- Available in 10 step delays from 1 ns to 10 ns.
- Low inherent delay (T_O); T_O = 3.0 ± 1.5 ns.

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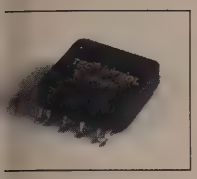
PASSIVE SURFACE-MOUNT DELAY LINES

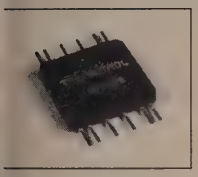


Gull-Wing—1/2" Square
GBF10 Series

- Total delay values from 10 to 100 ns.

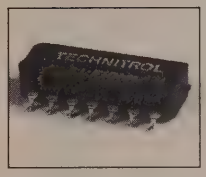
J-Lead—1/2" Square
BJF10 Series

- Total delay values from 10 to 100 ns.



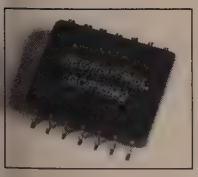
Ultra-Thin Flat-Pack
(.075" high)
BF10-2 Series

- Total delay values from 10 to 75 ns.



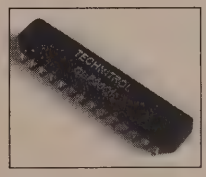
10-Tap Gull-Wing
GLF10 Series

- Total delay values from 10 to 200 ns.



10-Tap Gull-Wing
GCF10___2 Series

- Total delay values from 10 to 200 ns.
- Designed for ceramic substrate applications.



20-Tap Gull Wing
GLF20 Series

- Total delay values from 10 to 2000 ns.

- Designed for vapor phase reflow soldering at 215°C.
- Delays from 10 ns to 2000 ns.
- Standard impedance 100 ohms. Also available in 50 and 200 ohms.
- Typical distortion: ±10% maximum (preshoot and overshoot only).
- Some models available with delays of less than one ns, contact factory.
- Designed to use with TTL logic.
- To compensate for the low expansion coefficient of ceramic-substrate thick-film hybrids, see GCF10___2 series.

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POWER LINE FILTERS

Manufacturer	Starting EEM Page No.	EMI		RFI		Modules												Inter-national Adapters	Approvals
								Features											
		AC	DC	AC	DC	Power Entry	Inter-national	Power Switch	Fuse Holder	Voltage Selector	Dual Mode	PC Mount	Surface Mount	Cord Conn.	Lighted	Custom		
Aerovox	A•1585	√		√		√										√			FCC, VDE
Corcom Inc.	A•1586	√		√		√	√	√	√	√		√						√	UL, CSA, VDE, SEV
Eichhoff Electronics	A•1588	√		√		√	√	√	√	√		√				√			UL, CSA, VDE
Filter Concepts	A•1592	√	√	√	√	√	√	√						√		√			UL, CSA, VDE, TUV, MIL-STD # 461
JMK Inc.	A•1596	√	√	√	√	√	√									√			UL, CSA, VDE, TUV, MIL-STD # 15733
Okaya Electric America	A•1598	√		√			√					√				√			UL, CSA, VDE, SEV, SEMCO, TUV
Qualtek Electronics	A•1600	√		√		√	√	√	√	√	√	√				√			UL, CSA, VDE, SEV, HPF, SEMCO
RFI (Del Electronics)	A•1601	√	√	√	√	√	√	√	√						√	√			UL, MIL-STD # 220 & # 461
Schaffner EMC	A•1602	√	√	√	√	√	√	√	√	√	√	√			√	√			UL, CSA, VDE, SEV, TUV
Schurter, Inc.	A•1606	√	√	√	√	√	√	√	√			√	√	√	√	√			UL, CSA, VDE, SEV, SEMKO
Tamura	A•1610	√		√		√	√					√	√	√		√			UL, CSA, VDE
Tri-Mag Inc.	A•1612	√	√	√	√	√	√	√	√	√	√	√		√	√	√			UL, CSA, VDE, SEV, TUV, MIL-STD # MIL-F-15733

Aerovox® EMI/RFI Filters

Single and Three Phase up to 225 Amps

Standard Filters

Standard filters for a broad range of OEM applications, from games to state-of-the-art computors. Aerovox filters are manufactured to the highest standards of quality, safety and reliability.

Power Entry Modules

Power Entry Modules to reduce the conducted emissions at the power entry inlet of electronic equipment to acceptable FCC and/or VDE.

Custom Filters

When a standard filter product is not a suitable fit for a particular customer application, Aerovox's highly experienced design team will find a solution. In many cases, the solution is an economical and speedy modification of a standard design. Our development process assures that the final product will comply with FCC and VDE regulations.

Engineering and Test Facilities:

- Fully shielded room for testing customer equipment in a controlled electromagnetic environment
- Network analyzers (10kHz to 2.6Hz)
- Scanning programs
- An X-Y plotter and video plotter for visual recording
- CAD/CAM systems
- Impulse generators
- Synthesizer level generators
- LISN networks (50uh)
- and **25 plus years of EMI filter engineering experience**

Specialists in developing safety agency approved filter products.

Aerovox Electronic Group

742 Belleville Avenue, New Bedford, MA 02745-6194 TEL (508) 999-1000 FAX (508) 990-8696

corcom
RFI Power Line Filters

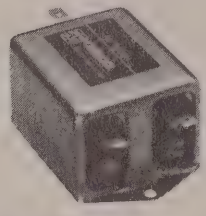
Corcom, Inc.
1600 Winchester Road
Libertyville, Illinois 60048 USA
TEL: 708-680-7400 FAX: 708-680-8169

Featured Products

A Series

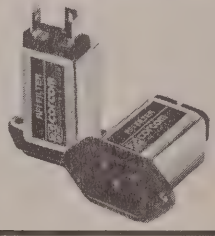
High performance 3-phase RFI filter for Wye and Delta applications. Common and differential mode suppression from 50kHz to 30mHz. Rated 20 to 60 amps.

AYO Series



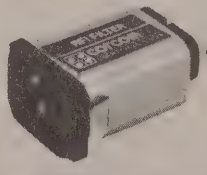
A new series of three phase filters for low current applications. These 3, 6 and 10 amp filters feature a Wye configuration for industrial three phase applications.

EAH/EBH Series



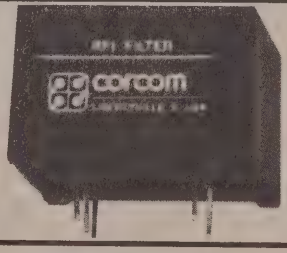
Health care filters with very low leakage current; small size, IEC Connector; 1-10 amp current rating; two performance levels case styles A and B from following page.

EAS/EBS Series



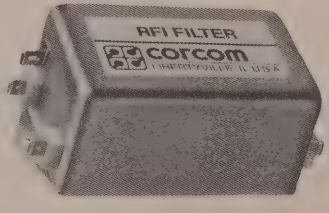
Snap-in susceptibility filter for general purpose, small size, two performance levels; low cost; current ratings 1-10 amps.

EDP/EOP Series



New susceptibility filter for PC Board mountable applications. The compact design allows pc mounting with minimal space requirements. Available from 1 to 10 amps, the filters meet European requirement for low leakage current.

HT/HQ Series



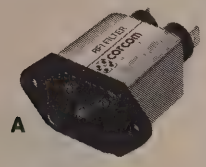
High Performance health care filters with very low leakage currents. Two performance levels for high or premium capabilities. 6-15 amp; fastons, wire leads or IEC socket.

See our pages in Vol. C, Section 2100; Vol. B, Section 4300.

corcom

RFI Power Line Filters

Corcom, Inc.
1600 Winchester Road
Libertyville, Illinois 60048 USA
TEL: 708-680-7400 FAX: 708-680-8169


A

B

C

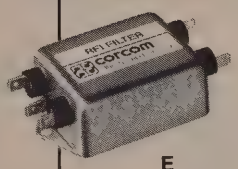
D

Corcom offers over 300 models of RFI filters—each designed and tested for susceptibility and/or emissions applications. As a world leader in RFI technology, Corcom offers a wide range of filters specifically designed to bring equipment (even those with switching power supplies) into compliance with strict FCC and VDE restrictions.

All Corcom filters receive approvals from major safety agencies throughout the world including UL, CSA, and VDE. Most have low leakage options with SEV approval.

Catalog filters are available off-the-shelf from over 175 distributor locations in the United States, and a strong network of reps and sales offices worldwide.

For more information, call or write for our free catalog: *RFI Power Line Filters.*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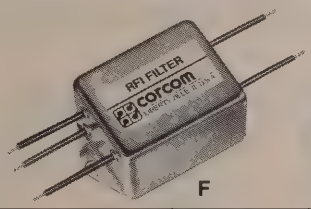
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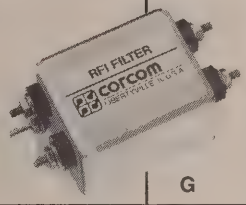
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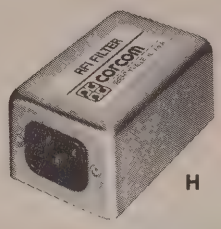
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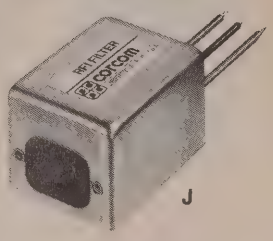
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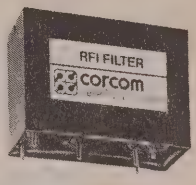

K

Susceptibility Filters

Series	Application	Std. Leakage	Low Leakage	Case† Styles	Current Ratings
H	Health care applications; very low leakage		EH	A,B,C,D,E	6-10
B	General purpose; small size; low cost	VB	EB	E,F,G	1-30
EEA, EEB	General purpose; compact design; IEC connector		EEA, EEB	A,B,C,D	1-10
ED	High performance; compact design; IEC connector		ED	A,B,C,D	1-10
K	Common mode & differential; general purpose	VK	EK	E,F,G,H	1-30
EC	High differential & common mode; general purpose		EC	A,B,C,D	1-10
R	Dual section; peremium performance; common & differential mode	VR	ER	E,F,G,H	1-20
S,V,W	High industrial applications	VS,VV,VW		E	3-20

Emissions Filters

Series	Application	Std. Leakage	Low Leakage	Case Styles	Current Ratings
SK	FCC A level emissions standard	VSK	ESK	E,F,G	3-30
EP	VDE A level, FCC B level switching power supplies		EP	E,F,G	3-10
X,Y,Z	3 performance levels for SMPS; compact design; PC board mount		EX,EY,EZ	E,K	1-6
G	SMPS FCC A level; Frequency>50kHz		EG	E	6-10
N	SMPS FCC B level; Frequency>50kHz	VN		E	6-10
T	High performance SMPS VDE A level small package	VT	ET	E,F,G,H	3-15
Q	Premium performance; SMPS VDE B level	VQ	EQ	E,F,J	3-6

†For susceptibility filters, not all case styles are available for all current ratings.

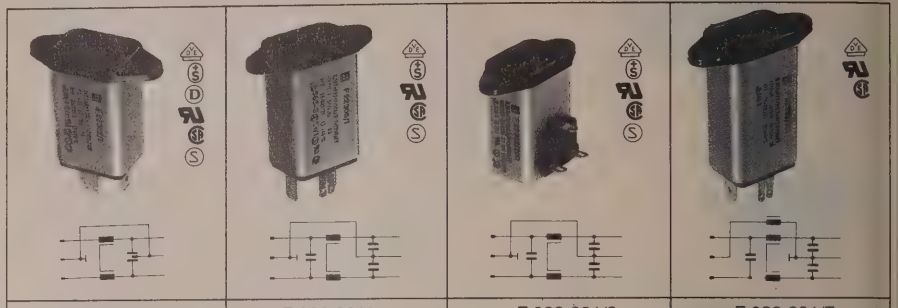
See our pages in Vol. C, Section 2100; Vol. B, Section 4300.

EICHHOFF

Eichhoff offers you advanced technology and custom capability in EMI/RFI solutions

Radio-Interference Suppression Filters with IEC power line connectors

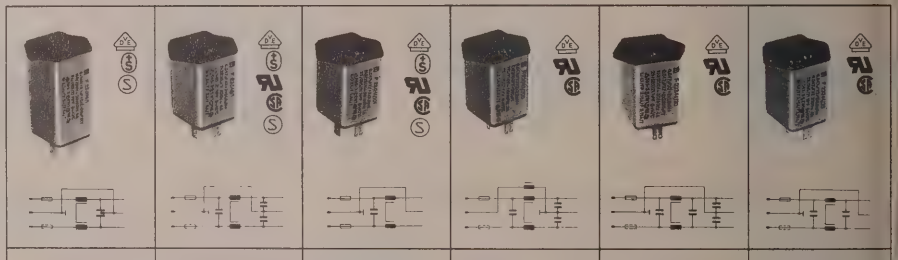
- Internationally Approved
- 125/250 VAC
- 1-6 Amp Current Rated
- Various Output types: Solder Tab, Wires Quick Connects



F 022-381/...– F 022-386/... F 012-124/...– F 012/137/...	F 022-301/...– F 022-306/... F 022-331/...– F 022-336	F 022-301/2..– F 022-306/2.. F 022-331/2..– F 022-336/2..	F 022-331/7..– F 022-336/7..

Radio-Interference Suppression Filters with power line connector and fuse holder for one or two fuses.

- Polyester Resin Sealed to Assure High Performance and Reliability
- Medical/UL 544
- 5 x 20 mm European Style Fuse Holder



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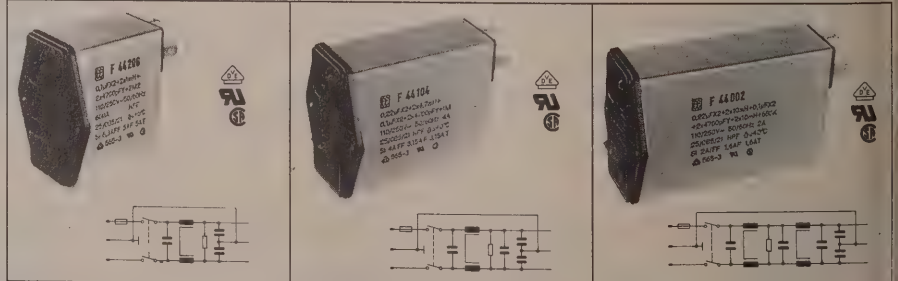
Radio-Interference Suppression Filters with power line connector, fuse holder and mains switch

- High Performance
- Multifunction
- 1-6 Amp Rated



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The leading European manufacturer since 1948.
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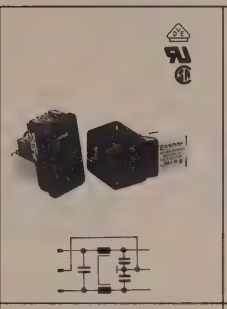
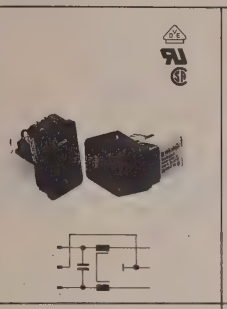
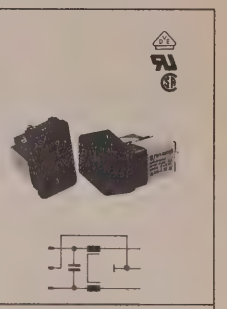
Resin sealed, high performance, high reliability power line filters.
Precise performance within product specifications.
Complete engineering capability for application assistance.

Radio-Interference Suppression Filters with IEC power line connector, voltage selector, and fuse holder, push button switch or rocker switch

- Panel or Snap-In Mounting
- International Safety Approvals
- Sealed in Polyester Resin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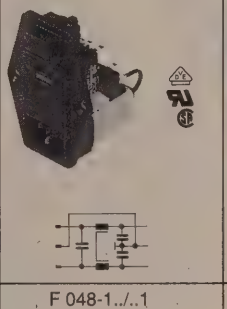
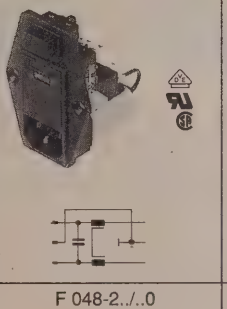
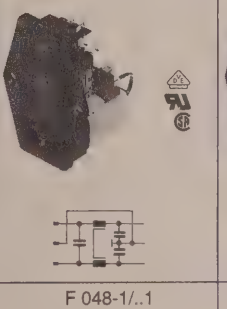
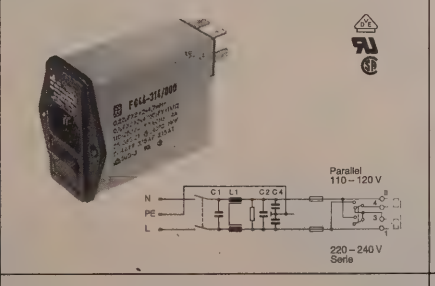
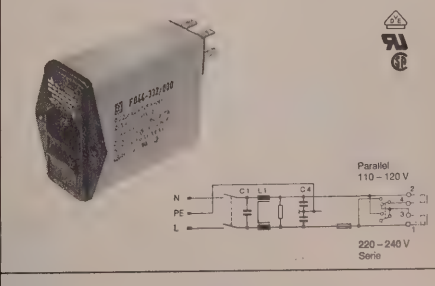
Radio-Interference Suppression Filters with IEC power line connector, fuse holder, voltage selector and push button switch or rocker switch

- 3 AG or European Style Fuse
- Panel Mount
- Medical/UL 544 Applications

			
F 048-1../..1 F 048-1../..0	F 048-2../..0	F 048-1/..1 F 048-1../..0	F 048-2../..0

Radio-Interference Suppression Filters with power line connector, fuse holder, mains switch and voltage selector

- Multifunction
- IEC Power Input
- 1 to 6 Amp Rated

		
Type	F 044-301/000- F 044-306/000 F 044-311/000- F 044-316/000	F 044-321/000- F 044-326/000 F 044-331/000- F 044-336/000

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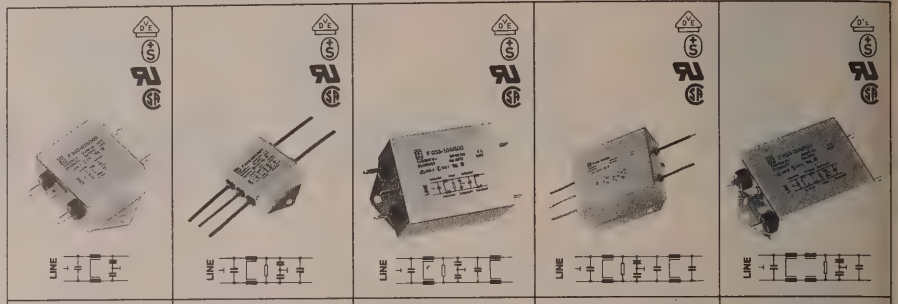
Eichhoff offers you advanced technology and custom capability in EMI/RFI power line filters.

Radio-Interference Suppression Filters. Encapsulation: rectangular metal case

- Low, Medium and High Performance Models
- 250/125 VAC
- .5 to 30 Amp Ratings
- PCB and Chassis Mount Types
- Various Output Connection Styles Available



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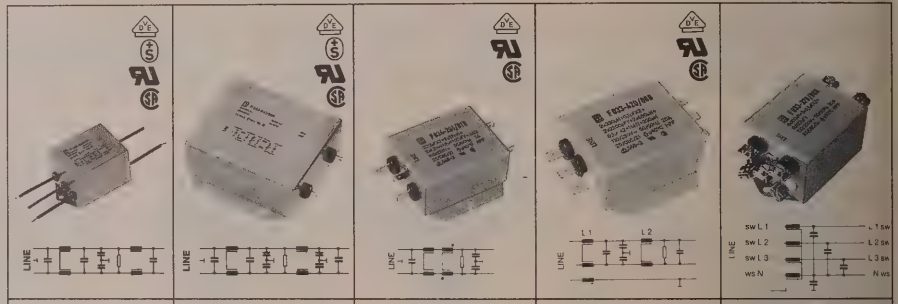
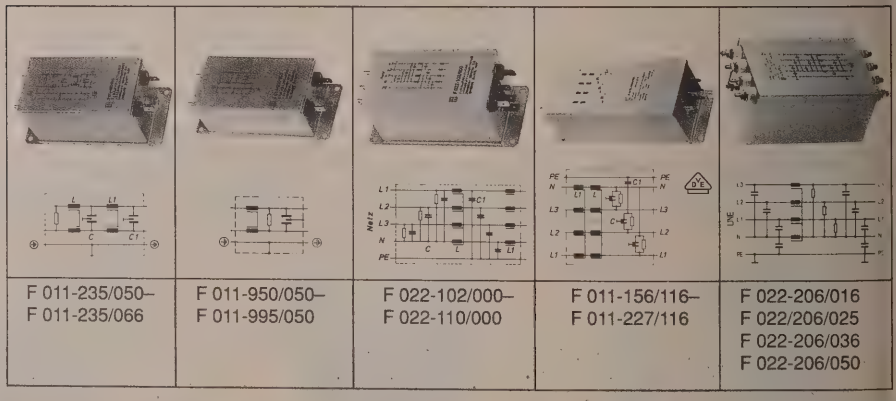


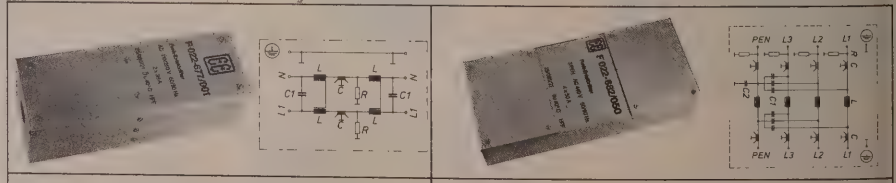
F 033-254/500–F 033-266/521 | F 033-304/500–F 033-316/521 | F 034-201/010–F 034-210/010 | F 033-411/000–F 033-420/000 | F 033-353/000–F 033-370/000

Three phase and custom high quality EMI/RFI solutions to meet demanding applications.

Complete catalog of specifications available upon request.



F 011-235/050–F 011-235/066 | F 011-950/050–F 011-995/050 | F 022-102/000–F 022-110/000 | F 011-156/116–F 011-227/116 | F 022-206/016 F 022/206/025 F 022-206/036 F 022-206/050



F 022-677/001–F 022-677/025 | F 022-682/001 F 022-682/050

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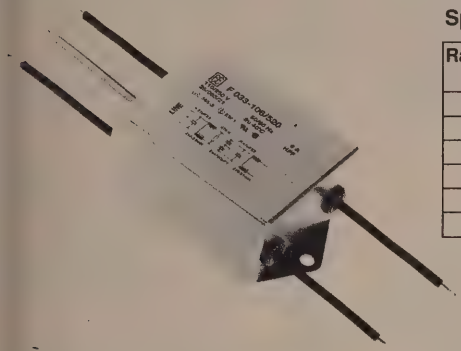
The leading European manufacturer since 1948.
Pioneer in EMI/RFI suppression.
Resin sealed, high performance, high reliability power line filters.
Precise performance within product specifications.
Complete engineering capability for application assistance.

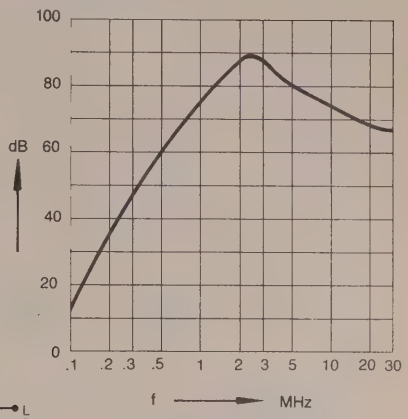
Filters for Switching Power Supplies, SCR and T²L Circuits



Specification

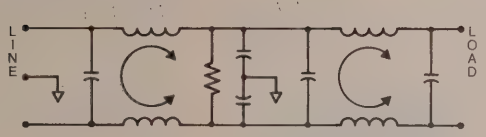
Rated current to VDE	Part Number	Case Size		
		L	W	H
1	F 33.151	1.77	2.05	1.18
2	F 33.152	1.77	2.05	1.18
4	F 33.154	2.09	2.52	1.18
6	F 33.156	2.09	2.52	1.18
10	F 33.160	2.09	2.52	1.18
16	F 33.166	2.09	3.35	1.54

Insertion Loss
Common Mode

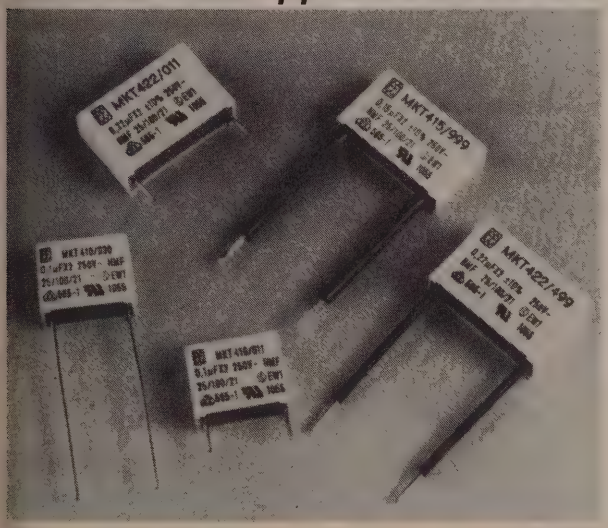


- Faston, Solder, Lead Connection
- Other insertion loss versions and case sizes available
- Hermetically Sealed in Polyester Resin

Electrical Schematic



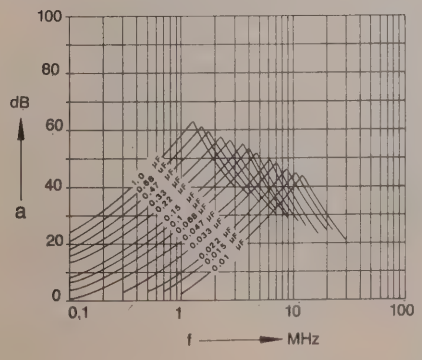
Line To Line Suppression Class X Film Capacitors



Specification

Capacitance	W (mm)	H (mm)	L (mm)	PCM* (mm)	
0.010 µF	5	11	18	15	KMT 254/954-310/011
0.015 µF	5	11	18	15	KMT 254/954-315/011
0.022 µF	5	11	18	15	KMT 254/954-322/011
0.033 µF	5	11	18	15	KMT 254/954-333/011
0.047 µF	6	12	18	15	KMT 254/954-347/011
0.068 µF	7.5	13.5	18	15	KMT 254/954-368/011
0.1 µF	8.5	14.5	18	15	KMT 254/755-410/011
0.15 µF	7	15	26.5	22.5	KMT 254/755-415/011
0.22 µF	8.5	17	26.5	22.5	KMT 254/755-422/011
0.33 µF	11	20	31	27.5	KMT 254/756-433/011
0.47 µF	12	20	31	27.5	KMT 254/756-447/011
0.68 µF	14.5	25	31	27.5	KMT 254/756-468/011
1.0 µF	16.5	28.5	31	27.5	KMT 254/756-510/011

Insertion Loss (50 Ω systems) wire length 6 mm



- UL 1283
  DIN 57 565 Part 1/VDE 0565 Part 1
  IEC-Publication 384-14 (1981)
  DIN 40 040
- Polyester film with vapor deposited aluminum enclosed in flame retardent (UL 94 VO) epoxy resin seal and case
- Tinned copper wire
  Solid/Stranded AWG 20, TR32, insulated
  Choice of quick connect terminals

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FILTER CONCEPTS INC.

- **Industry's Widest Selection of Standard Power Line EMI Filters for single and 3Ø applications.**
- **Custom AC and DC Power Line Filters from 1 to 150 Amps.**
- **Applications oriented to solve emission problems in Switch Mode Power Supplies, Variable Frequency Drives/Motor Controllers, Lasers, UPS's Medical Equipment, Telephony (AC & DC), etc.**

π FILTERS

LE SERIES
ECONOMICAL LOW LEAKAGE π SECTION FILTER

FCI's most economical and compact π section filter provides a useful combination of differential (L/L) and common mode (L/G) performance in a low leakage current design.

LE Series filters are designed for general purpose applications including supplementary filtering of switch mode power supplies with internal EMI filters.

Part No.	Current	Case	Leakage
LE5	5.0A	7/8x1-3/4x3-3/16	.30mA
LE10	10.0A	1-1/8x1-3/4x3-3/16	.30mA
LE15	15.0A	1-1/2x2x3-11/16	.30mA
LE20	20.0A	1-13/16x2-3/16x4	.30mA
LE30	30.0A	2x2-15/16x4-1/4	.45mA
LE40	40.0A	1-3/4x4-1/8x5-1/16	.45mA
LE75	75.0A	2-1/4x4-1/4x8-1/16	1.2mA
LE100	100.A	3x5-1/2x9-1/16	1.2mA

Rated Voltage: 250VAC, 50/60Hz
Insertion Loss: (50 ohms, typical)

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/L	8db	12db	45db	65db	65db	60db
L/G	10db	20db	32db	40db	45db	50db

LF SERIES
HIGH PERFORMANCE LOW LEAKAGE SWITCH MODE EMI FILTER

LF Series π section filters offer enhanced differential mode (L/L) and common mode (L/G) insertion loss for applications subject to the conducted limits of FCC and VDE while maintaining low ground leakage current.

The LF Series filter can function as a stand alone filter for switch mode applications or in conjunction with the power supply's internal EMI filter.

Part No.	Current	Case	Leakage
LF2	2.0A	7/8x1-3/4x3-3/16	.45mA
LF3	3.0A	1-1/4x2x3-3/16	.45mA
LF5	5.0A	1-1/2x2x3-11/16	.45mA
LF7	7.5A	1-1/2x2x3-11/16	.45mA
LF10	10.0A	1-13/16x2-3/16x4	.45mA
LF15	15.0A	2x2-15/16x4-1/4	.45mA
LF20	20.0A	1-1/2x4-1/8x5-1/16	.80mA
LF40	40.0A	3x5-1/2x9-1/16	1.4mA

Rated Voltage: 250VAC, 50/60Hz
Insertion Loss: (50 ohms, typical)

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/L	6db	33db	60db	60db	60db	60db
L/G	18db	30db	42db	50db	50db	50db

LX SERIES
ENHANCED PERFORMANCE LOW LEAKAGE SWITCH MODE EMI FILTER

LX Series π section filters feature additional line inductors providing up tp 30db of enhanced performance at the low frequency end of the VDE 0871/B conducted EMI spectrum.

The LX Series filter can augment existing EMI filters in switch mode power conversion/regulation equipment or function as the equipment's stand alone filter.

Part No.	Current	Case	Leakage
LX1	1.5A	1-1/4x2x3-3/16	.45mA
LX3	3.0A	1-1/2x2x3-11/16	.45mA
LX6	6.0A	2x2-15/16x4-1/4	.45mA
LX10	10.0A	2x2-3/4x6-7/16	.80mA
LX15	15.0A	3x3x6-13/16	1.5mA
LX20	20.0A	3x3x8-13/16	1.5mA
LX24	24.0A	2-1/4x4-1/4x11-1/16	1.5mA
LX30	30.0A	4x4x8-13/16	1.5mA
LX45	45.0A	4-3/4x5x13-1/4	1.5mA

Rated Voltage: 250VAC, 50/60Hz
Insertion Loss: (50 ohms, typical)

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/L	45db	65db	65db	65db	65db	60db
L/G	30db	42db	50db	50db	50db	50db

GF SERIES
SYSTEM EMI FILTER WITH GROUND ISOLATOR

A system filter with good general purpose performance. The GF Series was designed for AC input and distribution applications.

GF filters include an alternate ground termination for the AC input power to isolate AC mains' high frequency low impedance ground noise.

Part No.	Current	Case	Leakage
GF10	10.0A	1-1/2x2x3-11/16	1.0mA
GF20	20.0A	2x2-15/16x4-1/4	1.0mA
GF30	30.0A	2x2-15/16x4-1/4	1.5mA

Rated Voltage: 250VAC, 50/60Hz
Insertion Loss: (50 ohms, typical)

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/L	6db	20db	45db	55db	55db	50db
L/G	10db	22db	32db	45db	50db	50db

CORD CONNECTED

CF SERIES
HIGH ENERGY POWER LINE FILTER/CONDITIONER

CF filters provide convenient protection and isolation from power line disturbances including high voltage transients which saturate the typical internal EMI filter in electronic equipment.

The low cutoff freguency and high energy capability of the CF Series protects office equipment and laboratory instruments, reducing component failures and ghost faults.

Standard NEMA or CEE plug and receptacle interface is available for convenient installation.

Part No.	Rated Voltage	Current	Leakage
CF151	125VAC	15.0A	.50mA
CF152	250VAC	15.0A	1.0mA
CF201	125VAC	20.0A	.50mA

Insertion Loss: (50 ohms, typical)

	.02MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/L	20db	50db	65db	65db	65db	65db
L/G	18db	40db	60db	60db	60db	60db

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T FILTERS

SE SERIES
SWITCH MODE POWER SUPPLY FILTER

Our most compact and economical T section filter for applications using switch mode conversion & regulation technology and subject to FCC conducted EMI specifications.

SE Series EMI filters are designed to provide balanced differential (L/L) and common mode (L/G) insertion loss for maximum performance at 450KHz and above.

Available in standard packages from 3Amps to 60Amps, the SE Series is an excellent performer for many domestic applications.

Part No.	Current	Case	Leakage
SE3	3.0A	7/8x1-3/4x3-3/16	.80mA
SE7	7.5A	1-1/4x2x3-3/16	.80mA
SE15	15.0A	1-1/2x2x3-11/16	.80mA
SE20	20.0A	1-13/16x2-3/16x4	.80mA
SE30	30.0A	2x2-15/16x4-1/4	1.4mA
SE45	45.0A	2-3/4x3x6-1/16	1.4mA
SE50	50.0A	3x3x6-1/16	1.4mA
SE60	60.0A	3x3x6-13/16	1.6mA

Rated Voltage: 250VAC, 50/60Hz
Insertion Loss: (50 ohms, typical)

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/L	7db	15db	50db	60db	55db	50db
L/G	7db	15db	50db	65db	65db	55db

SF SERIES
HIGH PERFORMANCE SWITCH MODE EMI FILTER

SF Series T section filters are designed to effectively attenuate differential (L/L) and common mode (L/G) noise from switch mode power conversion & regulation circuits subject to FCC and VDE 0871/A conducted EMI limits.

Part No.	Current	Case	Leakage
SF3	3.0A	1-1/4x2x3-3/16	.80mA
SF7	7.5A	1-1/2x2x3-11/16	.80mA
SF10	10.0A	1-13/16x2-3/16x4	.80mA
SF15	15.0A	2x2-15/16x4-1/4	.80mA
SF20	20.0A	1-1/2x4-1/8x5-1/16	.80mA
SF24	24.0A	2-1/4x3-1/16x6-1/4	1.0mA
SF30	30.0A	2-3/4x3x6-1/16	1.4mA
SF45	45.0A	2-3/4x3x8-13/16	1.4mA
SF60	60.0A	4x4x8-13/16	1.6mA

Rated Voltage: 250VAC, 50/60Hz
Insertion Loss: (50 ohms, typical)

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/L	15db	45db	60db	60db	65db	60db
L/G	8db	45db	65db	65db	65db	60db

SX SERIES
ENHANCED PERFORMANCE SWITCH MODE EMI FILTER

With additional line inductors the SX Series T section filters provide up to 15db of enhanced performance to solve severe conducted EMI problems in the FCC and VDE 0871/A spectrums.

SX Series filters are available in standard current ratings of 3Amps to 60Amps providing high performance over a wide range of load currents and source impedances.

Part No.	Current	Case	Leakage
SX3	3.0A	1-1/2x2x3-11/16	.80mA
SX7	7.5A	2x2x5	.80mA
SX15	15.0A	2-3/4x3x6-1/16	1.4mA
SX20	20.0A	2-3/4x3x6-13/16	1.4mA
SX30	30.0A	2-3/4x3x8-13/16	1.4mA
SX45	45.0A	4x4x8-13/16	1.8mA
SX60	60.0A	4-3/4x5x10-1/4	1.8mA

Rated Voltage: 250VAC, 50/60Hz
Insertion Loss: (50 ohms, typical)

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/L	30db	60db	65db	65db	60db	50db
L/G	20db	60db	65db	65db	60db	55db

SW SERIES
WIDE BAND HIGH PERFORMANCE FILTER

Extended high and low frequency insertion ioss is provided with the SW Series of power line filters.

Designed to provide wide band EMI performance for VDE 0871/B and MIL STD 461 ground equipment, the SW Series maintains moderate leakage current for enhanced safety. Available in current ratings from 3Amps to 45Amps, the SW Series remains effective independent of wide variations in impedances and noise characteristics.

Part No.	Current	Case	Leakage
SW3	3.0A	1-13/16x2-3/16x4	2.4mA
SW5	5.0A	2x2x5	2.4mA
SW10	10.0A	2-3/4x3x6-1/16	2.4mA
SW20	20.0A	2-3/4x3x8-13/16	2.4mA
SW30	30.0A	4x4x8-13/16	2.4mA
SW45	45.0A	4-3/4x5x13-1/4	3.5mA

Rated Voltage: 250VAC, 50/60Hz
Insertion Loss: (50 ohms, typical)

	.05MHz	.50MHz	1.5MHz	5.0MHz	50MHz	0.1GHz
L/L	50db	65db	65db	65db	60db	50db
L/G	35db	65db	65db	65db	60db	50db

TF SERIES
HIGH PERFORMANCE LOW LEAKAGE EMI FILTER

TF Series filters provide high performance differential (L/L) and common mode (L/G) insertion loss for switch mode power conversion & regulation circuits with a requirement for reduced leakage currents.

TF Series filters feature inductive common mode (L/G) and capacitive differential mode (L/L) output impedance for minimized rectifier commutation noise.

Part No.	Current	Case	Leakage
TF1	1.0A	7/8x1-3/4x3-3/16	.45mA
TF2	2.0A	1-1/8x1-3/4x3-3/16	.45mA
TF3	3.0A	1-1/4x2x3-3/16	.45mA
TF5	5.0A	1-1/2x2x3-11/16	.45mA
TF10	10.0A	2x2-15/16x4-1/4	.45mA
TF20	20.0A	2-3/4x3x6-1/16	.80mA

Rated Voltage: 250VAC, 50/60Hz
Insertion Loss: (50 ohms, typical)

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/L	15db	45db	55db	60db	60db	60db
L/G	10db	50db	65db	65db	65db	60db

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DC FILTERS

DS SERIES
HIGH PERFORMANCE DC POWER FILTER

The DS Series of EMI filters provides effective attenuation in applications requiring DC power conversion.

The DS Series can be used successfully as án input or output filter in many applications.

Part No.	Current	Case
DS7	7.5A	7/8x1-3/4x3-3/16
DS15	15.0A	1-1/4x2x3-3/16
DS20	20.0A	1-1/4x2x3-3/16
DS30	30.0A	1-1/2x2x3-11/16
DS60	60.0A	2x2-15/16x4-1/4
DS100	100.A	2-3/4x3x6-1/16
DS150	150.A	4x4x6-13/16

Rated Voltage: 60 VDC
Insertion Loss: (50 ohms, typical)

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/G	40db	60db	60db	60db	60db	50db

DC SERIES
HIGH PERFORMANCE DC POWER FILTER

The DC Series provides two independent π section EMI filters for effective attenuation of switch mode converter & regulator EMI on power inputs or outputs.

DC Series π sections work equally well with balanced or unbalanced load currents, with chassis returns or with positive or negative polarities.

Part No.	Current	Case
DC3	3.0A	1-1/8x1-3/4x3-3/16
DC7	7.5A	1-1/4x2x3-3/16
DC15	15.0A	1-1/2x2x3-11/16
DC20	20.0A	1-13/16x2-3/16x4
DC30	30.0A	2x2-15/16x4-1/4
DC60	60.0A	2-3/4x3x6-1/16
DC100	100.A	4x4x8-13/16

Rated Voltage: 60 VDC
Insertion Loss: (50 ohms, typical)

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/G	40db	60db	60db	60db	60db	55db

DP SERIES
HIGH PERFORMANCE DC INPUT FILTERS

DP Series filters are designed for use as balanced input filters for DC input power supplies. By providing a very low impedance to their active loads, DP Series filters avoid power input overshoot and output regulation loop stability problems common to conventional EMI filters.

Polarity reversal and over voltage protection are additional features od the DP Series filters.

Part No.	Current	Case
DP5	5.0A	7/8x1-3/4x3-3/16
DP10	10.0A	1-1/8x1-3/4x3-3/16
DP15	15.0A	1-1/2x2x3-11/16
DP20	20.0A	1-13/16x2-3/16x4
DP30	30.0A	2x2-15/16x4-1/4
DP45	45.0A	3x3x6-1/16

Rated Voltage: 50 VDC
Insertion Loss: (50 ohms, typical)

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/L	40db	60db	60db	60db	50db	50db
L/G	20db	30db	45db	50db	45db	40db

DF SERIES
DC OUTPUT FILTER

DF Series filters provide an economical solution to output noise from typical multiple output switch mode power supplies.

Available in 4 and 6 conductor models, the DF Series can also isolate sensitive analog circuits from noisy system power buses.

Part No.	Current	Case
DF104	4x10A	1-1/4x3-1/16x2-13/16
DF106	6x10A	1-1/2x3-1/16x3-5/16

Rated Voltage: 60 VDC
Insertion Loss: (50 ohms, typical)

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/L	1db	10db	25db	35db	45db	40db
L/G	15db	25db	35db	50db	50db	50db

DL SERIES
MULTI CHANNEL DC INPUT/OUTPUT FILTER

DL Series filters provide independent multiple filter sections suitable for DC power or control lines.

Part No.	Current	Case
DL64	4x6.0A	1-1/4x3-1/16x2-13/16
DL66	6x6.0A	1-1/2x3-1/16x3-5/16

Rated Voltage: 60 VDC
Insertion Loss: (50 ohms, typical)

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/G	10db	20db	36db	56db	60db	55db

DH SERIES
ITE & TELEPHONY DC POWERLINE FILTERS

EN 60 950

DH Series power line EMI filters provide effective EMI attenuation for switch-mode DC to DC converters and regulators with DC power inputs and outputs.

UL recognized, CSA certified for applications in the ITE and telephony industries, DH series filters are non-polar and perform equally well with balanced and unbalanced lead currents.

Part No.	Current	Case
DH5	5.0A	1-1/2 x 2 x 3-11/16
DH10	10.0A	2 x 2 x 5
DH15	15.0A	2 x 2 -15/16 x 4-1/4
DH30	30.0A	2-1/4 x 3-1/16 x 6-5/8
DH60	60.0A	3 x 3 x 6-13/16
DH100	100.0A	4 x 4 x 8-13/16

Rated Voltage: 60 VDC
Insertion Loss: (50 ohms, typical)

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/L	30db	60db	60db	60db	60db	60db
L/G	20db	55db	60db	60db	60db	55db

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MIL PERFORMANCE

A2T SERIES
PREMIUM PERFORMANCE SEVERE ENVIRONMENT EMI FILTER

A2T Series power line filters are designed for typical switch mode power converters & regulators subject to MIL STD 461 conducted emission specifications in a MIL STD 462 type test environment.

A2T Series filters are designed for 50Hz to 400Hz AC power. The moderate ground leakage design of the A2T Series minimizes EMI ground currents and provides enhanced safety.

Part No.	Current	Case	Leakage
A2T2	2.5A	1-1/2x2x6-3/16	1.8mA
A2T5	5.0A	1-3/4x2-3/4x8-11/16	1.8mA
A2T10	10.0A	2-1/4x3-3/4x11-3/8	1.8mA
A2T15	15.0A	4x4x8-13/16	2.4mA
A2T30	30.0A	4-3/4x5x15-1/4	3.5mA

Rated Voltage: 250VAC, 50/60Hz
125VAC, 400Hz
Insertion Loss: (50 ohms, typical)

	.02MHz	.05MHz	.15MHz	1.5MHz	5.0MHz	50MHz
L/L	20db	40db	65db	65db	65db	60db
L/G	20db	50db	65db	65db	65db	60db

A3T SERIES
3 PHASE DELTA SEVERE ENVIRONMENT EMI FILTER

A3T Series 3 phase power line filters are designed to filter typical switch mode power conversion devices required to meet MIL STD 461 conducted emissions while maintaining low ground leakage currents.

Part No.	Current	Case	Leakage
A3T5	5.0A/PH	4x4x8-13/16	2.0mA

Rated Voltage: 250VAC, 50/60Hz
125VAC, 400Hz
Insertion Loss: (50 ohms, typical)

	.02MHz	.05MHz	.15MHz	1.5MHz	5.0MHz	50MHz
L/L	24db	34db	65db	65db	65db	60db
L/G	21db	50db	65db	65db	65db	60db

A4T SERIES
3 PHASE WYE SEVERE ENVIRONMENT EMI FILTER

A4T Series 3 phase power line filters are designed to filter typical switch mode power conversion devices required to meet MIL STD 461 conducted emissions while maintaining low ground leakage currents.

Part No.	Current	Case	Leakage
A4T5	5.0A/PH	4x4x10-13/16	2.0mA

Rated Voltage: 250/440VAC, 50/60Hz
125/220VAC, 400Hz
Insertion Loss: (50 ohms, typical)

	.02MHz	.05MHz	.15MHz	1.5MHz	5.0MHz	50MHz
L/N	22db	35db	50db	65db	65db	60db
L/G	21db	50db	65db	65db	65db	60db

D1L SERIES
HIGH PERFORMANCE SEVERE ENVIRONMENT DC POWER FILTER

D1L Series filters are designed for applications subject to MIL STD 461 conducted emissions limits.

The non-polar design of the D1L Series allows complete applications flexibility.

Part No.	Current	Case
D1L5	5.0A	1-1/4x2x3-3/16
D1L10	10.0A	1-1/2x2x3-11/16
D1L20	20.0A	2x2x5
D1L40	40.0A	2-3/4x3x6-1/16

Rated Voltage: 60VAC
Insertion Loss: (50 ohms, typical)

	.02MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	50MHz
L/G	22db	55db	60db	60db	60db	50db

D2L SERIES
HIGH PERFORMANCE SEVERE ENVIRONMENT DC POWER FILTER

D2L Series dual filters are designed for typical DC switch mode power conversion & regulation applications subject to MIL STD 461 conducted emissions specifcations.

D2L Series functions equally well with balanced or unbalanced load currents, with chassis returns or with positive or negative polarities.

Part No.	Current	Case
D2L5	5.0A	1-13/16x2-3/16x4
D2L10	10.0A	2x2x5
D2L20	20.0A	2-3/4x3x6-1/16
D2L40	40.0A	4x4x6-13/16

Rated Voltage: 60 VDC
Insertion Loss: (50 ohms, typical)

	.02MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	50MHz
L/G	22db	55db	60db	60db	60db	50db

3Ø FILTERS

3E SERIES
3 PHASE SWITCH MODE EMI FILTER

3E Series T section filters are designed to attenuate differential (L/N) and common mode (L/G) EMI from switch mode power circuits and power supplies in balanced or unbalanced 3 phase load configurations.

The 3E Series is available in Wye or Delta configurations. The Wye version can also be used for Delta applications.

Part No.	Current	Case	Leakage
3E15	15A/PH	3x3x6-1/16	1.2mA
3E20	20A/PH	4x4x6-13/16	1.2mA
3E30	30A/PH	4x4x6-13/16	1.4mA
3E45	45A/PH	4x4x8-13/16	1.6mA
3E60	60A/PH	4-3/4x5x10-1/4	1.6mA
3E80	80A/PH	4-3/4x6-1/2x12-1/4	2.4mA
3E100	100A/PH	4-3/4x6-1/2x14-1/4	2.4mA
3E150	150A/PH	5-3/4x7-1/2x14-1/2	3.5mA

Rated Voltage: 250/440VAC, 50/60Hz
Insertion Loss: (50 ohms, typical)

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/N	12db	22db	50db	55db	50db	50db
L/G	3db	25db	55db	60db	50db	50db

3F SERIES
HIGH PERFORMANCE 3 PHASE SWITCH MODE EMI FILTER

With extended low frequency performance, 3F Series EMI filters provide enhanced differential (L/N) and common mode (L/G) insertion loss for switch mode power circuits and supplies subject to FCC and VDE 0871/A spectrums. The 3F Series is available in Wye or Delta configurations.

3F Series filters are reliable performers with either balanced or unbalanced 3 phase load currents.

Part No.	Current	Case	Leakage
3F7	7.5A/PH	3x3x6-13/16	.80mA
3F15	15A/PH	4x4x8-13/16	.80mA
3F30	30A/PH	4-3/4x5x10-1/4	1.4mA
3F45	45A/PH	4-3/4x5x13-1/4	1.4mA
3F60	60A/PH	4-3/4x6-1/2x14-1/4	1.6mA
3F75	75A/PH	4-3/4x6-1/2x14-1/4	2.4mA
3F80	80A/PH	4-3/4x6-1/2x17-1/4	2.4mA
3F100	100A/PH	5-3/4x7-1/2x17-1/2	2.4mA

Rated Voltage: 250/440VAC, 50/60Hz
Insertion Loss: (50 ohms, typical)

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/N	15db	50db	60db	60db	60db	55db
L/G	10db	50db	65db	65db	65db	60db

3X SERIES
ENHANCED PERFORMANCE 3 PHASE FILTER

The 3X Series of T section 3 phase EMI filters feature additional line inductors, providing up to 15db of enhanced performance, for severe EMI requirements such as VDE 0871/A while maintaining moderate leakage current.

3X Series filters are available in Wye or Delta configurations.

Part No.	Current	Case	Leakage
3X3	3A/PH	3x3x6-13/16	.80mA
3X7	7.5A/PH	4x4x8-13/16	1.2mA
3X15	15A/PH	4-3/4x5x10-1/4	1.2mA
3X30	30A/PH	4-3/4x6-1/2x14-1/4	1.6mA
3X40	40A/PH	4-3/4x6-1/2x17-1/4	1.6mA
3X60	60A/PH	5-3/4x7-1/2x17-1/2	2.4mA

Rated Voltage: 250/440VAC, 50/60Hz
Insertion Loss: (50 ohms, typical)

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/N	30db	65db	65db	65db	60db	55db
L/G	20db	60db	65db	65db	60db	60db

3W SERIES
3 PHASE WIDE BAND HIGH PERFORMANCE FILTER

3W Series provides extended high and low frequency insertion loss while maintaining low ground leakage currents.

The unique design of the 3W filter maintains performance over a wide range of impedances.

Part No.	Current	Case	Leakage
3W10	10A/PH	4x4x10-13/16	2.4mA
3W20	20A/PH	4-3/4x5x15-1/4	3.2mA
3W30	30A/PH	4-3/4x6-1/2x17-1/4	3.2mA

Rated Voltage: 250/440VAC, 50/60Hz
Insertion Loss: (50 ohms, typical)

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	50MHz
L/N	52db	65db	65db	65db	65db	60db
L/G	40db	60db	65db	65db	65db	60db

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3Ø FILTERS

3B SERIES
3 PHASE ECONOMICAL π SECTION FILTER

FCI's most economical and compact 3 phase filter provides both differential and common mode performance in a π section circuit configuration. 3B Series filters are designed for general purpose applications including supplementary filtering at the system level.

Part No.	Current	Case	Leakage
3B8D	8A/PH	2-1/8 x 1-3/4 x 3-5/8	.80mA
3B16D	16A/PH	3 x 2 x 4	1.4mA
3B30D	30A/PH	4-1/8 x 1-3/4 x 4	1.4mA
3B60D	60A/PH	4-1/4 x 2-1/4 x 7-3/4	1.4mA
3B100D	100A/PH	5-1/2 x 3 x 9	1.4mA

Rated Voltage: 250VAC, 50/60Hz
Insertion Loss: (50 ohms, typical)

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/L	12db	20db	40db	60db	50db	50db
L/G	4db	18db	38db	44db	50db	50db

3L SERIES
3 PHASE ENHANCED PERFORMANCE FILTER

The 3L Series 3 phase π section filters are for use with switch mode loads of all types. 3L Series filters provide stand alone or enhancement level performance for FCC and VDE 0871/A requirements.

Part No.	Current	Case	Leakage
3L15	15A/PH	2-1/4x4-1/4x8-1/16	.80mA
3L30	30A/PH	3x5-1/2x9-1/16	1.1mA
3L45	45A/PH	4-3/4x5x10	1.4mA

Rated Voltage: 250/440VAC, 50/60Hz
Insertion Loss: (50 ohms, typical)

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/N	20db	35db	60db	60db	60db	55db
L/G	15db	30db	42db	60db	60db	55db

3V SERIES
PREMIUM PERFORMANCE 3 PHASE π FILTER

The 3V Series provides extended low frequency performance for VDE 0871/B type applications with switch mode power supplies.

3V Series filters operate equally well with balanced or unbalanced loads and provides significant attenuation in the 10KHz to 150KHz band.

Part No.	Current	Case	Leakage
3V16	16A/PH	4x4x10-13/16	1.8mA
3V24	24A/PH	4-3/4x5x15-1/4	1.8mA

Rated Voltage: 250/440VAC, 50/60Hz
Insertion Loss: (50 ohms, typical)

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/N	40db	55db	60db	65db	50db	55db
L/G	22db	40db	50db	55db	55db	45db

3H SERIES
HIGH VOLTAGE 3 PHASE POWER FILTER

3H Series filters are designed for equipment in an industrial environment powered by 480 VAC 3 phase AC power. Typical applications include motor controllers, laser power supplies and uninterruptable power supplies.

Part No.	Current	Case	Leakage
3H15	15A/PH	4x4x6-13/16	3.9mA
3H30	30A/PH	4-3/4x5x10-1/4	3.9mA
3H45	45A/PH	4-3/4x5x13-1/4	3.9mA
3H60	60A/PH	4-3/4x6-1/2x14-1/4	3.9mA
3H100	100A/PH	5-3/4x7-1/2x17-1/2	3.9mA

Rated Voltage: 480VAC, 50/60Hz
Insertion Loss: (50 ohms, typical)

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/L	10db	40db	60db	60db	60db	55db
L/G	10db	50db	60db	60db	60db	55db

3C SERIES
3 PHASE SCR FILTER

SCR phase regulation input line filter designed to suppress transients generated by thyristor circuit commutation currents.

Part No.	Current	Case	Leakage
3C20D	20A/PH	4x4x8-13/16	1.6mA
3C40D	40A/PH	4-3/4x5x13-1/4	2.4mA
3C60D	60A/PH	4-3/4x6-1/2x14-1/4	2.4mA

Rated Voltage: 250VAC, 50/60Hz
Insertion Loss: (50 ohms, typical)

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/L	50db	60db	65db	65db	65db	60db
L/G	5db	18db	40db	55db	60db	50db

3MC SERIES
3 PHASE MOTOR CONTROLLER FILTER

Motor controller output filter series designed to suppress the high frequency harmonics inherent with PWM wave forms.

Part No.	Current	Case	Leakage
3MC15	15A/PH	2-3/4x3x8-13/16	1.6mA
3MC40	40A/PH	4x4x10-13/16	2.4mA
3MC100	100A/PH	4-3/4x6-1/2x14-1/4	4.8mA

Rated Voltage: 480VAC, DC-200Hz
Insertion Loss: (50 ohms, typical)

	.15MHz	.50MHz	1.5MHz	5.0MHz	15MHz	50MHz
L/L	5db	15db	35db	55db	60db	30db
L/G	10db	20db	30db	50db	50db	24db

FCI reserves the right to make specification changes without notice. Consult the factory for current information.

FILTER CONCEPTS INC.

- **Industry's Widest Selection of Standard Power Line EMI Filters for single and 3Ø applications.**
- **Custom AC and DC Power Line Filters from 1 to 150 Amps.**
- **Applications oriented to solve emission problems in Switch Mode Power Supplies, Variable Frequency Drives/Motor Controllers, Lasers, UPS's Medical Equipment, Telephony (AC & DC), etc.**

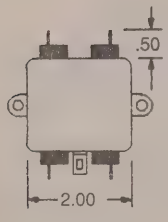
FILTER CONCEPTS INC.
2624 S. Rousselle St. ■ Santa Ana ■ California 92707 USA Fax (714) 545-4607 Tele. (714) 545-7003

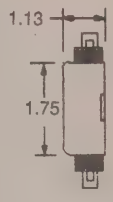
JMK filters

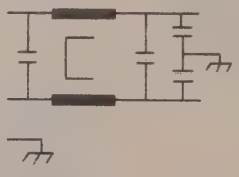
COMMERCIAL • RF INTERFERENCE • TEMPEST
DATA LINE • MILITARY • HARMONIC DISTORTION
TRANSIENT SUPPRESSION

JMK INC. has 25 years experience designing filters to meet unique or slightly different requirements. We have over 1000 designs which can be adapted to meet your requirements. Most of our designs carry UL, CSA, TUV, VDE, or IEC certifications. Our design department is comfortable discussing FCC, VDE, IEC, TEMPEST, MIL-STD-461, MIL-F-15733, or other specifications. Give us a call. You will like our service and production lead times.

221 SERIES



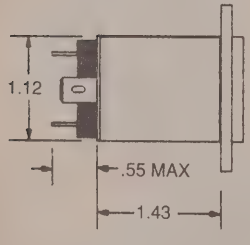




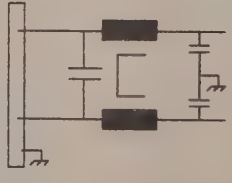
115/250 VAC
1, 2, 3, 5, 10, 20, 30 AMP

FREQ (MHz)	.01	.1	1	10	100
CM INS LOSS, db		15	48	50	35
DF INS LOSS, db		8	25	45	34

233 SERIES



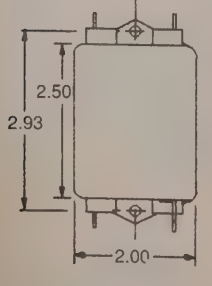
SNAP-IN ALSO AVAILABLE

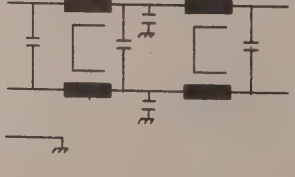


115/250 VAC
1, 3, 6, 10, 15 AMP

FREQ (MHz)	.01	.1	1	10	100
CM INS LOSS, db		12	38	50	37
DF INS LOSS, db		8	22	50	40

237 SERIES





115/250 VAC
1, 2, 3, 5, 10, 20 AMP

FREQ (MHz)	.01	.1	1	10	100
CM INS LOSS, db	3	35	70	65	50
DF INS LOSS, db		13	30	50	40

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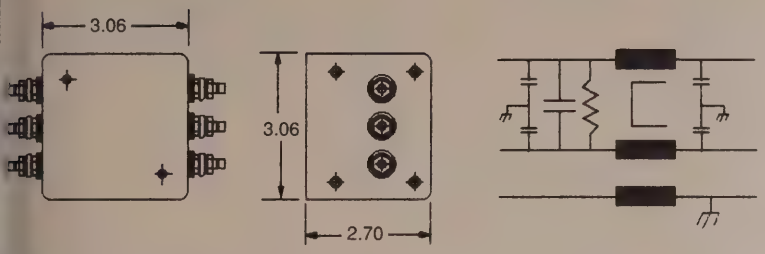
TRANSIENT SUPPRESSION

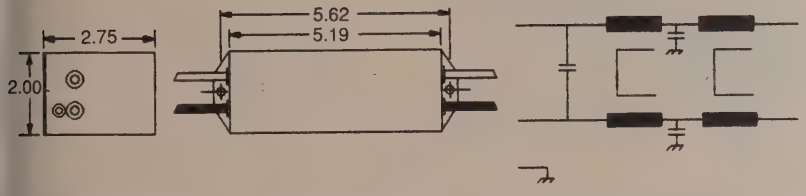
283 SERIES



115/250 VAC
20, 30 AMP

FREQ (MHz)	.01	.1	1	10	100
CM INS LOSS, db	2	15	48	80	50
DF INS LOSS, db	5	20	42	60	50

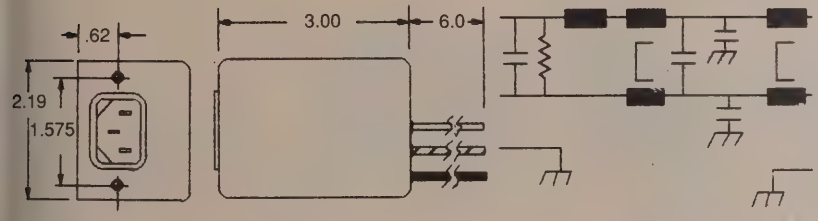
681 A SERIES



115/250 VAC
20, 30 AMP

FREQ (MHz)	.01	.1	1	10	100
CM INS LOSS, db	10	20	60	68	60
DF INS LOSS, db	25	30	60	68	60

720 SERIES



115/250 VAC
6, 8, 10, AMP

FREQ (MHz)	.01	.1	1	10	100
CM INS LOSS, db	10	55	70	70	50
DF INS LOSS, db	3	27	65	65	50

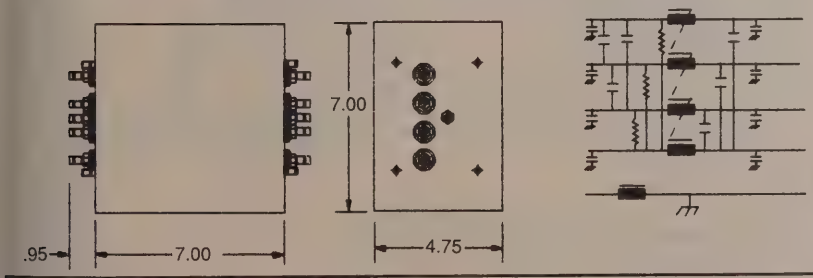
772 SERIES

SNAP-IN ALSO AVAILABLE

115/250 VAC
3, 6 AMP

FREQ (MHz)	.01	.1	1	10	100
CM INS LOSS, db	1	14	40	60	50
DF INS LOSS, db	1	11	30	50	44

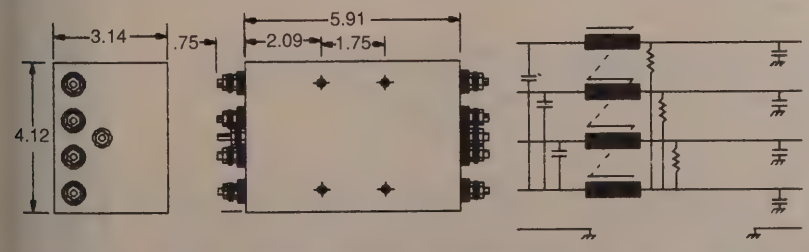
787 SERIES



250/440 VAC
45, 60, 80, 100 AMP

FREQ (MHz)	.1	1	10	100
CM INS LOSS, db (60)	20	62	50	35
DF INS LOSS, db	25	58	52	36

851 SERIES



250/440 VAC
35 AMP

FREQ (MHz)	.01	.1	1	10	100
CM INS LOSS, db		14	46	64	28
DF INS LOSS, db	12	27	47	65	28

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OKAYA ELECTRIC AMERICA, INC.

503 Wall Street, Valparaiso, IN. 46383

Ph: 219-477-4488

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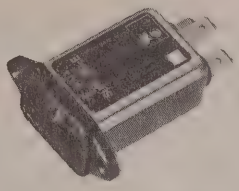
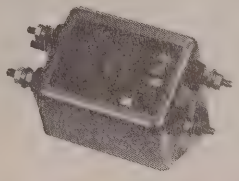
POWER LINE NOISE FILTERS

JG-SERIES



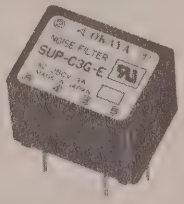
- Compact size.
- IEC input connector.
- UL 544, medical and dental equipment rating.
- Rated current from 3 amp to 15 amp at 250 VAC.
- Operating temp range from -25°C to +55°C.
- Faston and solder output terminals.
- 24 models in this series.

GH SERIES



- 20 db attenuation of 2000 V, 800 nsec pulses.
- Amorphous alloy core material.
- Bleed resistor for shock protection.
- Rated current from 5 amp to 20 amp at 250 VAC.
- Safety agency approvals: UL, CSA, VDE, SEMKO.
- Operating temperature range from -25°C to +55°C.
- Three terminal styles.

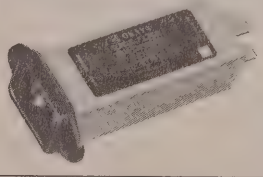
CG SERIES



- PCB mounting with wire leads.
- High attenuation in MF and HF bands.
- Compact size.
- Rated current from 2 amp to 6 amp at 250 VAC.
- Operating temperature range from -20°C to +65°C.
- Case material rated UL 94-VO.

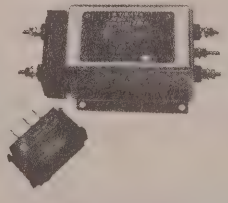
POWER LINE NOISE FILTERS WITH TVS PROTECTION

RAV-BG SERIES



- TVS protection (1000 amp 8 x 20µs wave, 500 times).
- Rated 3 or 6 amps at 250 VAC, 50/60 Hz.
- Both common and normal mode attenuation to 300 MHz.
- Operating temperature range -25°C to +65°C.
- IEC input connector.

SUP-KH WITH RAV-PWZ SURGE PROTECTOR



- EMI/RFI filter with transient voltage protection.
- Common and normal mode attenuation to 300 MHz.
- 125 VAC and 250 VAC models.
- TVS protection has line monitor indicator.
- TVS protector is replaceable.
- Rated current from 10 amps to 30 amps at 250 VAC.

TVS PROTECTION FOR POWER LINES

RAV-BWZ SERIES

- Designed specifically for use in AC powerline applications.
- Includes specially treated discharge electrodes for greatly enhanced noise immunity test and surge life.
- Optimum for the protection of single-phase power supply circuits.
- Operating temperature range -20°C to +70°C.

TVS PROTECTION FOR COMMUNICATION LINES

361LD SERIES

- Designed as surge absorbers for protection of telecommunication lines.
- Fast response time.
- Peak surge current (8/20µs) 2400 A.
- Peak surge voltage (1.2/50µs) 12 KV.

RA SERIES

- Inter-terminal capacity is extremely small, resulting in little influence on electronic circuits.
- May be used up to 300 times at 500A (8/20 µs).
- Fast response time.
- High insulation resistance (1×10^9 ohms min.)

OKAYA ELECTRIC AMERICA

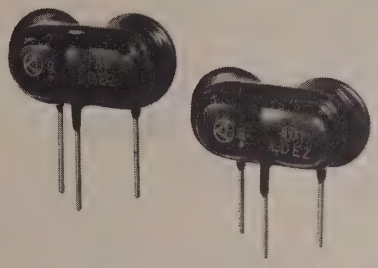
ISO 9001 CERTIFIED

ISO 9001 CERTIFIED

NEW

Low Cost And PCB Mount TVS Protection For Power Lines

SMALL SIZE



LOW COST

RAV-LDEZ

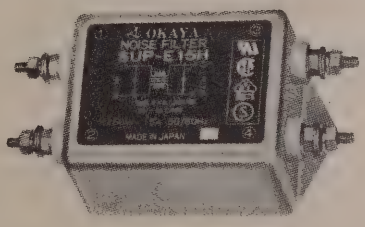
PCB MOUNT

SINGLE PHASE

RAV-BXZ-3C **RAV-BWZ-3C**

UL 544 MEDICAL FILTERS

TVSS



UL544

SUP-EH and **SUP-PH** Series
From 2Amp to 30Amp Available

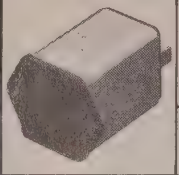
Call us about filters for powerline applications
to be used in Medical Devices

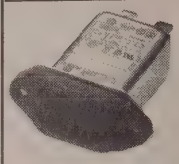
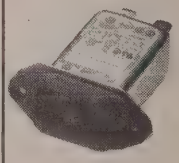
CUSTOM FILTER DESIGN AVAILABLE !

EMI/RFI POWER LINE FILTERS

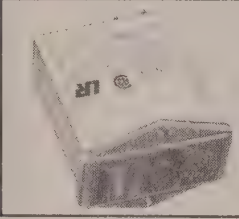
P / P C

Primary Power Components Div.
Qualtek ELECTRONICS CORPORATION

	P/N	AMP RATING	SIZE L x W x H
GENERAL PURPOSE			
	871-03/004	3	2.15 x 2.54 x 0.65
	871-05/003	5	2.54 x 2.54 x 0.79
	871-10/005	10	2.54 x 2.54 x 1.18
	871-20/008	20	3.25 x 2.77 x 1.15
	See Electrical Schematics FIG. A		
RIGHT ANGLE GENERAL PURPOSE			
	856-01/013	1	1.70 x 1.99 x 1.34
	856-03/014	3	1.70 x 1.99 x 1.34
	856-06/015	6	1.70 x 1.99 x 1.34
	856-10/016	10	1.70 x 1.99 x 1.34
	See Electrical Schematics FIG. A See Cutout Drawing STYLE 1		
FUSED GENERAL PURPOSE			
	860-02/001	2	2.54 x 1.73 x 1.29
	860-04/003	4	2.23 x 1.73 x 1.29
	860-06/005	6	2.54 x 1.73 x 1.29
	See Electrical Schematics FIG. A See Cutout Drawing STYLE 2		

	P/N	AMP RATING	SIZE L x W x H
COMPACT GENERAL PURPOSE			
	857-01/005	1	2.10 x 2.05 x 0.82
	857-03/017	3	2.10 x 2.05 x 0.82
	857-06/027	6	2.10 x 2.05 x 0.82
	857-10/033	10	2.10 x 2.05 x 0.82
	See Electrical Schematics FIG. A See Cutout Drawing STYLE 1		
HIGH PERFORMANCE			
	858-01/003	1	2.10 x 2.05 x 0.82
	858-03/007	3	2.10 x 2.05 x 0.82
	858-06/011	6	2.10 x 2.05 x 0.82
	858-10/015	10	2.10 x 2.05 x 0.82
	See Electrical Schematics FIG, A See Cutout Drawing STYLE 1		
LOW LEAKAGE MEDICAL			
	857-01/037	1	2.10 x 2.05 x 0.82
	857-03/038	3	2.10 x 2.05 x 0.82
	857-06/039	6	2.10 x 2.05 x 0.82
	857-10/040	10	2.10 x 2.05 x 0.82
	See Electrical Schematics FIG. B See Cutout Drawing STYLE 1		

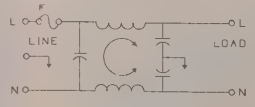
MULTI-FUNCTION MODULE

	864-03/001 864-06/005 864-10/009	3 6 10	3.51 x 2.58 x 1.99 3.51 x 2.58 x 1.99 3.51 x 2.58 x 1.99	Double Fuse Holder, Voltage Selector Switch, Double Pole Power Switch, IEC Connector Fuses - IEC 5 x 20mm or 3AG 6.3 x 32mm
	864-03/003 864-06/007 864-10/011	3 6 10	3.51 x 2.58 x 1.99 3.51 x 2.58 x 1.99 3.51 x 2.58 x 1.99	Single Fuse Holder, Voltage Selector Switch, Double Pole Power Switch, IEC Connector Fuse - IEC 5 x 20mm or 3AG 6.3 x 32mm
	See Electrical Schematics FIG. C			See Cutout Drawing STYLE 3

NOTE: Engineering Drawings and Insertion Loss Characteristics Available Upon Request.

ELECTRICAL SCHEMATICS

FIG. A



FUSE FOR 860 SERIES ONLY

FIG. B

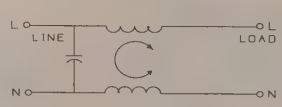
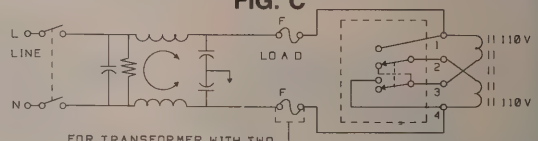


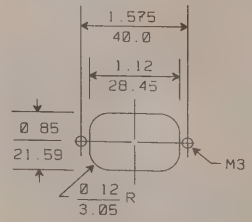
FIG. C



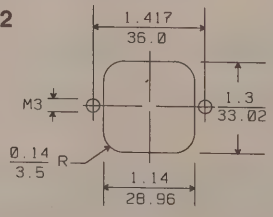
FOR TRANSFORMER WITH TWO SEPARATE WINDINGS — SINGLE FUSE — TRANSFORMER NOT INCLUDED

CUTOUT DRAWINGS

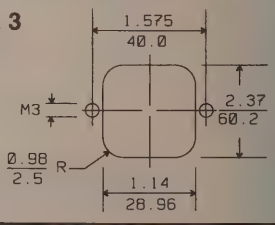
STYLE 1



STYLE 2



STYLE 3



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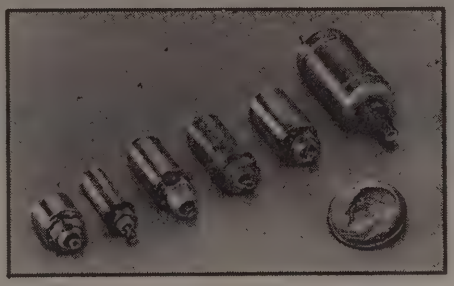

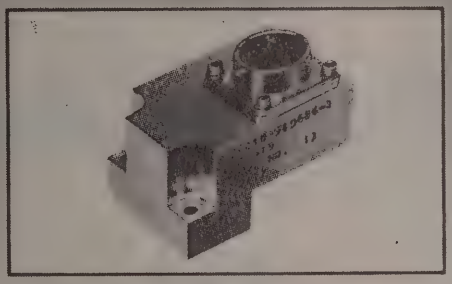

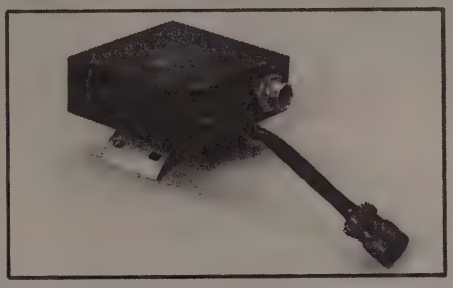

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FILTERS WITH IEC CONNECTORS

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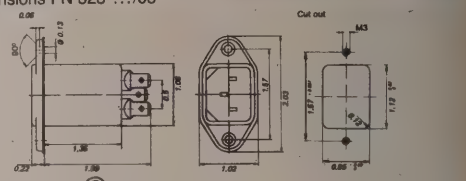
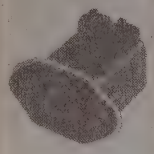
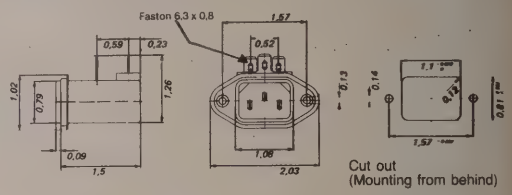
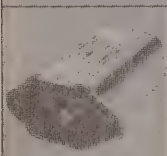
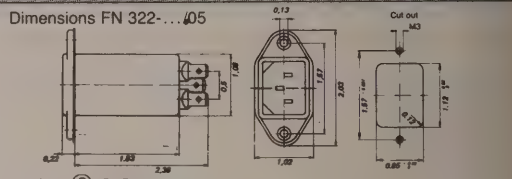
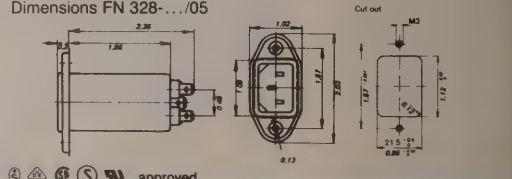
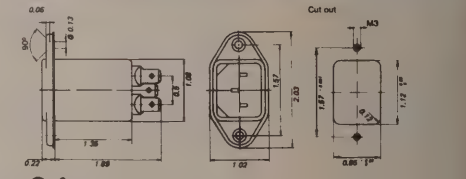
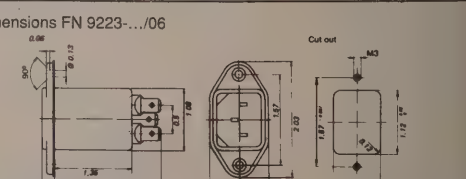
FILTER SERIES	FEATURES	FILTER NO.	AMPS	TERMINAL STYLE	DIMENSIONS/CUT OUT
FN 323	Power line filter Compact design	FN 323- 1/01 FN 323- 1/05 FN 323- 3/01 FN 323- 3/05 FN 323- 6/01 FN 323- 6/05 FN 323-10/01 FN 323-10/05	1 1 3 3 6 6 10 10	soldering lug fast-on soldering lug fast-on soldering lug fast-on soldering lug fast-on	Dimensions FN 323-.../05  approved FN 323-10 only approved
 FN 326	Power line filter with right angle output	FN 326- 1/02 FN 326- 1/06 FN 326- 1/07 FN 326- 3/02 FN 326- 3/06 FN 326- 3/07 FN 326- 6/02 FN 326- 6/06 FN 326- 6/07 FN 326-10/06 FN 326-10/07	1 1 1 3 3 3 6 6 6 10 10	for printed circuit soldering lug wires for printed circuit soldering lug wires for printed circuit soldering lug wires soldering lug wires	Dimensions FN 326-.../06  Cut out (Mounting from behind) approved/02 approved/FN 326 10 only approved

Comments: The FN 323 and 326 series of filters are intended for general purpose applications where average performance over a wide-frequency range is required. They are moderate in cost and extremely compact in design. The FN 323 and FN 326 series are available in low leakage versions for medical applications.

 FN 322	Power line filter for normal applications	FN 322- 1/01 FN 322- 1/05 FN 322- 3/01 FN 322- 3/05 FN 322- 6/01 FN 322- 6/05 FN 322-10/01 FN 322-10/05	1 1 3 3 6 6 10 10	soldering lug fast-on soldering lug fast-on soldering lug fast-on soldering lug fast-on	Dimensions FN 322-.../05  approved
FN 328	Power line filter for normal applications with earth line choke	FN 328- 1/01 FN 328- 1/05 FN 328- 3/01 FN 328- 3/05 FN 328- 6/01 FN 328- 6/05	1 1 3 3 6 6	soldering lug fast-on soldering lug fast-on soldering lug fast-on	Dimensions FN 328-.../05  approved

Comments: The FN 322 series is a family of filters featuring higher insertion loss than the FN 323 series. The 322 series is available in low leakage versions for medical applications.

In addition to these features the FN 328 provides an earth line choke. This can significantly improve your equipment's performance.

FN 223	Low Cost Compact Design	FN 223- 1/06 FN 223- 3/06 FN 223- 6/06	1 3 6	soldering lug/ fast-on	Dimensions FN 223-.../06  approved
FN 9223	Low Cost Compact Design IEC 950	FN 9223- 1/06 FN 9223- 3/06 FN 9223- 6/06	1 3 6	soldering lug/ fast-on	Dimensions FN 9223-.../06  IEC 950 approved

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POWER ENTRY MODULE SERIES

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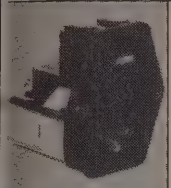
FILTER SERIES	FILTER NO.	AMPS	FUSE(S)	MOUNTING
 **FN 370**	FN 370-2/__ __	2	1	snap
	FN 370-4/__ __	4	1	snap
	FN 370-6/__ __	6	1	snap
	FN 372-2/__ __	2	2	snap
	FN 372-4/__ __	4	2	snap
	FN 372-6/__ __	6	2	snap
	FN 376-2/__ __	2	1	screw
	FN 376-4/__ __	4	1	screw
	FN 376-6/__ __	6	1	screw
	FN 378-2/__ __	2	2	screw
	FN 378-4/__ __	4	2	screw
	FN 378-6/__ __	6	2	screw
	FN 377-2/__ __	2	1	screw
	FN 377-4/__ __	4	1	screw
	FN 377-6/__ __	6	1	screw
	FN 379-2/__ __	2	2	screw
	FN 379-4/__ __	4	2	screw
	FN 379-6/__ __	6	2	screw

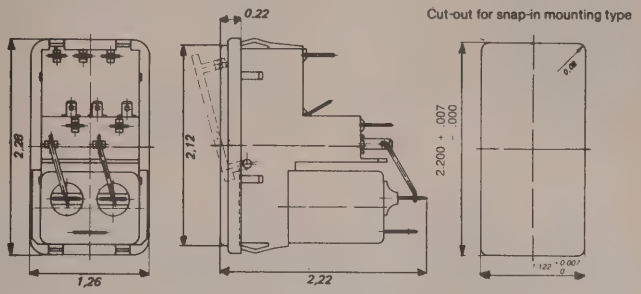
FEATURES

Power line filter with fuses and voltage selector

1 = Fuseholder European (DIN) style (5 x 20mm)
2 = Fuseholder US style (3 AG)

1 = Series Series 110, 220, 240V
2 = Series/Parallel 100, 120, 220, 240V
3 = Series/Parallel 115 230V

Dimensions for FN 370 Series (snap in version)
(For dimensions of screw mounting version see FN 380)



approved

Comments: The FN 370 combi filter line protects electronic equipment from common and differential mode line interference in the range of 150 kHz to 300 Mhz. It is especially suitable for use in equipment intended for world wide export. The voltage selector is designed for two, three or four different voltages. There are also FN 370 filters for medical devices available. The FN 377 and 379 provide higher performance in attenuation.

FN 380	FN 380-2/__ __	2	1	snap
	FN 380-4/__ __	4	1	snap
	FN 380-6/__ __	6	1	snap
	FN 382-2/__ __	2	2	snap
	FN 382-4/__ __	4	2	snap
	FN 382-6/__ __	6	2	snap
	FN 386-2/__ __	2	1	screw
	FN 386-4/__ __	4	1	screw
	FN 386-6/__ __	6	1	screw
	FN 388-2/__ __	2	2	screw
	FN 388-4/__ __	4	2	screw
	FN 388-6/__ __	6	2	screw
	FN 387-2/__ __	2	1	screw
	FN 387-4/__ __	4	1	screw
	FN 387-6/__ __	6	1	screw
	FN 389-2/__ __	2	2	screw
	FN 389-4/__ __	4	2	screw
	FN 389-6/__ __	6	2	screw

FEATURES

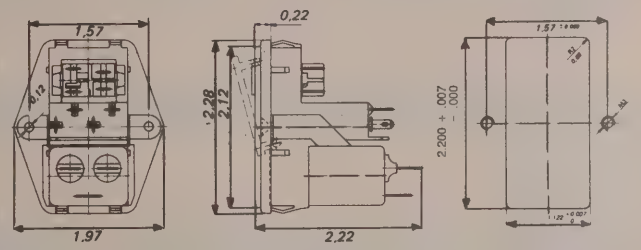
Power line filter with fuses and power switch

1 = Fuseholder European (DIN) style (5 x 20mm)
2 = Fuseholder US style (3 AG)

1 Pole rocker switch
2 Pole rocker switch

Dimensions for FN 380 Series (screw mounting version)
(For dimensions of snap in version see FN 370)

Cut-out for screw mounting type



approved

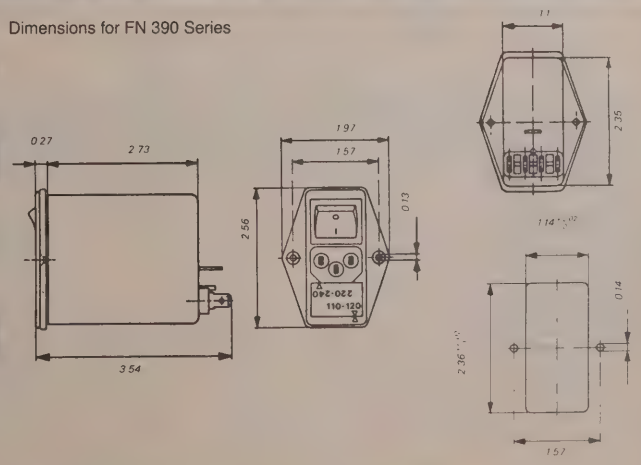
Comments: The space-saving, low-cost FN 380 line of combi filters is suitable for use in electric and electronic equipment. The FN 387 and 389 provide higher performance in attenuation. A version without y capacitors is available for medical devices.

FN 390	FN 393-1 /05	1	1	screw
	FN 393-2.5/05	2.5	1	screw
	FN 393-6 /05	6	1	screw
	FN 394-1 /05	1	2	screw
	FN 394-2.5/05	2.5	2	screw
	FN 394-6 /05	6	2	screw
	With earth line choke			
	FN 393E-1 /05	1	1	screw
	FN 393E-2.5/05	2.5	1	screw
	FN 393E-6 /05	6	1	screw
	FN 394E-1 /05	1	2	screw
	FN 394E-2.5/05	2.5	2	screw
	FN 394E-6 /05	6	2	screw
	High performance filter			
	FN 1393-1 /05	1	1	screw
	FN 1393-2.5/05	2.5	1	screw
	FN 1393-6 /05	6	1	screw
	FN 1393-10 /05	10	1	screw
	FN 1394-1 /05	1	2	screw
	FN 1394-2.5/05	2.5	2	screw
	FN 1394-6 /05	6	2	screw

FEATURES

Power line filter with on/off switch and voltage selector

Dimensions for FN 390 Series



approved

Comments: The FN 390 series of filtered power entry modules is available in three performance levels. Standard versions incorporate IEC connectors, 2-pole rocker switches and universal voltage selector/fuse drawers.

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FILTERS FOR CHASSIS MOUNTING

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FILTER SERIES	FILTER NO.	AMPS	TERMINAL STYLE
FN 610	FN 610- 1/06	1	soldering lug/fast-on
	FN 610- 1/07	1	wires
	FN 610- 3/06	3	soldering lug/fast-on
	FN 610- 3/07	3	wires
	FN 610- 6/06	6	soldering lug/fast-on
	FN 610- 6/07	6	wires
	FN 610-10/06	10	soldering lug/fast-on
	FN 610-10/07	10	wires
	FN 610-20/06	20	soldering lug/fast-on
	FN 610-30/03	30	clamp terminal
	FN 610-30/10	30	screw UNC 8-32

FEATURES

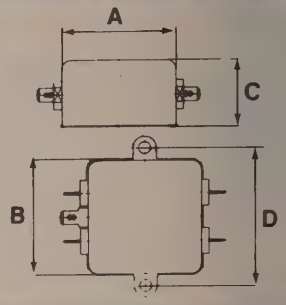
General purpose power line filter

DIMENSIONS/CUT OUT

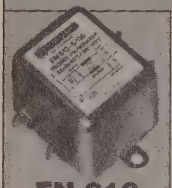
Case Dimensions FN 610 Series

Part Number / Dimensions (inches)	A	B	C	D
FN 610-1/06	1.29	1.73	.75	2.13
FN 610-3/06	1.29	1.73	.75	2.13
FN 610-6/06	1.29	1.73	.75	2.13
FN 610-10/06	1.29	1.73	1.14	2.13
FN 610-20/06	2.0	2.0	1.14	2.4
FN 610-30/03	3.92	3.33	1.50	3.74

approved



Comments: The FN 610 series of general purpose filters has been designed to be effective in a wide variety of applications with attenuations from 150 kHz to 300 Mhz. It is available in medical versions with reduced capacitance to ground. (Very low leakage current).

FILTER SERIES	FILTER NO.	AMPS	TERMINAL STYLE
 FN 612	FN 612- 1/06	1	soldering lug/fast-on
	FN 612- 1/07	1	wires
	FN 612- 3/06	3	soldering lug/fast-on
	FN 612- 3/07	3	wires
	FN 612- 6/06	6	soldering lug/fast-on
	FN 612- 6/07	6	wires
	FN 612-10/06	10	soldering lug/fast-on
	FN 612-10/07	10	wires
	FN 612-20/03	20	clamp terminals
	FN 612-20/06	20	soldering lug/fast-on
	FN 612-20/10	20	screw UNC 8-32
	FN 612-30/03	30	clamp terminal
	FN 612-30/10	30	screw UNC 8-32

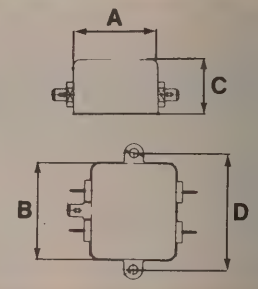
FEATURES

General purpose power line filter

Case Dimensions FN 612 Series

Part Number / Dimensions (inches)	A	B	C	D
FN 612-1/06	1.77	2.00	.87	2.4
FN 612-3/06	1.77	2.00	1.14	2.4
FN 612-6/06	1.77	2.00	1.14	2.4
FN 612-10/06	1.77	2.00	1.14	2.4
FN 612-20/06	2.05	2.64	1.57	2.95
FN 612-30/03	3.92	3.33	1.50	3.74

approved



Comments: The FN 612 series is a higher performance single stage filter as compared to the 610 series. The 612 features increased capacitance therefore higher insertion loss in the differential mode.

FILTER SERIES	FILTER NO.	AMPS	TERMINAL STYLE
FN 660	FN 660- 1/06	1	soldering lug/fast-on
	FN 660- 1/07	1	wires
	FN 660- 3/06	3	soldering lug/fast-on
	FN 660- 3/07	3	wires
	FN 660- 6/06	6	soldering lug/fast-on
	FN 660- 6/07	6	wires
	FN 660-10/06	10	soldering lug/fast-on
	FN 660-10/07	10	wires
	FN 660-16/03	16	clamp terminals
	FN 660-16/06	16	soldering lug/fast-on
	FN 660-16/10	16	screw UNC 8-32
	FN 660-20/03	20	clamp terminal
	FN 660-20/06	20	soldering lug/fast-on
	FN 660-20/10	20	screw UNC 8-32

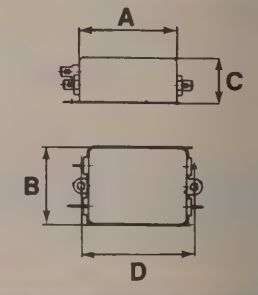
FEATURES

Power line filter with high attenuation

Case Dimensions FN 660 Series

Part Number / Dimensions (inches)	A	B	C	D
FN 660-1/06	2.0	1.77	1.14	2.4
FN 660-3/06	2.63	2.04	1.18	2.95
FN 660-6/06	2.63	2.04	1.18	2.95
FN 660-10/06	2.63	2.04	1.57	2.95
FN 660-16/06	2.63	2.04	1.57	2.95
FN 660-20/06	3.92	3.32	1.49	3.74

approved



Comments: The FN 660 series of two-stage filters has been designed to provide significantly higher performance than is possible with a single stage filter.

FILTER SERIES	FILTER NO.	AMPS	TERMINAL STYLE
FN 670	FN 670- 1.8/06	1.8	soldering lug/fast-on
	FN 670- 1.8/07	1.8	wires
	FN 670- 3 /06	3	soldering lug/fast-on
	FN 670- 3 /07	3	wires
	FN 670- 6 /06	6	soldering lug/fast-on
	FN 670- 6 /06C	6	soldering lug/fast-on
	FN 670- 6 /07	6	wires
	FN 670- 6 /07C	6	wires
	FN 670-10 /06	10	soldering lug/fast-on
	FN 670-10 /06C	10	soldering lug/fast-on
	FN 670-10 /07	10	wires
	FN 670-10 /07C	10	wires

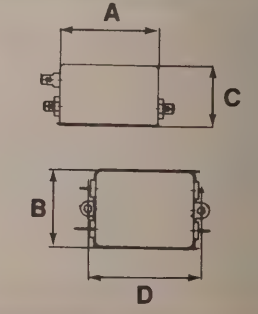
FEATURES

Power line filter for wideband interference suppression

Case Dimensions FN 670 Series

Part Number / Dimensions (inches)	A	B	C	D
FN 670-1.8/06	2.63	2.04	1.57	2.95
FN 670-3/06	2.63	2.04	1.57	2.95
FN 670-6/06	2.63	2.04	1.57	2.95
FN 670-6/06C	5.23	2.00	1.77	5.62
FN 670-10/06	3.92	3.32	1.49	3.74
FN 670-10/06C	5.23	2.00	1.77	5.62

approved



Comments: The FN 670 series of two stage filters has been designed specifically for use with switch mode power supplies. It has been designed for extremely low leakage current (less than half a milliamp). Therefore, it will not be affected by the high peak current which results from switching power supplies.

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FILTERS FOR CHASSIS MOUNTING

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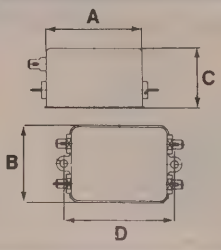
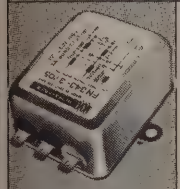
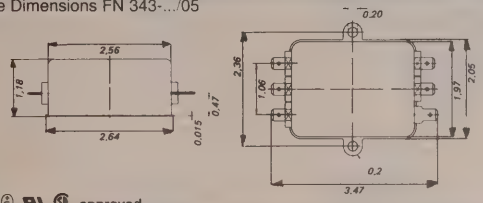
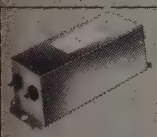
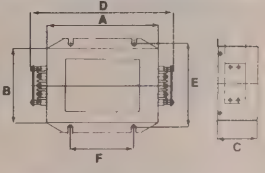
FILTER SERIES	FEATURES	FILTER NO.	AMPS	TERMINAL STYLE	DIMENSIONS/CUT OUT
FN 680 FN 682	Line filters for switching mode power supplies	FN 680- 1 /06 FN 680- 1 /07 FN 680- 2.5/06 FN 680- 2.5/07 FN 682- 4 /06 FN 682- 4 /07 FN 682- 6.5/06 FN 682- 6.5/07 FN 682-10 /06 FN 682-10 /07	1 1 2.5 2.5 4 4 6.5 6.5 10 10	soldering lug/fast-on wires soldering lug/fast-on wires soldering lug/fast-on wires soldering lug/fast-on wires soldering lug/fast-on wires	Case Dimensions FN 680/FN 682 Part Number / Dimensions (inches): A 2.00, B 2.01, C 1.14, D 2.4 FN 680-2.5/06: A 2.56, B 2.05, C 1.57, D 2.95 FN 682-4/06: A 2.56, B 2.05, C 1.57, D 2.95 FN 682-6.5/06: A 3.88, B 3.33, C 1.5, D 3.74 FN 682-10/06: A 3.88, B 3.33, C 2.23, D 3.74 approved 

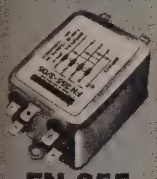
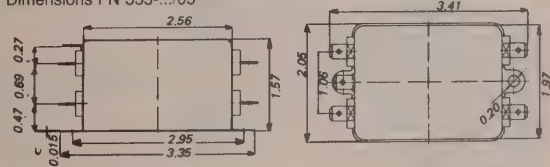
Comments: The FN 680 series of two stage high performance filters has been designed specifically to meet the requirements of VDE class B, which extends down to 10 kHz. These filters have no resonances above 20 kHz, and are especially effective against the switching transients which occur from switch mode power supplies.

FILTER SERIES	FEATURES	FILTER NO.	AMPS	TERMINAL STYLE	DIMENSIONS/CUT OUT
 **FN 343**	Power line filter with earth line choke	FN 343- 1/01 FN 343- 1/05 FN 343- 3/01 FN 343- 3/05 FN 343- 6/01 FN 343- 6/05 FN 343-10/05 FN 343-10/01	1 1 3 3 6 6 10 10	soldering lug fast-on soldering lug fast-on soldering lug fast-on soldering lug fast-on	Case Dimensions FN 343-.../05  approved

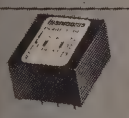
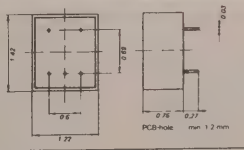
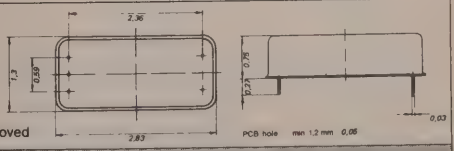
Comments: The FN 343 is a two stage filter whose excellent performance is primarily due to the additional earth line choke in ground lead. This gives dramatically improved performance in the common mode as compared to that of a similar filter without an earth line choke.

FILTER SERIES	FEATURES	FILTER NO.	AMPS	TERMINAL STYLE	DIMENSIONS/CUT OUT
 **FN 352Z FN 353Z**	Power line filter with high attenuation and surge voltage protection	FN 352Z-10/03 FN 352Z-20/03 FN 353Z-30/03	10 20 30	screw screw screw	Case Dimensions FN 352Z/FN 353Z Part Number / Dimensions (inches): A 5.9, B 3.93, C 2.16, D 7.68, E 4.4, F 3.35 FN 352Z-20 03: A 7.87, B 4.72, C 2.56, D 9.84, E 5.31, F 4.53 FN 353Z-30 03: A 7.87, B 4.72, C 2.56, D 9.84, E 5.31, F 4.53 approved 

Comments: The FN 352Z series of filters have been designed for extremely high performance. They provide the greatest maximum protection for electronic equipment. The three stage filters feature both differential and common mode chokes, as well as a varistor to attenuate transient voltage surges on the power line.

FILTER SERIES	FEATURES	FILTER NO.	AMPS	TERMINAL STYLE	DIMENSIONS/CUT OUT
 **FN 355**	3 phase power line filter	FB 355- 3/01 FN 355- 3/05 FN 355- 6/01 FN 355- 6/05 FN 355-10/01 FN 355-10/05 FN 355-20/03	3 3 6 6 10 10 20	soldering lug fast-on soldering lug fast-on soldering lug fast-on clamp terminal	Dimensions FN 355-.../05  approved

Comments: The FN 355 series of filters are three-phase filters designed for moderate performance. This filter is available with four lines and may be used for either a "y" or delta configuration.

FILTER SERIES	FEATURES	FILTER NO.	AMPS	TERMINAL STYLE	DIMENSIONS/CUT OUT
 **FN 405**	Power line filter for PCB mounting	FN 405-0.5/02 FN 405-1 /02 FN 405-3 /02 FN 405-6 /02	0.5 1 3 6	Pins 0.8 x 0.8 mm For printed circuit boards	Dimensions FN 405 Series  approved
FN 410	Power line filter for PCB mounting	FN 410-0.5/02 FN 410-1 /02 FN 410-3 /02 FN 410-6 /02	0.5 1 3 6	Pins 0.8 x 0.8 mm For printed circuit boards	Dimensions FN 410 Series  approved

Comments: The FN 405 and 410 filter series protect electronic circuits against malfunction of power line interference. This series is suitable for mounting onto the printed circuit boards of all electronic equipment.

SCHAFFNER
Schaffner EMC Inc.
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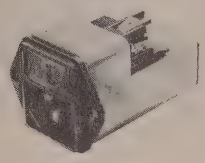
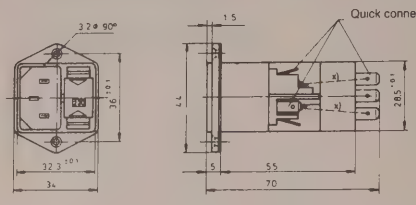
POWER ENTRY MODULES WITH RFI FILTER • CS Australia

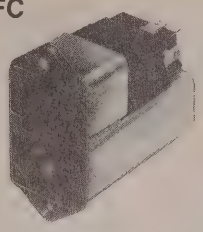
KFA ≙ AC Power Connector with 1 or 2 pole fuseholder and optional voltage selector. KFC, CD ≙ AC Power Connector with 1 or 2 pole fuseholder for 5×20mm or ¼×1¼" fuses and optional 2-3 position voltage selector (up to 4 pos. for the CD). CD includes integral or remote on/off switch.

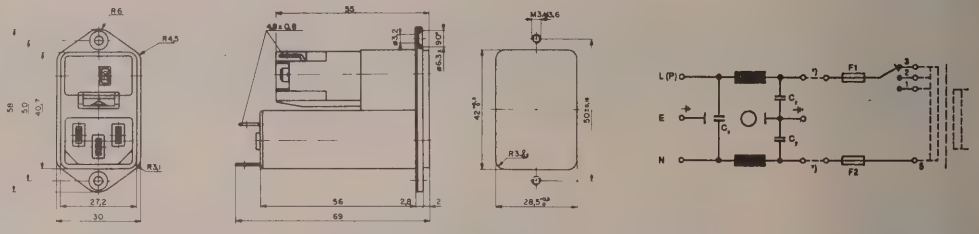
KFA with voltage selector



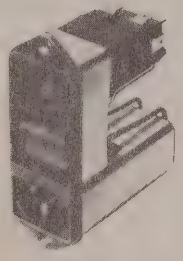


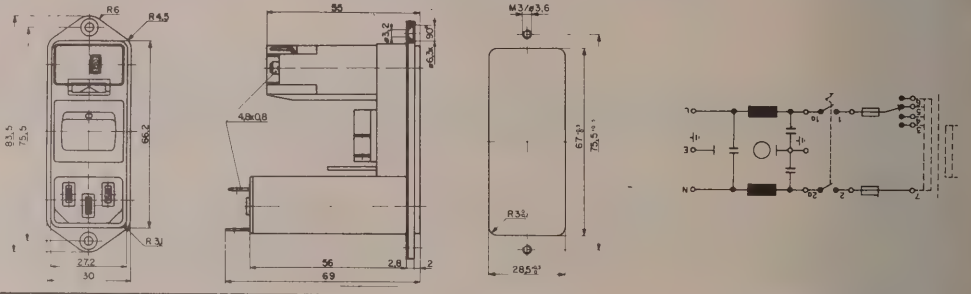
KFC



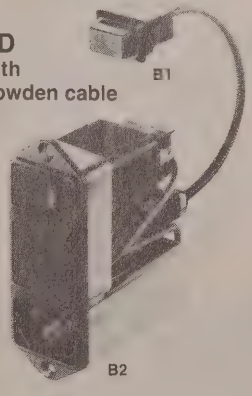


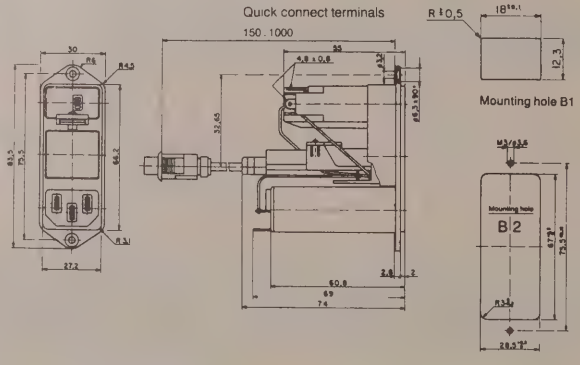
CD



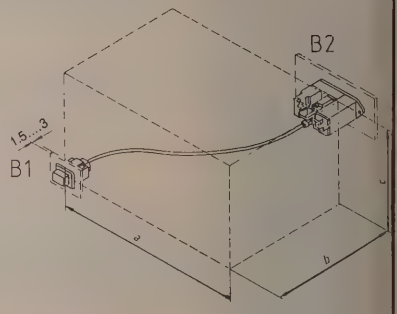


CD with Bowden cable





Mounting



KFA, KFC, CD Order Numbers (Casing, fusedrawer, and Bowden cable ordered separately)

Casings, 2-pole, standard or low-leakage (medical) filters		
<0.5mA @ 250V/50Hz	<5µA @ 250V/50Hz	I_N(A)
KFA 4301.5041	KFA 4301.5241	1
KFA 4301.5042	KFA 4301.5243	2
KFA 4301.5043	KFA 4301.5245	4
KFA 4301.5044	KFA 4301.5247	6
KFC 4303.5021	KFC 4303.5221	1
KFC 4303.5022	KFC 4303.5223	2
KFC 4303.5023	KFC 4303.5225	4
KFC 4303.5024	KFC 4303.5227	6
CD 14.4101.151	CDG4.4101.151	1
CD 24.4101.151	CDA4.4101.151	2
CD 34.4101.151	CDC4.4101.151	4
CD 44.4101.151	CDE4.4101.151	6
CD with Bowden cable		
CD 14.4199.151	CDG4.4199.151	1
CD 24.4199.151	CDA4.4199.151	2
CD 34.4199.151	CDC4.4199.151	4
CD 44.4199.151	CDE4.4199.151	6

Fusedrawers

KFA, with voltage selector for 5×20mm fuses, markings 110, 150, 220		KFA, without voltage selector for 5×20mm fuses		Standard	Medical (IEC 601-1 VDE 0750-1)
2-pole	2-pole with shorting bar	2-pole	2-pole with shorting bar		
4301.1014.01	4301.3536.01	4301.1401	4301.1413	•	
4301.1024.01	4301.3537.01	4301.1403	4301.1415		•
KFC, CD w/voltage selector markings 100, 120, 220, 240 for 5×20mm fuses		KFC, CD without voltage selector for 5×20mm fuses			
2-pole	2-pole with shorting bar	2-pole	2-pole with shorting bar		
4303.2014.01	4303.2036.01	4303.2401	4303.2411	•	
4303.2024.01	4303.2037.01	4303.2403	4303.2413		•
KFC, CD w/voltage selector markings 100, 120, 220, 240 for ¼×1¼" fuses		KFC, CD without voltage selector for ¼×1¼" fuses			
2-pole	2-pole with shorting bar	2-pole	2-pole with shorting bar		
4303.2714.01	4303.2736.01	4303.2902	4303.2912	•	
4303.2724.01	4303.2737.01	4303.2904	4303.2914		•

BOWDEN CABLE

886.0101	Standard cable <500mm	886.xxxx Custom cable (Note: for optimum actuation, specify according to guidelines in full-line catalog)
886.0501	Standard cable >500mm	

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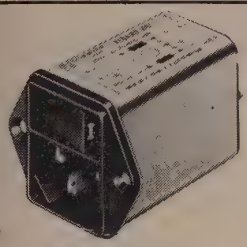
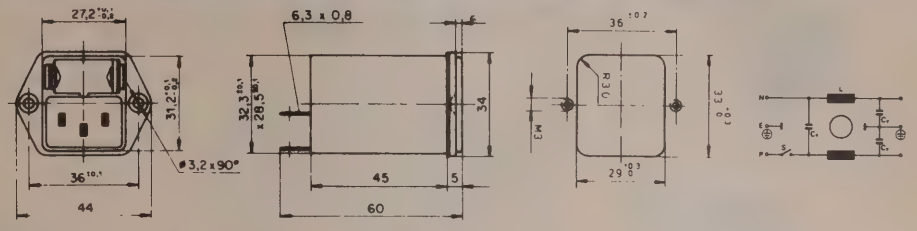
POWER ENTRY MODULES WITH RFI FILTER • CS Australia

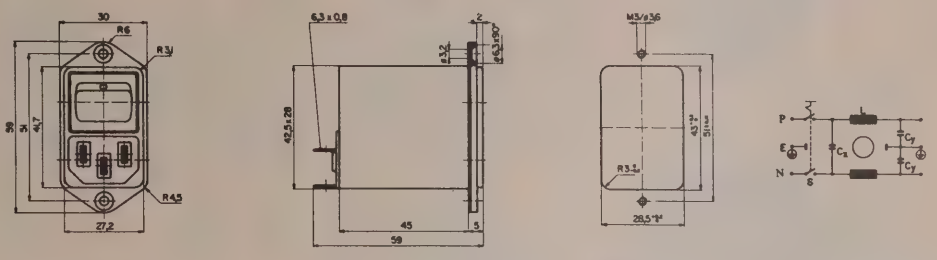
KFB ≙ AC Power Connector with 1 or 2 pole switch. Optional 125V or 250V red or green lighted switch. CE, CG ≙ AC Power Connector with 1 or 2 pole fuseholder for 5×20mm or ¼×1¼" fuses and optional 2-4 position series-parallel voltage selector. CG includes integral or remote on/off switch.

KFB 1-pole

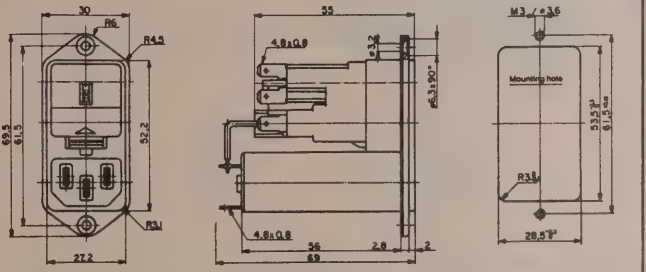




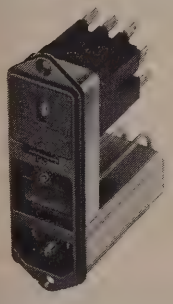
KFB 2-pole

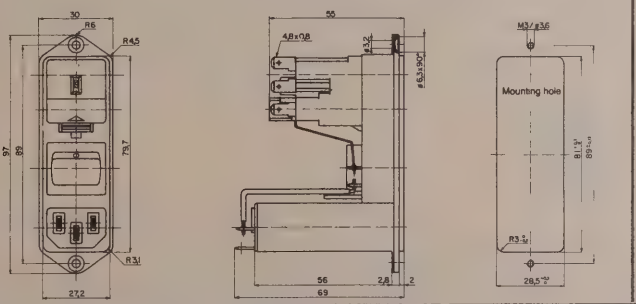


CE

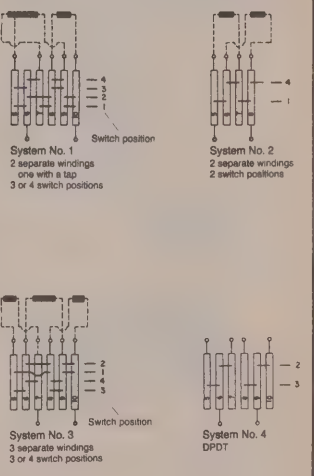


CG





VOLTAGE SELECTOR SYSTEMS



KFB Order Numbers

KFB 1-Pole <0.5mA @ 250v/50Hz Unlighted	<0.5mA @ 250v/50Hz red 125V	<0.5mA @ 250v/50Hz red 250V	I_N(A)	KFB 2-pole, standard filters <0.5mA @ 250v/50Hz Unlighted	<0.5mA @ 250v/50Hz red 125-250V	KFB 2-pole, low-leakage medical filters <5µA @ 250v/50Hz Unlighted	I_N(A)
KFB4302.5001	KFB4302.5031	KFB4302.5011	1	KFB4302.5311	Part	KFB4302.5331	1
KFB4302.5002	KFB4302.5032	KFB4302.5012	2	KFB4302.5312	Numbers	KFB4302 5333	2
KFB4302.5003	KFB4302.5033	KFB4302.5013	4	KFB4302.5313	Available	KFB4302.5335	4
KFB4302.5004	KFB4302.5034	KFB4302.5014	6	KFB4302.5314	On Request	KFB4302.5337	6

CE, CG Order Numbers (Casing, Fusedrawer, and voltage selector insert ordered separately)

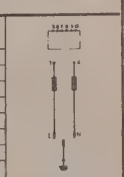
CE casings, standard filter <0.5mA @ 250V/50Hz 1-pole	2-pole	CE casings, low-leakage medical filter <5µA @ 250V/50Hz 2-pole	I_N(A)	CG casings, standard filter <0.5mA @ 250V/50Hz 1-pole	2-pole	CG casings, low-leakage medical filter <5µA @ 250V/50Hz 2-pole	I_N(A)
CE16.5100.151	CE10.6100.151	CEG0.6100.151	1	CG16.5101.151	CG10.6101.151	CGG0.6101.151	1
CE26.5100.151	CE20.6100.151	CEA0.6100.151	2	CG26.5101.151	CG20.6101.151	CGA0.6101.151	2
CE36.5100.151	CE30.6100.151	CEC0.6100.151	4	CG36.5101.151	CG30.6101.151	CGC0.6101.151	4
CE46.5100.151	CE40.6100.151	CEE0.6100.151	6	CG46.5101.151	CG40.6101.151	CGE0.6101.151	6

Fusedrawers

For 5×20mm fuses 1-pole black	2-pole black	2-pole black with shorting bar in the neutral side
4305.0006	4305.0001	4305.0021
For ¼×1¼" fuses		
1-pole grey	2-pole grey	2-pole grey with shorting bar in the neutral side
4305.0017	4305.0012	4305.0027

Voltage Selector Inserts

Order No.	System No.	Voltage Markings/Switch position 1	2	3	4
4305.0048.00	1,2	Without Markings			
4305.0048.01	1	100	120	220	240
4305.0048.03	2	110			220
4305.0048.05	2	115			230
4305.0050.00	3	Without Markings			
4305 0050.02	3	130	110	240	220
4305.0050.06	3	150	110		220
4305.0049.00	4	Without Markings			



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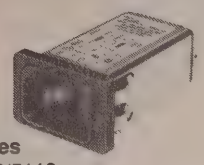
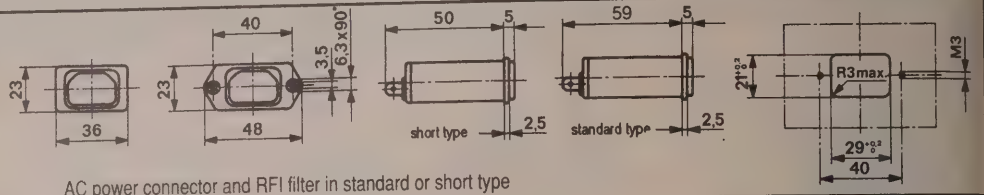
POWER ENTRY MODULES WITH RFI FILTER • ISO 9001 Quality certified

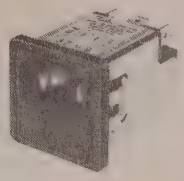
Series 5100/5110

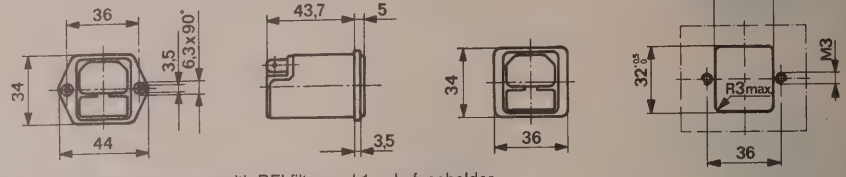




AC power connector and RFI filter in standard or short type

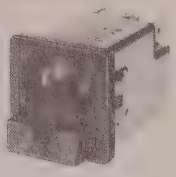
Series 5200

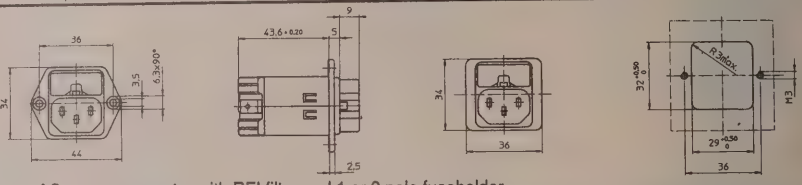




AC power connector with RFI filter and 1 pole fuseholder

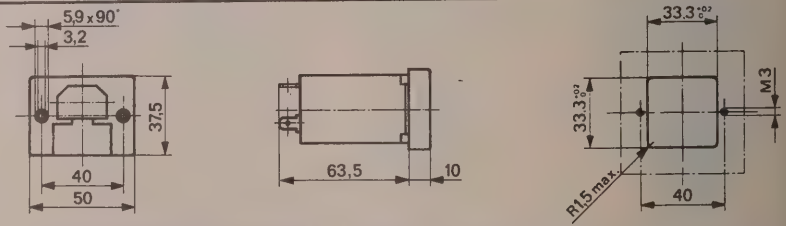
Series 5220



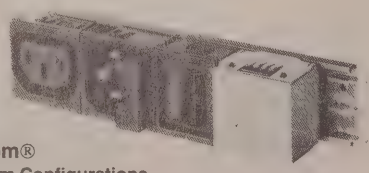


AC power connector with RFI filter and 1 or 2 pole fuseholder

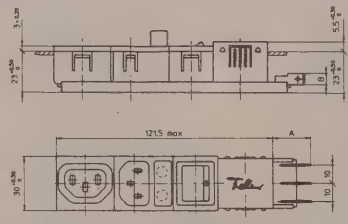
Series 8843



AC power connector with RFI filter and 2 pole fuseholder for 5 x 20 mm or 1/4 x 1-1/4" fuses



Felcom®
Custom Configurations
Available: AC inlet, outlet, 1 or 2 pole fuseholder, DPST switch, RFI filter



(l x w = 121.6+0.2 x 27.6+0.2)

A = 13.4 mm for solder terminals
17.0 mm for quick disconnect

Series 5100, 5110 Order Numbers

5100 (< 0.5 mA leakage current)		With low leakage medical filters (< 5 µA)			5110 (short type, < 0.5 mA leakage)		With low leakage medical filters (< 5 µA)		
Screw-on	Snap-in 0.8-3.0mm	Screw-on	Snap-in 0.8-3.0mm	I_N(A)	Screw-on	Snap-in 0.8-3.0mm	Screw-on	Snap-in 0.8-3.0mm	I_N(A)
5100.0133.1	5100.0143.1	5100.0133.3	5100.0143.3	1	5110.0133.1	5110.0143.1	5110.0133.3	5110.0143.3	1
5100.0233.1	5100.0243.1	5100.0233.3	5100.0243.3	2	5110.0333.1	5110.0343.1	5110.0333.3	5110.0343.3	3
5100.0433.1	5100.0443.1	5100.0433.3	5100.0443.3	4	5110.0633.1	5110.0643.1	5110.0633.3	5110.0643.3	6
5100.0633.1	5100.0643.1	5100.0633.3	5100.0643.3	6	5110.1033.1	5110.1043.1	5110.1033.3	5110.1043.3	10

Series 5200, 5220 Order Numbers. See EEM section 4300 for Schurter fuses.

5200 (< 0.5 mA leakage current)		With low leakage medical filters (< 5 µA)			5220 (< 0.5 mA leakage current)		With low leakage medical filters (< 5 µA)		
Screw-on	Snap-in 0.8-3.0mm	Screw-on	Snap-in 0.8-3.0mm	I_N(A)	Screw-on	Snap-in 0.8-3.0mm	Screw-on	Snap-in 0.8-3.0mm	I_N(A)
5200.0123.1	5200.0143.1	5200.0123.3	5200.0143.3	1	5220.0123.1	5220.0143.1	5220.0123.3	5220.0143.3	1
5200.0223.1	5200.0243.1	5200.0223.3	5200.0243.3	2	5220.0223.1	5220.0243.1	5220.0223.3	5220.0243.3	2
5200.0423.1	5200.0443.1	5200.0423.3	5200.0443.3	4	5220.0423.1	5220.0443.1	5220.0423.3	5220.0443.3	4
5200.0623.1	5200.0643.1	5200.0623.3	5200.0643.3	6	5220.0623.1	5220.0643.1	5220.0623.3	5220.0643.3	6

Series 8843 Order Numbers (casing & fuseholders ordered separately)

Casing (< 0.5 mA leakage current)	I_N(A)	Fuseholders (see EEM section 4300 for Schurter fuses)
8843.8123.1	1	8843.0901 for 1/4 x 1-1/4" fuses (6.3 x 32 mm)
8843.8323.1	3	
8843.8623.1	6	8843.0902 for 5 x 20 mm fuses
8843.8923.1	10	

FELCOM ® Order Numbers For Custom Configurations (1A-6A available)

5411.1#5Δ.••1	Appliance plug connector, fuseholder, power line filter (1A)
5421.205Δ.••1	Appliance plug connector, appliance outlet, power line filter (2A)
5423.4#5Δ.••1	Appliance plug connector, fuseholder, appliance outlet, power line filter (4A)
5424.6#5Δ.••1	Appliance plug connector, fuseholder, switch, power line filter (6A)
5431.105Δ.••1	Appliance plug connector, switch, appliance outlet, power line filter (1A)
5432.4#5Δ.••1	Appliance plug connector, fuseholder, switch, appliance outlet, power line filter (4A)

(see our full-line catalog for a complete list of available part numbers)

Order Number Key:
=1 fuse 5 x 20 mm
=2 2 fuses 5 x 20 mm
Δ=1 solder terminals 3.5 x 0.8 mm
Δ=3 quick disconnect 6.3 x 0.8 mm
•• = panel thickness: 1.0, 1.2, 1.5, 2.0, 2.5, 3.0 mm

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TAMURA COMMON MODE COILS FOR AC LINE & EMI/RFI FILTERING, 0.1 to 50MHz.

FEATURES

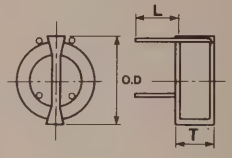
- Rated Voltage: 250VAC, 50/60 Hz.
- Rated Current: Spec'd at max. temp. rise.
- Insulation Resistance: 100 Megohms, 500VDC.
- Direct Current Resistance (DCR): Spec'd per line, input to output.
- Dielectric Voltage: 1.5kVAC (line to gnd); 2.0kVAC, CMF Series.
- Temperature Rise: ≤30˚C, CMT; ≤55˚C, CMF.
- Operating Temperature: -25˚C to +85˚C, CMT; -25˚ C to +60 ˚C, CMF.
- Creepage Distance: 3.2mm min., CMF series.

COMMON MODE NOISE FILTERING COILS

MODEL NO.	INDUCTANCE		DCR	DIA	PRICE (qty)		
	AMPS	mH min	(Ω)	mm	1-9	10-24	25-99
CMT-01102	1.0	2	0.25	0.4	$5.00	$4.50	$4.30
CMT-01104	1.0	4	0.35	0.4	5.70	5.10	4.80
CMT-01202	2.0	2	0.15	0.55	5.10	4.60	4.30
CMT-01301	3.0	1	0.10	0.7	4.70	4.20	4.00
CMT-02105	1.0	5	0.40	0.4	5.80	5.20	4.90
CMT-02107	1.0	7	0.50	0.4	6.00	5.40	5.10
CMT-02203	2.0	3	0.20	0.55	5.50	5.00	4.70
CMT-02302	3.0	2	0.10	0.7	5.10	4.60	4.30
CMT-03110	1.0	10	0.55	0.4	7.70	6.90	6.50
CMT-03305	3.0	5	0.15	0.7	7.20	6.50	6.10
CMT-03502	5.0	2	0.04	0.95	7.00	6.30	5.90
CMT-03801	8.0	1	0.02	1.2	6.70	6.00	5.70
CMF-0470	0.15	47	7.0	0.7	2.50	2.30	2.10
CMF-0330	0.2	33	6.0	0.7	2.50	2.30	2.10
CMF-0220	0.3	22	4.5	0.7	2.50	2.30	2.10
CMF-0100	0.45	10	3.0	0.7	2.50	2.30	2.10
CMF-0056	0.55	5.6	1.0	0.7	2.50	2.30	2.10
CMF-0033	0.8	3.3	0.7	0.7	2.50	2.30	2.10
CMF-6470	0.45	47	3.0	0.7	2.80	2.50	2.40
CMF-6330	0.5	33	2.5	0.7	2.80	2.50	2.40
CMF-6220	0.65	22	2.0	0.7	2.80	2.50	2.40
CMF-6100	0.9	10	0.6	0.7	2.80	2.50	2.40
CMF-6056	1.0	5.6	0.4	0.7	2.80	2.50	2.40
CMF-6033	2.0	3.3	0.3	0.7	2.80	2.50	2.40
CMF-8470	0.5	47	4.0	0.8	3.00	2.70	2.50
CMF-8330	0.65	33	3.0	0.8	3.00	2.70	2.50
CMF-8220	0.8	22	2.0	0.8	3.00	2.70	2.50
CMF-8100	1.0	10	0.7	0.8	3.00	2.70	2.50
CMF-8056	1.5	5.6	0.4	0.8	3.00	2.70	2.50
CMF-8033	2.0	3.3	0.3	0.8	3.00	2.70	2.50
CMF-2470	1.0	47	2.0	1.0	3.70	3.30	3.10
CMF-2330	1.2	33	0.8	1.0	3.70	3.30	3.10
CMF-2220	1.4	22	0.6	1.0	3.70	3.30	3.10
CMF-2100	2.2	10	0.3	1.0	3.70	3.30	3.10
CMF-2056	2.7	5.6	0.25	1.0	3.70	3.30	3.10
CMF-2033	4.0	3.3	0.08	1.0	3.70	3.30	3.10

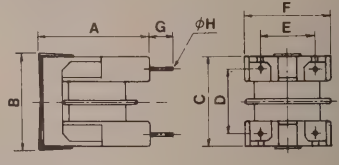
CMT SERIES (dim. mm)

SERIES PREFIX	O.D.	T	L±3mm
CMT-01	28	12.5	20
CMT-02	28	14.5	20
CMT-03	32	22	20



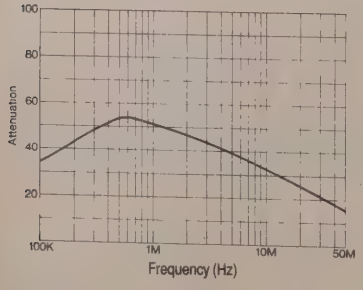
CMF SERIES (dim. mm)

SERIES PREFIX	A	B	C±1	D±1	E±.4	F±1	G±.8
CMF-0	20.5	17.5	18.0	12.5	10.0	16	4
CMF-6	28.0	22.5	18.0	12.5	10.0	18	4
CMF-8	31.0	24.0	22.0	16.0	10.0	20	4
CMF-2	33.5	38.5	37.0	30.0	12.5	21	4

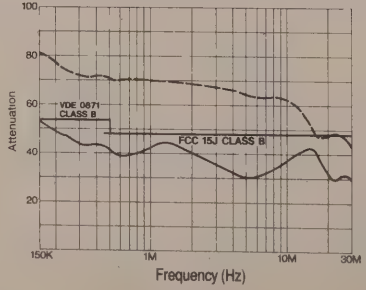


TYPICAL PERFORMANCE CHARACTERISTICS

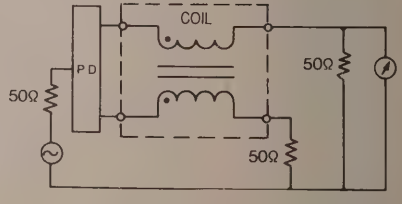
STATIC CHARACTERISTIC CMT-02105 IN CIRCUIT 1



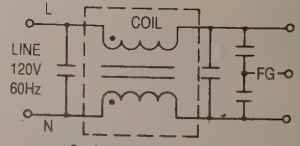
DYNAMIC CHARACTERISTIC CMT-02105 IN CIRCUIT 2



CIRCUIT 1



CIRCUIT 2



Switching Power Supply

Cy: 2200pf (line–to–FG)
Cx: 0.1µf (line–to–line)

CONTACT TAMURA for ORDERING, STOCK, OEM PRICING, DETAILED DATA SHEETS or YOUR CUSTOM REQUIREMENTS by FAX: 909/676-9482 or CALL: (909) 699-1270.

TAMURA EMI/RFI LINE FILTERS

Featuring Wire, Tab, Pin & Screw Terminal Type Connectors

UL File No. E92559

CSA File No. LR65763

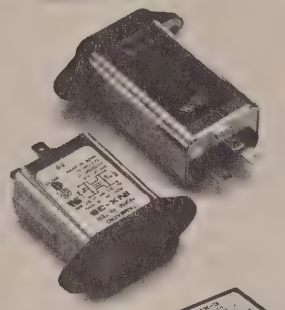
VDE File Nos. 7969-4730-1001, -1002, -1003

FEATURES*

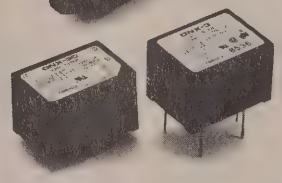
- Rated Voltage: 250VAC, 50/60 Hz.
- Output Connectors:
  ANX-L - lead wire
  ANX-F - fast-on tabs
  INX - inlet type
  ONX - pin type
- Leakage Current: ≤0.5ma.
- Insulation Resistance: 6,000 MΩ min., line-gnd, 250VDC.
- Direct Current Resistance (DCR):
  Spec'd per line, input to output.
- Dielectric Voltage: 2.0kVAC, 1 minute (line gnd);
  INX, X-S, ONX-C,D, 1.5kVAC.
- Temperature Rise: ≤30˚C.
- Operating Temp: -25˚C to +85˚C.
- UL File No: E92559.
- CSA File No: LR65763.
- VDE File No:
  INX, ANX-L, F, ONX; 7969-4730-1001.
  INX-S; 7969-4730-1003.
  ONX-C, D; 7969-4730-1002.

ANX-F

ANX-L



INX



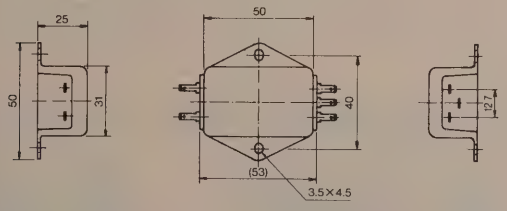
ONX

EMI/RFI LINE FILTERS RATING TABLE

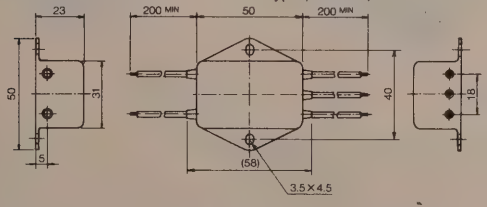
MODEL NO.	AMPS	DCR (Ω)	ATTENUATION[1]		PRICE (qty)		
			NORMAL MODE	COMMON MODE	1-9	10-24	25-99
ANX-1L,F[2]	1	0.5	25dB, 0.5-20MHz.	20dB, 0,1-10MHz.	$9.80	$8.80	$8.30
ANX-3L, F	3	0.15	25dB, 0.7-20MHz.	20dB, 0.2-10MHz.	9.80	8.80	8.30
ANX-6L	6	0.07	25dB, 1.0-20MHz.	20dB, 0.5-10MHz.	9.80	8.80	8.30
ANX-6F	6	0.05	25dB, 1.0-20MHz.	20dB, 0.5-10MHz.	9.80	8.80	8.30
INX-1	1	0.5	20dB, 1.0-20MHz.	20dB, 0,2-20MHz.	11.30	10.20	9.60
INX-3	3	0.2	20dB, 2.0-20MHz.	20dB, 0.3-20MHz.	11.30	10.20	9.60
INX-6	6	0.15	20dB, 3.0-20MHz.	20dB, 2.0-20MHz.	11.30	10.20	9.60
INX-05S	0.5	0.15	20dB, 2.0-30MHz.	20dB, 0.1-30MHz.	12.50	11.30	10.60
INX-1S	1	0.1	20dB, 3.0-30MHz.	20dB, 0.2-30MHz.	12.50	11.30	10.60
INX-3S	3	0.02	20dB, 6.0-30MHz.	20dB, 3.0-30MHz.	12.50	11.30	10.60
INX-6S	6	0.007	20dB, 8.0-30MHz.	20dB, 7.0-30MHz.	12.50	11.30	10.60
INX-10S	10	0.005	20dB, 9.0-30MHz.	20dB, 8.0-30MHz.	13.10	11.80	11.10
ONX-1	1	0.5	25dB, 0.3-20MHz.	20dB, 0.1-20MHz.	9.40	8.50	8.00
ONX-2	2	0.2	25dB, 0.4-20MHz.	20dB, 0.2-20MHz.	9.40	8.50	8.00
ONX-3	3	0.15	25dB, 0.5-20MHz.	20dB, 0.3-20MHz.	9.40	8.50	8.00
ONX-05C, D[3]	0.5	1.5	20dB, 0.3-30MHz.	25dB, 0.1-30MHz.	8.00	7.20	6.80
ONX-1C, D	1	0.4	20dB, 0.5-30MHz.	25dB, 0.1-30MHz.	8.00	7.20	6.80
ONX-2C, D	2	0.1	20dB, 1.0-30MHz.	25dB, 0.4-30MHz.	8.00	7.20	6.80
ONX-3C, D	3	0.05	20dB, 1.5-30MHz.	25dB, 2.0-30MHz.	8.00	7.20	6.80
ONX-5C, D	5	0.02	20dB, 2.0-30MHz.	25dB, 4.0-30MHz.	8.00	7.20	6.80

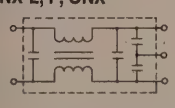
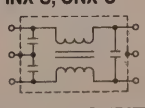
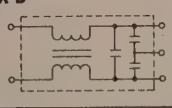
NOTE 1: Contact Tamura, Carson for static and dynamic attenuation characteristic curves.
NOTE 2: "L" or "F" suffix denotes lead wire or fast-on tab terminals, respectively... example: ANX-1L, ANX-1F.
NOTE 3: "C" or "D" suffix designates different models (example: ONX-1C, ONX-1D). "C" suffix has lower conducted emission under 3MHz while "D" suffix exhibits a flatter response above 10MHz. See note 1.

ANX-F Series: Fast-on Tab Terminal Type (dim. mm)

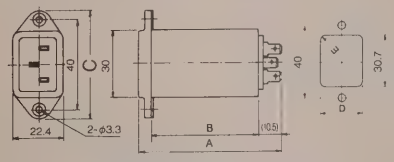


ANX-L Series: Lead Wire Terminal Type (dim. mm)



ANX-L, F, ONX	INX, INX-S, ONX-C	ONX-D
		

INX Series: Inlet Type (dim. mm, typical)



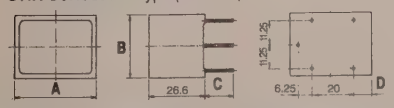
INX SERIES DIMENSIONS

SERIES PREFIX	A	B	C	D connector front/back	E connector front/back
INX	64.7±1	48	50	21.8 / 23.2	r=4 / r=5.5
INX-S	51.7±1	35	48	21.8 / 23.2	r=4 / r=5.5

ONX SERIES DIMENSIONS

SERIES PREFIX	A	B	C	D
ONX	38.5	29.5	≥15	8.3
ONX-C, D	41.4	28.7	≥4.2	9.5

ONX Series: Pin Type (dim. mm)



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your POWER Specialists

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(209) 651-2222

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FAX NUMBER: (209) 651-0188

TPY A/TPY B SERIES

THREE PHASE WYE FILTERS WITH CAPABILITIES TO ATTENUATE DIFFERENTIAL AND COMMON MODE NOISE, TO LEVEL A OR B, FROM SWITCHING POWER SUPPLIES. THIS SERIES OF "T" SECTION FILTERS HAS THE EXTENDED LOW FREQUENCY RANGE NECESSARY TO EITHER SUPPRESS SINGLE OR MULTIPLE SWITCHING POWER SUPPLIES IN BALANCED OR UNBALANCED LOAD CONFIGURATIONS.

SIMPLY SPECIFY EITHER TPYA OR TPYB FOR THE CONDUCTED LIMITS THAT YOU WANT TO MEET. THIS SERIES MAY ALSO BE CONNECTED IN A DELTA CONFIGURATION.

Part No.	Current	Case	Leakage*
TPYB7	7.5A/PH	7 x 4 x 4	2.0mA
TPYB15	15A/PH	8 x 5 x 4	2.0mA
TPYB30	30A/PH	12 x 6.5 x 4	2.4mA

Rated Voltage: 420/250 VAC, 47-63 Hz **Insertion Loss:** (50 ohms)
Test Voltage: Line to Line: 1.5KVDC
Line to Gnd: 2.0KVAC

	05MHz	15MHz	50MHz	1.5MHz	5.0MHz	20MHz
L/G	20db	60db	65db	65db	60db	60db
L/L	36db	65db	65db	65db	60db	55db

Part No.	Current	Case	Leakage*
TPYA15	15A/PH	7 x 4 x 4	2.0mA
TPYA30	30A/PH	8 x 5 x 4	2.4mA
TPYA45	45A/PH	12 x 6.5 x 4	3.0mA
TPYA60	60A/PH	12 x 6.5 x 4	3.0mA

Rated Voltage: 420/250 VAC, 47-63 Hz **Insertion Loss:** (50 ohms)
Test Voltage: Line to Line: 1.5KVDC
Line to Gnd: 2.0KVAC

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/G	10db	50db	65db	65db	65db	65db
L/L	20db	50db	60db	60db	50db	55db

* EACH LINE TO GND. @ 250VAC

K SERIES

TRI-MAG's "K" SERIES. RFI/EMI, LINE FILTERS HAVE BEEN DESIGNED AND DEVELOPED TO ALLOW ELECTRONIC EQUIPMENT, USING SWITCHING POWER SUPPLIES AND OTHER LOW IMPEDANCE NOISE SOURCES, TO MEET VDE 0871 AND THE RECENTLY ADOPTED FCC REGULATIONS GOVERNING THE INTERFERENCE POTENTIAL OF COMPUTER AND SIMILAR DIGITAL ELECTRONIC EQUIPMENT TO RADIO COMMUNICATIONS.

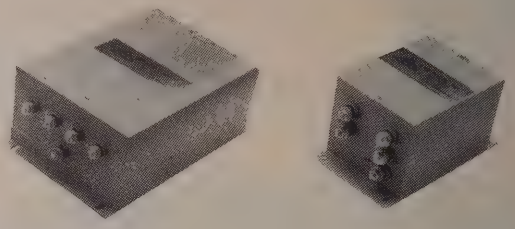
SERIES "K" FILTERS PROVIDE HIGH INSERTION LOSS FOR BOTH LINE-TO-GROUND AND LINE-TO-LINE GENERATED RFI/EMI INTERFERENCE. THESE FILTERS ARE RECOGNIZED BY UNDERWRITERS LABORATORIES, INC. UNDER ITS COMPONENT RECOGNITION SERVICES. OTHER APPROVALS (CSA, VDE, IEC) ARE IN PROCESS.

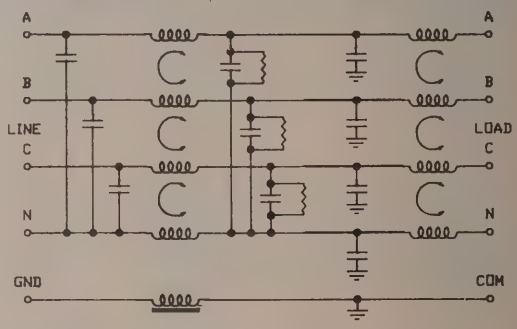
Part No.	Current	Case	Leakage*
K3	3A	2.5 × 2.0 × 1.5	1.0mA
K10	10A	2.8 × 2.2 × 1.5	1.0mA
K20	20A	3.8 × 3.3 × 1.5	1.0mA
K30	30A	4.25 × 3.0 × 2.7	1.0mA
K45	45A	8.0 × 5.0 × 4.0	1.0mA

Rated Voltage: 250VAC, 47-63 Hz **Insertion Loss:** (50 ohms)
Test Voltage: Line to Line: 1.5KVDC
Line to Gnd: 2.0KVAC

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/L	20db	60db	65db	65db	65db	60db
L/G	30db	60db	65db	65db	65db	60db

Three-Phase
Power Line Filters
FOR Switching Power Supplies
TO MEET FCC. VDE LEVEL A AND B

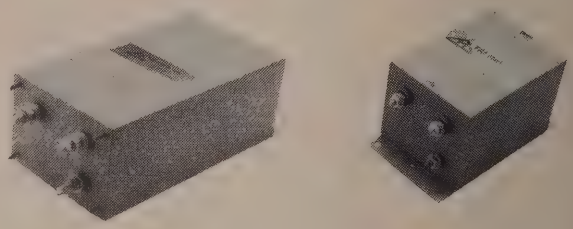




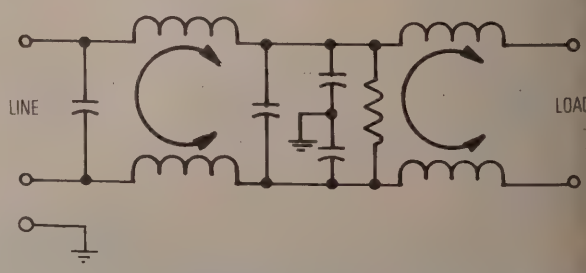
Part No.	Current	Case	Leakage*
TPY20	20A/PH	5 × 4 × 4	2.0mA
TPY30	30A/PH	5 × 4 × 4	2.0mA
TPY45	45A/PH	8 × 5 × 4	3.0mA
TPY60	60A/PH	8 × 5 × 4	3.0mA

Rated Voltage: 420/250 VAC, 47-63 Hz **Insertion Loss:** (50 ohms)
Test Voltage: Line to Line: 1.5KVDC
Line to Gnd: 2.0KVAC

	.05MHz	.15MHz	.50MHz	1.5MHz	5.0MHz	20MHz
L/G	12db	30db	55db	60db	50db	50db
L/L	18db	29db	50db	55db	50db	50db



SERIES "K"



For more Tri-Mag products see Volume D-4000 & 4025

TRI-MAG, Inc.
your POWER Specialists

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(209) 651-2222

ITT TELEX NUMBER: 4994462
CABLE ADDRESS: "TRIMAG"
FAX NUMBER: (209) 651-0188

For more Tri-Mag products see Volume D-4000 & 4025

MIF SERIES

MODULAR INTEGRATED FILTERS
(POWER ENTRY MODULE WITH FILTER)

SPEED UP AND SIMPLIFY SYSTEM INTEGRATION

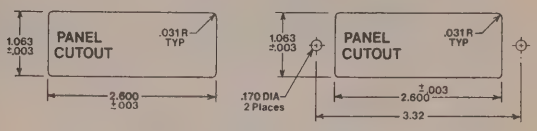
PEND'G

FEATURES:

- IEC CONNECTOR INPUT
- FUSED INPUT POWER
- SPARE FUSE HOLDER
- DPDT ON/OFF SWITCH
- VOLTAGE SELECTION SWITCH
- MINIMUM SPACE REQUIREMENT
- COST SAVING INTEGRATION
- SAFETY INTERLOCK ON FUSE

SPECIFICATIONS:

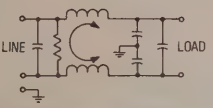
1. **Maximum Leakage Current Each**
   Line-to-Ground @ 115 VAC 60Hz, 0.5mA
   @ 250 VAC 50Hz, 1.0mA
2. **Hipot Rating** (One Minute)
   Line-to-Ground: 2000 VAC
   Line-to-Line: 1500 VDC
3. **Operating Frequency:** 47–63 Hz
4. **Rated Voltage:** 115/250 VAC



SERIES B FILTERS

TRI-MAG PART NO	B3-12S10EA B6-12S10EA	B3-12VS10E B6-12VS10E	B3-12S10EAVS B6-12S10EAVS	B3-12SF10EA B6-12SF10EA	B3-12SF10EAVS B6-12SF10EAVS	B3-12AVS3 B6-12AVS3	1.75 2.13 Dim "L"
RATED CURRENT 115VAC	3A/6A	3A/6A	3A/6A	3A/6A	3A/6A	3A/6A	
RATED CURRENT 250VAC	3A/6A	3A/6A	3A/6A	3A/6A	3A/6A	3A/6A	
IEC CONNECTOR	YES	YES	YES	YES	YES	YES	
FUSE HOLDER	YES	YES	YES	YES	YES	YES	
POWER SWITCH (DPDT)	YES	NO	YES	YES	YES	NO	
VOLTAGE SELECTOR SW	NO	YES	YES	NO	YES	YES	

MODEL	FREQUENCY-MHz .15	.20	50	10.0	20.0
B3	20dB	25dB	35dB	50dB	50dB
B6	20dB	25dB	35dB	50dB	50dB

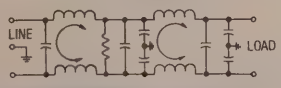


SERIES F,G & GBV FILTERS

TRI-MAG PART NO:	F6-12S10EA G3-12S10EA GBV3-12S10EA	F6-12VS10E G3-12VS10E ---	F6-12S10EAVS G3-12S10EAVS ---	F6-12SF10EA G3-12SF10EA ---	F6-12SF10EAVS G3-12SF10EAVS ---	2.13 2.13 2.13 Dim. "L"
RATED CURRENT 115VAC	6A/3A	6A/3A	6A/3A	6A/3A	6A/3A	
RATED CURRENT 250VAC	6A/3A	6A/3A	6A/3A	6A/3A	6A/3A	
IEC CONNECTOR	YES	YES	YES	YES	YES	
FUSE HOLDER	YES	YES	YES	YES	YES	
POWER SWITCH (DPDT)	YES	NO	YES	YES	YES	
VOLTAGE SELECTOR SW	NO	YES	YES	NO	YES	

"F" SERIES

"G" & "GBV" SERIES



MODEL	FREQUENCY-MHz .15	.20	.50	1.0	10.0	20.0
F6	45dB	50dB	65dB	70dB	70dB	70dB
G3	20dB	20dB	50dB	60dB	70dB	70dB
GBV3	60dB	65dB	70dB	70dB	70dB	70dB

SERIES K FILTERS

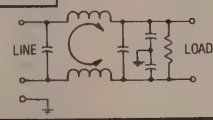
TRI-MAG PART NO:	K3-12S10EA	K3-12VS10E	K3-12S10EAVS	K3-12SF10EA	K3-12SF10EAVS	2.13 Dim. "L"
RATED CURRENT 115VAC	3A	3A	3A	3A	3A	
RATED CURRENT 250VAC	3A	3A	3A	3A	3A	
IEC CONNECTOR	YES	YES	YES	YES	YES	
FUSE HOLDER	YES	YES	YES	YES	YES	
POWER SWITCH (DPDT)	YES	NO	YES	YES	YES	
VOLTAGE SELECTOR SW	NO	YES	YES	NO	YES	

MODEL	FREQUENCY-MHz .15	.50	1.0	5.0	10.0	20.0
K3 LINE TO GROUND	60dB	65dB	65dB	65dB	65dB	65dB
K3 LINE TO LINE	50dB	65dB	65dB	65dB	65dB	65dB

MPA/MPB SERIES

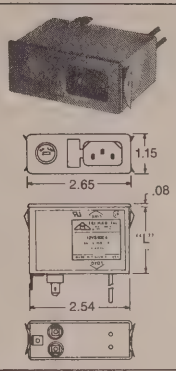
TRI-MAG PART NO:	MPA3-12S10EA MPB3-12S10EA	MPA3-12VS10E MPB3-12VS10E	MPA3-12S10EAVS MPB3-12S10EAVS	MPA3-12SF10EA MPB3-12SF10EA	MPA3-12SF10EAVS MPB3-12SF10EAVS	MPA3-12AVS3 MPB3-12AVS3	1.75 Dim "L"
RATED CURRENT 115VAC	3A	3A	3A	3A	3A	3A	
RATED CURRENT 250VAC	3A	3A	3A	3A	3A	3A	
IEC CONNECTOR	YES	YES	YES	YES	YES	YES	
FUSE HOLDER	YES	YES	YES	YES	YES	YES	
POWER SWITCH (DPDT)	YES	NO	YES	YES	YES	NO	
VOLTAGE SELECTOR SW	NO	YES	YES	NO	YES	YES	

MODEL	FREQUENCY-MHz .01	.02	.05	.15	.50	1.0	5.0	10.0	30.0
MPA	5dB	15dB	25dB	45dB	65dB	65dB	65dB	65dB	65dB
MPB	15dB	25dB	35dB	55dB	65dB	65dB	65dB	65dB	65dB

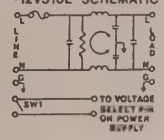


MIF CLIP MOUNT

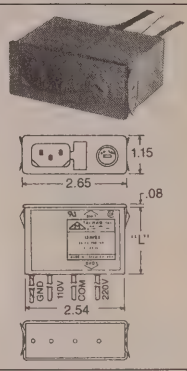
– 12VS10EA



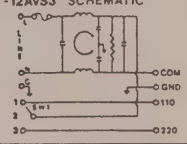
-12VS10E SCHEMATIC



– 12AVS3

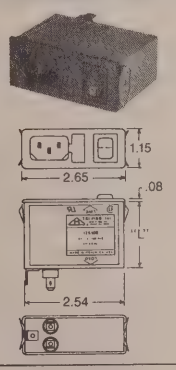


-12AVS3 SCHEMATIC

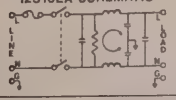


MIF CLIP MOUNT

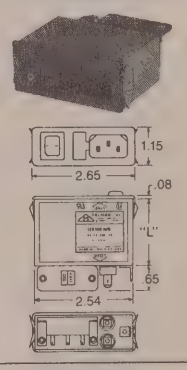
– 12S10E
– 12S10EA



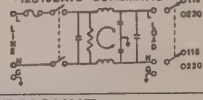
-12S10EA SCHEMATIC



– 12S10EAVS

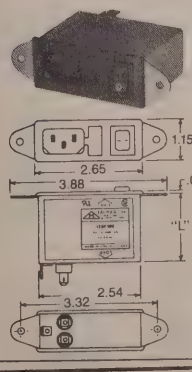


-12S10EAVS SCHEMATIC

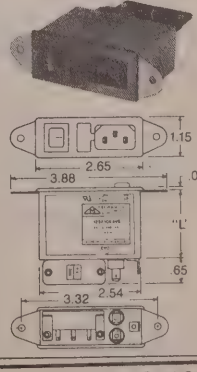


MIF FLANGE MOUNT

– 12SF10E
– 12SF10EA



– 12SF10EAVS



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CABLE ADDRESS: "TRIMAG"
FAX NUMBER: (209) 651-0188

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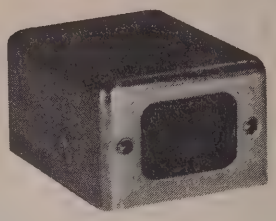
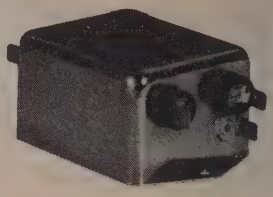
PA/PB SERIES

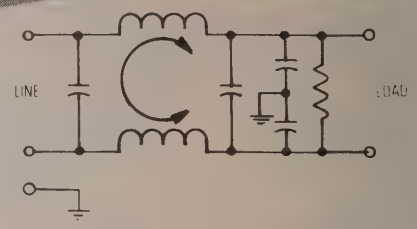




THE **TRI-MAG** PA/PB SERIES OF A.C. LINE FILTERS HAVE BEEN DEVELOPED PRIMARILY FOR COMPUTER SYSTEMS THAT USE SWITCHING POWER SUPPLIES. THE CURRENT RATINGS ARE HIGH ENOUGH TO ALLOW DESIGNERS TO PROTECT A COMPLETE COMPUTER SYSTEM FROM EXCEEDING THE CONDUCTED EMISSION LIMITS SPECIFIED EITHER BY FCC OR VDE.

THE PA IS AVAILABLE IN CURRENT RATINGS OF 1, 3, 5, 6 AND 10 AMPS AND THE PB IS AVAILABLE IN 1.3 AND 5 AMPS FOR OPERATION ON A.C. LINES OF 115 TO 250 VOLTS 50/60 Hz.

SPECIFY EITHER PA OR PB FOR THE CONDUCTED LIMITS THAT YOU WANT TO MEET.



Part No.	Current	Case	Leakage
PB1	1	2.5 × 2 × 1.5	1mA @ 250VAC
PB3	3	2.5 × 2 × 1.5	1mA @ 250VAC
PB5	5	2.8 × 2.0 × 1.5	1mA @ 250VAC

Rated Voltage: 250VAC, 47-63 Hz
Test Voltage: Line to Line: 1.5KVDC
Line to Gnd: 2.0KVAC
Insertion Loss: (50 ohms)

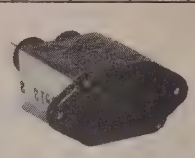
PB	.01MHz	.01MHz	.05MHz	.15MHz	.50MHz	1.0MHz	5.0MHz	10MHz	30MHz
	30db	35db	45db	65db	65db	65d	65db	65db	65db

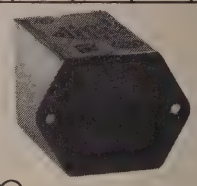
Part No.	Current	Case	Leakage
PA1	1	2.5 × 2 × 1.5	1mA @ 250VAC
PA3	3	2.5 × 2 × 1.5	1mA @ 250VAC
PA5	5	2.5 × 2 × 1.5	1mA @ 250VAC
PA6	6	2.8 × 2.2 × 1.5	1mA @ 250VAC
PA10	10	2.8 × 2.2 × 1.5	1mA @ 250VAC

Rated Voltage: 250VAC, 47-63 Hz
Test Voltage: Line to Line: 1.5KVDC
Line to Gnd: 2.0KVAC
Insertion Loss: (50 ohms)

PA	.01MHz	.02MHz	.05MHz	.15MHz	.50MHz	1MHz	5MHz	10MHz	30MHz
	25db	30db	40db	60db	65db	65db	65db	65db	65db

MPA/MPB SERIES

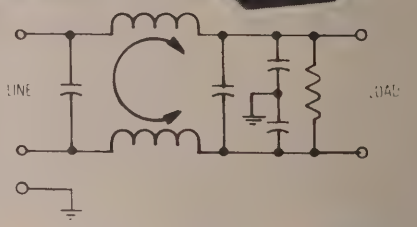




THE **TRI-MAG** MPA/MPB SERIES ARE THE "MINI" VERSIONS OF THE PA AND PB. THEY HAVE BEEN DEVELOPED TO SUPPRESS THE CONDUCTED EMISSIONS GENERATED BY SWITCHING POWER SUPPLIES. SINCE THESE SERIES ARE "MINI" IN SIZE AND COST, IT MAKES THEM IDEAL FOR COMPUTER PERIPHERALS.

THE MPA OR MPB IS AVAILABLE IN CURRENT RATINGS OF 2 AMPS FOR OPERATION ON A.C. LINES OF 115 TO 250 VOLTS, 50/60 Hz.

SPECIFY EITHER MPA OR MPB FOR THE CONDUCTED LIMITS THAT YOU WANT TO MEET.



Part No.	Current	Case	Leakage
MPB2-11	2	1.9 × 2.1 × 1.5	1mA @ 250VAC
MPB2-12	2	2 × 1.1 × 1.3	1mA @ 250VAC

Rated Voltage: 250VAC, 47-63 Hz
Test Voltage: Line to Line: 1.5KVDC
Line to Gnd: 2.0KVAC
Insertion Loss: (50 ohms)

MPB	.01MHz	.02MHz	.05MHz	.15MHz	.50MHz	1MHz	5MHz	10MHz	30MHz
	15db	25db	35db	55db	65db	65db	65db	65db	65db

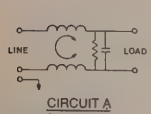
Part No.	Current	Case	Leakage
MPA2-11	2	1.5 × 1.1 × .8	1mA @ 250VAC
MPA2-12	2	2 × 1.1 × 1.3	1mA @ 250VAC

Rated Voltage: 250VAC, 47-63 Hz
Test Voltage: Line to Line: 1.5KVDC
Line to Gnd: 2.0KVAC
Insertion Loss: (50 ohms)

MPA	.01MHz	.02MHz	.05MHz	.15MHz	.50MHz	1MHz	5MHz	10MHz	30MHz
	5db	15db	25db	45db	65db	65db	65db	65db	65db

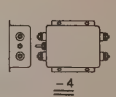
MEDICAL SERIES

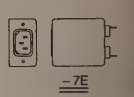
1. **RATED VOLTAGE:** 115/250VAC, 47–63Hz
2. **TEST VOLTAGE:**
   LINE TO GROUND: 2500 VDC
   LINE TO LINE: 1500 VDC
3. **LEAKAGE CURRENT:**
   M=2μA, MA=50μA, MB=250μA @ 115VAC

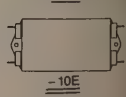


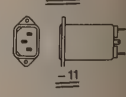
CIRCUIT A

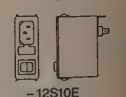
CIRCUIT B











		CONFIGURATIONS AVAILABLE						
	CIRCUIT	–1	–3	–4	–7E	–10E	–11	–12S10E
M3	A	×	–	–	–	×	×	–
M6	A	×	–	–	–	–	×	–
MA3	B	–	×	–	×	×	–	×
MA6	B	–	×	–	×	×	–	–
MA10	B	–	×	–	–	×	–	–
MA15	B	–	–	×	–	–	–	–
MA20	B	–	–	×	–	–	–	–
MB3	B	–	×	–	×	×	–	×
MB6	B	–	×	–	×	×	–	–
MB10	B	–	×	–	–	×	–	–
MB15	B	–	–	×	–	–	–	–
MB20	B	–	–	×	–	–	–	–

MINIGLOSSARY
BASIC ASCII CODE

				b7	0	0	0	0	1	1	1	1
				b6	0	0	1	1	0	0	1	1
				b5	0	1	0	1	0	1	0	1
b4	b3	b2	b1		0	1	2	3	4	5	6	7
0	0	0	0	0	NUL	DLE	SP	0	@	P	`	p
0	0	0	1	1	SOH	DC1	!	1	A	Q	a	q
0	0	1	0	2	STX	DC2	"	2	B	R	b	r
0	0	1	1	3	ETX	DC3	#	3	C	S	c	s
0	1	0	0	4	EOT	DC4	$	4	D	T	d	t
0	1	0	1	5	ENQ	NAK	%	5	E	U	e	u
0	1	1	0	6	ACK	SYN	&	6	F	V	f	v
0	1	1	1	7	BEL	ETB	'	7	G	W	g	w
1	0	0	0	8	BS	CAN	(	8	H	X	h	x
1	0	0	1	9	HT	EM	)	9	I	Y	i	y
1	0	1	0	10	LF	SUB	*	:	J	Z	j	z
1	0	1	1	11	VT	ESC	+	;	K	[	k	{
1	1	0	0	12	FF	FS	,	<	L	\	l	|
1	1	0	1	13	CR	GS	-	=	M	]	m	}
1	1	1	0	14	SO	RS	.	>	N	^	n	~
1	1	1	1	15	SI	US	/	?	O	_	o	DEL

Control Character Representations

NUL	Null
SOH	Start of Heading (CC)
STX	Start of Text (CC)
ETX	End of Text (CC)
EOT	End of Transmission (CC)
ENQ	Enquiry (CC)
ACK	Acknowledge (CC)
BEL	Bell
BS	Backspace (FE)
HT	Horizontal Tabulation (FE)
LF	Line Feed (FE)
VT	Vertical Tabulation (FE)
FF	Form Feed (FE)
CR	Carriage Return (FE)
SO	Shift Out
SI	Shift In
DLE	Data Link Escape (CC)
DC1	Device Control 1
DC2	Device Control 2
DC3	Device Control 3
DC4	Device Control 4
NAK	Negative Acknowledge (CC)
SYN	Synchronous Idle (CC)
ETB	End of Transmission Block (CC)
CAN	Cancel
EM	End of Medium
SUB	Substitute
ESC	Escape
FS	File Separator (IS)
GS	Group Separator (IS)
RS	Record Separator (IS)
US	Unit Separator (IS)
DEL	Delete

(CC) Communication Control
(FE) Format Effector
(IS) Information Separator

Special Graphic Characters

SP	Space
!	Exclamation Point
|	Logical OR
"	Quotation Marks
#	Number Sign
$	Dollar Sign
%	Percent
&	Ampersand
'	Apostrophe
(	Opening Parenthesis
)	Closing Parenthesis
*	Asterisk
+	Plus
,	Comma
-	Hyphen (Minus)
.	Period (Decimal Point)
/	Slant
:	Colon
;	Semicolon
<	Less Than
=	Equals
>	Greater Than
?	Question Mark
@	Commercial At
[	Opening Bracket
\	Reverse Slant
]	Closing Bracket
^	Circumflex
¬	Logical NOT
_	Underline
`	Grave Accent
{	Opening Brace
¦	Vertical Line (This graphic is stylized to distinguish it from Logical OR)
}	Closing Brace
~	Tilde

PRECISION FILTERS, INC.

New Filter/Amps

Amplified Performance at an Attenuated Price.

Designed for use in the 27000 Signal Conditioning System, the Precision 27604 quad programmable filter/amplifier module allows for up to 64 channels of programmable precision filtering in one 7"-high chassis. 4, 6 and 8 pole filters are offered with superior specifications.

All the Filter Types You Need

Your choice includes traditional filters as well as the advanced Precision elliptic filters. Choose from Bessel, Butterworth, constant time delay and elliptic. Low-pass, high-pass, band-pass or notch. Combine an assortment of filter types in one mainframe. Buy what you need now and expand later as test requirements change.

Superior Specifications

- Differential input—120 dB CMRR
- Programmable cutoffs from 1 Hz to 127.5 kHz, over a 255-to-1 range
- Distributed pre- and post gain totaling 1024, in factors of 2
- 0.1° phase match, typical
- 0.01 dB amplitude match, typical

Low Cost Per Channel

Extraordinary performance at ordinary prices per channel. We used our technology to contain cost in ways that preserve high performance.

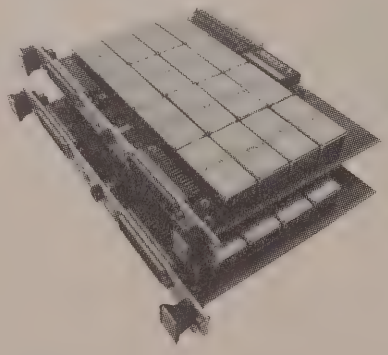
VMEbus Filters

Precision Anti-Alias Filters.

The high density VMF08 and VMF16 cards allow for larger channel count filter systems to be implemented in a few available VMEbus slots.

VMF08 Programmable Filters

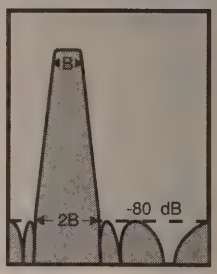
- 8 channels in a 6U VMEbus format
- Three standard 6-pole filter characteristics: LP1, HP1 and TD6
- Cutoff frequencies from 10 Hz to 127.5 kHz
- Cutoff programmable over a 255-to-1 range
- Amplitude match: 0.01 dB typical
- Phase match: 0.1° typical



VMF16 Fixed Frequency Filters

- 16 channels in a 6U VMEbus format
- Three standard 5-pole filter characteristics: LP5A, LP5B and TD5A
- Fixed cutoff frequency from 10 Hz to 25 kHz
- Cutoff programmable over a 255-to-1 range
- Amplitude match: 0.2 dB typical
- Phase match: 0.1° typical

Frequency-Band Translators



Applications

- Prog. matched band-pass filters
- Beam forming arrays
- Direction finding
- Sonar
- Frequency hopping
- Under-sampling anti-alias filters
- Increase dynamic range—reduce sampling rate

Custom Applications

- Matched programmable IF filters for direction finders
- Matched anti-alias filters for MRI
- Sonar arrays

Filter Type:	BBT1	BBT2
60 dB Shape Factor	<1.8	<4.5
1% Settling Time	10/B	3/B
Outband Rejection	75 dB	80 dB
Overshoot	19%	0

6772 Base-band Translator

- 2 to 32 Channel base-band array
- Prog. frequency: 20 Hz-100 kHz
- Prog. bandwidth: 25 Hz-31.5 kHz
- Match: 2° and 2%
- Pre- and post-translator gain

1776B Band-pass Translator

- 1-8 Channel band-pass array
- 1-16 Channel base-band array
- Prog. origination freq.: 10 Hz-400 kHz
- Prog. destination freq.: 10 Hz-400 kHz
- Prog. bandwidth: 1 Hz-50 kHz

• Information about Precision 6000 filter systems is located in Section 2750.
• See data acquisition systems in Section 2325• See amplifier systems in Section 1100.

Precision Filters, Inc. ● 240 Cherry Street ● Ithaca, New York 14850 ● 607-277-3550 ● Fax 607-277-4466

SIGNAL FILTERS

Manufacturer	Starting EEM Page No.	LC Filters				Frequency								Signal Conditioners				Other
		Low Pass	High Pass	Band pass (Incl. SAW)	Band Reject	AF	IF	RF Micro-wave	UHF/ VHF	AM	FM	TV	Video	Program-mable	Digital	Vari-able	Equal-izer	
Allen Avionics	A•1619	√	√	√	√			√				√	√					Waveguides, Attenuators, Equalizers
Avens Signal Equipment	A•1620					√§*	√§*			√§*			√	√*	√*	√*	√*	
Communication Coil	A•1623	√§*	√§*	√§*	√§*	√§*	√§*	√§*	√§*	√§*	√§*	√§*	√§*					
Communications & Energy Corp.	A•1625	√*	√*	√*	√*		√	√	√	√	√	√	√					Combiners for ITSF/MMDS, LPTV
Eagle Wichita	A•1626	√	√	√	√		√	√	√	√	√	√	√					
Electronic Precision Components	A•1633	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*					
Fee Fil-Mag	A•1634							√										
Frequency Devices	A•1638	√§	√§	√	√	√								√	√	√		Custom filter modules & instruments from 1Hz to 1MHz.
Genisco Electronics	A•1641	√§*				√§*	√§*		√§*									
Kappa Technologies	A•1642	√§																
KCK America, Inc.	A•1647	√						√										
KR Electronics Inc.	A•1649	√§*	√§*	√§*	√§*	√	√	√	√	√	√	√	√					
Krohn-Hite Corp.	A•1650													√		√		
Metuchen Capacitors	A•1651	√§*	√§*	√§*				√§*	√§*				√§*					EMI/RFI suppresion (resin & hermetic seal).
Microwave Filters Corp.	A•1655	√§*	√§*	√§*	√§*		√§*	√§*	√§*		√§*	√§*	√§*					Couplers, Multiplexers, Tunable Notch Filters, Tunable Bandpass Filters, High Power Filters, Filter Networks, Amplitude Equalized, Microwave Absorbers, Antennas, Encoder/ Decoding System for Wireless Cable.
Murata Erie North America	A•1660	√§		√§			√§	√§	√§	√§	√§	√§	√§					
NTK Technical Ceramics	A•1664			√§			√§	√§	PCA Electronics		A•1668		√§	√§				
Precision Filters	A•1673	√	√	√	√	√	√							√	√	√		Program-mable filters, Frequency-Band Translaters, VMEbus
RFI (Del Electronics)	A•1676	√§*	√§*	√§*	√§*												√*	
Spectrum Control	A•1677	√*						√*										
TTE Inc.	A•1680	√§	√§	√§	√	√	√	√	√	√	√	√	√			√	√	Switched filter banks.
Tusonix, Inc.	A•1684	√	√			√	√	√	√	√	√	√	√					
Valor Electronics	A•1686	√§																

MIL Spec. § Surface Mount.

CHARACTERISTICS OF BATTERIES AND FUEL CELLS

System	Anode	Cathode	Theoretical battery		Practical battery		
			Voltage, V	Capacity, Ah/kg	Typical voltage, V	Capacity[a]	
						Wh/kg	Wh/dm³
Primary:							
Leclanche	Zn	MnO_2	1.6	230	1.2	65	175
Magnesium	Mg	MnO_2	2.0	270	1.5	100	195
Organic cathode	Mg	*m*-DNB	1.8	1,400	1.15	130	180
Alkaline MnO_2	Zn	MnO_2	1.5	230	1.15	65	200
Mercury	Zn	HgO	1.34	185	1.2	80	370
Mercad	Cd	HgO	0.9	165	0.85	45	175
Silver oxide	Zn	AgO	1.85	285	1.5	130	310
Zinc-air	Zn	Air (O_2)	1.6	815	1.1	200	190
Li-organic electrolyte	Li	[b]	2.1-5.4	130-660	1.8-3.2	250	400
Secondary:							
Lead-acid	Pb	PbO_2	2.1	55	2.0	37	70
Edison	Fe	Ni oxides	1.5	195	1.2	29	65
Nickel-cadmium	Cd	Ni oxides	1.35	165	1.2	33	60
Silver-zinc	Zn	AgO	1.85	285	1.5	100	170
Silver-cadmium	Cd	AgO	1.4	230	1.05	55	120
Zinc-nickel oxide	Zn	Ni oxides	1.75	185	1.6	55	110
Zinc-air[c]	Zn	Air (O_2)	1.6	815	1.1	150	155
Cadmium-air[c]	Cd	Air (O_2)	1.2	475	0.8	90	90
Zinc-O_2	Zn	O_2	1.6	610	1.1	130	120
H_2-O_2	H_2	O_2	1.23	3,000	0.8	45	65
Reserve:							
Cuprous chloride	Mg	CuCl	1.5	240	1.4	45	65[d]
Silver-chloride	Mg	AgCl	1.6	170	1.5	60	95[d]
Zinc-silver oxide	Zn	AgO	1.85	285	1.5	30	75[e]
Thermal	Ca	[b]	2.8	240	2.6	10	20[f]
Ammonia-activated	Mg	*m*-DNB	2.2	1,400	1.7	22	60[g]
High-temperature	NA	S	2.1	685	1.8	200	[h]
	Li	S	2.2	1,150	1.8	200	[i]
Solid electrolyte	Ag	Polyiodide	0.66	. . .	0.6	180	75[j]
Fuel cell:							
Hydrogen[c]	H_2	Air	1.23	26,000	0.7		[k]
Hydrazine[c]	N_2H_4	Air	1.5	2,100	0.7	800[b]	[l]
Methanol[c]	CH_2OH	Air	1.3	1,400	0.9	175[b]	185[m]

a Delivered capacity when discharged at normal temperatures (20°C) at normal discharge rates.
b Based on fuel consumption only.
c Weight of air not considered in computation of watt hours.
d Water-activated
e Automatically activated; high rate discharge; 2- to 10-min rate.
f Fused salt; heat-activated; high rate discharge; 2- to 10-min rate.
g Four-minute discharge rate.
h β-alumina electrolyte, 300°C operation.
i Fused salt; 350°C operation.
j Solid $RbAg_4I_5$ electrolyte.
k Several different cathode materials used.
l Fuel consumption is based on source of H_2.
m Based on methanol battery-fuel supply in situ.

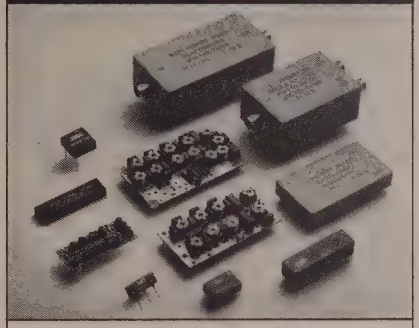
ALLEN AVIONICS, INC.

The world's most complete source of:
Video Delay Lines • General Purpose Delay Lines
Video Filters • LC Filters from 20Hz to 3GHz
Video Hum Eliminators & Isolation Transformers
Digital Delay Lines and Video Instrumentation.

LC FILTERS 20Hz TO 3GHz

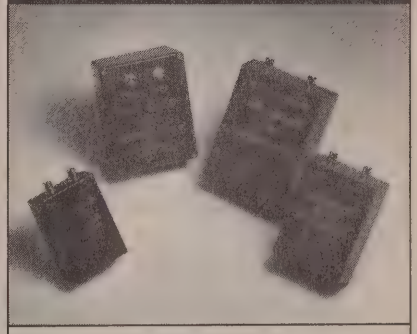
- Lowpass, Highpass Bandpass Band Reject
- Linear Phase
- Delay Equalized
- Anti-Aliasing
- Low Profile
- Sub-Miniature
- TO8
- Tubular
- Butterworth, Chebyshev, Eleptic, Bessel, Gaussian
- High-Rel Space Grade
- Commercial & Military
- Amplitude & Phase Matching
- Tempest

VIDEO FILTERS



- NTSC & PAL
- General Purpose Delay Equalized Lowpass Filters
- Component Signal Processing
- Pre & Post Filters for 4:2:2 Digital Signal Processing
- Triple Filters
- Brick Wall Filters
- High Performance Filters for HDTV
- Video Networks
- Bandpass
- Bandstop
- Gaussian

VIDEO HUM ELIMINATORS (HUMBUCKER) VIDEO ISOLATION TRANSFORMERS



HEC 1000
HEC 2000
Designed to remove all 50-60 Hz hum in video signals

VNE 75
Designed for HDTV systems and other high frequency bandwidth requirements

VIT 75
Video isolation transformer designed to eliminate ground loop problems in video signals

ALLEN AVIONICS, INC.

224 East Second Street, Mineola. NY 11501 • (516) 248-8080 • FAX (516) 747-6724

AVENS

CUSTOM DESIGN FILTER SYSTEM & PCB MODULE

1-(800) 452-1966

MULTI-FUNCTION FILTER SYSTEM

Model : 5100 / 5200

LOW COST PORTABLE FILTER

- Choice of Lowpass, Highpass, Bandpass, & Band-reject
- Single or Dual Channel
- 3 1/2 digit display
- Frequency Range: 0.01 Hz to 200 kHz
- Filter orders: 4th & 8th
- Butterworth, Bessel, Chebyshev, & Elliptic
- 20 dB (10x) Pre-amplification
- Single-ended or Differential input
- DC offset adjustable to 0.0
- Light weight (4 lbs) & compact (7"x9"x3")
- Rechargeable battery operation option

MODEL	DESCRIPTION
5111	Single Ch., 24 dB/oct, 10 mHz - 20 kHz
5112	Single Ch., 48 dB/oct, 10 mHz - 20 kHz
5121	Single Ch., 24 dB/oct, 0.1 Hz - 200 kHz
5122	Single Ch., 48 dB/oct, 0.1 Hz - 200 kHz
5131	Single Ch., 24 dB/oct, 1 Hz- 2 MHz
5211	Dual Ch., 24 dB/oct, 10 mHz -20 kHz
5212	Dual Ch., 48 dB/oct, 10 mHz - 20 kHz
5221	Dual Ch., 24 dB/oct, 0.1 Hz - 200 kHz
5222	Dual Ch., 48 dB/oct, 0.1 Hz - 200 kHz
5231	Dual Ch., 24 dB/oct, 1 Hz - 2 MHz

Model : 2100 / 2200

DUAL CHANNEL PROGRAMMABLE FILTER

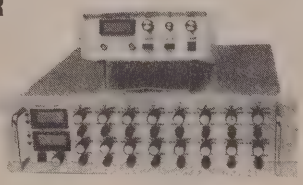
- Dual channel LOWPASS, or HIGHPASS/LOWPASS
- LCD displays parameter settings
- Frequency Range: 0.01 Hz to 200 kHz
- 8th order Butterworth/Bessel, & Chebyshev
- 1EEE-488 interface
- 1 : 1024 Pre-amplification
- Single-end, Differential, & Bypass
- DC offset adjustable to 0.0

MODEL	FUNCTIONS	RESPONSE
2100	Lowpass/Lowpass	Butterworh / Bessel
2110	Lowpass/Lowpass	0.1 dB ripple Chebyshev
2200	Highpass/Lowpass	Butterworth/ Bessel
2210	Highpass/Lowpass	0.1 dB ripple Chebyshev

Model : 4000

16 CHANNEL VARIABLE FILTER

- 16 channel LOWPASS, or 8 channel HIGHPASS/LOWPASS
- Multiplexed 3 1/2 digit LCD displays
- 10 mHz to 20 kHz, & 0.1 Hz to 200 kHz
- 8th order Butterworth, Bessel, Chebyshev & Elliptic
- Single-end or Differential input
- DC offset adjustable to 0.0
- 19" rack mountable case



P/N	FREQ RANGE	RESPONSE	ROLL-OFF
4124	10mHz - 20kHz	BUTTERWORTH	24 dB / OCT.
4128	10mHz - 20kHz	BUTTERWORTH	48 dB / OCT.
4138	10mHz - 20kHz	CHEBYSHEV	70 dB @ 2Fc
4148	10mHz - 20kHz	ELLIPTIC	80 dB @ 1.3Fc
4224	0.1Hz - 200kHz	BUTTERWORTH	24 dB / OCT.
4228	0.1Hz - 200kHz	BUTTERWORH	48 dB / OCT.
4238	0.1Hz - 200kHz	CHEBYSHEV	70 dB @ 2Fc
4248	0.1Hz - 200kHz	ELLIPTIC	60 dB @ 1.3Fc

Model : 6000

8 CHANNEL PROGRAMMABLE FILTER/AMPLIFIER

- 16 ch. LOWPASS, or 8 ch, HIGHPASS/LOWPASS
- Consist of one main frame and 8 plug-in cards
- Support 8 channel filters
- Front panel display of all parameters
- Cover frequencies: 0.01 Hz to 2.0 MHz
- Butterworth, Bessel, Chebyshev, Elliptic. & Linear Elliptic
- Lowpass, Highpass, Bandpass, & Band-reject
- Pre-amplification up to 60 dB
- Single-end or Differential input
- DC offset adjustable to 0.0
- Magnitude & Phase matching options
- 19" Rack-mountable case
- Rear panel in/out BNC connectors
- Can be modified to customers' spec
- IEEE Interface

MODEL	DESCRIPTION
MAIN UNIT	
6000	Main Frame w/ parallel interface
6000-Q	Main frame w/ GPIB IEEE-488 interface
FILTER CARD	
6410	4th order BESSEL Lowpass Filter
6411	4th order BESSEL Highpass Filter
6420	4th order BUTTERWORTH Lowpass Filter
6421	4th order BUTTERWORTH Highpass Filter
6430	4th order CHEBYSHEV Lowpass Filter
6431	4th order CHEBYSHEV Highpass Filter
6440	4th order ELLIPTIC Lowpass Filter
6441	4th order ELLIPTIC Highpass Filter
6810	8th order BESSEL Lowpass Filter
6811	8th order BESSEL Highpass Filter
6820	8th order BUTTERWORTH Lowpass Filter
6821	8th order BUTTERWORTH Highpass Filter
6830	8th order CHEBYSHEV Lowpass Filter
6831	8th order CHEBYSHEV Highpass Filter
6840	8th order ELLIPTIC Lowpass Filter
6841	8th order ELLIPTIC Highpass Filter

AVENS SIGNAL EQUIPMENT Corp.

P.O. BOX 1057, NEW YORK, NY 10002 TEL: (718) 827-5991/FAX: (718) 235-9805

AVENS

CUSTOM DESIGN FILTER SYSTEM & PCB MODULE

1-(800) 452-1966

MINIATURE ANALOG ACTIVE FILTER MODULE

MODEL : AS1000

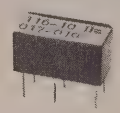
ANTI-ALIASING / HIGHPASS PRECISION MINI FILTER

8 PIN DIP : 0.47" x 0.47" x 0.4"H
16 PIN DIP : 0.85" x 0.47" x 0.4"H
22 PIN DIP : 1.15" x 0.57" x 0.4"H

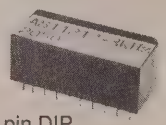
- Small Footprint, standard case size
- Available in 8 pin DIP, 16 pin DIP & 22 pin DIP
- Analog RC filter (not SWITCH-CAP Filter)
- No external component needed
- Filter orders from 2nd to 12th order
- Responses: Bessel, Butterworth, and Chevyshev
- Available in ANTI-ALIASING (Lowpass), and Highpass
- High input impedance (> 500 kohm)
- Low output impedance (< 50 ohm)
- Accurate passband gain (< 0.05 dB)
- Precision out-off freq. (< ±1%)
- Accept input signal up to ± 15V.
- Low power consumption(10 ma/4th order)
- Temperature stable

PIN	ROLL-OFF	MFG.	TYPE	PACKAGE
AS:1102	15 dB @ 3 Fc	Bessel	Lowpass	8 pins DIP
AS:1103	21 dB @ 3 Fc	Bessel	Lowpass	8 pins DIP
AS:1104	23 dB @ 3 Fc	Bessel	Lowpass	8 pins DIP
AS:1105	26 dB @ 3 Fc	Bessel	Lowpass	16 pins DIP
AS:1106	30 dB @ 3 Fc	Bessel	Lowpass	16 pins DIP
AS:1108	51 dB @ 4 Fc	Bessel	Lowpass	20 pins DIP
AS:11010	58 dB @ 4 Fc	Bessel	Lowpass	20 pins DIP
AS:11012	62 dB @ 4 Fc	Bessel	Lowpass	20 pins DIP
AS:1112	12 dB @ 2 Fc	Butterworth	Lowpass	8 pins DIP
AS:1113	18 dB @ 2 Fc	Butterworth	Lowpass	8 pins DIP
AS:1114	24 dB @ 2 Fc	Butterworth	Lowpass	8 pins DIP
AS:1115	30 dB @ 2 Fc	Butterworth	Lowpass	16 pins DIP
AS:1116	36 dB @ 2 Fc	Butterworth	Lowpass	16 pins DIP
AS:1117	42 dB @ 2 Fc	Butterworth	Lowpass	20 pins DIP
AS:1118	48 dB @ 2 Fc	Butterworth	Lowpass	20 pins DIP
AS:1119	54 dB @ 2 Fc	Butterworth	Lowpass	20 pins DIP
AS:11110	60 dB @ 2 Fc	Butterworth	Lowpass	20 pins DIP
AS:11111	66 dB @ 2 Fc	Butterworth	Lowpass	20 pins DIP
AS:11112	72 dB @ 2 Fc	Butterworth	Lowpass	20 pins DIP
AS:1122	13 dB @ 2 Fc	Chebyshev	Lowpass	8 pins DIP
AS:1123	22 dB @ 2 Fc	Chebyshev	Lowpass	8 pins DIP
AS:1124	30 dB @ 2 Fc	Chebyshev	Lowpass	8 pins DIP
AS:1125	40 dB @ 2 Fc	Chebyshev	Lowpass	16 pins DIP
AS:1126	50 dB @ 2 Fc	Chebyshev	Lowpass	16 pins DIP
AS:1128	72 dB @ 2 Fc	Chebyshev	Lowpass	20 pins DIP
AS:11210	65 dB @ 1.5 Fc	Chebyshev	Lowpass	20 pins DIP
AS:11212	55 dB @ 1.5 Fc	Chebyshev	Lowpass	20 pins DIP
AS:2114	24 dB @ 0.5 Fc	Butterworth	Highpass	16 pins DIP
AS:2116	36 dB @ 0.5 Fc	Butterworth	Highpass	18 pins DIP
AS:2118	48 dB @ 0.5 Fc	Butterworth	Highpass	20 pins DIP

8 pin DIP
0.47"L x 0.47"w X 0.4"H



16 pin DIP
0.85"L x 0.47"W x 0.4"H



22 pin DIP
1.15"L x 0.557"W x 0.4"H

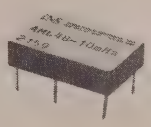
MODEL : AML / AMH / AMB / AMN

HIGH ORDER / ATTENUATION LOWPASS / HIGHPASS / BAND-PASS / BANDREJECT

24 PIN DIP : 0.85" x 0.47" x 0.4"H
48 PIN DIP : 1.25" x 0.77" x 0.4"H
64 PIN DIP :3.25" x 1.07" x 0.4"H

- Fast roll-off rate (over 115 dB/oct)
- Up to 30th order filter
- Standard 24, 48, 64 pin dip packet
- Analog RC Filter (not SWITCH-CAP)
- No external component needed
- Bessel, Butterworth, Chebyshev, & Elliptic
- Available in ANTI-ALIASTING (Lowpass), Highpass, Bandpass, Band-reject
- Pre-filter & post-filter gain
- Magnitude matched to 0.05 dB
- Phase matched to 0.5 degree
- High input impedance (>1 Mohm)
- Low output impedance (<50 ohm)
- Accurate passband gain (<0.01 dB)
- Precision cut-off freq. (<0.5%)
- Accept input signal up to ±15 V.
- Low power (10mA/4th order)
- Low thermal drift (<50 ppm/C)
- Custom design & modification available
- Military space version available

MODEL	DESCRIPTION	PACKAGE
AMB 4	4th ORDER Wideband Bandpass, 24 dB/oct	24 pin DIP
AMB 8	4th ORDER Wideband Bandpass, 48 dB/oct	48 pin DIP
AMN 4	4th ORDER Wideband Bandreject, 24 dB/oct	24 pin DIP
AMN 8	4th ORDER Wideband Bandreject, 48 dB/oct	48 pin DIP
AMH 4B	4 pole Butterworth Highpass, 24 dB / oct	24 pin DIP
AMH 8B	8 pole Butterworth Highpass, 48 dB / oct	48 pin DIP
AMH 10B	10 pole Butterworth Highpass, 60 dB / oct	48 pin DIP
AMH 12B	12 pole Butterworth Highpass, 72 dB / oct	48 pin DIP
AMH 14B	14 pole Butterworth Highpass, 84 dB / oct	48 pin DIP
AMH 16B	16 pole Butterworth Highpass, 96 dB / oct	48 pin DIP
AML 4B	4 pole Butterworth Lowpass, 24 dB / oct	24 pin DIP
AML 8B	8 pole Butterworth Lowpass, 48 dB / oct	48 pin DIP
AML 10B	10 pole Butterworth Lowpass, 60 dB / oct	48 pin DIP
AML 12B	12 pole Butterworth Lowpass, 72 dB / oct	48 pin DIP
AML 14B	14 pole Butterworth Lowpass, 84 dB / oct	48 pin DIP
AML 16B	16 pole Butterworth Lowpass, 96 dB / oct	48 pin DIP
AML P17B	17 pole Butterworth Lowpass, 102 dB / oct	48 pin DIP
AML 4C	4 pole Chebyshev Lowpass, 30 dB @ 2Fc	24 pin DIP
AML 8C	8 pole Chebyshev Lowpass, 70 dB @ 2Fc	48 pin DIP
AML 10C	10 pole Chebyshev Lowpass, 80 dB @ 1.75Fc	48 pin DIP
AML 12C	12 pole Chebyshev Lowpass, 50 dB @ 1.25Fc	48 pin DIP
AML 14C	14 pole Chebyshev Lowpass, 60 dB @ 1.25Fc	48 pin DIP
AML 16C	16 pole Chebyshev Lowpass, 70 dB @ 1.25Fc	48 pin DIP
AML 6E	6th ORDER Elliptic Lowpass, 80dB @ 2.25Fc	48 pin DIP
AML 8E	6th ORDER Elliptic Lowpass, 80dB @ 2.25Fc	48 pin DIP



24 pin DIP
1.25"L x 0.08"W x 0.4"H

48 pin DIP
2.50"L x 0.77"W x 0.4"H

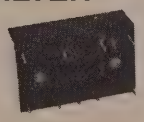
MODEL : AF2

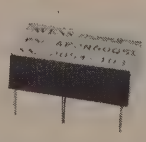
BANDPASS & NOTCH FILTER

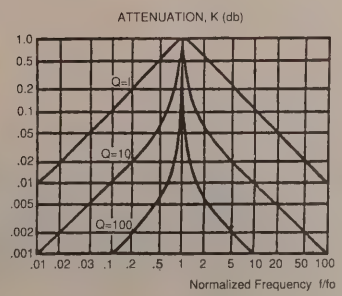
1.25" LX0.77'WX0.40"H

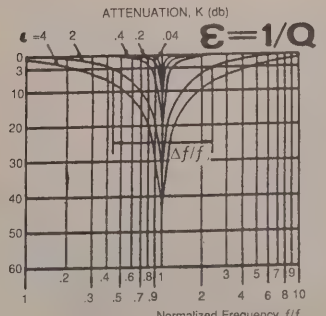
FEATURES

- 2nd order filter block
- Multi-outputs: Band-reject, Lowpass, Highpass, & Bandpass
- Adjustable Frequency & gain
- Variable Bandwidth
- Cascade to Implement high order filter
- 60Hz power noise rejection
- Low noise & low DC drift
- Fast delivery (1 week)









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AVENS

CUSTOM DESIGN FILTER SYSTEM & PCB MODULE

1-(800) 452-1966

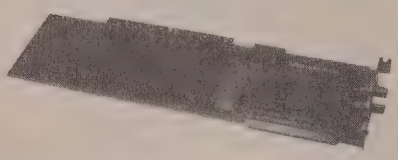
PROGRAMMABLE ANALOG ACTIVE FILTERS/AMPLIFIERS

MODEL ATC-F

PC XT/AT Plug-in Filter Card

FEATURES:

- Control thru XT/AT bus
- Single & Dual Channel
- Programmable parameters; 3 dB freq., center freq. pre-amp, & bandwidth
- Pre-filter gain up to 20 dB
- Freq. range: 10 mHz to 200 kHz
- Analog RC filter
- Buffered analog Input & Output
- Single-ended or Differential
- Lowpass, Highpass, Bandpass, & Band-reject
- 8th order Butterworth, Bessel, Chebyshev, & Elliptic
- Direct Control via pop-up menu
- Utility subroutines in C & QBASIC

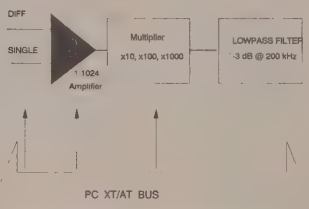


MODEL ATC-A

PC XT/AT Plug-in Amplifier Card

FEATURES:

- Control thru XT/AT bus
- Single & Dual Channel
- Analog IN / Analog OUT
- Buffered analog Input & Output
- 200 kHz Bandwidth
- Single-ended or Differential
- AC or DC coupled
- Built-in band-limited filter
- 1:1024 gain ratio in 3 decades
- Direct control via pop-up menu
- Utility subroutines in C & QBASIC

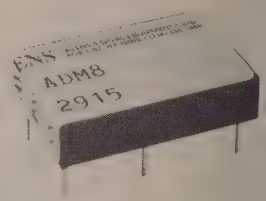


MODEL ADM8

8 BIT Programmable Amplifier module

FEATURES:

- DC Analog amplifier
- 8 bit CMOS, TTL compatible control
- 1 : 255 continuous gain control
- 200 kHz bandwidth
- Buffered analog Input & Output
- Single-ended or Differential
- Built-in analog filter (lowpass)
- Built-in decoupling capacitors
- High input impedance (> 1 Mohm)
- Low output impedance (< 1 ohm 8 DC)
- Low internal noise (< 50 uV)
- Compact size (1.25" x 0.8" x 0.4")



MODEL AD2 / AD3

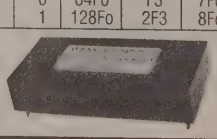
Miniature 2 BIT/4 settings
3 BIT/8 Independent settings

FEATURES:

- Binary selection, CMOS, TTL compatible
- Use analog switches (not SWITCH-CAP filter)
- Instantaneous selection (no latching)
- Filter order choices: 4th or 8th
- Available filter functions: Lowpass, Highpass, Bandpass, Band-reject
- Implements responses including: Bessel, Butterworth, and Chebyshev
- Accept input signal up to ±15V.
- Low DC shift among settings (< 2 mV)
- Customization and modification available

BINARY BIT		SELECTION SCHEME			
2	1	A	B	C	D
0	0	Fb	Fo	Fo	Fo
0	1	2Fo	2Fo	2Fo	F1
1	0	4Fo	F1	3Fo	F2
1	1	8Fo	2F1	4Fo	F3

BINARY BIT			SELECTION SCHEME			
3	2	1	A	B	C	D
0	0	0	Fo	Fo	Fo	F1
0	0	1	2Fo	2Fo	2Fo	F3
0	1	0	4Fo	F1	3Fo	F2
0	1	1	8Fo	2F1	4Fo	F4
1	0	0	16Fo	F2	5Fo	F5
1	0	1	32Fo	2F2	6Fo	F6
1	1	0	64Fo	F3	7Fo	F7
1	1	1	128Fo	2F3	8Fo	F8



MODEL AD8

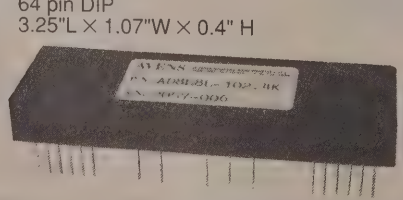
8 BIT/255 Continuous Settings
uP Compatible Interface

FEATURES:

- RC active filter (no SWITCH-CAP)
- Instantaneous or latching selection
- 8 Bit resolution 1:255 freq. ratio
- Filter orders : 4th, 6th, & 8th
- Responses: Butterworth, Chebyshev, Bessel, Elliptic, & Linear Elliptic
- Filter functions: Lowpass, Highpass, Bandpass, & Band-reject
- Magnitude & Phase matching
- Compatible w/popular microprocessor
- Customization & modification available

FMAX (HZ)	STEP SIZE (HZ)	FMIN (HZ)
102.0 k	400	400
51.0 k	200	200
25.5 k	100	100
12.7 k	50	50
10.2 k	40	40
8.1 k	20	20
2,550.	10	10
1,275.	5	5
1,020.	4	4
510.	2	2
255.	1	1
25.5	0.1	0.1

64 pin DIP
3.25"L × 1.07"W × 0.4" H



MODEL AD10

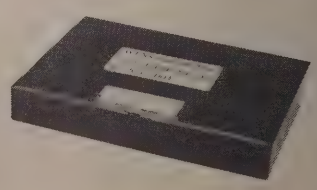
10 BIT/1024 Continuous Settings
DIP Switch Selections

FEATURES:

- Selection via built-in DIP Switch
- Can be programmed via external pins
- 1 : 1023 selectable frequency range
- Analog RC filter
- No clock & other component
- Lowpass, Highpass, Bandpass, & Band-reject
- 4th, 6th, 8th, & 10th order
- Butterworth, Bessel, Chebyshev, & Elliptic\
- Low DC shift (±5 mV)
- Internal DC compensated (±2mV)
- External adjustable DC Offset
- Built-in power decouplers

FMAX (HZ)	STEP SIZE (HZ)	FMIN (HZ)
102.4 k	100	100
51.2 k	50	50
20.5 k	20	20
10.2 k	10	10
5,120	5	5
2,050	2	2
1,024	1	1
102.4	0.1	0.1

3.5"L × 2.5"W × 0.5" H



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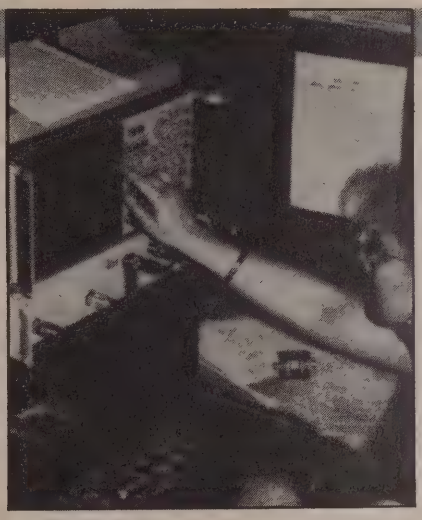
LC FILTER NETWORKS

COMMUNICATION COIL , INC. ✦ ASSURED RELIABILITY ✦ CUSTOM DESIGNS ✦ TIMELY DELIVERY ✦ MANUFACTURED TO SPEC.



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- LO-PASS
- BAND PASS
- NOTCH
- BUTTERWORTH
- ELLIPTIC
- PHASE MATCHING
- ANTI-ALIASING
- LO-PROFILE
- SUBMINIATURE
- HI-SELECTIVITY
- MIL-I-45208
- MIL-Q-9858A
- HI-PASS
- BAND REJECT
- BESSEL
- CHEBYSHEV
- GAUSSIAN
- DELAY MATCHING
- MULTI-POLE
- MINIATURE
- SURFACE MOUNT
- HERMETICALLY SEALED
- MIL-F-18327
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...BALUNS, COILS, CHOKES, INDUCTORS, TOROIDS, FILTERS, TRANSFORMERS...

MAXIMUM CURRENT CAPACITY—CONDUCTORS

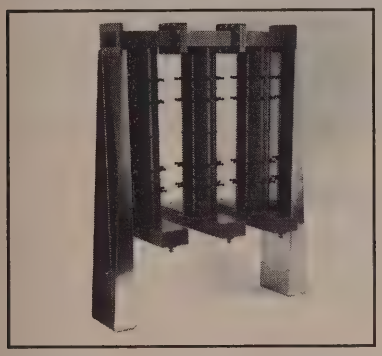
Size, AWG	MIL-W-5088				National Electrical Code	Underwriters Laboratory		American Insurance Association	500 c mils/A
	Copper		Aluminum			60°C	80°C		
	Single-wire	Wire-bundled	Single-wire	Wire-bundled					
30	...	...	...	...	...	0.2	0.4	...	0.20
28	...	...	...	...	...	0.4	0.6	...	0.32
26	...	...	...	...	...	0.6	1.0	...	0.51
24	...	...	...	...	...	1.0	1.6	...	0.81
22	9	5	...	...	...	1.6	2.5	...	1.28
20	11	7.5	...	...	...	2.5	4.0	3	2.04
18	16	10	...	...	6	4.0	6.0	5	3.24
16	22	13	...	...	10	6.0	10.0	7	5.16
14	32	17	...	...	20	10.0	16.0	15	8.22
12	41	23	...	...	30	16.0	26.0	20	13.05
10	55	33	...	...	35	...	...	25	20.8
8	73	46	58	36	50	...	...	35	33.0
6	101	60	86	51	70	...	...	50	52.6
4	135	80	108	64	90	...	...	70	83.4
2	181	100	149	82	125	...	...	90	132.8
1	211	125	177	105	150	...	...	100	167.5
0	245	150	204	125	200	...	...	125	212.0
00	283	175	237	146	225	...	...	150	266.0
000	328	200	...	...	275	...	...	175	336.0
0000	380	225	...	...	325	...	...	225	424.0

Standard - Specialized - Customized

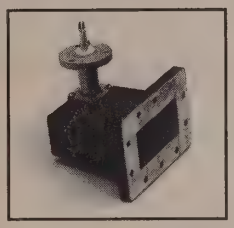
RF & MICROWAVE FILTERS *for* COMMUNICATIONS

COMMUNICATIONS & ENERGY CORP

WIRELESS CABLE & LOW POWER TV BROADCAST (LPTV)

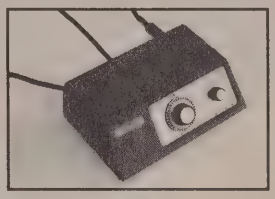


MMDS Channel Combiner



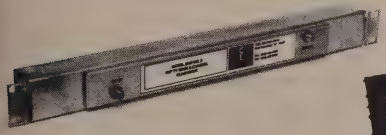
Adapter

Relay Antenna

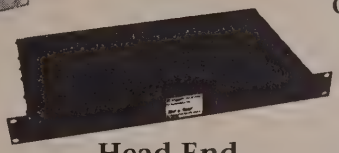


UHF-LPTV Converter-Descrambler

CATV - SMATV - SATELLITE TVRO - BROADBAND LAN

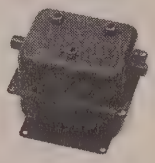


TV Channel Brickwall Deletion Filter



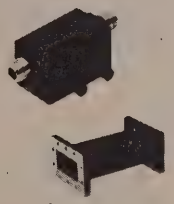
Head End TV Channel Scrambler

Pay-TV Security Traps and Off-Air Interference Filters



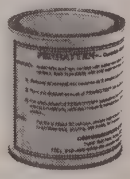
Channel Bandpass Filters

RF/MICROWAVE FILTERS



- BANDPASS
- BANDSTOP
- LOW-PASS
- HIGH-PASS
- MULTIPLEXERS
- TUNABLE

MICROWAVE ABSORBERS



FERRATTEN™ 2-Part Casting System

Emily Bostick
President

Glyn and Emily Bostick have been designing and marketing products for the communications industry for 25 years. They founded Microwave Filter Company in 1967 and were its chief executives until April 1992, when they left and started Communications & Energy Corporation.

COMMUNICATIONS & ENERGY CORP

Communications & Energy Corp.
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East Syracuse, New York 13057

(315) 452-0709 Phone
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(315) 458-9696 Modem
(800) 882-1587 *Toll Free*

FILTERS 1.0 MHz to 1.0 GHz

Eagle manufactures a wide variety of radio frequency filters. Our goal is to offer a wide variety of standard designs in order to ease the selection process and reduce costs to you the customer. In accordance with this goal the following unique approaches to RF filter manufacure have been taken.

Standard Frequency System-SFS™ Eagle has pioneered this in the filter industry. Basically SFS™ increments are by a fixed percentage. For example standard values would be 1.0 MHz, 1.2 MHz, 1.5 MHz rather then 1.0 , 2.0 , 3.0. As you can see by studying the cutoff frequencies this is identical as standard resistor values. Using this system as few as 46 cutoff frequencies blanket the spectrum from 1.0 MHz to 1.0 GHz. Experience has shown that 95% of the applications can use a standard filter rather than a custom design since a custom frequency can be no more then 5 % away from one of our standard frequencies..

Partially Assembled Module-PAM™ To insure quick delivery and maintain low costs Eagle has developed this concept. In this system the mechanical packages are designed for maximum flexibility both electrically and mechanically. Filter modules are partially assembled for each frequency group and installed into the proper enclosure. When an order is received the unit is trimmed to the final cutoff frequency resulting in a finished filter in days instead of weeks. Standard proven designs spare the customer of the unsurities and cost of custom units. Additionally, there are many standard, and stocked, values for each type of filter which are ready for 48 hour shipment.

Pricing-Eagle has the lowest prices for connectorized filters in low volumes. In 2-4 quantities the HLC700 lowpass filters begin at $95.20 for a standard frequency model. The tuneable filters are as low as $89.10 depending on the frequency range selected.

Due to limitations in space many filter types that are made by EAGLE are not listed here. Please write or call for the complete catalog of Eagle filters and other products.

HLC-700 Lowpass, Highpass, Bandpass and Bandstop Filters

HLC-700 Description:

Eagle HLC-700 series are compact, high performance filters. Stainless steel hardware and connectors assure that there is no corrosion due to galvanic potentials. Cases are solder sealed to keep out dust and foreign materials.

With minimum power ratings of 25 watts, and many models even higher, the spurious free dynamic range of these filters is tremendous. The filters are electrically very rugged, are resistant to ESD and EMP, and may be connected directly to antennas for receiver use or medium power transmitters.

HLC-700's are available in Lowpass, Highpass, Bandpass and Bandstop configurations. Lowpass and Bandpass filters are discussed on the following pages. Please request HLC-700 filter catalog for detailed specifications on Bandpass and Bandstop as well as complete information on Lowpass and Highpass filters.

HLC-700 Specifications:

Electrical

See appropriate data sheet

Mechanical

Dimensions:

Case A	2.0"W X 2.0"L X1.7"H
Case B	3.0"W X 6.0"L X 2.5"H
Case C	2.6"W X 4.0"L X 1.75"H

Dimensions do not include connectors

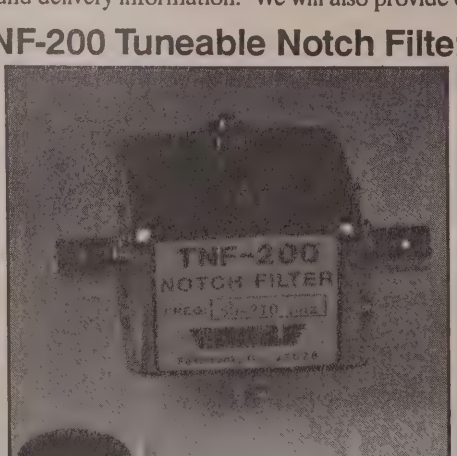
Weight: < 1.5 lbs

Environmental

Temperature:	
Operating:	-20° C to 70° C
Storage:	-55° C to 125° C
Humidity:	10 to 80 % non condensing.
Shock:	> 15G any axis @ 11mS MIL-E-5400T
Vibration:	> 25G 10 to 2000 Hz. MIL-E-5400T

HLC700 ORDERING- find the desired cutoff frequency in the table of standard cutoff frequencies. Then pick the number of sections desired and find the associated part number. Call the factory at the number below for price and delivery information. We will also provide engineering assistance in selecting a filter for your needs if desired.

TNF-200 Tuneable Notch Filters



Features

- Easily adjustable, multi-turn tuning element
- High rejection of notched frequency (typically 25 dB or better)
- Low VSWR for accurate measurements
- 10 Watt power rating

Specifications:

Electrical

Power rating:	10 watts at Notch, 50 watts if IL < 2.0 dB
Impedance:	50 ohms 5%
Insertion loss:	< 0.5 dB below 1.0 GHz
	< 1.0 dB below 2.0 GHz

Mechanical

Dimensions:	2.7"W X 2.0"L X 1.7"H
Weight:	6 Oz

Environmental

Temperature:	0° C to 70° C
Humidity:	10 to 80 % non cond.

Model No VS Range Table:

Model	Frequency MHz
TNF-201	1.5 - 2.5
TNF-202	2.5 - 5.0
TNF-203	5.0 - 10.0
TNF-205	9.5 - 18
TNF-207	15 - 30
TNF-208	30 - 75
TNF-210	50 - 210
TNF-220	100 - 350
TNF-230	250 - 850

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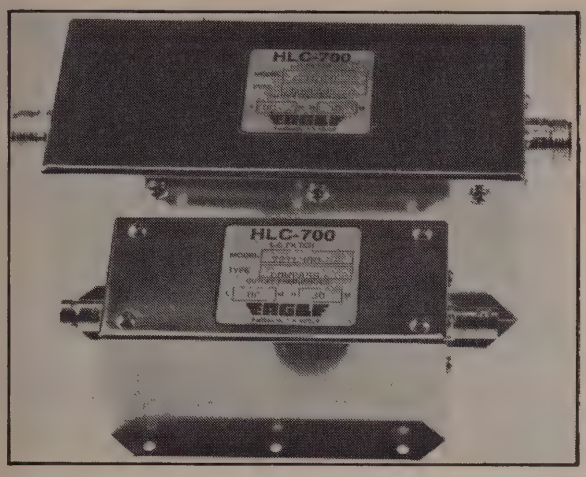
HLC700 Lowpass Filters-Enhanced Chebychev Topology



Features

- 46 Standard cutoff frequencies from 1.0 Mhz to 1000 Mhz
- Custom frequencies: $50.00 setup
- 500 watt and 1000 watt family available
- 7, 9, 11 or 13 sections
- Manufactured to MIL-STDS

EAGLE HLC700 enhanced chebychev low pass filters are available in four configurations: these are 7, 9, 11 or 13 sections. The enhanced chebyshev design yields a steeper transistion band with no increase in insertion loss. When used as signal filters these units offer excellent immunity from internal intermodulation due to the high power rating.

Specifications

Electrical

Impedance: 50 Ω ± 5%
VSWR: <1.4:1 (<-16 dB return loss)
Insertion loss: see table below
Passband ripple: <0.30 dB cutoffs below 200 MHz
<0.40 dB cutoffs above 200 MHz
Maximum stopband freq: see table below

Mechanical & Environmental: refer to page A•1626

Ordering information: Please see page A•1626

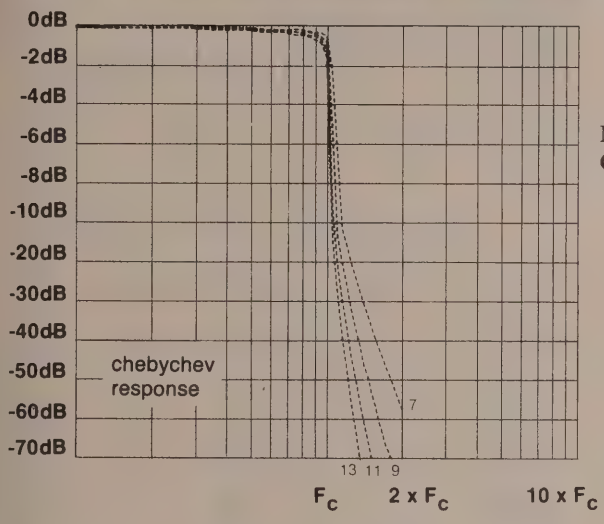


Table of Chebychev Filters by Series

Series	No of Sec	Ins loss	Power rating	stopband atten dB	Case size	Max Freq
HCA701	7	<0.4	100 W	-50	C	10 x Fc
HCB701	9	<0.5	70 W	-60	C	10 x Fc
HCC701	11	<0.6	70 W	-60	C	10 x Fc
HCD701	13	<0.8	50 W	-70	C	10 x Fc
HCA702	7	<0.4	100 W	-50	A	5 x Fc
HCB702	9	<0.5	100 W	-60	A	5 x Fc
HCC702	11	<0.5	100 W	-60	C	5 x Fc
HCD702	13	<0.8	70 W	-65	C	5 x Fc
HCA703	7	<0.5	50 W	-50	A	3 x Fc
HCB703	9	<0.7	50 W	-50	A	3 x Fc
HCC703	11	<0.8	50 W	-60	C	3 x Fc

Table of Standard Cutoff Frequencies

Cutoff FREQ	Seven Sec	Nine Sec	Eleven Sec	Thirteen Sec
1.0	HCA701L1R0	HCB701L1R0	HCC701L1R0	HCD701L1R0
1.2	HCA701L1R2	HCB701L1R2	HCC701L1R2	HCD701L1R2
1.5	HCA701L1R5	HCB701L1R5	HCC701L1R5	HCD701L1R5
2.2	HCA701L2R2	HCB701L2R2	HCC701L2R2	HCD701L2R2
2.7	HCA701L2R7	HCB701L2R7	HCC701L2R7	HCD701L2R7
3.3	HCA701L3R3	HCB701L3R3	HCC701L3R3	HCD701L3R3
3.9	HCA701L3R9	HCB701L3R9	HCC701L3R9	HCD701L3R9
4.7	HCA701L4R7	HCB701L4R7	HCC701L4R7	HCD701L4R7
5.1	HCA701L5R1	HCB701L5R1	HCC701L5R1	HCD701L5R1
5.6	HCA701L5R6	HCB701L5R6	HCC701L5R6	HCD701L5R6
6.2	HCA701L6R2	HCB701L6R2	HCC701L6R2	HCD701L6R2
6.8	HCA701L6R8	HCB701L6R8	HCC701L6R8	HCD701L6R8
7.5	HCA701L7R5	HCB701L7R5	HCC701L7R5	HCD701L7R5
8.2	HCA701L8R2	HCB701L8R2	HCC701L8R2	HCD701L8R2
9.1	HCA701L9R1	HCB701L9R1	HCC701L9R1	HCD701L9R1
10.0	HCA701L100	HCB701L100	HCC701L100	HCD701L100
12.0	HCA701L120	HCB701L120	HCC701L120	HCD701L120
15.0	HCA701L150	HCB701L150	HCC701L150	HCD701L150
22.0	HCA701L220	HCB701L220	HCC701L220	HCD701L220
27.0	HCA701L270	HCB701L270	HCC701L270	HCD701L270
33.0	HCA701L330	HCB701L330	HCC701L330	HCD701L330
39.0	HCA701L390	HCB701L390	HCC701L390	HCD701L390
47.0	HCA701L470	HCB701L470	HCC701L470	HCD701L470
51.0	HCA701L510	HCB701L510	HCC701L510	HCD701L510

Table of Standard Cutoff Frequencies

Cutoff FREQ	Seven Sec	Nine Sec	Eleven Sec	Thirteen Sec
56.0	HCA702L560	HCB702L560	HCC702L560	HCD702L560
62.0	HCA702L620	HCB702L620	HCC702L620	HCD702L620
68.0	HCA702L680	HCB702L680	HCC701L680	HCD702L680
75.0	HCA702L750	HCB702L750	HCC702L750	HCD702L750
82.0	HCA702L820	HCB702L820	HCC702L820	HCD702L820
91.0	HCA702L910	HCB702L910	HCC702L910	HCD702L910
100.0	HCA702L101	HCB702L101	HCC702L101	HCD702L101
120.0	HCA702L121	HCB702L121	HCC702L121	HCD702L121
150.0	HCA702L151	HCB702L151	HCC702L151	HCD702L151
220.0	HCA702L221	HCB702L221	HCC702L221	HCD702L221
270.0	HCA702L271	HCB702L271	HCC702L271	HCD702L271
330.0	HCA702L331	HCB702L331	HCC702L331	HCD702L331
390.0	HCA702L391	HCB702L391	HCC702L391	HCD702L391
470.0	HCA702L471	HCB702L471	HCC702L471	HCD702L471
510.0	HCA702L511	HCB702L511	HCC702L511	HCD702L511
560.0	HCA703L561	HCB703L561	HCC703L561	
620.0	HCA703L621	HCB703L621	HCC703L621	
680.0	HCA703L681	HCB703L681	HCC703L681	
750.0	HCA703L751	HCB703L751	HCC703L751	
820.0	HCA703L821	HCB703L821	HCC703L821	
910.0	HCA703L911	HCB703L911	HCC703L911	
1000.0	HCA703L102	HCB703L102	HCC703L102	

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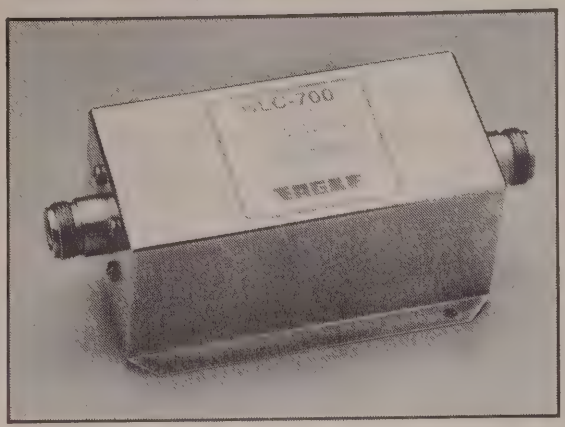
HLC700 Lowpass Filters-Elliptical Topology



Features

- **46 Standard cutoff frequencies from 1.0 Mhz to 1000 Mhz**
- **Custom frequencies: $75.00 setup**
- **Linear phase family available**
- **Sharp cutoff**
- **Manufactured to MIL-STDS**

EAGLE HLC700 elliptical low pass filters are available in four configurations: these are 7, 9, 11 or 13 sections. These filters are ideal for applications requiring a steep transistion band. When used as signal filters these units offer excellent immunity from internal intermodulation due to the high power rating.

Specifications

Electrical

Impedance: 50 Ω ± 5%
VSWR: <1.4:1 (<-16 dB return loss)
Insertion loss: see table below
Passband ripple: <0.30 dB cutoffs below 200 MHz
<0.40 dB cutoffs above 200 MHz
Maximum stopband freq: see table below

Mechanical & Environmental: refer to page A•1626

Ordering information: Please see page A•1626

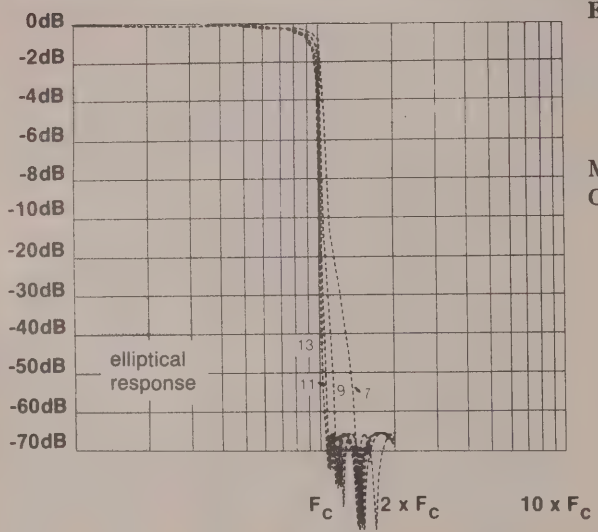


Table of Elliptical Filters by Series

Series	No of Sec	Ins loss	Power rating	stopband atten dB	Case size	Max Freq
HEA701	7	<0.4	50 W	-60	C	10 x Fc
HEB701	9	<0.5	50 W	-70	C	10 x Fc
HEC701	11	<0.6	50 W	-70	C	10 x Fc
HED701	13	<0.8	25 W	-70	C	10 x Fc
HEA702	7	<0.4	70 W	-55	A	5 x Fc
HEB702	9	<0.5	70 W	-60	A	5 x Fc
HEC702	11	<0.5	70 W	-60	C	5 x Fc
HED702	13	<0.8	50 W	-70	C	5 x Fc
HEA703	7	<0.5	50 W	-55	A	3 x Fc
HEB703	9	<0.7	50 W	-60	A	3 x Fc
HEC703	11	<0.8	50 W	-60	C	3 x Fc

Table of Standard Cutoff Frequencies

Cutoff FREQ	Seven Sec	Nine Sec	Eleven Sec	Thirteen Sec
1.0	HEA701L1R0	HEB701L1R0	HEC701L1R0	HED701L1R0
1.2	HEA701L1R2	HEB701L1R2	HEC701L1R2	HED701L1R2
1.5	HEA701L1R5	HEB701L1R5	HEC701L1R5	HED701L1R5
2.2	HEA701L2R2	HEB701L2R2	HEC701L2R2	HED701L2R2
2.7	HEA701L2R7	HEB701L2R7	HEC701L2R7	HED701L2R7
3.3	HEA701L3R3	HEB701L3R3	HEC701L3R3	HED701L3R3
3.9	HEA701L3R9	HEB701L3R9	HEC701L3R9	HED701L3R9
4.7	HEA701L4R7	HEB701L4R7	HEC701L4R7	HED701L4R7
5.1	HEA701L5R1	HEB701L5R1	HEC701L5R1	HED701L5R1
5.6	HEA701L5R6	HEB701L5R6	HEC701L5R6	HED701L5R6
6.2	HEA701L6R2	HEB701L6R2	HEC701L6R2	HED701L6R2
6.8	HEA701L6R8	HEB701L6R8	HEC701L6R8	HED701L6R8
7.5	HEA701L7R5	HEB701L7R5	HEC701L7R5	HED701L7R5
8.2	HEA701L8R2	HEB701L8R2	HEC701L8R2	HED701L8R2
9.1	HEA701L9R1	HEB701L9R1	HEC701L9R1	HED701L9R1
10.0	HEA701L100	HEB701L100	HEC701L100	HED701L100
12.0	HEA701L120	HEB701L120	HEC701L120	HED701L120
15.0	HEA701L150	HEB701L150	HEC701L150	HED701L150
22.0	HEA701L220	HEB701L220	HEC701L220	HED701L220
27.0	HEA701L270	HEB701L270	HEC701L270	HED701L270
33.0	HEA701L330	HEB701L330	HEC701L330	HED701L330
39.0	HEA701L390	HEB701L390	HEC701L390	HED701L390
47.0	HEA701L470	HEB701L470	HEC701L470	HED701L470
51.0	HEA701L510	HEB701L510	HEC701L510	HED701L510

Table of Standard Cutoff Frequencies

Cutoff FREQ	Seven Sec	Nine Sec	Eleven Sec	Thirteen Sec
56.0	HEA702L560	HEB702L560	HEC702L560	HED702L560
62.0	HEA702L620	HEB702L620	HEC702L620	HED702L620
68.0	HEA702L680	HEB702L680	HEC701L680	HED702L680
75.0	HEA702L750	HEB702L750	HEC702L750	HED702L750
82.0	HEA702L820	HEB702L820	HEC702L820	HED702L820
91.0	HEA702L910	HEB702L910	HEC702L910	HED702L910
100.0	HEA702L101	HEB702L101	HEC702L101	HED702L101
120.0	HEA702L121	HEB702L121	HEC702L121	HED702L121
150.0	HEA702L151	HEB702L151	HEC702L151	HED702L151
220.0	HEA702L221	HEB702L221	HEC702L221	HED702L221
270.0	HEA702L271	HEB702L271	HEC702L271	HED702L271
330.0	HEA702L331	HEB702L331	HEC702L331	HED702L331
390.0	HEA702L391	HEB702L391	HEC702L391	HED702L391
470.0	HEA702L471	HEB702L471	HEC702L471	HCD702L471
510.0	HEA702L511	HEB702L511	HEC702L511	HCD702L511
560.0	HEA703L561	HEB703L561	HEC703L561	
620.0	HEA703L621	HEB703L621	HEC703L621	
680.0	HEA703L681	HEB703L681	HEC703L681	
750.0	HEA703L751	HEB703L751	HEC703L751	
820.0	HEA703L821	HEB703L821	HEC703L821	
910.0	HEA703L911	HEB703L911	HEC703L911	
1000.0	HEA703L102	HEB703L102	HEC703L102	

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HLC72x Power Lowpass Filters

Features

- 36 Standard frequencies from 2.2 Mhz to 510 Mhz
- Two power ratings: 500 W or 1.0 KW
- Very low insertion loss: < 0.3 dB
- Sharp Cufoff: >50 dB @ 1.2 F_c

EAGLE HLC72x power filters are ideally suited for high power applications that require sharp cutoffs, small size and low loss. These filters are available in 9 or 11 sections. The proprietary topology yields sharpness approaching elliptical without generating the high internal voltages or currents normally associated with that topology.

Specifications
Electrical
Impedance: 50 Ω ± 5%
VSWR: <1.25:1 (<-19 dB return loss)
Insertion loss: see table below
Maximum stopband freq: see table below

Mechanical & Environmental: refer to page A•1626
Ordering information: Please see page A•1626

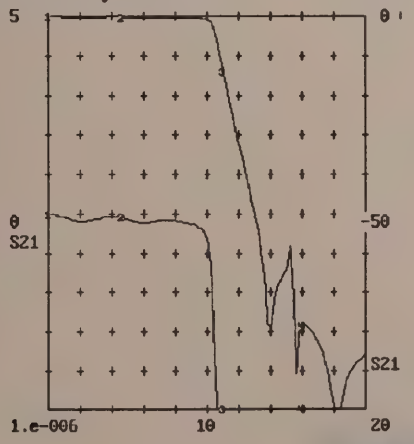
Specification Table of Power Filters

Series	No of Sec	Ins loss	Power rating	stopband atten dB	Case size	Max Freq
HCB721	9	<0.3	500 W	-50	C	10 x Fc
HCC721	11	<0.3	500 W	-60	C	10 x Fc
HKB721	9	<0.3	1000 W	-50	B	10 x Fc
HKC721	11	<0.3	1000 W	-60	B	10 x Fc
HCB722	9	<0.4	500 W	-50	C	5 x Fc
HCC722	11	<0.4	500 W	-60	C	5 x Fc
HKB722	9	<0.4	1000 W	-50	B	5 x Fc
HKC722	11	<0.4	1000 W	-60	B	5 x Fc

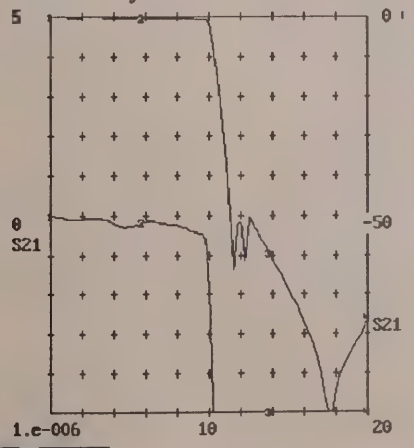
Table of Standard Cutoff Frequencies

Cutoff FREQ	500 Watt Nine Sec	500 Watt Eleven Sec	1000 Watt Nine Sec	!000 Watt Eleven Sec
2.2	HCB721L2R2	HCC721L2R2	HKB721L2R2	HKC721L2R2
2.7	HCB721L2R7	HCC721L2R7	HKB721L2R7	HKC721L2R7
3.3	HCB721L3R3	HCC721L3R3	HKB721L3R3	HKC721L3R3
3.9	HCB721L3R9	HCC721L3R9	HKB721L3R9	HKC721L3R9
4.7	HCB721L4R7	HCC721L4R7	HKB721L4R7	HKC721L4R7
5.1	HCB721L5R1	HCC721L5R1	HKB721L5R1	HKC721L5R1
5.6	HCB721L5R6	HCC721L5R6	HKB721L5R6	HKC721L5R6
6.2	HCB721L6R2	HCC721L6R2	HKB721L6R2	HKC721L6R2
6.8	HCB721L6R8	HCC721L6R8	HKB721L6R8	HKC721L6R8
7.5	HCB721L7R5	HCC721L7R5	HKB721L7R5	HKC721L7R5
8.2	HCB721L8R2	HCC721L8R2	HKB721L8R2	HKC721L8R2
9.1	HCB721L9R1	HCC721L9R1	HKB721L9R1	HKC721L9R1
10.0	HCB721L100	HCC721L100	HKB721L100	HKC721L100
12.0	HCB721L120	HCC721L120	HKB721L120	HKC721L120
15.0	HCB721L150	HCC721L150	HKB721L150	HKC721L150
22.0	HCB701L220	HCC721L220	HKB721L220	HKC721L220
27.0	HCB721L270	HCC721L270	HKB721L270	HKC721L270
33.0	HCB721L330	HCC721L330	HKB721L330	HKC721L330
39.0	HCB721L390	HCC721L390	HKB721L390	HKC721L390
47.0	HCB721L470	HCC721L470	HKB721L470	HKC721L470
51.0	HCB721L510	HCC721L510	HKB721L510	HKC721L510
56.0	HCB722L560	HCC722L560	HKB722L560	HKC722L560
62.0	HCB722L620	HCC722L620	HKB722L620	HKC722L620
68.0	HCB722L680	HCC722L680	HKB722L680	HKC722L680
75.0	HCB722L750	HCC722L750	HKB722L750	HKC722L750
82.0	HCB722L820	HCC722L820	HKB722L820	HKC722L820
91.0	HCB722L910	HCC722L910	HKB722L910	HKC722L910
100.0	HCB722L101	HCC722L101	HKB722L101	HKC722L101
120.0	HCB722L121	HCC722L121	HKB722L121	HKC722L121
150.0	HCB722L151	HCC722L151	HKB722L151	HKC722L151
220.0	HCB722L221	HCC722L221	HKB722L221	HKC722L221
270.0	HCB722L271	HCC722L271	HKB722L271	HKC722L271
330.0	HCB722L331	HCC722L331	HKB722L331	HKC722L331
390.0	HCB722L391	HCC722L391	HKB722L391	HKC722L391
470.0	HCB722L471	HCC722L471	HKB722L471	HKC722L471
510.0	HCB722L511	HCC722L511	HKB722L511	HKC722L511

Nine Section Performance



Eleven Section Performance



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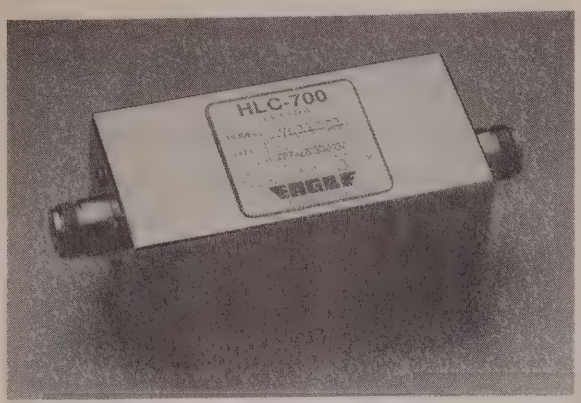
HLC73x- Lowpass, Linear Phase Filters



EAGLE HLC73x low pass linear phase filters are ideally suited for applications requiring sharp cutoffs with constant group delay characteristics. Such applications include; video, digital, I&Q modulators or others where the integrity of a complex waveform must be maintained.

Features

- 33 Standard frequencies from 3.0 Mhz to 240 Mhz
- Low insertion loss: < 0.6 dB at cutoff
- Excellent group delay characteristics
- Easily matched for I Q modulators

Specifications

Electrical

Impedance: 50 Ω % 5%
Return loss: >20 dB
Insertion loss: see table below
Maximum stopband freq: see table below
Group delay variation: <5 % DC-1.2*Fc

Mechanical & Environmental: refer to page A•1626
Ordering information: Please see page A•1626

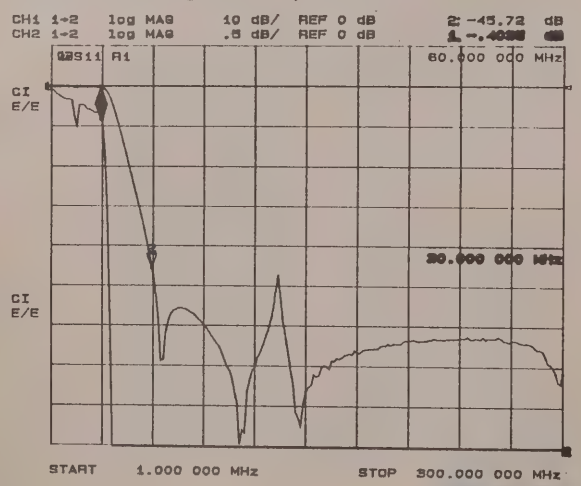
Specification Table of Linear Phase Filters

Series	No of Sec	Ins loss	Power rating	stopband atten dB	Case size	Max Freq
HLA731	7	<0.5	25 W	-45	D	10 x Fc
HLA732	7	<0.5	25 W	-45	C	5 x Fc
HLA733	7	<0.6	25 W	-45	C	5 x Fc

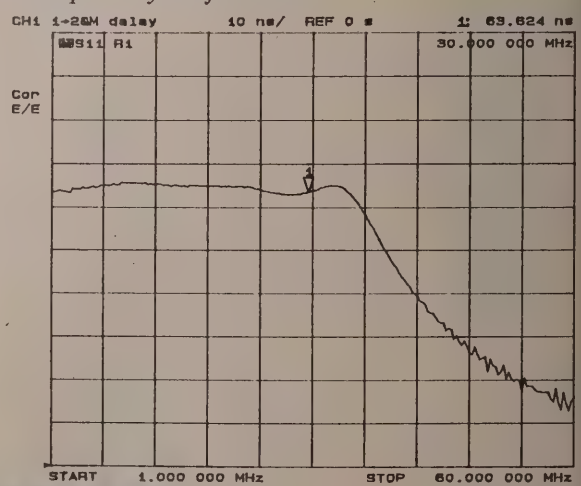
Table of Standard Cutoff Frequencies

Cutoff FREQ	Part Number
3.0	HLA731L2R2
3.3	HLA731L2R7
3.6	HLA731L3R3
3.9	HLA731L3R9
4.3	HLA731L4R7
4.7	HLA731L5R1
5.1	HLA731L5R6
5.6	HLA731L6R2
6.2	HLA731L6R8
6.8	HLA731L6R8
7.5	HLA731L7R5
8.2	HLA731L8R2
9.1	HLA731L9R1
10.0	HLA731L100
12.0	HLA732L120
15.0	HLA732L150
22.0	HLA732L220
27.0	HLA732L270
33.0	HLA732L330
39.0	HLA732L390
47.0	HLA732L470
51.0	HLA733L510
56.0	HLA733L560
62.0	HLA733L620
68.0	HLA733L680
75.0	HLA733L750
82.0	HLA733L820
91.0	HLA733L910
100.0	HLA733L101
120.0	HLA733L121
150.0	HLA733L151
220.0	HLA733L221
240.0	HLA733L241

Passband & Stopband Performance



Group Delay Performance



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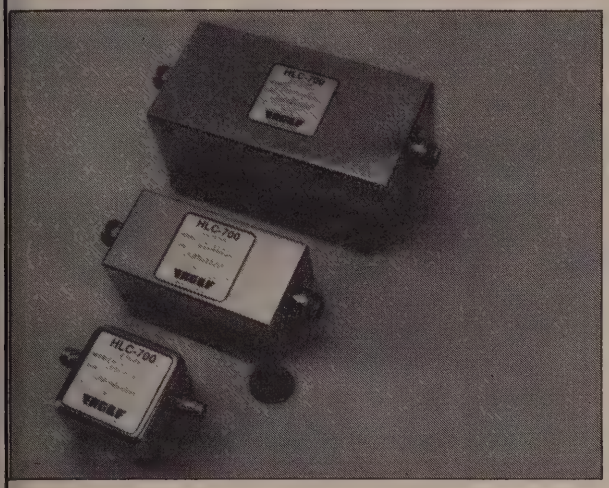
HLC-700 Highpass Filters



- 33 Standard cutoff frequencies
- Custom cutoff frequencies available
- Power ratings to 100 Watts
- Chebychev or elliptical response
- 7, 9, 11 or 13 sections
- Manufactured to MIL-STDS

EAGLE HLC-700 high pass filters are available in two families; these are: Chebychev and elliptical.These filters are available in thirty three standard cutoff frequencies and seven to thirteen sections. All of these high pass filters have infinite attenuation at DC.

Specifications:

Electrical

Series	SEC	IL	Power	Case	Max Freq
HXA701	7	<0.5	50 W	C	10 x Fc
HXB701	9	<0.7	50 W	C	10 x Fc
HXC701	11	<0.7	50 W	C	10 x Fc
HXD701	13	<1.0	25 W	C	10 x Fc
HXA702	7	<0.5	100W	A	5 x Fc
HXB702	9	<0.7	100W	C	5 x Fc
HXC702	11	<0.7	100W	C	5 x Fc
HXD702	13	<1.0	70W	C	5 x Fc

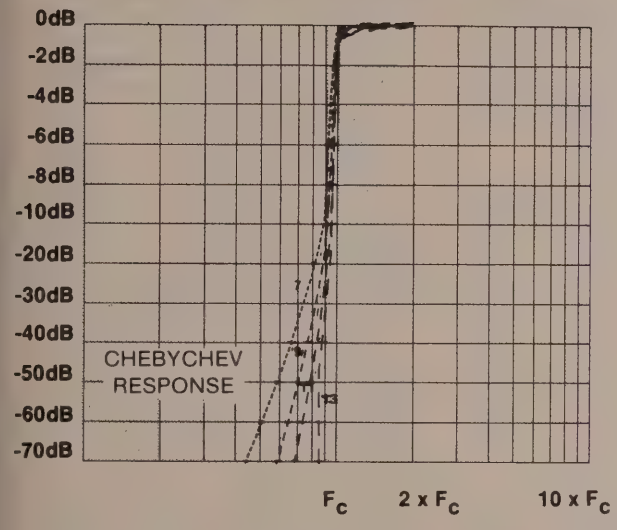
Substitute C for Chebychev or E for Elliptical in above series numbers.

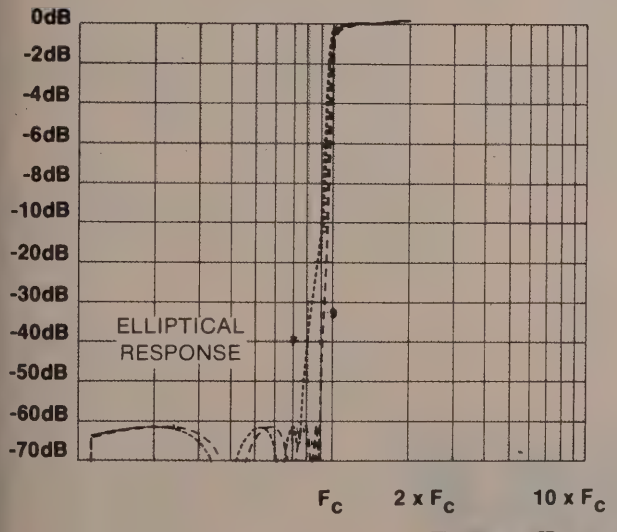
Mechanical: refer to page A•1626

Environmental: refer to page A•1626

Ordering procedure

Determine the filter best suited to the requirement from the typical curves. Check table above for suitable power, case and insertion loss. Find part number below for proper cutoff frequency. Call factory for price or to place order.





FREQ	Cheby PN	Ellip PN	FREQ	Cheby PN	Ellip PN
1.0	HCX701H1R0	HEX711H1R0	22.0	HCX701H220	HEX711H220
1.2	HCX701H1R2	HEX711H1R2	27.0	HCX701H270	HEX711H270
1.5	HCX701H1R5	HEX711H1R5	33.0	HCX701H330	HEX711H330
2.2	HCX701H2R2	HEX711H2R2	39.0	HCX701H390	HEX711H390
2.7	HCX701H2R7	HEX711H2R7	47.0	HCX701H470	HEX711H470
3.3	HCX701H3R3	HEX711H3R3			
3.9	HCX701H3R9	HEX711H3R9	56.0	HCX702H560	HEX712H560
4.7	HCX701H4R7	HEX711H4R7	62.0	HCX702H620	HEX712H620
5.6	HCX701H5R6	HEX711H5R6	82.0	HCX702H820	HEX712H820
6.2	HCX701H6R2	HEX711H6R2	91.0	HCX702H910	HEX712H910
6.8	HCX701H6R8	HEX711H6R8	100.0	HCX702H101	HEX712H101
8.2	HCX701H8R2	HEX711H8R2	120.0	HCX702H121	HEX712H121
9.1	HCX701H9R1	HEX711H9R1	150.0	HCX702H151	HEX712H151
10.0	HCX701H100	HEX711H100	220.0	HCX702H221	HEX712H221
12.0	HCX701H120	HEX711H120	270.0	HCX702H271	HEX712H271
15.0	HCX701H150	HEX711H150	330.0	HCX702H331	HEX712H331
			390.0	HCX702H391	HEX712H391
			470.0	HCX702H471	HEX712H471

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PRICE LIST 1993

Filters, Lowpass-Chebychev

Series	Price
HCA701L	105.00
HCB701L	124.00
HCC701L	135.00
HCD701L	159.00
HCA702L	102.00
HCB702L	119.00
HCC702L	129.00
HCD702L	169.00
HCA703L	109.00
HCB703L	119.00
HCC703L	135.00

Filters, Lowpass-Elliptical

Series	Price
HEA701L	139.00
HEB701L	159.00
HEC701L	205.00
HED701L	215.00
HEA702L	139.00
HEB702L	169.00
HEC702L	210.00
HED702L	235.00
HEA703L	159.00
HEB703L	199.00
HEC703L	219.00

Filters, Lowpass-Power

Series	Price
HCB721L	310.00
HCC721L	365.00
HKB721L	435.00
HKC721L	495.00
HCB722L	305.00
HCC722L	345.00
HKB722L	420.00
HKC722L	495.00

Filters, Low Pass-Linear Phase

HLA731 3-10 Mz	169.00
HLA732 12-47 Mz	155.00
HLA733 51-240 Mz	175.00

Filters, Highpass-Chebychev

HCA701H	105.00
HCB701H	117.00
HCC701H	149.00
HCA702H	105.00
HCB702H	119.00
HCC702H	159.00

Filters, Highpass-Elliptical

HEA701H	139.00
HEB701H	179.00
HEC701H	209.00
HEA702H	139.00
HEB702H	169.00
HEB703H	195.00

Filters, Highpass-Power

HCB721L	325.00
HCB722L	315.00
HKB721L	435.00
HKB722L	420.00

Filters, Tuneable Notch

Model	Price
TNF200 Series	
TNF20L1	169.00
TNF20L3	159.00
TNF20L5	159.00
TNF201	135.00
TNF202	135.00
TNF203	135.00
TNF205	119.00
TNF207	119.00
TNF208	119.00
TNF210	119.00
TNF220	105.00
TNF230	105.00
TNF300 Series	
TNF310 Multi Band	425.00
TNF320 Dual 2-30 Mz	735.00
TNF400 Series	
TNF411	269.00
TNF412	239.00
TNF413	239.00

Discounts

Discounts for quantity purchases apply to all of the filter products. The following table is the discount schedule for up to 9 units. Please contact the factory for discounts on purchases of 10 or more units.

Quan	Discount
2-4 units	10% off
5-9 units	15% off

Options

There are a variety of connectors available for the HLC700 series and TNF200 series filters. The following table lists the avaiilable connectors and the price.

Note: some connector options may not be available on some filters please contact the factory.

Option	Conn	Price
"B"	BNC female	STD
"N"	N female	10.00
"S"	UHF SO239	14.00
"M"	SMA female	20.50
"L"	LC female	70.00
"J"	SMB female	15.00

Ordering & terms

COD unless credit approved, which would then be net 30 days. Prices are US dollars and do not include shipping or handling charges. Freight on board point: Wichita, KS USA 67277. To order call or fax sales office in Wichita. We maintain a large inventory of standard products.

When ordering please list model number and quantities along with applicable options and other pertinent specifications to insure receiving the proper product.

For HLC700 products include type of filter and the cutoff frequencies. Please contact the sales department if assistance is required.

Note: Prices, specifications and availability are subject to change without notice.

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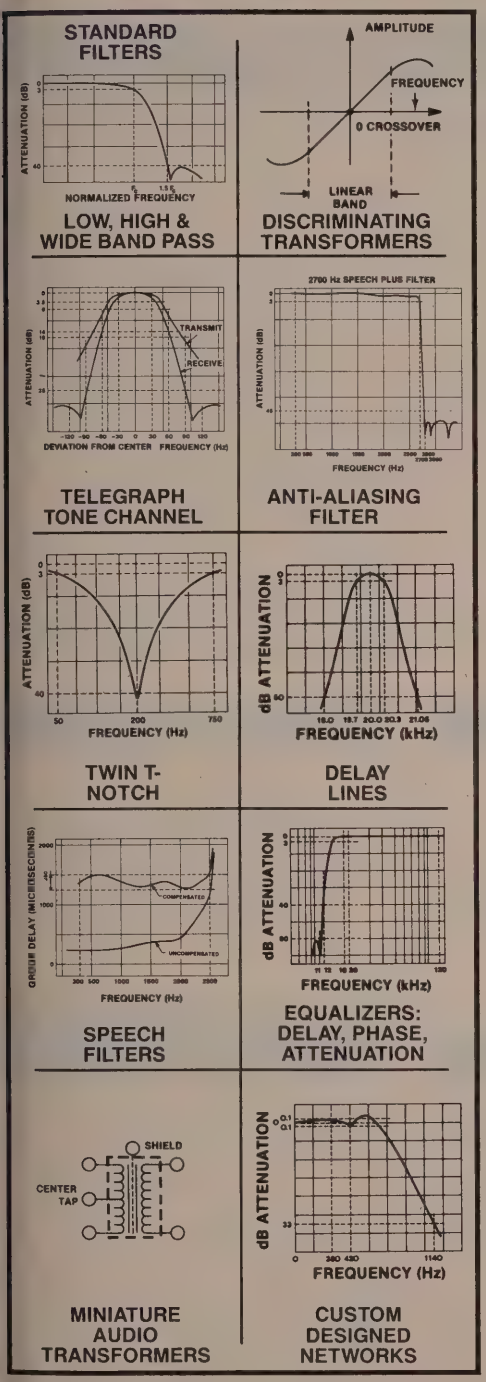

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- Telemetering
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For 802.3 10Base-T LAN Applications

Key Features

- All FEE Fil-Mag components are manufactured in ISO 9001 certified facilities to meet the highest international standards
- Components meet or exceed IEEE 802 10Base-T specification
- Compatible with multiple 10Base-T chips
- High performance for maximum EMI suppression
- High isolation voltages

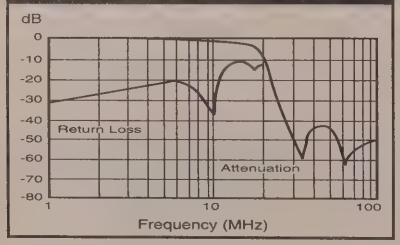
Surface Mount

- Proven in all surface mount soldering processes
- Available in tubes; tape and reel optional

Through-Hole

- Low-profile DIL packages
- Auto insertable
- SIP package (78Z1122F-01) ideal for multiport repeater hub applications

Typical Response Graph



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In the construction of the components described, the full intent of the specification will be met. FEE Fil-Mag, however, reserves the right to make, from time to time, such departures from the detail specifications as may be required to permit improvements in the design of its products.

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10Base-T Filters and Interface Modules

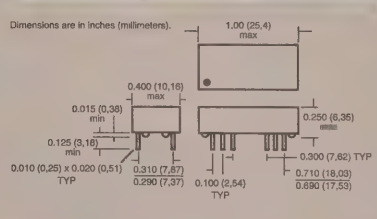
Electrical Specifications at 25°C

Part No	Insertion Loss to 10MHz dB max	Attenuation[4] 30-50MHz Tx	30-50MHz Rx	50-100MHz Tx	50-100MHz Rx	Return Loss 0.5-10MHz dB min 100	Crosstalk to 30MHZ dB min	Group Delay 5-10 MHz nS max	Common Mode Rejection dB min 50 MHz	100 MHz	Schem
78Z1100B	-1.0	-35	-18	-25	-25	-15	N/A	3.0	-22	-16	A
78Z1120B-01[1]	-1.0	-32	-25	-25	-25	-15	-30	4.0	-30	-25	B
78Z1120B-02	-1.0	-32	-25	-25	-25	-15	-30	4.0	-30	-25	C
78Z1120D-01	-1.0	-32	-25	-25	-20	-15	-30	4.0	-30	-25	D
78Z1122B-01[2]	-1.0	-32	-15	-35	-20	-15	-35	4.0	-35	-30	E
78Z1122B-11	-4.5	-30	-15	-30	-20	-15	-35	4.0	-35	-30	J
78Z1122B-12	-4.5	-30	-15	-30	-20	-15	-35	4.0	-35	-30	J
78Z1122B-13	-4.5	-30	-15	-30	-20	-15	-35	4.0	-35	-30	J
78Z1122D-01	-1.0	-30	-15	-30	-20	-15	-35	4.0	-35	-30	E
78Z1122D-11	-4.5	-30	-15	-30	-20	-15	-35	4.0	-35	-30	J
78Z1122D-12	-4.5	-30	-15	-30	-20	-15	-35	4.0	-35	-30	J
78Z1122D-13	-4.5	-30	-15	-30	-20	-15	-35	4.0	-35	-30	J
78Z1122F-01[3]	-1.0	-30	-15	-35	-20	-15	-31	4.0	-55	-45	G

Ratings:
Operating Temperature: 0 to 70°C

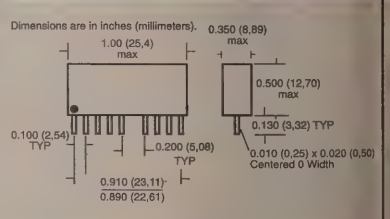
Notes:
1. Available with Butterworth filters: specify *78Z035*
2. Available with Butterworth filters: specify *78Z034*
3. SIP package ideal for multiport repeater hub applications
4. Both transmit and receive channels meet IEEE 802.3 specs
5. Isolation primary to secondary: DWV 2000 Vrms

DIL Package

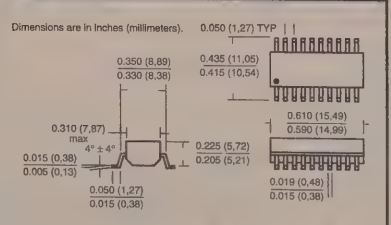


Note: For 78Z1122B-11/12/13 height = 0.480 (12,19) max

SIP Package

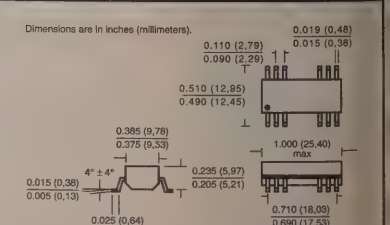


78Z1120D-01



Notes:
A. Each lead is within 0.010" (0,25) radius of its true position at the maximum material dimension
B. Coplanarity within 0.002" (0,05)
C. Mold flash or protrusion are not included in body dimensions but shall not exceed 0.006" (0,15)

78Z1122D-XX



Notes:
A. Each lead is within 0.010" (0,25) radius of its true position at the maximum material dimension
B. Coplanarity within 0.002" (0,05)
C. Mold flash or protrusion are not included in body dimensions but shall not exceed 0.006" (0,15)
D. Number of pins included on package is dependent upon product

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FEE Fil-Mag USA
9445 Farnham
San Diego, CA 92123
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Fax (619) 569-6073

For 802.3 10Base-T LAN Applications

IC Compatibility

The 78Z Series offers full compatibility with 10Base-T transceiver and multiport repeater ICs from all major manufacturers.

Packaging

FEE Fil-Mag's 78Z transformer/filter combination modules are packaged in surface mount, SIP, and DIP compatible packages as shown. Individual components are available in discrete form also (23Z114SM transformer and 78Z1100B/D filter). The choice of discrete components or combination transformer/filter modules is application dependent.

Module Types

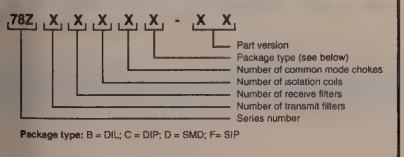
78Z1100X-XX:
Filter only

78Z1120X-XX:
Filter and isolation transformers

78Z1122X-XX:
Filter, isolation transformer, and common mode choke

78Z1122X-11,12,13:
Filter, isolation transformer, common mode choke, and resistance

Part Numbering Chart


78Z X X X X X - X X
Part version
Package type (see below)
Number of common mode chokes
Number of isolation coils
Number of receive filters
Number of transmit filters
Series number
Package type: B = DIL; C = DIP; D = SMD; F= SIP

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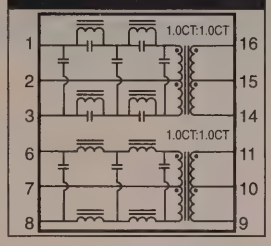
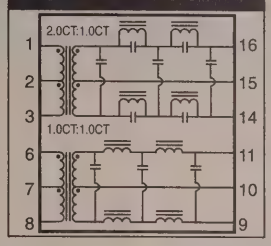
10Base-T Filters and Interface Modules

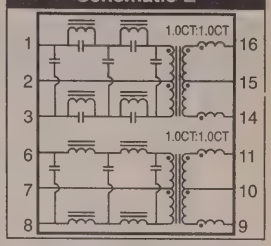
Schematic B



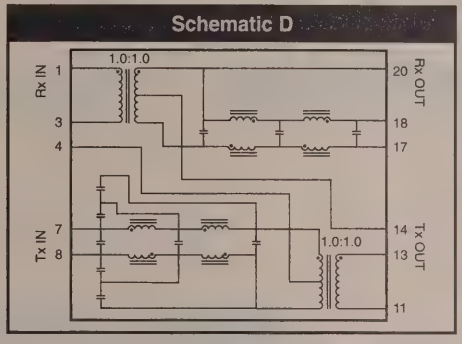
Schematic C



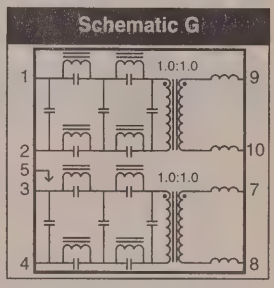
Schematic E



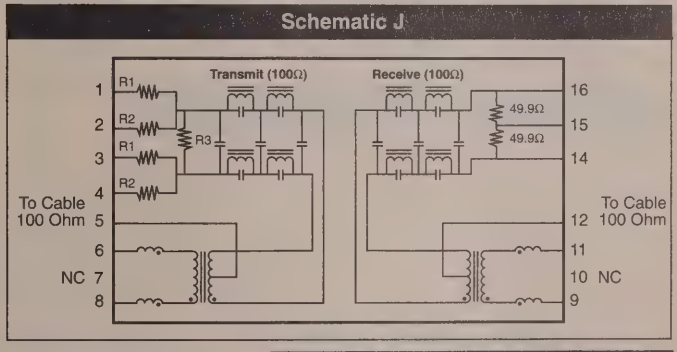
Schematic D



Schematic G



Schematic J



Part Numbers Cross Reference Chart

Catalog Part No	IC Manufacturer	IC Part No
78Z1120B/D/F-01 78Z1122B/D/F-01	AT&T	T7210 T7213 T7220 T7240
	National Semiconductor	DP83902
	Level One	LXT 902
	NCR	NCR92CO2A NCR92CO3
	Fujitsu	MB86962
	Phillips/Signetics	NE86C92
	Seeq	83C94
	Intel	82506TC
78Z034 78Z035	AMD	Am79C98
78Z1120F-01 78Z1122F-01 (multiport repeaters)	AT&T	T2200 T2201
	Level One	LXT 903
	Micro Linear	ML4653
	National Semiconductor	DP83950
	Intel	82505TA

Resistor Values (78Z1122B/D-11/12/13/15)

Part Number	R_1 (Ohms)	R_2 (Ohms)	R_3 (KOhms)
78Z1122B/D-11	42.2	280	5.11
78Z1122B/D-12	61.9	422	1.21
78Z1122B/D-13	57.6	232	N/A
78Z1122B/D-15	61.9	422	1.21

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San Diego, CA 92123
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Quad Filter Module

Key Features

- All FEE Fil-Mag components are manufactured in ISO 9001 certified facilities to meet the highest international standards
- 100% burn-in and pre-tested
- Surface mount assembly technology used
- Operating temperature is 0 to 70°C

Open Frame Through-Hole

- Compact open frame using SMD technology
- Design process and capabilities provide a cost effective method
- 64-pin open through-hole package
- All internal components are completely pre-tested
- Contact local customer service location for supplemental information on surface mount version

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FEE Fil-Mag®

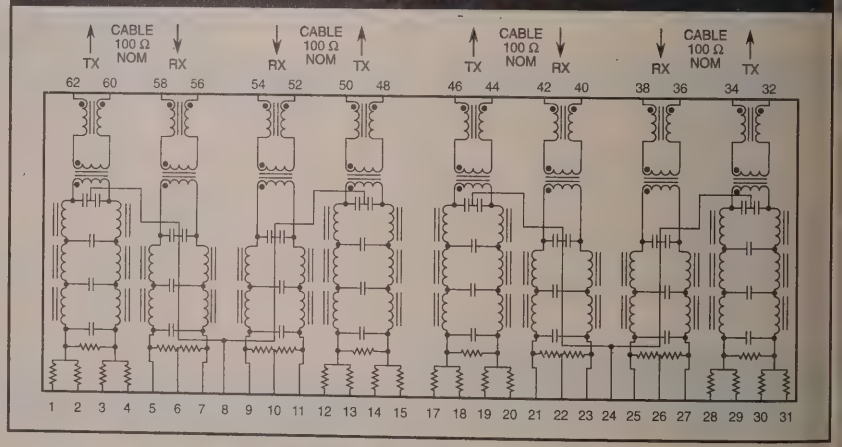
FEE Fil-Mag®

Quad Filter Module

Electrical Specifications for Each Channel at 25°C

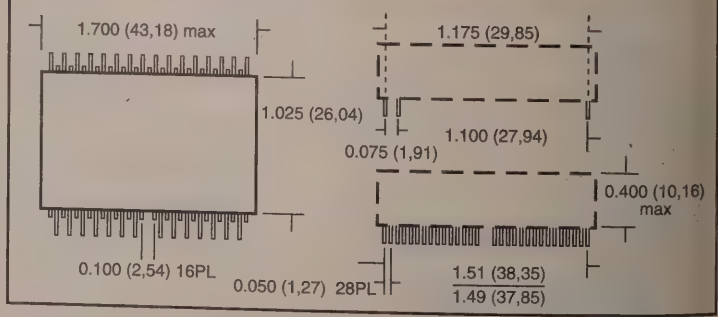
	Transmitter Side	Receiver Side
Cut-Off Frequency	17MHz ± .7MHz	17MHz ± .7MHz
Input Impedance	198 Ohms	50 Ohms
Insertion Loss @ 1MHz–10MHz	4.5 dB max	1.0 dB max
Minimum Attenuation		
@ 20MHz	7 dB	5 dB
@ 25MHz	18 dB	11 dB
@ 30MHz	30 dB	16 dB
@ 40MHz	33 dB	26 dB
Minimum Return Loss on an 85 Ohm Load @ 5MHz–10MHz	15 dB	15 db
Minimum Common Mode Rejection @ 30MHz–100MHz	30 dB	30 db
Input-Ouput Isolation	2,000 Vrms for 1 min.	2,000 Vrms for 1 min.
Transmitter/Receiver Characteristic		
Minimum Crosstalk @ 1MHz–10MHz Between Adjacent Channels	35 dB	35 dB
Isolation Between Adjacent Channels	500 Vrms for 1 min.	500 Vrms for 1 min.

Schematic



64-Pin Open Frame DIL Package

Dimensions are in inches (millimeters).



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High Impedance, High Frequency Data Line Filters for Data Communications and Telecommunications Applications

Key Features

- All FEE Fil-Mag components are manufactured in ISO 9001 certified facilities to meet the highest international standards
- Greater than or equal to 2000 Ohm impedance at 30 MHz
- Greater than or equal to 500 Ohm impedance at 300 MHz
- Higher attenuation in the common mode provides superior reduction in radiated noise

Surface Mount

- Part number 23Z4000SM
- Proven in all surface mount soldering processes
- Available in tubes; tape and reel optional

Through-Hole

- Low profile, 8-pin DIL
- Auto insertable

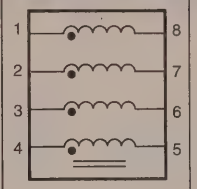
FEE Fil-Mag®

High Impedance, High Frequency Data Line Filters

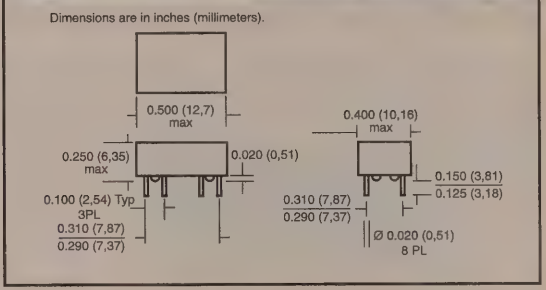
Electrical Specifications at 25°C

Part No	L_p µH min	L_L µH max	C_C pF max	DCR max	Isolation Vrms	Impedance (Ohms min) f=10MHz	f=20MHz	f=30MHz	f=50MHz	f=70MHz	f=100MHz	f=200MHz	f=300MHz
42Z4000	36	0.3	25	0.2	500	1000	1650	2000	1750	1375	100	720	500
23Z4000SM	36	0.3	25	0.2	500	1000	1650	2000	1750	1375	1000	720	500
						Common Mode Rejection (-dB typ)							
						f=10MHz		f=30MHz			f=100MHz		f=300MHz
						16		22			24		20

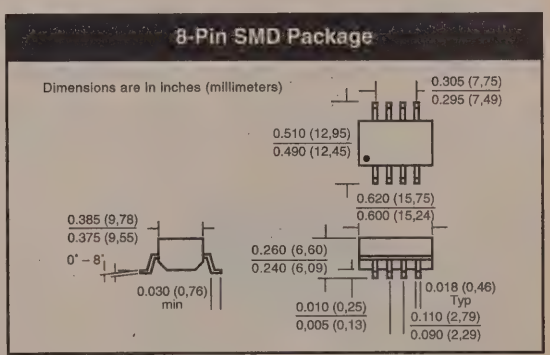
Schematic



8-Pin DIL Package



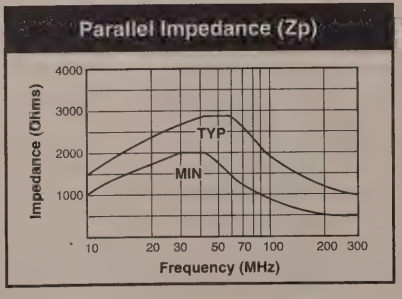
8-Pin SMD Package



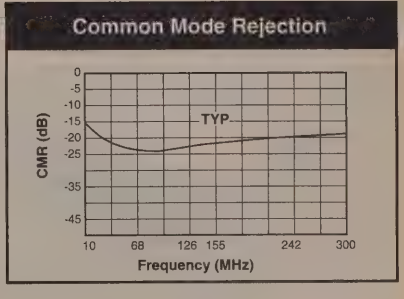
Notes:

A. Each lead is within 0.010" (0,25) radius of its true position at maximum material dimension
B. Coplanarity within 0.002" (0,05)
C. Mold flash or protrusion are not included in body dimensions but shall not exceed 0.006" (0,15)

Parallel Impedance (Zp)



Common Mode Rejection



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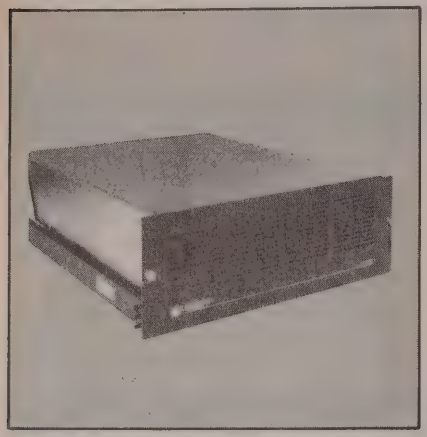
FREQUENCY DEVICES™

FILTER INSTRUMENTS

MODEL 9064 64 CHANNEL COMPUTER PROGRAMMABLE FILTER/AMPLIFIER INSTRUMENTS



FEATURES
- Lowest Cost per Channel
- Multi-Channel (up to 64 per chassis)
- 8 bit Filter Tuning Resolution
- 0.1 Hz to 100KHz tuning range
- Choice of Programmable Filter Types:
  -Low-Pass -High Pass
  -Bandpass -Bandreject (Notch)
- Choice of 8-pole Filter Transfer Functions:
  -Butterworth -Bessel
  -Elliptic -Linear Phase
- Programmable Amplifiers and Oscillators
- Lower Cost Non-Programmable Modules
- AC/DC Coupling
- Remote IEEE-488 or RS-232 Interface
- Common Input/Output Bus for Monitoring
- BNC Connectors for Analog I/O
- Battery Backed RAM

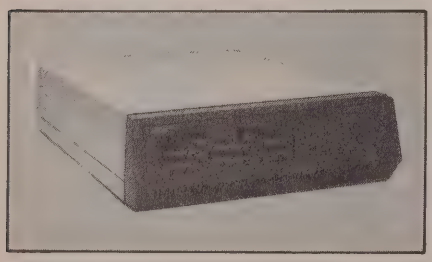
Our Model 9064 filter/amplifier system is an easy-to-use 64-Channel rack-mountable instrument with performance features far beyond its economical price.

The system is comprised of a mainframe and a wide selection of signal conditioning modules including filters, amplifiers, and oscillators.

Each mainframe holds up to 16 plug-in dual or quad channel cards that can be controlled from a remote computer over an RS-232 or IEEE-488 bus.

The 9064 provides an affordable, versatile, and convenient way to independently control the filtering and gain scaling of any multiple of 64 analog signal sources.

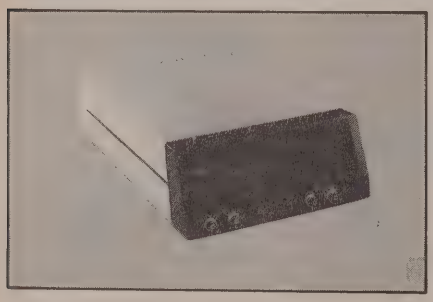
MODEL 9016 16-CHANNEL PROGRAMMABLE FILTER/AMPLIFIER SYSTEMS



FEATURES
- Local or remote programming
- Rack-mountable
- 3 1/2 digit frequency resolution, from 0.1 Hz to 102.4 KHz (optional 204.8KHz bandwidth)
- Gain/phase matched channels
- Selectable single-ended or differential input
- Pre/Post filter gain
- Non-volatile memory stores up to 8 set-ups per channel
- Wide variety of filter designs (see model 9064)

The Model 9016 is a 16-channel programmable filter instrument that allows you to amplify signals, and reject alias frequencies prior to recording or digitizing with unparalleled ease of use, versatility, and expandability. This multi-channel active filter features menu-driven set-up of each or every filter with five Command Function keys and a Help key. These keys provide convenient prompts that quickly and easily guide you through the configuration of the system.

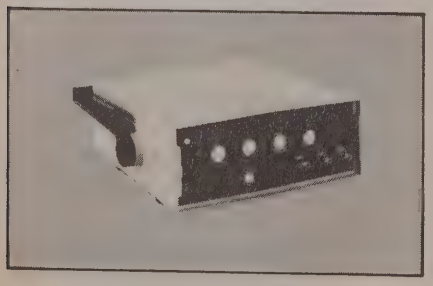
MODEL 9002 DUAL-CHANNEL PROGRAMMABLE FILTER INSTRUMENTS



FEATURES
- Programmable via local keypad or remote computer
- IEEE-488 or RS-232 Interface
- 3 1/2 digit frequency resolution, from 0.1Hz to 102.4KHz (optional 204.8KHz bandwidth)
- Selectable single-ended or differential input
- Gain/phase matched channels
- Non-volatile memory stores up to 8 setups per channel
- Programmable AC/DC coupling
- High resolution pre-post filter gain
- Dimensions: 3.5"H x 8.5"W x 17"D

The Model 9002 is a dual-channel programmable filter instrument that offers more high performance features than any other comparable instrument. Both channels are independently tunable from 0.1 Hz to 102.4 KHz with an optional 204.8KHz range. The 9002 also provides a broader range of filter types than higher priced models and is mountable in half a standard 19" rack assembly. The 9002 dual-channel filter instrument proves that good filters come in small packages.

THE 900 SERIES SINGLE-CHANNEL TUNABLE LOW-PASS FILTER INSTRUMENTS



FEATURES
- Differential Input Amplifier
- Front Panel Bypass Control
- BNC Connectors
- Selectable Pre-Filter Gain
- Tunable Corner Frequency
- Optional Battery Powered Version
- Dimensions: 3.5"H x 8.5"W x 9.3"D (89 x 216 x 236 mm)
- Models available: 8-pole Butterworth or Bessel Low-pass
- 0.1 Hz to 29.9KHz tuning range

The 900 Series Tunable Filter Instruments are designed to be a practical alternative to larger, more complicated filter instruments. Housed in an impact and corrosion resistant plastic case, the 900 Series Instruments can serve in a broad range of environments.

Their compact size and front panel controls make them easy-to-use. The 900 Series has proven to be a popular and affordably priced solution to signal conditioning applications.

FREQUENCY DEVICES ALSO OFFERS A BROAD LINE OF SIGNAL CONDITIONING COMPONENTS:
• Anti-Alias Filters • Programmable Filters • Telecom Filters • Programmable Amplifiers • Differential Buffers • Oscillators

25 LOCUST STREET, HAVERHILL, MA 01830 TEL: (508) 374-0761 • FAX (508) 521-1839

FREQUENCY DEVICES™

ANTI-ALIAS FILTERS

800 SERIES PRECISION DIGITALLY PROGRAMMABLE FILTER MODULES

FEATURES
- Phase/Gain Matched
- Low (90dB typ) Distortion
- Wide (100dB typ) Dynamic Range
- Extremely Steep Roll-Off
- 8-Bit Digitally Programmable Corner Frequency
- Internally Latched Data Lines to Store Frequency Selection Data

- Popular Transfer Characteristics for Broadest Application Scope
- Plug-in, Ready-to-Use, Fully Finished Filter Component
- Programmable from 0.1 Hz to 50 KHz

The *800 SERIES* are digitally programmable active filters, tunable over a 256:1 frequency range. These units contain 8 bits CMOS clocked "D" latches which can be digitally configured to operate in any one of three modes. Each unit is available with any one of five standard factory-set tuning ranges or 8-bit custom ranges. The 800 Series consists of the *848 Low-pass 8-Pole filters. 878 High-pass 8-pole filters, 844 Low-pass 4-pole filters, and 874 High-pass 4-pole filters.* All 800 Series models are fully finished, matched filters that require no external components or adjustments.

8-POLE MODELS

Low-pass (848 Series)
- Butterworth.....848P8B
- Linear Phase.....848DOW
- Bessel.....848P8L
- Elliptic.....848P8E

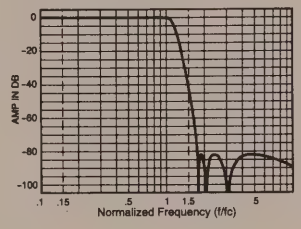
High-pass (878 Series)
- Butterworth.....878P8B
- Elliptic.....878P8E

4-POLE MODELS

Low-pass (844 Series)
- Butterworth.....844P8B
- Tschebychev.....844P8Y
- Bessel.....844P8L

High-pass (874 Series)
- Butterworth.....874P8B
- Tschebychev.....874P8Y

848 ELLIPTIC



D68 SERIES LINEAR ACTIVE FILTERS

FEATURES
- Compact size minimizes board space requirements
- Plug-in ready-to-use, reducing engineering design and manufacturing cycle time
- Factory tuned, no external clocks or adjustments needed
- Low harmonic distortion and wide signal-to-noise ratio to 16 bit resolution
- Broad range of transfer characteristics and corner frequencies to meet a wide range of applications

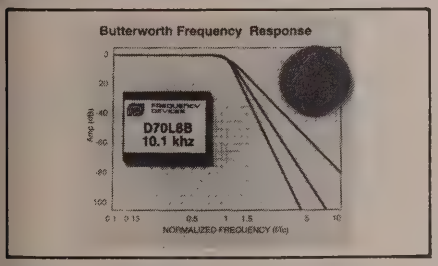
The *D68 SERIES* of small, fixed-frequency, precision active filters provides high-performance linear, multi-pole filtering in a compact package, with a broad range of corner frequencies and a choice of transfer functions. Individual D68 filters can serve in low pass or high pass applications or be combined to create custom band-pass or band-reject filters. Each model comes factory tuned to a user-specified corner frequency between 10Hz and 100kHz. These fully self-contained units require no external components or adjustments. They operate with low total harmonic distortion over a wide dynamic input voltage range from non-critical ±5V to ±18V power supplies.

AVAILABLE LOW-PASS MODELS
- D68L8B .....8-pole Butterworth
- D68L8E.....8-pole, 6 zero elliptic
- D68L8L.....8-pole Bessel
- D68L8D .....8-pole, 6 zero constant delay

AVAILABLE HIGH-PASS MODELS
- D68H8B.....8-pole Butterworth
- D68H8E .....8-pole, 6 zero elliptic

General Specifications
Pin-out/package data & ordering information

D70 SERIES LINEAR ACTIVE DIP FILTERS

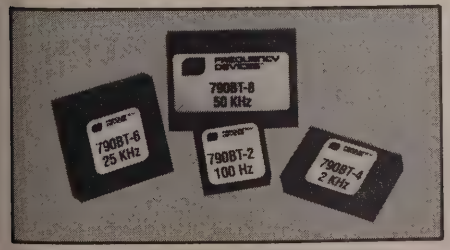


FEATURES
- Compact Dual In-Line Packaging
- Low (90dB typ) Distortion
- *Wide (100dB typ) Dynamic Range*
- User Specified Corner Frequency between 500 Hz and 50 kHz
- Plug-in, Ready-to-Use

The *D70 SERIES* of fixed-frequency linear active DIP filters offer a unique combination of small size and high performance. These Butterworth and Bessel low-pass filters combine the excellent performance of linear multi-pole filter design with the space saving of the dual in-line package (DIP). The D70 family of fully finished filters requires no external clocks, components or adjustments.

AVAILABLE LOW-PASS MODELS
- D70L8B .....8-pole Butterworth
- D70L6B .....6-pole Butterworth
- D70L4B .....4-pole Butterworth
- D70L8L.....8-pole Bessel
- D70L6L.....6-pole Bessel
- D70L4L.....4-pole Bessel

790 SERIES MATCHED LOW-PASS ACTIVE FILTERS

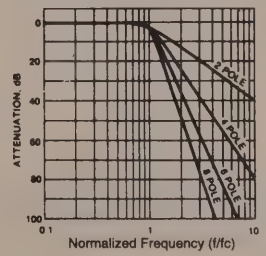


FEATURES
- 2-, 4-, 6-, & 8-Pole Low-pass Models
- Butterworth and Bessel Models
- Models for Matched Gain and Phase: General-Purpose: and Low-Power

The Frequency Devices *790 SERIES* are fixed-frequency low-pass active filters that meet a wide variety of price/performance requirements. Available in a wide choice of 64 basic models, this family offers the user 2-, 4-, 6-, or 8-pole Butterworth or Bessel transfer characteristics factory-tuned to user specified frequencies from 100 Hz to 50 KHz. Gain-and phase-matched to theoretical by precise tuning, 790 and 791 Models are ideal for critical multi-channel data acquisition pre-filtering. Economical and cost effective, the 792/3/4/5 models offer 32 basic active filter models. Low power consumption (down to 15µW) ideally suits 796/797 models for many types of battery-powered applications.

MODELS
All-Available in Butterworth or Bessel Response Curves, 2, 4, 6, or 8 Poles:
- Matched Gain and Phase 790/791
- General Purpose/Low-Cost.....792/795
- Low-Power Consumption 796/797

790 BUTTERWORTH



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eem

MINIGLOSSARY CONNECTORS

Connector terminology is often quite confusing. This confusion starts with the very names of connectors. The name of a connector may derive from its shape, application, type of conductor or even method of termination.

Shape—Circular, cylindrical, and rectangular.

Electrical application—High voltage, RF, microwave, input/output, etc.

Mechanical application—Printed circuit, rack & panel, cable, etc.

Conductor type—Coaxial, flat cable, ribbon cable, flex circuit, etc.

Termination method—Wirewrap, soldercup, solderless, etc.

Hardware such as clamps, hoods, and adapters are frequently used to convert cable connectors to rack and panel types. This adds to the name confusion. A very common telephone connector, for example (the "C" type) got its name from the model number of the original maker.

Contact: The part(s) of the connector that actually provides circuit continuity between its two sections—the parts which are normally mated. The back end of the connector should properly be called the *termination*. This is the point where the wires or PC board is attached to the connector.

Contact alignments: Often called *contact float*. Describes the amount of allowable contact movement within the connector body. Permits self-alignment.

Male vs. female: In the U.S. this describes the contact construction. In Europe this term is more often used to describe the outer shell mating action which may be the reverse of the contacts.

Closed entry: A female contact which prevents entry of a male contact larger than a specific size.

Open entry: A female contact designed for a specific size of male contact but which will allow entry of larger male contacts by spring action.

Hermaphrodite: Contacts or connector bodies which are the same configuration. Male/female designations do not apply. Bodies usually have some mechanical means for maintaining polarity.

Hermetic seal: Glass-to-metal seals at terminations. Often used improperly to describe vacuum-tight seals.

Waterproof seal: May or may not be truly *waterproof*. May prevent easy entrance of casual water by means of a rubber or other boot.

Printed circuit connector: Connectors which are used in conjunction with printed circuit boards. There are two distinctly different styles.

Edgeboard. May be called *edge* or *card*. The printed circuit (PC) board edge enters the connector.

Two-piece: One part of the connecting pair is physically attached to the PC board itself. The other part is attached to something else such as a cable or a motherboard.

Readout: Describes the arrangement at the terminating edge of a PC board. May be single or double. A double readout PC board has termination strips on each side not usually interconnected.

Ribbon connectors: A type of connector which allows flat "ribbon" cable to be attached to a round or rectangular connector but also used interchangeably for flat connectors to flat cable.

Ribbon contact connector: Describes the contacts in a rectangular connector which have a self-wiping mating action. Not the same as ribbon connector.

Solderless terminal: Any style of termination which does not require solder for a permanent connection. See *crimp* and *insulation displacement*.

Crimp termination: A stripped wire is inserted into a barrel or trough which is then crimped to the conductor with a suitable tool.

Insulation displacement: Unstripped insulated wire is fitted into a channel containing metal teeth which are forced through the insulation to make contact with the conductor.

Service rating: The maximum rated voltage and/or current which may be applied continuously. May be called *working voltage*. Can be confused with the term used to describe how many times a connector may be mated and separated.

Withstanding voltage: Also called *test voltage*. The voltage a connector must withstand for one minute without breakdown. Applied between connectors and between connectors and shell and any grounding devices of the connector.

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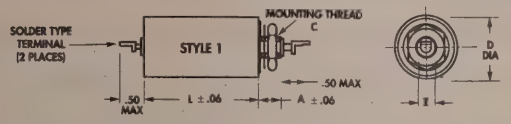
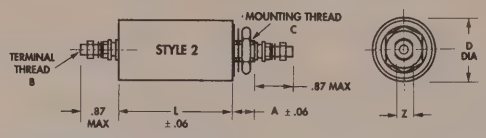
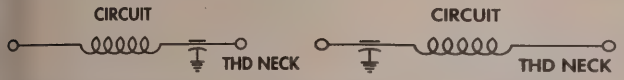
FILTERS—High Performance Feed-Through RFI Filters—Per MIL-F-15733





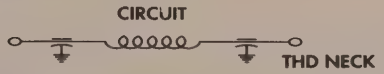
GF4000/GF4100 SERIES



Part Number	Current Amps	Voltage AC	Voltage DC	Terminal Dimensions L	D	A	Z	BThd	CThd	Insertion Loss At .15 MHz	Style
–1	1	30	100	2.00	.67	.34	.250	NA	5/16-24	40	1
–2	1	120	400	2.25	1.00	.34	.250	NA	5/16-24	40	1
–3	1	250	600	2.50	1.25	.50	.250	NA	7/16-20	40	1
–4	2	30	100	2.00	.87	.50	.250	NA	5/16-24	40	1
–5	2	120	400	2.25	1.25	.50	.370	NA	7/16-20	40	1
–6	2	250	600	2.50	1.25	.50	.370	NA	7/16-20	40	1
–7	5	30	100	2.37	1.50	.68	.250	NA	7/16-20	40	1
–8	5	120	400	2.50	1.50	.68	.370	NA	7/16-20	40	1
–9	5	250	600	2.75	1.50	.68	.370	NA	7/16-20	40	1
–10	10	30	100	3.50	1.75	.68	.658	NA	3/4-20	40	1
–11	10	120	400	4.00	1.75	.68	.658	NA	3/4-20	40	1
–12	10	250	600	4.25	1.75	.68	.658	NA	3/4-20	40	1
–13	15	30	100	3.50	1.75	.68	.658	8-32	3/4-20	35	1
–14	15	120	400	3.62	1.75	.68	.658	8-32	3/4-20	35	1
–15	15	250	600	3.93	1.75	.68	.658	8-32	3/4-20	35	1
–16	20	30	100	3.62	1.75	.68	.658	10-32	3/4-20	35	2
–17	20	120	400	3.75	1.75	.68	.658	10-32	3/4-20	35	2
–18	20	250	600	4.00	1.75	.68	.658	10-32	3/4-20	35	2
–19	30	30	100	3.75	1.75	.68	.658	10-32	3/4-20	35	2
–20	30	120	400	4.12	1.75	.68	.658	10-32	3/4-20	35	2
–21	20	250	600	4.37	1.75	.68	.658	10-32	3/4-20	35	2
–22	50	30	100	3.00	2.48	.75	1.055	1/4-28	1⅛-18	30	2
–23	50	120	400	4.50	2.48	.75	1.055	1/4-28	1⅛-18	30	2
–24	50	250	600	4.75	2.48	.75	1.055	1/4-28	1⅛-18	30	2
–25	75	30	100	3.50	2.48	.75	1.055	1/4-28	1⅛-18	25	2
–26	75	120	400	5.00	2.48	.75	1.055	1/4-28	1⅛-18	25	2
–27	75	250	600	5.25	2.48	.75	1.055	1/4-28	1⅛-18	25	2

Specifications subject to change without notice.

GF4200 SERIES



Part Number	Current Amps	Voltage AC	Voltage DC	Terminal Dimensions L	D	A	Z	BThd	CThd	Insertion Loss At .15 MHz	Style
–1	0.5	30	100	2.62	.67	.34	.250	NA	5/16-24	65	1
–2	0.5	120	400	2.75	.67	.34	.250	NA	5/16-24	60	1
–3	0.5	250	600	2.87	.87	.34	.250	NA	5/16-24	60	1
–4	1	30	100	2.75	.67	.34	.250	NA	5/16-24	60	1
–5	1	120	400	2.87	1.00	.50	.370	NA	7/16-20	60	1
–6	1	250	600	3.00	1.25	.50	.370	NA	7/16-20	60	1
–7	2	30	100	2.75	.87	.34	.250	NA	5/16-24	60	1
–8	2	120	400	2.37	1.25	.50	.370	NA	7/16-20	60	1
–9	2	250	600	2.87	1.25	.50	.370	NA	7/16-20	60	1
–10	5	30	100	2.75	1.50	.50	.370	NA	7/16-20	60	1
–11	5	120	400	3.00	1.50	.50	.370	NA	7/16-20	60	1
–12	5	250	600	3.75	1.50	.68	.658	NA	3/4-20	60	1
–13	10	30	100	3.00	1.50	.68	.658	NA	3/4-20	60	1
–14	10	120	400	3.50	1.50	.68	.658	NA	3/4-20	60	1
–15	10	250	600	3.75	1.75	.68	.658	NA	3/4-20	60	1
–16	15	30	100	3.12	1.75	.68	.658	8-32	3/4-20	60	2
–17	15	120	400	3.50	1.75	.68	.658	8-32	3/4-20	60	2
–18	15	250	600	3.75	1.75	.68	.658	8-32	3/4-20	60	2
–19	20	30	100	3.50	1.75	.68	.658	10-32	3/4-20	60	2
–20	20	120	400	3.75	1.75	.68	.658	10-32	3/4-20	60	2
–21	20	250	600	4.00	1.75	.68	.658	10-32	3/4-20	60	2
–22	30	30	100	3.75	1.75	.68	.658	10-32	3/4-20	60	2
–23	30	120	400	4.00	1.75	.68	.658	10-32	3/4-20	60	2
–24	30	250	600	4.25	1.75	.68	.658	10-32	3/4-20	60	2
–25	50	30	100	3.50	2.48	.75	1.055	1/4-28	1⅛-18	55	2
–26	50	120	400	5.00	2.48	.75	1.055	1/4-28	1⅛-18	55	2
–27	50	250	600	5.25	2.48	.75	1.055	1/4-28	1⅛-18	55	2

Specifications subject to change without notice.

GF4300 SERIES

Part Number	Current Amps	Voltage AC	Voltage DC	Terminal Dimensions L	D	A	Z	BThd	CThd	Insertion Loss At .15 MHz	Style
–1	0.5	30	100	2.37	.67	.34	.250	NA	5/16-24	55	1
–2	0.5	120	400	2.50	.67	.34	.250	NA	5/16-24	55	1
–3	0.5	250	600	2.62	.87	.34	.250	NA	5/16-24	55	1
–4	1	30	100	2.62	.87	.34	.250	NA	5/16-24	55	1
–5	1	120	400	2.87	1.00	.34	.250	NA	5/16-24	55	1
–6	1	250	600	3.37	1.25	.50	.250	NA	7/16-20	55	1
–7	2	30	100	2.62	1.25	.50	.370	NA	5/16-20	55	1
–8	2	120	400	2.87	1.25	.50	.370	NA	7/16-20	55	1
–9	2	250	600	3.37	1.25	.50	.370	NA	7/16-20	55	1
–10	5	30	100	3.37	1.50	.50	.370	NA	7/16-20	55	1
–11	5	120	400	3.50	1.50	.50	.370	NA	7/16-20	55	1
–12	5	250	600	3.75	1.50	.50	.370	NA	7/16-20	55	1
–13	10	30	100	3.00	1.75	.68	.658	NA	3/4-20	45	2
–14	10	120	400	4.12	1.75	.68	.658	NA	3/4-20	45	2
–15	10	250	600	4.37	1.75	.68	.658	NA	3/4-20	45	2
–16	15	30	100	3.00	1.75	.68	.658	8-32	3/4-20	40	2
–17	15	120	400	3.37	1.75	.68	.658	8-32	3/4-20	40	2
–18	15	250	600	3.50	1.75	.68	.658	8-32	3/4-20	40	2
–19	20	30	100	3.12	1.75	.68	.658	10-32	3/4-20	35	2
–20	20	120	400	3.37	1.75	.68	.658	10-32	3/4-20	35	2
–21	20	250	600	3.50	1.75	.68	.658	10-32	3/4-20	35	2
–22	30	30	100	4.25	1.75	.68	.658	10-32	3/4-20	35	2
–23	30	120	400	4.37	1.75	.68	.658	10-32	3/4-20	35	2
–24	30	250	600	4.48	1.75	.68	.658	10-32	3/4-20	35	2
–25	50	30	100	4.50	2.48	.75	1.055	1/4-28	1⅛-18	35	2
–26	50	120	400	5.75	2.48	.75	1.055	1/4-28	1⅛-18	35	2
–27	50	250	600	6.00	2.48	.75	1.055	1/4-28	1⅛-18	35	2

Specifications subject to change without notice.

GF4400 SERIES

Part Number	Current Amps	Voltage AC	Voltage DC	Terminal Dimensions L	D	A	Z	BThd	CThd	Insertion Loss At .15 MHz	Style
–1	.05	30	100	3.00	.67	.34	.250	NA	5/16-24	70	1
–2	.05	120	400	3.12	.67	.34	.250	NA	5/16-24	65	1
–3	.05	250	600	3.25	.67	.34	.250	NA	5/16-24	65	1
–4	.5	30	100	3.25	.87	.34	.250	NA	5/16-24	70	1
–5	.5	120	400	3.12	1.00	.50	.370	NA	7/16-20	70	1
–6	.5	250	600	3.25	1.00	.50	.370	NA	7/16-20	70	1
–7	1	30	100	3.00	1.25	.50	.370	NA	7/16-20	70	1
–8	1	120	400	3.12	1.25	.50	.370	NA	7/16-20	60	1
–9	1	250	600	3.25	1.25	.50	.370	NA	7/16-20	60	1
–10	2	30	100	3.12	1.25	.50	.370	NA	7/16-20	60	1
–11	2	120	400	3.25	1.25	.50	.370	NA	7/16-20	60	1
–12	2	250	600	3.50	1.25	.50	.370	NA	7/16-20	60	1
–13	5	30	100	3.62	1.50	.68	.658	NA	3/4-20	70	1
–14	5	120	400	3.75	1.50	.68	.658	NA	3/4-20	60	1
–15	5	250	600	3.87	1.50	.68	.658	NA	3/4-20	60	1
–16	10	30	100	3.62	1.75	.68	.658	NA	3/4-20	60	1
–17	10	120	400	3.93	1.75	.68	.658	NA	3/4-20	55	1
–18	10	250	600	4.12	1.75	.68	.658	NA	3/4-20	55	1
–19	15	30	100	3.75	1.75	.68	.658	8-32	3/4-20	55	2
–20	15	120	400	4.00	1.75	.68	.658	8-32	3/4-20	55	2
–21	15	250	600	4.25	1.75	.68	.658	8-32	3/4-20	55	2
–22	20	30	100	4.00	1.75	.68	.658	10-32	3/4-20	60	2
–23	20	120	400	4.25	1.75	.68	.658	10-32	3/4-20	50	2
–24	20	250	600	4.50	1.75	.68	.658	10-32	3/4-20	50	2
–25	30	30	100	4.25	1.75	.68	.658	10-32	3/4-20	50	2
–26	30	120	400	4.50	1.75	.68	.658	10-32	3/4-20	50	2
–27	30	250	600	4.75	1.75	.68	.658	10-32	3/4-20	50	2
–28	50	30	100	4.50	2.48	.75	1.055	1/4-28	1⅛-18	55	2
–29	50	120	400	4.75	2.48	.75	1.055	1/4-28	1⅛-18	50	2
–30	50	250	600	5.25	2.48	.75	1.055	1/4-28	1⅛-18	50	2

Specifications subject to change without notice.

SEE OUR PAGE IN SECTION 2460

KAPPA® TECHNOLOGIES INC.

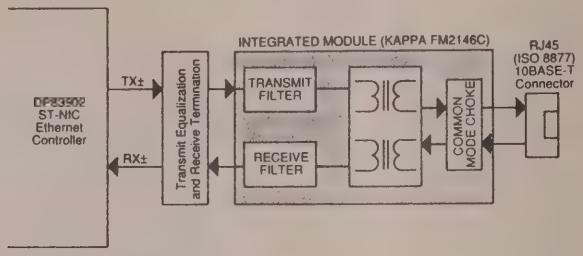
10BaseT Ethernet
Integrated Filter Modules

Features

- IEEE 802.3 compliant for 10BaseT
- 7-pole Transmit and 5-pole Receive Balanced Filters
- 2000Vrms Input-to-Output Isolation
- Matched to all major transceiver chip sets
- 16-pin DIL and SMD package options
- Common-mode chokes for EMI/RFI compliance

Typical Application

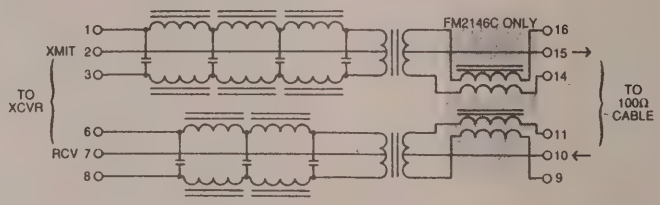
Ethernet (10BaseT) Typical Connection to Twisted-Pair



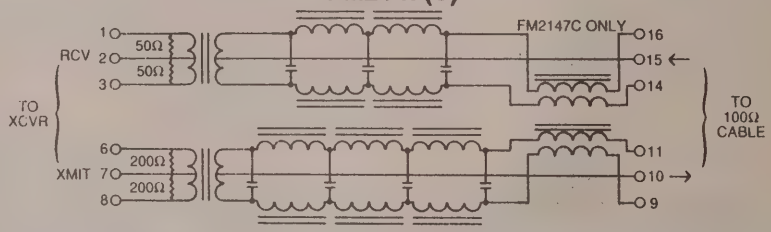
NOTES:
1/ "DP83902" is a National Semiconductor Ethernet Controller.

Schematic Diagrams

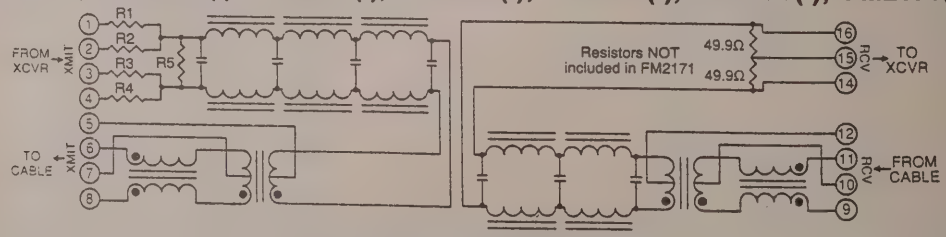
FM2146(C)(*), FM2173(C)(*)



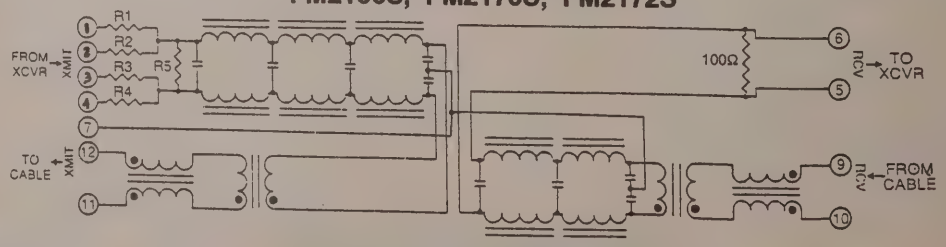
FM2147(C)



FM2148(*), FM2160(*), FM2164(*), FM2165(*), FM2169(*), FM2171(*), FM2176(C)(*)



FM2166S, FM2170S, FM2172S



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KAPPA® TECHNOLOGIES INC.

10BaseT Ethernet
Integrated Filter Modules

Ratings

General Specifications

- Cut-off Frequency (-3.0db).....17.0MHz (ref)
- Amplitude Slope (5-10MHz).....±0.40db max.
- Diff. Group Delay (1-10MHz).....2ns maximum
- Return Loss (1-10MHz).....-25db minimum
- Crosstalk (1-10MHz).....-30db minimum
- Common- to Diff.-mode Atten.[4].....-30db minimum

Environmental Specifications

- Operating Temperature .....-0°C to +70°C
- Non-operating Temperature .....-40°C to +100°C
- Isolation (Input-to-Output).....2000Vrms for 1 min.
- Insulation Resistance.....>1GΩ @ 2000Vrms

Electrical Specifications @ +25°C

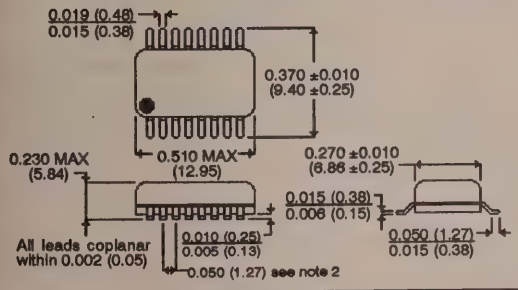
KAPPA PART NUMBER	I.L.(1,2) @10MHz (db max)		ATTENUATION (db min) see notes 1&2						TPI IMPEDANCE		Transmit Equalization Resistors (Ω) ±1%				
			20MHz		30MHz		40MHz								
	XMT	RCV	XMT	RCV	XMT	RCV	XMT	RCV	XMT	RCV	R1	R2	R3	R4	R5
FM2146(C)(*)	1.00	1.00	7.0	6.0	32.0	20.0	35.0	31.0	100Ω	100Ω	N/A	N/A	N/A	N/A	N/A
FM2147(C)(*)	1.00	1.00	7.0	7.0	24.0	22.0	24.0	31.0	400Ω	100Ω	200	200	N/A	N/A	N/A
FM2148(*)	1.00	1.00	7.0	5.0	30.0	16.0	33.0	26.0	400Ω	100Ω	61.9	422	61.9	422	1210
FM2160(*)	1.00	1.00	7.0	5.0	30.0	16.0	33.0	26.0	400Ω	100Ω	61.9	301	61.9	301	806
FM2164(*)	1.00	1.00	7.0	5.0	30.0	16.0	33.0	26.0	170Ω	100Ω	42.2	280	42.2	280	5110
FM2165(*)	1.00	1.00	7.0	5.0	30.0	16.0	33.0	26.0	400Ω	100Ω	61.9	301	61.9	301	806
FM2166S	1.00	1.00	7.0	5.0	30.0	20.0	33.0	26.0	100Ω	100Ω	42.2	280	42.2	280	5110
FM2169(*)	1.00	1.00	7.0	5.0	30.0	20.0	33.0	26.0	100Ω	100Ω	66.5	274	66.5	274	806
FM2170(*)	1.00	1.00	7.0	5.0	30.0	20.0	33.0	26.0	100Ω	100Ω	56.2	332	56.2	332	N/A
FM2171(*)	1.00	1.00	7.0	5.0	30.0	20.0	33.0	26.0	100Ω	100Ω	N/A	N/A	N/A	N/A	N/A
FM2172S	1.00	1.00	7.0	6.0	30.0	16.0	33.0	26.0	400Ω	100Ω	61.9	422	61.9	422	1210
FM2173(C)(*)	1.00	1.00	7.0	6.0	32.0	20.0	35.0	31.0	150Ω	150Ω	N/A	N/A	N/A	N/A	N/A
FM2176(C)(*)	1.00	1.00	7.0	6.0	32.0	20.0	35.0	31.0	100Ω	100Ω	57.6	324	57.6	324	768

(*) Insert package code: "D" = SOIC SMD (.050" pitch); "GW" = Wide-body SMD (.100" pitch); "S" = SIP; "W" = Wide-body DIL

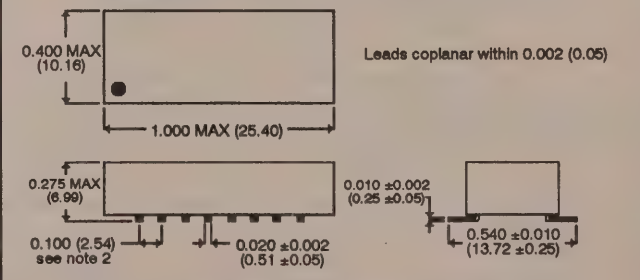
Notes to RATINGS:
[1] Referenced to the output level at 5MHz.
[2] Insertion Loss figures do NOT include losses due to pre-emphasis resistors.
[3] Refer to the **Schematics** and **Package Outlines** sections for details on package availability for each part.
[4] Units without common-mode chokes have a Common- to Differential-mode Rejection of -15db minimum from 1-100MHz.

Package Outlines

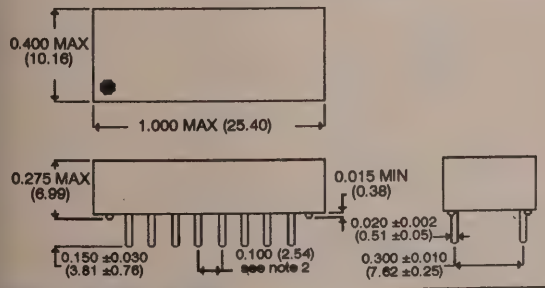
16-pin SOIC Gull-Wing SMD (0.050" pitch)



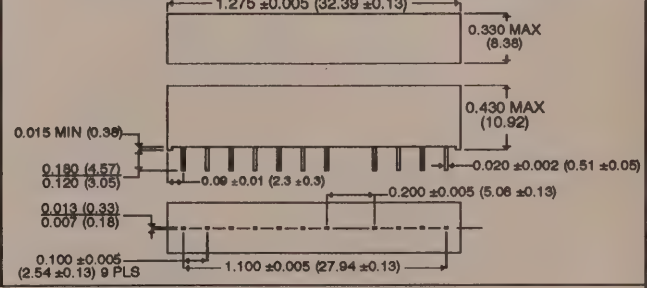
16-pin Wide-body Gull-Wing SMD (0.100" pitch)



16-pin Dual-In-Line



12-pin SIP (FM2166S, FM2170S and FM2172S only)



Notes to Package Outlines:
1. Dimensions are expressed in inches (mm).
2. Lead spacing shall be measured within this zone.
   a. Shoulder and lead tip dimensions are to centerline of leads.
3. Tolerance non-cumulative.
4. Lead Mtl: Alloy 42 per ASTM F-30 or equiv., electrotin-plated per MIL-T-10727.
5. Body Material: Plastic (epoxy or Diallyl Phthalate).
6. Round emboss in bottom-left corner, or notch on left end, denote lead no. 1
7. Body dimensions do not include molding flash which shall be ≤0.006 (0.15).
8. Each lead is within ±0.010 (±0.25) radius of its true position at max. mtl dimension.
9. Unit marking includes mfr's name, part number, date code and index mark.

Kappa Technologies Inc. • 1443 Pinewood Street Rahway, N.J. 07065 • Phone (908) 396-9400 • **Toll Free (800) 223-0603** • Fax (908) 388-4786

KAPPA® TECHNOLOGIES INC.

Token Ring
Interface Filter Modules

General Description

Kappa's Token Ring Interface Filter Modules provide all of the necessary magnetics, including electrical isolation transformers and waveform-shaping filters, for a complete Ring Interface circuit when combined with a front-end semiconductor (such as Texas Instruments' TMS38053 or TMS38054) and the appropriate external components (see Kappa Application Note AN-931).

The **FM2174** filter provides the appropriate impedance-matching transformer, LC filter and common-mode choke for connecting to 150Ω shielded twisted-pair ("STP") data-grade media.

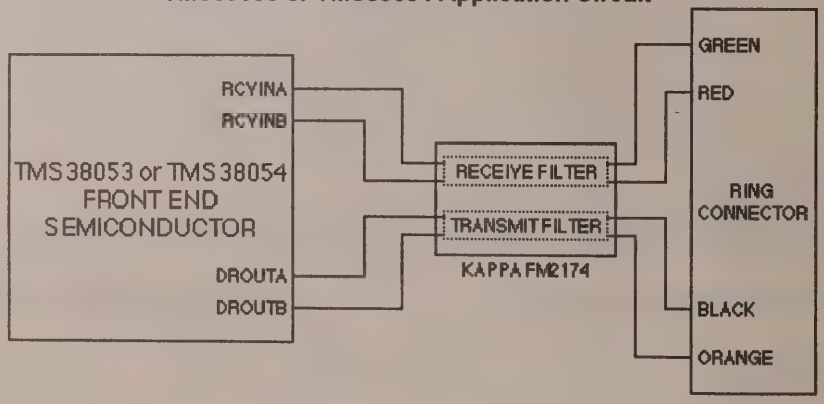
The **FM2175** filter is the same as FM2174 except it provides connectivity to either 150Ω STP or 100Ω unshielded twisted-pair ("UTP") cabling.

Features

- IEEE 802.5 compliance
- Both Transmit and Receive filters in one package
- 16-pin DIL and SMD package options
- Available in 150Ω STP version (FM2174), or both 150Ω STP and 100Ω UTP version(FM2175)
- Common-mode chokes for EMI/RFI filtering

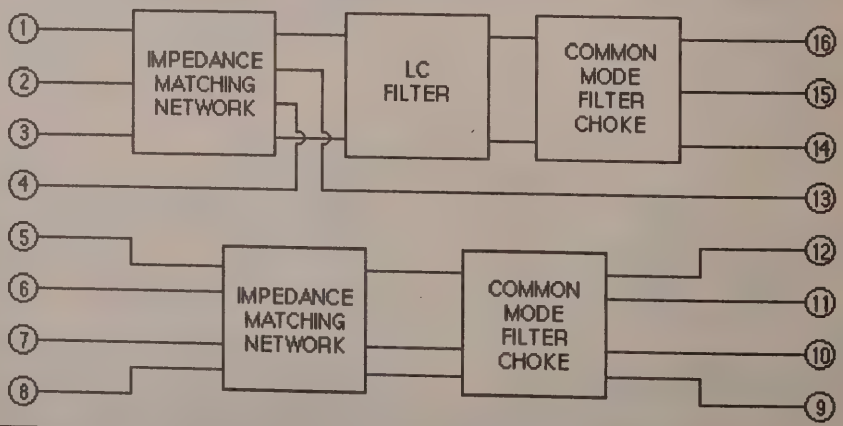
Typical Application

TMS38053 or TMS38054 Application Circuit



Schematic Diagram

FM2174 and FM2175



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KAPPA® TECHNOLOGIES INC.

Token Ring
Interface Filter Modules

Ratings

General Specifications

- Cut-off Frequency (-3.0db) .....33.0MHz (ref)
- Insertion Loss (1-16MHz) .....-0.4db max.
- Diff. Group Delay (2-16MHz).....1.0ns max.
- Return Loss (1-16MHz) .....-26db min.
- Crosstalk (1-16MHz) .....-50db min.
- Common-mode Atten. (10-70MHz) ...-30db min.

Environmental Specifications

- Operating Temperature .....-0°C to +70°C
- Non-operating Temperature .....-40°C to +100°C
- Isolation (Input-to-Output) .....2000Vrms (1 min)
- Insulation Resistance.....>1GΩ @ 2KVrms

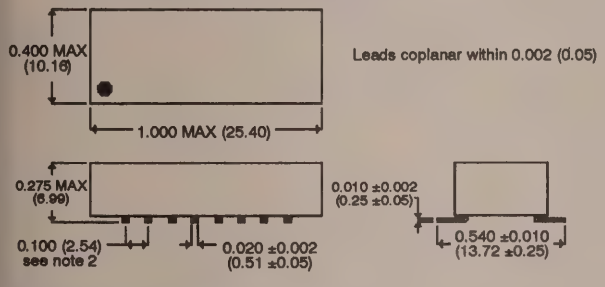
Electrical Specifications @ +25°C

KAPPA PART NUMBER	Insertion Loss @ 1-16 MHz (db max)	ATTENUATION (db min) referenced to 8 MHz			TWISTED-PAIR INTERFACE IMPEDANCE (Ω)	
		32 MHz	40 MHz	48 MHz	TRANSMIT	RECEIVE
FM2174(*)	0.40	2.00	6.00	10.00	150Ω	150Ω
FM2175(*)	0.40	2.00	6.00	10.00	150Ω or 100Ω	150Ω or 100Ω

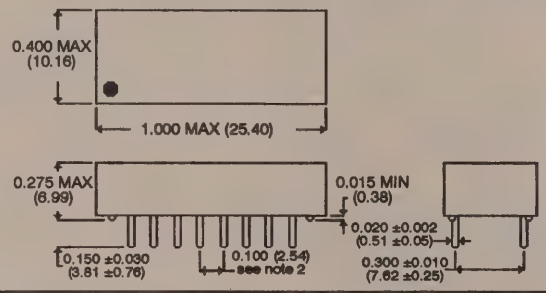
(*) Insert package code: **"GW"** = Wide-body Gull-wing SMD (0.100" pitch); **"W"** = Wide-body DIL

Package Outlines

16-pin Wide-body Gull-wing SMD (0.100" pitch)



16-pin Wide-body Dual-In-Line



Notes to Package Outlines:

1. Dimensions are expressed in inches (mm).
2. Lead spacing shall be measured within this zone.
   a. Shoulder and lead tip dimensions are to centerline of leads.
3. Tolerance non-cumulative.
4. Lead Mtl: Alloy 42 per ASTM F-30 or equiv., electrotin-plated per MIL-T-10727.
5. Body Material: Plastic (epoxy or Diallyl Phthalate).
6. Round emboss in bottom-left corner, or notch on left end, denote lead no. 1
7. Body dimensions do not include molding flash which shall be ≤0.006 (0.15).
8. Each lead is within ±0.010 (±0.25) radius of its true position at max. mtl dimension.
9. Unit marking includes mfr's name, part number, date code and index mark.

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MINIGLOSSARY
BASIC EBCDIC CODE

Bit Positions 4, 5, 6, 7	Second Hexadecimal Digit	Digit Punches	00				01				10				11				
			00	01	10	11	00	01	10	11	00	01	10	11	00	01	10	11	Bit Positions 0, 1
			00	01	10	11	00	01	10	11	00	01	10	11	00	01	10	11	Bit Positions 2, 3
			0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	First Hexadecimal Digit
			12				12	12		12	12	12		12	12				Zone Punches
				11				11	11	11		11	11	11		11			
					0		0		0	0	0		0	0			0		
			9	9	9	9	9	9	9	9									Digit Punches
			①	②	③	④	⑤	⑥	⑦	⑧					⑨	⑩	⑪	⑫	
0000	0	8-1	NUL	DLE	DS		SP	&	-									0	8-1
0001	1	1	SOH	DC1	SOS				⑬		a	j			A	J	⑭	1	1
0010	2	2	STX	DC2	FS	SYN					b	k	s		B	K	S	2	2
0011	3	3	ETX	TM							c	l	t		C	L	T	3	3
0100	4	4	PF	RES	BYP	PN					d	m	u		D	M	U	4	4
0101	5	5	HT	NL	LF	RS					e	n	v		E	N	V	5	5
0110	6	6	LC	BS	ETB	UC					f	o	w		F	O	W	6	6
0111	7	7	DEL	IL	ESC	EOT					g	p	x		G	P	X	7	7
1000	8	8		CAN							h	q	y		H	Q	Y	8	8
1001	9	8-1		EM							;	r	z	`	I	R	Z	9	9
1010	A	8-2	SMM	CC	SM		¢	!	⑮	:									8-2
1011	B	8-3	VT	CU1	CU2	CU3	.	$	,	#									8-3
1100	C	8-4	FF	IFS		DC4	<	*	%	@									8-4
1101	D	8-5	CR	IGS	ENQ	NAK	(	)	_	'									8-5
1110	E	8-6	SO	IRS	ACK		+	;	>	=									8-6
1111	F	8-7	SI	IUS	BEL	SUB	I	¬	?	"									8-7
			12				12				12	12		12	12	12		12	Zone Punches
				11				11				11	11	11		11	11	11	
					0				0		0		0	0	0		0	0	
			9	9	9	9									9	9	9	9	

Card Hole Patterns

①	12-0-9-8-1	⑤	No-Punches	⑨	12-0
②	12-11-9-8-1	⑥	12	⑩	11-0
③	11-0-9-8-1	⑦	11	⑪	0-8-2
④	12-11-0-9-8-1	⑧	12-11-0	⑫	0
				⑬	0-1
				⑭	11-0-9-1
				⑮	12-11

Control Character Representations

ACK	Acknowledge
BEL	Bell
BS	Backspace
BYP	Bypass
CAN	Cancel
CC	Cursar Control
CR	Carriage Return
CU1	Customer Use 1
CU2	Customer Use 2
CU3	Customer Use 3
DC1	Device Control 1
DC2	Device Control 2
DC4	Device Control 4
DEL	Delete
DLE	Data Link Escape
DS	Digit Select
EM	End of Medium
ENQ	Enquiry
EOT	End of Transmission
ESC	Escape
ETB	End of Transmission Block
ETX	End of Text
FF	Form Feed
FS	Field Separator
HT	Horizontal Tab
IFS	Interchange File Separator
IGS	Interchange Group Separator
IL	Idle
IRS	Interchange Record Separator
IUS	Interchange Unit Separator
LC	Lower Case
LF	Line Feed
NAK	Negative Acknowledge
NL	New Line
NUL	Null
PF	Punch Off
PN	Punch On
RES	Restore
RS	Reader Stop
SI	Shift In
SM	Set Mode
SMM	Start of Manual Message
SO	Shift Out
SOH	Start of Heading
SOS	Start of Significance
SP	Space
STX	Start of Text
SUB	Substitute
SYN	Synchronous Idle
TM	Tape Mark
UC	Upper Case
VT	Vertical Tab

Special Graphic Characters

¢	Cent Sign
.	Period, Decimal Point
<	Less-than Sign
(	Left Parenthesis
+	Plus Sign
|	Logical OR
&	Ampersand
!	Exclamation Point
$	Dollar Sign
*	Asterisk
)	Right Parenthesis
;	Semicolon
¬	Logical NOT
-	Minus Sign, Hyphen
/	Slash
,	Comma
%	Percent
_	Underscore
>	Greater-than Sign
?	Question Mark
:	Colon
#	Number Sign
@	At Sign
'	Prime, Apostrophe
=	Equal Sign
"	Quotation Mark

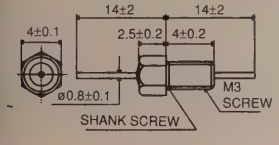
All the Suppliers You'll Ever Need

Protection Devices

EMI Suppression Filters

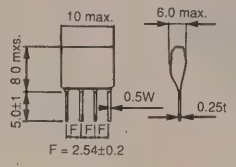
FTB Series

- *Voltage:* 100VDC, 250VDC
- *Equivalent Circuits:* C, T, Pi
- *Capacitance:* 22pF to .047mF
- *Tolerance:* +50-20%, +100-0%



NF Series

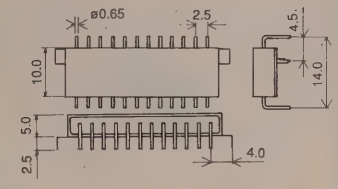
- *3 and 4 Leaded SIP Devices*
- *Circuits:* L, T, Pi, WT
- *Attenuation Frequencies:* -100Khz to 1GHz
- *Voltage:* 50VDC
- *Current:* 100mA MIN



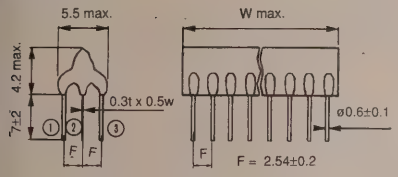
DIP Type EMI Filters

- *Attenuation:* 100MHz to 1GHz
- *Voltage:* 250VDC
- *Current:* 3A, 5A
- *Circuits:* C, T, L

L TYPE

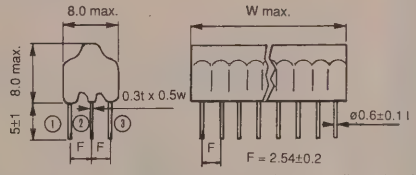


DIPC Series



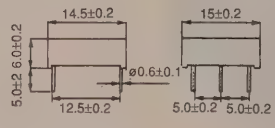
Number Of Channels	"W" Dimension
2	6.0
4	11.0
6	16.0
8	21.0
10	27.0

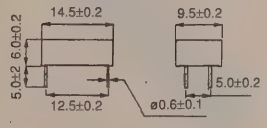
DIPB Series



DNF Series

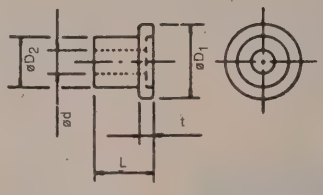
- *Attenuation:* 10KHz to 1GHz
- *Voltage:* 50VDC
- *Current:* 250mA MIN
- *Circuits:* Pi





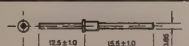
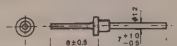
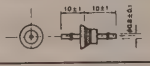
Ceramic Feed-through Capacitor

- *SL Temperature Characteristic with Values from 1pF to 56pF*
- *YN and YF T.C. have value from 43pF to 3000pF*
- *Voltage:* 50 VDC
- *Low Inductance*
- *High Self-Resonating Frequency*



Dimensions

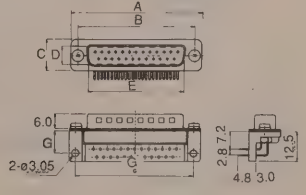
DIM / Style No.	D1(mm)	D2(mm)	d(mm)	t(mm)	L(mm)
PLE123 CN	1.85±0.1	1.40±0.1	0.70±0.85	0.50±0.8	3.0 max.
PLE12 CN	2.3±0.2	1.0±0.1	0.9±0.1	0.5±0.1	1.5±0.3
PLE22 CN	2.3±0.2	1.9±0.1	0.9±0.1	0.5±0.1	2.4±0.3
PLE32 CN	2.3±0.2	1.9±0.1	0.9±0.1	0.5±0.1	3.5±0.3
PLE23 CN	4.3±0.2	3.0±0.2	1.5±0.1	1.0±0.2	2.5±0.3
PLE33 CN	4.3±0.2	3.0±0.2	1.5±0.1	1.0±0.2	3.5±0.2
PLE254 CN	3.5±0.2	2.5±0.1	1.3±0.1	1.2±0.2	3.5±0.2
PLE255 CN	2.9±0.1	2.4±0.1	1.3±0.1	0.7±0.2	4.0±0.2

Type	Dimensions	Applied To:	Type	Dimensions	Applied To:
XN		Applicable Body Dimensions are 12,22 and 32	AN		Applicable Body Dimensions are 23,33
			VT		Applicable Body Dimensions are 501

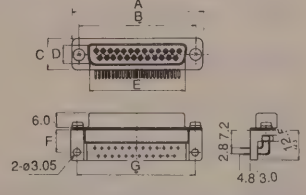
D-Sub Filter Connector

- *Filter Connector Available in 9, 15, 25 Pin Versions*
- *Straight or Right Angle*
- *Capacitance:* 47pF to 2000pF
- *Cut-Off Frequencies:* 1MHz to 100MHz
- *Attenuation:* 80dB

MALE TYPE



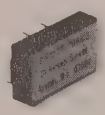
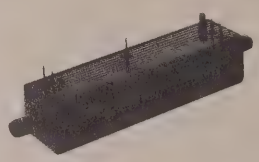
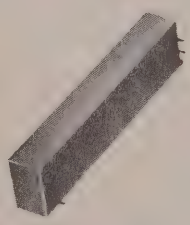
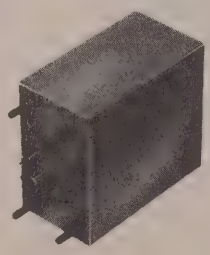
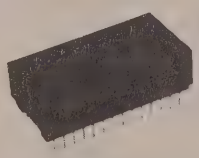
FEMALE TYPE



KCK America Inc.
4080 Winnetka Avenue, Rolling Meadows, Illinois 60008 U.S.A. • 708/577-0200 • Fax 708/577-0201 • Toll Free 1-800-323-6237

KR ELECTRONICS, INC. 91 Avenel Street, Avenel, New Jersey 07001 • (908) 636-1900 FAX: (908) 636-1982

CUSTOM & STANDARD FILTERS

LOWPASS	BANDPASS
	
HIGH PASS	**BAND REJECT**
	
MATCHED PHASE & ATTENUATION	**GROUP DELAY & ATTENUATION EQUALIZER NETWORKS**
	
For use in sonar and other multi-channel systems	To correct sytem introduced delay and attenuation distortion. Computer designed from system error curve.

KR Electronics can quickly and accurately design networks to meet your requirements and provide an immediate quotation. Computers are extensively used by our engineers to find the most cost effective solutions which satisfy your system needs. Through the use of circuit analysis programs these networks are evaluated to assure compliance with your specifications. Graphical and tabular data can be generated and supplied to illustrate typical network response. This data can be used to predict system performance.

- Application Assistance
- Immediate Quotation
- Custom and Standard
- MIL-F-18327
- Prototype Service

Thorough analysis of the design before production is used to check all applicable network parameters.

- Attenuation
- Phase/Group Delay
- Impedance
- Transient Response
- Network Sensitivity
- Temperature Analysis

Computer controlled network analyzers assure accurate and repeatable measurements. Automated equipment 100% tests all products, verifying compliance to your specifications.

- 100% Electrical Inspection
- Graphical & Tabular Data
- Attenuation
- Phase/Group Delay
- VSWR/Return Loss
- Impedance

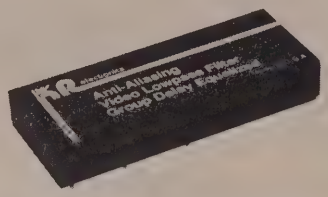
Some of KR's specialized design software include:

- Optimization and design of attenuation equalizers to correct for a prescribed frequency characteristic
- Design of group delay equalized filters yielding constant group delay and linear phase
- Optimization and design of group delay equalizers to correct for a prescribed frequency characteristic

- **Lowpass**
- **Bandpass**
- **Band Stop**
- **Highpass**
- **Notch**
- **Phase Matched**
- **Attenuation Matched**
- **Delay Lines**
- **Video & CCIR 601**
- **Anti-Aliasing**
- **SIN(X)/X Corrected**
- **Cable Equalizers**
- **Attenuation Equalizers**
- **Group Delay Equalizers**
- **Linear Phase**
- **Low Transient Response**
- **Bessel**
- **Butterworth**
- **Chebyshev**
- **Elliptic/Cauer**
- **Gaussian**
- **Transitional**
- **Equi-Ripple Phase**

KR ELECTRONICS, INC. 91 Avenel Street, Avenel, New Jersey 07001 • (908) 636-1900 FAX: (908) 636-1982

VIDEO & ANTI-ALIASING FILTERS



- Miniature
- Group Delay Equalized
- SIN(X)/X Compensation
- Custom Configurations

Designed and manufactured to meet the stringent requirements of analog and digital video systems, KR Electronics' group delay equalized lowpass filters are optimized for performance and size.

Typical transitions from the end of the passband to the start of the stopband range from 1.3 to 1.8 Group delay equalization is used to practically eliminate phase distortion. Flat amplitude response is exhibited up to the end of the passband.

These filters are ideally suited for anti-aliasing in A/D and D/A applications. For filters used after D/A conversion, Sin(X)/X shaping of the passband is available.

KR Electronics has a strong background in custom design and manufacture. This gives you the flexibility to specify the frequency, shape factor and package configuration that meet your particular requirement.

KR VIDEO FILTERS

KR Part Number	MDV8B250	MDV8B250-S	MDV8B500	MDV8B500-S	2067	2065
End of Passband (MHz)	2.5	2.5	5.0	5.0	5.0	6.0
Passband Ripple (dB)	<0.15	<0.20	<0.20	<0.20	<0.20	<0.10
Start of Stopband (MHz)	3.5	3.5	7.0	7.0	7.5	8.0
Stopband Attenuation (dB)	>45	>45	>45	>45	>40	>45
Group Delay Ripple (nsec)	<10	<10	<10	<10	<10	<10
Group Delay Control to (MHz)	2.375	2.375	4.75	4.75	4.80	5.40
Sampling Frequency (MHz)	6.75	6.75	13.5	13.5	12.27	13.5
Sin(X)/X Correction	NO	YES	NO	YES	YES	NO
Impedance Ω	75	75	75	75	75	75
Case Size	1 x 2.5 x .40	1 x 2.5 x .40	1 x 2.5 x .40	1 x 2.5 x .40	1 x 2.5 x .40	1 x 2.5 x .40

CHROMINANCE FILTERS

KR Part Number	XC1-275-675	XC1-275-675-S	XC2-220-675	XC2-220-675-S	XC3-220-675	XC3-220-675-S
End of Passband (MHz)	2.75	2.75	2.20	2.20	2.20	2.20
Passband Ripple (dB)	<0.20	<0.35	<0.10	<0.10	<0.20	<0.20
Start of Stopband (MHz)	4.0	4.0	4.0	4.0	3.2	3.2
Stopband Attenuation (dB)	>40	>40	>40	>40	>40	>40
Group Delay Ripple (nsec)	<15	<15	<20	<30	<60	<60
Group Delay Control to (MHz)	2.7	2.7	2.2	2.2	2.0	2.0
Sampling Frequency (MHz)	6.75	6.75	6.75	6.75	6.75	6.75
Sin(X)/X Correction	NO	YES	NO	YES	NO	YES
Impedance Ω	75	75	75	75	75	75
Case Size	1 x 2 x .40	1 x 2 x .40	1 x 1.75 x .40	1 x 1.75 x .40	1 x 1.5 x .40	1 x 1.5 x .40

LUMINANCE FILTERS

KR Part Number	XL1-575-1350	XL1-575-1350-S	XL2-550-1350	XL2-550-1350-S	XL3-550-1350	XL3-550-1350-S
End of Passband (MHz)	5.75	5.75	5.50	5.50	5.50	5.50
Passband Ripple (dB)	<0.20	<0.35	<0.15	<0.30	<0.15	<0.30
Start of Stopband (MHz)	7.60	7.60	8.0	8.0	8.0	8.0
Stopband Attenuation (dB)	>40	>40	>40	>40	>40	>40
Group Delay Ripple (nsec)	<15	<15	<15	<15	<20	<30
Group Delay Control to (MHz)	5.60	5.60	5.20	5.20	5.0	5.0
Sampling Frequency (MHz)	13.5	13.5	13.5	13.5	13.5	13.5
Sin(X)/X Correction	NO	YES	NO	YES	NO	YES
Impedance Ω	75	75	75	75	75	75
Case Size	1 x 2 x .40	1 x 2 x .40	1 x 1.75 x .40	1 x 1.75 x .40	1 x 1.5 x .40	1 x 1.5 x .40

KROHN-HITE CORPORATION
255 Bodwell Street • Avon • Massachusetts 02322
Tel: (508)580-1660 • Fax: (508)583-8989

NEW IEEE-488 PROGRAMMABLE FLEXI-FILTER FAMILY

Filter Types: Butterworth, Bessel and Chebyshev
Frequency Range: 0.1Hz to 200kHz (Option 002: 0.001Hz operation)
Attenuation Slope: Selectable to 78dB/octave
Multiple Modes: LP, HP, BP, BR and Amplifier Only
Input and Output: Differential or Single-Ended
Stopband Attenuation: >80dB
Input Gain: 0dB to 40dB
Output Gain: – 10dB to 40dB

NEW

CHANNELS MAX.	BATTERY OPERATION	MODEL	PRICE $
1	No	3000	2495
2	No	3010	2595
4	No	3012	3725
2	Yes	3020	2895
4	Yes	3022	3995

BENCHTOP/PROGRAMMABLE FILTERS

MODEL	CUTOFF FREQUENCY RANGE	FUNCTIONS LP	HP	BP	BR	AMP	# CH	ATTEN. SLOPE PER CHANNEL	SALIENT FEATURES PER CHANNEL	PRICE $
NEW 3900	1Hz-99kHz	•				•	2	115dB/Oct.	Dual channel, low-pass Elliptical; Differential or single-ended input; CMRR, 60dB; Amplifier gain to 60dB; Pre and post filter gain; IEEE-488.	3650
NEW 3901	1Hz-99kHz	•	•	•	•	•	2	115dB/Oct.	One channel high-pass, one low-pass, Elliptical; Differential or single-ended input; CMRR, 60dB; Amplifier gain to 60dB; Pre and post filter gain; IEEE-488.	3650
NEW 3940	3Hz-2MHz	•	•	•	•		2	24dB/Oct.	Dual channel Butterworth or Bessel; 20dB input and output gain; Noise, < 200μV; IEEE-488.	2450
NEW 3944	3Hz-2MHz	•	•	•	•		4	24dB/Oct.	Four channel Butterworth or Bessel; 20dB input and output gain; Noise, < 200μV; IEEE-488.	3850
NEW 3955	170Hz-25.6MHz	•				•	2	24dB/Oct.	Dual low-pass Butterworth; Amplifier mode to 50MHz; Pre and post filter gain; Selectable 1 meg or 50 ohm input impedance; IEEE-488.	3550

Rack Mount Kit for all units: RK-58. ($50).

BENCHTOP FILTERS

MODEL	CUTOFF FREQUENCY RANGE	FUNCTIONS BP	BR	HP	LP	# CHAN.	ATTEN. SLOPE dB/OCTAVE	NOISE (rms)	MAX. ATTEN. (dB)	OUTPUT VOLTS/AMPS	BANDWIDTH (3dB)	BATTERY KIT ($225)	RACK MOUNT KIT ($50)	PRICE $
3100A	10Hz-1MHz	•				1	24	100μV	80	3V/10mA	N/A	N/A	RK-314	1195
3103A	10Hz-3MHz	•				1	24	100μV	80	3V/10mA	N/A	N/A	RK-314	1250
3103A-4	10Hz-3MHz	•				1	18	100μV	80	3V/10mA	N/A	N/A	RK-314	1295
3200 †	20Hz-2MHz			•	•	1	24	100μV	80	3V/10mA	DC-10MHz	N/A	N/A	1150
3202 †	20Hz-2MHz	•	•	•	•	2	24,48	100μV	80	3V/10mA	DC-10MHz	N/A	N/A	1895
3500	20Hz-200kHz	•				1	24	200μV	60	5V/3.5mA	N/A	N/A	RK-38	1250
3550	2Hz-200kHz	•	•	•	•	1	24	200μV	60	5V/10mA	0.2Hz-3MHz	N/A	RK-38	1350
3700 *	0.2Hz-20kHz	•				1	24	200μV	80	5V/1mA	N/A	BK370	RK-38	1395

† Rack Model (19" Front Panel): Add suffix 'R' to Model No. when ordering. ($50) * Line/battery operation

NARROWBAND TRACKING FILTER

MODEL	FREQUENCY RANGE	BANDWIDTHS	PEAK OUTPUT VOLTS/mA	MAX. ATTEN.	NOISE RFI (rms)	TUNING MODES	RACK MOUNTING KIT	PRICE $
3800A	1Hz to 100kHz	0.001Hz, 0.01Hz, 0.1Hz, 1Hz, 10Hz, 100Hz, 1kHz, EXT	10V/5mA	40dB	100μV	Ref, Ref Track, Dial, Sig Track	RK-319 (add $50)	2525

PROGRAMMABLE PLUG-IN FILTER CARDS

MODEL	CUTOFF FREQUENCY RANGE	FUNCTIONS LP	HP	BP	BR	AMP	ATTEN. SLOPE dB/OCTAVE	NOISE MAX GAIN (RTI)	MAX. ATTEN. (dB)	OUTPUT Volts/Amps (rms)	BANDWIDTH	PRICE $
30A-1 †	1Hz-99kHz	•		*NEW*		•	115	10μV	80	7V/10mA	DC-99kHz	1345
30A-2 †	0.1Hz-9.9kHz	•				•	115	10μV	80	7V/10mA	DC-9.9kHz	1400
30A-3 †	0.01Hz-990Hz	•				•	115	10μV	80	7V/10mA	DC-990Hz	1445
31A-1 †	1Hz-99kHz		•			•	115	10μV	80	7V/10mA	1Hz-500kHz	1345
31A-2 †	0.1Hz-9.9kHz		•			•	115	10μV	80	7V/10mA	0.1Hz-100kHz	1400
31A-3 †	0.01Hz-990Hz		•			•	115	10μV	80	7V/10mA	0.01Hz-100kHz	1445
34A	3Hz-2MHz	•	•	•	•		24/48	200μV	80	4.6V/25mA	DC-10MHz	1595
35	170Hz-25.6MHz	•		*NEW*		•	24	500μV	80	2.1V/20mA	DC-25.6MHz	1800

† Differential or Single-Ended Input; CMRR, >60dB.

PROGRAMMABLE MAINFRAMES for PLUG-IN FILTER CARDS

MODEL	CHARACTERISTICS	STORED SETTINGS	IEEE-488 PROGRAMMING	RACK MOUNTING KIT	PRICE $
3905B	Holds up to 5 filter cards of any combination	85	Yes	RK-317 ($50)	1900
3916B	Holds up to 16 filter cards of any combination	25	Yes	RK-817 ($250)	2995

METUCHEN CAPACITORS INC.

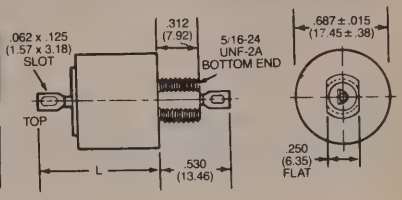
For your convenience we welcome credit card purchases (min. $35.00).

EMI/RFI Suppression Filters

FOR ADDITIONAL INFORMATION SEE OUR DATA PAGES IN THE CONNECTOR SECTION, VOLUME C PAGES C-1456 - C-1459

Part Number	Rated DC Current	Working Voltage 85°C	Working Voltage 125°C	Elec. CKT	Length "L" ± .030 (.76)	Minimum Insertion Loss (dB) Per MIL-STD 220 75 KHz	150 KHz	300 KHz	1 MHz	10 MHz	1 GHz
L, PI, T—.687 Dia.											
51-320-028	5 amp	250VDC	240VAC*	250VDC	L Top	.875 (22.23)	6	19	24	37	70	70
51-321-318	3 amp	250VDC	240VAC*	250VDC	Pi	1.170 (29.72)	6	31	55	70	70	70
51-321-610	1 amp	250VDC	240VAC*	250VDC	T	1.170 (29.72)	25	49	60	70	70	70

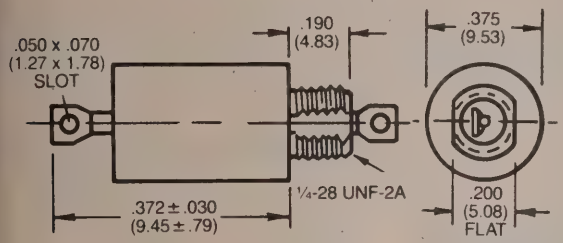
*0-60 Hz



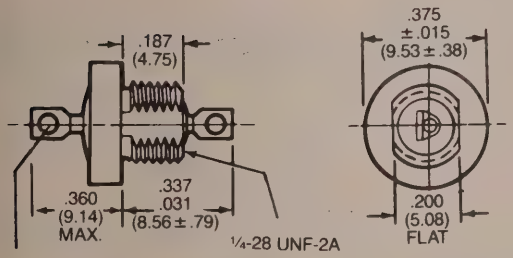
HERMETIC SEAL— FEED THROUGH CAPACITORS

Part Number	Rated DC Current	Working Voltage 85°C	Working Voltage 125°C	Capacitance And/Or Tolerance	Minimum Insertion Loss (dB) Per MIL-STD. 220 75KHz	150KHz	300KHz	1MHz	10MHz	1GHz
54-367-008	15 amp	100VDC	50VDC	1.4µF	20	28	33	44	60	70
54-367-006	15 amp	125VAC*	125VAC*	.25µF	9	14	19	30	50	70
51-359-001	15 amp	80VDC	50VDC	1.4µREF	18	28	33	44	60	70

54-367-008 54-367-006

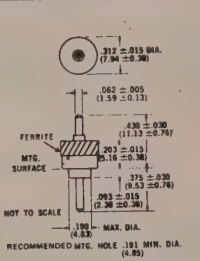


51-359-001

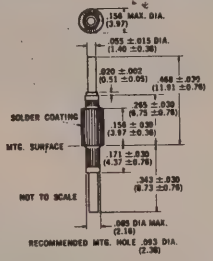


ECONOMICAL RESIN SEAL THREAD BUSHING

Ordering Number	Minimum Insertion Loss Per MIL-STD 200 10MHz	30MHz	100MHz	300MHz	1GHz	Capacitance and/or Tolerance	Elec. Ckt.	Rated DC Current	Working Voltage (VDC) 85°	125°
51-719-011	12	20	45	60	60	3000pF	Pi	10 amp	500	500
51-719-021	14	30	50	65	65	5500pF	Pi	10 amp	200	200
51-722-002	4	12	25	35	50	1000pF	L	25A	500	250
51-723-302	14	30	55	65	65	5500pF	Pi	10A	200	100
51-723-304	5	15	30	45	65	1300pF	Pi	10A	300	200

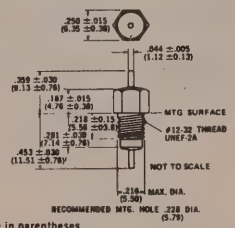


51-722-002



51-723-302
51-723-304

INCLUDES SOLDER MOUNTING WASHER

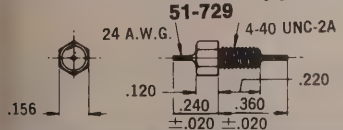


mm are in parentheses

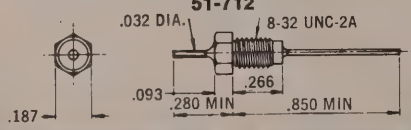
51-719-022
51-719-021
51-719-011
INCLUDES NUTS & LOCKWASHER

Resin Seal EMI/RFI Suppression Filters

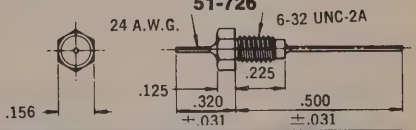
51-729



51-712



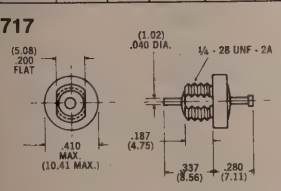
51-726



Part No.	Rated I_{DC} in Amps	Working Volts +85 °C	Working Volts +125 °C	DCR Max.	Capacitance Reference Only µF	Insertion Loss dB 1 MHz	10 MHz	100 MHz	200 MHz	1 GHz
51-712-001	10	200	100	.01	.0015	—	5	42	50	70
51-712-003	10	200	100	.01	.022	7	27	43	50	60
51-726-001	3	200	100	.01	.0015	—	5	42	50	70

Part No.	Rated I_{DC} in Amps	Working Volts +85 °C	Working Volts +125 °C	DCR Max.	Capacitance Reference Only µF	Insertion Loss dB 1 MHz	10 MHz	100 MHz	200 MHz	1 GHz
51-726-002	10	200	100	.01	.022	7	27	43	50	60
51-729-303	10	200	100	.01	.0015	—	5	42	60	70
51-729-304	10	200	100	.01	.022	7	27	43	50	55

51-717



100 VDC +85°C · L SECTIONS 125 VAC +125°C

Part No.	Rated I_{DC}	Working Volts +85°C	Working Volts +125°C	DCR Max.	Capacitance Reference Only	Insertion Loss dB 30 KHz	150 KHz	300 KHz	1 MHz	10 MHz	1 GHz
51-717-001	15 amps	100VDC	50VDC	.01	1.4 MFD	15	28	33	44	60	70
51-717-007	15 amps	125VAC*	125VAC*	.01	.015±20%	—	—	—	6	25	50

*0-400 Hz

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Metuchen Capacitors Inc./139 WHITE OAK LANE/P.O. BOX 499/OLD BRIDGE, N.J. 08857/908-679-3366/FAX 908-679-3222

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Military Filters

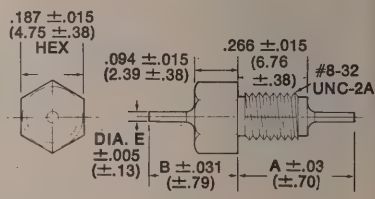
FOR ADDITIONAL INFORMATION SEE OUR DATA PAGES IN THE CONNECTOR SECTION, VOLUME C PAGES C•1456 - C•1459

Shown below are a few of the most commonly used Military approved filters. These filters are approved to MIL-F-15733. Metuchen Capacitors stocks several hundred different MIL-F-15733 filters from MIL-F-15733/23 thru MIL-F-15733/70. Those shown below are IN STOCK continuously and offer a wide selection for your various applications. Both hermetic and non-hermetic (resin seal) are listed as well as different electrical configurations—L's and A's and Voltages from 50 VDC to 125 VAC.

IN STOCK

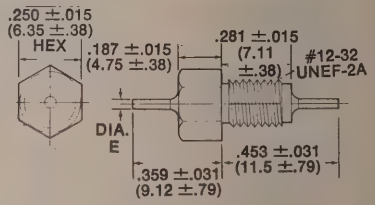
EMI/RFI Suppression Filters
RESIN SEAL

MIL P/N	Capacitance Ref-pf	Rtd. DC Voltage	Rtd. Current (A)	Electrical Circuit	Minimum Insertion Loss (dB) Per Mil-Std 220 100 kHz	1 MHz	5 MHz	10 MHz	50 MHz	100 MHz	200 MHz	1 GHz	A	B	C	E
MIL-F-15733/28-0001	1500	100	10	π	—	—	—	—	25	45	60	60	.890	.312	.266	.032
MIL-F-15733/28-0004	25,000	50	10	L-THD	—	10	—	28	—	41	44	60	.890	.312	.266	.040
MIL-F-15733/61-0008	5500	100	10	π	—	—	—	—	50	—	55	70	.500	.312	.266	.032
MIL-F-15733/61-0013	22,000	100	10	L-THD	—	10	22	30	—	50	—	70	.890	.280	.266	.032



IN STOCK

MIL P/N	Capacitance Ref-pF	Rated Voltage DC	Rated Current (A)	Electrical Circuit	Minimum Insertion Loss (dB) Per Mil-Std 220 100 kHz	1 MHz	3 MHz	10 MHz	50 MHz	100 MHz	500 MHz	1-10 GHz	E ±.005 (±.13)
MIL-F-15733/61-0002	1500	200	10	π	—	—	—	—	32	45	70	70	.032 (.81)



EMI/RFI Suppression Filters
HERMETIC SEAL

IN STOCK

MIL P/N	Rated Current	Working Volts +125°C	DCR Max. Ω	Reference Capacitance	Insertion Loss (dB) Per Mil-Std-220 30 kHz	150 kHz	300 kHz	1 MHz	10 MHz	1 GHz	Fig.
MIL-F-15733/49-0001	15 amps	100 VDC	.01	.68 μf	8	20	28	38	55	70	2
MIL-F-15733/49-0006	15 amps	50 VDC	.01	1.4 μf	15	28	33	44	60	70	1

FIG. 1

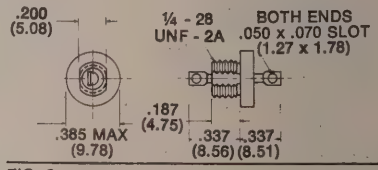
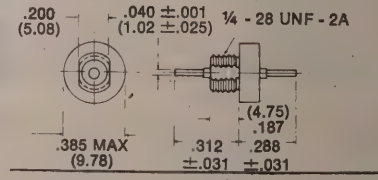
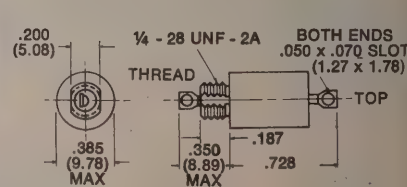


FIG. 2



IN STOCK

MIL P/N	Rated Current (Amps)	Filter Circuit	Working Volts 125°C AC	DC	Max. Voltage Drop	Insertion Loss (dB) Per Mil-Std-220 75 kHz	150 kHz	300 kHz	1 MHz	10 MHz	1 GHz
MIL-F-15733/26-0001	1	L-1	125	150	.25	—	13	24	45	80	70
MIL-F-15733/26-0003	1	L-2	125	150	.25	—	13	24	45	80	70
MIL-F-15733/26-0004	3	L-1	125	150	.15	—	8	15	30	68	70
MIL-F-15733/26-0006	3	L-2	125	150	.15	—	8	15	30	68	70
MIL-F-15733/26-0007	5	L-1	125	150	.075	—	8	14	25	58	70
MIL-F-15733/26-0010	5	L-2	125	150	.075	—	8	14	25	58	70



All EMI Filtered D Subminiature Connectors stocked by MCI are manufactured in the U.S.A. by **Spectrum Control, Inc...**
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METUCHEN CAPACITORS INC.

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ECONOMICAL PASS BAND FILTERS

IN STOCK

FOR ADDITIONAL INFORMATION SEE OUR DATA PAGES IN THE CONNECTOR SECTION VOLUME C PAGES C•1456 - C•1459

Spectrum designs and manufactures a variety of pass band filters for featuring low loss and a virtually flat pass band and high performance in the reject band. These filters are excellent performers for data transmission networks.

SINGLE LINE PASS BAND FILTERS

SPECTRUM PART NUMBER	F I G	RATED DC CURRENT	WORKING VOLTAGE 125°C	PASS BAND	LOAD AND SOURCE IMPEDANCE	MINIMUM INSERTION LOSS (db) NO LOAD PER MIL-STD-220			
						20 MHz	50 MHz	100 MHz	1 GHz
52-706-301	1	30 ma	100 VDC	DC-10MHz < 3db	50	12	30	48	70
52-706-306	1	30 ma	100 VDC	DC-1MHz < 3db	50	70	70	70	70
52-706-309	1	50 ma	100 VDC	DC-2.5MHz < 3db	50	50	70	70	70
52-706-310	1	30 ma	100 VDC	DC-33MHz < 3db	75	—	—	8	70
52-706-304	2	30 ma	100 VDC	DC-30MHz < 3db	50	—	10	30	60
52-713-301	3	30 ma	100 VDC	DC-100KHz < 3db	600	70	70	70	70
52-713-302	1	10 ma	200 VDC	DC-1MHz < 3db	600	—	—	43	70

*LINE TO LINE

52-706-301, 306, 309, & 310
52-713-302

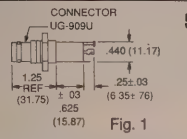

Fig. 1

52-706-304

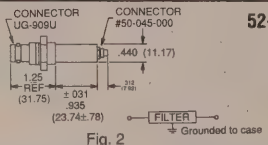

Fig. 2

52-713-301

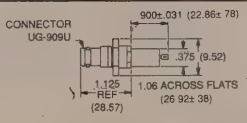

Fig. 3

UG909/U mating connector is UG-88

DUAL LINE PASS BAND FILTERS

*All mating connectors available from stock

SPECTRUM PART NUMBER	F I G	RATED DC CURRENT	WORKING VOLTAGE 125°C	PASS BAND	LOAD AND SOURCE IMPEDANCE	MINIMUM INSERTION LOSS (db) NO LOAD PER MIL-STD-220			
						20 MHz	50 MHz	100 MHz	1 GHz
52-792-001	1	150 ma	100 VDC	DC-8 KHz < 3db	93	10	30	50	70
52-792-003	2	150 ma	100 VDC	60K-8M < 3db	93	10	30	50	70
52-793-003	3	150 ma	100 VDC	DC-10MHz < 3db	93	—	10	25	60

NOTE: PASS BAND MEASURED IN DESIGN IMPEDANCE ATTENUATION CHARACTERISTICS MEASURED PER MIL-STD-220

*LINE TO LINE

52-792-001

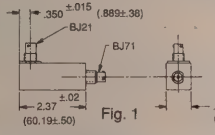

Fig. 1

52-792-003

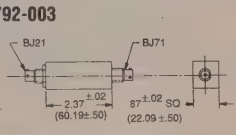

Fig. 2

52-793-003

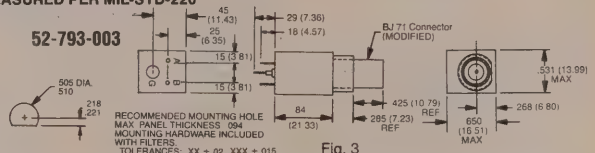

Fig. 3

POWER LINE FILTERS

*All mating connectors available from stock

SPECTRUM PART NUMBER	CURRENT RATING	VOLTAGE RATING	TEMPERATURE RANGE	DCR MAX. (ohms)	LEAKAGE CURRENT MAX	MINIMUM INSERTION LOSS (db)						
						50 KHz	150 KHz	300 KHz	1 Mhz	10 MHz	100 Mhz	1 GHz
52-378-001	3 amps	240 VAC 60 Hz Line to Line	– 55°C to 85°C	.3	50 MA	40	70	80	80	80	70	60
52-378-002	5 amps	240 VAC 60 Hz Line to Line	– 55°C to 85°C	.2	50 MA	24	60	0	80	80	70	70
52-387-010	10 amps	240 VAC 60 Hz Line to Line	– 55°C to 85°C	.2	50 MA	24	60	70	80	80	70	70
52-409-001	14 amps	240 VAC 60 Hz Line to Line	– 55°C to 85°C	.04	50 MA	14	30	45	80	80	70	60

52-378-001 & 002

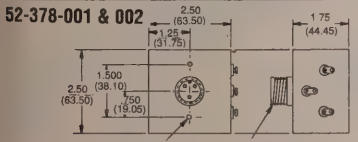

Fig. 1

52-387-010

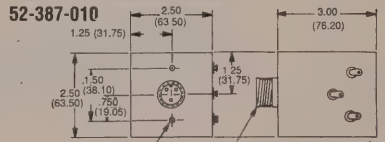

Fig. 2

52-409-001

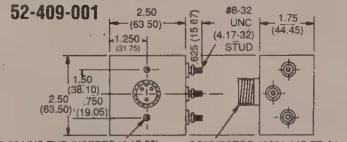

Fig. 3

BJ21 mating connector is PL20
BJ71 mating connector is PL75

HIGH PERFORMANCE POWER LINE FILTERS

*All mating connectors available from stock

SPECTRUM PART NUMBER	F I G	CURRENT RATING	VOLTAGE RATING	TEMPERATURE RATING	DCR MAX (ohms)	LEAKAGE CURRENT (MAX)	MODE	MINIMUM INSERTION LOSS (db) PER-MIL-STD-220							** GASKET SUPPLIED
								50K	150K	300K	1M	10M	100M	1G	
52-523-002	1	5A	120/240 VAC 60 Hz	– 40°C to + 65°C	.25	1 ma	COMM	—	55	60	80	80	70	60	572047-00532-03*
							DIFF	—	50	60	80	80	—	—	572016-00456-10**
52-600-001	2	5A	120/240 VAC 60 Hz	– 40°C to + 65°C	.20	1 ma	COMM	33	65	80	80	80	80	60	572047-00525-03*
							DIFF	37	65	80	80	80	—	—	572016-00457-10**
52-600-002	2	10A	120/240 VAC 60 Hz	– 40°C to + 65°C	.05	1 ma	COMM	—	50	70	80	80	70	60	
							DIFF	25	50	75	80	80	—	—	

52-523-002

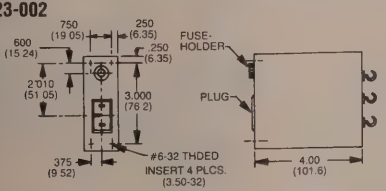

Fig. 1

52-600-001 & 002

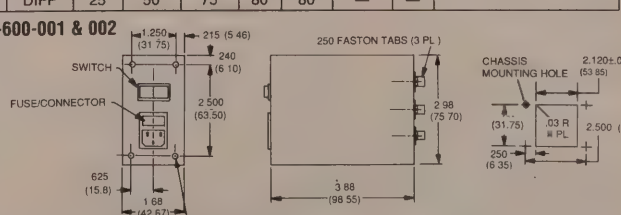

Fig. 2

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COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A
A/D acrylonitrile butadiene-styrene
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AFC audio frequency control
AFT automatic filter test
ALGOL algorithmic language
AM a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
ASIC application specific IC
ATE automatic test equipment
ATG automatic test generation
AWG American wire gauge

B
BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility syste

C
CAD computer-aided design
CAE computer-aided engineering
CAM computer-aided manufacture
CAMAC computer-automated measurement and control
CAPP computer-aided process planning
CAT computer-aided test
CATV cable television or community antenna television
CCC (leaded) ceramic chip carriers
CCD computer-controlled display
CERMET ceramic metal element
CIE computer-integrated engineering
CIM computer-integrated manufacturing
CLCC ceramic leadless chip carriers
CMOS complementary metal-oxide semiconductor
Comm. communications
CPS characters per second
CPU central processing unit

D
D/A digital to analog
DAC digital to analog converter
DBMS data base management system
DC direct current
DFT design for testability
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DRAM dynamic RAM
DTL diode transistor logic

E
EDA electronic design automation
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EIA Electronic Industries Association
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM erasable programmable ROM
ESR equivalent series resistance

F
FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G
GaAsFET gallium arsenide FET
CMIP commn management information protocol
GPIB general purpose interface bus
GPS global positioning system

H
HF high frequency (3 to 30 MHz)
HIPOT test, measurement, and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I
IAB Internet Activities Board
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared
ISDN integrated services digital network
ISO International Standards Organization

J
JEDEC Joint Electronic Device Engineering Council
JFET junction FET
JMOS junction MOS

K
kHz kilohertz (10^3 hertz)
KSR keyboard send /receive

L
LAN local area network
LC (filters) inductance/capacitance
LCC leaded chip carrier
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M
MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
µF microfarad
MHz megahertz
MIC microwave IC
MIPS million instructions per second
MIB microcomputer interface board
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor FET
MOSIGT metal oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N
NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM national instrumentation module
NOR not OR
NTC negative temperature coefficient

O
OCR optical character reader
OEM original equipment manufacturer
OR a logical operator
OSI open systems interconnection

P
PAL programmable array logic
PC printed circuit
PCB printed circuit board
PCM pulse code modulation
PCS plastic clad silica
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLCC plastic leaded chip carrier
PLL phased lock loop
PPI plan position indicator
PROM programmable ROM
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q
QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R
RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S
SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon-controlled switch
SDA source & detector assemblies
SGMP simple gateway monitoring protocol
SIDAC bidirectional voltage-triggered switch
SIMM single in-line memory module
SIP single in-line package
SMD surface mount device
SMT surface mount technology
SNMP simpole network management protocol
SO small outline
SOIC small outline IC
SOT small outline transistor
SSI small scale integration
SSR solid-state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T
TC temperature coefficient
TCE thermal coefficient of expansion
TXCO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U
UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

V
VAC volts (of) alternating current
VAN value-added network
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency (30 kHz to 300 MHz)
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W
WPS word processing software

Y
YIG yttrium iron garnet

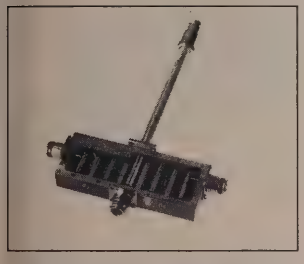
Z
ZIF zero insertion force

FILTERS FOR 5 Hz - 26 GHz

INNOVATION & SERVICE FOR OVER 25 YEARS

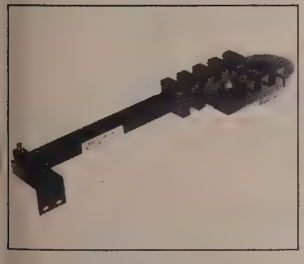
Subminiature Filters

Diplexer/Combiner 10 KHz Hi/Lo Pass

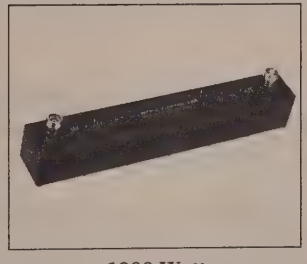


Triplexer: VHF Low Pass Filter & 2 Microwave Bandpass Filters

Stripline Filter Network



Waveguide Filter Network



1000 Watt Low Pass Filter 150 MHz

Microwave Filter Company, Inc. offers a wide range of products to meet custom or standard requirements for small or large program orders. The addition of Chesterfield Products in 1992 further expanded its capability to include custom LC filters for 5 Hz to 1 GHz and subminiature filters for 20 MHz to 1 GHz.

MFC's reputation for quick service resides in its ability to quote quickly and supply custom filters in as little as 3 days. Supporting its reputation, is the latest technology in simulation, design and test equipment, and a high level of quality assurance, including conformance to such military standards as MIL-I-45208 and MIL-STD-2000 to insure the reliability of all products.

MFC makes filters for all applications in RF & Microwave including:

CATV, SMATV, In-House TV/LAN, Satellite, LPTV, FM/TV Broadcast, Mobile Radio, Microwave TV (ITFS/MMDS), RF/MW Communications, Radar, Navigation, Electronic Warfare, Medical/Physics Research

FILTER SPECIALTIES

- Bandpass
- High Pass
- Low Pass
- Bandstop
- Multiplexers
- Tunable Notch
- Tunable Bandpass
- High Power Filters
- Filter Networks
- Couplers
- Amplitude Equalized
- Delay Equalized
- Microwave Absorbers

FILTER DESIGNS

- Waveguide
- Stripline/Microstrip
- Transmission Line
- Miniature/Subminiature
- Lumped Constant
- Crystal

For more information, ask for a full MFC LITERATURE PACKAGE.

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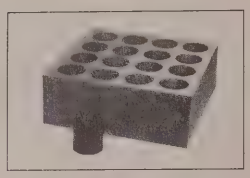
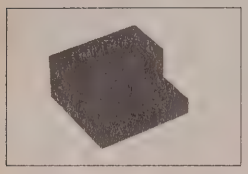
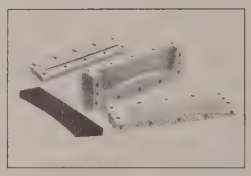


FERROFLOW™ Cures (Magnetic) Rigid



CARBOFLOW™ Cures (Non-Magnetic) Rigid



FLEXFLOW™ Cures (Magnetic) Flexible

FERROSORB™ is used to fabricate terminations, attenuators or spurious energy suppressors 1-26 GHz by casting or machining:

• RIGID, machinable stock comes in plates, rods and square or rectangular bars. Loads, terminations and other custom products are also available.

• FERROFLOW™ and CARBOFLOW™ are two part casting systems to produce rigid magnetic and non-magnetic parts.

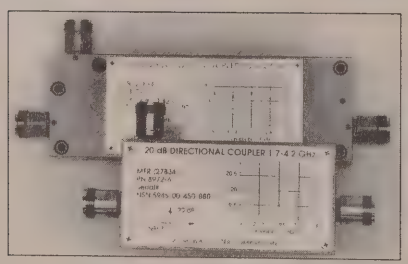
• Two part system FLEXFLOW™ produces flexible parts such as gaskets for double duty: sealing against moisture and RF leakage.

CATALOG F/81 describes these materials in detail: physical properties to machine and cast - including mold design. It also includes a design section for specifying a variety of other absorber shapes and styles.

For more information, ask for CATALOG F/81.

COUPLERS

COAXIAL COUPLERS FOR OCTAVE BANDWIDTHS 225 MHz TO 12 GHz
WAVEGUIDE COUPLERS FOR 2.2 GHz TO 22 GHz



Models 8972-1 and 8972-6 (30 and 20 dB Directional Couplers)

• ***SINGLE SECTION TRANSMISSION LINE:***
Offers frequency sensitivity of ± 1 dB using single quarter wave coupled lines.

• ***TWO SECTION TRANSMISSION LINE:***
Constructed with 2 quarter wave coupled lines providing flatter frequency sensitivity ± 0.2 dB across a slightly wider band.

• ***STRIPLINE:***
For lower cost and smaller construction.

• ***WAVEGUIDE CROSSGUIDE:***
Provides lowest insertion loss and highest power handling.

Custom designs are available, vigorously tested to military, environmental and quality assurance specifications, with special connector configurations to meet your needs.

For more information, ask for the COUPLER data sheet.

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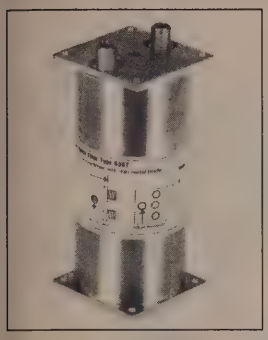
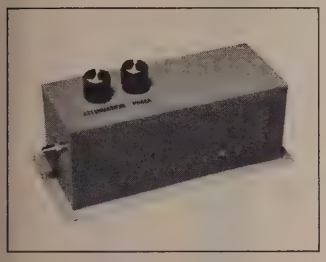
FAX: 315-463-1467

RF FILTERS FOR INTERFERENCE SUPPRESSION

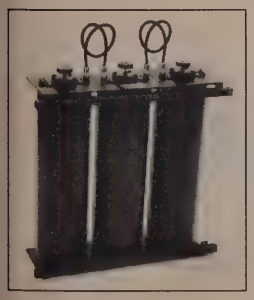


Model 6367
Tunable Notch Filter



Model 2903
Phase Canceler

Model 9603
High Q Notch Filter



Model 9393
High Q Bandpass Filter

TUNABLE NOTCH FILTERS 22-900 MHz

For suppression of harmonics and other unwanted carriers in electronic systems.

- 3 dB bandwidth adjustment 1-5 MHz typical.
- Notch depth dependent on 3 dB bandwidth and frequency (20 dB typical).
- Low power applications (<10 watts).

For more information, ask for CATALOG RF/88.

PHASE CANCELER 54-890 MHz

Suppresses interference which occurs at the same frequency as the desired signal, or which appears so close to it that application of filters is impractical.

Eliminates such interference as:

- Co-Channel
- Ghosting
- Harmonics
- Channel Overload
- Sideband Emissions
- Wideband Digital Terrestrial
- Strong Analog Terrestrial Carriers
- Co-Location of Transmitters

For more information, ask for CATALOG IPC/92.

HIGH Q NOTCH FILTERS 30-950 MHz

Designed for low loss applications for removing interfering carriers that cause intermodulation.

- Bandwidth: up to 3% bandwidth/center frequency.
- Phased together or cascaded, filter cavities can be combined to increase attenuation at a spot frequency or across a wider band.
- Excellent power handling and temperature stability.

For more information, ask for a HIGH Q NOTCH FILTER data sheet.

HIGH Q BANDPASS FILTERS 30-950 MHz

For multiplexing, preselecting and eliminating unwanted spurious transmit signals.

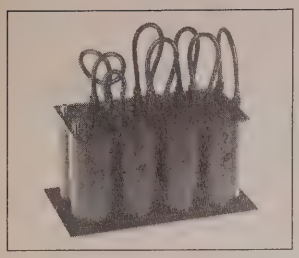
- Single, double and triple cavity models available.
- Temperature stable.
- Quarter wave cavities in a variety of diameters are available for increased Q, selectivity and low loss.

For more information, ask for a HIGH Q BANDPASS FILTER data sheet.

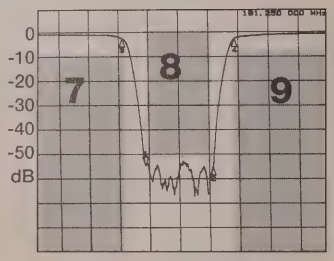
MICROWAVE FILTER COMPANY
6743 KINNE STREET
EAST SYRACUSE, NY 13057
800-448-1666 • 315-437-3953
FAX: 315-463-1467

"BRICKWALL" TV CHANNEL DELETION FILTERS

FOR NEW DATA/PROGRAM INSERTION



Single Channel
Hyperband 3271 ABY-FF



Single Channel 50 dB Stopband, Leaves Adjacents in Service 3271ABH-8

The "Brickwall" Deletion Filter line allows new spectrum allocation without sacrificing channels as guard bands. For CATV, SMATV, Security, In-House TV and Broadband Systems.

For any channel or groups of channels and special networks 5-806 MHz sub, low, FM, mid, super, hyper and UHF.

APPLICATIONS

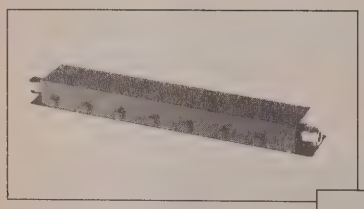
- Single Channel
- Low Pass/High Pass Enhancement
- Multiple Channel Deletion
- Broadband Sweeps

NETWORKS

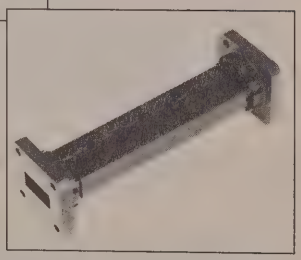
- Closed Circuit
- Batch Rescramble
- Batch Descramble
- Batch Convert

For more information, ask for CATALOG SUPERNOTCHER/91.

BANDPASS FILTERS 5 MHz-18 GHz



Sharp 3303 for Channels in Sub, Lo, Mid, Hi and Super Bands



CARS Band Channel or Full Band BPF

APPLICATIONS

- Modulator Noise
- Agile Modulator Clean-up
- Off Air Interference
- Processor Protection
- Receive Isolation
- Adjacent Cut-Off
- FM Channel Isolation
- Pole Mountable
- Sniffer Preselection
- CARS Band
- Single Pay TV Channel
- TVRO Block Preselection
- System Noise Test
- Wideband: Low VHF Band, Midband, Hi VHF Band

FILTER TYPES

- Helical Resonator
- Combline
- Cavities
- Lumped Constant
- Interdigital
- Waveguide
- Stripline

For more information, ask for CATALOG C/91.

MFC
MICROWAVE FILTER COMPANY

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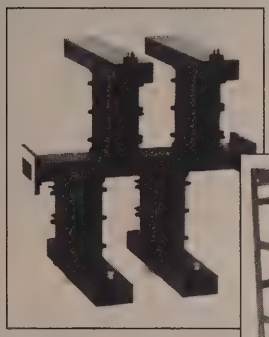
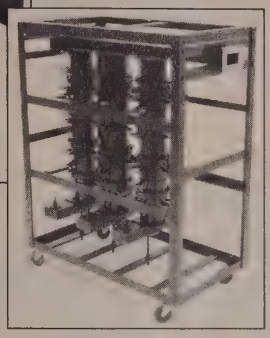
FAX: 315-463-1467

CHANNEL COMBINERS, ANTENNAS & ACCESSORIES

FOR MDS, MMDS AND ITFS



Model 9000
Non-Adjacent
Channel Combiner



Model 9500
Adjacent Channel
Combiner

Model 9778
Relay Antenna

MODEL 9500

Combines 4 adjacent channels to a common antenna line, with minimum impact in insertion loss (<2.0 dB), while maintaining high isolation between channels.

MODEL 9000

Has a loss of 0.7 dB or less, insuring minimum power loss and optimum broadcast range. Up to 16 non-adjacent channels can be combined to a common antenna line.

The bandwidth of both units accommodates NTSC, PAL and SECAM formats.

Accessories:
- Coax to Waveguide Adaptors
- Directional Couplers
- Filters
- Termination Plates
- Audio Video Diplexer

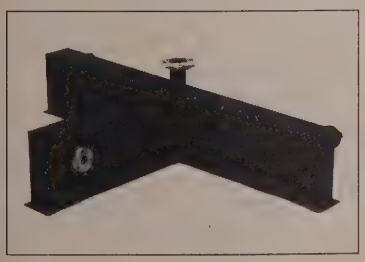
MMDS RELAY ANTENNA 2.5 TO 2.7 GHz

Allows MMDS operators to fill nulls in their primary pattern with the widest beamwidth available on the market.
- Widebeam (100° typical pattern).
- 21 - 24 dBi gain
- Performance is tested and guaranteed.

For more information, ask for BULLETIN 9500.

CHANNEL COMBINERS/FILTERS FOR LPTV/TRANSLATORS

FOR VHF AND UHF LOW POWER APPLICATIONS



Model 6464
UHF Channel
Combiner

- Sideband Suppression Filters
- Interference Filters for Broadcast Off Air & TVRO
- Channel Combiners
- Channel Bandpass Filters
- Harmonic Suppression Filters
- Filters for Combining Station Ancillary Frequency Bands
- TV Channel Security

For more information, ask for CATALOG LPTV/91!

MFC
MICROWAVE FILTER COMPANY

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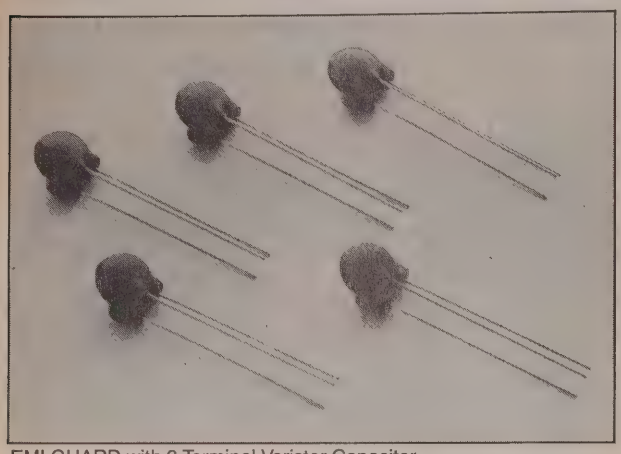
EAST SYRACUSE, NY 13057
800-448-1666 • 315-437-3953
FAX: 315-463-1467

EMI/RFI SUPPRESSION FILTERS

MURATA ERIE NORTH AMERICA



EMI-GUARD with 3 Terminal Varistor-Capacitor

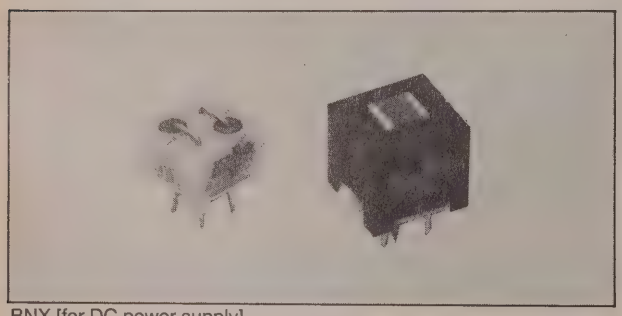
EMI-GUARD DSS710 D 223S 12-22

The DSS710 EMI-GUARD uses a new capacitor element which provides the varistor function. This varistor-capacitor not only works as a bypass capacitor but also directs high-voltage surges to ground. The DSS710 EMI-GUARD is a 3-terminal component so that its high frequency functions are substantially better than those of conventional capacitors. Furthermore, it is combined with ferrite beads to form a T-type filter circuit that effectively dampens noise.

The DSS710 EMI-GUARD efficiently removes quick-rising surges and high-frequency noise above 50 or 60 MHz which conventional capacitors and varistor-capacitors are incapable of removing.

Varistor capacitors are used even where EMI filters fail. They are self-healing and effective in circuits having 500-600V impulses.

A smaller version designated DSS706-351D221M25-50 provides a lower capacitance value aimed at signal line filtering.

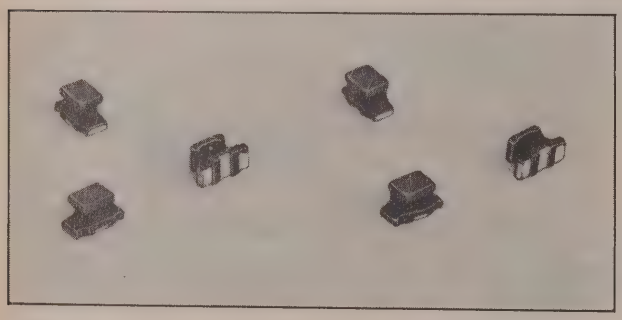


BNX [for DC power supply]

BLOCK TYPE EMIFIL®, BNP/BNX SERIES

Murata Erie's block type EMIFIL BNP/BNX Series completely eliminates noise over extremely wide frequency bands. The BNX is perfect for use in DC power circuits, while the BNP is ideal for eliminating noise in logic signal circuits. Both are designed to perfrom superbly—the result of Murata Erie's expertise in the fields of through-type barrier layer capacitors, monolithic chip capacitors and bead inductors.

Each block contains a number of compact EMI-suppression filters. In addition, the input/output terminals and the grounding terminal are aligned, thus permitting fast and easy assembly on any type of P.C. board.



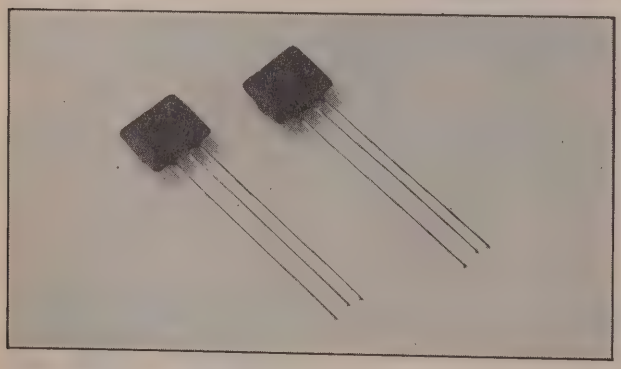
SURFACE MOUNT π CHIP FILTERS NFM52 SERIES AND NFM51 SERIES

The NFM52R Series chip is an efficient signal line noise suppression filter for high-speed digital signal lines where base-band frequencies and noise band frequencies are very close. A new, smaller version NFM51 provides cutoff frequencies up to 500 MHz.

Murata Erie has combined its superior ceramic technologies with a unique circuit configuration to realize outstanding noise suppression effect in these applications. The NFM52R Series assures noise reduction to meet the specifications of CISPR, FCC, etc.

APPLICATIONS

Noise suppression for compact digital instruments, laptop personal computers, HDTV, EDTV, portable VTR, etc.



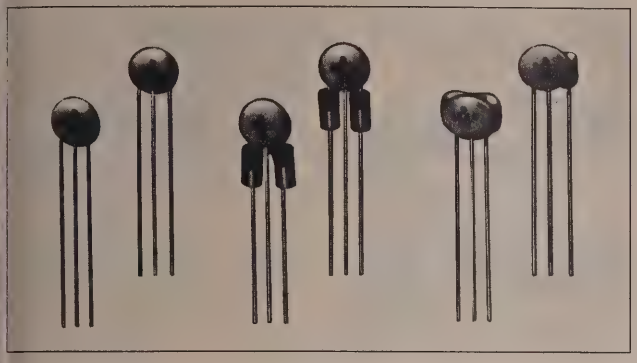
SIGNAL LINE NOISE FILTER, NFV610 SERIES

This high performance noise suppression filter utilizes a unique circuit design to provide exceptional performance in high speed, high impedance digital signal lines. Combining more components than previously available filters so that the high input and output impedances of digital IC's can be matched. This impedance matching greatly reduces the waveform distortions, created by reflections and ringing, that are apparent with convention filters.

MURATA ERIE NORTH AMERICA 220 Lake Park Dr., Smyrna, Georgia 30080 Tel: 1-800-831-9172 Telex: 26-1301 FAX: 1-404-684-1541

EMI/RFI SUPPRESSION FILTERS

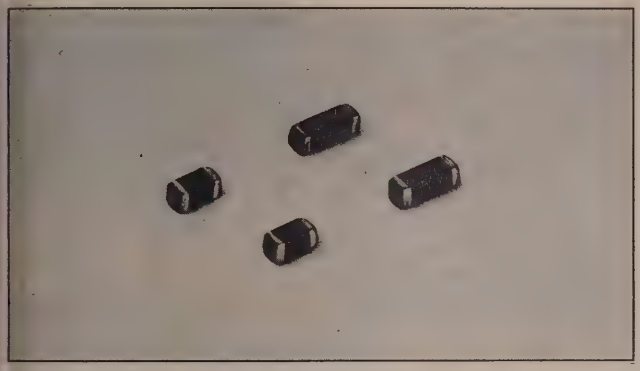
MURATA ERIE NORTH AMERICA



Disc-Type for PCB Mounting

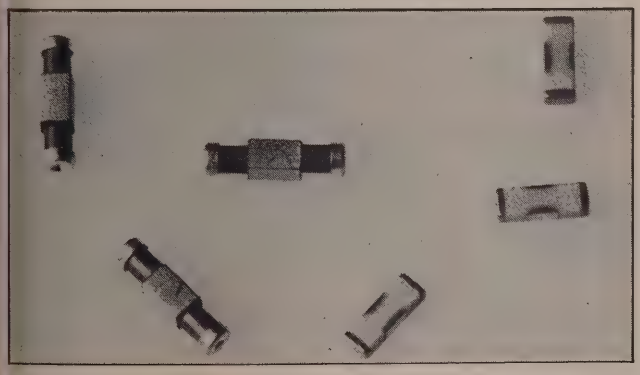
The three terminal design takes advantage of lead inductance and is actually a T type filter when compared to a normal two leaded disk capacitor. The advantage is that the inherent resonance is shifted up in frequency while at the same time the attenuation above the resonant point is improved because of the inductive elements.

These parts are available with or without ferrite beads. Ideally suited to both DC powerline filtering and signal line filtering particularly at I/O ports.



Surface Mount Ferrite Chips

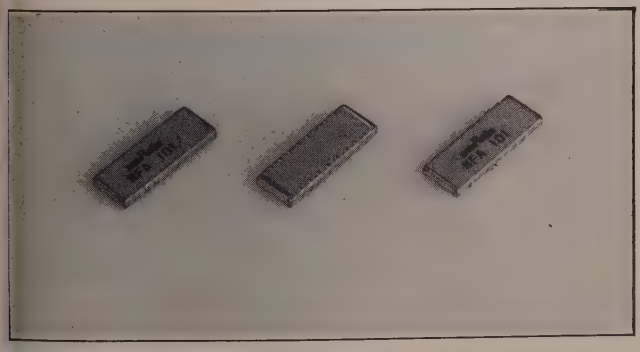
The BLM series of ferrites provide a wide range of attenuation from 70 Ohms to 2000 Ohms at 100 MHz due to a unique internal construction. This multilayer ferrite bead is an inexpensive and effective way to attenuating noise on signal and DC powerlines without introducing any capacitance. Available in STD EIA sizes 0603, 0805, 1206 and 1806.



Surface Mount Filters

The NFM41 series and the smaller NFM40 series SMT filter is a three terminal chip cap, essentially a feedthru capacitor where the NFM61R is a three terminal T filter.

The capacitive only filter, NFM41 series, is designed for low current 300mA signal line applications. The T series, NFM61R, is more suited to DC Powerline filtering because of the higher current rating of 2 amps and the T configuration which is more suited to low impedance circuits.



Surface Mount Filter Arrays

The NFA is similar to the NFM41 described above except that eight feedthru capacitors are combined in a single package. These components are ideally suited for high impedance I/O filtering, where PCB space is a premium.

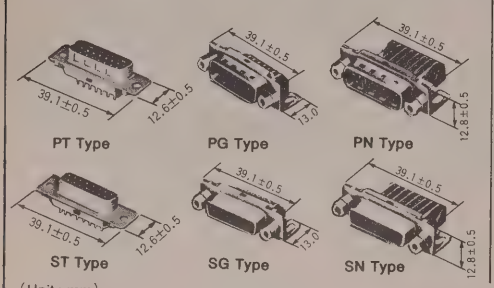
NEW EMI/RFI FILTERED CONNECTORS

MURATA ERIE NORTH AMERICA

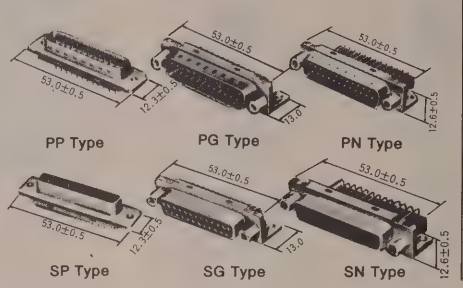
CUBN/L SERIES

DIMENSIONS: mm

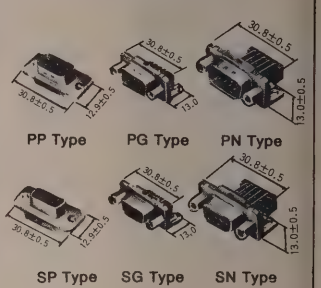
CUBN15 Series



CUBN/L25 Series



CUBN/L09 SERIES



(Unit : mm)

BUILT-IN FEED-THRU CAPACITOR

FEATURES

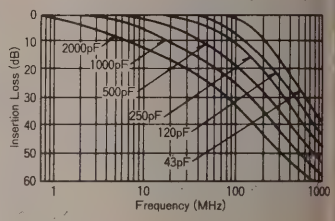
- Compatible with all "D" connectors
- Low Cost/High Reliability
- 6 capacitor values
- Excellent high frequency filtering characteristics

SPECIFICATIONS

Series	Number of Lines	Rated Voltage	Rated Current	Capacitance Value (pF)	Operating Temp. Range
CUBL09 CUBN09	9	100VDC	5ADC	43 ± 30%	-25°C to +85°C
				120 ± 30%	
CUBN15	15			250 ± 30%	
				500 ± 30%	
CUBL25 CUBN25	25			1000 +80% -20%	
				2000 +125% -25%	

Applications: Land and Mobile Radiotelephone, Personal Computer, Display, Monitor, Printer, Modem, POS

INSERTION LOSS (TYP)



BUILT-IN VARISTOR CAPACITOR

FEATURES

- Compact
- Surge Protection
- Mates with all conventional "D" connectors
- Low Cost/High Reliability

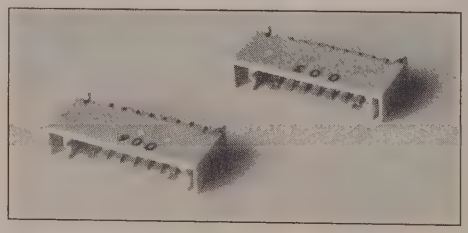
SPECIFICATIONS

Series	Number of Lines	Rated Voltage	Rated Current	Varistor Voltage	Capacitance Value (pF)	Operating Temp. Range
CUBL09 CUBN09	9	16VDC	5ADC	24VDC min.	3300 +200-0%	-25°C to +85°C
CUBN15	15					
CUBL25 CUBN25	25					

CUH SERIES

FEATURES

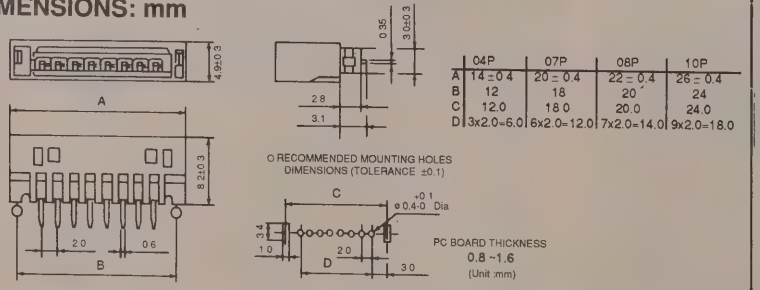
- 6 capacitor values
- 2.0 mm Pitch
- Noise suppression equal to 3-terminal capacitor
- UL-94V-O insulator
- Reduces PCB space requirements
- 4, 7, 8, 10 pins available



SPECIFICATIONS

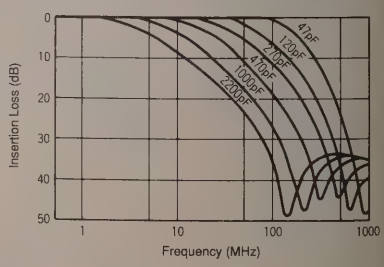
Operating Temp.	:	-25°C to +85°C
Rated Voltage	:	50VDC
Rated Current	:	2ADC
Test Voltage	:	125VDC
Insulation Resistance	:	500MΩ min

DIMENSIONS: mm



	04P	07P	08P	10P
A	14 ± 0.4	20 ± 0.4	22 ± 0.4	26 ± 0.4
B	12	18	20	24
C	12.0	18.0	20.0	24.0
D	3x2.0=6.0	6x2.0=12.0	7x2.0=14.0	9x2.0=18.0

INSERTION LOSS (TYPICAL)

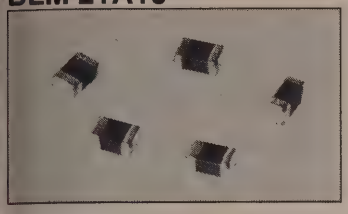


MURATA ERIE NORTH AMERICA 220 Lake Park Dr., Smyrna, Georgia 30080 Tel: 1-800-831-9172 Telex: 26-1301 FAX: 1-404-684-1541

NEW EMI/RFI FILTER PRODUCTS

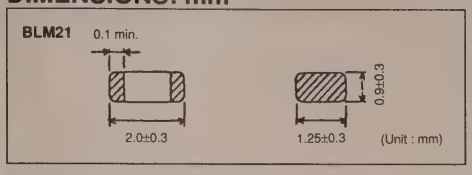
MURATA ERIE NORTH AMERICA

BLM 21A10



FEATURES
- Ultra miniature
- High Impedance
- 2.0 mm pitch mounting

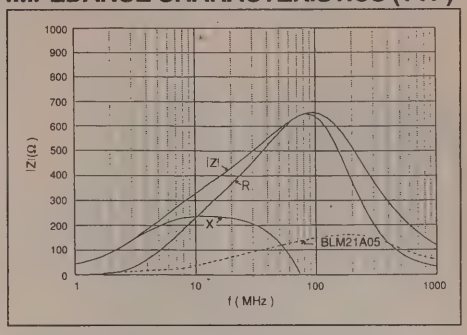
DIMENSIONS: mm



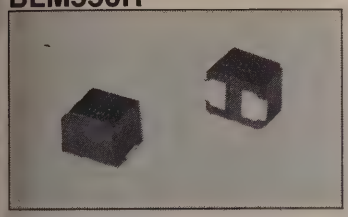
SPECIFICATIONS

Part Number	Characteristic Impedance (TYP) at 100MHz	Rated Current	DC resistance	Operating Temp. Range
BLM21A10	600Ω	200mA	1.5Ω max.	−55+125°C

IMPEDANCE CHARACTERISTICS (TYP)

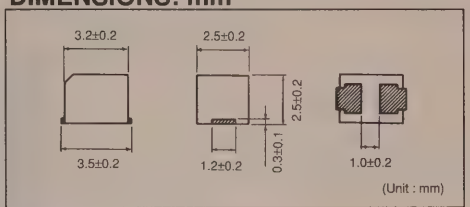


BLM550R

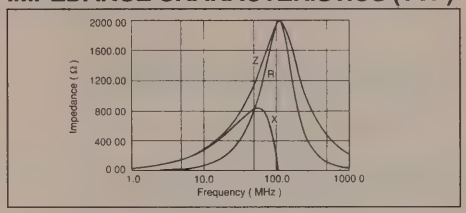


FEATURES
- High Impedance
- Magnetically shielded
- 500mA

DIMENSIONS: mm



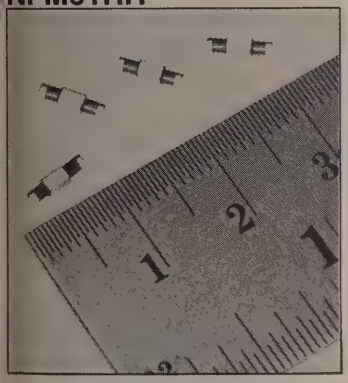
IMPEDANCE CHARACTERISTICS (TYP)



SPECIFICATIONS

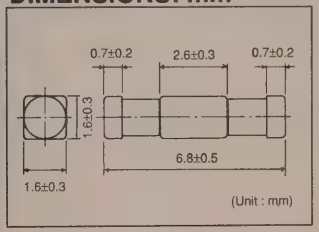
Part Number	Impedance (Ω) (TYP.)			Rated Current (mA)	DC Resistance (Ω min.)	Operating Temperature.
	at 1 MHz	at 100 MHz	at 300 MHz			
BLM550RA01	30	2000	800	500	0.7	-25 to +85°C

NFM61RH

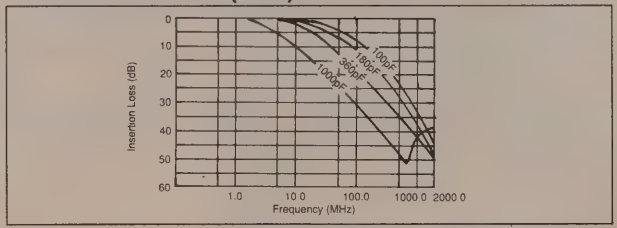


FEATURES
- T-type Chip Filter
- 2A Rating
- 4 STD Cap Values

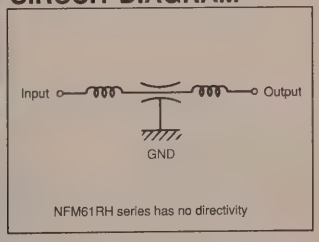
DIMENSIONS: mm



INSERTION LOSS (TYP)

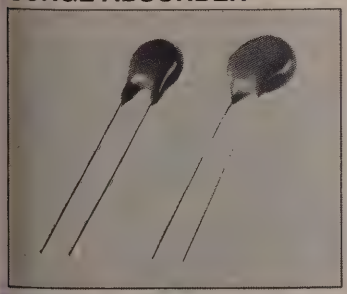


CIRCUIT DIAGRAM



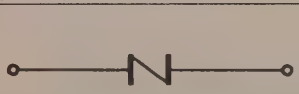
Part Number	Capacitance	Rated Voltage	Withstand Voltage	Rated Current	Insulation Resistance
NFM61RH00T101T1	100pF±30%	100 VDC	250 VDC	2 ADC	1000Ω min.
NFM61RH00T101B1					
NFM61RH00T181T1	180pF±30%				
NFM61RH00T181B1					
NFM61RH00T361T1	360pF±20%				
NFM61RH00T361B1					
NFM61RH10T102T1	1000pF$^{+80}_{-20}$%				
NFM61RH10T102B1					

DVZ07/DVZ10 SURGE ABSORBER



FEATURES
- Low Clamping Voltage
- Fast Response
- Positive and Negative Surge Protection
- 9mm to 14mm Dia.

CIRCUIT DIAGRAM



SPECIFICATIONS

Part Number	Maximum Allowable Voltage		Maximum Clamping Voltage		Withstanding Current Surge (A)	Capacitance (1kHz) (TYP.)	Application
	A Crms(V)	DC(V)	Vc(V)	Ip(A)			
DVZ07-551A221 DVZ10-551A221	140	180	360 360	10 25	600 1250	350pF 700pF	Telephone Lines 100 to 127VAC Lines
DVZ07-551A431 DVZ10-551A431	275	350	710 710	10 25	600 1250	200pF 400pF	200 to 250VAC Lines

Operating Temp. Range: -40 to +85°C

MURATA ERIE NORTH AMERICA

220 Lake Park Dr., Smyrna, Georgia 30080 Tel: 1-800-831-9172 Telex: 26-1301 FAX: 1-404-684-1541

TECHNICAL CERAMICS

NGK SPARK PLUGS (U.S.A.), INC.
CHICAGO OFFICE Telephone: (708) 824-1133, 1200 Business Center Dr., Suite 300, Mount Prospect, IL 60056
75 Main St., Milburn, NJ 07041 Telephone: (201) 376-6070
CALIFORNIA OFFICE Telephone: (408) 727-5180, 3255-2 Scott Blvd., Suite 101, Santa Clara, CA 95054

NTK

TECHNICAL CERAMICS

Since its founding in 1936, NTK Technical Ceramics has expanded its role in ceramics technology from industrial ceramics to piezoelectric and dielectric ceramics. From these new ceramics, NTK has developed a broad line of products for microwave, acoustic, electronic, and electromechanical applications. The company's substantial efforts in research and development in ceramics and related technologies has gained for NTK a position of leadership and reliability in state of the art modern technical ceramics.

455 KHZ FILTERS

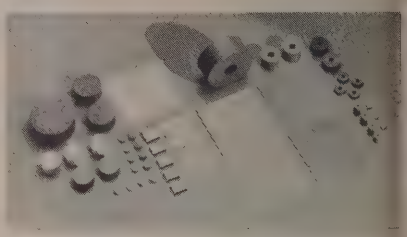
☐ Miniature ☐ Surface Mount

Featuring a complete line of filter characteristics, NTK's Ceramic Filters are temperature stable and cost effective.

MICROWAVE DIELECTRICS

☐ Resonators ☐ Substrates ☐ Metalized Substrates

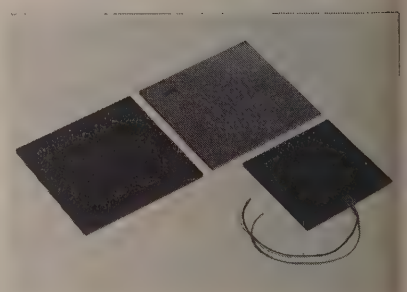
NTK offers the most complete line of high-Q Dielectrics for microwave applications available. Resonators and substrates are available in both standard and custom configurations.



PIEZO RUBBER

☐ Sheet Form ☐ Wire

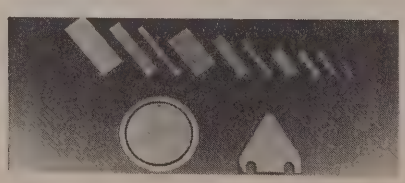
A unique, state of the art, flexible Piezoelectric material. Its durability and pressure stability make it an ideal material for advanced designs in acoustic applications.

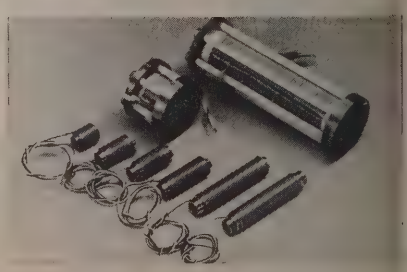


PIEZOELECTRIC ACTUATORS

☐ Bimorphs ☐ Piezo Stacks

Electromechanical devices for a broad range of displacement and sensor applications.





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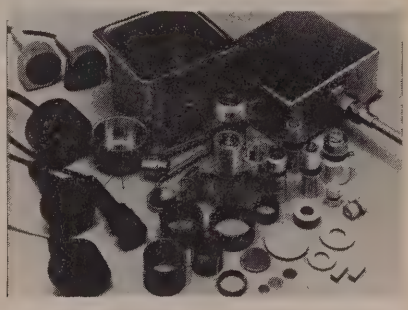
ULTRASONICS

☐ Transducers ☐ Meters ☐ Generators ☐ Cleaners

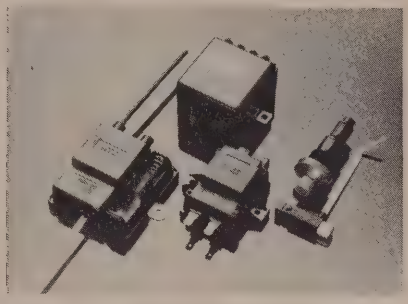
NTK's complete line of Ultrasonic Transducers and equipment include devices for air acoustics, fish finders, ultrasonic cleaners and power tools.



GAS IGNITOR PRODUCTS

☐ Piezo Ignitors ☐ Electronic Ignitors

State of the art PZT materials and 20 years of experience in gas ignition applications has resulted in the most comprehensive high-rel line of components for ignition systems.



PIEZOELECTRIC AUDIO TRANSDUCERS

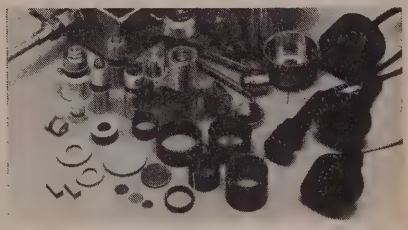
☐ Diaphragms ☐ Buzzers ☐ Speakers
☐ Tweeter Elements

NTK offers a complete line of high efficiency sound transducers in both standard and custom designs with a wide range including single, low frequency devices to broad-band voice and tweeter elements.

PIEZOELECTRIC CERAMICS

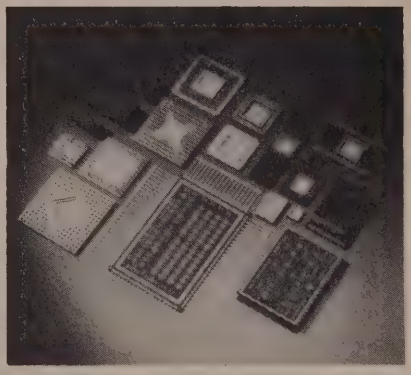
☐ Lead Zirconate Titanate

A complete family of PZT Ceramics including mil-std. compositions.



IC PACKAGES

Making full use of the excellent electrical, heat-radiating, mechanical, and heat-resistant properties of alumina ceramics, NTK manufactures various types of IC Packages by application of its metalizing and vitrifying techniques.



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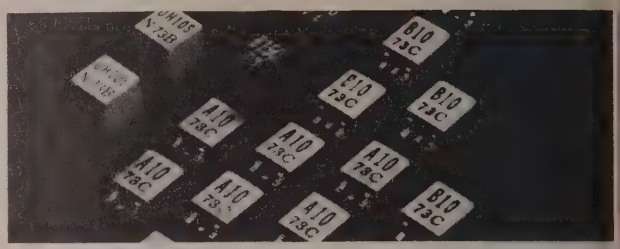
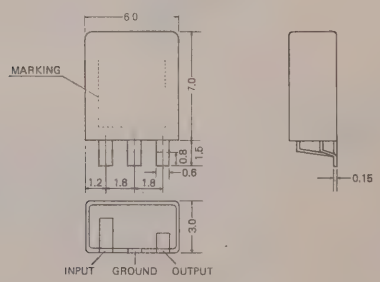
SURFACE MOUNT DEVICES 455KHZ CERAMIC FILTER MLF-B TYPE, MLF-G TYPE

These ceramic filters consist of three or four resonators. Ceramic filters are taped and reeled for automatic pick and place and I.R. reflowable. They are intended for use in circuit boards with SMD technology as an IF filter.



MLF-B TYPE

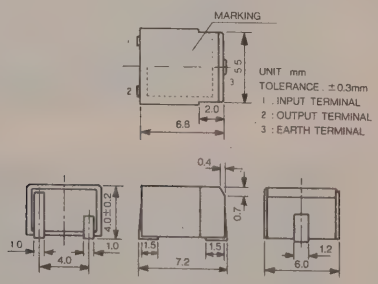
(Configuration/Dimensions)



Model	Characteristics	Center Freq. (KHz)	3dB BW (KHz)	40dB BW (KHz)	75dB BW (KHz)	Attn. (455±100) Min. (dB)	I.L. Max. (dB)	In/Out Imp. (K)
2 Filter Set	MLF-B10A MLF-B10B	455 (nom.)	±4	±9.5	—	37	4	1.5
3 Filter Set	MLF-B10A MLF-B10B MLF-B10C	455 (nom.)	±4	—	±10	60	5	1.5
2 Filter Set	MLF-B17A MLF-B17B	455 (nom.)	±7.5	±18	—	30	4	1.5
3 Filter Set	MLF-B17A MLF-B17B MLF-B17C	455 (nom.)	±7.5	—	±18	50	5	1.5

MLF-G TYPE

(Configuration/Dimensions)



Model / Item	Center Freq. (KHz) nom.	3dB BW (KHz)	30dB BW (KHz)	Attn (450KHz ±100) Min. (dB)	G.D. Max. (usec)	I.L. Max. (dB)	In/Out IMP. (K)
MLF- GR7	450	±3.5	±9.5	27	60	5	1.5
GR8	450	±4	±10	27	40	5	1.5
GR9	450	±4.5	±11	27	50	5	1.5
GR12	450	±6	±13	27	50	4	1.5
GR25	450	±9	±20	27	50	4	1.5
GR27	450	±11	±23	27	40	4	1.5
G30	450	±14	±28	27	25	4	1

• Low cost type is also available.

TECHNICAL CERAMICS

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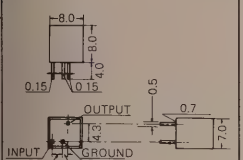
NTK PIEZO CERAMIC FILTERS FOR COMMUNICATIONS

PLASTIC CASE FILTERS

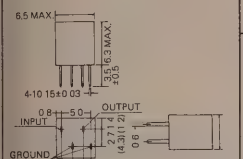
4 POLES

Dimensions Unit:: mm



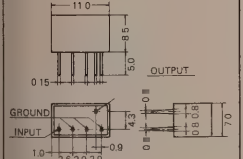
Model	Center Freq. (KHz)	6dB BW (KHz)	40dB BW Max. (KHz)	Attn. (455 ±100) Min. (dB)	I.L. Max. (dB)	In/Out Imp. (KΩ)
LF-B4	455	±2	±7.5	27	9	2
B6	455	±3	±9	27	8	2
B8	455	±4	9.5	27	7	2
B9	455	±4.5	±10	27	6	2
B10	455	±5	±11.5	27	6	2
B12	455	±6	±12.5	27	6	2
B15	455	±7.5	±15	27	6	2
B20	455	±10	±20	27	5	2
B25	455	±12.5	±24	27	5	2
B30	455	±15	±30	27	5	2
B4S	455	±2	±7.5	35	7	2
B6S	455	±3	±9	35	6	2
B8S	455	±4	±10.5	35	6	2

4 POLES



Model	Center Freq. (KHz)	6dB BW (KHz)	40dB BW Max. (KHz)	Attn. (455 ±100) Min. (dB)	I.L. Max. (dB)	In/Out Imp. (KΩ)
ULF-B4	455	±2	±7.5	27	9	2
B6	455	±3	±9	27	8	2
B8	455	±4	±10.5	27	7	2
B9	455	±4.5	±11	27	6	2
B10	455	±5	±11.5	27	6	2
B12	455	±6	±13	27	6	2
B15	455	±7.5	±15	27	6	1.5
B20	455	±10	±20	27	5	1.5
B25	455	±12.5	±25	27	5	1.5
B30	455	±15	±30	27	5	2

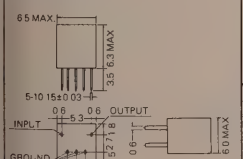
6 POLES



Model	Center Freq. (KHz)	6dB BW (KHz)	50dB BW Max. (KHz)	Attn. (455 ±100) Min. (dB)	I.L. Max. (dB)	In/Out Imp. (KΩ)
LF-H2S	455	±1	±5	35	10	2
H4S	455	±2	±7	45	9	2
H6S	455	±3	±8	45	8	2
H8S	455	±4	±9.5	45	7	2
H9S	455	±4.5	±10	45	6	2
H12S	455	±6	±12	40	6	2
H15S	455	±7.5	±15	40	6	1.5
H18S	455	±9	±18	40	6	1.5
H20S	455	±10	±20	40	6	1.5
H25S	455	±12.5	±24	40	6	1.5
H30S	455	±15	±30	40	6	1.5
H4SD	455	±2	±7	60	6	2
H6SD	455	±3	±9	60	6	2
H15SB	455	±7.5	±14*	50	5	1.5

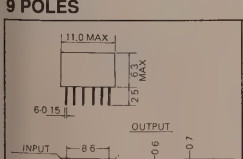
*:60dB

7 POLES



Model	Center Freq. (KHz)	6dB BW (KHz)	40dB BW Max. (KHz)	Attn. (455 ±100) Min. (dB)	I.L. Max. (dB)	In/Out Imp. (KΩ)
ULF-H8	455	±4	±10	40	5	1.5
H10	455	±5	±11	40	5	1.5
H12	455	±6	±12	40	5	1.5
H15	455	±7.5	±15	40	4	1.5
H20	455	±10	±20	35	4	1.5

9 POLES



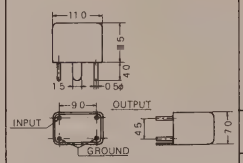
*:75dB **:60dB

Model	Center Freq. (KHz)	6dB BW (KHz)	70dB BW Max. (KHz)	Attn. (455 ±100) Min. (dB)	I.L. Max. (dB)	In/Out Imp. (KΩ)
ULF-K6	455	±3	±7.5	70	6	1.5
K8	455	±4	±10	70	6	1.5
K10	455	±5	±11	70	5	1.5
K10A	455	±5	±9*	70	5	1.5
K12	455	±6	±12	70	5	1.5
K15	455	±7.5	±13**	60	5	1.5
K15A	455	±7.5	±12.5	70	5	1.5

METAL CASE FILTERS

9 POLES

Dimensions Unit:: mm

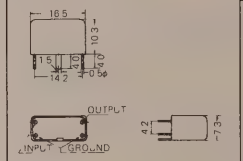


Model	Center Freq. (KHz)	6dB BW (KHz)	70dB BW Max. (KHz)	Attn. (455 ±100) Min. (dB)	I.L. Max. (dB)	In/Out Imp. (KΩ)
SLF-D4	455	±2	±5	70	9	2
D6	455	±3	±7.5	70	7	1.5
D8	455	±4	±9	70	6	1.5
D10	455	±5	±10	70	6	1.5
D12	455	±6	±11	70	6	1.5
D15	455	±7.5	±14	70	6	1.5
D18	455	±9	±17	70	5	1.5
D20	455	±10	±18	70	5	1.5
D10A	455	±5	±8.5	75	5	1.5
D15A	455	±7.5	±12.5	70	4	1.5

7 POLES

Model	Center Freq. (KHz)	6dB BW (KHz)	60dB BW Max. (KHz)	Attn. (455 ±100) Min. (dB)	I.L. Max. (dB)	In/Out Imp. (KΩ)
SLF-D4B	455	±2	±5	50	8	2
D6B	455	±3	±7.5	50	6	1.5
D8B	455	±4	±10	50	6	1.5
D12B	455	±6	±12	50	6	1.5
D15B	455	±7.5	±14	50	6	1.5
D18B	455	±9	±17	50	5	1.5

9 & 11 POLES



Model	Center Freq. (KHz)	6dB BW (KHz)	70dB BW Max. (KHz)	Attn. (455 ±100) Min. (dB)	I.L. Max. (dB)	In/Out Imp. (KΩ)
CLF-D2	455	±1	±4	70	10	2
D4	455	±2	±5	70	9	2
D6	455	±3	±7.5	70	7	1.5
D8	455	±4	±9	70	6	1.5
D10	455	±5	±10	70	6	1.5
D12	455	±6	±11	70	6	1.5
D15	455	±7.5	±14	70	6	1.5
D18	455	±9	±17	70	5	1.5
D20	455	±10	±18	70	5	1.5
D12A	455	±6	±11	85	5	1.5
D15A	455	±7.5	±12.5	80	6	1.5
D17B	455	±8.5	±15	70	7	1.5
D20A	455	±10	±15	70	4	1.5

LOW GROUP DELAY FILTERS

Dimensions

Same as CLF-D Type

Model	Center Freq. (KHz)	6dB BW (KHz)	70dB BW Max. (KHz)	Attn. (455 ±100) Min. (dB)	G.D. Max. (usec)	I.L. Max. (dB)	In/Out Imp. (K)
CLF-G8	455	±4	±10	60	80	10	1.5
G16	455	±8	±20	60	40	10	1.5
G26	455	±13	±30	60	35	10	1
G32	455	±16	±40	60	25	10	1

APPLICATIONS

- Pager
- Cellular Telephone
- SSB
- Cordless Telephone
- Radio
- Transceiver

FEATURES

- Compact Size
- High Performance
- Low Insertion Loss

Filter, Transformer and Common Mode Choke for 10 Base-T (Twisted Pair) 62 Pins

Electrical Specifications @ 25°C	
Dielectric Withstanding Voltage	2000 Vrms
Insertion Loss (1-10 MHz)	See Below
Crosstalk (1-10 MHz)	30 dB Min
Group Delay Change (1-10 MHz)	2.0 nS Max.
Cut-off Frequency	17.5 MHz ± 1.0 MHz

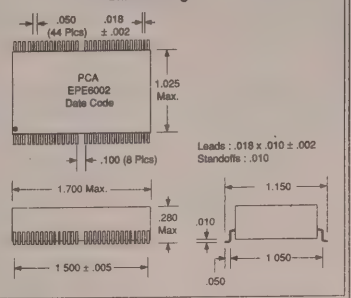
INSERTION LOSS (dB Max.) [1]	XMT	RCV
	8	1

ATTENUATION [2] (-dB Min.)	XMT	RCV
20 MHz	7.0	6.0
25 MHz	19.0	14.0
30 MHz	32.0	20.0
40 MHz	35.0	31.0

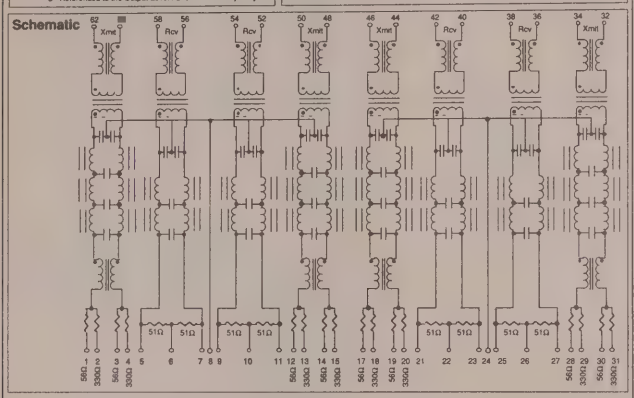
PCA Part Number: EPE6002

Notes : 1 Measured at Fundamental Frequency (10.0 MHz)
2 Referenced to the Output Level Fundamental Frequency

SMD Package



Schematic



Filter, Transformer and Common Mode Choke for 10 Base-T (Twisted Pair) 62 Pins

Electrical Specifications @ 25°C	
Dielectric Withstanding Voltage	2000 Vrms
Insertion Loss (1-10 MHz)	See Below
Crosstalk (1-10 MHz)	30 dB Min.
Group Delay Change (1-10 MHz)	2.0 nS Max.
Cut-off Frequency	17.5 MHz ± 1.0 MHz

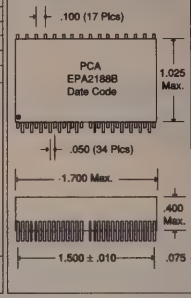
INSERTION LOSS (dB Max.) [1]	XMT	RCV
	8	1

ATTENUATION [2] (-dB Min.)	XMT	RCV
20 MHz	7.0	6.0
25 MHz	19.0	14.0
30 MHz	32.0	20.0
40 MHz	35.0	31.0

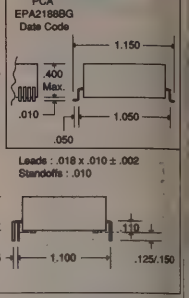
PCA Part Number: EPA2188B & EPA2188BG

Notes : 1 Measured at Fundamental Frequency (10.0 MHz)
2 Referenced to the Output Level Fundamental Frequency

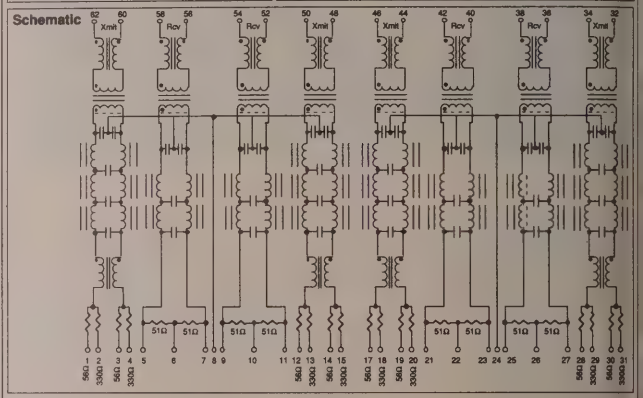
DIP Package



SMD Package



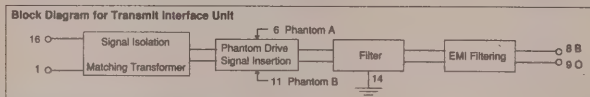
Schematic



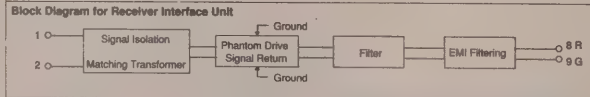
16 Pin DIP Mbps Token Ring Filters and Transformers for Transmit and Receive

Electrical Specifications @ 25°C									PCA Part Number
Characteristic Impedance 150 Ω									EPT7001 & EPT7001G
Insertion Loss	12 KHz	16 MHz	24 MHz	32 MHz	Return Loss	1-5 MHz	10-16 MHz	24 MHz	
	-3.0 Max.	-0.8 Max.	-1.7 Max.	-7.0 Min.		-20 dB Min.	-15 dB Min.	-5 dB Min.	
Common to Common Mode Rejection	100 KHz	20 MHz	200 MHz		Common to Differential Rejection	100 KHz	10 MHz	100 MHz	
	-65 dB Min.	-30 dB Min.	-20 dB Min.			-70 dB Min.	-55 dB Min.	-25 dB Min.	

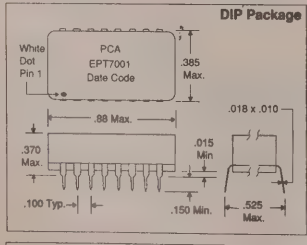
Block Diagram for Transmit Interface Unit



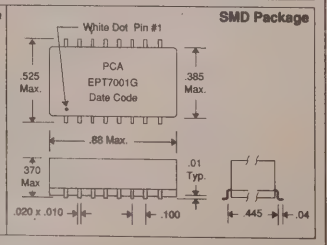
Block Diagram for Receiver Interface Unit



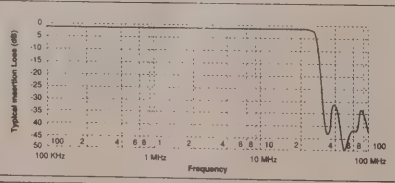
DIP Package



SMD Package



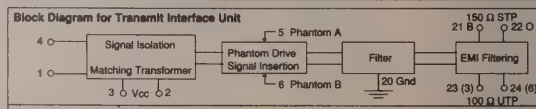
Graph



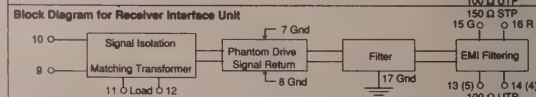
24 Pin DIP 4/16 Mbps Token Ring Filters and Transformers for Transmit and Receive

Electrical Specifications @ 25°C									PCA Part Number
Characteristic Impedance (Supports both STP and UTP Transmission)									EPT7002
Insertion Loss	12 KHz	16 MHz	24 MHz	32 MHz	Return Loss	1-5 MHz	10-16 MHz	24 MHz	
	-3.0 Max.	-0.8 Max.	-1.7 Max.	-7.0 Min.		-20 dB Min.	-15 dB Min.	-8 dB Min.	
Common to Common Mode Rejection	100 KHz	20 MHz	200 MHz		Common to Differential Rejection	100 KHz	10 MHz	100 MHz	
	-65 dB Min.	-30 dB Min.	-20 dB Min.			-70 dB Min.	-55 dB Min.	-25 dB Min.	

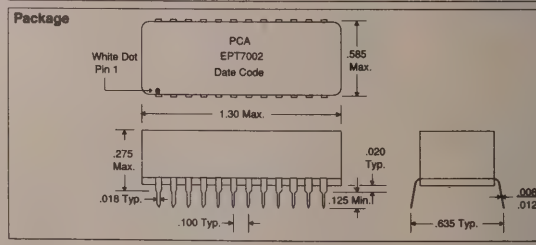
Block Diagram for Transmit Interface Unit



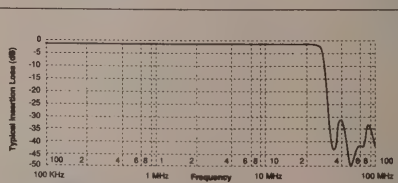
Block Diagram for Receiver Interface Unit



Package



Graph



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NORTH HILLS, CA 91343
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FAX: (818) 894-5791

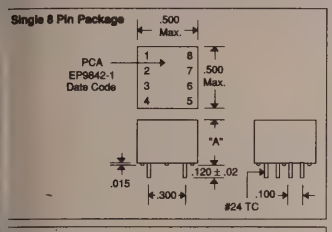
Token Ring Isolation Transformers

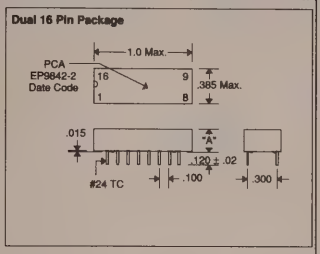
Features

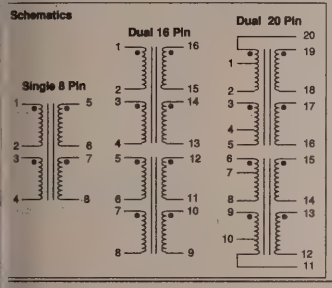
- Available in single and dual low profile packages
- Hipot - 500Vrms (to comply with LAN's International Safety Requirements)
- Designed for IBM and TI token ring for 4 MHz and 16 MHz applications. IEEE 802.5 compatible

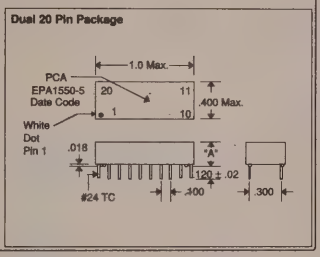
ELECTRICAL SPECIFICATIONS @ 25 °C *@ 100 KHz, 100 MV **@ 1.0 MHz

	4 MHz Applications		16 MHz Applications		16 MHz Applications		16 MHz Applications
PCA P/N	EP9842-1	EP9842-2	EPA1550-1	EPA1550-2	EPA1550-3	EPA1550-4	EPA1550-5
Package Style	Single	Dual	Single	Dual	Single	Dual	Dual
"A" Dimension	.370 Max.	.385 Max.	.250 Max.	.250 Max.	.250 Max.	.250 Max.	.250 Max.
Open Circuit Inductance*	1.0 mH Ref.		750 µH Ref.		250 µH Ref.		400 µH Min
Turns Ratio	1:1:2:2 ± 5%		1:1:1:1 ± 5%		1:1:2:2 ± 5%		2:9:22 ± 5%
Capacitor Winding	15 pF Max.		25 pF Max.		15 pF Max.		30 pF Max.
Leakage Inductance	.4 µH Max.		.20 µH Max.		.15 µH Max.		.03 µH Max.
Primary DCR	0.55 Ω Max.		1.0 Ω Max.		0.55 Ω Max.		0.4 Ω Max.
Secondary DCR	0.85 Ω Max.		1.0 Ω Max.		0.85 Ω Max.		0.8 Ω Max.
Insertion Loss @ 10 MHz	0.5 dB Max.		0.5 dB Max.		0.5 dB Max.		0.5 dB Max.
Common Mode Reject.**	-60 dB Min.		-60 dB Min.		-60 dB Min.		-60 dB Min.
Return Loss @ 5 MHz	20 dB Min..		20 dB Min.		20 dB Min.		20 dB Min.
Hipot	500 Vrms Between Pri and Sec & also from Coil to Coil in Dual Pkg.						500 Vrms (Wdg to Wdg)









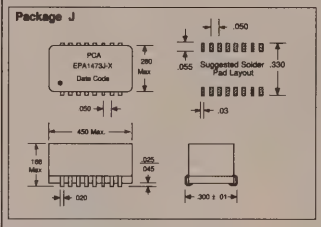
SO-16 SMD Isolation Transformers for LAN-ETHERNET Applications

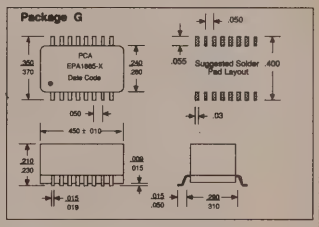
Features

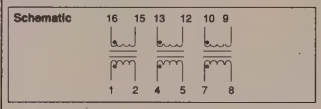
- Low profile for auto-insertion
- Low leakage inductance (LE) and interwinding capacitance (CW)
- Turns ratio - 1:1 ± 5%
- HIPOT-2000Vrms. (to comply with LANS safety requirements)
- Also available on 500Vrms, add "X" to the PCA P/N, eg. EPA1885-5X

ELECTRICAL SPECIFICATIONS AT 25 °C

PCA PART NO. PKG J	PCA PART NO. PKG G	OCL µH ± 20%	ET-CONSTANT V-µS Typ.	RISE TIME nS Max.	CW pF Max.	LE µH Max.	DCR Ω Max.
EPA1473J-1	EPA1885-1	25	2.0	3.0	5	0.15	0.15
EPA1473J-2	EPA1885-2	30	2.0	3.0	5	0.15	0.15
EPA1473J-3	EPA1885-3	35	2.0	3.0	6	0.15	0.20
EPA1473J-4	EPA1885-4	50	2.0	3.0	7	0.20	0.20
EPA1473J-5	EPA1885-5	75	2.4	3.0	8	0.20	0.30
EPA1473J-6	EPA1885-6	100	2.5	3.0	9	0.20	0.30
EPA1473J-7	EPA1885-7	125	3.0	3.0	10	0.25	0.30
EPA1473J-8	EPA1885-8	150	3.0	3.0	11	0.25	0.40
EPA1473J-9	EPA1885-9	175	3.0	3.5	12	0.25	0.50







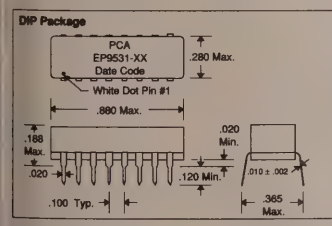
16 Pin DIP or SMD Isolation Transformers for LAN-ETHERNET Applications

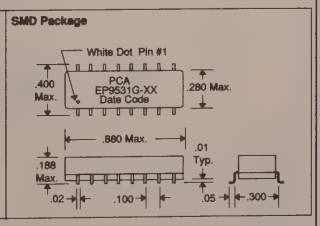
Features

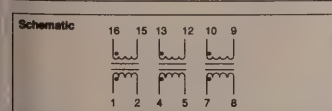
- Designed for IEEE 802.3 (10 Base 2, 10 Base 5) and ECMA Requirements)
- Low profile for auto-insertion
- Low leakage inductance (LE) and interwinding capacitance (CW)
- Turns ratio - 1:1 ± 5%
- Available on 16 pin DIP package and 16 pin SMD package
- HIPOT-2000Vrms. (to comply with LANS safety requirements)
- Also available on 500 Vrms, add "X" to the PCA P/N, eg. EP9531G-5X

ELECTRICAL SPECIFICATIONS AT 25 °C

PCA PART NO. DIP Pkg	PCA PART NO. SMD Pkg	OCL µH ± 20%	ET-CONSTANT V-µS Typ.	RISE TIME nS Max.	CW pF Max.	LE µH Max.	DCR Ω Max.
EP9531-1	EP9531G-1	25	2.0	3.0	5	0.15	0.15
EP9531-2	EP9531G-2	30	2.0	3.0	5	0.15	0.15
EP9531-3	EP9531G-3	35	2.2	3.0	6	0.15	0.20
EP9531-4	EP9531G-4	50	2.2	3.0	7	0.20	0.20
EP9531-5	EP9531G-5	75	2.5	3.0	8	0.20	0.25
EP9531-6	EP9531G-6	100	2.5	3.0	9	0.25	0.30
EP9531-7	EP9531G-7	125	3.0	3.0	10	0.25	0.30
EP9531-8	EP9531G-8	150	3.0	3.0	11	0.25	0.40
EP9531-9	EP9531G-9	175	3.5	3.5	12	0.25	0.50
EP9531-10	EP9531G-10	200	3.5	3.5	13	0.30	0.50
EP9531-11	EP9531G-11	250	4.0	4.0	14	0.35	0.60
EP9531-12	EP9531G-12	300	4.0	4.0	15	0.35	0.60







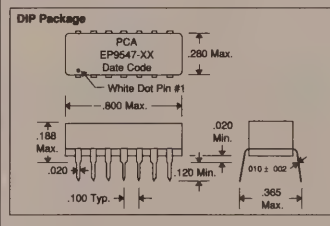
14 Pin DIP or SMD Isolation Transformers for LAN-ETHERNET Applications

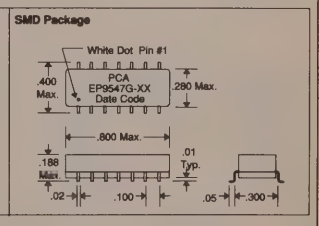
Features

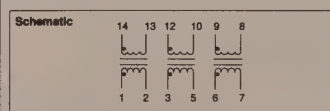
- Designed for IEEE 802.3 (10 Base 2, 10 Base 5) and ECMA Requirements)
- Low profile for auto-insertion
- Low leakage inductance (LE) and interwinding capacitance (CW)
- Turns ratio - 1:1 ± 5%
- Available on 14 pin DIP package and 14 pin SMD package
- HIPOT-2000Vrms. (to comply with LANS safety requirements)
- Also available on 500 Vrms, add "X" to the PCA P/N, eg. EP9531G-5X

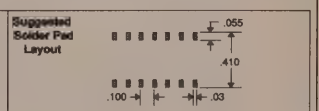
ELECTRICAL SPECIFICATIONS AT 25 °C

PCA PART NO DIP Pkg	PCA PART NO SMD Pkg	OCL µH ± 20%	ET-CONSTANT V-µS Typ.	RISE TIME nS Max.	CW pF Max.	LE µH Max.	DCR Ω Max.
EP9547-1	EP9547G-1	25	2.0	3.0	5	0.15	0.15
EP9547-2	EP9547G-2	30	2.0	3.0	5	0.15	0.15
EP9547-3	EP9547G-3	35	2.2	3.0	6	0.15	0.20
EP9547-4	EP9547G-4	50	2.2	3.0	7	0.20	0.20
EP9547-5	EP9547G-5	75	2.5	3.0	8	0.20	0.25
EP9547-6	EP9547G-6	100	2.5	3.0	9	0.25	0.30
EP9547-7	EP9547G-7	125	3.0	3.0	10	0.25	0.30
EP9547-8	EP9547G-8	150	3.0	3.0	11	0.25	0.40
EP9547-9	EP9547G-9	175	3.5	3.5	12	0.25	0.50
EP9547-10	EP9547G-10	200	3.5	3.5	13	0.30	0.50
EP9547-11	EP9547G-11	250	4.0	4.0	14	0.35	0.60
EP9547-12	EP9547G-12	300	4.0	4.0	15	0.35	0.60









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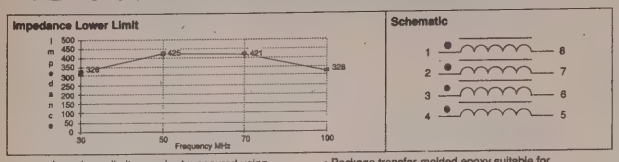
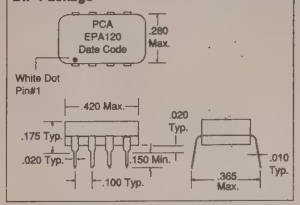
4 Line Common Mode Filter EPA120 & EPA120G

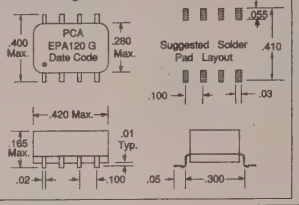


- Impedance limits per chart measured using HP4193A Vector Impedance Meter
- Max Current 1 A DC/Winding
- Temperature rise 45° C Max at 25° C ambient
- Package transfer-molded epoxy suitable for auto-insertion
- Part is symmetrical: May be inserted either way
- 300 Vac Hipot

DIP Package



SMD Package

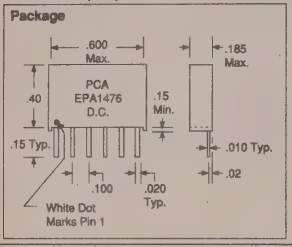


6 Pin DIL Low-Pass Filter EPA1476

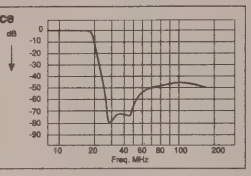
Features

- 10 Base-T Low-Pass Filter Module for 50 Ω System
- Cut-off Frequency : 17 MHz

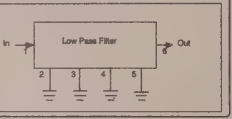
Package



Impedance Graph



Schematic



Twisted Pair Coupling Transformers For 10 Base-T

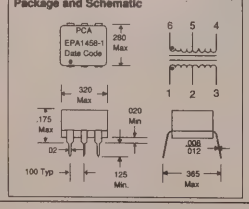
Features

- Available in single and dual low profile packages.
- Meets IEEE 802.3 10 Base-T
- Low leakage inductance (LE) and interwinding capacitance (CW)
- Hipot - 2000 Vrms

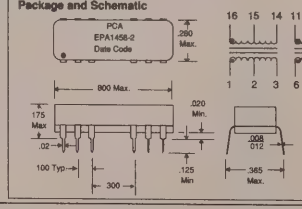
Electrical Specifications EPA1458-1 & -2

PCA Part No. Single	PCA Part No. Dual	OCL µH Min.	Turns Ratio (± 2 %)	ET V-µS Ref.	Rise Time nS Max.	CW pF Max.	LE µH Max.	DCR Ω Max.
EPA1458-1	EPA1458-2	200	1CT:1CT	3.5	4.2	20.0	0.17	0.9

Package and Schematic



Package and Schematic



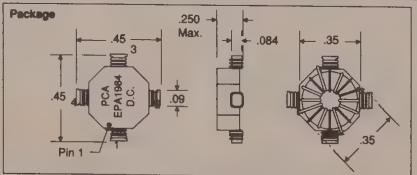
Surface Mount Tech. Low Power Inductor

Features ■ Low Profile ■ Pick & Place Compatible ■ No Internal Solder Connection

Electrical Specifications

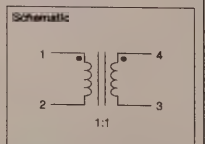
Inductance	100 µH ± 10 % @ 10 KHz, 0.73 Adc	Interwinding Capacitance	175 pF Typ. @ 10 KHz, 1.0V
Inductance	100 µH (Windingd in Parallel)	Leakage Inductance	1.68 µH Typ. @ 10 KHz, 1.0V
Inductance	400 µH (Windings in Series)	DCR	0.43 Ω Typ. (Windingd in Parallel)
Current	0.73 Adc	DCR	1.70 Ω Typ. (Windingd in Series)
Peak Current	0.73 Adc (Windingd in Parallel)	Hipot	100 Vrms
Peak Current	.365 Adc (Windings in Series)	Turns Ratio	1:1

Package



PCA P/N : **EPA1984**

Schematic



4/93

Toroidal Power Inductors EP9585-1 to -13

Features ■ 2:1 Inductance swing from 0 ADC to max rated DC current ■ Available with or without case ■ 40° C max temperature rise

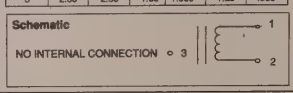
PART NUMBER	INDUCTANCE RATED ADC µH MIN	ADC AMPS	TEST LEVEL @ 15.75 KHz VRMS	INDUCTANCE @ 0 ADC µH MIN	DCR OHMS MAX	ET 20 KHz V-µS	ET 40 KHz V-µS	LEAD DIA INCH ± .005	PACKAGE
EP9585-1	17	17	1.1	40	.0065	190	130	.081	3
EP9585-2	32	16	2.2	74	.0092	290	200	.081	4
EP9585-3	60	16	3.9	125	.012	390	270	.081	5
EP9585-4	14	10	0.6	27	.009	135	95	.057	1
EP9585-5	23	11	1.1	46	.012	170	120	.057	2
EP9585-6	43	10	1.7	90	.018	280	195	.057	3
EP9585-7	78	10	3.2	165	.025	430	300	.057	4
EP9585-8	144	10	5.7	275	.032	570	400	.057	5
EP9585-9	32	6.5	0.85	64	.025	200	140	.04	1
EP9585-10	52	7	1.5	97	.032	230	160	.04	2
EP9585-11	98	6	2.4	185	.048	400	280	.04	3
EP9585-12	175	6	4.6	330	.068	820	425	.04	4
EP9585-13	335	6	8.5	600	.095	840	580	.04	5

ADC=Rated DC Current

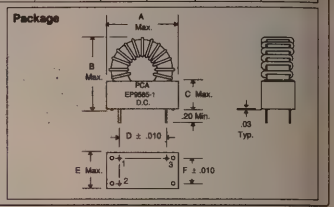
Package Dimensions

PKG	A	B	C	D	E	F
1	1.20	1.20	.45	.800	.80	.400
2	1.45	1.45	.70	.900	.80	.600
3	1.60	1.75	.70	.900	.80	.600
4	2.00	2.00	.90	1.200	.95	.70
5	2.30	2.30	1.00	1.500	1.20	.900

Schematic



Package



ISDN "S" Interface Isolation Transformers

FEATURES

- Available in single and dual low profile packages.
- Meet CCITT 1.430 four wire "S" interface.
- HIPOT-2000 Vrms (to comply with International standards).
- Longitudinal Balance (10 KHz - 3000 KHz) - 60 dB Min.

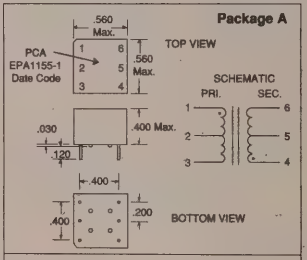
ELECTRIAL SPECIFICATIONS

PCA P/N	Turns Ratio (± 5%)	OCL mH Ref..	LE µH Max.	CW pF Max.	Prim DCR Ω (Typ.)	Sec DCR Ω (Typ.)	Package Schematic
EPA1155-1	1:1	22	5	110	2.5	2.5	A
EPA1155-2	1:1.8	22	8	100	2.5	4.5	B
EPA1155-3	1:2	22	8	100	2.5	5.0	A
EPA1155-4	1:2.5	22	12	100	2.5	6.0	B
EPA1155-5	1:2	22	30	100	2.5	5.0	A
EPA1155-6	1:1	22	5	110	2.5	2.5	C
EPA1155-7	1:2	22	8	100	2.5	5.0	C
EPA1155-8	1:2	22	30	100	2.5	5.0	C
EPA1155-11	1:1 ± 2%	22	5	100	2.75	2.75	D

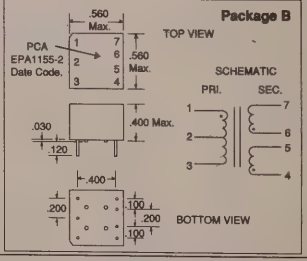
IC Manufacturer	IC Part Number	PCA Part Number Transmit	PCA Part Number Receive
AMD	79C30A	EPA1155-7	EPA1155-7
Intel	29C53	EPA1155-2	EPA1155-4
Mitel	MT8930	EPA1155-3	EPA1155-3
Motorola	MC145474	EPA1155-1	EPA1155-1
Motorola	MC145475	EPA1155-1	EPA1155-1

IC Manufacturer	IC Part Number	PCA Part Number Transmit	PCA Part Number Receive
National	TP3420	EPA1155-3	EPA1155-1
National	TP3421		
Siemens	PEB2080	EPA1155-3	EPA1155-3
SGS Thompson	5420	EPA1155-3	EPA1155-3

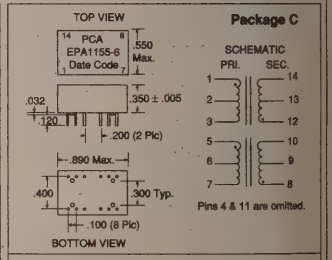
Package A



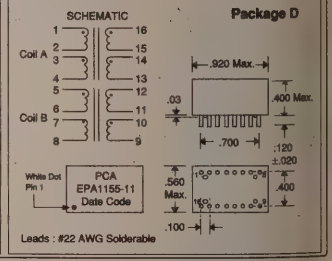
Package B



Package C



Package D



Transformer and Commom Mode Choke

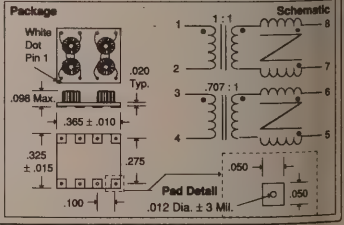
Features ■ For PCMCIA Applications ■ Low Profile ■ Hipot complies with LANS Safety Regulations

PCA P/N : **EPA2453**

Electrical Specifications

Primary (1 & 2) Inductance	160µH Typ. @ 100kHz , 1.0Vrms ≈ 80µH, @4MHz
Primary (3 & 4) Inductance	80 µH Typ. @ 100kHz, 1.0Vrms
Primary Et	3.0 V µsec Typ (1 & 2).
Interwinding Capacitance	10 pF Max.
Leakage Inductance	0.25 µH Max. (Measured from Pins 1 & 2 with 7 & 8 shorted)
Primary DCR	0.3 Ω Max. (1 & 2)
Hipot	2000 Vrms
Turns Ratio	Pins(1-2):(9-10), 1: 1 Pins(4-5):(6-7), .707: 1
Polarity	1° 3° 6° 8° (In Phase)

Package



Schematic

PCA ELECTRONICS INC.
16799 SCHOENBORN ST.
NORTH HILLS, CA 91343
TEL: (818) 892-0761
FAX: (818) 894-5791

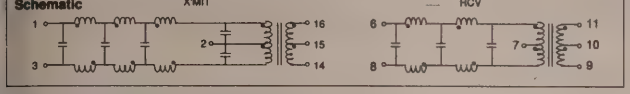
Filter and Transformer for 10 Base-T (Twisted Pair) 16 Pin DIP or SMD

Electrical Specifications @ 25°C	
Dielectric Withstanding Voltage	2000 Vrms
Insertion Loss (1-10 MHz)	0.8 dB Max.
Crosstalk (1-10 MHz)	-30 dB Min.
Group Delay Change (1-10 MHz)	2.0 nS Max.
Cut-off Frequency	17 MHz ± 0.7 MHz

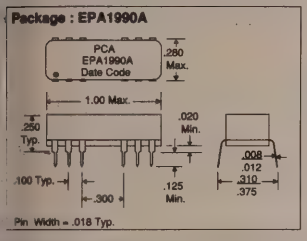
INSERTION LOSS [1] (dB Max.)		ATTENUATION [2] (-dB Min.)								PCA Part Numbers	
		20 MHz		25 MHz		30 MHz		40 MHz			
XMIT	RCV	XMIT	RCV	XMIT	RCV	XMIT	RCV	XMIT	RCV	16 Pin DIP	16 Pin Gull-Wing SMD
.75	.65	7.0	6.0	19.0	14.0	32.0	20.0	35.0	31.0	EPA1990A	EPA1990AG

Notes : 1. Measured at Fundamental Frequency (10.0 MHz)
2. Referenced to the Output Level Fundamental Frequency

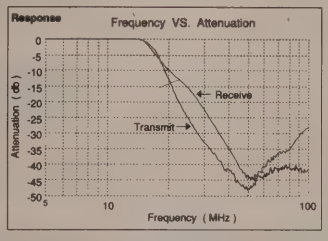
Schematic



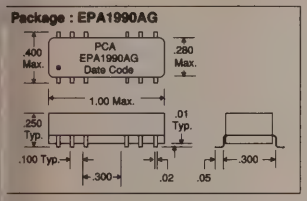
Package : EPA1990A



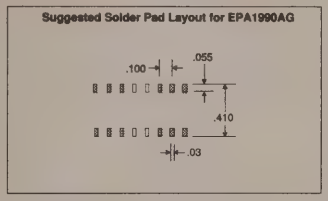
Response Frequency VS. Attenuation



Package : EPA1990AG



Suggested Solder Pad Layout for EPA1990AG



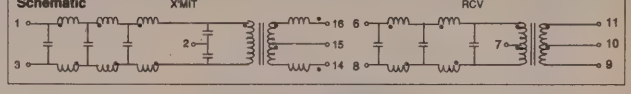
Filter, Transformer and Common Mode Choke for 10 Base-T (Twisted Pair) 16 Pin DIP or SMD

Electrical Specifications @ 25°C	
Dielectric Withstanding Voltage	2000 Vrms
Insertion Loss (1-10 MHz)	0.8 dB Max.
Crosstalk (1-10 MHz)	-30 dB Min.
Group Delay Change (1-10 MHz)	2.0 nS Max.
Cut-off Frequency	17 MHz ± 0.7 MHz

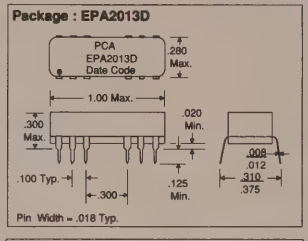
INSERTION LOSS [1] (dB Max.)		ATTENUATION [2] (-dB Min.)								PCA Part Numbers	
		20 MHz		25 MHz		30 MHz		40 MHz			
XMIT	RCV	XMIT	RCV	XMIT	RCV	XMIT	RCV	XMIT	RCV	16 Pin DIP	16 Pin Gull-Wing SMD
.75	.65	7.0	6.0	19.0	14.0	32.0	20.0	35.0	31.0	EPA2013D	EPA2013DG

Notes : 1. Measured at Fundamental Frequency (10.0 MHz)
2. Referenced to the Output Level Fundamental Frequency

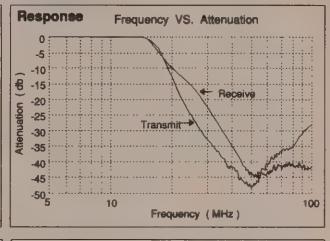
Schematic



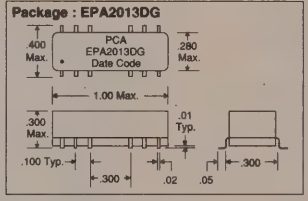
Package : EPA2013D



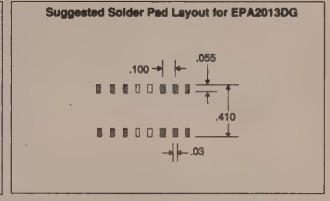
Response Frequency VS. Attenuation



Package : EPA2013DG



Suggested Solder Pad Layout for EPA2013DG

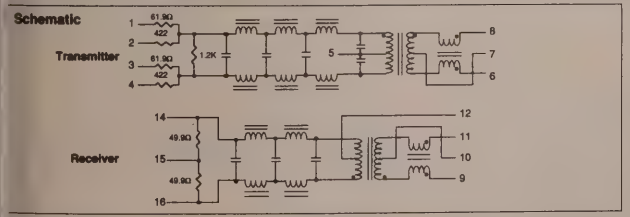


Filter, Transformer and Common Mode Choke for 10 Base-T (Twisted Pair) 16 Pin DIL or SMD

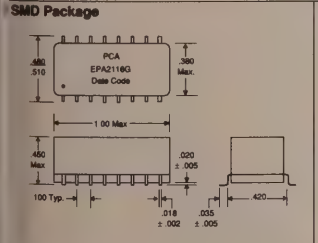
16 Pin Balanced Low Pass Filter Electrical Specifications @ 25°C			
Transmitter : 7 Pole Balanced Low-Pass 100 Ω		Receiver : 5 Pole Balanced Low-Pass 100 Ω	
Isolation (Input - Output)	2000 Vrms (for 1 Minute)	Isolation (Input - Output)	2000 Vrms (for 1 Minute)
Input Impedance	200 Ω Nom.	Input Impedance	50 Ω Nom.
Insertion Loss	.45 dB Max. (1-10 MHz)	Insertion Loss	1.0 dB Max. (1-10 MHz)
Cut-Off Freq.	17 MHz ± 70 MHz	Cut-Off Freq.	17 MHz ± 70 MHz
*Attenuation Referenced to Filter Output @ 5.0 MHz	20 MHz 7 dB Min.	*Attenuation Referenced to Filter Output @ 5.0 MHz	20 MHz : 5 dB Min.
	25 MHz 18 dB Min.		25 MHz 11 dB Min
	30 MHz 30 dB Min.		30 MHz 16 dB Min.
	40 MHz : 33 dB Min.		40 MHz : 26 dB Min.
Return Loss	15 dB Min. (5-10 MHz)	Return Loss	15 dB Min (5-10 MHz)
Common Mode Rej.	30 dB Min. (1-100 MHz)	Common Mode Rej.	30 dB Min. (1-100 MHz)
Transmitter to Receiver Characteristics			
Hipot	500 Vrms (for 1 Minute)		
Crosstalk Attenuation	35 dB Min.Between Channels (1-10 MHz)		

PCA Part Numbers
EPA2116
EPA2116G

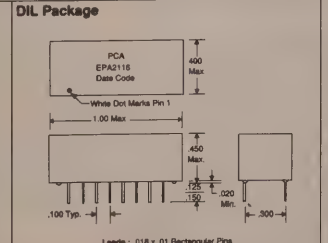
Schematic



SMD Package



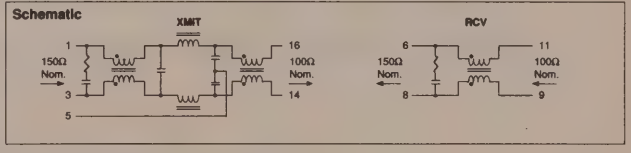
DIL Package



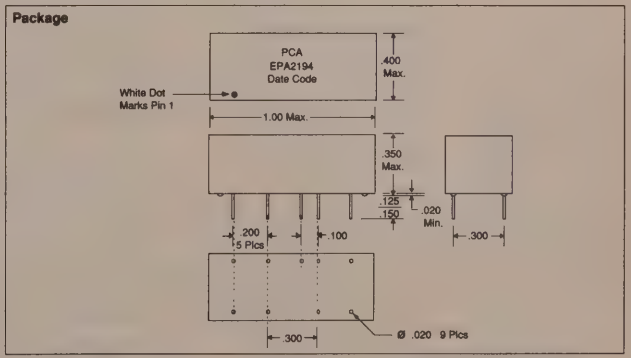
Filter and Transformer for 10 Base-T (Twisted Pair) 16 Pin DIL

Electrical Specifications @ 25°C			
TRANSMIT		XMIT / RCV	
Cut Off Frequency (Ref to 8 MHz) 3dB	25 MHz ± 1 MHz	Return Loss (5-10 MHz)	15 dB Min.
Insertion Loss (1-16 MHz)	3.0 dB Max.	Crosstalk (1-10 MHz)	30 dB Min.
*Attenuation (Ref to 8 MHz) 32 MHz	XMIT 4 dB Min.	Common Mode (10-70 MHz)	30 dB Min (XMIT)
40 MHz	8 dB Min	Rejection (10-70 MHz)	15 dB Min. (RCV)
48 MHz	12 dB Min	Isolation	2000 Vrms Min for 1 Minute
* Includes Loss from Internal	150 Ω - 100 Ω Matching	PCA Part Number	EPA2194
Group Delay (8-16 MHz)	4.0 nS Max		

Schematic



Package



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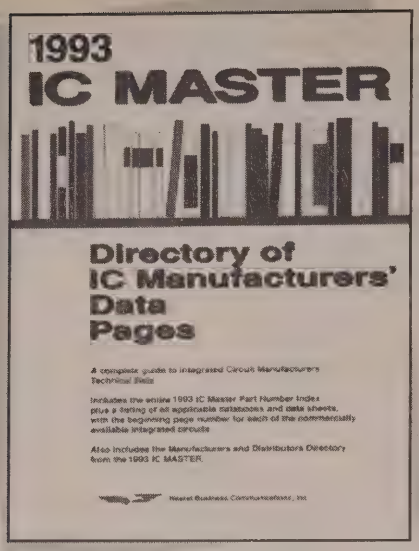
16799 SCHOENBORN ST.
NORTH HILLS, CA 91343
TEL: (818) 892-0761
FAX: (818) 894-5791



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- 32 band-pass channels.
- 64 prog. amplifier channels.
- Differential input, gain, calibration, monitor, and other options, of course.
- Zero suppress.

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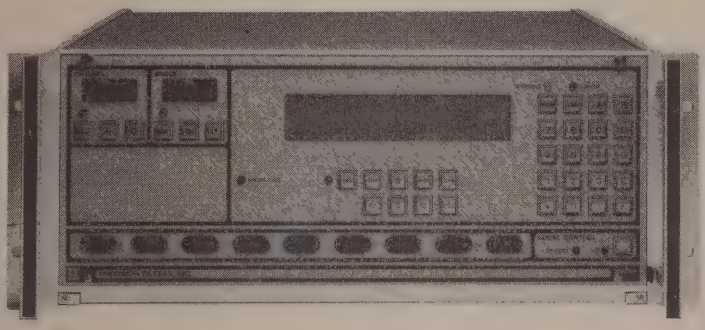
- 204.7 kHz filters, 130 dB/octave.
- Filter match 0.25° and 0.25% typ.



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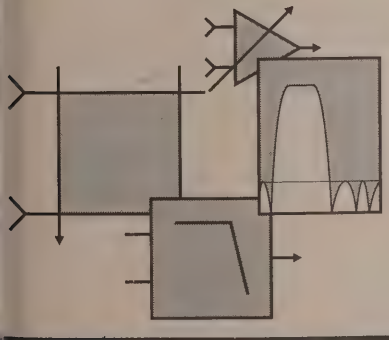
Get all you need today.
Change and upgrade later.



Friendly Functions
- Cal subsystem for go/no-go cal, end-to-end cal, plus diagnostics.
- Group configuration for easy control.
- Up-load and down-load for easy setup.
- Overload detection.
- System status, other reports.

Friendly Choice
- Programmable filters—HP, LP, BP, notch, anti-alias, one-third octave.
- Programmable amplifiers—pre, post, auto-gain ranging.
- Prog. frequency-band translators.
- Switch matrices—4x4 to 32x32.
- Buffered I/O to sense/control other devices.
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- Serial or GPIB computer interfaces.
- Custom systems from standard proven hardware that's available.
- Buy only what you need now, add and change as needs change.

128 filters in a mainframe

Filters are offered in a wide variety of types that you can mix and match within the 16 card mainframe.

Filters come one, two, four, or eight per card, depending on resolution and other performance features.

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We have a tradition of leading the way to higher frequency filters. We introduced the industry's first 2 MHz bandwidth filters for programmable use. 80 dB/octave attenuation. Time delay superior to Bessel.

Elliptics as sharp as 130 dB/octave

Precision was first to offer elliptics with 80 dB/octave attenuation. Now we're the first to add the sharper option of 130 dB/octave for frequencies up to 204 kHz.

Passband ripple is 0.044 dB p-p, and there's 1° phase match up to the cutoff frequency.

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You can mix types of filters. You can also add a variety of preamps, post amps, gain ranging amplifiers, and transducer amplifier/filters.

A variety of additional system enhancements match the Precision 6000 to your requirements. Frequency-band translators, switch matrices, buffered I/O interface cards and prototype cards are available for your system.

Easy programming

Set up the system at the front panel. One command uploads the set-up to a host computer. Down-load later to program the system. Choice of serial or GPIB computer interfaces.

Precision family of signal conditioners

Call Precision Filters for all your signal conditioning requirements. Signal switching systems, A/D conversion systems, and VXI-based systems are available. See Section 2325.

• See amplifier systems, transducer/amplifier systems, and auto-ranging amplifier systems in Section 1100.
• See other data acquisition systems in Section 2325.

Precision Filters, Inc. ● 240 Cherry Street ● Ithaca, New York ● 607-277-3550 ● Fax 607-277-4466

PRECISION FILTERS, INC.

A growing selection of filters

Precise programmable filters are offered in a wide variety of types that you can mix and match within the 16 card capacity of the Precision 6000 mainframe. Filters come one, two, four or eight channels per card, depending on resolution and other performance features.

Custom systems at off-the-shelf prices

Not only can you mix various types of filters, you can also add a variety of preamps, post-amps, gain ranging amps, and transducer amps (see Section 1100), as well as other signal conditioning devices such as frequency-band translators and switch matrices (see Section 2325).

Filter model selection guide (Filter cards plug into System 6000 mainframe.)

	6602B 6622	6604B 6624	6611A	6612A 6632	6614	6618	6694
Channels per system	32	64	16	32	64	128	64
Channels per card	2	4	1	2	4	8	4
Max cutoff freq (Hz)	204.7 k	25.575 k	2.048 M	204.7 k	32 k	12.8 k	25.594 k
Min cutoff freq (Hz)	0.1	0.1	20	0.1	1.0	1	0.25*
Bits in a range	10, 11†	10	10	10,11†	4	2	12
Filter types	HP1, LP1, TD6, HLP	HP1, LP1, TD6, HLP	HP1, LP1, TD6	HP8, LP8, TD8	HP1, LP1, TD6, HLP	HP1, LP1, TD6	NF1

* Limited use below 25 Hz. Specified performance at 25 Hz to maximum cutoff frequency.

† 11 bits on Models 6602B, 6612A, 6622, and 6632, ranges -A and -E.

Filter type selection guide

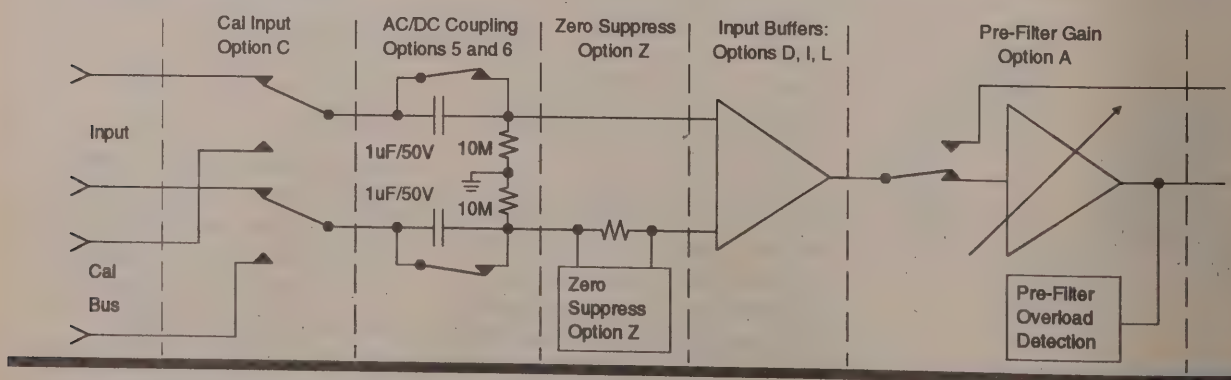
	HLP	HP1	HP8	LP1	LP8	TD6A	TD6B	TD8A	TD8B
Filter type	HP/LP	HP	HP	LP	LP	LP	LP	LP	LP
Function	*	Cauer	Cauer	Cauer	Cauer	†	‡	†	‡
Number of poles, zeros	6p,6z	6p,6z	8p,6z	6p,6z	8p,6z	6p,4z	6p,6z	8p,6z	8p,8z
Pass-band ripple (dB p-p)	0.1	0.1	0.044	0.1	0.044	–	0.2	–	0.2
Cutoff freq amplitude (dB)	–2.40	–3.01	–0.044	–3.01	–0.044	–9.61	–3.01	–10.06	–3.01
Stop-band frequency	0.383/2.61 Fc	0.508 Fc	0.637 Fc	1.971 Fc	1.569 Fc	3.535 Fc	4.893 Fc	–	3.335 Fc
Stop-band attn. (dB)	80	80.07	84.36	80.07	84.36	–	70.0	–	80.28
Attn. slope (dB/oct)	59.5	81.8	130	81.8	130	39.1	30.0	33.7	46.3

* Unity normalized natural frequencies; plug programmable for high-pass or low-pass.

† TD6A and TD8A: Bessel filter with zeros.

‡ TD6B: 6 pole Bessel w/4 stop-band zeros & 2 pass-band zeros; TD8B 8 pole Bessel w/ 6 stop-band zeros & 2 pass-band zeros.

Filter Channel with Options



- See amplifier systems, transducer/amplifier systems, and auto-ranging amplifier systems in Section 1100.
- See other data acquisition systems in Section 2325.

Precision Filters, Inc. ● 240 Cherry Street ● Ithaca, New York ● 607-277-3550 ● Fax 607-277-4466

6602B & 6622 Dual filter/amps
80 dB/octave—204.7 kHz

Model number	Low range (Hz)			High range (Hz)		
	Min	Max	Step	Min	Max	Step
A	1.0	2047.0	1.0	2100	204,700	100
B	1.0	1023.0	1.0	1100	102,300	100
C	0.1	102.3	0.1	110	10,230	10
E	0.1	204.7	0.1	210	20,470	10
I				100	204,700	100
J				100	102,300	100

6604B & 6624 Quad filter/amps
80 dB/octave—25.575 kHz

Model number	Low range (Hz)			High range (Hz)		
	Min	Max	Step	Min	Max	Step
A-	1.0	1023.0	1.0	1025	25,575	25
B	0.1	102.3	0.1	110	1,230	10
K	25	25,575	25			
L	10	10,230	10			
M	1.0	1,023	1.0			
N	0.1	102.3	0.1			

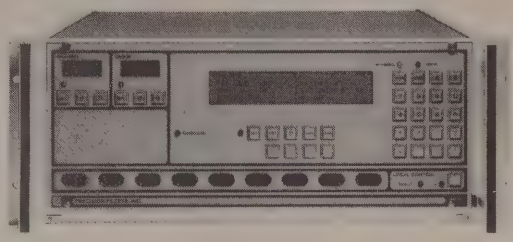
6611A Single filter/amp
80 dB/octave—2.048 MHz

Model number	Frequency range (Hz)		Cutoff frequencies (Hz)		
			Step size		
	Min	Max	20	200	2k
A	20	2.048	20-20.48k	20.6-204.8k	206k-2.048M
B	20	1.024	20-10.24k	10.4k-102.4k	104k-1.024M

6612A & 6632 Dual filter/amps
130 dB/octave—204.7 kHz

Model number	Low range (Hz)			High range (Hz)		
	Min	Max	Step	Min	Max	Step
A	1.0	2047.0	1.0	2100	204,700	100
B	1.0	1023.0	1.0	1100	102,300	100
C	0.1	102.3	0.1	110	10,230	10
E	0.1	204.7	0.1	210	20,470	10

PRECISION FILTERS, INC.
CONDITIONERS • SWITCHES • DATA ACQUISITION • SYSTEMS



6614 Quad filter/amps
80 dB/octave—32 kHz

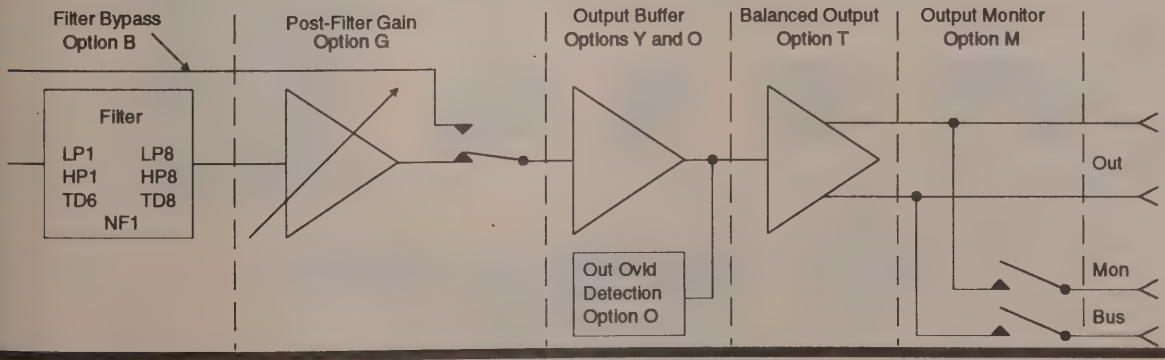
Range	Cutoff frequency (Hz)			Range	Cutoff frequency (Hz)		
	Min	Max	Step		Min	Max	Step
F04	1	16	1	F10	100	1600	100
F05	2	32	2	F11	200	3200	200
F06	5	80	5	F12	500	8000	500
F07	10	160	10	F13	1k	16k	1k
F08	20	320	20	F14	2k	32k	2k
F09	50	800	50				

6618 Octal filter/amps
80 dB/octave—custom frequency

Model number	Description
6618-XXX-YYY	XXX = Frequency, YYY = Filter type
6618-FX?-YYY	FX? = Four custom cutoff frequencies, YYY = Filter type: HP1, LP1, TD6

6694 Quad notch filter/amps
Programmable notch filters

Model number	Cutoff frequencies (Hz)			Range
	Min	Max	Step	
6694-A	1025	25,594	6.25	High
	25	1023.75	0.25	Low
	0.25	24.75	0.25	Limited use

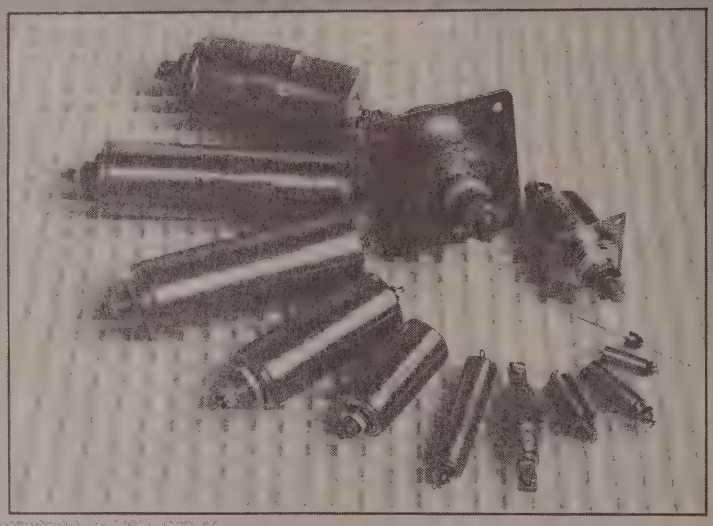


• See amplifier systems, transducer/amplifier systems, and auto-ranging amplifier systems in Section 1100.
• See other data acquisition systems in Section 2325.

Precision Filters, Inc. ● 240 Cherry Street ● Ithaca, New York ● 607-277-3550 ● Fax 607-277-4466

RFI Corporation

EMI/EMC/RFI/EMP FILTERS



RFI/EMC filters for 600 OHM signal and telephone circuit applications are designed to cover the broad frequency spectrum requirements of our most sophisticated communication systems.

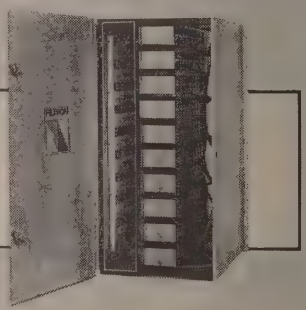
Go right to the pros...RFI. RFI has the talent and experience to solve a multitude of tough EMI/EMC/RFI/EMP problems. After all, we're the leader in customized multi-circuit filters in tight packages and we've got over 40,000 approved designs to back it up.
Don't need a RFI original? We can still help you. Our catalog of standard filters includes:

- **Signal line, data transmission, telephone and fire alarm filters** for secured or TEMPEST installations pre-wired to your specifications in RF shielded cabinets.
- **Powerline filters** including **U.L. Listed** for high-power installations, shielded rooms, communication centers and military areas. From 5 to 2000 Amperes.

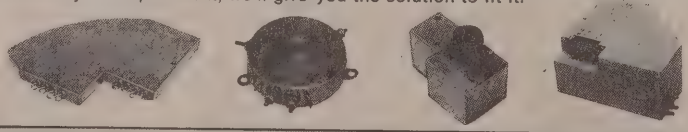
Filtron customers! We are now a part of RFI.

Whatever your filter needs... custom-designed or standard... come to the source...RFI. We've been doing it right since 1961. Our sales and engineering staff are ready to assist you. Call them today.

RF Shielded Communications Filtered Cabinets



Give us your requirement, we'll give you the solution to fit it.



RFI Corporation

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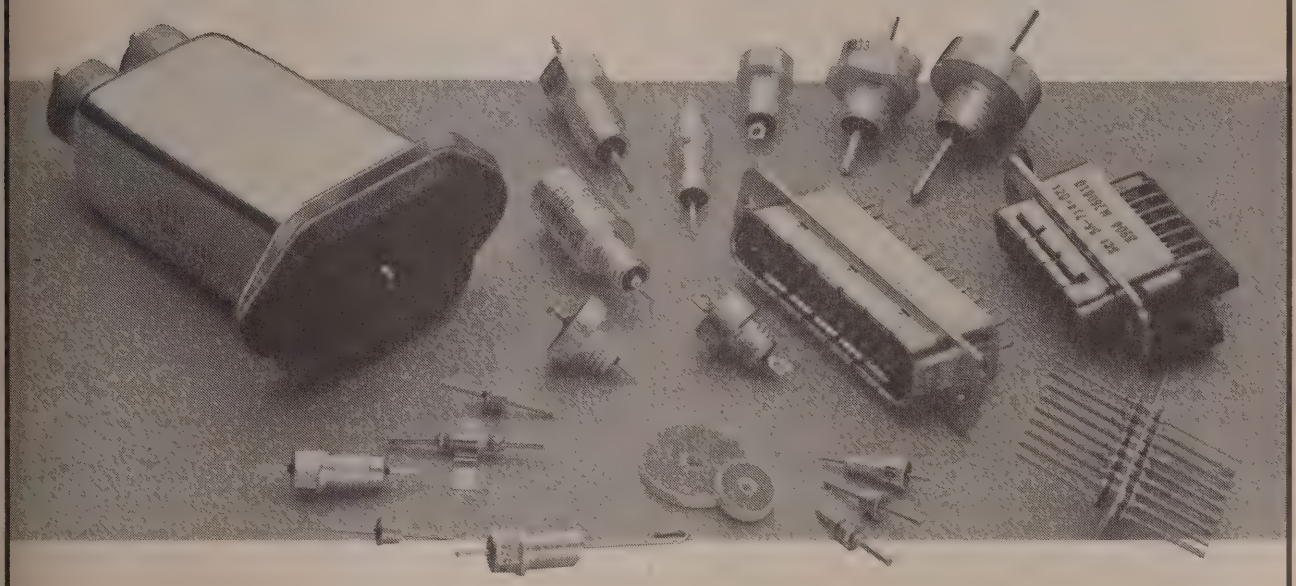
Clean up Electronic Pollution



with Spectrum Control EMI/RFI Filters and Connectors

Dedication to Quality

Spectrum Control has invested all of the resources necessary to establish the most efficient and accurate design, material, assembly and testing procedures. The Spectrum production process is an outgrowth of our Quality Management System which instills in every member of the Spectrum team a single-minded purpose of achieving defect-free production. We're proud to produce the highest quality and most reliable filters, capacitors and filtered connectors in the industry.

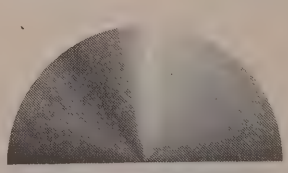
Reliable On-Time Delivery

Recognizing the importance of on-time delivery to our customers, Spectrum Control has instituted a flexible order processing/ production system to achieve consistent, on-time delivery performance. This system has enabled Spectrum to establish the industry's shortest product lead times.

Whether it be MRP II, continuous flow manufacturing or just-in-time . . . we deliver to meet our customer's needs.

Custom Filter Solutions

Despite the breadth of our EMI/ RFI filter and connector product line, there exist certain applications which demand a custom EMC solution. Our engineering staff will work with your production team to design an EMI/RFI filter or connector which meets your individual requirements. And our integrated engineering and manufacturing operation ensures your custom filter will be produced in accordance with the quality standards established for our standard components . . . with a timely and dependable delivery schedule.



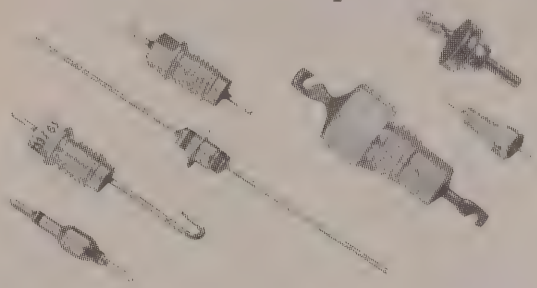
SPECTRUM CONTROL INC.

6000 West Ridge Road, Erie, PA 16506 ■ Phone: 814-835-4000 ■ Fax: 814-835-9000

EMI/RFI Filters and Connectors

SPECTRUM CONTROL INC.

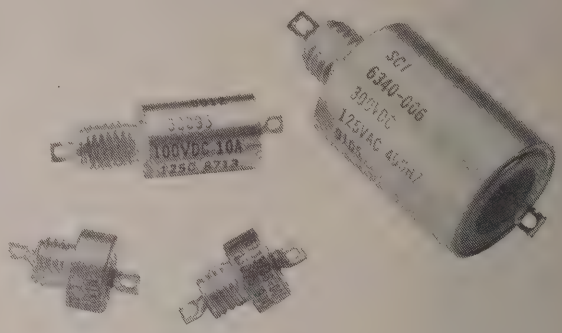
Resin Sealed / Solder-in Filters and Capacitors



Cost effective filtering is available in a wide range of threaded and solder-in bushings, capacitance values, temperature characteristics and circuit types. A high temperature series (300°C) facilitates a variety of soldering techniques. All parts are built in accordance with MIL-F-15733 and MIL-F-28861.

Applications: Transceivers, microwave filters, telecommunications equipment, industrial control systems, and multi-circuit filter assemblies.

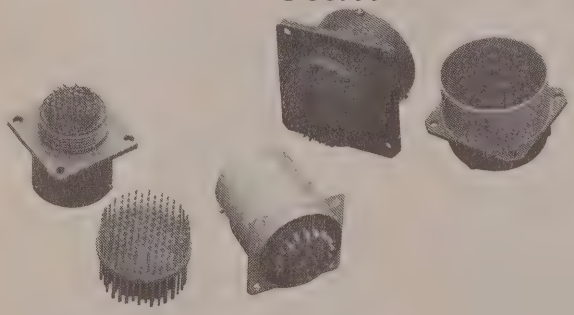
Hermetically Sealed Filters and Capacitors



These filters and capacitors are ideal for EMI/RFI filtering in hostile environments. Design flexibility is enhanced through a wide range of bushing sizes and circuit types. These filters are built in accordance with MIL-F-15733 or MIL-F-28861, with Q.P.L. listings to both.

Applications: Power supplies, aerospace products and multisection filters.

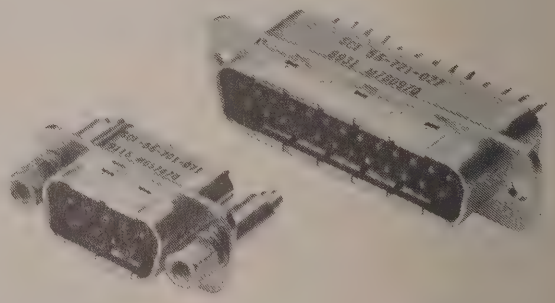
Filtered Circular Connectors MIL-C-38999



This line of filtered connectors employs multi-layer ceramic capacitors for effective filtering and to allow customization for specific applications. This connector series is available in shell sizes 8 through 25, insert arrangements of up to 128 pins, a wide range of capacitance values and mounting configurations.

Applications: These connectors are intermateable and, in most cases, completely interchangeable with the standard unfiltered connectors found in the MIL-C-38999 series.

Filtered Subminiature D Connectors



Spectrum connectors ensure volumetric efficiency by placing filtering in existing connector space, freeing on-board filter area for other uses. RF integrity is enhanced through one-piece housing with grounding springs and solid internal ground plane. Shell sizes 9 through 50 are available with multiple termination types. Programmable filter locations using Pi filters or feedthrough capacitors.

Applications: Computers, telecommunications, data security and industrial control equipment.

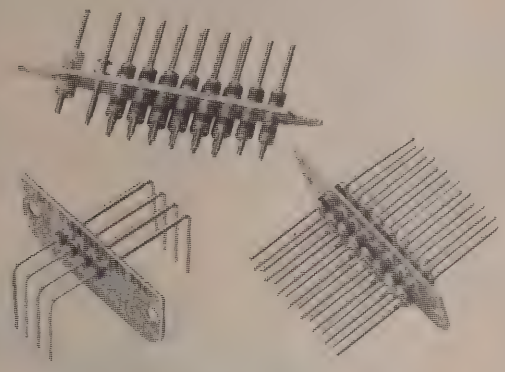
SPECTRUM CONTROL INC.

6000 West Ridge Road, Erie, PA 16506 ■ Phone: 814-835-4000 ■ Fax: 814-835-9000

EMI/RFI Filters and Connectors

SPECTRUM CONTROL INC.

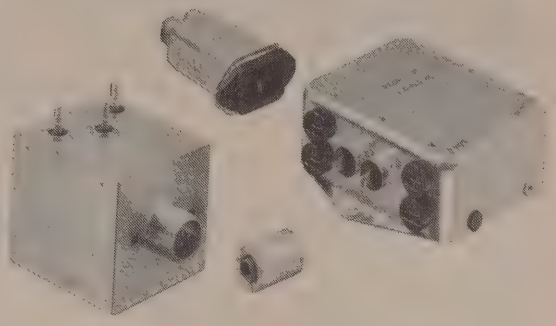
Filter Plate Assemblies



Programmable filter loctions and close center-to-center spacing accommodates design and volumetric considerations. Solderable gold plated pins allow for board installation or connector mounting. These assemblies are tested 100% of critical parameters.

Applications: Telecommunications equipment, industrial control systems and military/aerospace products.

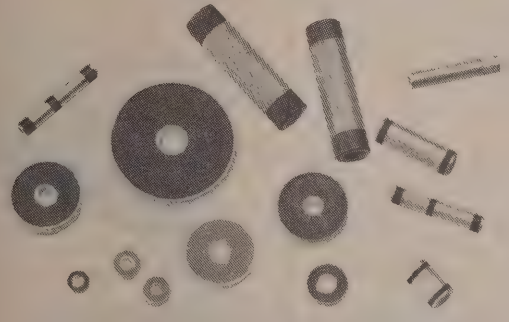
Multisection Filters



A number of standard filters as well as custom designed filters enable you to satisfy varied mounting and/or filtering requirements. Safety and reliability are ensured through 100% testing of critical parameters, with all filters built in accordance with MIL-F-15733. UL and C.S.A. recognition is available on selected filters.

Applications: Power and signal line filters for power supplies, secure communication, UPS systems and computers.

Tubular / Discoidal Filters and Capacitors



The small size of these components offers mounting advantages by allowing for high density placement. All parts are 100% tested to critical parameters, available in wide capacitance value range and temperature stability, and supplied with solderable, plated terminations with nickel barrier to prevent leeching.

Applications: Components used in the assembly of filter pins, filtered connectors and filter plates.

EMC Testing Services

Our state-of-the-art EMC test facility uses fiber optic sensing probes an anechoic chamber, shielded chamber and an all-weather, open field test site. Filtering solutions can be provided for any EMC problem identified.

Testing in accordance with FCC, UL, SAE, SAMA, VDE, CISPR, CSA and to military specifications MIL-STD-461A, B and C, MIL-STD-462, MIL-STD-463 and provide TEMPEST services and products.

SPECTRUM CONTROL INC.

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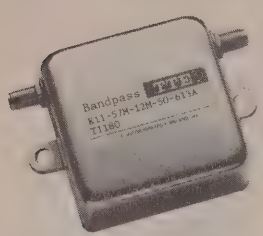
TTE® America's Filter Specialist Since 1956

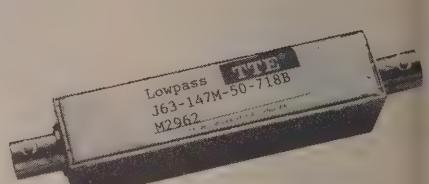
Passive *Bandpass Filters*



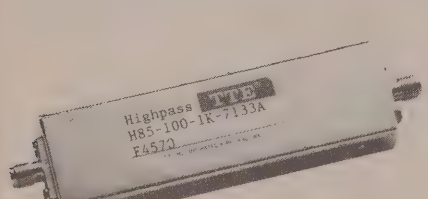
- Designs Include : Bessel, Butterworth, Chebyshev and Elliptical Function
- Number of poles : 2 to 6
- Frequency Range : 100Hz to 3GHz
- Package Styles : PCB, BNC or SMA
- Guaranteed Shipment : 10 Working Days ARO (QTY 1-10)

Passive *Lowpass Filters*

- Designs Include : Bessel, Butterworth, Chebyshev and Elliptical Function
- Number of poles : 2 to 11
- Frequency Range : 10Hz to 3GHz
- Package Styles : PCB, BNC or SMA
- Guaranteed Shipment : 10 Working Days ARO (QTY 1-10)



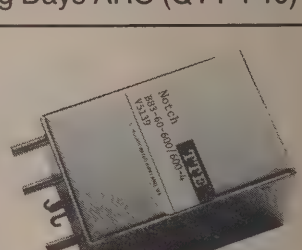
Passive *Highpass Filters*



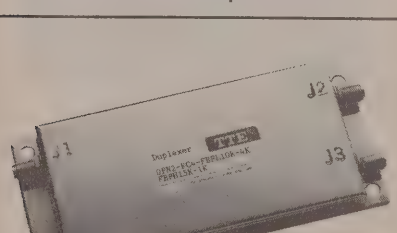
- Designs Include : Bessel, Butterworth, Chebyshev and Elliptical Function
- Number of poles : 2 to 11
- Frequency Range : 100Hz to 3GHz
- Package Styles : PCB, BNC or SMA
- Guaranteed Shipment : 10 Working Days ARO (QTY 1-10)

Passive *Band Rejection Filters*

- Designs Include : Butterworth, Chebyshev and Elliptical Function
- Number of poles : 2 to 6
- Frequency Range : 1kHz to 3GHz
- Package Styles : PCB, BNC or SMA
- Guaranteed Shipment : 10 Working Days ARO (QTY 1-10)



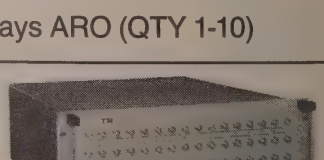
Passive *Diplexers & Duplexers*



- Designs Include : Butterworth and Chebyshev
- Types : Contiguous or Noncontiguous Passbands
- Number of poles : 2 to 6
- Frequency Range : 10kHz to 3GHz
- Package Styles : SMA
- Shipment : 10 Working Days ARO (QTY 1-10)

Filter Systems

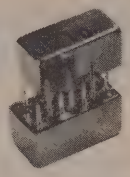
These bench top and rack mounting enclosures will accept from 1 to 36 filters. Any T T E active or passive filter may be specified.



Need technical assistance? Call our engineering hot line (310) 445-2793.

T T E, Incorporated *2251 Barry Avenue Los Angeles, California 90064-1400*
FAX: (800)473-2791 / (310)445-2791 TELEPHONE: (800)776-7614 / (310)478-8224

TTE® Stock 50Ω Lowpass Filters



Lowpass - DIP Cases, DC to 200MHz

Model No.	Passband 1dB Max. @	Passband 3dB Nom. @	Stopband 40dB Min. @	VSWR Typ. to 0.5dB	Case No.	Price Ea. Qty. 1-9
DL-5	5MHz	6MHz	10MHz	1.7:1	484	$10.95
DL-10.7	11MHz	14MHz	24MHz	1.7:1	484	$10.95
DL-21.4	22MHz	24.5MHz	41MHz	1.7:1	484	$10.95
DL-30	32MHz	35MHz	61MHz	1.7:1	484	$10.95
DL-50	48MHz	55MHz	90MHz	1.7:1	484	$10.95
DL-70	60MHz	67MHz	117MHz	1.7:1	484	$10.95
DL-90	81MHz	90MHz	157MHz	1.7:1	484	$10.95
DL-100	98MHz	108MHz	189MHz	1.7:1	484	$10.95
DL-150	140MHz	155MHz	300MHz	1.7:1	484	$10.95
DL-200	190MHz	210MHz	390MHz	1.7:1	484	$10.95

Elliptical Lowpass - DIP Cases, DC to 200MHz

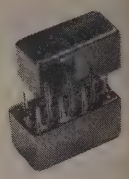
Model No.	Passband 1dB Max. @	Passband 3dB Nom. @	Stopband 40dB Min. @	VSWR Typ. to 0.5dB	Case No.	Price Ea. Qty. 1-9
EL-5	5MHz	5.4MHz	7.3MHz	1.5:1	484	$19.95
EL-10.7	11MHz	11.8MHz	15.9MHz	1.5:1	484	$19.95
EL-21.4	22MHz	23.5MHz	31.8MHz	1.5:1	484	$19.95
EL-30	30MHz	32.1MHz	43.3MHz	1.5:1	484	$19.95
EL-50	50MHz	53.5MHz	72.3MHz	1.5:1	484	$19.95
EL-70	70MHz	74.9MHz	101.1MHz	1.5:1	484	$19.95
EL-90	90MHz	96.3MHz	130.0MHz	1.5:1	484	$19.95
EL-100	100MHz	107MHz	144.5MHz	1.5:1	484	$19.95
EL-150	150MHz	160.5MHz	216.7MHz	1.5:1	484	$19.95
EL-200	200MHz	214MHz	288.9MHz	1.5:1	484	$19.95

Bessel Lowpass - DIP Cases, DC to 200MHz

Model No.	Passband 1.2dB Max. @	Passband 3dB Nom. @	Stopband 20dB Min. @	VSWR Typ. to $.2F_{3dB}$	Case No.	Price Ea. Qty. 1-9
TL-5	5MHz	8.6MHz	25.6MHz	1.5:1	484	$19.95
TL-10.7	11MHz	18.8MHz	56.5MHz	1.5:1	484	$19.95
TL-21.4	22MHz	37.6MHz	112.9MHz	1.5:1	484	$19.95
TL-30	30MHz	51.3MHz	153.9MHz	1.5:1	484	$19.95
TL-50	50MHz	85.5MHz	256.6MHz	1.5:1	484	$19.95
TL-70	70MHz	119.7MHz	359.2MHz	1.5:1	484	$19.95
TL-90	90MHz	153.9MHz	461.8MHz	1.5:1	484	$19.95
TL-100	100MHz	171.1MHz	513.2MHz	1.5:1	484	$19.95
TL-150	150MHz	256.6MHz	769.7MHz	1.5:1	484	$19.95
TL-200	200MHz	342.0MHz	1026.0MHz	1.5:1	484	$19.95

1. Other frequencies are available. Call for information.
2. Case options, BNC, SMA and N connectors are available. BNC (B) package: add $25.00, SMA (A) package: add $28.00 and N (N) connector package: add $32.00. To order add a letter to the part number as follows: DL-5-B for BNC connectors, DL-5-A for SMA connectors or DL-5-N for N connectors. The standard configuration is Plug to Jack.
3. The prices listed are for sales in the United States, Canada and Mexico. The price in other countries is $13.95 for the DL series and $25.94 for the EL and TL series in quantities of 1-9 units.
4. The minimum order is $100. Any TTE products may be purchased to meet this minimum.

TTE® Stock 50Ω Bandpass Filters



Constant Impedance Bandpass - DIP Cases, 21.4MHz - 70MHz

Model No.	Center Freq. F_O	Passband 1dB Max. @	Stopband 20dB Min. @	VSWR 1.3:1 Typ.	Case No.	Price Ea. Qty. 1-9
K50-21.4	21.4MHz	18MHz & 25MHz	1.3MHz & 150MHz	DC / 220MHz	484	$14.75
K50-30	30.0MHz	23MHz & 35MHz	1.9MHz & 210MHz	DC / 330MHz	484	$14.75
K50-42	42.0MHz	35MHz & 49MHz	2.6MHz & 300MHz	DC / 400MHz	484	$14.75
K50-50	50.0MHz	41MHz & 58MHz	3.1MHz & 350MHz	DC / 440MHz	484	$14.75
K50-60	60.0MHz	50MHz & 70MHz	3.8MHz & 400MHz	DC / 500MHz	484	$14.75
K50-70	70.0MHz	58MHz & 82MHz	4.4MHz & 490MHz	DC / 550MHz	484	$14.75

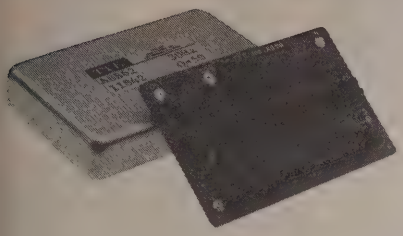
Narrow Bandpass - PCB Cases, 10.7MHz to 200MHz

Model No.	Center Freq. F_O	% BW @ 3dB	Passband 3dB Min. BW	Stopband 40dB Max. BW	VSWR @ F_O Typ.	Case No.	Price Ea. Qty. 1-4
DK-10.7-5P	10.7MHz	5%F_O	535kHz	4.28MHz	1.5:1	1212	$39.95
DK-21.4-5P	21.4MHz	5%F_O	1.07MHz	8.56MHz	1.5:1	1212	$39.95
DK-30-5P	30.0MHz	5%F_O	1.50MHz	12.00MHz	1.5:1	1212	$39.95
DK-40-5P	40.0MHz	5%F_O	2.00MHz	16.00MHz	1.5:1	1212	$39.95
DK-50-5P	50.0MHz	5%F_O	2.50MHz	20.00MHz	1.5:1	1212	$39.95
DK-60-5P	60.0MHz	5%F_O	3.00MHz	24.00MHz	1.5:1	1212	$39.95
DK-70-5P	70.0MHz	5%F_O	3.50MHz	28.00MHz	1.5:1	1212	$39.95
DK-80-5P	80.0MHz	5%F_O	4.00MHz	32.00MHz	1.5:1	1212	$39.95
DK-90-5P	90.0MHz	5%F_O	4.50MHz	36.00MHz	1.5:1	1212	$39.95
DK-100-5P	100.0MHz	5%F_O	5.00MHz	40.00MHz	1.5:1	1212	$39.95
DK-120-5P	120.0MHz	5%F_O	6.00MHz	48.00MHz	1.5:1	1212	$39.95
DK-130-5P	130.0MHz	5%F_O	6.50MHz	52.00MHz	1.5:1	1212	$39.95
DK-150-5P	150.0MHz	5%F_O	7.50MHz	60.00MHz	1.5:1	1212	$39.95
DK-180-5P	180.0MHz	5%F_O	9.00MHz	72.00MHz	1.5:1	1212	$39.95
DK-200-5P	200.0MHz	5%F_O	10.00MHz	80.00MHz	1.5:1	1212	$39.95

1. Other frequencies are available. Call for information.
2. Case options, BNC, SMA and N connectors are available. BNC (B) package: add $25.00, SMA (A) package: add $28.00 and N (N) connector package: add $32.00. To order add a letter to the part number as follows: DK150-5P-B for BNC connectors, DK150-5P-A for SMA connectors or DK150-5P-N for N connectors. The standard configuration is Plug to Jack.
3. The prices listed are for sales in the United States, Canada and Mexico. The price in other countries is $51.94 for the -5P series and $45.44 for the -10P and -15P series in quantities of 1-4 units.
4. The minimum order is $100. Any TTE products may be purchased to meet this minimum.

TTE offers many other filter types from stock including Highpass Filters. Our new catalog is over 100 pages of filter products including active filters, switchable filter banks and Microwave Filters. Specials to 18GHz are available.

TTE® America's Filter Specialist Since 1956

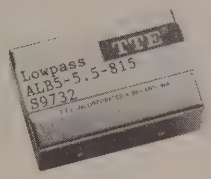


Active *Bandpass Filters*

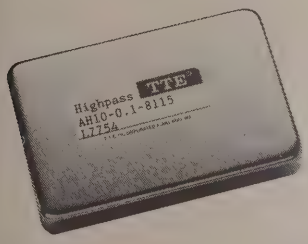
- Designs Include : Bessel, Butterworth, Chebyshev
- Number of poles : 1 to 3 pole pair
- Frequency Range : 1Hz to 200kHz
- Package Styles : PCB, BNC or SMA
- Guaranteed Shipment : 10 Working Days ARO (QTY 1-10)

Active *Lowpass Filters*

- Designs Include : Bessel, Butterworth and Chebyshev
- Number of poles : 2 to 10
- Frequency Range : 0.1Hz to 1MHz
- Package Styles : PCB, BNC or SMA
- Guaranteed Shipment : 10 Working Days ARO (QTY 1-10)



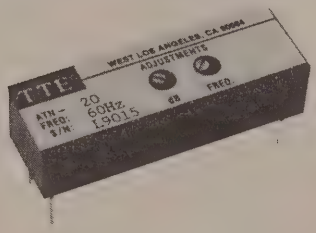
Active *Highpass Filters*



- Designs Include : Bessel, Butterworth and Chebyshev
- Number of poles : 2 to 10
- Frequency Range : 0.1 Hz to 1 MHz
- Package Styles : PCB, BNC or SMA
- Guaranteed Shipment : 10 Working Days ARO (QTY 1-10)

Active *Band Rejection Filters*

- Designs Include : Twin—T Notch
- Types : Fixed and Adjustable
- Frequency Range : 1Hz to 10kHz
- Package Styles : PCB, BNC or SMA
- Guaranteed Shipment : 10 Working Days ARO (QTY 1-10)

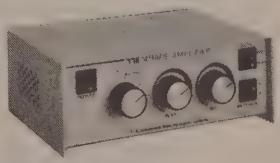


Active *PROGRAMMABLE*

- Designs Include : Butterworth and Chebyshev
- Types : Lowpass and Highpass
- Number of poles : 5
- Frequency Range : 1Hz to 128kHz
- Package Styles : PCB
- Shipment : 10 Working Days ARO (QTY 1-10)

411AFS Amplifier & Anti-Aliasing Filter System

This filter system is used in laboratories that analyze speech and other audio and sub-audio utterances. ***Stock Delivery.***



Need technical assistance? Call our engineering hot line (310) 445-2793.

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FAX: (800)473-2791 / (310)445-2791 TELEPHONE: (800)776-7614 / (310)478-8224

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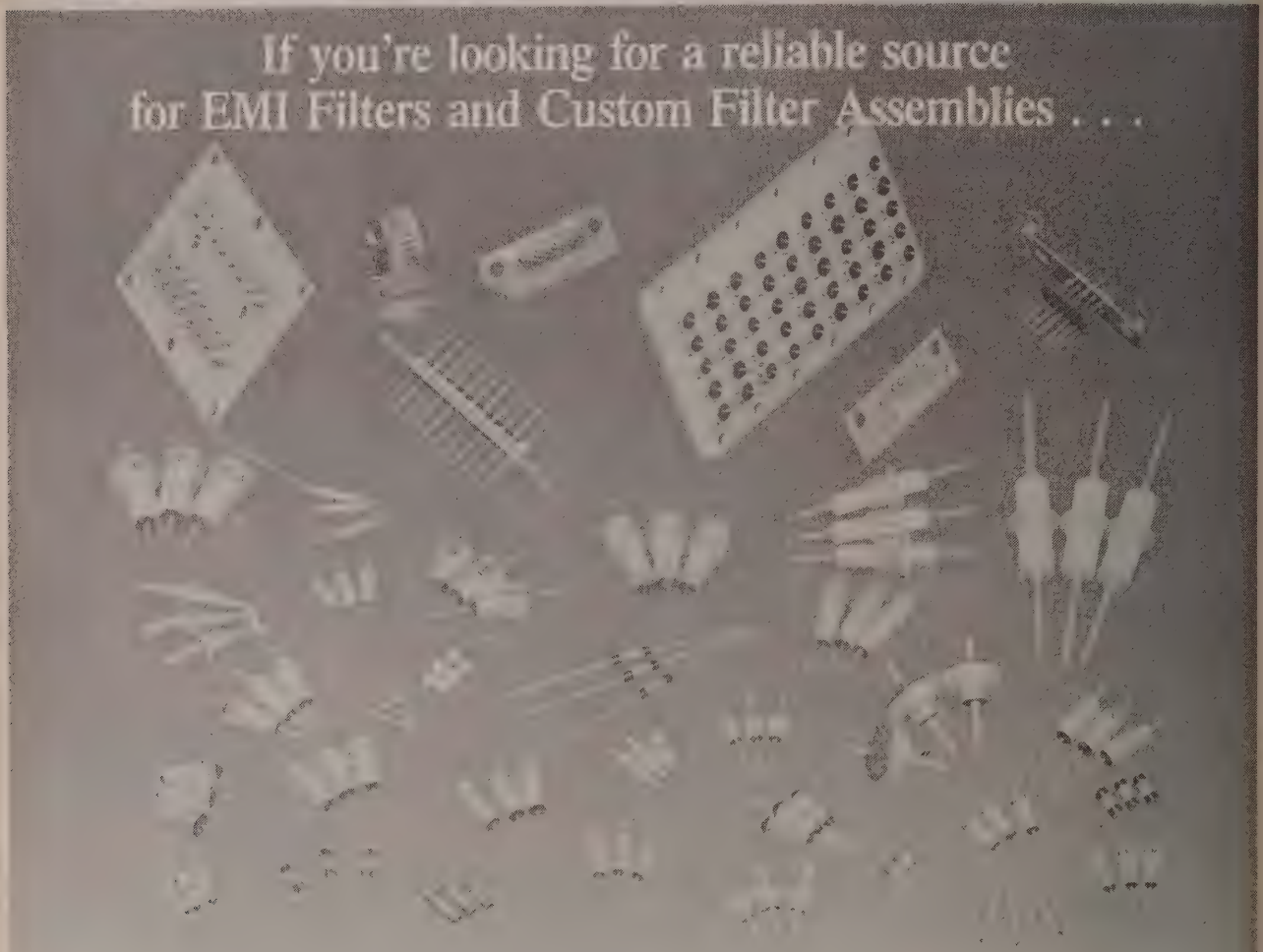
If you're looking for a reliable source for EMI Filters and Custom Filter Assemblies . . .



Tusonix, as a QPL source, is proud of its JIT performance

Tusonix offers the industry standards in both single layer and multilayer EMI/RFI ceramic feed-through filters and capacitors in commercial and QPL versions. Most are available from stock in production quantities, ready for immediate shipment.

When it comes to custom packaging EMI/RFI feed-thru filters and/or filter capacitors, Tusonix offers a complete in-house custom assembly capability. Every assembly is 100% tested in Tusonix' quality assurance laboratories. The result is a reliable, economic assembly that satisfies your unique needs.

Tusonix also offers high voltage and QPL ceramic disc capacitors, close tolerance tubular ceramic capacitors to Mil-C-20D, ceramic trimmer capacitors to Mil-C-81, and Weecon ceramic plate capacitors in a wide range of capacitance values/tolerances, temperature characteristics, and case sizes.

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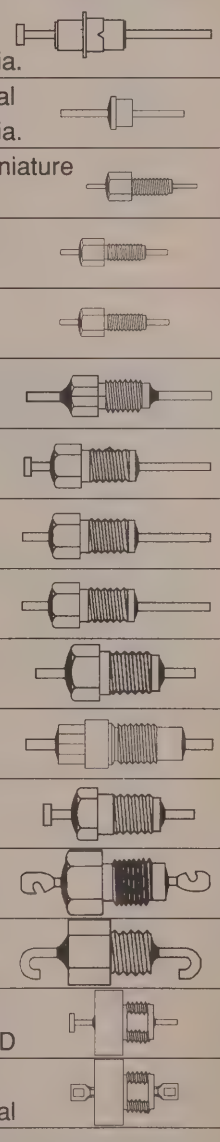
EMI/RFI FILTERS/CAPACITORS
INDUSTRY STANDARD ITEMS . . . IN STOCK AT TUSONIX

PART NUMBER	CAP. (uF)	TOL.	CRKT	DCWV @125C	I-DC AMPS	10 MHz (dB)	100 MHz (dB)	1 GHz (dB)	PHYSICAL DESCRIPTION
4151-000	.012	GMV	PI	70	10	25	65	70	Eyelet .145" Dia.
4151-001	.022	GMV	PI	70	10	35	70	70	
4300-007	.001	GMV	C	200	10	5	20	35	GlasSeal .128" Dia.
4300-005	.010	GMV	C	50	10	20	35	50	
4403-036	.015	GMV	C	50	10	20	35	55	4-40 Miniature Thread
4403-040	.027	GMV	C	50	10	28	48	65	
4400-034	.005	GMV	C	100	10	15	30	45	4-40 Thread
4400-041	.050	GMV	C	50	10	35	45	60	
4261-000	.002	GMV	PI	100	3	5	42	70	4-40 Thread
4261-001	.0055	GMV	PI	50	3	14	55	70	
4260-002	.0075	GMV	PI	50	3	18	65	70	6-32 Thread
4402-060	.027	GMV	L	100	10	28	45	65	
4201-001	.0015	GMV	PI	100	10	5	45	65	8-32 Thread
2425-003-X7R-102-P	.001	GMV	C	100	10	5	20	35	
4251-002	.012	GMV	PI	125	10	28	65	70	8-32 Thread
4251-003	.022	GMV	L	100	10	27	43	60	
4251-004	.028	GMV	PI	70	10	38	75	75	8-32 Thread
4251-006	.100	GMV	C	100	10	37	48	65	
4202-004	.0025	GMV	PI	350	15	5	50	70	12-32 Thread
4202-051	.005	GMV	PI	100	10	20	65	70	
4253-000	.012	GMV	PI	70	10	45	75	75	12-32 Thread
4253-002	.050	GMV	PI	70	10	60	75	75	
4202-021	.0015	GMV	PI	200	10	5	45	70	12-28 Thread
2499-003-X5W-502M	.005	20%	C	500	10	15	30	45	
4206-006	.003	GMV	PI	500	25	10	55	70	5/16-32 Thread
2432-002-X5U-.502M	.005	20%	C	1000	20	15	30	45	
327-010-X5U-102M	.001	20%	C	500	15	5	20	35	1/4-28 Thread
2443-008-X5S-152M	.0015	20%	C	500	15	6	22	37	
4600-000	1.4	GMV	C	50	15	60	65	70	1/4-28 POTTED
4600-050	1.4	GMV	L	50	15	60	65	70	
4601-000	1.4	GMV	C	50	15	60	65	70	1/4-28 GlasSeal
4601-050	1.4	GMV	L	50	15	60	65	70	



Authorized Distributors:

Newark Electronics	312-784-5100
Penstock, Inc.	408-730-0300
T.T.I., Inc.	817-740-9000

TUSONIX
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Phone: 602-744-0400 FAX: 602-744-6155

Filter Modules

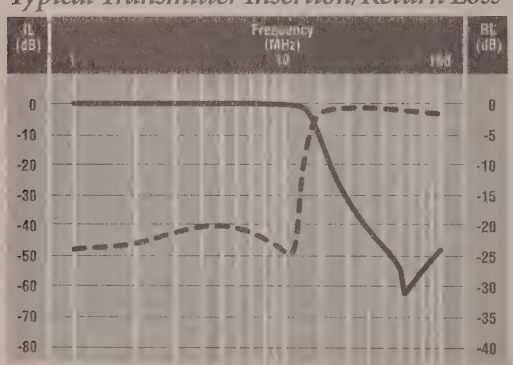
Twisted-pair integrated Filter Modules for 10BASE-T applications.

10BASE–T Filters

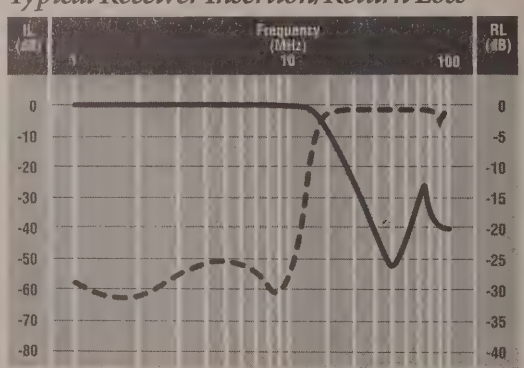
Part Number Through Hole	Part Number Surface Mount	Description and Comments	Xmtr and Filter Network	Common Mode Choke Xmit	Common Mode Choke Rcv	Resistor Network	Package (dimensions in inches) L	W	H	Comments
PT3877 or PT3882		100 or 150 ohm cable	x				1.0	0.40	0.25	16–pin DIL
PT3984	ST3984	PT3877 in DIP & SMD	x				1.0	0.30	0.20	16p DIP/20p SMD
FL1012 or FL1066		FL1012 has CMC on Xmit only	x	x	x		1.0	0.40	0.35	16–pin DIL
	SF1012		x	x	x		1.0	0.30	0.25	20–pin SMD
FL1003 or FL1037		2 pinout variations	x	x	x		1.5	0.30	0.45	14–pin SIL
FL1027			x	x	x		2.0	0.34	0.55	18–pin SIL
FL1046		Smaller FL1003	x	x	x		1.1	0.30	0.45	10–pin SIL
FL1034		Elliptical filter	x	x	x		1.28	0.58	0.35	24–pin DIP
FL1020			x	x	x	x	1.0	0.40	0.35	16–pin DIL
	SF1020		x	x	x	x	0.9	0.40	0.38	16–pin SMD
FL1006		Dual filter (2 x FL1020)	x	x	x	x	0.9	1.03	0.40	30–pin
FL1010 – 004	FL1010 – 002	Quad filter (4 x FL1020)	x	x	x	x	1.7	1.03	0.40	62–pin
FL1057 – 002	FL1057 – 001	Low cost Quad filter	x	x	x	x	1.7	1.03	0.40	62–pin
	FL1094S or FL1095S	PCMCIA FL1020	x	x	x	x	0.89	0.53	0.098	14–pin SMD

Additional filter modules are available utilizing different resistor values for different chip sets. Dimensions represent maximum package envelope including standoff height.

Typical Transmitter Insertion/Return Loss



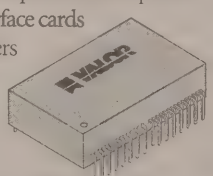
Typical Receiver Insertion/Return Loss



= Insertion Loss
= Return Loss

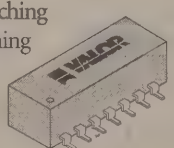
Ethernet 10BASE–T and Token Ring network products for:

- Workstations and personal computers
- Adapter or interface cards
- MAU transceivers
- Repeaters
- Concentrators



Characteristics

- EMI filtering and noise suppression
- Signal isolation
- Impedance matching
- Signal conditioning and shaping
- Overvoltage protection



Features

- Designed for low insertion loss, low delay distortion and high attenuation in the stop band
- 500 V rms and 2000 V rms isolation
- Through–hole and surface–mount packages
- Quad and Dual filters available
- Low cost
- Custom designs available

For information on other Valor products, see Section 5600 - Pulse Transformers, Section 4025 - Converters

For additional information on these products, please call your local Valor representative or distributor as listed in the front of this volume.

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Valor Europe: Valor Electronics GmbH, Steinstraße 68, 8000 München 80, Federal Republic of Germany, **Phone:** 49-89-4802823, FAX 49-89-484743

Filter Modules

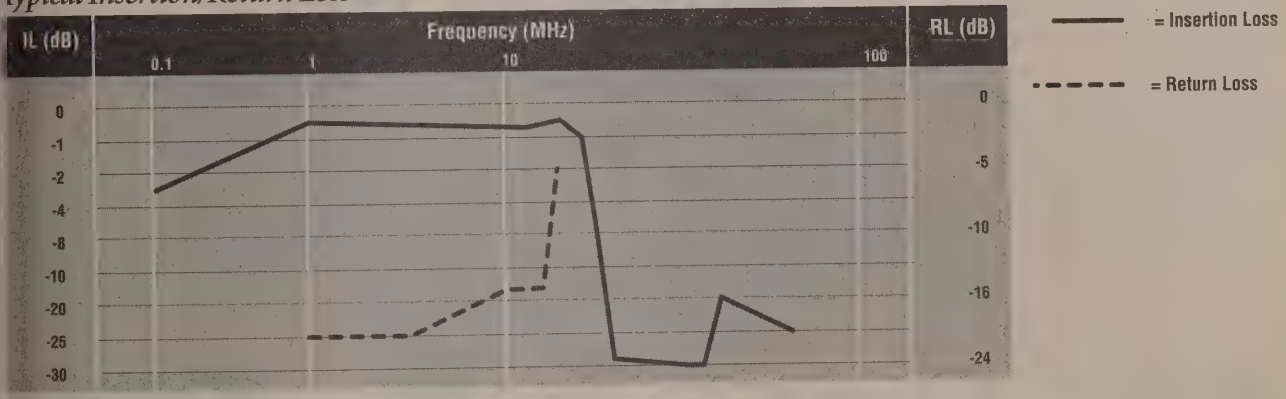
Isolation & shaping units for Token Ring applications.

Token Ring (4/16 Mbps) Filters

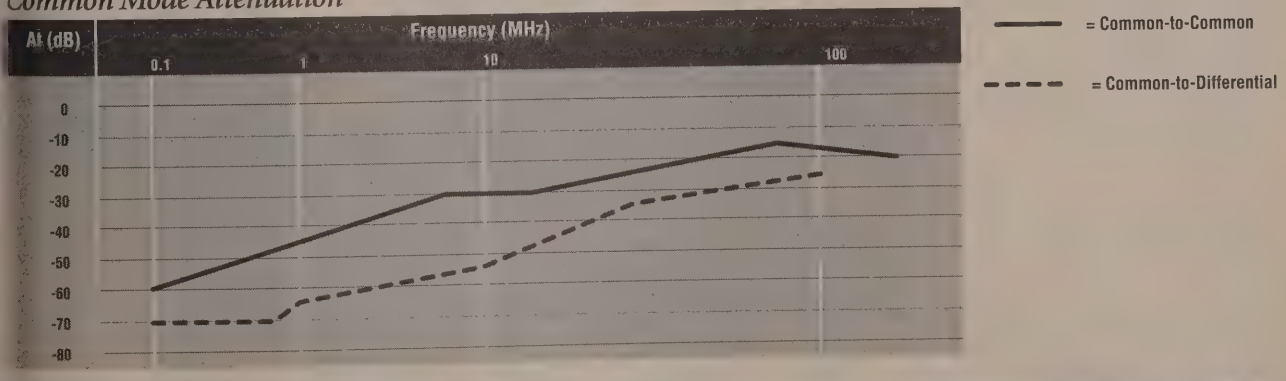
Part Number		Description and Comments	Media	Package (dimensions in inches)			
Through Hole	Surface Mount			L	W	H	Comments
PT3968	ST3968	Transmit channel	STP	0.9	0.4	0.39	16–pin DIP/SMD
PT3969	ST3969	Receive channel	STP	0.9	0.4	0.39	16–pin DIP/SMD
PT4077		Receive channel with phantom output	STP	0.9	0.4	0.39	16–pin DIP
FL1025	SF1025	Either transmit or receive channel	STP	1.0	0.5	0.38	16–pin DIP/SMD
PT7060	ST7060	150/100 Ω transformer with common-mode choke	STP/UTP	0.8	0.3	0.18	14–pin DIP/SMD
PT7082	ST7082	150/100 Ω transformer with common-mode choke	STP/UTP	0.9	0.4	0.38	16–pin DIP/SMD
FL1013		150/100 Ω media filter	STP/UTP	1.1	0.3	0.45	16–pin DIL
	SF1069	150/100 Ω media filter for 16 Mbps with equalizer	STP/UTP	0.9	0.4	0.38	16–pin SMD
MD6020	SD6020	Dual-channel station TRIM for T.I. chipset	STP/UTP	1.27	0.77	0.29	24–pin DIL/SMD
MD6022	SD6022	Dual-channel repeater TRIM for T.I. chipset	STP/UTP	1.27	0.77	0.29	24–pin DIL/SMD
MD6025	SD6025	Dual-channel TRIM for TROPIC™	STP/UTP	1.27	0.67	0.295	24-pin DIL/SMD
MD6010		Dual-channel TRIM with ring interface IC	STP/UTP	2.5	2.1	0.48	36-pin DIL

Dimensions represent maximum package envelope including standoff height.
TRIM stands for Token Ring Interface Module.
TROPIC is a trademark of National Semiconductor Corporation.

Typical Insertion/Return Loss



Common Mode Attenuation



For information on other Valor products, see Section 5600 - Pulse Transformers, Section 4025 - Converters

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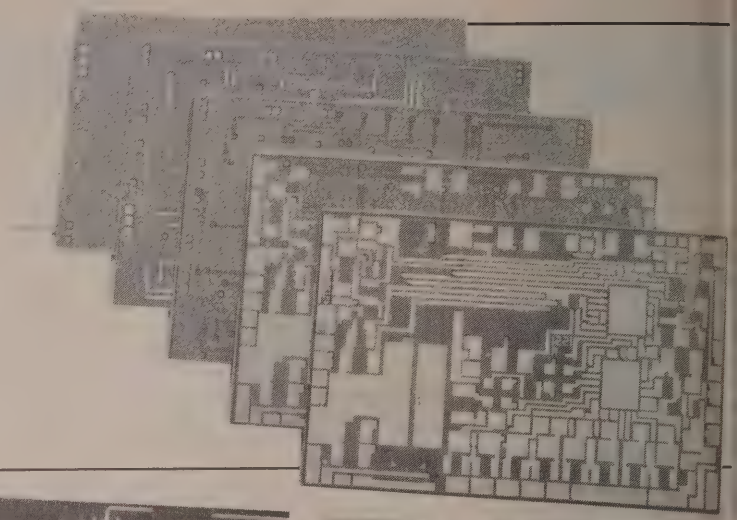
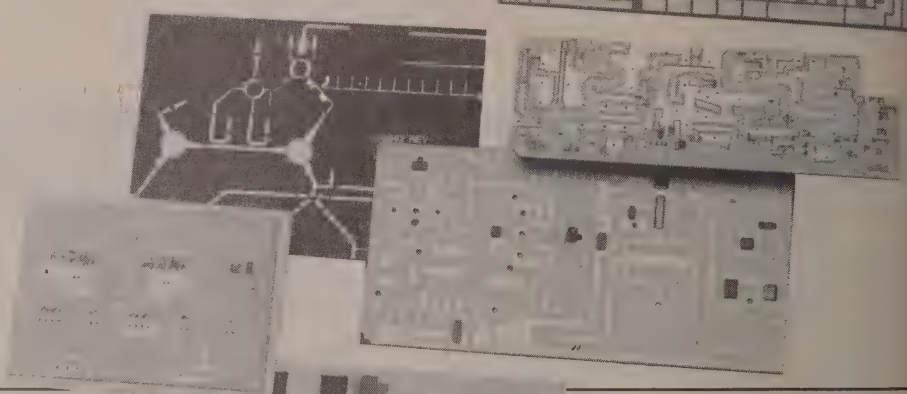
FAX: 508—686-0622

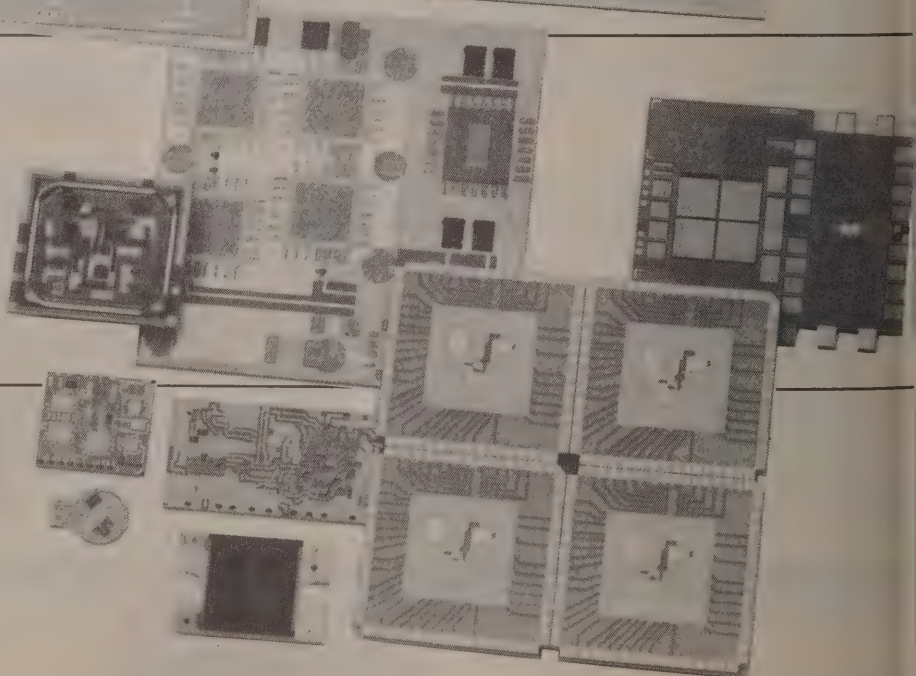
CUSTOM THICK FILM SUBTRATES



Thick Film Substrates
- In House Design
- Prototype and Production Quantities
- Multilayer as well as Single Layer
- Various Substrate Materials:
  - Alumina
  - Beryllium Oxide
  - Ferrite
  - Quartz
- Printing: Gold, Platinum, Silver, Copper



RF Circuits
- Fine Line Definition and Tight Tolerances
- Through Hole Metallization
- Fritless Gold Helping to Reduce Insertion Loss
- Mixed Metals Providing Excellent Wire Bonding and Solderability.



Specialty Applications
- Edge Metallization
- Wide Variety of Conductor and Resistor Systems
- Resistor Printing on Dielectric
- Solder Printing and Reflow
- Nickel Barrier Plating for Chip Components

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- Laser and Abrasive Trimming
- Dicing
- Engineering Services
- Cost Competitive
- Excellent Customer Service

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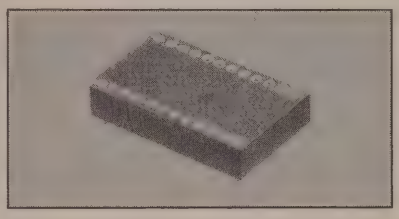
Correct-A-Chip Technology:
Interconnection/Packaging Solutions to Board Redesign, Rework & Enhancement Problems

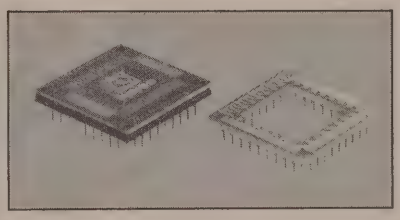
The introduction of new devices and packages, and the disappearance of others, can cause major problems — and create new opportunities — for the PC board designer. Aries Correct-A-Chip technology was developed specifically to help convert problems to opportunities by enabling you to upgrade or further enhance your products without costly redesign or rework, and without scrapping what might amount to significant stocks of board and parts inventories. The technology not only enhances performance but can significantly reduce both rework costs and time-to-market.

Essentially, Correct-A-Chip is an adapting/ enhancing interconnect technology that lets you solve replacement, upgrade or redesign problems by performing any one or combination of the following functions:

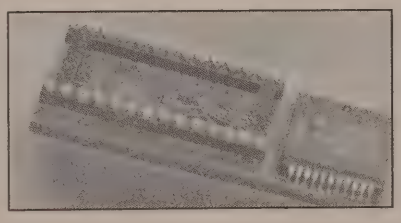
1. **Rerouting circuitry to change the pinouts within the same package style.** This is accomplished by the Correct-A-Chip socket.



2. **Converting from one termination style to another — e.g., from surface mount to thru-hole...or PLCC to SOIC, etc...or vice versa.** This is the job of the Correct-A-Chip adapter.



3. **Adding componentry or functionality within the same space...or deleting componentry to achieve the same or greater functionality with less componentry in less space at less cost.** This is achieved with the Correct-A-Chip semi-hybrid daughterboard.



The variations within these three primary capabilities are endless...as are the combinations achievable with one Correct-A-Chip interconnect!

A fourth Correct-A-Chip product line — test heads — is also available for allowing emulator and logic analysis hardware to interface with SMT pads on the board to be tested, without having to solder the chip to the board.

Problems, Problems, Problems – and Sensible Solutions...Fast

To illustrate just how versatile Correct-A-Chip technology is in solving board redesign or rework problems, consider a few of these every day real-world occurrences. You'll probably recognize some of them as similar to those you've encountered.

Problem: You need to replace a 16 pin DIP device with an 18 pin DIP device.
Solution: Don't think new PCB layout...think Correct-A-Chip technology.

Problem: You need to change pinouts to achieve new circuitry.
Solution: Don't think PCB redesign...think Correct-A-Chip socket.

Problem: You need to reduce propagation delays and noise while saving valuable real estate.
Solution: Put your microprocessor-related circuitry on a Correct-A-Chip semi-hybrid daughterboard.

Problem: You need to replace an obsolete DIP device with an enhanced surface mount device.
Solution: Don't think board rework...think Correct-A-Chip adapters.

Problem: You have a very expensive Motorola 68XXX ceramic PGA microprocessor designed into your system.
Solution: Aries' PQFP to PGA adapter is pin to pin equivalent and saves lots of money by allowing you to use the less costly PQFP device.

Problem: Your boards are set up for 28 pin DIP 264 Kbit EPROMs but you want to use a new 2 Mbit EPROM in a 32 pin PLCC package.
Solution: Don't trash your boards or settle for less than 2 Mbits...think Aries Correct-A-Chip adapters.

The Ultimate Problem:
You need to make a change that's going to keep your board current, improve it or reduce its cost.
The Ultimate Solution:
Correct-A-Chip technology lets you accomplish the change quickly, easily, inexpensively with no board redesign or rework.

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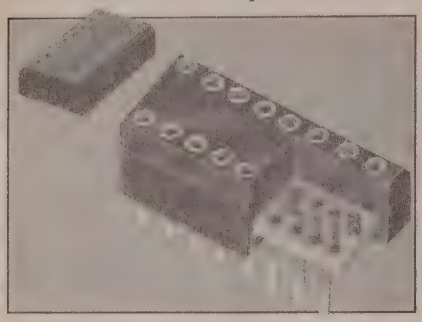
Correct-A-Chip Technology: Interconnection/Packaging Solutions to Board Redesign, Rework & Enhancement Problems

Taking New Routes for Design Flexibility... the Correct-A-Chip Socket



The "standard" Correct-A-Chip socket represents the most basic Correct-A-Chip technology. This clever component actually has a printed circuit board in the molded socket body that reroutes the circuit paths, and thus the pinouts, from the original design to the needs of the new design. All you need to give us is your "from-to" list.

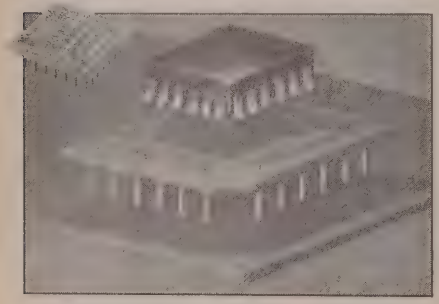
Use of the Correct-A-Chip socket lets you defer costly engineering changes to your PCB by accommodating alternative IC devices that may be required because of availability or obsolescence. With the Correct-A-Chip socket, you can use the new device without additional jumper wires, PC layers, cut traces or other costly, undesirable changes.

Additional pull-ups, bypass caps, etc. can also be incorporated right inside the molded body of the Correct-A-Chip socket.

Alternative ICs can be made immediately interchangeable without changing or replacing your PCB. Field upgrades or retrofits can be achieved with speed and efficiency. Multilayer PCB needs can be reduced by retracing current paths in the Correct-A-Chip rather than through layers of the PCB. And board circuit errors can be corrected without adding jumpers or cutting traces.

For applications facing the added problem of severe height restrictions, Aries LO-PROfile Correct-A-Chip daughterboards provide the same circuitry re-routing capability as our Correct-A-Chip sockets in a package only .250 (6,35) high. Although the IC leads must be trimmed, formed, and soldered to the Correct-A-Chip daughterboard to achieve the low profile, Aries can provide this service at a very low cost.

Easing the Way to Surface Mount and Other Conversions Made Easy... the Correct-A-Chip Adapter



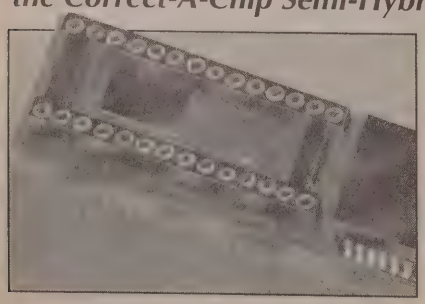
As the trend towards surface mount continues, many manufacturers are caught in the transition. They have a significant investment in thru-hole board production and assembly equipment, processes and training. But, what about all the thru-hole boards currently in production — or design — that could benefit from a surface mount device?

And what about all those board designs that now actually require a surface mount part because of a discontinued thru-hole device?

Unlike the Correct-A-Chip socket, the Correct-A-Chip adapter converts from one termination style to another. For example, it lets users of thru-hole boards take advantage of surface mount devices without any change to the boards. The new device is surface mount soldered to the Correct-A-Chip adapter which plugs directly into the unchanged thru-hole board. The change could even go the other way, if necessary...from thru-hole to surface mount if that were required.

With the Correct-A-Chip adapter, you can just as easily change termination styles within thru-hole or surface mount technologies. For example, you can go from a DIP to a PGA or vice versa on a thru-hole board. Or, you might want to change from a PLCC to SOIC package or the other way around. The Correct-A-Chip adapter will make any of those changes possible...with no need for board redesign or rework.

Performance and/or Function Enhancement... the Correct-A-Chip Semi-Hybrid Daughterboard



For applications that require you to enhance performance and functionality with new and/or additional componentry — in the same board space — Aries has developed the Correct-A-Chip semi-hybrid daughterboard.

Utilizing Aries' surface mount and other packaging techniques, the Aries semi-hybrid daughterboard is a factory programmed, custom interconnect product that incorporates application specific circuitry and expanded componentry to achieve enhanced performance capabilities within the existing socket envelope. The semi-hybrid daughterboard may or may not also incorporate socketing to convert pinouts and/or termination styles.

Continued on next page

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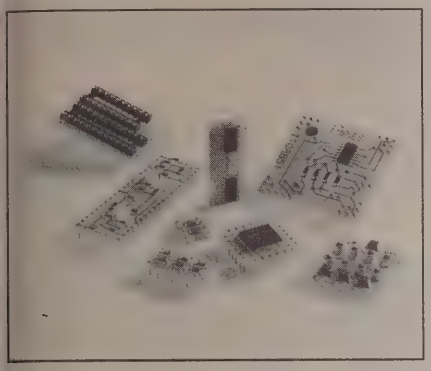
Correct-A-Chip Technology: Interconnection/Packaging Solutions to Board Redesign, Rework & Enhancement Problems (Continued)

Correct-A-Chip Semi-Hybrid Daughterboard (Continued)



A Single Solution to Multiple Problems –

To demonstrate the complete range of capabilities of the Correct-A-Chip semi-hybrid daughterboard, imagine that you just came up with a new design that required:

1. a switch to a SMT device for increased performance, where a thru-hole was previously used
2. a rerouting of the circuitry to achieve new pinouts
3. an additional surface mount component to achieve even greater functionality
4. and a 28 pin DIP package

And, you'd have to achieve all that in the **same space!!**

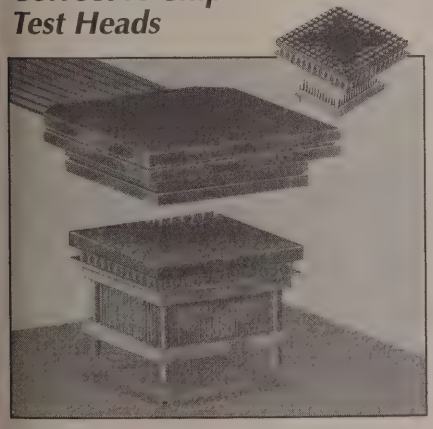
Without Correct-A-Chip technology it would be virtually impossible to even pursue a solution that didn't include extensive board redesign. However, a single programmed Correct-A-Chip semi-hybrid daughterboard could — and actually has — solved any or all of those problems!!

Essentially, the Correct-A-Chip semi-hybrid daughterboard lets you expand componentry and functionality and use all types and combinations of footprints in conjunction with surface mount technology to create what is, in effect, a chip emulator in a compact connector package. To further optimize board space, Aries can use both sides of the Correct-A-Chip daughterboard to incorporate all the new and/or added circuitry and componentry required by your redesign problem. Depending on the application, Correct-A-Chip semi-hybrid daughterboard technology can save as much as 5" sq. (127 mm) or more of board space!

New designs can be made much more versatile by laying out "function sites" on mother boards, and various plug-in functions can then be socketed into the sites depending on application requirements. Older designs can be easily and efficiently upgraded by replacing the original ICs with, for example, RAM/ROM/EPROMs that have better, faster or even totally different circuit functions (e.g., clock/timers, speech synthesizers, etc.).

Depending on the application, Correct-A-Chip technology can be packaged to provide all or any combination of the above capabilities.

Correct-A-Chip Test Heads



These Correct-A-Chip components provide a means of testing surface mount PC boards without soldering the chip to the board. Essentially, a Correct-A-Chip test head permits you to interface emulator and logic analysis hardware to a wide variety of different surface mount footprints.

With thru-hole boards, you can plug the emulator probe directly into the thru-holes (or socket) and perform your board test. But these probes don't mate with surface mount pads. Enter the Correct-A-Chip test head and exit the problem.

As shown in the accompanying illustration, male pins from the test hardware probe plug into the socket portion of the test head. The adapting board of the test head converts the footprint to the necessary configuration. Spring contacts below the adapting board rest on (and mate with) the surface mount pads on the motherboard to complete the circuit from emulator to board.

Like our other Correct-A-Chip products, the use of Correct-A-Chip test heads can save you a lot of time and money...in this case by allowing you to identify bad boards *before* costly surface mount devices are soldered in place.

Aries Correct-A-Chip test heads are available in a variety of configurations to meet your board testing needs. For example:

- Series 65 Correct-A-Chip Test Heads for JEDEC Type QFP to PGA in standard pin counts from 68 to 196
- Series 66 Correct-A-Chip Test Heads for EIAJ Type QFP Packages in standard pin counts from 64 to 256
- Series 67 Correct-A-Chip Test Heads for Specific Chips, including the most popular devices from Motorola, Intel and AMD.

Our test heads are built for heavy duty use. They'll withstand more than 100,000 insertion/withdrawal cycles, which means they'll last as long as you're building and testing boards!

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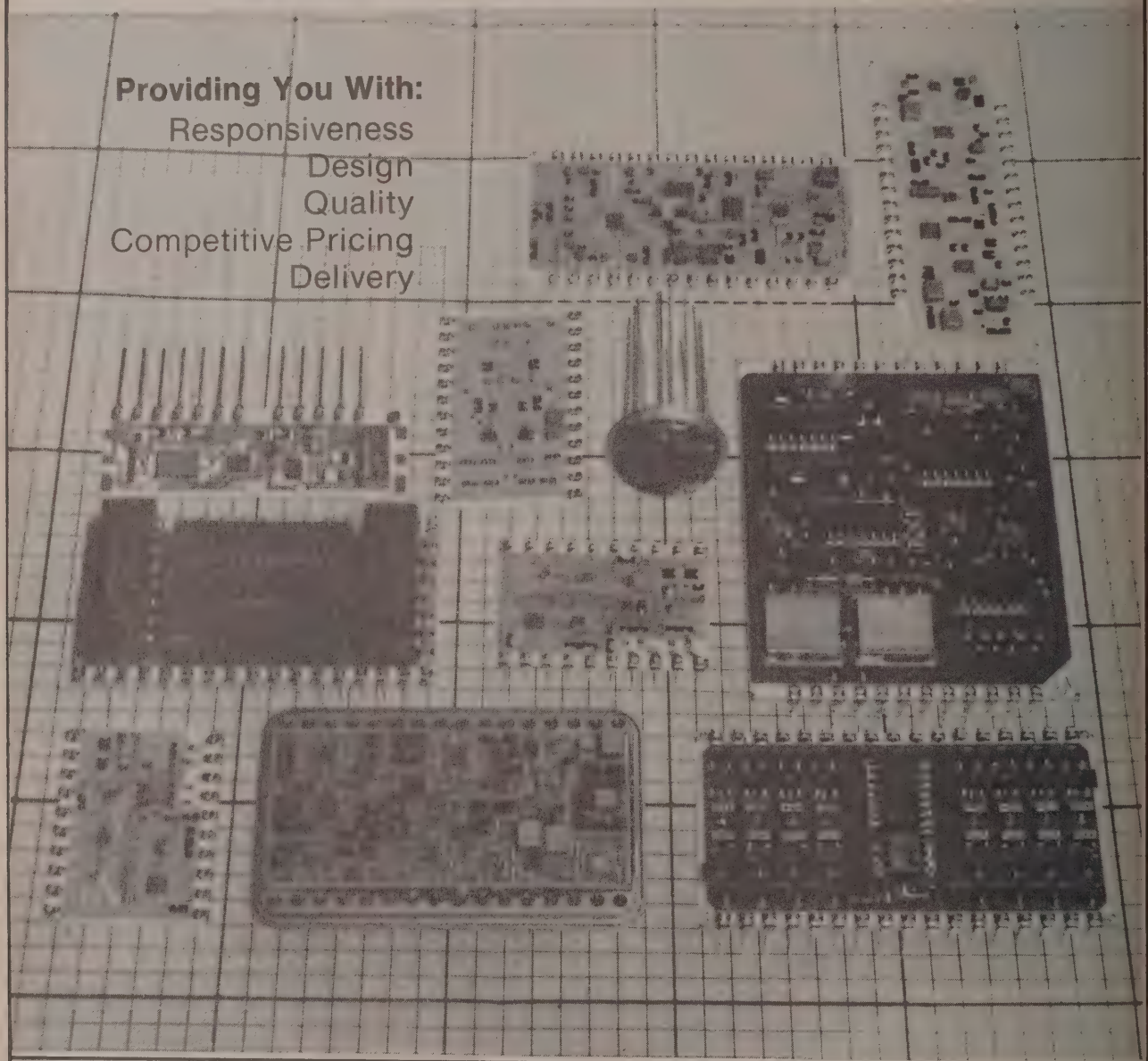

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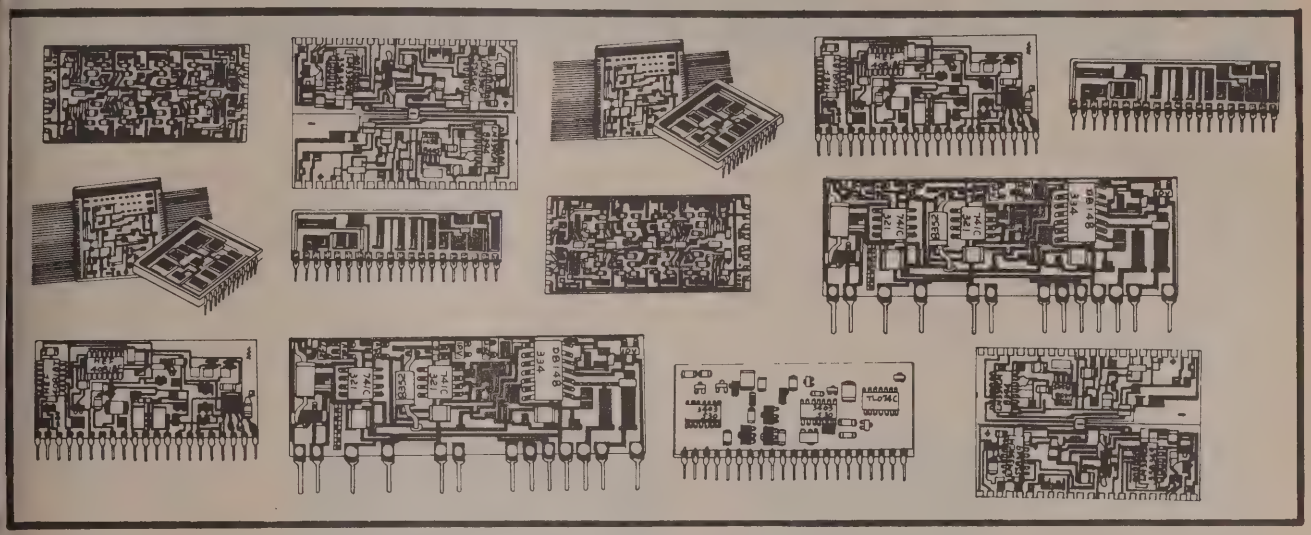
THICK & THIN HYBRIDS



THICK FILM

GENERAL TECHNICAL SPECIFICATION

SUBSTRATE:
Material-96% Al O , 99% BeO
CONDUCTOR:
Material-Pd/Ag, Pt/Ag, Pd/Au, Pt/Au, Au, Ag.
Line spacing-0.000" minimum spacing
Through hole-yes
Line width-0.005" minimum width
Crossover-yes
Multilayer-4 conductor layers
RESISTOR:
Range-0.1ohm-10M ohm(higher values on request)
TCR-30 ohm-30K(ohm: + 50PPM/C), 10 ohm-1M (OHM:+100PPM/C), 0.1 ohm-10M(ohm:+250PPM/C)
TCR tracking-10 PPM/C for 10 ohm-1M ohm
Tolerance-+1% for 1 ohm-10M ohm, +0.3% for 10 ohm -10M ohm on request
Loading capability-50 W/in
Long term stabiltiy-0.3% for 10 ohm-1M ohm
TRIMMING CAPABILITY:
Passive trim-Ratio match
Active trim-voltage,Current, Frquency, Phase.
TECHNICAL CAPABILITY:
* Multi zpnes furnace with termperature controllable at+1%
* Aluminum ultrasonic wire bonder
* Laser trimmers
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* Solder dircrete
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SUBSTRATE MATERIALS
* 99.6% alumina as fired or polished, 1" and 2" square, 0.010", 0.015" and 0.025" thick.
* Quartz, fused silicas, ferrites and beryllium oxide are accepted.
* Flat and rectangular.
* Size between 0.5" to a maxium of 2" for both length and width.

SPUTTER METALLIZATION
* Use TaN/TiW/Au metallization.
* TaN(Resistive layer):Heat-treatable to 50 ohms/Sq.
* TiW(Barrier layer): 500A±100A.
* Au(Conductive layer): 6000 A±10%,99.99% gold.

MASKS
* Mask making service.
* Emulsion mask: 3" x 3" with 2" x 2" pattern.
* 10X,20X,30X and 40X magnification.

ELECTROPLATING
* 99.99% gold.
* plated to 4 microns ±20%.
* Plated to customer specifications.

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* Precision substrate cutting with automatic dicing saw.

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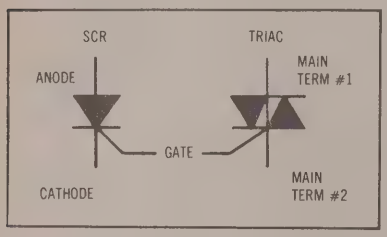
MINIGLOSSARY THYRISTORS/ HIGH POWER DIODES

THYRISTORS

A thyristor is a four-layer semiconductor (pnpn) that can be switched from an OFF to an ON state. This is usually done by a voltage or current pulse to the gate terminal. The device will then continue to conduct so long as the principal current of the device flows through the thyristor's two main terminals.

In many respects a thyristor is analogous to an electromechanical latching relay. In fact, thyristors have largely replaced these relays in newer equipment designs. But, misapplications and/or failure to fully understand the parameters of these and other solid state devices often leads to catastrophic field failures.

The terminology shown on this page has been condensed from common industry data books and is intended to be a guide for the engineer.



di/dt: *Critical rate of rise of ON state current* is the user's maximum design limit (Fig. 1).

di_R/dt: *Rate of decay of ON state current* (Fig. 1 & 2).

dv/dt (critical): *Rate of rise of OFF state voltage*. Lowest voltage rate of rise to cause a thyristor to turn ON.

dv/dt (reapplied) : *Rate of rise of reapplied OFF state voltage.*

I_{FSM}: *Nonrepetitive ON state surge current in diodes.* Maximum peak value of ½ cycles (60 Hz) a diode can withstand up to 100 times in its lifetime.

I_{TSM}: *Nonrepetitive ON state surge current in thyristors*. Maximum peak value of 60 Hz cycles a thyristor can withstand up to 100 times in its lifetime.

I_{DRM}/I_{RRM}: *Maximum peak forward/ reverse leakage current* at specified temperature and repetitive conditions.

I_{GDM}: *Continuous gate current not to trigger*. Highest dc gate current that will *not* cause thyristor to switch from OFF to ON at a specific temperature.

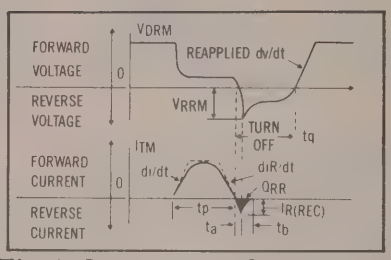


Fig. 1. Concurrent voltage and current waveforms

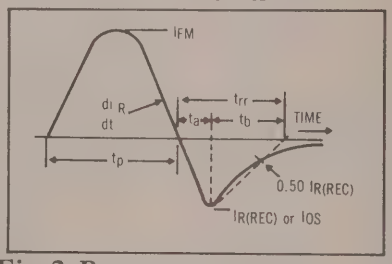


Fig. 2. Recovery current waveform

I_{GT}: *Continuous gate trigger current.* Absolute minimum gate current required to switch thyristor from OFF to ON.

I_H: *Holding Current*. Minimum current required to hold thyristor ON.

I_L: *Latching current*. Minimum current required to hold thyristor ON after removal of gate drive.

$I_{(REC)}$: *Recovery current*. Peak value of reverse current during recovery or turn OFF (Fig. 1 & 2).

I_{OS}: *Overshoot current*. See $I_{R(REC)}$.

I^2t: Maximum ON state, short time thermal capacity of the silicon element for operations less than ½ cycle of 180° conduction angle.

$I_{T(AV)}$: *Average ON state current* (max.)

Q_{RR}: *Reverse recovered charge* (Fig. 1).

$R_{\theta JC}$: *Junction-to-case thermal resistance* in degrees C per watt.

$T_{C(MAX)}$: *Max. allowable case temperature*.

$T_{J(MAX)}$: *Maximum allowable junction temp.*

t_d: *Delay time*. Interval between a specified point at beginning of gate pulse and the instant at which the principal voltage drops to a specified value. (OFF-ON) (Fig. 3)

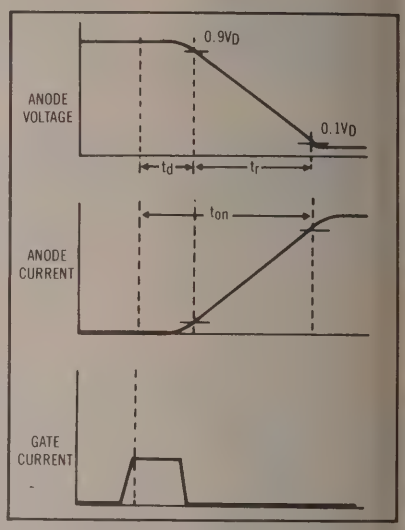


Fig. 3. Turn-on time waveforms

t_{on}: *Turn-on time*. The sum of delay time and rise time. (OFF-ON) (Fig. 3)

t_q: *Turn-off time.* Time between principal current reaching zero and the instant thyristor can block forward voltage without turning ON. (Fig. 1)

t_r: *Rise time*. Time between principal voltage dropping from one value to a second lower value when thyristor turns from OFF to ON. (Fig. 3)

t_{rr}: *Reverse recovery time*. (Fig. 2)

V_{DRM}/V_{RRM}: *Maximum repetitive peak OFF state/reverse voltage* excluding non-repetitive transients.

V_{DSM}/V_{RSM}: *Maximum nonrepetitive peak OFF state/reverse voltage*.

V_{FM}/V_{TM}: *Maximum forward voltage drop* at a specific forward current and case temp.

V_{GDM}: *Gate nontrigger voltage*. Highest dc voltage that will *not* cause thyristor to switch from OFF to ON.

V_{LATCH}: *Latching voltage*. Voltage required for thyristor to latch ON at a given gate current and junction temp.

$V_{TM(DYN)}$: *Dynamic ON state voltage*. Transient ON state voltage of thyristor when triggered into conduction for a given load and time.

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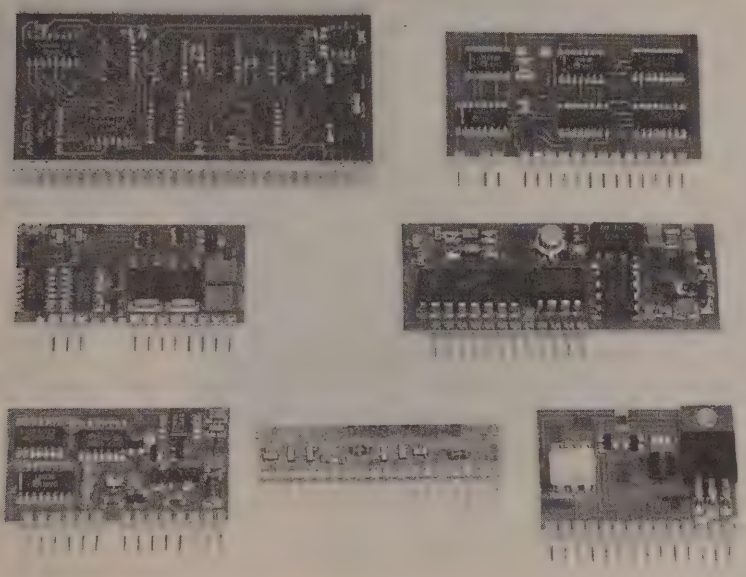

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- In-house photographic reduction and film processing yield optimum detail
- High resolution screen fabrication system assures ultimate precision

Manufacturing
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- Burn-in and 100% load testing assure a flawless finished product

Whether your needs are design-to-spec or build-to-print, we pledge that we will provide you with the finest engineering, manufacturing, quality assurance and customer service in the industry. Contact Gordos today. Put a winner to work for you.

See Gordos Relays in Section 4500 and Gordos Data Acquisition & Control Products in Section 2325.
Products and specifications subject to change without notice.
Consult factory for application assistance.

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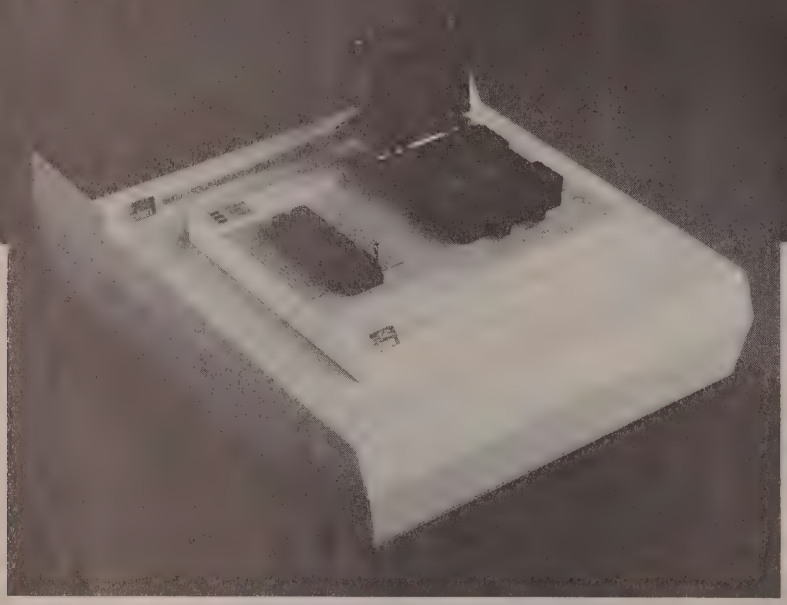
APPROVED DEVICE PROGRAMMING

USA HOTLINE
1-800-541-ELAN

FROM UNDER $1000



MEMORY -
EPROM, Flash, EEPROM, PROM, etc.

LOGIC -
PLD, GAL, EPLD, CPAL, etc.

MICRO -
INTEL, NEC, AMD, HITACHI, MOTOROLA, NS, PHILIPS, SGS, JEIDA/PCMCIA Card - INTEL, MITSUBISHI, FUJITSU, EPSON, ITT, CANON, TI, TOSHIBA, etc.

ICP -
IN CIRCUIT PROGRAMMING (CUSTOM/BASIC)

Elan puts you YEARS ahead in:

- ✓ *programming integrity*
- ✓ *speed*
- ✓ *support*

configurations for all your applications

Model 3000 - PC Remote Programmers
Model 4000 - Production Copiers
Model 5000 - Editing Programmers
Model 6000 - Single Site Universal Programmer
Model 5J08 - JEIDA/PCMCIA Card Copiers
"J" Series - OEM/PCMCIA Systems

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Segensworth West, Fareham
Hampshire, England PO15 5SJ
Tel: 0489 579799 Fax: 0489 577516

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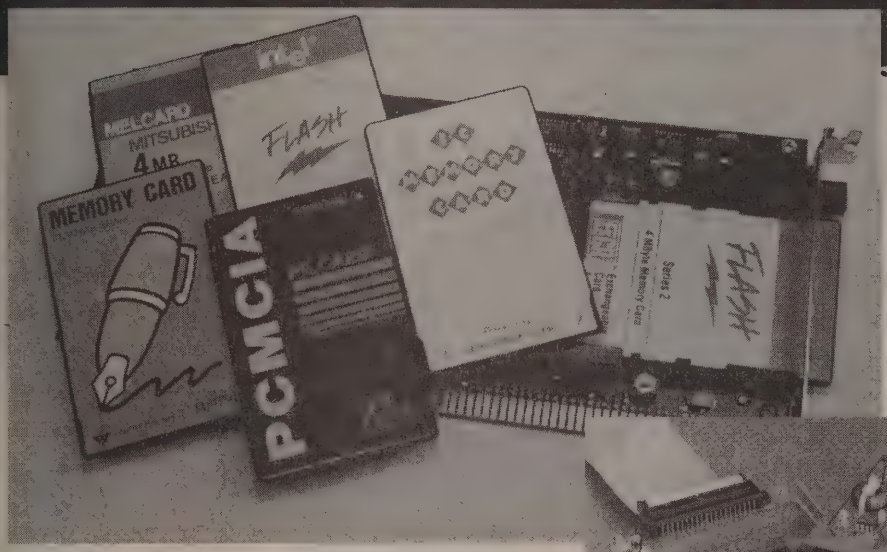
Call Now: 1-800-541-ELAN *for your free device wall chart.*

COMPLETE LINE OF IC CARD CONTROLLERS, VERIFIERS/TESTERS



ExCA/PCMCIA/JEIDA IC Card Functional Verifiers/Testers

1-800-541-3526

MSD3 offers a range of IC Card functional verifiers, testers and operators for the ISA/EISA/SCSI Bus structures, including systems for 3 volt Memory and I/O cards.

These systems are ideal for the end user, OEM and VAR alike, accepting 2 Type I or Type II cards or 1 Type III Disk Drive in the same space.

Anywhere stringent quality control, critical performance and complete customer satisfaction is required, MSD3 products are the answer.

Applications include medical, military, aerospace, process control, etc.

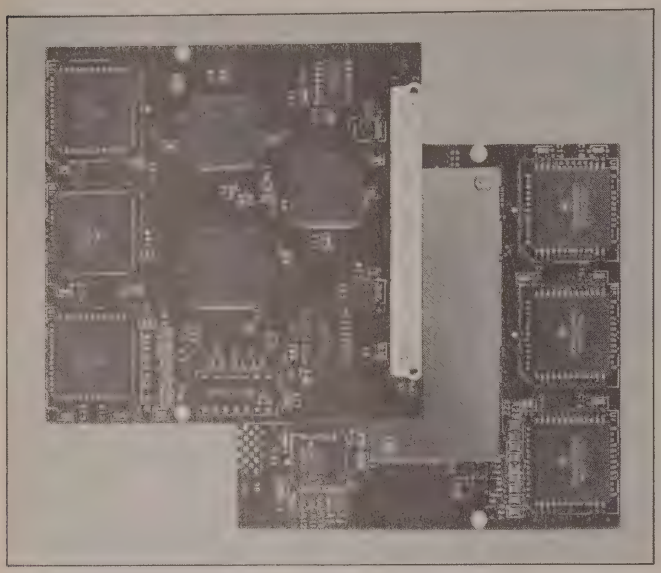
ExCA/PCMCIA/JEIDA IC Card Controllers

SCSI, ExCA/PCMCIA/JEIDA IC Card Systems

Memory Systems Design Development and Distribution, Inc.
365-700 Woodview Ave.
Morgan Hill, CA 95037
PHONE: (408) 778-7267
FAX: (408) 778-2597

PCMCIA is a trademark of the Personal Computer Memory Card International Association.
EXCA is a trademark of Intel Corporation.
JEIDA is a trademark of the Japan Electronic Industry Development Association.

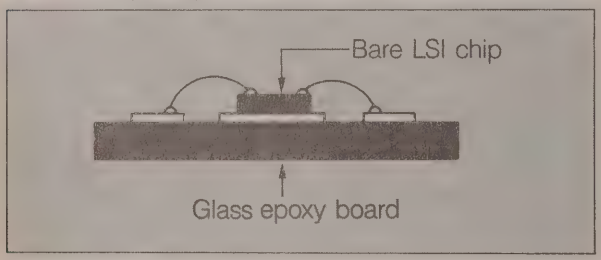
MULTICHIP MODULES for high power & high frequency



As a leading manufacturer of MCMs, FDK can meet your exact needs for high quality customized circuits. Just give us your specifications, and we'll do the rest.

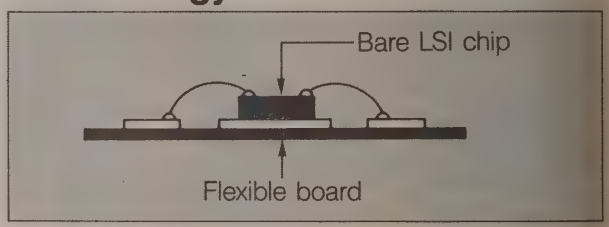
- Combination technology of COB and COM
  (COB: Chip on board
  COM: Chip on metal)
- Low thermal resistance
- 6 to 10 layer substrate
- Fine pattern pitch
  (4 mill)
- High reliability
  (85°C, 85%, 1000H clear
  PCT121°C 2atm 96H clear)

● COB (Chip-on-board) technology



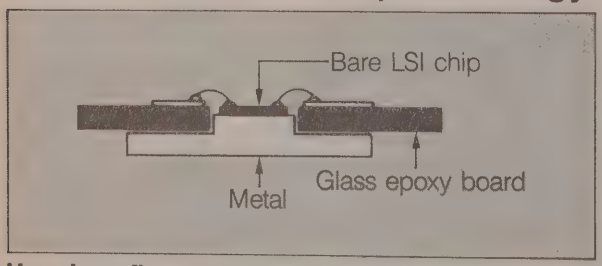
User benefits
- Reduction of product size and weight, made possible by larger-scale integration
- Low cost
- High mechanical strength

● COF (Chip-on-flexible-board) technology



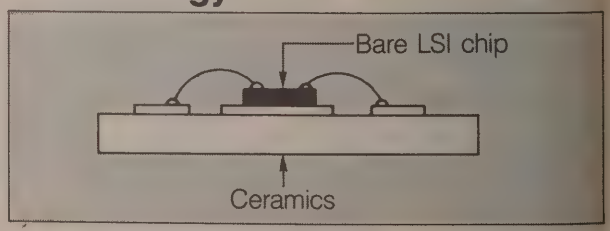
User benefits
- Reduction of product size and weight, made possible by larger-scale integration
- Low cost
- Flexible mounting

● COM (Chip-on-metal) technology



User benefits
- Reduction of product size and weight, made possible by larger-scale integration
- Low cost
- High mechanical strength
- High power

● COC (Chip-on-ceramics) technology



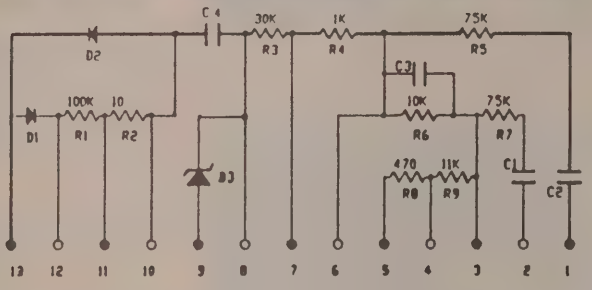
User benefits
- Large scale of integration
- High reliability
- Ease of customization
- Total cost reduction

FDK
Your Best Strategic Partner
FDK AMERICA, INC.
A Division of Fuji Electrochemical Co., Ltd. Japan
3099 North First Street, San Jose, California 95134, U.S.A. TEL: 408-432-8331 FAX: 408-435-7478
Dallas TEL: 214-650-7742 FAX: 214-650-7792 **Boston** TEL: 617-487-3198 FAX: 617-487-3199

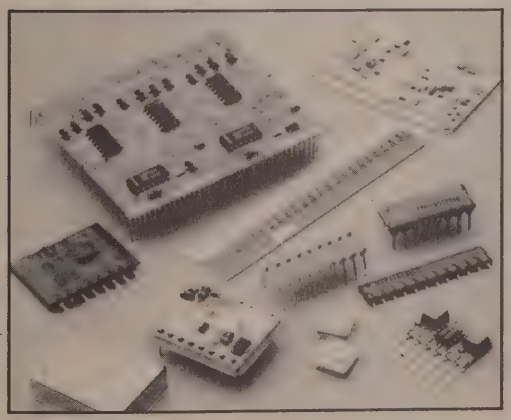
U.S. MADE

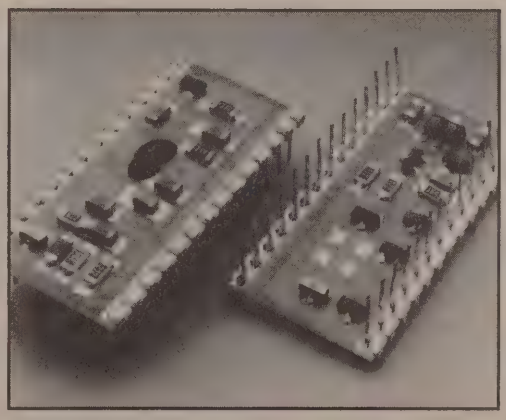
CUSTOM THICK FILM NETWORKS

FAST TURNAROUND



- DIP'S, SIP'S, Custom Packages, Coating Choices. Any schematic with Resistors, Capacitors, Inductors, Diodes and other active components. Production and testing any volume. SMD Turn Key Assembly.
- Hybrids, Die Attach, Wire Bond.
- Laser Trimming Services.





See our Oscillator/Crystal Pages Vol. A•1406 & A•1407

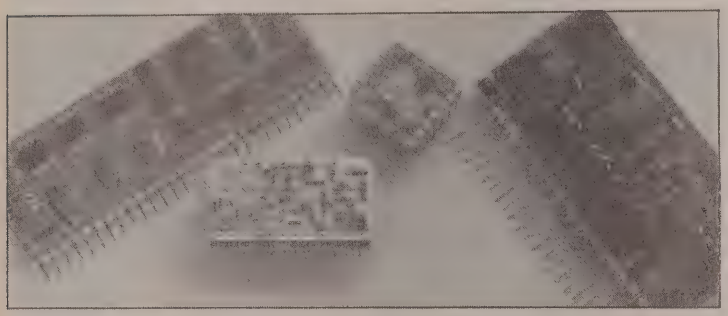
HYBRIDS INTERNATIONAL, LTD.

311 N. LINDENWOOD DRIVE / OLATHE, KANSAS 66062

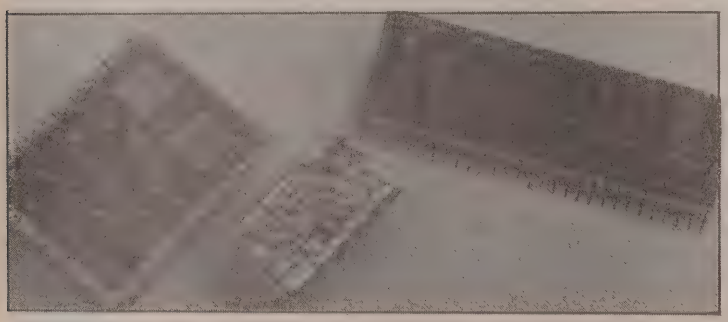
PHONE: (913) 764-6400 • FAX (913) 764-6409

HEI INC
HYBRID ELECTRONICS
Box 5000 1495 Steiger Lake Lane
Victoria, MN 55386

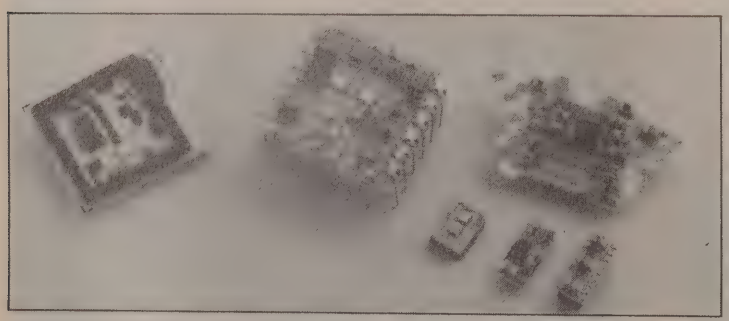
Custom Hybrid Design and Production Service



Hybrid analog and digital circuits for industrial equipment such as analog controls, pressure sensors, signal amplifiers and optical sensors.



Digital hybrid circuits in computer peripherals such as printers, disk drives and optical scanners.



Miniature hybrid amplifiers and control circuits used for medical equipment such as hearing aid amplifiers, intravenous drip sensors, ultrasound imaging, blood sensors and nerve stimulators.

For more than 25 years, HEI, Inc. has excelled in the manufacture of custom thick-film hybrid circuits. HEI specializes in "ultra-miniature" hybrids, having produced some of the smallest outlines in the industry. We offer our customers close liaison and professional services from initial design through final production.

HEI's advanced automation technology ensures that our customers consistently receive the high quality products they expect. Our separate prototype facilities combined with short- and long-run production capabilities give customers the convenience of "flexible scheduling" and short lead times to meet the demands of JIT and other ship-to-stock programs.

Throughout our company, we share one goal: exceeding your expectations.

HEI INC
Phone 612-443-2500
Fax 612-443-2668

HEI INC
HYBRID ELECTRONICS
Box 5000 1495 Steiger Lake Lane
Victoria, MN 55386

Custom Hybrid Design and Production Service

FACILITIES

- 22, 000 sq. ft. state of the art manufacturing facility in Minneapolis, MN. An additional 12,000 sq. ft. in Sauk Centre, MN.
- Separate proto development lab for quick turn-around.

ENGINEERING DESIGN

- Multiple CAD systems for fast, accurate and efficient circuit layout.
- Engineering resources for both analog and digital designs.
- Preliminary layouts and designs are discussed with each customer to ensure conformance to requirements.

PROCESSES AND CAPABILITIES

- Palladium silver, gold and copper printing processes.
- Chip-and-wire, flip-chip and surface mount semi-conductor integration.
- Double-side resistor printing and multi-layer processing with through-hole via technology.
- Active circuit resistor trimming to a voltage, current or frequency.

MANUFACTURING

- Clean room printing, firing and trimming of all circuits.
- Totally automated component integration, bonding, dicing and testing.
- Manufacturing processes to accommodate low to high volume requirements.

TESTING

- All parts are functionally tested to customer standards.
- Temperature cycling, burn-in, vibration, humidity and testing under load conditions can also be supplied.

STATISTICAL PROCESS CONTROL

- HEI employs statistical process control to monitor all critical processes and to ensure that parts consistently conform to established quality standards.

QUALITY

- HEI provides the highest standards of quality from the initial design consultation through manufacture and delivery of the final product.

HEI INC
Phone 612-443-2500
Fax 612-443-2668

HEI INC
HYBRID ELECTRONICS
Box 5000 1495 Steiger Lake Lane
Victoria, MN 55386

Express Quote

Please make a photo copy of this page, fill out the copy and Fax or mail it to HEI

CUSTOMER INFORMATION

Customer _____

Address _____

City _____ State _____ Zip _____

Engineer _____ Title _____ Telephone _____

Purchasing _____ Title _____ Telephone _____

APPROXIMATE USAGE

Prototypes _____ Date Required _____

Production _____ Date Required _____

Production Target Price _____

APPLICATION AND FUNCTION _____

SCHEMATIC (Please attach) Include component values, part numbers and vendors, power supply voltages, operating temperature and functional testing requirements.

RESISTORS

Tolerance _____ %

Power Dissipation _____

Temperature Coefficient _____ ppm/°C from _____ °C to _____ °C

Tracking or Ratio Match Requirements _____

CAPACITORS

Tolerance _____ %

Temperature Coefficient _____ ppm/°C from _____ °C to _____ °C

Voltage Rating _____ volts

MECHANICAL

Size Restrictions: Length _____ Width _____ Seated Height _____

Lead Spacings: _____ .100 _____ .125 _____ .150 Other _____

HEI INC
Phone 612-443-2500
Fax 612-443-2668

MICRO-PRECISION TECHNOLOGIES INC.

12B Manor Parkway • Salem, NH 03079 • Tel: (603) 893-7600 • Fax: (603) 893-9110

HYBRID IC, MULTICHIP MODULES (MCM)

FILM	SUBSTRATES	CONDUCTORS	RESISTORS	LINE / SPACE RESOLUTION	SPECIAL METALIZATIONS	LASER TRIMMING CAPABILITIES
THICK FILM	Alumina 96% as Fired Thickness .005" to .080" Size up to 4.5" Square Inch	Au Ag Pt / Au Pd / Au	1-160MΩ	Std. Line/ Spacing .005" Fine Lines/ Spacing .002"	N / A	Kerf Width .001-.003" Tolerances 0.1% Typical Measuring Accuracy: 50ppm Ratio: up to 4ppm
THIN FILM	Alumina 99.5% as Fired/Polished Beryllia Glass Quartz Silicon Thickness: .005" to .080" Size: Up to 3 3/4 x 4 1/2" 5.0" wafer	TiW/Au Cr/Au Cr/Cu/Au Au to Specification Multilayer of Conductors	TaN = 20 to 150 Ω/Sq. NiCr = 50 to 200 Ω/Sq. SiCr = 1K to 10K Ω/Sq.	Std. Lines .002" Fine Lines Spacing .0003"	Ag, Al, Cr, Cu, Ni & Ti	Kerf Width .0006-.0012" Tolerances .1% Tighter Tolerances Obtainable (Material Dependent) Typical Measuring Accuracy: 50ppm Ratio: up to 4ppm

Standard Products

Resistor Networks
RC Networks
Chip Resistors
FET Drivers
PIN Diode Drivers
RF/Microwave Amplifier
Switch
VCO
Fiber Optic Hybrids

MICROWAVE PIN DIODE DRIVERS

Features

- MIL-STD-883 Screening
- -65° to +150°C Storage Temp Range
- TTL Compatible Inputs
- -55° to +125°C Operating Temp Range

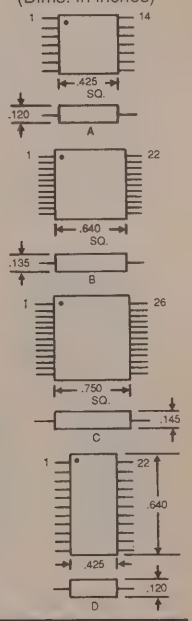
- **MPT offers a complete line of Pin Diode Switch Drivers with Output Current Capabilty of 10 mA to 50 mA and Switching Speeds as fast as 6 ns. ECL Compatible Driver is also available.**
- **All MPT Drivers are designed by our experienced engineering staff, thus, if the Drivers listed in the table do not meet your requirements: We would be happy to discuss a custom circuit to fit your exact needs.**

MODEL	CHANNEL NUMBER	OUTPUT CURRENT DC (mA) POSITIVE MIN	POSITIVE MAX	NEGATIVE MIN	NEGATIVE MAX	MIN PEAK (Ma) POS	MIN PEAK (Ma) NEG	OUTPUT VOLTAGE OPEN CKT (VEE = -12) (V) POS	OUTPUT VOLTAGE OPEN CKT (VEE = -12) (V) NEG	MAX SWITCH TIME (ns) TON	MAX SWITCH TIME (ns) TOFF	MAX REP RATE (MHZ)	OPERATING VOLTAGE LIMIT +5 V MIN	+5 V MAX	VEE MIN	VEE MAX	PACKAGE
PD111[1]	1	12	18	12	18	300	300	2.5	5.5	15	18	5	4.5	5.5	4.5	16	A
PD211[2]	2	12	18	12	18	300	300	2.5	5.5	15	18	5	4.5	5.5	4.5	16	A
PD217	2	24/60	36/60	24/40	36/60	N/A	N/A	3.5	11.0	100	200	1	4.5	5.5	4.5	16	D
PD311[3]	1	8	12	24	36	300	300	4.0	11.0	6	8	20	4.5	5.5	4.5	5.5	A
PDF311	1	8	12	34	36	300	300	4.0	11.0	12	15	10	4.5	5.5	4.5	16	A
PD350	3	40	60	40	60	N/A	N/A	3.5	11.0	100	200	1	4.5	5.5	4.5	16	B
PD450	4	40	60	40	60	N/A	N/A	3.5	11.0	100	200	1	4.5	5.5	4.5	16	B
PD630[4]	6	24	36	12	18	N/A	N/A	4.0	5.0	45	50	1	4.5	5.5	4.5	16	B
PD650[1]	6	40	60	40	60	N/A	N/A	3.5	11.0	100	200	1	4.5	5.5	4.5	16	B
PD1050[4]	10	40	60	24	36	N/A	N/A	4.0	5.0	45	50	1	4.5	5.5	4.5	16	C
PDF2311	2	8	12	24	36	300	300	4.0	11.0	12	15	10	4.5	5.5	4.5	16	D
PDF3311	3	10	14	10	14	300	300	4.0	4.5	10	10	10	4.5	5.5	4.5	12	B

NOTES:
1. PD111 is available in a smaller package (.380" x .380" x .090")
2. Different output are available for PD211:
   PD211B: positive output current + 30 mA ± 20%
   PD211-10: negative output voltage -10V ± 20%
   PD211-30: negative output voltage -10V ± 20% and negative output current -30mA ± 20%
   Any combination of the above is available
3. Different output current are available for PD311:
   PD311B: ± 40mA (MIN), ± 60mA (MAX)
   PD311C: ± 10mA (MIN), ± 15mA (MAX)
   PD311D: ± 24mA (MIN), ± 12mA (MAX)
   PD311E: ± 8mA (MIN), ± 12mA (MAX)
4. PD630 and PD1050 are with decoder input.

Packages

(Dims. in inches)



MONOSTABLE MULTIRIGGER (P/N CP8079)

Features

- Hi-Rel Thin Film Microcircuit
- Three Trigger-Outputs
- To-5 Package
- MIL-STD-833 Screening

Absolute Maximum Ratings

- Supply Voltage +8.0 VDC
- Operating Temp. -55°C to +125°C
- Storage Temp. -65°C to +150°C

Specifications

- Supply Voltage +6.0 VDC (max)
- Power Dissipation +42 mW (max)
- Input Voltage +5 V (max)
- Input Pulse Width to Trigger 100 ns (min)
- Output Pulse Amplitude +4.0 V (min)
- Output Rise Time 100 ns (max)
- Output Fall Time 20 ns (max)
- Minimum Amplitudes to Trigger +3 V, -1.5 V, +2 V
- Minimum Voltage to Inhibit +2.0 V
- Output Impedance 1000 ohms (max)

Pin Connection

Pin	Connection	Pin	Connection
1	INPUT	5	INPUT
2	INPUT	6	+6 V
3	NC	7	OUPUT
4	GND	8	+6 V

Quality: Micro-Precision Technologies Inc. quality organization maintains a system at a high level of screeing which includes the following:

- Continuous In-Prosess Inspection
- Stabilization Bake (150°c)
- Temperature Cycling
- Thermal Shock
- Constant Acceleration
- Fine Leak Test
- Gross Leak Test
- Burn in @ 125° for 160 hrs.
- Final Electrical Testing
- External Visual

MICRO-PRECISION TECHNOLOGIES' large capacity, high through-put, load-lock production system with: Microprocessor Controller, DC or RF Planar, Magnetron Sputtering, RF Etching and Substrate Heating to 400°c.

COMPLETE PROCESSING: Photo Coating; Photo Imaging/Etching under class 100 Laminar Flow in a Modern Class 1000 Facility.

PRECISION MASK ALIGNMENT TOOLING for Quality High Resolution Printing (contact or proximity) includes: a) Regulated UV/Deep UV Exposure, b) 4.2" Square Collimated Beam, c) Zeiss MJM Optics for Accurate Alignment

AUTOMATIC DICING SAW provides precision Substrate Sawing and Scribing to .0001 inch tolerances.

INTERNATIONAL SENSOR SYSTEMS, INC.

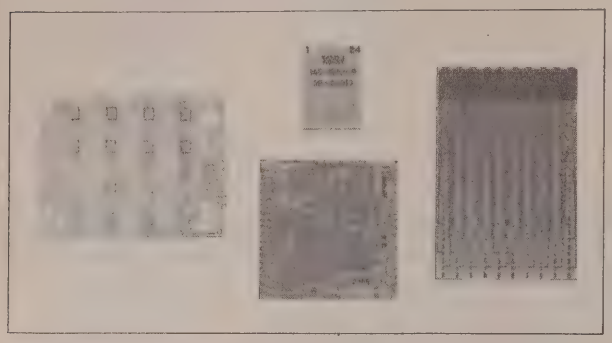
P.O. Box 345
Industrial Park
AURORA, NEBRASKA 68818

Telephone (402) 694-6111
FAX (402) 694-6180

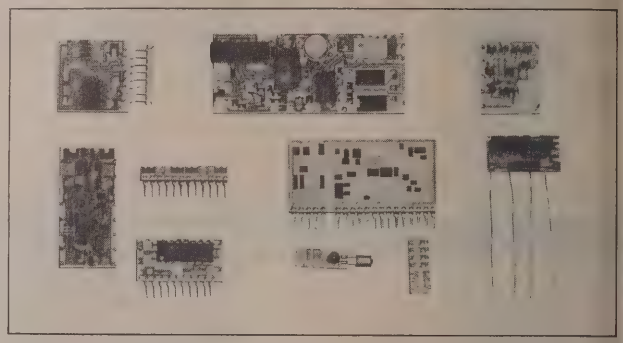
HYBRID THICK FILM TECHNOLOGY

FEATURES

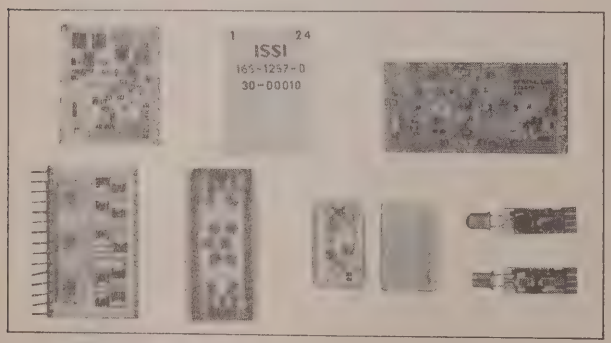
- one time insertion costs
- functional modularity
- high quality components
- compact
- low profile
- low mass
- high performance
- small
- extreme temperature operating range
- military specification capabilities



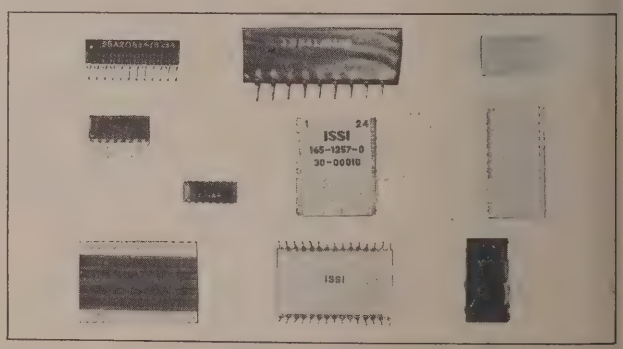
METALIZED SUBSTRATES — Simple or complex, single or multi-layer conductor patterns with Pd. Ag (Palladium Silver), Pt. Ag. (Platinum Silver), Au, (Gold), Pt. Au. (Platinum Gold) inks. Insulation with high temperature glass dielectric or low temperature glaze. Film Resistors from 1 ohm to 150 megohm, tolerances to ±0.1%, T.C.R. to 50 ppm, 1/10 w to 10 watt power dissipation, laser or abrasive trimming.



SOLDER REFLOW TECHNOLOGY — Compact networks with thick film resistors, IC packages, chip capacitors, inductors, discrete components, SOT package, diode bridge assembly, high and low temperature solder, standard or custom pinouts. Special devices with photo-transistors, LED's and functional sub-assemblies.



CHIP AND WIRE TECHNOLOGY — Microcircuit assembly of functional thin film integrated circuit or component chips into operational devices. All available IC & component chips assembled to a thick film circuit by solder or epoxy bonding. Chips wired into circuit with either gold or aluminum wire. (Thermocompression or thermosonic wire bonding). Special handling for static control. Components actively or passively trimmed to guarantee functional specifications.



CUSTOM PACKAGES — Single-in-line or Dual-in-line pinout packages, conformally coated, metal can, plastic or ceramic covered and sealed. Customer markings as well as manufacturer's identification for traceability. Leak tested, temperature cycling and burn-in before final test to insure reliability. Heat sink attached to either alumina or beryllium oxide to obtain maximum power dissipation.

TECHNICAL SERVICES

• Circuit design • layout (including conversion of existing circuitry to thick film technology) • material selection • rubylith production • screen fabrication • product tooling • product testing • and building to print. Testing includes functional electrical and mechanical parameters • burn-in • leak testing • and temperature cycling.

APPLICATIONS

• Memory • logic • linear circuits • A-D • D-A • timing • filters • isolation • pulse shaping • impedance matching • signal generation • switching • sequencing • and many other medium range energy dissipation functions or a combination thereof.

ISSI MILITARY SPECIFICATION CAPABILITIES

MIL-I-45208 Inspection System Requirements
MIL-STD-45662 Calibration System Requirements
MIL-STD-883 Test Methods & Procedures for Microelectronics
Certificate of Compliance furnished upon request.

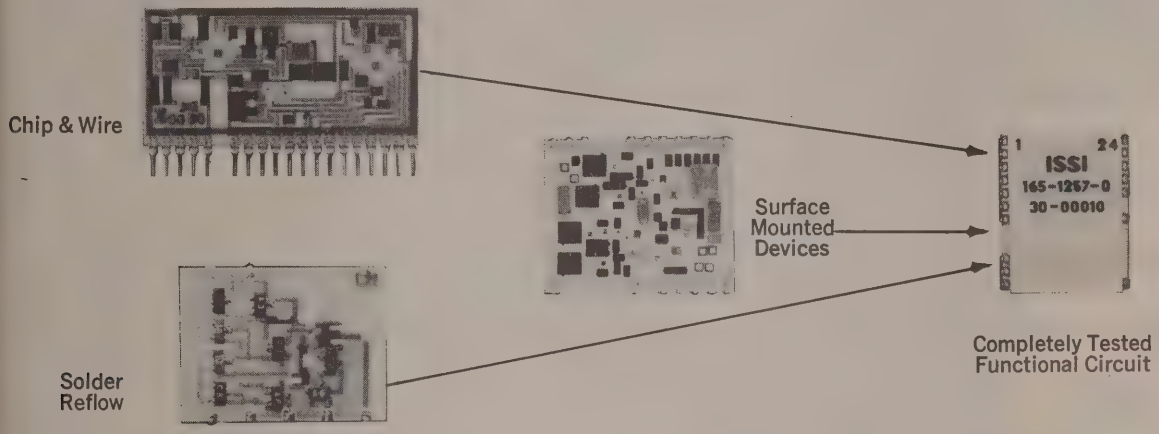
INTERNATIONAL SENSOR SYSTEMS, INC.

P.O. Box 345
Industrial Park
AURORA, NEBRASKA 68818

Telephone (402) 694-6111
FAX (402) 694-6180

HYBRID THICK FILM PRODUCTS AND SERVICES

Custom and Surface Mount Packages



CUSTOM PACKAGES

- Single In-line (SIP)
  - High Temp Solder
  - Low Temp Solder
- Hybrid
  - Flat Packs
- Dual In Line (DIP)
- Surface Mount
  - PCB Base
  - Ceramic Base
  - (See opposite page for details)
- Multi-layer Circuit
- Encapsulated
- X-tal Can Covers
- Ceramic Cover
  - High Temperature Sealant
  - Low Temperature Sealant
- Plastic Covers

CUSTOM COMPONENTS

- Custom Thick Film Metallized Substrates, Pd Ag, Pt Ag, Au, Pt Au, Dielectric, Glaze
- Networks, Specialized Resistor
  - Resistor-Capacitor
  - Resistor-Capacitor-Inductor
  - EMI/RFI Shielded
- Special Devices
- Amplifiers
- Oscillators
- Time Base Modules
- A-D, D-A Converters
- Fiber Optic
  - (Transceivers, Bar Code Readers)
- Solid State Relays
- Microwave
- Control Circuit
- Display Panels

TECHNICAL SERVICES

- Circuit Design
- Circuit Layout (Includes conversion to Thick Film)
- Material Selection
- Create Rubyliths
- Component Specification
- Tooling
- Product Testing
- Build to Print

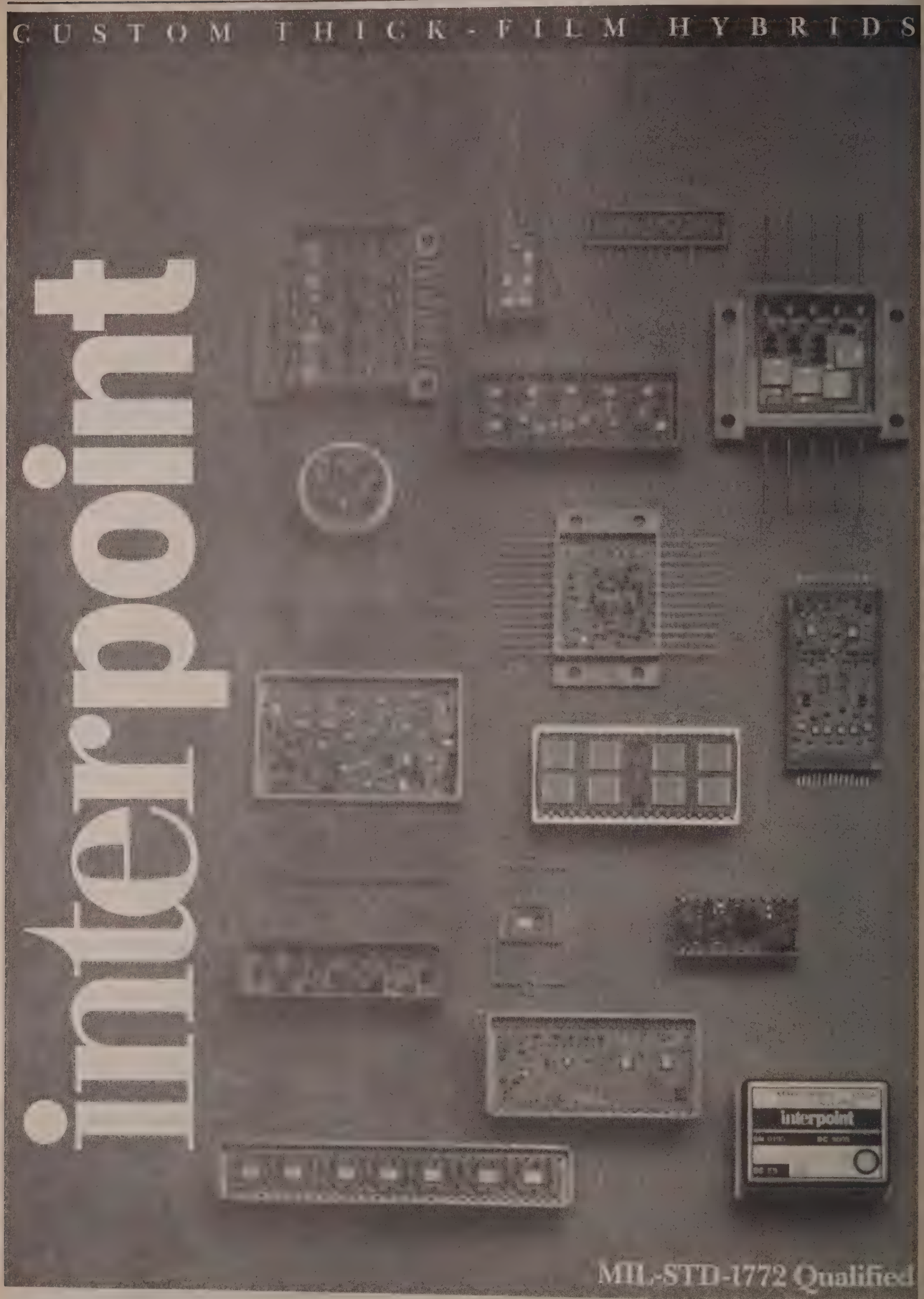
TECHNICAL CAPABILITIES

- Solder Reflow
  - IC Packages, Discrete Components (Capacitors, Bridges, L E.D.'s etc.)
- Chip and Wire
  - All Component Chips
  - All Available Integrated Circuits
  - Thermo-Compression Bonding (Au Wire)
  - Thermo Sonic Bonding (Au Wire)
  - Ultrasonic Bonding (Al Wire)
- Special Static Handling
- Resistance & Capacitance Trimmed (Active and Passive)

MILITARY SPECIFICATION CAPABILITIES

- MIL-I-45208 Inspection Systems Requirements
- MIL-STD-45662 Calibration System Requirements
- MIL-STD-883 Test Methods and Procedures for Microelectronics
- Certificate of Compliance furnished upon Request

PO BOX 345, INDUSTRIAL PARK
AURORA, NE 68818
TELEPHONE (402) 694-6111


CUSTOM THICK-FILM HYBRIDS
interpoint
interpoint
MIL-STD-1772 Qualified

R E L I A B I L I T Y

20 Years of Hi-Rel Expertise

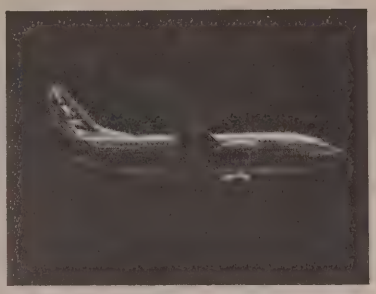
Interpoint Corporation is the premier world-wide supplier of thick-film hybrids for high reliability electronic applications. For over two decades it has proven itself by building custom microcircuits for the most demanding applications—commercial and military aircraft, computers, medical electronics, missile systems, satellite payloads.

Interpoint is a dedicated hybrid manufacturer—our entire corporate mission is design and production of superior microcircuits. Founded in 1969 as Integrated Circuits Incorporated, Interpoint was one of the first suppliers to offer full certification and qualification to the highest quality standards under MIL-STD-1772—and one of the first to implement Statistical Process Controls and Computer Integrated Manufacturing.

The Choice is Yours

Interpoint offers the system designer more choices than any other microcircuit manufacturer.

- Choose domestic manufacturing in our MIL-STD-1772, 50,000 square foot Redmond Washington plant. Or pick cost effective off-shore production in our 40,000 square foot, military quality facility in Taiwan.
- Select test standards—up to full MIL-STD-883C test procedures are available in-house as well as custom screening to your own specifications.
- Choose package styles, from full hermetic welded cases to cost effective ceramic and plastic potted styles.
- Select the delivery system—large or small orders, inventory stock or just-in-time.



In programs that need the highest levels of reliability, Interpoint hybrids are the first choice. Interpoint hybrids are used on virtually every airliner in the West, the most advanced fighter aircraft, in medical electronics, computers, and industrial controls.

Short Lead Times

Interpoint has become one of the acknowledged industry leaders in applying systems management techniques to the hybrid process—from initial design and analysis through production and final test. This expertise means high reliability, fast turn-around, and precision engineering for each circuit.

Interpoint can produce a prototype of your circuit in as little as 8 to 12 weeks.

PROVEN RELIABILITY: WITH THE INDUSTRY'S WIDEST CHOICE OF DOMESTIC AND INTERNATIONAL MANUFACTURE.

A Single World-wide Quality Standard

Interpoint is the only thick-film hybrid supplier to provide both the highest standards of quality and a choice between domestic and international production.

Our US facility is fully qualified under MIL-STD-1772 and the company is listed in MIL-M-38510G's Qualified Manufacturer's List (QML).

We apply the same quality standards —the same source controls and process requirements—to our Interpoint manufacturing facility in Kaohsuing, Taiwan. This facility has been audited and approved for military program level production by some of the largest suppliers of Hi-Rel electronics.

Interpoint offers a complete in-house screening capability that includes full compliance with MIL-STD-883C method 5008. Screening includes electrical test over temperature; visual inspection; gross and fine leak tests; stabilization bake; temperature cycling, constant acceleration, and burn-in.

SPECIFICATIONS WORKED TO: INTERPOINT, REDMOND	
Overall Facilities	MIL-STD-1772
Inspection Systems	MIL-I-45208
Clean Room and Workstation Requirements	FED-STD-209
Configuration Control	MIL-STD-481, DOD-STD-480
Corrective Action, Nonconforming Material	MIL-STD-1520
ESD Control Program	DOD-STD-1686
Hybrid Microcircuit	
Calibration Program	MIL-C-45662
Test Methods and Procedures	MIL-STD-883

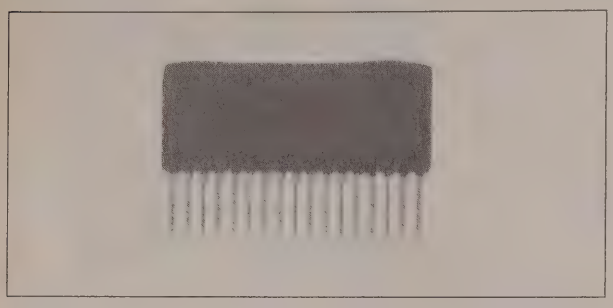
interpoint

MIL-STD-1772 Qualified

10301 Willows Road
Redmond, WA 98052
TEL: (206) 882-3100
FAX: (206) 882-1990

custom circuit module design (hybrid ICs)

MURATA ERIE NORTH AMERICA



Murata Erie offers custom Thick Film Circuit Module design engineering and production capabilities. Our advanced computer aided design and manufacturing (CAD/CAM) systems allow us to respond to your various needs with quality and speed. If you have an application that could use our established Thick Film Technology, please contact us for engineering consultation.

ORDERING INFORMATION

Please provide the following information when inquiring about custom modules:

- Functional description of circuit
- Application
- Resistor and capacitor values and tolerance if known
- Manufacturer and part number of all active devices (Semiconductors)
- Package type preferred (SIP or DIP or SMD)
- Package dimensions (LxWxH)
- Your target cost for module
- Your development schedule requirements
- Your production schedule
- Expected annual usage (EAU)

SURFACE MOUNTABLE COMPONENTS FOR CIRCUIT MODULES

MOUNTABLE COMPONENTS

SEMICONDUCTORS

A highly functional and highly integrated circuit can be realized by integrating various chip components and semiconductors on one substrate. Murata Erie not only has the technology to put these components together on the substrate, but Murata Erie also supplies the components. Again, this relates to the vertical integration theme of Murata Erie.

RESISTORS

Resistance Range	10Ω to 10MΩ
Tolerance	±10%, ±5%, ±2%, ±1%
Power Rating	Max. 1W/Element
TCR	±100, ±200ppm/°C

CAPACITORS

Chip Monolithic Ceramic Capacitors	Cap. Range	1pF to 2.2μF
	Tolerance	±1%, ±2%, ±5%, ±10%, ±20%, +80/–20%
	TCC	COG, X5R, Y5V
	Voltage	25V DC, 50V DC, 100 V DC
Tantalum Capacitors	Cap. Range	0.1μF to 100μF
	Tolerance	±10%, ±20%
	Voltage	4V to 35V DC

INDUCTORS

Inductance Range	0.15μH to 2.2mH
Tolerance	±5%, ±10%, ±20%
Q	Min. 20
Current	35mA to 800mA

FILTERS

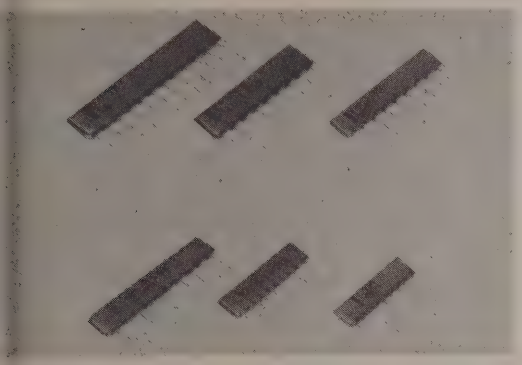
AM	Center Frequeny (fo)	Within 455±2.0KHz
	3dB Band Width	Within 4.5/5.5KHz
	Insertion Loss	Max. 6dB
	Spurious Attenuation	Min. 10dB (at f0 to 2.2MHz)
	I/O Matching Impedance	3.0KΩ
FM	Center Frequency (fo)	Within 10.640 to 10.760MHz±30KHz
	3dB Band Width	230/280±50KHz, 180±40KHz
	Insertion Loss	Max. 7dB
	Spurious Attenuation	Min. 25dB
	I/O Matching Impedance	330Ω
EMI	Capacitance	22pF to 22000pF+50%/–20%
	Rated Voltage	100V DC
	Rated	300mA DC
	Insulation Resistance	Min. 10000mΩ
	Resistance (DC)	Max. 0.3Ω

RESONATORS

Frequency Range	2.0 to 32.0MHz
Oscillating Frequency Initial Tolerance	±0.3%, ±0.5%
Oscillating Frequency Tolerance Stability	±0.3%, ±0.5% (–20°C to +80°C)
Aging Tolerance (10 Years at Normal Temp.)	±0.3%, ±0.5%

circuit modules (hybrid ICs)
RC and C modules

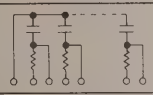
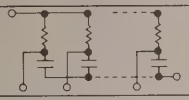
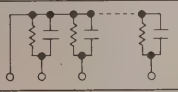
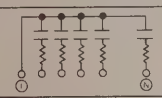
MURATA ERIE NORTH AMERICA



These products represent our most standard Hybrid line. Consisting of standard Resistor/Capacitor and Capacitor network circuit configurations, the customer decides the individual component values. Once a customer determines the ideal values of capacitor and resistor, Murata Erie can provide these products in mass production quantities.

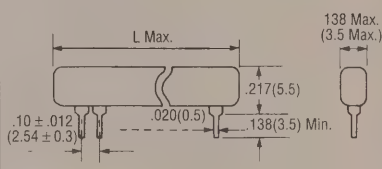
Contact Murata Erie Circuit Module Group For Design Options.

TYPICAL RC MODULE CONFIGURATIONS

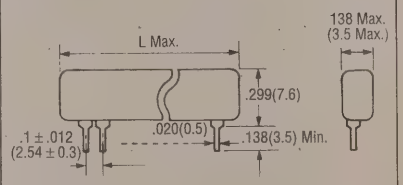
Prefix	Circuit Type	Circuit	Configuration			
ARCL	L		Number of Pins		9	
			Number of Components	R	4	
				C	4	
			Length (mm)		.965(24.5)	
ARCL	S		Number of Pins		6	10
			Number of Components	R	4	8
				C	4	8
			Length (mm)		.689(17.5)	1.083(27.5)
ARCL	X		Number of Pins		5	9
			Number of Components	R	4	8
				C	4	8
			Length (mm)		.571(14.5)	.965(24.5)
ARC	I		Number of Pins		10	
			Number of Components	R	9	
				C	9	
			Length (mm)		1.083(27.5)	
ARC	8E		Number of Pins		8	
			Number of Components	R	6	
				C	1	
			Length (mm)		.866(22)	
ARC	10E		Number of Pins		10	
			Number of Components	R	6	
				C	1	
			Length (mm)		1.063(27)	

Dimensions: (mm)

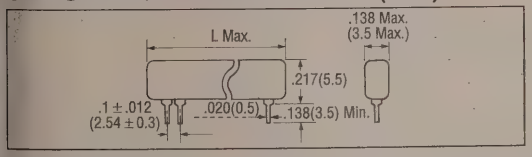
ARCL



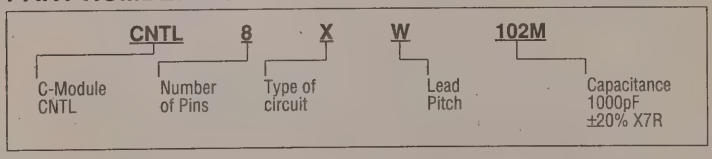
ARC



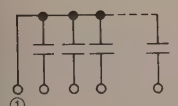
TYPICAL C MODULE CONFIGURATIONS
CNT SERIES DIMENSIONS: In. (mm)



PART NUMBERING SYSTEM



MOST COMMON CAPACITOR MODULES: (CNT SERIES)

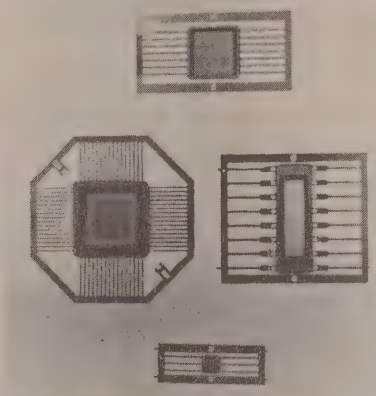
Circuit	Capacitance /1 Element	Cap. Rating	Cap. Tol. (%)	Temp. Char.	Part Number	Part Number	Part Number	Part Number
	47pF	50VDC	10	COG	—	—	CNTL9XW470K	—
	100pF	50VDC	10	COG	CNTL5XW101K	CNTL8XW101K	CNTL9XW101K	CNTL10XW101K
	470pF	50VDC	10	COG	CNTL5XW471K	—	CNTL9XW471K	—
	1000pF	50VDC	20	X7R	—	CNTL8XW102M	CNTL9XW102M	CNTL10XW102M
	10000pF	25VDC	20	X7R	—	CNTL8XW103M	CNTL9XW103M	CNTL10XW103M
	.1μF	16VDC	–20, +80	Y5V	—	CNTL8XW104Z	CNTL9XW104Z	CNTL10XW104Z
	# of Pins				5	8	9	10
	# of Elements				4	7	8	9
	Length				.571 (14.5)	.866 (22.0)	.965 (24.5)	1.063 (27.0)
	Top.				–35°C to +85°C			
	Tstg.				–40°C to +85°C			

MURATA ERIE NORTH AMERICA Marketing Communications 2200 Lake Park Dr., Smyrna, Georgia 30080 Tel: 1-800-831-9172 Telex: 26-1301 FAX: 1-404-684-1541

HERMETIC PACKAGES FOR MICROCIRCUITS

MINI-SYSTEMS, INC.
Electronic Package Division
168 East Bacon St., P.O. Box 1597, Plainville, MA 02762
TEL (508) 695-2000 FAX (508) 695-8758 TWX 510-600-4340

GLASS FLATPACKS & CHIP CARRIERS

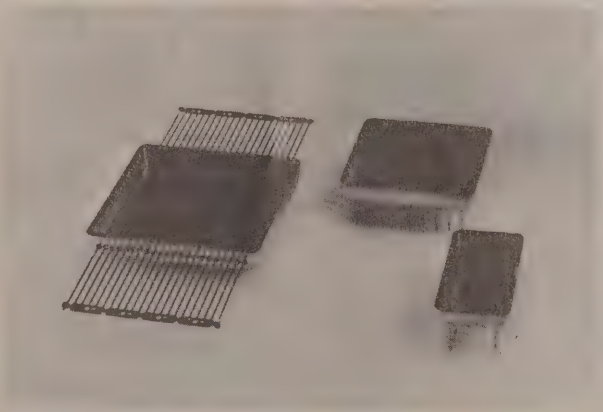


- Computer Aided Design
- Moderate tooling for custom packages
- Sealed by reflow soldering

Features

- Over 460 tooled variations
- Body sizes from 1/8″ square to 1″ square
- Lead counts up to 148
- Lead spacing .025, .030, .040, .050, .100
- Base materials ASTM F-15, Alumina, Metalized Alumina, Beryllia
- Custom lead forming (leaded chip carrier or gull wing)
- Gold, Nickel, Silver, and custom plating
- Matching combination lids available

METAL PLUG-INS & FLATPACKS

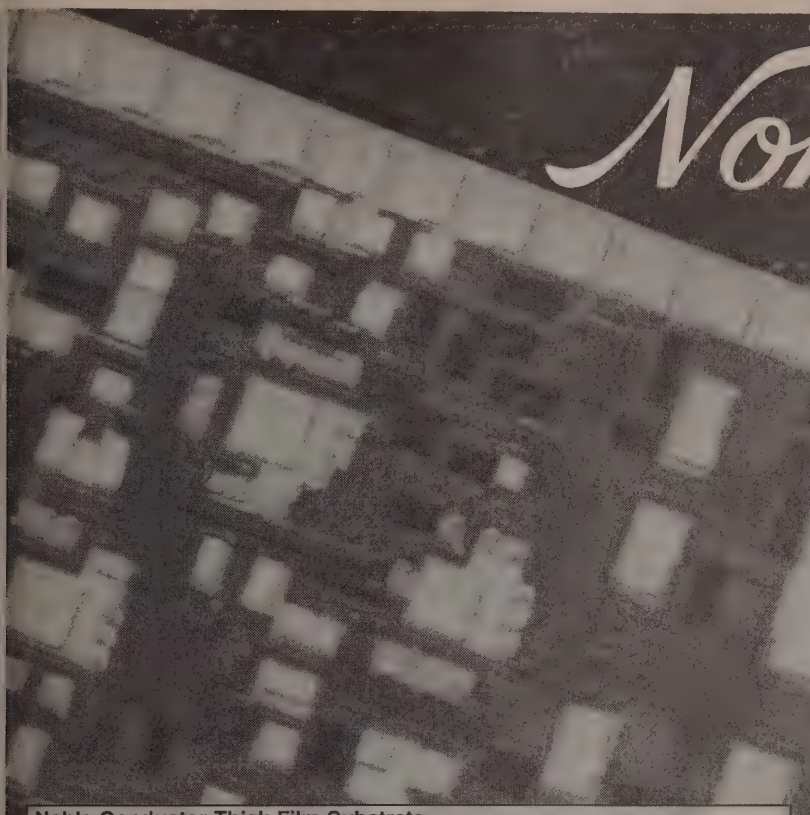


- Custom variations invited
- Used to enclose large, Hi-Rel hybrids
- Sealed by reflow soldering or seam welding

Features

- Unibody™ one piece case (ASTM-F-15 Alloy)
- Body sizes from .625 square to 1.97 × 2.97 available
- Lead spacings: .100 for Plug-ins .050, .100 for flatpacks
- Lead forming available
- Round or ribbon leads available
- Selective ground pins available
- Gold, Nickel, and selective plating
- Matching step lids available

WRITE OR CALL FOR OUR CATALOG



Noritake

Thick Film Circuit Substrates

More companies are now switching from standard circuit boards to Noritake Printed Thick Film Substrates.

- Better Heat Dissipation
- Smaller Geometries Improve Performance
- Better Reliability in High Temperature Environment
- Reduce Costs By Adding More Functions to One Circuit
- Smaller and Tighter Configurations

Noritake's experience with fired ceramics dates back to 1904. For over twenty years, Noritake has been a major supplier to Automotive, Computer and Telecommunications customers for printed thick film substrates.

Noritake's state-of-the-art technology produces thick film multilayer substrates with resistors. Ultra modern, fully automated facilities have the capacity to manufacture over 6 million pieces per month.

Noritake also offers super fine line thick film circuit substrates with fine line density that appears only in thin film products. Thick film products provide superior conductivity at lower costs than thin film products.

Call 1-800-837-4727.

Noritake Co., Inc.
2635 Clearbrook Drive
Arlington Heights, IL 60005

Noble Conductor Thick Film Substrate

Item			Specification		Condition
Conductor	Resistivity		Pd-Ag 15 ~ 50mΩ/□ Pt-Ag 2 ~ 4mΩ/□ Au 2 ~ 4mΩ/□		
	Adhesion		Initial	≧2.5kgs	2mm Square Pad 0.6φ Tinned Copper Wire
			Aged (150℃, 48hrs)	≧2.0kgs	
	Solder Leach Resistance		Solder Leach≦40μm		Line Width: 500μm Solder:62Sn/36Pb/2Ag 235℃, 5sec
Item			Preferred	Acceptable	Condition
Resistor	Resistance Value		10Ω~2MΩ	20mΩ~100MΩ	RuO_2 System
	TCR		±250ppm/℃	±100ppm/℃	-55 ~ 25℃, 25 ~ 125℃
	Tracking TCR		±100ppm/℃	±10ppm/℃	-55 ~ 25℃, 25 ~ 125℃
	Dissipation		150mW/mm²	-	
	Resistance Value Tolerance		≧±1.0%	±0.3%	
	Stability	Thermal Shock	≦±1.5%	-	430℃, 5mins
		Humidity	≦±2.0%	-	85℃, 85%RH, 1000hrs
		Thermal Cycling	≦±2.0%	-	-40℃~+150℃,500 cycles
		High Temp. Storage	≦±1.5%	-	150℃, 1000hrs
Crossovers	Insulation Resistance		≧100MΩ	-	Measure Voltage 100V

Non Noble Conductor Thick Film Substrate

Item			Specification		Condition
Conductor	Resistivity		Cu:≦2mΩ/□ (Fired Thickness 20μm)		
	Adhesion		Initial	≧2.5kgs	2mm Square Pad 0.6φ Tinned Copper Wire
			Aged (150℃, 48hrs)	≧2.0kgs	
	Solder Leach Resistance		Solder Leach≦25μm		Line Width: 500μm Solder:62Sn/36Pb/2Ag 235℃, 5sec
Item			Preferred	Acceptable	Condition
Resistor	Resistance Value		10Ω~ 2MΩ	-	LaB_6,SnO_2 System
	TCR		±300ppm/℃ ±150ppm/℃	-	-55 ~ 25℃, 25 ~ 125℃
	Dissipation		40~600mW/mm²	-	
	Resistance Value Tolerance		≧±1.0%	-	
	Stability	Solder Dipping	≦±1.5%	-	235℃,10sec
		Humidity	≦±2.0%	-	85℃,85%RH, 1000hrs
		Thermal Cycling	≦±1.5%	-	-40℃~+150℃ 500 cycles
		High Temp. Storage	≦±2.0%	-	150℃, 1000hrs

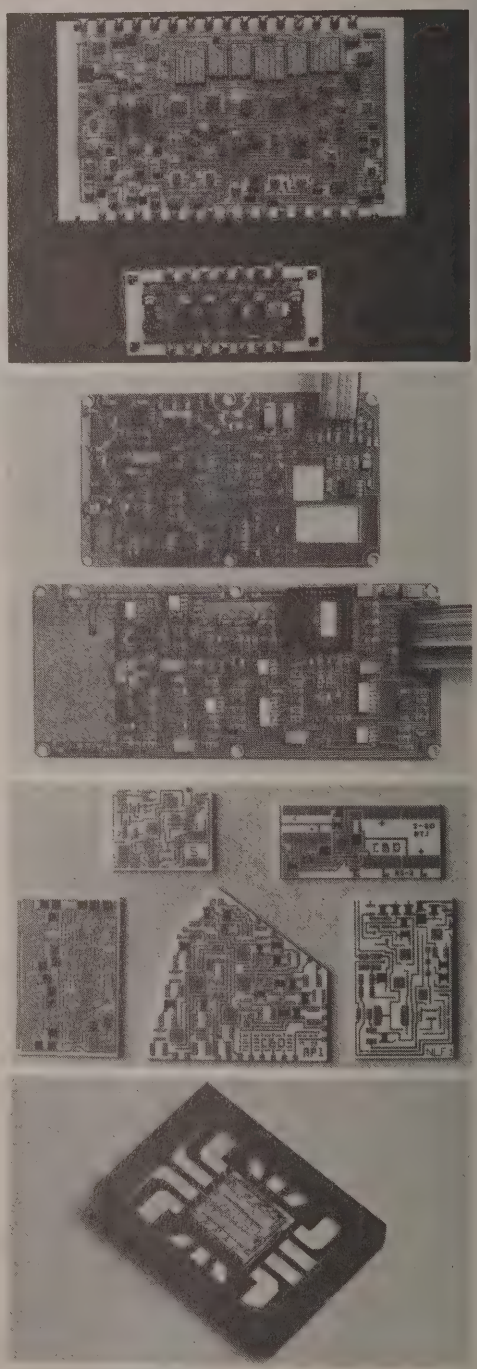
NWμ

CUSTOM THICK FILM HYBRID CIRCUITS

Northwest Microcircuits began operations in 1983 after discovering a growing demand for high reliability custom thick film hybrids in the Pacific Northwest. Our experiences since that day have brought us from simple resistor networks to thick film multilayer chip-and-wire hybrid circuits. Our circuit applications have varied from switch attenuators, RC networks, digital dividers, to prosthesis control circuits for the medical industry and the number of applications continues to grow. We recognize the continuing demand for quality thick film hybrid circuits in either prototype or production quantities. We have no minimum quantity limitations and have low non-recurring engineering charges. For your next thick film hybrid or special packaging application let our experience and services work for you.

Technical Services and Process Capabilities

- Complete design and manufacturing services; conductor/resistor layout; screen fabrication; CAD generated drawings; we will work from customer schematics, layouts, or film positives.
- Thick film screening and firing of conductor, resistor and dielectric materials; 5 mil lines and 5 mil spaces; Ag and Au based conductors; 10Ω/■ to 10MΩ/■ resistor inks; down to 50 PPM/°C TCR.
- Resistor trimming to .1% tolerances; abrasive or laser; active or passive; negligible post-trim drift.
- Die attach and wire bonding of semiconductor die; gold or aluminum wire bonding from .7 mil to 3 mil wire diameter.
- Hermetic or epoxy sealing; metal, plastic, or ceramic packaging; customer PN marking; conformal coating.
- Automatic pick-and-place of surface mount components on ceramic or PCB; reflow soldering.
- Functional and qualification testing to commercial or military specification.



NORTHWEST MICROCIRCUITS, INC.

211 S. 9th St. • P.O. Box 1479 • Philomath, OR 97370
TEL: (503) 929-6424 • FAX: (503) 929-6428

Raytheon

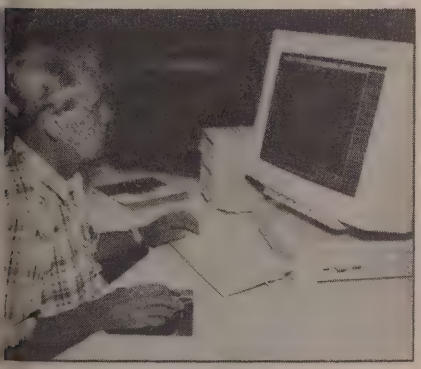
Quincy Operation Microelectronics Facility

Raytheon Company's Quincy Operation is the Raytheon Microelectronics Center of Excellence for high reliability electronic components. Product lines include hybrid digital and microwave modules, analog and power modules, Multichip Modules (MCMs), High-Density Power Supplies, Multilayer Substrates, Advanced Substrates, Microwave Integrated Circuits (MICs), Surface Acoustic Wave (SAW) Devices and Display Devices.

Raytheon Quincy Operation . . . Microelectronics Center of Excellence

Raytheon Full Service Support . . . From Design to Quality Production

The Quincy Operation is supported by other Raytheon Divisions and laboratories to ensure the latest advances in materials, integrated circuit technology, and systems design are available for your applications.



Computer Aided Engineering/ Computer Aided Design (CAE/CAD)

We can focus our full computer aided engineering/design (CAE/CAD), development and support services to meet your advanced system and component production needs. Let our Total Quality Management work for you.

Raytheon Company Produces Quality Microelectronics for Military, Space and Commercial Markets

The Raytheon Quincy Facility, Certified MIL-STD-1772, includes over 44,500 sq. ft. Class 100,000 Clean Room, and complete engineering and environmental test and evaluation equipment. Automated assembly and test support production capacity of over 400,000 hybrid circuit assemblies per year. Reliability standards for Raytheon hybrid microelectronics products adhere to MIL-HDBK-217 and MIL-SSTD-785B. Screening per MIL-STD-883 is accomplished in a dedicated Class 10,000 Clean Room area.

High throughput computer controlled robotic assembly includes machine vision.

Raytheon **Raytheon Company, Quincy Operation • 465 Centre Street, Quincy, MA 02269**
617.479.5300 FAX 617.984.4196

Raytheon

LTCC - Low Temperature Cofired Ceramic

Raytheon Company, a leading supplier of high reliability microelectronics for military, space and commercial applications, now has Low Temperature Cofired Ceramic (LTCC) design, development and production capability. LTCC is an enabling technology for high density digital and microwave components. Raytheon's state-of-the-art LTCC processing facility consists of seven core manufacturing work cells supporting Tape Blanking, via Formation, Conductor Deposition, Lamination, Burnout/Cofire and Dicing.

LTCC Applications

LTCC is particularly useful in high density applications where surface interconnection and component space is limited. Advances in materials and processes now make LTCC the cost competitive choice for:

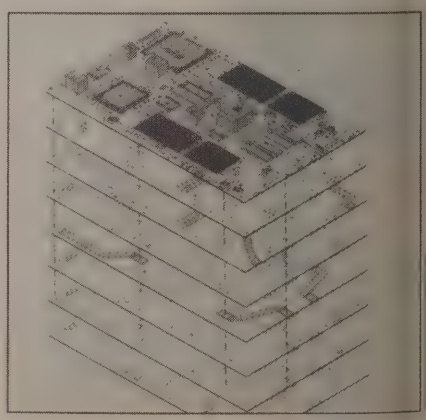
- Digital Multichip Modules (MCMs)
- Wideband RF Assemblies
- Transmit/Receive Modules
- Phased Array Radars
- Patch Radiators
- Conformal Array Architectures

High volume hybrid microcircuit production is conducted at Raytheon's Quincy Operation, the largest full service hybrid manufacturing facility in the world. The certified MIL-STD-1772 facility includes over 44,500 sq. ft. Class 100,000 Clean Room environment.

RF Receiver in LTCC Package

Raytheon Can Meet Your High Volume LTCC Production Needs

- Controlled Impedance Structures
- Up to 10 in. x 10 in. Format
- 5M mil Lines and Spaces on 3.5 mil Tape Layers
- From 6 to 40 Layers
- Complex Shapes/Profiles/Housings
- Laser Trimmable Buried Components
- 4 mil Electrical Layers
- Cofired and Postfired Paste Systems
- High & Low Temperature Solder Attach
- Thermal via Arrays for Power MMICs
- Electrical Performance Up to MMWave
- High Current Lines
- Microstrip to Stripline Transitions
- Design, Drafting, Assembly and Test



MultiLayer LTCC RF/Power Conditioning Substrate

Raytheon

Raytheon Company, Quincy Operation • 465 Centre Street, Quincy, MA 02269
617.479.5300 FAX 617.984.4196

Raytheon

Multichip Modules (MCM)

From the Total Quality Source

Raytheon MCMs . . . Complete System Solutions in a Package.

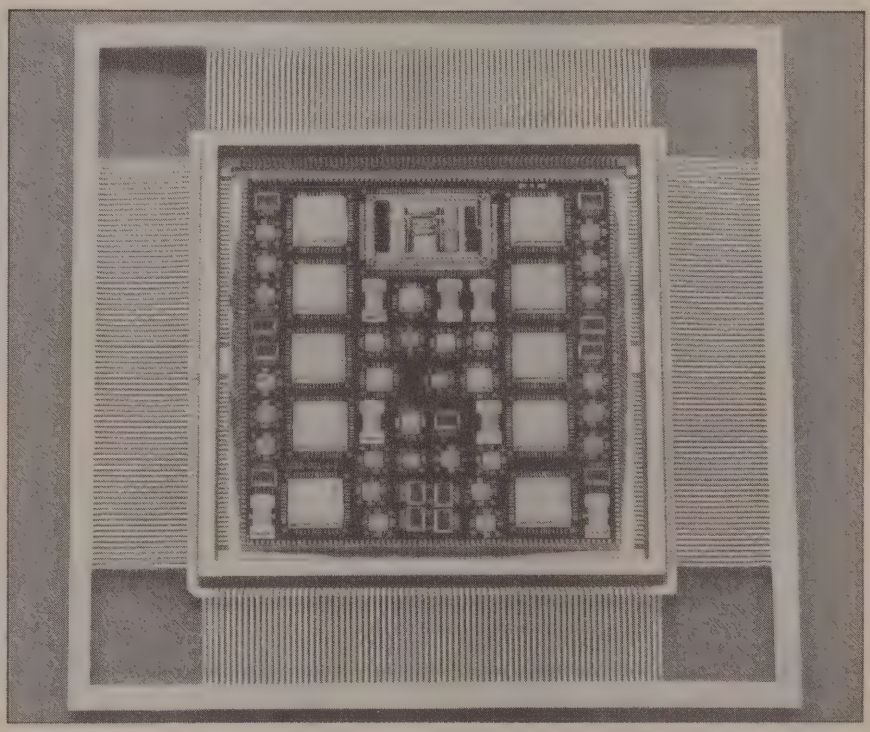
Raytheon Company, a leader in advanced electronics and systems for military, space and commercial markets, offers high quality Multichip Modules (MCMs) to meet your high performance system needs. Years of leadership in system integration, device, substrate and interconnect system development and manufacturing technology make Raytheon the premier source for your MCM applications. We offer turnkey MCM service, from design through Total Quality manufacturing and test. Let us put our strength on your most challenging MCM applications.

Complete MCM Solutions from the Total Quality Source

Come to Raytheon for Total Quality MCM solutions. We offer a full line of MCM products and services and can tailor a program to meet your speed, power, weight, and cost requirements. Raytheon MCMs include:

- High Density Memory Modules
- High Speed Digital Processors
- High Density Power Modules
- Integrated Multifunction Modules

You can use our advanced CMOS ICs, or other off-the-shelf ICs in our high performance MCM interconnect package.



Raytheon MCM-D Demonstrates 50Mhz Operation.

MCM Substrate Options

We build our MCMs from the ground up. Raytheon can design and manufacture your MCM application using high performance substrate and interconnect systems, including:

- Low Temperature Cofire Ceramic (LTCC) MCM-C
- High Temperature Cofire Ceramic (HTCC) MCM-C
- Thin Film Copper on Polyimide (Cu/pl) MCM-D
- Thin Film Copper or Aluminum on Silicon Dioxide ($Si0_2$) MCM-D
- Chip-on-Board MCM-L

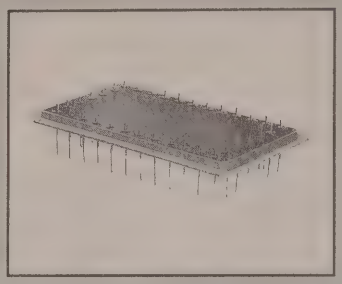
Raytheon is also developing Diamond Substrate MCM-D for advanced, high power applications.

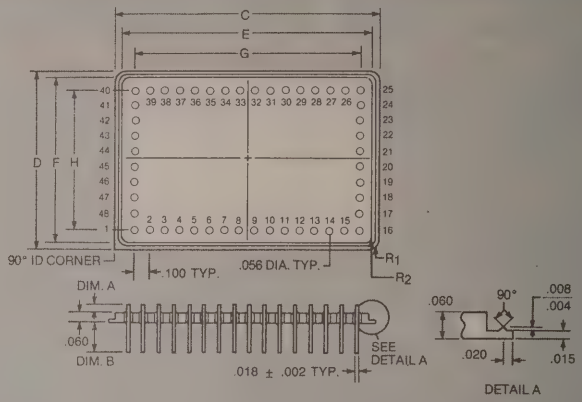
Raytheon **Raytheon Company, Quincy Operation • 465 Centre Street, Quincy, MA 02269**
617.479.5300 FAX 617.984.4196

REEVES-HOFFMAN
DIVISION DYNAMICS CORPORATION OF AMERICA

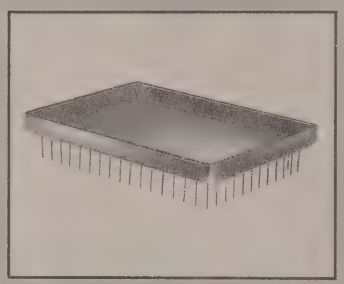
HERMETIC SEALS

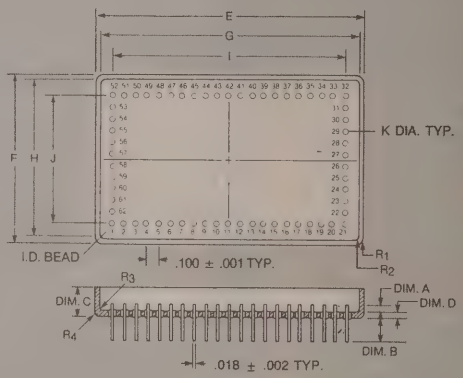
PLATFORMS
Kovar or CRS Material



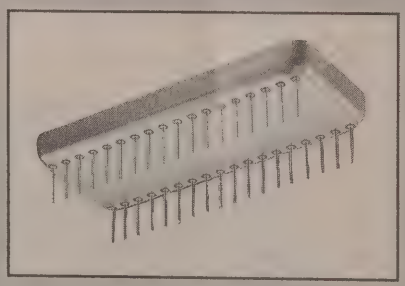


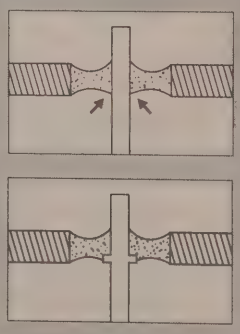
DRAWN TUB PLUG-INS
Kovar or CRS Material





SHOULDERED LEAD PLUG-INS





CONVENTIONAL LEAD:
Cracking can occur at the glass climb areas (miniscus).

REEVES-HOFFMAN SHOULDERED LEAD:
Glass seal terminates at the larger diameter pedestal portion of the one-piece lead.

Reeves-Hoffman has solved the common problem of meniscus cracks and chip-outs that occur during the handling of standard glass-to metal sealed packages in the production of microcircuits. With our new shouldered lead plug-in packages, you no longer have to worry about corrosion and salt spray failures due to exposed base metal.

The "shouldered" portion of the lead is actually a pedestal of metal around which the glass is sealed. The metal pedestal (or shoulder) strengthens the glass seal. Glass cracking and chip-outs caused by bending stress from the flexure of the lead are virtually eliminated. The result? No more salt spray failures!

For superior package durability and the confidence to meet the corrosion requirements your devices demand, contact Reeves-Hoffman for design details.

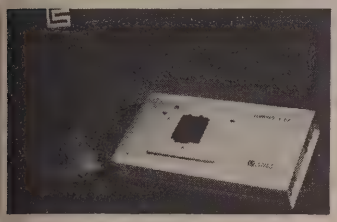
For further information or catalog, contact your Reeves-Hoffman representative or
Reeves-Hoffman Division, Dynamics Corporation of America • 400 W. North Street, Carlisle, PA 17013 USA • Phone 717-243-5929 • FAX 717-243-0079

SYSTEM GENERAL

P.O. Box 361898, Milpitas, CA 95036-1898 U.S.A.
Tel: 408-263-6667 • Fax: 408-262-9220 • BBS: 817-381-0404
1-800-967-4PRO

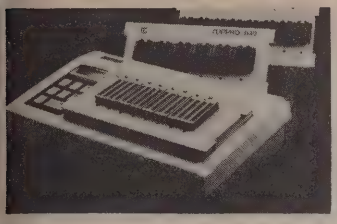
Who Is System General?

- We have been manufacturing Industrial-Grade Programmers Since 1984
- All Programmers Have Been Formally Certified By All Major IC Mfrs
- All Software Updates Are Provided FREE for the Lifetime of the Product
- We Specialize in the Support of Unusual Devices. Call for Quote
- Exclusive Auto Sense™ feature eliminates operational error
- Production Models Have the Highest Throughout in the Industry
- Our ZERO DOWN-TIME Policy Guarantees a Loaner Unit Within 24 Hours



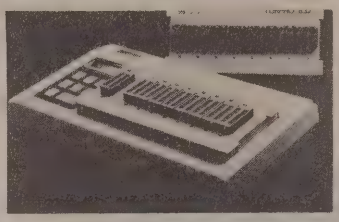
TURPRO - 1/FX

- Universal Production Pin-Driven IC Programmer
- Drop-In Replacement for Data I/O, w/Handler Interface
- Supports All Device Technologies and Packages to 84 Pins and beyond
- Vector Tests PLDs to 44 Pins
- Parallel Port File Downloads for High Speed Transfer



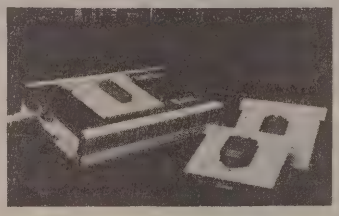
TURPRO - 840

- Universal Memory/Micro Gang/Set Programmer, 8 at a Time
- Supports 24, 28, 32, 40 & 44 Pin Devices in DIP/PLCC
- Stand-Alone and/or Computer Remote Via RS232C From PC
- Parallel Port File Downloads for High Speed Transfer
- Full Editor in Remote
- Device Auto-Id, Easy-To-Use



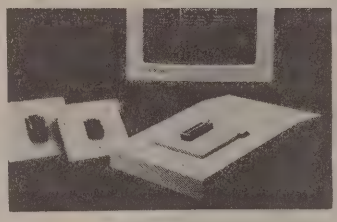
TURPRO - 832

- Universal Memory Gang/Set Programmer, 8 at a Time
- Supports 24, 28 & 32 Pin Devices in DIP/PLCC
- Stand-Alone and/or Computer Remote Via RS232C From PC
- Parallel Port File Downloads for High Speed Transfer
- Full Editor in Remote
- Device Auto-ID, Easy-To-Use



TURPRO - 1

- Universal Engineering Pin-Driven IC Programmer
- Drop-In Replacement for Data I/O
- Supports All Device Technologies and Packages to 84 Pins and beyond
- Vector Tests PLDs to 44 Pins



APRO

- Universal Engineering Memory/Micro Programmer
- Supports 24, 28, 32, 40 & 44 Pin Devices In DIP/PLCC
- Computer Remote Via RS232C From PC at 115.2 K Baud
- Full Editor
- Device Auto-Id, Easy-To-Use
- Only $895, Optional EPLD Support for $1,295

System General Product Comparison Chart

	APRO	T-832 GANG	T-832 SET	T-840	T-1	T-1/FX
Programmer User Interface						
Standalone Programming Operations	No	Yes	Yes	Yes	No	No
Must have PC to Operate	Yes	No	No	No	Yes	Yes
RS232 for Computer Remote Control	Yes	Opt	Yes	Yes	Yes	Yes
PC Interface Software	Yes	Opt	Yes	Yes	Yes	Yes
Parallel Port for High Speed Transfer	No	Opt	Yes	Yes	No	Yes
Operates with Device Handler	No	No	No*	No*	No	Yes
Programmer Device Support:						
Standard on-board RAM (Bits)	8MEG	N/A	8MEG	8MEG	256K	8MEG
E/EPROMs (24,28 & 32-pin DIP)	Yes	Yes	Yes	Yes	Yes	Yes
FLASH EPROMS to 32-pin DIP	Yes	Yes	Yes	Yes	LEVII	LEVII
EPROMs 40-pin, 16bit-wide	Yes	No	No	Yes	Yes	Yes
GANG E/EPROMS To 32-pin Dip	No	Yes	Yes	Yes	No	No
"SET" E/EPROMs to 32-pin DIP	No	Opt	Yes	Yes	No	No
GANG/SET Memories to 40-pin DIP	No	No	No	Yes	No	No
Sequential "SET" Programming	Yes	N/A	N/A	N/A	Yes	Yes
40-pin (Intel) Micros	Yes	No	No	Yes	Yes	Yes
Motorola Micros	No	No	No	Yes	No	Yes
Bipolar PROMs to 24-pin DIP	No	No	No	No	LEVII	LEVII
PLDs to 28-pin DIP	No*	No	No	No	LEVI	LEVI
PLDs to 40-pin DIP	No*	No	No	No	LEVII	LEVII
PLDs to 84-pin (& beyond)	No	No	No	No	LEVIII	LEVIII
Single PLCC Device Options	Yes	Opt	Yes	Yes	Yes	Yes
GANG PLCC E/EPROM Options	Yes	Opt	Yes	Yes	No	No
Programmer Architecture						
Pin Driver Architecture	Yes	Yes	Yes	Yes	Yes	Yes
Turbo Mapping™ Technology	Yes	Yes	Yes	Yes	Yes	Yes
Fast EPROM Programming Speeds	Yes	Yes	Yes	Yes	No	Yes
Auto Sense™ Feature	Yes	Yes	Yes	Yes	Yes	Yes
Programmer Price:	$895	$1995	$2695	$3995	$1695	$2495
Level Upgrade	N/A	$ 700	N/A	N/A	$ 600 EA	$ 800 EA

*Call For Support

Call Us Now For Turnkey Solutions

Raytheon

When Your Cathode Ray Tube Needs Are Very Special

Come to Raytheon for a wide range of special-purpose, high-performance Cathode Ray Tubes (CRTs), custom-designed for specific applications. Raytheon's Quincy Display Devices group can meet the most difficult specifications. CRTs for all military environments, air traffic control, simulators, projectors, marine radar and other high-performance commercial end uses are our specialty.

Raytheon offers extensive applications engineering expertise to tailor existing CRTs to meet your requirements, or to design various elements to meet your exacting specification.

Raytheon CRTs are available in quantities of one to thousands; from 'bare bulb' to packaged assemblies containing any of the following elements:

- Magnetic shield
- Contrast-enhancement filter
- Focus coil
- Flying leads
- Multi-pin connectors
- Protective panel
- Magnetic deflection coil
- Beam centering devices
- Encapsulation
- Input circuitry for arc protection
- Tension band or other implosion protection feature

Each of these features is carefully selected from standard product, or custom-designed to satisfy the user's requirements. Encapsulation may include two or more shock-absorbing materials (such as silicon) of differing densities, resilience, thermal conductivity and energy absorbing properties arranged to control weight distribution, minimize mechanical resonances, prevent electrical leakage and breakdown, facilitate heat dissipation, allow for differential thermal expansion, and cushion the CRT against shock and vibration.

Raytheon's RAYVUE™ organically compounded, narrow-pass contrast enhancement filters offer bandpass tailoring to match phosphor spectral response, providing the highest efficiency available.

Raytheon CRT assemblies are installed in nearly every military aircraft of the United States, NATO, and several other countries, as well as on surface ships, submarines, land vehicles and fixed ground-based installations, such as Patriot missile launchers.

Raytheon provides the 23-inch diameter tubes for the en-route air traffic control centers and the 16-inch CRTs for airport control towers ("BRITE") displays. Recently, Raytheon designed and built the high brightness ten and fourteen-inch-square "Tower Monitors" for the FAA Advanced Automation System air traffic control system. Many foreign governments also utilize Raytheon CRTs in their air traffic control systems.

Raytheon's Product Assurance department administers systems for rigorously maintaining the highest quality, reliability and safety for all its display products. The Quincy manufacturing plant is qualified to MIL-Q-9858A and MIL-1772. Our extensive in-house processes include an environmental laboratory for computer-controlled tests of shock, vibration (including random), humidity, temperature, altitude, pressure, salt spray, and solar radiation exposure. Nearby laboratories assist with tests of explosive atmosphere, sand and fungus growth.

Raytheon company is a Massachusetts-based Fortune-50 Company with operations equally divided between defense and commercial electronics, manufacturing, aircraft, major home appliances, construction and pollution control systems.

Call Raytheon when 'good enough' just won't do.

We Thrive On Challenges.

Raytheon

Raytheon Company, Quincy Operation • 465 Centre Street, Quincy, MA 02269
617.479.5300 FAX 617.984.4196

Representation in: England • Netherlands • Israel • Italy • Japan • Korea • Germany

A•1718

MICROWAVE COMPONENTS

Manufacturer	Starting EEM Page No.	Terminations			RF Switches			Phase Shifters	Mixers	Oscillators	RF Relays	Phase Detectors	Isolators	IF Amplifiers	Circulators	Frequency	
		Antenna	Coaxial	Feedthru	Diodes	Transfer	MIC									Multipliers	Synthesizers
Electro-Films Inc.	A•1721						√	√	√	√		√	√	√	√		
Mini-Circuits Labs	A•1724		√		√	√	√§	√	√§*			√§*		√§		√*	
Murata Erie North America	A•1847									√§			√§		√§		
Noise-Com Inc.	A•1848				√									√			
TRAK Microwave	A•1852									√			√		√	√	√

* MIL Spec. § Surface Mount.

Manufacturer	Starting EEM Page No.	Attenuators					Couplers	Power Distributors		Filters			Capacitors		Cable Assemblies	
		Fixed	Variable	Step	Coaxial	Programmable		Microwave	UHF/VHF	Waveguide	Coax	SAW	SLC	MLC	<6 GHz	>6 GHz
Amitron	A•1720	√§														
Electro-Films Inc.	A•1721	√		√												
JFW Industries	A•1722	√				√§										
Kay Elemetrics Co.	A•1846		√*	√*	√*	√*										
Mini-Circuits Labs	A•1724	√*	√*	√	√		√§*				√					
Murata Erie North America	A•1847						√§				√§	√			√	
Noise-Com Inc.	A•1848									√						
NTK Technical Ceramics	A•1849										√§					
Raytheon/MSD	A•1850										√§	√				

* MIL Spec. § Surface Mount.

MICROWAVE SYSTEMS & SUBSYSTEMS

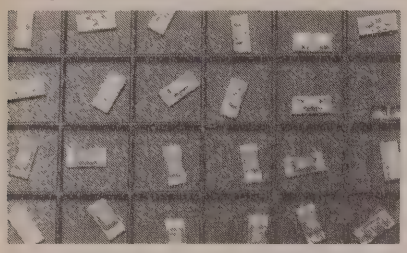
Manufacturer	Starting EEM Page No.	Amplifiers			Receivers	Generators	Modulators		Detectors
		Klystron	Microwave	Parametric			Microwave	Pulse	
Noise Com Inc.	A•1848		√						

* MIL Spec.

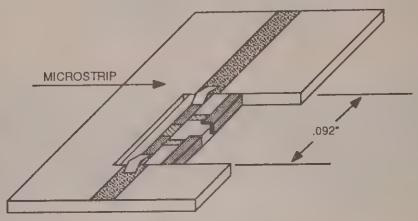
AMITRON
85 FLAGSHIP DRIVE • NORTH ANDOVER, MA 01845 • TEL.: 508—686-1882
FAX: 508—686-0622

THICK FILM MICROWAVE COMPONENTS

Chip Attenuators



- Termination Resistors
- D.C. "Ground Block" Terminations
- Solderable Ground Planes
- Wire Bondable or Solderable Input and Output Conductors
- 1 to 15dB Stock (-01)
- Custom 2 to 6 weeks delivery

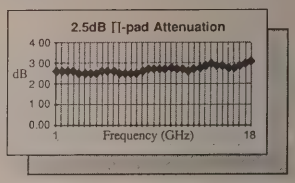


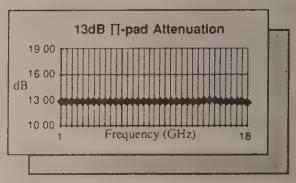
Π CHIP ATTENUATOR

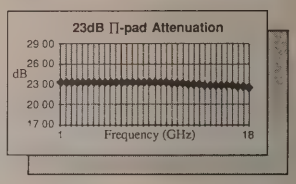
Standard Features Include (-01)
Chip Construction designed for MIC assembly
- Ground plane metalization suitable for soldering or epoxying
- Wire or ribbon bondable gold top conductor lines
- Size: Length .092"
  Width .045" Thickness .010"

Ordering Instructions for π-Pads:
Amitron Part Number = AMP-XX.XdB-01
AMP = Amitron π-PAD
XX.X - Desired Attenuation
01 = Standard Features

ATTENUATOR PERFORMANCE

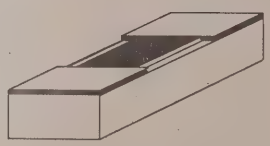






Chip Resistors

- Nickel Barrier
- Wide Range 50 Miliohms to 1 Gigaohm.
- Laser or Abrasive Trimmed to Tight Tolerances.
- Custom or Standard Sizes
- Many Available from Stock
- Specials for Microwave Applications



AR 1000 Series
(No Wrap)

AMITRON Series	Width ±.003"	Length ±.003"	Thickness Note 1
AR1001	.020	.040	.010
AR1002	.025	.050	.010
AR1003	.050	.050	.010
AR1004	.025	.100	.010
AR1005	.050	.075	.010
AR1006	.100	.050	.010
AR1007	.020	.020	.010
AR1008	.100	.100	.020
AR1009	.050	.050	.020
AR1010	.120	.240	.030

AR XXXX / X / 000-0 / XX / X

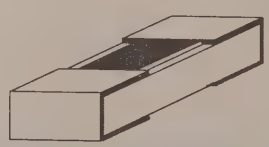
CHIP DESIGN:
X XXX
- Chip Size (see charts)
- Resistor Metalization:
  1 = standard resistor
  2 = dual wrap resistor
  3 = single wrap resistor

OPTIONS:
O = No Options
T = SN62 soldering tinning
M = Back Metalization
UP = Unpassivated
R = Pt/Au input metalization

TOLERANCES (±):
D5 = .5%
01 = 1%
02 = 2%
05 = 5%
10 = 10%

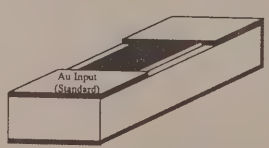
TERMINATION METALIZATION:
Q = Palladium/Silver
R = Platinum/Gold
S = Platinum/Palladium/Gold
T = Gold
QN = Nickel

RESISTANCE SPECIFICATIONS:
First three (3) digits represent significant figures, digit after the dash(-) specifies the number of zeros. If fractional values of an Ω are required, the letter "D" shall be substituted for one of the significant digits and succeeding digits of the group shall represent significant figures.



AR 2000 Series
(Dual Wrap Termination)

AMITRON Series	Width ±.003"	Length Note 1	Thickness Note 1
AR2001	.020	.030	.015
AR2002	.020	.040	.015
AR2003	.030	.050	.015
AR2004	.050	.050	.015
AR2005	.050	.075	.015
AR2006	.050	.100	.015
AR2007	.050	.150	.015
AR2008	.100	.100	.015
AR2009	.050	.030	.015
AR2010	.015	.040	.010



AR 3000 Series
(Single Wrap Termination)

AMITRON Series	Width ±.003"	Length Note 1	Thickness Note 1
AR3001	.020	.030	.015
AR3002	.020	.040	.015
AR3003	.025	.045	.010
AR3004	.025	.045	.015
AR3005	.055	.065	.015
AR3006	.055	.065	.025
AR3007	.025	.045	.025
AR3008	.020	.040	.010
AR3009	.050	.065	.025
AR3010	.102	.110	.010
AR3011	.050	.050	.020
AR3012	.020	.040	.025
AR3013	.055	.065	.010
AR3014	.025	.045	.025

Note:
1. Tolerances vary with configuration; consult factory for details.

THIN-FILM MICROWAVE COMPONENTS

Metalized Plates

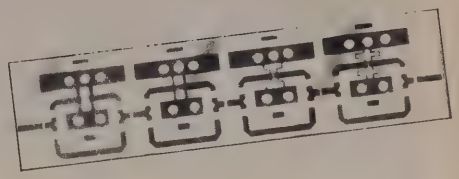
Electro-Films, Inc. offers a wide variety of metalized substrates suitable for Microwave Hybrid and Microwave Integrated Circuit applications. E.F.I.'s unique, economical fabrication process provides an exceptional range of dimensions, metalization and circuitry. Typical applications include: amplifiers, oscillators, UCO's, limiters, couplers, filters, attenuators, with frequency response thru 18 GHz and into the millimeter wave length range.

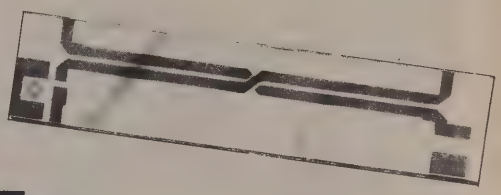
SUBSTRATE MATERIALS

- Alumina (as fired or polished) standard thicknesses of .010", .015", and .025", Dielectric Constant 9.8 typ. @ 25°C—10 GHz
- Quartz—BeO, Various thicknesses
- Sizes— Up to 4.1" x 3.3"

METALIZATION

- Sputtered in various combinations of NiCr, Cr, Ni, Au, Cu, TaN, TiW, Ti, Mo, Pd, TaW
- Electroplated — Cu, Ni, Au, up to 300 micro-inches
- Excellent adhesion (typically 7-10,000 lbs./in^2)
- One, Two or Six Surfaces
- Through Holes — metalized or non-metalized

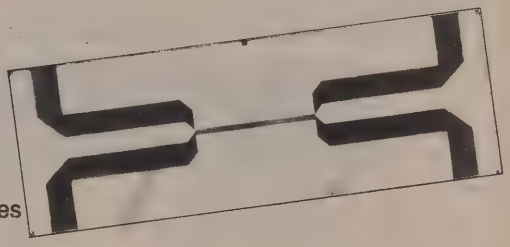




Patterned & Etched Substrates

Electro-Films, Inc. can handle the transition from a circuit requirement to a finished thin-film micro-component with in-house artwork and photo mask generation. E.F.I.'s processing techniques and quality control guarantee optimum quality in prototype or production quantities. E.F.I. is a thin-film specialist with unequalled productivity.

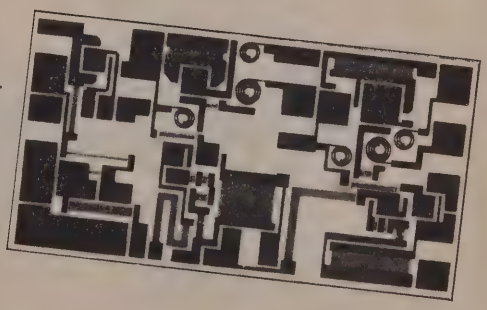
- Conductor only or resistor conductor patterns
- Resistive films — high stability NiCr or self passivating TaN
- In house laser machining for round or odd shaped substrates
- Metalized through holes
- Patterned edges
- Planar Inductors
- Lange couplers with fine line patterns, line and space tolerances as tight as ±.000050"
- Attenuator chips



Precision Chip Resistors

These precision Chip resistors are edge trimmed to tolerance providing excellent high frequency response. Edge trimming leaves a solid symmetrical block resistor void of any laser cuts eliminating the capacitive effects from a plunge or "L" cut trim.

- Resistance range 20ohm to 1 Kohm edge trimmed, 1 Kohm to 1 meg ohm non-edge trimmed
- Automatic laser trimming to ±.05% absolute
- Edge trim for high frequency applications
- Gold or solder coated terminations over a nickel barrier
- TCR ±50, 25 or 10 PPM °C — NiCr ±200, or100 PPM °C — TaN
- Single side or wrap around terminations
- Sizes — .020" x .040" to .100" x .100".



For other components, see our ad under "Resistor Products"

ELECTRO-FILMS INCORPORATED

111 GILBANE STREET, WARWICK CENTRAL INDUSTRIAL PARK, WARWICK, RI 02886
Tel. (401) 738-9150 • FAX 401-738-4389

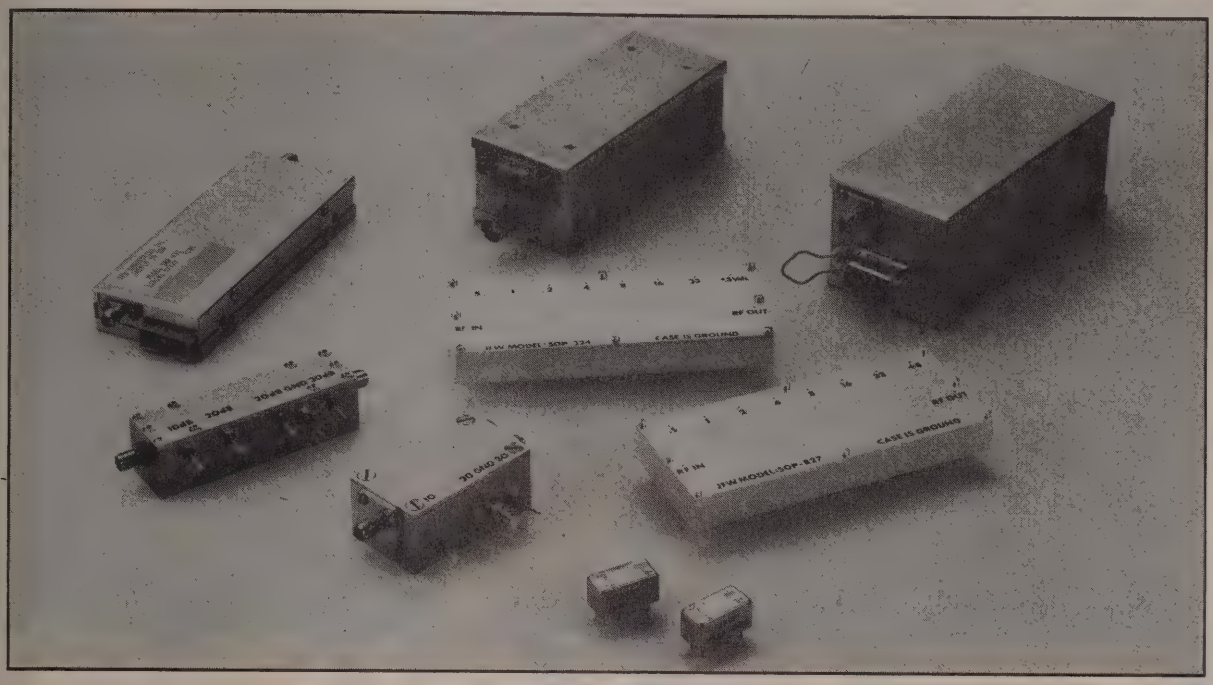
High Power Fixed Attenuators & Terminations

Model #	Frequency	Value	Power
Fixed Attenuators			
50FHB-XXX-5	DC-4 GHz	1-30 dB	5 Watts
50FHB-XXX-10	DC-4 GHz	1-30 dB	10 Watts
50FH-XXX-5	DC-2000 MHz	1-20 dB	5 Watts
50FH-XXX-10	DC-2000 MHz	1-20 dB	10 Watts
50FHC-XXX-20N	DC-4 GHz	1-30 dB	20 Watts
50FHC-XXX-50N	DC-4 GHz	1-20 dB	50 Watts
50FHC-XXX-50N	DC-3 GHz	21-30 dB	50 Watts
50FH-XXX-30	DC-2000 MHz	3,6,10,20 & 30 dB	30 Watts
50FH-XXX-50	DC-2000 MHz	3,6,10,20 & 30 dB	50 Watts
50FH-XXX-100	DC-1000 MHz	3,6,10,20 & 30 dB	100 Watts
50FHE-XXX-200	DC-1000 MHz	3-60 dB	200 Watts
50FH-XXX-300	DC-1000 MHz	1,2,3,6,10,20 & 30 dB	300 Watts
Terminations			
50T-XXX	DC-2000 MHz	50 Ohms	5 Watts
50T-XXX	DC-2000 MHz	50 Ohms	30 Watts
50T- 032-XXX	DC-1000 MHz	50 Ohms	100 Watts
50T-133-XXX	DC-1000 MHz	50 Ohms	200 Watts
50T-069-XXX	DC-1000 MHz	50 Ohms	300 Watts

JFW Industries, Inc.
5134 Commerce Square Drive
Indianapolis, IN 46237
Tel: (317) 887-1340 • Fax: (317) 881-6790

Specialist in Attenuation and RF Switching

See our high power attenuator & termination advertisement in this section.



Programmable Attenuators

Model #	Frequency	Range	Steps
Solid State			
50P-172	20-300 MHz	0-63 dB	1 dB
50P-323/D	20-500 MHz	0-63 dB	1 dB
50P-609	20-1000 MHz	0-63.5 dB	.5 dB
50P-686	20-1000 MHz	0-127 dB	1 dB
50P-827	10-600 MHz	0-63.5 dB	.5 dB
Relay			
50P-033	DC-1000 MHz	0-10 dB	1 dB
50P-034	DC-1500 MHz	0-100 dB	10 dB
50P-076	DC-1000 MHz	0-127 dB	1 dB
50P-077	DC-1000 MHz	0-63 dB	1 dB
50P-591	DC-3 GHz	0-85 dB	1 dB
50P-766	DC-5 GHz	0-70 dB	10 dB
50P-832	DC-1000 MHz	0-127 dB	1 dB
Analog			
50AP-016	50-1000 MHz	0-25 dB	continuous
50AP-059	20-1000 MHz	0-25 dB	continuous
75AP-008	20-600 MHz	0-25 dB	continuous
75AP-012	20-1000 MHz	0-25 dB	continuous

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See our high power attenuator & termination advertisement in this section.

THE SOLID SOURCE

signal processing components dc to 8 GHz

In today's tough competitive military and commercial markets, Mini-Circuits provides you that extra edge. From your initial design to full-scale production, we offer total support to satisfy or exceed your specific requirements.

- **WIDEST SELECTION OF COMPONENTS** 14 product lines with more than 1,000 off-the-shelf catalog models.
- **EXTENSIVE DATABASE** actual performance data on all catalog items plus 5,000 custom models.
- **STRONG APPLICATIONS SUPPORT** an engineering team ready to recommend optimum catalog models, discuss custom designs, and provide solutions to your specific needs.
- **ONE-WEEK SHIPMENT GUARANTEE** catalog items will be shipped in one week or less or we'll deduct 1% each day we're late.
- **UNRIVALED QUALITY** statistical process control with 4.5-sigma repeatability on most models, 5-year guarantee on all Ultra-Rel™ mixers.
- **UNMATCHED PRICES** often thirty to fifty percent lower than the competition.
- **HIGH-VOLUME CAPABILITY** worldwide manufacturing facilities to supply large-quantity production needs on short notice.
- **CONSISTENT NEW PRODUCT DEVELOPMENT** to meet our obligation to support your future designs.

• MIXERS • POWER SPLITTER/COMBINERS • AMPLIFIERS • ELECTRONIC ATTENUATORS • DIGITAL ATTENUATORS • ATTENUATORS/TERMINATIONS • FILTERS
• DIRECTIONAL COUPLERS • RF TRANSFORMERS • I&Q/QPSK MODULATORS • PHASE DETECTORS • FREQUENCY DOUBLERS • LIMITERS • SWITCHES/DRIVERS

finding new ways...
setting higher standards

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For detailed specs on all Mini-Circuits products refer to • THOMAS REGISTER Vol. 23 • MICROWAVES PRODUCT DIRECTORY • EEM • MINI-CIRCUITS' 740-pg HANDBOOK.

A•1724

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* Performance curves and detailed data for Mini-Circuits products are contained in the RF/IF Designers Handbook. Write or call for your free, personal copies.

In Stock...Immediate Delivery

For custom versions of standard models consult our applications dept.

Using This Guide

Over 1000 Mini-Circuits IF/RF/Microwave Signal-Processing components are completely specified and described in this Guide. These Products are all available with guaranteed shipment of one week.

The large number of available models is offered so that the design engineer may select a model that closely fits the application requirement. In situations where there is a need for special electrical performance, mechanical configurations, environmental screening, or very low cost units, please contact our Applications Department. See page 39. In many cases, we produce special components in less than two weeks.

table of contents

The table of contents on page two lists product sub groups with corresponding specification pages and product group technical information including articles.

model number index

In each product group, model numbers are listed in alphanumeric order with page references to electrical specifications. All surface-mount models are highlighted with an indicator. See page 5.

SMD

Surface-mount devices are included in almost every product group. See model number index page 5. Product group specification sections indicate non-hermetic and tape and reel package availability. Technical articles are listed on pages 19 through 22.

tape and reel packaging

Designers applying automated assembly procedures for surface-mount components will find a listing for tape width, reel size, package number, and number of devices on a reel; "footprints" for the various packages are shown.

designer kits index

An assortment of models within a product group are listed and offered at discounted prices for breadboard and prototype designs. See page 37.

specifications

The specification pages in each section include, for every model, a photo, complete electrical specifications, price, page number for CAPD, schematic diagram, pin connections (for pc board models) or connector markings, and reference designations for the case style and outline drawing. Each model within a series has a case style and outline drawing reference. Comments applicable to the specifications are listed under Notes which appear for each page spread.

Using the latest industry criteria for specifying mixer and I and Q modulator performance, "typical" conversion loss has been deleted and replaced with $\overline{x}$ and σ (sigma) average value and standard deviation of values for conversion loss. A discussion of these new parameter listings is given. See page 17.

PARTNER PROGRAM℠

A revolutionary new concept that lets you lower the cost of doing business in the 90's. A true partnership is described where your savings keep growing year in and year out. Details of the program and the easy procedure to join are simply explained. See pages 11 through 13.

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Mini-Circuits

case style outline drawings

Case Style and Outline Drawings include information on case dimensions, tolerances, case material and finish, bracket options and "footprint" sketches for pc board design using surface-mount units. See page 25.

The information is arranged in tabular form with alphanumeric reference designations. Each alpha designation refers to a particular outline drawing. A photo of each case style is shown and designated on the model specification page.

computer-automated performance data (CAPD)

This symbol signifies that computer-automated performance date, CAPD,is available. A significant number of pages in our Handbook are devoted to Mini-Circuits' exclusive computer-automated performance data. These pages describe the most complete detailed data and performance curves ever available on characteristics of over 1000 catalogue products. Page numbers referencing this data appears on each product specifications page.

ULTRA-REL™ MIXERS
5-YR. GUARANTEE *

This symbol identifies products that are manufactured with extra reliability. See page 15 for a complete explanation.

prices

The prices shown are the U.S. unit list prices for the quantity indicated. For unit prices in higher quantities, and for a formal quote, contact our nearest distribution center, authorized local distributor, sales office or the factory. See back cover.

ordering information and warranty

For warranty, terms of payment, shipping instructions, and one-week guaranteed shipping conditions. See Pages 9 and 10.

technical assistance

For literature requests, assistance in selecting models, understanding model specifications, requesting additional model performance data, contact our Applications Engineering Department. See page 39.

sales assistance

For assistance in purchasing products, obtaining quotes, opening up an account, requesting order status information, assistance in obtaining same or next day delivery, contact our Sales Department.

NSN numbers

Specification pages contain a listing of Mini-Circuits' models that have been assigned a National Stock Number (NSN).

listing of reps, authorized distributors distribution centers

A complete list of Mini-Circuits' sales representatives, local distributors, and major Distribution Centers puts you in immediate contact with our Sales Support team to answer questions, assist in component selection, and expedite orders. See back cover.

In Stock...Immediate Delivery

For custom versions of standard models consult our applications dept.

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Quality Excellence

Quality Excellence is the foundation for the total operation of our business and the keystone of our goal of customer satisfaction. It is, therefore, our policy to:

- Consistently provide products and services that will exceed the quality expectations of our customers.
- Actively pursue ever-improving quality through process improvement programs that will enable each member to do their job right the first time, and with a continuing level of quality improvement.

Quality will continue to be a major, strategic thrust in Mini-Circuits. It lies at the heart of everything we do.

Through active planning in every function in the company, we will strive to provide products and services that consistently meet all quality, schedule, and cost objectives. Furthermore, we will dedicate ourselves to continually improving the quality of our products and services by focusing on our processes and procedures.

Our ability to develop and administer a disciplined system for achieving continuous quality improvement is at the heart of accomplishing all strategic business objectives and indeed will determine how successful we are in securing our future.

That success will depend on releasing the power of each individual to contribute in a positive, productive working environment through enthusiastic and conscientious efforts for quality excellence and customer satisfaction in everything we do.

Every member is a part of our quality system:

- Each of us will strive to understand and satisfy the quality expectations of our customers (meaning the next internal organization in the process as well as the eventual end-customer).
- Each of us will strive to identify and eliminate the sources of error and waste in our processes and procedures.
- Each of us will aid the quality-planning and improvement efforts of others for the good of the corporation as a whole.
- Each of us will know what is expected individually and then surpass it.
- Each of us will take ownership of problems and resolve them.
- Each of us will voice opinions freely in efforts to overcome obstacles and increase creative contributions to our business.
- Each of us will track progress.

Each leader, manager, and officer is responsible for:

- Communicating our quality policy to each member.
- Clarifying specific responsibilities for quality.
- Developing and reviewing strategic quality plans and objectives on an on-going basis.
- Implementing a quality management system to carry out the plans and achieve objectives.
- Monitoring and continually improving the level of customer satisfaction.
- Monitoring and continually improving the defect and error rate of internal processes and systems.
- Developing joint quality plans with suppliers and other business partners.
- Implementing, funding, and reviewing specific quality improvement programs.
- Providing education and training in quality disciplines for all members.

Harvey Kaylie

HARVEY KAYLIE
President and Chief Executive Officer

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Wharf Road
Frimley Green
Camberley, Surrey GU16 6LF
England
44-252-835094

☐ AMERICAN EXPRESS VISA
☐ MASTERCARD/VISA/ ACCESS/EUROCARD

ordering and delivery information

Refer to the rep listing in this handbook for Mini-Circuits worldwide network of sales representatives and distributors ready to serve your needs, supply your orders, and answer your questions promptly and courteously.

Federal supply code: 15542

how to order

Your local representative or distributor is the contact for both sales and service assistance for products listed in this catalog. These local offices have the latest price and delivery information on all models. They can also provide details on ordering procedures, service information and application engineering data. Your order may be sent directly to Mini-Circuits or to any of the local sales offices listed.

Prices listed in this catalog are domestic F.O.B. Brooklyn, New York. Mini-Circuits reserves the right to change specifications, models, prices, or designs without prior notice and without liability for such changes. Minimum order $50.00.

shipping instructions

Shipments can be made by either air or surface carriers. If specific shipping instructions do not accompany the order, Mini-Circuits will specify the carrier to be used. For air shipments, Mini-Circuits has arranged for substantial discounts with Federal Express.

terms

Net 30 days from date of invoice. If credit is not established with Mini-Circuits, shipments will be made C.O.D. (cash on delivery) or prepaid. We also accept most major credit cards. If prepaying, please include freight.

warranty

Scientific Components Corporation, Mini-Circuits division, warrants each product manufactured by Mini-Circuits to meet all published specifications and to be free from defects in material and workmanship. The Company's liability under this warranty is limited to repair, adjustment and/or replacement of defective parts returned, freight paid by Buyer, to the factory within a period of one year from date of shipment from the factory unless a shorter period is specified. International customers may ship to the Company's nearest Distributor.

Damage by misuse or abnormal conditions of operation, or evidence of partial or complete disassembly voids this warranty. SINCE MINI-CIRCUITS HAS NO CONTROL OVER CONDITIONS OF USE, NO WARRANTY IS MADE OR IMPLIED AS TO SUITABILITY FOR CUSTOMERS' INTENDED USE. BEYOND SUCH PERFORMANCE SPECIFICATIONS AS ARE MADE A PART OF THE PURCHASE ORDER.

Equipment shipped F.O.B. Mini-Circuits' plant or Distribution Center shall become the property of the Buyer upon delivery to carrier. Damage in shipment should be handled by the Buyer directly with the carrier by immediately requesting carrier's inspection upon evidence of damage in shipment. A fee will be charged to the Buyer to cover the costs of inspection and test of units returned under this warranty and subsequently found to meet specifications or to be faulty for reasons which are not Mini-Circuits' responsibility. This warranty excludes all other warranties expressed or implied. Mini-Circuits shall not be liable for any special indirect or consequential damages.

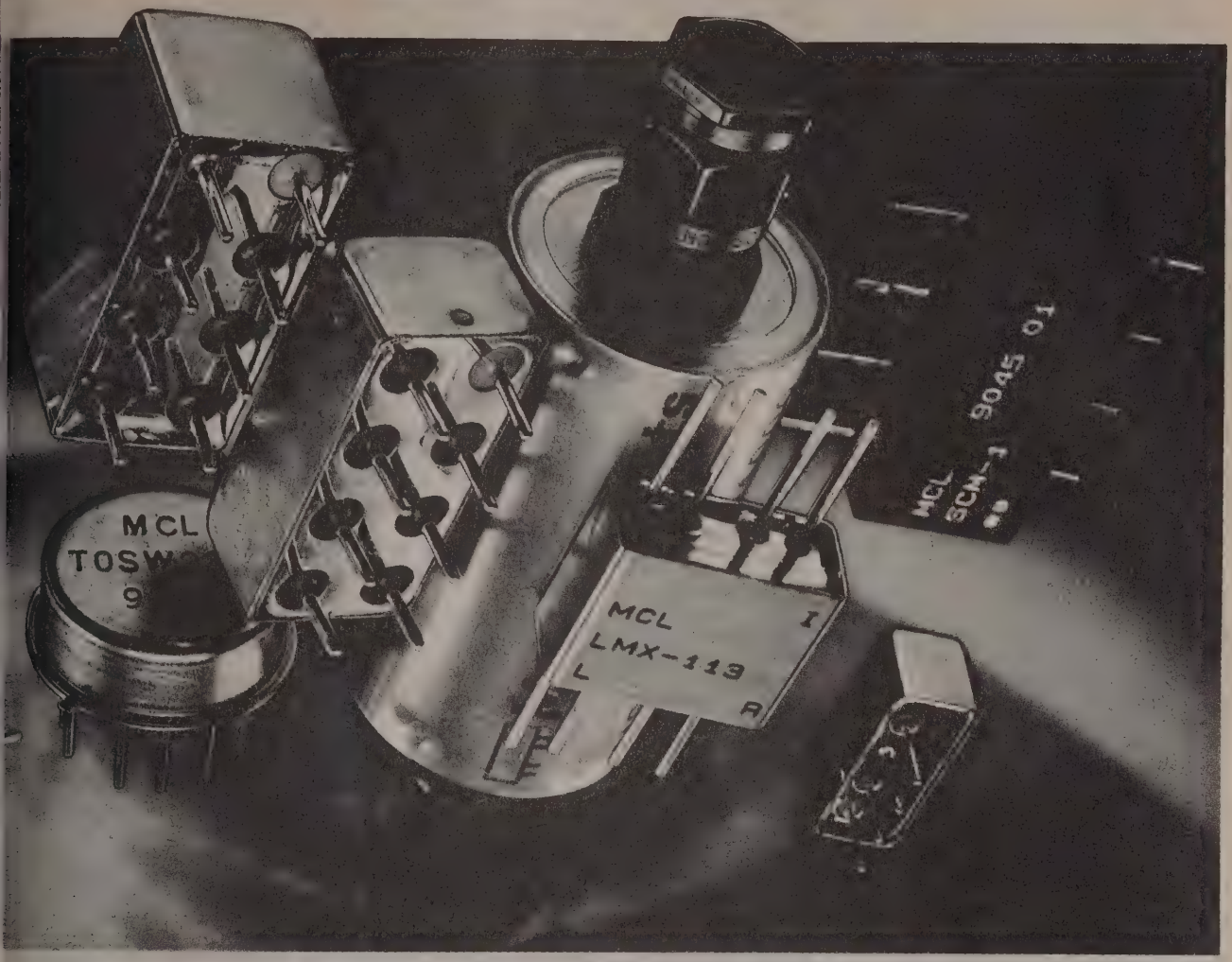
ALL MINI-CIRCUITS SHIPPED WITHIN

All Mini-Circuits' components listed in the latest published catalog, in all configurations and connector types, will be processed and shipped within one week after an order is received, or if the order calls for scheduled shipments, we will ship on or before the due date. If we're late, we'll deduct one percent per day from your bill (maximum deduction up to 25%, as allowed by law): but don't count on this discount since we intend to meet each and every scheduled shipment.

What makes this fast turnaround possible? First, fast manufacturing throughput achieved using powerful statistical process-control techniques coupled with the latest computer-automated production and test equipment. Second, a worldwide distribution network, with a major Distributor Center in the U.S. and in England, backed by 16 regional distributors.

We wholeheartedly encourage you to place your orders with your local distributor. But let's be realistic. Although our distributors stock our products, not every distributor will carry every single catalog item, especially in substantial quantities. In such instances, when the need for components is urgent, contact a Mini-Circuits' Distribution Center listed and you will be covered by our shipment guarantee.

F144 REV. B



RF/IF CATALOG PRODUCTS ONE-WEEK... GUARANTEED!

United States
△Mini-Circuits

NEW YORK	MISSOURI
8AM-5:30 PM EST	9AM-8PM EST
(phone) 800-247-6343	(phone) 800-654-7949
(phone) 718-934-4500	(phone) 417-335-5935
(fax) 718-332-4661	(fax) 417-335-5945

Europe
△Mini-Circuits/Dale
8:30 AM-5:30 PM
(phone) 44-25-283-5094 (fax) 44-252-837010

Guaranteed order processing is another expression of Mini-Circuits' dedicated effort for world-class quality...meeting and exceeding customers' expectations. Write, phone, or fax your order and be confident that it will be shipped on time, every time by Mini-Circuits

CONDITIONS OF GUARANTEE

- ORDER PLACEMENT—guarantee applies only to orders placed with Mini-Circuits' distribution center△ or with a participating distributor.*
- ORDER REQUIREMENT—guarantee starts after all details of the purchase order is received complete.
- SHIPMENT TIME—guarantee applies for work days Monday through Friday, holidays excluded.
- TRANSPORTATION—does not apply to situations where shipping is inhibited due to strikes, weather, or conditions beyond our control.
- GOVERNMENT REGULATIONS—does not apply to purchase orders inhibited by government rules, regulations, export licenses, and/or customs approval.
- QUANTITIES—guarantee applies to normal distribution quantities, which vary according to product line.
- CREDIT RATING—guarantee limited to companies with approved credit rating at time of shipment.
- LETTERS OF CREDIT—guarantee limited to meeting terms of LC.

finding new ways ...
setting higher standards

Mini-Circuits

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Join Mini-Circuits

PARTNER PROGRAM℠

GUARANTEED SAVINGS...

A Revolutionary New Concept that lets you lower your cost of doing business in the 90's.

How the program works*...

The Partner Program℠ pricing concept is simple... the more you buy, the lower the price. Every time you make a purchase of a Mini-Circuits model, the price you pay corresponds to the total quantity of the present purchase plus the quantity of all your previous annual purchases of the same model going back to January 1, 1990 (see formula below). As the cumulative total enters into a higher quantity price break, the unit price of your present purchase is lowered, and it never stops. You can enjoy a lifetime of volume quantity price reductions on all of our catalog, and most of our custom products.

$Qty_A = Qty_B + Qty_C$

A = price calculation
B = base-cumulative annual
C = present purchase

*Subject to Partner Program℠ Terms and Conditions.

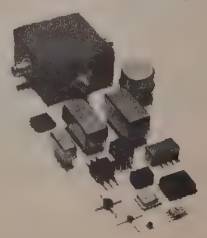
The Partner Program℠ makes sense

Today, everybody is talking about the highly competitive business environment and the global challenges of the 90's. In typical Mini-Circuits tradition, we're not talking... we're taking action.

The Partner Program℠ is our way of sharing risks and earning the rewards of doing business with you.

Mini-Circuits is committed to a total partnership for improving quality and reducing manufacturing thru-put time. The end result, lower costs. As Partners, we both share in these savings.

That's what true partnership is all about.



YEAR IN AND YEAR OUT!

Your savings keep growing...

When you start the Partner Program℠ the cumulative quantity purchased from Mini-Circuits before January 1, 1993, is the base quantity for computing prices. The base quantity increases each year as additional purchases are made. Savings occur as the base quantity throws your present purchase to a higher quantity price break.

For example, consider the purchase of 350 pieces of model GAR-1 in 1992, 1993, and 1994. In 1993, the unit price would be at the 700 piece level and in 1994 at the 1050 piece level. If in 1995, only 100 pieces are purchased, the unit price would be at the 1150 quantity level and your savings would continue.

Joining the Partner Program℠

The program is limited to qualified customers at no cost or obligation. Simply request a Partner Program℠ kit to receive details, terms and conditions, and registration form.

We'll take care of all the details and manage the statistics for your account.

You can place your orders in the usual manner with Mini-Circuits or any Mini-Circuits Distribution Center, or authorized participating distributor. Your purchases will be tallied and tracked in the Mini-Circuits computer. In 1993, you will be eligible to receive automatic discounts based on your purchases in 1992.

ACT NOW!

We're ready to start building this far-reaching program of long term partnership ***now.***

Join the ***Partner Program℠ TODAY!***

To find out more about this offer see the Terms & Conditions defined on the next page.

finding new ways...
setting higher standards

Mini-Circuits™ WE ACCEPT AMERICAN EXPRESS AND VISA

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For detailed specs on all Mini-Circuits products refer to • THOMAS REGISTER Vol. 23 • MICROWAVES PRODUCT DIRECTORY • EEM • MINI-CIRCUITS' 740-pg HANDBOOK.

F149 Rev. Orig.

Mini-Circuits

PARTNER PROGRAM℠

TERMS & CONDITIONS

This program is offered to qualified customers for the purpose of maintaining a mutually beneficial long term relationship.

As a participant of this program, you will share in the results of Mini-Circuits' commitment to quality by earning cumulative annual quantity price break reductions on all of your Mini-Circuits purchases.[1]

As the cumulative total enters into a higher quantity price break, the unit price of your present purchase is lowered, and it never stops. You can enjoy a lifetime of volume quantity price reductions on all of our catalog, and most of our custom products.

For a particular purchase of quantity C in the present year, the price shall correspond to quantity A according to the following formula.

QTY A = QTY B + QTY C

where QTY B = cumulative annual quantity purchased in preceding years as of January 1, 1990.

joining the program

Qualified customers automatically join the Partner Program by making a purchase of a Mini-Circuits model[2] from a Mini-Circuits distribution center, authorized local distributor, or from the factory direct.

qualified customers

The program is limited to original users. Companies reselling Mini-Circuits products do not qualify. Original users shall mean approved companies, universities, schools, organizations, a division or subsidiary of a corporation, and a department or location of a government agency. For corporations issuing a corporate contract to Mini-Circuits, a division of the corporation may combine quantities purchased by other divisions for cumulative total quantity calculations. In absence of a corporate contract, each division must join the Partner Program℠ individually.

maintaining qualification

A good credit standing with Mini-Circuits is a criteria to remain a participant of the program.

purchase location eligibility

Purchases from Mini-Circuits or a Mini-Circuits distribution center qualify for the program. Purchases from an authorized participating distributor qualify for the program when documentation of purchase is supplied to Mini-Circuits.

product eligibility

All catalog models and most special models are included in the program.

product ineligibility

Purchases made for the following do not qualify for the program: special testing, lot testing, serializing, source inspections, and qualification testing. Furthermore, purchases during special promotions or for multi-year or special contracts do not qualify. Highly specialized custom designed models may not be included in the program. Please consult with the Partner Program manager.

purchase quantities

Quantities credited to the program include only the net quantity of each model shipped to the customer in a specific calendar year. Different models may not be combined.

minimum purchase quantities

The base year quantity equals the total cumulative consecutive annual quantity purchased in preceding years as of January 1, 1990. However, if the quantity purchased for a model in a year is less than 2% of the quantity purchased in the previous year, then the cumulative total for the previous years shall revert to zero, i.e., base year quantity equals zero.

partner program changes

Mini-Circuits reserves the right to make changes to the program without prior notice.

partner program validity

The partner program is void where prohibited by law.

[1]Subject to the provisions of the terms and conditions given herein.
[2]All catalogs and most special products are eligible.

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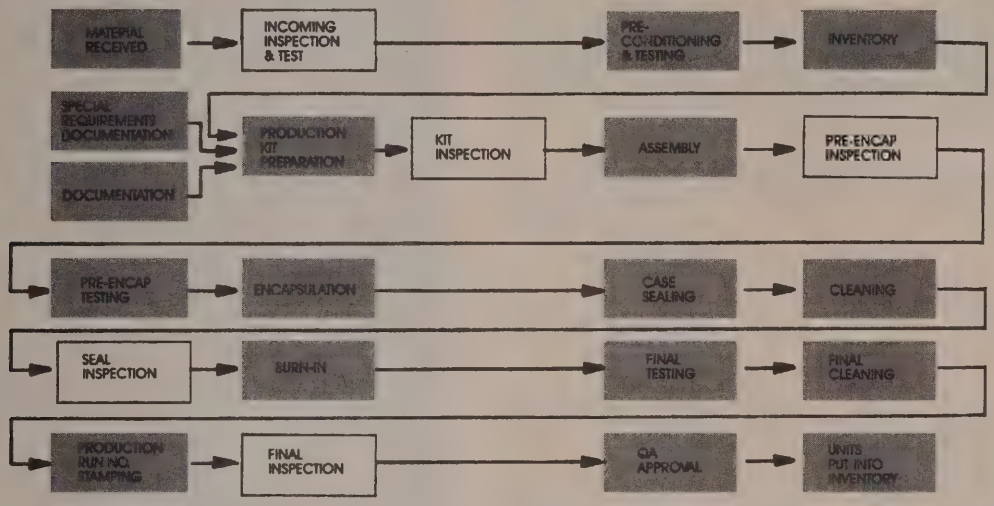
Mini-Circuits Guarantees Quality

Although we have gone beyond our past objective of exceeding 0.1% AQL- no rejects, not even one per 1000 units - this is not satisfactory anymore. Our present commitments are to achieve a Cpk of 1.5, or 4.5 sigma: not even 4 rejects per million units. Mini-Circuits' process controls using SPC, pre-control and design of experiments reduce variability of performance. "Skinny Sigma" is our way of life and it can be yours. Specify Mini-Circuits RF signal processing components to reduce your inspection costs and improve your production yields.

How Mini-Circuits achieves high reliability



Environmental Specifications

All MCL products are manufactured under exacting quality assurance and control standards. As a minimum they will meet published specifications after being subjected to any or all of the following physical and environmental tests of MIL-STD-202, unless otherwise noted. For amplifiers, see the table of environmental specifications at the beginning of the amplifier section of the Handbook.

Rating or Test	MIL-STD-202		Package Type			
	Method	Condition	Hermetic	Nonhermetic		
				Metal	Plastic	Connectored
Temperature Operating, °C (1)	—	—	-55 to 100	-55 to 100	-20 to 85	-55 to 100
Temperature Storage, °C (1)	—	—	-55 to 100	-55 to 100	-55 to 100	-55 to 100
Altitude: 150,000 feet	105	E	Yes	Yes	Yes	Yes
Humidity: 90% RH, 65°C	106	—	Yes	Yes (2)	(3)	Yes (2)
Thermal Shock: -65 to 125°C	107	B	Yes	Yes	-55 to 100	-55 to 100
Fine Leak, atm-cc/s	112	C	1×10^{-7}	Not Appl.	Not Appl.	Not Appl.
Gross Leak, atm-cc/s	112	D	1×10^{-5}	Not Appl.	Not Appl.	Not Appl.
Drop: random, 45 minutes	203	—	Yes	Yes	Yes	Yes
Vibration: 2 to 2000Hz, 20 G's, 12 hours	204	D	Yes	Yes	Yes	Yes
Solderability: 95% coverage	208	—	Yes	Yes	Yes	Not Appl.
Solder heat: 260°C 10 seconds (4)	210	B	Yes	Yes	Yes	Not Appl.
Terminal tensile strength: 4-1/2 lbs, 10 seconds (5)	211	A	Yes	Yes	Yes	Not Appl.
Terminal fatigue: 2 lbs 3 cycles (5)	211	C	Yes	Yes	Yes	Not Appl.
Mechanical shock: 100 G's, 6ms	213	I	Yes	Yes	Yes	Yes
Solvent resistance	215	—	Yes	Yes	Yes	Yes

Notes:
1. Extended temperature ranges are available for some models; consult factory.
2. Nonhermetic metal-cased units may require bake-out after test to restore full performance.
3. Humidity capabilities of plastic-cased units available on special request.
4. For surface-mount models, peak temperature during reflow: 230°C or more, depending upon mode.
5. Not applicable to surface-mount models

In Stock...Immediate Delivery

For custom versions of standard models consult our applications dept.

Product Testing For High Reliability

Ultra-Rel

Mini-Circuit's mixers, phase detectors, frequency doublers and limiters are "Ultra-Rel": They carry a five-year guarantee, a reliability breakthrough attributed mainly to unique Ultra-Rel diodes that easily meet and exceed MIL-STD-883 tests. Each type of diode must pass the following grueling tests:

LIFE	1000 hrs. T_A + 125°C 50 mA ac
THERMAL SHOCK	-65° to +125°C, 200 cycles, 5 min. dwell
MECHANICAL SHOCK	1.5k G's, 0.5 usec pulse
VIBRATION	variable frequency 20 to 2,000 Hz.
TEMPERATURE CYCLE	-65°C to +125°C, 200 cycles, 10 min. dwell
AUTOCLAVE (pressure pot)	14.7 psi, T_A + 121°C, 96 hr.
85/85	85°C/@85% humidity 168 hr., no bias
ACCELERATED HI-TEMPERATURE STORAGE	300°C, 325°C, 350°C storage until 50% failures

HTRB Testing

Certain models, identified individually in the catalog, instead have their diodes subjected to high-temperature, reverse-bias (HTRB) testing. This is an accelerated-life screening test generally reserved for space applications. Here the Schottky and PIN diodes are subjected to a one-volt negative bias at 150°C for 168 hours. The objective of this accelerated aging stress is to force time/temperature-related failures and thus screen out potentially unreliable devices.

/MIL, TX, and Hi-Rel Products

All hermetically sealed MCL models can be subjected to screening and to environmental testing. These tests are designed to eliminate early failures and to ensure performance in hostile environments. Many models having such testing performed are available from stock parts, designated by a /MIL, TX or Hi-Rel suffix to the model number. For your convenience, the table below summarizes availability and applicable MIL Spec by product line. A brief description of the test procedures follows the table.

Of course, if you have a specific screening requirement for any model, which is not available from a stock item, or for a non-hermatic model, contact our Applications Engineering staff and they will suggest the most cost-effective means of satisfying your reliability needs.

/MIL Models

Mixers, Frequency Doublers and Phase Detectors are tested in accordance with MIL-M-28837. Pre-conditioning, Group A (screened) and Group B are performed on each inspection lot.

Power Splitters are tested in accordance with MIL-P-23971. Group A and Group B are performed on each inspection lot.

These models may be ordered by adding the suffix /MIL to the model number.

Product Line	Applicable Suffix *TX	*Hi-Rel	*/MIL	Applicable Std or Specification for reference
Amplifiers	Not applicable	No	No	MIL-STD-883
Digital Step Attenuators	Not applicable	No	No	MIL-STD-883
Directional Couplers	Not applicable	Yes	No	MIL-C-15370
Electronic Attenuators/ Switches	No	Yes	Yes	MIL-M-28837
Filters	Not applicable	Yes	No	MIL-F-18327
Fixed Attenuators	Not applicable	Yes	No	MIL-A-3933
Frequency Doublers	Yes	Yes	Yes	MIL-M-28837
I & Q Modulators and Demodulators	No	No	No	MIL-M-28837
Limiters	No	No	No	MIL-M-28837
Mixers	Yes	Yes	Yes	MIL-M-28837
Phase Detectors	No	Yes	Yes	MIL-M-28837
Phase Modulators	No	No	No	MIL-M-28837
Power Splitter/ Combiners	Not applicable	Yes	Yes	MIL-P-23971
Switches	Not applicable	Yes	No	MIL-STD-883
Terminations	Not applicable	No	No	MIL-D-39030
Transformers	Not applicable	Yes	No	MIL-T-55631

*Check with our Sales Department for specific models available as Hi-Rel, /MIL or TX..

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Mini-Circuits

TX Models

TX Models employ hermetically sealed diodes which have passed the following tests in accordance with MIL-STD-750:

1) HIGH TEMP. STORAGE	Method 1032
2) TEMP. CYCLING	Method 1051, Cond. C
3) CONSTANT ACCELERATION	Method 2006 (Y1 Orientation, 20,000 G's
4) FINE AND GROSS LEAK	Method 1071, Cond. C and H
5) BURN-IN	Method 1038, Cond. B

The end product is then further screened by being subjected to:

1) THERMAL SHOCK	MIL-STD-202, Method 107, Cond. A (100°C)
2) BURN-IN	96 hours at 100°C with 8mA at 1kHz
3) FINE AND GROSS LEAK	MIL-STD-202, Method 112, Cond. C and D

These models may be ordered by adding the suffix TX to the model number. Also, some models in the product lines having a "No" entry in the TX column of the table may be available with similar screening on special order.

Hi-Rel Models

Mixers, Phase Detectors, Frequency Doublers and Electronic Attenuators/Switches are tested to the following per MIL-STD-202:

1) THERMAL SHOCK	Method 107, Cond. A (100°C)
2) BURN-IN	Method 108, Cond. A (100°C, 8mA ac)
3) FINE AND GROSS LEAK	Method 112, Cond. C and D

Power splitter/combiners, Directional Couplers, Transformers, Fixed Attenuators, Filters and Limiters are tested to the following per MIL-STD-202:

1) BAKE-IN	Method 108, Cond. A (100°C, no excitation)
2) THERMAL SHOCK	Method 102, Cond. A (100°C)
3) FINE & GROSS LEAK	Method 112, Cond. C and D

Switches incorporating PIN diodes are tested to the following per MIL-STD-202, as a minimum:

1) THERMAL SHOCK	Method 107, Cond. A (100°C)
2) BURN-IN	Method 108, Cond. A (100°C, diode current applied)

For additional tests applicable to specific switch models, please consult our Sales Department.

These models may be ordered by adding the suffix Hi-Rel to the model number.

Meeting Customer Needs

The following table outlines generic types of tests we do to satisfy customer's needs per specific contractual requirements. Each entry encompasses one or more QCPs (Quality Control Procedures) which are particularized as to test conditions. The principal MIL standards referenced in the QCPs are listed.

QCP GROUP	TEST	METHODS OF MIL-STD -202	-810	-883
02-00	THERMAL SHOCK	107	503	1010
03-00	RANDOM VIBRATION	214		
04-00	MECHANICAL SHOCK	207,213	516	
05-00	CONSTANT ACCELERATION	212		2001
06-00	BAKE-IN/BURN-IN	108		1015
07-00	SEAL TESTS	112		
08-00	MOISTURE RESISTANCE	106	507	
09-00	RADIOGRAPHIC	209		2012
10-00	SINE VIBRATION	201	514	
11-00	HIGH FREQUENCY VIBRATION	204		
12-00	HUMIDITY	103		
13-00	ALTITUDE (BAROMETRIC PRESSURE)	105	500	
14-00	SALT-SPRAY	101	509	
15-00	TERMINAL STRENGTH	211		
16-00	RESISTANCE TO SOLVENTS	215		
17-00	SOLDERABILITY	208		
18-00	RESISTANCE TO SOLDERING HEAT	210		
19-00	IMMERSION	104		
20-00	EXPLOSION	109	511	
21-00	SAND AND DUST	110	510	
22-00	FUNGUS TEST		508	
25-00	PARTICLE IMPACT NOISE DETECTION (PIND)			2020

Connector Specifications

All coaxial connectors used in MCL products meet applicable requirements of MIL-C-39012 including mating compatibility, coupling proof torque, contact retention, materials and finish durability.

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Statistical Process Control - Key to Competitive Manufacturing

In today's tough world market environment, the need to be better is more demanding, and the need to be more competitive is a necessity to survive. A company cannot rest on the success of past performance and expect to continue to remain successful. There are many well known examples of companies both large and small that were once leaders in their field and now are skeletons of themselves or just plain dead and buried.

How does one get more competitive? The answer is simple. Exceed your customers' needs and expectations ...provide, in the manner required by the customer, a quality product, at low cost, on time, every time. In most manufacturing organizations a significant cost factor is attributed to the cost of purchased materials and they may range from 25% to 80% of the cost of the entire product. Because of the significance of purchased material to total cost, the quality of the purchased material is important and essential to the competitiveness of the manufacturing organization.

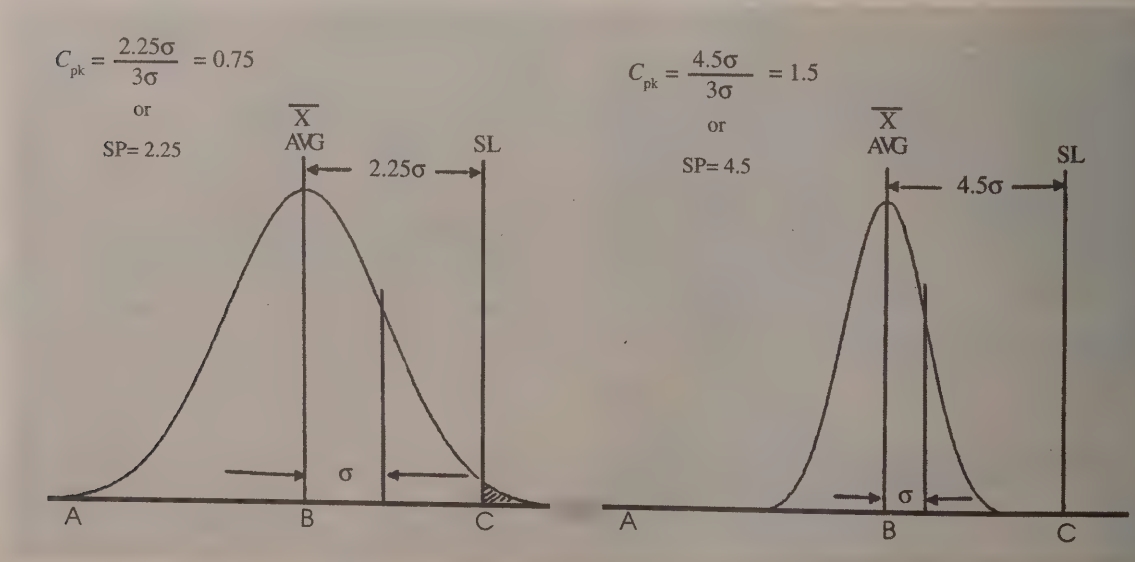
This paper will discuss the effects of quality on the direct and indirect causes that contribute to the real cost of the purchased material. A measure of the quality of the material will be described by a quality factor, Cpk. The higher the value of Cpk, the better the quality of the product. Cpk is a measure of the repeatability of material performance. The higher the number, the better is the consistency of performance or the less is the variation in performance. Therefore, once designed in, the material should be consistent enough so that its variations are not transparent to the final product.

In manufacturing, variation is evil! If the value of Cpk for a purchased part is low, and Cpk varies from production lot-to-lot, then it can be projected the process for manufacturing the part is not in control, performance will be inconsistent, rejects can be expected, and the true cost of the purchased part will be significantly higher than the price shown on the purchase order.

With the abundance of low cost computers and hand held scientific calculators, the ability to calculate Cpk is easily attainable. Cpk is a quality factor that is based on the statistical calculation of mean value, $\bar{x}$ and standard deviation, sigma. Cpk is the difference in value between the mean value and the closest spec limit divided by 3 sigma.

$$Cpk = \frac{(\text{spec limit - mean value})}{3 \text{ sigma}}$$

At Mini-Circuits we use SP (Sigma Performance) = 3 times Cpk. We must measure variation to control it. If we can measure it we can tell when it gets better or worse. We need to know what works and what doesn't work. How much a manufacturing process varies is measured by Sigma (σ). In the figures below, the average (AVG) tells us where the process is centered. The spread or width is measured by sigma. The figures below show how the product is distributed. The height of the graph measures how often values occur. The spread measures how far the values are from the



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AVG. If the product is well controlled, there will be little variation, more values of units will occur nearer the target, $\bar{x}$, and sigma will be small.

Manufactured products are either good or bad depending on whether they do what the customer wants them to do. Specification limits were the measure of success, where product within spec was good and out of spec bad. It is not enough in today's market place to just meet spec! In the figures below, a spec limit (SL) is compared to the product distribution. Product built outside, or to the right of the spec limit, is very bad; even product built just to the left of the spec limit is not good. Small (skinny) Sigma means the product will be far from the spec limit and close to the AVG value (very good product, what today's customers demand).

We can compare different processes by measuring variation and the distance from the average to the spec limit. But only if we measure the distance in terms of sigma, as shown in the figures. The real distance is the same for both figures (C-B), meaning both processes are centered and the AVG values are equal. But, in terms of product quality, the figure on the right is far superior ($4.5 > 2.25$) because the variation between units is much less as given by the skinnier value of sigma.

For convenience, we normalize by dividing the distance (C-B) by sigma (considered a relative ideal), and get the capability index, Cpk, a figure of merit. The skinnier the σ is, the higher the Cpk, and the less variation, unit-to-unit.

The "goodness" of the purchased parts, Cpk, will affect the actual real cost of the purchased material. This real cost can vary and will depend on the original design and the specifications describing the purchased material. The real cost depends on the sum of both direct and indirect costs. These are:

Costs additive to the cost of purchased parts:

A. Direct costs of poor quality parts:

1. Warranty
2. Scrap and repair
3. Inspection/test

B. Indirect costs of poor quality parts:

1. Lost sales - customers switching to competition
2. Field trips, retrofits, settlements
3. Downtime, line shut downs, delinquencies, rescheduling
4. Inventory build-up, obsolete material, MRB, material expediting, material shrinkage
5. Engineering changes and redesign, documentation changes, material selection and separation.

C. Indirect costs, demands of the manufacturing system on company's resources

1. Space
2. Manpower, receiving, production control, manufacturing, sales, finance, engineering, QA, accounting, maintenance, house cleaning.
3. Utilities (lighting, heating, air conditioning, telephone)
4. Capital equipment (testing, incoming inspection and production, data processing)
5. Finances, cost to maintain higher inventory of all material
6. Data processing and data entry

Description of costs to the manufacturer of poor quality parts received.

When poor quality parts are received, the manufacturer must maintain an incoming inspection department to check parts for conformance to specifications. If all parts were received with a Sigma Performance = 4.5 or, Cpk = 1.5, then the demands for incoming inspection would evaporate. However, this is not the case in the real world today. Therefore, the cost of the inspection department is visually spread out and amortized as a percentage of the total cost of all material received. However, when poor quality parts are received, there are direct additional costs that are incurred by the manufacturing organization. These costs include additional testing and inspection so that additional manpower and capital equipment are required. In addition, there are added costs associated with documents DMR, RTV etc.; MRB meetings; purchasing costs, such as expediting, search for alternatives, rescheduling and issuing of p.o. change orders; and engineering costs for evaluation and test.

In addition to incoming inspection costs, the delays of incoming material to the production floor will generate additional manufacturing costs. These include rescheduling and smaller production runs (less parts available); inefficiency of resources, such as manpower and machines, increased space requirements and WIP; increased material shrinkage, and increased manufacturing throughput time.

The results of these manufacturing delays and costs will cause shipment delays and increased manufacturing costs that may be passed on to customers. Both factors contributing to a less competitive position!

To pursue Mini-Circuits' goal to exceed our customer's expectations, Mini-Circuits is striving to achieve an SP of 4.5 or, Cpk = 1.5. All mixer and I & Q modulator conversion loss is specified in statistical terms. We are vigorously pursuing statistical process control and statistical specifications on all our products to enable our customers to receive the highest quality and value, at the lowest cost ... the key to competitive manufacturing.

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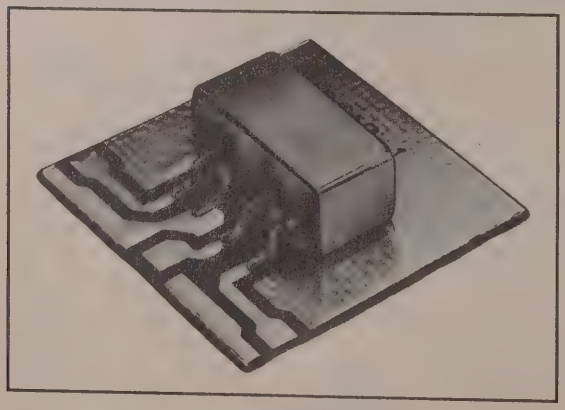
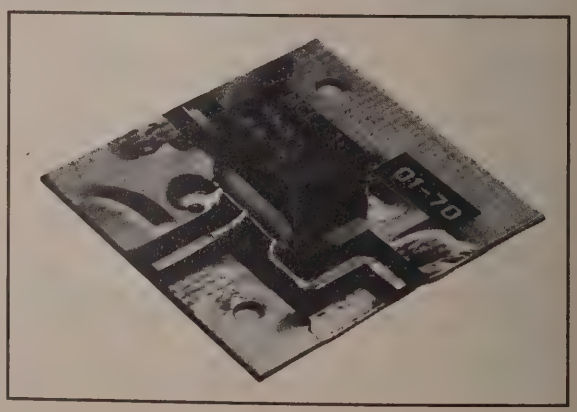
Practical Considerations for Attaching Surface-Mount Components

Mini-Circuits manufactures many RF/IF signal processing components in packages suitable for surface mounting:

SURFACE-MOUNT MODELS MODEL-NO. PREFIXES OF EACH PRODUCT TYPE, AVAILABLE IN THE SURFACE-MOUNT CASE STYLES SHOWN CASE STYLE AND DESCRIPTION		MIXERS	POWER SPLITTER / COMBINERS	AMPLIFIERS, MONOLITHIC	DIRECTIONAL COUPLERS	FILTERS	PHASE DETECTORS	SWITCHES	TRANSFORMERS	BI-PHASE MODULATORS/ ELECTRONIC ATTENUATOR/ SWITCHES
KK	SM, 6-LEAD, PLASTIC	ASK							T TT	
TT	SM, LEADLESS, 0.2" HT, SM, LEADLESS, 0.275" HT	RMS								RAS
WW	SM, 4-LEAD, PLASTIC, MAR			MAR-SM						
XX	SM, 8-LEAD, GLASS, HERMETIC							KSW KSWA KSWHA		
	SM, 8-LEAD, PLASTIC							MSW MSWA		
YY	SM, 8-SHORT-LEAD, 0.23" HT, SM, 8-SHORT-LEAD, 0.28" HT	SCM	SCP		SCDC	SCLF				
KKK	SM, 16-LEAD, PLASTIC							YSW YSWA		
MMM	SM, 4-LEAD, SOT143			VAM						
NNN	SM, 4-PIN, 0.23" HT, METAL	TUF								TFAS
QQQ	SM, 6-SHORT-LEAD, 0.2" HT	LRMS	LRPS LRPQ		LRDC					LRAS
RRR	SM, 4-LEAD, PLASTIC, MAV			MAV-SM						
TTT	SM, LEADLESS, 0.15" HT, SM, LEADLESS, 0.23" HT	SYM					SYPD			SYAS
AF	SM, 4-LEAD, CERAMIC, HERMETIC			RAM						
AG	SM, 16-LEAD, CERAMIC, HERMETIC							VSW VSWA		
AH	SM, LEADLESS, 0.25" HT		SYPQ							
AT	SM, LEADLESS, 0.16" HT								TC	

LEGEND: SM = Surface Mount; HT = Height of Case; MAR, MAV = Abbreviation of Model Prefix





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The photos included illustrate some of these components soldered to circuit boards.

What automated soldering methods can be considered for Mini-Circuits' surface-mount components? There are two basic methods: reflow and wave soldering. Generally, reflow soldering can be done when (1) there are only surface-mount components, or (2) these are present together with through-hole components and the latter will be soldered in a separate (wave-soldering) step. The surface-mount components can be located on both the upper and lower sides of the board, when reflow is used. Wave soldering is suitable for through-hole components mounted on top of the board as well as for surface-mount components on the bottom of the board. Both ceramic and polymer-based boards can be accommodated.

Reflow

Reflow requires applying a controlled amount of solder and flux to the areas where connections are to be made. A common technique is to print a pattern of solder paste on the board, and then put the components onto their places. They tend to stay in position because of the stickiness of the paste. Optionally, components can be held with chip-bonding epoxy. When heat is applied, it must produce a time-temperature profile suitable for accomplishing several process steps as illustrated in Figure 1.

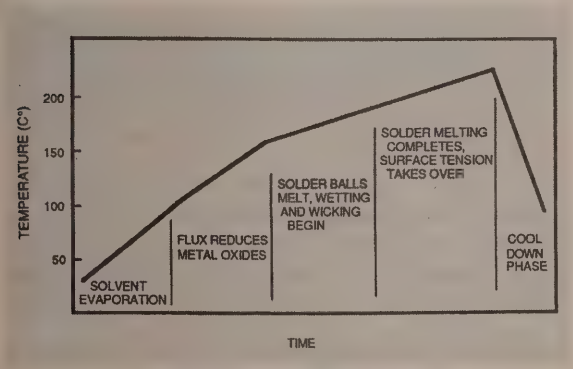

Fig. 1 Solder Reflow Phases

First, solvent evaporation is done at temperatures up to about 100°C. Second, flux reduces metal oxides as temperature rise to the solder melting point, typically 183°C. Third, as temperature continues to rise, the solder particles in the paste melt and wetting and wicking in the joint area begin. In the next step when temperature reaches a peak around 215°, surface tension shapes the fillet of fully molten solder. It takes only a few seconds for proper solder wetting at that temperature. The length of time that the work is actually above 200 is usually limited to one or two minutes to avoid damage. Many plastic-encapsulated components can withstand several minutes of solder-melt temperature when reflowed. Even at the higher temperature experienced in wave soldering (see below), such components tend to withstand several seconds immersion in molten solder.

There are several techniques for applying the heat needed for reflow. Two of the most common are infrared and vapor-phase. Infrared heat sources operate at very high temperature and are placed at the inner walls of the chamber, not in contact with the work. The actual temperature of the work is strongly affected by its mass, geometry and composition, as well as belt speed. Organic materials such as epoxy-based boards tend to absorb the IR radiation and conduct the heat to metal parts which, by themselves, would tend to reflect the IR away. On the other hand, in the vapor-phase soldering process the vapor surrounding the work is maintained at the optimum solder-wetting temperature. This is accomplished by boiling an inert liquid in a tank. The boiling point is approximately 215°C. When the work is held in the vapor just above the liquid, the heat at that temperature is transferred to all surfaces quite uniformly.

Figures 2 and 3 illustrate profiles obtained with both relow processes. Separately controlled heating zones in an IR oven provide an opportunity to shape the profile more optimally than is typical of the vapor phase process. However, the infrared method may require more careful setup to avoid undesired nonumiformity of heating.

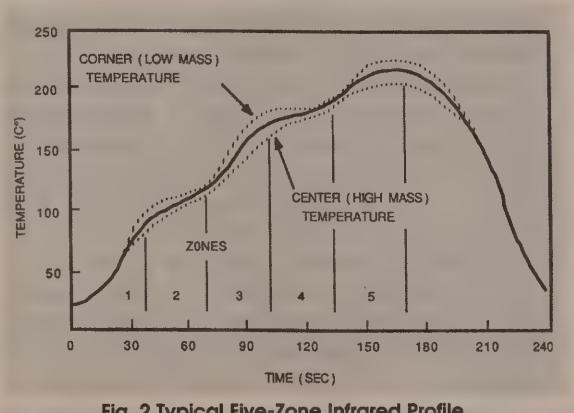

Fig. 2 Typical Five-Zone Infrared Profile.

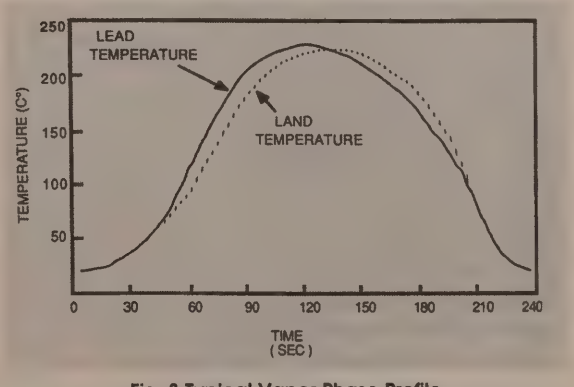

Fig. 3 Typical Vapor Phase Profile

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Wave Soldering

This method applied molten solder to the bottom side of a circuit board after a preheating sequence, with cool-down following the soldering. There are variations to the method, mainly characterized by the shape of the solder wave; the choice among them is influenced by the type of assembly and the components being mounted. Solder temperature, typically 260°C, is higher than the peak temperatures used in the reflow method. The temperature profile experienced by the board and components increases during preheat to about 150° at at rate similar to reflow, but then rises rapidly when the solder wave impinges.

Components housed in molded plastic cases may be better suited to reflow soldering, because of the possibility of micro-cracks developing at the leads if they are wave soldered. Resistance to this defect is enhanced when moisture is baked out of the plastic material before soldering by either method; 24 hours at 125°C is usually effective.

Some Pointers

Among the considerations for successful attachment of surface-mount components are:

- Lead coplanarity, and wettability by the solder.
- Compatibility of solder composition with finish on components and circuit board.
- Amount of solder deposited.
- Internal heating of components.
- Component placement and orientation accuracy.

Leads on a component should all be in the same plane. More departure from coplanarity can be tolerated in the reflow method than in wave soldering, because in reflow the surface tension in the molten solder tends to bridge small gaps and ensure an acceptable fillet. In wave soldering, special techniques are used to counteract the tendency of surface tension to deposit excess solder and cause undesired bridging between metallization areas. Even so, better coplanarity may be requuired when wave soldering to ensure good joints.

Wetting, or the ability of solder to adhere to the entire joint surfaces uniformly, is enhanced when clean surfaces on the component leads and circuit board are provided. If the quality of initially suitable surface finishes is preserved by proper handling and storage, the flux applied in the soldering operation should suffice to remove any metallic oxides. Compatibility of the solder includes closeness of its melting point with that of the metallization finishes, and the minimization of materials such as gold which promote the formation of brittle intermetallic compounds with tin-lead solder. The amount of solder to be deposited depends upon joint geometry, but once determined the deposition can be controlled to a few thousandths of an inch by using preforms or printing the solder pattern.

Concern about internal heating of components during soldering becomes greater when the size or complexity of individual components increases, or where an assembly contains a mix of large and small components. In the latter case the heating rates can be disparate, or a large component may mask a small one from the source of heat. Careful study and experimentation may be needed to optimize the process. Measurement of air temperature in the processing chamber, even at several points, may not be sufficient with infrared heating. Monitoring with a surface temperature profiler can ensure that small components are not being overheated.

While high accuracy is needed for component placement on a circuit board, this requirement is eased somewhat in the case of reflow, because surface tension in the molten solder has a self-centering action. This assumes that a proper metallized footprint has been provided. Correct orientation of components requires assurance that when they are supplied in tape-and-reel, all have been inserted into the tape in a constant and known orientation. Also, the tape cavity dimensions must ensure that the orientation is maintained. Especially when component placement is done manually, a clear orientation index is necessary on each component. The following considerations tend to keep the components, once placed, from becoming dislodged before the solder solidifies: When all surface-mount components are on top of the board, the stickiness of solder paste and then the surface tension of molten solder usually suffice. Components on the bottom of the board may need pre-attachement with an adhesive such as epoxy. Caution is then necessary to prevent low-viscosity constituents of the adhesive from spreading onto the metallization areas ("creep"), which could inhibit solder wetting.

Automated Soldering of Mini-Circuits Surface -Mount Components

Of course, the surface-mount models listed at the beginning of the article can also be mounted by hand-soldering techniques. But, pertinent to the advantage afforded by automated assembly is that most can be soldered in their standard configuations, or require simple modification to

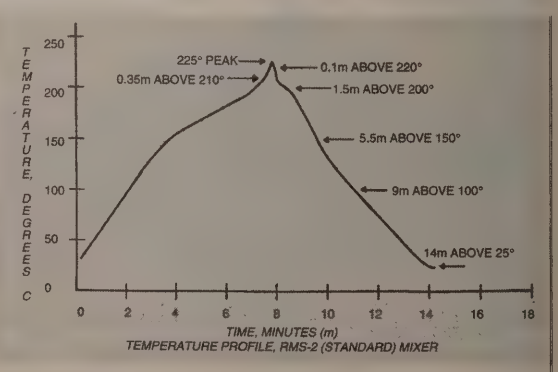

Fig. 4 Temperature Profile, RMS-2 Mixer

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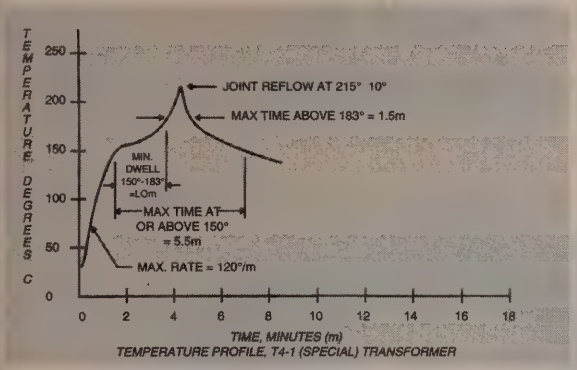

Fig. 5 Temperature Profile, T4-1 Transformer

their internal connection method or omission of a plastic enclosure, depending upon the particular temperature profile specified for a customer's application.

Examples of Soldering Temperature Profiles for Mini-Circuits Components

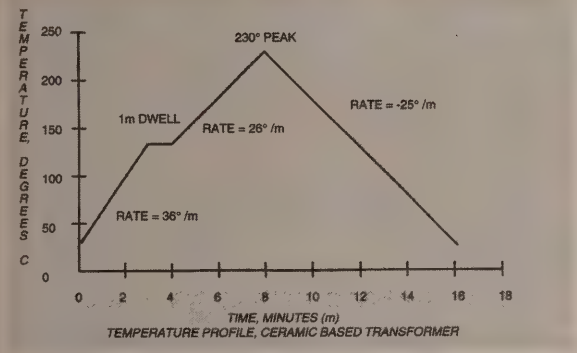

Fig. 6 Temperature Profile, Ceramic-Base Transformer

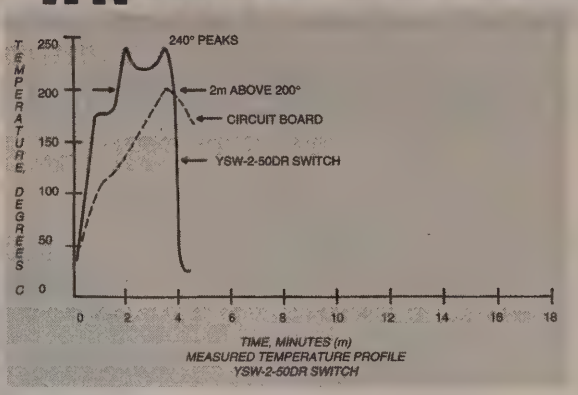

Fig. 7 Temperature Profile, YSW-2-50DR Switch

Mixer model RMS-2 meets the temperature profile shown in Figure 4 in its standard configuration. Transformer model T4-1 meets the profile in Figure 5 when a solder having 260°C solidus is used for its internal connections. A special transormer model designated TC, having a smaller version of case style TT100, has a ceramic base and no lid. It accepts the temperature profile shown in Figure 6. All three of these profiles were set by customer's specifications. As a final example, GaAs switches with drivers, in plastic case style KKK155 are designed to withstand a reflow heating and cooling cycle lasting 4 minutes, in which the component itself exceeds 200°C for 2 minutes. Figure 7 shows actual temperatures measured on a switch and on the circuit board to which it is being mounted, using an infrared reflow machine having four zones and seven source panels in a 72-inch overall length. The same GaAs switches in metal-ceramic case style AG191 will withstand a peak case temperature up to 275°C.

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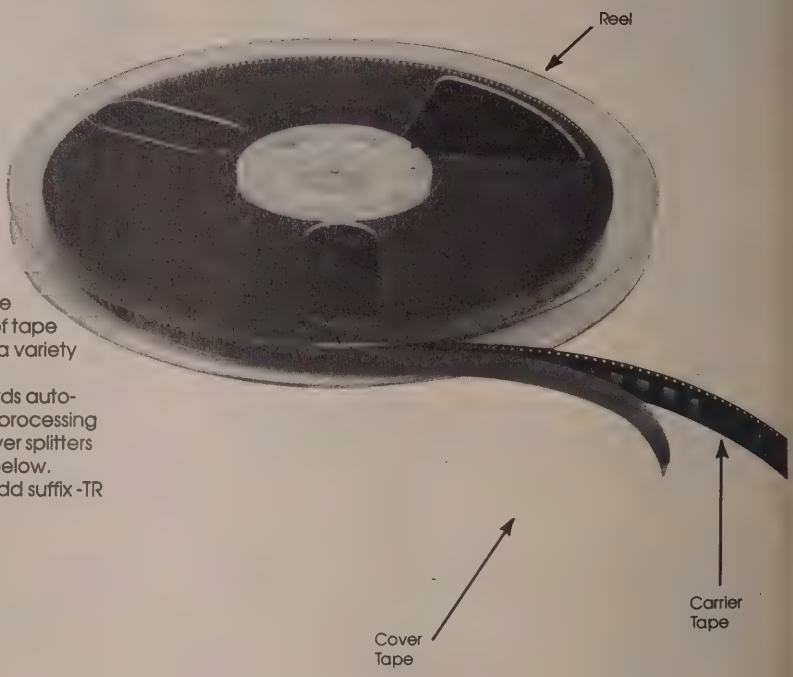
tape and reel packaging for surface mount devices

Design-For-Assembly (DFA) and Design-For-Manufacture (DFM) stand tall alongside CAD/CAM in the quest to optimize profitability, production efficiency and equipment operating usage.

Automation of surface-mount assembly by the use of pick-and-place equipment to handle tiny components has been enhanced by evolutionary improvements in tape-and-reel systems which can accommodate as many as 4000 parts on a 13-inch reel. This results in less frequent component reloading and less downtime of the assembly equipment. Other advantages of tape feeders include versatility or the ability to handle a variety of parts.

Mini-Circuits has kept pace with the trend towards automated assembly and offers RF/Microwave signal-processing components (mixers, amplifiers, transformers, power splitters and switches) in tape-and-reel format as shown below.

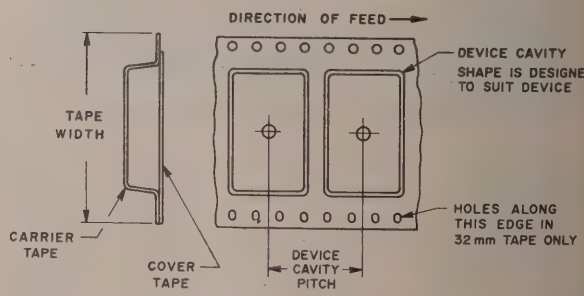
To order a tape-and-reel packaged product, add suffix -TR to its model number.

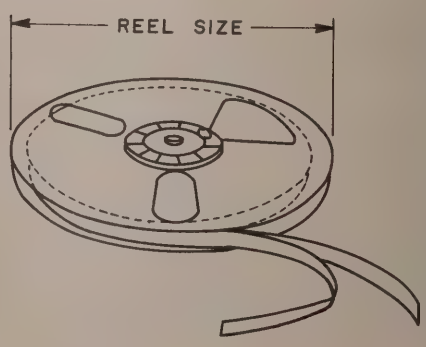


packaging information

Packaging Part No.	Case Style	Tape Width (mm)	Reel Size (inches)	Device Cavity Pitch (mm)	Devices per Reel	Orientation Figure No.
F1	KK81	24	13	12	500	T-001
F2	TT100	16	13	12	500	T-002
F3	TT240	16	13	12	500	T-002
F4	WW107	12	7	8	1000	T-003
F5	YY101	32	13	16	500	T-004
F6	YY161	32	13	16	500	T-004
F7	KKK155	24	13	16	500	T-005
F8	MMM168	8	7	4	3000	T-006
F9	NNN150	24	13	16	500	T-007
F10	QQQ130	24	13	16	500	T-008
F11	RRR137	12	7	8	500	T-009
F12	TTT166	24	13	12	500	T-010
F13	TTT167	24	13	12	500	T-010
F14	AF190	12	7	8	500,1000	T-011
F15	AG191	16	13	12	500	T-005
F16	XX211	12	7	8	500	T-004
F17	AT224	12	7	8	500	T-012

tape illustration





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device orientation

Fig. T-001

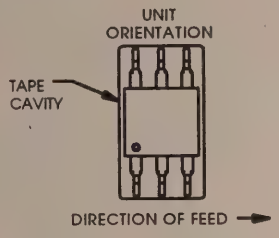


Fig. T-002

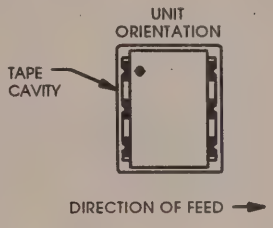


Fig. T-003

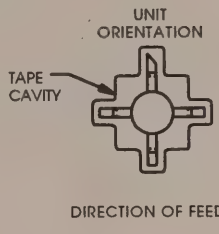


Fig. T-004

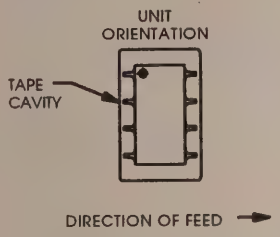


Fig. T-005

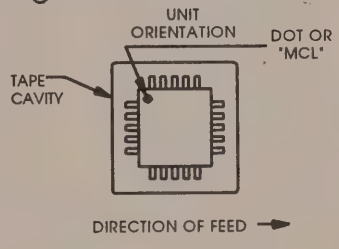
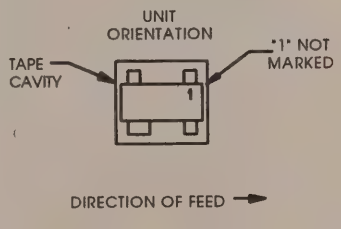


Fig. T-006



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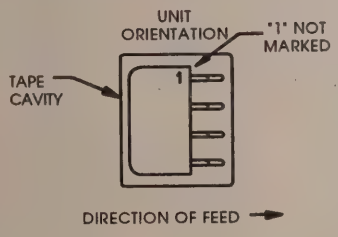


Fig. T-008

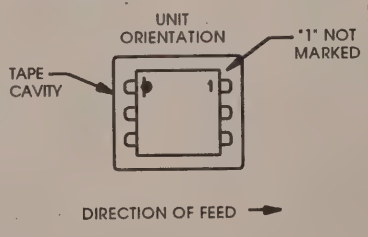


Fig. T-009

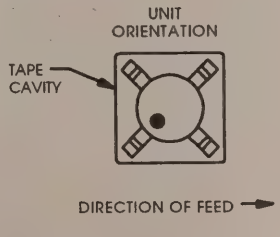


Fig. T-010

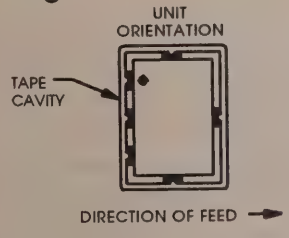


Fig. T-011

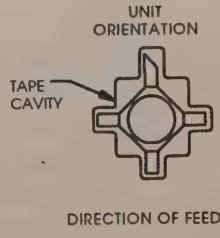
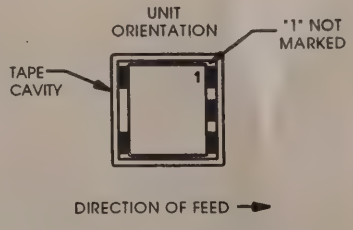


Fig. T-012



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CAPO now available! computer-automated performance data

case styles

outline dimensions (inch / mm)

case no.	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T	wt. grams.	NOTES*
A01	.770 19.56	.800 20.32	.385 9.78	.400 10.16	.370 9.40	.400 10.16	.200 5.08	.20 5.08	.14 3.56	.031 .79									5.2	A1,B3,E1,B7
A03	.480 12.19	.500 12.70	.390 9.91	.405 10.29	.210 5.33	.230 5.84	.100 2.54	.20 5.08	.14 3.56	.020 .51									2.3	A1,B4,E1,B7
A04	.770 19.56	.800 20.32	.200 5.08	.210 5.33	.370 9.40	.400 10.16	.200 5.08	.20 5.08	.14 3.56	.031 .79									3.7	A1,B3,E1,B7
A05	.770 19.56	.800 20.32	.240 6.10	.250 6.35	.370 9.40	.400 10.16	.200 5.08	.20 5.08	.14 3.56	.031 .79									3.7	A1,B3,E1,B7
A06	.770 19.56	.800 20.32	.285 7.24	.310 7.87	.370 9.40	.400 10.16	.200 5.08	.20 5.08	.14 3.56	.031 .79									5.2	A1,B3,E1,B7
A11	.480 12.19	.500 12.70	.240 6.10	.255 6.48	.210 5.33	.230 5.84	.100 2.54	.20 5.08	.14 3.56	.020 .51									1.9	A1,B4,E1,B7
B02	.480 12.19	.500 12.70	.240 6.10	.255 6.48	.210 5.33	.230 5.84	.16 4.06	.100 2.54	.14 3.56	.20 5.08	.020 .51								1.9	A1,B4,E1,B7
B13	.480 12.19	.500 12.70	.390 9.91	.405 10.29	.210 5.33	.230 5.84	.16 4.06	.100 2.54	.14 3.56	.20 5.08	.020 .51								2.3	A1,B4,E1,B7
C07	.770 19.56	.810 20.57	.380 9.65	.410 10.41	.030 .76	.200 5.08	.20 5.08	.14 3.56											11.0	A1,E1,B7
C145	.770 19.56	.810 20.57	.380 9.65	.410 10.41	.030 .76	.200 5.08	.20 5.08	.14 3.56											11.0	A1,E1,B7
D08	1.000 25.40	1.025 26.04	.390 9.91	.430 10.92	.500 12.70	.525 13.34	.025 .64	.300 7.62	.200 5.08	.09 2.29	.13 3.30	.150 3.81	.20 5.08	.14 3.56					8.5	A1,E1,B7
D09	1.000 25.40	1.025 26.04	.240 6.10	.280 7.11	.500 12.70	.525 13.34	.025 .64	.300 7.62	.200 5.08	.09 2.29	.13 3.30	.150 3.81	.20 5.08	.14 3.56					7.5	A1,E1,B7
E10	1.580 40.13	1.620 41.15	.380 9.65	.410 10.41	.770 19.56	.810 20.57	.030 .76	.200 5.08	.10 2.54	.20 5.08	.14 3.56								23.0	A1,E1,B7
F14	2.00 50.80	2.00 50.80	.75 19.05	1.00 25.40	.25 6.35	1.500 38.10	.125 3.18	.39 9.91	1.00 25.40	.50 12.70	1.00 25.40								170.0	A10, C1,D2
F53	2.00 50.80	2.0 50.80	.75 19.05	1.00 25.40	.13 3.30	1.750 44.45	.125 3.18	.39 9.91	1.00 25.40	.50 12.70	1.00 25.40								170.0	A10 C1,D2
F183	1.26 32.00	1.00 25.40	.70 17.78	.200 5.08	.200 5.08	.860 21.84	.125 3.18	.35 8.89	.63 16.00	.38 9.65	5.00 127.00								24	A4,B1,D17
G15	1.25 31.75	1.25 31.75	.75 19.05	.63 16.00	.38 9.65	.61 15.49	— —	.80 20.32	.80 20.32	.76 19.30	.125 3.18	1.688 42.88	2.18 55.37	.75 19.05	.07 1.78				85.0	A10,A18,B1, D1,D7
G144	1.25 31.75	1.25 31.75	— —	.63 16.00	.38 9.65	.61 15.49	— —	— —	— —	.76 19.30	.125 3.18	1.688 42.88	2.18 55.37	.75 19.05	.07 1.78				85.0	A10,A18, B6,D6
H16	1.25 31.75	1.25 31.75	.75 19.05	.63 16.00	.38 9.65	1.000 25.40	.125 3.18	1.000 25.40	— —	— —	.125 3.18	1.688 42.88	2.18 55.37	.75 19.05	.07 1.78				70.00	A10,A18,B1, D2,D3,D4
J17	1.25 31.75	1.25 31.75	.75 19.05	.63 16.00	.38 9.65	1.000 25.40	.125 3.18	1.000 25.40	— —	— —	.125 3.18	1.688 42.88	2.18 55.37	.75 19.05	.07 1.78				75.0	A10,A18, B1,D2,D3
K18	1.25 31.75	1.25 31.75	.75 19.05	.63 16.00	.38 9.65	1.000 25.40	.125 3.18	1.000 25.40	— —	— —	.125 3.18	1.688 42.88	2.18 55.37	.75 19.05	.07 1.78				70.0	A10,A18,B1, C1,D2,D3
L19	1.50 38.10	1.13 28.70	1.00 25.40	.50 12.70	.155 3.94	2.345 59.56	.138 3.51	.987 25.07	2.50 63.50	.10 2.54	.31 7.87	1.19 30.23	— —	.66 16.76	— —	— —	.150 3.81		37.0	A6,A11,A18, B2,D6
L20	2.25 57.15	1.38 35.05	1.24 31.50	.50 12.70	.150 3.81	3.100 78.74	.138 3.51	1.238 31.45	3.25 82.55	.10 2.54	.40 10.16	1.86 47.24	— —	.64 16.26	— —	— —	.150 3.81		74.0	A6,A11,A18, B2,D5
M21	1.50 38.10	1.13 28.70	1.00 25.40	.50 12.70	.155 3.94	2.345 59.56	.138 3.51	.987 25.07	2.50 63.50	.10 2.54	.31 7.87	.75 19.05	1.19 30.23	.66 16.76	— —	— —	.150 3.81		40.0	A6,A11,A18, B2,C1,D6
M22	2.25 57.15	1.38 35.05	1.24 31.50	.50 12.70	.150 3.81	3.100 78.74	.138 3.51	1.238 31.45	3.25 82.55	.10 2.54	.40 10.16	1.15 29.21	1.86 47.24	.64 16.26	— —	— —	.150 3.81		74.0	A6,A11,A18, B2,C1,D5
M23	2.25 57.15	1.38 35.05	1.24 31.50	.50 12.70	.150 3.81	3.100 78.74	.138 3.51	1.238 31.45	3.25 82.55	.10 2.54	.63 16.00	1.06 26.92	1.63 41.40	.69 17.53	— —	— —	.150 3.81		70.0	A6,A11,A18, B2,C1,D6

tolerance .x±.1 .xx±.03 .xxx±.015 inch **oz. = grams x.0353**

* NOTES:

A. MATERIAL AND FINISH
- A1. Header material: C.R.S. Pin material: #52 alloy. Finish: electro tin, hot-oil flowed. Cover material: cupro-nickel.
- A6. Case material: aluminum alloy. Finish: blue paint over irridite.
- A10. Case material: aluminum alloy. Finish: grey paint.
- A11. Case material: aluminum alloy. Finish: blue anodized.
- A18. Mounting bracket finish: irridite or clear anodize.

B. MOUNTING
- B1. Mounting bracket available on request. Add suffix B to part number.
- B2. Mounting bracket available on request. For bracket mounted on connector end add suffix B to part number and $5.00 to unit cost. For bracket mounted on the rear, add suffix BR to part number and add $1.50 to unit cost
- B3. Insulated spacer available. Request P/N B14-045-01.
- B4. Insulated spacer available. Request P/N B-14-047-01.
- B6. Bracket version only.
- B7. Pin's meniscus (of header): 0.015" max.

C. MARKING
- C1. For port markings 1, 2, and 3 see specification data sheet.

D. CONNECTORS
- D1. Connectors: SMA Standard. BNC on request (no charge). Male SMA on request, consult factory.
- D2. Connectors: please specify, unless otherwise noted; BNC is standard, TNC, SMA and Type N, consult factory. (ZAPD -4 units not available with BNC).
- D3. For Bracket Version, Option B, this dimension, "C"", changes from 0.75 to 0.94 inches.
- D4. FTB Models available:
  - *A15 female BNC/isolated female BNC.
  - *C15 male BNC/isolated female BNC.

  FT Models available:
  - *A16 female BNC/female BNC 75 ohms.
  - *B16 female BNC/male BNC 75 ohms.
  - *C16 male BNC/female BNC 75 ohms.
- D5. Connectors: BNC standard, TNC consult factory.
- D6. Connectors: Female SMA only. Male SMA available on request, consult factory.
- D7. For ZFSC-5 a fifth connector is offered as Port 5 in-line and opposite of sum(s) port.

E. SPECIAL TOLERANCES
- E1. Pin diameter ±.005 inch.

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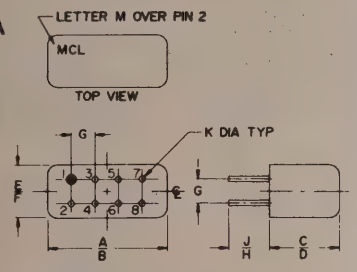
Distribution Centers/NORTH AMERICA 800-654-7949 417-335-5935 Fax 417-335-5945 EUROPE 44-252-835094 Fax 44-252-837010

Mini-Circuits

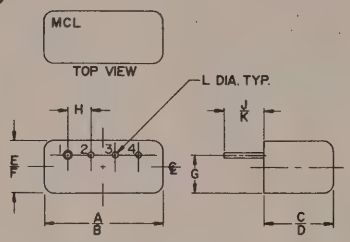
outline drawings

A



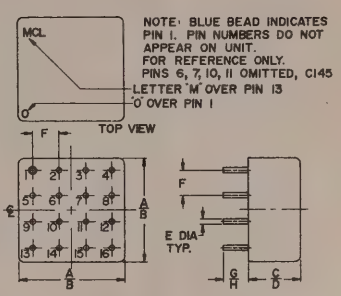
NOTE: Blue Bead indicates pin 1.
Pin numbers do not appear on unit.
For reference only.

B



NOTE: Blue Bead indicates pin 1.
Pin numbers do not appear on unit.
For reference only.

C



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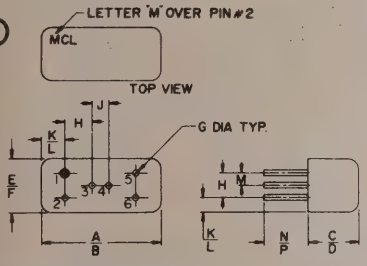
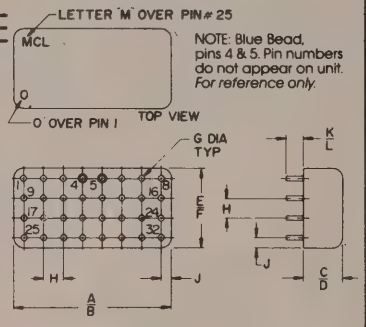


NOTE: Blue Bead indicates pin 1.
Pin numbers do not appear on unit.
For reference only.

E



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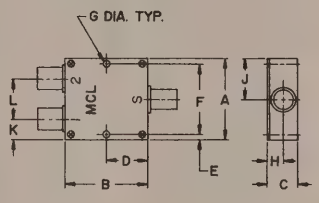

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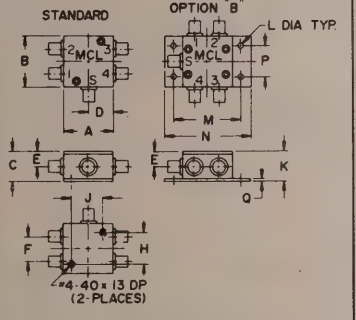

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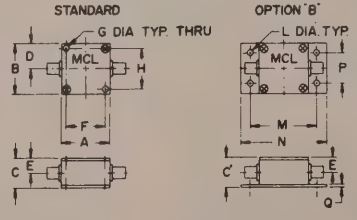

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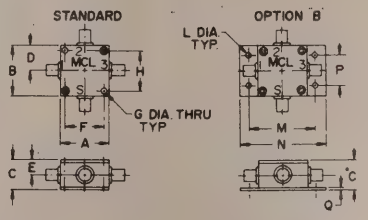

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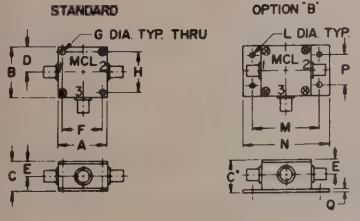

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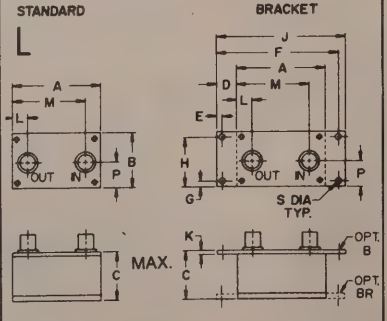

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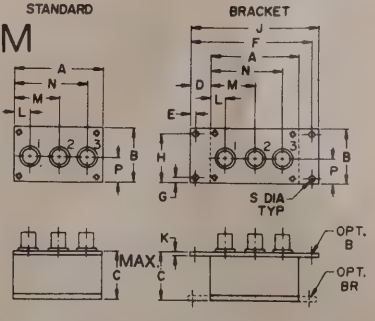

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case styles
outline dimensions (inch / mm)

case no.	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T	wt. grams.	NOTES*
N24	1.50 38.10	1.13 28.70	1.00 25.40	.50 12.70	.155 3.94	2.345 59.56	.138 3.51	.987 25.07	2.50 63.50	.10 2.54	.32 8.13	.75 19.05	1.18 29.97	.31 7.87	.56 14.22	.81 20.57	.150 3.81		45.0	A6, A11, A18, B2, D6
N27	2.25 57.15	1.38 35.05	1.24 31.50	.50 12.70	.150 3.81	3.100 78.74	.138 3.51	1.238 31.45	3.25 82.55	.10 2.54	.48 12.19	1.13 28.70	1.78 45.21	.36 9.14	.69 17.53	1.01 25.65	.150 3.81		92.0	A6, A11, A18, B2, D7
P25	2.25 57.15	1.38 35.05	1.24 31.50	.50 12.70	.150 3.81	3.100 78.74	.138 3.51	1.238 31.45	3.25 82.55	.10 2.54	.78 19.81	1.47 37.34	— —	.38 9.65	1.00 25.40	— —	.150 3.81		86.0	A6, A11, A18, B2, D7
P26	1.50 38.10	1.13 28.70	1.00 25.40	.50 12.70	.155 3.94	2.345 59.56	.138 3.51	.987 25.07	2.50 63.50	.10 2.54	.50 12.70	1.00 25.40	— —	.31 7.87	.81 20.57	— —	.150 3.81		42.5	A6, A11, A18, B2, D6
Q28	4.06 103.12	1.60 40.64	1.50 38.10	3.56 90.42	.24 6.10	.88 22.35	.36 9.14	.160 4.06	.4 10.16	.69 17.53	.58 14.73	.66 16.76	3.13 79.50	.8 20.32	.06 1.53				300.0	A10, A18, D9
R29	4.06 103.12	1.60 40.64	1.50 38.10	3.56 90.42	.24 6.10	.88 22.35	.36 9.14	.160 4.06	.4 10.16	.69 17.53	.58 14.73	.66 16.76	3.13 79.50	.8 20.32	.06 1.53				300.0	A10, A18, C2, D9
R30	6.69 169.93	1.60 40.64	1.50 38.10	6.22 157.99	.24 6.10	.88 22.35	.36 9.14	.160 4.06	.40 10.16	.69 17.53	.55 13.97	.66 16.76	5.72 145.29	.81 20.57	.06 1.53				500.0	A5, A18, C2, D9
R31	9.31 236.47	1.60 40.64	1.50 38.10	8.84 224.54	.24 6.10	.88 22.35	.36 9.14	.160 4.06	.40 10.16	.69 17.53	.54 13.72	.66 16.76	8.34 211.84	.81 20.57	.06 1.53				700.0	A5, A18, C2, D9
R67	6.69 169.93	1.60 40.64	1.50 38.10	6.22 157.99	.24 6.10	.88 22.35	.36 9.14	.160 4.06	.40 10.16	.69 17.53	1.22 30.99	.66 16.76	5.72 145.29	.81 20.57	.06 1.53				500.0	A5, A18, D9
S32	3.75 95.25	2.00 50.80	1.8 45.72	.19 4.83	3.375 85.72	.19 4.83	1.625 41.27	.156 3.96	.6 15.24	.4 10.16	.5 12.70	1.30 33.02	.09 2.29	.38 9.65	3.00 76.20	.30 7.62	2.60 66.04		220.0	A7, A18, D19
T34	4.75 120.65	2.00 50.80	2.21 56.13	.19 4.83	4.375 111.13	.23 5.84	1.540 39.12	.144 3.66	.58 14.73	.34 8.64	.50 12.70	1.50 38.10	1.00 25.40	.12 3.05	.38 9.65	4.00 101.60	.30 7.62	2.60 66.04	440.0	A7, A8, A18, D16
T35	4.75 120.65	2.00 50.80	2.40 60.96	.19 4.83	4.375 111.13	.23 5.84	1.540 39.12	.144 3.66	.58 14.73	.34 8.64	.50 12.70	1.50 38.10	1.00 25.40	.12 3.05	.38 9.65	4.00 101.60	1.50 38.10	5.00 127.00	700.0	A7, A8, A18, D16
U36	7.00 177.80	3.25 82.55	2.13 54.10	.25 6.35	6.500 165.10	.38 9.65	2.500 63.50	.156 3.96	.88 22.35	.73 18.54	.63 16.00	1.13 28.70	2.23 56.64	.125 3.17	.50 12.70	6.00 152.40			900.0	A7, A8, A18, D6
U111	7.00 177.80	3.25 82.55	3.13 79.50	.25 6.35	6.500 165.10	.38 9.65	2.500 63.50	.156 3.96	.88 22.35	.43 10.92	.63 16.00	1.00 25.40	2.63 66.80	.125 3.17	.50 12.70	6.00 152.40	2.23 56.64		1100.0	A8, A18, D6
U200	7.00 177.80	3.25 82.55	2.13 54.10	.25 6.35	6.500 165.10	.38 9.65	2.500 63.50	.156 3.96	.73 18.54	.53 13.46	.20 5.08	.70 17.78	1.25 31.75	.125 3.17	.50 12.70	6.00 152.40	2.15 54.61	.50 12.70	1000.0	A7, A18, D6
V37	.83 21.08	.83 21.08	.75 19.05	.37 9.40	.42 10.67	1.25 31.75	.100 2.54	1.150 29.21	.095 2.41	.735 18.67	.21 5.33	.106 2.69	.06 1.52						34.0	A10, A18, C1, D17
W38	.30 7.62	.27 6.86	.23 5.84	.010 0.25	.042 1.07	.020 0.51	.100 2.54	.05 1.27	.09 2.29	.37 9.40	.036 0.91								.50	A3, E2
X65	.30 7.62	.27 6.86	.23 5.84	.010 0.25	.042 1.07	.020 0.51	.100 2.54	.05 1.27	.04 1.02	.12 3.05	.300 7.62	.35 8.89							.50	A3, E2
Y39	1.25 31.75	1.25 31.75	.75 19.05	.63 16.00	.36 9.14	1.000 25.40	1.000 25.40	.125 3.17	.125 3.17	.46 11.68	2.18 55.37	1.688 42.88	.07 1.78	.750 19.05	.50 12.702	.80 20.32	.45 11.43	.29 7.37	50.0	A4, A18, B1, D6, D22
Z40	7.06 179.32	3.13 79.50	.88 22.35	.250 6.35	1.750 44.45	5.310 134.87	6.810 172.97	.312 7.92	2.875 73.03	.144 3.66	3.53 89.66	.44 11.18	.415 10.54	.89 22.61					800.0	A10, D11
Z54	3.50 88.90	2.13 54.10	.88 22.35	.250 6.35	— —	— —	3.250 82.55	— —	— —	.125 3.17	1.750 44.45	.44 11.18	.415 10.54	.89 22.61	.250 6.35	1.813 46.05			250	A10, D11
Z184	2.26 57.40	2.00 50.80	.70 17.78	.200 5.08	— —	— —	2.060 52.32	— —	— —	.125 3.17	1.13 28.70	.35 8.89	.38 9.65	.500 12.70	.200 5.08	— —			59	A4, D17
AA46	.830 21.08	.580 14.73	.265 6.73	.13 3.30	.415 10.54	.340 8.64	.025 0.63	.50 12.70											6.4	A2, E1
BB48	.50 12.70	.39 9.91	.225 5.72	.025 0.63	.07 1.78	.100 2.54	.250 6.35	.350 8.89	.06 1.52	.31 7.87									3.0	A1, E1
CC51	2.00 50.80	2.00 50.80	.75 19.05	.938 23.83	.13 3.30	1.750 44.45	.125 3.17	.38 9.65	1.00 25.40	1.25 31.75									120.0	A10, D11

tolerance .x±.1 .xx±.03 .xxx±.015 inch **oz. = grams x.0353**

* NOTES:

A. MATERIAL AND FINISH
- A1. Header material: C. R. S. Pin material: #52 alloy. Finish: electro tin, hot oil flowed. Cover material: cupro-nickel.
- A2. Case material: C. R. S. Pin material: #52 alloy. Cover material: stainless steel. Finish: gold flash per MIL-G-45204.
- A3. Case material: epoxy. Pin material: iron-nickel alloy. Finish: bright tin-plate per MIL-T-10727
- A4. Case material: aluminum alloy. Finish: irridite per MIL-C-5541.
- A5. Case material: C. R. S. Finish: grey paint over hot-tin dip.
- A6. Case material: aluminum alloy. Finish: blue paint over irridite
- A7. Case material: aluminum alloy. Finish: case black paint. Heat sink: black anodize. Baseplate iridite per MIL-C-5541.
- A8. Case material: aluminum alloy. Finish: case irridite. Heat sink: black anodize.
- A10. Case material: aluminum alloy. Finish: grey paint.
- A11. Case material: aluminum alloy. Finish: blue anodized.
- A18. Mounting bracket finish: irridite or clear anodize.

B. MOUNTING
- B1. Mounting bracket available on request. Add suffix B to part number.
- B2. Mounting bracket available on request. For bracket mounted on connector end add suffix B to part number and $5.00 to unit cost. For bracket mounted on the rear, add suffix BR to part number and add $1.50 to unit cost.

C. MARKING
- C1. For port markings 1, 2, and 3 see specification data sheet.
- C2. Consecutive marking, n = no. of way power-splitter.

D. CONNECTORS
- D6. Connectors: Female SMA only. Male SMA available on request, consult factory.
- D7. Connectors: BNC only.
- D9. Connectors: BNC standard. TNC or Female SMA on request, consult factory.
- D11. Connectors: Please specify; Type N or SMA.
- D16. Connectors: Please specify, unless otherwise noted SMA is standard for model ZHL-2-12 for all other models BNC is standard. TNC, N, or SMA available on request. consult factory.
- D17. Connectors: Female SMA only.
- D22. Gain Control Terminal on Models ZFL-1000G and ZFL-1000GH only.

E. SPECIAL TOLERANCES
- E1. Pin diameter ±.005 inch.
- E2. Lead width ±.010; lead thickness ±.005 inch.

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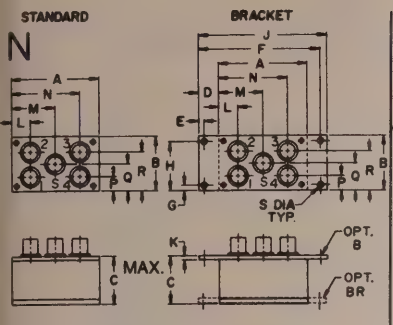
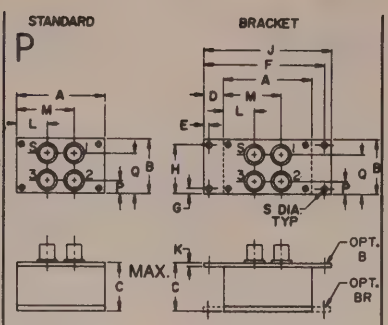
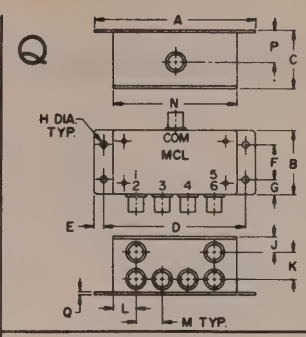
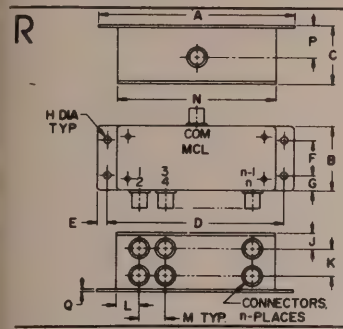
outline drawings

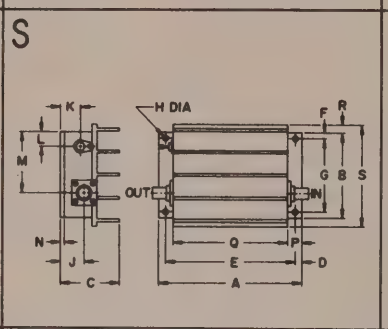
Mini-Circuits

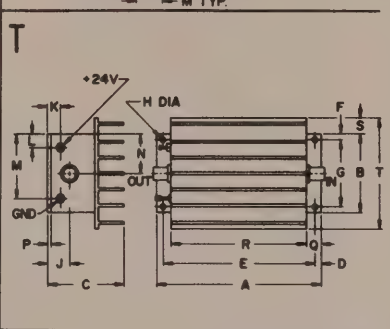


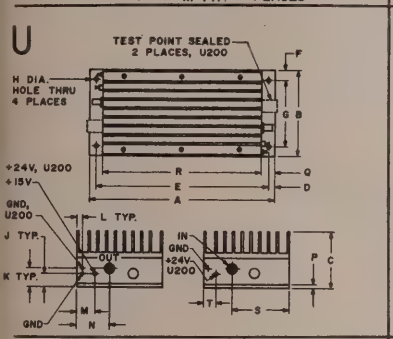


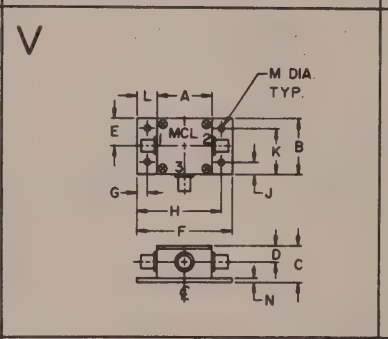


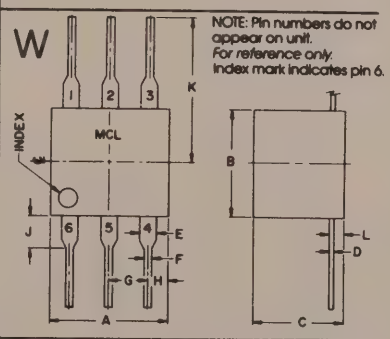


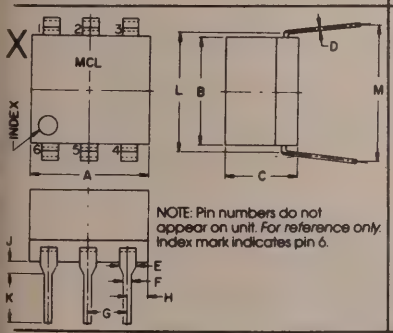


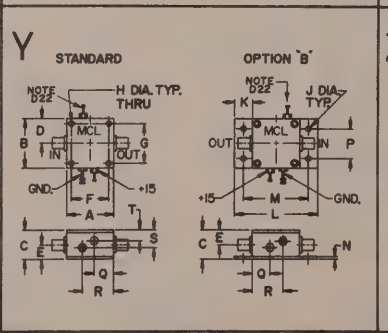


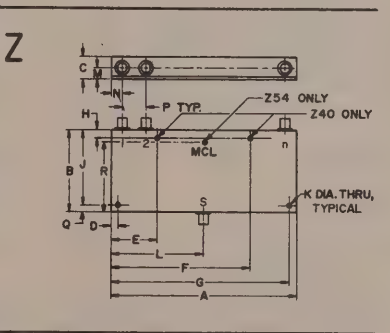


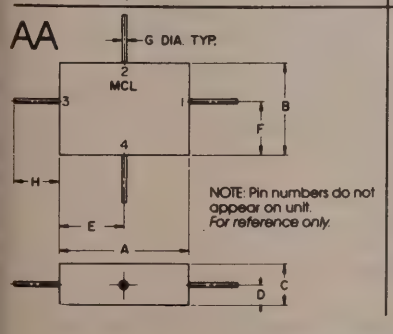


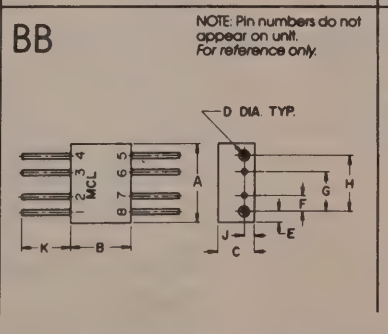


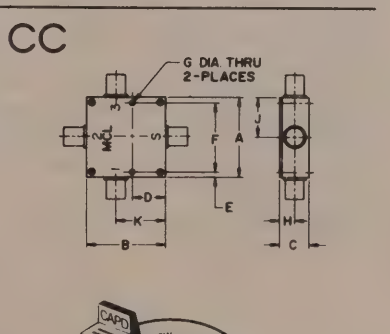












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CAPO now available! computer-automated performance data

28

case styles

outline dimensions (inch / mm)

case no.	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T	wt. grams.	NOTES*
DD52	2.00 50.80	2.00 50.80	.75 19.05	.90 22.86	.156 3.96	1.688 42.88	.125 3.18	.392 9.96	1.00 25.40	.50 12.70	1.00 25.40	1.25 31.75							225.0	A10, D11
FF55	1.40 35.56	.58 14.73	.73 18.54	2.59 65.79	— —														40.0	A9, D12
FF56	.98 24.89	.43 10.92	.47 11.94	1.70 43.18	— —														18.0	A9, D13
FF57	1.54 39.12	.72 18.29	.81 20.57	2.96 75.18	.82 20.83														90.0	A9, D14
FF58	1.40 35.56	.58 14.73	.61 15.49	2.59 65.79	.64 16.26														45.0	A9, D15
FF99	1.27 32.26	.72 18.29	.47 11.94	1.98 50.29															42.0	A9, D13
GG60	2.31 58.67	1.20 30.48	.60 15.24	.125 3.18	2.062 52.37	.30 7.62	.53 13.46	.63 16.00											75.0	A10, D10
HH68	9.31 236.47	1.60 40.64	3.57 90.68	8.84 224.54	.25 6.35	.88 22.35	.36 9.14	.160 4.06	.34 8.64	.69 17.53	.54 13.72	.66 16.76	8.34 211.84	.33 8.38	.06 1.52				1090.0	A5, A18, D10
JJ77	1.50 38.10	1.13 28.70	.97 24.64	.50 12.70	.155 3.94	2.345 59.56	.14 3.56	.850 21.59	2.50 63.50	.10 2.54	.44 11.18	.75 19.05	.63 16.00	.54 13.72	.37 9.40	.43 10.92	.150 3.81	.73 18.54	50.0	A6, A11, A18, D17
KK81	.30 7.62	.27 6.86	.23 5.84	.010 0.25	.042 1.07	.020 0.51	.100 2.54	.05 1.27	.05 1.27	.035 0.89	.036 0.91	.26 6.60	.575 14.61						.50	A3, E2, F1
LL85	1.43 36.32	.58 14.73	.75 19.05																21.5	A9, D18
LL86	1.19 30.23	.58 14.73	.51 12.95																14.0	A9, D19
LL87	1.43 36.32	.82 20.83	.68 17.27																48.5	A9, D20
LL88	1.43 36.32	.61 15.49	.75 19.05																24.0	A9, D21
NN92	3.66 92.96	3.25 82.55	2.13 54.10	.25 6.35	3.16 80.26	.38 9.65	2.50 63.50	.156 3.96	.72 18.29	.64 16.26	.74 18.80	1.78 45.21	2.30 58.42	.125 3.18	.50 12.70	2.66 67.56			440.0	A7, A8, A18, D6
PP94	.360 9.14	.250 6.35	.25 6.35	.016 0.41	.020 0.51	.04 1.02	.200 5.08												1.5	A12, C3
PP120	.50 12.70	.21 5.33	.150 3.81	.016 0.41	.020 0.51	.04 1.02	.300 7.62												1.5	A12, C3
PP163	.360 9.14	.400 10.16	.350 8.89	.016 0.41	.020 0.51	.040 1.02	.200 5.08												2.9	A12, C3
QQ95	.500 12.70	.250 6.35	.26 6.60	.016 0.41	.020 0.51	.04 1.02	.300 7.62	.150 3.81	.150 3.81	.075 1.91									3.5	A12, C3
QQ96	.600 15.24	.250 6.35	.26 6.60	.016 0.41	.020 0.51	.04 1.02	.400 10.16	.200 5.08	.200 5.08	.100 2.54									4.0	A12, C3
RR93	4.06 103.12	1.60 40.64	2.125 53.98	3.56 90.42	.25 6.35	.88 22.35	.36 9.14	.160 4.06	.4 10.16	.69 17.53	.58 14.73	.66 16.76	3.13 79.50	.8 20.32	.06 1.52	.33 8.38			350.0	A5, A10, A18, D9

tolerance .x±.1 .xx±.03 .xxx±.015 inch **oz. = grams x.0353**

* NOTES:

A. MATERIAL AND FINISH
- A3. Case material: epoxy. Pin material: iron-nickel alloy. Finish: bright tin-plate per MIL-T-10727.
- A5. Case material: C.R.S. Finish: grey paint over hot-tin dip.
- A6. Case material: aluminum alloy. Finish: blue paint over iridite.
- A7. Case material: aluminum alloy. Finish: case black paint. Heat sink: black anodize. Baseplate iridite per MIL-C-5541.
- A8. Case material: aluminum alloy. Finish: case iridite. Heat sink: black anodize.
- A9. Case material: brass. Finish: nickel plate.
- A10. Case material: aluminum alloy. Finish: grey paint.
- A11. Case material: aluminum alloy. Finish: blue anodized.
- A12. Header finish: gold plate per MIL-G-45204. Case material: cupro-nickel
- A18. Mounting bracket finish: iridite or clear anodize.

C. MARKING
- C3. For Pin designations see specification data sheet.

D. CONNECTORS
- D6. Connectors: Female SMA only. Male SMA available on request, consult factory.
- D9. Connectors: BNC standard. TNC or Female SMA on request, consult factory.
- D10. Connectors: BNC standard. SMA on request, consult factory.
- D11. Connectors: Please specify; Type N or SMA.
- D12. Connectors: Male BNC, Female BNC standard. Other combinations with SMA available on request, consult factory.
- D13. Connectors: Male SMA. Female SMA only.
- D14. Connectors: Male N, Female N standard. Combinations with BNC, SMA, TNC available on request, consult factory.
- D15. Connectors: Male TNC. Female TNC only.
- D17. Connectors. Female SMA only.
- D18. Connectors: Male BNC only.
- D19. Connectors: Male SMA only.
- D20. Connectors: Male Type N only.
- D21. Connectors: Male TNC only.

E. SPECIAL TOLERANCES
- E2. Lead width ±.010; lead thickness ±.005 inch.

F. PACKAGING
- F1-17. Tape and reel packaging available. See Tape and Reel Packaging information for details.

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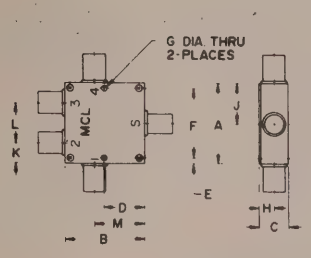
Mini-Circuits

outline drawings

DD



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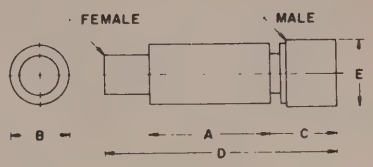

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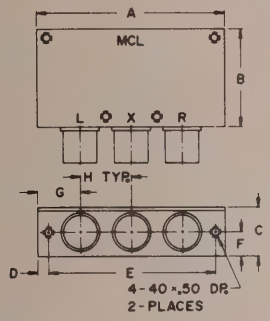

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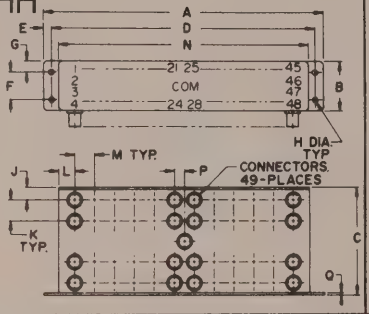

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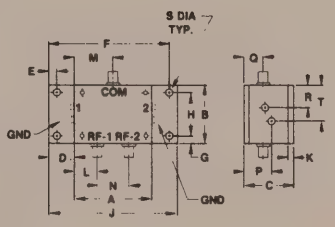

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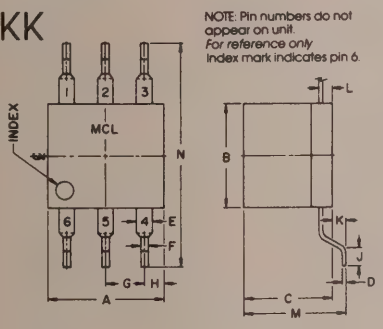

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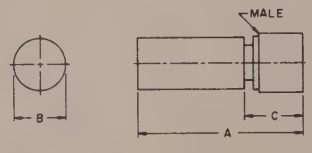

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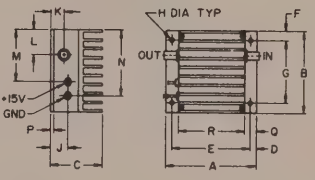

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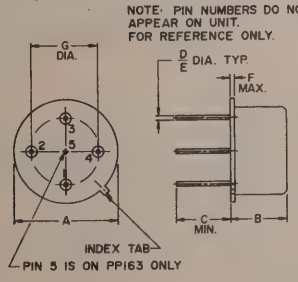

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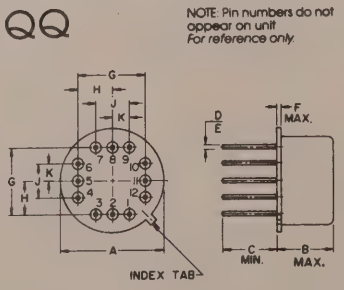

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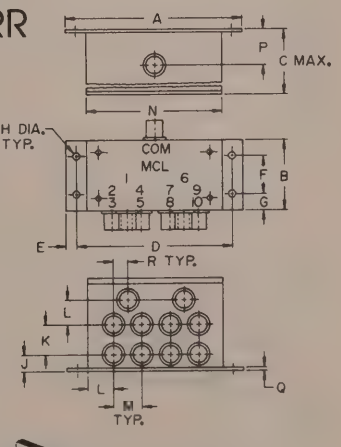


In Stock...Immediate Delivery

For custom versions of standard models consult our applications dept.

CAPO now available! computer-automated performance data

case styles
outline dimensions (inch / mm)

case no.	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T	wt. grams.	NOTES*
SS98	1.25 31.75	1.56 39.62	.75 19.05	.63 16.00	.39 9.91	1.56 39.62	1.000 25.40	— —	.125 3.18	.46 11.68	2.18 55.37	1.688 42.88	.07 1.78	.750 19.05	.50 12.70	.80 20.32	.45 11.43	.29 7.37	85.0	A8, A18, B1, D6
TT100	.250 6.35	.310 7.87	.20 5.08	.100 2.54	.050 1.27	.035 0.89	.040 1.02	.070 1.78	.270 6.86	.050 1.27									.50	A14, F2
TT146	.250 6.35	.310 7.87	.275 6.99	.100 2.54	.050 1.27	.035 0.89	.040 1.02	.070 1.78	.270 6.86	.050 1.27									.50	A14, F0
TT240	.250 6.35	.310 7.87	.20 5.08	.100 2.54	.050 1.27	.035 0.89	.040 1.02	.070 1.78	.270 6.86	.050 1.27									.50	A20, F2
TT241	.250 6.35	.310 7.87	.275 6.99	.100 2.54	.050 1.27	.035 0.89	.040 1.02	.070 1.78	.270 6.86	.050 1.27									.50	A20, F0
UU102	3.50 88.90	2.00 50.80	.50 12.70	.150 3.81	3.350 85.09	1.00 25.40	.125 3.18	1.75 44.45	.20 5.08	.55 13.97									120.0	A10, C2, D17
UU179	8.50 215.90	3.95 100.33	.75 19.05	.250 6.35	8.250 209.55	— —	.187 4.75	4.250 107.95	.38 9.65	.500 12.70	.475 12.07	3.475 88.27							282	A4, D17
UU181	2.25 57.15	2.30 58.42	.63 16.00	.125 3.18	2.125 53.98	— —	.125 3.18	1.13 28.70	.31 7.87	.500 12.70	.125 3.18	2.175 55.24							51	A4, D17
UU182	2.75 69.85	2.80 71.12	.63 16.00	.125 3.18	2.625 66.68	— —	.125 3.18	1.38 35.05	.31 7.87	.500 12.70	.125 3.18	2.675 67.95							67	A4, D17
UU187	6.00 152.40	1.62 41.15	.88 22.35	250 6.35	5.750 146.05	.810 20.57	.144 3.66	3.00 76.20	.44 11.18	1.00 25.40	— —	— —							274	A4, D23
UU188	3.50 88.90	2.13 54.10	.88 22.35	.150 3.81	3.350 85.09	1.06 26.92	.125 3.18	1.75 44.45	.44 11.18	.89 22.61	— —	— —							184	A4, D23
UU215	4.00 101.60	1.25 31.75	.38 9.65	.125 3.18	3.875 98.43	.500 12.70	#2-56 —	2.00 50.80	.19 4.83	.500 12.70	— —	1.125 28.58							77	A4, D17
UU233	1.50 38.10	1.00 25.40	.38 9.65	.125 3.18	1.375 34.93	.500 12.70	#2-56 —	.75 19.05	.19 4.83	.50 12.70									28.0	A8, B8, C2, D17
UU244	2.25 57.15	1.25 31.75	.50 12.70	.150 3.81	2.100 53.34	.62 15.75	.125 3.18	1.12 28.45	.19 4.83	.50 12.70									70	A4, C2, D17
VV105	.085 2.16	.060 1.52	.020 .51	.006 .15	.020 .51	.46 11.68													.015	A13, C4, E2
WW107	.020 .51	.10 2.54	.020 .51	.092 2.34	.085 2.16	.060 1.52	.008 .20	.026 .66											.015	A13, C4, E2, F4
XX112	.18 4.57	.18 4.57	— —	.40 10.16	.36 9.14	.050 1.27	.015 .38	.005 .13	.005 .13	.07 1.78	.06 1.52								.15	A15, E2
XX211	.163 4.14	.202 5.13	.077 1.96	.25 6.35	.22 5.59	.050 1.27	.017 .43	.009 .23	.025 .63	.03 .76	— —								.10	A13, E5, F16
YY101	.75 19.05	.38 9.65	.20 5.08	.010 .25	.050 1.27	.020 .51	.200 5.08	.075 1.91	.600 15.24	.450 11.43	.035 .89	.47 11.94	.100 2.54	.150 3.81					1.6	A13, E2, E5 F5
YY109	.75 19.05	.38 9.65	.20 5.08	.010 .25	.050 1.27	.020 .51	.200 5.08	.075 1.91	.600 15.24	— —	.16 4.06	.72 18.29	— —	— —					1.6	A13, E2, E5
YY161	.75 19.05	.38 9.65	.28 7.11	.010 .25	.050 1.27	.020 .51	.200 5.08	.075 1.91	.600 15.24	.450 11.43	.035 .89	.47 11.94	.100 2.54	.150 3.81					1.6	A13, E2, F6
ZZ121	1.25 31.75	1.25 31.75	.75 19.05	.63 16.00	.38 9.65	.61 15.49	— —	.800 20.32	.800 20.32	.76 19.30	.125 3.18	1.688 42.88	2.18 55.37	.75 19.05	.07 1.78				85.0	A10, A18, B1, D6
AAA118	1.50 38.10	.50 12.70	.935 23.75	.040 1.02	1.100 27.94	.19 4.83	.400 10.16	.15 3.81	.600 15.24	.300 7.62	.20 5.08	.14 3.56							.19	A1, E1, B7
BBB123	.145 3.69	.100 2.54	.04 1.02	.006 .15	.030 .76	.488 12.40													.015	A13, C5, E2
CCC127	2.25 57.15	1.38 35.05	1.24 31.50	.50 12.70	.150 3.81	3.100 78.74	.138 3.51	1.238 31.45	3.25 82.55	.12 3.05	.80 20.32	.69 17.53	1.60 40.64	.60 15.24	1.200 30.48	.52 13.21	.82 20.83	.150 3.81	80.0	A6, A11, A18, D17

tolerance .x±.1 .xx±.03 .xxx±.015 inch **oz. = grams x.0353**

* NOTES:

A. MATERIAL AND FINISH
- A1. Header material: C.R.S. Pin material: #52 alloy. Finish: electro tin, hot oil flowed. Cover material: cupro-nickel.
- A4. Case material: aluminum alloy. Finish: irridite per MIL-C-5541.
- A6. Case material: aluminum alloy. Finish: blue paint over irridite.
- A8. Case material: aluminum alloy. Finish: case irridite Heat sink, black anodize.
- A10. Case material: aluminum alloy. Finish: grey paint.
- A11. Case material: aluminum alloy. Finish: blue anodized.
- A13. Case material: plastic. Lead finish: Tin plate.
- A14. Case material: ceramic or plastic, ceramic base. Terminations: palladium platinum silver.
- A15. Case material: kovar. Lead material: kovar. Finish: gold plate per MIL-G-45204 .
- A18. Mounting bracket finish: irridite or clear anodize.
- A20. Case material: ceramic. Terminations: solder plate over nickel. Board edges straight.

B. MOUNTING
- B1. Mounting bracket available on request. Add suffix B to part number.
- B7. Pin's meniscus (of header) 0.015" max.
- B8. #2-56 UNC-2B mounting holes provided to .32" deep minimum.

C. MARKING
- C2. Consecutive marking n = no. of way power splitter.
- C4. RF input lead (1) identified by diagonally cut lead; may additionally have orientation mark. Model dash number identified by color dot or alphanumeric code on case. See Specification Data Sheet.
- C5. RF output is identified by index mark, model dash number by alphanumeric code.

D. CONNECTORS
- D6. Connectors: Female SMA only. Male SMA available on request, consult factory.
- D17. Connectors: Female SMA only.

E. SPECIAL TOLERANCES
- E1. Pin diameter ±.005 inch.
- E2. Lead width ±.010; lead thickness ±.005 inch.
- E5. For SCM mixers, long lead version (YY109) is available upon request; consult factory. To order short lead version (case YY101) add -NL suffix.

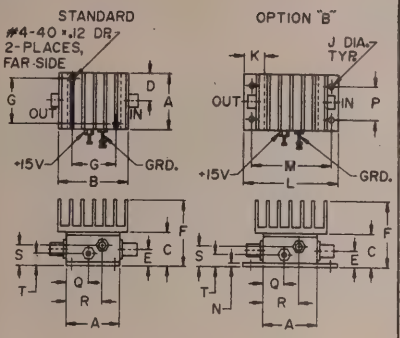
F. PACKAGING
- F0. Not available in Tape & Reel.
- F1-17. Tape and reel packaging available. See Tape and Reel Packaging Information for details.

Mini-Circuits™ Distribution Centers/NORTH AMERICA P.O. Box 350166, Brooklyn, New York 11235-0003 (718) 934-4500 Fax (718) 332-4661
800-654-7949 417-335-5935 Fax 417-335-5945 EUROPE 44-252-835094 Fax 44-252-837010

outline drawings

Mini-Circuits

SS



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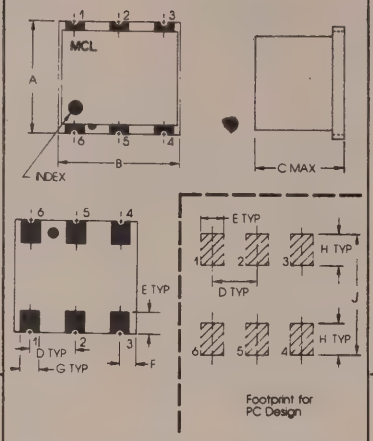

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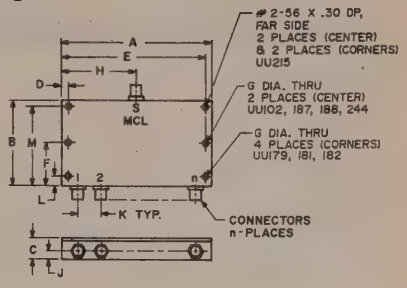

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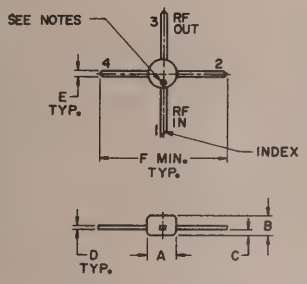

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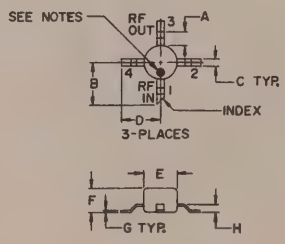

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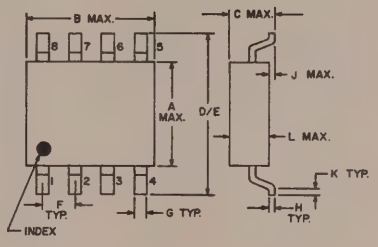

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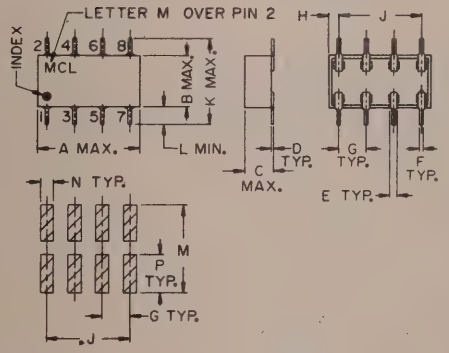

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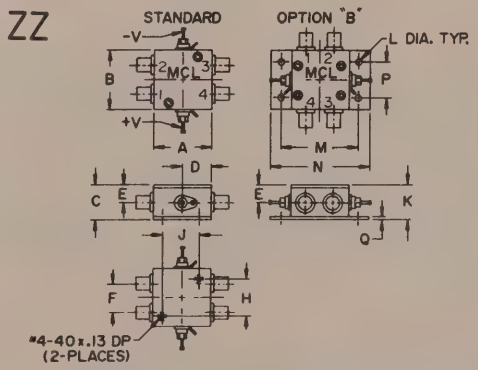

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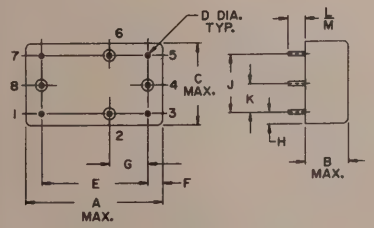

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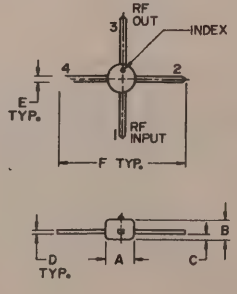

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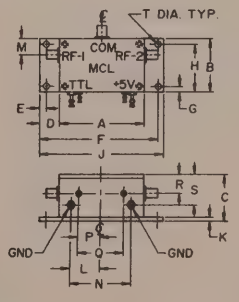

In Stock...Immediate Delivery

For custom versions of standard models consult our applications dept.

CAPO now available! computer-automated performance data

case styles

outline dimensions (inch / mm)

case no.	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T	wt. grams.	NOTES*
DDD131	7.00 177.80	3.25 82.55	3.13 79.50	.25 6.35	6.500 165.10	.38 9.65	2.500 63.50	.144 3.66	.88 22.35	.73 18.54	.63 16.00	1.13 28.70	2.23 56.64	.125 3.18	.50 12.70	6.00 152.40	2.23 56.64	8.35 212.09	1884.0	A7, A18, D6
EEE132	.90 22.86	.90 22.86	.675 17.15	.245 6.22	.45 11.43	1.34 34.04	.09 2.29	1.152 29.26	.09 2.29	.712 18.08	.22 5.59	.106 2.69	.05 1.27						50.0	A4, A18, D6
FFF122	.83 21.08	.83 21.08	.18 4.57	.10 2.54	.100 2.54	.600 15.24	.95 24.13	.017 .43	.15 3.81										5.0	A15, E1
GGG126	2.25 57.15	1.38 35.05	1.24 31.50	.50 12.70	.150 3.81	3.100 78.74	.138 3.51	1.238 31.45	3.25 82.55	.12 3.05	.80 20.32	.69 17.53	— —	.60 15.24	1.200 30.48	.52 13.21	.82 20.83	.150 3.81	80.0	A6, A11, A18, D17
HHH141	2.00 50.80	2.00 50.80	.95 24.13	1.000 25.40	.100 2.54	1.800 45.72	.125 3.18	.62 15.75	1.00 25.40	1.35 34.29									200.0	A10, C1, D6
JJJ142	1.25 31.75	1.25 31.75	.75 19.05	.63 16.00	.38 9.65	.32 8.13	— —	.80 20.32	.80 20.32										70.0	A10, D17
JJJ245	.75 19.05	1.00 25.40	.58 14.73	.38 9.65	.29 7.37	.35 8.89													22.0	A4, B9, D6
KKK155	.32 8.13	.445 11.30	.090 2.29	.006 .152	.012 .30	.070 1.78	.050 1.270	.010 .254	.015 .38	.030 .762	.050 1.270	.050 1.270							.40	A13, F7
MMM168	.045 1.14	.053 1.35	.110 2.79	.120 3.05	.035 .89	005 .13	.089 2.26	.104 2.64	.070 1.78	.080 2.03	.018 .46	.022 .56	.030 .76	.033 .84	.015 .38	.018 .46	.024 .61	.006 .15	1.0	A13, F8
NNN150	.50 12.70	.48 12.19	.255 6.48	.240 6.10	23 5.84	.21 5.33	.06 1.52	.100 2.54	.09 2.29	.16 4.06	.020 .51	.09 2.29	.005 .13						1.9	A1, E1, F9, B7
PPP83	.75 19.05	.38 9.65	.20 5.08	.010 .25	.05 1.27	.020 .51	.200 5.08	.075 1.91	.200 5.08	.14 3.56	.060 1.52								1.6	A13, E2
QQQ130	.310 7.87	.310 7.87	.20 5.08	.10 2.54	.010 .25	.100 2.54	.050 1.27	.400 10.16	.42 10.67	.120 3.05	.060 1.52	.100 2.54	.02 .51						.55	A13, E2, F10

tolerance .x±.1 .xx±.03 .xxx±.015 inch **oz. = grams x.0353**

* NOTES:

A. MATERIAL AND FINISH
- A1. Header material C.R.S. Pin material: #52 alloy. Finish: electro tin, hot oil flowed. Cover material: cupro-nickel.
- A4. Case material: aluminum alloy. Finish: irridite per MIL-C-5541.
- A6. Case material: aluminum alloy. Finish: blue paint over irridite.
- A7. Case material: aluminum alloy. Finish: case black paint. Heat sink: black anodize. Baseplate irridite per MIL-C-5541.
- A10. Case material: aluminum alloy. Finish: grey paint.
- A11. Case material: aluminum alloy. Finish: blue anodized.
- A12. Header finish: gold plate per MIL-G-45204. Case material: cupro-nickel.
- A13. Case material: plastic. Lead finish: Tin plate.
- A15. Case material: kovar. Lead material: kovar. Finish: gold plate per MIL-G-45204.
- A18. Mounting bracket finish: irridite or clear anodize.

B. MOUNTING
- B7. Pin's meniscus (of header) 0.015" max.
- B9. No mounting holes.

C. MARKING
- C1. For port markings 1, 2, and 3 see specification data sheet.
- C3. For Pin designations see specification data sheet.

D. CONNECTORS
- D6. Connectors: Female SMA only. Male SMA available on request, consult factory.
- D17. Connectors: Female SMA only.

E. SPECIAL TOLERANCES
- E1. Pin diameter ±.005 inch.
- E2. Lead width ±.010; lead thickness ±.005 inch

F. PACKAGING
- F1-17. Tape and reel packaging available. See Tape and Reel Packaging Information for details.

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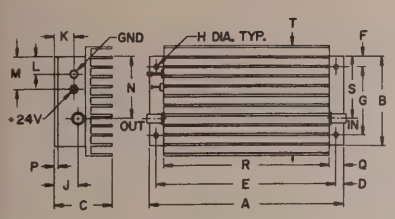
800-654-7949 417-335-5935 Fax 417-335-5945 EUROPE 44-252-835094 Fax 44-252-837010

Mini-Circuits

outline drawings

DDD



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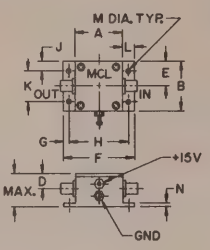

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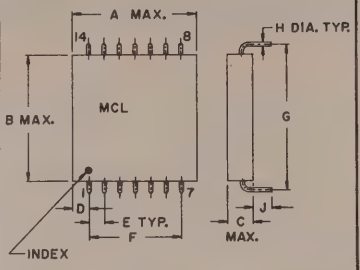

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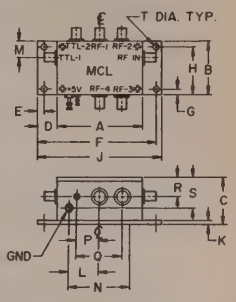

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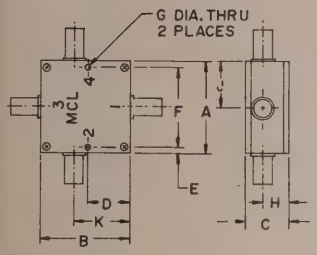

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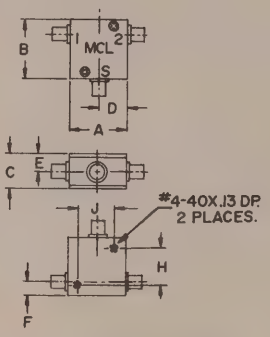

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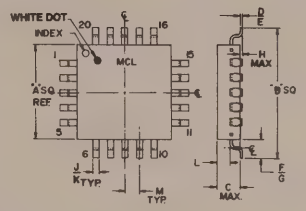

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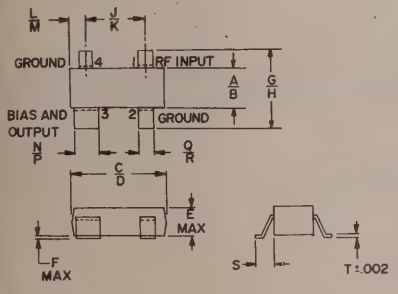
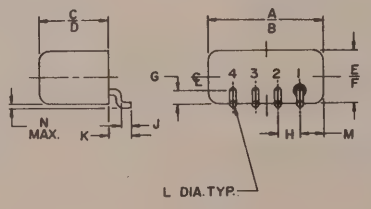


NNN

NOTE:
BLUE BEAD INDICATES PIN #1.
PIN NUMBERS DO NOT APPEAR
ON UNIT. FOR REFERENCE ONLY.



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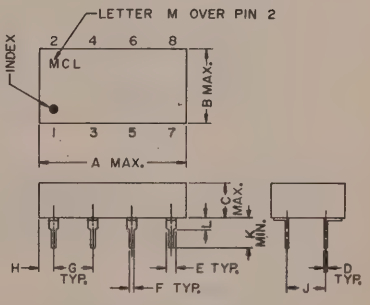
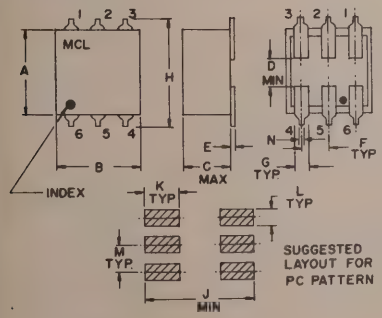
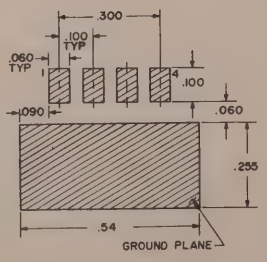


QQQ





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case styles

outline dimensions (inch / mm)

case no.	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T	wt. grams.	NOTES*
RRR137	.28 7.11	.14 3.56	.030 .76	.020 .51	.145 3.68	.110 2.79	.006 .15	.010 .25	.030 .76										.015	A13, C5, E2, F11
SSS173	1.25 31.75	1.25 31.75	.75 19.05	.63 16.00	.38 9.65	1.000 25.40	.125 3.18	1.000 25.40	— —	— —	.125 3.18	1.688 42.88	2.18 55.38	.75 19.05	.07 1.78				75	A10, A18, D17
TTT166	.375 9.53	.500 12.70	.15 3.81	.020 .51	.075 1.91	.250 6.35	.325 8.26	.187 4.75	.050 1.27	.050 1.27	.070 1.78	.270 6.86	.540 13.72	.060 1.52	.095 2.41	.445 11.30	.208 5.28	.415 10.54	.8	A19, F12
TTT167	.375 9.53	.500 12.70	.23 5.84	.020 0.51	.075 1.91	.250 6.35	.325 8.26	.187 4.75	.050 1.27	.050 1.27	.070 1.78	.270 6.86	.540 13.72	.060 1.52	.095 2.41	.445 11.30	.208 5.28	.415 10.54	.8	A19, F13
VVV180	1.80 45.72	1.75 44.45	.50 12.70	.125 3.18	1.675 42.55	.125 3.18	.125 3.18	1.625 41.28	.23 5.84	.63 16.00	1.13 28.70	.88 22.35							34	A4, D17
AB185	4.76 120.90	3.00 76.20	.53 13.46	.150 3.81	4.610 117.09	1.500 38.10	.125 3.18	.50 12.70	.25 6.35	1.13 28.70	.500 12.70								183	A4, D17
AB186	4.76 120.90	3.00 76.20	.53 13.46	.150 3.81	4.610 117.09	1.500 38.10	.125 3.18	.38 9.65	.25 6.35	.88 22.35	.500 12.70								153	A4, D17
AB204	6.13 155.70	3.00 76.20	.53 13.46	.162 4.11	5.962 151.43	1.500 38.10	.116 2.95	.50 12.70	.25 6.35	1.13 28.70	.50 12.70								215	A4, C2, D17
AF190	.180 4.57	.090 2.29	.020 .51	.100 2.54	.083 2.11	.076 1.93	.005 .13	.022 .56											.04	A16, C6, E3, F14
AG191	.310 7.87	.400 10.16	.095 2.41	.003 .08	.007 .18	.035 .89	.055 1.40	.020 .51	.050 1.27										.40	A17, C7, E4, F15
AH202	.375 9.53	.500 12.70	.25 6.35	.020 .51	.035 .89	.050 1.27	.140 3.56	.180 4.57	.320 8.13	.360 9.14	.450 11.43	.465 11.81	.095 2.41	.135 3.43	.240 6.10	.280 7.11			.80	A19
AR214	2.25 57.15	1.38 35.05	1.25 31.75	.50 12.70	.150 3.81	3.100 78.74	.138 3.51	1.238 31.45	3.25 82.55	.12 3.05	.69 17.53	1.50 38.10	.30 7.62	.41 10.41	.71 18.03	.41 10.41	.150 3.81		74.0	A6, A18, D17
AT224	.150 3.81	.150 3.81	.150 3.81	.050 1.27	.030 .76	.025 .64	.028 .71	.050 1.27	.160 4.06	.030 0.76									.15	A21, F17

tolerance .x±.1 .xx±.03 .xxx±.015 inch **oz. = grams x.0353**

*NOTES:

A. MATERIAL AND FINISH
- A4. Case material: aluminum alloy. Finish: irridite per MIL-C-5541.
- A6. Case material: aluminum alloy. Finish: blue paint over irridite.
- A10. Case material: aluminum alloy. Finish: grey paint.
- A11. Case material: aluminum alloy. Finish: blue anodized.
- A13. Case material: plastic. Lead finish: Tin plate.
- A16. Case material: ceramic. Lead material: #42 alloy. Finish: tin plate.
- A17. Case material: CRS. Lead material: kovar. Finish: gold plate 50 micro inches.
- A18. Mounting bracket finish: irridite or clear anodize.
- A19. Case material plastic, G-10 base. Termination finish: solder plate
- A21. Open-style, ceramic base. Termination finish: solder plate over nickel.

C. MARKING
- C2. Consecutive marking n = no. of way power splitter.
- C5. RF output is identified by index mark.
- C6. RF input lead (1) identified by diagonally cut lead. Orientation is also indicated by underline in marking.
- C7. lead #1 is identified by diagonally cut lead, located near letter M in marking.

D. CONNECTORS
- D17. Connectors; Female SMA only.
- D23. Connectors. Please specify female type N or SMA.

E. SPECIAL TOLERANCES
- E2. Lead width ±.010; lead thickness ±.005 inch.
- E3. Lead width ±.005; lead thickness ±.002; cap diameter ±.005 inch.
- E4. All tolerances are ±.005 except where minimum or maximum limits are shown.

F. PACKAGING
- F1-17. Tape and reel packaging available. See Tape & Reel packaging information for details.

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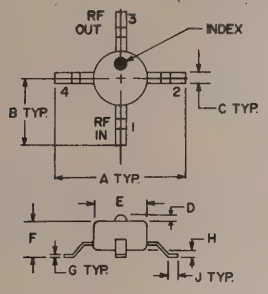
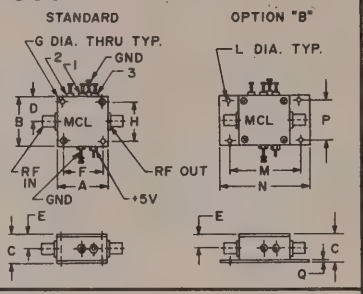
Mini-Circuits

outline drawings

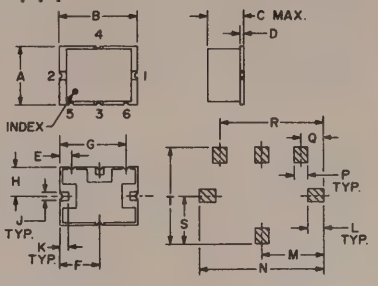
RRR



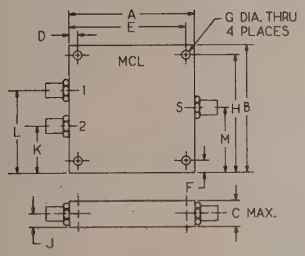
SSS



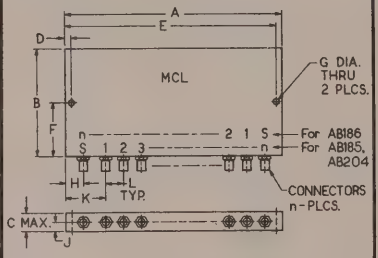
TTT



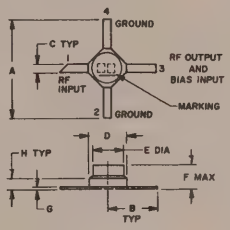
VVV



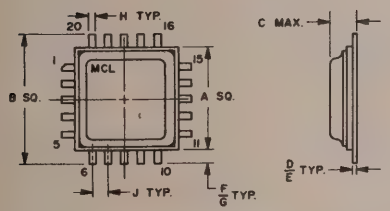
AB



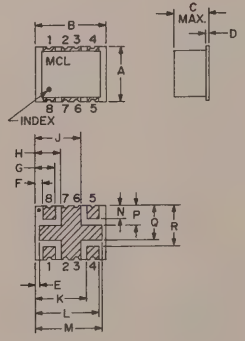
AF



AG



AH



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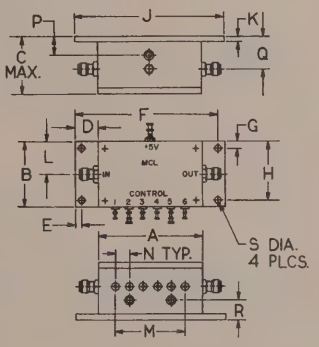
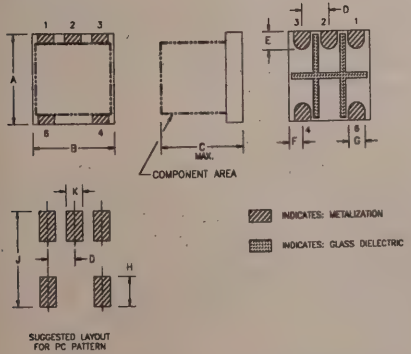


AT



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designers kits

Mini-Circuits offers a wide range of plug-in and surface-mount component kits to aid the engineer during the evaluation, design, and prototype stages. In addition, there are kits offered to provide components for use in the testing laboratory. These kits contain a carefully-selected group of models that will enable the largest versatility of usage by the engineer.

As an example of Mini-Circuit's quest to exceed our customer's expectations, these kits are priced up to 40 percent lower than the cost of individual units and are available from stock.

TYPE	KIT NO.	QTY. EACH MODEL	MODEL NUMBERS	TOTAL QUANTITY UNITS	PRICE
FREQUENCY MIXERS	K-SYM*	1	SYM-2, -11, -860, -11LH, 11MH, 11H	6	59.95
	K-TUF*	1	TUF-1, 1SM, -2, -2SM, -3, -3SM, -5, -5SM, -11A, -11ASM, -860, -860SM	12	79.95
	K1-RMS*	1	RMS-1, -1W, -2, -2D, -2U, -5, -11A, -860	8	59.95
	K1-LRMS*	1	LRMS-1, -1W, -2, -2D, -2U, -5, -11A, -860	8	59.95
	K2-LRMS*	1	LRMS-1LH, -2LH, 5LH, -1MH, -2MH, 5MH, -1H, -2UH, -5H	9	89.95
	K-SM*	2	SYM-2, RMS-2, LRMS-2, SCM-2, TUF-2SM	10	59.95
	K-860*	2	SYM-860, RMS-860, LRMS-860, TUF-860SM	8	82.60
POWER SPLITTERS	K1-PS*	1	SCP-2-1A, SCP-3-1, SCPQ-21.4, SCPQ-90, SCPQ-180, SCPQ-400	6	59.95
	K2-PS	1	PSCQ-2-21.4, -2-50, -2-90, -2-180, -2-250, -2-400	6	99.95
	K3-PS	2	PSC-2-1-75, -3-1-75, -4-1-75	6	99.95
	K4-PS	2	PSC-2-1, PSCJ-2-1, AND 1 EACH PSC-3-1A, PSC-4-3	6	99.95
AMPLIFIERS	DAK-2	5	MAR-1, -2, -3, -4, -6, -7, -8	35	59.95
	DAK-2SM*	5	MAR-1SM, -2SM, -3SM, -4SM, -6SM, -7SM, -8SM	35	61.95
	DAK-3*	3	MAR-1, -1SM, -2 -2SM, -3, -3SM, -4, -4SM MAR-6, -6SM, -7, -7SM, -8, -8SM, MAV-11, -11SM	48	59.95
	K1-MAN	1	MAN-1LN, 1HLN, -1, -2	4	59.95
	K2-MAN	1	MAN-1AD, 11AD, 2AD	3	59.95
	K-ZFL	1	ZHL-6A, ZFL-1000, ZFL-2000	3	395.00
CHIP CAPACITORS	KCAP-1	50	10PF, 22PF, 47PF, 68PF, 100PF, 220PF, 470PF, 680PF, 1000PF, 2200PF, 4700PF, 6800PF, .010UF, .022UF, .047UF, .068UF, .100UF	850	99.95
DIGITAL STEP ATTENUATORS	K-TOAT	1	TOAT-124, -3610, -51020	3	149.95
	K-ZFAT	1	ZFAT-R512, -124, -3610, -51020	4	299.95
ELECTRONIC ATTENUATORS	K-PAS	1	PAS-1, -3, -2000	3	99.95

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TYPE	KIT NO.	QTY. EACH MODEL	MODEL NUMBERS	TOTAL QUANTITY UNITS	PRICE
FIXED ATTENUATORS/ TERMINATIONS	K1-AT	4	AT-3, -6, -10, -20	16	49.95
	K2-AT	1	AT-1, -2, -3, -4, -5, -6, -7, -8, -9, -10, AT-12, -15, -20, -30, -40, -3-75, -6-75, AT-10-75, -15-75, -20-75	20	49.95
	K1-MAT	2	MAT-3, 6, 9, 10, 12, 15, 20, 40	16	49.95
	K2-MAT	1	MAT-1, -2, -3, -4, -5, -6, -7, -8, -9 MAT-10, -12, -15, -20, -25, -30, -40	16	49.95
	K1-CAT	2	CAT-3, -6, -10, -20	8	89.95
	K2-CAT	1	CAT-1, -2, -3, -4, -5, -6, -7, -8, -9, CAT-10, -12, -15, -20, -30, -40	15	199.95
	K-CAT-75	1	CAT-3-75, -6-75, -10-75, -15-75, -20-75	5	74.95
	K1-SAT	2	SAT-3, -6, -10, -20	8	109.95
	K2-SAT	1	SAT-1, -2, -3, -4, -5, -6, -7, -8, -9, SAT-10, -12, -15, -20, -30, -40	15	219.95
	K-NAT	2	NAT-3, -6, -10, -20	8	149.95
	K-TRM	2	BTRM-50, STRM-50, NTRM-50	6	49.95
DIRECTIONAL COUPLERS	K1-DC	1	ZFDC-10-5, -15-5, -20-5 (BNC CONNECTORS)	3	199.95
	K2-DC	1	ZFDC-10-1, -20-4	2	89.95
	K3-DC	1	PDC-10-6, -15-21, -20A-5	3	79.95
	K4-DC	1	PDC-10-1-75, -15-6-75, 20-3-75, 20-6-75	4	59.95
	K5-DC	1	PDC-10-1, -10-54, -10-6	3	53.95
	K6-DC	1	ZFDC-10-21-75, -20-3-75, -3375 (BNC CONNECTORS)	3	119.95
	K7-DC	1	ZEDC-10-2B, -15-2B, ZFDC-20-4 (SMA CONNECTORS)	3	149.95
FILTERS	K-SCF*	1	SCLF-21.4, -30, -45, -135, -190, -380, -420	7	59.95
	K-PHP	1	PHP-50, -100, -150, -175, -200, -250, -300, PHP-400, -500, -600, -700, -800, -900, -1000	14	149.95
	K-LHP	1	SLP-50, -100, -300, -550, -1000, SHP-200, -400, -700	8	249.00
	K-PLP	1	PLP-5, -10.7, -21.4, -30, -50, -70, -90, PLP-100, -150, -200, -250, -300, -450, -550, PLP-600, -750, -800, -850, -1000, -1200	20	159.95
PHASE DETECTORS	K-PD*	1	MPD-1, MPD-2, MPD-21, SYPD-1, SYPD-2	5	79.95
SWITCHES	K1-KSW*	1	KSW-2-46, KSWA-2-46, KSWHA-1-20	3	99.95
	K-YSW*	2	YSW-2-50DR, YSWA-2-50DR	4	59.95
	K2-KSW*	1	KSW-2-46, KSWA-2-46, KSWHA-1-20, YSW-2-50DR, YSWA-2-50DR	5	124.95
	K-ZFSW	1	ZFSW-2-46, ZFSWA-2-46	2	139.95
RF TRANSFORMERS	TTK-1	2	TT1-6, 1.5-1, 2.5-6, 4-1, 4-1A, 16-1, 25-1	14	79.95
	TK-5	2	T1-1T, T1-6T, T2-1T, T2.5-6T, T3-1T, T4-1T, T4-6T, T5-1T, T8-1T, T13-1T, T16-6T	22	79.95
	TK-6	2	T1-1, 1.18-3, 1-6, 1.5-1, 1.5-6, 2.5-6, 4-6, 9-1, 16-1, 36-1	20	79.95
	THK-1	3	T1-1H, T4-1H AND 2 EACH T9-1H, T16-1H	10	59.95
	TMK-2	2	TMO-1-1, -2-1, -4-1, -9-1, -16-1	10	59.95

NOTES: * KITS CONTAINING SURFACE-MOUNT UNITS.
(1) AVAILABLE FROM MINI-CIRCUITS DISTRIBUTOR CENTERS.
(2) SORRY, NO SUBSTITUTIONS ALLOWED.
(3) PRICES AND SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE.

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Mini-Circuit's Applications Support Team

Mini-Circuit's is dedicated to providing our customers world class quality of service, support, and products. This handbook, with over 740 pages of technical data, represents one element of our program to support our customers. Another very important and dynamic element is our Applications Support team.

Our team of dedicated Applications engineers are prepared to respond courteously, promplty, knowledgeably, and patiently to questions and challenges posed by customers.

Whether on the phone to provide customers with immediate answers to specifications; or helping customers select the best cost/performance component for their particular application; or engaging in serious discussions on creating custom devices that are currently not available in the marketplace; or visiting customer facilities for technical meetings and seminars, our engineers will always be available to help you.

... guide the customer through decision making on spec requirements ...

Despite our wide variety of over 1,000 signal-processing components listed in this Handbook and our catalogs, there is often a need to meet a spec somewhat different than one listed for a standard catalog item; perhaps a mixer with a slightly lower conversion loss, or an amplifier with just a little more gain, or a filter with a cutoff frequency a trifle higher than a catalog model. Here's how our Applications engineer proceeds:

1) Each section of this Handbood includes a Specifications Check List which customers are asked to review. This sheet includes the pertinent parameters for the product and is intended to guide the customer through decision making on spec requirements and the most critical parameters for the intended publication.
2) Our Applications engineer will work with our Design Engineering team to check the feasibility of designing a new product to meet the specific spec; of course, if modification of an existing product is possible, this approach can slash development time and costs.
3) If the design is indeed feasible, samples will be fabricated, tested to assure they meet the intended design goals, and then shipped to the customer for final evaluation in the intended application.

Here is a brief summary of services available from our Applications Support team:

- respond to technical questions regarding specs and performance of catalog components and applications of our products.
- provide more detailed CAPD (computer-automated performance data) than published in our catalogs, product data sheets, and Handbook. Although our published CAPD data is quite comprehensive, we strongly urge our customers to request more detailed data when their application needs (very narrow bandwidth, tight IM specs, linear filter phase response, etc.) dictate a closer look at specific measurement points. Our enormous database on catalog and custom models is offered, at no extra charge, to eliminate any need for guesswork on the part of design engineers striving to deliver a cost-effective and reliable system.
- analyze customer specifications and recommend, wherever possible, a catalog component that provides the optimum cost/performance selection.
- discuss, in detail, MIL-specs that may appear confusing to customers first encountering them. What they mean, definitions of terms, and how to be in conformance are explained to lighten the load at the customer's site.
- correlate customer's test requirements with those of our Computer Test department.
- review customer's environmental requirements and suggest, where applicable, cost-effective solutions.

... offer test procedures and statistical data ...

- after determining critical parameters dictated for a customer's requirement, offer test procedures and statistical data to most effectively focus on those parameters.
- keep customers aware of our latest new products during discussions of applications and new system designs.
- interface with customers requesting Return Merchandise Approval (RMA). Quite often a courteous and thorough discussion relating to a component's failure to meet specs may be traced to improper test setup, poor matching, or other problems at the customer site; suggested solutions often negate the need to return the product.
- respond to customer requests for literature. Quickly send catalogs, notes, computerized test data, statistical data, or new product data.

We encourage our customers to take full advantage of our Applications Support group's expertise. Contact us with any questions you may have, problems we may be able to solve for you, and assistance on recommending products in our catalog line or in developing new designs for your next generation system. We promise a prompt, courteous, and perceptive response.

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SPECIAL PRODUCTS

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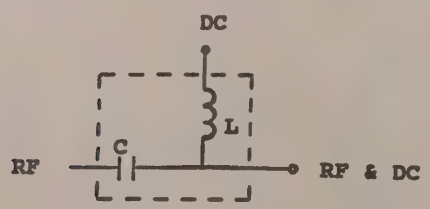
all about our special products

Standard catalog products provide a choice of case styles, having different mounting or connector configurations. For example, a 7 dBm mixer is available in surface mount (RMS, LRMS, SYM, TUF-SM), metal shield plug-in (SBL, SRA), and miniature shield (TFM, TSM) cases, as well as connectorized cases (ZP, ZLW, ZAD, ZEM, ZFM, ZAM). Most of our products can be supplied in a similar range of configurations. As wide as this choice is, it may not cover your intended application.

For example, using a standard splitter from the catalog may result in your needing adapters to mate with a different kind of connector in your system, or you may require custom cables. Either way will increase your overall cost. We are receptive to your special requirements, and can offer custom case styles to reduce the cost of your project. The figure at lower right illustrates a power splitter with 3 built-in cables for the output. The unit has a dedicated pin at the bottom for the input, as well as pins for mounting the unit. These custom features enable it to be used without external cables or mounting hardware. It also has a shielded case and can operate in a severe humid environment. Sounds too expensive? Not at Mini-Circuits. We can produce custom components with very competitive pricing. All custom requirements receive special attention from our Applications Department. So, if you need something special, do not compromise. We can help you in special ways which will reduce your cost and improve reliability by minimizing overall component count.

bias-tee

Supplying RF and DC to active devices is accomplished by a simple network as shown.



Internal capacitor C blocks the DC from exiting the RF port, and the inductor L provides high impedance to RF signals and therefore isolates the DC source from the RF signal path. Thus, RF and DC are combined at the port designated "RF & DC", which feeds the active device. The amount of DC voltage that can be applied is limited by the breakdown voltage of the capacitor. As DC current is increased approaching magnetic saturation of the inductor, insertion loss at low RF frequency increases and isolation from the RF to DC port decreases. So, it is necessary to limit the DC current to the maximum value specified, 200 mA.

Wideband performance of the bias-tee is helpful in pulse operation and wideband characterization of active devices. The device can also be used as a DC block by leaving the DC port open, shorted, or terminated in a 50-ohm load.

instrumentation amplifier

An instrumentation amplifier consists of an amplifier and integral DC power supply, and is powered by 110V or 220V AC. This self-contained amplifier uses less bench space than an equivalent modular amplifier and separate DC supply. It has integral forced-air coding to maintain its components at proper operating temperatures, and a front-panel LED indicator which warns of any operating conditions causing excessive heating of the amplifier.

Mini-Circuits has three instrumentation amplifiers covering the 0.5-1000 MHz range, having power output to 40 dBm at 1 dB compression, and 45dBm at saturation. This capability helps characterization testing of high power devices. These continuous wide bandwidth amplifiers require no turning and can be driven from low power sources to provide high power with low distortion over their entire bandwidth. They are suitable for swept, fixed frequency, CW or pulse operation in a wide variety of laboratory, industrial, test and communication applications including, RF, television, EMI susceptibility and antenna testing; magnetic resonance imaging and nuclear magnetic resonance spectroscopy.

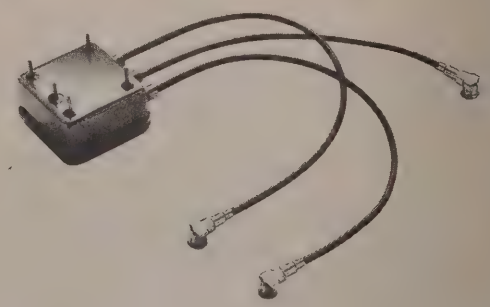
impedance matching pad, 50 to 75 ohms

BMP-5075 is a matching pad which transforms 50 ohms impedance to 75 ohms an d vice versa.

It is a minimum loss resistive transformation network having a wide bandwidth, DC-2000 MHz. Its most common application is in measurement of 75 ohms devices. Most commonly available instrumentation have 50 - ohm characteristic impedance. This can be converted to 75 ohms by using the BMP-5075 matching pad. To ensure precision interface, the pad has 75-ohm and 50-ohm BNC connectors at the corresponding ends.

Good frequency response is very important to minimize the droop of pulse signals and allow characterizing them accurately. This is accomplished in a 75-ohm system with the BMP-5075, which has response down to DC.

example of a special product: power splitter with cables



3 Way VHF Band Power Splitter/Combiner. This unit is printed circuit board mountable and has RG178 (50-ohm) cables directly pigtailed into its three outputs. Eliminating the use of output connectors allows miniaturization of the entire design to be performed. The rugged body design plus the special strain relief mechanism on the cables make such units capable of operating under vigorous vibration conditions.

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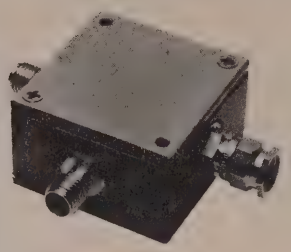
Bias-Tee

Mini-Circuits

0.1 to 6000 MHz
case style selection

outline drawings see Table of Contents



MODEL NO.	FREQ. MHz f_L-f_U	INSERTION LOSS, dB L Typ.	L Max.	M Typ.	M Max.	U Typ.	U Max.	ISOLATION, dB (RF port to DC port) (RF&DC port to DC port) L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	VSWR** L Typ.	L Max.	M Typ.	M Max.	U Typ.	U Max.	CAPD DATA (see RF/IF Designer handbook) Page	CASE STYLE ▼ Note B	Connection	PRICE $ Qty. (1-9)
ZFBT-4R2G	10-4200	0.15	0.6	0.6	1.2	0.6	1.6	32	20	40	20	50	20	1.06:1	1.2:1	1.13:1	1.3:1	1.13:1	1.3:1		K18	gf	59.95
ZFBT-6G	10-6000	0.15	0.6	0.6	1.4	1.0	2.2	32	20	40	20	30	17	1.06:1	1.2:1	1.13:1	1.3:1	1.13:1	1.5:1	see	K18	gf	79.95
✣ ZFBT-4R2GW	0.1-4200	0.15	0.8	0.6	1.2	0.6	1.6	25	15	40	20	50	20	1.06:1	1.6:1	1.13:1	1.3:1	1.13:1	1.3:1	below	K18	gf	79.95
✣ ZFBT-6GW	0.1-6000	0.15	0.8	0.6	1.4	1.0	2.2	25	15	40	20	30	17	1.06:1	1.6:1	1.13:1	1.3:1	1.13:1	1.5:1		K18	gf	89.95

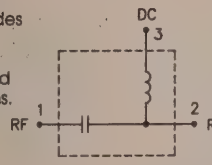
L = low range (f_L to 10 f_L) M = mid range (10 f_L to f_U/2) U = upper range (f_U/2 to f_U)

features

- Wide band coverage 0.1 to 6000 MHz
- Low insertion loss 0.6 dB typ.
- Good isolation 40dB typ.
- Small size 1.25" x 1.25" x 0.75" (Excluding connectors)

applications

- Biasing amplifiers
- Biasing of laser diodes
- DC return
- DC blocking
- Good for digital and analog applications.



NOTES:

* Insertion loss and isolation are guaranteed up to 20 dBm-RF power and 200 mA DC current.
** VSWR measured with open and short at DC port.
✣ Insertion loss 1 dB Max. and isolation 7 dB Min. 0.1 to 0.3 MHz.
▼ Connectors: SMA-F at "RF", "DC", and SMA-M at "RF & DC" port.
A. General Quality Control Procedures, Environmental Specifications, Hi-Rel, MIL and TX description are given in section 0, see "Mini-Circuits Quality" article.
B. Connector types and case mounted options, case finishes are given in section 0, see "Case styles & Outline Drawings"
C. Prices and specifications subject to change without notice.
1. Absolute maximum power, voltage and current ratings:
   1a. max. input current: 500 mA
   1b. max. RF power: 30 dBm
   1c. max. voltage at DC port: 30V
2. DC resistance from DC to RF & DC port: 4.5 ohm typical.

coaxial connection

Port	gf
RF	1
RF & DC	2
DC	3

FREQ. (MHz)	Pin (dBm)	INSERTION LOSS (dB) with current 0mA	20mA	50mA	100mA	150mA	200mA	ISOLATION (dB) (Pin = -10dBm) with current 10mA	20mA	50mA	100mA	150mA	200mA	VSWR (:1)
0.100	19.8	0.17	0.17	0.16	0.17	0.20	0.24	19.46	19.04	17.83	14.58	12.66	11.75	1.16
0.266	19.8	0.13	0.13	0.13	0.14	0.14	0.15	25.86	25.53	24.52	21.43	19.31	18.16	1.07
0.531	19.8	0.12	0.12	0.12	0.11	0.11	0.11	29.17	28.98	28.36	26.18	24.40	23.37	1.04
1.059	19.8	0.13	0.13	0.12	0.11	0.12	0.12	30.81	30.74	30.56	29.62	28.62	27.92	1.02
10.000	18.5	0.16	0.17	0.17	0.16	0.16	0.16	30.06	30.07	30.07	30.20	30.38	30.56	1.04
114.750	19.5	0.22	0.25	0.24	0.22	0.22	0.22	34.45	34.49	34.27	33.99	33.83	33.59	1.07
324.250	19.7	0.50	0.55	0.53	0.52	0.53	0.56	44.65	44.61	44.25	43.90	43.91	43.34	1.06
743.250	18.7	0.28	0.31	0.30	0.29	0.29	0.29	51.19	50.50	50.16	50.65	51.69	52.47	1.06
952.750	18.2	0.31	0.33	0.33	0.31	0.32	0.33	40.75	40.80	40.97	40.97	40.93	40.95	1.11
1162.250	17.8	0.38	0.39	0.39	0.39	0.40	0.40	50.39	50.91	51.15	50.58	50.72	50.51	1.13
1581.250	18.0	0.46	0.48	0.47	0.46	0.48	0.49	42.58	42.59	43.94	43.77	44.36	44.17	1.13
1790.750	18.1	0.51	0.54	0.53	0.52	0.53	0.55	56.38	56.76	60.01	59.86	59.44	60.10	1.13
2000.250	17.1	0.46	0.48	0.47	0.46	0.46	0.47	45.46	45.57	45.73	45.48	46.14	45.28	1.12
2524.000	14.4	0.40	0.42	0.41	0.42	0.43	0.44	53.15	53.72	52.19	53.17	52.67	53.67	1.12
2838.250	15.6	0.56	0.57	0.56	0.57	0.58	0.60	62.03	59.57	62.12	58.64	62.66	59.55	1.11
3047.750	14.2	0.45	0.48	0.47	0.46	0.46	0.49	52.46	52.25	51.55	51.33	51.46	50.99	1.09
3362.000	14.5	0.64	0.65	0.65	0.63	0.63	0.64	56.88	56.06	58.34	53.03	56.48	53.92	1.08
3676.250	15.1	0.73	0.74	0.75	0.75	0.75	0.75	46.32	47.19	46.36	45.53	46.19	45.65	1.07
3885.750	15.1	0.81	0.81	0.81	0.81	0.81	0.81	41.83	41.45	41.71	40.96	41.48	41.14	1.06
4200.000	17.9	1.04	1.07	1.07	1.06	1.05	1.06	28.42	28.36	28.24	28.14	28.01	27.92	1.09
4502.500	-0.6	1.17	1.19	1.18	1.19	1.17	1.16	28.15	28.10	28.05	27.96	27.84	27.87	1.14
4802.000	-0.7	1.26	1.26	1.27	1.25	1.22	1.20	37.95	38.01	38.19	37.93	37.58	37.51	1.12
5251.250	-1.1	1.19	1.17	1.16	1.13	1.11	1.09	49.68	51.04	49.12	49.37	49.13	48.19	1.11
5550.750	-2.0	1.65	1.63	1.60	1.56	1.54	1.51	38.44	38.56	38.36	38.07	37.85	38.19	1.10
6000.000	-2.4	1.70	1.71	1.65	1.59	1.54	1.50	34.37	34.36	34.23	34.40	34.49	34.48	1.12

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RF Instrument

Amplifiers

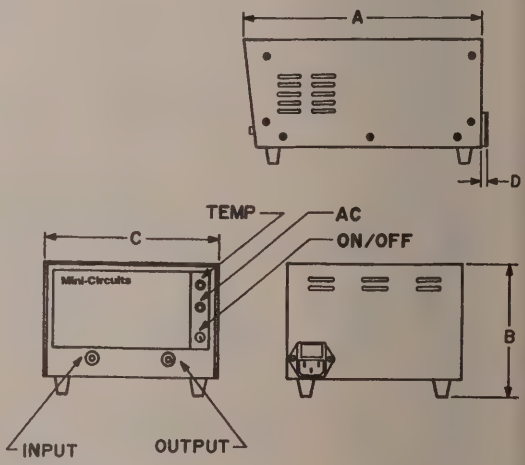
high power

up to 10W (+40 dBm) output
.5 to 1000 MHz, 50 ohms

MODEL NO	FREQ. MHz	GAIN, dB		MAXIMUM POWER, dBm			DYNAMIC RANGE		VSWR		AC POWER			CAPD DATA	CASE STYLE	CONNECTION	PRICE $
	f_L - f_U	min.	flatness max.	OUTPUT (1dB comp.) TYP.	OUTPUT (1dB comp.) MIN	INPUT Max. (no damage)	NF dB typ.	IP3 dBm typ.	In	Out	Volt (Note 1)	Freq. Hz.	VA max.	Page			(Qty 1-9)
TIA-900-10	100-900	28	±2.5	+42	+40	+25	13	51	2.5:1	2.5:1	110	50/60	475	0-65	AP176	—	3,695.
TIA-1000-4	100-1000	19	±1.5	+39	+36	+25	12	48	2.5:1	2.5:1	110	50/60	400	0-65	AP176	—	1,995.
TIA-1000-1R8	0.50-1000	35	±2.0	+35	+32	+7	8*	45	1.9:1	2.5:1	110	50/60	140	0-65	AP175	—	1,495.

Features

- Wide bandwidth, 0.5-1000 MHz, 50-ohm amplifiers
- Instrument model, with built-in power supply, 110/220V operation
- High Power Output, (at 3.5 dB compression)
  45 dBm TYPICAL FOR TIA-900-10
  42 dBm TYPICAL FOR TIA-1000-4
  37 dBm TYPICAL FOR TIA-1000-1R8
- High Gain, 38 dB TYPICAL FOR TIA-1000-1R8
  34 dB TYPICAL FOR TIA-900-10
- High Reverse Isolation, 80 dB TYPICAL FOR TIA-900-10
  AND TIA-1000-1R8
  55 dB TYPICAL FOR TIA-1000-4
- 100% Burn-in at +25°C, 48 hours
- Thermally self-protected, led indicator



Notes:

* NF above 400 MHz. At low frequency, NF increases to 16 dB Typ.
A. General Quality Control Procedures, Environmental Specifications, HI-Rel, MIL and TX description are given in section 0, see "Mini-Circuits Guarantees Quality" article.
C. Prices and Specifications subject to change without notice.
1. Add dash 2 (-2) to model no. for 220V operation.
2. Gain and maximum output power specified at 25°C ±5°C., over temperature, specifications degrade approximately 1dB, gain flatness ±2.5dB maximum for TIA-1000 1R8 and TIA-1000-4.
3. With no load, max. input (no damage) reduce by 10 dB.
4. VSWR specified at:
   350-900 MHz FOR TIA-900-10
   350-1000 MHz FOR TIA-1000-4
   340-1000 MHz FOR TIA-1000-1R8
5. Operating temperature: 0°C to +55°C.
   Storage temperature: -40°C to +70°C.

Outline drawing and dimensions.

Case No.		A	B	C	D	wt. grams.	NOTES
AP175	inch	9.8	5.0	6.7	0.2	3500	A10, D7, G1, G2
	mm	248.9	127.0	170..2	5.1		
AP176	inch	19.5	6.0	12.5	0.2	9500	A10, D7, G1, G2
	mm	495.3	152.4	317.5	5.1		

A10. Case material; aluminum alloy. Finish, grey paint.
D7. Connectors: BNC only.
G1. Keep area adjacent to fan and louvers clear to permit air flow to pass. Caution: Do not insert anything especially conductors or fingers into case opening. Physical injury shock or death may occur.
G2. Configured for either 110 volt or 220 volt AC operation; specify when ordering

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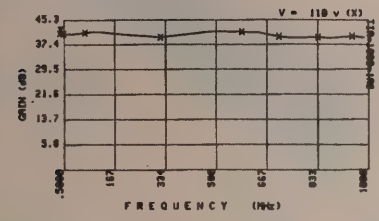
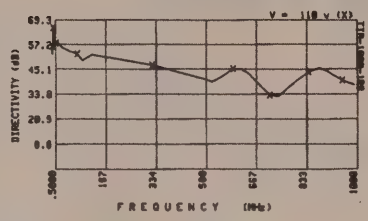
Mini-Circuits

TIA-1000-1R8

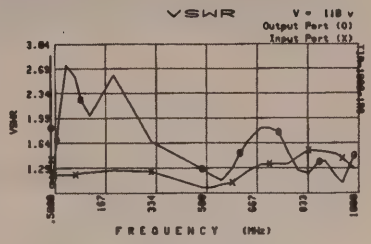
GAIN



DIRECTIVITY



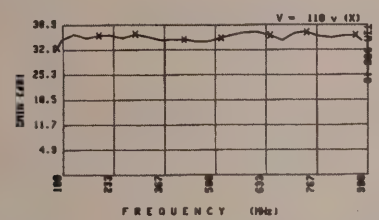
VSWR



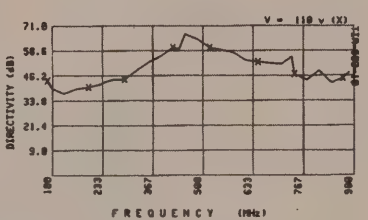
FREQUENCY (MHz)	GAIN (dB)	DIRECTIVITY (dB)	VSWR (:1) IN	VSWR (:1) OUT	N.F. (dB)	Pout (dBm) (@1dB COMPR)
0.5	40.65	56.72	1.42	2.89	—	36.10
12.6	40.48	58.36	1.20	1.36	17.34	36.62
99.5	40.98	50.05	1.23	2.26	14.13	36.19
207.6	40.33	51.07	1.27	2.61	10.29	34.61
332.2	39.43	47.81	1.25	1.67	8.38	33.50
500.0	41.26	41.27	1.03	1.29	7.60	33.68
600.9	41.12	46.09	1.10	1.30	7.43	34.12
693.4	40.22	37.38	1.35	1.86	7.22	34.10
816.5	39.40	40.92	1.46	1.27	7.20	34.08
1000.0	39.47	38.45	1.30	1.48	7.30	33.50

TIA-900-10

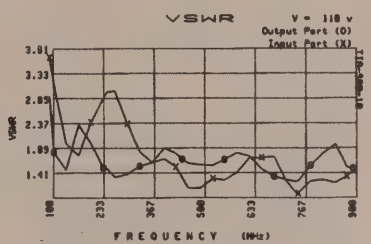
GAIN



DIRECTIVITY



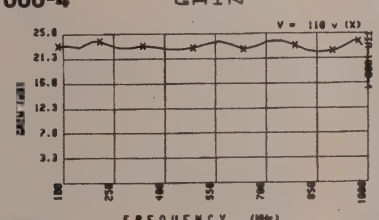
VSWR



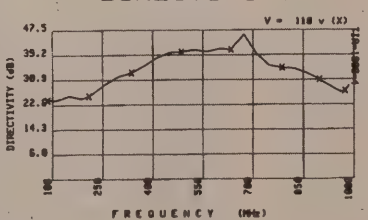
FREQUENCY (MHz)	GAIN (dB)	DIRECTIVITY (dB)	VSWR (:1) IN	VSWR (:1) OUT	N.F. (dB)	Pout (dBm) (@1dB COMPR)
100.0	32.45	44.22	3.67	2.92	12.95	42.71
143.6	36.07	37.71	2.01	1.50	12.56	42.25
251.1	35.50	43.52	3.01	1.53	16.19	43.63
337.6	35.47	49.49	1.85	1.57	14.65	41.86
449.8	34.52	59.78	1.36	1.71	13.29	41.91
498.9	34.28	64.65	1.16	1.60	12.79	41.94
594.7	36.86	58.18	1.45	1.83	11.30	42.30
692.9	34.67	52.96	1.76	1.38	13.14	43.78
788.7	35.85	44.67	1.29	1.59	9.42	44.30
900.0	34.61	48.53	1.47	1.54	11.37	42.16

TIA-1000-4

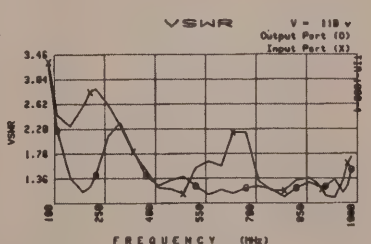
GAIN



DIRECTIVITY



VSWR



FREQUENCY (MHz)	GAIN (dB)	DIRECTIVITY (dB)	VSWR (:1) IN	VSWR (:1) OUT	N.F. (dB)	Pout (dBm) (@1dB COMPR)
100.0	23.15	23.27	3.33	3.27	13.27	40.63
202.2	24.07	23.74	2.57	1.14	14.65	40.14
313.4	22.86	31.20	2.25	2.30	14.30	37.90
389.3	23.04	34.78	1.51	1.41	13.14	38.79
500.5	22.93	39.37	1.11	1.40	12.02	38.58
614.5	23.49	40.43	1.58	1.18	11.69	40.33
725.7	24.15	38.75	1.33	1.24	9.76	41.58
801.6	23.34	34.20	1.17	1.06	7.26	42.06
912.8	22.38	30.28	1.19	1.23	8.32	41.00
1000.0	23.23	28.13	1.74	1.52	8.82	37.01

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CAPO now available! computer-automated performance data

Impedance Matching Pad

BMP

50 to 75 ohm minimum loss
DC to 2000 MHz

MODEL NO.	FREQUENCY RANGE, MHz f_L	f_U	ATTENUATION dB Nom.	Flatness max. L	M	U	VSWR max. L	M	U	CAPD DATA Page	CASE STYLE Note B	CONNECTION	PRICE $ (Qty 1-9)
BMP-5075	DC	2000	5.7±0.1	0.2	0.3	0.4	1.06:1	1.22:1	1.4:1	See below	FF55*	—	24.95

L = DC - 100 MHz **M** = 100 - 1000 MHz **U** = 1000 - 2000 MHz

features:

- Minimum loss pad for resistive matching of 75 Ohm impedance to 50 Ohms and vice versa
- Wide frequencies coverage DC-2000 MHz
- Excellent VSWR 1.15:1 Typical

Notes:

* 75 ohm male BNC at one end, 50 ohm Female BNC at other end
$\bar{x}$ average of attenuation
σ standard deviation
A. General Quality Control Procedures, Environmental Specifications, Hi-Rel, MIL and TX description are given in section 0, see "Mini-Circuits Guarantees Quality" article.
B. Connector types and case mounted options, case finishes are given in section 0, see "Case Styles & Outline Drawings".
C. Prices and Specifications subject to change without notice.
1. Absolute maximum power, voltage and current ratings:
1a. RF input power, 1/4W.

FREQ. (MHz)	Attenuation (dB) $\bar{x}$	σ	VSWR (:1) 50Ω $\bar{x}$	σ	75Ω $\bar{x}$	σ
1.000	5.71	0.00	1.01	0.01	1.01	0.01
10.995	5.73	0.01	1.01	0.01	1.01	0.01
20.990	5.71	0.00	1.01	0.01	1.01	0.01
40.980	5.71	0.01	1.01	0.01	1.01	0.01
60.970	5.72	0.00	1.01	0.01	1.01	0.01
80.960	5.72	0.01	1.01	0.01	1.01	0.01
100.950	5.71	0.01	1.01	0.01	1.01	0.01
140.930	5.72	0.01	1.01	0.01	1.01	0.01
205.897	5.72	0.01	1.01	0.01	1.01	0.01
250.875	5.72	0.01	1.01	0.01	1.01	0.01
345.828	5.72	0.01	1.01	0.01	1.01	0.01
415.792	5.72	0.00	1.01	0.01	1.02	0.01
485.757	5.72	0.01	1.02	0.01	1.03	0.01
500.750	5.70	0.01	1.02	0.01	1.03	0.01
550.725	5.70	0.01	1.02	0.01	1.03	0.01
690.655	5.70	0.02	1.04	0.01	1.04	0.01
760.620	5.70	0.01	1.04	0.01	1.05	0.01
895.552	5.70	0.01	1.06	0.01	1.06	0.01
1000.500	5.68	0.00	1.08	0.01	1.07	0.01
1105.448	5.66	0.01	1.10	0.01	1.08	0.01
1240.380	5.67	0.01	1.12	0.01	1.09	0.01
1310.345	5.63	0.00	1.13	0.01	1.10	0.01
1380.310	5.64	0.01	1.14	0.01	1.11	0.01
1450.275	5.67	0.02	1.15	0.01	1.12	0.01
1500.250	5.63	0.01	1.16	0.02	1.12	0.01
1585.208	5.63	0.02	1.18	0.02	1.12	0.01
1725.137	5.66	0.01	1.20	0.02	1.12	0.01
1795.103	5.60	0.03	1.22	0.03	1.11	0.01
1930.035	5.65	0.03	1.25	0.03	1.09	0.01
2000.000	5.63	0.03	1.26	0.03	1.09	0.01

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Mini-Circuits

return loss Vs. VSWR

table of return loss vs. voltage standing wave ratio

RETURN LOSS (dB)	VSWR	RETURN LOSS (dB)	VSWR	RETURN LOSS (dB)	VSWR	RETURN LOSS (dB)	VSWR	RETURN LOSS (dB)	VSWR
46.064	1.01	13.842	1.51	9.485	2.01	7.327	2.51	5.999	3.01
40.086	1.02	13.708	1.52	9.428	2.02	7.294	2.52	5.97	3.02
36.607	1.03	13.577	1.53	9.372	2.03	7.262	2.53	5.956	3.03
34.151	1.04	13.449	1.54	9.317	2.04	7.230	2.54	5.935	3.04
32.256	1.05	13.324	1.55	9.262	2.05	7.198	2.55	5.914	3.05
30.714	1.06	13.201	1.56	9.208	2.06	7.167	2.56	5.893	3.06
29.417	1.07	13.081	1.57	9.155	2.07	7.135	2.57	5.872	3.07
28.299	1.08	12.964	1.58	9.103	2.08	7.105	2.58	5.852	3.08
27.318	1.09	12.849	1.59	9.051	2.09	7.074	2.59	5.832	3.09
26.444	1.10	12.736	1.60	8.999	2.10	7.044	2.60	5.811	3.10
25.658	1.11	12.625	1.61	8.949	2.11	7.014	2.61	5.791	3.11
24.943	1.12	12.518	1.62	8.899	2.12	6.984	2.62	5.771	3.12
24.289	1.13	12.412	1.63	8.849	2.13	6.954	2.63	5.751	3.13
23.686	1.14	12.308	1.64	8.800	2.14	6.925	2.64	5.732	3.14
23.127	1.15	12.207	1.65	8.752	2.15	6.896	2.65	5.712	3.15
22.607	1.16	12.107	1.66	8.705	2.16	6.867	2.66	5.693	3.16
22.120	1.17	12.009	1.67	8.657	2.17	6.839	2.67	5.674	3.17
21.664	1.18	11.913	1.68	8.611	2.18	6.811	2.68	5.654	3.18
21.234	1.19	11.818	1.69	8.565	2.19	6.783	2.69	5.635	3.19
20.828	1.20	11.725	1.70	8.519	2.20	6.755	2.70	5.617	3.20
20.443	1.21	11.634	1.71	8.474	2.21	6.728	2.71	5.598	3.21
20.079	1.22	11.545	1.72	8.430	2.22	6.700	2.72	5.579	3.22
19.732	1.23	11.457	1.73	8.386	2.23	6.673	2.73	5.561	3.23
19.401	1.24	11.370	1.74	8.342	2.24	6.646	2.74	5.542	3.24
19.085	1.25	11.285	1.75	8.299	2.25	6.620	2.75	5.524	3.25
18.783	1.26	11.202	1.76	8.257	2.26	6.594	2.76	5.506	3.26
18.493	1.27	11.120	1.77	8.215	2.27	6.567	2.77	5.488	3.27
18.216	1.28	11.039	1.78	8.173	2.28	6.541	2.78	5.470	3.28
17.949	1.29	10.960	1.79	8.138	2.29	6.516	2.79	5.452	3.29
17.690	1.30	10.881	1.80	8.091	2.30	6.490	2.80	5.435	3.30
17.445	1.31	10.804	1.81	8.051	2.31	6.465	2.81	5.417	3.31
17.207	1.32	10.729	1.82	8.011	2.32	6.440	2.82	5.400	3.32
16.977	1.33	10.654	1.83	7.972	2.33	6.415	2.83	5.383	3.33
16.755	1.34	10.581	1.84	7.933	2.34	6.390	2.84	5.365	3.34
16.540	1.35	10.509	1.85	7.894	2.35	6.366	2.85	5.348	3.35
16.332	1.36	10.437	1.86	7.856	2.36	6.341	2.86	5.331	3.36
16.131	1.37	10.367	1.87	7.818	2.37	6.317	2.87	5.315	3.37
15.936	1.38	10.298	1.88	7.781	2.38	6.293	2.88	5.298	3.38
15.747	1.39	10.230	1.89	7.744	2.39	6.270	2.89	5.281	3.39
15.563	1.40	10.163	1.90	7.707	2.40	6.246	2.90	5.265	3.40
15.385	1.41	10.097	1.91	7.671	2.41	6.223	2.91	5.248	3.41
15.211	1.42	10.032	1.92	7.635	2.42	6.200	2.92	5.232	3.42
15.043	1.43	9.968	1.93	7.599	2.43	6.177	2.93	5.216	3.43
14.879	1.44	9.904	1.94	7.564	2.44	6.154	2.94	5.200	3.44
14.719	1.45	9.842	1.95	7.529	2.45	6.131	2.95	5.184	3.45
14.564	1.46	9.780	1.96	7.494	2.46	6.109	2.96	5.168	3.46
14.412	1.47	9.720	1.97	7.460	2.47	6.086	2.97	5.152	3.47
14.264	1.48	9.660	1.98	7.426	2.48	6.064	2.98	5.137	3.48
14.120	1.49	9.601	1.99	7.393	2.49	6.042	2.99	5.121	3.49
13.979	1.50	9.542	2.00	7.360	2.50	6.021	3.00	5.105	3.50

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active

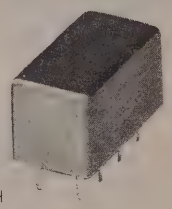
Frequency Mixers

LOAD INSENSITIVE

UNCL-X1 (+7 dBm LO, up to +1 dBm RF)
UNCL-X1MH (+13 dBm LO, up to +7 dBm RF)

case style selection

outline drawings see Table of Contents



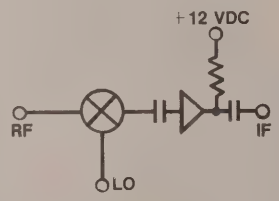
UNCL-X
UNCL-X1MH

MODEL NO.	FREQUENCY MHz LO/RF f_L-f_U	IF	CONVERSION GAIN, dB Mid-Band m $\bar{x}$	σ	Min.	Total Range Min.	LO-RF ISOLATION, dB L Typ.	Min.	M Typ.	Min.	U Typ.	Min.	LO-IF ISOLATION, dB L Typ.	Min.	M Typ.	Min.	U Typ.	Min.	INPUT POWER (dBm) 1 dB Comp Typ.	DC POWER Volt	Current (mA)	CAPD DATA (see RF/IF Designer Handbook) Page	Case Style Note B	CONNECTION	Price $ Qty. (1-9)
UNCL-X1	1-500	10-500	1.57	.05	-1.0	-1.0	60	40	30	25	25	20	50	30	30	20	26	18	1	12	36	1-280	A01	a	23.95
UNCL-X1MH	1-500	10-500	2.41	.015	0.5	0	60	40	35	25	30	20	50	30	25	18	18	14	7	12	60	1-276	A01	a	27.95

L=low range (f_L to 10 f_L) M=mid range (10f_L to f_U/2) U=upper range (f_U/2 to f_U)

features

2-tone 3rd-order IM
insensitive to IF load
VSWR 1.2:1, IF/RF ports

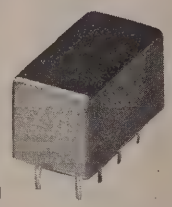


LOW NOISE (4.3 dB typ.)

UNCL-R1 (+7 dBm LO, up to −10 dBm RF)
UNCL-R1H (+17 dBm LO, up to +1 dBm RF)

case style selection

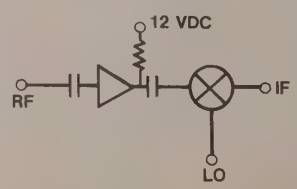
outline drawings see Table of Contents



UNCL-R1
UNCL-R1H

MODEL NO.	FREQUENCY MHz LO/RF f_L-f_U	IF	CONVERSION GAIN, dB Mid-Band m $\bar{x}$	σ	Min.	Total Range Typ.	Min.	LO-RF ISOLATION, dB L Typ.	Min.	M Typ.	Min.	U Typ.	Min.	LO-IF ISOLATION, dB L Typ.	Min.	M Typ.	Min.	U Typ.	Min.	INPUT POWER (dBm) 1 dB Comp Typ.	DC POWER Volt	Current (mA)	CAPD DATA (see RF/IF Designer Handbook) Page	Case Style Note B	CONNECTION	Price $ Qty. (1-9)
UNCL-R1	10-500	DC-500	5.53	.11	2	5	2	65	45	55	40	47	35	40	30	30	20	25	17	-10	12	35	1-272	A01	b	23.95
UNCL-R1H	10-500	DC-500	6.32	.23	3	6	2	65	45	55	40	47	35	40	30	35	25	28	19	1	12	60	1-274	A01	b	27.95

L=low range (f_L to 10 f_L) M=mid range (10 f_L to f_U/2) U=upper range (f_U/2 to f_U)



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10 to 500 MHz

Mini-Circuits

ULTRA-REL™ MIXERS

5-YR. GUARANTEE *

LOW LO DRIVE

UNCL-L1 (−4 dBm LO, up to 1 dBm RF)
UNCL-L1H (+6 dBm LO, up to 14 dBm RF)

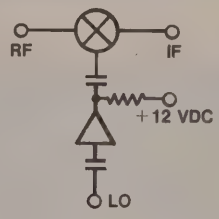
case style selection

outline drawings see Table of Contents

UNCL-L1
UNCL-L1H

MODEL NO.	FREQUENCY MHz LO/RF f_L-f_U	IF	CONVERSION LOSS, dB Mid-Band $\bar{x}$	σ	Total Range Min.	Max.	LO-RF ISOLATION, dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	LO-IF ISOLATION, dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	INPUT POWER 1 dB Comp Typ.	DC POWER Volt	Current (mA)	CAPD DATA (see RF/IF Designer Handbook) Page	Case Style Note B	CONNECTION	Price $ Qty. (1-9)
UNCL-L1	10-500	DC-500	5.73	.08	8.0	8.5	45	30	35	20	25	17	32	20	23	15	18	12	1	12	35	1-278	A01	c	23.95
UNCL-L1H	10-500	DC-500	5.73	.07	8.0	8.5	45	25	36	20	24	17	32	18	25	15	18	10	14	12	60	1-270	A01	c	27.95

L = low range (f_L to 10 f_L) M = mid range (10 f_L to f_U/2) U = upper range (f_U/2 to f_U)



NOTES

$\bar{x}$ Average of conversion loss at center of mid-band frequency (f_L+f_U/4)
σ Standard deviation
A. General Quality Control Procedures, Environmental Specifications, Hi-Rel, MIL and TX description are given in section 0, see "Mini-Circuits Guarantees Quality" article.
B. Connector types and case mounted options, case finishes are given in section 0, see "Case Styles & Outline Drawings".
C. Prices and Specifications subject to change without notice.

pin connections

PORT	a	b	c
LO	7	7	1
RF	8	1	7
IF	1	8	8
DC	4	4	4
GND EXT.	3,5,6	3,5,6	3,5,6
CASE GND	3,5,6	3,5,6	3,5,6
NOT USED	2	2	2

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SURFACE MOUNT MIXERS

...with a difference

actual size

up to 1900MHz from $6.25

Now available, a large variety of tiny, ultra-rel high performance mixers to handle your applications from extra wideband, high isolation, low two-tone third-order IM, to very low +3dBm LO power. Mini-Circuits' new LRMS-series Ultra-Rel™ mixers are offered with a difference... unprecedented reliability. Units are manufactured with Ultra-Rel diodes, all-welded construction, metal stubs to all connections, and to 4.5 sigma performance repeatability. Each Ultra-Rel™ LRMS mixer can withstand strenuous shock and vibration, will perform over a -55° to +100°C range, and is guaranteed for five years. Aim for 4.5 sigma repeatability in your product designs by specifying Mini-Circuits' Ultra-Rel™ LRMS mixers, available for immediate delivery in tape-and-reel format (500 units, 16mm width) at prices from $6.25.

SPECIFICATIONS: all spec limits are 4.5 σ from mean

Model	Freq. Range LO. RF	(MHz) IF	LO Level (dBm)	Conv. Loss Mean ($\bar{X}$) mid-band (dB)	L-R Isol. Mean ($\bar{X}$) mid-band (dB)	Price $ (1-9)
LRMS-2L	800-1000	DC-200	+3	6.6	24	6.95
LRMS-1	0.5-500	DC-500	+7	6.4	45	6.25
LRMS-1W	2.0-750	DC-750	+7	5.8	45	6.75
LRMS-2	5-1000	DC-1000	+7	6.8	38	6.95
LRMS-2D	5-1000	DC-1000	+7	6.8	40	7.25
LRMS-2U	10-1000	10-1000	+7	6.5	46	11.45
LRMS-5	5-1500	DC-1000	+7	6.0	41	13.95
LRMS-11A	1400-1900	40-500	+7	7.0	25	16.95
LRMS-1LH	2.0-500	DC-500	+10	5.8	47	7.95
LRMS-2LH	5-1000	DC-1000	+10	6.6	40	8.95
LRMS-5LH	10-1500	DC-900	+10	5.4	38	14.95
LRMS-1MH	2.0-500	DC-500	+13	5.7	44	8.95
LRMS-2MH	5-1000	DC-1000	+13	6.6	44	9.95
LRMS-5MH	10-1500	DC-900	+13	5.8	46	15.95
LRMS-1H	2.0-500	DC-500	+17	6.3	44	10.95
LRMS-2H	5-1000	DC-900	+17	7.2	36	11.95
LRMS-2UH	10-1000	10-750	+17	7.1	38	14.45
LRMS-5H	10-1500	DC-900	+17	7.2	45	17.95

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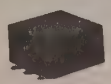
ULTRA-REL™ MIXERS

5-YR. GUARANTEE *

LEVEL 3 (+3 dBm LO, up to −3 dBm RF)
low LO power
400 MHz to 1400 MHz

RMS



LRMS

MODEL NO.	FREQUENCY MHz LO/RF f_L-f_R	FREQUENCY MHz IF	CONVERSION LOSS (dB) $\bar{x}$	CONVERSION LOSS (dB) σ	CONVERSION LOSS (dB) Min.	ISOLATION LO-RF (dB) Typ.	ISOLATION LO-RF (dB) Min.	ISOLATION LO-IF (dB) Typ.	ISOLATION LO-IF (dB) Min.	CAPD DATA (see RF/IF Designer Handbook) Page	Case Style Note B	CONNECTION	Price $ Qty. (1-9)
● RMS-2L	800-1000	DC-200	5.34	0.077	8.4	24	16	20	12	1-210	TT146	W	6.95
● RMS-5L	400-1400	DC-800	5.34	0.077	9.8	22	14	18	6	1-210	TT146	W	13.95
● LRMS-2L	800-1000	DC-200	5.34	0.077	8.4	24	16	20	12	1-210	QQQ130	W	6.95
● LRMS-5L	400-1400	DC-800	5.34	0.077	9.8	22	14	18	6	1-210	QQQ130	W	13.95

features

- low LO power: 3 dBm.
- RMS-2L is usable at 0 dBm LO.
- wide band coverage: 400-1400 MHz.
- 1 dB compression, −3 dBm typical.
- miniature surface mount (0.25″ x 0.31″ x 0.2″).
- conversion loss spec limit 4.5 σ typical from mean.
- ideal for cellular applications.

NOTES

$\bar{x}$ Average of conversion loss at center of mid-band frequency ($f_L+f_R/4$)
σ Standard deviation
● Surface-mount, non-hermetic, available on tape and reel
A. General Quality Control Procedures, Environmental Specifications, HI-Rel, MIL and TX description are given in section 0, see "Mini-Circuits Guarantees Quality" article.
B. Connector types and case mounted options, case finishes are given in section 0, see "Case Styles & Outline Drawings".
C. Prices and Specifications subject to change without notice.
1. Absolute maximum power, voltage and current ratings:
1a. RF power, 50mW
1b. Peak IF current, 40mA

pin connections

PORT	W
LO	1
RF	4
IF	5
GND EXT.	2,3,6
CASE GND	—
NOT USED	—

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Frequency Mixers

40 KHz to 4.3 GHz

LEVEL 7 (+7 dBm LO, up to +1 dBm RF)

surface-mount, non-hermetic, available on tape & reel

case style selection

outline drawings see Table of Contents

RMS† LRMS† ASK-KK81 TUF-SM SCM SYM

MODEL NO.	FREQUENCY MHz LO/RF f_L-f_U	IF	CONVERSION LOSS dB Mid-Band m $\bar{x}$	σ	Max.	Total Range Max.	LO-RF ISOLATION, dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	LO-IF ISOLATION, dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	CAPD DATA (see RF/IF Designer Handbook) Page	Case Style Note B	CONNECTION	Price $ Qty. (1-9)
RMS-1	0.5-500	DC-500	5.94	.05	7.0	8.5	55	50	33	25	27	20	55	45	30	23	24	19	1-218	TT100	w	6.25
RMS-1W	2-750	DC-750	5.83	.21	7.5	8.5	70	45	45	28	38	22	60	45	40	25	30	20	1-282	TT100	w	6.75
RMS-1BM	5-600	DC-600	6.0	.05	7.0	7.5	65	45	50	32	35	23	55	40	40	25	35	22	—	TT100	w	6.25
RMS-2	5-1000	DC-1000	6.67	.26	8.0	9.5	60	40	40	20	25	18	55	30	30	20	20	12	1-224	TT100	w	6.95
RMS-2D	5-1000	DC-1000	6.81	.06	8.0	10.0	59	40	40	30	33	22	55	30	40	22	30	20	1-284	TT100	w	7.25
RMS-2U	10-1000	10-750	6.79	.16	8.0	9.5	55	40	40	30	30	25	55	30	35	25	30	22	1-230	TT100	w	11.45
RMS-5	5-1500	DC-1000	5.92	.34	7.5	9.5	60	40	40	20	30	18	55	30	30	18	15	8	1-232	TT100	w	13.95
RMS-11A	1500-1900	40-400	—	.19	—	9.0			25 (typ.)		17 (min.)				23 (typ.)		15 (min.)		1-212	TT100	w	16.95
○ RMS-11F	350-2000	DC-400	5.5	.20	7.0	9.2	37	26	36	20	32	20	22	14	29	22	28	22	—	TT240	w	4.95***
RMS-11X	5-1900	5-1000	7.1	.10	8.2	9.8	58	45	35	20	27	18	56	45	37	20	27	20	—	TT240	gk	3.95***
RMS-30	200-3000	DC-1000	6.5	.20	9.0	9.8			27 (typ.)		17 (min.)				20 (typ.)		7 (min.)		—	TT241	w	6.95***
RMS-860**	800-1050	DC-250	5.5	.23	7.5	7.5			36 (typ.)		25 (min.)				24 (typ.)		18 (min.)		1-286	TT100	w	11.45
LRMS-1	0.5-500	DC-500	5.94	.05	7.0	8.5	55	50	33	25	27	20	55	45	30	23	24	19	1-218	QQQ130	w	6.25
LRMS-1W	2-750	DC-750	5.83	.21	7.5	8.5	70	45	45	28	38	22	60	45	40	25	30	20	1-282	QQQ130	w	6.75
LRMS-2	5-1000	DC-1000	6.67	.26	8.0	9.5	60	40	40	20	25	18	55	30	30	20	20	12	1-224	QQQ130	w	6.95
LRMS-2D	5-1000	DC-1000	6.81	.06	8.0	10.0	59	40	40	30	33	22	55	30	40	22	30	20	1-284	QQQ130	w	7.25
LRMS-2U	10-1000	10-750	6.79	.16	8.0	9.5	55	40	40	30	30	25	55	30	35	25	30	22	1-230	QQQ130	w	11.45
◇ LRMS-1R	0.5-500	DC-500	5.80	.16	7.0	8.5	55	50	33	25	27	20	55	45	30	23	24	19	1-218	QQQ130	w	14.45
◇ LRMS-2R	5-1000	DC-1000	6.60	.14	8.0	10.0	55	40	39	20	22	17	46	35	30	20	18	11	1-222	QQQ130	w	14.95
LRMS-5	5-1500	DC-1000	5.92	.34	7.5	9.5	60	40	40	20	30	18	55	30	30	18	15	8	1-232	QQQ130	w	13.95
◇ LRMS-5R	10-1500	DC-1000	5.62	.12	8.0	9.9	50	40	34	20	22	18	50	27	30	15	14	7	1-232	QQQ130	w	16.95
LRMS-11A	1500-1900	40-400	—	.19	—	9.0			25 (typ.)		17 (min.)				23 (typ.)		15 (min.)		1-212	QQQ130	w	16.95
LRMS-860**	800-1050	DC-250	5.5	.23	7.5	7.5			36 (typ.)		25 (min.)				24 (typ.)		18 (min.)		1-286	QQQ130	w	11.45
ASK-1	1-600	DC-600	5.58	.06	7.0	8.5	50	30	35	25	30	20	45	35	30	20	25	15	1-76	KK81	w	6.95
ASK-2	1-1000	DC-1000	6.79	.10	8.0	9.8	60	40	35	18	26	16	50	30	25	17	15	10	1-248	KK81	w	8.25
TUF-1SM	2-600	DC-600	5.85	.04	7.0	8.0	60	50	42	30	37	25	60	45	47	30	36	22	1-192	NNN150	z	4.25
TUF-2SM	50-1000	DC-1000	5.85	.07	7.5	9.0	58	40	47	30	42	25	50	35	44	20	29	18	1-194	NNN150	z	5.2
† TUF-3SM	0.15-400	DC-400	4.7	.02	7.0	8.0	60	50	46	30	35	25	60	40	47	25	35	20	1-200	NNN150	z	6.1
TUF-5SM	20-1500	DC-1000	5.7	.04	9.0	9.0	54	40	42	30	39	25	40	25	32	18	23	8	1-206	NNN150	z	9.45
TUF-5XSM	1-1500	1-1000	5.9	.10	7.0	9.0	60	40	40	20	28	17	60	45	45	25	38	20	—	NNN150	gm	11.95
TUF-11ASM	1400-1900	40-500	6.8	.30	8.6	8.6			33 (typ.)		20 (min.)				29 (typ.)		15 (min.)		1-290	NNN150	z	16.95
TUF-860SM	800-1050	DC-250	5.6	.24	7.75	7.75			35 (typ.)		25 (min.)				27 (typ.)		20 (min.)		1-292	NNN150	z	9.45
SCM-1	1-500	DC-500	5.72	.10	7.0	8.0	60	40	45	35	40	30	50	40	45	35	40	25	1-236	YY101	d	4.25
SCM-2	5-1000	DC-500	5.76	.03	7.5	9.8	50	40	40	25	35	20	55	30	40	25	30	18	1-238	YY101	k	5.45
SCM-5	1250-1800	DC-500	5.82	.19	—	8.0			28 (typ.)		17 (min.)				18 (typ.)		8 (min.)		1-196	YY101	r	11.95
SCM-2500	500-2500	DC-500	5.88	.08	6.9	10.0	35	22	35	22	35	22	18	12	18	12	18	12	1-266	YY101	r	11.95
SYM-2	2-1000	DC-1000	5.4	.10	7.2	9.5	70	45	50	30	40	25	63	40	48	24	37	20	1-66	TTT166	x	11.95
SYM-860	800-1050	DC-250	5.6	.10	7.0	7.0			39 (typ.)		25 (min.)				37 (typ.)		20 (min.)		1-292	TTT166	x	8.95
SYM-11	1-2500	10-600	7.0	.30	9.0	10.5	63	40	40	24	34	20	61	40	35	20	28	15	1-288	TTT167	x	9.95
SYM-12	5-1200	DC-1000	6.5	.30	8.0	9.0	68	45	50	30	37	25	56	40	46	25	29	18	—	TTT166	x	9.45
SYM-2500	1-2500	DC-500	6.5	.1	8.5	9.8	70	50	50	25	36	20	60	45	30	10	16	8	—	TTT167	x	11.95

L = low range (f_L to 10 f_L) M = mid range (10 f_L to f_U/2) U = upper range (f_U/2 to f_U)

m = mid band (2f_L to f_U/2)

NOTES:

$\bar{x}$ Average of conversion loss at center of mid-band frequency (f_L+f_U/4)
σ Standard deviation
❑ Non-hermetic
◇ Hermetic sealed diodes
† Phase detection, positive polarity except RMS-860 and LRMS-860
○ Frequency ranges specified: m = 350-1000 MHz, L = 350-750 MHz, M = 750-1000 MHz, U = 1000-2000 MHz
• ASK plug-in mounting case X65
** Phase detection, negative polarity
*** Price for quantities 10-49
A. General Quality Control Procedures, Environmental Specifications, Hi-Rel, MIL and TX description are given in section 0, see "Mini-Circuits Guarantees Quality" article.
B. Connector types and case mounted options, case finishes are given in section 0, see "Case Styles & Outline Drawings".
C. Prices and Specifications subject to change without notice.
1. Absolute maximum power, voltage and current ratings:
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1b. Peak IF current, 40mA

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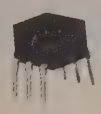
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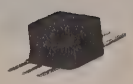
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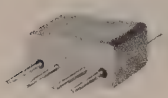
TUF
TFM


LMX

PAM

MODEL NO.	FREQUENCY MHz LO/RF f_L-f_U	IF	CONVERSION LOSS dB Mid-Band m $\bar{x}$	σ	Max.	Total Range Max.	LO-RF ISOLATION, dB L Typ.	Min.	M Typ.	Min.	U Typ.	Min.	LO-IF ISOLATION, dB L Typ.	Min.	M Typ.	Min.	U Typ.	Min.	CAPD DATA (see RF/IF Designer Handbook) Page	Case Style Note B	CONNECTION	Price $ Qty. (1-9)
❑ ASK-1*	1-600	DC-600	5.58	.06	7.0	8.5	50	30	35	25	30	20	45	35	30	20	25	15	1-76	W38	w	6.95
❑ ASK-2*	1-1000	DC-1000	6.79	.10	8.0	9.8	60	40	35	18	26	16	50	30	25	17	15	10	1-248	W38	w	8.25
TFM-2	1-1000	DC-1000	5.74	.07	7.5	8.5	50	45	40	25	30	25	45	40	35	25	25	20	1-66	B02	z	13.95
† TFM-2P	1-1000	DC-1000	5.74	.07	7.5	8.5	50	45	40	25	30	25	45	40	35	25	25	20	1-66	B02	z	13.95
† TFM-3	0.04-400	DC-400	4.70	.06	7.0	8.0	60	50	50	35	35	25	55	40	45	30	35	25	1-68	B02	z	21.45
† TFM-4	5-1250	DC-1250	6.47	.05	7.5	8.5	50	45	40	30	30	25	45	40	35	25	25	20	1-70	B02	z	23.45
TFM-5	5-1500	DC-1000	6.33	.06	8.5	9.5	60	45	35	25	30	25	60	40	35	15	25	14	1-268	B02	aa	25.45
TFM-11	1-2000	5-600	7.16	.07	8.5	9.0	50	45	35	25	25	20	45	40	27	20	25	20	1-72	B13	z	47.45
TFM-12	800-1250	50-90	5.71	.14	—	7.5	35	25	35	25	35	25	30	20	30	20	30	20	1-74	B13	z	47.45
TFM-2400	750-2400	DC-400	6.65	.20	—	9.0	30	20	30	20	30	20	30	10	30	10	30	10	1-266	B13	aa	28.95
TFM-4300	300-4300	DC-800	5.87	.13	—	10.5	30	20	—	—	30	17	15	7	—	—	10	7	1-246	B13	aa	38.95
LMX-3	0.04-400	DC-400	4.84	.05	7.0	8.0	60	50	50	35	35	25	45	40	35	25	25	20	1-68	BB48	q	25.95
LMX-113	5-1000	DC-1000	5.72	.05	7.0	8.0	50	40	40	25	35	25	45	35	35	30	30	20	1-78	BB48	q	16.95
LMX-124	0.5-500	DC-500	5.18	.06	6.5	7.0	50	40	45	25	45	22	45	40	40	30	30	20	1-80	BB48	q	27.95
LMX-149	10-1500	DC-1500	6.58	.09	7.5	9.0	55	40	45	35	30	20	50	40	40	25	20	12	1-82	BB48	q	29.95
LMX-156	800-2500	DC-1500	7.09	.37	9.0	9.0	35	25	35	25	35	25	22	17	22	17	22	17	1-214	BB48	q	44.95
❑ PAM-42	2000-4200	DC-1300	8.13	.14	—	8.5			25 (typ.)		17 (min.)				12 (typ.)		8 (min.)		1-84	AA46	ac	27.95
❑ TUF-1	2-600	DC-600	5.85	.04	7.0	8.0	60	50	42	30	37	25	60	45	47	30	36	22	1-192	B02	z	4.25
❑ TUF-2	50-1000	DC-1000	5.85	.07	7.5	9.0	58	40	47	30	42	25	50	35	44	20	29	18	1-194	B02	z	5.20
❑ TUF-3	0.15-400	DC-400	4.7	.02	7.0	8.0	60	50	46	30	35	25	60	40	47	25	35	20	1-200	B02	z	6.10
❑ TUF-5	20-1500	DC-1000	5.7	.04	9.0	9.0	54	40	42	30	39	25	40	25	32	18	23	8	1-206	B02	z	9.45
❑ TUF-5X	1-1500	1-1000	5.9	.10	7.0	9.0	60	40	40	20	28	17	60	45	45	25	38	20	—	B02	gm	11.95
❑ TUF-11A	1400-1900	40-500	6.8	.30	8.6	8.6			33 (typ.)		20 (min.)				29 (typ.)		15 (min.)		1-290	B02	z	16.95
❑ TUF-860	800-1050	DC-250	5.6	.24	7.75	7.75			35 (typ.)		25 (min.)				27 (typ.)		20 (min.)		1-292	B02	z	9.45

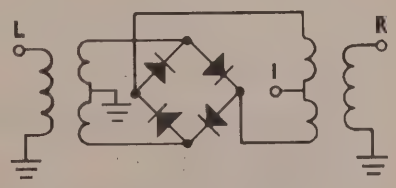
L = low range (f_L to 10 f_L)

M = mid range (10 f_L to f_U/2)
m = mid band (2f_L to f_U/2)

U = upper range (f_U/2 to f_U)

NSN GUIDE

MCL NO.	NSN
ASK-1	5895-01-320-0366
TFM-2	5895-01-135-1852
TFM-3	5895-01-112-0031
TFM-12	5895-01-179-5686
TFM-4	5895-01-317-9388



pin connections see case style outline drawings

PORT	d	k	q	r	w	x	z	aa	ac	gk	gm
LO	8	8	8	1	1	2	4	1	3	1	4
RF	1	1	5	8	4	1	1	4	1	5	2
IF	3,4^	3	4	3	5	3	2	2	4	4	1
GND EXT.	2,5,6,7	2,5,6,7	1,2,3,6,7	2,4,5,6,7	2,3,6	4,5,6	3	3	2	2,3,6	3
CASE GND	—	—	1,2,3,6,7	—	—	—	3	3	2	—	3
NOT USED	—	4	—	—	—	—	—	—	—	—	—

^ pins must be connected together externally

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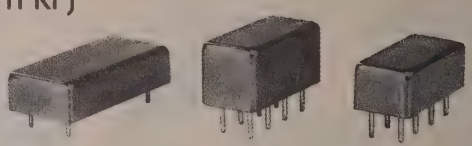
case style selection

outline drawings see Table of Contents



GRA SRA SBL SMA

MODEL NO.	FREQUENCY MHz LO/RF f_L-f_U	IF	CONVERSION LOSS dB Mid-Band m $\bar{x}$	σ	Max.	Total Range Max.	LO-RF ISOLATION, dB L Typ.	Min.	M Typ.	Min.	U Typ.	Min.	LO-IF ISOLATION, dB L Typ.	Min.	M Typ.	Min.	U Typ.	Min.	CAPD DATA (see RF/IF Designer Handbook) Page	Case Style Note B	CONNECTION	Price $ Qty. (1-9)
GRA-1	5-500	DC-500	5.96	.09	7.0	8.5	50	45	45	30	35	25	45	35	40	25	30	20	1-92	D09	y	14.95
GRA-3	.025-200	DC-200	4.78	.07	7.5	8.5	60	50	45	35	35	25	45	35	40	30	30	20	1-46	D09	y	18.45
GRA-6	.003-100	DC-100	4.70	.14	7.5	8.5	60	50	45	30	35	25	60	45	40	25	30	20	1-48	D09	y	28.95
GRA-8	.0005-10	DC-10	6.03	.08	7.5	8.5	60	50	50	40	45	35	60	50	50	40	45	35	1-50	D09	y	31.95
☆ SRA-1	.5-500	DC-500	5.11	.09	7.0	8.5	50	45	45	30	35	25	45	35	40	25	30	20	1-92	A01	e	13.45
SRA-1TX	.5-500	DC-500	5.68	.04	7.0	8.5	50	45	45	30	35	25	45	35	40	25	30	20	1-92	A01	e	59.95
SRA-1W	1-750	DC-750	5.80	.04	7.5	8.5	50	45	45	30	35	25	45	30	40	25	30	20	1-54	A01	f	15.95
SRA-1-1	.1-500	DC-500	4.81	.11	7.5	8.5	50	45	45	30	35	25	45	30	40	25	30	20	1-52	A01	e	14.95
SRA-2	1-1000	.5-500	5.66	.07	7.5	8.5	45	30	35	20	30	20	45	30	30	20	30	20	1-56	A01	j	15.95
SRA-2CM	5-1000	DC-1000	5.27	.04	7.0	8.5	60	50	35	30	30	25	50	45	30	25	25	20	1-96	A01	f	14.95
SRA-3	.025-200	DC-200	4.61	.06	7.5	8.5	60	50	45	35	35	25	45	35	40	30	30	20	1-46	A01	e	15.95
SRA-4	5-1250	.5-500	5.71	.08	7.5	8.5	50	40	40	20	30	20	50	40	40	20	30	20	1-122	A01	j	17.95
SRA-5	5-1500	10-600	6.69	.07	8.0	8.5	50	45	35	30	30	20	45	40	30	25	25	15	1-20	A06	m	24.95
SRA-6	.003-100	DC-100	4.58	.05	7.5	8.5	60	50	45	30	35	25	60	45	40	25	30	20	1-48	A01	d	24.95
SRA-8	.0005-10	DC-10	5.69	.11	7.5	8.5	60	50	50	40	45	35	60	50	50	40	45	35	1-50	A01	d	29.95
SRA-11	5-2000	10-600	6.72	.07	8.5	9.0	50	45	35	25	30	20	45	40	30	20	25	15	1-58	A06	m	20.95
SRA-12	800-1250	50-90	6.21	.13	7.5	7.5	32	25	35	25	35	25	30	20	30	20	30	20	1-74	A06	m	29.95
SRA-149	5-500	DC-500	5.61	.07	6.5	8.0	60	50	55	45	53	40	50	40	35	25	30	24	1-240	A06	p	9.95
SRA-2000	100-2000	DC-600	8.60	.15	9.5	9.5	37 (typ.)		20 (min.)				30 (typ.)		20 (min.)				1-60	A06	m	21.95
SRA-2400	750-2400	DC-400	5.95	.26	9.0	9.0	30	20	30	20	30	20	30	8	30	8	30	8	1-266	A06	s	22.95
SRA-3500**	500-3500	DC-1000	7.28	.31	9.5	9.5	30	17	30	17	30	17	20	8	20	8	20	8	1-244	A06	s	28.95
❑ SBL-1	1-500	DC-500	5.60	.09	7.0	8.0	60	45	45	35	40	25	45	35	40	25	30	20	1-62	A06	d	4.75
❑ SBL-1X	10-1000	5-500	5.88	.10	7.5	8.0	50	40	40	30	30	20	50	45	40	35	35	25	1-64	A06	j	6.45
❑ SBL-1Z	10-1000	DC-500	6.27	.09	7.5	9.0	50	40	35	25	25	20	40	25	25	18	19	15	1-114	A06	s	7.45
❑ SBL-1-1	0.1-400	DC-400	4.84	.04	7.0	8.0	50	45	45	30	35	25	45	30	40	25	30	20	1-116	A06	d	7.45
❑ SBL-3	.025-200	DC-200	4.81	.05	7.5	8.5	55	50	45	30	35	25	45	35	40	30	30	20	1-118	A06	d	7.45
❑ SBL-11	5-2000	10-600	7.08	.11	8.5	9.0	50	45	35	25	30	20	45	40	30	20	25	15	1-58	A06	m	19.95
SIMA-5	2-1500	DC-1000	7.01	.08	8.0	9.0	65	44	44	23	31	22	54	38	30	18	25	11	1-198	A06	n	24.95

L = low range (f_L to 10 f_L)

M = mid range (10 f_L to $f_U/2$)
m = mid band ($2f_L$ to $f_U/2$)

U = upper range ($f_U/2$ to f_U)

NOTES:

- $\bar{x}$ Average of conversion loss at center of mid-band frequency ($f_L+f_U/4$)
- σ Standard deviation
- ❑ Non-hermetic
- ☆ HTRB tested, 5-year guarantee
- † Phase detection, positive polarity
- * Conversion loss 9.5dB maximum from 0.01 to 0.015 MHz
- ** Conversion loss 10dB maximum at IF=1000 MHz
- A. General Quality Control Procedures, Environmental Specifications, Hi-Rel, MIL and TX description are given in section 0, see "Mini-Circuits Guarantees Quality" article.
- B. Connector types and case mounted options, case finishes are given in section 0, see "Case Styles & Outline Drawings".
- C. Prices and Specifications subject to change without notice.
- 1. Absolute maximum power, voltage and current ratings:
  - 1a. RF power, 50mW
  - 1b. Peak IF current, 40mA

MIL-M-28837/1, NSN GUIDE

MCL NO.	NSN	MIL-M-28837/1*
GRA-1	5895-00-480-2849	
GRA-3	5895-01-169-1815	
GRA-8	5895-01-247-5627	
SAM-1	5895-01-117-2926	
SAM-2	5895-01-165-6621	
SAM-3	5895-01-062-9973	
SAM-5	5895-01-036-9507	
SBL-1	5895-01-126-4913	
SBL-1X	5895-01-179-8084	
SRA-1	5895-00-008-8272	03
SRA-1-1	5962-01-113-5431	
SRA-1-TX	5895-01-163-9247	
SRA-1-1-TX	5895-01-151-6753	
SRA-11-TX	5895-01-163-9248	
SRA-1W	5895-01-163-0433	09
SRA-3	5895-01-021-5914	
SRA-4	5826-01-155-6545	
SRA-6	5895-01-124-0117	
SRA-8	5985-01-081-0977	
SRA-11	5895-01-273-0883	
SBL-3	5895-01-326-6030	
TAK-5	5895-01-271-0842	
TAK-6	5895-01-231-2372	
TSM-1	5895-01-121-7958	

*units are not QPL- listed

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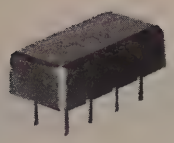
500 Hz to 3.5 GHz

Mini-Circuits

ULTRA-REL™ MIXERS

5-YR. GUARANTEE *


TAK

TSM

SAM

ROSE

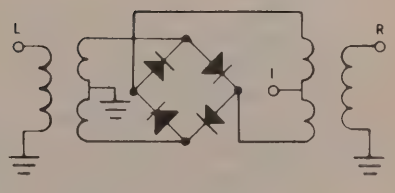
MODEL NO.	FREQUENCY MHz LO/RF f_L-f_U	IF	CONVERSION LOSS dB Mid-Band m $\bar{x}$	σ	Max.	Total Range Max.	LO-RF ISOLATION, dB L Typ.	Min.	M Typ.	Min.	U Typ.	Min.	LO-IF ISOLATION, dB L Typ.	Min.	M Typ.	Min.	U Typ.	Min.	CAPD DATA (see RF/IF Designer Handbook) Page	Case Style Note B	CONNECTION	Price $ Qty. (1-9)
TAK-5*	.01-250	DC-250	4.65	.02	7.0	8.5	60	50	50	35	40	35	55	45	45	30	35	25	1-86	A04	e	20.95
TAK-5R	.05-200	DC-200	4.70	.05	6.5	8.0	55	50	45	35	45	35	50	45	40	30	40	30	1-88	A04	d	20.95
TAK-6	.5-600	DC-600	5.58	.04	7.5	8.5	60	50	50	30	40	25	55	45	45	30	30	20	1-90	A04	e	20.95
TAK-6R	.5-600	DC-600	5.40	.11	7.0	8.0	55	50	45	30	35	30	45	40	40	25	30	25	1-90	A04	f	20.95
TAK-7	2-1000	5-500	5.86	.08	7.5	8.5	45	30	35	20	30	20	45	30	35	20	30	20	1-56	A04	j	20.95
TSM-1	1-600	DC-600	5.71	.04	7.5	8.5	60	45	45	35	35	25	55	45	40	30	35	25	1-102	A11	e	19.95
TSM-2	1-1000	DC-1000	5.55	.08	7.5	10.0	55	45	40	20	35	18	50	40	40	20	25	18	1-66	A11	f	20.95
TSM-3	.1-500	DC-500	4.75	.04	7.5	8.5	60	50	50	35	35	25	55	45	45	30	35	25	1-106	A11	e	21.95
† TSM-5	5-1500	DC-1000	6.16	.04	8.5	9.5	60	45	35	25	30	25	60	45	35	25	25	16	1-268	A11	e	27.95
SAM-1	1-600	DC-600	5.67	.05	7.0	8.5	55	45	45	30	35	20	50	40	40	25	30	20	1-102	A03	e	16.95
SAM-2	1-1000	DC-1000	5.68	.08	7.5	9.5	55	45	40	25	35	20	50	40	40	25	30	25	1-66	A03	f	20.45
SAM-3	0.1-500	DC-500	5.04	.07	7.0	8.5	60	50	50	35	35	30	50	40	45	30	30	20	1-106	A03	e	19.95
SAM-4	5-1250	0.5-1000	5.98	.18	8.5	8.5	55	40	35	25	30	20	50	40	35	25	30	20	1-108	A03	j	23.95
SAM-5	5-1500	0.5-1000	5.81	.08	7.5	8.5	55	40	35	25	30	20	50	40	35	25	30	20	1-110	A03	j	29.95
ROSE-1	1-600	DC-600	5.08	.03	6.5	7.5	40	30	35	25	30	20	55	40	40	20	25	18	1-100	PP94	ab	11.95
ROSE-2	1-1000	DC-1000	5.60	.23	7.0	8.0	61	45	37	22	25	18	55	40	26	17	16	12	–	PP94	ab	16.95

L = low range (f_L to 10 f_L) M = mid range (10 f_L to f_U/2) U = upper range (f_U/2 to f_U)
m = mid band (2f_L to f_U/2)

pin connections see case style outline drawings

PORT	d	e	f	j	m	n	p	s	t	y	ab
LO	8	8	8	8	8	8	8	1	1	1	1
RF	1	1	1	3,4 ^	1	1	2	8	8	6	3
IF	3,4 ^	3,4 ^	3,4 ^	1	3	3	5,6 ^	3	5,6 ^	4	2
GND EXT.	2,5,6,7	2,5,6,7	2,5,6,7	2,5,6,7	2,5,6,7	2,4,5,6,7	1,3,4,7	2,5,6,7	2,3,4,7	2,3,5	4
CASE GND	–	2	2,5,6,7	2,5,6,7	2,5,6,7	2,5,6,7	3,4,7	2,5,6,7	3,4,7	–	4
NOT USED	–	–	–	–	4	–	–	4	–	–	–

^ pins must be connected together externally



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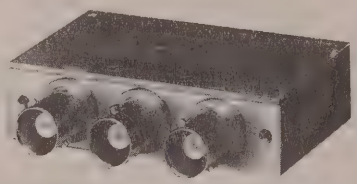
widest-variety of connector types

Frequency Mixers

LEVEL 7 (+7 dBm LO, up to +1 dBm RF)

case style selection

outline drawings see Table of Contents



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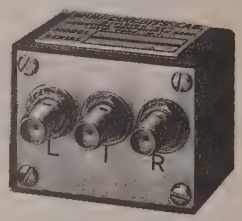

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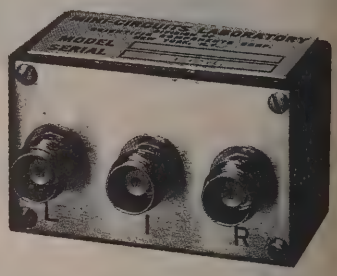

ZAD

MODEL NO.	FREQUENCY MHz LO/RF f_L-f_U	FREQUENCY MHz IF	CONVERSION LOSS dB Mid-Band m $\bar{x}$	σ	Max.	Total Range Max.	LO-RF ISOLATION, dB L Typ.	Min.	M Typ.	Min.	U Typ.	Min.	LO-IF ISOLATION, dB L Typ.	Min.	M Typ.	Min.	U Typ.	Min.	CAPD DATA (see RF/IF Designer Handbook) Page	Case Style Note B	CONNECTION	Price $ Qty. (1-9)
ZP10514	.2-500	DC-500	5.18	.026	7.0	8.5	55	45	50	35	35	30	50	40	36	30	30	20	1-124	GG60	ag	62.95
△ ZLW-1	.5-500	DC-500	5.81	.08	7.0	8.5	50	45	45	30	35	25	45	35	40	25	30	20	1-92	M21	ae	51.95
△ ZLW-1W	1-750	DC-750	5.74	.05	7.5	8.5	50	45	45	30	35	25	45	30	40	25	30	20	1-54	M21	ae	56.95
△ ZLW-1-1	.1-500	DC-500	4.82	.07	7.5	8.5	50	45	45	30	35	25	45	30	40	25	30	20	1-52	M21	ae	53.95
△ ZLW-2	1-1000	DC-1000	5.68	.08	7.5	9.5	55	45	40	25	35	20	50	40	40	25	30	20	1-66	M21	ae	56.95
△ ZLW-3	.025-200	DC-200	4.61	.06	7.5	8.5	60	50	45	35	35	25	45	35	40	30	30	20	1-46	M21	ae	53.95
△ ZLW-5	5-1500	10-600	5.81	.08	7.5	8.5	55	40	35	25	30	20	50	40	35	25	30	20	1-120	M21	ae	61.95
△ ZLW-6	.003-100	DC-100	4.58	.05	7.5	8.5	60	50	45	30	35	25	60	45	40	25	30	25	1-48	M21	ae	64.95
△ ZLW-8	.0005-10	DC-10	5.66	.08	7.5	8.5	60	50	50	40	45	35	60	50	50	40	45	35	1-50	M21	ae	69.95
△ ZLW-11	5-2000	10-600	6.85	.10	8.5	9.0	50	45	35	25	30	20	45	40	30	20	25	15	1-58	M21	ae	71.95
△ ZLW-12	800-1250	50-90	6.21	.13	—	7.5	35	25	35	25	35	25	30	20	30	20	30	20	1-74	M21	ae	71.95
ZAD-1	.5-500	DC-500	5.24	.10	7.0	8.5	50	45	45	30	35	25	45	35	40	25	30	20	1-92	M22	ae	43.95
ZAD-1W	1-750	DC-750	5.56	.05	7.5	8.5	50	45	45	30	35	25	45	30	40	25	30	20	1-54	M22	ae	45.95
ZAD-1-1	.1-500	DC-500	4.83	.04	7.5	8.5	50	45	45	30	35	25	45	30	40	25	30	20	1-52	M22	ae	44.95
ZAD-2	1-1000	.5-500	5.66	.07	7.5	8.5	45	30	35	20	30	20	45	30	35	20	30	20	1-56	M22	ad	49.95
ZAD-3	.025-200	DC-200	4.61	.06	7.5	8.5	60	50	45	35	35	25	45	35	40	30	30	20	1-46	M22	ae	45.95
ZAD-4	5-1250	.5-500	5.71	.08	7.5	8.5	50	40	40	20	30	20	50	40	40	20	30	20	1-122	M22	ad	51.95
ZAD-6	.003-100	DC-100	4.65	.08	7.5	8.5	60	50	45	30	35	25	60	45	40	25	30	20	1-48	M22	ae	51.95
ZAD-8	.0005-10	DC-10	5.79	.05	7.5	8.5	60	50	50	40	45	35	60	50	50	40	45	35	1-50	M22	ae	54.95
ZAD-11	5-2000	10-600	7.12	.12	8.5	9.0	50	45	35	25	30	20	45	40	30	20	25	15	1-58	M22	ae	61.95
ZAD-12	800-1250	50-90	6.21	.13	7.5	7.5	35	25	35	25	35	25	30	20	30	20	30	20	1-74	M22	ae	61.95

L = low range (f_L to 10 f_L)

M = mid range (10 f_L to f_U/2)
m = mid band (2f_L to f_U/2)

U = upper range (f_U/2 to f_U)

NOTES:

$\bar{x}$ Average of conversion loss at center of mid-band frequency (f_L+f_U/4)
σ Standard deviation
△ Available only with SMA connectors
† Phase detection, positive polarity
A. General Quality Control Procedures, Environmental Specifications, Hi-Rel, MIL and TX description are given in section 0, see "Mini-Circuits Guarantees Quality" article.
B. Connector types and case mounted options, case finishes are given in section 0, see "Case Styles & Outline Drawings"
C. Prices and Specifications subject to change without notice.
1. Absolute maximum power, voltage and current ratings:
1a. RF power, 50mW
1b. Peak IF current, 40mA

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500 Hz to 4.3 GHz

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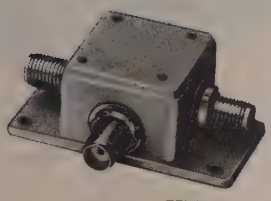
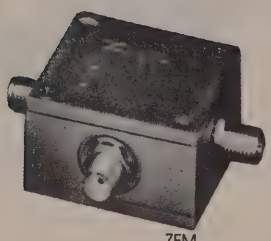
ULTRA-REL™ MIXERS

5-YR. GUARANTEE *



ZEM



ZFM

ZAM

MODEL NO.	FREQUENCY MHz LO/RF f_L-f_U	IF	CONVERSION LOSS dB Mid-Band m $\bar{x}$	σ	Max.	Total Range Max.	LO-RF ISOLATION, dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	LO-IF ISOLATION, dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	CAPD DATA (see RF/IF Designer Handbook) Page	Case Style Note E	CONNECTION	Price $ Qty. (1-9)
△ ZEM-2B	10-1000	DC-1000	5.74	.07	7.0	8.5	55	50	30	25	25	20	55	45	30	20	25	20	1-66	V37	ad	59.95
△ ZEM-4300	300-4300	DC-1000	6.65	.06	—	9.5	40	20	—	—	30	17	15	8	—	—	15	8	1-246	V37	af	79.95
ZFM-1W	10-750	DC-750	5.42	.14	7.0	8.0	50	45	45	30	35	25	45	40	40	25	27	20	1-54	K18	ad	51.95
ZFM-2	1-1000	DC-1000	5.72	.06	7.5	8.5	50	45	40	25	30	25	45	40	35	25	25	20	1-66	K18	ad	53.95
ZFM-3	0.04-400	DC-400	4.78	.03	7.0	8.0	60	50	50	35	35	25	55	40	45	30	35	25	1-68	K18	ad	61.95
† ZFM-4	5-1250	DC-1250	5.70	.34	7.5	8.5	50	45	40	30	30	25	45	40	35	25	25	20	1-70	K18	ad	61.95
ZFM-5X	1-1500	1-1000	5.9	.10	7.0	9.0	60	40	40	20	28	17	60	45	45	25	38	20	—	K18	ad	59.95
ZFM-11	1-2000	5-600	7.03	.17	8.5	9.0	50	45	35	25	25	20	45	40	27	20	25	20	1-72	K18	ad	89.95
ZFM-12	800-1250	50-90	5.67	.12	—	7.5	35	25	35	25	35	25	30	20	30	20	30	20	1-74	K18	ad	79.95
△ ZFM-2000	100-2000	DC-600	7.49	.20	9.5	9.5	—	—	37	20	—	—	—	—	—	—	30	20	1-60	K18	ad	71.95
△ ZFM-4212	2000-4200	DC-1300	5.44	.088	—	8.5	—	—	25	17	—	—	—	—	18	10	—	—	1-84	K18	ad	54.95
△ ZAM-42	1500-4200	DC-500	5.67	.11	—	8.5	25	14	25	14	25	14	18	10	18	10	18	10	1-85	F14	af	54.95

L = low range (f_L to 10 f_L)

M = mid range (10 f_L to f_U/2)
m = mid band (2f_L to f_U/2)

U = upper range (f_U/2 to f_U)

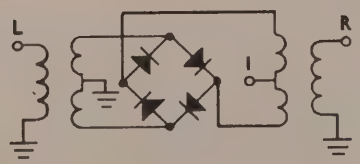
NSN GUIDE

MCL NO.	NSN
ZAD-1B(BNC)	5985-00-280-7750
ZAD-4B	5895-01-127-0376
ZAD-6B	5895-01-344-7843
ZEM-2	5895-01-235-7834
ZFM-2	4935-01-230-3782
ZFM-3	5895-01-257-9523
ZFM-3 (SMA)	5895-01-214-7362
ZLW-1W	5895-00-607-7010
ZLW-2	6920-01-037-1974
ZLW-2B	5840-01-186-8398
ZP10514	6625-01-108-6156

coaxial connections

see case style outline drawings

PORT	ad	ae	af	ag
LO	1	1	2	L
RF	2	3	1	R
IF	3	2	3	X
GND EXT.	—	—	—	—
CASE GND	—	—	—	—
NOT USED	—	—	—	—



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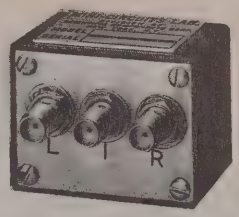
56

broadband high dynamic range
Frequency Mixers

LEVEL 10 (+10 dBm LO, up to +5 dBm RF)
50 KHz to 3 GHz

case style selection

outline drawings see Table of Contents



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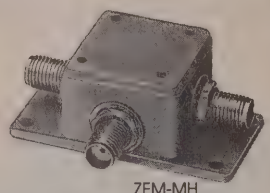
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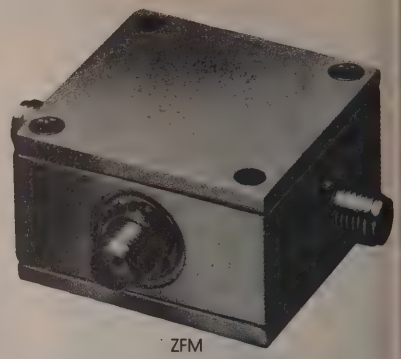
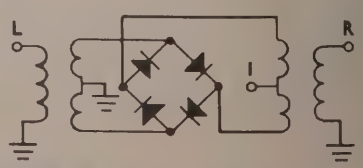

ZFM

MODEL NO.	FREQUENCY MHz LO/RF f_L-f_U	IF	CONVERSION LOSS dB Mid-Band m $\bar{x}$	σ	Max.	Total Range Max.	LO-RF ISOLATION, dB L Typ.	Min.	M Typ.	Min.	U Typ.	Min.	LO-IF ISOLATION, dB L Typ.	Min.	M Typ.	Min.	U Typ.	Min.	CAPD DATA (see RF/IF Designer Handbook) Page	Case Style Note B	CONNECTION	Price $ Qty. (1-9)
†● RMS-1LH	2-500	DC-500	5.36	.08	7.0	8.0	58	45	44	25	30	20	55	40	40	25	28	17	1-220	TT100	w	7.95
†● RMS-2LH	5-1000	DC-1000	6.44	.10	8.0	9.5	58	40	39	20	22	16	52	30	30	17	18	11	1-226	TT100	w	8.95
†● RMS-5LH	10-1500	DC-900	5.27	.09	8.0	9.8	58	35	38	20	25	18	56	30	38	14	17	6	1-294	TT100	w	14.95
†● LRMS-1LH	2-500	DC-500	5.36	.08	7.0	8.0	58	45	44	25	30	20	55	40	40	25	28	17	1-220	QQQ130	w	7.95
†● LRMS-2LH	5-1000	DC-1000	6.44	.10	8.0	9.5	58	40	39	20	22	16	52	30	30	17	18	11	1-226	QQQ130	w	8.95
†● LRMS-5LH	10-1500	DC-900	5.27	.09	8.0	9.8	58	35	38	20	25	18	56	30	38	14	17	6	1-294	QQQ130	w	14.95
TFM-15	10-3000	10-800	6.75	.08	8.0	8.5	35	25	35	25	35	25	30	20	30	20	30	20	1-126	B13	aa	49.95
TFM-150**	10-2000	DC-1000	6.19	.11	8.0	8.0	32	25	35	25	35	25	33	20	30	20	30	20	1-128	B13	aa	45.45
TFM-2LH	2-1000	DC-1000	5.70	.177	7.5	9.2	62	45	44	25	37	25	58	40	45	25	31	18	1-262	B02	z	16.95
LMX-123	10-3000	10-1000	5.94	.08	8.0	8.5	35	25	35	20	30	15	35	25	30	25	30	20	1-130	BB48	q	69.95
† LMX-148	10-1500	DC-1500	6.48	.08	7.0	10.0	45	40	35	30	25	20	40	35	35	25	20	12	1-132	BB48	q	29.95
LMX-1481	3-1100	DC-1100	6.70	.12	8.5	9.8	65	45	40	25	30	18	57	38	30	20	20	14	1-208	BB48	q	23.95
SRA-2CR	10-1000	5-500	5.68	.12	7.5	8.0	50	40	40	30	30	20	40	25	30	18	25	15	1-242	A01	s	17.95
SRA-215	.05-1500	.05-500	5.20	.08	7.5	9.0	25	20	35	25	30	20	25	20	35	25	25	15	1-134	A01	m	28.95
SRA-220	.05-2000	.05-500	5.59	.11	8.0	9.0	25	20	40	30	30	20	25	20	40	30	25	15	1-136	A01	m	31.95
ZFM-15	10-3000	10-800	6.13	.14	8.0	8.5	35	25	35	25	35	25	30	20	30	20	30	20	1-126	K18	ad	89.95
ZFM-150**	10-2000	DC-1000	6.05	.12	8.0	8.0	32	25	35	25	35	20	33	20	30	20	25	20	1-128	K18	ad	69.95
● SCM-1LH	1-500	DC-500	5.75	.20	7.0	8.0	60	40	50	35	40	30	50	40	45	35	40	25	—	YY101	d	6.25
● SCM-2LH	5-1000	DC-500	7.15	.20	8.4	9.7	65	40	50	25	44	20	58	40	50	25	28	15	—	YY101	d	7.45
● SCM-5LH	1250-1800	DC-500	6.0	.46	—	8.8			26 (Typ.)		17 (Min.)				18 (Typ.)		8 (Min.)		—	YY101	d	13.95
● SCM-2500LH	500-2500	DC-500	5.6	.20	6.8	10.0			35 (Typ.)		20 (Min.)				18 (Typ.)		10 (Min.)		—	YY101	r	13.95
❑ SBL-1LH	2-500	DC-500	5.8	.03	7.0	8.0	75	45	68	35	56	25	61	35	45	25	36	20	1-252	A06	d	5.75
❑ SBL-1-1LH	.2-400	DC-400	5.2	.06	7.0	9.0	67	45	64	30	51	25	62	30	52	25	34	20	1-256	A06	d	8.45
❑ SBL-1XLH	10-1000	5-500	6.0	.12	7.5	8.5	50	40	40	25	30	20	70	45	55	40	45	30	1-258	A06	j	7.45
❑ SBL-2LH	5-1000	DC-1000	5.9	.09	7.5	9.5	67	45	61	30	57	30	68	40	54	30	43	20	1-262	A06	h	8.45
❑ SBL-3LH	.07-250	DC-250	4.9	.22	7.0	8.5	60	45	60	35	45	30	57	35	53	30	42	25	1-264	A06	d	8.45
❑ SBL-11LH	5-2000	10-600	7.0	11	8.5	9.5	60	45	45	30	30	20	50	35	30	20	25	16	1-254	A06	m	20.95
● SYM-11LH	1-2000	10-600	7.0	10	8.3	9.85	60	40	45	25	37	25	59	40	33	20	25	20	1-296	TTT167	x	11.95
▽❑ TUF-1LH	2-600	DC-600	6.0	.17	7.0	8.0	70	50	50	30	42	25	65	45	50	30	41	22	1-316	B02	z	6.25
▽❑ TUF-2LH*	50-1000	DC-1000	5.2	.3	7.0	8.5	58	40	44	30	39	25	60	35	50	25	38	20	1-262	B02	z	7.20
▽❑ TUF-3LH	0.15-400	DC-400	4.8	.37	7.0	8.0	67	50	51	30	40	25	67	40	45	25	34	20	1-318	B02	z	8.10
▽❑ TUF-5LH	20-1500	DC-1000	6.9	.27	8.5	9.0	53	40	42	30	38	25	40	25	30	18	22	8	1-320	B02	z	11.45
▽❑ TUF-11ALH	1400-1900	40-500	7.0	.20	8.6	8.6			36 (Typ.)		20 (Min.)				28 (Typ.)		15 (Min.)		1-322	B02	z	18.95
▽❑ TUF-860LH	800-1050	DC-250	6.3	.27	7.9	7.9			35 (Typ.)		25 (Min.)				27 (Typ.)		18 (Min.)		1-324	B02	z	11.45
ROK-2500LH	1-2500	DC-500	6.4	.2	8.4	9.0	55	40	48	20	30	20	55	38	27	15	22	15	—	PP230	ah	32.95

L = low range (f_L to $10f_L$) M = mid range ($10f_L$ to $f_U/2$) U = upper range ($f_U/2$ to f_U)
m = mid band ($2f_L$ to $f_U/2$)

NOTES:

- $\bar{x}$ Average of conversion loss at center of mid-band frequency ($f_L+f_U/4$)
- σ Standard deviation
- ● Surface-mount, non-hermetic, available on tape and reel
- ❑ Non-hermetic
- † Phase detection, positive polarity
- ▽ For surface-mount version add suffix SM (case style NNN150); available on tape and reel.
- * L=50-100 MHz; M=100-500 MHz
- ** Below 10 MHz IF, conversion loss increase up to 6 dB higher as frequency decreases to DC.
- *** Price for quantities 10-49
- A. General Quality Control Procedures, Environmental Specifications, Hi-Rel, MIL and TX description are given in section 0, see "Mini-Circuits Guarantees Quality" article.
- B. Connector types and case mounted options, case finishes are given in section 0, see "Case Styles & Outline Drawings".
- C. Prices and Specifications subject to change without notice.
- 1. Absolute maximum power, voltage and current ratings:
  - 1a. Level 10 mixers, RF power 50mW
  - 1b. Level 13 mixers, RF power 200mW (except RMS-MH, 150mW)
  - 1c. Peak IF current, 40mA



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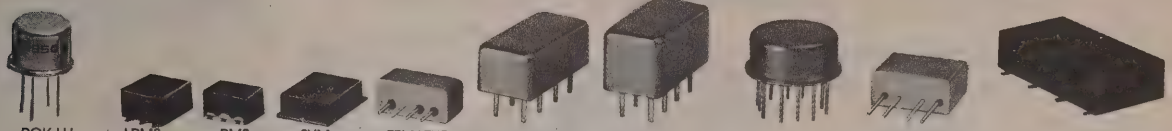
5-YR. GUARANTEE *

LEVEL 13 (+13 dBm LO, up to +9 dBm RF)
25 KHz to 4.3 GHz



ROK-LH LRMS RMS SYM TFM/ TUF SBL / SIMA SRA ROK-MH LMX SCM

MODEL NO.	FREQUENCY MHz LO/RF f_L-f_U	FREQUENCY MHz IF	CONVERSION LOSS dB Mid-Band m $\bar{x}$	σ	Max.	Total Range Max.	LO-RF ISOLATION, dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	LO-IF ISOLATION, dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	CAPD DATA (see RF/IF Designer Handbook) Page	Case Style Note B	CONNECTION	Price $ Qty. (1-9)
†● RMS-1MH	2-500	DC-500	5.65	.08	7.0	8.0	58	45	44	25	30	20	55	40	36	25	28	17	1-222	TT100	w	8.95
†● RMS-2MH	5-1000	DC-1000	6.72	.08	8.5	9.5	55	40	39	20	22	16	52	35	30	17	18	12	1-228	TT100	w	9.95
†● RMS-2UMH	10-1000	20-500	7.0	.1	8.5	9.5	52	40	43	30	33	25	53	30	44	25	39	22	—	TT100	w	14.45
†● RMS-5MH	10-1500	DC-900	5.67	.09	9.0	9.5	58	40	40	20	26	18	50	30	38	18	17	8	1-234	TT100	w	15.95
†● RMS-25MH	5-2500	5-1500	7.0	.20	8.5	9.8	54	28	32	23	32	20	34	23	32	25	28	17	—	TT240	w	7.95***
†● LRMS-1MH	2-500	DC-500	5.65	.08	7.0	8.0	58	45	44	25	30	20	55	40	36	25	28	17	1-222	QQQ130	w	8.95
†● LRMS-2MH	5-1000	DC-1000	6.72	.08	8.5	9.5	55	40	39	20	22	16	52	35	30	17	18	12	1-228	QQQ130	w	9.95
†● LRMS-2UMH	10-1000	20-500	7.0	.1	8.5	9.5	52	40	43	30	33	25	53	30	44	25	39	22	—	QQQ130	w	14.45
†● LRMS-5MH	10-1500	DC-900	5.67	.09	9.0	9.5	58	40	40	20	26	18	50	30	38	18	17	8	1-234	QQQ130	w	15.95
SIMA-5MH	2-1500	DC-1000	7.11	.11	8.6	9.0	70	44	44	23	31	22	57	38	30	20	25	15	1-204	A06	n	28.95
TFM-1MH	2-500	DC-500	5.80	.05	7.5	8.5	50	45	40	30	30	20	45	40	35	25	25	20	1-138	B02	z	24.95
TFM-3MH	1-250	DC-250	4.79	.23	7.0	8.5	50	45	40	30	28	23	45	40	35	25	26	20	1-140	B02	z	24.95
TFM-12MH	0.5-2000	0.2-600	6.99	.16	8.0	9.5	60	45	35	30	30	25	55	40	30	25	25	20	1-104	B13	z	48.95
TFM-42MH	10-4200	10-1000	7.46	.12	8.5	11	35	25	40	25	35	25	35	20	35	25	27	20	1-94	B13	z	69.95
LMX-123MH	10-2500	10-500	6.80	.074	8.5	9.6	42	22	35	20	28	20	33	20	36	20	36	15	1-298	BB48	q	70.95
LMX-125MH	0.5-500	DC-500	5.80	.07	7.0	9.0	45	40	45	40	40	30	45	40	40	35	35	25	1-142	BB48	q	62.95
❑ SBL-1MH	1-500	DC-500	5.73	.08	7.5	8.5	50	35	45	30	35	25	45	30	40	25	30	20	1-144	A06	d	10.45
❑ SBL-1ZMH	2-1100	DC-500	6.63	.10	8.0	9.0	50	40	40	30	30	20	40	30	25	20	25	15	1-260	A06	s	12.45
SRA-1MH	.5-500	DC-500	5.65	.04	7.0	8.5	50	45	45	30	35	25	45	35	40	25	30	20	1-146	A01	e	14.95
SRA-3MH	.025-200	DC-200	4.77	.07	7.5	8.5	60	50	45	35	35	25	45	35	40	30	30	20	1-148	A01	e	16.95
SRA-2010MH	10-2000	DC-600	7.50	.20	8.5	9.8	50	45	45	30	40	25	45	45	35	30	35	20	1-98	A06	m	38.95
ROK-186MH	5-2500	10-1000	6.57	.11	8.5	9.5	33	25	35	25	25	20	33	20	31	25	27	20	1-112	QQ96	v	47.95
ZEM-4300MH	300-4300	DC-1000	6.42	.15	—	8.5	40	20	—	—	40	20	14	7	—	—	12	7	1-302	V37	af	89.95
ZEM-M2TMH	10-2400	10-1000	6.9	.10	9.0	9.5	49	40	43	35	42	35	49	40	44	30	40	30	—	V37	af	114.95
● SYM-11MH	50-2000	50-1000	6.6	.10	8.0	9.9	55	35	44	25	30	20	40	25	36	20	29	20	1-300	TTT167	x	15.95
▽❑ TUF-1MH	2-600	DC-600	6.3	.12	7.0	8.0	68	50	50	30	43	25	65	45	48	30	37	22	1-138	B02	z	7.25
▽❑ TUF-2MH*	50-1000	DC-1000	6.0	.25	7.5	9.0	58	40	47	30	37	25	55	35	47	20	32	18	1-326	B02	z	8.20
▽❑ TUF-3MH	0.15-400	DC-400	5.0	.33	7.0	8.0	60	50	46	30	35	25	60	40	42	25	35	20	1-140	B02	z	9.10
▽❑ TUF-5MH	20-1500	DC-1000	7.0	.25	8.5	9.0	50	40	41	30	35	25	38	25	28	18	20	8	1-328	B02	z	12.45
▽❑ TUF-11AMH	1400-1900	40-500	7.4	.20	8.6	8.6			33 (Typ.)		20 (Min.)				24 (Typ.)		15 (Min.)		1-330	B02	z	19.95
▽❑ TUF-860MH	800-1050	DC-250	6.8	.32	8.3	8.3			35 (Typ.)		25 (Min.)				27 (Typ.)		18 (Min.)		1-332	B02	z	12.45
▽❑ TUF-2500MH	400-2500	30-800	7.3	.15	8.5	10.0			32 (Typ.)		24 (Min.)				27 (Typ.)		17 (Min.)		—	B02	z	24.95
ZLW-186MH	2-2500	2-1000	6.9	.11	8.5	9.5	33	25	35	25	30	20	42	25	49	25	32	20	—	M21	ae	69.95

L = low range (f_L to 10 f_L) M = mid range (10 f_L to f_U/2) U = upper range (f_U/2 to f_U)

m = mid band ($2f_L$ to f_U/2)

NSN GUIDE

MCL NO.	NSN	MCL NO.	NSN
ZFM-150	5895-01-217-6878	TFM-3MH	5895-01-302-7047
TFM-15	5895-01-292-2759	LMX-148	5962-01-357-4432

pin and coaxial connections see case style outline drawings

PORT	d	e	h	j	m	n	q	r	s	v	w	x	z	aa	ad	ae	af	ah
LO	8	8	8	8	8	8	8	1	1	5	1	2	4	1	1	1	2	4
RF	1	1	1	3,4^	1	1	5	8	8	11	4	1	1	4	2	3	1	2
IF	3,4^	3,4^	3,4^	1	3	3	4	3	3	2	5	3	2	2	3	2	3	1
GND EXT.	2,5,6,7	2,5,6,7	2,5,6,7	2,5,6,7	2,5,6,7	2,4,5,6,7	1,2,3,6,7	2,4,5,6,7	2,5,6,7	1,3,4,6,7,8,9,10,12	2,3,6	4,5,6	3	3	—	—	—	3
CASE GND	—	2	2,5,6	2,5,6,7	2,5,6,7	2,5,6,7	1,2,3,6,7	—	2,5,6,7	1,3,4,6,7,8,9,10,12	—	—	3	3	—	—	—	3
NOT USED	—	—	—	—	4	—	—	—	4	—	—	—	—	—	—	—	—	—

^ pins must be connected together externally

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CAPD now available! computer-automated performance data

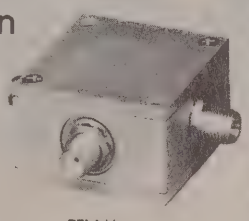
very high dynamic range

Frequency Mixers

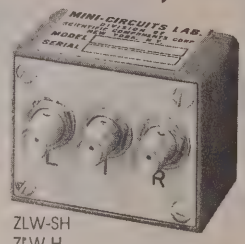
LEVEL 17 (+17 dBm LO, up to +10 dBm RF)

case style selection

outline drawings see Table of Contents



ZFM-H



ZLW-SH
ZLW-H

ZAD-SH
ZAD-H

MODEL NO.	FREQUENCY MHz LO/RF f_L-f_U	FREQUENCY MHz IF	CONVERSION LOSS dB Mid-Band $\bar{x}$	CONVERSION LOSS dB Mid-Band $m\sigma$	CONVERSION LOSS dB Mid-Band Max.	CONVERSION LOSS dB Total Range Max.	LO-RF ISOLATION, dB L Typ.	LO-RF ISOLATION, dB L Min.	LO-RF ISOLATION, dB M Typ.	LO-RF ISOLATION, dB M Min.	LO-RF ISOLATION, dB U Typ.	LO-RF ISOLATION, dB U Min.	LO-IF ISOLATION, dB L Typ.	LO-IF ISOLATION, dB L Min.	LO-IF ISOLATION, dB M Typ.	LO-IF ISOLATION, dB M Min.	LO-IF ISOLATION, dB U Typ.	LO-IF ISOLATION, dB U Min.	CAPD DATA (see RF/IF Designer Handbook) Page	Case Style Note B	CONNECTION	Price $ Qty. (1-9)
❑ SBL-173H	5-1200	1-1200	5.7	.10	7.0	8.5	40	35	35	25	35	20	40	35	35	20	30	20	—	A06	u,f	21.95
❑ SBL-2500H	5-2500	1-1000	5.5	.10	7.5	10.5	46	35	44	30	35	25	50	35	44	27	32	19	—	A06	f	33.95
☆ SRA-1H	.5-500	DC-500	6.01	.08	7.5	8.5	55	45	45	30	35	25	45	35	40	30	30	20	1-150	A01	e	20.95
☆ SRA-1WH	1-750	DC-750	5.85	.11	7.5	8.5	50	40	45	25	35	25	45	35	40	30	30	20	1-152	A01	f	24.95
☆ SRA-2H	2-1000	DC-1000	6.34	.14	7.5	10	50	40	35	25	35	25	45	30	30	20	25	20	1-154	A01	f	38.95
☆ SRA-3H	.05-200	DC-200	5.18	.05	7.0	7.5	50	45	40	30	35	25	45	35	40	30	30	20	1-156	A01	e	22.95
SRA-6H	.01-50	DC-50	4.97	.06	6.0	7.0	50	45	45	30	35	25	50	40	47	35	32	25	1-162	A01	e	38.95
SRA-11H	10-3000	10-1000	6.83	.09	10	12	27	20	25	18	23	16	27	20	25	18	23	16	1-158	A01	m	47.95
SRA-173H	5-1200	DC-1200	5.38	.05	7.0	8.5	40	35	35	25	35	20	40	35	35	20	30	20	1-160	A01	u,f	31.95
SIMA-5H	2-1500	DC-1000	6.94	.07	8.5	8.5	65	35	44	23	40	22	54	25	30	23	25	13	1-202	A06	m	32.95
● SYM-11H	50-2000	50-1950	6.3	.10	7.5	9.0	45	35	40	25	37	25	40	25	32	20	30	20	1-304	TTT167	x	17.95
GRA-1H	.5-500	DC-500	5.87	.09	7.5	8.5	55	45	45	30	35	25	45	35	40	30	30	20	1-50	D08	y	21.95
GRA-3H	.05-200	DC-200	4.85	.07	7.0	7.5	55	45	45	30	35	25	45	35	40	30	30	20	1-156	D08	y	24.95
GRA-6H	.01-50	DC-50	5.04	.05	6.0	7.0	50	45	45	30	35	25	50	40	47	35	32	25	1-162	D08	y	34.95
☆ ZLW-1H	.5-500	DC-500	6.13	.08	7.5	8.5	55	45	45	30	35	25	45	35	40	30	30	20	1-150	M21	ae	56.95
☆ ZLW-1WH	1-750	DC-750	6.07	.13	7.5	8.5	50	45	45	25	35	25	45	35	40	25	30	20	1-152	M21	ae	59.95
☆ ZLW-2H	2-1000	DC-1000	6.34	.14	7.5	10	50	40	35	25	35	25	45	35	30	20	25	20	1-154	M21	ae	64.95
☆ ZLW-3H	.05-200	DC-200	5.18	.05	7.0	7.5	55	45	45	30	35	25	45	35	40	30	30	20	1-156	M21	ae	58.95
ZLW-11H	10-3000	10-1000	6.83	.09	10	12	27	20	25	18	23	16	27	20	25	18	23	16	1-158	M21	ae	99.95
☆ ZAD-1H	.5-500	DC-500	6.16	.08	7.5	8.5	50	45	45	30	35	25	45	35	40	30	30	20	1-150	M22	ae	48.95
☆ ZAD-1WH	1-750	DC-750	6.16	.09	7.5	8.5	50	45	45	25	35	25	45	35	40	25	30	20	1-152	M22	ae	52.95
☆ ZAD-2H	2-1000	DC-1000	6.22	.15	7.5	10	50	40	35	25	35	25	45	35	30	20	25	20	1-154	M22	ae	59.95
☆ ZAD-3H	.05-200	DC-200	4.89	.09	7.0	7.5	55	45	45	30	35	25	45	35	40	30	30	20	1-156	M22	ae	50.95
ZAD-11H	10-3000	10-1000	6.83	.09	10	12	27	20	25	18	23	16	27	20	25	18	23	16	1-158	M22	ae	89.95

L = low range (f_L to 10 f_L) M = mid range (10 f_L to f_U/2) U = upper range (f_U/2 to f_U)

m = mid band (2f_L to f_U/2)

NOTES:

- $\bar{x}$ Average of conversion loss at center of mid-band frequency (f_L+f_U/4)
- σ Standard deviation
- ● Surface-mount, non-hermetic, available on tape and reel
- ❑ Non-hermetic
- ☆ HTRB tested, 5-year guarantee
- † Phase detection, positive polarity
- ▽ For surface-mount version add suffix SM (case style NNN150) which is available on tape and reel.
- A. General Quality Control Procedures, Environmental Specifications, Hi-Rel, MIL and TX description are given in section 0, see "Mini-Circuits Guarantees Quality" article.
- B. Connector types and case mounted options, case finishes are given in section 0, see "Case Styles & Outline Drawings".
- C. Prices and Specifications subject to change without notice.
- 1. Absolute maximum power, voltage and current ratings:
  - 1a. RF power 200mW
  - 1b. Peak IF current, 40mA
- 2. Two-Tone 3rd order IM below IF, each tone at 0dBm (200 and 202 MHz), LO at +17dBm (180 MHz). All models 60dB typ., 55dB min., except 55dB typ., 45dB min. for TFM-3H, TAK-3H, ZFM-3H, ZLW-3SH, ZAD-3SH.

MIL-M-28837/1, NSN GUIDE

MCL NO.	NSN	MIL-M-28837/1*
GRA-1H	5895-01-284-6870	
GRA-3H	5895-01-171-0974	
SRA-1H	6625-00-594-0223	08
SRA-1WH	5895-00-576-0716	
SRA-2H	5895-01-063-1078	
SRA-3H	5895-01-117-4537	
SRA-11H	5895-01-192-0173	
SRA-11H-TX	5895-01-137-9278	
ZAD-1WH	5895-01-045-4647	
ZAD-3H	5895-01-149-0771	
ZLW-1H	5985-01-080-7637	
ZLW-1HB	5962-01-045-7500	
ZLW-1HB(SMA)	5895-01-141-4646	
TAK-1H	5895-01-167-9721	
TAK-1WH	5895-01-282-0079	
TAK-3H	5895-01-274-2678	
TFM-1H	5895-01-129-0110	
TFM-2H	5895-01-235-1274	
ZAD-11H	5985-01-288-9999	
ZAD-3SHB	5895-01-264-8994	
ZFM-3H	5895-01-290-0300	
ZAD-11HB(TNC)	5895-01-312-3006	

* units are not QPL listed

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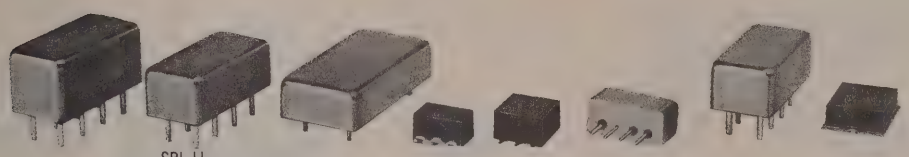
10 kHz to 3 GHz

Mini-Circuits

ULTRA-REL™ MIXERS

5-YR. GUARANTEE *

LEVEL 17S (+17 dBm LO, up to +14 dBm RF)



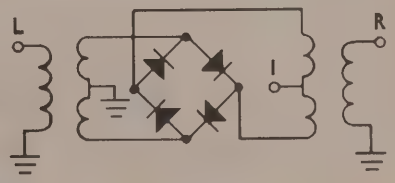
SRA-H | SBL-H SIMA-H SRA-SH | GRA-H | RMS-H | LRMS-H | TFM-H TUF-H | TAK-H | SYM-H

MODEL NO.	FREQUENCY MHz LO/RF f_L-f_U	IF	CONVERSION LOSS dB Mid-Band m $\bar{x}$	σ	Max.	Total Range Max.	LO-RF ISOLATION, dB L Typ.	Min.	M Typ.	Min.	U Typ.	Min.	LO-IF ISOLATION, dB L Typ.	Min.	M Typ.	Min.	U Typ.	Min.	CAPD DATA (see RF/IF Designer Handbook) Page	Case Style Note B	CONNECTION	Price $ Qty. (1-9)
†● RMS-1H	2-500	DC-500	6.25	.034	7.0	8.5	55	44	44	25	33	20	50	34	45	25	37	22	1-306	TT100	w	10.95
†● RMS-1WH	5-750	DC-750	7.00	.11	8.5	8.8	55	40	43	22	28	20	52	30	38	22	29	20	1-308	TT100	w	11.95
†● RMS-2H	5-1000	DC-900	6.98	.054	8.5	9.3	55	40	39	22	33	20	52	30	45	22	30	17	1-310	TT100	w	11.95
†● RMS-2UH	10-1000	10-750	7.10	.083	8.5	9.6	50	40	38	30	30	23	50	30	40	25	34	22	1-312	TT100	w	14.45
†● RMS-5H	10-1500	DC-900	6.36	.05	8.0	9.8	65	40	36	20	22	15	50	30	30	18	17	7	1-250	TT100	w	17.95
†● LRMS-1H	2-500	DC-500	6.25	.034	7.0	8.5	55	44	44	25	33	20	50	34	45	25	37	22	1-306	QQQ130	w	10.95
†● LRMS-1WH	5-750	DC-750	7.00	.11	8.5	8.8	55	40	43	22	28	20	52	30	38	22	29	20	1-308	QQQ130	w	11.95
†● LRMS-2H	5-1000	DC-900	6.98	.054	8.5	9.3	55	40	39	22	33	20	52	30	45	22	30	17	1-310	QQQ130	w	11.95
†● LRMS-2UH	10-1000	10-750	7.10	.083	8.5	9.6	50	40	38	30	30	23	50	30	40	25	34	22	1-312	QQQ130	w	14.45
†● LRMS-5H	10-1500	DC-900	6.36	.05	8.0	9.8	65	40	36	20	22	15	50	30	30	18	17	7	1-250	QQQ130	w	17.95
SRA-173SH	5-1200	1-1200	5.7	.10	7.0	8.5	40	35	35	25	35	20	40	35	35	20	30	20	—	A06	u,f	33.95
SRA-2500SH	5-2500	1-1000	5.8	.10	7.5	10.5	40	25	37	28	30	18	50	35	42	25	25	17	—	A06	f	35.95
TFM-1H	2-500	DC-500	6.14	.11	7.5	8.5	50	45	40	30	30	20	45	40	35	25	25	20	1-164	B02	z	25.95
TFM-2H	5-1000	DC-1000	6.12	.12	7.0	10	50	45	40	30	30	20	45	40	35	25	25	17	1-166	B02	z	36.95
TFM-3H	.1-250	DC-250	4.58	.11	7.0	8.5	50	45	40	30	28	23	45	40	35	25	26	20	1-170	B02	z	25.95
† TFM-4H	5-1200	DC-1200	5.24	.05	8.0	9.0	50	40	35	25	30	20	50	40	35	20	30	20	1-174	B13	z	39.45
TAK-1H	2-500	DC-500	5.93	.08	7.5	8.5	50	40	40	30	30	25	45	35	35	25	25	20	1-164	A05	e	21.45
TAK-1WH	5-750	DC-750	5.71	.08	7.5	9.0	50	40	40	30	30	25	45	35	35	25	30	20	1-168	A05	f	25.95
TAK-3H	.05-300	DC-300	4.82	.09	7.0	8.5	55	45	40	30	30	25	50	40	35	25	25	20	1-172	A05	e	23.45
ZFM-1H	2-500	DC-500	6.14	.11	7.5	8.5	50	45	40	30	30	25	45	35	35	25	25	20	1-164	K18	ad	64.95
ZFM-2H	5-1000	DC-1000	6.12	.12	7.0	10	50	40	40	30	30	20	45	40	35	25	25	17	1-166	K18	ad	71.95
ZFM-3H	.05-300	DC-300	5.18	.11	7.0	8.5	55	45	40	30	30	25	50	40	35	25	25	20	1-172	K18	ad	64.95
† ZFM-4H	5-1200	DC-1200	4.97	.11	8.0	9.0	50	40	35	25	30	20	50	40	35	20	30	20	1-174	K18	ad	73.95
ZLW-1SH	2-500	DC-500	5.93	.08	7.5	8.5	50	40	40	30	30	25	45	35	35	25	25	20	1-164	M21	ae	62.95
ZLW-1WSH	5-750	DC-750	5.83	.07	7.5	9.0	50	45	40	30	30	20	45	40	35	25	30	20	1-168	M21	ae	66.95
ZLW-3SH	.05-300	DC-300	4.65	.09	7.0	8.5	55	45	40	30	30	25	50	40	35	25	25	20	1-172	M21	ae	64.95
ZAD-1SH	2-500	DC-500	5.98	.08	7.5	8.5	50	40	40	30	30	25	45	35	35	25	25	20	1-164	M22	ae	54.95
ZAD-1WSH	5-750	DC-750	5.64	.08	7.5	9.0	50	45	40	30	30	20	45	40	35	25	30	20	1-168	M22	ae	56.95
ZAD-3SH	.05-300	DC-300	5.08	.09	7.0	8.5	55	45	40	30	30	25	50	40	35	25	25	20	1-172	M22	ae	55.95
▽□ TUF-1H	2-600	DC-600	5.90	.18	7.0	8.0	68	50	50	30	43	25	62	45	48	30	33	22	1-164	B02	z	9.25
▽□ TUF-2H	50-1000	DC-1000	6.20	.22	7.5	9.0	58	40	47	30	42	25	58	35	44	25	28	18	1-166	B02	z	10.20
▽□ TUF-3H	0.15-400	DC-400	5.00	.33	7.0	8.0	60	50	50	35	40	30	60	40	45	25	35	20	1-170	B02	z	11.10
▽□ TUF-5H	20-1500	DC-1000	7.50	.17	8.5	9.0	62	55	50	40	38	25	40	25	29	18	20	8	1-334	B02	z	14.45
▽□ TUF-11AH	1400-1900	40-500	7.30	.28	9.0	9.0			35 (Typ.)		25 (Min.)				30 (Typ.)		15 (Min.)		1-336	B02	z	21.95
▽□ TUF-860H	800-1050	DC-250	6.80	.31	8.3	8.3			38 (Typ.)		25 (Min.)				24 (Typ.)		18 (Min.)		1-338	B02	z	14.45

L = low range (f_L to 10 f_L)

M = mid range (10 f_L to f_U/2)
m = mid band (2f_L to f_U/2)

U = upper range (f_U/2 to f_U)



pin and coaxial connections

see case style outline drawings

PORT	e	f	m	u	w	x	y	z	ad	ae
LO	8	8	8	3,4 ^	1	2	1	4	1	1
RF	1	1	1	1	4	1	6	1	2	3
IF	3,4 ^	3,4 ^	3	8	5	3	4	2	3	2
GND EXT.	2,5,6,7	2,5,6,7	2,5,6,7	2,5,6,7	2,3,6	4,5,6	2,3,5	3	—	—
CASE GND	2	2,5,6,7	2,5,6,7	2,5,6,7	—	—	—	3	—	—
NOT USED	—	—	4	—	—	—	—	—	—	—

^ pins must be connected together externally

CAPD now available! computer-automated performance data

In Stock...Immediate Delivery

For custom versions of standard models consult our applications dept.

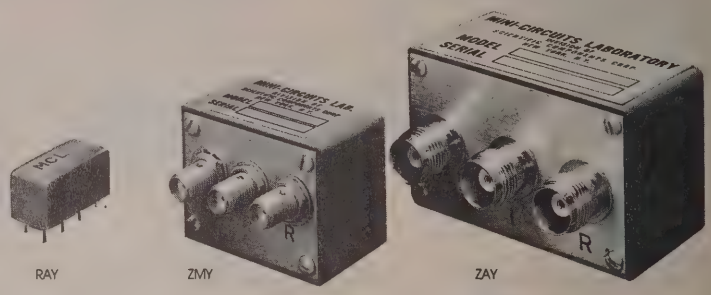
ultra-low distortion
Frequency Mixers

LEVEL 23 (+23 dBm LO, up to +15 dBm RF)

10 KHz to 2.5 GHz

case style selection

outline drawings see Table of Contents



RAY ZMY ZAY

MODEL NO.	FREQUENCY MHz LO/RF f_L-f_U	IF	CONVERSION LOSS dB Mid-Band m $\bar{x}$	σ	Max.	Total Range Max.	LO-RF ISOLATION, dB L Typ.	Min.	M Typ.	Min.	U Typ.	Min.	LO-IF ISOLATION, dB L Typ.	Min.	M Typ.	Min.	U Typ.	Min.	CAPD DATA (see RF/IF Designer Handbook) Page	Case Style Note B	CONNECTION	Price $ Qty. (1-9)
☆ RAY-1	5-500	DC-500	6.57	.09	7.5	8.5	55	45	40	30	30	25	55	45	40	30	30	20	1-176	A01	e	40.95
☆ RAY-2	10-1000	DC-1000	6.89	.22	8.5	10.0	50	35	40	30	35	25	50	35	35	25	25	20	1-178	A01	f	64.45
☆ RAY-3	.07-200	DC-200	5.53	.08	7.5	8.0	55	45	40	30	30	25	55	45	40	30	30	20	1-180	A01	e	40.95
RAY-6	0.03-50	DC-50	5.36	.15	7.5	8.5	60	50	45	30	35	25	60	45	40	25	30	20	1-182	A01	d	52.45
RAY-6U	0.01-100	DC-100	5.09	.15	7.0	8.0	60	50	50	40	40	30	50	45	40	30	35	25	1-216	A01	e	46.95
RAY-11	100-2500	DC-500	6.23	.21	9.0	9.0	35	25	32	25	32	25	14	10	20	10	20	10	1-314	A01	s	74.95
☆ ZMY-1	5-500	DC-500	6.62	.10	7.5	8.5	55	45	40	30	30	25	55	45	40	30	30	20	1-176	M21	ae	67.95
☆ ZMY-2	10-1000	DC-1000	6.89	.22	8.5	10.0	50	35	40	30	35	25	50	35	35	25	25	20	1-178	M21	ae	84.95
☆ ZMY-3	.07-200	DC-200	5.53	.08	7.5	8.0	55	45	40	30	30	25	55	45	40	30	30	20	1-180	M21	ae	69.95
☆ ZAY-1	5-500	DC-500	6.57	.09	7.5	8.5	55	45	40	30	30	25	55	45	40	30	30	20	1-176	M22	ae	64.95
☆ ZAY-2	10-1000	DC-1000	6.89	.22	8.5	10.0	50	35	40	30	35	25	50	35	35	25	25	20	1-178	M22	ae	84.95
☆ ZAY-3	.07-200	DC-200	5.53	.08	7.5	8.0	55	45	40	30	30	25	55	45	40	30	30	20	1-180	M22	ae	64.95

L = low range (f_L to 10 f_L) M = mid range (10 f_L to f_U/2) U = upper range (f_U/2 to f_U)
m = mid band (2f_L to f_U/2)

NOTES:

$\bar{x}$ Average of conversion loss at center of mid-band frequency (f_L+f_U/4)
σ Standard deviation
☆ HTRB tested, 5-year guarantee
A. General Quality Control Procedures, Environmental Specifications, Hi-Rel, MIL and TX description are given in section 0, see "Mini-Circuits Guarantees Quality" article.
B. Connector types and case mounted options, case finishes are given in section 0, see "Case Styles & Outline Drawings".
C. Prices and Specifications subject to change without notice.
1. Absolute maximum power, voltage and current ratings:
   1a. Level 23 and 23S mixers, RF power 350mW
   1b. Level 27 mixers, RF power 500mW
   1c. Peak IF current, 40mA

MIL-M-28837/1*, NSN GUIDE

MCL NO.	NSN
RAY-1	5895-01-105-6188
RAY-2	5895-01-111-7368
RAY-3	5895-01-064-5082
RAY-6	5895-01-317-5882
SAY-11	5895-01-199-3893
VAY-1	5895-01-232-5890
ZMY-1B	5895-01-213-3888
ZMY-2	4935-01-080-7636

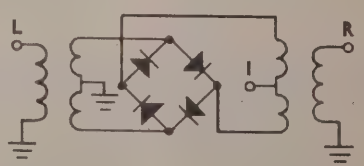
*units are not QPL listed

pin and coaxial connections

see case style outline drawings

PORT	d	e	f	m	s	ad	ae
LO	8	8	8	8	1	1	1
RF	1	1	1	1	8	2	3
IF	3,4^	3,4^	3,4^	3	3	3	2
GND EXT.	2,5,6,7	2,5,6,7	2,5,6,7	2,5,6,7	2,5,6,7		
CASE GND	—	2	2,5,6,7	2,5,6,7	2,5,6,7		
NOT USED	—	—	—	4	4		

^ pins must be connected together externally



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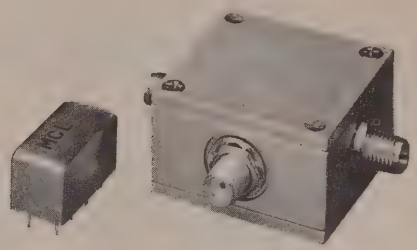
Mini-Circuits

ULTRA-REL™ MIXERS

5-YR. GUARANTEE *

LEVEL 23S (+23 dBm LO, up to +20 dBm RF)

100 KHz to 2.4 GHz



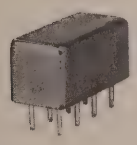
SAY ZFY

MODEL NO.	FREQUENCY MHz LO/RF f_L-f_U	IF	CONVERSION LOSS dB Mid-Band $\bar{x}$	m σ	Max.	Total Range Max.	LO-RF ISOLATION, dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	LO-IF ISOLATION, dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	CAPD DATA (see RF/IF Designer Handbook) Page	Case Style Note B	CONNECTION	Price $ Qty. (1-9)
SAY-1	0.1-500	.01-500	4.85	.18	6.0	7.5	40	20	46	35	40	30	37	23	46	35	40	30	1-184	A01	m	62.95
SAY-2	0.1-1000	.01-500	5.40	.24	7.5	9.5	40	20	40	30	30	25	37	23	40	25	25	15	1-186	A01	m	67.95
SAY-11	10-2400	5-1000	7.40	.09	8.5	10	28	20	26	20	25	20	28	20	26	20	25	20	1-188	A01	m	72.95
ZFY-1	0.1-500	.01-500	4.85	.18	6.0	7.5	40	20	46	35	40	30	37	23	46	35	40	30	1-184	K18	ad	74.95
ZFY-2	0.1-1000	.01-500	5.40	.24	7.5	9.5	40	20	40	30	30	25	37	23	40	25	25	15	1-186	K18	ad	79.95
ZFY-11	10-2400	5-1000	7.40	.09	8.5	10	28	20	25	20	25	20	28	20	26	20	25	20	1-188	K18	ad	84.95

L = low range (f_L to 10 f_L) M = mid range (10 f_L to f_U/2) U = upper range (f_U/2 to f_U)
m = mid band (2f_L to f_U/2)

LEVEL 27 (+27 dBm LO, up to +24 dBm RF)

0.5 MHz to 500 MHz



VAY

MODEL NO.	FREQUENCY MHz LO/RF f_L-f_U	IF	CONVERSION LOSS dB Mid-Band $\bar{x}$	m σ	Max.	Total Range Max.	LO-RF ISOLATION, dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	LO-IF ISOLATION, dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	CAPD DATA (see RF/IF Designer Handbook) Page	Case Style Note B	CONNECTION	Price $ Qty. (1-9)
VAY-1	0.5-500	.02-500	5.79	.15	7.5	8.5	47	40	46	35	35	25	35	28	46	35	35	25	1-190	A01	m	84.95

L = low range (f_L to 10 f_L) M = mid range (10 f_L to f_U/2) U = upper range (f_U/2 to f_U)
m = mid band (2f_L to f_U/2)

CAPD now available! computer-automated performance data

In Stock...Immediate Delivery

For custom versions of standard models consult our applications dept.

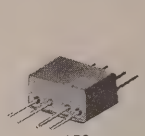
Power Splitter/Combiners

2 WAY-0°

4 KHz to 2 GHz

case style selection

outline drawings see Table of Contents


LPS

PSC-2

LRPS

MODEL NO.	FREQ. RANGE MHz f_L-f_U	ISOLATION dB L Typ.	ISOLATION dB L Min.	ISOLATION dB M° Typ.	ISOLATION dB M° Min.	ISOLATION dB U Typ.	ISOLATION dB U Min.	INSERTION LOSS, dB Above 3dB L Typ.	INSERTION LOSS, dB Above 3dB L Max.	INSERTION LOSS, dB Above 3dB M° Typ.	INSERTION LOSS, dB Above 3dB M° Max.	INSERTION LOSS, dB Above 3dB U Typ.	INSERTION LOSS, dB Above 3dB U Max.	PHASE UNBALANCE Degrees L Max.	PHASE UNBALANCE Degrees M° Max.	PHASE UNBALANCE Degrees U Max.	AMPLITUDE UNBALANCE dB L Max.	AMPLITUDE UNBALANCE dB M° Max.	AMPLITUDE UNBALANCE dB U Max.	CAPD DATA (see RF/IF Designer handbook) Page	CASE STYLE Note B	CONNECTION	PRICE $ Qty. (1-9)
● LRPS-2-1	5-500	50	25	33	24	30	23	0.25	0.5	0.3	0.6	0.5	1.2	1.0	2.0	3.0	0.15	0.2	0.3	2-118	QQQ130	am	8.95
●■ LRPS-2-1-75	2-500	35	18	35	25	27	20	0.30	0.8	0.35	0.6	0.5	1.0	1.0	2.0	3.0	0.15	0.2	0.3	—	QQQ130	am	8.95
●■ LRPS-2-1W-75	10-650	28	22	29	24	30	20	0.5	1.0	0.6	0.75	0.6	1.2	1.0	2.0	3.0	0.15	0.2	0.3	—	QQQ130	am	9.95
● LRPS-2-4	10-1000	25	20	23	16	19	14	0.3	0.5	0.4	0.9	0.8	1.5	1.0	3.0	5.0	0.15	0.2	0.4	2-120	QQQ130	am	19.95
● LRPS-2-11	20-2000	19	15	21	15	30	15	0.6	0.8	0.7	1.0	0.8	1.5	2.0	3.0	5.0	0.2	0.3	0.7	—	QQQ130	gn	24.95
● LRPS-2-980	800-980			30	18					0.5	1.0				3.0			0.5		—	QQQ130	am	8.95
LPS-109	10-500	35	25	30	25	30	25	0.3	0.5	0.4	0.6	0.5	1.1	2.0	3.0	4.0	0.15	0.2	0.3	2-84	BB48	an	17.95
PSC-2-1	0.1-400	20	15	25	20	25	20	0.2	0.6	0.4	0.75	0.6	1.0	2.0	3.0	4.0	0.15	0.2	0.3	2-84	A01	ap	10.95
PSC-2-1W	1-650	25	20	35	20	25	20	0.3	0.6	0.5	0.9	0.7	1.0	2.0	3.0	4.0	0.15	0.2	0.3	2-85	A01	ap	16.95
✣ PSC-2-2	0.004-60	27	20	30	20	27	20	0.3	0.6	0.3	0.6	0.6	1.0	2.0	3.0	4.0	0.15	0.25	0.3	2-85	A01	ap	23.95
PSC-2-4	10-1000	30	25	25	20	25	20	0.6	1.0	0.6	1.2	0.7	1.3	2.0	4.0	8.0	0.15	0.2	0.4	2-86	A01	ap	23.95
PSC-2-5	10-1400	28	18	22	17	24	17	0.3	0.6	0.6	1.0	0.9	1.6	2.0	3.0	4.0	0.15	0.2	0.4	2-29	A01	ap	29.95
PSC-2-11	5-2000	21	16	22	18	19	9	0.5	0.8	0.6	0.9	0.7	1.5	1.0	3.0	6.0	0.20	0.4	1.0	—	A06	ap	34.95
PSC-2-45	700-900			20	17					0.2	0.4				3.0			0.2		2-86	A01	ap	22.95
■ PSC-2-1-75	0.25-300	20	15	30	20	20	15	0.4	0.75	0.4	0.75	0.4	1.0	2.0	3.0	5.0	0.15	0.2	0.3	2-87	A01	ap	13.45
■ PSC-2-1-75A*	1-200	35	27	46	35	36	25	0.1	0.3	0.2	0.4	0.35	0.6	1.0	1.0	2.0	0.1	0.15	0.15	2-97	A06	ap	14.45
■ PSC-2-1V-75	40-450			31	27					0.5	1.0				4.0			0.3		2-96	A01	ap	14.45
■ PSC-2-1W-75**	30-600	30	22	—	—	30	20	0.4	0.8	—	—	0.6	1.2	2.0	—	4.0	0.2	—	0.3	2-97	A06	ap	18.95
✣■ PSC-2-2-75	0.008-60	35	20	40	25	30	22	0.1	0.4	0.15	0.4	0.3	0.8	1.0	1.0	1.0	0.15	0.15	0.15	2-96	A01	ap	23.95
■ PSC-2-4-752	10-850	31	20	32	23	23	15	0.3	0.5	0.4	0.6	0.5	1.0	2.0	5.0	10.0	0.1	0.2	0.5	2-88	A01	ap	23.95
■ PSC-2375	55-85			35	25					0.3	0.5				1.0			0.1		2-87	A01	ap	23.95

L = low range (f_L to 10 f_L) M = mid range (10 f_L to f_U/2) U = upper range (f_U/2 to f_U)

NOTES:

- ● Surface-mount, non-hermetic, available on tape and reel
- ✪ When only specification for M range given, specification applies to entire frequency range.
- ✣ At low range frequency band (fL to 10 fL), linearly derate maximum input power by 13 dB.
- ■ Denotes 75 Ohm model, for coax connector models 75 Ohm BNC connectors are standard.
- * VSWR typical 1.1:1 over total range of frequency, max 1.2:1 for low and upper range, max 1.15:1 for mid range.
- ** VSWR low range 1.1:1 typical, 1.3:1 max; upper range 1.15:1 typical, 1.25:1 max.
- A. General Quality Control Procedures, Environmental Specifications, Hi-Rel, MIL and TX description are given in section 0, see "Mini-Circuits Guarantees Quality" article.
- B. Connector types and case mounted options, case finishes are given in section 0, see "Case styles & Outline Drawings".
- C. Prices and specifications subject to change without notice.
- 1. Absolute maximum power, voltage and current ratings:
  - 1a. Matched power rating, 1 Watt except PSC-2-11, 0.5 Watt
  - 1b. Internal load dissipation, 0.125 Watt

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50 ohms and 75 ohms

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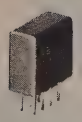
MSC-2

TSC-2

SCP-2

TO5SC

MODEL NO.	FREQ. RANGE MHz f_L-f_U	ISOLATION dB L Typ.	ISOLATION dB L Min.	ISOLATION dB M Typ.	ISOLATION dB M Min.	ISOLATION dB U Typ.	ISOLATION dB U Min.	INSERTION LOSS, dB Above 3dB L Typ.	INSERTION LOSS, dB Above 3dB L Max.	INSERTION LOSS, dB Above 3dB M Typ.	INSERTION LOSS, dB Above 3dB M Max.	INSERTION LOSS, dB Above 3dB U Typ.	INSERTION LOSS, dB Above 3dB U Max.	PHASE UNBALANCE Degrees L Max.	PHASE UNBALANCE Degrees M Max.	PHASE UNBALANCE Degrees U Max.	AMPLITUDE UNBALANCE dB L Max.	AMPLITUDE UNBALANCE dB M Max.	AMPLITUDE UNBALANCE dB U Max.	CAPD DATA (see RF/IF Designer handbook) Page	CASE STYLE Note B	CONNECTION	PRICE $ Qty. (1-9)
MSC-2-1	0.1-450	20	15	30	20	30	20	0.3	0.5	0.4	0.75	0.6	1.0	2.0	3.0	4.0	0.15	0.2	0.3	2-89	A03	ap	18.95
MSC-2-1W	2-650	22	18	30	20	22	18	0.3	0.5	0.5	0.8	0.8	1.2	1.0	2.0	4.0	0.3	0.2	0.3	2-89	A03	ap	20.95
MSC-2-5	5-1500	18	16	20	16	20	14	0.6	0.8	0.6	0.8	0.6	1.1	2.0	3.0	5.0	0.2	0.3	0.4	2-29	A03	ap	24.95
MSC-2-11	5-2000	18	16	20	16	18	11	0.6	0.8	0.6	0.8	1.2	1.8	2.0	3.0	5.0	0.2	0.3	0.5	2-94	A03	ap	29.95
TSC-2-1	1-400	30	25	30	25	30	20	0.25	0.5	0.4	0.75	0.8	1.0	2.0	3.0	4.0	0.15	0.2	0.6	2-90	B02	aj	15.95
● SCP-2-1	0.1-400	25	15	30	20	25	20	0.3	1.2	0.2	0.6	0.4	1.1	2.0	2.0	3.0	0.15	0.2	0.3	2-92	YY101	aq	10.45
● SCP-2-1A	1-550	25	20	25	20	25	20	0.3	0.6	0.3	0.6	0.7	1.3	2.0	2.0	3.0	0.15	0.2	0.4	2-92	YY101	aq	10.45
TO5SC-110	5-500	36	20	40	25	36	20	0.3	0.6	0.3	0.7	0.6	1.0	1.0	2.0	2.0	0.10	0.20	0.2	—	PP163	ak	19.95
TO5SC-2-1	1-500	30	20	28	20	26	20	0.2	0.5	0.3	0.7	0.7	1.5	2.0	1.0	2.5	0.25	0.25	0.4	2-95	PP163	ak	18.95

L = low range (f_L to 10 f_L) M = mid range (10 f_L to f_U/2) U = upper range (f_U/2 to f_U)

MIL-P-23971/15, NSN GUIDE

MCL NO.	NSN	MIL-P-23971/15*
MSC-2-1	6625-01-124-8595	02
PSC-2-1	6625-00-548-0739	01
PSC-2-1W	5985-01-190-7701	
PSC-2-2	6625-01-143-2571	
PSC-2-4	6625-01-230-0492	
TSC-2-1	5895-01-332-8100	

* units are not QPL listed

pin connections see case style outline drawings

PORT	aj	ak	am	an	ap	aq	gn
SUM PORT	1	2	6	1	1	1	6
PORT 1	2	1	4	4	5	5	4
PORT 2	4	3	3	5	6	6	3
GND EXT.	3	4,5	1	2,3,6,7,8	2,3,4,7,8	2,3,4,7,8	1,2,5
CASE GND	3	4,5	—	2,3,6,7,8	2,3,4,7,8	—	—
NOT USED	—	—	2,5	—	—	—	—

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For custom versions of standard models consult our applications dept.

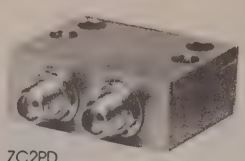
Power Splitter/Combiners

2 WAY-0°

2 KHz to 10 GHz

case style selection

outline drawings see Table of Contents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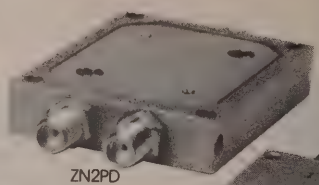
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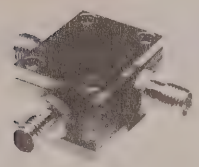
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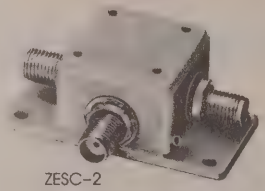
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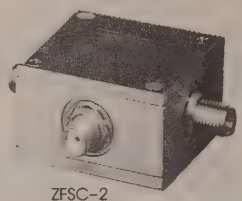
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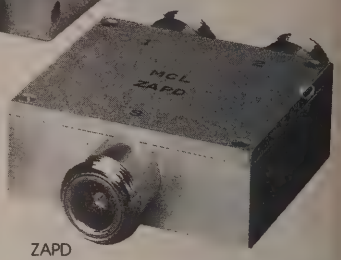

ZAPD

MODEL NO.	FREQ. RANGE MHz f_L-f_U	ISOLATION dB L Typ.	ISOLATION dB L Min.	ISOLATION dB M° Typ.	ISOLATION dB M° Min.	ISOLATION dB U Typ.	ISOLATION dB U Min.	INSERTION LOSS, dB Above 3dB L Typ.	INSERTION LOSS, dB Above 3dB L Max.	INSERTION LOSS, dB Above 3dB M° Typ.	INSERTION LOSS, dB Above 3dB M° Max.	INSERTION LOSS, dB Above 3dB U Typ.	INSERTION LOSS, dB Above 3dB U Max.	PHASE UNBALANCE Degrees L Max.	PHASE UNBALANCE Degrees M° Max.	PHASE UNBALANCE Degrees U Max.	AMPLITUDE UNBALANCE dB L Max.	AMPLITUDE UNBALANCE dB M° Max.	AMPLITUDE UNBALANCE dB U Max.	VSWR (:1) S Typ.	VSWR (:1) S Max.	VSWR (:1) OUT Typ.	VSWR (:1) OUT Max.	CAPD DATA (see RF/IF Designer handbook) Page	CASE STYLE Note B	CONNECTION	PRICE $ Qty. (1-9)
ZESC-2-11	10-2000	19	10	18	13	20	11	0.5	0.9	0.5	1.0	0.6	1.2	1	3	6	0.20	0.30	0.50					2-94	V37	qr	71.95
ZFSC-2-1	5-500	30	25	28	20	25	20	0.2	0.5	0.3	0.6	0.6	0.8	2	4	4	0.15	0.15	0.30					2-91	K18	qr	44.95
■ ZFSC-2-1-75	0.25-300	20	15	30	25	20	20	0.4	0.75	0.4	0.75	0.4	1.0	2	3	5	0.15	0.20	0.30					2-91	K18	qr	45.95
■ ZFSC-2-1W-75	5-600	44	26	45	30	31	20	0.22	0.6	0.27	0.7	0.46	0.9	1	2	3	0.20	0.30	0.40					—	K18	qr	50.95
ZFSC-2-1W	1-750	30	20	28	20	25	20	0.2	0.5	0.4	0.8	0.8	1.0	2	4	4	0.15	0.15	0.30					2-28	K18	qr	48.95
ZFSC-2-2	10-1000	30	20	25	20	23	18	0.2	0.5	0.5	1.0	0.9	1.2	2	4	4	0.15	0.15	0.30					2-28	K18	qr	51.95
ZFSC-2-4	0.2-1000	20	15	25	20	23	18	0.2	0.5	0.5	1.0	0.9	1.2	2	4	4	0.15	0.15	0.30					2-29	K18	qr	55.95
ZFSC-2-5	10-1500	25	15	30	20	25	18	0.25	0.6	0.5	1.0	0.8	1.5	2	3	4	0.15	0.20	0.50					2-29	K18	qr	59.95
✣ ZFSC-2-6°	0.002-60	27	20	30	20	27	20	0.3	0.6	0.3	0.6	0.6	1.0	2	3	4	0.15	0.20	0.30					2-30	K18	qr	49.95
✣■ ZFSC-2-6-75	0.004-60	30	20	35	20	25	20	0.5	0.8	0.4	0.8	0.7	1.0	1	2	3	0.15	0.20	0.30					2-30	K18	qr	51.95
ZFSC-2-11	10-2000	14	10	16	14	20	15	1.2	1.5	1.2	1.5	1.0	2.2	1	2	4	0.20	0.30	0.50					2-94	K18	qr	64.95
△ ZFSC-2-2500	10-2500	16	11	17	14	17	14	0.5	0.8	0.6	1.4	0.8	1.5	1	4	8	0.20	0.30	0.40					2-94	K18	qr	74.95
ZMSC-2-1	0.1-400	20	15	25	20	25	20	0.2	0.5	0.4	0.75	0.6	1.0	2	3	4	0.15	0.20	0.30					2-32	M21	qt	49.95
ZMSC-2-1W	1-650	25	20	35	20	25	20	0.3	0.5	0.5	0.8	0.7	1.0	2	3	4	0.15	0.20	0.30					2-32	M21	qt	54.95
✣ ZMSC-2-2°	0.002-60	27	20	30	20	27	20	0.3	0.6	0.3	0.6	0.6	1.0	2	3	4	0.15	0.25	0.30					2-43	M21	qt	59.95
ZSC-2-1	0.1-400	20	15	25	20	25	20	0.2	0.5	0.4	0.75	0.6	1.0	2	3	4	0.15	0.20	0.30					2-32	M22	qt	47.95
ZSC-2-1W	1-650	25	20	35	25	25	20	0.3	0.5	0.5	0.8	0.7	1.0	2	3	4	0.15	0.20	0.30					2-32	M22	qt	49.95
✣ ZSC-2-2°	0.002-60	25	20	30	20	27	20	0.3	0.6	0.3	0.6	0.6	1.0	2	3	4	0.15	0.25	0.30					2-33	M22	qt	52.95
✣■ ZSC-2-2-75°	0.002-60	25	20	30	20	27	20	0.3	0.6	0.3	0.6	0.6	1.0	2	3	4	0.15	0.25	0.30					2-96	M22	qt	53.95
ZSC-2-4	10-1000	25	20	35	20	25	20	0.2	0.5	0.5	0.8	0.7	1.3	2	4	6	0.15	0.20	0.30					2-33	M22	qt	52.95
■ ZSC-2375	55-85			35	25					0.3	0.5				1			0.10						2-31	M22	qt	52.95
■ ZSC-2-1-75	0.25-300	20	15	30	20	20	15	0.4	0.75	0.4	0.75	0.4	1.0	2	3	5	0.15	0.20	0.30					2-31	M22	qt	49.95
ZC2PD-900	800-900			30	20					0.1	0.4				2			0.20						2-109	F183	qs	64.95
ZN2PD-920	800-920			30	20					0.15	0.4				2			0.20						2-108	VVV180	qs	59.95
ZN2PD-920W	700-1050			22	15					0.15	0.5				3			0.30						2-108	VVV180	qs	54.95
	GHz																										
IZY2PD-64	5.8-6.4			35	24					0.2	0.5				5			0.3						—	JJJ245	qs	89.95
IZY2PD-86	7.0-8.6			30	18					0.1	0.5				6			0.25						—	JJJ245	qs	94.95
ZAPD-1	0.5-1.0			25	19					0.25	0.6				2			0.20						2-34	F14	qr	54.95
ZAPD-2	1.0-2.0			25	19					0.25	0.6				2			0.20						2-34	F14	qr	54.95
ZAPD-4	2.0-4.2			25	19					0.4	0.8				6			0.40						2-35	F14	qr	59.95
ZAPD-21	0.5-2.0			25	18					0.25	1.0				3			0.20						2-35	F53	qr	59.95
	GHz	L1		U1				L1		U1				L1	U1		L1	U1									
ZFSC-2-9G	3.5-9.0	18	12	20	12			0.5	1.5	0.6	1.2			7	10		0.30	0.50						2-93	JJJ142	qs	59.95
ZFSC-2-10G	2.0-10.0	15	9	20	12			0.5	1.5	0.6	1.6			7	12		0.60	0.50						2-93	JJJ142	qs	69.95

see Performance Data and curves

L = low range (f_L to 10 f_L)
L1 = f_L to 6 GHz

M = mid range (10 f_L to f_U/2)
U1 = 6 GHz to f_U

U = upper range (f_U/2 to f_U)

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50 ohms and 75 ohms

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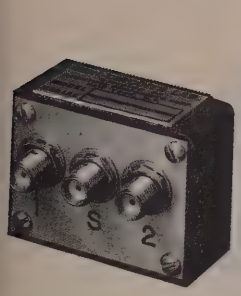
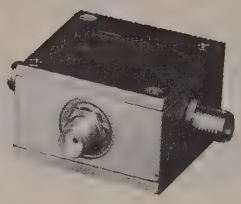
2 WAY–0° RESISTIVE

DC to 4.2 GHz



ZMSC–2

ZSC–2



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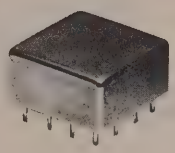

PRSC

MODEL NO.	FREQ. RANGE MHz f_L-f_U	ISOLATION dB L Typ.Min.	ISOLATION dB M Typ.Min.	ISOLATION dB U Typ.Min.	INSERTION LOSS, dB Above 6dB L Typ.	L Max.	M Typ.	M Max.	U Typ.	U Max.	PHASE UNBALANCE Degrees L Max.	PHASE UNBALANCE Degrees M Max.	PHASE UNBALANCE Degrees U Max.	AMPLITUDE UNBALANCE dB L Max.	AMPLITUDE UNBALANCE dB M Max.	AMPLITUDE UNBALANCE dB U Max.	CAPD DATA (see RF/IF Designer handbook) Page	CASE STYLE Note B	CONNECTION	PRICE $ Qty. (1-9)
ZFRSC-42	DC-4200	6.2	6.5	7.0	0.1	0.2	0.1	0.5	0.4	1.4	1	3	5	0.1	0.2	0.5	2-90	K18	ar	59.95
ZFRSC-2075	DC-2000	6.2	6.6	7.0	0.1	0.2	0.3	0.6	0.5	1.4	1	2	5	0.1	0.2	0.5	2-88	K18	ar	59.95
ZFRSC-2050	DC-2000	6.2	6.6	7.0	0.1	0.2	0.3	0.6	0.5	1.4	1	2	5	0.1	0.2	0.5	2-95	K18	ar	59.95
PRSC-2050	DC-2000	6.0	6.2	6.5	0.1	0.3	0.2	0.7	0.5	1.0	1	3	5	0.1	0.3	0.5	2-95	C145	au	29.95

L = DC to 100 MHz M = mid range (100 MHz to $f_U/2$) U = upper range ($f_U/2$ to f_U)

Above models are resistive power dividers to enable frequency coverage from dc to the highest rated frequency. Since resistive power dividers do not provide a high degree of isolation (basically isolation equals the insertion loss between ports), an amplifier such as Mini-Circuits' ZFL series is recommended when high isolation is required. Matched power rating 0.75W, internal load dissipation 0.375W.

NOTES:

* Isolation specified to 0.004 MHz
o When only specification for M range given, specification applies to entire frequency range.
✣ At low range frequency band (fL to 10 fL), linearly derate maximum input power by 13 dB.
■ Denotes 75 Ohm model, for coax connector models 75 Ohm BNC connectors are standard.
▲ Available only with BNC connectors
△ Available only with SMA connectors
A. General Quality Control Procedures, Environmental Specifications, Hi-Rel, MIL and TX description are given in section 0, see "Mini-Circuits Guarantees Quality" article.
B. Connector types and case mounted options, case finishes are given in section 0, see "Case styles & Outline Drawings".
C. Prices and specifications subject to change without notice.
1. Absolute maximum power, voltage and current ratings:
1a. Matched power rating, models ZAPD, ZN2PD, ZC2PD 10 Watt other models 1 Watt
1b. Internal load dissipation 0.125 Watt

pin and coaxial connections

see case style outline drawing

PORT	ar	as	at	au
SUM PORT	3	S	2	5
PORT 1	1	1	1	3
PORT 2	2	2	3	15
GND EXT.				1,2,4,8,9,12,13,14,16
CASE GND				1,2,4,8,9,12,13,14,16
NOT USED				

MIL-P-23971/15*, NSN GUIDE

MCL NO.	NSN
ZAPD-1(TNC)	5985-01-250-4883
ZAPD-2(SMA)	5895-01-229-7431
ZAPD-4	6625-01-173-1887
ZFSC-2-1	6625-01-139-3499
ZFSC-2-1(SMA)	6625-01-213-6490
ZFSC-2-1(BNC)	5985-01-176-4551
ZFSC-2-1-75	5895-01-325-4795
ZFSC-2-1W(SMA)	6625-01-200-5094
ZFSC-2-1W	5895-01-348-3534
ZFSC-2-2B(SMA)	6625-01-362-1801
ZFSC-2-2(SMA)	6625-01-333-1127
ZFSC-2-2B	5895-01-330-4416
ZFSC-2-4(TNC)	5985-01-250-4882
ZFSC-2-5	6625-01-253-2444
ZFSC-2-6B	5985-01-315-2869
ZFRSC-2050B	5985-01-310-5746
ZFRSC-2075	5985-01-266-6144
ZFRSC-42	5985-01-332-3083
ZMSC-2-1	5985-01-333-1128
ZMSC-2-1B	5895-01-253-2445
ZMSC-2-1BR	5985-01-338-9329
ZMSC-2-1W	5895-01-127-0232
ZSC-2-1(TNC)	6625-01-310-2129
ZSC-2-1	5895-01-214-6032
ZSC-2-1B	6625-01-018-1066
ZSC-2-1B(TNC)	6625-01-109-3706
ZSC-2-1(BNC)	5895-01-036-6254
ZSC-2-1B(BNC)	6625-00-270-3055
ZSC-2-1W	5895-01-283-0850
ZSC-2-1WB	6625-01-264-8985
ZSC-2-1-75B	5895-01-136-8182
ZSC-2-2B	5820-01-136-7245
ZSC-2-2-75B	5915-01-012-8162

*units are not QPL listed

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Power Splitter/Combiners

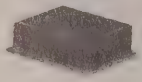
2 WAY–90°

0.42 MHz to 4.2 GHz

case style selection

outline drawings see Table of Contents

RPQ



SYPQ

PSCQ–2

SCPQ

LRPQ

MODEL NO.	FREQ. RANGE MHz f_L-f_U	ISOLATION dB Typ.	ISOLATION dB Min.	INSERTION LOSS, dB Avg. of Coupled Outputs less 3dB Typ.	INSERTION LOSS, dB Avg. of Coupled Outputs less 3dB Max.	PHASE UNBALANCE Degrees Max.	AMPLITUDE UNBALANCE dB Max.	CAPD DATA (see RF/IF Designer handbook) Page	CASE STYLE Note B	CONNECTION	PRICE $ Qty. (1-9)
PSCQ-2-0.455	0.42-0.51	30	25	0.1	0.5	3	1.2	2-99	A01	aw	25.95
PSCQ-2-1.25	1.13-1.38	29	25	0.4	0.7	3	1.2	2-36	A01	aw	14.95
PSCQ-2-1.5	1.4-1.7	29	25	0.4	0.7	3	1.2	2-36	A01	aw	14.95
PSCQ-2-3.4	3.0-3.8	30	25	0.4	0.7	3.8	1.2	2-36	A01	aw	19.95
PSCQ-2-4.0	3.5-4.5	36	25	0.4	0.7	3	1.5	2-100	A01	aw	14.95
PSCQ-2-6.4	5.8-7.0	30	25	0.4	0.7	3	1.2	2-37	A01	aw	14.95
PSCQ-2-7.5	7.0-8.0	35	25	0.4	0.7	3	1.2	2-37	A01	aw	14.95
PSCQ-2-8	2.0-8.0	36	27	0.3	0.7	6	0.5	—	A01	aw	49.95
PSCQ-2-10.5	9.0-11.0	25	20	0.4	0.7	3	1.2	2-37	A01	aw	14.95
PSCQ-2-13	12-14	29	25	0.4	0.7	3	1.2	2-38	A01	aw	14.95
PSCQ-2-14	12-16	30	25	0.3	0.6	3	1.8	2-38	A01	aw	19.95
PSCQ-2-17.5	16-19	28	25	0.6	0.7	3	1.6	2-38	A01	aw	14.95
PSCQ-2-21.4	20-23	30	25	0.4	0.7	3	1.2	2-39	A01	aw	14.95
PSCQ-2-26	14-30	25	20	0.4	0.7	3	1.5	2-100	A01	aw	23.95
PSCQ-2-32	3.2-32	32	25	0.4	0.8	5	0.4	—	A01	gx	89.95
PSCQ-2-40	23-40	21	18	0.3	0.7	3	1.5	2-100	A01	aw	19.95
PSCQ-2-50	25-50	30	20	0.3	0.7	3	1.5	2-39	A01	aw	23.95
PSCQ-2-70	40-70	30	20	0.3	0.7	3	1.5	2-39	A01	aw	23.95
PSCQ-2-70N	66-74	22	19	0.2	0.5	0.8	0.25	2-101	A01	aw	23.95
PSCQ-2-85A	55-85	35	20	0.3	0.6	3	0.6	—	A01	ax	24.95
PSCQ-2-90	55-90	30	20	0.3	0.7	3	1.2	2-40	A01	aw	23.95
PSCQ-2-120	80-120	25	18	0.3	0.7	3	1.5	2-40	A01	aw	23.95
PSCQ-2-160	100-160	24	19	0.3	0.7	3	1.5	2-101	A01	aw	23.95
PSCQ-2-180	120-180	23	15	0.3	0.7	4	1.2	2-40	A01	aw	23.95
PSCQ-2-250	150-250	30	22	0.4	0.8	4	1.5	2-41	A01	aw	23.95
PSCQ-2-300	220-300	27	20	0.3	0.7	3	1.3	2-101	A01	aw	23.95
PSCQ-2-400	250-400	23	16	0.5	0.9	4	1.5	2-41	A01	aw	23.95
PSCQ-2-450	350-450	23	16	0.5	0.9	5	1.5	2-41	A01	aw	23.95
PSCQ-2-550	450-550	19	15	0.4	0.7	5	1.5	2-42	A01	aw	23.95
PSCQ-2-1000	800-1000	27	20	0.28	0.6	3	1.3	2-109	A05	ax	25.95
● SCPQ-10.5	9-11	31	20	0.15	0.7	3	1.2	—	YY101	aw	13.95
● SCPQ-21.4	20-23	32	25	0.15	0.5	2.5	1	2-98	YY101	aw	13.95
● SCPQ-90	55-90	26	20	0.2	0.7	3	1.2	2-98	YY101	aw	13.95
● SCPQ-180	120-180	20	16	0.3	0.7	3	1.2	2-98	YY161	aw	13.95
● SCPQ-400	250-400	20	16	0.3	0.7	3	1.2	2-99	YY161	aw	14.95
● LRPQ-70*	65-75	30	20	0.1	0.5	3	1	2-119	QQQ130	ay	9.95
● LRPQ-700*	500-700	23	18	0.2	0.6	3	1.5	2-119	QQQ130	ay	9.95
● LRPQ-980*	820-980	28	20	0.15	0.5	4	1	2-120	QQQ130	ay	13.95
● RPQ-820	760-860	22	15	0.15	0.7	4	1	—	TT100	gp	13.95
● RPQ-1495	1400-1600	18	14	0.3	0.8	5	1	—	TT100	gp	15.95
● SYPQ-21.4	20-23	33	25	0.1	0.4	3	1.1	2-98	AH202	av	13.95
● SYPQ-70	65-75	31	24	0.1	0.4	3	1.1	2-119	AH202	av	13.95

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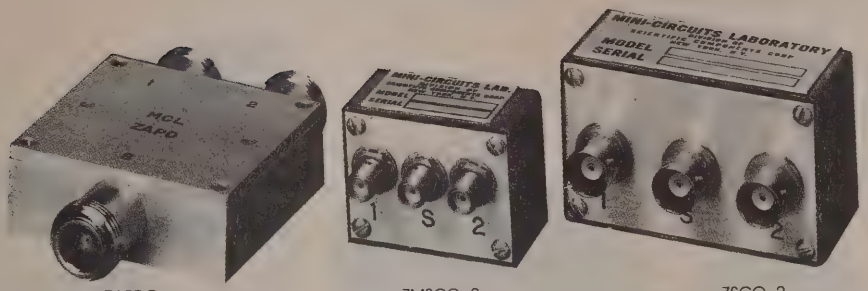
50 ohms

Mini-Circuits



ZAPDQ ZMSCQ-2 ZSCQ-2

MODEL NO.	FREQ. RANGE MHz f_L-f_U	ISOLATION dB Typ.	ISOLATION dB Min.	INSERTION LOSS, dB Avg. of Coupled Outputs less 3dB Typ.	INSERTION LOSS, dB Avg. of Coupled Outputs less 3dB Max.	PHASE UNBALANCE Degrees Max.	AMPLITUDE UNBALANCE dB Max.	CAPD DATA (see RF/IF Designer handbook) Page	CASE STYLE Note B	CONNECTION	PRICE $ Qty. (1-9)
ZAPDQ-2	1000-2000	22	16	0.4	1.4	6.0	0.8	2-42	F14	ar	79.95
ZAPDQ-4	2000-4200	22	16	0.4	0.9	8.0	1.0	2-42	F14	ar	79.95
ZMSCQ-2-21.4	20-23	30	25	0.4	0.7	3.0	1.2	2-39	M21	at	61.95
ZMSCQ-2-50	25-50	30	20	0.3	0.7	3.0	1.5	2-39	M21	at	61.95
ZMSCQ-2-90	55-90	30	20	0.3	0.7	3.0	1.2	2-40	M21	at	61.95
ZMSCQ-2-120	80-120	25	18	0.3	0.7	3.0	1.5	2-99	M21	at	61.95
ZMSCQ-2-180	120-180	23	15	0.3	0.7	4.0	1.2	2-40	M21	at	61.95
ZSCQ-2-50	25-50	30	20	0.3	0.7	3.0	1.5	2-39	M22	at	54.95
ZSCQ-2-90	55-90	30	20	0.3	0.7	3.0	1.2	2-39	M22	at	54.95
ZSCQ-2-180	120-180	23	15	0.3	0.7	4.0	1.2	2-40	M22	at	54.95

NOTES:

- Surface-mount, non-hermetic, available on tape and reel
- LRPQ units have bottom barrier ground plane insulated with glass barrier

A. General Quality Control Procedures, Environmental Specifications, Hi-Rel, MIL and TX description are given in section 0, see "Mini-Circuits Guarantees Quality" article.

B. Connector types and case mounted options, case finishes are given in section 0, see "Case styles & Outline Drawings".

C. Prices and specifications subject to change without notice.

1. Absolute maximum power, voltage and current ratings:
   1a. Matched power rating

models	ZAPDQ	10 Watt
model	SCPQ-10.5	0.5Watt
models	PSCQ-2-8,PSCQ-2-32	50mW
all other models		1Watt

   1b. Internal load dissipation 0.125 Watt

pin connections

PORT	ar	at	av	aw	ax	ay	gp	gx
SUM PORT	3	2	1	1	1	6	4	1
PORT 1	1	1	5	2	2	4	1	2
PORT 2	2	3	8	5	8	1	3	5
GND EXT.			2,3,6,7	3,4,7,8	3,4,5,6	2,5	2,5	3,4,7,8
CASE GND			—	3,4,7,8	3,5,6	—	—	3,4,7,8
50 OHM TERM.			4	6	7	3	6	—
NOT USED			—	—	—	—	—	6

NSN GUIDE

MCL NO.	NSN
PSCQ-2-180	6625-01-186-4456
PSCQ-2-90	6625-01-160-0151
PSCQ-2-70	5985-01-292-8834
PSCQ-2-550	5895-01-347-0206

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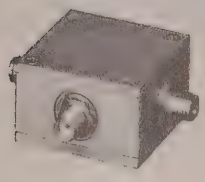
Power Splitter/Combiners

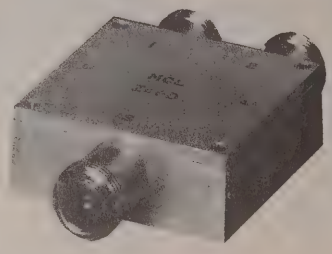
2 WAY-180°
10 kHz TO 2000 MHz

case style selection
outline drawings see Table of Contents

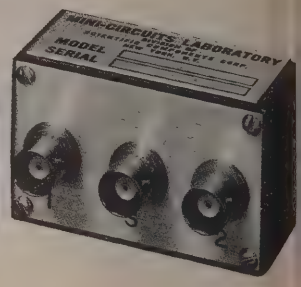
SCPJ-2

PSCJ-2


ZFSCJ-2


ZAPDJ-2

ZMSCJ-2



ZSCJ-2

MODEL NO.	FREQ. RANGE MHz f_L-f_U	ISOLATION dB L Typ.	ISOLATION dB L Min.	ISOLATION dB M° Typ.	ISOLATION dB M° Min.	ISOLATION dB U Typ.	ISOLATION dB U Min.	INSERTION LOSS, dB Above 3dB L Typ.	INSERTION LOSS, dB Above 3dB L Max.	INSERTION LOSS, dB Above 3dB M° Typ.	INSERTION LOSS, dB Above 3dB M° Max.	INSERTION LOSS, dB Above 3dB U Typ.	INSERTION LOSS, dB Above 3dB U Max.	PHASE UNBALANCE Degrees L Max.	PHASE UNBALANCE Degrees M° Max.	PHASE UNBALANCE Degrees U Max.	AMPLITUDE UNBALANCE dB L Max.	AMPLITUDE UNBALANCE dB M° Max.	AMPLITUDE UNBALANCE dB U Max.	CAPD DATA (see RF/IF Designer handbook) Page	CASE STYLE Note B	CONNECTION	PRICE $ Qty. (1-9)
PSCJ-2-1	1-200	35	30	35	25	30	23	0.75	1	0.5	0.8	0.75	1.2	2	2.5	4	0.15	0.15	0.3	2-43	A01	az	23.95
PSCJ-2-1W	100-600			30	20					1.0	1.9				6			0.5		—	A06	az	26.95
✣ PSCJ-2-2	0.01-20	35	25	30	25	25	18	0.3	0.8	0.2	0.5	0.3	0.6	1*	2	2.5	0.1	0.1	0.2	2-43	A01	az	34.95
■ PSCJ-2-1-75	1-200	35	30	31	25	26	20	0.6	1.2	0.8	1.2	1.2	1.6	2	4	6	0.15	0.2	0.5	2-45	A01	az	23.95
●■ SCPJ-2-1W-75	10-500	30	25	27	20	22	16	1.0	1.5	1.1	1.6	1.5	2.2	3	4	6	0.3	0.5	0.9	—	YY161	az	26.95
ZFSCJ-2-1	1-500	30	20	33	25	30	18	1	1.5	1	1.5	1	1.5	2	4	6	0.15	0.2	0.5	2-44	K18	as	59.95
△✣ ZFSCJ-2-2	0.01-20	35	25	30	25	25	18	0.3	0.8	0.2	0.5	0.3	0.6	1*	2	2.5	0.1	0.1	0.2	2-43	K18	as	57.95
ZFSCJ-2-3	5-300	30	20	33	25	30	18	1	1.5	1	1.5	1	1.5	2	4	6	0.15	0.2	0.5	2-44	K18	as	49.95
△ ZFSCJ-2-4	50-1000	30	20	—	—	25	18	1.2	1.9	—	—	1.6	2.4	6	—	7	0.6	—	0.6	2-102	K18	as	69.95
ZMSCJ-2-1	1-200	35	30	35	25	30	23	0.75	1	0.6	0.8	0.75	1.2	2	2.5	4	0.15	0.15	0.3	2-45	M21	at	57.95
✣ ZMSCJ-2-2	0.01-20	35	25	30	25	25	18	0.3	0.8	0.2	0.5	0.3	0.6	1*	2	2.5	0.1	0.1	0.2	2-43	M21	at	67.95
ZSCJ-2-1	1-200	35	30	35	25	30	23	0.75	1	0.6	0.8	0.75	1.2	2	2.5	4	0.15	0.15	0.3	2-45	M22	at	51.95
✣ ZSCJ-2-2	0.01-20	35	25	30	25	25	18	0.3	0.8	0.2	0.5	0.3	0.6	1*	2	2.5	0.1	0.1	0.2	2-43	M22	at	59.95
ZAPDJ-2	1000-2000	22	18	22	18	22	18	1.3	1.8	1.3	1.8	1.3	1.8	6	6	6	0.8	0.8	0.8	2-102	F14	as	71.95

L = low range (f_L to 10 f_L) M = mid range (10 f_L to f_U/2) U = upper range (f_U/2 to f_U)

NOTES:
- * Phase unbalance is 3 degrees max from fL to 3 fL.
- ✪ When only specification for M range given, specifications applied to entire frequency range.
- ● Surface-mount, non-hermetic, available on Tape and Reel.
- ■ Denotes 75 Ohm model, for coax connector models 75 Ohm BNC connectors are standard.
- △ Available only with SMA connectors.
- ✣ At low range frequency band (fL to 10 fL), linearly derate maximum input power by 13 dB.

A. General Quality Control Procedures, Environmental Specifications, Hi-Rel, MIL and TX description are given in section 0, see "Mini-Circuits Guarantees Quality" article.
B. Connector types and case mounted options, case finishes are given in section 0, see "Case styles & Outline Drawings".
C. Prices and specifications subject to change without notice.
1. Absolute maximum power, voltage and current ratings:
   1a. Matched power rating, 1 Watt, except models PSCJ-2-1W and SCPJ-2-1W-75 0.5 Watt
   1b. Internal load dissipation 0.125 Watt

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50 ohms and 75 ohms

Mini-Circuits

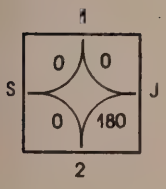
2 WAY–0°/180°

5 to 200 MHz

PMT

MODEL NO.	FREQ. RANGE MHz	ISOLATION dB			INSERTION LOSS, dB Above 3dB			PHASE UNBALANCE Degrees			AMPLITUDE UNBALANCE dB			CAPD DATA (see RF/IF Designer handbook)	CASE STYLE	CONNECTION	PRICE $
	f_L-f_U	L Typ. Min.	M Typ. Min.	U Typ. Min.	L Typ. Max.	M Typ. Max.	U Typ. Max.	L Max.	M Max.	U Max.	L Max.	M Max.	U Max.	Page	Note B		Qty. (1-9)
PMT-1	5-200	22 20	24 20	24 18	0.8 1.0	0.9 1.1	1.0 1.5	2	4	8	0.1	0.2	0.5	2-83	A01	ba	23.95
■ PMT-1-75	5-200	22 18	22 18	22 18	1.0 1.3	1.0 1.4	1.0 1.5	2	4	8	0.1	0.2	0.5	2-83	A01	ba	23.95

L = low range (f_L to 10 f_L) M = mid range (10 f_L to f_U/2) U = upper range (f_U/2 to f_U)



- S-J ports, isolation 40 dB typical
- Inphase ports, S-1 and S-2, insertion loss 0.2 dB typical
- Amplitude unbalance defined by input S or J ports to output 1 and 2

pin and coaxial connections

see case style outline drawing

PORT	as	at	az	ba
SUM PORT	S	2	1	1
PORT 1	1	1	5	2
PORT 2	2	3	6	3
PORT J			—	4
GND EXT.			2,3,4,7,8	5,6,7,8
CASE GND			2,3,4,7,8	5,6,7,8

NSN GUIDE

MCL NO.	NSN
PSCJ-2-2	5985-01-332-3084
ZSCJ-2-2	5895-01-340-7761

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Power Splitter/Combiners

3 WAY–0°

10 kHz to 4.2 GHz

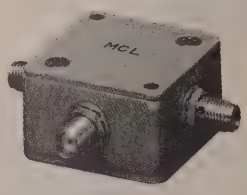
case style selection

outline drawings see Table of Contents

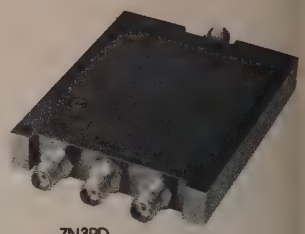
LRPS-3

PSC–3

SCP–3



ZFSC–3



ZN3PD

MODEL NO.	FREQ. RANGE MHz f_L-f_U	ISOLATION dB L Typ.	Min.	M° Typ.	Min.	U Typ.	Min.	INSERTION LOSS, dB Above 4.8dB L Typ.	Max.	M° Typ.	Max.	U Typ.	Max.	PHASE UNBALANCE Degrees L Max.	M Max.	U Max.	AMPLITUDE UNBALANCE dB L Max.	M° Max.	U Max.	VSWR (:1) S Typ.	Max.	OUT Typ.	Max.	CAPD DATA (see RF/IF Designer handbook) Page	CASE STYLE Note B	CONNECTION	PRICE $ Qty. (1-9)
PSC-3-1	1-200	45	30	40	30	40	25	0.6	1.0	0.4	0.7	0.6	1	1	2	4	0.15	0.2	0.3					2-46	A01	bb	23.95
PSC-3-1A	1-300	38	30	33	23	29	22	0.2	0.5	0.2	0.7	0.6	1.5	1	3	5	0.2	0.3	0.6					2-104	A01	bb	26.95
PSC-3-1W	5-500	25	20	31	15	25	15	0.4	0.8	0.4	1.4	0.8	1.4	2	3	5	0.1	0.3	0.6					2-46	A01	bc	35.95
✣ PSC-3-2	0.01-30	35	30	40	25	30	25	0.25	0.45	0.15	0.45	0.45	0.75	1	2	4	0.2	0.3	0.4					2-105	A01	bb	35.95
■ PSC-3-1-75	1-200	35	23	35	25	35	25	0.6	1.0	0.3	0.7	0.6	1	2	3	4	0.15	0.2	0.3					2-48	A01	bb	23.95
■ PSC-3-1-75-2	10-300	28	20	25	20	28	20	0.2	0.4	0.3	0.5	0.4	0.7	2	3	4	0.15	0.2	0.3					2-48	A01	bc	27.95
PSC-3-13	1-200	45	35	45	30	37	30	0.25	0.5	0.35	0.6	0.35	0.6	1	3	4	0.1	0.2	0.2					2-47	A01	bb	29.95
PSC-3-13-39	0.5-50	47	33	46	35	40	33	0.15	0.4	0.15	0.4	0.15	0.4	1	1	2	0.1	0.1	0.1					2-105	A01	bb	29.95
● LRPS-3-1	10-300	25	20	25	20	25	20	0.2	0.6	0.3	0.8	0.5	1.2	1	2	4	0.1	0.3	0.7					—	QQQ130	gt	19.95
● SCP-3-1	1-300	30	25	25	20	20	15	0.3	0.6	0.4	0.8	0.7	1.5	1	2	4	0.1	0.15	0.5					2-104	YY101	bd	16.95
ZN3PD-900	800-900			30	20					0.2	0.4				—			0.5		1.09	1.30	1.09	1.30	2-103	UU181	be	74.95
ZN3PD-900W	650-1050			22	15					0.3	0.8				—			0.8		1.09	1.80	1.09	1.30	2-103	UU181	be	69.95

see Performance Data and curves

L = low range (f_L to 10 f_L) M = mid range (10 f_L to f_U/2) U = upper range (f_U/2 to f_U)

NOTES:

* Isolation 25 dB, -55 to 0 deg.C over 0.01-0.1 MHz

● Surface-mount, non-hermetic, available on tape and reel

■ Denotes 75 Ohm model, for coax connector models 75 Ohm BNC connectors are standard.

✣ At low range frequency band (f_L to 10 f_L), linearly derate maximum input power by 13 dB.

✪ When only specification for M range given, specifications applied to entire frequency range.

A. General Quality Control Procedures, Environmental Specifications, Hi-Rel, MIL and TX description are given in section 0, see "Mini-Circuits Guarantees Quality" article.

B. Connector types and case mounted options, case finishes are given in section 0, see "Case styles & Outline Drawings".

C. Prices and specifications subject to change without notice.

1. Absolute maximum power, voltage and current ratings:
   - 1a. Matched power rating, models ZA3PD, ZN3PD 10 Watt; other models 1 Watt
   - 1b. Internal load dissipation 0.375 Watt

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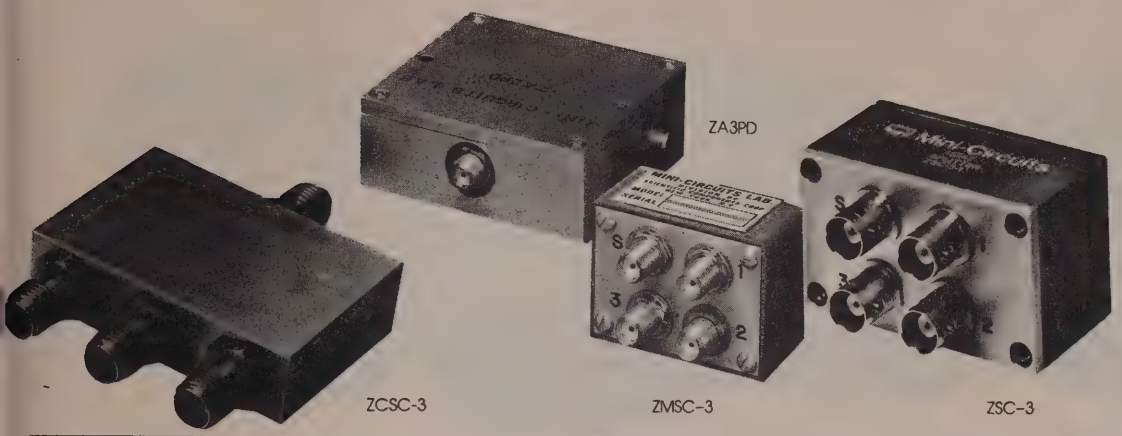
50 ohms and 75 ohms

Mini-Circuits



MODEL NO.	FREQ. RANGE MHz f_L-f_U	ISOLATION dB L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	INSERTION LOSS, dB Above 4.8dB L Typ.	L Max.	M Typ.	M Max.	U Typ.	U Max.	PHASE UNBALANCE DEGREES L Max.	M Max.	U Max.	AMPLITUDE UNBALANCE dB L Max.	M Max.	U Max.	CAPD DATA (see RF/IF Designer handbook) Page	CASE STYLE Note B	CONNECTION	PRICE $ Qty. (1-9)
ZFSC-3-1	1-500	30	20	30	20	25	18	0.4	0.75	0.5	0.9	0.8	1.2	2	3	4	0.2	0.3	0.4	2-50	J17	be	51.95
ZFSC-3-1W	2-750	30	20	30	20	25	18	0.4	0.75	0.5	1.0	1.0	1.6	3	5	7	0.2	0.3	0.5	2-50	J17	be	53.95
ZFSC-3-13	1-200	45	30	48	35	37	30	0.25	0.5	0.35	0.6	0.35	0.6	1	3	5	0.1	0.2	0.2	2-47	J17	be	51.95
ZFSC-3-4	1-1000	35	20	20	18	20	17	0.2	0.5	0.7	1.4	1.0	2.0	3	6	10	0.2	0.4	0.9	2-51	J17	be	59.95
ZA3PD-1	500-1000	20	14	20	14	20	14	0.3	0.6	0.3	0.6	0.3	0.6	—	—	—	0.4	0.4	0.4	2-52	CC51	be	89.95
ZA3PD-1.5	750-1500	20	14	20	14	20	14	0.3	0.7	0.3	0.7	0.3	0.7	—	—	—	0.4	0.4	0.4	2-52	CC51	be	89.95
ZA3PD-2	1000-2000	20	15	20	15	20	15	0.3	0.6	0.3	0.6	0.3	0.6	—	—	—	0.3	0.3	0.3	2-53	CC51	be	89.95
ZA3PD-4	2000-4200	18	14	18	14	18	14	0.7	1.0	0.7	1.0	0.7	1.0	—	—	—	0.9	0.9	0.9	2-53	CC51	be	89.95
ZCSC-3-R3	2-300	32	28	31	28	32	22	0.3	0.8	0.4	1.0	0.8	1.2	1	2	3	0.1	0.3	0.3	—	UU233	be	43.95
ZMSC-3-1	1-200	45	35	40	25	40	25	0.3	0.5	0.4	0.7	0.6	1	1	2	4	0.15	0.2	0.3	2-51	P26	be	57.95
✤ ZMSC-3-2*	0.01-30	35	30	40	25	30	25	0.25	0.45	0.15	0.45	0.45	0.75	1	2	4	0.2	0.3	0.4	2-47	P26	be	67.95
ZSC-3-1	1-200	45	30	40	25	40	25	0.3	0.5	0.4	0.7	0.6	1.0	1	2	4	0.15	0.2	0.3	2-51	P25	be	51.95
✤ ZSC-3-2*	0.01-30	35	30	40	25	30	25	0.25	0.45	0.15	0.45	0.45	0.75	1	2	4	0.2	0.3	0.4	2-47	P25	be	61.95
■ ZSC-3-1-75	1-200	35	30	35	25	35	25	0.6	1.0	0.4	0.7	0.6	1.0	2	3	4	0.15	0.2	0.3	2-48	P25	be	52.95
■ ZSC-3-2-75	0.02-20	35	30	35	25	30	20	0.2	0.5	0.25	0.6	0.45	0.75	2	3	4	0.2	0.3	0.4	2-49	P25	be	62.95

L = low range (f_L to 10 f_L) M = mid range (10 f_L to f_U/2) U = upper range (f_U/2 to f_U)

pin and coaxial connections

see case style outline drawings

PORT	bb	bc	bd	be	gt
SUM PORT	6	1	6	S	6
PORT 1	1	5	1	1	1
PORT 2	2	7	2	2	2
PORT 3	5	8	5	3	3
GND EXT.	3,4,7,8	2,3,4,6	3,4,7,8		4,5
CASE GND	3,4,7,8	2,3,4,6	—		—

MIL-P-23971/15, NSN GUIDE

MCL NO.	NSN
PSC-3-1	6625-01-015-6027
PSC-3-1W	5985-01-295-5898
PSC-3-13	6625-01-249-8011
ZFSC-3-4(SMA)	6625-01-333-1126
ZFSC-3-1	6625-01-235-6873
ZFSC-3-13	5895-01-335-1824
ZMSC-3-2B	6625-01-303-4624
ZMSC-3-1B(SMA)	6625-01-170-0102
ZSC-3-1	6625-01-327-4755
ZSC-3-1B(BNC)	6625-01-008-9566
ZSC-3-2BR	5985-01-315-2870
ZSC-3-2B(BNC)	5820-01-120-9320
ZA3PD-2	5895-01-357-3919
ZFSC-3-1(SMA)	5895-01-361-8520

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PowerSplitter/Combiners

4 WAY–0°

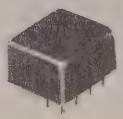
2 KHz to 4.2 GHz

case style selection

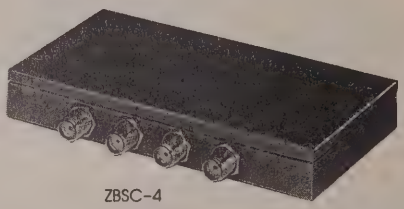
outline drawings see Table of Contents

SCP–4

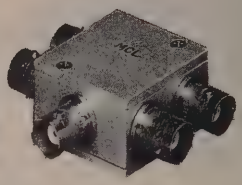
PSC–4



PSC–4A



ZBSC–4



ZFSC–4

MODEL NO.	FREQ. RANGE MHz	ISOLATION dB						INSERTION LOSS, dB Above 6dB						PHASE UNBALANCE Degrees			AMPLITUDE UNBALANCE dB			CAPD DATA (see RF/IF Designer handbook)	CASE STYLE	CONNECTION	PRICE $
		L		M		U		L		M		U		L	M	U	L	M	U				
	f_L-f_U	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Max.	Typ.	Max.	Typ.	Max.	Max.	Max.	Max.	Max.	Max.	Max.	Page	Note B		Qty. (1-9)
PSC-4-1	0.1-200	33	20	30	20	27	20	0.4	0.6	0.5	0.75	0.7	1	4	6	8	0.15	0.2	0.25	2-54	A01	bf	35.95
PSC-4-1W	1-500	29	20	27	18	25	18	0.4	0.8	0.5	1	0.8	1.5	1	3	5	0.2	0.3	0.5	2-106	A01	bf	38.95
■ PSC-4-1-75	1-200	30	20	25	20	25	20	0.4	0.7	0.5	0.9	0.7	1.2	2	3	4	0.15	0.2	0.3	2-62	A01	bf	32.95
PSC-4-3	0.25-250	33	20	30	20	27	20	0.4	0.7	0.5	0.75	0.7	1.2	4	6	8	0.15	0.2	0.25	2-55	A01	bf	31.95
PSC-4-5	1-800	29	20	24	18	25	17	0.4	0.8	0.6	1.5	1.3	2.5	1	4	5	0.2	0.5	0.6	2-106	A01	bf	45.45
✥ PSC-4-6	0.01-40	35	18	32	25	25	18	0.4	0.8	0.3	0.5	0.5	1	2	2	2	0.1	0.15	0.2	2-55	A01	bf	36.95
■ PSC-4-1W-75	5-650	38	22	40	22	25	18	0.6	0.9	0.65	1.2	0.9	1.5	1	3	5	0.2	0.3	0.6	—	A05	bf	39.95
PSC-4A-4	10-1000	25	20	21	15	18	15	0.5	0.8	0.8	1.8	1.5	2.5	4	16	20	0.2	0.5	0.7	2-54	C07	bg	64.95
■ PSC-4A-475	10-800	30	20	33	20	25	18	0.4	0.7	0.6	0.9	1.2	1.6	—	—	—	0.2	0.4	0.8	2-62	C07	bg	64.95
■ PSC-4A-1W-75*	30-600	27	20	—	—	22	18	0.6	0.8	—	—	0.8	1.1	2	—	5	0.2	—	5	2-107	C07	bg	49.95
● SCP-4-1	1-400	32	23	26	18	21	17	0.4	1.2	0.6	1.2	1.0	1.5	1	4	9	0.2	0.3	0.5	—	YY101	bv	24.95
● SCP-4-1W	10-650	34	28	23	18	21	15	0.7	1.0	0.9	1.5	1.1	1.9	3	7	12	0.2	0.4	0.7	—	YY101	bv	26.95
ZBSC-413	10-800	26	20	18	15	18	15	0.6	1	1	1.5	1.6	2	4	8	8	0.2	0.4	0.6	2-57	UU102	bh	99.95
ZFSC-4-1	1-1000	25	20	23	18	20	15	0.4	1.2	0.6	1.5	1.6	2.5	4	8	8	0.2	0.4	0.7	2-56	G15	bh	89.95
ZFSC-4-1W	10-500	23	20	23	20	23	20	0.6	1.5	0.6	1.5	0.6	1.5	4	8	8	0.2	0.3	0.4	2-50	G15	bh	84.95
ZFSC-4-3	10-300	32	28	38	30	38	30	0.5	0.8	0.6	0.9	0.9	1.2	4	6	8	0.1	0.1	0.2	2-57	G15	bh	78.95
■ ZFSC-4375	50-90	34	30	34	30	34	30	0.3	0.8	0.3	0.8	0.3	0.8	4	6	8	0.15	0.15	0.15	2-63	G15	bh	89.95
■ ZFSC-4-2-75-1**	200-800	25	20	—	—	25	20	0.8	1.6	—	—	1	1.6	4	16	20	0.2	—	0.4	2-63	G15	bh	84.95
■ ZFSC-4-175	10-1000	35	25	38	20	22	18	0.5	0.8	0.6	1.2	0.9	2	—	—	—	0.2	0.3	0.6	2-61	G15	bh	89.95

L = low range (f_L to 10 f_L) M = mid range (10 f_L to f_U/2) U = upper range (f_U/2 to f_U)

NOTES:

- ● Surface-mount, non-hermetic, available on tape and reel
- ■ Denotes 75 Ohm model, for coax connector models 75 Ohm BNC connectors are standard.
- ○ When only specification for M range given, specification applies to entire frequency range.
- ✥ At low range frequency band (f_L to 10f_L), linearly derate maximum power by 13 dB.
- * Maximum VSWR: input 1.5:1, output 1.3:1
- ** Frequency range L=f_L to f_U/2. Up to 15V and 15mA DC may be passed from input to all outputs.

A. General Quality Control Procedures, Environmental Specifications, Hi-Rel, MIL and TX description are given in section 0, see "Mini-Circuits Guarantees Quality" article.

B. Connector types and case mounted options, case finishes are given in section 0, see "Case styles & Outline Drawings".

C. Prices and specifications subject to change without notice.

1. Absolute maximum power, voltage and current ratings:

1a. Matched power rating,
Models ZA4PD, ZB4PD-4, ZB4PD1, ZN4PD, ZC4PD 10 Watt
Models PSC-4-5, PSC-4-1W, SCP-4-1W, ZCSC-4-1W 0.5 Watt
All other models 1 Watt

1b. Internal load dissipation,
Model ZB4PD-1750-75 0.750 Watt
Models ZA4PD, ZB4PD-4, ZB4PD, ZB4PD1, ZN4PD, ZC4PD, ZCSC 0.375 Watt
All other models 0.250 Watt

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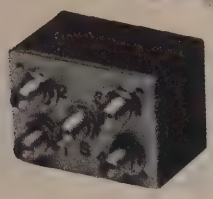
50 ohms and 75 ohms

Mini-Circuits

ZB4PD1

ZB4PD

ZA4PD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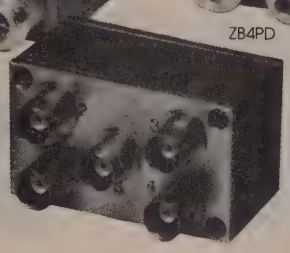
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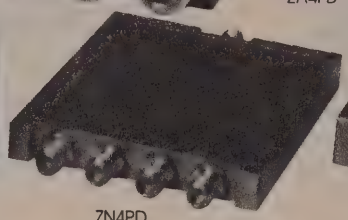
ZN4PD
ZCSC-4

ZC4PD

MODEL NO.	FREQ. RANGE MHz f_L-f_U	ISOLATION dB L Typ.	L Min.	M° Typ.	M° Min.	U Typ.	U Min.	INSERTION LOSS, dB Above 6dB L Typ.	L Max.	M° Typ.	M° Max.	U Typ.	U Max.	PHASE UNBALANCE Degrees L Max.	M° Max.	U Max.	AMPLITUDE UNBALANCE dB L Max.	M° Max.	U Max.	VSWR (:1) S Typ.	S Max.	OUT Typ.	OUT Max.	CAPD DATA (see RF/IF Designer hand-book) Page	CASE STYLE Note B	CONNECTION	PRICE $ Qty. (1-9)
ZCSC-4-1W	10-650	34	22	23	17	21	15	0.7	1.2	0.9	1.5	1.1	1.9	3	7	12	0.2	0.4	0.7					—	UU244	bh	79.95
ZMSC-4-1	0.1-200	33	20	30	20	27	20	0.4	0.6	0.5	0.75	0.7	1.0	4	6	8	0.15	0.20	0.25					2-60	N24	bh	66.95
✣ ZMSC-4-2	0.002-20	30	20	33	25	33	25	0.45	0.75	0.3	0.5	0.7	1.0	4	6	8	0.15	0.20	0.25					2-60	N24	bh	76.95
ZMSC-4-3	0.25-250	33	20	30	20	27	20	0.4	0.7	0.5	0.75	0.7	1.2	4	6	10	0.15	0.20	0.25					2-61	N24	bh	64.95
ZSC-4-1	0.1-200	33	20	30	20	27	20	0.4	0.6	0.5	0.75	0.7	1.0	4	6	8	0.15	0.20	0.25	see				2-60	N27	bh	59.95
■ ZSC-4-1-75	1-200	30	20	25	20	25	20	0.4	0.7	0.5	0.8	0.7	1.2	4	6	10	0.15	0.20	0.30					2-62	N27	bh	59.95
✣ ZSC-4-2	0.002-20	30	20	33	25	33	25	0.45	0.75	0.3	0.5	0.7	1.0	4	6	8	0.15	0.20	0.25	Performance				2-60	N27	bh	74.95
ZSC-4-3	0.25-250	33	20	30	20	27	20	0.4	0.7	0.5	0.75	0.7	1.2	4	6	10	0.15	0.20	0.25					2-61	N27	bh	56.95
■ ZSC-4-3-75	0.25-250	28	20	30	20	27	20	0.4	0.8	0.3	0.7	0.5	1.0	1	2	3	0.15	0.20	0.25	Data and				2-107	N27	bh	56.95
ZA4PD-2	1000-2000	25	16	25	16	25	16	0.3	1.0	0.3	1.0	0.3	1.0		6		0.70	0.70	0.70					2-58	DD52	bh	89.95
ZA4PD-4	2000-4200	25	16	25	16	25	16	0.5	1.0	0.3	1.0	0.3	1.0		16		0.80	0.80	0.80	curves				2-58	DD52	bh	89.95
ZB4PD-42	1700-4200	23	16	23	16	23	16	0.5	1.4	0.5	1.4	0.5	1.4		8		0.80	0.80	0.80					2-59	Z54	bh	99.95
ZB4PD-4	3700-4200	24	15	24	15	24	15	0.6	1.1	0.6	1.1	0.6	1.1		8		0.80	0.80	0.80					2-59	Z54	bh	94.95
■ ZB4PD-1750-75	875-1750			30	20					0.4	0.8				3			0.4		1.08	1.50	1.25	1.50	—	Z54	bh	99.95
ZB4PD1-930	850-930			30	20					0.3	0.5				5			0.25		1.10	1.25	1.09	1.25	2-111	UU188	bh	99.95
ZB4PD1-930W	725-1050			22	15					0.3	0.8				5			0.40		1.20	1.80	1.10	1.30	2-111	UU188	bh	94.95
ZC4PD-900	800-900			30	20					0.3	0.6				3			0.20		1.08	1.25	1.17	1.30	2-118	ZZZ184	bh	89.95
ZN4PD-920	800-920			30	20					0.25	0.5				2			0.20		1.08	1.25	1.07	1.25	2-110	UU182	bh	84.95
ZN4PD-920W	670-1000			22	15					0.3	0.6				3			0.20		1.20	1.60	1.07	1.25	2-110	UU182	bh	79.95

L = low range (f_L to 10 f_L) M = mid range (10 f_L to f_U/2) U = upper range (f_U/2 to f_U)

pin and coaxial connections

see case style outline drawing

PORT	bf	bg	bh	bv
SUM PORT	4	2	S	3
PORT 1	7	8	1	2
PORT 2	8	12	2	4
PORT 3	1	5	3	6
PORT 4	2	9	4	8
GND EXT.	3,5,6	All other pins		1,5,7
CASE GND	3,5,6	All other pins		1,5,7

MIL-P-23971/15, NSN GUIDE

MCL NO.	NSN	MIL-P-23971/15*
PSC-4-1	5895-01-065-0106	-10
PSC-4-2	5825-01-044-8945	
PSC-4-3	5895-01-105-6189	-11
PSC-4-6	5985-01-332-3086	
PSC-4A-4	5895-01-347-0205	
ZFSC-4-1	6625-01-303-4623	
ZFSC-4-1A	5825-01-227-6681	
ZFSC-4-3B	5985-01-253-2843	
ZMSC-4-1B	4935-01-229-3228	
ZSC-4-1B	5820-00-270-3056	
ZSC-4-2B	5820-01-120-5238	
ZSC-4-2B(BNC)	5820-01-120-5238	
ZSC-4-3B	6625-01-038-8553	
ZSC-4-1B(BNC)	6625-00-270-3056	
ZSC-4-1B(TNC)	6625-01-109-3707	
ZSC-4-2BR	6625-01-357-2227	

* units are not QPL listed.

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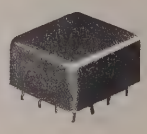
Power Splitter/Combiners

5 WAY - 0°

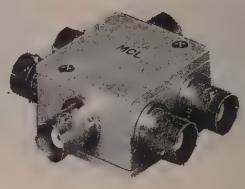
1 MHz to 750 MHz

case style selection

outline drawings see Table of Contents



PSC-5



ZFSC-5

MODEL NO.	FREQ. RANGE MHz f_L-f_U	ISOLATION dB L Typ.	L Min.	M° Typ.	M° Min.	U Typ.	U Min.	INSERTION LOSS, dB Above 7.0dB L Typ.	L Max.	M° Typ.	M° Max.	U Typ.	U Max.	PHASE UNBALANCE Degrees L Max.	M° Max.	U Max.	AMPLITUDE UNBALANCE dB L Max.	M° Max.	U Max.	CAPD DATA (see RF/IF Designer handbook) Page	CASE STYLE Note B	CONNECTION	PRICE $ Qty. (1-9)
PSC-5-1	1-300	25	20	23	18	20	17	0.2	0.5	0.6	1.0	1.5	2.0	2	4	8	0.2	0.3	0.6	2-64	C07	bj	64.45
PSC-5-2	250-750			22	17					1.1	2.5				14			0.7		—	C07	gq	67.95
■ PSC-5-1-75	1-300	35	20	30	18	25	17	0.4	0.6	0.6	0.9	0.9	1.3	2	4	8	0.2	0.3	0.6	2-64	C07	bj	64.45
ZFSC-5-1	1-300	25	20	23	18	20	17	0.2	0.5	0.6	1.0	1.5	2.0	2	4	8	0.2	0.3	0.6	2-64	G15	bm	99.95

L = low range (f_L to 10 f_L) M = mid range (10 f_L to f_U/2) U = upper range (f_U/2 to f_U)

NOTES:

■ Denotes 75 Ohm model, for coax connector models 75 Ohm BNC connectors are standard.

⊙ When only specification for M range given, specification applies to entire frequency range.

A. General Quality Control Procedures, Environmental Specifications, Hi-Rel, MIL and TX description are given in section 0, see "Mini-Circuits Guarantees Quality" article.

B. Connector types and case mounted options, case finishes are given in section 0, see "Case styles & Outline Drawings".

C. Prices and specifications subject to change without notice.

1. Absolute maximum power, voltage and current ratings:

1a. Matched power rating:

Models ZB6PD, ZC6PD	10 Watt
Model PSC-5-2	2 Watt
All other models	1 Watt

1b. Internal load dissipation:

Models ZB6PD, ZC6PD	0.875 Watt
Model PSC-5-2	0.625 Watt
All other models	0.500 Watt

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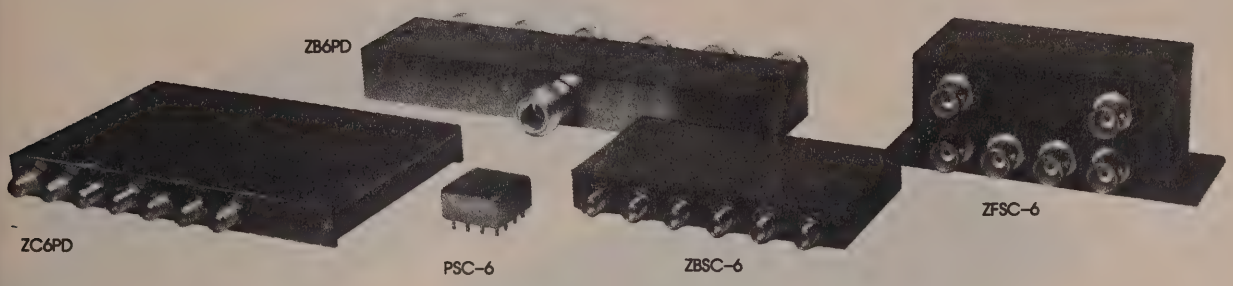
50 ohms and 75 ohms

Mini-Circuits

6 WAY–0°

1 MHz to 2 GHz



MODEL NO.	FREQ. RANGE MHz f_L-f_U	ISOLATION dB L Typ.	L Min.	M° Typ.	M° Min.	U Typ.	U Min.	INSERTION LOSS, dB Above 7.8dB L Typ.	L Max.	M° Typ.	M° Max.	U Typ.	U Max.	PHASE UNBALANCE Degrees L Max.	M° Max.	U Max.	AMPLITUDE UNBALANCE dB L Max.	M° Max.	U Max.	VSWR (:1) S Typ.	S Max.	OUT Typ.	OUT Max.	CAPD DATA (see RF/IF Designer handbook) Page	CASE STYLE Note B	CONNECTION	PRICE $ Qty. (1-9)
PSC-6-1	1-175	30	24	26	18	26	18	0.50	0.80	0.70	1.00	1.00	1.50	4	6	12	0.2	0.4	0.8					2-67	C07	bk	74.95
■ PSC-6-1-75	1-300	35	25	30	23	25	18	0.40	0.90	0.60	1.10	0.60	1.30	2	4	8	0.2	0.3	0.6					2-65	C07	bk	78.95
ZC6PD-960	890-960			30	20					0.40	0.80			—	—	—		0.4		1.20	1.50	1.10	1.50	2-112	AB185	bn	124.95
ZC6PD-960W	700-1000			28	15					0.40	1.00			—	—	—		0.6		1.30	1.50	1.20	1.50	2-112	AB185	bn	119.95
ZC6PD-1900	1700-1900			30	20					0.40	0.80			—	—	—		0.5		1.10	1.40	1.10	1.50	2-113	AB185	bn	134.95
ZC6PD-1900W	1500-2000			30	15					0.50	1.00			—	—	—		0.6		1.10	1.68	1.10	1.50	2-113	AB185	bn	129.95
ZBSC-611	10-200	28	22	26	20	23	20	0.50	0.80	0.70	1.00	0.90	1.20	4	5	6	0.2	0.3	0.5					2-66	UU102	bn	114.95
ZBSC-615	1-500	30	25	26	18	24	18	0.50	0.80	0.70	1.20	1.00	2.20	4	5	20	0.2	0.4	1.2					2-66	UU102	bn	119.95
ZB6PD1-900	800-900			32	20					0.30	0.70			—	—	—		0.5		1.10	1.50	1.13	1.35	2-114	UU187	bn	139.95
ZB6PD1-960	890-960			35	20					0.30	0.80			—	—	—		0.6		1.10	1.30	1.10	1.30	2-114	UU187	bn	139.95
ZB6PD1-1900	1700-1900			32	20					0.40	0.80			—	—	—		0.6		1.10	1.30	1.09	1.40	2-115	UU187	bn	149.95
ZFSC-6-1	1-175	27	22	26	20	26	20	0.75	1.00	0.75	1.20	0.80	1.20	2	6	12	0.2	0.4	0.6					2-67	Q28	bn	99.95
■ ZFSC-6-1-75	1-200	30	25	30	22	20	18	0.75	1.00	0.75	1.00	0.90	1.20	2	6	12	0.2	0.4	0.6					2-65	Q28	bn	102.95
ZFSC-6-110	1-500	35	25	26	20	25	20	0.50	0.80	0.60	1.10	1.00	1.70	2	6	12	0.3	0.3	0.8					2-67	Q28	bn	109.95

L = low range (f_L to 10 f_L) M = mid range (10 f_L to f_U/2) U = upper range (f_U/2 to f_U)

pin and coaxial connections

ee case style outline drawing

PORT	bj	bk	bm	bn	gq
SUM PORT	1	1	S	S (COM)	1
PORT 1	4	3	1	1	3
PORT 2	8	4	2	2	8
PORT 3	12	8	3	3	12
PORT 4	16	12	4	4	16
PORT 5	15	16	5	5	15
PORT 6	—	15	—	6	—
GND EXT.	2,5,7,11,13,14	2,5,7,11,13,14	—	—	2,5,7,11,13,14
CASE GND	2,5,7,11,13,14	2,5,7,11,13,14	—	—	4,6,9,10
NOT USED	3,6,9,10	6,9,10	—	—	—

NSN GUIDE

MCL NO.	NSN
PSC-5-1	6625-01-255-3143
ZFSC-6-1(BNC)	6625-01-225-6965
ZFSC-6-1(SMA)	6625-01-263-9871
PSC-6-1	6625-01-249-8012

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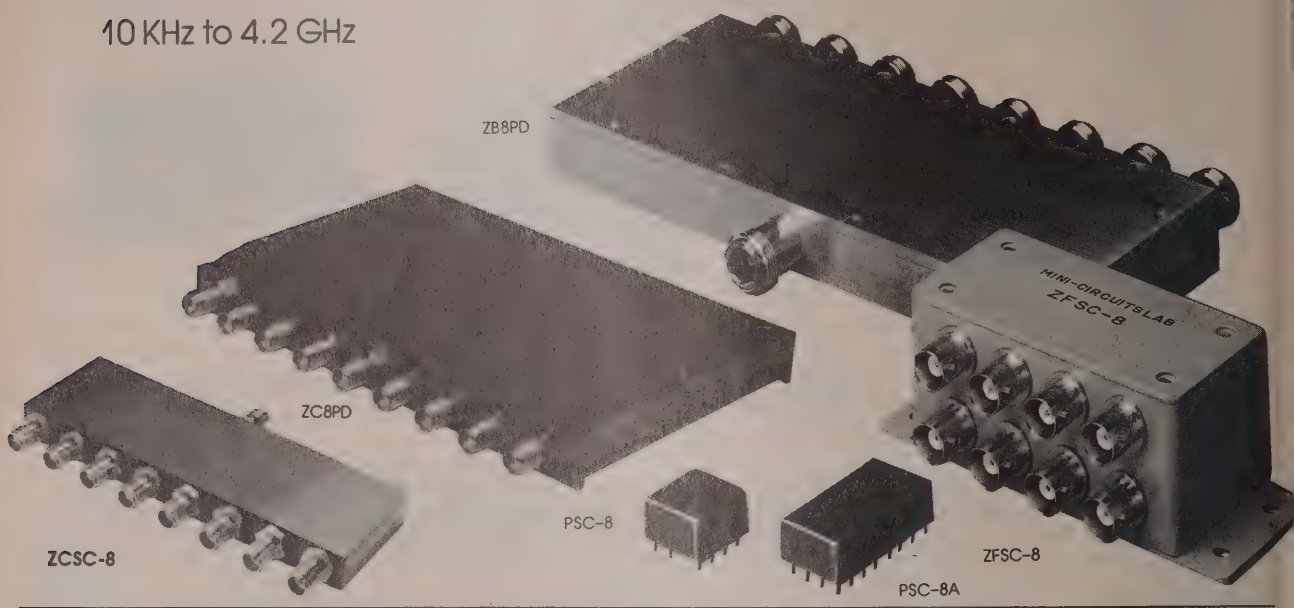
Power Splitter/Combiners

8 WAY–0°

10 KHz to 4.2 GHz



MODEL NO.	FREQ. RANGE MHz	ISOLATION dB						INSERTION LOSS, dB Above 9dB						PHASE UNBALANCE Degrees			AMPLITUDE UNBALANCE dB			CAPD DATA (see RF/IF Designer handbook)	CASE STYLE	CONNECTION	PRICE $
		L		M°		U		L		M°		U		L	M°	U	L	M°	U				
	f_L-f_U	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Max.	Typ.	Max.	Typ.	Max.	Max.	Max.	Max.	Max.	Max.	Max.	Page	Note B		Qty. (1-9)
	PSC-8-1	0.5-175	30	25	30	20	25	18	0.8	1.2	0.8	1.2	1.0	1.6	1.0	2.5	5.0	0.2	0.3	0.5	2-68	C07	bp	74.95
■	PSC-8-1-75	0.5-175	25	20	30	20	25	20	0.5	1.0	0.6	1.1	0.7	1.3	1.0	2.5	5.0	0.2	0.2	0.3	2-73	C07	bp	78.95
✤	PSC-8-6	0.01-10	40	20	40	25	28	23	0.3	0.7	0.5	1.0	0.6	1.1	1.0	2.5	4.0	0.1	0.2	0.3	2-69	C07	bp	93.95
	PSC-8A-4	5-500	25	20	23	18	20	15	0.7	1.2	1.0	1.8	1.4	2.5	3.0	8.0	16.0	0.2	0.3	0.5	2-68	E10	bq	103.95
■	PSC-8A4-75	1-300	26	20	30	25	30	23	0.8	1.2	0.7	1.1	0.9	1.3	1.0	3.0	8.0	0.2	0.2	0.4	2-72	E10	br	93.95
	ZC8PD-900*	800-900			30	20					0.4	0.7				5.0			0.4		2-115	AB186	—	158.95
	ZCSC-8-1	2-250	37	27	30	20	24	18	0.65	1.2	0.8	1.2	1.0	1.6	2.0	4.0	8.0	0.2	0.3	0.5	—	UU215	—	119.95
	ZFSC-8-1	0.5-175	30	25	30	20	25	18	0.8	1.2	0.8	1.2	1.0	1.6	1.0	2.5	5.0	0.2	0.2	0.3	2-68	R29	—	99.95
■	ZFSC-8-1-75	0.5-175	25	20	30	20	25	20	0.5	1.0	0.6	1.1	0.7	1.3	1.0	2.5	5.0	0.2	0.3	0.5	2-73	R29	—	102.95
■	ZFSC-82-75	10-900	35	17	23	17	20	15	0.6	0.9	0.9	1.6	1.6	2.7	2.0	4.0	10.0	0.2	0.5	1.2	2-73	R29	—	139.95
■	ZFSC-84-75	1-300	26	20	30	25	30	23	0.8	1.5	0.7	1.1	0.9	1.5	1.0	3.0	8.0	0.2	0.2	0.4	2-72	R29	—	119.95
■	ZFSC-8375	50-90	30	25	30	25	25	25	1.0	1.0	1.0	1.3	1.3	1.3	2.0	2.0	2.0	0.2	0.2	0.2	2-72	R29	—	119.95
	ZFSC-8-4	5-700	35	20	25	17	20	17	0.8	1.2	1.2	1.8	1.8	2.5	2.0	5.0	15.0	0.2	0.4	0.7	2-70	R29	—	128.95
	ZFSC-8-43	10-1000	23	20	25	20	26	20	1.0	1.6	1.4	1.8	2.1	2.9	5.0	10.0	20.0	0.2	0.4	0.7	2-70	R29	—	138.95
✤	ZFSC-8-6	0.01-10	35	20	40	25	35	25	0.3	0.7	0.2	0.6	0.3	0.7	1.0	2.0	3.0	0.1	0.2	0.3	2-69	R29	—	109.95
	ZB8PD-2	1000-2000			24	17					0.8	1.3				18.0			0.8		2-71	Z40	—	138.95
	ZB8PD-4	2000-4200			23	16					0.8	1.8				10.0			1.2		2-71	Z40	—	138.95

L = low range (f_L to 10 f_L) M = mid range (10 f_L to f_U/2) U = upper range (f_U/2 to f_U)

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Mini-Circuits

50 ohms and 75 ohms

9 WAY - 0°

2 MHz to 300 MHz

PSC-9

MODEL NO.	FREQ. RANGE MHz f_L-f_U	ISOLATION dB L Typ. Min.	ISOLATION dB M Typ. Min.	ISOLATION dB U Typ. Min.	INSERTION LOSS, dB Above 9.6dB L Typ. Max.	INSERTION LOSS, dB Above 9.6dB M Typ. Max.	INSERTION LOSS, dB Above 9.6dB U Typ. Max.	PHASE UNBALANCE Degrees L Max.	PHASE UNBALANCE Degrees M Max.	PHASE UNBALANCE Degrees U Max.	AMPLITUDE UNBALANCE dB L Max.	AMPLITUDE UNBALANCE dB M Max.	AMPLITUDE UNBALANCE dB U Max.	CAPD DATA (see RF/IF Designer handbook) Page	CASE STYLE Note B	CONNECTION	PRICE $ Qty. (1-9)
PSC-9-1	2-300	38 25	26 20	22 15	0.6 1.1	0.9 1.4	1.5 2.0	2.0	5.0	8.0	0.2	0.3	0.8	—	C07	gr	93.95

L = low range (f_L to 10 f_L) M = mid range (10 f_L to f_U/2) U = upper range (f_U/2 to f_U)

NOTES:

- VSWR, input 1.06:1 typical, 1.2:1 max; output 1.17:1 typical, 1.35:1 max
- ✣ Below 0.1 MHz power handling decrease as to typically 15 dBm at 0.01 MHz, 23 dBm at 0.025 Mhz, and 29 dBm at 0.05 MHz.
- ■ Denotes 75 Ohm model, for coax connector models 75 Ohm BNC connectors are standard.
- ⊙ When only specification for M range given, specification applies to entire frequency range.
- A. General Quality Control Procedures, Environmental Specifications, Hi-Rel, MIL and TX description are given in section 0, see "Mini-Circuits Guarantees Quality" article.
- B. Connector types and case mounted options, case finishes are given in section 0, see "Case styles & Outline Drawings".
- C. Prices and specifications subject to change without notice.
- 1. Absolute maximum power, voltage and current ratings:
  - 1a. Matched power rating,
    - Models ZB8PD, ZC8PD, 10 Watt
    - Model PSC-9-1, 0.5 Watt
    - All other models 1 Watt
  - 1b. Internal load dissipation,
    - Model PSC-9-1, 1.5 Watt
    - All other models, 0.62 Watt

pin connections

see case style outline drawings

PORT	SUM	#1	#2	#3	#4	#5	#6	#7	#8	#9	NOT USED	GND EXT.	CASE GND
bp	2	1	5	9	13	16	12	8	4	—	10,11	3,6,7,14,15	3,6,7,14,15
bq	29	7	16	31	24	9	2	26	17	—	—	4,5,15	All other pins
br	29	7	16	31	24	9	2	26	17	—	—	15	All other pins
gr	1	9	13	14	15	16	12	8	4	3	—	2,5,6,10,11	2,5,6,10,11

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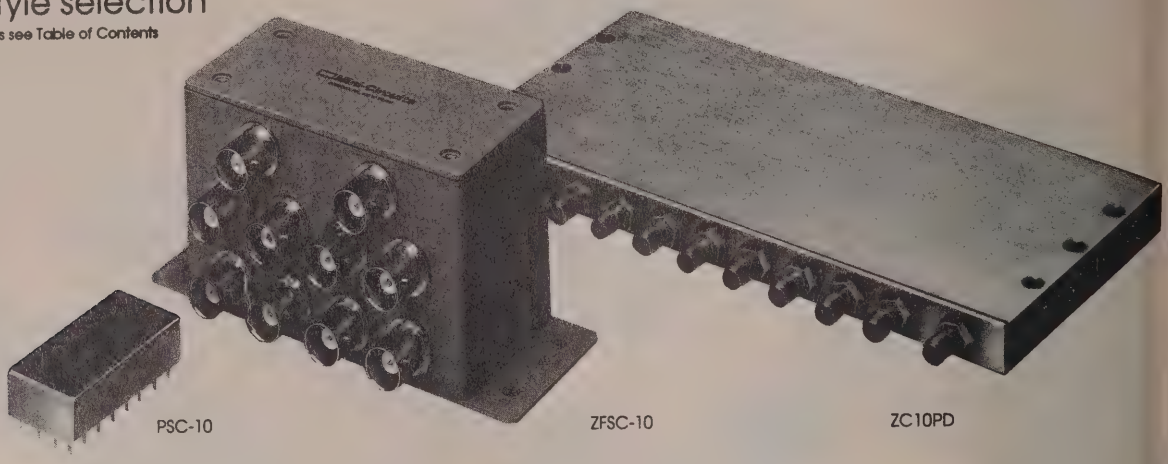
Power Splitter/Combiners

10 WAY - 0°

0.5 to 900 MHz

case style selection

outline drawings see Table of Contents



PSC-10 ZFSC-10 ZC10PD

MODEL NO.	FREQ. RANGE MHz	ISOLATION dB						INSERTION LOSS, dB Above 10dB						PHASE UNBALANCE Degrees			AMPLITUDE UNBALANCE dB			CAPD DATA (see RF/IF Designer handbook)	CASE STYLE	CONNECTION	PRICE $
		L		M°		U		L		M°		U		L	M°	U	L	M°	U				
	f_L-f_U	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Max.	Typ.	Max.	Typ.	Max.	Max.	Max.	Max.	Max.	Max.	Max.	Page	Note B		Qty. (1-9)
PSC-10-1	1-150	36	23	27	23	23	18	0.3	0.6	0.4	0.8	1.0	1.3	1	4	10	0.1	0.2	0.3	2-74	E10	bs	85.95
ZFSC-10-1	0.5-100	28	20	30	24	27	20	0.5	0.8	0.4	1.0	0.8	1.5	2	6	10	0.2	0.3	0.4	2-74	RR93	—	119.95
ZC10PD-900	800-900			25	20					1.5	2.0				—			0.8		2-120	AB204	—	178.95

L = low range (f_L to 10 f_L) M = mid range (10 f_L to f_U/2) U = upper range (f_U/2 to f_U)

NOTES:

- ■ Denotes 75 Ohm model, for coax connector models 75 Ohm BNC connectors are standard.
- ○ When only specification for M range given, specification applies to entire frequency range.
- A. General Quality Control Procedures, Environmental Specifications, Hi-Rel, MIL and TX description are given in section 0, see "Mini-Circuits Guarantees Quality" article.
- B. Connector types and case mounted options, case finishes are given in section 0, see "Case styles & Outline Drawings".
- C. Prices and specifications subject to change without notice.
- 1. Absolute maximum power, voltage and current ratings:
  - 1a. Matched power rating,
    Model ZC10PD, 10 Watt
    All other models, 1 Watt
  - 1b. Internal load dissipation,
    All models, 0.87 Watt

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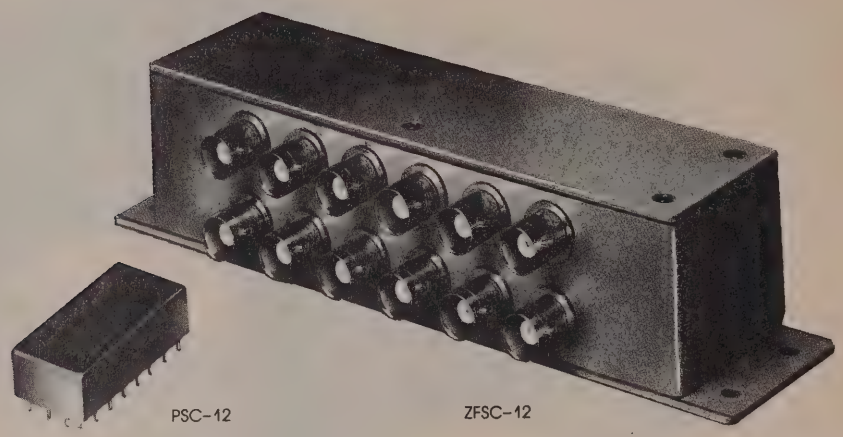
50 ohms and 75 ohms

Mini-Circuits

12 WAY - 0°

1 MHz to 500 MHz



PSC-12 ZFSC-12

MODEL NO.	FREQ. RANGE MHz	ISOLATION dB						INSERTION LOSS, dB Above 10.8dB						PHASE UNBALANCE Degrees			AMPLITUDE UNBALANCE dB			CAPD DATA (see RF/IF Designer handbook)	CASE STYLE	CONNECTION	PRICE $
		L		M		U		L		M		U		L	M	U	L	M	U				
	f_L-f_U	Typ.	Min.	Typ.	Min.	Typ.	Min.	Typ.	Max.	Typ.	Max.	Typ.	Max.	Max.	Max.	Max.	Max.	Max.	Max.	Page	Note 1		Qty. (1-9)
PSC-12-1	1-200	35	30	27	20	21	18	0.5	0.8	0.8	1.2	1.0	1.4	1	4	6	0.2	0.4	0.7	2-75	E10	bu	88.95
ZFSC-12-1	1-200	30	25	35	20	28	20	0.8	1.2	1.1	1.4	1.3	1.6	4	8	16	0.1	0.2	0.3	2-75	R67	—	174.95
ZFSC-12-11	10-300	28	20	33	25	28	20	1.1	1.3	1.1	1.5	1.5	1.8	2	4	6	0.2	0.3	0.4	2-75	R67	—	174.95
■ ZFSC-12-1-75	10-200	35	27	—	—	27	20	0.5	0.8	—	—	0.8	1.3	—	—	—	0.25	—	0.4	2-76	R67	—	179.95
■ ZFSC-12-175	10-500	23	20	24	20	22	18	0.9	1.2	1.0	1.3	1.2	1.6	—	—	—	0.4	0.5	0.8	2-76	R67	—	197.95

L = low range (f_L to 10 f_L) M = mid range (10 f_L to f_U/2) U = upper range (f_U/2 to f_U)

pin connections

see case style outline drawings

PORT	SUM	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12	NOT USED	GND EXT.	CASE GND
bs	29	7	16	31	24	9	2	26	17	4	5	—	—	15	All other pins	All other pins
bu	5	7	8	1	2	31	32	25	26	22	30	19	27	11,14,21	4	All other pins

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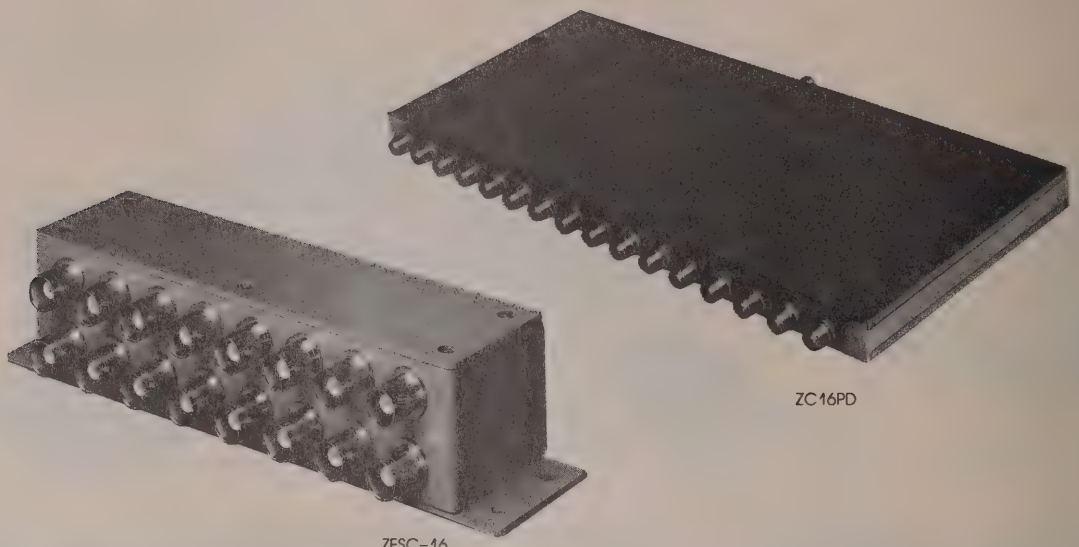
Power Splitter/Combiners

16 WAY–0°
10 KHz to 2100 MHz



ZC16PD

ZFSC–16

MODEL NO.	FREQ. RANGE MHz f_L-f_U	ISOLATION dB L Typ.	ISOLATION dB L Min.	ISOLATION dB M° Typ.	ISOLATION dB M° Min.	ISOLATION dB U Typ.	ISOLATION dB U Min.	INSERTION LOSS, dB Above 12dB L Typ.	INSERTION LOSS, dB Above 12dB L Max.	INSERTION LOSS, dB Above 12dB M° Typ.	INSERTION LOSS, dB Above 12dB M° Max.	INSERTION LOSS, dB Above 12dB U Typ.	INSERTION LOSS, dB Above 12dB U Max.	PHASE UNBALANCE Degrees L Max.	PHASE UNBALANCE Degrees M° Max.	PHASE UNBALANCE Degrees U Max.	AMPLITUDE UNBALANCE dB L Max.	AMPLITUDE UNBALANCE dB M° Max.	AMPLITUDE UNBALANCE dB U Max.	VSWR (:1) S Typ.	VSWR (:1) S Max.	VSWR (:1) OUT Typ.	VSWR (:1) OUT Max.	CAPD DATA (see RF/IF Designer handbook) Page	CASE STYLE Note B	connection	PRICE $ Qty. (1-9)
ZFSC-16-1	0.5-125	30	24	25	18	20	15	1.0	1.2	1.1	1.3	1.2	1.4	1	3	5	0.1	0.2	0.5	see				2-78	R30	–	172.95
■ ZFSC-16-1-75	1-150	30	25	30	25	25	20	0.8	1.1	0.7	1.1	1.0	1.3	1	3	5	0.1	0.2	0.4	Performance				2-77	R30	–	182.95
ZFSC-16-3*	1-30	45	35	45	40	41	35	0.5	0.9	0.5	0.9	0.5	0.9	1	2	3	0.1	0.1	0.1					2-78	R30	–	172.95
✣■ ZFSC-16-675	0.01-25	25	20	40	25	25	20	0.8	1.1	0.4	0.8	1.0	1.6	1	3	5	0.1	0.2	0.4	Data and				2-77	R30	–	189.95
ZFSC-16-12	0.1-200	33	20	27	20	26	20	0.6	1.5	0.7	1.0	0.9	1.2	2	6	9	0.4	0.2	0.4	curves				2-79	R30	–	189.95
ZC16PD-900	800-900			30	20					0.5	1.0							0.5		1.06	1.20	1.06	1.20	2-117	UU179	–	295.00
ZC16PD-960	890-960			28	20					0.5	1.0							0.5		1.06	1.30	1.06	1.20	2-116	UU179	–	295.00
ZC16PD-960W	700-1000			26	15					0.5	1.3							0.6		1.10	1.60	1.06	1.30	2-116	UU179	–	265.00
ZC16PD-1900	1700-1900			30	20					0.5	1.0							0.8		1.15	1.35	1.06	1.30	2-117	UU179	–	349.00
ZC16PD-1900W	1500-2100			30	15					0.7	1.4							0.8		1.25	1.60	1.15	1.35	—	UU179	–	319.00

L=low range (f_L to 10 f_L) M=mid range (10f_L to f_U/2) U=upper range (f_U/2 to f_U)

NOTES:

■ Denotes 75 Ohm model, for coax connector models 75 Ohm BNC connectors are standard.

o When only specification for M range given, specification applies to entire frequency range.

✣ At low range frequency band (f_L to 10 f_L), linearly derate maximum input power by 13 dB.

' For adjacent ports, isolation is 28 dB minimum.
Adjacent ports defined as: (1,3) (5,7) (9,11) (13,15)
(2,4) (6,8) (10,12) (14,16)

A. General Quality Control Procedures, Environmental Specifications, Hi-Rel, MIL and TX description are given in section 0, see "Mini-Circuits Guarantees Quality" article.

B. Connector types and case mounted options, case finishes are given in section 0, see "Case styles & Outline Drawings".

C. Prices and specifications subject to change without notice.

1. Absolute maximum power, voltage and current ratings:
1a. Matched power rating, 1 Watt
1b. Internal load dissipation, 0.87 Watt

NSN GUIDE

MCL NO.	NSN
ZFSC-16-1 (BNC)	5820-01-9321

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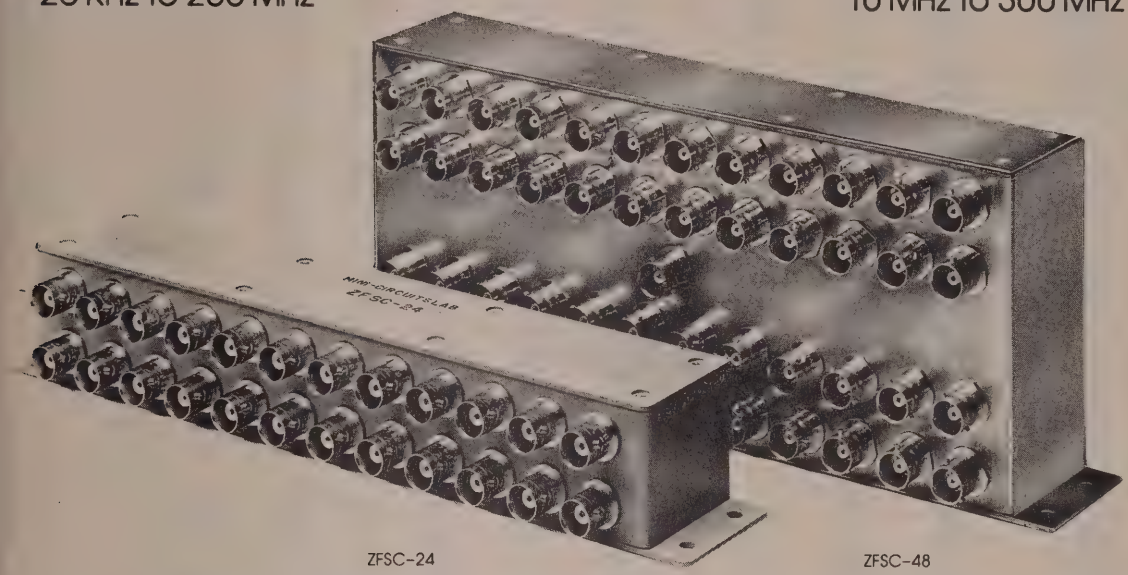
50 ohms and 75 ohms

Mini-Circuits

24 WAY–0°
25 KHz to 200 MHz

48 WAY–0°
10 MHz to 300 MHz



ZFSC–24 ZFSC–48

MODEL NO.	FREQ. RANGE MHz	ISOLATION dB			INSERTION LOSS, dB 24 WAY (above 13.8dB) 48 WAY (above 16.8dB)			AMPLITUDE UNBALANCE dB			CAPD DATA (see RF/IF Designer handbook)	CASE STYLE	connection	PRICE $
	f_L-f_U	L Typ.Min.	M Typ.Min.	U Typ.Min.	L Typ. Max.	M Typ. Max.	U Typ. Max.	L Max.	M Max.	U Max.	Page	Note B		Qty. (1-9)
ZFSC-24-1	0.2-100	25 20	25 20	25 20	1.0 2.0	1.0 2.0	1.0 2.0	0.2	0.4	0.5	2-80	R31	–	264.95
ZFSC-24-11	1-200	33 25	22 20	20 17	0.9 1.7	1.0 1.8	1.3 2.2	0.2	0.8	0.8	2-80	R31	–	274.95
■ ZFSC-24-11-75	1-200	35 25	33 20	27 20	0.6 1.3	0.8 1.5	1.1 2.0	0.2	0.4	0.6	-	R31	–	274.95
✣ ZFSC-24-6	0.025-50	30 25	39 28	30 22	0.4 1.0	0.4 1.0	0.6 1.5	0.2	0.3	0.7	2-81	R31	–	274.95
ZFSC-48-1	10-300	30 25	28 20	23 20	1.0 1.5	1.8 2.2	2.0 2.5	0.6	0.7	0.9	2-82	HH68	–	590.00
■ ZFSC-48-1-75	10-300	30 25	28 20	23 20	1.2 2.0	2.1 2.5	2.3 3.0	0.6	0.7	1.0	2-82	HH68	–	590.00

L=low range (f_L to 10 f_L) M=mid range (10f_L to f_U/2) U=upper range (f_U/2 to f_U)

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For custom versions of standard models consult our applications dept.

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Amplifier Selection Guide

GROUP		MODEL NO.	FREQ. (MHz) f_L f_U	GAIN (dB) MIN.	MAX (1) POWER (dBm)	N.F. (dB) TYP.	3rd ORDER I.P. (dBm)	VSWR IN	VSWR OUT	DC POWER V VOLT	DC POWER I (mA)	CASE STYLE	STD. CONN.	OPTION
MONOLITHIC	PIN	MAR-1	DC-1000	13.0	+1.5	5.5	+14.0	1.3:1	1.3:1	+5.00	17	VV105		SMT ▲
		MAR-2	DC-2000	8.5	+4.5	6.5	+17.0	1.3:1	1.4:1	+5.00	25	VV105		SMT ▲
		MAR-3●	DC-2000	8.0	+10.0	6.0	+23.0	1.5:1	1.7:1	+5.00	35	VV105		SMT ▲
		MAR-4	DC-1000	7.0	+12.5	6.5	+25.5	1.6:1	2.0:1	+5.25	50	VV105		SMT ▲
		MAR-6●	DC-2000	9.0	+2.0	3.0	+14.5	1.5:1	1.4:1	+3.50	16	VV105		SMT ▲
		MAR-7●	DC-2000	8.5	+5.5	5.0	+19.0	1.4:1	1.5:1	+4.00	22	VV105		SMT ▲
		MAR-8	DC-1000	19.0	+12.5	3.3	+27.0	3.1:1	3.1:1	+7.80	36	VV105		SMT ▲
		MAV-1	DC-1000	12.5	+1.5	5.5	+14.0	1.4:1	1.3:1	+5.00	17	BBB123		
		MAV-2	DC-1500	7.5	+4.5	6.5	+17.0	1.3:1	1.4:1	+5.00	25	BBB123		SMT ▲
		MAV-3	DC-1500	7.5	+10.0	6.0	+23.0	1.3:1	1.6:1	+5.00	35	BBB123		SMT ▲
		MAV-4	DC-1000	7.0	+11.5	7.0	+24.5	1.4:1	1.8:1	+5.25	50	BBB123		SMT ▲
		MAV-11	10-1000	9.0	+17.5	3.6	+30.0	1.5:1	1.7:1	+5.50	60	BBB123		SMT ▲
	SMT ▲	RAM-1	DC-1000	13.0	+1.5	5.5	+14.0	1.3:1	1.3:1	+5.00	17	AF190		
		RAM-2	DC-2000	8.5	+4.5	6.5	+17.0	1.2:1	1.4:1	+5.00	25	AF190		
		RAM-3	DC-2000	8.0	+10.0	6.0	+23.0	1.6:1	1.7:1	+5.00	35	AF190		
		RAM-4	DC-1000	7.0	+12.5	6.5	+25.5	1.4:1	1.9:1	+5.25	50	AF190		
		RAM-6	DC-2000	9.0	+2.0	2.8	+14.5	1.4:1	1.3:1	+3.50	16	AF190		
		RAM-7	DC-2000	8.5	+5.5	4.5	+19.0	2.0:1	1.8:1	+4.00	22	AF190		
		RAM-8	DC-1000	19.0	+12.5	3.0	+27.0	3.1:1	3.1:1	+7.80	36	AF190		
VAR. GAIN	CON	ZFL-1000G	10-1000	17.0	+3	12.0	+13	2.0:1	2.0:1	+15.00	100	Y39	SMA	—
		ZFL-1000GH	10-1200	24.0	+13	15.0	+25	2.2:1	2.0:1	+15.00	170	Y39	SMA	—
LOW NOISE (N.F. < 4.0 dB)	PIN	MAN-1LN	0.5-500	28.0	+8	2.8	+18	1.8:1	1.8:1	+12.00	60	A05		
		AMP-76	5-500	26.0	+13.5	3.1	+28	2.0:1	2.0:1	+15.00	68	PP120		
		AMP-77	5-500	15.0	+16	3.3	+32	2.0:1	2.0:1	+15.00	56	PP120		
		AMP-75	5-500	19.0	+12	2.4	+28	2.0:1	2.0:1	+15.00	29	PP120		
		AMP-15	5-1000	13.0	+8	2.8	+22	2.0:1	2.0:1	+15.00	29	PP120		
		AMP-11-2	5-1000	14.0	+3.5	3.0	+13	2.0:1	2.0:1	+15.00	12	PP120		
		MAN-1HLN	10-500	10.0	+15	3.7	+30	1.8:1	1.8:1	+12.00	70	A06		
		TO-0812LN	800-1200	20.0	+8	1.6	+18	2.5:1	2.5:1	+15.00	70	QQ96		
		TO-1217LN	1200-1700	20.0	+10	1.6	+25	2.5:1	2.5:1	+15.00	70	QQ96		
		TO-1724LN	1700-2400	20.0	+10	1.6	+22	2.5:1	2.5:1	+15.00	70	QQ96		
	CON	ZFL-500LN	0.1-500	24.0	+5	2.9	+14	1.5:1	1.6:1	+15.00	60	Y39	SMA	BNC
		ZFL-1000LN	0.1-1000	20.0	+3	2.9	+14	1.5:1	2.0:1	+15.00	60	Y39	SMA	—
		ZFL-500HLN	10-500	19.0	+16	3.8	+30	1.5:1	1.5:1	+15.00	110	Y39	SMA	—
		ZEL-0812LN	800-1200	20.0	+8	1.5	+18	2.5:1	2.5:1	+15.00	70	EEE132	SMA	—
		ZHL-0812HLN	800-1200	30.0	+26	1.5	+36	2.4:1	2.4:1	+15.00	725	NN92	SMA	
		ZEL-1217LN	1200-1700	20.0	+10	1.5	+25	2.5:1	2.5:1	+15.00	70	EEE132	SMA	—
		ZHL-1217HLN	1200-1700	30.0	+26	1.5	+36	2.4:1	2.4:1	+15.00	725	NN92	SMA	
		ZEL-1724LN	1700-2400	20.0	+10	1.5	+22	2.5:1	2.5:1	+15.00	70	EEE132	SMA	—
		ZHL-1724HLN	1700-2400	30.0	+26	1.5	+36	2.4:1	2.4:1	+15.00	725	NN92	SMA	
HIGH ISOLATION	PIN	MAN-2AD	2-1000	9.0	−2	6.5	+14	2.0:1	2.0:1	+15.00	22	A05		
		MAN-11AD	2-2000	8.0	−3.5	6.5	+14	3.0:1	2.0:1	+15.00	22	A05		
		MAN-1AD	5-500	16.0	+7	7.2	+20	1.6:1	1.7:1	+12.00	85	A05		
	CON	ZFL-2AD	2-1000	10.0	−2	6.5	+14	2.0:1	2.0:1	+15.00	22	Y39	SMA	—
		ZFL-11AD	2-2000	8.0	−3.5	6.5	+14	2.5:1	2.0:1	+15.00	22	Y39	SMA	—
		ZFL-1HAD	10-500	10.0	+20	7.5	+30	1.3:1	1.35:1	+15.00	115	SS98	SMA	—
		ZHL-1HLD	225-400	23.0	+27	2.5	+40	2.0:1	2.0:1	+24.00	525	T34	SMA	—

(1) Minimum output power at 1 dB gain compression

▲ SMT Surface Mount

● Alternate package style SOT 143, see VAM series on page 3-15

Using the Selection Guide

Locate the Mini-Circuits' amplifier best suited for your particular application quickly with this convenient Selection Guide. Amplifiers are grouped into eight major categories and then listed in the sequence of frequency span.

If your amplifier requirements are not met by the catalog models listed, we encourage you to contact our Application Engineering Department. You will find them courteous and eager to support your needs with their depth of knowledge coupled with our extensive database on engineering and catalog models.

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GROUP		MODEL NO.	FREQ. (MHz) f_L f_u	GAIN (dB) MIN.	MAX(1) POWER (dBm)	N.F. (dB) TYP.	3rd ORDER I.P. (dBm)	VSWR IN	VSWR OUT	DC POWER V VOLT	DC POWER I (mA)	CASE STYLE	STD. CONN.	OPTION
LOW POWER	PIN	MAN-1	0.5-500	28.0	+8	4.5	+18	1.8:1	1.8:1	+12.00	60	A05		
		MAN-2	0.5-1000	18.0	+9	6.0	+19	1.8:1	1.8:1	+12.00	85	A05		
		AMP-74	5-500	27.0	+7	5.0	+20	2.0:1	2.0:1	+15.00	44	PP120		
		AMP-3G	30-3000	8.0	+9.5	3.5	+20	2.6:1	2.5:1	+15.00	55	PP120		
	CON	ZFL-500	0.05-500	20.0	+9	5.3	+18	1.9:1	1.9:1	+15.00	60	Y39	SMA	BNC
		ZFL-1000	0.1-1000	17.0	+9	6.0	+18	1.5:1	2.0:1	+15.00	105	Y39	SMA	—
		ZFL-750	0.2-750	18.0	+9	6.0	+18	1.5:1	2.0:1	+15.00	90	Y39	SMA	—
MEDIUM POWER	PIN	AMP-2000	10-2000	20.0	+16	5.0	+25	2.0:1	2.0:1	+15.00	100	QQ96		
	CON	ZHL-6A	.0025-500	21.0	+23	7.5	+34	1.8:1	2.0:1	+24.00	350	S32	BNC	—
		ZFL-1000H	10-1000	28.0	+20	5.0	+33	2.0:1	2.0:1	+15.00	150	SS98	SMA	—
		ZFL-1000VH	10-1000	20.0	+26	4.5	+38	1.8:1	2.0:1	+15.00	320	SS98	SMA	—
		ZFL-2000	10-2000	20.0	+16	7.0	+25	2.0:1	2.0:1	+15.00	100	SS98	SMA	—
		ZHL-1042J	10-4200	25.0	+20	4.5	+30	2.5:1	2.5:1	+15.00	300	NN92	SMA	—
HIGH POWER (UP TO 10W)	CON	ZHL-32A	.05-130	25.0	+29	10.0	+38	2.0:1	2.0:1	+24.00	600	S32	BNC	SMA,N
		ZHL-3A	.4-150	24.0	+29.5	11.0	+38	2.0:1	2.0:1	+24.00	600	S32	BNC	SMA,N
		ZHL-5W-1	1-500	40.0	+37	8.0	+49	2.0:1	2.5:1	+24.00	3300	DDD131	SMA	—
		ZHL-1A	2-500	16.0	+28	11.0	+38	2.0:1	2.0:1	+24.00	600	S32	BNC	SMA,N
		ZHL-1-2W	5-500	29.0	+33	12.0	+44	2.0:1	2.0:1	+24.00	900	T35	BNC	SMA,N
		ZHL-2	10-1000	16.0	+29	9.0	+38	2.0:1	2.0:1	+24.00	600	T34	BNC	SMA,N
		ZHL-2-8	10-1000	27.0	+29	10.0	+38	2.0:1	2.0:1	+24.00	600	T34	BNC	SMA,N
		ZHL-2-12	10-1200	24.0	+29	10.0	+38	2.0:1	2.0:1	+24.00	750	T34	SMA	—
		ZHL-42W	10-4200	30.0	+28	8.0	+38	2.5:1	2.5:1	+15.00	880	U36	SMA	—
		ZHL-4240W	10-4200	40.0	+28	8.0	+38	2.5:1	2.5:1	+15.00	900	U36	SMA	—
		ZHL-900-10W	480-900	19.0	+38	10.0	+50	2.0:1	2.0:1	+24.00	5500	DDD131	SMA	—
		ZHL-1000-3W	500-1000	38.0	+35	9.0	+45	2.0:1	2.5:1	+24.00	2000	DDD131	SMA	—
		ZHL-7-2W	600-800	28.0	+33	12.0	+43	2.0:1	2.0:1	+24.00	900	T35	BNC	SMA,N
		ZHL-42	700-4200	30.0	+28	10.0	+38	2.5:1	2.5:1	+15.00	880	U36	SMA	—
		ZHL-4240	700-4200	40.0	+28	8.0	+38	2.5:1	2.5:1	+15.00	900	U36	SMA	—
LOW DISTORTION FEED FORWARD	CON	ZHL-1-50P3	50-500	22.0	+30	7.0	+50	1.5:1	1.5:1	+24.00	1300	U200	SMA	—
		ZHL-2-50P3	50-1000	21.0	+25	8.0	+43	2.0:1	2.0:1	+24.00	650	U200	SMA	—

Environmental Specifications

MODEL	OPERATING TEMP.	STORAGE TEMP.	STABILIZATION BAKE (NON-OPER.) 125°C 24 hr.	TEMPERATURE CYCLING (NON-OPER.) −55°C TO +100°C	CONSTANT ACCELERATION (Y_1 PLANE ONLY)	BURN-IN (DC. ON) 85°C 160 hr.	SEAL TEST FINE	SEAL TEST GROSS
AMP	−54°C→ 85°C	−55°C→100°C	✓	✓	✓	✓	✓	✓
MAN	−54°C→ 85°C	−55°C→100°C	✓	✓	✓	✓	✓	✓
MAR	−20°C→ 85°C	−55°C→100°C	✓	✓	✓	✓	N.A.	N.A.
MAV/VAM	−20°C→ 85°C	−55°C→100°C	✓	✓	✓	✓	N.A.	N.A.
TO	−54°C→ 85°C	−55°C→100°C	✓	✓	✓	✓	✓	✓
ZEL	−54°C→ 85°C	−55°C→100°C	✓	✓	N.A.	✓	N.A.	N.A.
ZFL	−20°C→ 71°C	−55°C→100°C	✓	✓	N.A.	✓	N.A.	N.A.
ZFL-2000	−55°C→100°C	−55°C→100°C	✓	✓	N.A.	✓	N.A.	N.A.
ZHL	−20°C→ 65°C	−55°C→100°C	✓	✓	N.A.	✓	N.A.	N.A.
ZHL-HLN	−54°C→ 65°C	−55°C→100°C	✓	✓	N.A.	✓	N.A.	N.A.
RAM	−54°C→125°C	−65°C→+150°C	✓	✓	✓	✓	✓	✓

NOTES: Units are designed and manufactured to meet the environmental specifications as indicated.

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For custom versions of standard models consult our applications dept.

CAPO now available! computer-automated performance data

broadband plug-in and surface mount
Monolithic Amplifiers

50 ohms

up to 56 mW (+ 17.5 dBm) output
dc to 2 GHz

case style selection

outline drawings Table of Contents

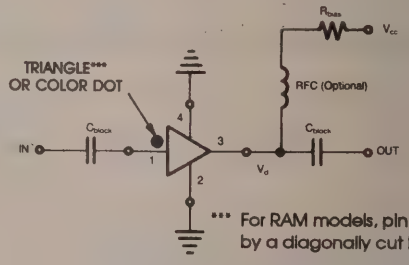
RAM

MAR

MAR-SM

MODEL NO.	○FREQ. MHz f_L	f_U	GAIN, dB Typical (at MHz) 100	500	1000	2000	note 2 MIN.	MAXIMUM POWER, dBm Typ. Output (1 dB Comp.)	Input (no damage)	DYNAMIC RANGE NF dB Typ.	IP3 dBm Typ.	VSWR Typ. In	Out	MAXIMUM RATING (25 °C) I (mA)	P (mW)	DC POWER at Pin 3 Current (mA)	Volt Typ.	CAPD DATA (see RF/IF Designer Handbook) Page	Case Style Note B	CONNECTION	Price◆ $ (Qty 25)
❑ MAR-1	DC	1000	18.5	17.5	15.5	—	13.0	+1.5	+13	5.5	+14.0	1.3:1	1.3:1	40	200	17	5.00	3-22	VV105	cb	0.99
❑ MAR-2	DC	2000	12.5	12.3	12.0	11.0	8.5	+4.5	+13	6.5	+17.0	1.3:1	1.4:1	60	325	25	5.00	3-22	VV105	cb	1.35
❑ MAR-3	DC	2000	12.5	12.2	12.0	10.5	8.0	+10.0	+13	6.0	+23.0	1.5:1	1.7:1	70	400	35	5.00	3-22	VV105	cb	1.45
❑ MAR-4	DC	1000	8.3	8.2	8.0	—	7.0	+12.5	+13	6.5	+25.5	1.6:1	2.0:1	85	500	50	5.25	3-23	VV105	cb	1.55
❑ MAR-6	DC	2000	20.0	18.5	16.0	11.0	9.0	+2.0	+13	3.0	+14.5	1.5:1	1.4:1	50	200	16	3.50	3-23	VV105	cb	1.29
❑ MAR-7	DC	2000	13.5	13.1	12.5	11.0	8.5	+5.5	+13	5.0	+19.0	1.4:1	1.5:1	60	275	22	4.00	3-23	VV105	cb	1.75
❑ MAR-8	DC	1000	32.5	28.0	22.5	—	19.0	+12.5	+13	3.3	+27.0	#	#	65	500	36	7.80	3-24	VV105	cb	1.70
❑● MAR-1SM	DC	1000	18.5	17.5	15.5	—	13.0	+1.5	+13	5.5	+14.0	1.3:1	1.2:1	40	200	17	5.00	3-22	WW107	cb	1.04
❑● MAR-2SM	DC	2000	12.5	12.3	12.0	11.0	8.5	+4.5	+13	6.5	+17.0	1.5:1	1.4:1	60	325	25	5.00	3-22	WW107	cb	1.40
❑● MAR-3SM	DC	2000	12.5	12.2	12.0	10.5	8.0	+10.0	+13	6.0	+23.0	1.5:1	1.7:1	70	400	35	5.00	3-22	WW107	cb	1.50
❑● MAR-4SM	DC	1000	8.3	8.2	8.0	—	7.0	+12.5	+13	7.0	+25.5	1.5:1	1.9:1	85	500	50	5.25	3-23	WW107	cb	1.60
❑● MAR-6SM	DC	2000	20.0	18.5	16.0	11.0	9.0	+2.0	+13	3.0	+14.5	1.7:1	1.7:1	50	200	16	3.50	3-23	WW107	cb	1.34
❑● MAR-7SM	DC	2000	13.5	13.1	12.5	11.0	8.5	+5.5	+13	5.0	+19.0	1.7:1	1.7:1	60	275	22	4.00	3-23	WW107	cb	1.80
❑● MAR-8SM	DC	1000	32.5	28.0	22.5	—	19.0	+12.5	+13	3.3	+27.0	#	#	65	500	36	7.80	3-24	WW107	cb	1.75
● RAM-1	DC	1000	19.0	17.5	15.5	—	13.0	+1.5	+13	5.5	+14.0	1.3:1	1.3:1	40	200	17	5.00	3-22	AF190	cb	4.95
● RAM-2	DC	2000	12.5	12.0	11.8	11.0	8.5	+4.5	+13	6.5	+17.0	1.2:1	1.4:1	60	325	25	5.00	3-22	AF190	cb	4.95
● RAM-3	DC	2000	12.5	12.2	12.0	10.5	8.0	+10.0	+13	6.0	+23.0	1.6:1	1.7:1	80	425	35	5.00	3-22	AF190	cb	4.95
● RAM-4	DC	1000	8.5	8.2	8.0	—	7.0	+12.5	+13	6.5	+25.5	1.4:1	1.9:1	100	540	50	5.25	3-23	AF190	cb	4.95
● RAM-6	DC	2000	20.0	19.0	16.0	11.0	9.0	+2.0	+13	2.8	+14.5	1.4:1	1.3:1	50	200	16	3.50	3-23	AF190	cb	4.95
● RAM-7	DC	2000	13.5	13.1	12.5	11.0	8.5	+5.5	+13	4.5	+19.0	2.0:1	1.8:1	60	275	22	4.00	3-23	AF190	cb	4.95
● RAM-8	DC	1000	32.5	28.0	23.0	—	19.0	+12.5	+13	3.0	+27.0	#	#	65	420	36	7.80	3-24	AF190	cb	4.95

Typical Biasing Configuration



*** For RAM models, pin 1 is identified by a diagonally cut lead.

NOTES:

- •• Typical gain at 1500 MHz
- ❑ Non-hermetic
- ● Surface-mount, available on tape and reel
- ◆ Price of MAR-1 and MAR-1SM are for 100 quantity, price of RAM models is for 1-9 quantity.
- # Dash-8 models input and output impedances are not 50 ohms, see S-parameter data. Conditionally stable, source and load VSWR<3:1 required. Dash-6 models conditionally stable, source and load VSWR<5:1 required.
- ○ Low frequency cutoff determined by external coupling capacitors.
- B. Connector types and case mounted options, case finishes are given in section 0, see "Case styles & outline drawings".
- C. Prices and specifications subject to change without notice.
- D. For Quality Control Procedures see section 0, "Mini-Circuits Guarantees Quality" article. For Environmental Specifications see page 3-13.
- 2. Minimum gain at highest frequency and over full temperature range.
- 3. Model number designated by color dot or alphanumeric code marking.
- 4. Frequency at which output power, NF and IP3 are specified: 500MHz for MAR-1, MAR-6, MAR-1SM, MAR-6SM, RAM-1, RAM-6, MAV-1, MAV-11, VAM-6, 1000MHz for all other models.
- 5. MAV-1SM thru MAV-11SM available on tape and reel, see case style RRR137 outline drawing.
- 6. Dash-6 models potentially unstable with very high VSWR terminations.

marking identification

Model	Alphanumeric Code	Color Dot
MAR-1/SM	A01	Brown
MAR-2/SM	A02	Red
MAR-3/SM	A03	Orange
MAR-4/SM	A04	Yellow
MAR-6/SM	A06	White
MAR-7/SM	A07	Violet
MAR-8/SM	A08	Blue
RAM-1	1	—
RAM-2	2	—
RAM-3	3	—
RAM-4	4	—
RAM-6	6	—
RAM-7	7	—
RAM-8	8	—
MAV-1/SM	1	—
MAV-2/SM	2	—
MAV-3/SM	3	—
MAV-4/SM	4	—
MAV-11/SM	A	—
VAM-3	A03	—
VAM-6	A06	—
VAM-7	A07	—

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Mini-Circuits

MAV

VAM

VAM Actual size

MODEL NO.	●FREQ. MHz f_L	f_u	GAIN, dB Typical (at MHz) 100	500	1000	2000	note 2 MIN.	MAXIMUM POWER, dBm Typ Output (1 dB Comp.)	Input (no damage)	DYNAMIC RANGE NF dB Typ.	IP3 dBm Typ.	VSWR Typ. In	Out	MAXIMUM RATING (25 °C) I (mA)	P (mW)	DC POWER at Pin 3 Current (mA)	Volt Typ.	CAPD DATA (see RF/IF Designer Handbook) Page	Case Style Note B	CONNECTION	Price $ (QTY 25)
❑ MAV-1	DC	1000	18.5	17.0	15.0	—	12.5	+1.5	+13	5.5	+14.0	1.4:1	1.3:1	40	200	17	5.00	3-24	BBB123	cb	1.10
❑ MAV-2	DC	1500	12.5	12.0	11.0	10.0**	7.5	+4.5	+13	6.5	+17.0	1.3:1	1.4:1	60	325	25	5.00	3-24	BBB123	cb	1.40
❑ MAV-3	DC	1500	12.5	12.0	11.0	10.0**	7.5	+10.0	+13	6.0	+23.0	1.3	1	1.6:1	70	400	35	5.00	3-25	BBB123	cb	1.50
❑ MAV-4	DC	1000	8.3	8.0	7.5	—	7.0	+11.5	+13	7.0	+24.5	1.4:1	1.8:1	85	500	50	5.25	3-25	BBB123	cb	1.60
❑ MAV-11	10	1000	12.7	12.0	10.5	—	9.0	+17.5	+13	3.6	+30.0	1.5:1	1.7:1	80	550	60	5.50	3-25	BBB123	cb	2.10
❑● VAM-3	DC	2000	11.5	11.5	11.0	9.5	7.5	+9.0	+13	6.0	+22.0	1.5:1	1.7:1	60	240	35	4.70	3-26	MMM168	cb	1.45
❑● VAM-6	DC	2000	19.5	18.0	15.0	10.0	8.0	+2.0	+13	3.0	+14.0	1.6:1	1.5:1	40	125	16	3.30	3-26	MMM168	cb	1.29
❑● VAM-7	DC	2000	13.0	12.6	12.0	9.8	7.8	+5.5	+13	5.0	+18.0	1.5:1	1.5:1	50	175	22	3.80	3-26	MMM168	cb	1.75

features

- cascadable
- excellent repeatability
- wide bandwidth DC-2000 MHz
- unconditionally stable, except MAR-6, MAR-6SM, RAM-6, VAM-6, MAR-8, MAR-8SM, RAM-8
- low cost, MAR, MAV, VAM models
- hermetically sealed, RAM models
- low noise figure, 2.8 to 3.6 dB typ. MAR–6, MAR–8, MAV–11, RAM–6, RAM–8, VAM–6
- high output power, +17 dBm typ., MAV–11

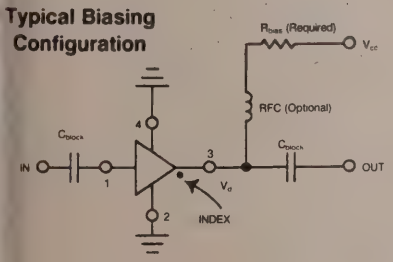
NSN GUIDE

MCL No.	NSN
MAR-3	5962-01-339-2933

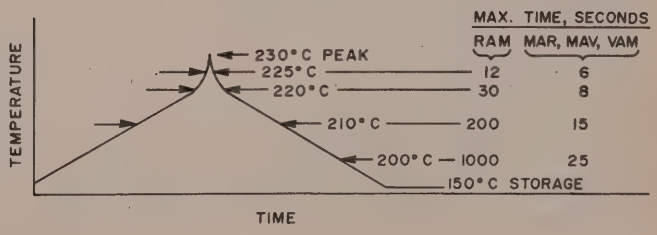
pin connections

PORT	cb
RF IN	1
RF OUT	3
DC	3
CASE GND	2,4
NOT USED	—

Typical Biasing Configuration



REFLOW - SOLDERING PROFILE



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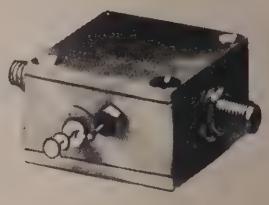
broadband, linear
Low-Noise Amplifiers

up to 40mW (+16dBm) output
0.1 to 1000 MHz

case style selection
outline drawings see Table of Contents

AMP

MAN


ZFL

MODEL NO.	FREQ. MHz f_L	FREQ. MHz f_u	GAIN, dB Min.	Flatness Max. m	Flatness Max. Total Range	MAXIMUM POWER, dBm Output (1 dB Comp.)	MAXIMUM POWER, dBm Input (no damage)	DYNAMIC RANGE NF dB Typ.	DYNAMIC RANGE IP3 dBm Typ.	VSWR In	VSWR Out	DC POWER Volt V.	DC POWER Current (mA)	CAPD DATA (see RF/IF Designer Handbook) Page	Case Style Note B	CONNECTION	Price $ Qty (1-9)
AMP-11-2	5	1000	14	±1.0	±1.0	-3.5	+13	3	+13	2:1	2:1	15	12	3-27	PP120	cd	44.95
AMP-15	5	1000	13	±0.6	±1.2	+8	+13	2.8	+22	2:1	2:1	15	29	3-27	PP120	cd	40.95
AMP-75	5	500	19	±0.4	±1.0	+12	+13	2.4	+28	2:1	2:1	15	29	3-27	PP120	cd	43.95
AMP-76	5	500	26	±0.7	±1.0	+13.5	+6	3.1	+28	2:1	2:1	15	68	3-35	PP120	cd	78.95
AMP-77	5	500	15	±0.4	±1.0	+16	+13	3.3	+32	2:1	2:1	15	56	3-28	PP120	cd	45.95
MAN-1LN	0.5	500	28	±0.5	±1.4	+8	+15	2.8	+18	1.8:1	1.8:1	12	60	3-28	A05	cc	19.95
MAN-1HLN	10	500	10	±0.5	±0.8	+15	+15	3.7	+30	1.8:1	1.8:1	12	70	3-28	A06	cc	19.95
ZFL-500HLN	10	500	19	—	±0.4	+16	+15	3.8	+30	2:1	2:1	15	110	3-29	Y39	-	99.95
ZFL-500LN*	0.1	500	24	—	±0.3	+5	+5	2.9	+14	1.5:1	1.6:1	15	60	3-29	Y39	-	79.95
ZFL-1000LN	0.1	1000	20	—	±0.5	+3	+5	2.9	+14	1.5:1	2:1	15	60	3-29	Y39	-	89.95

L_W = Low Range (f_L to $f_{u/2}$) m = mid Range (2 f_L to $f_{u/2}$) U = Upper Range ($f_{u/2}$ to f_u)

features
- ideal for printed-circuit designs (MAN & AMP series)
- smooth response over entire band, no external resonances
- low impedance, less susceptible to EMI
- easy to use, 50 ohm input/output
- all models are cascadable

NOTES
* VSWR 1.6:1 maximum from 0.1 to 0.2 MHz. Also available with BNC connectors.
△ Available only with SMA connectors
B. Connector types and case mounted options, case finishes are given in section 0, see "Case styles & outline drawings".
C. Prices and specifications subject to change without notice.
D. For Quality Control Procedures see section 0, "Mini-Circuits Guarantees Quality" article. For Environmental Specifications see page 3-13.
1. Absolute maximum power, voltage and current rating:
1a. AMP models, 17V DC.
1b. MAN models, 12.5V DC.
2. With no load at output, derates maximum input power (no damage) by 10 dB.
3. ZEL and TO models, NF specified at room temperature, increases to 2 dB typical at +85 deg.C.
4. ZHL models, NF specified at room temperature, increases to 2.3 dB maximum at +65 deg.C.

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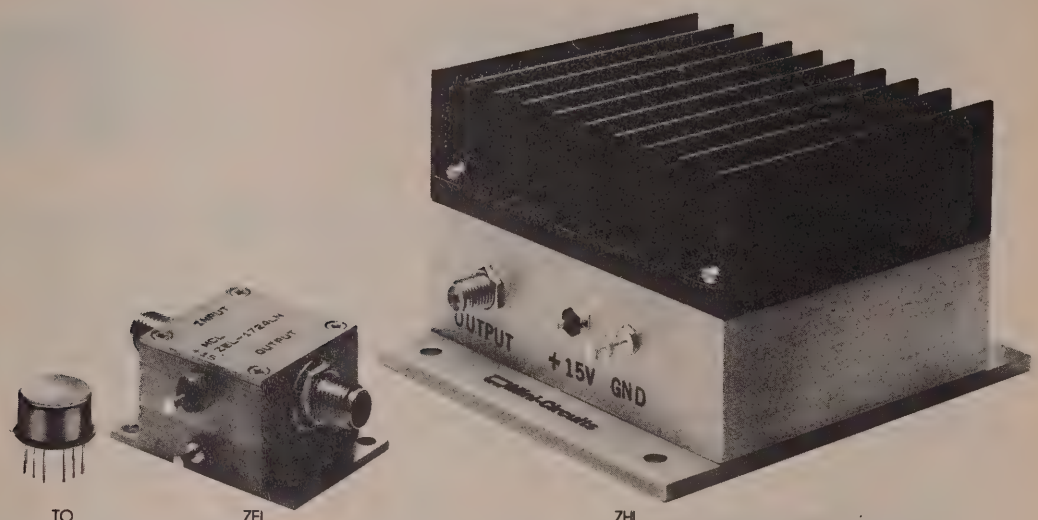
50 ohms

Mini-Circuits

up to 400 mW (+26 dBm) output
800 to 2400 MHz



TO ZEL ZHL

MODEL NO.	FREQ. MHz f_L	f_u	NF, dB Max.	GAIN, dB Min.	Flatness Max.	MAXIMUM POWER, dBm Output (1 dB Comp.)	Input (no damage)	INTERCEPT POINT, dBm IP3 Typ.	VSWR In	Out	DC POWER Volt V.	Current (mA)	CAPD DATA (see RF/IF Designer Handbook) Page	Case Style Note B	CONNECTION	Price $ Qty (1-9)
TO-0812LN	800-1200		1.6	20	±1.0	+8	+13	+18	2.5:1	2.5:1	15	70	3-30	QQ96	ce	199.00
TO-1217LN	1200-1700		1.6	20	±1.0	+10	+13	+25	2.5:1	2.5:1	15	70	3-30	QQ96	ce	199.00
TO-1724LN	1700-2400		1.6	20	±1.0	+10	+13	+22	2.5:1	2.5:1	15	70	3-30	QQ96	ce	199.00
ZEL-0812LN	800-1200		1.5	20	±1.0	+8	+13	+18	2.5:1	2.5:1	15	70	3-31	EEE132	-	274.95
ZEL-1217LN	1200-1700		1.5	20	±1.0	+10	+13	+25	2.5:1	2.5:1	15	70	3-31	EEE132	-	274.95
ZEL-1724LN	1700-2400		1.5	20	±1.0	+10	+13	+22	2.5:1	2.5:1	15	70	3-31	EEE132	-	274.95
ZHL-0812HLN	800-1200		1.5	30	±1.0	+26	+10	+36	2.4:1	2.4:1	15	725	3-32	NN92	-	349.95
ZHL-1217HLN	1200-1700		1.5	30	±1.0	+26	+10	+36	2.4:1	2.4:1	15	725	3-32	NN92	-	349.95
ZHL-1724HLN	1700-2400		1.5	30	±1.0	+26	+10	+36	2.4:1	2.4:1	15	725	3-32	NN92	-	349.95

features

- very low noise
- high dynamic range (ZHL–HLN series)
- ideal for printed-circuit designs (TO series)
- smooth response over entire band, no external resonance
- easy to use, 50 ohms input/output
- all models are cascadable

pin connections

PORT	cc	cd	ce
RF IN	1	2	5
RF OUT	8	4	11
DC	5	1	2
CASE GND	2,3,4,6	3	1,3,4,6,7,8,9,10,12
NOT USED	7	—	—

CAPD now available! computer-automated performance data

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88

broadband, linear
Amplifiers

Variable Gain

up to 20mW (+13 dBm) output
10 to 1200 MHz

case style selection

outline drawings see Table of Contents

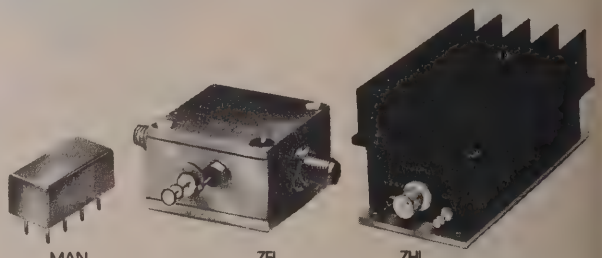
ZFL

MODEL NO.	FREQ. MHz f_L	FREQ. MHz f_u	GAIN, dB Min.	GAIN, dB Flatness Max.	GAIN, dB Control range	MAXIMUM POWER, dBm Output (1 dB Comp.)	MAXIMUM POWER, dBm Input (no damage)	DYNAMIC RANGE NF dB Typ.	DYNAMIC RANGE IP3 dBm Typ.	VSWR In	VSWR Out	DC POWER Volt V.	DC POWER Current (mA)	CAPD DATA (see RF/IF Designer Handbook) Page	Case Style Note B	CONNECTION	Price $ Qty (1-9)
ZFL-1000GH *	10	1200	24	±1.5	30**	+13	+10	15	+25	2.2:1	2:1	15	170	3-35	Y39	-	219.00
ZFL-1000G *	10	1000	17	±1.5	30**	+3	+10	12	+13	2:1	2:1	15	100	3-30	Y39	-	199.00

* ZFL-1000GH and ZFL-1000G, all specifications at 0 Volts control voltage.
** Response time (10% to 90%) 25µsec., control voltage 0 to 5 volts.

High Isolation

up to 500mW (+27 dBm) output
2 to 2000 MHz



MAN ZFL ZHL

MODEL NO.	FREQ. MHz f_L	FREQ. MHz f_u	GAIN, dB Min.	GAIN, dB Flatness Max. m	GAIN, dB Flatness Max. Total Range	MAX. POWER, dBm Output (1 dB Comp.) L_W	MAX. POWER, dBm Output (1 dB Comp.) U	MAX. POWER, dBm Input (no damage)	DYNAMIC RANGE NF dB Typ.	DYNAMIC RANGE IP3 dBm Typ.	VSWR In	VSWR Out	ACTIVE DIRECTIVITY* dB L_W Typ.	ACTIVE DIRECTIVITY* dB L_W Min.	ACTIVE DIRECTIVITY* dB U Typ.	ACTIVE DIRECTIVITY* dB U Min.	DC POWER Volt V.	DC POWER Current (mA)	CAPD DATA (see RF/IF Designer Handbook) Page	Case Style Note B	CONNECTION	Price $ Qty (1-9)
MAN-1AD	5	500	16	±0.5	±1.0	+7	+6	+15	7.2	+20	1.6:1	1.7:1	35	25	30	20	12	85	3-34	A05	cc	26.45
MAN-11AD	2	2000	8	±0.5	±1.5	-2	-3.5	+10	6.5	+14	3.0:1	2.0:1	21	14	16	12	15	22	3-34	A05	cc	31.95
MAN-2AD	2	1000	9	±0.4	±0.7	-2	-2	+10	6.5	+14	2.0:1	2.0:1	24	19	19	14	15	22	3-34	A05	cc	23.95
ZFL-11AD	2	2000	8	±0.5	±1.3	-2	-3.5	+10	6.5	+14	2.5:1	2.0:1	21	14	16	12	15	22	3-34	Y39	-	91.95
ZFL-2AD	2	1000	10	±0.4	±0.5	-2	-2	+10	6.5	+14	2.0:1	2.0:1	24	19	19	14	15	22	3-34	Y39	-	83.95
ZFL-1HAD**	10	500	10	—	±1.0	+20	+20	+17	7.5	+30	1.3:1	1.35:1	30	20	25	18	15	115	3-35	SS98	-	210.00
△ ZHL-1HLD	225	400	23	—	±1.0	+27	+27	+10	2.5	+40	2.0:1	2.0:1	34	28	34	28	24	525	3-35	T34	-	395.00

L_W = Low Range (f_L to $f_{u/2}$) m = mid Range (2 f_L to $f_{u/2}$) U = Upper Range ($f_{u/2}$ to f_u)

* Active Directivity (dB) = Isolation (dB) - Gain (dB)
** Input VSWR of ZFL-1HAD in 10-20 MHz band increases to 1.45:1 at -55 deg.C.

NOTES:

△ Available only with SMA connectors
▼ SMA standard: Also available with BNC or type N connectors, please consult factory.
B. Connector types and case mounted options, case finishes are given in section 0, see "Case styles & outline drawings".
C. Prices and specifications subject to change without notice.
D. For Quality Control Procedures see section 0, "Mini-Circuits Guarantees Quality" article. For Environmental Specifications see page 3-13.
1. Absolute maximum power, voltage and current rating:
   1a. AMP models, 17V DC
   1b. MAN models, 12.5V DC
   1c. ZHL models, 28V DC (except ZHL-1HAD, 17V DC)
   1d. ZFL models, 17V DC (except ZFL-AD, 16V DC)
2. With no load output, derate maximum input power (no damage) by 10 dB.

pin connections

PORT	cc	cd
RF IN	1	2
RF OUT	8	4
DC	5	1
CASE GND	2,3,4,6	3
NOT USED	7	—

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50 ohms

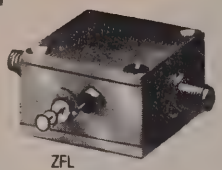
Mini-Circuits

Low Power

up to 10mW (+10 dBm) output
50 KHz to 3000 MHz

case style selection

outline drawings see Table of Contents


ZFL

AMP

MAN

MODEL NO.	FREQ. MHz f_L	f_U	GAIN, dB Min.	Flatness Max.	MAXIMUM POWER, dBm Output (1 dB Comp.) L_W	U	Input (no damage)	DYNAMIC RANGE NF dB Typ.	IP3 dBm Typ.	VSWR In	Out	DC POWER Volt V.	Current (mA)	CAPD DATA (see RF/IF Designer Handbook) Page	Case Style Note B	CONNECTION	Price $ Qty (1-9)
▼ ZFL-500	0.05	500	20	±1.0	—	+9	+5	5.3	+18	1.9:1	1.9:1	15	80	3-37	Y39	-	69.95
ZFL-750	0.2	750	18	±0.5	—	+9 ***	+5	6.0	+18	1.5:1	2:1	15	90	3-37	Y39	-	74.95
ZFL-1000	0.1	1000	17	±0.6	—	+9 *	+5	6.0	+18	1.5:1	2:1*	15	105	3-37	Y39	-	79.95
AMP-3G	30	3000	8	±0.75	+9.5	+9.5	+13	3.5**	+20	2.6:1	2.5:1	15	55	3-38	PP120	cd	89.95
AMP-74	5	500	27	±1.0	+7.0	+7.0	+13	5.0	+20	2:1	2:1	15	44	3-36	PP120	cd	44.95
MAN-1	0.5	500	28	±1.4	+8	+8	+15	4.5	+18	1.8:1	1.8:1	12	60	3-36	A05	cc	15.95
MAN-2	0.5	1000	18	±1.5	+9	+7	+15	6.0	+19	1.8:1	1.8:1	12	85	3-36	A05	cc	19.95

L_W = low range (f_L to $f_U/2$) m = mid range ($2f_L$ to $f_U/2$) U = upper range ($f_U/2$ to f_U)

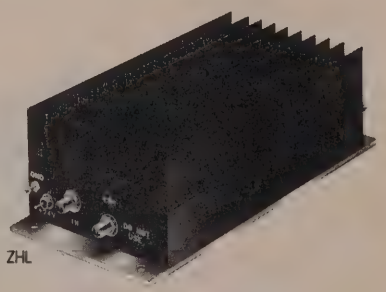
* ZFL-1000 output VSWR 2.8:1 maximum over 750-1000 MHz; 1 dB compression +7 dBm at 500-1000 MHz.
** NF increases with decreasing frequency, 5 dB typical at 300 MHz, and 10 dB typical at 30 MHz.
*** +7 dBm from 500 to 750 MHz.

High Power

feed-forward, low-distortion

case style selection

outline drawings see Table of Contents


ZHL

MODEL NO.	FREQ. MHz f_L	f_U	GAIN, dB Min.	Flatness Max.	MAX. POWER, dBm Output (1 dB Comp.)	Input (no damage)	DYNAMIC RANGE NF dB Typ.	Intercept Point dBm, Min 2nd** order In-Band	3rd* order	VSWR In/Out	DC POWER Volt V.	Current (A)	CAPD DATA (see RF/IF Designer Handbook) Page	Case Style Note B	CONNECTION	Price $ Qty (1-9)
ZHL-1-50P3	50	500	22	±1.0	+27***	+15	7	+70	+50	1.5:1	24	1.30	3-47	U200	-	695.00
ZHL-2-50P3	50	1000	21	±1.0	+25	+15	8	+63	+43	2.0:1	24	0.65	3-47	U200	-	895.00

* IP3 measured at +15 dBm output each fundamental tone, at room temperature.
** IP2 +50 dBm typical for out band products.
*** +30 dBm at 50-250 MHz.

features

- high 3rd order I.P., typically 20 dB above 1 dB compression
- high 2nd order I.P., typically 40 dB above 1 dB compression
- high reverse isolation, 55 dB typical (ZHL-1-50P3), 45 dB typical (ZHL-2-50P3)

CAPD now available! computer-automated performance data

In Stock...Immediate Delivery

For custom versions of standard models consult our applications dept.

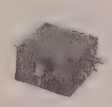
broadband, linear Amplifiers

Medium Power

up to 400mW (+26 dBm) output
2.5 KHz to 4.2 GHz

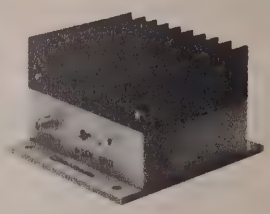
case style selection

outline drawings see Table of Contents

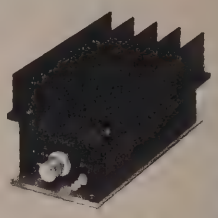


ZFL-case Y39

ZFL-case SS98



ZHL-1042J



ZHL-A

AMP

MODEL NO.	FREQ. MHz f_L	f_U	GAIN, dB Min.	Flatness Max.	MAXIMUM POWER, dBm Output (1 dB Comp.)	Input (no damage)	DYNAMIC RANGE NF dB Typ.	IP3 dBm Typ.	VSWR In	Out	DC POWER Volt V.⊕	Current (mA)	CAPD DATA (see RF/IF Designer Handbook) Page	Case Style Note B	CONNECTION	Price $ Qty (1-9)
ZFL-2000	10-2000		20	±1.5	+16*	+5	7	+25	2:1	2:1	15	100	3-40	Y39	-	219.00
ZFL-1000H	10-1000		28	±1.0	+20	+5	5	+33	2:1	2:1	15	160	3-39	SS98	-	219.00
ZFL-1000VH	10-1000		20	±1.0	+26 **	+15	4.5	+38	1.8:1	2.5:1	15	320	3-39	SS98	-	229.00
ZHL-1042J	10-4200		25	±1.5	+20	+10	4.5	+30	2.5:1	2.5:1	15	330	3-40	NN92	-	495.00
▲ ZHL-6A	.0025-500		21	±1.0	+23	+10	7.5***	+34	1.8:1	2:1***	24	350	3-41	S32	-	199.00
AMP-2000	10-2000		20	±1.5	+15.0	+5	-	+25	2:1	2:1	15	100	3-38	QQ96	ce	139.95

* +15 dBm below 1000 MHz
** +24 dBm at 500-1000 MHz
*** NF specified above 10 MHz and output VSWR 2.2:1 above 400 MHz

NSN GUIDE

MCL NO.	NSN
ZHL-1A	6130-01-088-2322
ZHL-1A(BNC)	5895-01-123-0792
ZHL-1A(SMA)	5895-01-201-4500
ZHL-3A	5895-01-194-1718
ZHL-32A	5895-01-238-7973
ZHL-42A(SMA)	5895-01-253-2397
ZHL-4240	5895-01-263-5871
ZHL-5W-1	5825-01-339-2539
ZFL-1000H	5895-01-299-5588
ZFL-2000	5895-01-220-2213
ZFL-2000B	5895-01-220-2213

NOTES:

⊕ Max. voltage Vdc
△ Available only with SMA connectors
▲ Available only with BNC connectors
B. Connector types and case mounted options, case finishes are given in section 0, see "Case styles & outline drawings".
C. Prices and specifications subject to change without notice.
D. For Quality Control Procedures see section 0, "Mini-Circuits Guarantees Quality" article. For Environmental Specifications see page 3-13.
1. With no load output, derate maximum input power (no damage) by 10 dB.

pin connections

PORT	ce
RF IN	5
RF OUT	11
DC	2
CASE GND	1,3,4,6,7,8,9,10,12
NOT USED	—

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50 ohms

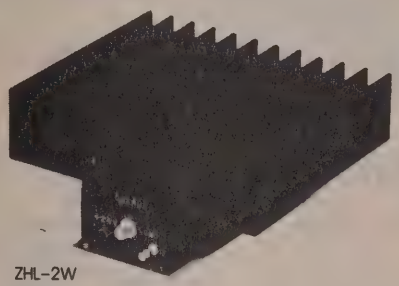
Mini-Circuits

High Power

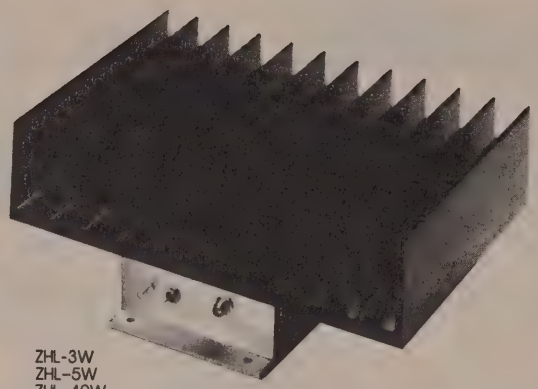
up to 10 Watts (+40 dBm) output
50 KHz to 4.2 GHz

case style selection

outline drawings see Table of Contents



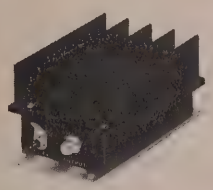
ZHL-2W



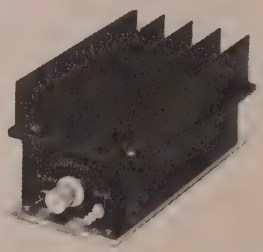
ZHL-3W
ZHL-5W
ZHL-10W

MODEL NO.	FREQ. MHz f_L	FREQ. MHz f_U	GAIN, dB Min.	GAIN, dB Flatness Max.	MAXIMUM POWER, dBm Output (1 dB Comp.)	MAXIMUM POWER, dBm Input (no damage)	DYNAMIC RANGE NF dB Typ.	DYNAMIC RANGE IP3 dBm Typ.	VSWR In	VSWR Out	DC POWER Volt V	DC POWER Current (A)	CAPD DATA (see RF/IF Designer Handbook) Page	Case Style Note B	CONNECTION	Price $ Qty (1-9)
ZHL-1-2W	5	500	29	±1.0	+33	+10	12	+44	2:1	2:1	24	0.9	3-46	T35	—	525.00
ZHL-7-2W	600	800	28	±1.0	+33	+10	12	+43	2:1	2:1	24	0.9	3-46	T35	—	590.00
ZHL-1000-3W	500	1000	38	±1.0*	+35**	0	9	+45	2:1	2.5:1	24	2.0	3-46	DDD131	—	695.00
ZHL-5W-1	1	500	40	±1.5	+37	0	8	+49	2:1	2.5:1	24	3.3	3-48	DDD131	—	995.00
ZHL-900-10W	480	900	19	±1.0	+38	+25	10	+50	2:1	2:1	24	5.5	3-48	DDD131	—	1995.00

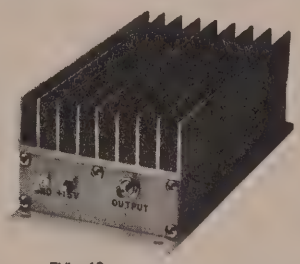
* 1.5 dB over temperature range -20 to +65 deg. C.
** +37 dBm typical



ZHL-A



ZHL



ZHL-42

MODEL NO.	FREQ. MHz f_L	FREQ. MHz f_U	GAIN, dB Min.	GAIN, dB Flatness Max.	MAXIMUM POWER, dBm Output (1 dB Comp.)	MAXIMUM POWER, dBm Input (no damage)	DYNAMIC RANGE NF dB Typ.	DYNAMIC RANGE IP3 dBm Typ.	VSWR In	VSWR Out	DC POWER Volt V	DC POWER Current (A)	CAPD DATA (see RF/IF Designer Handbook) Page	Case Style Note B	CONNECTION	Price $ Qty (1-9)
ZHL-1A	2	500	16	±1.0	+28	+20	11	+38	2:1	2:1	24	0.60	3-41	S32	—	199.00
ZHL-3A	0.4	150	24	±1.0	+29.5	+10	11	+38	2:1	2:1	24	0.60	3-42	S32	—	199.00
ZHL-32A	0.05	130	25	±1.0	+29	+10	10	+38	2:1	2:1	24	0.60	3-42	S32	—	199.00
ZHL-2	10	1000	16	±1.0	+29	+20	9	+38	2:1	2:1	24	0.60	3-43	T34	—	349.00
ZHL-2-8	10	1000	27	±1.0	+29*	+5	10	+38	2:1	2:1	24	0.60	3-43	T34	—	525.00
ZHL-2-12	10	1200	24	±1.0	+29	+10	10	+38	2:1	2:1	24	0.75	3-43	T34	—	625.00
ZHL-42	700	4200	30	±1.0	+28	+5	10	+38	2.5:1	2.5:1	15	0.88	3-44	U36	—	895.00
ZHL-4240	700	4200	40	±1.5	+28	-5	8	+38	2.5:1	2.5:1	15	0.90	3-45	U36	—	1395.00
ZHL-42W	10	4200	30	±1.5	+28**	0	8***	+38	2.5:1	2.5:1	15	0.88	3-44	U36	—	1095.00
ZHL-4240W	10	4200	40	±1.5	+28**	-5	8***	+38	2.5:1	2.5:1	15	0.90	3-45	U36	—	1495.00

* +28.5 dBm maximum at 1000-1200 MHz
** +27 dBm at 10-700 MHz
*** Below 100 MHz NF increases to 15 dB at 10 MHz

CAPD now available! computer-automated performance data

In Stock...Immediate Delivery

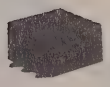
For custom versions of standard models consult our applications dept.

low current, bi-phase
Electronic Attenuators/Switches

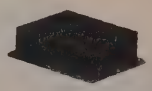
1 MHz to 2.0 GHz

case style selection

outline drawings see Table of Contents


LRAS

TFAS


SYAS

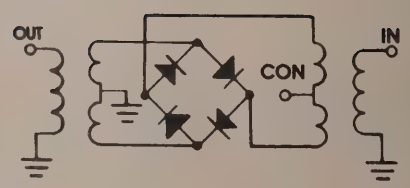
PAS
GAS

MODEL NO.	FREQUENCY MHz IN f_L-f_U	CON	INSERTION LOSS dB (±20 mA) Mid-Band m Typ.	Mid-Band m Max.	Total Range Typ.	Total Range Max.	MAX. INPUT POWER dBm (±20 mA) 1 dB comp.	no damage	IN-OUT ISOLATION dB (0 mA) L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	BI-PHASE $\overline{X}$ (±20 mA) Δ AMP (dB) m	Δ AMP (dB) Total Range	Phase(deg) Deviation From 180° m	Phase(deg) Deviation From 180° Total Range	CAPD DATA (see RF/IF Designer handbook) Page	CASE STYLE Note B	connection	PRICE $ Qty. (1-9)
PAS-1*	5-450	DC-0.05	3.5	4.0	3.5	4.7	20	30	65	50	45	35	35	25	0.1	0.1	0.5	1.2	4-10	A01	cf	33.95
PAS-2*	10-1000	DC-0.05	4.0	6.0	6.5	8.5	20	30	50	40	40	30	35	25	0.1	0.3	0.5	1.0	4-10	A01	cg	47.95
PAS-3*	1-200	DC-0.05	1.4	2.0	1.6	2.5	15	30	65	50	50	40	50	35	0.1	0.1	0.5	1.0	4-11	A01	cf	34.95
PAS-2000**	100-2000	DC-0.5	4.2	6.5	5.4	7.5	19✲	25	30	22	—	—	26	20	0.3	0.4	5.0	8.0	4-11	A05	ch	24.95
❑ TFAS-1*	2-400	DC-0.05	1.4	2.0	1.6	3.0	20✣	25	65	45	45	33	35	25	0.1	0.1	1.0	2.0	4-12	B02	cm	13.95
❑ TFAS-2**	10-1000	DC-0.5	3.7	4.5	5.0	8.0	17★	25	50	30	42	20	31	20	0.1	0.2	2.0	3.0	4-12	B02	cm	17.95
❑ TFAS-860**	500-1000	DC-0.5	—	—	1.5	5.4	14	25	30	(typ.)		20	(min.)		—	0.3	—	4.0	4-13	B02	cm	19.95
● SYAS-1*	2-400	DC-0.05	1.4	2.0	1.6	3.0	20✣	25	65	45	45	33	35	25	0.1	0.1	1.0	2.0	4-12	TTT167	ck	9.95
● SYAS-2**	10-1000	DC-0.05	4.0	6.0	4.5	7.0	17★	25	59	40	42	28	28	20	0.1	0.3	2.0	3.0	4-12	TTT167	ck	13.95
● SYAS-860**	600-1000	DC-0.5	—	—	2.7	5.7	14	25	25	(typ.)		18	(min)		—	0.5	—	4.0	4-13	TTT166	ck	15.95
ZFAS-2000**	100-2000	DC-0.5	4.2	6.5	5.4	7.5	19✲	25	30	22	—	—	26	20	0.3	0.4	5.0	8.0	4-11	K18	cn	64.95

L=low range (f_L to 10 f_L) M=mid range (10f_L to f_U/2) U=upper range (f_U/2 to f_U)
m=mid band (2f_L to f_U/2)

NOTES:

- * Recommended for electronic attenuator
- ▪▪ Recommended for bi-phase modulator
- ● Surface-mount, non-hermetic, available on tape and reel
- ■ Denotes 75 Ohm model, for coax connector models 75 Ohm BNC connectors are standard.
- ❑ Non-hermetic, TFAS units available in surface-mount, add suffix SM (case style NNN-150), which is available on tape and reel.
- ✲ +15 dBm from 100-800 MHz
- ✣ +15 dBm from 2-10 MHz
- ★ +13 dBm from 10-500 MHz
- A. General Quality Control Procedures, Environmental Specifications, Hi-Rel, MIL and TX description are given in section 0, see "Mini-Circuits Guarantees Quality" article.
- B. Connector types and case mounted options, case finishes are given in section 0, see "Case styles & Outline Drawings".
- C. Prices and specifications subject to change without notice.
- 1. Absolute maximum power, voltage and current ratings:
  - 1a. Control current, 30mA



Mini-Circuits™
Distribution Centers/NORTH AMERICA 800-654-7949 417-335-5935 Fax 417-335-5945
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EUROPE 44-252-835094 Fax 44-252-837010

50 and 75 ohms

Mini-Circuits

case style selection

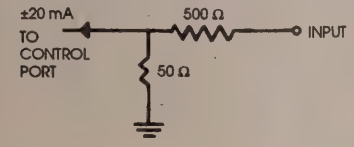
outline drawings see Table of Contents

ZFAS ZMAS ZAS

MODEL NO.	FREQUENCY MHz IN f_L-f_U	CON	INSERTION LOSS dB (±20 mA) Mid-Band m Typ.	Mid-Band m Max.	Total Range Typ.	Total Range Max.	MAX. INPUT POWER dBm (±20 mA) 1 dB comp.	no damage	IN-OUT ISOLATION dB (0 mA) L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	BI-PHASE X (±20 mA) Δ AMP (dB) m	Total Range	Phase(deg) Deviation From 180° m	Total Range	CAPD DATA (see RF/IF Designer handbook) Page	CASE STYLE Note B	connection	PRICE $ Qty. (1-9)
ZMAS-1*	5-450	DC-0.05	3.5	4	3.5	4.7	20	30	65	50	55	45	35	25	0.10	0.1	0.5	1.2	4-10	M21	cp	66.95
ZMAS-3*	1-200	DC-0.05	1.4	2	1.6	2.5	15	30	65	50	50	40	50	35	0.10	0.1	0.5	1.0	4-11	M21	cp	67.95
ZAS-1*	5-450	DC-0.05	3.5	4	3.5	4.7	20	30	65	50	55	45	35	25	0.10	0.1	0.5	1.2	4-10	M22	cp	59.95
ZAS-3*	1-200	DC-0.05	1.4	2	1.6	2.5	15	30	65	50	50	40	50	35	0.10	0.1	0.5	1.0	4-11	M22	cp	59.95
❑ GAS-1**	5-450	DC-0.05	3.3	4	3.5	5.0	20	25	60	48	45	35	35	25	0.10	0.1	1.0	1.5	4-10	A05	cf	13.95
❑ GAS-2**	10-1000	DC-0.05	4.3	6	5.2	8.5	20	25	55	40	35	25	28	20	0.10	0.3	1.5	3.0	4-10	A05	cg	15.95
❑ GAS-3**	5-200	DC-0.05	1.2	2	1.4	2.5	20	25	50	45	45	35	40	30	0.10	0.1	0.5	1.0	4-11	A05	cf	14.95
● RAS-1**	2-400	DC-0.05	1.4	2	1.6	3.2	20✲	25	65	45	45	28	32	22	0.10	0.1	1.0	2.0	-	TT146	ge	7.95
◗■ RAS-2-75**	10-1000	DC-0.05	4.1	6	4.5	7.5	20	25	58	40	42	28	39	20	0.15	0.3	1.5	3.0	-	TT100	cj	9.95
◗■ LRAS-2-75**	10-1000	DC-0.05	4.1	6	4.5	7.5	20	25	58	40	42	28	39	20	0.15	0.3	1.5	3.0	-	QQQ130	cj	9.95

L = low range (f_L to 10 f_L) M = mid range (10f_L to f_U/2) U = upper range (f_U/2 to f_U)
m = mid band (2f_L to f_U/2)

suggested control port biasing configuration



pin and coaxial connections

see case style outline drawings

PORT	cf	cg	ch	cj	ck	cm	cn	cp	ge
INPUT	1	1	1	4	1	1	2	3	4
OUTPUT	8	8	8	1	2	4	1	1	1
CONTROL	3,4 ^	3,4 ^	3	5	3	2	3	2	5
GND EXT.	2,5,6,7	2,5,6,7	2,5,6,7	2,3,6	4,5,6	3	—	—	2,3,6
CASE GND	2	2,5,6,7	2,5,6,7	—	—	3	—	—	—
NOT USED	—	—	4	—	—	—	—	—	—

^ Pins must be connected together externally.

NSN GUIDE

MCL NO.	NSN
PAS-1	5985-01-282-2105
PAS-2	5985-01-192-0100
PAS-3	5895-01-067-3035
ZAS-3B	5985-01-267-2832
ZMAS-1	5985-01-140-4291

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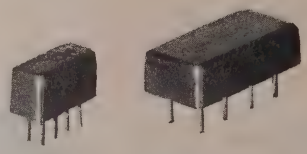
rugged, one-piece design

Fixed Attenuators

1 to 40 dB

DC to 1500 MHz



MAT AT

case style selection

outline drawings see Table of Contents

MODEL NO.	FREQUENCY RANGE, MHz	ATTENUATION dB Nom.	FLATNESS, MAX. L	M	U	VSWR max. L	M	U	CAPD DATA (see RF/IF Designer handbook) Page	CASE STYLE Note B	connection	PRICE $ Qty. (1-9)
MAT-1	DC-1500	1±0.2	0.3	0.4	0.5	1.3	1.5	1.7	6-6	A11	cr	4.45
MAT-2	DC-1500	2±0.2	0.3	0.4	0.8	1.3	1.5	1.7	6-6	A11	cr	4.45
MAT-3	DC-1500	3±0.2	0.3	0.6	1.0	1.3	1.5	1.7	6-6	A11	cr	4.45
MAT-4	DC-1500	4±0.2	0.3	0.6	1.0	1.3	1.5	1.7	6-7	A11	cr	4.45
MAT-5	DC-1500	5±0.3	0.3	0.6	1.0	1.3	1.5	1.7	6-7	A11	cr	4.45
MAT-6	DC-1500	6±0.3	0.3	0.6	1.0	1.3	1.5	1.7	6-7	A11	cr	4.45
MAT-7	DC-1500	7±0.3	0.3	0.6	1.0	1.3	1.5	1.7	6-7	A11	cr	4.45
MAT-8	DC-1500	8±0.3	0.3	0.6	1.0	1.3	1.5	1.7	6-8	A11	cr	4.45
MAT-9	DC-1500	9±0.4	0.3	0.6	1.0	1.3	1.5	1.7	6-8	A11	cr	4.45
MAT-10	DC-1500	10±0.4	0.3	0.6	1.0	1.3	1.5	1.7	6-8	A11	cr	4.45
MAT-12	DC-1500	12±0.4	0.3	0.6	1.0	1.3	1.5	1.7	6-8	A11	cr	4.45
MAT-15	DC-1500	15±0.4	0.4	0.7	1.1	1.3	1.5	1.7	6-9	A11	cr	4.45
MAT-20	DC-1500	20±0.5	0.4	0.8	1.3	1.3	1.6	1.8	6-9	A11	cr	4.45
MAT-25	DC-1500	25±0.5	0.4	0.8	1.3	1.3	1.6	1.8	–	A11	cr	4.45
MAT-30	DC-1000	30±0.5	0.5	1.0	—	1.3	1.6	—	6-9	A11	cr	4.45
MAT-40	DC-500	40±0.6	1.0	—	—	1.5	—	—	6-9	A11	cr	4.45
AT-1	DC-1500	1±0.2	0.3	0.4	0.5	1.3	1.5	1.7	6-6	A04	cr	3.65
AT-2	DC-1500	2±0.2	0.3	0.4	0.8	1.3	1.5	1.7	6-6	A04	cr	3.65
AT-3	DC-1500	3±0.2	0.3	0.6	1.0	1.3	1.5	1.7	6-6	A04	cr	3.65
■ AT-3-75	DC-500	3±0.2	0.9	—	—	2.0	—	—	6-6	A04	cr	3.65
AT-4	DC-1500	4±0.2	0.3	0.6	1.0	1.3	1.5	1.7	6-7	A04	cr	3.65
AT-5	DC-1500	5±0.3	0.3	0.6	1.0	1.3	1.5	1.7	6-7	A04	cr	3.65
AT-6	DC-1500	6±0.3	0.3	0.6	1.0	1.3	1.5	1.7	6-7	A04	cr	3.65
■ AT-6-75	DC-500	6±0.3	1.0	—	—	2.0	—	—	6-7	A04	cr	3.65
AT-7	DC-1500	7±0.3	0.3	0.6	1.0	1.3	1.5	1.7	6-7	A04	cr	3.65
AT-8	DC-1500	8±0.3	0.3	0.6	1.0	1.3	1.5	1.7	6-8	A04	cr	3.65
AT-9	DC-1500	9±0.4	0.3	0.6	1.0	1.3	1.5	1.7	6-8	A04	cr	3.65
AT-10	DC-1500	10±0.4	0.3	0.6	1.0	1.3	1.5	1.7	6-8	A04	cr	3.65
■ AT-10-75	DC-500	10±0.4	1.0	—	—	2.0	—	—	6-8	A04	cr	3.65
AT-12	DC-1500	12±0.4	0.3	0.6	1.0	1.3	1.5	1.7	6-8	A04	cr	3.65
AT-15	DC-1500	15±0.4	0.4	0.7	1.1	1.3	1.5	1.7	6-9	A04	cr	3.65
■ AT-15-75	DC-500	15±0.4	0.8	—	—	1.5		—	6-9	A04	cr	3.65
AT-20	DC-1500	20±0.5	0.4	0.8	1.3	1.3	1.6	1.8	6-9	A04	cr	3.65
■ AT-20-75	DC-500	20±0.5	1.1	—	—	2.0	—	—	6-9	A04	cr	3.65
AT-30	DC-1000	30±0.5	0.5	1.0	—	1.3	1.6	—	6-9	A04	cr	3.65
AT-40	DC-500	40±0.6	1.0	—	—	1.5	—	—	6-9	A04	cr	3.65

L = DC–500 MHz M = DC–1000 MHz U = DC–1500 MHz

NOTES:

▽ Four different case styles available:
NAT (N connectors) case style FF57
CAT (BNC connetors) case style FF55
SAT (SMA connecotors) case style FF56
TAT (TNC connectors) Please consult factory

■ Denotes 75 ohm models. For coax connector models 75 ohm BNC connectors are standard.

A. General Quality Control Procedures, Environmental Specifications, Hi-Rel, MIL and TX description are given in section 0, see "Mini-Circuits Guarantees Quality" article.

B. Connector types and case mounted options, case finishes are given in section 0, see "Case styles & outline drawings".

C. Prices and specifications subject to change without notice.

1. Absolute maximum power, voltage and current rating:
1a. RF power for AT, CAT, NAT, TAT 1 Watt
1b. RF power for MAT, SAT 0.5 Watt
1c. RF power for all terminations 0.25 Watt

pin connections

see case style outline drawings

PORT	cr
INPUT	1
OUTPUT	8
GND	2,3,4,5,6,7

designers kits available

KIT NO.	MODEL TYPE	No. of Units in Kit	DESCRIPTION	PRICE $ per kit
K1-AT	AT	16	4 of each 3, 6, 10, 20 dB	49.95
K2-AT	AT	20	1 of each 1 to 40 dB	
K1-MAT	MAT	16	2 of each 3, 6, 9, 10, 12, 15, 20, 40 dB	49.95
K2-MAT	MAT	16	1 of each 1 to 40 dB	

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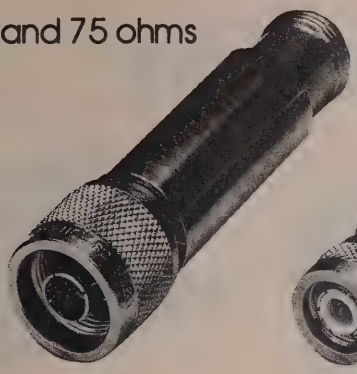
Mini-Circuits

50 ohms and 75 ohms



NAT

TAT (consult factory)

CAT

SAT

MODEL NO.	FREQUENCY RANGE, MHz	ATTENUATION dB Nom.	ATTENUATION dB L	ATTENUATION dB M	ATTENUATION dB U	VSWR MAX. L	VSWR MAX. M	VSWR MAX. U	CAPD DATA (see RF/IF Designer handbook) Page	CASE STYLE Note B	connection	PRICE $ Qty. (1-9) NAT	PRICE $ Qty. (1-9) CAT	PRICE $ Qty. (1-9) SAT
_AT-1	DC-1500	1±0.2	0.3	0.4	0.5	1.3	1.5	1.7	6-6	▽	-	23.95	16.95	20.95
_AT-2	DC-1500	2±0.2	0.3	0.4	0.8	1.3	1.5	1.7	6-6	▽	-	23.95	16.95	20.95
_AT-3	DC-1500	3±0.2	0.3	0.6	1.0	1.3	1.5	1.7	6-6	▽	-	23.95	16.95	20.95
■ CAT-3-75	DC-500	3±0.2	0.9	—	—	2.0	—	—	6-6	FF55	-	—	16.95	—
_AT-4	DC-1500	4±0.2	0.3	0.6	1.0	1.3	1.5	1.7	6-6	▽	-	23.95	16.95	20.95
_AT-5	DC-1500	5±0.3	0.3	0.6	1.0	1.3	1.5	1.7	6-7	▽	-	23.95	16.95	20.95
_AT-6	DC-1500	6±0.3	0.3	0.6	1.0	1.3	1.5	1.7	6-7	▽	-	23.95	16.95	20.95
■ CAT-6-75	DC-500	6±0.3	1.0	—	—	2.0	—	—	6-7	FF55	-	—	16.95	—
_AT-7	DC-1500	7±0.3	0.3	0.6	1.0	1.3	1.5	1.7	6-7	▽	-	23.95	16.95	20.95
_AT-8	DC-1500	8±0.3	0.3	0.6	1.0	1.3	1.5	1.7	6-7	▽	-	23.95	16.95	20.95
_AT-9	DC-1500	9±0.4	0.3	0.6	1.0	1.3	1.5	1.7	6-7	▽	-	23.95	16.95	20.95
_AT-10	DC-1500	10±0.4	0.3	0.6	1.0	1.3	1.5	1.7	6-8	▽	-	23.95	16.95	20.95
■ CAT-10-75	DC-500	10±0.4	1.0	—	—	2.0	—	—	6-8	FF55	-	—	16.95	—
_AT-12	DC-1500	12±0.4	0.3	0.6	1.0	1.3	1.5	1.7	6-8	▽	-	23.95	16.95	20.95
_AT-15	DC-1500	15±0.4	0.4	0.7	1.1	1.3	1.5	1.7	6-8	▽	-	23.95	16.95	20.95
■ CAT-15-75	DC-500	15±0.4	0.8	—	—	1.5		—	6-9	F55	-	—	16.95	—
_AT-20	DC-1500	20±0.5	0.4	0.8	1.3	1.3	1.6	1.8	6-9	▽	-	23.95	16.95	20.95
■ CAT-20-75	DC-500	20±0.5	1.1	—	—	2.0	—	—	6-9	FF55	-	—	16.95	—
_AT-30	DC-1000	30±0.5	0.5	1.0	—	1.3	1.6	—	6-9	▽	-	23.95	16.95	20.95
_AT-40	DC-500	40±0.6	1.0	—	—	1.5	—	—	6-9	▽	-	23.95	16.95	20.95

Add prefix letter N, C or S to _AT where applicable

L = DC–500 MHz M = DC–1000 MHz U = DC–1500 MHz

NSN GUIDE

MCL NO.	NSN
AT-6	5985-01-275-0339
BTRM-50	6625-01-325-7972
BTRM-75	5985-01-328-7420
CAT-15	5985-01-299-9257
CAT-20	5985-01-265-0338
CAT-30	5985-01-290-0943
CAT-5	5985-01-299-9258
CAT-6	5985-01-300-0481
MAT-1	5985-01-265-8138
MAT-10	5985-01-294-4719
MAT-15	5985-01-294-4720
MAT-2	5985-01-336-3058
MAT-20	5985-01-294-4721
MAT-3	5985-01-274-6609
MAT-4	5985-01-326-6977
MAT-5	5985-01-336-3720
MAT-6	5985-01-295-0261
MAT-7	5985-01-326-6978
MAT-9	5985-01-332-4595
NAT-3	5985-01-298-0747
NAT-10	5985-01-291-5548
NAT-30	5985-01-298-0746
SAT-6	5985-01-237-5343
SAT-10	5985-01-250-4812
SAT-30	5985-01-190-6838

Terminations

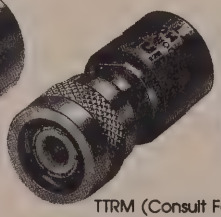
DC to 2000 MHz
50 ohms and 75 ohms

case style selection

outline drawings see Table of Contents

For Notes see opposite page

NTRM



TTRM (Consult Factory)

BTRM

STRM

MODEL NO.	IMPEDANCE OHMS	FREQUENCY RANGE, MHz	RETURN LOSS, dB, MIN. DC-500	RETURN LOSS, dB, MIN. DC-1000	RETURN LOSS, dB, MIN. DC-2000	CAPD DATA (see RF/IF Designer handbook) Page	CASE STYLE Note B	connection	PRICE $ Qty. (1-9)
BTRM-50	50	DC-2000	35	30	21	6-10	LL85	-	8.25
■ BTRM-75	75	DC-1000	30	20	—	6-10	LL85	-	9.95
STRM-50	50	DC-2000	40	35	26	6-10	LL86	-	9.45
NTRM-50	50	DC-2000	35	30	21	6-10	LL87	-	9.45

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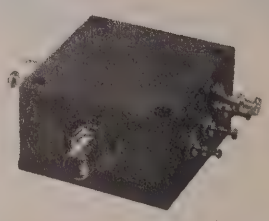
CAPD now available! computer-automated performance data

pin diode, precision
Digital Step Attenuators

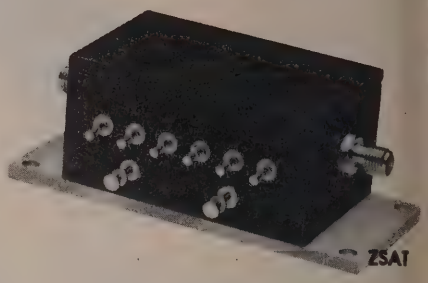
with TTL Control Inputs

0.5 to 20 dB steps,
up to 35 dB attenuation
10 MHz to 1 GHz

TOAT



ZFAT



ZSAT

MODEL NO.	FREQ. MHz f_L	FREQ. MHz f_U	PRIMARY ATTNENUATION STEPS (dB) @TTL CONTROL PORT #1	#2	#3	ATTENUATION (dB) LOGIC STATE* (1,1,1)** Nom.	(0,0,0) Max.	VSWR L	M	U	CAPD DATA (see RF/IF Designer Handbook) Page	Case Style Note B	CONNECTION	Price $ Qty. (1-9)
TOAT-R512	10	1000	0.5±0.18	1±0.25	2±0.25	3.5	4.0	1.6	1.4	1.5	5-6	QQ96	cq	59.95
TOAT-124	10	1000	1±0.25	2±0.25	4±0.3	7.0	4.0	1.6	1.4	1.5	5-7	QQ96	cq	59.95
TOAT-3610	10	1000	3±0.3	6±0.4	10±0.4	19.0	4.0	1.6	1.4	1.5	5-8	QQ96	cq	59.95
TOAT-4816	10	1000	4±0.4	8±0.4	16±0.5	28.0	4.0	1.6	1.4	1.5	5-9	QQ96	cq	59.95
TOAT-51020	10	1000	5±0.4	10±0.4	20±0.5	35.0	4.0	1.6	1.4	1.5	5-10	QQ96	cq	59.95
ZFAT-R512	10	1000	0.5±0.18	1±0.25	2±0.25	3.5	4.0	1.6	1.4	1.5	5-6	SSS173	-	89.95
ZFAT-124	10	1000	1±0.25	2±0.25	4±0.3	7.0	4.0	1.6	1.4	1.5	5-7	SSS173	-	89.95
ZFAT-3610	10	1000	3±0.3	6±0.4	10±0.4	19.0	4.0	1.6	1.4	1.5	5-8	SSS173	-	89.95
ZFAT-4816	10	1000	4±0.4	8±0.4	16±0.5	28.0	4.0	1.6	1.4	1.5	5-9	SSS173	-	89.95
ZFAT-51020	10	1000	5±0.4	10±0.4	20±0.5	35.0	4.0	1.6	1.4	1.5	5-10	SSS173	-	89.95
			SDC CONTROL PORTS											
ZSAT-31R5	10	1000	(1) 0.5±0.18 (4) 4±0.3	(2) 1±0.25 (5) 8±0.4	(3) 2±0.25 (6)16±0.5	31.5	7.0	1.7	1.5	1.6	—	AR214	-	119.00

L = 10 to 100 MHz M = 100 to 500 MHz U = 500 to 1000 MHz

features

- wide frequency band, 10-1000 MHz
- excellent step accuracy, 0.2 dB typ.
- excellent VSWR, 1.3 typ.
- low DC current, 6 mA typ.
- operates over -55° to 100 °C
- small case, 0.6" dia., TO-8

Additional Specifications

DC Voltage +5V
DC current 10mA max.
Switching Time (50% TTL to within specified accuracy of the next-selected attenuation step, and to within 0.1 dB of steady-state Thru-Loss) 10 µs typ., 15µs max.
TTL input High Threshold 2V min.
TTL input Low Threshold 0.8V max.
TTL Toggle Rate: 50 kHz typ.
1dB compression: 0 dBm (10-100MHz)
+10dBm (100-1000MHz)
For ZSAT-31R5:
1dB compression: +10 dBm (10-100 MHz)
+15 dBm (100-1000 MHz)

NOTES:

* For ZSAT-31R5: Total attenuation (1,1,1,1,1,1)
Thru-Loss (0,0,0,0,0,0)
** Total attenuation above thru-loss.
A. General Quality Control Procedures, Environmental Specifications, Hi-Rel, MIL and TX description are given in section 0, see "Mini-Circuits Guarantees Quality" article.
B. Connector types and case mounted options, case finishes are given in section 0, see "Case Styles & Outline Drawings".
C. Prices and Specifications subject to change without notice.
1. Absolute maximum power, voltage and current rating:
1a. Input power, 15 dBm
1b. DC voltage, 5.5 Volts
1c. TTL, 5.5 Volts
1d. Storage temperature -55°C to +125°C for TOAT models.
2. Step accuracy is specified for basic steps. For combination of steps accuracy is additive.
3. Thru-loss is minimum insertion loss with all attenuation elements bypassed (All TTL controls state are Low).

Logic function:

TTL High activates associated in-line attenuation
TTL Low bypasses this attenuation

pin connections

see case style outline drawing

PORT	cq
RF IN	4
RF OUT	11
TTL CONTROL #1	2
TTL CONTROL #2	3
TTL CONTROL #3	1
+5V DC	12
CASE GND	5,6,7,8,9,10

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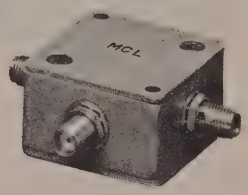
high power Directional Couplers

Mini-Circuits

20 dB
30 MHz to 970 MHz

case style selection
outline drawings see Table of Contents

PDC



ZFDC

MODEL NO.	FREQ. RANGE MHz f_L-f_U	COUPLING dB Nom.	Flatness	MAINLINE LOSS dB L Typ.	L Max.	M° Typ.	M° Max.	U Typ.	U Max.	DIRECTIVITY dB L Typ.	L Min.	M° Typ.	M° Min.	U Typ.	U Min.	VSWR (:1) Typ.	POWER INPUT, W L Max.	POWER INPUT, W MU Max.	CAPD DATA (see RF/IF Designer handbook) Page	CASE STYLE Note B	connection	PRICE $ Qty. (1-9)
PDC20-400HP	40-400	21.5±0.5	±0.6	0.1	0.3	0.2	0.4	0.2	0.5	30	20	30	20	27	18	1.1	10	10	—	A01	gh	49.95
PDC20-900HP	800-900	20.2±0.6	±0.5			0.25	0.5					24	20			1.1	5	5	—	A01	cu	39.95
PDC20-970HP	860-970	20.2±0.6	±0.5			0.25	0.5					24	20			1.1	5	5	—	A01	cu	39.95
✦ ZFDC-20-1H**	30-400	20.5±0.5	±0.4	0.15	0.4	0.15	0.4	0.3	0.4	30	25	30	25	30	23	1.2	25	25	7-13	J17	de	58.95
△✦ ZFBDC20-900HP	800-900	20.7±0.6	±0.6			0.1	0.4					28	20			1.1	10	10	—	J17	gj	79.95
△✦ ZFBDC20-970HP	860-970	20.4±0.6	±0.6			0.1	0.4					28	20			1.1	10	10	—	J17	gj	79.95

L = low range (f_L to $10f_L$) M = mid range ($10 f_L$ to $f_U/2$) U = upper range ($f_U/2$ to f_U)

features
- High power operation
- Very low insertion loss
- Excellent directivity
- Excellent VSWR, 1.1:1 typical
- Wide bandwidth, 30-400 MHz model ZFDC-20-1H and 40-400 MHz model PDC-20-R4-10W
- Cellular application, models PDC-20-R9, PDC-20-R97, ZFDC-20-R9BD, ZFDC-20-R97BD

NOTES:
* L = 30-100 MHz, M = 100-200 MHz
** L = 40-100 MHz, M = 100-200 MHz
✦ Bi-directional
△ Available only with SMA connectors.
° When only specification for M range given, specification applies to entire frequency range.
A. General Quality Control Procedures, Environmental Specifications, Hi-Rel, MIL and TX description are given in section 0, see "Mini-Circuits Guarantees Quality" article.
B. Connector types and case mounted options, case finishes are given in section 0, see "Case Styles & Outline Drawings"
C. Prices and specifications subject to change without notice.
2. Mainline Loss includes theorical power loss at coupled port.
3. For PDC models, external heat sinking is recommended to reduce case temperature.

pin and coax connections
See case style outline drawing

PORT	cu	gh	de	gj
INPUT	1	1	S	2
OUTPUT	4	2	1	3
COUPLED (forward)	3	5	3	1
COUPLED (reverse)	—	—	2	S
NOT USED	6	—	—	—
CASE GND	2,5,7,8	3,4,6,7,8	—	—

directional coupler
NSN GUIDE

MCL NO.	NSN	MIL-C 15370/18*
PDC-10-1	5985-01-178-4406	002
PDC-10-1-75	5985-01-294-3796	
PDC-10-2	5985-01-178-4406	008
PDC-10-21	5985-01-130-0177	003
PDC-10-22	5985-01-190-7738	
PDC-15-6	5985-01-147-0160	009
PDC-20-3	5985-01-076-8477	001
TDC-10-1	5905-01-226-3428	
ZDC-10-1-BNC	5985-01-125 3467	
ZDC-20-1	5985-01-178-4405	
ZDC-20-3-BNC	5985-01-096-5007	
ZDC-20-38	5985-01-264-9105	
ZEDC-10-2	5985-01-251-2669	
ZFDC-10-1	5985-01-230-6676	
ZFDC-10-1(SMA)	5985-01-179-5122	
ZFDC-10-1B	5985-01-135-9780	
ZFDC-10-2	5985-01-208-5694	
ZFDC-10-21	5985-01-253-0600	
ZFDC-10-6B	5985-01-314-4176	
ZFDC-15-5	5985-01-298 0144	
ZFDC-15-6	5985-01-330-6792	
ZFDC-20-2	5985-01-230-6676	
ZFDC-20-3(BNC)	5985-01-146-0478	
ZFDC-20-3(TNC)	5985-01-226-7882	
ZFDC-20 4	5985-01-266-9992	
ZFDC-20-5(BNC)	5985-01-097-2192	
ZMDC-10-1	4935-01-227-6945	
ZMDC-10-1B	4935-01-227-6945	
ZMDC-20-3	5985-01-193-8515	

* units are not QPL listed.

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98

very broadband

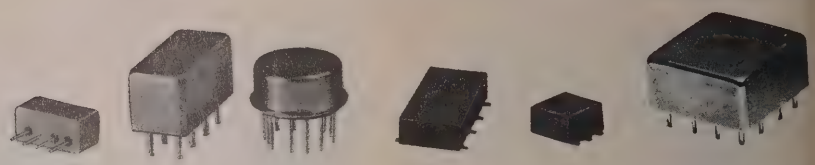
Directional Couplers

6 to 30 dB

5 KHz to 2000 MHz

case style selection

outline drawings see Table of Contents



TDC PDC TODC SCDC LRDC P4DC PDC-20A-5

MODEL NO.	FREQ. RANGE MHz f_L-f_U	COUPLING dB Nom.	Flatness	MAINLINE LOSS dB L Typ.	L Max.	M○ Typ.	M○ Max.	U Typ.	U Max.	DIRECTIVITY dB L Typ.	L Min.	M○ Typ.	M○ Min.	U Typ.	U Min.	VSWR (:1) Typ.	POWER INPUT, W L Max.	POWER INPUT, W MU Max.	CAPD DATA (see RF/IF Designer handbook) Page	CASE STYLE Note B	CONNECTION	PRICE $ Qty. (1-9)
TDC-6-1	10-400	6.3±0.4	±0.4	2.0	2.4	2.0	2.4	2.0	2.5	36	30	30	25	20	15	1.5	1	2	7-8	B02	cw	23.95
TDC-10-1	1-400	10.0±0.5	±0.5	1.2	1.5	1.0	1.3	1.2	1.5	35	25	30	20	20	15	1.5	1	2	7-8	B02	cw	17.95
TDC-10-2	5-1000	11±0.5	±0.6	1.4	1.8	1.5	1.8	1.6	2.0	50	35	25	20	20	15	1.5	0.5	0.5	7-8	B02	cw	25.95
PDC-10-1	0.5-500	11.5±0.5	±0.6	0.85	1.3	0.65	1.0	0.85	1.3	32	25	32	25	22	15	1.2	1.5	3	7-9	A01	cu	13.45
✦ PDC-10-1BD	1-400	11.5±0.5	±0.5	0.6	0.9	0.8	1.1	0.9	1.3	55	35	35	20	22	15	1.2	2.0	4	7-19	A01	cu	11.45
✣ PDC-10-2	250-1000	10.5±0.5	±0.6	1.4	1.6	—	—	1.6	2.0	30	23	—	—	25	15	1.5	—	5	7-9	A01	cu	34.45
PDC-10-5	1-2000	10.5±0.5	±1.0	1.2	1.9	1.3	1.9	2.0	2.5	38	25	30	18	22	18	1.3	0.5	0.5	7-9	A01	cu	40.95
PDC-10-6	0.005-20	11±0.5	±0.5	0.4	1.2	0.4	0.8	0.4	1.0	40	30	40	30	35	25	1.3	1.5	3	7-10	A01	cu	23.95
PDC-10-21**	1-1000	11±0.5	±0.5	1.2	1.7	1.2	1.7	1.6	2	40	30	25	20	25	20	1.3	1	2	7-10	A01	cu	32.95
PDC-10-22	5-750	11±0.5	±0.5	1.1	1.6	1.2	1.7	1.6	1.9	35	30	25	20	25	20	1.25	1	2	7-10	A01	cu	23.95
PDC-10-54	10-1500	10.5±0.5	±0.7	1.2	1.8	1.3	1.9	1.6	2.3	35	25	28	23	28	23	1.3	0.5	0.5	7-11	A01	cu	35.95
PDC-15-6	0.01-35	15±0.5	±0.5	0.3	0.6	0.2	0.4	0.3	0.6	38	30	35	25	28	20	1.15	2	4	7-11	A01	cu	23.95
PDC-15-21	1-500	14.7±0.5	±0.6	0.7	1.1	0.7	1.1	0.8	1.2	35	30	35	30	30	23	1.4	1	2	7-11	A01	cu	23.95
PDC-20-1*	25-400	21±0.75	±0.5	0.2	0.25	0.3	0.35	0.35	0.5	25	20	35	25	25	20	1.25	3	5	7-12	A01	cu	23.95
✦ PDC-20-1BD	0.5-200	19.2±0.5	±0.5	0.3	0.5	0.3	0.5	0.4	0.6	40	30	35	20	22	18	1.1	3	5	7-19	A01	cv	16.95
PDC-20-1W	10-700	19.2±0.5	±0.5	0.25	0.5	0.4	0.7	0.7	1.1	34	30	27	23	23	20	1.4	1	2	7-12	A01	cu	23.95
PDC-20-3	0.2-250	19.5±0.5	±0.5	0.35	0.6	0.25	0.5	0.35	0.6	36	30	33	25	25	20	1.2	1.5	4	7-12	A01	cu	15.95
✦ PDC-20-3BD	0.2-250	19.5±0.5	±0.5	0.3	0.6	0.25	0.5	0.35	0.6	47	40	40	25	30	20	1.1	1.5	4	7-19	A01	cv	17.95
PDC-20A-5	0.1-2000	20.0±0.5	±1.0	0.6	1.5	0.6	1.5	1.9	2.9	34	20	25	15	20	10	1.5	0.5	2	7-15	C145	cy	44.95
■ PDC-10-1-75	1-250	10.5±0.5	±0.75	1.1	1.5	1.1	1.5	1.1	1.5	30	20	30	20	30	20	2.0	2	4	7-16	A01	cu	14.95
■ PDC-10-6-75	0.2-100	10.0±0.5	±0.2	1.2	1.6	0.9	1.2	0.9	1.3	50	30	40	25	37	25	1.5	1	2	7-16	A01	cu	23.95
■ PDC-15-6-75	0.02-35	14.5±0.5	±0.5	0.3	0.7	0.3	0.7	0.3	0.7	35	20	35	20	35	20	1.3	1.5	4	7-16	A01	cu	25.95
■ PDC-20-3-75	1-150	19.5±0.5	±0.75	0.35	0.8	0.35	0.8	0.35	0.8	25	20	25	20	25	20	2.0	2	4	7-17	A01	cu	14.95
■ PDC-20-6-75	0.05-40	20.4±0.3	±0.25	0.1	0.25	0.1	0.2	0.1	0.3	45	35	35	20	25	18	1.2	1.5	3	7-17	A01	cu	23.95
TODC-10-1	10-400	11.3±0.5	±0.5	1.2	1.5	1.0	1.3	1.2	1.5	35	25	30	20	25	20	1.5	0.5	1	7-13	QQ96	ct	17.95
● SCDC-11-2	500-1100	11.3±0.5	±0.6	—	—	1.1	1.8	—	—	—	—	20	10	—	—	1.4	2	2	7-18	YY161	cx	11.95
● SCDC-25-2	500-1100	25.5±0.75	±0.8	—	—	0.5	1.0	—	—	—	—	22	10	—	—	1.4	2	2	7-18	YY161	cx	13.95
● LRDC-20-2	300-1100	20.5±1.0	±1.3	—	—	0.25	0.6	—	—	—	—	22	10	—	—	1.2	2	2	7-20	QQQ130	cz	15.95
●■ LRDC-10-1-75	5-600	10.7±0.5	±0.5	0.9	1.3	1.0	1.4	1.2	1.8	29	22	27	18	23	14	1.3	1	1	—	QQQ130	cz	11.95
●■ LRDC-10-2-75	30-1000	10.0±0.5	±0.6	1.0	1.5	1.1	1.5	1.3	1.8	21	17	22	17	19	15	1.3	1	1	—	QQQ130	cz	13.95
●■ LRDC-10-2W-75	30-1200	10.0±0.5	±0.8	1.0	1.5	1.1	1.6	1.3	2.0	21	17	22	17	18	15	1.3	1	1	—	QQQ130	cz	15.95
●■ LRDC-12-1-75	5-600	12.2±0.5	±0.6	0.4	0.8	0.5	1.0	0.8	1.5	20	17	21	18	20	12	1.3	1	1	—	QQQ130	cz	11.95
✱ P4DC-30A-2	5-1000	30.5±0.5	±1	0.7	1.2	0.7	1.2	0.8	1.5	30	15	32	20	20	10	1.15	1	2	7-22	C07	da	34.95

L = low range (f_L to $10f_L$) M = mid range (10 f_L to $f_U/2$) U = upper range ($f_U/2$ to f_U)

NOTES:

* L = 25-50 MHz, M = 50-300 MHz, U = 300-400 MHz
** Upper range coupling ±0.75 dB
*** Above 1000 MHz, coupling flatness ±1 dB.
✦ Bi-directional
✣ $L = f_L$-$2f_L$
✱ 4-coupled ports, isolation between coupled ports, 25 dB minimum.
● Surface-mount, non-hermetic, available on tape and reel
○ When only specification for M range given, specification applies to entire frequency range.
△ Available only with SMA connectors
■ Denotes 75 Ohm model, for coax connector models 75 Ohm BNC connectors are standard.
A. General Quality Control Procedures, Environmental Specifications, Hi-Rel, MIL and TX description are given in section 0, see "Mini-Circuits Guarantees Quality" article.
B. Connector types and case mounted options, case finishes are given in section 0, see "Case styles & Outline Drawings".
C. Prices and specifications subject to change without notice.
2. Mainline Loss includes theorical power loss at coupled port. All models are licensed under U.S. Patent 3,426,298.

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50 ohms and 75 ohms

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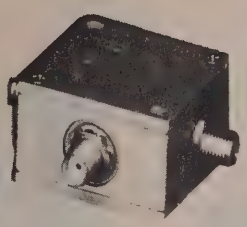
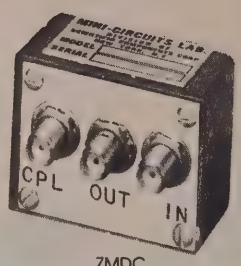
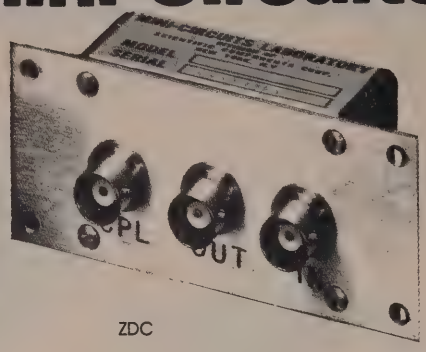
ZEDC


ZFDC



ZMDC



ZDC

MODEL NO.	FREQ. RANGE MHz f_L-f_U	COUPLING dB Nom.	Flatness	MAINLINE LOSS dB L Typ.	L Max.	M° Typ.	M° Max.	U Typ.	U Max.	DIRECTIVITY dB L Typ.	L Min.	M° Typ.	M° Min.	U Typ.	U Min.	VSWR (:1) Typ.	POWER INPUT, W L Max.	MU Max.	CAPD DATA (see RF/IF Designer handbook) Page	CASE STYLE Note B	CONNECTION	PRICE $ Qty. (1-9)
ZEDC-10-2B	1-1000	11±0.5	±0.75	1.3	1.5	1.5	1.8	1.5	1.8	35	30	30	20	18	13	1.3	1.5	3	7-15	V37	db	64.95
ZEDC-15-2B	1-1000	15±0.5	±0.5	0.5	1.0	0.8	1.2	1.0	1.4	35	30	30	25	25	15	1.15	1.5	3	7-15	V37	db	64.95
ZFDC-10-1	1-500	10.5±0.25	±0.6	1.0	1.3	0.8	1.1	1.0	1.3	32	25	33	25	22	15	1.2	1.5	3	7-9	K18	db	44.95
ZFDC-10-2	10-1000	10.75±0.5	±0.5	1.5	2.0	1.2	1.6	1.5	2.0	35	28	30	25	27	20	1.5	1.5	3	7-14	K18	db	51.95
ZFDC-10-5	1-2000	10.8±0.5	±1.0	1.2	1.9	1.2	1.8	1.8	2.5	38	25	30	18	22	18	1.3	0.5	0.5	7-9	K18	db	84.95
ZFDC-10-6	0.005-20	11±0.5	±0.5	0.4	1.2	0.4	0.8	0.4	1.0	40	30	40	30	35	25	1.3	1.5	3	7-10	K18	db	52.95
ZFDC-10-21**	1-1000	11±0.5	±0.5	1.2	1.7	1.2	1.7	1.6	2.0	40	30	25	20	25	20	1.2	1	2	7-10	K18	db	54.95
■ ZFDC-10-1-75	1-400	10.5±0.5	±0.5	1.0	1.4	1.1	1.5	1.1	1.6	46	30	44	28	34	20	1.3	2	4	7-21	K18	db	45.95
■ ZFDC-10-21-75	10-750	11±0.5	±0.75	1.5	1.8	1.5	1.9	1.7	2.1	36	30	30	20	26	20	1.4	1	2	7-21	K18	db	54.95
ZFDC-10-22	1-750	11±0.5	±0.5	1.1	1.6	1.2	1.7	1.4	1.9	35	30	25	20	25	20	1.25	1	2	7-10	K18	db	49.95
ZFDC-15-5	1-2000	15.5±0.5	±1.0	1.2	1.8	1.2	1.8	1.3	2.3	30	20	25	20	18	11	1.3	0.5	2	7-14	K18	db	71.95
ZFDC-15-6	0.03-35	15±0.5	±0.5	0.3	0.6	0.2	0.4	0.3	0.6	38	30	35	25	28	20	1.15	2	4	7-11	K18	db	49.95
■ ZFDC-15-6-75	0.02-35	14.5±0.5	±0.5	0.3	0.7	0.3	0.7	0.3	0.7	35	20	35	20	35	20	1.3	1.5	4	7-16	K18	db	49.95
ZFDC-20-3	0.2-250	19.5±0.5	±0.25	0.35	0.6	0.25	0.5	0.35	0.6	36	25	33	25	25	20	1.2	1.5	4	7-12	K18	db	44.95
■ ZFDC-20-3-75	10-250	19.3±0.5	±0.3	0.25	0.4	0.3	0.5	0.4	0.6	29	25	29	25	28	24	1.2	1	2	7-21	K18	db	49.95
ZFDC-20-4	1-1000	19.5±0.5	±0.5	1.2	1.5	0.6	0.8	1.2	1.5	36	28	27	20	23	18	1.1	.5	2	7-14	K18	db	64.95
Δ ZFDC-20-4L	10-1000	20.2±0.5	±0.5	0.2	0.5	0.3	0.7	0.7	1.2	40	20	30	16	20	14	1.1:1	1	1	—	K18	db	64.95
ZFDC-20-5***	0.1-2000	19.5±0.5	±0.5	0.3	1	0.7	1.4	1.5	2.3	30	20	27	20	22	10	1.2	.5	2	7-20	K18	db	84.95
■ ZFDC-3375	0.2-200	30.5±0.5	±0.6	0.5	0.8	0.6	0.9	0.7	1.0	30	25	25	20	19	15	1.6	.5	2	7-12	K18	db	45.95
ZMDC-10-1	0.5-500	11.5±0.5	±0.6	0.85	1.3	0.65	1.0	0.85	1.3	32	25	32	25	22	15	1.2	1.5	3	7-9	M21	dd	49.95
✤ ZMDC-10-2	250-1000	10.5±0.5	+0.5	1.1	1.4	—	—	1.6	1.9	40	30	—	—	20	15	1.5	—	5	7-9	M21	dd	59.95
ZMDC-15-6	0.1-35	15±0.5	±0.5	0.4	0.6	0.2	0.4	0.4	0.6	38	30	35	25	28	20	1.15	2	4	7-11	M21	dd	59.95
ZMDC-20-1*	25-400	21±0.75	±0.5	0.2	0.25	0.3	0.35	0.35	0.5	25	20	35	25	25	20	1.25	3	5	7-12	M21	dd	59.95
ZMDC-20-3	0.2-250	19.5±0.5	±0.5	0.35	0.5	0.35	0.5	0.35	0.6	36	30	33	25	25	20	1.2	1.5	4	7-12	M21	dd	49.95
ZMDC-30-1	0.1-250	30±0.5	±0.5	0.4	0.6	0.5	0.8	0.55	0.85	23	18	20	15	17	10	1.5	1.0	3	7-13	M21	dd	49.95
ZDC-10-1	0.5-500	11.5±0.5	±0.6	0.85	1.3	0.65	1.0	0.85	1.3	32	25	32	25	22	15	1.2	1.5	3	7-9	M22	dd	44.95
✤ ZDC-10-2	250-1000	10.5±0.5	±0.5	1.1	1.4	—	—	1.6	1.9	40	25	—	—	20	15	1.5	—	4	7-9	M22	dd	51.95
ZDC-15-2	0.5-250	15±0.5	±0.5	0.8	1.2	0.7	1.0	0.9	1.2	32	28	32	28	32	28	1.4	1.5	3	7-20	M22	dd	51.95
ZDC-15-6	.01-35	15±0.5	±0.5	0.3	0.6	0.2	0.4	0.3	0.6	38	30	35	25	28	20	1.15	2	4	7-11	M22	dd	51.95
ZDC-20-1*	25-400	20±0.5	±0.5	0.2	0.25	0.3	0.35	0.35	0.5	25	20	35	25	25	20	1.25	3	5	7-12	M22	dd	51.95
ZDC-20-3	0.2-250	19±0.5	±0.5	0.35	0.6	0.25	0.2	0.35	0.6	36	30	33	25	25	20	1.2	1.5	4	7-12	M22	dd	44.95
■ ZDC-10-1-75	1-250	10.5±0.5	±0.75	1.1	1.5	1.1	1.5	1.1	1.5	30	20	30	20	30	20	2	2	4	7-16	M22	de	44.95
■ ZDC-15-6-75	.02-35	14.5±0.5	±0.6	0.3	0.6	0.2	0.4	0.4	0.6	35	30	35	25	28	20	1.5	2	4	7-16	M22	de	52.95
■ ZDC-20-3-75	1-150	19.5±0.5	±0.75	0.35	0.8	0.35	0.8	0.35	0.8	25	20	25	20	25	20	2	2	4	7-17	M22	de	45.95
■ ZDC-2375	50-100	10.5±0.3	±0.2	—	—	—	—	1.1	1.3	—	—	—	—	35	30	1.3	—	4	7-17	M22	de	52.95
■ ZDC-20-3-75-1	55-90	18.6±0.5	±0.3	0.4	0.6	0.4	0.6	0.4	0.6	35	30	35	30	35	30	1.2	—	4	7-22	M22	de	52.95

L = low range (f_L to $10f_L$) M = mid range ($10 f_L$ to $f_U/2$) U = upper range ($f_U/2$ to f_U)

pin and coax connections see case style outline drawing

ort	ct	cu	cv	cw	cx	cy	cz	da	db	dd	de
iput	5	1	1	1	1	14	6	8	1	3	S
utput	8	4	4	2	2	8	1	12	2	2	1
oupled (forward)	2	3	3	4	5	5	4	2,1,13,14*	3	1	3
oupled (reverse)	—	—	6	—	—	—	—	—	—	—	2
ot Used	11	6	—	—	3,6	—	3	—	—	—	—
ase GND	All other pins	2,5,7,8	2,5,7,8	3	4,7,8	All other pins	2,5	All other pins	—	—	—

4-coupled ports #1, #2, #3, #4 consecutively

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Filters low pass

pin models

DC-1.2 GHz
50 ohms and 75 ohms

case style selection

outline drawings see Table of Contents

SCLF

PLP

MODEL NO.	PASSBAND, MHz (loss < 1dB)	fco, MHz Nom. (loss 3dB)	STOP BAND, MHz (loss > 20dB)	STOP BAND, MHz (loss > 40dB)	VSWR, Passband Typ.	VSWR, Stopband Typ.	CAPD DATA (see RF/IF Designer handbook) Page	CASE STYLE Note B	CONNECTION	PRICE $ (Note 2) Qty. (1-9)
● SCLF-5	DC-5.0	5.8	8-10	10-200	1.7:1	18:1	—	YY161	cr	14.95
● SCLF-8	DC-8.0	9.2	12.5-16.5	16.5-200	1.7:1	18:1	—	YY161	cr	12.95
● SCLF-21.4	DC-22	24.5	32-41	41-200	1.7:1	18:1	8-19	YY161	cr	11.45
● SCLF-30	DC-30	35	47-61	61-200	1.7:1	18:1	8-19	YY161	cr	11.45
● SCLF-45	DC-45	55	70-90	90-200	1.7:1	18:1	8-19	YY161	cr	11.45
● SCLF-135	DC-135	155	210-300	300-600	1.7:1	18:1	8-20	YY161	cr	11.45
● SCLF-190	DC-190	210	290-390	390-800	1.7:1	18:1	8-20	YY161	cr	11.45
● SCLF-380	DC-380	440	580-750	750-1800*	1.7:1	18:1	8-21	YY161	cr	11.45
● SCLF-420	DC-420	570	750-920	920-2000*	1.7:1	18:1	8-21	YY161	cr	11.45
● SCLF-550	DC-550	605	800-1050	1050-2000*	1.7:1	18:1	—	YY161	cr	12.95
PLP-1.9**	DC-1.9	2.5	3.4-4.7	4.7-200	1.7:1	18:1	—	A01	cr	13.95
PLP-2.5**	DC-2.5	2.75	3.8-5.0	5.0-200	1.7:1	18:1	—	A01	cr	14.95
PLP-5	DC-5	6	8-10	10-200	1.7:1	18:1	8-12	A01	cr	11.45
■ PLP-7-75	DC-7	8	11-15	15-200	1.7:1	18:1	—	A01	cr	12.95
PLP-10.7	DC-11	14	19-24	24-200	1.7:1	18:1	8-12	A01	cr	11.45
PLP-15	DC-15	17	23-32	32-200	1.7:1	18:1	—	A01	cr	11.45
PLP-21.4	DC-22	24.5	32-41	41-200	1.7:1	18:1	8-12	A01	cr	11.45
PLP-30	DC-32	35	47-61	61-200	1.7:1	18:1	8-13	A01	cr	11.45
PLP-50	DC-48	55	70-90	90-200	1.7:1	18:1	8-13	A01	cr	11.45
PLP-70	DC-60	67	90-117	117-300	1.7:1	18:1	8-13	A01	cr	11.45
PLP-90	DC-81	90	121-157	157-400	1.7:1	18:1	8-14	A01	cr	11.45
PLP-100	DC-98	108	146-189	189-400	1.7:1	18:1	8-14	A01	cr	11.45
PLP-150	DC-140	155	210-300	300-600	1.7:1	18:1	8-14	A01	cr	11.45
PLP-200	DC-190	210	290-390	390-800	1.7:1	18:1	8-15	A01	cr	11.45
PLP-250	DC-225	250	320-400	400-1200	1.7:1	18:1	8-15	A01	cr	11.45
PLP-300	DC-270	297	410-550	550-1200	1.7:1	18:1	8-15	A01	cr	11.45
PLP-450	DC-400	440	580-750	750-1800	1.7:1	18:1	8-16	A01	cr	11.45
PLP-550	DC-520	570	750-920	920-2000	1.7:1	18:1	8-16	A01	cr	11.45
PLP-600	DC-580	640	840-1120	1120-2000	1.7:1	18:1	8-16	A01	cr	11.45
■ PLP-600-75	DC-580	640	840-1120	1120-2000	1.7:1	18:1	—	A01	cr	12.95
PLP-750	DC-700	770	1000-1300	1300-2000	1.7:1	18:1	8-17	A01	cr	11.45
PLP-800	DC-720	800	1080-1400	1400-2000	1.7:1	18:1	8-17	A01	cr	11.45
PLP-850	DC-780	850	1100-1400	1400-2000	1.7:1	18:1	8-17	A01	cr	11.45
■ PLP-850-75	DC-750	850	1150-1490	1490-2000	1.7:1	18:1	—	A01	cr	12.95
PLP-1000	DC-900	990	1340-1750	1750-2000	1.7:1	18:1	8-18	A01	cr	11.45
PLP-1200	DC-1000	1200	1620-2100	2100-2500	1.7:1	18:1	8-18	A01	cr	11.45

NOTES:

* 35 dB for SCLF-380, SCLF-420 and SCLF-550 models
** 1dB compression at +13 dBm input power
● Surface-mount, non-hermetic, available on tape and reel.
■ Denotes 75 ohm model, for coax connector models 75 ohm BNC connectors are standard.
▽ Three different case styles available:
For SMA connector, case style FF99
BNC connector, case style FF55
N-type connector, case style FF57
A. General Quality Control Procedures, Environmental Specifications, Hi-Rel, MIL and TX description are given in section 0, see "Mini-Circuits Guarantees Quality" article.
B. Connector types and case mounted options, case finishes are given in section 0, see "Case styles & outline drawings".
C. Prices and specifications subject to change without notice.
1. Absolute maximum power, voltage and current rating:
1a. RF power, 0.5 Watt
2. Price shown is for B prefix, for N prefix add $3, for S prefix add $2.
3. Models are available with male/female coax connectors, for other configurations and inter-series versions consult factory. See section 0, case styles and outline drawings.

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BNC, SMA or N connector models

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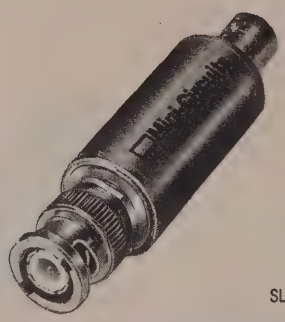
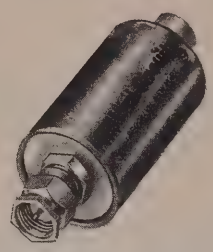
NLP



BLP



SLP

MODEL NO.	PASSBAND, MHz (loss < 1dB)	fco, MHz Nom. (loss 3dB)	STOP BAND, MHz (loss > 20dB)	STOP BAND, MHz (loss > 40dB)	VSWR, Passband Typ.	VSWR, Stopband Typ.	CAPD DATA (see RF/IF Designer handbook) Page	CASE STYLE Note B	CONNECTION	PRICE $ (Note 2) Qty. (1-9)
_LP-1.9**	DC-1.9	2.5	3.4-4.7	4.7-200	1.7:1	18:1	—	▽	—	34.95
_LP-2.5**	DC-2.5	2.75	3.8-5.0	5.0-200	1.7:1	18:1	—	▽	—	35.95
_LP-5	DC-5	6	8-10	10-200	1.7:1	18:1	8-12	▽	—	32.95
■ BLP-7-75	DC-7	8	11-15	15-200	1.7:1	18:1	—	FF55	—	33.95
_LP-10.7	DC-11	14	19-24	24-200	1.7:1	18:1	8-12	▽	—	32.95
_LP-15	DC-15	17	23-32	32-200	1.7:1	18:1	—	▽	—	32.95
_LP-21.4	DC-22	24.5	32-41	41-200	1.7:1	18:1	8-12	▽	—	32.95
_LP-30	DC-32	35	47-61	61-200	1.7:1	18:1	8-13	▽	—	32.95
_LP-50	DC-48	55	70-90	90-200	1.7:1	18:1	8-13	▽	—	32.95
_LP-70	DC-60	67	90-117	117-300	1.7:1	18:1	8-13	▽	—	32.95
_LP-90	DC-81	90	121-157	157-400	1.7:1	18:1	8-14	▽	—	32.95
_LP-100	DC-98	108	146-189	189-400	1.7:1	18:1	8-14	▽	—	32.95
_LP-150	DC-140	155	210-300	300-600	1.7:1	18:1	8-14	▽	—	32.95
_LP-200	DC-190	210	290-390	390-800	1.7:1	18:1	8-15	▽	—	32.95
_LP-250	DC-225	250	320-400	400-1200	1.7:1	18:1	8-15	▽	—	32.95
_LP-300	DC-270	297	410-550	550-1200	1.7:1	18:1	8-15	▽	—	32.95
_LP-450	DC-400	440	580-750	750-1800	1.7:1	18:1	8-16	▽	—	32.95
_LP-550	DC-520	570	750-920	920-2000	1.7:1	18:1	8-16	▽	—	32.95
_LP-600	DC-580	640	840-1120	1120-2000	1.7:1	18:1	8-16	▽	—	32.95
■ BLP-600-75	DC-580	640	840-1120	1120-2000	1.7:1	18:1	—	FF55	—	33.95
_LP-750	DC-700	770	1000-1300	1300-2000	1.7:1	18:1	8-17	▽	—	32.95
_LP-800	DC-720	800	1080-1400	1400-2000	1.7:1	18:1	8-17	▽	—	32.95
_LP-850	DC-780	850	1100-1400	1400-2000	1.7:1	18:1	8-17	▽	—	32.95
■ BLP-850-75	DC-750	850	1150-1490	1490-2000	1.7:1	18:1	—	FF55	—	33.95
_LP-1000	DC-900	990	1340-1750	1750-2000	1.7:1	18:1	8-18	▽	—	32.95
_LP-1200	DC-1000	1200	1620-2100	2100-2500	1.7:1	18:1	8-18	▽	—	32.95

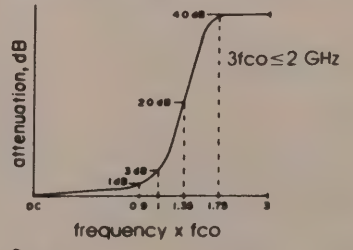
For connector selection, add prefix letter B, N, or S to _LP where applicable (see note 2)

frequency filters

NSN GUIDE

MCL NO.	NSN
PLP-30	5915-01-355-9433
PLP-100	5915-01-332-1091
SLP-30	5915-01-327-4692
SHP-200	5915-01-360-0677

LOW PASS
TYPICAL FREQUENCY RESPONSE



pin connections

see case style outline drawings

PORT	cr
INPUT	1
OUTPUT	8
GND	2,3,4,5,6,7

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102

Filters bandpass

50 ohms

10.7 MHz to 70 MHz
Center Frequency

case style selection

outline drawings see Table of Contents

FF
PBP
PBLP

NBLP
NIF
NBP

constant impedance

MODEL NO.	CENTER FREQ. MHz	PASSBAND, MHz (loss < 1dB)	STOP BANDS (loss > 10dB) at MHz	STOP BANDS (loss > 20dB) at MHz	VSWR, 1.3:1, Typ. TOTAL BAND, MHz	CAPD DATA (see RF/IF Designer handbook) Page	CASE STYLE Note B	connection*	PRICE $ (note 2a) Qty. (1-9)
_IF-21.4	21.4	18-25	4.9 & 85	1.3 & 150	DC-220	8-22	▽	cs	14.95
_IF-30	30	25-35	7 & 120	1.9 & 210	DC-330	8-22	▽	cs	14.95
_IF-40	42	35-49	10 & 168	2.6 & 300	DC-400	8-22	▽	cs	14.95
_IF-50	50	41-58	11.5 & 20	3.1 & 350	DC-440	8-23	▽	cs	14.95
_IF-60	60	50-70	14 & 240	3.8 & 400	DC-500	8-23	▽	cs	14.95
_IF-70	70	58-82	16 & 280	4.4 & 490	DC-550	8-23	▽	cs	14.95

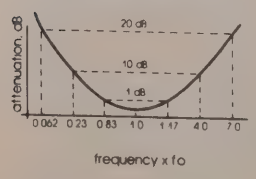
For connector selection, add prefix letter P, B, N or S to _IF where applicable (see note 2)

elliptic response

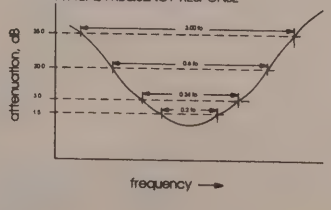
MODEL NO.	CENTER FREQ. MHz	PASSBAND I.L. 1.5 dB MAX. (MHz)	3 dB BANDWIDTH TYPICAL (MHz)	STOP BANDS I.L. > 20 dB at MHz	STOP BANDS I.L. > 35 dB at MHz	PASSBAND VSWR MAX.	STOP BAND VSWR TYPICAL	CAPD DATA (see RF/IF Designer handbook) Page	CASE STYLE Note B	connection*	PRICE $ (note 2b) Qty. (1-9)
_BP-10.7	10.7	9.5-11.5	8.9-12.7	7.5 & 15	0.6 & 50-1000	1.7:1	16:1	8-24	▽	cr	18.95
_BP-21.4	24.1	19.2-23.6	17.9-25.3	15.5 & 29	3.0 & 80-1000	1.7:1	16:1	8-24	▽	cr	18.95
_BP-30	30	27.0-33.0	25-35	22 & 40	3.2 & 99-1000	1.7:1	16:1	8-24	▽	cr	18.95
_BP-60	60	55.0-67.0	49.8-70.5	44 & 79	4.6 & 190-1000	1.7:1	16:1	8-25	▽	cr	18.95
_BP-70	70	63.0-77.0	58.0-82.0	51 & 94	6.0 & 193-1000	1.7:1	16:1	8-25	▽	cr	18.95

For connector selection, add prefix letter P, B, N or S to _BP where applicable (see note 2)

BANDPASS, CONSTANT IMPEDANCE
TYPICAL FREQUENCY RESPONSE



BANDPASS, ELLIPTICAL
TYPICAL FREQUENCY RESPONSE



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flat time delay

Filters low pass

DC–1.87 GHz

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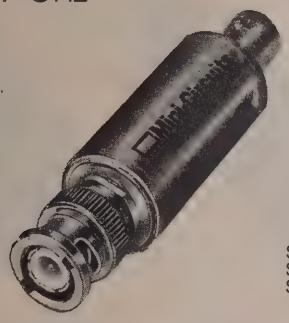
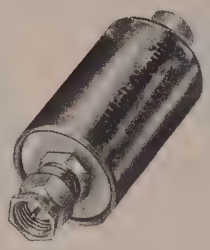




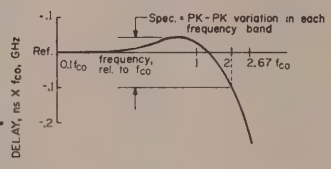
MODEL NO.	PASSBAND, MHz (loss<1.2dB) Min.	fco, MHz (loss 3dB) Nom.	STOPBAND, MHz loss > 10dB	STOPBAND, MHz loss > 20dB	VSWR DC-0.2fco X̄	VSWR DC-0.6fco X̄	GROUP DELAY VARIATION, ns DC-fco X̄	GROUP DELAY VARIATION, ns DC-2fco X̄	GROUP DELAY VARIATION, ns DC-2.67fco X̄	CAPD DATA (see RF/IF Designer handbook) Page	CASE STYLE Note B	connector	PRICE $ (note 2c) Qty. (1-9)
_BLP-39	DC-23	39	78-117	117	1.3:1	2.3:1	0.70	4.0	5.00	8-31	▽	cr	19.95
_BLP-117	DC-65	117	234-312	312	1.3:1	2.4:1	0.35	1.4	1.90	8-31	▽	cr	19.95
_BLP-156	DC-94	156	312-416	416	1.3:1	1.1:1	0.30	1.1	1.50	8-31	▽	cr	19.95
_BLP-200	DC-120	200	400-534	534	1.6:1	1.9:1	0.40	1.3	1.60	8-32	▽	cr	19.95
_BLP-300	DC-180	300	600-801	801	1.25:1	2.2:1	0.20	0.6	0.80	8-32	▽	cr	19.95
_BLP-467	DC-280	467	934-1246	1246	1.25:1	2.2:1	0.15	0.4	0.55	8-32	▽	cr	19.95
▼ _BLP-933	DC-560	933	1866-2490	2490	1.3:1	2.2:1	0.09	0.2	0.28	8-33	▽	-	38.95
▼ _BLP-1870	DC-850	1870	3740-5000	5000	1.45:1	2.9:1	0.05	0.1	0.15	8-33	▽	-	38.95

For connector selection, add prefix letter P, B, N or S to _BLP where applicable. (see note 2)

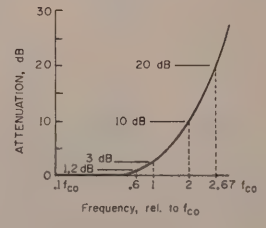
features

- Flat group delay for low pulse distortion.
- Delay and selectivity are both controlled by design.
- Wide selection of cutoff frequencies, 48-to-1 range. Custom Fco values are available.
- Choice of pin package of connectorized models.

TYPICAL GROUP DELAY



TYPICAL FREQUENCY RESPONSE
Insertion Loss



NOTES:

- • Connection for plug-in models (PIF, PBP, PBLP)
- ▼ _BLP-933 and _BLP-1870 available only with N and SMA connectors.
- ▽ Four different case styles available:
  For plug-in models, case style A01
  SMA connector models, case style FF99
  BNC connector models, case style FF55
  N-type connector models, case style FF57
- A. General Quality Control Procedures, Environmental Specifications, Hi-Rel, MIL and TX description are given in section 0, see "Mini-Circuits Guarantees Quality" article.
- B. Connector types and case mounted options, case finishes are given in section 0, see "Case styles & outline drawings".
- C. Prices and specifications subject to change without notice.
- 1. Absolute maximum power, voltage and current rating:
  1a. RF power, 0.5 Watt
- 2. 2a. Price for PIF-series only, SIF $38.95, BIF $36.95, NIF $39.95
  2b. Price for PBP-series only, SBP $42.95, BBP $40.95, NBP $43.95
  2c. Price for PBLP-series only, SBLP $38.95, BBLP $36.95, NBLP $39.95
- 3. Models are available with male/female coax connectors, for other configurations and inter-series versions consult factory. See section 0, case styles and outline drawings.
- 4. All filters, except pin units (PIF, PBP and PBLP) are non-hermetic.

pin connections

see case style outline drawings

PORT	cr	cs
INPUT	1	1
OUTPUT	8	6
GND	2,3,4,5,6,7	2,3,4,5,6,7

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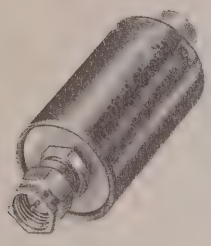
For custom versions of standard models consult our applications dept.

Filters, high pass

25 MHz–2.2 GHz
50 ohms

PHP


SHP

BHP

NHP

MODEL NO.	STOP BAND, MHz (loss > 40dB)	STOP BAND, MHz (loss > 20dB)	fco, MHz Nom. (loss 3dB)	PASSBAND, MHz (loss < 1dB)	VSWR, Stopband Typ.	VSWR, Passband Typ.	CAPD DATA (see RF/IF Designer handbook) Page	CASE STYLE Note B	connection	PRICE $ (Note 2) Qty. (1-9)
PHP-25	DC-13	13-19	25	27.5-200	18:1	1.7:1	8-26	A01	cr	16.95
PHP-50	DC-20	20-26	37	41-200	17:1	1.5:1	8-26	A01	cr	14.95
PHP-100	DC-40	40-55	82	90-400	17:1	1.5:1	8-26	A01	cr	14.95
PHP-150	DC-70	70-95	120	133-600	17:1	1.8:1	8-27	A01	cr	14.95
PHP-175	DC-70	70-105	140	160-800	17:1	1.5:1	8-27	A01	cr	14.95
PHP-200	DC-90	90-116	164	185-800	17:1	1.6:1	8-27	A01	cr	14.95
PHP-250	DC-100	100-150	205	225-1200	17:1	1.3:1	8-28	A01	cr	14.95
PHP-300	DC-145	145-170	245	*290-1200	17:1	1.7:1	8-28	A01	cr	14.95
PHP-400	DC-210	210-290	360	395-1600	17:1	1.7:1	8-28	A01	cr	14.95
PHP-500	DC-280	280-365	454	500-1600	17:1	1.9:1	8-29	A01	cr	14.95
PHP-600	DC-350	350-440	545	600-1600	17:1	2.0:1	8-29	A01	cr	14.95
PHP-700	DC-400	400-520	640	700-1800	17:1	1.6:1	8-29	A01	cr	14.95
PHP-800	DC-445	445-570	710	780-2000	17:1	2.1:1	8-30	A01	cr	14.95
PHP-900	DC-520	520-660	820	910-2100	17:1	1.8:1	8-30	A01	cr	14.95
PHP-1000	DC-550	550-720	900	1000-2200	17:1	1.9:1	8-30	A01	cr	14.95
_HP-25	DC-13	13-19	25	27.5-200	18:1	1.7:1	8-26	▽	-	38.95
_HP-50	DC-20	20-26	37	41-200	17:1	1.5:1	8-26	▽	-	36.95
_HP-100	DC-40	40-55	82	90-400	17:1	1.5:1	8-26	▽	-	36.95
_HP-150	DC-70	70-95	120	133-600	17:1	1.8:1	8-27	▽	-	36.95
_HP-175	DC-70	70-105	140	160-800	17:1	1.5:1	8-27	▽	-	36.95
_HP-200	DC-90	90-116	164	185-800	17:1	1.6:1	8-27	▽	-	36.95
_HP-250	DC-100	100-150	205	225-1200	17:1	1.3:1	8-28	▽	-	36.95
_HP-300	DC-145	145-190	245	*290-1200	17:1	1.7:1	8-28	▽	-	36.95
_HP-400	DC-210	210-290	360	395-1600	17:1	1.7:1	8-28	▽	-	36.95
_HP-500	DC-280	280-365	454	500-1600	17:1	1.9:1	8-29	▽	-	36.95
_HP-600	DC-350	350-440	545	600-1600	17:1	2.0:1	8-29	▽	-	36.95
_HP-700	DC-400	400-520	640	700-1800	17:1	1.6:1	8-29	▽	-	36.95
_HP-800	DC-445	445-570	710	780-2000	17:1	2.1:1	8-30	▽	-	36.95
_HP-900	DC-520	520-660	820	910-2100	17:1	1.8:1	8-30	▽	-	36.95
_HP-1000	DC-550	550-720	900	1000-2200	17:1	1.9:1	8-30	▽	-	36.95

For connector selection, add prefix letter B, N, or S to _HP where applicable (see Note 2)

NOTES:

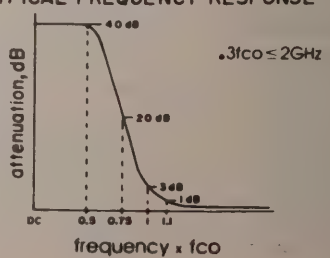
* Insertion loss 1.5 dB maximum
▽ Three different case styles available:
SMA connector models, case style FF99
BNC connector models, case style FF55
N-type connector models, case style FF57
A. General Quality Control Procedures, Environmental Specifications, Hi-Rel, MIL and TX description are given in section 0, see "Mini-Circuits Guarantees Quality" article.
B. Connector types and case mounted options, case finishes are given in section 0, see "Case styles & outline drawings".
C. Prices and specifications subject to change without notice.
1. Absolute maximum power, voltage and current rating:
1a. RF power, 0.5 Watt
2. Price shown is for B prefix, for N prefix add $3, for S prefix add $2.
3. Models are available with male/female coax connectors, for other configurations and inter-series versions consult factory. See section 0, case styles and outline drawings.

pin connections

see case style outline drawings

PORT	cr
INPUT	1
OUTPUT	8
GND	2,3,4,5,6,7

HIGH PASS
TYPICAL FREQUENCY RESPONSE



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Limiters

Mini-Circuits

50 ohms
10 KHz to 900 MHz

broadband, minimal Δ phase +3 to +20 dBm input

PLS

MODEL NO.	FREQUENCY MHz F_L F_U	INPUT dBm Min.	INPUT dBm Max.	*OUTPUT dBm Typ.	CONTROL CURRENT (mA) Typ.	LIMITING Input range, Δ Output/Δ 1dB Input dBm	amp, dB	phase, deg.	CAPD DATA (see RF/IF Designer handbook) Page	CASE STYLE Note B	connection	PRICE $ Qty. (1-9)
PLS-1	0.1 - 150	6	20	−4.0	3	6 to 10 10 to 16 16 to 20	0.10 0.15 0.15	0.8 0.8 0.7	10-5	A01	dm	22.95
PLS-2	100 - 900	3	15	−5.0	5	3 to 8 8 to 12 12 to 15	0.20 0.40 0.40	2.0 2.0 2.0	10-5	A01	dn	22.95
PLS-6	0.01 - 1	6	20	−0.5	5	6 to 10 10 to 16 16 to 20	0.20 0.10 0.20	1.0 1.0 1.5	10-6	A01	dp	35.95

NSN GUIDE

MCL NO.	NSN
PLS-1	5895-01-105-7820
PLS-6	5820-01-249-8320

NOTES:

* Typical output level at typical control current, level may be changed by varying current.
A. General Quality Control Procedures, Environmental Specifications, Hi-Rel, MIL and TX description are given in section 0, see "Mini-Circuits Guarantees Quality" article.
B. Connector types and case mounted options, case finishes are given in section 0, see "Case styles & outline drawings".
C. Prices and specifications subject to change without notice.
1. Absolute maximum power, voltage and current rating:
1a. RF input power, 100mW
1b. Control current, 10mA

pin connections

see case style outline drawings

PORT	dm	dn	dp
INPUT	1	1	1
OUTPUT	8	8	8
CONTROL	3,4 ^	3,4 ^	3,4
GND EXT.	2,5,6,7	2,5,6,7	2,5,6,7
CASE GND	2	2,5,6,7	—

^ pins must be connected together externally

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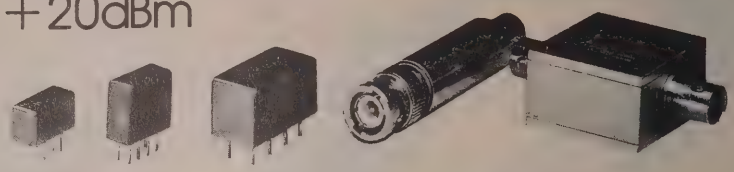
high rejection of 1st and 3rd harmonics

Frequency Doublers

input power 0 to +20dBm

5 KHz to 3000 MHz
case style selection

outline drawings see Table of Contents



SK AK RK FD FK

MODEL NO.	FREQUENCY MHz Input	FREQUENCY MHz Output	RF INPUT PWR. dBm Min.	RF INPUT PWR. dBm Max.	CONVERSION LOSS dB Input freq.	CONVERSION LOSS dB Typ.	CONVERSION LOSS dB Max.	*HARMONIC OUTPUT, dB F1 Typ.	F1 Min.	F3 Typ.	F3 Min.	F4 Typ.	F4 Min.	CAPD DATA (see RF/IF Designer handbook) Page	CASE STYLE Note B	connection	PRICE $ Qty. (1-9)
SK-2	1-500	2-1000	1	10	1-100	13.0	15.0	40	30	50	40	16	12	9-6	B02	df	26.45
					100-300	13.5	15.5	25	20	40	30	16	12				
					300-500	14.0	17.5	20	15	30	25	16	12				
AK-2	1-500	2-1000	1	10	1-100	13.0	15.0	40	30	50	40	16	12	9-6	A03	dg	20.95
					100-300	13.5	15.5	25	20	40	30	16	12				
					300-500	14.0	17.5	20	15	30	25	16	12				
AK-3000	70-1500	140-3000	12	15	70-1000	10.5	14.0	31	20	40	25	14	10	9-8	A03	ga	59.95
					1000-1500	11.5	16.0	22	15	30	20	30	14				
RK-2	5-500	10-1000	1	15	5-100	13.0	16.0	40	30	50	40	16	12	9-6	A01	dg	17.95
					100-300	13.5	15.5	25	20	40	30	16	12				
					300-500	14.0	16.5	20	15	30	25	16	12				
RK-3	0.05-150	0.1-300	0	13	0.05-50	11.0	13.0	40	30	45	30	16	12	9-6	A01	dh	15.95
					50-150	11.5	15.0	35	20	40	20	16	12				
RK-5	10-800	20-1600	10	20	10-100	13.0	15.0	20	12	25	20	15	12	9-7	A01	dg	49.95
					100-400	12.5	16.0	20	12	30	20	15	12				
					400-800	13.0	16.0	20	12	25	18	15	10				
RK-6	0.005-25	0.01-50	0	10	0.005-1	11.0	13.0	40	30	45	30	16	12	9-8	A01	dj	25.95
					1-25	11.5	15.0	35	20	40	20	16	12				
RK-3000	70-1500	140-3000	12	15	70-1000	11.0	14.0	31	20	40	25	15	10	9-8	A01	ga	54.95
					1000-1500	12.0	17.5	22	15	30	20	30	14				
FD-2	5-500	10-1000	1	15	5-100	13.0	16.0	40	30	50	40	16	12	9-6	FF55	-	40.95
					100-300	13.5	15.5	25	20	40	30	16	12				
					300-500	14.0	16.5	20	15	30	25	16	12				
FK-5	10-1000	20-2000	10**	20	10-600	13.0	15.0	20	10	16	20	15	10	9-7	H16	-	69.95
					600-1000	14.0	17.0	20	10	25	20	25	15				
△ FK-3000	70-1500	140-3000	12	15	70-1000	11.0	14.0	31	20	40	25	15	10	9-8	H16	-	79.95
					1000-1500	12.0	17.5	22	15	30	20	30	14				

NOTES:

- * Harmonic output below power level of F2
- ** Minimum input power +13 dBm above 700 MHz
- ● Surface-mount, non-hermetic, available on tape and reel.
- △ Available only with SMA connectors
- A. General Quality Control Procedures, Environmental Specifications, Hi-Rel, MIL and TX description are given in section 0, see "Mini-Circuits Guarantees Quality" article.
- B. Connector types and case mounted options, case finishes are given in section 0, see "Case Styles & Outline Drawings".
- C. Prices and Specifications subject to change without notice.
- 1. Absolute maximum power, voltage and current rating:
  1a. RF input power, 200mW

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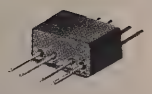
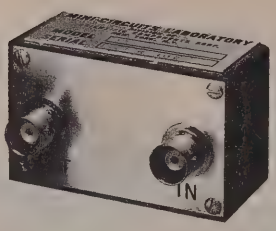
50 ohms

Mini-Circuits

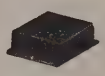


LK

MK



GK



SYK

MODEL NO.	FREQUENCY MHz Input	Output	RF INPUT PWR. dBm Min.	Max.	CONVERSION LOSS dB Input freq.	Typ.	Max.	*HARMONIC OUTPUT, dB F1 Typ.	Min.	F3 Typ.	Min.	F4 Typ.	Min.	CAPD DATA (see RF/IF Designer handbook) Page	CASE STYLE Note B	connection	PRICE $ Qty. (1-9)
● SYK-2R	10-1000	20-2000	12	16	10-500	10.5	14.0	35	25	42	25	20	10	--	TT167	gc	29.95
					500-1000	11.5	16.0	32	20	37	20	20	10				
LK-3000	70-1500	140-3000	12	15	70-1000	10.5	14.0	31	20	40	25	15	10	9-8	BB48	dk	64.95
					1000-1500	11.5	16.0	22	15	35	20	20	14				
MK-2	5-500	10-1000	1	15	5-100	13.0	16.0	40	30	50	40	16	12	9-6	L19	-	52.95
					100-300	13.5	15.5	25	20	40	30	16	12				
					300-500	14.0	16.5	20	15	30	25	16	12				
MK-3	0.05-150	0.1-300	0	13	0.05-50	11.0	13.0	40	30	45	30	16	12	9-6	L19	-	47.95
					50-150	11.5	15.0	35	20	40	20	16	12				
MK-5	10-1000	20-2000	10**	20	10-600	13.0	15.0	20	10	26	20	15	10	9-7	L19	-	76.95
					600-1000	14.0	17.0	20	10	25	20	25	15				
GK-2	5-500	10-1000	1	15	5-100	13.0	16.0	40	30	50	40	16	12	9-6	L20	-	45.95
					100-300	13.5	15.5	25	20	40	30	16	12				
					300-500	14.0	16.5	20	15	30	25	16	12				
GK-3	0.05-150	0.1-300	0	13	0.05-50	11.0	13.0	40	30	45	30	16	12	9-6	L20	-	43.95
					50-150	11.5	15.0	35	20	40	20	16	12				
GK-5	10-1000	20-2000	10**	20	10-600	13.0	15.0	20	10	26	20	15	10	9-7	L20	-	67.95
					600-1000	14.0	17.0	20	15	25	20	25	15				

applications

- Wideband frequency multiplier chains
- Low spurious frequency multiplier chains
- FM, PM modulation chains
- Double frequency range of signal generators

pin connections

see case style outline drawings

PORT	df	dg	dh	dj	dk	ga	gc
INPUT	1,2 ^	1,3,4 ^	1,3,4 ^	1,3,4 ^	4	1	2
OUTPUT	4	8	8	8	8	8	1
GND EXT.	3	2,5,6,7	2,5,6,7	2,5,6,7	1,2,3,5,6,7	1,2,3,4,5,6,7	4
CASE GND	3	2,5,6,7	2	—	1,2,3,5,6,7	1,2,3,4,5,6,7	4
NOT USED	—	—	—	—	—	—	3

^ pins must be connected together externally

NSN GUIDE

MCL NO.	NSN
AK-2	5895-01-131-4569
FD-2	5895-00-087-7925
FK-5	5985-01-204-9746
MK-3BR	5895-01-332-8582
RK-2	5895-01-268-7337
RK-3	5895-01-143-3726
RK-3-TX	5895-01-160-8656
SK-2	6625-01-247-8425

In Stock...Immediate Delivery

For custom versions of standard models consult our applications dept.

highest figure of merit

Phase Detectors

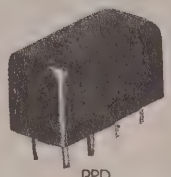
1000mV DC output, +7dBm RF

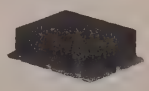
case style selection

outline drawings see Table of Contents

LPD

MPD


RPD


SYPD

ZRPD

MODEL NO.	FREQUENCY MHz RF1 RF2	I	POWER IN RF1 RF2 (dBm)	SCALE FACTOR mV/degree	IMPEDANCE (ohms) OUTPUT LOAD I	ISOLATION (dB) RF1-RF2 Min.	OUTPUT POLARITY RF1/RF2 in-phase	DC OUTPUT (mV) MAX. Typ.	MAX. Min.	OFFSET Typ.	OFFSET Max.	FIGURE-OF-MERIT M Typ.	CAPD DATA (see RF/IF Designer handbook) Page	CASE STYLE Note B	connection	PRICE $ Qty. (1-9)
LPD-1	1-100	DC-50	7	8	500	40	neg.	1000	750	0.2	1	143	12-7	BB48	eb	26.45
MPD-1	1-100	DC-50	7	8	500	40	neg.	1000	750	0.2	1	143	12-7	A11	ea	21.45
MPD-2	10-200	DC-50	7	8	500	40	neg.	1000	750	0.3	1	143	12-8	A11	ea	24.95
MPD-21	50-400	DC-50	7	7	500	40*	neg.	800	600	0.5	1	120	12-7	A11	ea	26.95
RPD-1	1-100	DC-50	7	8	500	40	neg.	1000	750	0.2	1	143	12-7	A01	ea	18.45
RPD-2	5-150	DC-50	7	8	500	40	neg.	1000	750	0.3	1	143	12-8	A01	ea	20.95
● SYPD-1	1-100	DC-50	7	8	500	40	neg.	1000	750	0.2	1	143	12-7	TTT167	ec	14.95
● SYPD-2	10-200	DC-50	7	8	500	40	neg.	1000	750	0.3	1	143	12-7	TTT167	ec	18.95
ZRPD-1	1-100	DC-50	7	8	500	40	neg.	1000	750	0.2	1	143	12-7	M22	gg	57.95

NOTES:

* 30 dB from 200 to 400 MHz
● Surface-mount, non-hermetic, available on tape and reel
A. General Quality Control Procedures, Environmental Specifications, Hi-Rel, MIL and TX description are given in section 0, see "Mini-Circuits Guarantees Quality" article.
B. Connector types and case mounted options, case finishes are given in section 0, see "Case Styles & Outline Drawings".
C. Prices and Specifications subject to change without notice.
1. Absolute maximum power, voltage and current rating:
1a. RF input power, 50mW
1b. Peak IF current, 20mA

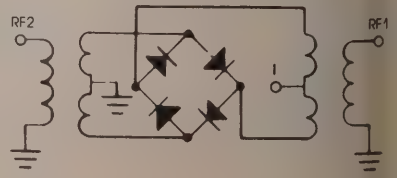
NSN GUIDE

MCL NO.	NSN
MPD-1	6625-01-294-7152
RPD-1	5895-01-250-8525

pin and coaxial connections

see case style outline drawings

PORT	ea	eb	ec	gg
RF REF (RF2)	8	8	2	1
RF IN (RF1)	1	5	1	3
DC OUT (I)	3,4	4	3	2
GND EXT.	2,5,6,7	1,2,3,6,7	4,5,6	—
CASE GND	2	1,2,3,6,7	—	—



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wideband, 360° in 90° steps

Phase Modulators

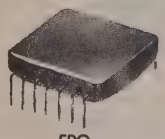
Mini-Circuits

QPSK

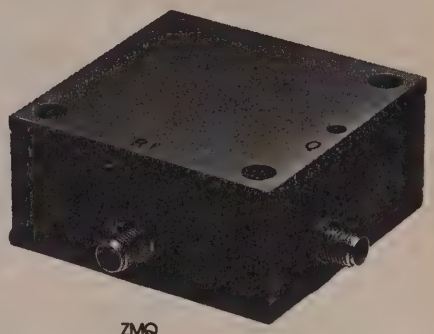
case style selection

outline drawings see Table of Contents

QMC


FPQ

PMQPW
PMQ


ZMQ

MODEL NO.	FREQ. (MHz)	INSERTION LOSS dB		AMPLITUDE UNBAL., dB		PHASE UNBAL., Deg (±)		1 dB COMPRESSION dBm	VSWR, Typ.		CAPD DATA (see RF/IF Designer handbook)	CASE STYLE	connection	PRICE $
		Typ.	Max.	Typ.	Max.	Typ.	Max.	Typ.	IN	OUT	Page	Note B		Qty. (1-9)
QMC-100	50-100	5.6	7.5	0.2	0.8	3	6	4	1.5:1	1.9:1	11-17	C07	dq	128.95
QMC-170	90-170	5.6	7.5	0.3	0.8	3	6	4	1.3:1	1.5:1	11-19	C07	dq	128.95
QMC-1050	800-1050	5.5	7.5	0.5	1.0	3	7	4	2.0:1	2.0:1	11-19	C07	dr	119.95
PMQ-94	47-94	5.5	7.0	0.4	1.2	3	5	4	1.7:1	1.7:1	11-16	AAA118	ds	119.95
PMQ-330	200-330	5.8	8.0	0.4	1.5	3	6	4	1.5:1	1.5:1	11-16	AAA118	ds	119.95
PMQ-440	240-440	5.9	8.0	0.5	1.8	3	7	4	1.5:1	1.5:1	11-18	AAA118	ds	119.95
FPQ-76	60-90	5.4	7.0	0.1	0.9	2	5	4	1.5:1	1.7:1	11-14	FFF122	df	149.95
FPQ-331	205-331	6.0	8.0	0.6	1.5	3	6	4	1.4:1	1.7:1	11-14	FFF122	df	149.95
FPQ-440	240-440	6.2	8.0	0.5	1.5	4	6	4	1.4:1	1.7:1	11-15	FFF122	df	149.95
FPQ-475	421-475	6.8	8.0	0.8	1.5	3	6	4	1.7:1	1.7:1	11-15	FFF122	df	149.95
PMQPW-150*	30-150	6.0	10.5	0.4	0.9	3	8	4	2:1	2:1	11-18	AAA118	ds	172.95
PMQPW-250*	50-250	6.5	10.5	0.5	1.2	3	8	4	1.7:1	1.4:1	11-17	AAA118	ds	172.95
△ ZMQ-1050	800-1050	5.5	7.5	0.5	1.0	3	7	4	2.0:1	2.0:1	11-19	HHH141	du	169.95

features

- octave & multi-octave bandwidth
- good phase & amplitude balance
- hermetically sealed metallic enclosure with bent leads or plug-in version.
- capable of meeting MIL-M-28837 requirements

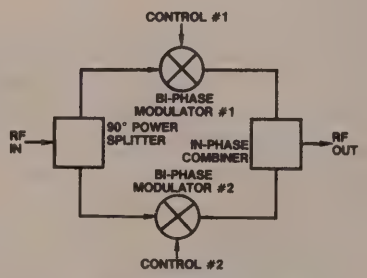
pin and coaxial connections

see case style outline drawings

PORT	dq	dr	ds	df	du
RF IN	13	13	8	1	3
RF OUT	1	2	4	8	1
CONTROL-1	5	4	2	5	4
CONTROL-2	8	1	6	10	2
NOT USED	2	9,12,16	—	—	—
GND EXT.	3,4,6,7,9,10, 11,12,14,15,16	3,5,6,7,8, 10,11,14,15	1,3,5,7	2,3,4,6,7,9, 11,12,13,14	—
CASE GND	3,4,6,7,10, 11,14,15	3,5,6,7,8, 10,11,14,15	1,3,5,7		—

PHASE SHIFT VS. CONTROL CURRENT

CONT.-1 (mA)	CONT.-2 (mA)	PHASE SHIFT (Deg.)
+20	+20	0 (REF)
+20	−20	90
−20	−20	180
−20	+20	270



QPSK Modulator Block Diagram

NOTES:

* Protected under patent No. 4,673,898
△ Available only with SMA connectors
A. General Quality Control Procedures, Environmental Specifications, Hi-Rel, MIL and TX description are given in section 0, see "Mini-Circuits Guarantees Quality" article.
B. Connector types and case mounted options, case finishes are given in section 0, see "Case styles & outline drawings".
C. Prices and specifications subject to change without notice.
1. Absolute maximum power, voltage and current rating: 1a. Input power, 100mW; 1b. Control current, 40mA
2. All specifications at control current ±20mA
3. Control ports drive with 50 ohms source

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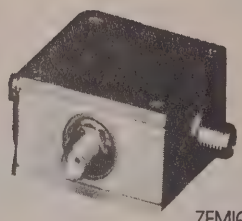
Modulators/ Demodulators 50 ohms

I&Q Modulators

high rejection of carrier and sideband
9 MHz to 1880 MHz



ZFMIQ

MIQA

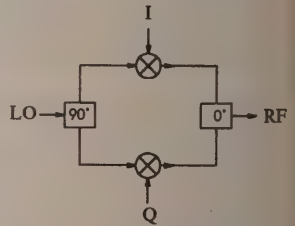
case style selection

outline drawings see Table of Contents

MODEL NO.	FREQUENCY (MHz) RF(signal)/ LO(carrier) f_L	f_U	I & Q Min.	Max.	CONVERSION LOSS (dB) $\bar{x}$	σ	Max.	CARRIER REJECTION (-dBc) Typ.	Min.	SIDEBAND REJECTION (-dBc) Typ.	Min.	HARMONIC SUPPRESSION (-dBc) 3xI/Q Typ.	Min.	5xI/Q Typ.	Min.	CAPD DATA (see RF/IF Designer handbook) Page	CASE STYLE Note B	CONNECTION	PRICE $ Qty. (1-9)
MIQA-10M	9	11	DC	2	5.8	0.20	7.0	41	30	40	30	58	48	68	58	—	A06	dv	49.95
MIQA-21M	20	23	DC	3	6.2	0.14	7.0	50	40	40	30	48	40	65	55	—	A06	gd	39.95
MIQA-70M	66	73	DC	5	6.2	0.10	7.0	38	30	38	30	48	45	58	55	11-20	A06	dv	39.95
MIQA-70ML	66	73	DC	5	5.7	0.10	6.5	38	30	38	30	48	43	58	55	11-26	A06	dv	49.95
MIQA-91M	86	95	DC	5	5.5	0.10	6.5	38	30	38	30	48	45	58	55	11-22	A06	dv	49.95
MIQA-100M	95	105	DC	5	5.5	0.10	6.5	38	30	38	30	48	45	58	55	11-22	A06	dv	49.95
MIQA-108M	103	113	DC	5	5.5	0.10	6.5	38	30	38	30	48	43	58	55	11-23	A06	dv	49.95
MIQA-195M	185	205	DC	5	5.6	0.10	6.5	38	30	38	30	48	45	58	55	11-23	A06	dv	49.95
MIQC-88M	52	88	DC	5	5.7	0.10	7.5	41	35	34	30	52	40	66	50	11-20	C07	dx	49.95
MIQC-176M	104	176	DC	5	5.5	0.10	7.0	38	30	36	30	47	35	70	50	11-21	C07	dx	54.95
MIQC-895M	868	895	DC	5	8.0	0.10	10.5	40	30	40	30	52	35	58	50	11-21	C07	dw	99.95
MIQC-1785M	1710	1785	DC	5	9.0	0.30	10.5	35	25	35	25	40	33	65	50	—	C07	dx	99.95
MIQC-1880M	1805	1880	DC	5	9.0	0.30	10.5	35	25	35	25	40	33	65	50	—	C07	dx	99.95
△ ZAMIQ-895M	868	895	DC	5	8.0	0.10	10.5	40	30	40	3	52	35	58	50	—	HHH141	gv	149.95
△ ZFMIQ-10M	9	11	DC	2	5.8	0.20	7.0	41	30	40	30	58	45	68	58	—	J17	dz	89.95
△ ZFMIQ-70ML	66	73	DC	5	5.7	0.1	6.5	38	30	38	30	48	43	58	55	—	J17	dz	89.95
△ ZFMIQ-91M	86	95	DC	5	5.5	0.17	6.5	38	30	38	30	48	45	58	55	11-22	J17	dz	89.95
△ ZFMIQ-100M	95	105	DC	5	5.5	0.17	6.5	38	30	38	30	48	45	58	55	11-22	J17	dz	89.95
△ ZFMIQ-108M	103	113	DC	5	5.8	0.12	6.5	38	30	38	30	48	43	58	55	—	J17	dz	89.95
																			Qty. (1-49)
❑ MIQY-70M	67	73	DC	5	5.8	0.20	7.0	40	35	36	30	47	40	60	50	11-20	C07	dy	19.95
❑ MIQY-140M	137	143	DC	5	5.8	0.20	7.0	34	30	36	30	45	35	60	50	11-26	C07	dy	19.95

features

- cellular applications, radar and communication systems
- good carrier and sideband rejections
- excellent 3rd and 5th order harmonic suppression
- all MIQA and MIQC models, metal case and hermetically sealed



I & Q Modulator Block Diagram

NOTES:

- $\bar{x}$ Average of conversion loss at center of mid-band frequency ($f_L+f_U/4$)
- σ Standard deviation
- ❑ Non-hermetic
- △ Available only with SMA connectors
- A. General Quality Control Procedures, Environmental Specifications, Hi-Rel, MIL and TX description are given in section 0, see "Mini-Circuits Guarantees Quality" article.
- B. Connector types and case mounted options, case finishes are given in section 0, see "Case styles & outline drawings".
- C. Prices and specifications subject to change without notice.
- 1. Absolute maximum power, voltage and current rating: 1a. LO power, 50mW 1b. I&Q current, 40mA
- 2. Operating LO power: 10 ± 1dBm
- 3. 1dB compression: 0dBm typical
- 4. Conversion Loss = (I+Q) power, dBm - RF power, dBm
- 5. Carrier and sideband rejections measured at -5dBm I/Q power.
- 6. Q=I-90° for MIQA-70M Q=I+90° for all other models

pin and coaxial connections

see case style outline drawings

PORT	dv	dw	dx	dy	dz	gd	gu	gv
LO (carrier)	1	13	13	13	1	1	13	1
RF (signal)	8	2	1	1	3	8	1	3
I (0°)(ref.)	7	4	8	8	5	7	8	4
Q (90°)*	4	1	5	5	2	4	5	2
ISOLATED**	—	9,12,16	—	10,11	—	—	10,11	—
50Ω TERM. EXT.	2	—	—	—	—	—	—	—
NOT USED	—	—	—	—	—	2	—	—
GND EXT.	3,5,6	3,5,6,7,8, 10,11,14,15	2,3,4,6,7,9,10, 11,12,14,15,16	2,3,4,6,7,9, 12,14,15,16	—	3,5,6	2,3,4,6,7,9, 12,14,15,16	—
CASE GND	3,5,6	3,5,6,7,8, 10,11,14,15	3,4,6,7,10,11, 14,15	3,4,6,7,14, 15	—	3,5,6	3,4,6,7, 14,15	—

* For I&Q modulators: Q(90°) for lower sideband suppression.
For I&Q demodulators: Q= -90° for LO>RF
Q= +90° for LO<RF

** For MIQY, external variable capacitors can be connected at pins 10 and 11 to ground for improvement of sideband rejection (modulators) or phase unbalance (demodulators).

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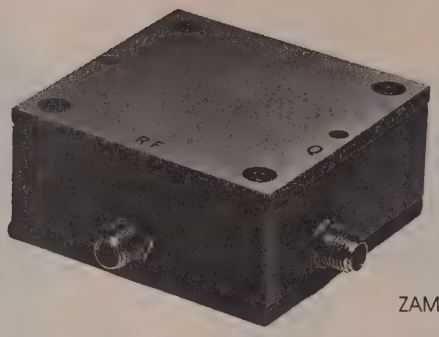
Mini-Circuits

I&Q Demodulators

good amplitude and phase unbalance
1.15 MHz to 895 MHz

MIQY
MIQC

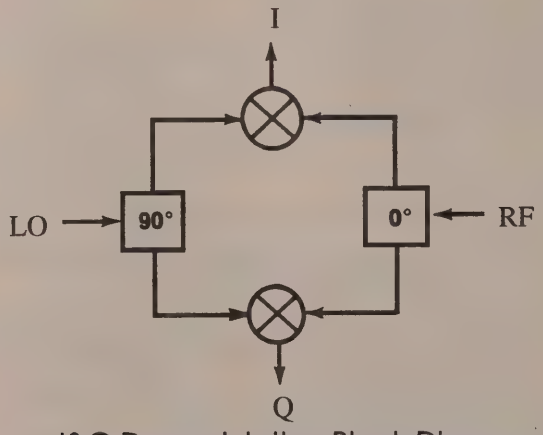


ZAMIQ

MODEL NO.	FREQUENCY (MHz) RF(signal)/ LO(carrier) f_L	f_U	I & Q Min.	Max.	CONVERSION LOSS (dB) $\bar{x}$	σ	Max.	AMPLITUDE UNBALANCE (dB) Typ.	Max.	PHASE UNBALANCE (Deg.) Typ.	Max.	HARMONIC SUPPRESSION (-dBc) 3xI/Q Typ.	Min.	5xI/Q Typ.	Min.	CAPD DATA (see RF/IF Designer handbook) Page	CASE STYLE Note B	CONNECTION	PRICE $ Qty. (1-9)
MIQA-10D	9	11	DC	2	6.0	0.10	7.0	0.15	0.3	1.0	3	50	35	65	55	11-24	A06	dv	49.95
MIQA-21D	20	23	DC	3	6.1	0.15	7.0	0.15	0.6	0.7	3	64	35	67	50	—	A06	gd	49.95
MIQC-895D	868	895	DC	5	8.0	0.2	10.5	0.15	0.3	1.5	4	40	35	55	50	11-24	C07	dw	99.95
△ ZFMIQ-10D	9	11	DC	2	6.0	0.1	7.0	0.15	0.3	1.0	3.0	50	35	65	55	—	J17	dz	89.95
△ ZAMIQ-895D	868	895	DC	5	8.0	0.2	10.5	0.15	0.3	1.5	4.0	52	35	58	50	—	HHH141	gv	149.95
																			Qty. (1-49)
❑ MIQY-1.25D	1.15	1.35	DC	0.2	5.0	0.1	6.0	0.15	0.4	1.0	3.0	59	40	67	55	—	C07	gu	29.95
❑ MIQY-70D	67	73	DC	5	5.5	0.25	7.0	0.10	0.6	0.5	3	52	40	66	50	11-25	C07	dy	19.95
❑ MIQY-140D	137	143	DC	5	5.5	0.25	7.0	0.10	0.6	0.5	3	47	35	70	50	11-25	C07	dy	19.95

features

- cellular applications, radar and communication systems
- good amplitude and phase unbalance
- excellent 3rd and 5th order harmonic suppression



I&Q Demodulation Block Diagram

NOTES:

$\bar{x}$ Average of conversion loss at center of mid-band frequency ($f_L+f_U/4$)
σ Standard deviation
❑ Non-hermetic
A. General Quality Control Procedures, Environmental Specifications, Hi-Rel, MIL and TX description are given in section 0, see "Mini-Circuits Guarantees Quality" article.
B. Connector types and case mounted options, case finishes are given in section 0, see "Case styles & outline drawings".
C. Prices and specifications subject to change without notice.
1. Absolute maximum power, voltage and current rating:
1a. LO/RF power, 50mW.
1b. I&Q current, 40mA
2. Operating LO power: 10 ± 0.5dBm
3. 1dB compression at +4dBm RF input
4. DC offset 1mV typical
5. Conversion Loss = RF power, dBm - (I+Q) power, dBm

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112

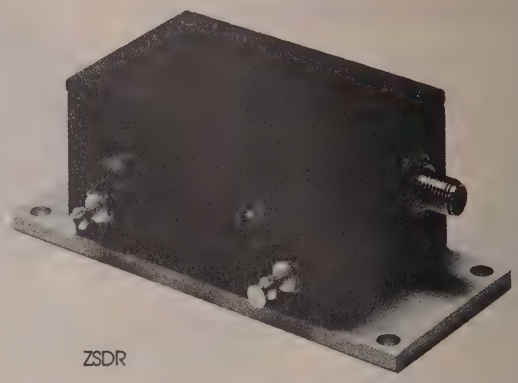
Switches, with TTL Drivers

SPDT/ SP4T
pin diode
10 to 3000 MHz

case style selection

outline drawings see Table of Contents

TOSW



ZSDR

MODEL NO.	TYPE	FREQUENCY MHz $f_L - f_U$	INSERTION LOSS dB low-band lw Typ.	lw Max.	upper band U Typ.	U Max.	IN-OUT ISOLATION, dB frequency band L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	CAPD DATA (see RF/IF Designer handbook) Page	CASE STYLE Note B	connection	PRICE $ Qty. (1-9)
TOSW-230	SPDT	10-3000	1.3	1.9	1.8	2.7	60	40	40	28	35	22	13-12	QQ96	ee	49.95
TOSW-425	SP4T	10-2500	1.1	1.7	1.5	2.5	60	40	40	30	35	22	13-12	QQ96	ed	69.95
ZSDR-230	SPDT	10-3000	1.3	1.9	1.8	2.7	60	40	40	28	35	22	13-12	CCC127	-	89.95
ZSDR-425	SP4T	10-2500	1.1	1.7	1.5	2.5	60	40	40	30	35	22	13-12	GGG126	-	109.95

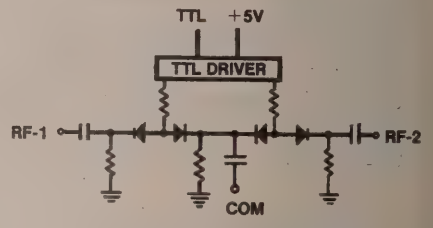
ADDITIONAL SPECIFICATIONS

VSWR ("ON" STATE): 1.3 TYP., 1.9 MAX.
SWITCHING TIME (QSEC): 2.0 TYP., 4.0 MAX.
1 dB COMPRESSION POINT: FROM 10-100 MHz INCREASE FROM 6 TO 19 dBm.
ABOVE 100 MHz, 19 dBm MIN.
SUPPLIED VOLTAGE: +5V
TTL INPUT HIGH THRESHOLD 2 VOLTS MIN.
TTL INPUT LOW THRESHOLD 0.8 VOLTS MAX.

NOTES:

** Video break through is defined as leakage of TTL switching signal to RF output ports.
● Surface-mount, non-hermetic, available on tape and reel; *(Except VSW and VSWA models are hermetically sealed).
✪ Typical isolation at 5 MHz is 80 dB and decreases 5 dB/octave from 5-1000 MHz.
A. General Quality Control Procedures, Environmental Specifications, Hi-Rel, MIL and TX description are given in section 0, see "Mini-Circuits Guarantees Quality" article.
B. Connector types and case mounted options, case finishes are given in section 0, see "Case styles & Outline Drawings".
C. Prices and specifications subject to change without notice.
1. Absolute maximum power, voltage and current ratings for pin diode switches, TOSW and ZSDR models:
1a. RF input power, +20 dBm for low range frequency, +28 dBm for mid range frequency, +30 dBm for upper range frequency.
1b. Supply current, 10 mA.
2. Absolute maximum power, voltage and current ratings for GaAs switches, VSW, VSWA, YSW, YSWA, ZYSW AND ZYSWA models:
2a. RF input power, +22 dBm from DC to 2 GHz, +24 dBm from 2 GHz to 5 GHz.
2b. For YSWA, VSWA and ZYSWA, +20 dBm at "OFF" port, +24 dBm total.
3. For reflective switches, VSW, YSW, ZYSW models, OFF state of RF output is low impedance.

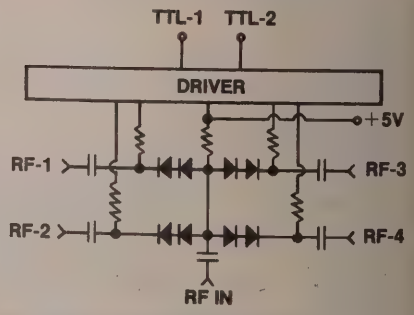
MODEL TOSW-230 & ZSDR-230



TTl LOGIC FOR ZSDR-230 & TOSW-230

TTL 1:	RF-1/OFF	RF-2/ON
TTL 0:	RF-1/ON	RF-2/OFF

MODEL TOSW-425 & ZSDR-425



TTL LOGIC FOR ZSDR-425 & TOSW-425

	TTL-1	TTL-2
RF-1	1	0
RF-2	1	1
RF-3	0	1
RF-4	0	0

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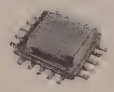
Mini-Circuits

SPDT
GaAs, reflective and absorptive
dc to 5 GHz

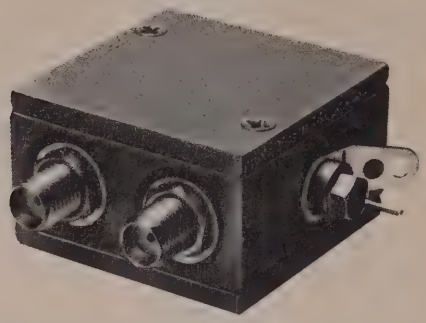
case style selection

see case style outline drawings



VSWA
VSW

YSWA
YSW



ZYSWA
ZYSW

MODEL NO.	FREQ. GHz	INSERTION LOSS, dB FREQUENCY BAND A Typ.	A Max.	B Typ.	B Max.	C Typ.	C Max.	1dB COMPRESSION, dBm FREQUENCY BAND A Typ.	A Min.	B Typ.	B Min.	C Typ.	C Min.	°IN-OUT ISOLATION, dB FREQUENCY BAND A Typ.	A Min.	B Typ.	B Min.	C Typ.	C Min.	CAPD DATA (see RF/IF Designer handbook) Page	CASE STYLE Note B	connection	PRICE $ Qty. (1-9)
● VSW-2-50DR*	DC-5	1.0	1.5	1.2	1.7	1.5	2.1	20	15	20	19	24.0	20	50	41	40	32	28	22	13-14	AG191	ef	42.95
● VSWA-2-50DR*	DC-5	1.1	1.5	1.4	1.9	1.9	2.7	18	13	20	17	22.5	20	50	38	38	27	30	19	13-14	AG191	ef	43.95
● YSW-2-50DR	DC-5	0.9	1.5	1.3	1.7	1.4	2.1	20	15	20	19	24.0	20	50	41	40	32	28	22	13-14	KKK155	ef	14.95
● YSWA-2-50DR	DC-5	1.1	1.5	1.4	1.9	1.9	2.7	18	13	20	17	22.5	20	42	38	31	27	20	19	13-14	KKK155	ef	23.95
ZYSW-2-50DR	DC-5	0.9	1.5	1.3	1.7	1.4	2.1	20	15	20	19	24.0	20	50	41	40	32	28	22	13-14	ZZ121	eg	59.95
ZYSWA-2-50DR	DC-5	1.1	1.5	1.4	1.9	1.9	2.7	18	13	20	17	22.5	20	42	38	31	27	20	19	13-14	ZZ121	eg	69.95

A = DC to 500MHz B = 500MHz to 2000MHz C = 2000MHz to 5000MHz

features

- excellent repeatability, specification limits 4.5 σ typical from mean.
- high isolation, 80 dB typical at 5 MHz.
- low video break thru, 30 mVP-P typical.
- very fast switching, 3 nsec typical.
- low DC power consumption, 120mW typical.
- VSW/A-2-50DR AND YSW/A-2-50DR available in tape & reel.

pin and coaxial connections

see case style outline drawings

PORT	ed	ee	ef	eg
RF IN	8	8	4	3
RF OUT 1	4	5	12	2
RF OUT 2	6	11	14	1
RF OUT 3	10	—	—	—
RF OUT 4	12	—	—	—
TTL-1	2	3	2	4
TTL-2	3	—	—	—
+5V	1	1	19	+5 VDC
-5V	—	—	7	-5 VDC
NOT USED	—	—	9,17	
GND EXT.	5,7,9,11	2,4,6,7,9, 10,12	All other pins	
CASE GND	5,7,9,11	2,4,6,7,9, 10,12	All other pins	

ADDITIONAL SPECIFICATIONS

	MIN.	TYP.	MAX.	UNITS
VSWR (ON)	—	1.4	2.0	
** VIDEO BREAK THROUGH TO RF	—	30	—	mV p-p
RISE/FALL TIME (10% TO 90%)	—	1.5	3.0	nsec
SWITCHING TIME (FROM 50% TTL TO 90% RF)	—	3.0	5.0	nsec
POSITIVE SUPPLY VOLTAGE	4.8	5.0	5.8	V
NEGATIVE SUPPLY VOLTAGE	4.8	5.0	5.8	V
+5V POWER SUPPLY CURRENT		12	20	mA
-5V POWER SUPPLY CURRENT		12	20	mA
TTL LOGIC: TTL INPUT HIGH	RF-OUT #1 OFF, RF-OUT #2 ON			
TTL INPUT LOW	RF-OUT #1 ON , RF-OUT #2 OFF			
TTL SPECS: TTL VOLTAGE	0	—	5.5	V
TTL TOGGLE RATE	0	80	—	MHz
TTL INPUT: HIGH, THRESHOLD	2.0	—	—	V
HIGH, CURRENT	—	2	5	mA
LOW, THRESHOLD	—	—	0.8	V
LOW, CURRENT	—	—	0.2	mA

OPERATING TEMPERATURE:
FOR VSW AND VSWA MODELS: -55°C TO +100°C
ALL OTHER MODELS: -55°C TO +85°C
STORAGE TEMPERATURE:
FOR VSW AND VSWA MODELS: -62°C TO +125°C
ALL OTHER MODELS: -62°C TO +100°C
MOISTURE RESISTANCE OF MODELS ON THIS PAGE IS NOT GUARANTEED.

CAPD now available! computer-automated performance data

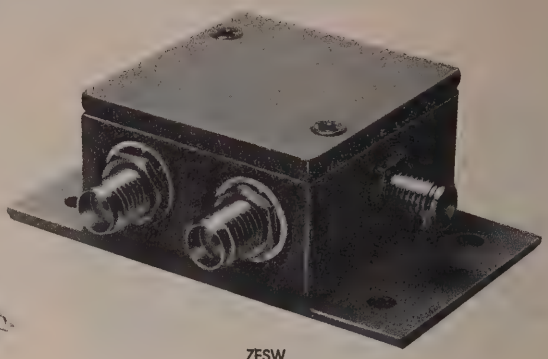
In Stock...Immediate Delivery

For custom versions of standard models consult our applications dept.

GaAs <5 nsec
Switches

SPDT
reflective and absorptive
dc to 4.6 GHz

case style selection
see case style outline drawings



KSW
KSWA

ZFSW
ZFSWA

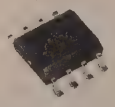
MODEL NO.	FREQ. GHz	ABSORPTIVE	REFLECTIVE	INSERTION LOSS, dB FREQUENCY BAND A Typ.	A Max.	B Typ.	B Max.	C Typ.	C Max.	1dB COMPRESSION, dBm FREQUENCY BAND A Typ.	B Typ.	C Typ.	IN-OUT ISOLATION, dB FREQUENCY BAND A Typ.	A Min.	B Typ.	B Min.	C Typ.	C Min.	CAPD DATA (see RF/IF Designer handbook) Page	CASE STYLE Note B	connection	PRICE $ Qty. (1-9)
● KSW-2-46	DC-4.6		●	0.9	1.1	1.0	1.3	1.3	1.7	10	17	27	60	50	45	40	30	23	13-15	XX112	eh	36.95
● KSWA-2-46	DC-4.6	●		0.8	1.1	0.9	1.3	1.5	2.6	10	17	27	60	45	50	40	30	25	13-15	XX112	eh	58.95
ZFSW-2-46	DC-4.6		●	0.9	1.1	1.0	1.3	1.3	1.7	10	17	27	60	50	45	40	30	23	13-15	G144	ej	79.95
ZFSWA-2-46	DC-4.6	●		0.8	1.1	0.9	1.3	1.5	2.6	10	17	27	60	45	50	40	30	25	13-15	G144	ej	89.95

A=DC to 200MHz B=200MHz to 1000MHz C=1000MHz to 4600MHz

ADDITIONAL SPECIFICATIONS

CONTROL VOLTAGE LOGIC: -8V ON
0V OFF
ALL SPECIFICATIONS, EXCEPT COMPRESSION, APPLY FOR
CONTROL VOLTAGE -8V TO -5V (2.5 mA TYPICAL)
RISE/FALL TIME, TYPICAL 2 nsec
VSWR, TYPICAL 1.3:1
MTBF: 5 MILLION HOURS AT +55°C
KSW-2-46: 7 MILLION HOURS AT 100°C
KSWA-2-46: 11 MILLION HOURS AT 100°C

Control 1	Control 2	RF Out 1	RF out 2
−8V	0V	ON	OFF
0V	−8V	OFF	ON



MSW
MSWA

MODEL NO.	FREQ. GHz	ABSORPTIVE	REFLECTIVE	INSERTION LOSS, dB FREQUENCY BAND A Typ.	A Max.	B Typ.	B Max.	C Typ.	C Max.	D Typ.	D Max.	1dB COMPRESSION, dBm FREQUENCY BAND A Typ.	B Typ.	C Typ.	D Typ.	IN-OUT ISOLATION, dB FREQUENCY BAND A Typ.	A Min.	B Typ.	B Min.	C Typ.	C Min.	D Typ.	D Min.	CAPD DATA (see RF/IF Designer handbook) Page	CASE STYLE Note B	connection	PRICE $ Qty. (1-9)
● MSW-2-20	DC-2.0		●	0.30	0.6	0.4	0.7	0.50	1.0	0.75	1.3	+22	+23	+24	+25	55	50	43	36	34	28	24	20	—	XX211	et	3.75
● MSWA-2-20	DC-2.0	●		0.65	0.9	0.9	1.2	0.95	1.3	1.20	1.5	+20	+24	+27	+29	60	50	45	37	40	32	30	25	—	XX211	es	4.75

A=DC-100MHz B=100-500MHz C=500-1000MHz D=1000-2000MHz

ADDITIONAL SPECIFICATIONS

CONTROL LOGIC:

CONTROL 1	CONTROL 2	RF-OUT 1	RF-OUT 2
0	-V	OFF	ON
-V	0	ON	OFF

ALL SPECIFICATIONS, EXCEPT COMPRESSION AND INTERCEPT, APPLY FOR CONTROL VOLTAGE -8V TO -5V.

CONTROL CURRENT 20µA MAXIMUM, AT "0" STATE (0 TO -0.2V)
200µA MAXIMUM, AT "-V" STATE (UP TO -8V)

	MSW-2-20	MSWA-2-20
RISE/FALL TIME (10% - 90%), TYPICAL	2 nsec	3 nsec
SWITCHING TIME, 50% OF CONTROL TO:		
90% RF (TURN-ON), TYPICAL	4 nsec	5.5 nsec
10% RF (TURN-OFF), TYPICAL	4 nsec	3 nsec
VIDEO LEAKAGE, 0/-5V CONTROL, TYPICAL	15 mVp-p	8 mVp-p

OPERATING TEMPERATURE: -40°C TO +85°C

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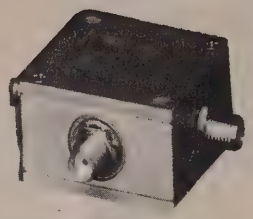
Mini-Circuits

SPST
hi-isolation, absorptive
dc to 2 GHz

KSWHA



ZFSWHA

MODEL NO.	FREQ. GHz TYPE	ABSORPTIVE	INSERTION LOSS, dB FREQUENCY BAND A Typ.	A Max.	B Typ.	B Max.	1dB COMPRESSION, dBm FREQUENCY BAND A Typ.	B Typ.	IN-OUT ISOLATION, dB FREQUENCY BAND A Typ.	A Min.	B Typ.	B Min.	CAPD DATA (see RF/IF Designer handbook) Page	CASE STYLE Note B	connection	PRICE $ Qty. (1-9)
● KSWHA-1-20	DC-2.0	●	0.8	1.2	1.3	1.7	19	26	75	60	65	58	13-11	XX112	ek	34.95
△ ZFSWHA-1-20	DC-2.0	●	0.8	1.2	1.3	1.7	19	26	75	60	65	58	13-11	J17	em	74.95

A=DC to 200MHz B=200MHz to 2000MHz

features

- hi-isolation absorptive switch, 75 dB at 200 MHz, 65 dB at 2 GHz.
- very fast switching, 3 ns typical.
- hermetically sealed glass-metal package.
- compatible with surface mount soldering techniques.

ADDITIONAL SPECIFICATIONS

Control logic:

	ON	OFF
Control 1	−V	0
Control 2	0	−V

All specifications, except compression and intercept, apply for control voltage −8V to −5V Control current is 200 μA max. in this voltage range.

		A	B	UNITS
3rd ORDER INTERCEPT	TYP.	+35	+46	dBm
VSWR "ON" IN & OUT,	MAX.	1.25:1	1.50:1	
VSWR "OFF" IN,	MAX.	1.25:1	1.50:1	
OUT,	MAX.	1.40:1	1.50:1	
		TYP.	MAX.	UNITS
RISE/FALL TIME (10%-90%)		3	5	ns
SWITCHING TIME, 50% OF CONTROL TO:				
90% RF (TURN ON)		7	10	ns
10% RF (TURN OFF)		3	10	ns
VIDEO LEAKAGE, 0/−5V CONTROL		30	50	mV p-p

OPERATING TEMPERATURE: −55 to 100 Deg. C.
STORAGE TEMPERATURE: −55 to 150 Deg. C.
MTBF: 15 million hours at 55 deg. C, 11 million hours at 100 deg. C.

NOTES:

1. Surface-mount, non-hermetic, available on tape and reel,
2. Available only with SMA connectors
3. General Quality Control Procedures, Environmental Specifications, HI-Rel, MIL and TX description are given in section 0, see "Mini-Circuits Guarantees Quality" article. Connector types and case mounted options, case finishes are given in section 0, see "Case styles & Outline Drawings".
4. Prices and specifications subject to change without notice.
5. Absolute maximum power, voltage and current ratings for KSW, KSWA, ZFSW, ZFSWA models:
   1a. RF power input, +30 dBm except below 500 MHz +27 dBm;
   1b. Control voltage -10 V maximum.
6. Absolute maximum power, voltage and current ratings for MSW, MSWA models:

2a. RF power input, (25°C)		DC-100	100-500	500-2000	MHz
MSW-2-20:	Steady state 0/-8V control,	+23	+27	+31	dBm
	As modulator	+11	+17	+21	dBm
MSWA-2-20:	Steady state 0/-8V control,	+24	+27	+33	dBm
	As modulator	+12	+17	+23	dBm

   2b. Control current, 500μA (Occurs at -9V to -12V typical)
7. Absolute maximum power, voltage and current ratings for KSWHA, ZFSWHA models:

3a. RF power input, (Above 20°C derate power linearly to zero at 150°C.)	DC-20	20-500	500-2000	MHz
Steady state 0/-8V control,	+23	+30	+33	dBm
As modulator *	+14.5	+20	+27	dBm

   * In modulator service, unrestricted switching is permitted with RF applied.
   3b. Control current, 500μA (Occurs at -9V to -12V typical)
8. For reflective switches, KSW, ZFSW, MSW, models, OFF state of RF output is low impedance.
9. For surface-mount units, to ensure proper performance, connect case to upper PC board ground, and interconnect top and bottom PC board grounds very close to case location.

pin and coaxial connections

see case style outline drawings

PORT	eh	ej	ek	em	es	et
RF IN	2	S	1	1	2	1
RF OUT 1	5	3	5	2	8	6
RF OUT 2	8	2			5	3
CONTROL 1	3	4	2	S	3	5
CONTROL 2	1	1	3	3	1	4
50-OHM TERM.	—	—	—	—	—	—
GND EXT.	4,6,7		4,6,7,8	—	4,6,7	2,7,8
CASE GND	—		4,6,7,8	—	4,6,7	2,7,8

In Stock...Immediate Delivery

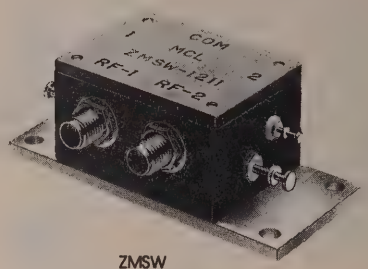
For custom versions of standard models consult our applications dept.

Switches

SPST/SPDT pin diode
10 to 2500 MHz

case style selection
outline drawings see Table of Contents

PSW



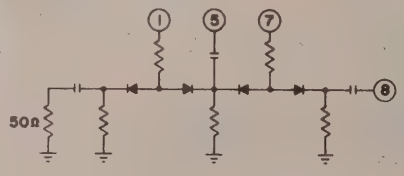
ZMSW

MODEL NO.	TYPE	FREQUENCY MHz $f_L - f_U$	INSERTION LOSS dB low-band lw Typ.	lw Max.	upper band U Typ.	U Max.	IN-OUT ISOLATION, dB frequency band L Typ.	L Min.	M Typ.	M Min.	U Typ.	U Min.	CAPD DATA (see RF/IF Designer handbook) Page	CASE STYLE Note B	connection	PRICE $ Qty. (1-9)
PSW-1111	SPST	10-2500	1.1	1.7	1.7	2.7	50	40	35	30	28	22	13-13	A06	en	32.95
PSW-1211	SPDT	10-2500	1.1	1.7	1.7	2.7	50	40	35	30	28	22	13-13	A06	ep	32.95
ZMSW-1111	SPST	10-2500	1.1	1.7	1.7	2.7	50	45	35	30	28	22	13-13	JJ77	eq	69.95
ZMSW-1211	SPDT	10-2500	1.1	1.7	1.7	2.7	50	45	35	30	28	22	13-13	JJ77	er	69.95

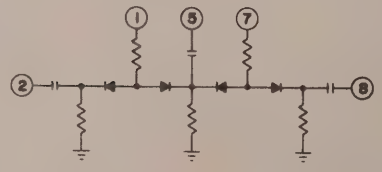
L=low range (f_L to 10 f_L) M=mid range (10f_L to f_U/2) U=upper range (f_U/2 to f_U)
lw=low band (f_L to f_U/2)

ADDITIONAL SPECIFICATIONS:
VSWR 1.6 max. ("on" state)
Switching time: 4μ sec. max.
Rise time: 2μ sec typical
Control voltage +5V on condition, 0V off condition
1 dB compression for all pin diode switches from 10 to 100 MHz increase from 6 to 19 dBm. Above 100 MHz, 19 dBm min.

Model PSW-1111



Model PSW-1211



pin and coaxial connections
see case style outline drawings

PORT	en	ep	eq	er
RF IN	5	5	com	com
RF OUT 1	8	2	–	RF-1
RF OUT 2	–	8	RF-1	RF-2
CONTROL 1	7	1	–	1
CONTROL 2	–	7	2	2
50-OHM TERM.	1	–	1	—
GND EXT.	2,3,4,6	3,4,6	—	—
CASE GND	3,6	3,6	—	—

NSN GUIDE

MCL NO.	NSN
PSW-1211	5985-01-328-8006

NOTES:
- surface-mount, non-hermetic, available on tape and reel
- A. General Quality control procedures. Environmental Specifications, Hi-Reel, MIL and TX description are give in section 0, see "Mini-Circuits Guarantees Quality" article.
- B. Connector types and case mounted options, case finishes are given in section 0, see "Case styles & Outline Drawings".
- C. Prices and specifications subject to change without notice.
- 1. Absolute maximum power, voltage and current ratings for PSW, ZMSW models:
  - 1a. RF power input, +20 dBm;
  - 1b. Control current, 5mA.
- 2. Absolute maximum power, voltage and current ratings for MSWT models:

2a.	input power, dBm (25°C)	DC-100 MHz	100-500 MHz	500-2000 MHz
	steady state 0/-8V control	+24	+27	+33 dBm
	modulator application	+12	+17	+23 dBm

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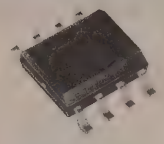
Mini-Circuits

TRANSFER
dc to 2 GHz
case style selection

outline drawings see Table of Contents


MSWT

MODEL NO.	FREQ. MHz	PATH	INSERTION LOSS, dB FREQUENCY BAND A Typ.	A Max.	B Typ.	B Max.	C Typ.	C Max.	D Typ.	D Max.	1dB COMPRESSION, dBm FREQUENCY BAND A Typ.	B Typ.	C Typ.	D Typ.	ISOLATION, dB FREQUENCY BAND A Typ.	A Min.	B Typ.	B Min.	C Typ.	C Min.	D Typ.	D Min.	CAPD DATA (see RF/IF Designer handbook) Page	CASE STYLE Note B	connection	PRICE $ Qty. (1-9)
● MSWT-4-20	DC-2000	Tx-J1/J2	0.9	1.2	1.1	1.5	1.25	1.8	1.45	2.2	18	25	28	29	51	44	34	27	26	21	19	15				
		J1/J2-Rx Tx-Rx	1.1	1.4	1.3	1.7	1.5	2.0	1.6	2.2	16	18	20	22	52 60	46 53	37 41	31 36	29 34	24 27	21 28	17 21	—	XX211	eu	5.75

A=DC to 100MHz B=100MHz to 500MHz C=500MHz to 1000MHz D=1000MHz to 2000MHz

features

- Wide band, DC-2 GHz
- Very fast switching, 4ns typical
- Low-cost plastic package
- Compatible with surface mount soldering techniques
- Low video leakage to 50 Ohm RF ports, 15 mV p-p typical in 500 MHz video bandwidth.

ADDITIONAL SPECIFICATIONS

		A	B	C	D
VSWR (All Ports)	Typ.	1.2	1.25	1.4	1.4
	Max.	1.45	1.65	1.8	1.9

	Typ.	Max.	Units
Rise/Fall time (10%-90%)	2	—	ns
Switching time, 50% of control to:			
90% RF (Turn-on)	4	—	ns
10% RF (Turn-off)	4	—	ns
Video leakage 0/-5 V control	15	—	mV p-p

Control Voltage, current:
"0" State (0 to -0.2V) 20μA max.
"-V" State (-8 to -5V) 200μA max.

Operating temperature: -40 to +85 Deg. C
Storage temperature: -55 to +100 Deg. C

pin connections

see case style outline drawings

PORT	eu
Tx	2
Rx	6
J1	4
J2	8
CONTROL V1	1
CONTROL V2	3
CONTROL V3	5
CONTROL V4	7

control logic

Control Inputs V1	V2	V3	V4	"On" Path (other paths are "OFF")
0	-v	-v	-v	Tx-J2
-v	0	-v	-v	Tx-J1
-v	-v	0	-v	Rx-J1
-v	-v	-v	0	Rx-J2
0	-v	0	-v	Tx-J2 & Rx-J1
-v	0	-v	0	Tx-J1 & Rx-J2

Transmit-Receive Switch: Application Note

The functional schematic diagram for a diversity application of the switch is shown in Figure 1, with the required external components including 4 independent drivers at the control ports. When operation as a transfer switch is desired only 2 drivers are needed, one connected to the V1 and V3 ports together, and the other connected to the V2 and V4 ports. In either case, two DC return paths are needed for the control voltages, represented by the ground symbols in the diagram. These returns must be via oppositely situated RF ports (Tx and Rx or J1 and J2), and can be furnished incidentally by the user's RF terminating devices themselves. However, if those devices are AC-coupled (that is, they contain DC blocking capacitors), then the shunt resistors shown in the diagram are needed. The resistors should be installed either at the Tx and Rx ports (connection shown as solid), or at J1 and J2 (shown dotted), with equal effect. If one external RF device has a DC return to ground, for example, then only one resistor is needed; it must be installed at the opposite RF port of the switch. The resistance of each of the external DC returns should be 20K ohms or less, for proper ON/OFF FETs.

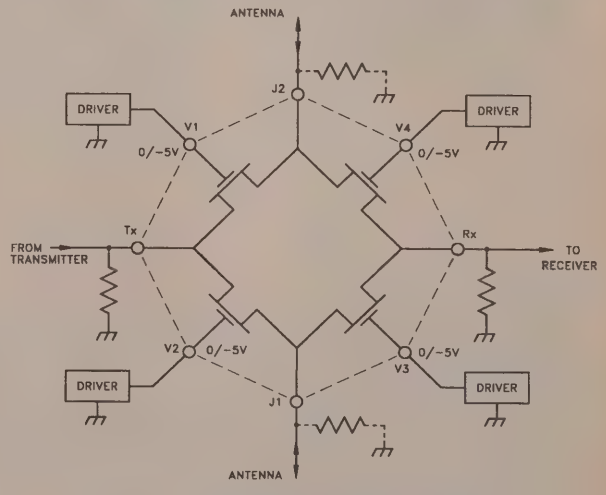


Figure 1. FUNCTIONAL SCHEMATIC DIAGRAM (Transmit-Receive application)

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wideband
RF Transformers

4KHz to 800MHz

case style selection

outline drawings see Table of Contents

T, TH, TT

	MODEL NO.	Ω RATIO	FREQUENCY MHz	INSERTION LOSS * 3 dB MHz	INSERTION LOSS * 2 dB MHz	INSERTION LOSS * 1 dB MHz	CAPD DATA (see RF/IF Designer handbook) Page	CASE STYLE Note B	CONNECTION	PRICE $ Qty. (1-9)
A*	T1-1T	1	.05-200	.05-200	.08-150	.2-80	14-8	▽	ev	4.45
	T1-6T	1	.015-300	.015-300	.021-150	.03-50	14-8	▽	ev	6.95
	T2-1T	2	.07-200	.07-200	.1-100	.5-50	14-8	▽	ev	4.95
	T2.5-6T	2.5	.01-100	.01-100	.02-50	.50-20	14-8	▽	ev	4.95
	T3-1T	3	.05-250	.05-200	.1-200	.5-70	14-8	▽	ev	4.95
	T4-1	4	.2-350	.2-350	.35-300	2-100	14-9	▽	ev	3.25
	T4-6T	4	.02-250	.02-250	.05-150	0.1-100	14-9	▽	ev	4.45
	T5-1T	5	.3-300	.3-300	.6-200	5-100	14-9	▽	ev	4.95
	T8-1T	8	.3-140	.3-140	.7-90	1-60	14-9	▽	ev	7.95
	T13-1T	13	.3-120	.3-120	.7-80	5-20	14-9	▽	ev	4.95
	T16-6T	16	.03-75	.03-75	.06-30	.1-20	14-10	▽	ev	5.65
	T4-1H	4	10-350	10-350	15-300	25-200	14-10	▽	ew	5.95
	TMO1-1T	1	.05-200	.05-200	.08-150	.2-80	14-10	A11	ew	7.95
	TMO2-1T	2	.07-200	.07-200	.1-100	.5-50	14-10	A11	ew	8.45
	TMO2.5-6T	2.5	.01-100	.01-100	.02-50	.05-20	14-10	A03	ew	8.45
	TMO3-1T	3	.05-250	.05-250	.1-200	.5-70	14-11	A03	ew	7.95
	TMO4-1	4	.2-350	.2-350	.35-300	2-100	14-11	A11	ew	6.25
	TMO5-1T	5	.3-300	.3-300	.6-200	5-100	14-11	A11	ew	8.45
	TMO13-1T	13	.3-120	.3-120	.7-80	5-20	14-11	A11	ew	8.45
	TX16-R3T	16	40-300	40-300	60-220	70-150	-	TT100	ev	4.95
B*	✣ TT1-6	1	.004-500	.004-500	.02-200	.1-50	14-12	▽	ex	6.95
	TT1.5-1	1.5	.075-500	.075-500	.2-100	1-50	14-12	▽	ex	5.95
	TT2.5-6	2.5	.01-50	.01-50	.025-25	.05-10	14-12	▽	ex	6.45
	TT4-1	3	.05-200	.05-200	.2-50	1-30	14-12	▽	ex	5.95
	TT4-1A	4	0.1-300	0.1-300	0.2-250	0.3-180	14-12	▽	ex	6.95
	TT16-1	16	0.1-45	0.1-45	0.14-35	1-20	14-13	▽	ex	9.95
	TT25-1	25	.02-30	.02-30	.05-20	.1-10	14-13	▽	ex	9.95
	TTMO25-1	25	.02-30	.02-30	.05-20	.1-10	14-13	A03	ey	11.95
	TTMO1-1	1	.005-100	.005-100	.01-75	.05-40	14-13	A03	ey	11.45
	TTMO4-1A	4	0.1-300	0.1-300	0.2-250	0.3-180	14-13	A03	ey	13.95

NOTES:

* FOR A AND B CONFIGURATIONS:
Typical Amplitude Unbalance: 0.1 dB over 1 dB frequency range; 0.5 dB over entire frequency range.
Typical Phase Unbalance: 1.0° over 1 dB frequency range; 5.0° over entire frequency range.

▽ Three case styles available: Plug-in case style X65; Surface-mount case style KK81; Radial lead case style W38.

✲ Insertion loss referenced to mid-band loss

✣ Insertion loss is specified with input at pin 4 and output at pin 2, all other pins are grounded.

A. General Quality Control Procedures, Environmental Specifications, Hi-Rel, MIL and TX description are given in section 0, see "Mini-Circuits Guarantees Quality" article.

B. Connector types and case mounted options, case finishes are given in section 0, see "Case Styles & Outline Drawings".

C. Prices and Specifications subject to change without notice.

1. Absolute power, voltage and current ratings:
   1a. RF input power: For T2-1-2W and T4-1-2W, 2 Watt;
   All other models 0.25 Watt
   1b. DC current, 30mA

2. For T,TT, TH and TX series, operating temperature range is -20°C to +85°C.

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12.5 to 1800 ohms

Mini-Circuits

TX

TMO, TTMO

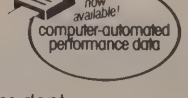
TO

C -

MODEL NO.	Ω RATIO	FREQUENCY MHz	INSERTION LOSS * 3 dB MHz	2 dB MHz	1 dB MHz	CAPD DATA (see RF/IF Designer handbook) Page	CASE STYLE Note B	CONNECTION	PRICE $ Qty. (1-9)
T1-1	1	.15-400	.15-400	.35-200	2-50	14-14	T	ez	3.25
T1.18-3	1.18	0.01-250	0.01-250	0.02-200	0.03-50	14-14	T	ez	5.65
T1-6	1	.01-150	.01-150	.02-100	.05-50	14-14	T	ez	5.65
T1.5-1	1.5	.1-300	.1-300	.2-150	.5-80	14-14	T	ez	4.45
T1.5-6	1.5	.02-100	.02-100	.05-50	0.1-25	14-14	T	ez	5.65
T2-1-2W	2	5-120	—	—	5-120	-	T	ez	5.95
T2.5-6	2.5	.01-100	.01-100	.02-50	.05-20	14-15	T	ez	4.45
T4-1-2W	4	10-250	—	—	10-250	-	T	ez	5.95
T4-6	4	.02-200	.02-200	.05-150	.1-100	14-15	T	ez	4.45
T9-1	9	.15-200	.15-200	.3-150	2-40	14-15	T	ez	3.95
T16-1	16	.3-120	.3-120	.7-80	5-20	14-15	T	ez	4.45
T36-1	36	.03-20	.03-20	.05-10	.1-5	14-15	T	ez	6.95
TO-75	1	10-500	—	10-500	40-250	14-16	PP94	fa	6.95
T1-1H	1	8-300	8-300	10-200	25-100	14-16	T	ez	5.95
T9-1H	9	2-90	2-90	3-75	6-50	14-16	T	ez	6.45
T16-1H	16	7-85	7-85	10-65	15-40	14-16	T	ez	6.45
TMO1-02	1	1-800	1-800	2-500	—	14-16	A11	fc	9.45
TMO1-1	1	.15-400	.15-400	.35-200	2-50	14-17	A11	fb	6.25
TMO1.5-1	1.5	.1-300	.1-300	.2-150	.5-8	14-17	A11	fb	8.45
TMO2.5-6	2.5	.01-100	.01-100	.02-50	.05-20	14-17	A03	fb	7.95
TMO4-6	4	.02-200	.02-200	.05-150	.1-100	14-17	A03	fb	7.95
TMO6-1	6	.3-200	.3-200	.5-150	5-50	14-17	A11	fb	7.95
TMO9-1	9	.15-200	.15-200	.3-150	2-40	14-18	A11	fb	7.95
TMO16-1	16	.3-120	.3-120	.7-80	5-20	14-18	A11	fb	7.95
TX1-1	1	0.3-400	0.3-400	0.6-200	2-50	14-14	TT100	ez	3.50
TX1-R5	1	0.8-500	0.8-500	1.2-350	3.2-180	-	TT100	ez	3.75
TX1.5-1	1.5	0.25-300	0.25-300	0.3-150	0.5-80	14-14	TT100	ez	4.70
TX16-1	16	0.4-120	0.4-120	0.7-80	5-20	14-15	TT100	ez	4.70

pin connections see case style outline drawings

PORT	ev	ew	ex	ey	ez	fa	fb	fc
PRIMARY DOT	4	1	4	1	4	1	1	1
PRIMARY	6	5	6	5	6	2	5	3
PRIMARY CT	—	—	5	3	—	—	—	—
SECONDARY DOT	3	2	3	2	3	4	2	2
SECONDARY	1	6	1	6	1	3	6	4
SECONDARY CT	2	4	2	4	—	—	—	—
CASE EXT.	—	—	—	—	—	—	—	—
CASE GND	—	7,8	—	7,8	—	—	7,8	—
NOT USED	5	3	—	—	2,5	—	3,4	5,6,7,8



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wideband RF Transformers

5KHz to 1500MHz

case style selection

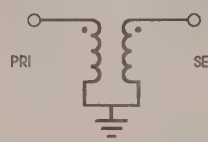
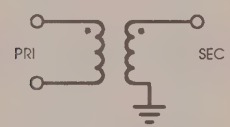
outline drawings see Table of Contents

Style X65

Standard W38

Style KK81

T, TH, TT

	MODEL NO.	Ω RATIO	FREQUENCY MHz	INSERTION LOSS* 3 dB MHz	2 dB MHz	1 dB MHz	CAPD DATA (see RF/IF Designer handbook) Page	CASE STYLE Note B	CONNECTION	PRICE $ Qty. (1-9)
D 	T2-1	2	.050-600	.050-600	.1-400	.5-200	14-19	▽	fd	3.95
	T3-1	3	.5-800	.5-800	2-400	—	14-19	▽	fd	4.45
	T4-2	4	.2-600	.2-600	.5-500	2-250	14-19	▽	fd	3.95
	T8-1	8	.15-250	.15-250	.25-200	2-100	14-19	▽	fd	3.95
	T14-1	14	.2-150	.2-150	.5-100	2-50	14-19	▽	fd	4.95
	TMO2-1	2	.050-600	.050-600	.1-400	.5-200	14-20	A11	fe	7.95
	TMO3-1	3	.5-800	.5-800	2-400	—	14-20	A11	fe	8.45
	TMO4-2	4	.2-600	.2-600	.5-500	2-250	14-20	A11	fe	7.95
	TMO8-1	8	.15-250	.15-250	.25-200	2-100	14-20	A11	fe	7.95
	TMO14-1	14	.2-150	.2-150	.5-100	2-50	14-20	A11	fe	8.45
	FT1.22-1	1.22	.005-100	.005-100	.01-50	.05-25	14-21	H16	—	35.95
	FT1.5-1	1.5	.1-400	.1-400	.5-200	1-100	14-21	H16	—	35.95
E 	FTB1-1	1	.2-500	.2-500	.5-300	1-100	14-18	H16	—	36.95
	FTB1-6	1	.01-125	.01-125	.05-50	.1-25	14-18	H16	—	36.95
	■ FTB1-1-75	1	.5-500	.5-500	5-300	10-100	14-18	H16	—	36.95

NOTES:

▽ Three case styles available: Plug-in case style X65; Surface-mount case style KK81; Radial lead case style W38.
* Insertion loss referenced to mid-band loss
■ Denotes 75 ohm model, for coax connector models 75 ohm BNC connectors are standard.
A. General Quality Control Procedures, Environmental Specifications, Hi-Rel, MIL and TX description are given in section 0, see "Mini-Circuits Guarantees Quality" article.
B. Connector types and case mounted options, case finishes are given in section 0, see "Case Styles & Outline Drawings".
C. Prices and Specifications subject to change without notice.
1. Absolute power, voltage and current ratings:
   1a. RF input power: All models 0.25 Watt
   1b. DC current, 30mA
2. For TC, T, TT and TH series, operating temperature range is -20°C to +85°C.

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12.5 to 700 ohms

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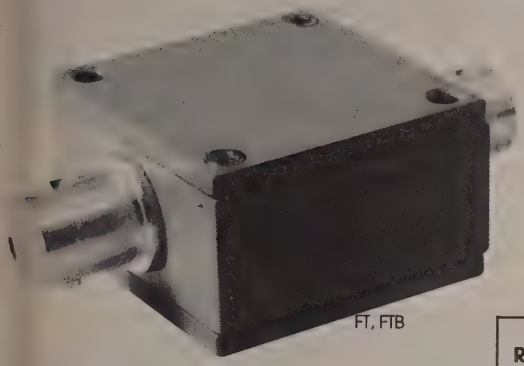
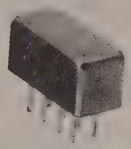
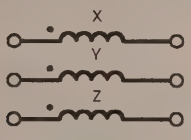
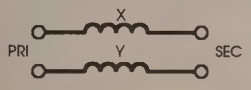


FT, FTB



TMO, TTMO

TC

	MODEL NO.	Ω RATIO	FREQUENCY MHz	INSERTION LOSS* 3 dB MHz	2 dB MHz	1 dB MHz	CAPD DATA (see RF/IF Designer handbook) Page	CASE STYLE Note B	CONNECTION	PRICE $ Qty. (1-9)
F										
	T-622	1:1:1	0.1-200	0.1-200	0.5-100	5-80	14-22	T	ff	3.25
	T-626	1:1:1	0.01-10	0.01-10	0.02-5	.04-2	14-22	T	ff	3.95
	T2-613-1	1:1:2	0.07-200	0 07-200	0.1-100	0.5-50	14-22	T	fg	1.95
G										
	TC1-15	1	350-1500	—	350-800	800-1500	—	AT224	gw	4.95
H										
	TC4-14	4	200-1400	200-1400	300-1300	800-1100	—	AT224	gs	5.45

NSN GUIDE

MCL NO.	NSN						
FTB1-1-75	5950-01-132-8034	T9-1	5950-01-105-8153	T4-1H-X65	5950-01-328-8975	TMO4-1	5950-01-067-1012
FTB1-6	5950-01-225-8773	T16-1	5950-01-094-7439	TT1-6-X65	5950-01-272-2298	TMO4-2	5950-01-091-3553
FT1.5-1	5950-01-325-4686	T16-1-X65	5950-01-272-2297	TT4-1A	5950-01-331-7777	TMO4-6	5950-01-132-8102
T1-1	5950-01-128-3745	T1-1T	5950-01-153-0668	TMO1-1	5950-01-213-3735	TMO5-1T	5950-01-183-0779
T1-1-KK81	5950-01-347-0310	T1-1T-X65	5950-01-340-7040	TMO1-1T	5950-01-326-2772	TMO6-1	5950-01-364-7803
T1-1-X65	5950-01-327-5916	T1-6T	5950-01-256-2173	TMO2-1	5950-01-183-6414	TMO9-1	5950-01-141-0174
T2-1	5950-01-106-1218	T2-1T-KK81	5950-01-347-0311	TMO2.5-6	5950-01-215-4038	TMO-13-1T	5950-01-168-7512
T4-1	5950-01-024-7626	T3-1T	5950-01-153-0298	TMO2.5-6T	5950-01-215-8697	TMO16-1	5950-01-138-4593
T4-2	5950-01-361-1794	T16-6T	5950-01-336-0939	TMO3-1T	5950-01-168-7512		

pin connections

see case style outline drawings

PORT	fd	fe	ff	fg	gs	gw
PRIMARY DOT	6	1	X1 Y2 Z3	X1 Y5 Z3	6	—
PRIMARY	3	6	X6 Y5 Z4	X2 Y6 Z4	4	X1 Y3
PRIMARY CT	—	—	—	—	—	—
SECONDARY DOT	1	2	—	—	3	—
SECONDARY	3	6	—	—	1	X6 Y4
SECONDARY CT	—	—	—	—	2	—
CASE EXT.	3	6	—	—	—	—
CASE GND	—	7,8	—	—	—	—
NOT USED	2,4,5	3,4,5	—	—	—	2

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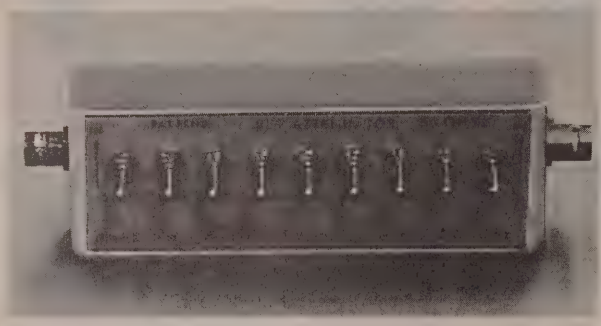
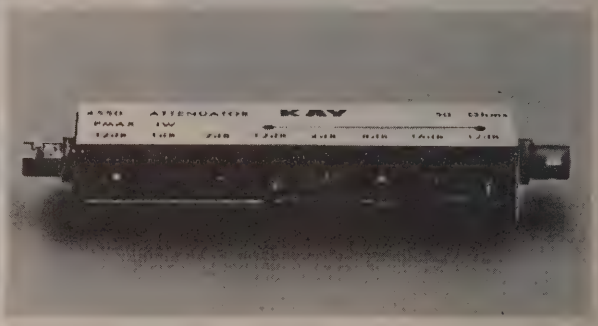


Model 839 Manual In-Line Attenuator



Model 4550 Programmable Attenuator

- ✔ History of Durability
- ✔ Impressive Accuracy
- ✔ Quick Delivery
- ✔ Long Operational Life
- ✔ *NEW* Low Prices
- ✔ Microstrip Line/SMD Construction
- ✔ Custom Models Available

Manual In-Line Attenuators

837	50Ω	DC-1500MHz	0-102.5dB	.5dB Steps
839	50Ω	DC-2000MHz	0-101dB	1dB Steps
1/839	50Ω	DC-1000MHz	0-22.1dB	.1dB Steps
847	75Ω	DC-1000MHz	0-102.5dB	.5dB Steps
849	75Ω	DC-1500MHz	0-101dB	1dB Steps
1/849	75Ω	DC-500MHz	0-22.1dB	.1dB Steps
860	50Ω	DC-1500MHz	0-132dB	1dB Steps
865	600Ω	DC-1MHz	0-132dB	1dB Steps
870	75Ω	DC-1000MHz	0-132dB	1dB Steps

Programmable Attenuators

4440	50Ω	DC-1500MHz	0-130dB	10dB Steps
4450	50Ω	DC-1500MHz	0-127dB	1dB Steps
1/4450	50Ω	DC-1000MHz	0-16.5dB	.1dB Steps
4460	50Ω	DC-1500MHz	0-31dB	1dB Steps
4480	50Ω	DC-1500MHz	0-63dB	1dB Steps
4540	50Ω	DC-500MHz	0-130dB	10dB Steps
4550	50Ω	DC-500MHz	0-127dB	1dB Steps
1/4550	50Ω	DC-500MHz	0-16.5dB	.1dB Steps
4560	50Ω	DC-500MHz	0-31dB	1dB Steps
4580	50Ω	DC-500MHz	0-63dB	1dB Steps

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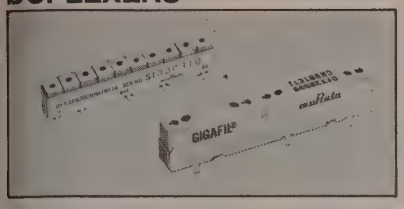
DUPLEXERS



Murata Erie offers a complete selection of dielectric resonator-based Duplexers. Single package, separated pair and surface mount versions are available.

FEATURES

- Low insertion loss thru the use of dielectric resonators. • Small and light
- Excellent mechanical stability • High power ratings
- Excellent temperature stability thru temperature compensated dielectric constant (0 ± 5ppm/°C max.)

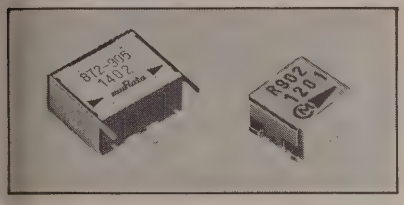
FILTERS

Murata Erie offers a wide selection of dielectric resonator-based filters (Gigafils®) specifically designed for telecommunications application.

FEATURES

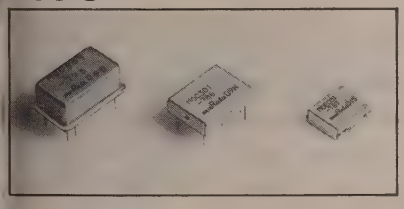
- Extremely low insertion loss • Small size and light weight
- Surface mount units available • Low V.S. W.R. Characteristics
- Excellent temperature and mechanical stability

ISOLATORS



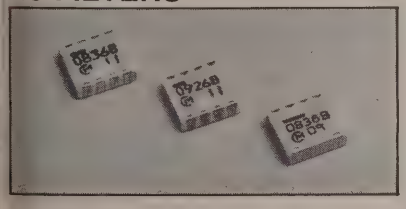
Murata Erie microwave isolators feature small size for surface mounting combined with excellent electrical performance. Typical isolation is 12 dB within insertion loss of 0.9 dB. Power ratings 2.5 to 10W depending on model.

VCO'S



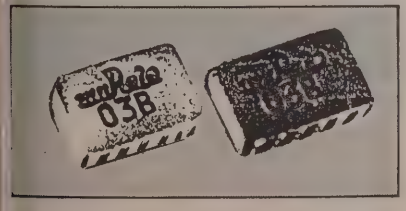
Compact VCO's designed for mobile communications applications are also included in the Murata Erie line of dielectric resonator-based products. These devices are designed for local oscillator use in the high MHz ranges and offer excellent mechanical and frequency stability in compact packages.

LC FILTERS



Monolithic Chip LC Filter

Murata Erie's LC Chip Filter offers an alternative to discrete component filtering. Monolithic layer technology makes the small size, 5.7 x 5.0 x 2.2mm and 4.5 x 3.21 x 1.5mm, possible. Additional features include integral metal shields, surface mount capability, and tape and reel packaging. The filters are available in bandpass and lowpass responses and cover a range of frequencies from 250 MHz to 3.0 Ghz.



Monolithic Directional Coupler/Power Divider

Murata Erie's new directional couplers utilize multi layer technology to reduce the board space associated with conventional couplers. The couplers are available to operate in a variety of frequency ranges within the overall range of 800MHz to 3GHz. Coupling values include 10, 14, and with other options possible. In addition to the directional couplers 3dB power dividers are available with 90°, phase shift. There are several size package options depending upon the power rating of the device. Sizes include 4.5 x 3.2 x 1.5mm up to 8.0 x 5.0 x 2.1mm. Both parts are surface mountable, IR reflowable, and packaged in tape and reel for auto insertion.

MURATA ERIE NORTH AMERICA 220 Lake Park Dr., Smyrna, Georgia 30080 Tel: 1-800-831-9172 Telex: 26-1301 FAX: 1-404-684-1541

Noise Com: Quality. Performance. Service.

From the leader in noise sources.

Hermetically sealed noise diodes

NC 100 through NC 400 Series

DC to 110 GHz

- Chips and five package options
- Flat output
- Operating temperature -55 to +125° C
- Storage temperatures -65 to +150° C
- Meet MIL-STD-750
- Wide variety of packages

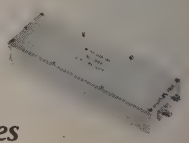
Drop-in noise modules for BITE applications

NC 500 Series

200 kHz to 5 GHz

- Drop-in TO-8 packages
- Economical solution to BITE
- 31 dB or 51 dB ENR
- Minimum crest factor 5:1
- Operating temperature -55 to +85° C
- Storage temperature -65 to +175° C
- Temperature coefficient 0.01 dB/° C
- 50-ohm Load impedance

Amplified noise modules

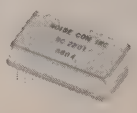


NC 1000 Series

DC to 6 GHz

- High power—up to 13 dBm
- Female SMA connector (BNC available as option)
- Flat response— ±0.75 dB
- Operating temperature -35 to +100° C
- Storage temperatures -65 to +150° C

Plug-in amplified noise modules



NC 2000 Series

100 Hz to 2000 MHz

- 24-pin and 14-pin packages
- Minimum crest factor 5:1
- High-end roll off 6 dB per octave
- Operating voltage of +15 VDC, +12 VDC optional
- Storage temperature -65 to +125° C
- Operating temperature -55 to +85° C
- Temperature coefficient 0.025 dB/° C typical

Calibrated coaxial noise sources

NC 3000 Series

10 kHz to 40 GHz

- Noise output rise and fall times less than 1 μS
- 6, 15.5, 30 dB ENR and higher outputs available
- Noise output variation with temperature less than 0.01 dB/° C
- Noise output with voltage less than 0.1 dB/% Δ V
- Operating temperature -55 to +85° C
- Storage temperatures -65 to +125° C
- Maximum input power +28 VDC at 20 mA

Calibrated millimeter-wave waveguide noise sources

NC 5000 Series

18 to 110 GHz

- Narrow or wideband performance with low or high output
- Noise output rise and fall times less than 1 μS
- VSWR less than 1.35:1
- Noise output variation with temperature less than 0.01 dB/° C
- Noise output with voltage less than 0.1 dB/% Δ V
- Operating temperature -55 to +85° C
- Storage temperatures -65 to +125° C
- Maximum input power +28 VDC at 20 to 30 mA (+15 VDC available)

Call Gary Simonyan at 201-261-8797 for fast response!

NOISE/COM

Number One in Noise Sources.

E. 49 Midland Avenue, Paramus, New Jersey 07652

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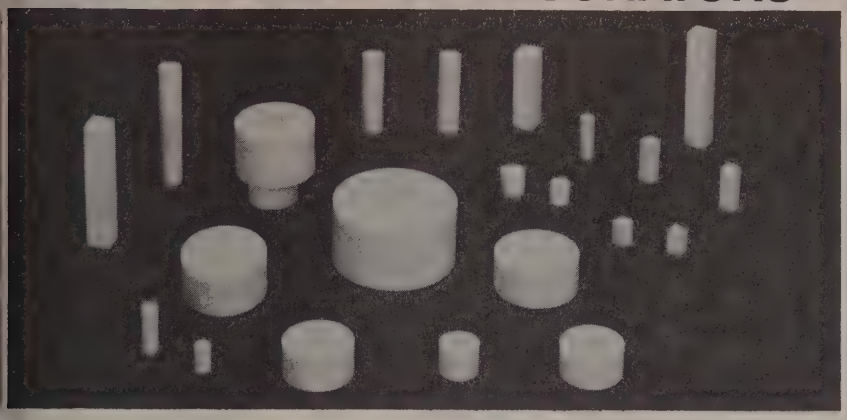
NTK TECHNICAL CERAMICS

NGK SPARK PLUGS (U.S.A.), INC.
CHICAGO OFFICE Telephone: (708) 824-1133, 1200 Business Center Dr., Suite 300, Mount Prospect, IL 60056
75 Main St., Milburn, NJ 07041 Telephone: (201) 376-6070
CALIFORNIA OFFICE Telephone: (408) 727-5180, 3255-2 Scott Blvd., Suite 101, Santa Clara, CA 95054

NTK DIELECTRIC RESONATORS

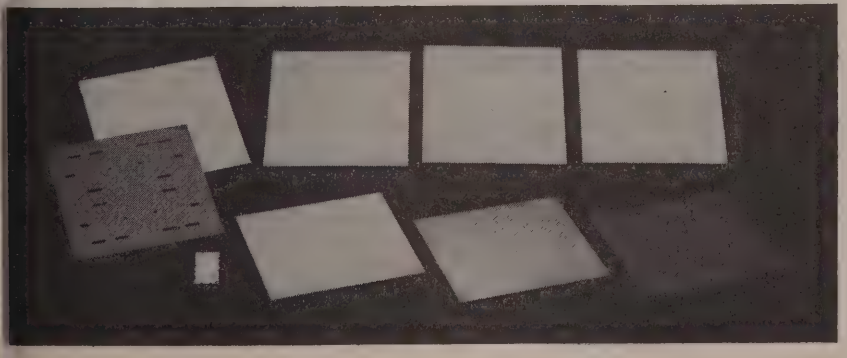


FEATURES
- High Q
- Broad range of dielectric constant
- Optional T.C.'s
- Optional T.C. tolerances

APPLICATIONS
- DRO
- Filter

Characteristics / Notation	A	F	T	O
Relative dielectric constant K	12.6	34	81	6.2
Temp. coeff. of freq. π f(ppm/°C)	+10	0 ~ +10	+10 +20	-45
Q(=1/tanδ) (Measurement frequency)	18000 (13GHz)	8000 (8GHz)	1500 (2.7 GHz)	1000 (7GHz)
Volume resistivity (Ω•cm) (25°C)	1.1×10^{14}	1.1×10^{13}	7.6×10^{13}	5×10^{15}
Linear expansion coeff. (ppm/°C) (30 - 400°C)	7.6	9.5 - 11	10.0	3.0
Density (g/cm^3)	3.93	4.5	5.454	2.56
Bending strength (kg/cm^2)	3900	1500	2000	1700
Thermal conductivity (cal/cm-sec.°C)	0.06	0.0044	0.0067	0.0060
Water absorption (%)	<0.01	<0.01	<0.01	<0.01

NTK DIELECTRIC SUBSTRATES FOR MICROWAVE USE



FEATURES
- Surface finish to .2 microns
- Available with plating
- High Q
- Excellent uniformity
- Wide range of available thickness

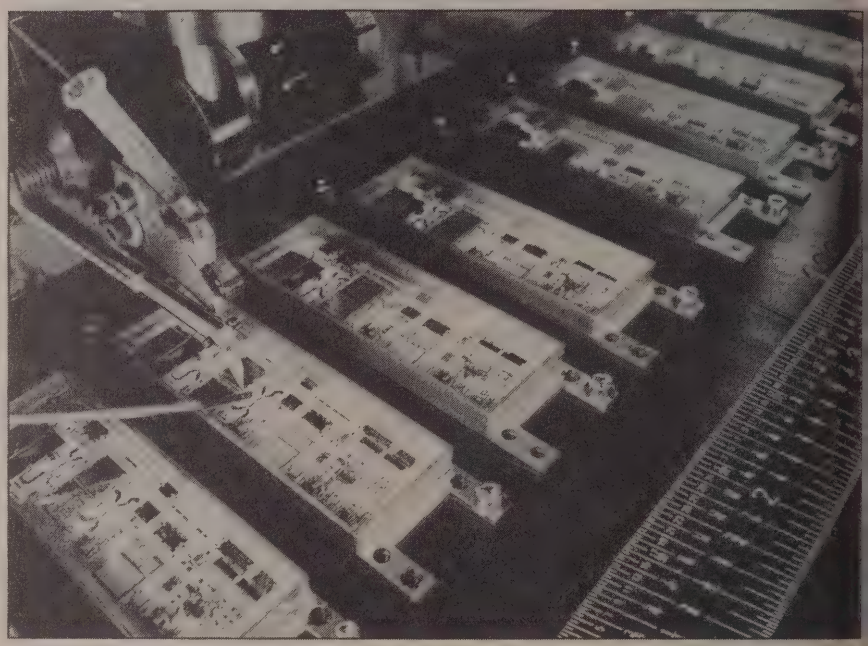
APPLICATIONS
- Microwave substrates
- Precision capacitors
- Stripline filters

Shape		Material	Dielectric constant K	Temperature coefficient of capacitance (ppm/°C)	Q (= 1/tan δ) Measured frequency	Linear expansion coefficient (ppm/°C)
A ± 0.2 (m/m)	T ± 0.02 (m/m)					
20 ~ 60	0.2 ~ 2.5	A	12.6	0 ± 30	18000 (13GHz)	7.6
		F	35.8		8000 (8GHz)	9.5
		T	81		1500 (2.7GHz)	10.0

Raytheon

Solid State Transmit / Receive Modules

Raytheon Company, a leader in advanced electronics and systems for military, space and commercial markets, offers a full line of high quality Solid State Transmit / Receive Modules to meet your high performance radar and wireless communication system needs. Developed primarily for advanced military radar systems, active aperture solid state transmit / receive modules provide high transmit power over narrow or wide operating bandwidth, low noise receive operation and high system reliability. Raytheon high performance GaAs Monolithic Microwave Integrated Circuit (MMIC) components and advanced multilayer ceramic substrates are assembled in a lightweight, compact hermetic package in our automated production line. Raytheon T/R Modules power ground based radars, satellite communications arrays and Intelligent Vehicle Highway Systems.



Raytheon's Automated Assembly Lines Can Produce 10,000 Solid State T/R Modules Per Month

Raytheon T/R Modules Meet Your Advanced System Requirements

Raytheon can apply its leadership in phased array radar systems development, GaAs MMIC device and advanced ceramic materials and manufacturing technology to meet your advanced systems needs. Raytheon solid state modules are available at UHF, VHF, RF and MMW frequencies. Wideband modules are available for high performance applications. High efficiency Raytheon solid state T/R modules support pulsed and continuous wave radar systems, satellite communications systems, DBS and GPS receivers, and advanced avionics systems.

Proven Raytheon GaAs MMIC chip designs for low noise and power amplifiers, mixers, and control circuits provide the basis for Raytheon high performance T/R Module products. Up to 10 Watts per module has been achieved at X-Band. High gain, high output power, low noise wideband modules demonstrate excellent gain and phase uniformity. We can manufacture either Thin Film Networks (TFN) or Low Temperature Cofired Ceramic (LTCC) for low cost, multilayer substrate architectures.

Raytheon

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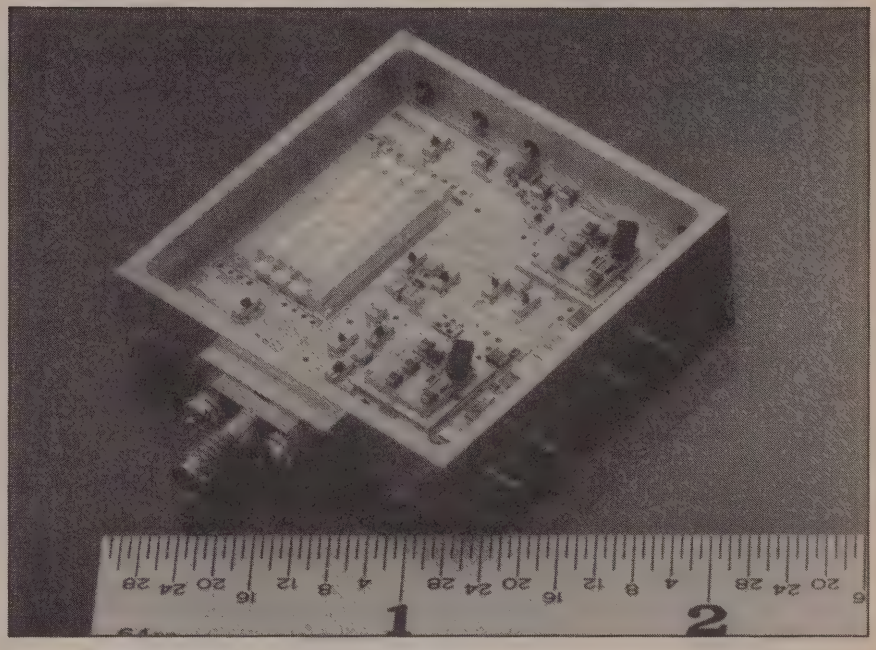
Raytheon

High Performance SAW Devices

Raytheon Company, a leader in advanced electronics and systems for military, space and commercial markets, offers a full line of high quality Standing Acoustic Wave (SAW) Devices to meet your high performance system needs. Years of pioneering leadership in system integration, device, and manufacturing technology development make Raytheon the premier source for your high performance, high volume applications. We offer a complete range of SAW devices including mil-spec, high-rel delay lines, filters, coded devices, and oscillators. We offer turnkey service - from design through Total Quality manufacturing and test. Let us put our strength on your most challenging SAW applications.

High Performance SAW Solutions from the Total Quality Source

Come to Raytheon for your commercial or military radar, data communications and wireless system applications. We can supply devices alone or complete assemblies such as SAW-stabilized oscillators, switchable filter banks, unity gain bandpass filters and pulse expansion and compression systems. Our SAW devices can be used as narrow, wideband and differential delay lines, resonators, tapped and dispersive delay lines, correlators and oscillators. E-Beam photolithography, ion-beam milling, Reactive Ion Etching, sputter deposition of multilayer substrates, laser probe measurement and laser trimming processes yield high performance devices that require no final tuning.



Raytheon AQP (All-Quartz Package) Hybrid SAW Provides Excellent Long Term Frequency Stability (<1 ppm/year)

Tens of thousands of Raytheon SAW devices have been delivered to customers.

High Performance SAW Oscillator

Our All-Quartz Package (AQP) technique provides a compact, hermetic package compatible with hybrid assemblies. Special mounting provides low vibration sensitivity. Raytheon SAWs are extremely stable over time. Typical performance of our low phase noise, frequency stable SAW oscillators:

Output Frequency	354 Mhz
Initial set-on frequency accuracy	<±2 ppm
Long term frequency stability	<1 ppm/year
Phase Noise (SSB) @ 100 Hz offset	<-110dBc/Hz
Noise Floor	<-170dBc/Hz
Vibration Sensitivity	$<1x10^{-9}$/g
Output Power	16 dBm
Harmonics	<-40 dBc
Spurious	<-100 dBc
Size	1.5"x1.5"x0.6"

Raytheon

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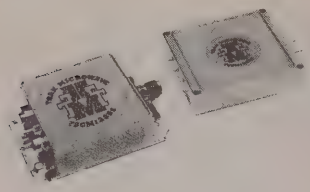
TRAK® MICROWAVE

Crystal Controlled Oscillators

60 MHz–18 GHz Miniature Crystal Controlled Oscillators and Oscillator/Multipliers



ELECTRICAL SPECIFICATIONS (general)
Frequency set accuracy at room temperature: ±0.001%
Frequency stability: ±0.003%
Aging rate: ±0.0005% per year
Power variation with temperature: ±2 dB

Power supply: +15 VDC (other voltages optional)
Load VSWR: 1.5:1 maximum
Temperature Range: -55 to +85°C. (to +125°C with degradation)
Contact factory for other frequencies and/or power levels. (A 1 watt output series is available.)

10 MILLIWATTS MINIMUM OUTPUT

FREQUENCY RANGE	CURRENT mA, nom. at +15 VOLTS	P.C. BOARD MOUNT MODEL NUMBER	MICROSTRIP MODEL NUMBER	BASE PLATE MOUNT MODEL NUMBER	HARMONICS OF CRYSTAL OSCILLATOR UP TO 2nd HARMONIC OF OUTPUT FREQUENCY
60 - 120 MHz	25	5040 - 1056	5140 - 1057	5040 - 1057	> 30 dBc
121 - 240 MHz	35	5041 - 1056	5141 - 1057	5041 - 1057	> 30 dBc
241 - 360 MHz	35	5042 - 1056	5142 - 1057	5042 - 1057	> 30 dBc
361 - 720 MHz	50	5043 - 1056	5143 - 1057	5043 - 1057	> 30 dBc
721 - 1200 MHz	50	5044 - 1056	5144 - 1057	5044 - 1057	> 30 dBc
1.2 - 1.7 GHz	60	-	-	5044 - 1110	> 40 dBc
1.7 - 2.0 GHz	65	-	-	5044 - 1111	> 40 dBc
2.0 - 2.3 GHz	65	-	-	5044 - 1310	> 40 dBc
2.3 - 2.5 GHz	75	-	-	5044 - 1313	> 40 dBc
2.5 - 4.0 GHz	100	-	-	5044 - 1311	> 40 dBc
4.0 - 6.0 GHz	110	-	-	5044 - 1611	> 40 dBc
6.0 - 8.0 GHz	110	-	-	5044 - 1615	> 40 dBc
8.0 - 10.0 GHz	120	-	-	5045 - 1911	> 40 dBc
10.0 - 12.0 GHz	140	-	-	5045 - 1913	> 40 dBc
12.0 - 18.0 GHz	150	-	-	5045 - 1240	> 40 dBc

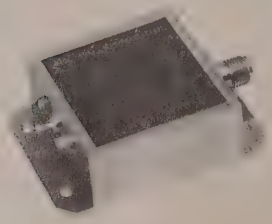
100 MILLIWATTS MINIMUM OUTPUT

FREQUENCY RANGE	CURRENT mA, nom. at +15 VOLTS	P.C. BOARD MOUNT MODEL NUMBER	MICROSTRIP MODEL NUMBER	BASE PLATE MOUNT MODEL NUMBER	HARMONICS OF CRYSTAL OSCILLATOR UP TO 2nd HARMONIC OF OUTPUT FREQUENCY
60 - 120 MHz	40	5040 - 1086	5140 - 1087	5040 - 1087	> 20 dBc
121 - 240 MHz	50	5041 - 1086	5141 - 1087	5041 - 1087	> 20 dBc
241 - 360 MHz	50	5042 - 1086	5142 - 1087	5042 - 1087	> 20 dBc
361 - 720 MHz	70	5043 - 1086	5143 - 1087	5043 - 1087	> 20 dBc
721 - 1200 MHz	70	5044 - 1086	-	5044 - 1087	> 20 dBc
1.2 - 1.7 GHz	80	-	-	5044 - 1120	> 40 dBc
1.7 - 2.0 GHz	90	-	-	5044 - 1121	> 40 dBc
2.0 - 2.3 GHz	90	-	-	5044 - 1320	> 40 dBc
2.3 - 2.5 GHz	100	-	-	5044 - 1321	> 40 dBc

AVAILABLE OPTIONS:
- Gating
- Heater Control
- Frequency Trim
- One watt versions are available

NOTE: Size may vary with options. Contact Factory.

SC Cut Crystal Controlled Oscillators



These oscillators are similar to those above but offer the advantage of higher stability over temperature (2 ppm from -54 to +85°C) and lower phase noise under vibration. See our complete catalog or contact our representative or the factory for complete specifications.

Frequency Range (MHz)	Power Output +10 dBm MIN. MODEL NO.	Power Out +20 dBm MIN. MODEL NO.
60– 120	5091–1000	5092–1000
121– 240	5091–1001	5092–1001
241– 360	5091–1003	5092–1003
361– 720	5091–1004	5092–1004
721–1200	5091–1005	5092–1005

Above 1200 MHz contact factory

Current	180 mA typical at +25°C	250 mA typical at +25°C
	230 mA typical at –54°C	300 mA typical at –54°C

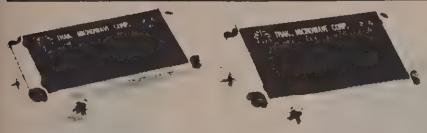
How to order: *Specify model number and exact frequency*

TRAK Microwave Corp. • Dept E3, 4726 Eisenhower • Tampa FL 33634 • Phone 813-884-1411 • FAX 813-886-2794 • TELEX 52-827
TRAK Europe • Dept E3, Dunsinane Avenue • Dundee Scotland DD2 3PN • Phone 44-382-833411 • FAX 44-382-833599

TRAK MICROWAVE

Frequency Multipliers

Specifications subject to change without notice.



These drop-in multipliers demonstrate our capability in miniature frequency multipliers. They incorporate both lumped element filter techniques and new processes for miniaturizing combline filters.

	#1	#2	#3
Output Frequency	480 MHz	960 MHz	11 GHz
Multiplication Factor	X4	X2	X11
Size (nominal)	1.6 x 0.8 x 0.4 in. (41 x 20 x 10 mm)	1.6 x 0.8 x 0.4 in. (41 x 20 x 10 mm)	2.1 x 0.7 x 0.4 in. (53 x 18 x 10 mm)
Input Power (nom.)	+10 dBm	+10 dBm	+10 dBm
Output Power (nom.)	+5 dBm	+5 dBm	+7 dBm
Harmonics/Spurs (all three models)	-91 dBc ..... from 10 to 250 MHz -65 dBc ..... above 250 MHz		

X5 or X6 Active Multipliers

These are examples of a new family of multiplier/amplifier chains utilizing TRAK's thin-film construction techniques for high performance and high reliability in a rugged, compact package. Hi-Rel versions for space application are available.

Typical Specifications

Electrical Specifications
Multiplication Factor .. X5 or X6
Input Frequency Range ..... 500 to 700 MHz, typical
Output Bandwidth ... 6%, typical
RF Power Input ..... −6 dBm to +6.8 dBm
Power Output ..... +13 dBm, minimum, S band
Harmonics and Spurious ..... −65 dBc, maximum
Power Supply ..... +15 VDC at 140 mA, nominal

Environmental Conditions
Operating Temperature Range ..... −54 to +85°C

Mechanical Specifications
Size ..... 2.93 X .84 X .35 inches (75 X 21 X 9 mm) nominal, excluding projections
Weight ..... 1.3 ounces (36 grams)
RF Connectors ..... SMA, female (removable)

Comb Multiplier 100 MHz

This comb multiplier represents our latest size reduction for this type of product. Just fasten it down, solder the tab to your circuit, inject the 100 MHz signal and you have combs from 100 MHz to 18 GHz.

Guaranteed Specifications

Electrical Specifications
Input ..... 100 MHz @ 500 mW
Output ..... 0.100-18 GHz, −40 dBm, minimum
Input VSWR 2.0:1
Spurious ..... −40 dBc

Environmental Conditions
Operating Temperature Range ..... −54 to +85°C

Mechanical Specifications
Size ..... .85 X .63 X .22 inches (22 X 16 X 6 mm) excluding projections
Weight ..... .32 ounces (9.0 grams)

Surface Mount Multiplier

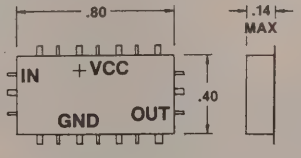
This hermetically sealed surface mount frequency multiplier is an example of TRAK's continuing progress in shrinking RF and microwave components. The unit provides gain and is filtered to assure harmonics are at least 50 dB below the carrier. This packaging technique is available from TRAK for both active and passive multipliers with outputs through 5.2 GHz. Various multiplication factors, bandwidths, gain, and filtering trade-offs can be selected.

Typical Specifications

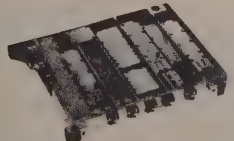
Model Number 3890-1100
Multiplication Factor .. 4
Input Frequency ..... 320 ±5 MHz
Input Power ..... +11 dBm ±2 dB
Output Frequency ... 1280 ±20 MHz
Output Power..... +13 dBm ±2 dB
Spurious/Harmonics .. >50 dBc
Input/Output VSWR .. 2.0:1 max
DC Power +12 VDC at 75 mA max

Environmental Conditions

Operating Temperature ..... -54 to +85ºC
Vibration ..... 20 g, 20-2000 Hz
Shock ..... 100 g, 11 ms
Altitude ..... 70,000 feet



Switched Multiplier



This is an example of a custom-designed frequency multiplier assembly used in a space application. It includes switchable multipliers and uses microstrip circuitry for ruggedness. Special packaging techniques have been used to reduce its overall volume and weight.

Typical Specifications

Input Frequency ..... S Band
Input Power ..... −8 to +10 dBm, typical
Multiplication Factors . x2, x4, x6 and x8
Output Power ..... +13 dBm, typical
Bandwidth ..... 2%, typical (wider bandwidths optional. Contact factory regarding trade offs.)
Harmonics ..... −40 dBc
Spurious ..... −60 dBc
Power Supply ..... +15 VDC at 885 mA, typical
Operating Temperature Range ..... −20 to +77°C
Size ..... 8.5 X 7.0 X .63 inches (216 X 178 X 16 mm) nominal excluding projections
Weight ..... 32 ounces (907 grams), typical
RF Connectors ..... SMA, female, 90 degree sweep angle connector

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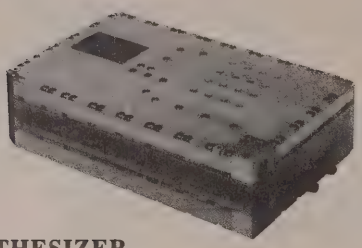
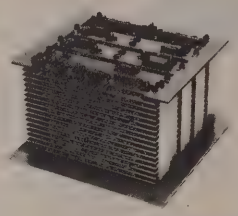
TRAK Europe • Dept E3, Dunsinane Avenue • Dundee Scotland DD2 3PN • Phone 44-382-833411 • FAX 44-382-833599

TRAK MICROWAVE



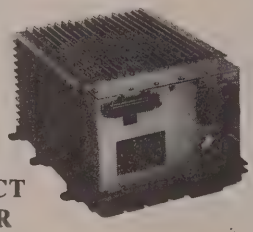
WIDEBAND INDIRECT SYNTHESIZER

Frequency ..... Ku-Band, Octave BW
Step Size ..... 5 MHz Frequency Accuracy ..... 2 PPM
Switching Speed ..... 150 µsec, typical
VSWR ..... 1.5:1 Power ..... +5 dBm ±2 dB
Spurious ..... -60 dBc Harmonics ..... -15 dBc
Phase Noise:
10 KHz ..... -70 dBc/Hz 1 MHz -120 dBc/Hz
100 KHz ..... -75 dBc/Hz 10 MHz -140 dBc/Hz
Reference Output ..... 100 MHz, ±2 dBm, typical
Power Dissipation ..... 35 W
Size ..... 8 x 5 x 2 in. Weight ... 4.8 lbs, max.



HIGH-RESOLUTION INDIRECT SYNTHESIZER

Frequency ..... 1.6 - 2.8 GHz
Step Size ..... 100 Hz
Frequency Accuracy ..... Function of External Reference
Switching Speed ..... 350 µsec, typical
VSWR ..... 1.7:1 Power ..... +5 dBm, nominal
Spurious ..... -68 dBc Harmonics ..... -45 dBc
Phase Noise:
10 KHz ..... -98 dBc/Hz 1 MHz -134 dBc/Hz
100 KHz ..... -105 dBc/Hz 10 MHz -150 dBc/Hz
Power Dissipation ..... 31.25 W
Size .. 7.5 x 7.25 x 5.25 in. Weight ... 13 lbs, max.



MULTI-CHANNEL INDIRECT FREQUENCY SYNTHESIZER

Frequency ..... 5-17 GHz, triple output
Step Size ..... 2.5 MHz Frequency Accuracy ..... 2 PPM
Switching Speed ..... 500 µsec, typical
VSWR ..... 2:1 Power ..... +2 dBm ±2 dB
Spurious ..... -70 dBc Harmonics ..... -15 dBc
Phase Noise:
10 KHz ..... -75 dBc/Hz 1 MHz ..... -120 dBc/Hz
100 KHz ..... -90 dBc/Hz 10 MHz ... -140 dBc/Hz
Reference Output ..... 100 MHz, +2 dBm, typical
Power Dissipation ..... 43 W
Size .. 7.7 x 6.8 x 4.7 in. Weight ... 9 lbs, max.

TRAK Microwave Synthesizer

Frequency ..... 7.9-8.4 GHz
Step Size ..... 10 MHz Frequency Accuracy ..... ± 1 ppm
Switching Speed ..... 20 µsec to phase coherency
VSWR ..... 1.5 : 1 Power ..... +16 dBm minimum
Spurious ..... -60 dBc Harmonics ..... -40 dBc
Phase Noise, Synthesizer:
1 kHz ..... -95 dBc/Hz 10 kHz ..... -100 dBc/Hz
Phase Coherent Ref. Outputs ... 20 MHz, 60 MHz, 1080 MHz
Phase Noise, 1080 MHz Reference:
1 kHz ..... -120 dBc/Hz 10 kHz ..... -125 dBc/Hz
Power Dissipation ..... 20 W
Size ..... 7 x 5.4 x 3 in. Weight ..... 3.5 lbs. max.

TRAK specializes in custom-designed products that meet exacting performance parameters. Contact TRAK Sales for further information on any of these or other new products.
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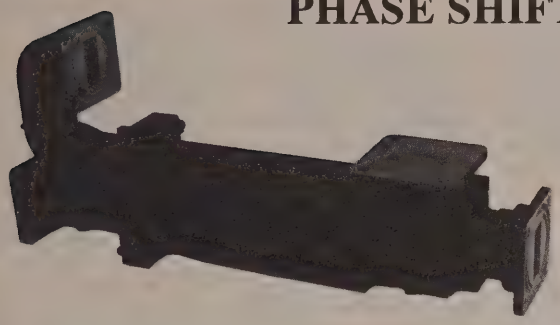
TRAK MICROWAVE

PHASE SHIFT CIRCULATORS

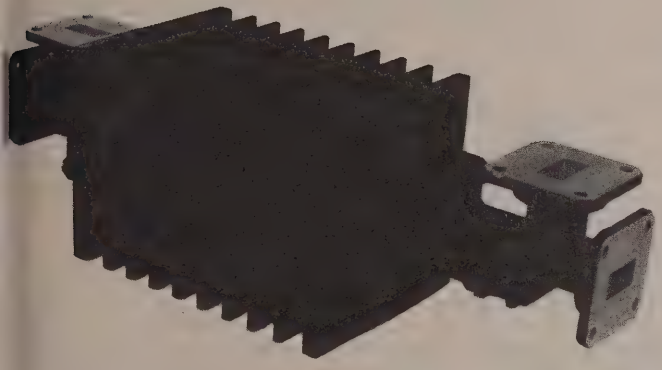


LIGHTWEIGHT HIGH POWER CIRCULATOR

X-band (WR90)
Isolation: ..... 20 dB min.
Insertion Loss: ..... 0.2 dB, typical
VSWR: ..... 1.2:1 max.
Power Rating: ..... 20 KW peak, 1.8 KW average
Cooling: ..... Conduction/convection

HIGH POWER CIRCULATOR

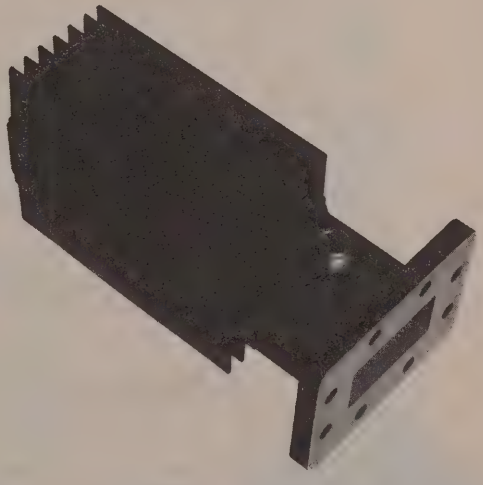
X-band (WR112)
Isolation: ..... 25 dB, min.
Insertion Loss: ..... 0.2 dB typical
VSWR: ..... 1.2:1 max.
Power Rating: ..... 250 KW peak, 6 KW average
Cooling: ..... Conduction/convection
Temperature Range: ..... –30° to + 70° C.



HIGH POWER CIRCULATOR FOR SATELLITE COMMUNICATIONS

Ku-band (WR62)
Isolation: ..... 23 dB min.
Insertion Loss: ..... 0.3 dB max., 0.2 dB typical
VSWR: ..... 1.15:1 typical
Power Rating: ..... 2.5 KW CW
Cooling: ..... Forced air

LIGHTWEIGHT WAVEGUIDE LOADS



MEDIUM POWER TERMINATION FOR TROPOSCATTER COMMUNICATION SYSTEM

C-band (WR187)
VSWR: ..... 1.1:1 typical
Power Rating: ..... 150 W CW
Sampler: ..... –43 dBc

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TRAK MICROWAVE

Circulators & Isolators

MICpuck™ and Micropuck® Models

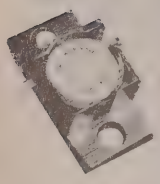
MICpuck™ Circulators

MODEL NUMBER	FREQUENCY RANGE (GHz)	BANDWIDTH %	ISOLATION dB min.	INSERTION LOSS dB max.	VSWR max.	OPERATING TEMP. °C	PEAK POWER WATTS	AVG. POWER WATTS	HEAT SINK TEMP.	SIZE (INCHES NOMINAL) L x W x H
L9*6001	4-8	5	20	.5	1.25	-54° to +95°	50	25	+50	.62 x .500 x .24
L9*6001	4-8	10	18	.6	1.30	-54° to +95°	50	25	+50	.62 x .500 x .24
L9*9001	8-12	5	20	.45	1.20	-54° to +95°	50	25	+50	.50 x .350 x .14
L9*9001	8-12	10	18	.55	1.30	-54° to +95°	50	25	+50	.50 x .350 x .14
L9*2001	12-18	5	18	.6	1.30	-54° to +95°	50	25	+50	.50 x .350 x .14
L9*2001	12-18	10	17	.7	1.35	-54° to +95°	50	25	+50	.50 x .350 x .14

MICpuck™ Isolators

MODEL NUMBER	FREQUENCY RANGE (GHz)	BANDWIDTH %	ISOLATION dB min.	INSERTION LOSS dB max.	VSWR max.	OPERATING TEMP. °C	PEAK POWER WATTS	AVG. POWER WATTS	HEAT SINK TEMP.	SIZE (INCHES NOMINAL) L x W x H
M9*6001	4-8	5	20	.5	1.25	-54° to +95°	50	0.7	+95	.62 x .500 x .24
M9*6001	4-8	10	18	.6	1.30	-54° to +95°	50	0.7	+95	.62 x .500 x .24
M9*9001	8-12	5	20	.45	1.20	-54° to +95°	50	0.7	+95	.50 x .350 x .14
M9*9001	8-12	10	18	.55	1.30	-54° to +95°	50	0.7	+95	.50 x .350 x .14
M9*2001	12-18	5	18	.6	1.30	-54° to +95°	50	0.7	+95	.50 x .350 x .14
M9*2001	12-18	10	17	.7	1.35	-54° to +95°	50	0.7	+95	.50 x .350 x .14

Flange Mount Micropuck® Isolators



MODEL NUMBER	FREQUENCY RANGE (GHz)	BANDWIDTH %	ISOLATION dB min.	INSERTION LOSS dB max.	VSWR max.	OPERATING TEMP. °C	PEAK POWER WATTS	AVG. POWER WATTS	HEAT SINK TEMP.	SIZE (INCHES NOMINAL) L x W x H
F9*6101	4-8	10	20	.5	1.25	-54° to +95°	50	.7	95	.62 x .375 x .21
F9*9001	8-12	10	20	.4	1.25	-54° to +95°	50	.5	95	.50 x .25 x .18
F9*2001	12-18	10	17	.5	1.35	-54° to +95°	50	.5	95	.50 x .25 x .18
F9A6141	3.7-4.3	FULLBAND	15	.6	1.45	-30° to +70°	50	.7	70	.62 x .375 x .21
F9A9101**	8-12	FULLBAND	16	.7	1.45	-54° to +95°	50	.7	95	.62 x .375 x .21
F9A2201**	12-18	FULLBAND	17	.7	1.50	-55° to +100°	50	.5	95	.50 x .25 x .18

Flangeless Micropuck® Circulators

MODEL NUMBER	FREQUENCY RANGE (GHz)	BANDWIDTH %	ISOLATION dB min.	INSERTION LOSS dB max.	VSWR max.	OPERATING TEMP. °C	PEAK POWER WATTS	AVG. POWER WATTS	HEAT SINK TEMP.	SIZE (INCHES NOMINAL) L x W x H
G9*6101	4-8	10	20	.5	1.25	-54° to +95°	50	25	50	.375 x .375 x .21
G9*9001	8-12	10	20	.4	1.25	-54° to +95°	50	29	50	.25 x .25 x .18
G9*2001	12-18	10	17	.5	1.35	-54° to +95°	50	20	50	.25 x .25 x .18
G9A9101**	8-12	FULLBAND	16	.7	1.45	-54° to +95°	50	20	50	.375 x .375 x .21

Flangeless Micropuck® Isolators

MODEL NUMBER	FREQUENCY RANGE (GHz)	BANDWIDTH %	ISOLATION dB min.	INSERTION LOSS dB max.	VSWR max.	OPERATING TEMP. °C	PEAK POWER WATTS	AVG. POWER WATTS	HEAT SINK TEMP.	SIZE (INCHES NOMINAL) L x W x H
H9*6101	4-8	10	20	.5	1.25	-54° to +95°	50	.5	50	.375 x .375 x .21
H9*9001	8-12	10	20	.4	1.25	-54° to+ 95°	50	.7	50	.25 x .25 x .18
H9*2001	12-18	10	17	.5	1.35	-54° to +95°	50	.5	50	.25 x .25 x .18
H9A9101**	8-12	FULLBAND	16	.7	1.45	-54° to +95°	50	.7	50	.25 x .25 x .18
H9A2201	12-18	FULLBAND	17	.7	1.50	-55° to +100°	50	.5	50	.375 x .375 x .21

* Specify center frequency when ordering. Model designation will be completed by TRAK.
**These units are normally available from stock or from our distributors.

NOTES: (1) Upper frequency limit cannot exceed 18 GHz. (2) If your lower frequency limit is below the lower limit stated for a particular model, select the preceding model. If your upper frequency limit will exceed 12 GHz, select the next higher frequency model.

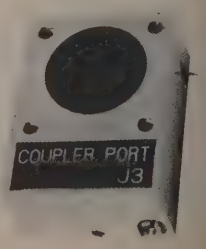
Communications Band Models

Circulator

Frequency ..... 860-900 MHz
Isolation ..... 23 dB min.
Insertion Loss ..... .35 dB max.
VSWR ..... 1.25:1 All Ports
Power Rating ..... 65 watts avg.
Temp. Operating ..... 0° to +70°C
Size ..... 0.96 diameter x .25" high

High Power Isolator

Frequency ..... 865-900 MHz
Isolation ..... 25 dB min.
Insertion Loss ..... 0.25 dB max., 0.2 dB typ.
VSWR ..... 1.20:1 max.
Power Rating ..... 50 watts
Temperature ..... 0° to +50°C
Size (inches) ..... 1.82 x 1.32 x .66
Coupler on terminated port provides reverse power monitor signal.



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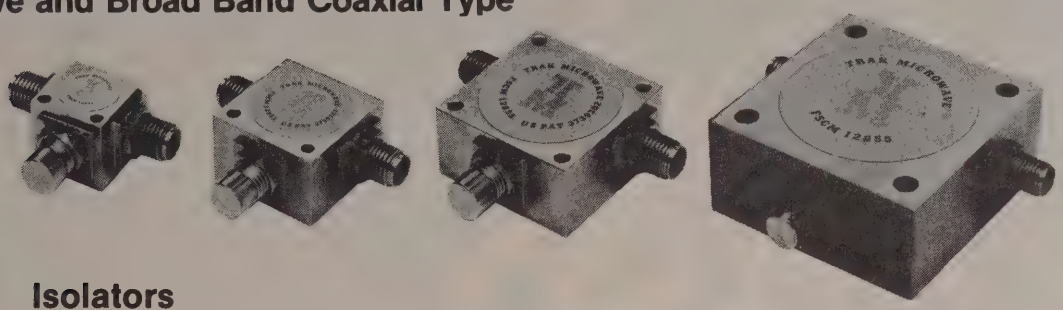
TRAK® MICROWAVE

Circulators & Isolators

Octave and Broad Band Coaxial Type

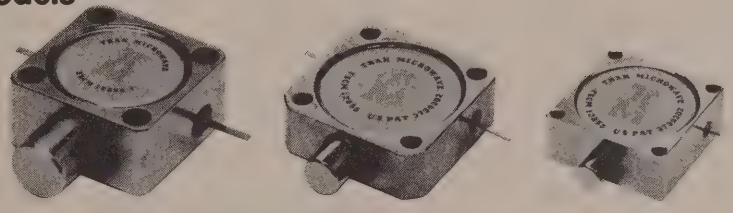


Isolators

FREQUENCY RANGE (GHz)	MODEL NUMBER	ISOLATION dB min.	INSERTION LOSS dB max.	VSWR max.	OPERATING TEMP. °C.	PEAK POWER KW	AVERAGE POWER WATTS	HEAT SINK TEMP. °C.	SIZE (INCHES NOMINAL) L W H
1.0 - 2.0	60A1101*	15	0.6	1.40	0 to +50	0.1	1.0	+50	1.60 × 1.60 × 0.75
2.0 - 4.0	60A3001*	18	0.5	1.30	-10 to +70	0.1	1.0	+70	1.00 × 1.00 × 0.50
2.0 - 6.0	60A3401*	12	1.0	1.65	-10 to +60	0.1	1.0	+60	1.00 × 1.00 × 0.50
2.6 - 5.2	60A3011*	18	0.5	1.30	-25 to +80	0.1	1.0	+80	1.00 × 1.00 × 0.50
3.0 - 6.0	60A6301*	18	0.5	1.40	-45 to +85	0.1	1.0	+85	0.75 × 0.75 × 0.50
4.0 - 8.0	60A6001*	18	0.5	1.30	-45 to +95	0.1	3.0	+95	0.75 × 0.75 × 0.50
5.0 - 10.0	60A6071*	18	0.5	1.30	-55 to +95	0.1	2.0	+95	0.75 × 0.75 × 0.50
6.0 - 12.0	60A9201*	16	0.7	1.35	-55 to +95	0.1	1.0	+95	0.75 × 0.75 × 0.50
6.0 - 18.0	60A2601*	12	1.0	1.67	-40 to +80[2]	0.1	3.0	+80	0.50 × 0.50 × .375
6.5 - 18.0	60A2701*	14	1.0	1.50	-54 to +95	0.1	3.0	+95	0.50 × 0.50 × .375
7.0 - 18.0	60A2171	13	0.75	1.58	-40 to +65	0.5	3.0	+65	0.50 × 0.50 × .375
7.5 - 18.0	60A2301*	14	0.9	1.50	-54 to +95	0.5	3.0	+85	0.50 × 0.50 × 0.50
8.0 - 12.4	20B9201*	20	0.5	1.30	-55 to +95	0.1	3.0	+95	0.50 × 0.50 × 0.50
8.0 - 16.0	60A2001*	17	0.5	1.35	-40 to +95	0.5	3.0	+95	0.50 × 0.50 × 0.50
8.0 - 16.0	60A2501	17	0.5	1.35	-40 to +95	0.1	3.0	+95	0.50 × 0.50 × .375
8.0 - 18.0	60A2051*	14	0.6	1.50	-54 to +95	0.5	3.0	+95	0.50 × 0.50 × 0.50
8.0 - 20.0	60A2401*	12	1.0	1.67	-40 to +80	0.1	1.0	+80	0.50 × 0.50 × .375
12.0 - 18.0	20B2201*	18	0.5	1.30	-55 to +110	0.5	3.0	+110	0.50 × 0.50 × 0.50
18.0 - 22.0	20A8021*	18	0.7	1.30	-54 to +95	0.5	1.0	+95	0.50 × 0.50 × .375
18.0 - 26.5	60A8101*	14	1.0	1.50	-54 to +95	0.1	1.0	+95	0.50 × 0.50 × .375

*These units are normally available from stock or from our distributors.
NOTES:
(1) Circulators are also available.
(2) The insertion loss for Model 60A2601 is 1.5 dB maximum from -54°C to +95°C. Other specifications are unchanged over this temperature range.
Specifications subject to change without notice.

Drop-In Broad Band Models



Isolators

FREQUENCY RANGE (GHz)	MODEL NUMBER	ISOLATION dB min.	INSERTION LOSS dB max.	VSWR max.	OPERATING TEMP. °C.	PEAK POWER KW	AVERAGE POWER WATTS	HEAT SINK TEMP. °C.	SIZE (INCHES NOMINAL) L W H
2.0 - 4.0	69A3101*	16	0.6	1.40	-10 to +70	0.1	1.0	+70	.875 × .875 × .345
2.5 - 5.0	69A3181	16	0.6	1.40	-10 to +85	0.1	1.0	+70	.875 × .875 × .345
2.6 - 5.2	69A3111*	16	0.6	1.40	-25 to +85	0.1	1.0	+85	.875 × .875 × .345
		16	0.7	1.40	-54 to +95	0.1	1.0	+95	.875 × .875 × .345
3.0 - 6.0	69A6201*	16	0.6	1.40	-25 to +85	0.1	1.0	+85	.875 × .875 × .345
4.0 - 8.0	69A6001*	16	0.6	1.40	-40 to +85	0.1	1.0	+85	0.75 × 0.75 × 0.25
4.7 - 10.0	69A6051	12	1.0	1.50	-40 to +85	0.1	1.0	+85	0.75 × 0.75 × 0.25
5.0 - 10.0	69A6101*	16	0.6	1.40	-30 to +70	0.1	1.0	+70	0.75 × 0.75 × 0.25
6.0 - 18.0	69A2601*[2]	10	1.2	2.0	-40 to +80	0.1	1.0	+80	0.50 × 0.50 × 0.20
7.5 - 18.0	69A2041*	12	1.0	1.65	-40 to +80	0.1	1.0	+80	0.50 × 0.50 × 0.25
8.0 - 12.0	69A9201*	17	0.6	1.40	-40 to +85	0.1	1.0	+85	0.50 × 0.50 × 0.25
8.0 - 16.0	69A9301*	14	0.8	1.50	-40 to +85	0.1	1.0	+85	0.50 × 0.50 × 0.25
8.0 - 18.0	69A2031*	13	1.0	1.60	-40 to +80	0.1	1.0	+80	0.50 × 0.50 × 0.25
12.0 - 18.0	69A2201*	17	0.7	1.50	-55 to +100	0.1	1.0	+95	0.50 × 0.50 × 0.25

*These units are normally available from stock or from our distributors.
NOTES: (1) Circulators are also available. (2) For Model 69A2601 only, the insertion loss is 1.5 dB maximum from -54°C to +95°C.
Specifications subject to change without notice.

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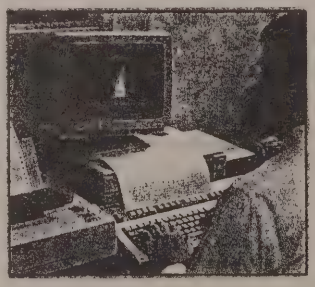

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See pages A•1931—A•1944 (resistors), A•1081 (capacitors), A•1216 (inductors).

RESISTORS

Manufacturer	Starting EEM Page No.	Bulk Ceramic	Carbon Comp.	Film			Wirewound	Foil	Fuse	Chip	Networks	Features								Varistors
												Power								
				Metallized	Non-metallized	Carbon						>2W to <5W	5W to 15W	>15W	Precision	High Voltage >1000V	Non-Inductive	Flame Retardant	Fused	
Robert G.Allen	A•1860	√§	√	√	√	√	√			√	√	√	√	√		√	√	√		
Amitron	A•1865									√§*	√§	√§	√§		√§					
AVX Corporation	A•1866									√	√	√	√							
Beckman Industrial Corp.	A•1868			√§							√§*				√					
Bourns	A•1869			√							√§*									
Cableform Inc.	A•1875					√§						√§	√§	√§	√§	√§	√§			
Caddock Electronics	A•1876			√	√					√	√	√	√	√	√	√	√	√		
Carborundum Co.	A•1904	√										√		√		√	√			
Clarostat Sensors and Controls	A•1906	√*	√*	√*		√*	√*					√*	√*	√*	√*	√*	√*	√*		
Colber Corp.	A•1907	√					√					√	√	√				√		
CTS Corp./Resistor Network Div.	A•1908										√						√	√		
Dale Electronics	A•1910			√§*	√§*		√§*		√	√	√	√	√	√	√	√	√	√		
Electro-Films, Inc.	A•1932									√§*	√§*				√§*		√§*			
General Resistance	A•1935						√*				√				√*		√*			
Huntington Electric	A•1936	√§*					√§*					√§	√§	√§		√§	√§			√§
Imperial Astronics	A•1940						√*					√*	√*	√*						
International Manufacturing Services	A•1944			√§						√§		√§	√§		√§	√§	√§	√§		
IRC	A•1946			√			√			√	√	√	√							
Isotek Corp.	A•1953							√§			√	√	√	√	√		√			
Julie Research Labs	A•1929						√*					√*	√*							
K & M Electronics	A•1956											√	√		√	√	√	√		
KOA Speer	A•1958			√§*	√§*	√§			√§	√§	√§				√§*			√§		
KRL-Bantry Components	A•1973			√§	√§		√§*		√§			√§*	√§*	√§*	√§*		√§*	√§*		
Maida Development	A•1980																			√
Memcor-Truohm	A•1984						√					√*	√*	√*		√*	√*	√*		
Micro-Ohm Corp.	A•1985			√§		√	√		√	√§	√	√	√	√	√		√	√	√	
Mills Resistor Co.	A•1987						√				√	√	√	√	√		√	√		
Milwaukee Resistor Corp.	A•1988						√§													
Mini-Systems Inc.	A•1993			√§*	√§*					√§*	√§*	√§	√§		√§*					
Murata Erie North America	A•1995										√									
Ohmite Manufacturing	A•1996		√*	√§*	√§*	√§*	√§*			√	√§	√	√	√		√	√	√		√
Ohmtek/Vishay	A•2001			√§*	√§*					√§*	√§*				√§*					
Paccom Electronics	A•2005	√§		√§			√		√	√§	√	√	√	√						
Pacific Resistor	A•2006						√*		√*		√*	√*	√*		√*					
Philips Components/ Discrete Products	A•2010			√§	√§	√	√			√§	√	√			√			√		√
Piconics, Inc.	A•2013			√§*						√§*	√§*	√§*	√§*	√§*	√§*	√§*				
Precision Resistive Products	A•2014														√					
Precision Resistor	A•2016						√					√§			√	√	√			
RCD Components	A•2019	√		√§*	√§*	√§	√§*	√§*	√§	√§*	√§*	√§*	√§*	√*	√§*	√§*	√§*	√§*	√§*	
State of the Art	A•2020									√§*	√§*				√§*	√§				
TEPRO of Florida	A•2028																			
Vermont Precision Resistor	A•2036	√					√			√	√	√	√		√					
Victoreen, Inc.	A•2038											√	√			√	√			
Vishay Resistors (VEC)	A•2041							√§*		√§	√§*	√	√		√§		√§	√§		
World Products	A•2050																	√		√§

* MIL Spec. § Surface Mount.

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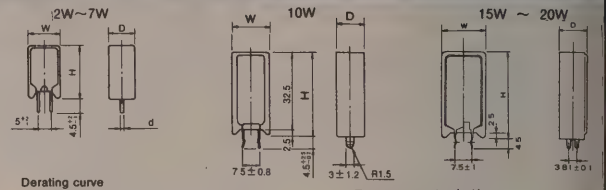
CERAMIC INSULATED RESISTORS (STANDARD)

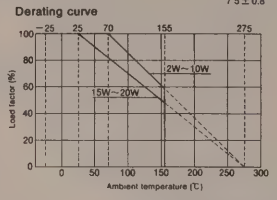
- **MNS**
- **MNR**
- **MNG**

Terminals and leads in the same direction; space-saving types

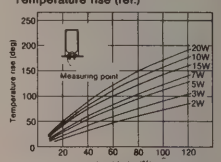


Rated power (W)	Dimensions (mm) W	D	H	d	Resistance range MNS Standard	MNS UL	MNR Standard	MNR UL	MNG Standard	Weight (g)
2	11±1	7±1	20.5±1.5	0.8±0.1	0.15 ~ 200	0.15 ~ 200	100 ~ 13K	100 ~ 13K	0.082 ~ 33	3.7
3	12±1	8±1	25.0±1.5	0.8±0.1	0.27 ~ 360	0.27 ~ 360	100 ~ 22K	100 ~ 22K	0.18 ~ 68	5.3
5	13±1	9±1	25.5±1.5	0.8±0.1	0.3 ~ 510	0.3 ~ 5.10	100 ~ 27K	100 ~ 27K	0.22 ~ 91	6.4
7	13±1	9±1	38.5±1.5	1.0±0.1	0.51 ~ 1.5K	—	200 ~ 56K	—	—	10.2
10	16±1	12±1	35.0±1.5	—	1.0 ~ 1K	—	—	—	—	15.5
15	20±1.2	13±1	38.0±1.5	—	1.0 ~ 2.0K	—	—	—	—	30.0
20	20±1.2	13±1	45.0±1.5	—	1.0 ~ 3.0K	—	—	—	—	41.0

Derating curve



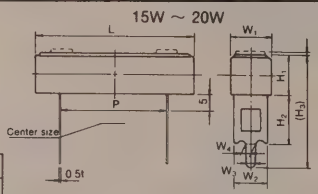
Temperature rise (ref.)

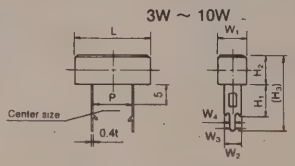


- **MPS**
- **MPR**
- **MQS**
- **MQR**

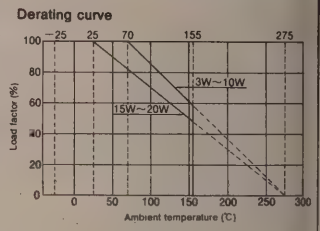
PCB direct-mounting types

Types using lower heat conductive terminal (approx. 50% of MPS, MPR)





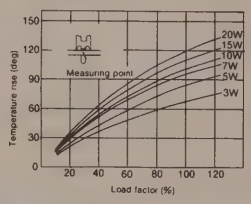
Derating curve



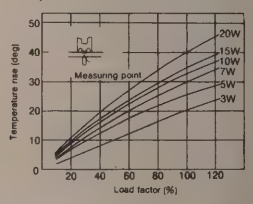
Rated power (W)	Dimensions (mm) L	P	W_1	W_2	W_3	W_4	H_1	H_2	(H_3)
3	24 ±1.2	12.5±1	9 ±1	5±0.2	1.4±0.1	1.6±0.1	9 ±1	10^{+2}_{-1}	23.5
5	27 ±1.5	15 ±1	9.5±1	5±0.2	1.4±0.1	1.6±0.1	99.5±1	10^{+2}_{-1}	24
7	35 ±1.5	22.5±1	9.5±1	5±0.2	1.4±0.1	1.6±0.1	9.5±1	10^{+2}_{-1}	24
10	48 ±1.5	35 ±1	9.5±1	5±0.2	1.4±0.1	1.6±0.1	9.5±1	10^{+2}_{-1}	24
15	48 ±1.5	32.5±1	12.5±1.2	10±0.5	2.7±0.1	3 ±0.1	12.5±1.2	15±1.5	34.5
20	63.5±2	50 ±1.5	12.5±1.2	10±0.5	2.7±0.1	3 ±0.1	12.5±1.2	15±1.5	34.5

Rated power (W)	Resistance range MPS Standard	MPS UL	MPR Standard	MPR UL	MQS Standard	MQR Standard	Weight (g)
3	0.22 ~ 390		100 ~ 39K	100 ~ 22K	0.22 ~ 390	100 ~ 22K	5.5
5	0.47 ~ 680	0.47 ~ 680	100 ~ 11K	100 ~ 27K	0.47 ~ 680	100 ~ 27K	6.5
7	0.68 ~ 1000	0.68 ~ 1000	200 ~ 100K	100 ~ 56K	0.68 ~ 1000	200 ~ 56K	8.3
10	1.0 ~ 1500	1.0 ~ 1000	200 ~ 150K	200 ~ 75K	1.0 ~ 1500	200 ~ 75K	11.0
15	1.0 ~ 2000	1.0 ~ 2000	510 ~ 200K	510 ~ 110K	1.0 ~ 2000	510 ~ 110K	17.8
20	1.0 ~ 3000	1.0 ~ 3000	510 ~ 240K	510 ~ 180K	1.0 ~ 3000	510 ~ 180K	22.8

Temperature rise (ref.) MPS, MPR

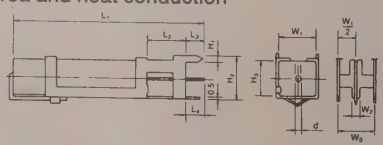


Temperature rise (ref.) MQS, MQR

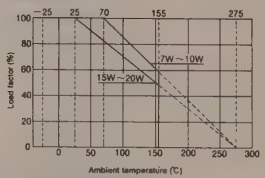


- **MVS**
- **MVR**

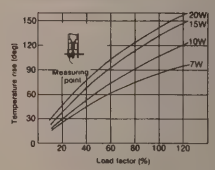
Designed for minimal PCB occupation area and heat conduction



Derating curve



Temperature rise (ref.)



Rated power (W)	Dimensions (mm) L_1	L_2	L_3	L_4	H_1	H_2	H_3	W_1	W_2	W_3	d ±0.1	Resistance range MVS	MVR	Weight
7	49 ±1.5	10±1	4.0±0.2	5.0±0.5	1.5±0.1	11±1	9pm1	9.5±1	1.5±0.1	10±1	0.8	0.51 ~ 1500	200 ~ 56K	10.0
10	67 ±1.5	10±1	4.0±0.2	5.0±0.5	1.5±0.1	11±1	9±1	9.5±1	1.5±0.1	10±1	0.8	1 ~ 2000	200 ~ 75K	13.3
15	62.5±1.5	10±1	4.5±0.2	6.5±1	2.5±0.15	14±1	12.5±1.2	12.5±1.2	2.5±0.15	13±1	1.0	1 ~ 2000	510 ~ 110K	22.1
20	78 ±2	10±1	4.5±0.2	6.5±1	2.5±0.15	14±1	12.5±1.2	12.5±1.2	2.5±0.15	13±1	1.0	1 ~ 3000	510 ~ 180K	26.4

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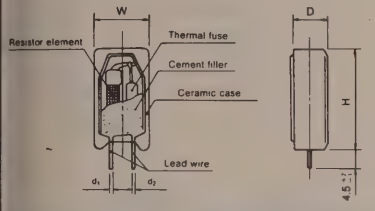
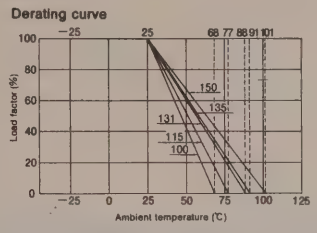
THERMAL FUSE INCORPORATED CEMENT RESISTORS

- **MEG**
- **MES**
- **MER**

Since thermal fuses are incorporated, cement resistors respond quickly to overloading as well as external overheating.

These resistors also provide outstanding features against surges. Therefore they are suitable for the prevention of inrush current for switching regulators.





Type	Dimensions (mm) W	D	H	d_1	d_2	Temperature range of each element MEG	MES	MER
02	11±1	7±1	20.5±1.5	0.8±0.1	0.6±0.1	4.7～20	0.15～200	100～13K
03	12±1	8±1	25.0±1.5	0.8±0.1	0.6±0.1	4.7～20	0.27～360	100～22K
05	13±1	9±1	25.5±1.5	0.8±0.1	0.6±0.1	4.7～91	0.3～510	100～27K
07	13±1	9±1	38.5±1.5	1.0±0.1	1.0±0.1	—	0.51～1500	—

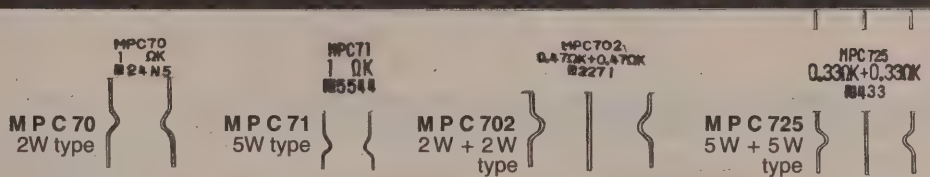
Type	Resistance range	Tolerance	Type of thermal fuse: Nominal operating temp	Operating temp	Continuous Rated power
02	0.15Ω～13kΩ	J:±5% K:±10%	**100**	**95±**	**0.7W**
			115	**110±4**	**1.0W**
			131	126±4	1.4W
			135	130±4	1.5W
			150	145±4	1.9W
03	0.27Ω～22kΩ		100	95 pm	0.75W
			115	110 pm4	1.05W
			131	126±4	1.45W
			135	130±4	1.55W
			150	145±4	2.0W
05	0.3Ω～27kΩ		100	95±	0.8W
			115	110±4	1.1W
			131	126±4	1.5W
			135	130±4	1.6W
			150	145±4	2.1W
07	0.51Ω～1.5kΩ		101	99±	1.3W
			113	109±	1.6W
			121	119±4	1.9W
			133	129±4	2.2W
			147	139±4	2.7W

MPC Series Metal Plate Cement Resistors

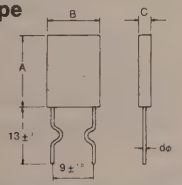
- **MPG**

Compact type with any safety design on nonflammability and insulation.

Low resistance and strong at surge current

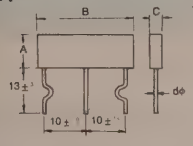


Single type



Model	Rated power (W)	Resistance range (Ω)	Tolerance	A (mm)	B (mm)	C (mm)	dφ (mm)	Remarks
MPC 70	1	0.1～1.0	K	8±1.0	13±1.0	4±0.5	0.6	
MPC 78	2	0.1～0.47	K	8±1.0	13±1.0	4±0.5	0.6	Low distortion factor products for acoustic products
MPC 76	2	0.01, 0.05	K	8±1.0	13±1.0	4±0.5	0.6	
MPC 71	5	0.1～1.0	K	18±1.0	14±1.0	5±0.5	0.6	
MPC 75	3	0.01, 0.05	K	18±1.0	14±1.0	5±0.5	0.8	
MPC 74	5	0.1～1.0	K	18±1.0	14±1.0	5±0.5	0.8	Low distortion factor products for acoustic products
MPC722	10	2.2, 3.3	J	18±1.0	26±1.0	5±0.5	0.8	

Double type

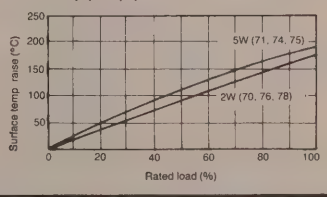


Model	Rated power (W)	Resistance range (Ω)	Tolerance	A (mm)	B (mm)	C (mm)	dφ (mm)	Remarks
MPC702	2+2	0.22+0.22～0.47+0.47	K	10±1.0	26.5±1.0	5±0.5	0.6	
MPC722	5+5	0.1+0.1～0.47+0.47	K	17±1.0	26±1.0	5±0.5	0.8	Resistor have ideling terminal
MPC725	5+5	0.22+0.22～0.47+0.47	K	17±1.0	26±1.0	5±0.5	0.8	

• The terminals are of straight type and kink-forming type.

Item	Specification	Remarks
Temp. coeff. of resistance	±350ppm/°C>	
Short-time overload	±2%>	10× rated power for 5 sec.
Withstanding voltage	±2%>	500V for 1 min.
Insulation resistance	10MΩ>	500V megger.
Damp. load life	±5%>	40°C 95% RH, for 1000hr.
Load life	±5%>	70°C for 1000hr.
Unflammability	PASS	According to UL 492-2•7•8

Applied power vs. surface temp. (Example)



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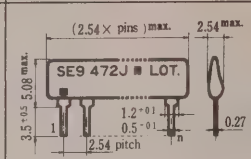
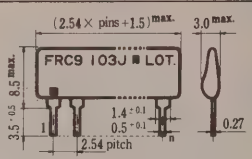
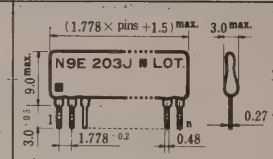
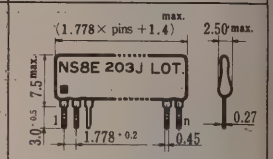
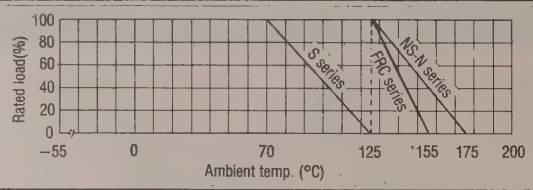
THIN FILM SPECIFICATIONS AVAILABLE UPON REQUEST

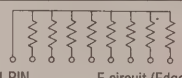
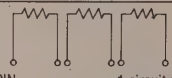
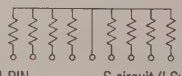
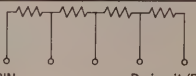
Thick Film Resistor Networks

SIP type hybrid thick film resistor networks

	Standard products (Low profile)	For burn-in: High power	For burn-in: Shrink type (1.778mm pitch)	
	S series	F R series	N series	N S series
Appearance / Dimensions				
Example	S E 9 472 J Type Circuit Elements Value Tolerance	FRC 9 103 J Type Elements Value Tolerance	N E 9 203 J Type Circuit Elements Value Tolerance	NS E 8 203 J Type Circuit Elements Value Tolerance
Rated power	0.125W/element	0.250W/element	0.250W/element	0.250W/element
Max. working voltage	100V	200V	200V	200V
Resistance range	22Ω ~ 1 MΩ	22Ω ~ 1 MΩ	22Ω ~ 470kΩ	22Ω ~ 470kΩ
Resistance tolerance	G(±2%)J(±5%)K(±10%)	G(±2%)J(±5%)K(±10%)	G(±2%)J(±5%)K(±10%)	G(±2%)J(±5%)K(±10%)
Temp. coeff. of resistance	±200ppm/°C	±250ppm/°C	±250ppm/°C	±250ppm/°C
Operating temp. range	−55 ~ +125°C	−55 ~ +155°C	−55 ~ +175°C	−55 ~ +175°C

Derating curve

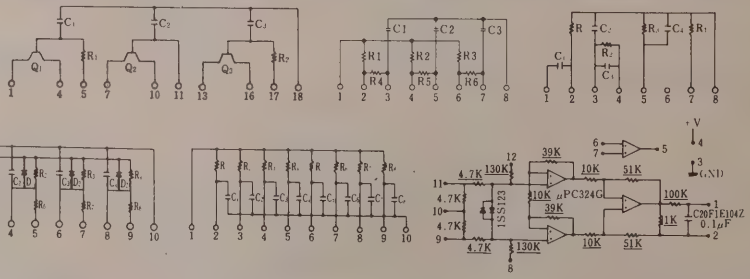


Series	Standard circuit	Standard elements	Series	Standard circuit	Standard elements
S E F R C N N S	 1 PIN E circuit (Edge common type)	3 ~ 12 4 ~ 14 4 ~ 21 4 ~ 13	S I	 1 PIN 1 circuit (Individual type)	2 ~ 7
S S	 1 PIN S circuit (I Symmetrical type)	4 ~ 12	S D	 1 PIN D circuit (Divider type)	3 ~ 12

Custom H.I.C. & Resistor Networks

Our H.I.C. and resistor networks, using alumina or organic substrate and being finished with surface mount, can respond to various custom requests such as circuits, relative ratio, double-sided print, crossover print, etc.

Circuit example



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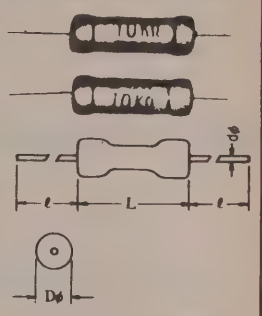
Flame-Proof Metal Oxide Film Resistors — Standard Size

Axial-lead type			DIMENSIONS					
Model	Rated power (W)	Resistance range (Ω)	Tolerance	L (mm)	Dϕ (mm)	ℓ (mm)	dϕ (mm)	Remark
RNU 1/2 RSU 1/2	1/2	0.1~9.1 10~20 K	J	9±1	3.5±1	30±3	0.65±0.1	dϕ =0.8 for miniaturized resistors
RNU 1 RSU 1	1	0.1~9.1 10~100 K	J	12^{+1}_{-2}	4±1	38±3	0.8±0.1	
RNU 2 RSU 2	2	0.1~9.1 10~100 K	J	16^{+1}_{-2}	6±1	38±3	0.8±0.1	
RNU 3 RSU 3	3	0.1~9.1 10~150 K	J	26^{+1}_{-2}	8.5±1	38±3	0.8±0.1	

Axial lead type



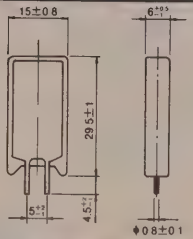
See the spec. for taping

MNM Space-saving thin type

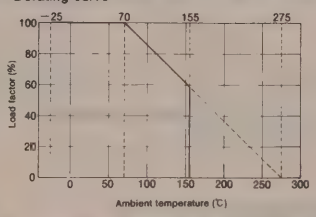
Rated power, resistance range, and tolerance

Type	Rated power	Nominal resistance
05	5W	1Ω ~ 20MΩ

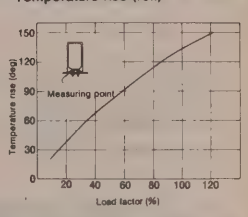
* The wire-wound type is used for 1Ω ~ 43Ω, and the film type is for 47Ω or more.



Derating curve



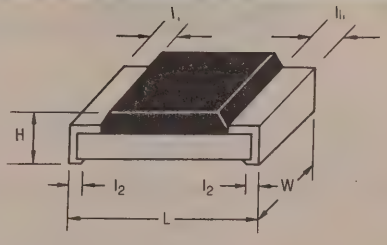
Temperature rise (ref.)

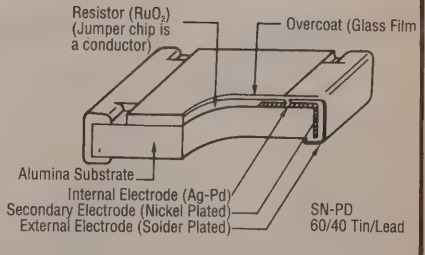


Thick Film Chip Resistors

PERFORMANCE CHARACTERISTICS

ELECTRICAL	CR21 (0805)	CR32 (1206)
Power rating @70°C Temperature coefficient Derated to 0 load at	0.10 watt ±100, 200, 300ppm/°C 125°C	0.125 watt ±100, 200, 300ppm/°C 125°C
Maximum working voltage Maximum overload voltage Operating-temperature range	100V 200V −55°C to +125°C	200V 400V −55°C to +125°C
Resistance range (1% Tolerance) E96, 100ppm/°C (5% Tolerance) E24, 200ppm/°C, 300ppm/°C	10 ohm to 1 megohm 1 ohm to 3.3 megohm zero ohm Jumpter <0.05 ohm	10 ohm to 1 megohm 1 ohm to 10 megohm zero ohm Jumper <0.05 ohm
	*Special value on request	





CHIP DIMENSIONS

Type	L	W	H	l_1	l_2
CR32 (1206)	0.120±0.004 (3.05±0.10)	0.061±0.004 (1.55±0.10)	0.024±0.004 (0.60±0.10)	0.020±0.008 (0.50±0.20)	0.020±0.008 (0.50±0.20)
CR21 (0805)	0.081±0.004 (2.05±0.10)	0.049±0.004 (1.25±0.10)	0.020±0.004 (0.50±0.10)	0.016±0.008 (0.40±0.20)	0.016±0.008 (0.40±0.20)
CR16 (0603)	0.063±0.004 (1.60±0.10)	0.031±0.004 (0.80±0.10)	0.020±0.004 (0.50±0.10)	0.012±0.008 (0.30±0.20)	0.012±0.008 (0.30±0.20)

Quality, Dependability and Service for more than 30 years. Over 80% of all orders shipped from warehouse stock.

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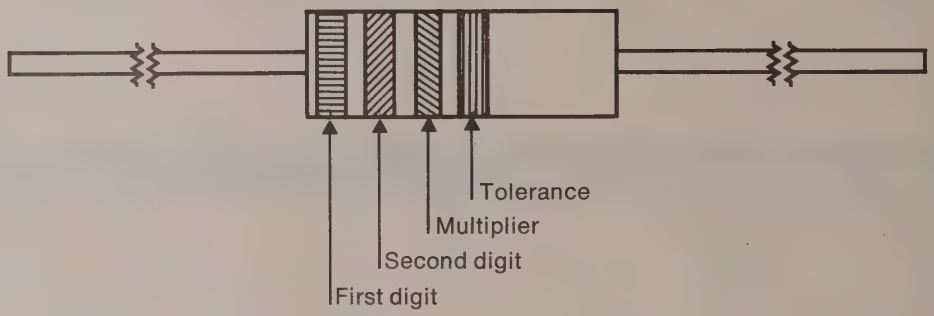
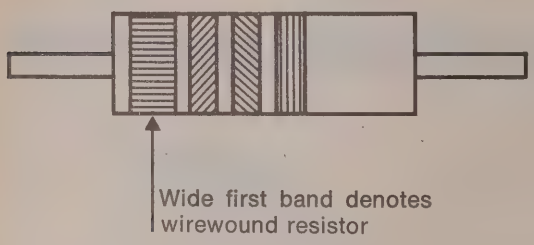
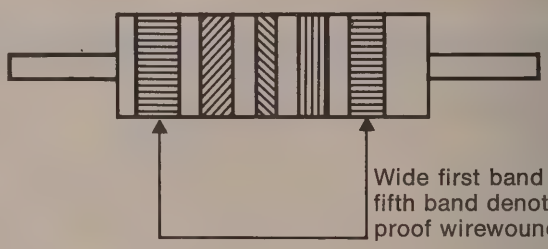
MINIGLOSSARY
RESISTOR COLOR CODES

EIA/MIL Resistor Color Codes



Color code for general-purpose industrial resistors

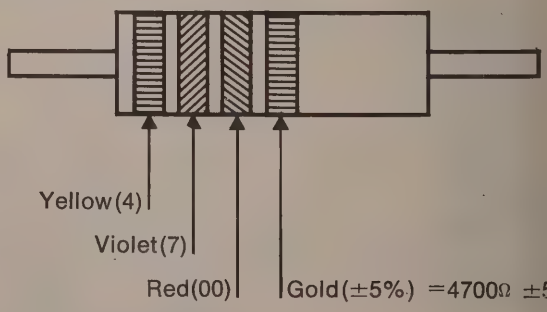




Color code for general-purpose wirewound resistors

Color	Significant digit	Multiplier	Tolerance
Black	0	1	—
Brown	1	10	± 1%
Red	2	100	± 2%
Orange	3	1000	± 3%
Yellow	4	10,000	± 4%
Green	5	100,000	—
Blue	6	1,000,000	—
Violet	7	10,000,000	—
Gray	8	—	—
White	9	—	—
Gold	—	0.1	± 5%
Silver	—	0.01	±10%
No color	—	—	±20%

Example:



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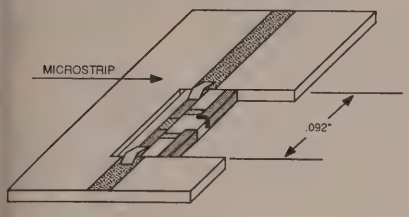
FAX: 508—686-0622

THICK FILM MICROWAVE COMPONENTS
CHIP ATTENUATORS



01 — STANDARD FEATURES INCLUDE:

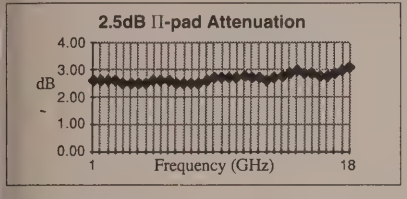
- Chip construction designed for MIC assembly
- Ground plane metalization suitable for soldering or epoxying
- Wire or ribbon bondable gold top conductor lines
- Size: Length .092"
  Width <.045"
  Thickness .010"

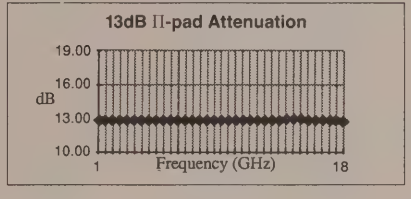
ORDERING INSTRUCTIONS FOR Π-PADS:

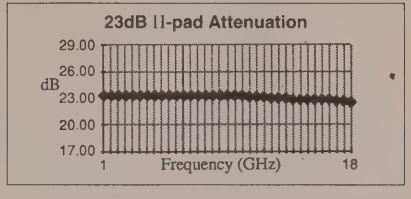
Amitron Part Number = AMP-XX.XdB-01
AMP = Amitron Π-pad
XX.X = Desired Attenuation
01 = Standard Features

ATTENUATOR PERFORMANCE

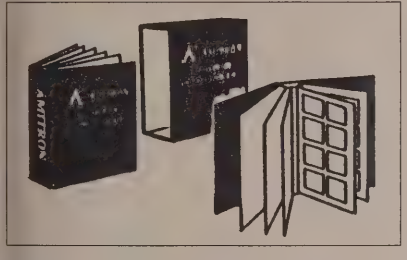
AMITRON has manufactured Π-pads up to 45 dB.
High power balanced attenuators, 4 watts average handling power capability available.





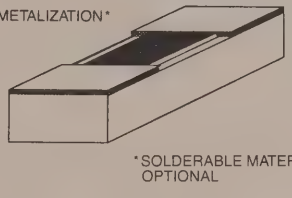


CHIP RESISTOR KITS



AMITRON Engineering Chip Resistor Kits provide a variety of resistor values allowing engineers the flexibility to more readily develop new designs or modify existing circuits. Standard Kits include resistors with 30 different values ranging from 1 ohm to 820K ohms, 20 resistors per value packaged in separate containers. Resistor sizes = .020" width × .040" length × .015" thick with gold metalization pads for aluminum gold wire bonding.

STANDARD KIT RESISTOR STYLE



*SOLDERABLE MATERIAL OPTIONAL

RESISTOR SPECIFICATIONS:

Resistance Values (ohms): Tolerance ±5%

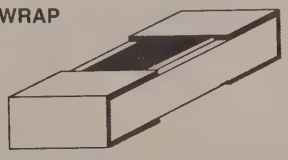
1	10	100	1.0K	10K	100K
1.8	18	180	1.8K	18K	180K
3.3	33	330	3.3K	33K	330K
4.7	47	470	4.7K	47K	470K
8.2	82	820	8.2K	82K	820K

Temperature Coefficient of Resistance (TCR) ±200 PPM from −55°C to −125°C.
Power Rating 50 milliwatts (without heat sinking).

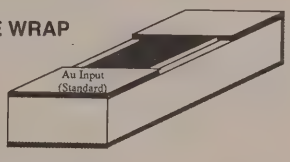
OPTIONS:

- Additional Values to megohm range at $50 per package of 20 after purchase of initial kit
- Solder Tinning
- Dual Wrap or Single Wrap Chip Resistor Styles:

DUAL WRAP



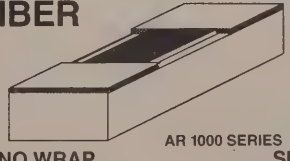
SINGLE WRAP



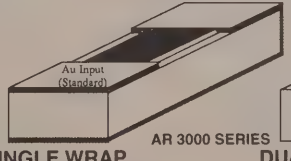
CHIP RESISTOR PART NUMBER GUIDE

AR XXXX / X / 000-0 / XX / X

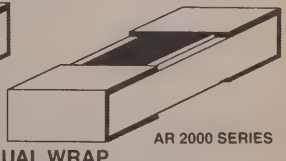
- **CHIP DESIGN:**
  X XXX
  - Chip Size (see charts)
  - Resistor Metalization:
    1 = standard resistor
    2 = dual wrap resistor
    3 = single wrap resistor
- **TERMINATION METALIZATION**
  Q = Palladium/Silver
  R = Platinum/Gold
  S = Platinum/Palladium/Gold
  T = Gold
  QN = Nickel Barrier
- **OPTIONS:**
  O = No options
  T = SN62 solder tinning
  M = Back Metalization
  UP = Unpassivated
  R = Pt/Au Input metalization
- **TOLERANCE (+/−):**
  D5 = .5%
  01 = 1%
  02 = 2%
  05 = 5%
  10 = 10%
- **RESISTANCE SPECIFICATIONS:**
  First three (3) digits represent significant figures, digit after the dash (–) specifies the number of zeros. If fractional values of an Ω are required, the letter "D" shall be substituted for one of the significant digits and succeeding digits of the group shall represent significant figures.



AR 1000 SERIES



AR 3000 SERIES



AR 2000 SERIES

NO WRAP

AMITRON Series	Width	Length	Thickness
AR1001	.020	.040	.010
AR1002	.025	.050	.010
AR1003	.050	.050	.010
AR1004	.025	.100	.010
AR1005	.050	.075	.010
AR1006	.100	.050	.010
AR1007	.020	.020	.010
AR1008	.100	.100	.020
AR1009	.050	.050	.020
AR1010	.120	.240	.030

SINGLE WRAP

AMITRON Series	Width	Length	Thickness
AR3001	.020	.030	.015
AR3002	.020	.040	.015
AR3003	.025	.045	.010
AR3004	.025	.045	.015
AR3005	.055	.065	.015
AR3006	.055	.065	.025
AR3007	.025	.045	.025
AR3008	.020	.040	.010
AR3009	.050	.065	.025
AR3010	102	.110	.010
AR3011	.050	.050	.020
AR3012	.020	.040	.025
AR3013	.055	.065	.010
AR3014	.025	.045	.025

DUAL WRAP

AMITRON Series	Width	Length	Thickness
AR2001	.020	.030	.015
AR2002	.020	.040	.015
AR2003	.030	.050	.015
AR2004	.050	.050	.015
AR2005	.050	.075	015
AR2006	.050	.100	.015
AR2007	.050	.150	.015
AR2008	.100	.100	015
AR2009	.050	.030	.015
AR2010	.015	.040	.010

The above configurations are only a sample of resistor sizes available. Please call for additional part numbers to meet your design requirements. As with the above standard chips (AR1000, 2000, 3000), AMITRON will supply special configurations, such as the AR4000 series (partial wraps), upon request.

Thick Film Chip Resistors CR05/CR10/CR21/CR32 Series

AVX CORPORATION
A KYOCERA GROUP COMPANY

Part Numbering System:

CR	32	101	J	T

Style
CR –Chip
CJ = Zero Ohm

Case Size
05 = 0402
10 = 0603
21 = 0805
32 = 1206

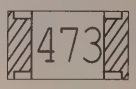
Resistance Code
For G, J, K Tol.
3 digit code (E–24)
2 sig. digits plus no. of zeros.
Examples:
2.2Ω = 2R2
10Ω = 100
100Ω = 101
1KΩ = 102

For F Tol. only
4 digit code (E–96)
3 sig. digits plus no. of zeros
Examples:
10Ω = 10R0
100Ω = 1000
1KΩ = 1001

Resistance Tolerance
K = ±10%
J = ±5%
G = ±2%
F = ± 1% (Available in case size CR21 and CR32 only)

Packaging
B = Bulk
S = 13"Reel Punched Paper Tape (10K pcs/reel)
SE = 13" Reel Embossed Plastic Tape (10K pcs/reel)
T = 7" Reel Punched Paper Tape (5K pcs/reel)
UE = 7" Reel Embossed Plastic Tape (4K pcs/reel)
Z = 13" Reel Punched Paper Tape (50K pcs/reel–CR05 only)

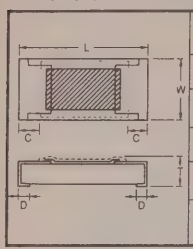
Marking



3 digit indication
Ex. 47 X 103 = 47000 = 47k
000 : 0
100 : 10
102 : 1 k
105 : 1 M

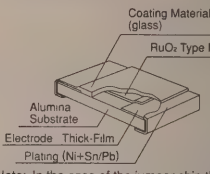
Marking available as follows:
Series: CR32, CJ32, CR21, CJ21
Tolerances: G (±2%), J (±5%), K (±10%)

Dimensions: inches (mm)



	CR05 (CJ05)	CR10 (CJ10)	CR21 (CJ21)	CR32 (CJ32)
L	1.00 +.10 -.05 (.040 +.004 -.002)	1.60 ±.10 (.060 ±.004)	2.00 ±.10 (.080 ±.004)	3.10 ±.10 (.120 ±.004)
W	0.50 +.10 -.05 (.020 +.004 -.002)	0.80 +.15 -.10 (.030 +.006 -.004)	1.25 +.15 -.10 (.050 +.006 -.004)	1.55 +.15 -.10 (.060 +.006 -.004)
T	0.35 ±.05 (.014 ±.002)	0.50 ±.10 (.020 ±.004)	0.50 ±.10 (.020 ±.004)	0.55 +.10 -.05 (.022 +.004 -.002)
C	0.20 -.15 (.008 ±.006)	0.25 ±.20 (.010 ±.008)	0.25 ±.20 (.010 ±.008)	0.45 ±.20 (.018 ±.008)
D	0.20 +.15 -.10 (.008 +.006 -.004)	0.20 +.20 -.15 (.008 +.008 -.006)	0.40 ±.20 (.016 ±.008)	0.45 ±.20 (.018 ±.008)

Construction

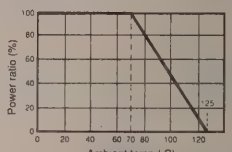


Note: In the case of the jumper chip the resistor element is a conductor.

Chip Resistor Ratings

Spec \ Style	CR05 (0402)	CR10 (0603)		CR21 (0805)				CR32 (1206)			
Power	0.063(1/16)W	0.063(1/16)W		0.100(1/10)W				0.15(1/8)W			
Voltage	50V	50V		100V				200V			
Tolerance	J (±5%)	J (±5%)	K (±10%)	F (±1%)	G (±2%)	J (±5%)	K (±10%)	F (±1%)	G (±2%)	J (±5%)	K (±10%)
Value Range	2.2Ω ƒ 2.2MΩ	10Ω ƒ 2.2MΩ	2.2Ω ƒ 10MΩ	10Ω ƒ 1MΩ	10Ω ƒ 2.2MΩ	10Ω ƒ 10MΩ	2.2Ω ƒ 10MΩ	10Ω ƒ 1MΩ	10Ω ƒ 2.2MΩ	10Ω ƒ 10MΩ	2.2Ω ƒ 10MΩ
Working Temp	-55°C to approximately +125°C										

Derating Curve



Under high temperatures, power derating must follow curve.

Temperature Coefficient of Resistance

	CR05			CR10					CR21									CR32								
Tolerance	J ±5%			J ±5%		K ±10%			F ±1%		G ±2%			J ±5%			K ±10%		F ±1%	G ±2%		J ±5%		K ±10%		
Resistance Range	2.2Ω ƒ 100Ω	100Ω ƒ 1MΩ	1MΩ ƒ 2.2MΩ	10Ω ƒ 1MΩ	1MΩ ƒ 2.2MΩ	2.2Ω ƒ 100Ω	10Ω ƒ 1MΩ	1MΩ ƒ 10MΩ	10Ω ƒ 100Ω	100Ω ƒ 1MΩ	10Ω ƒ 100Ω	100Ω ƒ 1MΩ	1MΩ ƒ 2.2MΩ	10Ω ƒ 100Ω	100Ω ƒ 1MΩ	1MΩ ƒ 10MΩ	2.2Ω ƒ 10Ω	10Ω ƒ 1MΩ	1MΩ ƒ 10MΩ	10Ω ƒ 1MΩ	10Ω ƒ 1MΩ	1MΩ ƒ 2.2MΩ	10Ω ƒ 1MΩ	1MΩ ƒ 10MΩ	2.2Ω ƒ 10Ω	10Ω ƒ 1MΩ	1MΩ ƒ 10MΩ
TCR (ppm/°C)	-100 ƒ +500	-300 ƒ +300	-600 ƒ +200	±200	-600 ƒ +300	-100 ƒ +600	±200	-600 ƒ +300	±200	±100	±200	±100	-600 ƒ +300	±200	±100	-600 ƒ +300	-100 ƒ +600	±200	-600 ƒ +300	±100	±100	-600 ƒ +300	±100	-600 ƒ +300	-100 ƒ +600	±100	-600 ƒ +300

Chip Resistor Arrays CRA2A/CRA3A Series

Part Numbering System:

CRA3A	3E	103	J	T

Packaging
B = Bulk
T = Taping

Resistance Tol.
K = ±10%
J = ±5%
G = ±2% (option)

Resistance Code
E–24 series

Number of Elements
4E = 4 elements
3E = 3 elements
2E = 2 elements

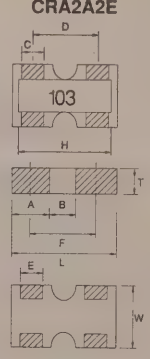
Style
CRA3A/CRA2A
multiple resistor chip

Items	Specifications
Rated Power	1/16W(0.063W)/Element @ 70°C
Max Working Volt. (1)	12V
Max Allow. Volt. (2)	50V (1 sec)
Resistance Value	10Ω - 2.2MΩ
Tolerance	J; ±5%; K; ±10%; (G; ±2% opt.)
No. of Elements	2 or 3
Working Temp.	-55°C to +125°C

(1) Max. working volt 12V or rated power x resistance value whichever is less.
(2) Max. working volt. and max. allowable voltage depend on resistance value.

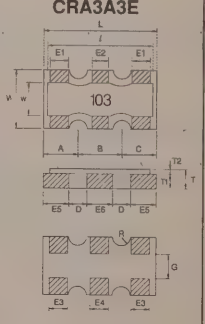
Dimensions: mm (inches)

CRA2A2E



L	2.00 ±.20	(.079 ±.008)
W	1.25 ±.20	(.049 ±.008)
T	0.50 ±.20	(.020 ±.008)
A	0.75 ±.15	(.030 ±.006)
B	0.50 ±.15	(.020 ±.006)
C	0.40 ±.15	(.016 ±.006)
D	1.20 ±.15	(.047 ±.006)
E	0.40 ±.15	(.016 ±.006)
F	1.25 ±.15	(.049 ±.006)
G	0.80 ±.15	(.031 ±.006)
H	1.90 ±.15	(.075 ±.006)

CRA3A3E



L	3.00 ±.20	(.118 ±.008)
W	1.55 ±.20	(.060 ±.008)
T	0.55 ±.20	(.022 ±.008)
A	1.00 ±.20	(.039 ±.008)
B	1.00 ±.20	(.039 ±.008)
C	1.00 ±.20	(.039 ±.008)
D	0.50 ±.15	(.020 ±.006)
E1	0.40 ±.15	(.016 ±.006)
E2	0.35 ±.15	(.014 ±.006)
E3	0.40 ±.15	(.016 ±.006)
E4	0.35 ±.15	(.014 ±.006)
E5	0.75 ±.15	(.030 ±.006)
E6	0.50 ±.15	(.020 ±.006)
R	0.25 ±.15	(.010 ±.006)
I	2.80 ±.15	(.110 ±.006)
w	0.90 ±.15	(.035 ±.006)
G	0.90 ±.15	(.035 ±.006)
T1	0.50 ±.15	(.020 ±.006)
T2	0.03 +.05 -.02	(.001 +.006 -.001)

W	1.60 ±.10	(.063 ±.004)
L	3.20 ±.10	(.126 ±.004)
T	0.50 ±.10	(.020 ±.004)
C	0.30 ±.20	(.012 ±.008)
D	0.20 ±.10	(.008 ±.004)
E1	0.30 ±.10	(.012 ±.004)
E2	0.30 ±.10	(.012 ±.004)
E3	0.50 ±.15	(.020 ±.008)
F	0.80 ±.7	(.031 ±.003)
G	0.30 ±.15	(.012 ±.008)

CRA3A4E

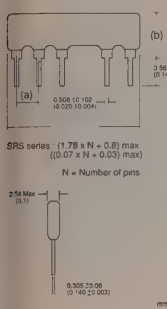
Thick Film Resistor Networks SRS, SRD, TRD, MRD & RD Series

AVX CORPORATION
A KYOCERA GROUP COMPANY

Part Numbering System:

SRD	SA	10	PC	472	G	☐	☐
Product Series	**Circuit Type**	**No. of pins**	**Lead Pitch & Shape**	**Resistance Value**	**Resistance Tolerance**	**Option**	**Packaging**
RD, MRD, SRD, TRD or SRS	SA, SB, SD, SE or SF	4 – 14	Pitch: P = 2.54mm(0.1in.), S = 1.78mm (0.07 in.); Shape: C = Center Lead	3 digits. 2 sig. digits plus number of zeros (Example: 472 = 4.7Ω)	J = ±5%, G = ±2%, F = ±1%	☐ = TCR ±250ppm/°C, A = TCR ±100ppm/°C	☐ = Bulk, M = Magazine (580mm), T = Ammo Pack, W = Magazine (508mm)

Dimensions

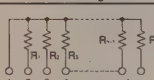
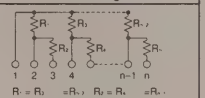
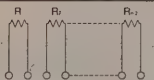
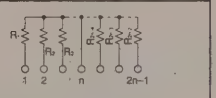
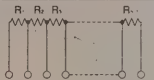
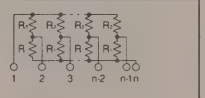


Type	Series	Lead Pitch (a)	Height (b)	Circuit	Wattage
Standard	SRD	2.54 (0.10)	4.96 Max (0.196)	SA, SC, SD, SE	125mW/R
				SB	200mW/R
				SF	125mW/pin
	SRS	1.78 (0.07)		SA, SC, SD, SE	100mW/R
				SB	125mW/R
				SF	100mW/pin
Low Profile	TRD	2.54 (0.10)	3.5 Max (0.138)	SA, SC, SD, SE	62.5mW/R
				SB	100mW/R
				SF	62.5mW/pin
High Power	RD		8.13 Max (0.320)	SA, SC, SD, SE	250mW/R
				SB	400mW/R
				SF	250mW/pin
	MRD		6.5 Max (0.256)	SB	250mW/R

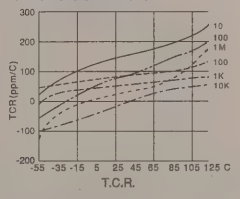
Specifications

Item		Rating				
		SRD	TRD	RD	MRD	SRS
Rated Power (70°C)	SA	125mW/R	62.5mW/R	250mW/R	—	100mW/R
	SB	200mW/R	100mW/R	400mW/R	250mW/R	125mW/R
	SC	125mW/R	62.5mW/R	250mW/R	—	100mW/R
	SD	125mW/R	62.5mW/R	250mW/R	—	100mW/R
	SE	125mW/R	62.5mW/R	250mW/R	—	100mW/R
	SF	125mW/R	62.5mW/pin	250mW/pin	—	100mW/pin
Max Working Voltage	100V					
Nominal Res. Value and Tolerance	F: ±1% (51Ω–1.0MΩ) G: ±2% (22Ω–2.2MΩ) J: ±5% (10Ω–2.2MΩ)					
Working Temp. Range	-55°C to +125°C					
Std. Pin Config.	SIP 4 to 14 pin					

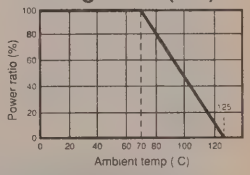
Standard Circuit Block Diagrams

	Type	Circuit Block Diagram		Type	Circuit Block Diagram
SA	Bussed resistor array (4 to 14 pin)		SD	Divided resistor array (5 to 13 pin)	
SB	Isolated resistor array (4 to 14 pin)		SE	Center common resistor array (5 to 13 pin)	
SC	Series resistor array (4 to 14 pin)		SF	Dual terminator resistor array (5 to 13 pin)	

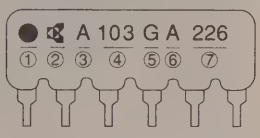
Temperature Characteristic



Derating Curve (SIP)



Component Marking



① Pin #1 Indicator
② Manufacturer Trademark
③ Circuit
④ Resistance Code (10kΩ)
⑤ Resistance Tolerance (±2%)
⑥ TCR (±100ppm/°C)
⑦ Date Code 2–26 (YR–WK)

Part Numbering System:

RC A 10 X7R 103 – 221 / 331

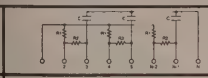
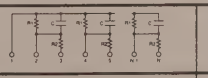
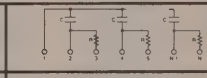
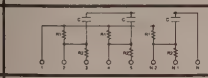
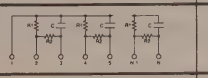
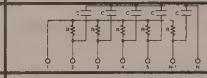
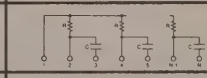
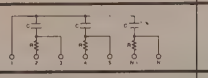
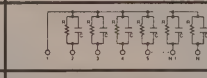
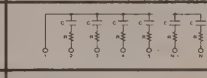
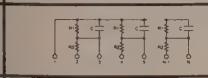
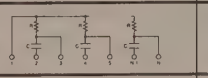
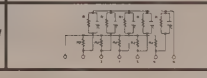
- Resistance Code of R2 (if applicable)
- Resistance Code of R1
- Capacitance Code
- Temperature Characteristic of Capacitors
  - CG(NPO) = 0 ± 30ppm/°C
  - X7R = ± 15%
  - Y5V = +22/-82°C
- Number of pins: 7 – 14
- Circuit Type: A, B, C, G, H, I, K, L, M, N, P, Q, S, T, U, V, W
- Product Series: RC

Specifications

Resistor	Rated Power	Max 125mW/R				
	Rated Voltage	Max 100V				
	Resistance Range	10Ω to 50Ω		51Ω to 500kΩ	501kΩ to 2.2MΩ	
	Tolerance	±5%		±2%	±2%	
	T.C.R.	±250ppm/°C		±100ppm/°C	±250ppm/°C	
Capacitor	T.C.C.	CG(NP0) ±30ppm/°C	X7R ±15%		Y5V +22/-82%	
	Rated Voltage	50VDC	25VDC	50VDC	16VDC	25VDC	50VDC
	Cap. Range	10pF-1800pF	68nF-0.12μF	680pF-56nF	0.68μF-1μF	0.33μF-0.47μF	10MF-0.22μF
	Cap. Tolerance	J (±5%)	K (±10%)		Z (+80/-20%)		
	Withstanding Volt.	Apply 2.5 x rated voltage for 1 to 5 sec. (charging/discharging current < 50mA)					
	Insul. Resistance	10,000MΩ or 500MΩ μF Min., whichever is less					
	Q*2	Q ≥ 400+20C (C: Cap (μF))	—		—		
	Tan *2	—	2.5% Max		5% Max		
	Storage Temp.	-25 to +125°C			-30 to +85°C		
	Working Temp.	-55 to +70°C			-30 to +70°C		
	Std. No. of Pins	4 to 14 pin					
	Insul. Resistance	10,000MΩ Min.					

Thick Film Resistor/Multilayer Ceramic Capacitor Networks RC Series

Standard Circuit Blocks

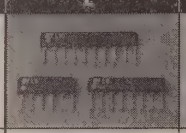
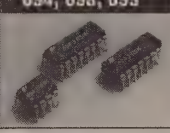
A		SIP 8,10, 12,14 pins	H		SIP 7,9, 11,13 pins	Q		SIP 7 thru 14 pins	M		SIP 7,9, 11,13 pins
B		SIP 8,10, 12,14 pins	I		SIP 7,9, 11,13 pins	S		SIP 7 thru 14 pins	N		SIP 7,9, 11,13 pins
C		SIP 8,10, 12,14 pins	K		SIP 7,9, 11,13 pins	T		SIP 7 thru 14 pins	P		SIP 7 thru 14 pins
G		SIP 7,9, 11,13 pins	L		SIP 7,9, 11,13 pins	U		SIP 7 thru 14 pins	V		SIP 10 pins
									W		SIP 7 thru 14 pins

Beckman Industrial™

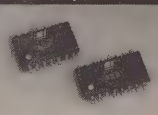
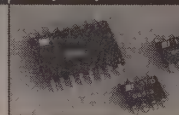
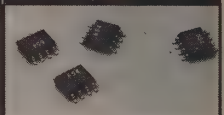
Affiliate of Emerson Electric Co.

RESNET®
Resistor Networks & Chips
Precision Thin Film
Economical Thick Film

SIPS AND DIPS

Model	1	694, 698, 699	887, 888	898, 899	M10/H12
					
Element	COST EFFECTIVE THICK FILM	PRECISION THIN FILM	COST EFFECTIVE THICK FILM	COST EFFECTIVE THICK FILM	COST EFFECTIVE THICK FILM LADDER
Type	Conformal SIP	Molded DIP	Ceramic DIP	Ceramic DIP	Conformal SIP
# of Pins	4 to 14	8, 14, 16	18, 20	14,16	10, 12
Resistance Range, Ohms	22 to 1 Meg	100 to 100K	22 to 2.2 Meg	22 to 1 Meg	10K to 100K
Resistance Tolerance	±2%	±1% to ±0.1%	±2%	±2%	±2%
TCR, ppm/°C	±100	±50	±100	±100	±100
TCR Tracking, ppm/°C	±50	±5	±50	±50	Accuracy
Power Rating, Watts Bussed	0.125 at 70°C	0.05 at 70°C	0.125 at 70°C	0.125 at 70°C	M10 / H12
(Per Resistor) Isolated	0.200 at 70°C	0.10 at 70°C	0.250 at 70°C	0.250 at 70°C	±1/2 LSB / ±1 LSB

SURFACE MOUNT

Model	627, 628	664, 667, 668 / 688	628 (R/2R Ladder)	654
				
Element	COST EFFECTIVE THICK FILM	PRECISION THIN FILM	COST EFFECTIVE THICK FILM	50Ω RF ATTENUATOR THIN FILM
Type	.220" SOM	.150" SOIC / .300"SOL	.220" SOM	.150" SOIC
# of Pins	14, 16	8, 14, 16 / 16	16	8
Resistance Range, Ohms	22 to 1 Meg	1K to 100K	10K to 100K	2dB to 16dB Attenuation
Resistance Tolerance	±2%	±1% to ±0.1%	±2%	±0.2dB @ 1GHz
TCR, ppm/°C	±100	±25	±100	±25
TCR Tracking, ppm/°C	±50	±5	–	N/A
Power Rating, Watts Bussed	0.16 at 70°C	0.10 at 70°C	0.4 at 70°C	0.4 Max.
(Per Resistor) Isolated	0.32 at 70°C	0.10 at 70°C	±1/2 LSB Accuracy	Package Power

CHIP RESISTORS

Model	BCR 1/32	BCR 1/16	BCR 1/10	BCR 1/8	BCR 1/4	BCR 1/2	BCR 1	BCT
Industry Style, Inch	0402	0603	0805	1206	1210	2010	2512	0805
Standard Resistance Tolerance	±1% (F Tol.), ±2% (G Tol.), ±5% (J Tol.)							±0.1%(B Tol.)
Standard Resistance Range, Ohm	4.7 to 2.2Meg	10 to 1 Meg G & J Tol. - E24, F Tol. - E96						10 to100K
Power Rating, Watts (@ 70°C)	0.031	0.063	0.100	0.125	0.250	0.500	1.0	0.063
High Power Rating, Watts (@ 70°C)	–	–	0.125	0.250	–	–	–	–
TCR, ppm/°C	*	±100ppm (F Tol.), ±200ppm (G&J Tol.)					±200ppm	±50ppm
Packaging Options Paper Tape	10,000 pcs.	5,000 pcs.			N/A			
(Quantity/Reel) Embossed Tape	N/A	N/A			4,000 pcs			

CUSTOM NETWORKS - Special resistance values, resistor combinations and package arrangements are available if an "off-the-shelf" resistor package doesn't meet your needs. For additional information and complete product specifications contact the factory or your local Beckman Industrial sales representative.

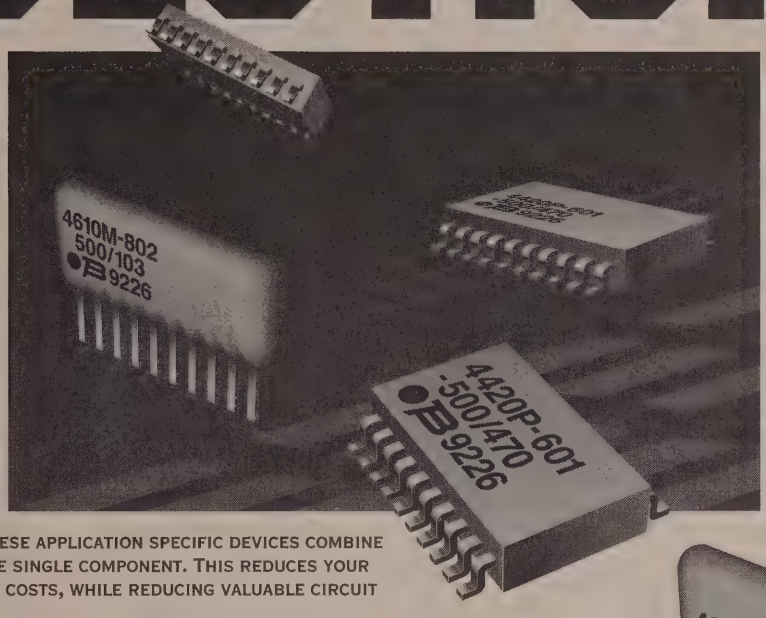
* R ≤10Ω: -200ppm/°C to +500ppm/°C • 10Ω <R ≤1MegΩ: ±250ppm/°C • >1MegΩ: ±300ppm/°C

For Customer Service or Assistance with Applications
Telephone: (714) 447-2345 / Fax: (714) 447-2500

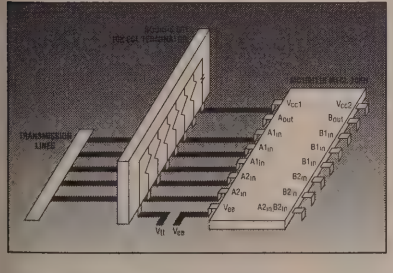
APPLICATION SPECIFIC

RESISTOR NETWORK

SOLUTIONS



THROUGH ADVANCED PACKAGING AND CIRCUIT TECHNOLOGY, BOURNS OFFERS A WIDE ASSORTMENT OF RESISTOR NETWORK AND RESISTOR/CAPACITOR NETWORK PACKAGES FOR SPECIFIC DESIGN REQUIREMENTS. THESE APPLICATION SPECIFIC DEVICES COMBINE MULTIPLE FUNCTIONS IN ONE SINGLE COMPONENT. THIS REDUCES YOUR ASSEMBLY AND COMPONENT COSTS, WHILE REDUCING VALUABLE CIRCUIT BOARD SPACE.



Typical ECL Application
The 800 Series provides decoupling capacitors, reduces board component count, optimizes data transmission, and minimizes overshoot, undershoot and ringing. The 801 RC network is used with 10K ECL design. The 801 can terminate up to 6 transmission lines and provide a 0.01uF capacitor to reduce cross talk and feedthrough effects.

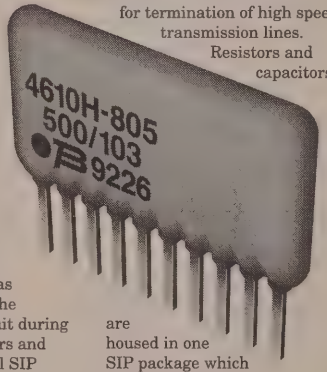
EMI/RFI Filter Solutions
Designed specifically for PC, data terminal, test equipment and process controller applications, these resistor networks are available in wide body SMT and molded DIP packages. These low-pass filters are ideal for installation between I/O drivers and RS 232 connectors.

RC Termination Solutions
This series is designed to eliminate transmission line effects, such as signal reflections and ringing which influence high speed CMOS. The networks capacitor blocks DC currents while acting as a short circuit during signal transitions, reducing power consumption. Combining resistors and capacitors in one package saves board space. High profile conformal SIP design is available in 4 to 18 pin counts.

SCSI Interface Solutions
These resistor networks provide the terminating resistors for SCSI implementation. They optimize transmission by eliminating overshoot and ringing. Bourns provides an assortment of package configurations to address this solution, including molded DIP and SIP styles, and conformation SIP styles.

When it comes to application specific solutions, there's no equivalent to Bourns.

Emitter Coupled Logic Solutions
Digital systems incorporating ECL or other ultra-high switching speed logic families require signal termination to prevent transmission line effects such as reflections and ringing due to fast transition times. The 800 Series is ideal for termination of high speed transmission lines. Resistors and capacitors are housed in one SIP package which minimizes board space, routing problems and manufacturing cost per installed resistive function.



Data Package
For more information on how Bourns can provide solutions to your application specific needs, send for a complete data package today which includes application notes, recommended circuits and complete product specifications.

BOURNS INC.
Dedicated to Innovative Solutions

United States: (801) 750-7200; FAX: 801-750-7253; **Switzerland:** 042-33 33 33, Telex: 868 722, FAX: 042-33 05 10; **Benelux:** 070-387 44 00, Telex: 32 023, FAX: 070-387 62 30; **Germany:** 0711-22 93 0. FAX: 0711-29 15 68; **France:** 01-40 03 36 04, Telex: 220 381, FAX: 01-40 03 36 14; **Ireland:** 021-35 70 01, Telex: 75 904, FAX: 021-35 74 43; **United Kingdom:** 0276-69 23 92, Telex: 859 735, FAX: 0276-69 10 37; **Singapore:** (65) 738-0290; FAX: 65-733-7960; **Hong Kong:** (852) 7360308, FAX: 852-3170836; **Korea** (82) 2-556-3619, FAX: 82-2-556-9016; **Japan:** (03) 3221-9726; FAX: (03) 3239-2817
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(801) 750-7200 • FAX: (801) 750-7253

THICK FILM RESISTOR NETWORKS

General Specifications

The following specifications apply to all Bourns standard networks (Series 4100, 4300, 4400, 4600 and 4800).

Environmental Specifications

Tests per MIL-R-83401 . . . ΔR Maximum
Short Time Overload (STOL) . . ±0.25%
Load Life . . . ±1.00%
Thermal Shock . . . ±0.25%*
Power Conditioning . . . ±0.50%*
Mechanical Shock . . . ±0.25%
Moisture Resistance . . . ±0.50%
Resistance to Solder Heat . . . ±0.25%
Terminal Strength . . . ±0.25%
Vibration . . . ±0.25%
Low Temperature Storage . . . ±0.25%
High Temperature Exposure . . . ±0.50%
Low Temperature Operation . . . ±0.25%
Operating Temperature . . . −55 to +125°C
Storage Temperature . . −65 to +150°C

*Thermal Shock and Power Conditioning Combined . . . ±0.7% maximum

Mechanical Specifications

Flammability . . . Conforms to UL94V-0
Leadframe . . . Copper (Olin 194) Tin/lead Finish
Body Material
Molded Product . . . Epoxy/Novolac
Conformal Product . . . Epoxy/Anhydride
Lead Solderability and Solvent Resistance . . . Meet requirements of MIL-R-83401

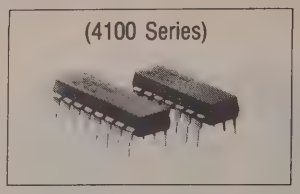
Electrical Specifications

Standard Resistance Range . . . 10 ohms to 10 megohms
Resistance Tolerance (Bussed and Isolated Circuits)
±2.0% . . . 50 ohms to 5 megohms*
±1 ohm . . . 10 ohms to 49 ohms
Dual Terminator
±2.0% . . . 100 ohms to 5 megohms*
±2 ohms . . . 10 ohms to 99 ohms
Maximum Operating Voltage
Through-Hole Components . . . 100V
SMD Components . . . 50V
Temperature Coefficient (TCR)
±100PPM/°C 50 ohms to 2.2 megohms
±250PPM/°C Below 50 ohms and above 2.2 megohms
TCR Tracking . . . 50PPM/°C maximum Equal value resistors
Insulation Resistance (@100V) . . . 10,000 megohms minimum
Dielectric Withstanding Voltage 200VRMS . . . 1Ma maximum leakage current
*Above 5 megohms = ±5.0%

STANDARD RESISTANCE VALUES
(003, 104 Circuits)

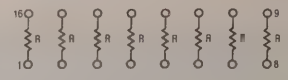
Resistance			
Ohms		Code	
R_1	R_2	R_1	R_2
160	240	161	241
180	390	181	391
220	270	221	271
220	330	221	331
330	390	331	391
330	470	331	471
3000	6200	302	622

Molded DIP

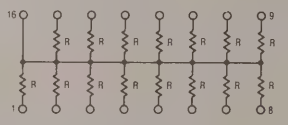


The Molded DIP product is suitable for automatic insertion and is in the standard JEDEC MS-001, .300 row spacing package. This product is available with 8, 14, 16, 18 or 20 pins.

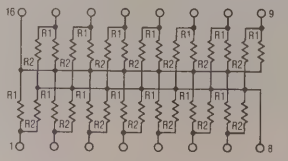
ISOLATED RESISTORS
(001 Circuit)



BUSSED RESISTORS
(002 Circuit)



DUAL TERMINATORS
(003 Circuit)

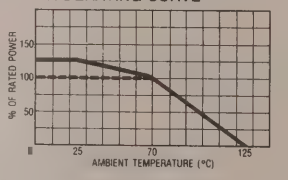


POWER RATINGS @ 70°C

Resistor
001 Circuit 250W
002 Circuit 125W
003 Circuit 125W

Package
4108R . . . 1.69W
4114R . . . 2.00W
4116R . . . 2.25W
4118R . . . 2.50W
4120R . . . 2.80W

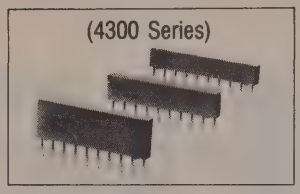
POWER DERATING CURVE



Bourns Resistor Networks power ratings are specified at +70°C, derated to zero at +125°C.

+25°C power ratings are 1.25 X the rated power specified at @ +70°C.

Molded SIP

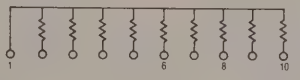


The Molded SIP product is suitable for automatic insertion and is available in low profile (.195" high), medium profile (.250" high) and high profile (.350" high) styles.

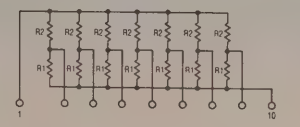
PIN COUNTS AVAILABLE
Low Profile . . . 6-8-9-10-11
Medium Profile . . . 4-6-8-10
High Profile . . . 4-6-8-10

ISOLATED RESISTORS
(102 Circuit)

BUSSED RESISTORS
(101 Circuit)



DUAL TERMINATOR
(104 Circuit)



MAXIMUM PACKAGE POWER
(Watts @ 70°C)

Pins	Low Profile	Medium Profile	High Profile
4	—	.600	.800
6	.750	.900	1.200
8	1.000	1.200	1.600
9	1.125	—	—
10	1.250	1.500	2.000
11	1.375	—	—

MAXIMUM RESISTOR POWER
(Watts @ 70°C)

Profile	Isolated 102 Circuit	Bussed 101 Circuit	Dual Terminator 104 Circuit
Low	.300	.200	.200
Medium	.400	.250	.250
High	.500	.300	.300

Pins	A - Maximum Inches	(mm)
4	.384	(9.76)
6	.584	(14.84)
8	.784	(19.92)
9	.884	(22.46)
10	.984	(25.00)
11	1.084	(27.54)

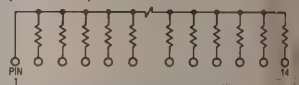
Profile	B - Maximum Inches	(mm)
Low	.195	(4.96)
Medium	.250	(6.35)
High	.350	(8.89)

Conformal SIP

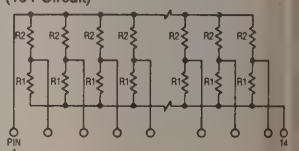
The Conformal SIP product is a lower cost alternative to the molded product and is suitable for use where manual insertion is employed. This product is available in all pin counts from 4 through 14 pins, in low profile (.200" high), medium profile (.250" high) and high profile (.350" high) packages.

ISOLATED RESISTORS
(102 Circuit)

BUSSED RESISTORS
(101 Circuit)



DUAL TERMINATOR
(104 Circuit)



MAXIMUM PACKAGE POWER
(Watts @ 70°C)

Pins	Low Profile	Medium Profile	High Profile
4	.500	.600	.800
5	.625	.750	1.000
6	.750	.900	1.200
7	.875	1.050	1.400
8	1.000	1.200	1.600
9	1.125	1.350	1.800
10	1.250	1.500	2.000
11	1.375	1.650	2.200
12	1.500	1.800	2.200
13	1.625	1.950	2.600
14	1.750	2.100	2.800
15	1.875	2.250	3.000
16	2.000	2.400	3.200

MAXIMUM RESISTOR POWER
(Watts @ 70°C)

Profile	Isolated 102 Circuit	Bussed 101 Circuit	Dual Terminator 104 Circuit
Low	.300	.200	.200
Medium	.400	.250	.250
High	.500	.300	.300

Pin Count	A - Maximum Inches	(mm)
4	.398	(10.11)
5	.498	(12.65)
6	.598	(15.19)
7	.698	(17.73)
8	.798	(20.27)
9	.898	(22.81)
10	.998	(23.35)
11	1.098	(27.89)
12	1.198	(30.43)
13	1.298	(32.97)
14	1.398	(35.51)

Profile	B - Maximum Inches	(mm)
Low	.200	(5.08)
Medium	.250	(6.35)
High	.350	(8.89)

BOURNS, INC. • 1400 NORTH 1000 WEST STREET • LOGAN, UT 84321
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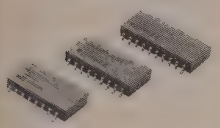
THICK FILM RESISTOR NETWORKS

Medium Body SMD

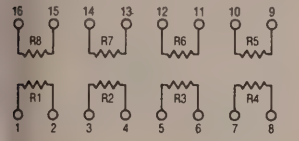
(4800 Series)



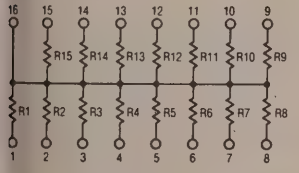
The SOM package is a surface-mount device (SMD) available in 14, 16, 18 and 20 pin versions. The Model 48XXP is designed per the EIA SOGN-0002 standard with gull wing leads, the most popular package style in the industry.

ISOLATED RESISTORS
001 circuit)

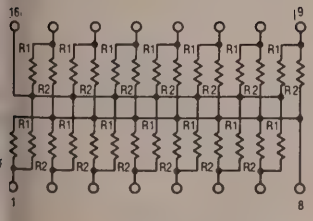
004 circuit) Available in 16 & 20 pins only



BUSSED RESISTORS
002 Circuit)



DUAL TERMINATOR
003 Circuit)



POWER RATINGS @ 70°C

Resistor
001 Circuit 080W
002 Circuit 080W
003 Circuit 080W
004 Circuit 160W

Package
4814 . . . . . 1.12W
4816 . . . . . 1.28W
4818 . . . . . 1.44W
4820 . . . . . 1.60W

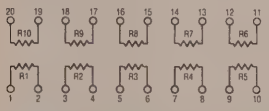
Wide Body SMD

(4400 Series)

The SOL package is a surface-mount device (SMD) available in 16 and 20 pin configurations. These devices are available in the standard JEDEC MS-013 SOL (.300 wide) package with gull wing leads (Model 44XXP) and are also available with J-Hook leads (Model 44XXJ) for use where mounting area is restricted. The J-Lead version of the SOL package mounts on the same land pattern as the EIA SOM (.220 wide) medium body package.

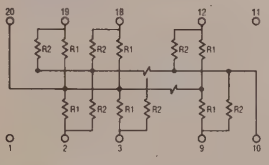
ISOLATED RESISTORS
(001 Circuit)

(004 Circuit) Available in 16 & 20 pins only



BUSSED RESISTORS
(002 Circuit)

DUAL TERMINATOR
(003 Circuit)



POWER RATINGS @ 70°C

Resistor
001 Circuit 160W
002 Circuit 160W
003 Circuit 115W
004 Circuit 160W

Package
4416 . . . . . 1.6W
4420 . . . . . 2.0W

Military Qualified Networks

GENERAL SPECIFICATIONS

These specifications are applicable to all Military Qualified Networks.

	Characteristic K	Characteristic M
Electrical Specifications		
Temperature Coefficient of Resistance (TCR)	±100ppm	±300ppm
Maximum Ambient Temperature @ Rated Power	70°C	70°C
Maximum Ambient Temperature @ Zero Power	125°C	125°C
Resistance Tolerance	F = ±1%	F = ±1%
Resistance Range 51 ohm - 1 meg only	G = ±2%	G = ±2% J = ±5%
Environmental Specifications	**K**	**M**
Thermal Shock ΔR Plus Power Conditioning ΔR	±0.7%	±0.7%
Low Temperature Operation ΔR	±0.25%	±0.5%
Short Time Overload ΔR	±0.25%	±0.5%
Terminal Strength ΔR	±0.25%	±0.25%
Resistance to Soldering Heat - ΔR	±0.25%	±0.25%
Moisture Resistance ΔR	±0.5%	±0.5%
Shock ΔR	±0.25%	±0.25%
Vibration - High Frequency ΔR	±0.25%	±0.25%
Life ΔR	±0.5%	±2.0%
High Temperature Exposure ΔR	±0.5%	±1.0%
Low Temperature Storage ΔR	±0.25%	±0.5%
Insulation Resistance	10,000 MegΩ	10,000 MegΩ

Mechanical Specifications
Flammability . . . . . Conforms to UL94V-0
Lead Frame Material . . . . . Copper (OLIN 194) tin/lead finish
Body Material . . . . . Epoxy resin/Novolac

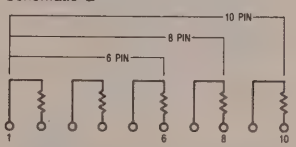
MILITARY SIP NETWORKS M83401 SERIES

MILITARY QUALIFIED MOLDED SIPs

Low Profile (M83401-07, 08, 09)
High Profile (M83401-04, 05, 06)

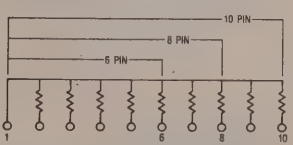
These SIP Resistor Networks are qualified in accordance with MIL-R-83401 and are available in bussed and isolated electrical configurations in pin counts of 6, 8 and 10 pins, with both low and high profile packages available.

ISOLATED RESISTORS
Schematic G



These models incorporate 3, 4 or 5 isolated thick-film resistors of equal value, each connected between two pins.

BUSSED RESISTORS
Schematic C



These models incorporate 5, 7 or 9 thick-film resistors of equal value, each connected between a common bus (pin 1) and a separate pin.

MILITARY DIP NETWORKS M83401 SERIES

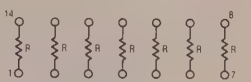
MILITARY QUALIFIED MOLDED DIPs

14-Pin (M83401-01)
16-Pin (M83401-02)

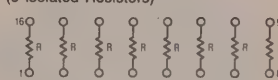
These Molded DIP Resistor Networks are qualified in accordance with MIL-R-83401 and are available in bussed and isolated electrical configurations in 14 and 16 pin packages.

ISOLATED RESISTORS
Schematic A

Style 01 - 14-Pin
(7 Isolated Resistors)



Style 02 - 16 Pin
(8 Isolated Resistors)



BUSSED RESISTORS
Schematic B

Specifications are subject to change without notice.

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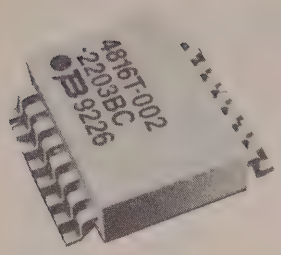
THIN FILM RESISTOR NETWORKS



Model 4800T
SMT
Medium Body
Gull Wing
14, 16, 18, 20 Pin

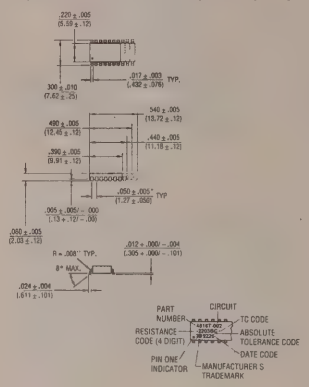
- **Increased lead density**
- **Substrate of 99.5% pure alumina ceramic**
- **Custom circuits available per factory**

Electrical Characteristics
Resistance Range....10 to 100K ohms
Resistance Tolerance
.....±0.1%, ±0.5%, ±1%, ±2%
Temperature Coefficient
.....±100ppm/°C, ±50ppm/°C, ±25ppm/°C
TCR Tracking.....Consult Factory
Temperature Range
.....-55°C to +125°C
Noise.....Consult Factory

Environmental Characteristics
TESTS PER MIL-STD-202, 83401
.....TESTING IN PROGRESS – CONSULT FACTORY FOR CURRENT DATA
Thermal Shock.....
Low Temperature Operation .....
Short Time Overload.....
Resistance to Soldering Heat.....
Moisture Resistance.....
Mechanical Shock.....
Life .....
25°C Double Load.....
Insulation Resistance
.....10,000 megohms minimum

Physical Characteristics
Lead Frame Material
...Copper (Olin 194) 60/40 solder dip
Body Material Flammability
.....Conforms to UL94V-0
Body Material .....Novolac Epoxy

TYPICAL PART MARKING
Represents total content. Layout may vary.

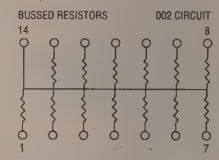


Governing dimensions are in inches. Dimensions in parentheses are metric (mm) and are approximate.

ISOLATED RESISTORS
(001 CIRCUIT)
Available in 14, 16, 18, and 20 Pin

These models incorporate 7, 8, 9, or 10 thin-film resistors of equal value, each connected between a separate pin.
Power Rating per Resistor .....0.10 watt
Resistance Range .....50 to 100K ohms

BUSSED RESISTORS
(002 CIRCUIT)
Available in 14, 16, 18, and 20 Pin



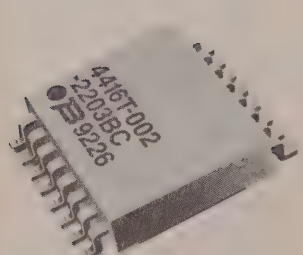
These models incorporate 13, 15, 17, or 19 thin-film resistors of equal value, each connected by a common pin.
Power Rating per Resistor .....0.08 watt
Resistance Range .....10 to 100K ohms

HOW TO ORDER

48 16 T - 002 - 2222 F A

Model
(48 = Medium Body Gull Wing)
Number of Pins
Physical Config.
•T = Thin Film
Electrical Configuration
•002 = Bussed
•001 = Isolated
Resistance Code
•First 3 digits are significant
•Fourth digit represents the number of zeros to follow.
Absolute Tolerance Code
•B = ±0.1% •F = ±1%
•C = ±0.25% •G = ±2 %
•D = ±0.5%
Temperature Coefficient Code
•A = ±100ppm/°C •C = ±25ppm/°C
•B = ±50ppm/°C

Consult factory for other available options.
Specifications are subject to change without notice.



Model 4400T
SMT
Wide Body
Gull Wing
16 and 20 Pin

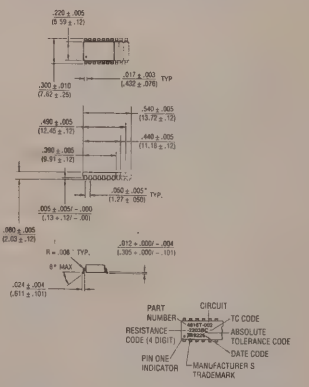
- **Increased lead density**
- **Custom circuits available per factory**
- **Substrate of 99.5% pure alumina ceramic**

Electrical Characteristics
Resistance Range....10 to 100K ohms
Resistance Tolerance
.....±0.1%, ±0.5%, ±1%, ±2%
Temperature Coefficient
.....±100ppm/°C, ±50ppm/°C, ±25ppm/°C
TCR Tracking.....Consult Factory
Temperature Range
.....-55°C to +125°C
Noise.....Consult Factory

Environmental Characteristics
TESTS PER MIL-STD-202, 83401
.....TESTING IN PROGRESS – CONSULT FACTORY FOR CURRENT DATA
Thermal Shock.....
Low Temperature Operation .....
Short Time Overload.....
Resistance to Soldering Heat.....
Moisture Resistance.....
Mechanical Shock.....
Life .....
25°C Double Load.....
Insulation Resistance
.....10,000 megohms minimum

Physical Characteristics
Lead Frame Material
...Copper (Olin 194) 60/40 solder dip
Body Material Flammability
.....Conforms to UL94V-0
Body Material .....Novolac Epoxy

TYPICAL PART MARKING
Represents total content. Layout may vary.

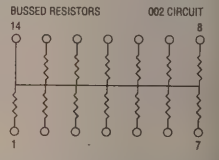


Governing dimensions are in inches. Dimensions in parentheses are metric (mm) and are approximate.

ISOLATED RESISTORS
(001 CIRCUIT)
Available in 14, 16, 18, and 20 Pin

These models incorporate 7, 8, 9, or 10 thin-film resistors of equal value, each connected between a separate pin.
Power Rating per Resistor .....0.10 watt
Resistance Range .....50 to 100K ohms

BUSSED RESISTORS
(002 CIRCUIT)
Available in 14, 16, 18, and 20 Pin



These models incorporate 13, 15, 17, or 19 thin-film resistors of equal value, each connected by a common pin.
Power Rating per Resistor .....0.08 watt
Resistance Range .....10 to 100K ohms

HOW TO ORDER

48 16 T - 002 - 2222 F A

Model
(48 = Medium Body Gull Wing)
Number of Pins
Physical Config.
•T = Thin Film
Electrical Configuration
•002 = Bussed
•001 = Isolated
Resistance Code
•First 3 digits are significant
•Fourth digit represents the number of zeros to follow.
Absolute Tolerance Code
•B = ±0.1% •F = ±1%
•C = ±0.25% •G = ±2 %
•D = ±0.5%
Temperature Coefficient Code
•A = ±100ppm/°C •C = ±25ppm/°C
•B = ±50ppm/°C

Consult factory for other available options.
Specifications are subject to change without notice.

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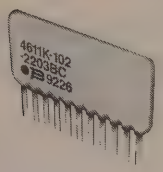
THIN FILM RESISTOR NETWORKS

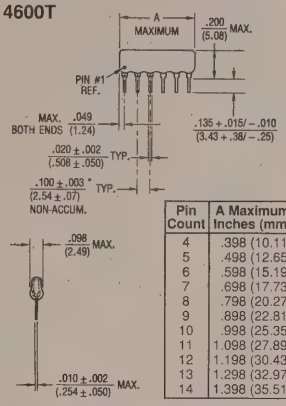


4600 T, S, K
Conformal SIP
4 - 16 Pin

- **Low profile provides compatibility with DIPs**
- **Also available in medium profile (4600S) and high profile (4600K)**
- **Custom circuits available per factory**
- **Laser marking on contrasting background**

Electrical Characteristics
Resistance Range
Bussed.....49.9 to 100K ohms
Isolated.....20 to 200K ohms
Series.....20 to 100K ohms
Resistance Tolerance
.....±0.1%, ±0.5%, ±1%, ±2%
Temperature Coefficient
...±100ppm/°C, ±50ppm/°C, ±25ppm/°C
TCR Tracking.....Consult Factory
Temperature Range...-55°C to +125°C
Noise.....Consult Factory
Environmental Characteristics
TESTS PER MIL-R- 83401 ΔR MAX.
TESTING IN PROGRESS – CONSULT FACTORY FOR CURRENT DATA
Thermal Shock and Power Conditioning.....
Low Temperature Operation.....
Short Time Overload
Terminal Strength.....
Resistance to Soldering Heat.....
Moisture Resistance.....
Mechanical Shock.....
Vibration.....
Life.....
High Temperature Exposure.....
Low Temperature Storage.....
25°C Double Load.....
Insulation Resistance
.....10,000 megohms minimum
Lead Solderability/Solvent Resistance
.....Meet requirements of MIL-R-83401
Physical Characteristics
Body Material Flammability
.....Conforms to UL94V-0
Lead Frame Material
Copper (OLIN 194) 60/40 solder dip
Body Material
...Epoxy resin/anhydride disphenol A

4600T



Pin Count	A Maximum Inches (mm)
4	.398 (10.11)
5	.498 (12.65)
6	.598 (15.19)
7	.698 (17.73)
8	.798 (20.27)
9	.898 (22.81)
10	.998 (25.35)
11	1.098 (27.89)
12	1.198 (30.43)
13	1.298 (32.97)
14	1.398 (35.51)

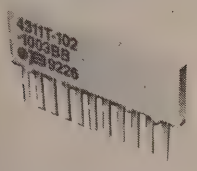
Maximum package length is equal to .100" (2.54mm) times the number of pins, less .002" (.005mm).
Governing dimensions are in inches. Dimensions in parentheses are metric (mm) and are approximate.
*Terminal centerline to centerline measurements made at point of emergence of the lead from the body.

HOW TO ORDER

46 11 T - 101 - 2222 F A

Model
(46 = Conformal SIP)
Number of Pins
Physical Config.
•T = Low Profile Thin Film
•S = Medium Profile Thin Film
•K = High Profile Thin Film
Electrical Configuration
•101 = Bussed
•102 = Isolated
•106 = Series
Resistance Code
•First 3 digits are significant
•Fourth digit represents the number of zeros to follow.
Absolute Tolerance Code
•B = ±0.1% •F = ±1%
•D = ±0.5% •G = ±2 %
Temperature Coefficient Code
•A = ±100ppm/°C •C = ±25ppm/°C
•B = ±50ppm/°C

Consult factory for other available options.
Specifications are subject to change without notice.

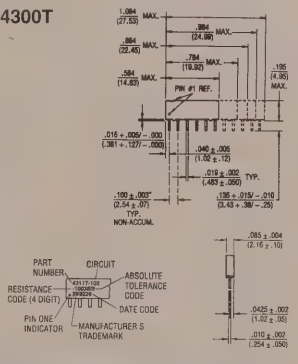


4300 T, S, K
Molded SIP
6, 8, 9, 10, 11 Pin

- **Low profile provides compatibility with DIPs**
- **Also available in medium profile (4300S) and high profile (4300K)**
- **Custom circuits available per factory**
- **Laser marking on contrasting background**

Electrical Characteristics
Resistance Range
Bussed.....49.9 to 100K ohms
Isolated.....20 to 200K ohms
Series.....20 to 100K ohms
Resistance Tolerance
.....±0.1%, ±0.5%, ±1%, ±2%
Temperature Coefficient
...±100ppm/°C, ±50ppm/°C, ±25ppm/°C
TCR Tracking.....Consult Factory
Temperature Range...-55°C to +125°C
Noise.....Consult Factory
Environmental Characteristics
TESTS PER MIL-R- 83401 ΔR MAX.
TESTING IN PROGRESS – CONSULT FACTORY FOR CURRENT DATA
Thermal Shock and Power Conditioning.....
Low Temperature Operation.....
Short Time Overload
Terminal Strength.....
Resistance to Soldering Heat.....
Moisture Resistance.....
Mechanical Shock.....
Vibration.....
Life.....
High Temperature Exposure.....
Low Temperature Storage.....
25°C Double Load.....
Insulation Resistance
.....10,000 megohms minimum
Lead Solderability/Solvent Resistance
.....Meet requirements of MIL-R-83401
Physical Characteristics
Body Material Flammability
.....Conforms to UL94V-0
Lead Frame Material
Copper (OLIN 194) 90/10 plated
Body Material
.....Novolac epoxy

4300T



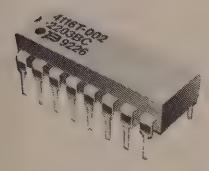
Governing dimensions are in inches. Dimensions in parentheses are metric (mm) and are approximate.
*Terminal centerline to centerline measurements made at point of emergence of the lead from the body.

HOW TO ORDER

43 11 T - 101 - 2222 F A

Model
(43 = Molded SIP)
Number of Pins
Physical Config.
•T = Low Profile Thin Film
•S = Medium Profile Thin Film
•K = High Profile Thin Film
Electrical Configuration
•101 = Bussed
•102 = Isolated
•106 = Series
Resistance Code
•First 3 digits are significant
•Fourth digit represents the number of zeros to follow.
Absolute Tolerance Code
•B = ±0.1% •F = ±1%
•D = ±0.5% •G = ±2 %
Temperature Coefficient Code
•A = ±100ppm/°C •C = ±25ppm/°C
•B = ±50ppm/°C

Consult factory for other available options.
Specifications are subject to change without notice.

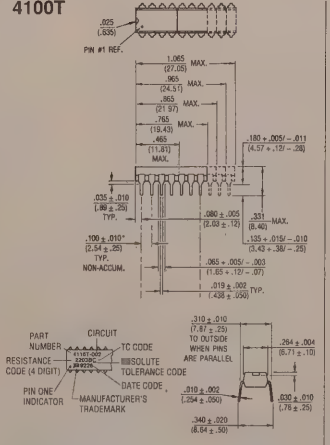


4100 T
Molded DIP
8, 14, 16, 18, 20 Pin

- **Low noise characteristics**
- **Custom circuits available per factory**
- **Substrate of 99.5% pure alumina ceramic**

Electrical Characteristics
Resistance Range....50 to 100K ohms
Resistance Tolerance
.....±0.1%, ±0.5%, ±1%
Temperature Coefficient
...±100ppm/°C, ±50ppm/°C, ±25ppm/°C
TCR Tracking.....Consult Factory
Temperature Range...-55°C to +125°C
Noise.....Consult Factory
Environmental Characteristics
TESTS PER MIL-R- 83401
TESTING IN PROGRESS – CONSULT FACTORY FOR CURRENT DATA
Thermal Shock .....
Low Temperature Operation.....
Short Time Overload
Resistance to Soldering Heat.....
Moisture Resistance.....
Mechanical Shock.....
Life.....
High Temperature Storage.....
Low Temperature Storage .....
25°C Double Load.....
Insulation Resistance
.....10,000 megohms minimum
Physical Characteristics
Lead Frame Material .....Copper (Olin 194) 90/10 electroplate
Body Material Flammability
.....Conforms to UL94V-0
Body Material .....Novolac Epoxy

4100T



Governing dimensions are in inches. Dimensions in parentheses are metric (mm) and are approximate.
*Terminal centerline to centerline measurements made at point of emergence of the lead from the body.

HOW TO ORDER

41 16 T - 002 - 2222 F A

Model
(41 = Molded DIP)
Number of Pins
Physical Config.
•T = Thin Film
Electrical Configuration
•002 = Bussed •001 = Isolated
Resistance Code
•First 3 digits are significant
•Fourth digit represents the number of zeros to follow.
Absolute Tolerance Code
•B = ±0.1% •F = ±1%
•D = ±0.5%
Temperature Coefficient Code
•A = ±100ppm/°C •C = ±25ppm/°C
•B = ±50ppm/°C

Consult factory for other available options.
Specifications are subject to change without notice.

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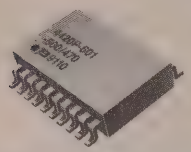
APPLICATION SPECIFIC RESISTOR NETWORKS



EMI/RFI Filters
Low Pass Wide Body SMT and Molded DIP Packages

- Reduce the emission of EMI/RFI noise by filtering out the high-frequency content of digital signals at the board level.
- Replace expensive and bulky inductive devices typically used to suppress EMI/RFI
- Minimize space and routing problems, and reduce manufacturing cost per installed resistive and capacitive function
- Increase board yields and reliability by reducing component count

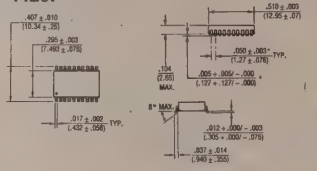
Electrical Specifications – Resistors
Standard Resistance Range*
.....10 ohms to 100 ohms
Series Resistance Tolerance .....±10%
Temperature Coefficient of Resistance
.....±300ppm/°C
Operating Voltage
.....50 volts maximum
Operating Temperatures
.....+10°C to +85°C
*Other Resistance Values Available, 10 ohms – 1 megohm

Electrical Specifications – Capacitors
Standard Capacitance Range
.....50pF to 200pF
Capacitance Tolerance.....+30%
Temperature Characteristic....±Z5U
Operating Temperatures
.....+10°C to +85°C
Voltage Rating .....25 volts
Dielectric Withstand Voltage
.....2.5 x rated voltage
Insulation Resistance
.....10,000 megohms minimum

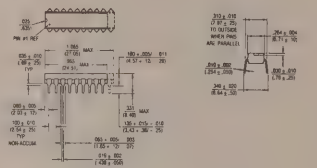
Environmental Specifications – Resistors
TESTS PER MIL-R-83401 ..ΔR MAXIMUM
Thermal Shock .....±0.25%
Mechanical Shock.....±0.25%
Moisture Resistance (no power applied)
.....±0.50%
Resistance to Solder Heat ...±0.25%
Terminal Strength .....±0.25%
Vibration.....±0.25%

Mechanical Specifications
Flammability .....Conforms to UL94V-0
Leadframe
...Copper (Olin 194) – 60/40 solder dipped
Body Material .....Epoxy/Novolac
Lead Solderability and Solvent Resistance
.....Meet requirements of MIL-R-83401

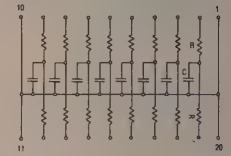
4420P



4118R and 4120R



TYPICAL CIRCUIT
4120R-601-RC/CC
4420R-601-RR/CC



HOW TO ORDER

44 20 P - 601 - RC/CC

Model
(44 = SMD SOIC Pkg)
(41 = Molded DIP)
Number of Pins
Physical Config.
•P = Surface Mount Device (SMD)
•R = Molded DIP
Electrical Configuration
Resistance/Capacitance Code
•First 2 digits are significant
•Third digit represents the number of zeros to follow.

Consult factory for other available options.
Specifications are subject to change without notice.

RC Termination
Conformal SIP Package

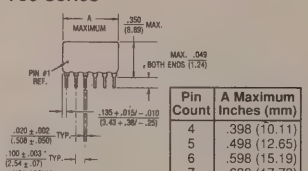
- Reduced insertion time
- Low noise termination for CMOS
- Combined resistors and capacitors in SIP package saves space
- Insulation resistance testing for reliability
- Pin counts from 4 to 18 available

Electrical Characteristics – Resistors
Standard Resistance Range
.....22 ohms to 1 megohm
Resistance Tolerance ±2%
.....50 ohms to 1 megohm
Operating Voltage
.....50 volts maximum

Electrical Characteristics – Capacitors
Capacitance Range
.....39 pF to 39,000 pF
Capacitance Range
.....330 pF to 39,000 pF X7R
Capacitance Range
.....39 pF to 270 pF NPO
Capacitance Tolerance.....±20%
Operating Temperature
.....-55°C to +125°C
Voltage Rating .....50 volts

Physical Characteristics
Flammability
.....Conforms to UL94V-0
Lead Frame Material
.....Copper (OLIN 194) 90/10 plated
Body Material.....Conformal coat

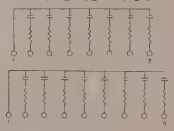
700 Series



Pin Count	A Maximum Inches (mm)
4	.398 (10.11)
5	.498 (12.65)
6	.598 (15.19)
7	.698 (17.73)
8	.798 (20.27)
9	.898 (22.81)
10	.998 (25.35)
11	1.098 (27.89)
12	1.198 (30.43)
13	1.298 (32.97)
14	1.398 (35.51)
15	1.498 (38.04)
16	1.598 (40.59)
17	1.698 (43.13)
18	1.798 (45.67)

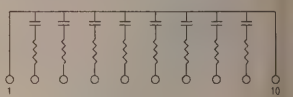
Governing dimensions are in inches. Dimensions in parentheses are metric (mm) and are approximate.
*Terminal centerline to centerline measurements made at point of emergence of the lead from the body.

AC TERMINATORS – 701



NO. OF LINES	BOURNS P/N	PACKAGE
7	4608H-701-RC/CC	High Profile Conformal SIP
8	4609H-701-RC/CC	
9	4610H-701-RC/CC	

AC TERMINATORS – 702



NO. OF LINES	BOURNS P/N	PACKAGE
8	4610H-702-RC/CC	High Profile Conformal SIP

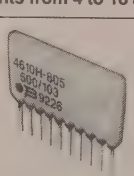
For all AC terminators, standard R values are 50, 68, 75 and 100 ohms. Standard values for C are 47, 100, 500 and 1000pF. See data sheet to select custom combinations of R and C.

HOW TO ORDER

46 08 H - 701 - RC/CC

Model
(46 = Conformal SIP)
Number of Pins
•4 to 18
Physical Config.
(•H = High Profile)
Electrical Configuration
•701 = Single Termination
•702 = Double Termination
Resistance/Capacitance Code
•First 2 digits are significant
•Third digit represents the number of zeros to follow.

Consult factory for other available options.
Specifications are subject to change without notice.



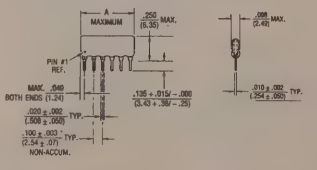
ECL Terminators
Conformal SIP Package Medium & High Profile

- Provides decoupling capacitors
- Optimizes data transmission in ECL systems
- Reduces manufacturing costs per installed resistive function
- Increases board yields and reliability by reducing component count

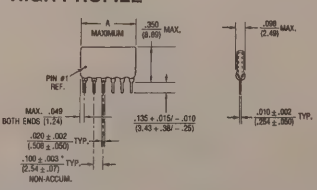
Electrical Characteristics
Resistance Tolerance.....±2%
Resistance Power.....0.1 watt
Capacitance Tolerance.....±20%
Capacitor Dielectric Type.....X7R
Capacitance Voltage Rating...50 Volts

Physical Characteristics
Flammability
.....Conforms to UL94V-0
Leadframe.....Copper (Olin 194)
Body Material.....Epoxy/Anhydride
.....(Conformal Material)
Custom Resistance Range
.....10 ohms to 10 megohms
Custom Capacitance Range
.....39 pF to 39,000 pF
NPO and Z5U dielectrics available on a custom basis.

MEDIUM PROFILE



HIGH PROFILE



HOW TO ORDER

46 08 M - 801 - 500 103

Model
(46 = Conformal SIP)
Number of Pins
(8, 10, 12)
Physical Config.
•M = Medium Profile
Electrical Configuration
Resistance Code
•First 2 digits are significant
•Third digit represents the number of zeros to follow.
•Units = ohms
Capacitance Code
•First 2 digits are significant
•Third digit represents the number of zeros to follow.
•Units = picofarads

Consult factory for other available options.
Specifications are subject to change without notice.

Cableform - Beman

Zion Cross Roads, Troy VA 22974 TEL: 804/589-8224 FAX: 804/589-3803

Carbon Film Resistors

HIGH VOLTAGE RESISTORS

Type	Volts Max.	Watts Max.	Dimensions—Inches L	D	ID	FD	Ohms Min.	Ohms Max.	Available in Fig. No.'s
CFA	2,500	.5	¾	¼			10K	1G	2
CFB	5,000	1	1½	¼			20K	2G	2
CFC	3,500	1	1	5/16			10K	10G	1,2,4
CFD	10,000	2	1¾	5/16			10K	25G	1,2,4
CFE	15,000	3	3	5/16	NA	NA	20K	25G	1,2,4
CFF	30,000	5	5½	5/16			40K	25G	1,2,4
CFG	15,000	4	2½	9/16			20K	25G	1,2
CFH	25,000	6	4	9/16			40K	25G	1,2
CFJ	40,000	10	6½	9/16			70K	25G	1,2
NFA	2,500	.5	¾	¼			10K	1G	3
NFB	5,000	1	1½	¼			20K	2G	3
NFC	3,500	1	1	5/16	NA	NA	10K	10G	3
NFD	10,000	2	1¾	5/16			10K	25G	3
NFE	15,000	3	3	5/16			20K	25G	3
*CJA	25 KV	10	4½	¾	½	—	50K	100G	5
*CJB	35 KV	20	6½	1 1/8	¾	13/16	100K	100G	5,6
*CJC	65 KV	30	10½	1 1/8	¾	13/16	200K	100G	5,6
*CJD	90 KV	60	14½	1½	1 1/8	1 9/64	400K	100G	5,6
*CJE	40 KV	35	6½	2	1 9/16	1 9/64	300K	100G	5,6
*CJF	125 KV	100	18½	2	1 9/16	1 9/64	700K	100G	5,6

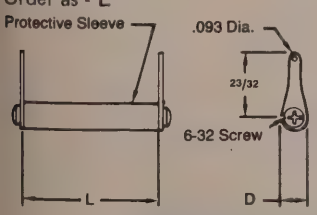
*Sleeving available on request. Standard Tolerances are 15%, 10% 5% and 3%.

PRECISION TOLERANCE RESISTORS

Type	Volts Max.	Watts Max.	Dimensions—Inches L	D	Resistance Value (Max.) ±2%	±1%	Available in Fig. No.'s
MP-1	5KV	1	1½	¼	2G	1G	2
MP-2	10KV	2	2	5/16	20G	5G	1,2,4
MP-4	20KV	4	3½	5/16	50G	10G	1,2,4
MP-6	30KV	6	6	5/16	50G	10G	1,2,4
MP-8	30KV	8	5	9/16	50G	10G	1,2
MP-10	60KV	10	11	5/16	50G	10G	1,2,4
MP-12	50KV	12	8	9/16	50G	10G	1,2
MP-20	80KV	20	13	9/16	50G	10G	1,2
SP-1	5KV	1	1½	¼	100G	25G	2
SP-2	10KV	2	2	5/16	100G	25G	1,2,4
SP-4	20KV	4	3½	5/16	100G	25G	1,2,4
SP-6	30KV	6	6	5/16	100G	25G	1,2,4
SP-8	30KV	8	5	9/16	100G	25G	1,2
SP-10	60KV	10	11	5/16	100G	25G	1,2,4
SP-12	50KV	12	8	9/16	100G	25G	1,2
SP-20	80KV	20	13	9/16	100G	25G	1,2

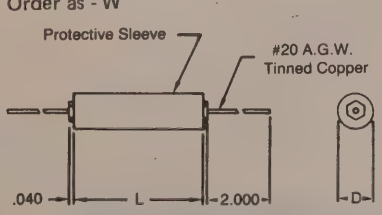
NOTE: Megohm equal 10^6, Gigohm equals 10^9, Teraohm equals 10^{12}.

Order as - L



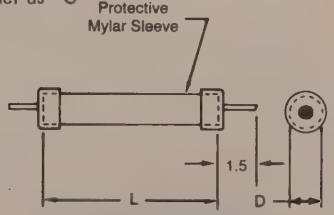
RADIAL LUG
FIG. 1

Order as - W



THREADED AXIAL WIRE LEAD
FIG. 2

Order as - C



CAPPED AXIAL WIRE LEAD
FIG. 3

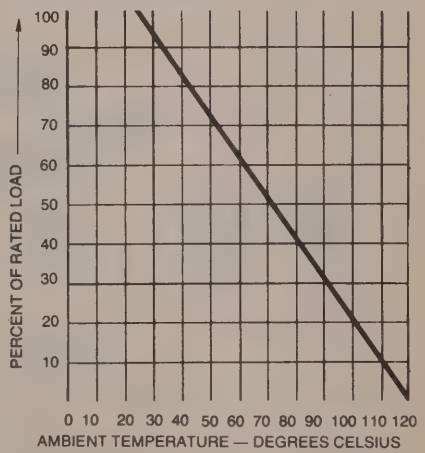
TEST DATA

Voltage and Temperature Characteristics

Type	Voltage Coeficient Neg. PPM/V Avg.	Temperature Coefficient Neg. PPM/°C Avg.
CFA	20-50	1100-4000
CFB	10-25	1100-4000
CFC	15-40	1100-5000
CFD	7-20	1000-4800
CFE	4-10	950-4400
CFF	2-6	900-4200
CFG	3-7.5	900-4200
CFH	1.5-4.5	875-4100
CFJ	1-2.5	850-4000
All SF Types	Less than 15% of Value at Max. Voltage	2000-5000
CJA	1.25-3.5	850-4900
CJB	.6-1.7	775-4500
CJC	.35-.9	725-4300
CJD	.2-.5	700-4000
CJE	.35-1	730-4200
CJF	.1-.25	675-3800
All SJ Types	Less than 15% of Value at Max. Voltage	2000-5000

NF Types have same characteristics as CF Types. HF Types are approximately 30% lower in V.C. and 10% lower in T.C. as compared to the CF Types.

Power Derating



CADDOCK
HIGH PERFORMANCE FILM RESISTORS

High Performance Film Resistors

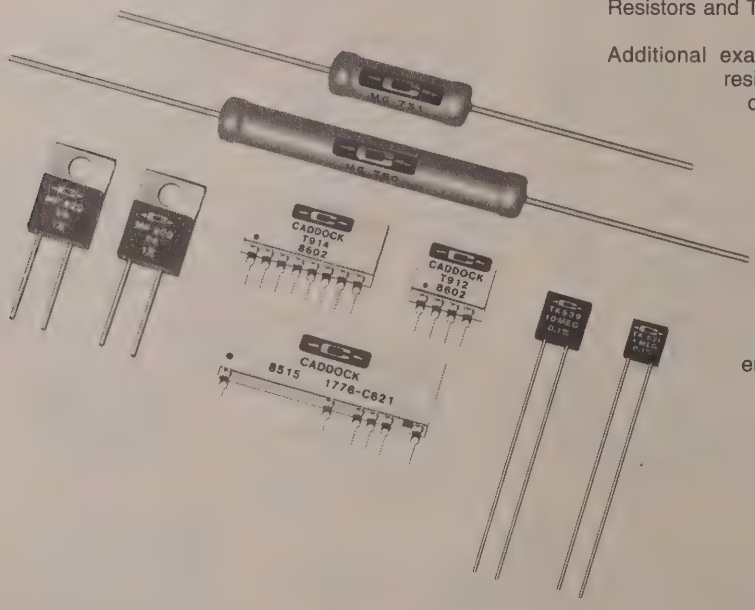
The Caddock Electronics General Catalog describes over 200 in-production models of precision discrete resistors and resistor networks that utilize Caddock's high stability, extended life Micronox® and Tetrinox® resistance films. With over 30 years of experience and an exceptional record of in-circuit performance and reliability, Caddock Electronics continues to lead the industry in the development, production and on-time delivery of high performance film resistors.

Caddock's Advanced Resistor Technology Provides Many Exceptional Performance Advantages:

Caddock's advanced resistor technology began in 1962 with the introduction of Micronox® harsh environment, high power and high voltage resistors. The Caddock technology was further extended in 1975 with the development of the Tetrinox® resistance system that made possible the introduction of low TC, ultra-stable resistors and resistor networks.

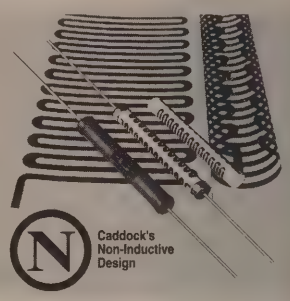
These technological advances have provided the electronics industry with a selection of precision resistor types that provide many high performance advantages.

- **Precision** - Tolerances as close as 0.01%.
- **Long-Term Stability** - Better than 0.005% per 1,000 hours of operation under full load operating conditions.
- **Higher Power Ratings** - Up to five times higher than other resistor technologies.
- **High Operating Temperatures** - Up to +275°C.
- **Ultra-Low Temperature Coefficients** - Standard to less than 10 ppm/°C and custom values as low as 2 ppm/°C.
- **Non-Inductive Design -** Available in resistance values from as low as 0.05 ohm to as high as 10,000 Megohms.



Non-inductive Performance along with Caddock's Patented Design which Enhances High Stability in Both High-Power and High-Voltage Resistor Applications.

For wide-band, high frequency applications, the advantages of Caddock's Non-Inductive Serpentine Pattern are available in most models of Micronox® resistors. This special sepentine pattern provides for neighboring lines to carry currents in opposite directions thereby achieving maximum cancellation of flux fields over the entire length of the resistor.



The result is a truly non-inductive resistor that is about as inductive as a straight piece of wire the length of the resistor body. This efficient design means faster settling times and minimum distortion in all types of high frequency circuits.

The High-Performance Capabilities of Caddock Film Resistors Can Provide Improved Accuracy and Stability to Precision Circuitry:

Because of the special advantages of Caddock's resistance film technology, Caddock High Performance Film Resistors are often specified in the precision circuits that ultimately establish the overall accuracy and stability of the equipment.

Examples of such applications include many types of precision high-voltage supplies and voltage references that have achieved improved accuracy and extended-life stability through the use of Caddock Type MG Precision High-Voltage Resistors and Type T912 Precision Resistor Networks.

Additional examples of the application of this advanced resistor technology include the industry-wide use of Caddock Type 1776 and Type 1787 Precision Decade Divider Resistors in the signal input circuits of laboratory and bench-type digital voltage and current measuring instruments.

An introduction and index to these Caddock resistor technologies is provided on the next page. Additional information and technical assistance is also available directly from our application engineering team.

We welcome your call.

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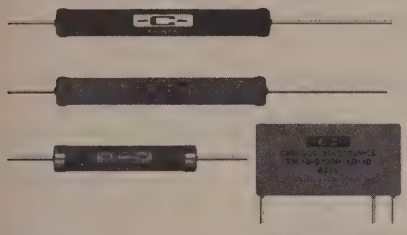
Index to Caddock High Performance Film Resistors

CADDOCK
HIGH PERFORMANCE FILM RESISTORS

Precision High Voltage Resistors and High Voltage Divider Networks



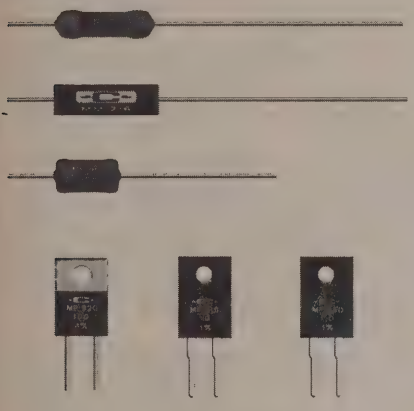
Type TG Low TC Precision High Voltage Resistors
Temperature Coefficient of 25 ppm/°C from -55°C to +125°C — Page C4

Type MG Precision High Voltage Resistors with Extended Resistance Range
Resistance Values to 10,000 Megohms, TC of 80 ppm/°C — Pages C5 and C6

Type MX Lab Grade Precision High Voltage Resistors
High Voltage Resistors for Laboratory and Industrial Applications — Page C7

Type THV Precision High Voltage Divider Networks
Ratio Temperature Coefficients to 10 ppm/°C from -55°C to +125°C,
Ratio Tolerances to 0.25% at 10 KVDC, 15 KVDC or 20 KVDC — Page C8

Power Film and Precision Film Resistors



Type MS and MR Power Film Resistors
Operating Temperature to +275°C, Power Ratings to 15 Watts,
Non-Inductive Design — Pages C9 and C10

Type MM and ML Precision Film Resistors
High Temperature Resistors for Geophysical, Aerospace
and Industrial Requirements — Page C11

Type MV Low Resistance Power Film Resistors ***NEW RESISTANCE RANGE***
Values from 0.1 ohm to 50 ohms, Power Ratings to 10 Watts,
Operating Temperature to +275°C and Non-Inductive Design — Page C12

Type MP 820 and MP 821 Kool-Tab® Power Film Resistors ***NEW 0.05Ω TO 10KΩ***
Non-Inductive 20 Watt Power Resistor in the TO-220 Power Package
with Metal Mounting Tab — Page C14

Type MP 800 Series Kool Pak™ Power Film Resistors ***NEW TO-126 Style***
Non-Inductive, 8 Watts, Model MP 808, TO-126 Style
Non-Inductive, 16 Watts, Model MP 816, TO-220 Style — Page C15 and C16
Both Models Utilizing a High Thermal Conductivity Molding Compound

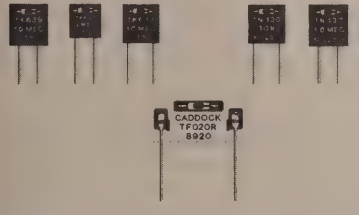
Non-Inductive, 25 Watts, Model MP 825, T0126 Style
Non-Inductive, 50 Watts, Model MP 850, TO-220 Style — Page C15 and C16
Both Models with Integral Copper Heat Sink Flush with Mounting Surface

Power Radial-Lead and Extended Resistance Range Radial-Lead Resistors

Type MK 132 and MK 120 Precision Film Resistors
3/4 and 1/2 Watt Ratings at +125°C, 1 ohm to 5 Megohms — Pages C17 and C18

Type MK 632 and MK 620 Extended Resistance Range Film Resistors
Resistance Range from 2.1 Megohms to 100 Megohms — Pages C17 and C18

Low Temperature Coefficient Precision and Ultra-Precision Film Resistors

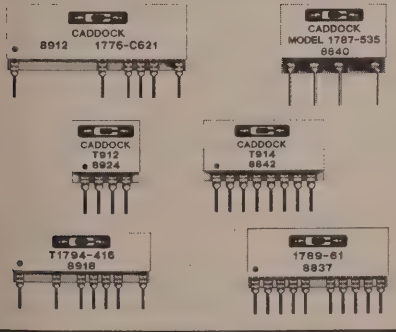


Type TK Low TC Precision Radial-Lead Film Resistors
Resistance Range from 1 Kohm to 10 Megohms, Tolerances to 0.05%,
T.C. of 5, 10 or 20 ppm/°C from -55°C to +125°C — Pages C19 and C20

Type TN Lab Grade Low TC Precision Film Resistors
Tolerances to 0.025%, Resistance Range from 1 Kohm to 1 Megohm,
Temperature Coefficient of 5, 10 or 20 ppm/°C from 0°C to +70°C — Page C21

Type TF Low TC Ultra-Precision Film Resistors
Resistance Range from 1 Kohm to 125 Megohms,
Temperature Coefficients to 5 ppm/°C, Tolerances to 0.01% — Page C22

Precision and Ultra-Precision Standard Resistor Networks and Custom Resistor Networks



Type 1776 Precision Decade Resistor Voltage Dividers
39 Models of Input Voltage Dividers for Digital Multimeters and other
Range-Switching Circuits, Ratio Tol. to 0.02%, Ratio TC to 5ppm/°C — Pages C23 and C24

Type 1787 Precision Current Shunt Resistor Networks
3 and 4-step Current Shunt Resistor Networks for
Current Sensing in Multi-Range Instrumentation — Pages C25 and C26

Type T912 and T914 Precision Resistor Networks
Two Resistor and Four Resistor Networks with Precise Ratio Performance,
Ratio Tolerances to 0.01%, Ratio TC to 2 ppm/°C — Page C27

Custom Precision Resistor Networks
Ratio TC to 5 ppm/°C, Ratio Tolerances to 0.01%,
Resistance Range from 0.5 ohm to 50 Megohms — Page C28

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CADDOCK
HIGH PERFORMANCE FILM RESISTORS

Caddock process control, quality control and test programs

The outstanding levels of performance and reliability that Caddock resistors provide are maintained through intensive programs for manufacturing and process control, quality assurance testing and reliability verification:

Manufacturing Control

Our manufacturing controls include processes for power conditioning, over-voltage conditioning and maximum temperature conditioning. We also perform many in-process tests to verify the performance levels and consistency of all our resistor types, and to screen out defects which do not meet our high standards.

Quality Control

The Caddock Quality Control System covers every step in the manufacturing process from the examination of incoming raw materials to the final testing and packaging of each resistor product.

To meet the most stringent Q.C. requirements, Caddock's Quality Control Procedures have been approved as being in conformance to MIL-I-45208 in surveys by military and space systems customers.

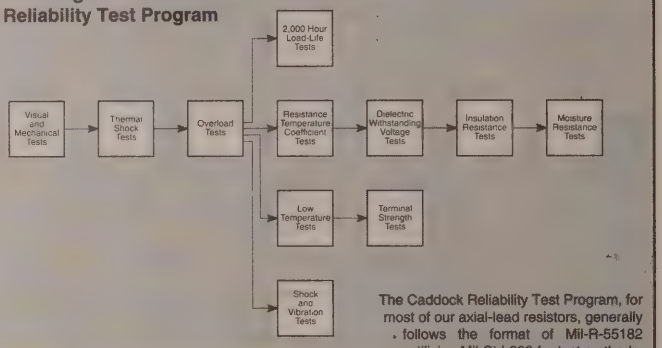
Reliability Verification

In addition to tests for tolerance, stability and temperature characteristics that are a part of our normal manufacturing procedures, we also perform semi-annual reliability tests to confirm compliance to our exacting product specifications.

The flow diagram of the Caddock Reliability Test Program for axial-lead resistors illustrates the sequence of the tests in this program.

Data from the Caddock Reliability Test Program is available to assist designers in qualifying Caddock resistor products for use on high reliability programs.

Flow Diagram of Caddock Reliability Test Program



The Caddock Reliability Test Program, for most of our axial-lead resistors, generally follows the format of Mil-R-55182 utilizing Mil-Std-202 for test methods.

Customer Required Quality Assurance Testing

For our customers whose program requirements for performance, quality and reliability verification include added testing, our specially developed in-house testing capabilities and data acquisition systems give us the ability to perform customer required testing for the most demanding program requirements.

Design Assistance and Assistance in Developing the Resistor Product Specifications

By providing design assistance and technical support at the initiation of a new design and a new Specification Control Drawing (SCD), we have often been able to achieve improvements in both the resistor product performance and cost while fully achieving the program's quality objectives.

For assistance in design and specification development and assistance in the application of our quality assurance testing capabilities to your specific circuit performance and program needs, call or write our Applications Engineers at our Applied Sciences Division in Roseburg, Oregon.

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FAX: (503) 496-0408

Type TG Low TC Precision High Voltage Resistors

CADDOCK
HIGH PERFORMANCE FILM RESISTORS

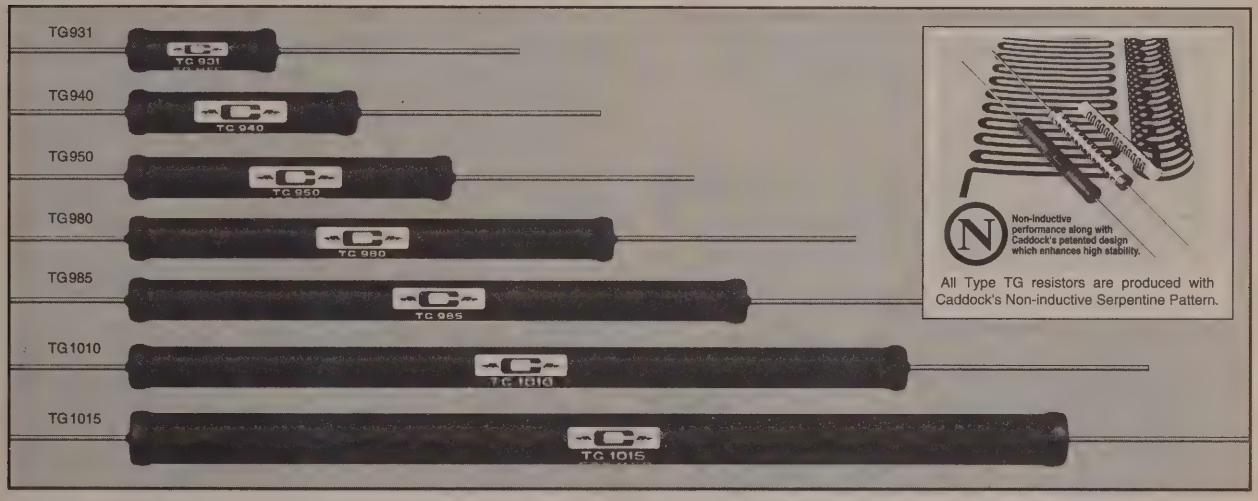
TC of 25 ppm/°C from -55°C to +125°C, Resistance Range from 1 Megohm to 1,000 Megohms

To meet the precision temperature stability requirements of high accuracy, high voltage systems, Caddock introduces the Type TG Low TC Precision High Voltage Resistors. These resistors utilize our proven Tetrinox® resistance system to achieve the unique combination of low temperature coefficient with high stability performance at high operating voltages.

The Type TG Low TC Precision High Voltage Resistors are designed to meet the demanding stability requirements of TWT power supplies, electron microscopes, X-ray systems, high resolution CRT displays and geophysical instruments.

The performance features of the Type TG Low TC Precision High Voltage Resistors are:

- Temperature Coefficient: 25 ppm/°C from -55°C to +125°C.
- Load Life Stability of 0.25% per 1,000 hours at +125°C.
- Resistance Tolerance from ±1.0% to ±0.1%.
- Resistance Range from 1 Megohm to 1,000 Megohms.
- Maximum Continuous Operating Temperature of +225°C.
- The low temperature coefficient minimizes the self-drift due to power dissipation warm-up.



Model No.	Wattage	Max. Continuous Oper. Volt.	Dielect. Strength	TC ppm/°C	Resistance Min.	Resistance Max.	Dimensions in inches and (millimeters) A	B	C
TG931	1.0	4,000	750	25	1 Meg	50 Meg	1.000 ±.060 (25.40 ±1.52)	.315 ±.030 (8.00 ±.76)	.040 ±.002 (1.02 ±.05)
TG940	1.5	6,000	750	25	1.5 Meg	100 Meg	1.500 ±.060 (38.10 ±1.52)	.315 ±.030 (8.00 ±.76)	.040 ±.002 (1.02 ±.05)
TG950	2.0	10,000	1,000	25	2 Meg	200 Meg	2.125 ±.060 (53.98 ±1.52)	.315 ±.030 (8.00 ±.76)	.040 ±.002 (1.02 ±.05)
TG980	3.0	15,000	1,000	25	3 Meg	300 Meg	3.125 ±.060 (79.38 ±1.52)	.315 ±.030 (8.00 ±.76)	.040 ±.002 (1.02 ±.05)
TG985	4.0	20,000	1,000	25	4 Meg	400 Meg	4.000 ±.120 (101.60 ±3.05)	.315 ±.030 (8.00 ±.76)	.040 ±.002 (1.02 ±.05)
TG1010	5.0	25,000	1,000	25	5 Meg	500 Meg	5.000 ±.120 (127.00 ±3.05)	.315 ±.030 (8.00 ±.76)	.040 ±.002 (1.02 ±.05)
TG1015	6.0	30,000	1,000	25	6 Meg	1,000 Meg	6.000 ±.120 (152.40 ±3.05)	.350 ±.040 (8.89 ±1.02)	.040 ±.002 (1.02 ±.05)

Extended Maximum Continuous Operating Voltage Rating

Maximum continuous operating voltages up to 60% higher than the values listed in the table can be achieved through special factory conditioning, provided the power ratings are not exceeded. To specify maximum continuous operating voltages above the values listed in the table, add a "-15" to the model number (Example: TG950-15). Note that the standard overload and overvoltage ratings do not apply to the "-15" resistors.

Combine Type TG and Type TK Resistors for Low Ratio TC Tracking

The Type TG Low TC Precision High Voltage Resistors can be used in combination with the low Absolute Temperature Coefficient of the Type TK Low TC Precision Radial-Lead Film Resistors (Model TK133 with TC of 5 ppm/°C) to achieve 30 ppm/°C Ratio TC without special matching.

With special matching, a **Ratio TC of 10 ppm/°C** can be achieved.

The low temperature coefficient for both the Type TG and Type TK resistors will also minimize ratio drift due to power dissipation warm-up.

Specifications:

Resistance Tolerance: ±1% (tolerances to 0.1% on special order).

Temperature Coefficient: 25 ppm/°C referenced to 25°C, ΔR taken at -55°C and +125°C.

Insulation Resistance: 10,000 Megohms, min.

Overload/Overvoltage: 5 times rated power with applied voltage not to exceed 1.5 times maximum continuous operating voltage for 5 seconds. ΔR 0.20% max.

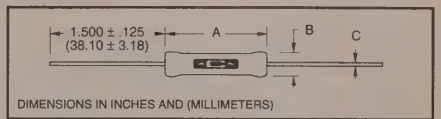
Thermal Shock: Mil-Std-202, Method 107, Cond. B, ΔR 0.20% max.

Moisture Resistance: Mil-Std-202, Method 106, ΔR 0.20% max.

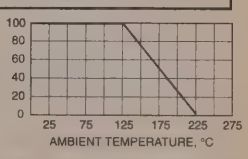
Load Life: 1,000 hours at rated power, ΔR 0.25%.

Lead Material: Gold Plated.

Encapsulation: Silicone Conformal.



Derating Curve:



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CADDOCK
HIGH PERFORMANCE FILM RESISTORS

Type MG Precision High Voltage Resistors

Now with Extended Resistance Range to 10,000 Megohms and Additional Models

Temperature Coefficient as tight as 80 ppm/°C, Combined with Excellent Long-Term Stability, and Precision Tolerances.

Caddock's Micronox® resistance films are the source of the Type MG Precision High Voltage Resistors' outstanding combination of performance features:

- Single-resistor values as high as 10,000 Megohms.
- Maximum continuous operating voltages as high as 48,000 volts ("-15" Ratings).
- Overvoltage capabilities of 150% of standard working voltages for all models and values.
- Resistance Tolerances from ±1.0% to ±0.1%.
- Temperature Coefficient, for standard resistance range, of 80 ppm/°C in combination with resistance tolerances as tight as ±0.1%.
- Typical extended life stability of 0.02% per 1,000 hours for standard resistance range as demonstrated by reliability testing.

This exceptional performance has been proven through many years of use in equipment that demands the highest reliability and stability, including TWT amplifiers, X-ray systems, geophysical instruments and medical electronics.

Preconditioning for Power and Voltage Ratings

All power ratings and maximum operating voltage ratings are for continuous duty. These ratings are based on pre-stress voltage levels applied during the manufacturing process to provide for stable resistor performance even under momentary overload conditions.

Maximum operating voltages 60% higher than the values listed in the table may be specified by adding "-15" to the model number (Example: MG750-15), provided power ratings are not exceeded. Note that overload and overvoltage ratings do not apply to the "-15" resistors.

Non-Inductive Performance

Most models are manufactured with Caddock's Non-Inductive Design which uses a serpentine resistive pattern that provides for neighboring lines to carry current in opposite directions, thereby achieving maximum cancellation of flux fields over the entire length of the resistor. This efficient non-inductive construction is accomplished without derating of any performance advantages.

Model No.	Wattage	Max. Continuous Oper. Volt.	Dielect. Strength	Resistance			Dimensions in inches and (millimeters)		
				Min.	Standard Max.	Extended Max.	A	B	C
MG650	.5	600	750	200 Ω	5 Meg	N/A	.313 ±.020 (7.95 ±.51)	.094 ±.015 (2.39 ±.38)	.025 ±.002 (.64 ±.05)
MG655	.5	600	750	200 Ω	8 Meg	N/A	.313 ±.030 (7.95 ±.76)	.109 ±.015 (2.77 ±.38)	.025 ±.002 (.64 ±.05)
MG660	.6	1,000	750	400 Ω	10 Meg	N/A	.500 ±.030 (12.70 ±.76)	.094 ±.015 (2.39 ±.38)	.025 ±.002 (.64 ±.05)
MG680	.8	2,000	750	600 Ω	20 Meg	N/A	.750 ±.030 (19.05 ±.76)	.094 ±.015 (2.39 ±.38)	.025 ±.002 (.34 ±.05)
MG710	1.0	4,000	750	800 Ω	50 Meg	N/A	1.000 ±.040 (25.40 ±1.02)	.094 ±.015 (2.39 ±.38)	.025 ±.002 (.64 ±.05)
MG712	.6	1,000	750	800 Ω	20 Meg	N/A	.400 ±.060 (10.16 ±.152)	.140 ±.030 (3.56 ±.76)	.025 ±.002 (.64 ±.05)
MG714	1.0	1,000	750	200 Ω	20 Meg	N/A	.562 ±.060 (14.27 ±1.52)	.150 ±.030 (3.81 ±.76)	.032 ±.002 (.81 ±.05)
MG715	1.0	2,000	750	400 Ω	50 Meg	N/A	.750 ±.060 (19.05 ±1.52)	.140 ±.030 (3.56 ±.76)	.025 ±.002 (.64 ±.05)
MG716	1.5	4,000	750	600 Ω	75 Meg	N/A	1.000 ±.060 (25.40 ±1.52)	.140 ±.030 (3.56 ±.76)	.025 ±.002 (.64 ±.05)
MG717	1.5	2,000	750	600 Ω	75 Meg	225 Meg	.710 ±.050 (18.03 ±1.27)	.240 ±.030 (6.10 ±.76)	.040 ±.002 (1.02 ±.05)
MG720	2.0	6,000	750	1 K	150 Meg	N/A	1.500 ±.080 (38.10 ±2.03)	.140 ±.030 (3.56 ±.76)	.025 ±.002 (.64 ±.05)
MG721	2.0	4,000	750	200 Ω	100 Meg	300 Meg	1.000 ±.050 (25.40 ±1.27)	.240 ±.030 (6.10 ±.76)	.040 ±.002 (1.02 ±.05)
MG725	2.5	10,000	750	1.5 K	200 Meg	N/A	2.000 ±.080 (50.80 ±2.03)	.140 ±.030 (3.56 ±.76)	.025 ±.002 (.64 ±.05)
MG730	3.0	6,000	1,000	500 Ω	250 Meg	750 Meg	1.500 ±.080 (38.10 ±2.03)	.240 ±.030 (6.10 ±.76)	.040 ±.002 (1.02 ±.05)
MG731	2.6	4,000	1,000	200 Ω	150 Meg	750 Meg	1.000 ±.060 (25.40 ±1.52)	.315 ±.030 (8.00 ±.76)	.040 ±.002 (1.02 ±.05)
MG735	3.6	10,000	1,000	750 Ω	300 Meg	1,000 Meg	2.000 ±.080 (50.80 ±2.03)	.240 ±.030 (6.10 ±.76)	.040 ±.002 (1.02 ±.05)
MG740	3.6	6,000	1,000	300 Ω	300 Meg	1,500 Meg	1.500 ±.060 (38.10 ±1.52)	.315 ±.030 (8.00 ±.76)	.040 ±.002 (1.02 ±.05)
MG745	5.0	15,000	1,000	1 K	500 Meg	1,500 Meg	3.000 ±.100 (76.20 ±2.54)	.240 ±.030 (6.10 ±.76)	.040 ±.002 (1.02 ±.05)
MG750	5.0	10,000	1,000	400 Ω	500 Meg	2,500 Meg	2.125 ±.060 (53.98 ±1.52)	.315 ±.030 (8.00 ±.76)	.040 ±.002 (1.02 ±.05)
MG780	7.5	15,000	1,000	600 Ω	750 Meg	3,750 Meg	3.125 ±.060 (79.38 ±1.52)	.315 ±.030 (8.00 ±.76)	.040 ±.002 (1.02 ±.05)
MG785	8.0	20,000	1,000	800 Ω	1,000 Meg	5,000 Meg	4.000 ±.120 (101.60 ±3.05)	.315 ±.030 (8.00 ±.76)	.040 ±.002 (1.02 ±.05)
MG810	10.0	25,000	1,000	1 K	1,250 Meg	6,250 Meg	5.000 ±.120 (127.00 ±3.05)	.315 ±.030 (8.00 ±.76)	.040 ±.002 (1.02 ±.05)
MG815	15.0	30,000	1,000	1 K	2,000 Meg	10,000 Meg	6.000 ±.120 (152.40 ±3.05)	.350 ±.040 (8.89 ±1.02)	.040 ±.002 (1.02 ±.05)

Models with low inductance construction are in shaded areas.
Models with Caddock's Non-Inductive Serpentine Pattern are in non-shaded areas.

Specifications:

Resistance Tolerance:

Resistance Range	Tolerance
Standard	±1%, ±0.5%, ±0.25%, ±0.1%
St'd with "-15" rating	±1%
Extended Range	±1%

Temperature Coefficient:

Resistance Range	TC Specifications
Standard and St'd with "-15" rating	±80 ppm/°C from -15°C to +105°C, referenced to +25°C.
Extended Range	±80 ppm/°C from +25°C to +105°C, -200 ppm/°C to +50 ppm/°C from -15°C to +25°C.

Insulation Resistance: 10,000 Megohms, min.

Overload/Overvoltage: 5 times rated power with applied voltage not to exceed 1.5 times maximum continuous operating voltage for 5 seconds.

Resistance Range	Overload/Overvoltage, ΔR
Standard	0.5% max.
St'd with "-15" rating	N/A
Extended Range	0.8% max.

Thermal Shock: Mil-Std-202, Method 107, Cond. C, ΔR 0.25% max.

Moisture Resistance: Mil-Std-202, Method 106, ΔR 0.4% max.

Load Life: 1,000 hours at rated power.

Resistance Range	Load Life, ΔR
Standard	0.5% max.
St'd with "-15" rating	0.8% max.
Extended Range	0.8% max.

Lead Material: Gold Plated.

Encapsulation: Silicone Conformal.

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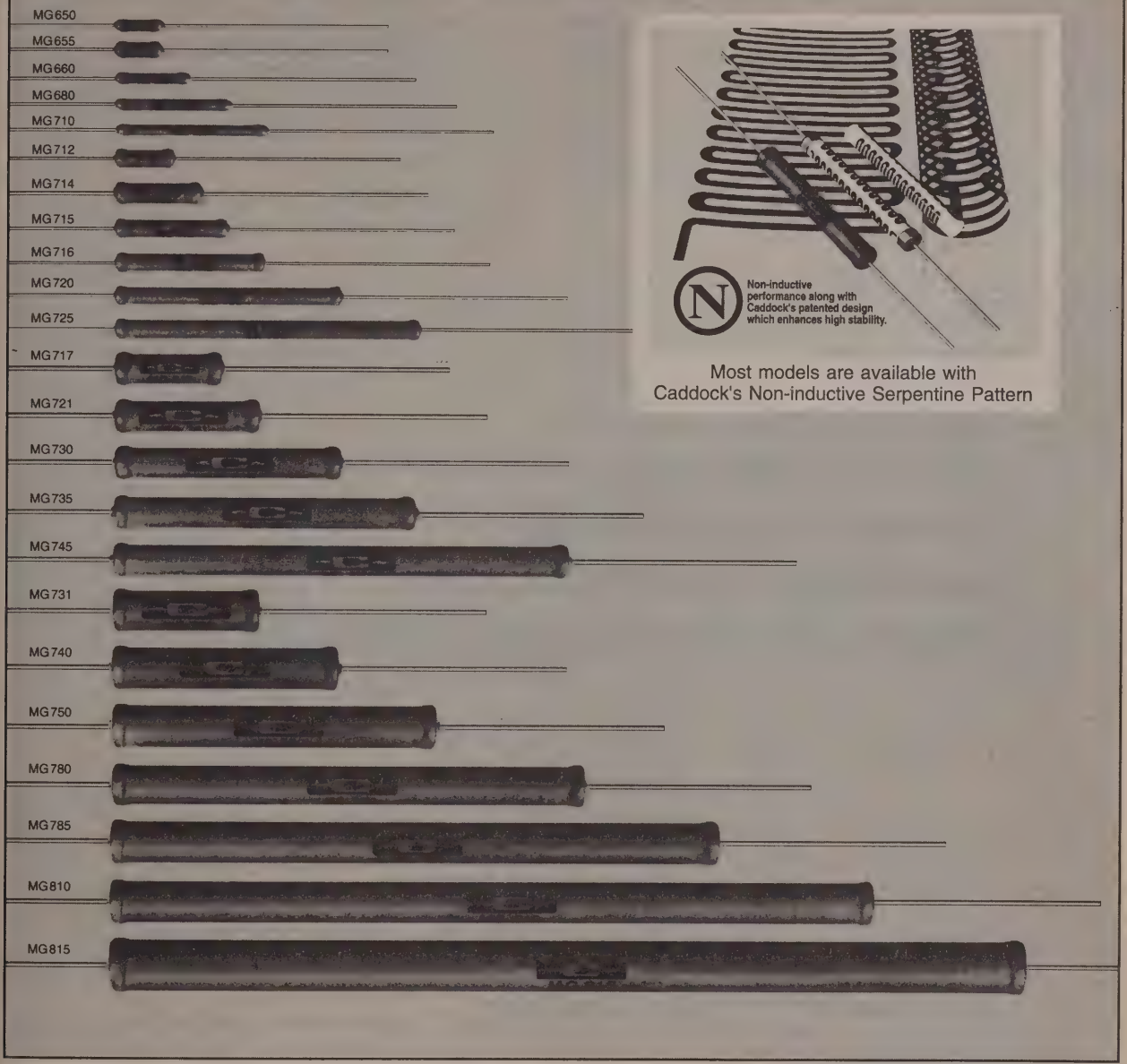
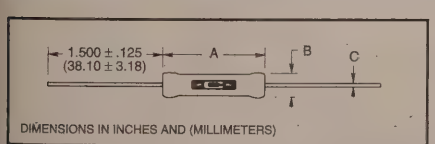
Type MG Precision High Voltage Resistors

CADDOCK
HIGH PERFORMANCE FILM RESISTORS



Most models are available with Caddock's Non-inductive Serpentine Pattern



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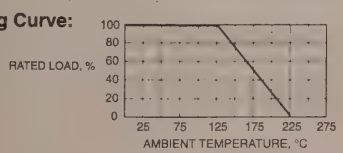

Design Assistance in Developing High Voltage Resistor Sets with Low TC Tracking.

For immediate engineering assistance in developing Low Ratio TC matched high voltage resistor sets, call or write our Applications Engineering and we will be pleased to offer the best solution from our high voltage resistor product capabilities.

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HIGH PERFORMANCE FILM RESISTORS

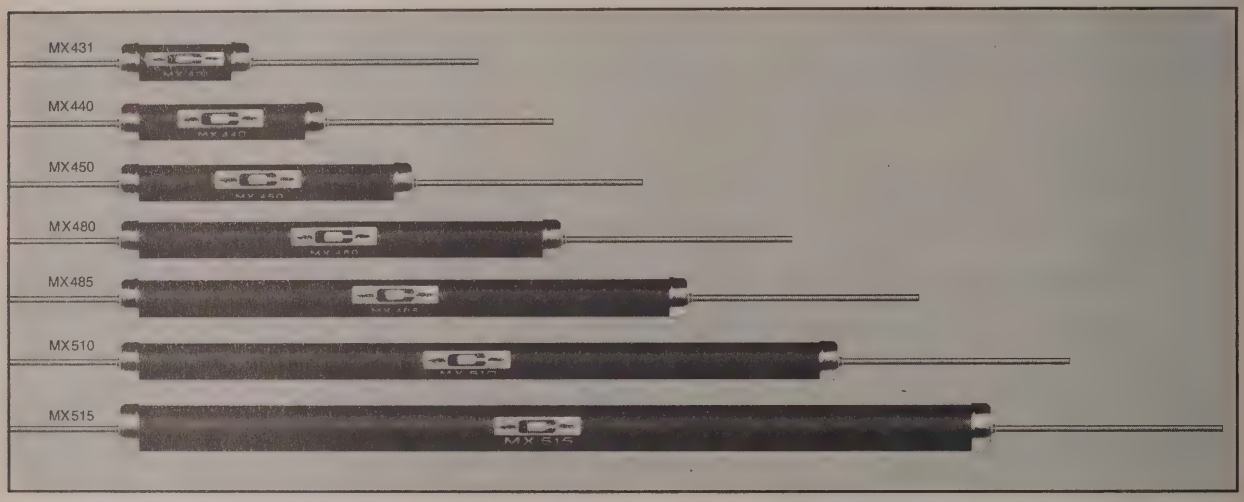
Type MX Lab Grade Precision High Voltage Resistors

High Voltage Resistors for Laboratory and Industrial Applications

The Type MX Lab Grade Precision High Voltage Resistors were specifically developed for use in high performance laboratory and industrial high voltage systems. These resistors combine the proven performance of Caddock's Micronox® resistance system with new cost efficient design elements. These resistors are intended for the design of high voltage systems where the system is not exposed to full military or space grade operating conditions. For full military or space grade operating conditions, we recommend Caddock's **Type TG Low TC Precision High Voltage Resistors** or **Type MG Precision High Voltage Resistors.**

The performance features of the Type MX Lab Grade Precision High Voltage Resistors are:

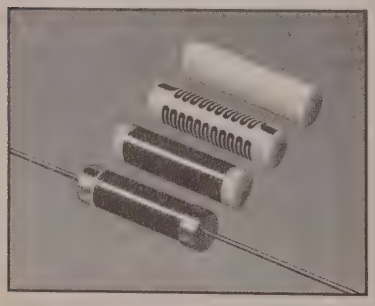
- Seven Models with Voltage Ratings from 7.5 KV to 48 KV.
- Temperature Coefficient: 80 ppm/°C from 0°C to +70°C.
- Load Life Stability of 0.50% per 1,000 hours.
- Resistance Tolerance from ±0.1% to ±10%.
- Non-Inductive Design.
- Resistance Range from 1 Megohm to 2,000 Megohms.



Model No.	Wattage	Max. Continuous Oper. Volt.	TC ppm/°C	Resistance		Dimensions in inches and (millimeters)		
				Min.	Max.	A	B	C
MX431	2.5	7,500	80	1 Meg	150 Meg	.940 ±.040 (23.88 ±1.02)	.270 ±.020 (6.86 ±.51)	.040 ±.002 (1.02 ±.05)
MX440	3.5	11,000	80	1.5 Meg	300 Meg	1.450 ±.040 (36.83 ±1.02)	.270 ±.020 (6.86 ±.51)	.040 ±.002 (1.02 ±.05)
MX450	5.0	16,000	80	2 Meg	500 Meg	2.080 ±.040 (52.83 ±1.02)	.270 ±.020 (6.86 ±.51)	.040 ±.002 (1.02 ±.05)
MX480	7.5	24,000	80	3 Meg	750 Meg	3.080 ±.050 (78.23 ±1.27)	.270 ±.020 (6.86 ±.51)	.040 ±.002 (1.02 ±.05)
MX485	10.0	32,000	80	4 Meg	1,000 Meg	3.940 ±.050 (100.08 ±1.27)	.270 ±.020 (6.86 ±.51)	.040 ±.002 (1.02 ±.05)
MX510	12.5	40,000	80	5 Meg	1,250 Meg	4.940 ±.080 (125.48 ±2.03)	.270 ±.020 (6.86 ±.51)	.040 ±.002 (1.02 ±.05)
MX515	15.0	48,000	80	6 Meg	2,000 Meg	5.940 ±.080 (150.88 ±2.03)	.330 ±.020 (8.38 ±.51)	.040 ±.002 (1.02 ±.05)

Type MX Resistors Utilize Caddock's Patented Coating Design

Type MX Lab Grade Precision High Voltage Resistors combine Caddock's Non-Inductive serpentine pattern with a patented, high thru-put screen printed silicone coating. The alignment of the gap in the coating pattern with the gap in the serpentine resistor pattern provides a complete encapsulation of the resistor element. The cap and lead assemblies are pressed onto the resistor core, finishing the resistor and providing rugged terminal attachment.



Specifications:

Resistance Tolerance: ±1%, ±2%, ±5% or ±10% (tolerance to ±0.5%, ±0.25% or ±0.1% on special order).

Temperature Coefficient: 80 ppm/°C referenced to 25°C, ΔR taken at 0°C and +70°C.

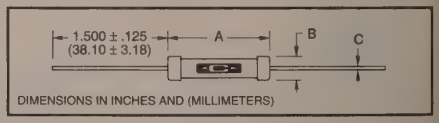
Thermal Shock: Mil-Std-202, Method 107, Cond. A, ΔR, 0.20% max.

Moisture Resistance: Mil-Std-202, Method 106, ΔR, 0.40% max.

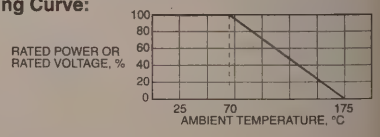
Load Life: 1,000 hours at rated power at 70°C, ΔR, 0.50% max.

Lead Material: Tinned copper clad steel.

Encapsulation: Screen printed silicone coating over resistor element.



Derating Curve:



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Type THV Precision High Voltage Divider Networks

CADDOCK
HIGH PERFORMANCE FILM RESISTORS

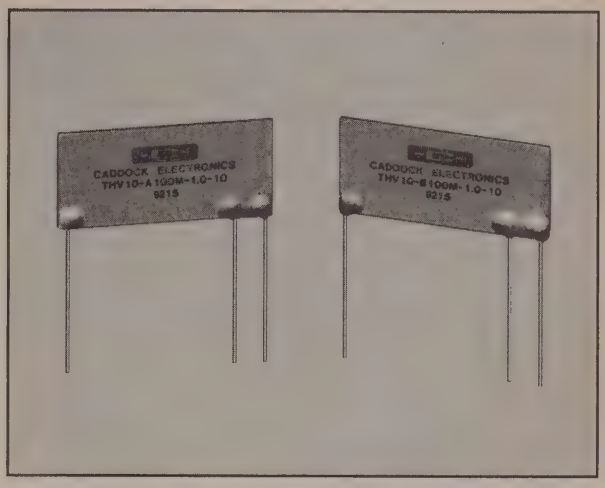
Ratio TC to 10 ppm/°C, Ratio Tolerance to ±0.25%, Voltage Ratings of 10 KV, 15 KV or 20 KVDC

The Type THV Precision High Voltage Divider Networks introduce Caddock's advanced high voltage resistor technology which doubles the allowable working voltage over the length of the high voltage section. This technology combines Caddock's Tetrinox® resistance films with a patented laser-generated V-Notch Geometry which optimizes the voltage gradient over the length of the resistance pattern.

Type THV networks provide tighter ratio temperature coefficients and tighter ratio tolerances than have previously been available in standard high voltage divider products.

- Ratio Temperature Coefficients of 10 ppm/°C or 25 ppm/°C from -55°C to +125°C.
- Ratio Tolerances of ±0.25%, ±0.5%, ±1.0% or ±2.0% at Rated Voltage.
- Voltage Rating of 10 KVDC, 15 KVDC or 20 KVDC at +125°C.
- Standard Voltage Division Ratios of 1,000:1 or 100:1, with custom ratios available.

These specifications can provide important improvements in performance in many types of advanced electronic systems, including TWT power supplies, radar systems, X-ray systems, analytical equipment and high resolution CRT displays.



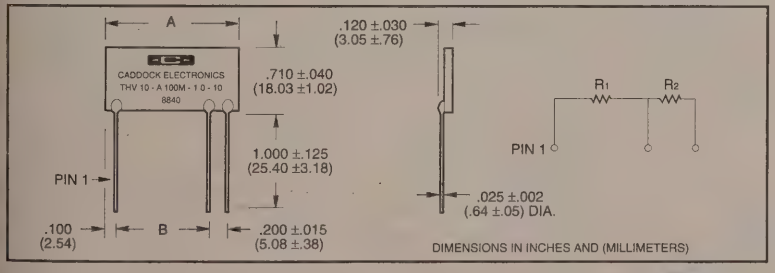
For complete information on price and delivery of both evaluation and production quantities, contact our Sales Office.

Standard Type THV Precision High Voltage Divider Networks

Model No.	Voltage Rating	Ratio Code Letter	Voltage Division	Resistance			Dimensions inches (mm)	
				R1	R2	Total	A	B
THV10	10 KVDC	A	1,000:1	99.9 Meg	100 K	100 Meg	1.500 ±.030 (38.10 ±.76)	1.100 ±.015 (27.94 ±.38)
		B	100:1	99 Meg	1 Meg	100 Meg		
THV15	15 KVDC	A	1,000:1	149.85 Meg	150 K	150 Meg	2.050 ±.030 (52.07 ±.76)	1.650 ±.015 (41.91 ±.38)
		B	100:1	148.5 Meg	1.5 Meg	150 Meg		
THV20	20 KVDC	A	1,000:1	199.8 Meg	200 K	200 Meg	2.600 ±.030 (66.04 ±.76)	2.200 ±.015 (55.88 ±.38)
		B	100:1	198 Meg	2 Meg	200 Meg		

Ordering Information: THV10 - A 100M - 1.0 - 10

- **Model Number:** THV10
- **Ratio Code Letter:** A
- **Total Resistance Value of the Divider:** 100M
- **Ratio Temperature Coefficient from -55°C to +125°C:** -25 = 25 ppm/°C, -10 = 10 ppm/°C
- **Standard Ratio Tolerance at Rated Voltage:** -2.0 = 2.0%, -0.5 = 0.5%, -1.0 = 1.0%, -0.25 = 0.25%



Specifications:

Ratio Tolerance: See ordering information.

Absolute Tolerance: ±1.0% for all resistors.

Ratio Temperature Coefficient: See ordering information.

Absolute Temperature Coefficient: 30 ppm/°C. Referenced to 25°C, ΔR taken at -55°C and +125°C.

Voltage Rating: Rated voltage applied to R1 and R2 in series.

Load Life: Ratio change with rated voltage applied for 1,000 hours at +125°C, 0.4% max.

Overvoltage: 1.5 times rated voltage for 5 seconds, ratio change 0.5% max.

Thermal Shock: Mil-Std-202, Method 107, Cond. C, ratio change 0.25% max.

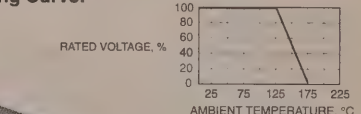
Moisture Resistance: Mil-Std-202, Method 106, ratio change 0.5% max.

Lead Material: Gold Plated.

Encapsulation: Silicone Conformal with Dielectric Withstanding Voltage of 750 volts.

Insulation Resistance: 10,000 Megohms, min.

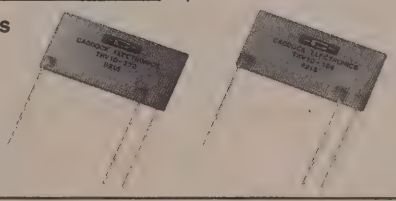
Derating Curve:



Custom Type THV Precision High Voltage Divider Networks

Custom Type THV Precision High Voltage Divider Networks can be produced with a broad range of resistance values, voltage ratios, voltage ratings, ratio tolerances and ratio temperature coefficients.

Contact our Applications Engineering about your custom high voltage divider requirement.



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HIGH PERFORMANCE FILM RESISTORS

Type MS and MR Power Film Resistors

Power Film Resistor Family with Wide Resistance Range and +275°C Maximum Temperature

With power ratings to 15 watts and voltage ratings as high as 6,000 volts in an axial-lead resistor with values to 30 Megohms, the Type MS Power Film Resistors deliver the performance capabilities that can simplify circuit design and reduce equipment cost and complexity.

Type MS Power Film Resistors provide all these features in a single resistor:

- Full power and voltage ratings, without derating:
  - for non-inductive performance.
  - for high resistance values that extend the critical resistance value up to 10 times.
- Higher voltage ratings without the limitations of minimum wire size and spacing.
- Excellent long-term stability.
  Tests demonstrate typical stability of 0.05% per 1,000 hours over extended life.

Micronox® Resistance Films

Type MS performance begins with Caddock's Micronox® resistance films. Produced exclusively by Caddock Electronics, these proven complex oxide films have been used reliably for over 30 years in Caddock's precision power resistor products.

Micronox® resistance films are fired directly onto a ceramic core at temperatures above 1400°F. These resistance films have demonstrated outstanding stability when exposed to a high ambient temperature, thermal shock and high power densities.

This unique approach to precision power resistors opens new design possibilities by providing a wider resistance range, precise temperature characteristics, and higher temperature and power handling capability.

Non-inductive Performance along with Caddock's Patented Design which Enhances High Stability in High-Power Resistor Applications.

Most models are manufactured with Caddock's Non-Inductive serpentine resistive pattern that provides for neighboring lines to carry current in opposite directions, thereby achieving maximum cancellation of flux fields over the entire length of the resistor. This efficient non-inductive construction is accomplished without derating of any performance advantages.

The result is a truly non-inductive resistor that is about as inductive as a straight piece of wire the length of the resistor body. This efficient design means faster settling times and minimum distortion in all types of high frequency circuits.

Carefully Controlled Manufacturing and Test Procedures Assure Compliance with Strict Quality Control Requirements.

Manufacturing Control

Type MS Resistors are produced under intensive manufacturing controls with processes which include power conditioning, overvoltage conditioning and maximum temperature conditioning.

Quality Control

From the certification and testing of all materials, to the supervision of manufacturing processes, all Caddock Type MS and MR Power Film Resistors are produced under procedures that have been approved for conformance to the requirements of Mil-I-45208 in many recent surveys.

Reliability Verification

Type MS resistors are included in the Caddock Reliability Testing Program. Conformance to specification parameters including Extended Life, Shock, Vibration and Humidity are verified on a periodic basis. Data from Type MS resistors can be compared by similarity to other Caddock resistor types, since Type ML, MM, MS, MP, MG and MK represent an identical combination of materials - aluminum oxide substrate, Micronox® resistance film and silicone insulating coating.

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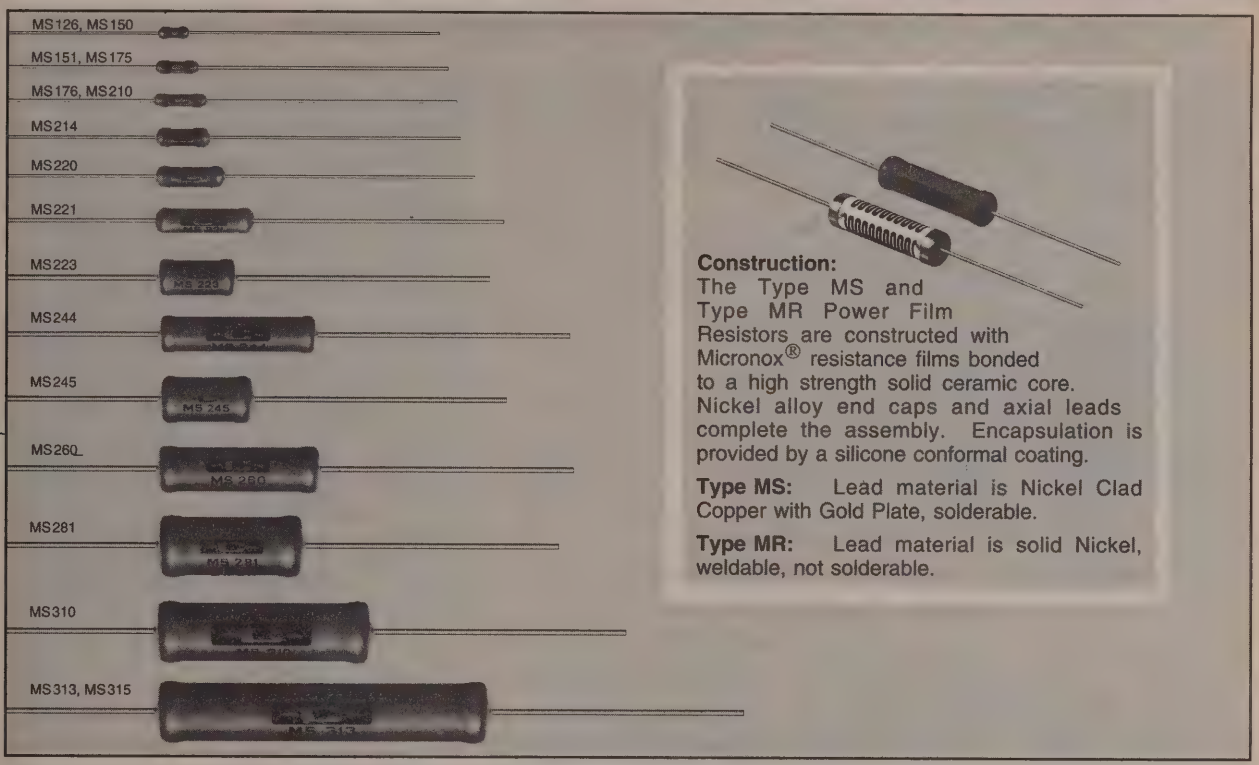
Type MS and MR Power Film Resistors

CADDOCK
HIGH PERFORMANCE FILM RESISTORS



Construction:
The Type MS and Type MR Power Film Resistors are constructed with Micronox® resistance films bonded to a high strength solid ceramic core. Nickel alloy end caps and axial leads complete the assembly. Encapsulation is provided by a silicone conformal coating.

Type MS: Lead material is Nickel Clad Copper with Gold Plate, solderable.

Type MR: Lead material is solid Nickel, weldable, not solderable.

Model No.	Wattage	Max. Voltage	Dielect. Strength	TC ppm/°C	Resistance Min.	Resistance Max.	Dimensions in inches and (millimeters) A	B	C	Leadwire
MR129	.25	200	500	150	50 Ω	500 K	.188 ±.020 (4.78 ±.51)	.070 ±.015 (1.78 ±.38)	.020 ±.002 (.51 ±.05)	Nickel *
MR154	.40	300	750	150	50 Ω	1 Meg	.250 ±.020 (6.35 ±.51)	.094 ±.015 (2.39 ±.38)	.025 ±.002 (.64 ±.05)	Nickel *
MR178	.60	500	750	150	50 Ω	3 Meg	.313 ±.020 (7.95 ±.51)	.094 ±.015 (2.39 ±.38)	.025 ±.002 (.64 ±.05)	Nickel *
MS126	.25	200	500	50	20 Ω	1 Meg	.188 ±.020 (4.78 ±.51)	.070 ±.015 (1.78 ±.38)	.020 ±.002 (.51 ±.05)	Gold Plated
MS150	.50	—	500	50	20 Ω	2 K	.188 ±.020 (4.78 ±.51)	.070 ±.015 (1.78 ±.38)	.020 ±.002 (.51 ±.05)	Gold Plated
MS151	.50	300	750	50	20 Ω	2 Meg	.250 ±.020 (6.35 ±.51)	.094 ±.015 (2.39 ±.38)	.025 ±.002 (.64 ±.05)	Gold Plated
MS175	.75	—	750	50	20 Ω	2 K	.250 ±.020 (6.35 ±.51)	.094 ±.015 (2.39 ±.38)	.025 ±.002 (.64 ±.05)	Gold Plated
MS176	.75	500	750	50	45 Ω	5 Meg	.313 ±.020 (7.95 ±.51)	.094 ±.015 (2.39 ±.38)	.025 ±.002 (.64 ±.05)	Gold Plated
MS210	1.0	—	750	50	45 Ω	3 K	.313 ±.020 (7.95 ±.51)	.094 ±.015 (2.39 ±.38)	.025 ±.002 (.64 ±.05)	Gold Plated
MS214	1.0	500	750	50	45 Ω	5 Meg	.313 ±.030 (7.95 ±.76)	.109 ±.025 (2.77 ±.64)	.025 ±.002 (.64 ±.05)	Gold Plated
MS220	2.0	1,000	800	50	20 Ω	10 Meg	.400 ±.060 (10.16 ±1.52)	.140 ±.030 (3.56 ±.76)	.025 ±.002 (.64 ±.05)	Gold Plated
MS221	3.0	1,000	800	50	45 Ω	10 Meg	.575 ±.050 (14.61 ±1.27)	.165 ±.030 (4.19 ±.76)	.032 ±.002 (.81 ±.05)	Gold Plated
MS223	3.0	800	1,000	50	20 Ω	4 Meg	.480 ±.060 (12.19 ±1.52)	.230 ±.030 (5.84 ±.76)	.040 ±.002 (1.02 ±.05)	Gold Plated
MS244	4.0	2,000	1,000	50	45 Ω	15 Meg	.950 ±.060 (24.13 ±1.52)	.230 ±.030 (5.84 ±.76)	.040 ±.002 (1.02 ±.05)	Gold Plated
MS245	4.0	800	1,000	50	20 Ω	6 Meg	.570 ±.060 (14.48 ±1.52)	.300 ±.030 (7.62 ±.76)	.040 ±.002 (1.02 ±.05)	Gold Plated
MS260	6.0	2,000	1,000	50	45 Ω	15 Meg	.970 ±.060 (24.64 ±1.52)	.300 ±.030 (7.62 ±.76)	.040 ±.002 (1.02 ±.05)	Gold Plated
MS281	8.0	2,000	1,000	50	45 Ω	8 Meg	.910 ±.060 (23.11 ±1.52)	.350 ±.040 (8.89 ±1.02)	.040 ±.002 (1.02 ±.05)	Gold Plated
MS310	10.0	4,500	1,000	50	45 Ω	20 Meg	1.250 ±.070 (31.75 ±1.78)	.350 ±.040 (8.89 ±1.02)	.040 ±.002 (1.02 ±.05)	Gold Plated
MS313	12.5	6,000	1,000	50	50 Ω	30 Meg	2.000 ±.080 (50.80 ±2.03)	.350 ±.040 (8.89 ±1.02)	.040 ±.002 (1.02 ±.05)	Gold Plated
MS315	15.0	—	1,000	50	50 Ω	1 Meg	2.000 ±.080 (50.80 ±2.03)	.350 ±.040 (8.89 ±1.02)	.040 ±.002 (1.02 ±.05)	Gold Plated

Models with low inductance construction are in shaded areas.
Models with Caddock's Non-Inductive Serpentine Pattern are in non-shaded areas.

Specifications:

Resistance Tolerance: ±1% (tolerances to 0.1% on special order).

Temperature Coefficient: See Table for TC value. TC referenced to 25°C, ΔR taken at -15°C and +105°C.

Insulation Resistance: 10,000 Megohms, min.

Overload/Overvoltage: 5 times rated power with applied voltage not to exceed 1.5 times maximum continuous operating voltage for 5 seconds. ΔR 0.5% max. or 0.5 ohm max., whichever is greater.

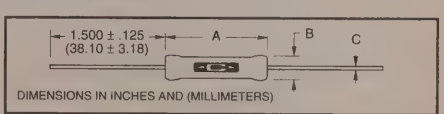
Thermal Shock: Mil-Std-202, Method 107, Cond. C, ΔR 0.5% max. or 0.5 ohm max., whichever is greater.

Moisture Resistance: Mil-Std-202, Method 106, ΔR 0.5% max. or 0.5 ohm max., whichever is greater.

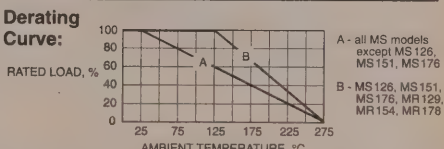
Load Life: 1,000 hours at rated power, ΔR 0.5% max. or 0.5 ohm max., whichever is greater.

Maximum Operating Temperature: +275°C.

Encapsulation: Silicone Conformal.



Derating Curve:



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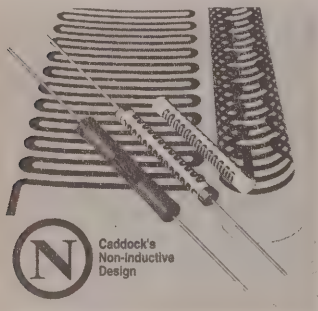
CADDOCK
HIGH PERFORMANCE FILM RESISTORS

Type MM and ML Precision Film Resistors

High Temperature Resistors for Geophysical, Aerospace and Industrial Requirements

Type MM and ML resistors have a proven performance history in industrial, computer, military and space applications. Utilizing our proven Micronox® resistance films, these resistors are available with power ratings up to 3 watts and resistance values to 15 Megohms. These resistors are ideal for applications requiring tolerances as close as 0.1% and extended life stability of 0.1% per 1,000 hours.

Most models of Type MM and ML resistors are manufactured with Caddock's Non-Inductive Design that provides for neigh-boring lines to carry current in opposite directions. This efficient non-inductive construction is accomplished without derating of any performance advantages.

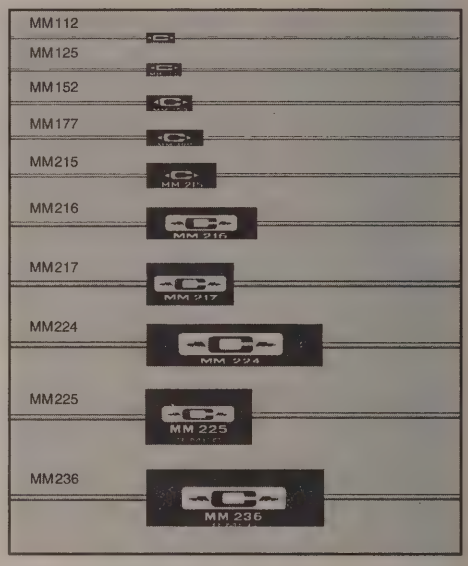


Type MM features:

- Max. Operating Temperature to +275°C.
- High Power Rating at +125°C.
- TC of 50 ppm/°C from -15°C to +105°C.
- Non-Inductive Performance Available.

Type ML features:

- Non-Inductive performance at a low cost.
- TC of 50 ppm/°C from -15°C to +105°C.



Model No.	Watt-age	Max. Voltage	Oper. Temp. (Max.)	Dielect. Strength	Resistance		Dimensions in inches and (millimeters)		
					Min.	Max.	A	B	C
MM112	.12	200	275°C	400	45 Ω	500 K	.160 ±.010 (4.06 ±.26)	.065 ±.010 (1.65 ±.26)	.016 ±.002 (.41 ±.05)
MM125	.25	200	275°C	500	30 Ω	1 Meg	.188 ±.020 (4.78 ±.51)	.070 ±.015 (1.78 ±.38)	.020 ±.002 (.51 ±.05)
MM152	.4	300	275°C	750	30 Ω	2 Meg	.250 ±.020 (6.35 ±.51)	.094 ±.006 (2.39 ±.15)	.025 ±.002 (.64 ±.05)
MM177	.6	500	275°C	750	45 Ω	5 Meg	.313 ±.020 (7.95 ±.51)	.094 ±.006 (2.39 ±.15)	.025 ±.002 (.64 ±.05)
MM215	1.0	800	275°C	1,000	45 Ω	10 Meg	.400 ±.020 (10.16 ±.51)	.150 ±.010 (3.81 ±.26)	.025 ±.002 (.64 ±.05)
MM216	1.5	1,000	275°C	1,000	45 Ω	10 Meg	.625 ±.030 (15.88 ±.76)	.190 ±.020 (4.83 ±.51)	.032 ±.002 (.81 ±.05)
MM217	1.5	800	275°C	1,500	30 Ω	4 Meg	.500 ±.030 (12.70 ±.76)	.250 ±.020 (6.35 ±.51)	.040 ±.002 (1.02 ±.05)
MM224	2.0	2,000	275°C	1,500	45 Ω	15 Meg	1.000 ±.030 (25.40 ±.76)	.250 ±.020 (6.35 ±.51)	.040 ±.002 (1.02 ±.05)
MM225	2.0	800	275°C	2,000	30 Ω	6 Meg	.600 ±.030 (15.24 ±.76)	.330 ±.020 (8.38 ±.51)	.040 ±.002 (1.02 ±.05)
MM236	3.0	2,000	275°C	2,000	45 Ω	15 Meg	1.000 ±.030 (25.40 ±.76)	.330 ±.020 (8.38 ±.51)	.040 ±.002 (1.02 ±.05)
ML104	.08	200	175°C	400	50 Ω	300 K	.160 ±.010 (4.06 ±.26)	.065 ±.010 (1.65 ±.26)	.016 ±.002 (.41 ±.05)
ML114	.15	200	175°C	500	50 Ω	500 K	.188 ±.020 (4.78 ±.51)	.070 ±.015 (1.78 ±.38)	.020 ±.002 (.51 ±.05)
ML124	.25	300	175°C	750	50 Ω	600 K	.250 ±.020 (6.35 ±.51)	.094 ±.006 (2.39 ±.15)	.025 ±.002 (.64 ±.05)
ML131	.4	500	175°C	750	50 Ω	1 Meg	.313 ±.020 (7.95 ±.51)	.094 ±.006 (2.39 ±.15)	.025 ±.002 (.64 ±.05)
ML181	.6	600	175°C	750	50 Ω	5 Meg	.400 ±.020 (10.16 ±.51)	.150 ±.010 (3.81 ±.26)	.025 ±.002 (.64 ±.05)
ML212	1 0	1,000	175°C	1,000	45 Ω	10 Meg	.625 ±.030 (15.88 ±.76)	.190 ±.020 (4.83 ±.51)	.032 ±.002 (.81 ±.05)
ML213	1.0	800	175°C	1,500	30 Ω	4 Meg	.500 ±.030 (12.70 ±.76)	.250 ±.020 (6.35 ±.51)	.040 ±.002 (1.02 ±.05)
ML218	1.25	2,000	175°C	1,500	45 Ω	15 Meg	1.000 ±.030 (25.40 ±.76)	.250 ±.020 (6.35 ±.51)	.040 ±.002 (1.02 ±.05)
ML219	1.25	800	175°C	2,000	30 Ω	6 Meg	.600 ±.030 (15.24 ±.76)	.330 ±.020 (8.38 ±.51)	.040 ±.002 (1.02 ±.05)
ML226	2.0	2,000	175°C	2,000	45 Ω	15 Meg	1.000 ±.030 (25.40 ±.76)	.330 ±.020 (8.38 ±.51)	.040 ±.002 (1.02 ±.05)

Models with low inductance construction are in shaded areas.
Models with Caddock's Non-Inductive Serpentine Pattern are in non-shaded areas.

Specifications:

Resistance Tolerance: ±1% (tolerances to 0.1% on special order).

Temperature Coefficient: 50 ppm/°C referenced to 25°C, ΔR taken at -15°C and +105°C.

Insulation Resistance: 10,000 Megohms, min.

Overload/Overvoltage: 5 times rated power with applied voltage not to exceed 1.5 times maximum continuous operating voltage for 5 seconds, ΔR 0.5% max. or 0.5 ohm max., whichever is greater.

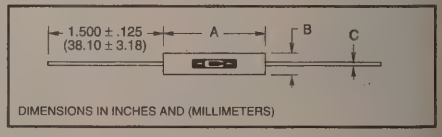
Thermal Shock: Mil-Std-202, Method 107, Cond. F, ΔR 0.2% max. or 0.5 ohm max., whichever is greater.

Moisture Resistance: Mil-Std-202, Method 106, ΔR 0.5% max. or 0.5 ohm max., whichever is greater.

Loadlife: 1,000 hours at rated power, ΔR 0.5% max. or 0.5 ohm max., whichever is greater.

Lead Material: Gold Plated.

Encapsulation: Type MM: Black Transfer Molded. Type ML: Transfer Molded.



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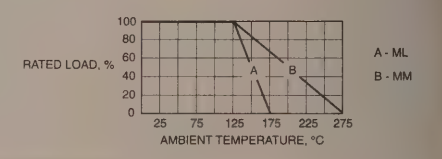

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Type MV Low Resistance Power Film Resistors

CADDOCK
HIGH PERFORMANCE FILM RESISTORS

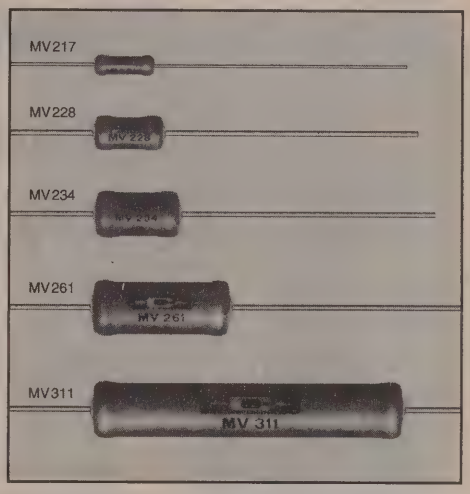
Values from 0.1 Ohm to 50 Ohms with Exclusive Non-Inductive Design

Type MV Low Resistance Power Film Resistors combine Caddock's Exclusive Non-Inductive Design with many high performance capabilities of Micronox® resistance films to achieve these special advantages:

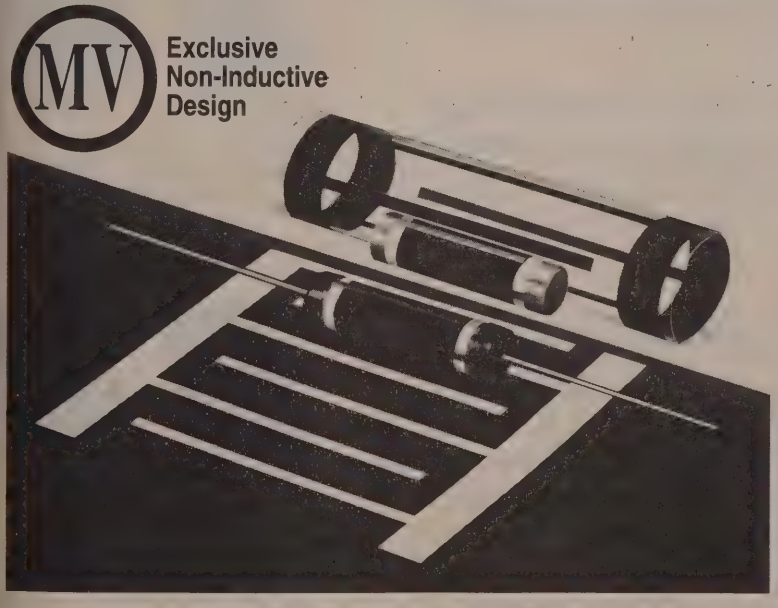
- Low Resistance - from 0.1 ohm to 50 ohms.
- Maximum Operating Temperature up to +275°C.
- Five Sizes and Power Ratings.
- Full Power Ratings without derating for Non-Inductive Performance.

The interdigitated terminations in the Type MV resistors provide a multiple-path distribution of the current into parallel resistance sections, which provides low resistance values and non-inductive performance. This Exclusive Non-Inductive Design provides significant performance improvements in high speed or inductance sensitive electronic circuits, including high performance power amplifiers, high-speed data transmission systems, high frequency video amplifiers, current switching circuits and current sensing circuits.

For complete price and delivery information on the Type MV resistors, call or write our Sales Office.



Model No.	Watt-age	Oper. Temp. (Max.)	Dielect. Strength	Resistance		Dimensions in inches and (millimeters)			Leadwire
				Min.	Max.	A	B	C	
MV217	1.5	275°C	800	0.2 Ω	50 Ω	.400 ±.060 (10.16 ±1.52)	.140 ±.030 (3.56 ±.76)	.025 ±.002 (.64 ±.05)	Gold Plated
MV228	2.0	275°C	1,000	0.1 Ω	50 Ω	.480 ±.060 (12.19 ±1.52)	.230 ±.030 (5.84 ±.76)	.040 ±.002 (1.02 ±.05)	Gold Plated
MV234	3.0	275°C	1,000	0.1 Ω	50 Ω	.570 ±.060 (14.48 ±1.52)	.300 ±.030 (7.62 ±.76)	.040 ±.002 (1.02 ±.05)	Gold Plated
MV261	6.0	275°C	1,000	0.1 Ω	50 Ω	.910 ±.060 (23.11 ±1.52)	.350 ±.030 (8.89 ±.76)	.040 ±.002 (1.02 ±.05)	Gold Plated
MV311	10.0	275°C	1,000	0.1 Ω	50 Ω	2.000 ±.080 (50.80 ±2.03)	.350 ±.040 (8.89 ±1.02)	.040 ±.002 (1.02 ±.05)	Gold Plated



Specifications:

Resistance Tolerance: ±1% (2%, 5% and 10% are also available).

Temperature Coefficient: 5 ohms and above ±100 ppm/°C, referenced to 25°C, ΔR taken at -15°C and +105°C.
Below 5 ohms ±(200 ppm + 0.00002 ohm)/°C, referenced to 25°C, ΔR taken at -15°C and +105°C.

Insulation Resistance: 10,000 Megohms, min.

Momentary Overload: 5 times rated power for 5 seconds, ΔR ±(1 percent + 0.001 ohm) max.

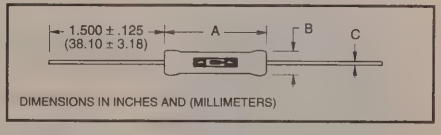
Thermal Shock: Mil-Std-202, Method 107, Cond. C, ΔR ±(1 percent + 0.001 ohm) max.

Moisture Resistance: Mil-Std-202, Method 106, ΔR ±(1 percent + 0.001 ohm) max.

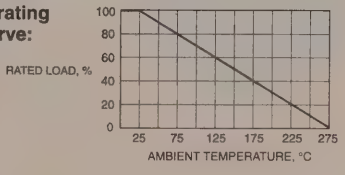
Load Life: 1,000 hours at rated power, ΔR ±(1 percent + 0.001 ohm) max.

Encapsulation: Silicone Conformal.

Measurement Note: For these specifications, resistance measurement shall be made at a point 0.3 inch (7.62 mm) from the resistor body.



Derating Curve:



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CADDOCK
HIGH PERFORMANCE FILM RESISTORS

And Now 50 Watts!

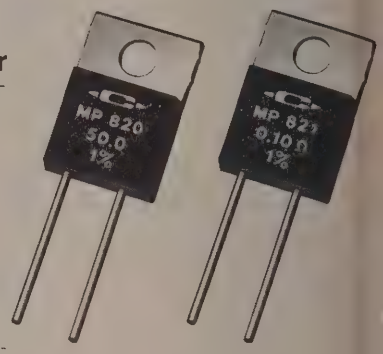
More *New* Power Resistors

Non-Inductive Designs
TO-220 Style Power Packages

See Page C14
20 Watts
Down to 0.05 Ω

MP 820 Kool-Tab® Power Film Resistor

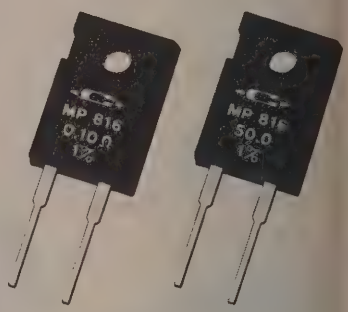
- 20 Watts at 25°C Case Temperature derated to zero at 175°C
- Metal Mounting Tab
- Best High Frequency Performance
- Resistance Range of 0.05 ohm to 10K
- Tolerance ±1%, ±2%, ±5% or ±10%



See Page C15 and C16
16 Watts
Down to 0.10 Ω

MP 816 Kool-Pak™ Power Film Resistor

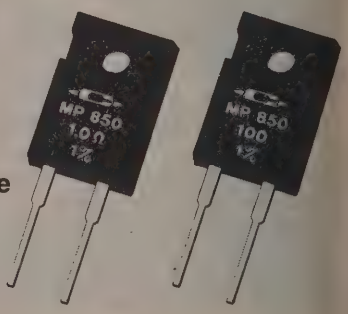
- 16 Watts at 25°C Case Temperature derated to zero at 150°C
- *Lower Cost*
- Thermally Conductive Molded Package
- Resistance Range of 0.10 ohm to 10K
- Tolerance ±1%, ±2%, ±5% or ±10%



See Page C15 and C16
50 Watts

MP 850 Kool-Pak™ Power Film Resistor

- 50 Watts at 25°C Case Temperature derated to zero at 150°C
- Copper Heat Sink Integral in the Molded Package
- Resistance Range of 1.0 ohm to 10K
- Tolerance ±1%, ±2%, ±5% or ±10%



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MP 820 and MP 821 Kool-Tab® Power Film Resistors

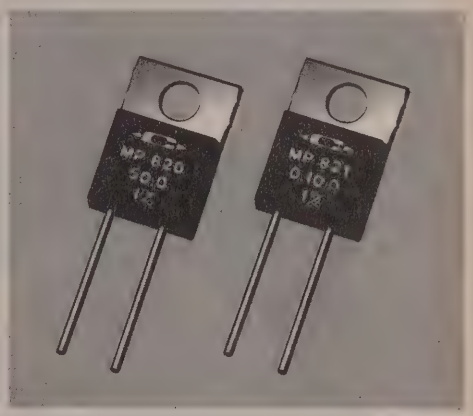
CADDOCK
HIGH PERFORMANCE FILM RESISTORS

20 Watts in the TO-220 Power Package with Metal Mounting Tab - 0.05 Ohm to 10 Kohm

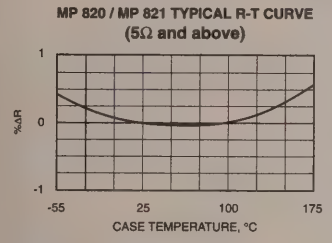
Series MP 820 Kool-Tab® Power Film Resistors introduce our proven Micronox® resistance film system in the widely accepted TO-220 Power Package to provide a compact 20 watt heat sink mountable resistor. The non-inductive design makes this resistor ideal in high frequency communications and power switching circuits.

The special performance features of the series MP 820 Kool-Tab® Power Film Resistor include:

- **20 Watt power rating at 25°C case temperature.**
- **Resistance values to 0.05 ohm for current sense applications.**
- **Non-Inductive Design.**
- Single screw mounting simplifies resistor attachment to the heat sink.
- Low profile provides an easier fit in tight places.
- A molded silicone case for environmental protection.
- Resistor element is electrically isolated from the metal heat sink tab.



Model No.	Power Rating	Dielect. Strength V_{RMS} AC	Max. Voltage	Resistance		Leadwire
				Min.	Max.	
MP820	20 Watts *	1,500	300	10.0 Ω	10 K	Tinned Copper
MP821	20 Watts *	1,500	——	0.05 Ω	9.99 Ω	Tinned Copper



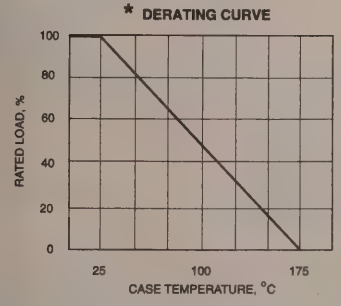
Temperature Coefficient:
TC referenced to 25°C, ΔR taken at +175°C

MP 820:
All resistance values, 0 to +50 ppm/°C

MP 821:
5.00 ohms to 9.99ohms, 0 to +50 ppm/°C
0.50 ohm to 4.99 ohms, 0 to +100 ppm/°C
0.05 ohm to 0.49 ohm, 0 to +200 ppm/°C

Non-Inductive Design

Series MP 820 Kool-Tab® Power Film Resistors are constructed with our Micronox® resistance film fired onto a flat substrate which is thermally bonded to the copper heat sink tab. The resistor body is then molded in silicone to finish the TO-220 configuration. The lead wire attachment and resistance element geometry are configured to provide outstanding non-inductive performance.



The case temperature is to be used for purposes of establishing the maximum applied power. See Derating Curve. The case temperature measurement is made on the metal mounting tab against the molded body, the device mounted on a heat sink, with thermal grease applied at a mounting torque of 6 to 8 in-lbs. Without a heat sink, when in free air at 25°C, the MP 820 / MP 821 is rated for 2.25 watts.

Derating for case temperature above 25°C is 0.133 W/°C.

Mounting Note: Maximum torque to be applied to mounting screw is 8 in-lbs.

Specifications:

Resistance Tolerance: ±1% (0.5%, 2%, 5% and 10% are also available).

Insulation Resistance: 10,000 Megohms, min.

Terminal Strength: Mil-Std-202, Method 211, Cond. A (Pull Test) 5 lbs., ΔR ±(0.2 percent + 0.001 ohm) max.

Thermal Shock: Mil-Std-202, Method 107, Cond. F, ΔR ±(0.3 percent + 0.001 ohm) max.

Momentary Overload: 2 times rated power with applied voltage not to exceed 1.5 times maximum continuous operating voltage for 5 seconds, ΔR ±(0.3 percent + 0.001 ohm) max.

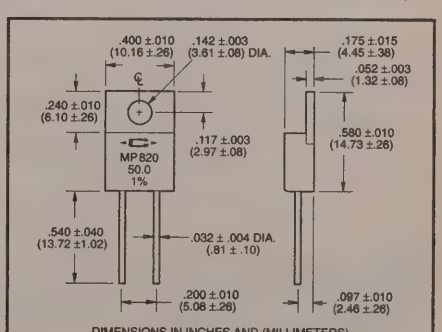
Moisture Resistance: Mil-Std-202, Method 106, ΔR ±(0.5 percent + 0.001 ohm) max.

Load Life: 2,000 hours at rated power, ΔR ±(1.0 percent + 0.001 ohm). Power rating dependent upon case temperature. See derating curve.

Shock: 100G, Mil-Std-202, Method 213, Cond. I, ΔR ±(0.2 percent + 0.001 ohm) max.

Vibration, High Frequency: Mil-Std-202, Method 204, Cond. D, ΔR ±(0.2 percent + 0.001 ohm) max.

Measurement Note: For these specifications, resistance measurement shall be made at a point 0.2 inch (5.08 mm) from the resistor body.



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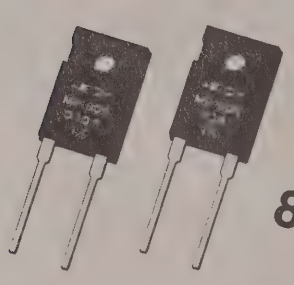
CADDOCK
HIGH PERFORMANCE FILM RESISTORS

Type MP Kool-Pak™ Power Film Resistors

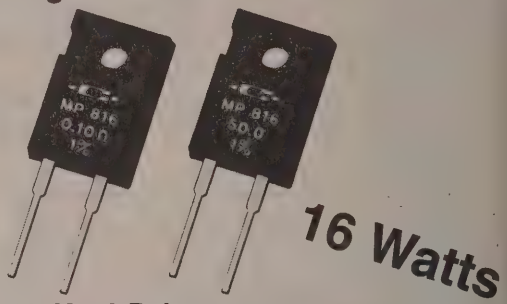
TO-126 and TO-220 Style Power Packages - Non-Inductive Designs

MP808 and MP816 Power Packages are Cost Effective Designs with an All Molded Package Configuration



MP 808 Kool-Pak™ Power Resistors
TO-126 Style Power Package

- 8 Watts at 25°C Case Temperature derated to zero at 150°C
- Thermally Conductive Molded Package
- Lower Cost
- Resistance Range of 0.10 ohm to 10K



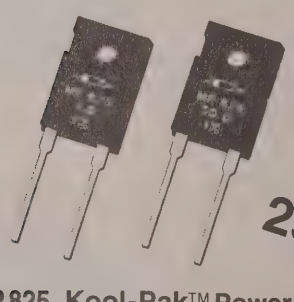
MP 816 Kool-Pak™ Power Resistors
TO-220 Style Power Package

- 16 Watts at 25°C Case Temperature derated to zero at 150°C
- Thermally Conductive Molded Package
- Lower Cost
- Resistance Range of 0.10 ohm to 10K

Construction of MP808 and MP816: The MP 808 and MP 816 Kool-Pak™ Power Film Resistors are constructed with Caddock's Micronox® resistance film fired onto a flat ceramic substrate. The terminal attachment and resistance element geometry are configured to provide outstanding non-inductive performance. The resistor body is completely surrounded by a high thermal conductivity molding compound to finish this **cost effective power resistor package.**

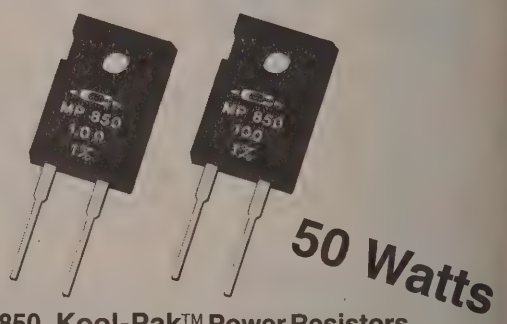
Patents Pending

MP825 and MP850 Power Packages Include an Integral Metal Mounting Surface for Highly Efficient Thermal Transfer



MP 825 Kool-Pak™ Power Resistors
TO-126 Style Power Package

- 25 Watts at 25°C Case Temperature derated to zero at 150°C
- Copper Heat Sink Integral in the Molded Package
- Resistance Range of 0.10 ohm to 10K



MP 850 Kool-Pak™ Power Resistors
TO-220 Style Power Package

- 50 Watts at 25°C Case Temperature derated to zero at 150°C
- Copper Heat Sink Integral in the Molded Package
- Resistance Range of 1.0 ohm to 10K

Construction of MP825 and MP850: The MP 825 and MP 850 Kool-Pak™ Power Film Resistors are constructed with Caddock's Micronox® resistance film fired onto a flat ceramic substrate. The terminal attachment and resistance element geometry are configured to provide outstanding non-inductive performance. **The ceramic substrate is bonded to a copper heat sink which becomes the metal mounting surface.** This assembly is molded in a high thermal conductivity molding compound with the copper heat sink flush with the back surface of the part.

Patents Pending

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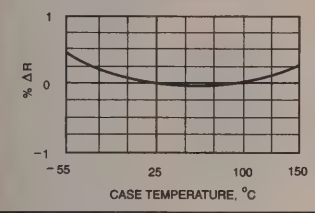
Type MP Kool-Pak™ Specifications and Dimensions

Model No.	Power Rating	Package	Dimensions	Dielect. Strength V_{RMS} AC	Max. Voltage	Resistance		Leadwire	Comments
						Min.	Max.		
MP808	8 Watts *	TO-126 Style	Figure 1	1,500	300	0.10 Ω	10 K	Tinned Copper	All Molded Package
MP816	16 Watts *	TO-220 Style	Figure 2	1,500	300	0.10 Ω	10 K	Tinned Copper	All Molded Package
MP825	25 Watts *	TO-126 Style	Figure 1	1,500	300	0.10 Ω	10 K	Tinned Copper	Integral Metal Mounting Surface in Molded Package
MP825	50 Watts *	TO-220 Style	Figure 2	1,500	300	1.0 Ω	10 K	Tinned Copper	Integral Metal Mounting Surface in Molded Package

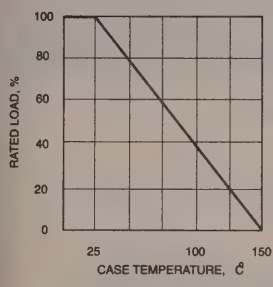
TYPICAL R-T CURVE
(5 Ω and above)



Temperature Coefficient:
TC referenced to 25°C, ΔR taken at +150°C

5.00 ohms and above, 0 to +50 ppm/°C
0.50 ohm to 4.99 ohms, 0 to +100 ppm/°C
0.10 ohm to 0.49 ohm, 0 to +200 ppm/°C

*** DERATING CURVE**

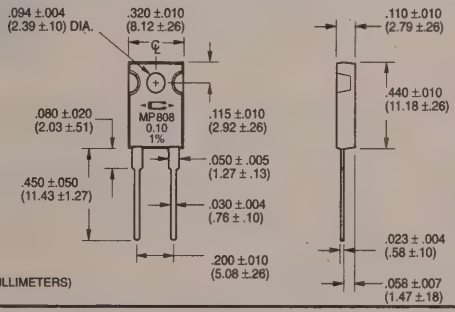


The case temperature is to be used for purposes of establishing the maximum applied power. See Derating Curve. The case temperature measurement is made with the thermocouple contacting the bottom insulated mounting surface of the package (center of bottom surface), the device mounted on a heat sink, thermal grease applied at a mounting torque of 6 to 8 in-lbs. Without a heat sink, when in free air at 25°C, the MP808 and the MP825 are rated for 1.25 watts, the MP816 and the MP 850 are rated for 2.25 watts.

Deratings for case temperature above 25°C are:
MP808: 0.064 W/°C MP816: 0.128 W/°C
MP825: 0.200 W/°C MP850: 0.400 W/°C

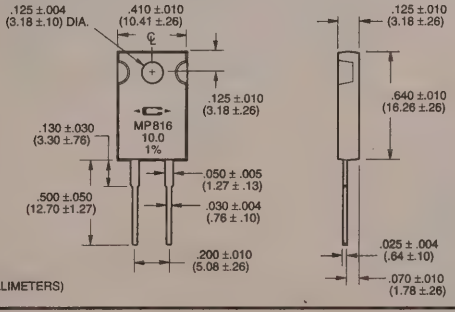
Mounting Note: The MP Kool-Pak™ Resistors must be mounted using a screw and compression washer mounting technique. This will provide sufficient pressure on the package over time and through large temperature variations to maintain the maximum power dissipation capability. Maximum torque to be applied to mounting screw is 8 in-lbs.

Figure 1
TO-126 Style
MP808, MP825



DIMENSIONS IN INCHES AND (MILLIMETERS)

Figure 2
TO-220 Style
MP816, MP850



DIMENSIONS IN INCHES AND (MILLIMETERS)

Specifications:

Resistance Tolerance: ±1% (0.5%, 2%, 5%, 10%, and 20% are also available).

Insulation Resistance: 10,000 Megohms, min.

Terminal Strength: Mil-Std-202, Method 211, Cond. A (Pull Test) 5 lbs.
MP808, MP816, MP825:
ΔR ±(0.2 percent + 0.001 ohm) max.
MP 850:
ΔR ±(0.2 percent + 0.01 ohm) max.

Thermal Shock: Mil-Std-202, Method 107, Cond. F.
MP808, MP816, MP825:
ΔR ±(0.3 percent + 0.001 ohm) max.
MP 850:
ΔR ±(0.3 percent + 0.01 ohm) max.

Momentary Overload:
MP816 and MP850: 2 times rated power with applied voltage not to exceed 1.5 times maximum continuous operating voltage for 5 seconds.
MP816:
ΔR ±(0.3 percent + 0.001 ohm) max.
MP 850:
ΔR ±(0.3 percent + 0.01 ohm) max.

MP808 and MP825: 1.5 times rated power with applied voltage not to exceed 1.5 times maximum continuous operating voltage for 5 seconds.
MP808, MP825:
ΔR ±(0.3 percent + 0.001 ohm) max.

Moisture Resistance: Mil-Std-202, Method 106.
MP808, MP816, MP825:
ΔR ±(0.5 percent + 0.001 ohm) max.
MP 850:
ΔR ±(0.5 percent + 0.01 ohm) max.

Load Life: 2,000 hours at rated power. Power rating dependent upon case temperature. See derating curve.
MP808, MP816, MP825:
ΔR ±(1.0 percent + 0.001 ohm) max.
MP 850:
ΔR ±(1.0 percent + 0.01 ohm) max.

Shock: 100G, Mil-Std-202, Method 213, Cond. I.
MP808, MP816, MP825:
ΔR ±(0.2 percent + 0.001 ohm) max.
MP 850:
ΔR ±(0.2 percent + 0.01 ohm) max.

Vibration, High Frequency: Mil-Std-202, Method 204, Cond. D.
MP808, MP816, MP825:
ΔR ±(0.2 percent + 0.001 ohm) max.
MP 850:
ΔR ±(0.2 percent + 0.01 ohm) max.

Measurement Note: For these specifications, resistance measurement shall be made at a point 0.2 inch (5.08 mm) from the resistor body.

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CADDOCK
HIGH PERFORMANCE FILM RESISTORS

Type MK Precision Power Radial-Lead Film Resistors

Non-Inductive with New Expanded Resistance Range — 1 Ohm to 100 Megohms

Here are the low cost precision resistors that provide high density packaging in large volume printed circuit applications. Available in two miniature rectangular package configurations with standard lead spacings, Type MK Precision Power Radial-Lead Film Resistors now cover the entire resistance range from 1 ohm to 100 Megohms.

Constructed with Caddock's Micronox® resistance films fired onto a solid ceramic substrate, Type MK Precision Film Resistors combine all of these outstanding advantages:

- **±1% Resistance Tolerance is Standard** - tolerances to ±0.1% are available on special order.
- **Operating Temperature** - from -55°C to +175°C.
- **Full Power Rating at +125°C.**
- **Temperature Coefficient is Only 50 ppm/°C from 5 ohms to 5 Megohms and 80 ppm/°C up to 100 Megohms** - referenced to 25°C with the ΔR taken at -15°C and +105°C.
- **Extended Life Stability is Typically Better Than 0.1% per 1,000 Hours.**
- **Caddock's Non-Inductive Performance** - provides faster settling times and minimum distortion in all types of high frequency circuits.

This combination of performance advantages in a small, standardized case can simplify many engineering and production problems:

One size of Type MK resistor can replace many sizes of axial-lead resistors.

This table of "RN" style axial-lead resistors shows the many sizes and power ratings that can be replaced with either of the two models of Type MK Precision Film Resistors within the maximum allowable voltage ratings.

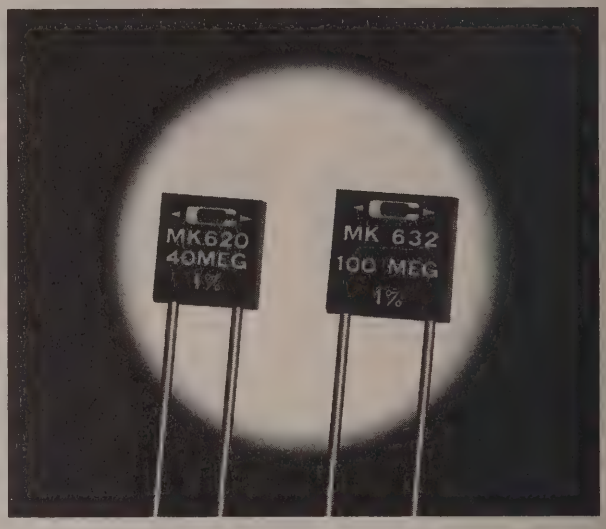
Comparison of Type MK and "RN" Ratings and Dimensions

Resistor Type	Power Rating	Maximum Resistance	Mounting Hole Spacing	
MK120 or MK620	.50 W	40 Megohms	.150 (3.81)	Even the smallest Type MK resistor can replace all of these RN type resistors
MK132 or MK632	.75 W	100 Megohms	.200 (5.08)	
RN50	.05 W	1 Megohm	.400 (10.15)	
RN55	.10 W	5 Megohms	.500 (12.70)	
RN60	.125 W	10 Megohms	.625 (15.90)	
RN65	.25 W	20 Megohms	.875 (22.20)	
RN70	.50 W	40 Megohms	1.000 (25.40)	

DIMENSIONS IN INCHES AND (MILLIMETERS)

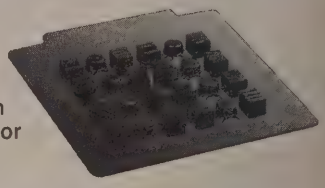
The largest Type MK - rated at .75 watt - requires less board space than even the .05 watt RN50.

The smallest Type MK - rated at .50 watt - provides power dissipation **equal** to the RN70 resistor. The RN70 resistor requires a mounting hole spacing of 1 inch and a side-to-side spacing of .25 inch, resulting in a total mounting area of .25 square inch - **10 times the area required for a .50 watt Type MK resistor!**



One standard resistor configuration can simplify board layouts.

With the exceptionally wide range of resistance values that are available in each model of Type MK Precision Film Resistors, circuits can now be designed for maximum packaging densities without the need for leaving extra space where resistor value changes can require larger resistors or non-uniform lead spacings.



Standardization of resistor size can speed assembly procedures and reduce procurement costs.

The standardization of resistor size can pay additional dividends by simplifying assembly procedures. The radial leads do not require additional bending prior to insertion, and the standard lead spacing can reduce the time required for assembly.

The combination of higher power ratings and smaller size can also lower procurement costs. By reducing the wide variety of sizes and types of axial-lead resistors to a single, standardized resistor type, unit prices can be lowered and inventory problems simplified. For specific price and delivery information, call or write our Sales Office.

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Type MK Precision Power Radial-Lead Film Resistors

CADDOCK
HIGH PERFORMANCE FILM RESISTORS

Type MK Precision Film Resistors - Low and Standard Resistance Ranges

Model No.	Wattage	Max. Voltage	Oper. Temp. Max.	Dielect. Strength	Resistance			Dimensions	Encapsulation	Leadwire
					Low Min.	Standard Min.	Standard Max.			
MK120	.50	200	175°C	300	1 Ω	5 Ω	2 Meg	Ref. Case "A" Dwg.	Transfer Molded	Tinned Copper
MK132	.75	400	175°C	400	1 Ω	5 Ω	5 Meg	Ref. Case "B" Dwg.	Transfer Molded	Tinned Copper

Resistance Tolerance: ±1% (tolerances to ±0.1% available on values of 30 ohms or higher).

Overload/Overvoltage: 5 times rated power with applied voltage not to exceed 1.5 times maximum continuous operating voltage for 5 seconds, ΔR ±(0.15 percent + 0.01 ohm) max.

Operating Temperature: -55°C to +175°C.

Temperature Coefficient:

Resistance Range	Temp. Coef.
Standard : 5 Ω and above	50 ppm/°C
Low : 1 Ω to 4.99 Ω	200 ppm/°C

Temperature Coefficient referenced to +25°C, ΔR taken at -15°C and +105°C.

Insulation Resistance: 10,000 Megohms, minimum.

Load Life: 1,000 hours at rated power at +125°C, ΔR ±(0.4 percent + 0.01 ohm) max.

Thermal Shock: Mil-Std-202, Method 107, Cond. B, ΔR ±(0.2 percent + 0.01 ohm) max.

Moisture Resistance: Mil-Std-202, Method 106, ΔR ±(0.5 percent + 0.01 ohm) max.

Type MK Precision Film Resistors - Extended Resistance Range

Model No.	Wattage	Max. Voltage	Oper. Temp. Max.	Dielect. Strength	TC ppm/°C	Resistance		Dimensions	Encapsulation	Leadwire
						Min.	Max.			
MK620	.50	200	175°C	300	80	2.01 Meg	40 Meg	Ref. Case "A" Dwg.	Transfer Molded	Tinned Copper
MK632	.75	400	175°C	400	80	5.01 Meg	100 Meg	Ref. Case "B" Dwg.	Transfer Molded	Tinned Copper

Resistance Tolerance: ±1% (consult factory for tighter tolerances).

Overload/Overvoltage: 1.5 times max. voltage for 5 seconds, ΔR 0.5% max.

Operating Temperature: -55°C to +175°C.

Temperature Coefficient: See Table for TC value. TC referenced to +25°C, ΔR taken at -15°C and +105°C.

Insulation Resistance: 10,000 Megohms, minimum.

Load Life: 1,000 hours at rated power, ΔR 0.5% max.

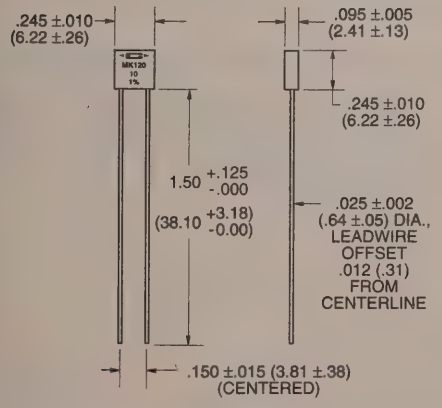
Thermal Shock: Mil-Std-202, Method 107, Cond. B, ΔR 0.5% max.

Moisture Resistance: Mil-Std-202, Method 106, ΔR 0.5% max.

Case "A"

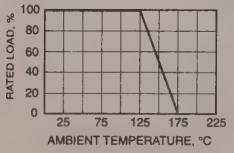
ALL DIMENSIONS IN INCHES AND (MILLIMETERS)

Model MK 120 and MK 620



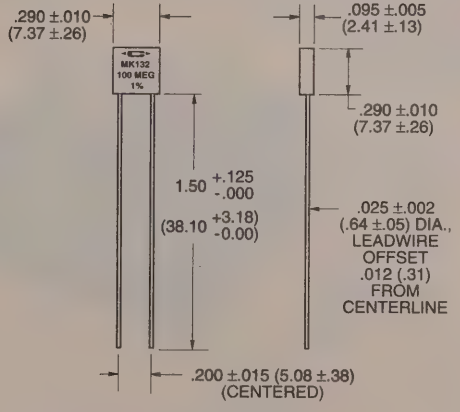
Measurement Note: Resistance measurement on low resistance values shall be made at a point within 0.2 inch (5.08 mm) of the body.

Derating Curve:



Case "B"

Model MK 132 and MK 632



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CADDOCK
ELECTRONICS, INCORPORATED

APPLICATIONS ENGINEERING
APPLIED SCIENCES DIVISION
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CADDOCK
HIGH PERFORMANCE FILM RESISTORS

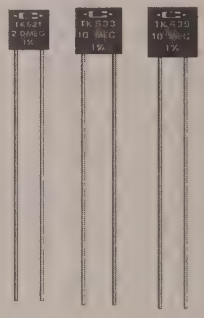
Type TK Low TC Precision Radial-Lead Film Resistors

Low TC of 5 ppm/°C, 10 ppm/°C or 20 ppm/°C and Resistance Range from 1Kohm to 10 Megs

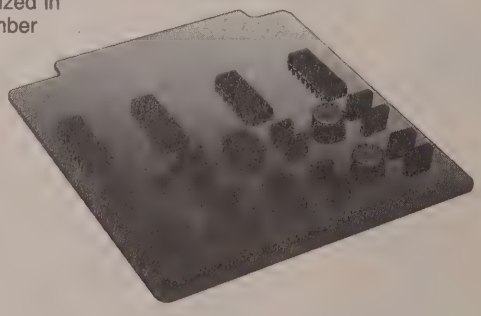
Caddock introduces a new design element for precision electronic circuitry - an advanced technology breakthrough that solves many critical circuit stability problems - the **Type TK Low TC Precision Radial-Lead Resistors with the Tetrinox® resistance system.**

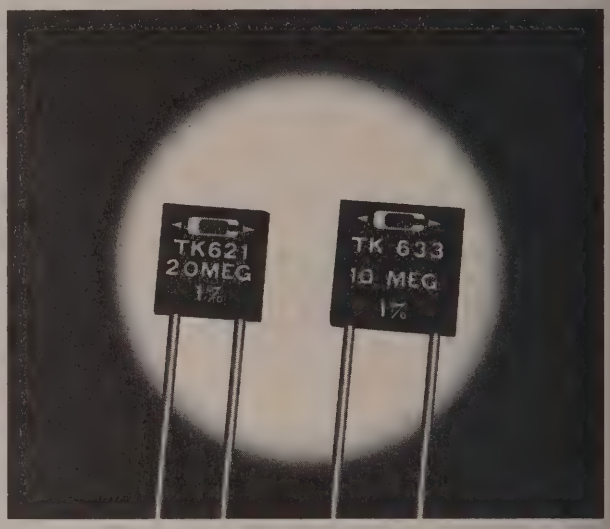
Type TK Low TC Precision Radial-Lead Film Resistors provide a combination of performance advantages never before available in a resistive component:

- **Low Temperature Coefficient** - better than 5 ppm/°C, 10 ppm/°C or 20 ppm/°C over the entire temperature range from -55°C to +125°C!
- **Long-Term Absolute Stability** - better than ±0.05% per 2,000 hours of operation.
- **Extended Resistance Range** - from 1,000 ohms to 10 Megohms.
- **Precision Tolerances** - ±1% is standard, and tolerances as close as ±0.05% are available.
- **Wide Operating Temperature Range** - from -55°C to +175°C.
- **Small Size** - with three miniature rectangular cases for maximum packaging density and minimum mounting area.
- **High Power Density** - with power ratings of .2 watt and .3 watt in molded cases, the largest of which is a standard CK06 package.



- **Caddock's Non-Inductive Performance** - provides faster settling times and minimum distortion in all types of high frequency circuits.
- **High Density Packaging** - the radial-lead mounting and small rectangular case of the Type TK resistors permit high packaging densities in low profile circuitry. Because the three models of the Type TK resistors are available in an exceptionally wide range of resistance values, lead spacing and mounting space can be standardized in a larger number of designs.





Building on over 20 years of experience with our unique complex oxide technology, Caddock has perfected the Tetrinox® resistance system - the first high resistance system to provide a TC that is well within 10 ppm/°C and that is also essentially linear over the entire temperature range from -55°C to +125°C.

The exceptional performance of Type TK resistors can achieve improvements in many circuit applications:

Low TC "Matched-Pair" Voltage Dividers Can be Assembled Without Pre-Selection of Resistors.

An important application for Type TK resistors is in "matched-pair" voltage dividers where the low 10 ppm/°C temperature coefficient provides ratio tracking of less than 20 ppm/°C without resistor pre-selection or special testing.

With factory selection, Type TK resistor pairs can be matched to within 1 ppm/°C.

Extended Resistance Range Reduces Power Requirements

Because the Type TK resistors provide resistance values as high as 10 Megohms - values that are up to 100 times higher than other types of ultra-low TC resistors - engineers can now design precision circuits with lower current drain and lower power requirements.

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Type TK Low TC Precision Radial-Lead Film Resistors

CADDOCK
HIGH PERFORMANCE FILM RESISTORS

Type TK Low TC Precision Radial-Lead Film Resistors - Standard Resistance Range

Model No.	Temperature Coefficient ppm/°C	Wattage @ +125°C	Max. Working Voltage	Dielect. Strength	Resistance Min.	Resistance Max.	Dimensions	Encapsulation	Leadwire
TK121	5, 10 or 20	.2	200	300	1 K	500 K	Ref. Case "A" Dwg.	Transfer Molded	Tinned Copper
TK133	5, 10 or 20	.3	300	400	1 K	1.5 Meg	Ref. Case "B" Dwg.	Transfer Molded	Tinned Copper
TK139	5, 10 or 20	.3	300	400	1 K	1.5 Meg	Ref. Case "C" Dwg.	Transfer Molded	Tinned Copper

Temperature Coefficient Identification:
5 ppm/°C Silver Dot
10 ppm/°C No Dot
20 ppm/°C Green Dot

Resistance Tolerance: ±1% (tolerances to ±0.05% on special order).

Operating Temperature: -55°C to +175°C.

TC Temperature Range: -55°C to +125°C.

Overload:* 6.25 times rated power for 5 seconds at voltage not to exceed 1.5 times maximum rated working voltage, ΔR less than 0.05%.

Thermal Shock: Mil-Std-202, Method 107, Cond. B, ΔR less than 0.05%.

Low Temperature Operation:* ΔR less than 0.02%.

Dielectric Withstanding Voltage:* ΔR less than 0.02%.

Moisture Resistance:* Mil-Std-202, Method 106, ΔR less than 0.02%.

Load Life:* 2,000 hours at +125°C, for 1K up to 300K ΔR less than 0.05%, above 300K ΔR less than 0.10%

Shelf Life (Typical): 25 ppm/year.

Insulation Resistance: 10,000 Megohms.

Vibration:* ΔR less than 0.01%.

Shock:* ΔR less than 0.02%.

* Test methods per specifications and procedures of Mil-R-55182/9.

Type TK Low TC Precision Radial-Lead Film Resistors - Extended Resistance Range

Model No.	Temperature Coefficient ppm/°C	Wattage @ +125°C	Max. Working Voltage	Dielect. Strength	Resistance Min.	Resistance Max.	Dimensions	Encapsulation	Leadwire
TK621	5, 10 or 20	Limited by Maximum Working Voltage	200	300	501 K	2 Meg	Ref. Case "A" Dwg.	Transfer Molded	Tinned Copper
TK633	5, 10 or 20		300	400	1.51 Meg	10 Meg	Ref. Case "B" Dwg.	Transfer Molded	Tinned Copper
TK639	5, 10 or 20		300	400	1.51 Meg	10 Meg	Ref. Case "C" Dwg.	Transfer Molded	Tinned Copper

Temperature Coefficient Identification:
5 ppm/°C Silver Dot
10 ppm/°C No Dot
20 ppm/°C Green Dot

Resistance Tolerance: ±1% (tolerances to ±0.05% on special order).

Operating Temperature: -55°C to +175°C.

TC Temperature Range: -55°C to +125°C.

Overload:* 1.5 times rated working voltage for 5 seconds, ΔR less than 0.2%.

Thermal Shock: Mil-Std-202, Method 107, Cond. B, ΔR less than 0.1%.

Low Temperature Operation:* ΔR less than 0.05%.

Dielectric Withstanding Voltage:* ΔR less than 0.05%.

Moisture Resistance:* Mil-Std-202, Method 106, ΔR less than 0.05%.

Load Life:* 2,000 hours at +125°C, ΔR less than 0.2%.

Shelf Life (Typical): 25 ppm/year.

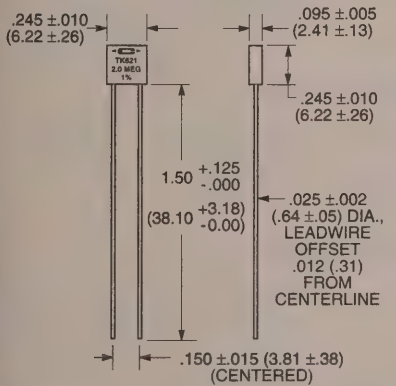
Insulation Resistance: 10,000 Megohms.

Vibration:* ΔR less than 0.05%.

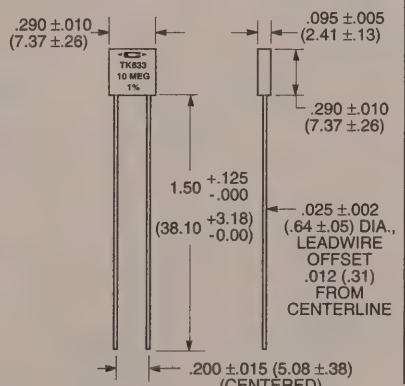
Shock:* ΔR less than 0.05%.

* Test methods per specifications and procedures of Mil-R-55182/9.

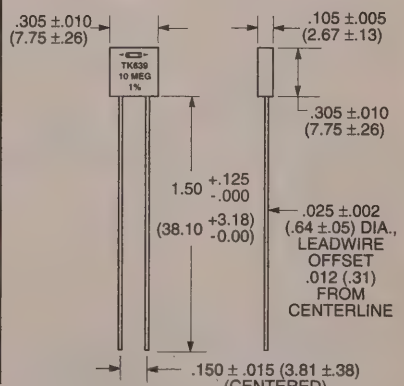
Case "A"
Model TK 121 and TK 621



Case "B"
Model TK 133 and TK 633



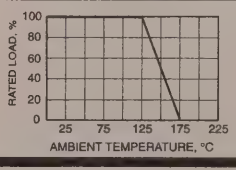
Case "C"
Model TK 139 and TK 639



Ordering Information

TK633 - 10 Meg - 0.1% - 10 ppm/°C
Model Number | Resistor Value | Tolerance | Temperature Coefficient

Derating Curve:



DIMENSIONS IN INCHES AND (MILLIMETERS)

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CADDOCK
HIGH PERFORMANCE FILM RESISTORS

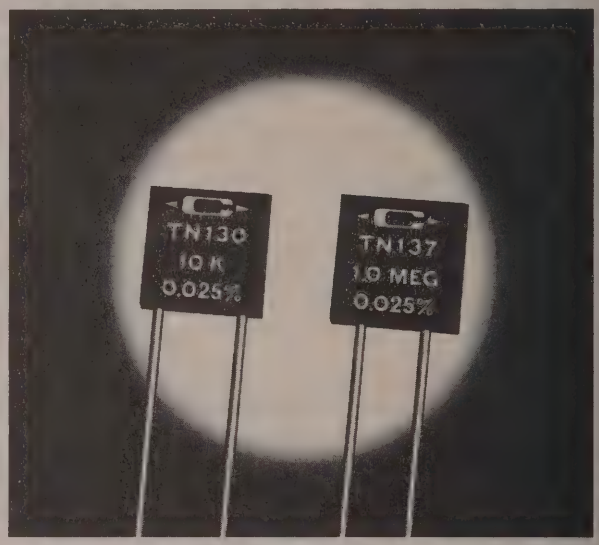
Type TN Lab Grade Low TC Precision Film Resistors

Low TC of 5 ppm/°C, 10 ppm/°C or 20 ppm/°C from 0°C to 70°C
Tolerance of ±0.025%, ±0.05%, ±0.1% to ±1%, Values from 1 Kohm to 1 Meg

Type TN Lab Grade Low TC Film Resistors were specifically developed for use in 0°C to +70°C applications which require a low temperature coefficient and a high degree of precision. These resistors combine the outstanding characteristics of Caddock's Tetrinox® resistance system with a space efficient, non-inductive, radial-lead design. These resistors are intended for precision analog designs where the system is not exposed to full military or space grade operating conditions. For full military or space grade operating conditions, we recommend Caddock's **Type TK Low TC Precision Radial-Lead Film Resistors.** For lab grade applications which require higher voltage ratings (up to 1,400 volts) and power ratings (up to 0.75 watt), we recommend Caddock's **Type TF Low TC Ultra-Precision Film Resistors**.

The performance features of the Type TN Lab Grade Low TC Precision Film Resistors are:

- **Low Temperature Coefficient** - 5, 10 or 20 ppm/°C.
- **Ultra-Precision** - 6 standard tolerances from ±0.025% to ±1%.
- **Resistance Range** - from 1 Kohm to 1 Megohm.
- **Non-Inductive Design**.
- **Radial-Lead Design** - conserves board space.



Type TN Lab Grade Low TC Precision Film Resistors

Model No.	Temperature Coefficient ppm/°C	Wattage @ +70°C	Max. Working Voltage	Dielect. Strength	Resistance Min.	Resistance Max.	Dimensions
TN130	5, 10 or 20	.3	200	400	1 K	1 Meg	Ref. Case "A" Dwg.
TN137	5, 10 or 20	.3	200	400	1 K	1 Meg	Ref. Case "B" Dwg.

Temperature Coefficient Identification:
5 ppm/°C Silver Dot
10 ppm/°C No Dot
20 ppm/°C Green Dot

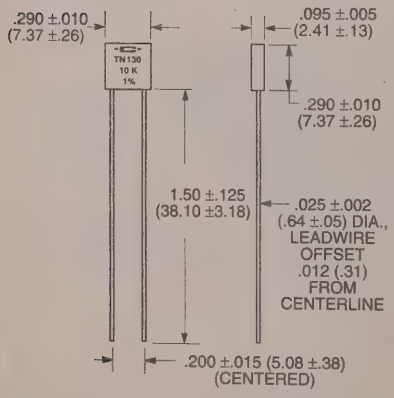
Ordering Information:

TN130 - 10 K - 0.025% - 10 ppm/°C

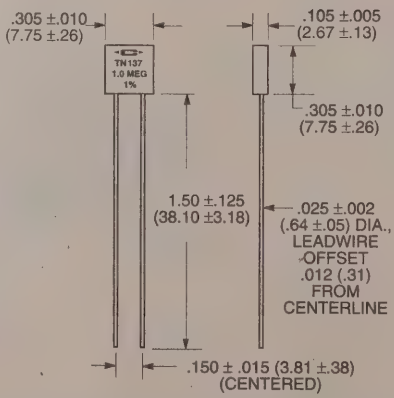
Model Number | Resistor Value | Tolerance | Temperature Coefficient

ALL DIMENSIONS IN INCHES AND (MILLIMETERS)

Case "A"
Model TN 130



Case "B"
Model TN 137

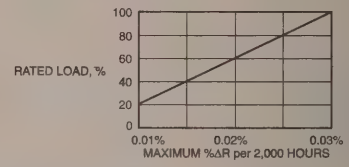


Specifications:

Resistance Tolerance: ±0.025%, ±0.05%, ±0.10%, ±0.25%, ±0.50% or ±1.0%.

Absolute Temperature Coefficient: 5ppm/°C, 10ppm/°C or 20ppm/°C referenced 25°C, ΔR taken at 0°C and +70°C.

Load Stability at +70°C:



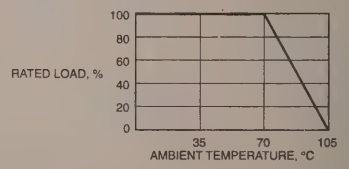
Shelf Life (Typical): 25 ppm/year.

Storage Temperature: -55°C to +105°C.

Encapsulation: Transfer Molded.

Leadwire: Tinned Copper.

Derating Curve:



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Type TF Low TC Ultra-Precision Film Resistors

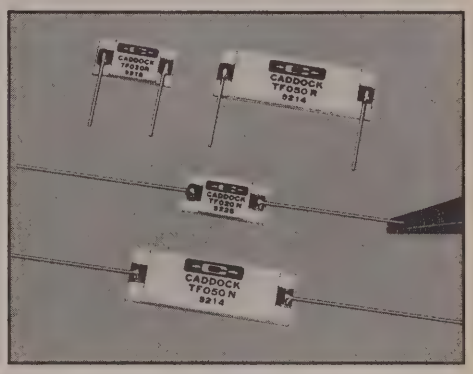
CADDOCK
HIGH PERFORMANCE FILM RESISTORS

Absolute TC to 5 ppm/°C, Values from 1 Kohm to 125 Megohms, Absolute Tolerance to ±0.01%

Type TF precision resistors employ the Caddock Tetrinox® resistance films - the resistance system that sets a new standard for high value, ultra-stable precision resistors that provide an exceptional combination of performance characteristics:

- **Ultra-Precision** - Seven standard resistance tolerances from ±1% to ±0.01%.
- **A Wide Range of Resistance Values** - from 1 Kohm to 125 Megohms.
- **Low Temperature Coefficient** - 5 ppm/°C, 10 ppm/°C or 15 ppm/°C.
- **Long-Term Stability** - to 0.01% per 1,000 hours.

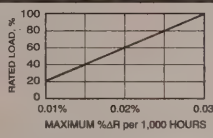
This completely new approach to quantity production of ultra-precision resistors is the result of combining our unique complex oxide technology with an advanced high thru-put laser manufacturing capability.



Type TF - Standard Resistance Range - 1 Kohm to 10 Megohms

Model Number		Wattage @ +70°C	Maximum Continuous Oper. Voltage	Resistance		Dimensions inches (mm)	
Axial Leads	Radial Leads			Min.	Max.	A	B
TF020N	TF020R	.33	300	1 K	2 Meg	.750 ±.020 (19.05 ±.51)	.375 ±.020 (9.53 ±.51)
TF050N	TF050R	.75	1,400	10 K	10 Meg	1.500 ±.020 (38.10 ±.51)	.500 ±.020 (12.70 ±.51)

Load Stability:



Shelf Life: Typically 0.005% per year

Type TF - Extended Resistance Range - 2 Megohms to 125 Megohms

Model Number		Wattage @ +70°C	Maximum Continuous Oper. Voltage	Resistance		Dimensions inches (mm)	
Axial Leads	Radial Leads			Min.	Max.	A	B
TF626N	TF626R	.33	300	2.01 Meg	35 Meg	.750 ±.020 (19.05 ±.51)	.375 ±.020 (9.53 ±.51)
TF656N	TF656R	.75	1,400	10.01 Meg	125 Meg	1.500 ±.020 (38.10 ±.51)	.500 ±.020 (12.70 ±.51)

Load Stability: 1,000 hours at rated voltage at +70°C, maximum ΔR 0.03%

Shelf Life: Typically 0.010% per year

Specifications:

Apply to all Type TF resistor models

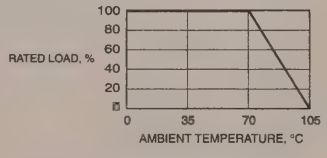
Absolute Temperature Coefficient: 5 ppm/°C, 10 ppm/°C or 15 ppm/°C referenced to 25°C, ΔR taken at -15°C and +105°C.

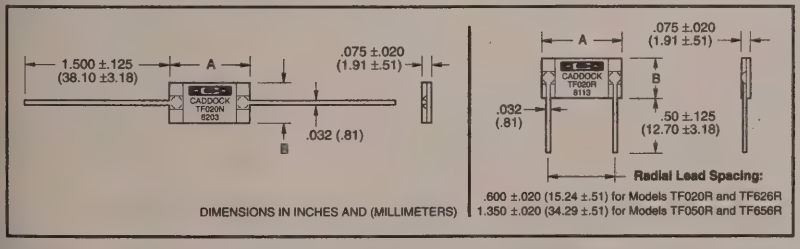
Resistance Tolerance: ±0.01%, ±0.025%, ±0.05%, ±0.10%, ±0.25%, ±0.50% or ±1.0%.

Storage Temperature: -55°C to +105°C.

Leadwire: Tinned Copper.

Derating Curve:




1.500 ±.125 (38.10 ±3.18)
A
.075 ±.020 (1.91 ±.51)
B
.032 (.81)
.032 (.81)
.50 ±.125 (12.70 ±3.18)
Radial Lead Spacing:
.600 ±.020 (15.24 ±.51) for Models TF020R and TF626R
1.350 ±.020 (34.29 ±.51) for Models TF050R and TF656R
DIMENSIONS IN INCHES AND (MILLIMETERS)

Ordering Information

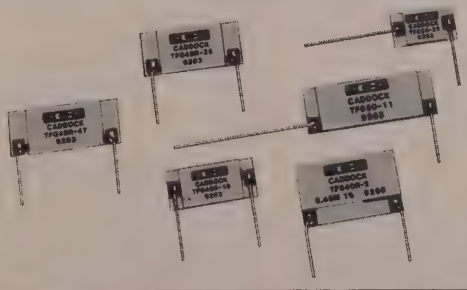
TF050R - 10 Meg - 0.01% - 10 ppm/°C

Model Number | Resistor Value | Tolerance | Temperature Coefficient

Custom Type TF Resistors

Additional cost savings can be realized when your high volume ultra-precision Type TF resistor is optimized for:

- Voltage rating
- Power rating
- Mechanical configuration
- Ratio matched sets



And for special requirements, custom Type TF resistors are available with:

- TC of 5 ppm/°C, 10 ppm/°C, 15 ppm/°C, 20 ppm/°C or 25 ppm/°C.
- Shelf stability of 0.0025% per year.

Type TF resistors can also be produced with custom-spaced radial leads that will plug directly into your existing circuit layout.

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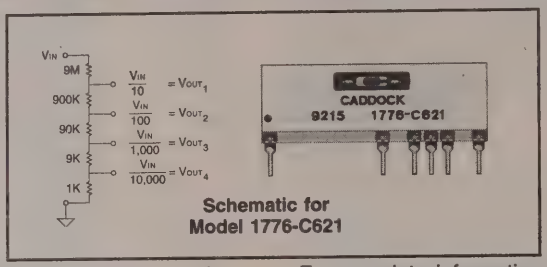
CADDOCK
HIGH PERFORMANCE FILM RESISTORS

Type 1776 Precision Decade Resistor Voltage Dividers

Input Voltage Dividers for Digital Multimeters and Range-Switching Instruments

The exceptional performance of this extensive family of Type 1776 Precision Decade Resistor Voltage Dividers has been achieved through the special combination of advantages provided by Caddock's Tetrinox® resistance films. This advanced film resistor technology provides the performance characteristics required by the precision input signal circuits of both bench-type and laboratory digital instruments.

In addition to requiring less board space, these compact precision resistor networks deliver higher performance than selected discrete resistor sets and thin-film networks.



Schematic for Model 1776-C621

There are now 39 standard models in the expanded family of Type 1776 precision resistor networks that include -

- 3, 4 and 5 - decade voltage dividers with ratios from 10:1 to 10,000:1.
- 1,200 volts continuous ratings and overvoltage to 2,000 volts.
- Many combinations of Ratio and Absolute Tolerance, and Ratio and Absolute Temperature Coefficient.

For complete information on quantity price and delivery, call or write our Sales Office.

Model No.	Resistance Values					Fig.	Voltage Rating ⑦	Absolute Tolerance %	Ratio Tolerance % ①	Absolute TC ppm/°C	Ratio TC ppm/°C ②	Voltage Coefficient of Ratio ppm/volt ③	Ratio Stability % Change in Ratio		
	R1	R2	R3	R4	R5								Load Life ④	Shelf Life ⑤	Over-Voltage ⑥
1776-C61	9 Meg	900 K	90 K	9 K	900	6	1200	0.1	0.1	30	10	0.1	0.01	0.005	0.01
1776-C611	9 Meg	900 K	90 K	9 K	900	6	1200	0.1	0.05	30	10	0.1	0.01	0.005	0.01
1776-C6117	9 Meg	900 K	90 K	9 K	900	6	1200	0.1	0.02	30	10	0.1	0.01	0.005	0.01
1776-C62	9 Meg	900 K	90 K	9 K	1 K	6	1200	0.1	0.1	30	10	0.1	0.01	0.005	0.01
1776-C621	9 Meg	900 K	90 K	9 K	1 K	6	1200	0.1	0.05	30	10	0.1	0.01	0.005	0.01
1776-C6217	9 Meg	900 K	90 K	9 K	1 K	6	1200	0.1	0.02	30	10	0.1	0.01	0.005	0.01
1776-C732	9 Meg	900 K	90 K	9 K	900	7	1200	0.25	0.25	50	50	0.5	0.04	0.02	0.04
1776-C73	9 Meg	900 K	90 K	9 K	900	7	1200	0.1	0.1	50	50	0.5	0.04	0.02	0.04
1776-C742	9 Meg	900 K	90 K	9 K	1 K	7	1200	0.25	0.25	50	50	0.5	0.04	0.02	0.04
1776-C74	9 Meg	900 K	90 K	9 K	1 K	7	1200	0.1	0.1	50	50	0.5	0.04	0.02	0.04
1776-232	9 Meg	900 K	90 K	9 K	900	3	1200	0.25	0.25	50	50	0.3	0.04	0.02	0.04
1776-23	9 Meg	900 K	90 K	9 K	900	3	1200	0.1	0.1	50	50	0.2	0.02	0.01	0.02
1776-231	9 Meg	900 K	90 K	9 K	900	3	1200	0.1	0.05	50	50	0.2	0.02	0.01	0.02
1776-242	9 Meg	900 K	90 K	9 K	1 K	3	1200	0.25	0.25	50	50	0.3	0.04	0.02	0.04
1776-24	9 Meg	900 K	90 K	9 K	1 K	3	1200	0.25	0.1	50	50	0.2	0.02	0.01	0.02
1776-241	9 Meg	900 K	90 K	9 K	1 K	3	1200	0.25	0.05	50	50	0.2	0.02	0.01	0.02
1776-10	9 Meg	900 K	90 K	10 K	N/A	4	1200	+0, -0.5	0.1	30	10	0.02	0.01	0.005	0.01
1776-105	9 Meg	900 K	90 K	10 K	N/A	4	1200	+0, -0.5	0.1	30	5	0.02	0.01	0.005	0.01
1776-C10	9 Meg	900 K	90 K	10 K	N/A	9	1200	+0, -0.5	0.1	30	10	0.02	0.01	0.005	0.01
1776-C105	9 Meg	900 K	90 K	10 K	N/A	9	1200	+0, -0.5	0.1	30	5	0.02	0.01	0.005	0.01
1776-1	9 Meg	900 K	90 K	10 K	N/A	2	1200	0.25	0.05	30	10	0.02	0.01	0.005	0.01
1776-14	9 Meg	900 K	90 K	10 K	N/A	2	1200	0.25	0.1	30	10	0.02	0.01	0.005	0.01
1776-8	9 9 Meg	90 K	10 K	N/A	N/A	1	1200	0.25	0.1	30	25	0.2	0.02	0.01	0.02
1776-81	9.9 Meg	90 K	10 K	N/A	N/A	1	1200	0.25	0.05	30	25	0.2	0.02	0.01	0.02
1776-9	9.9 Meg	90 K	10 K	N/A	N/A	1	1200	0.25	0.1	30	10	0.02	0.01	0.005	0.01
1776-91	9.9 Meg	90 K	10 K	N/A	N/A	1	1200	0.25	0.05	30	10	0.02	0.01	0.005	0.01
1776-912	9.9 Meg	90 K	10 K	N/A	N/A	1	1200	0.25	0.02	30	5	0.02	0.01	0.005	0.01
1776-C4	10 Meg	1 1111M	101.01K	10.01K	1.0001K	8	1200	0.25	0.25	30	10	0.1	0.01	0.005	0.01
1776-C44	10 Meg	1.1111M	101.01K	10.01K	1.0001K	8	1200	0.1	0.1	30	10	0.1	0.01	0.005	0.01
1776-C441	10 Meg	1.1111M	101.01K	10.01K	1.0001K	8	1200	0.1	0.05	30	10	0.1	0.01	0.005	0.01
1776-C4417	10 Meg	1.1111M	101.01K	10.01K	1.0001K	8	1200	0.1	0.02	30	10	0.1	0.01	0.005	0.01
1776-C3	10 Meg	1.1111M	101.01K	10.01K	1.0001K	8	1200	0.5	0.5	50	50	0.5	0.04	0.02	0.04
1776-C34	10 Meg	1 1111M	101.01K	10.01K	1.0001K	8	1200	0.25	0.25	50	50	0.5	0.04	0.02	0.04
1776-C532	900 K	90 K	9 K	900	N/A	5	750	0.25	0.25	25	25	0.4	0.02	0.01	0.02
1776-C53	900 K	90 K	9 K	900	N/A	5	750	0.1	0.1	25	15	0.3	0.02	0.01	0.02
1776-C531	900 K	90 K	9 K	900	N/A	5	750	0.1	0.05	25	15	0.3	0.02	0.01	0.02
1776-C542	900 K	90 K	9 K	1 K	N/A	5	750	0.25	0.25	25	25	0.4	0.02	0.01	0.02
1776-C54	900 K	90 K	9 K	1 K	N/A	5	750	0.1	0.1	25	15	0.3	0.02	0.01	0.02
1776-C541	900 K	90 K	9 K	1 K	N/A	5	750	0.1	0.05	25	15	0.3	0.02	0.01	0.02

Specifications:

(Numbers inside circles reference columns in Model No. table)

① **Ratio Tolerance:** Maximum ratio difference between two resistors in the network. (See the specific Figures for the Ratio Definition).

② **Ratio Temperature Coefficient:** Ratio track from 0°C to +70°C.

③ **Voltage Coefficient of Ratio (ppm/volt):** R1 in series with any combination of R2, R3, R4 and R5, 100 volts to rated voltage.

④ **Load Life:** Ratio stability of resistance under full load, rated voltage applied to R1 in series with any combination of R2, R3, R4 and R5.

⑤ **Shelf Stability of Ratio:** Six months at shelf conditions.

⑥ **Overvoltage:** Maximum voltage of 1.67 times rated DC voltage. Volts DC or peak AC applied to R1 and any combination of R2, R3, R4 and R5 in series with R1 for 10 seconds.

⑦ **Voltage Rating:** DC or RMS AC voltage applied to R1 in series with any combination of R2, R3, R4 and R5.

Storage Temperature: -55°C to +85°C.

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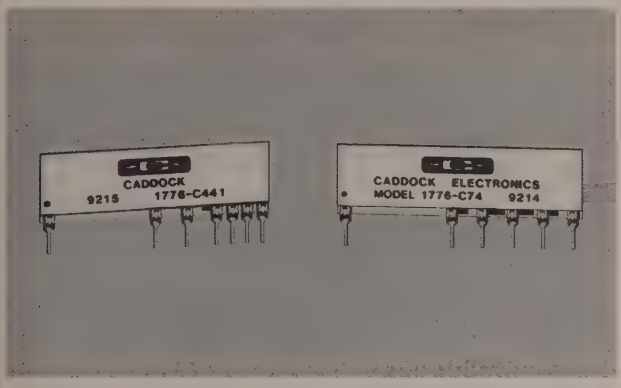
Type 1776 Precision Decade Resistor Voltage Dividers

CADDOCK
HIGH PERFORMANCE FILM RESISTORS



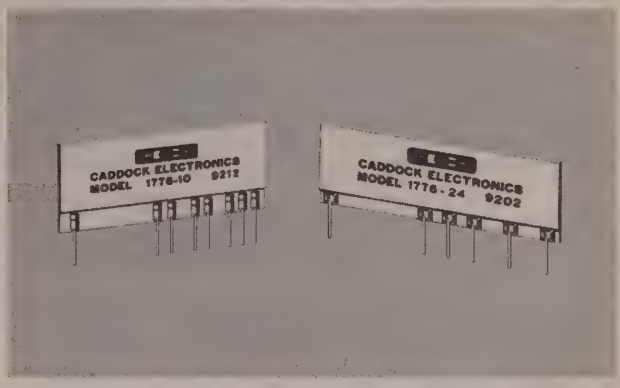
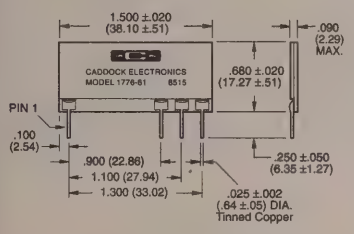


Figure 1



RATIO DEFINITION:
ALL RESISTORS RATIO ONE ANOTHER

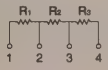
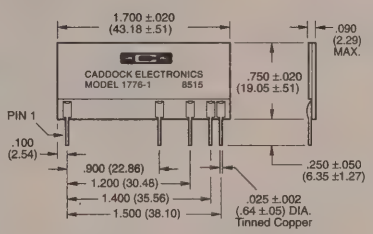
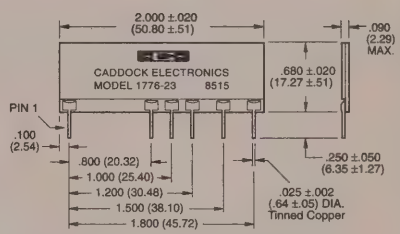


Figure 2



RATIO DEFINITION:
ALL RESISTORS RATIO ONE ANOTHER

Figure 3



RATIO DEFINITION:
ALL RESISTORS RATIO ONE ANOTHER

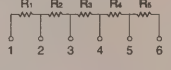
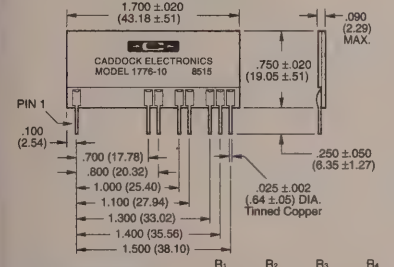


Figure 4



RATIO DEFINITION:
ALL RESISTORS RATIO ONE ANOTHER

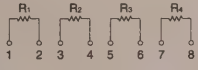
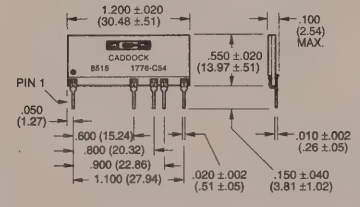


Figure 5



RATIO DEFINITION:
ALL RESISTORS RATIO ONE ANOTHER

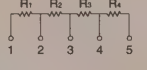
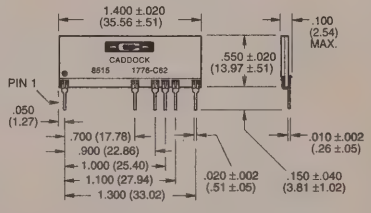


Figure 6



RATIO DEFINITION: Where $R_T = R_1 + R_2 + R_3 + R_4 + R_5$
RATIO 1 $(R_2 + R_3 + R_4 + R_5):R_T$
RATIO 2 $(R_3 + R_4 + R_5):R_T$
RATIO 3 $(R_4 + R_5):R_T$
RATIO 4 $(R_5):R_T$

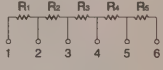
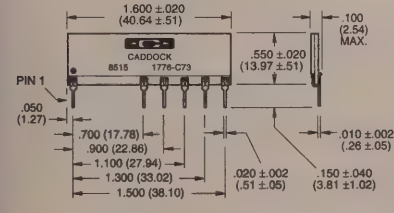


Figure 7



RATIO DEFINITION:
ALL RESISTORS RATIO ONE ANOTHER

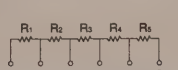
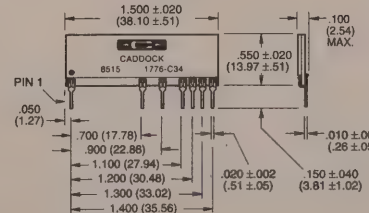


Figure 8



RATIO DEFINITION:
RATIO 1 $R_1:R_2$
RATIO 2 $R_1:R_3$
RATIO 3 $R_1:R_4$
RATIO 4 $R_1:R_5$

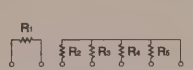
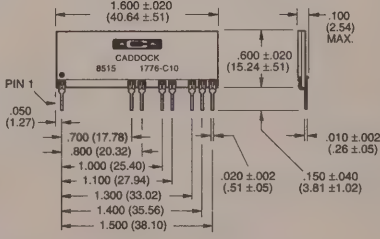
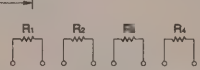


Figure 9



RATIO DEFINITION:
ALL RESISTORS RATIO ONE ANOTHER



DIMENSIONS IN INCHES AND (MILLIMETERS)

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CADDOCK
HIGH PERFORMANCE FILM RESISTORS

Type 1787 Current Shunt Resistor Networks

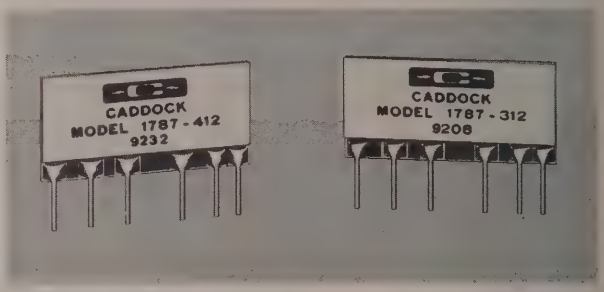
Accurate Current Sensing in Multi-Range Instrumentation

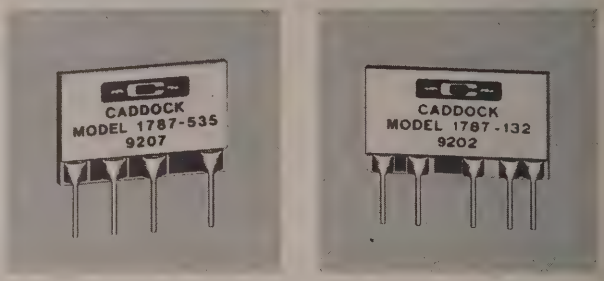
Type 1787 Current Shunt Resistor Networks utilize Caddock's Micronox® resistance films and advanced high thru-put laser manufacturing capabilities to achieve many vital advantages in precision current measurement circuits, including laboratory and bench-type digital instrumentation:

- The thin-profile single-package configuration replaces as many as four discrete current shunt resistors.
- The monolithic construction and standardized lead spacing simplify installation.
- Caddock Micronox® resistance films provide exceptional stability for improved long-term measurement accuracy.

Twelve standard models in five network arrangements provide the specific accuracy and resistance values required for a wide range of current measuring instruments and circuits.

Prototype quantities of most models of the Type 1787 Current Shunt Resistor Networks are available either from stock or within 6 weeks after receipt of order.





Model No.	Resistance Values				Power Rating Watts				Max. Power Rating Watts Total Pkg.	Fig.	Absolute Tolerance % ①	Maximum Absolute TC ppm/°C ②	Absolute Stability Max. % Change in Resistance Value	
	R_A	R_B	R_C	R_D	R_A	R_B	R_C	R_D					Load Life ③	Shelf Life ④
1787-31	999.9 Ω	99.9 Ω	9.9 Ω	0.9 Ω	0.25	0.25	0.50	1.0	1.0	1	0.25	80	0.05	0.03
1787-312	999.9 Ω	99.9 Ω	9.9 Ω	0.9 Ω	0.25	0.25	0.50	1.0	1.0	1	0.10	80	0.03	0.02
1787-41	1,000 Ω	100 Ω	10 Ω	1 Ω	0.25	0.25	0.50	1.0	1.0	2	0.25	80	0.05	0.03
1787-412	1,000 Ω	100 Ω	10 Ω	1 Ω	0.25	0.25	0.50	1.0	1.0	2	0.10	80	0.03	0.02
1787-5	999 Ω	99 Ω	9 Ω	N/A	0.25	0.25	0.75	N/A	0.75	3	0.25	50	0.04	0.02
1787-53	999 Ω	99 Ω	9 Ω	N/A	0.25	0.25	0.75	N/A	0.75	3	0.10	50	0.02	0.01
1787-535	999 Ω	99 Ω	9 Ω	N/A	0.25	0.25	0.75	N/A	0.75	3	0.05	50	0.02	0.01
1787-6	1,000 Ω	100 Ω	10 Ω	N/A	0.25	0.25	0.75	N/A	0.75	4	0.25	50	0.04	0.02
1787-64	1,000 Ω	100 Ω	10 Ω	N/A	0.25	0.25	0.75	N/A	0.75	4	0.10	50	0.02	0.01
1787-645	1,000 Ω	100 Ω	10 Ω	N/A	0.25	0.25	0.75	N/A	0.75	4	0.05	50	0.02	0.01
1787-13	99.9 Ω	9.9 Ω	0.9 Ω	N/A	0.25	0.50	1.0	N/A	1.0	5	0.25	100	0.05	0.03
1787-132	99.9 Ω	9.9 Ω	0.9 Ω	N/A	0.25	0.50	1.0	N/A	1.0	5	0.10	100	0.03	0.02

① **Absolute Tolerance:** Tolerance of R_A, R_B, R_C or R_D when measured in accordance with proper Figure No.

② **Absolute Temperature Coefficient:** Temperature coefficient of R_A, R_B, R_C or R_D from 0°C to +70°C, referenced to +25°C.

③ **Load Life:** Stability of R_A, R_B, R_C or R_D with full power applied individually for 2,000 hours at +70°C.

④ **Shelf Life:** Stability of R_A, R_B, R_C or R_D for six months at shelf conditions.

Storage Temperature: -55°C to +85°C.

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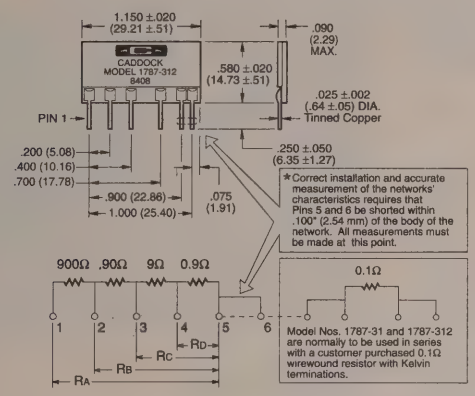
Type 1787 Current Shunt Resistor Networks

CADDOCK
HIGH PERFORMANCE FILM RESISTORS

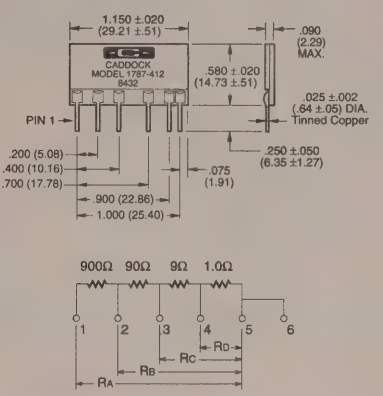
Figure 1 - Model Nos. 1787-31 and 1787-312



Model Nos. 1787-31 and 1787-312 Measurement Connections

Resistances		Kelvin Connections			
"R"	Total Value	Sense Lead P_1	Current Lead C_1	Current Lead C_2	Sense Lead P_2
R_A	999.9 Ω	Pin 1	Pin 1	Pin 5 *	Pin 6 *
R_B	99.9 Ω	Pin 1	Pin 2	Pin 5 *	Pin 6 *
R_C	9.9 Ω	Pin 1	Pin 3	Pin 5 *	Pin 6 *
R_D	0.9 Ω	Pin 1	Pin 4	Pin 5 *	Pin 6 *

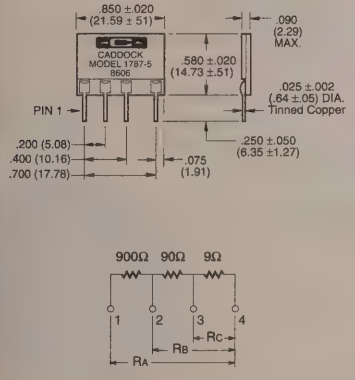
Figure 2 - Model Nos. 1787-41 and 1787-412



Model Nos. 1787-41 and 1787-412 Measurement Connections

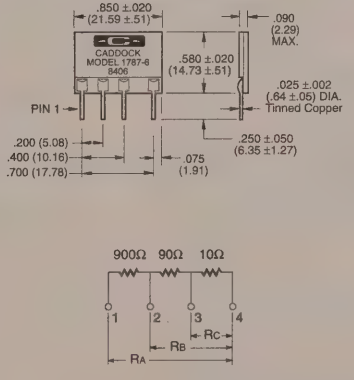
Resistances		Kelvin Connections			
"R"	Total Value	Sense Lead P_1	Current Lead C_1	Current Lead C_2	Sense Lead P_2
R_A	1,000 Ω	Pin 1	Pin 1	Pin 5	Pin 6
R_B	100 Ω	Pin 1	Pin 2	Pin 5	Pin 6
R_C	10 Ω	Pin 1	Pin 3	Pin 5	Pin 6
R_D	1 Ω	Pin 1	Pin 4	Pin 5	Pin 6

Figure 3 - Model Nos. 1787-5, 1787-53 and 1787-535



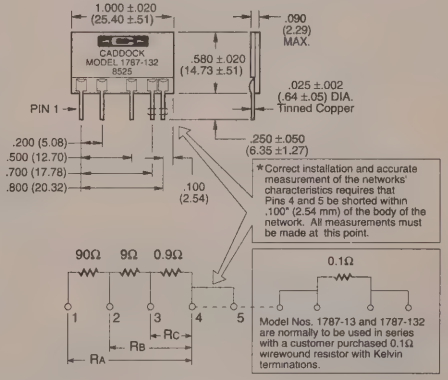
Resistances	
"R"	Total Value
R_A	999 Ω
R_B	99 Ω
R_C	9 Ω

Figure 4 - Model Nos. 1787-6, 1787-64 and 1787-645



Resistances	
"R"	Total Value
R_A	1,000 Ω
R_B	100 Ω
R_C	10 Ω

Figure 5 - Model Nos. 1787-13 and 1787-132



Model Nos. 1787-13 and 1787-132 Measurement Connections

Resistances		Kelvin Connections			
"R"	Total Value	Sense Lead P_1	Current Lead C_1	Current Lead C_2	Sense Lead P_2
R_A	99.9 Ω	Pin 1	Pin 1	Pin 4 *	Pin 5 *
R_B	9.9 Ω	Pin 1	Pin 2	Pin 4 *	Pin 5 *
R_C	0.9 Ω	Pin 1	Pin 3	Pin 4 *	Pin 5 *

DIMENSIONS IN INCHES AND (MILLIMETERS)

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CADDOCK
ELECTRONICS, INCORPORATED

APPLICATIONS ENGINEERING
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CADDOCK
HIGH PERFORMANCE FILM RESISTORS

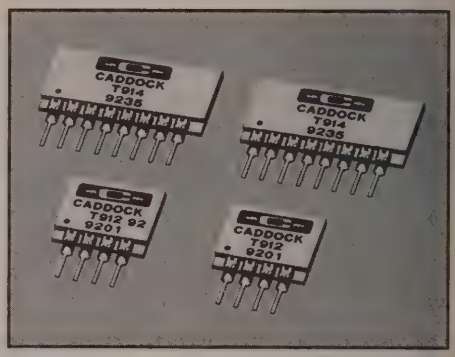
Type T912 and T914 Precision Resistor Networks

Resistor Pairs and Quads with Ratio Characteristics for Precision Analog Circuits

Type T912 and T914 Precision Resistor Networks are constructed with Caddock Tetrinox® resistance films to achieve the precise ratio performance and stability required by highly accurate amplifier circuits, voltage reference circuits and precision bridge circuits.

- **Ratio Tolerance** - from ±0.1% to ±0.01%.
- **Ratio Temperature Coefficient** - 10 ppm/°C, 5ppm/°C or 2 ppm/°C.
- **Absolute Temperature Coefficient** - 25 ppm/°C.
- **Ratio Stability of Resistance at Full Load for 2,000 hours** - within ±0.01%.
- **Shelf Life Stability of Ratio for 6 Months** - within ±0.005%.

Both the T912 and the T914 are available in 14 standard resistance values between 1,000 ohms and 1 Megohm. Caddock's high thru-put manufacturing capability assures that prototype and large-volume production quantities are available either from stock or within 6 weeks after receipt of order.



Standard Type T912 and Type T914 Precision Resistor Networks

In addition to the 14 standard **equal value** models of the Type T912 and T914, the Type T912 can also be ordered with -

- **10:1 Resistance Ratio** - for use in amplifier gain-setting.
- **9:1 Resistance Ratio** - for use in voltage reference dividers.

Ordering Information: T912 - A 10K - 010 - 02

Model Number

Ratio Code Letter: *

A - T912 with R_1: R_2 where $R_2 = 10R_1$

1K:10K	10K:100K	40K:400K
2K:20K	20K:200K	50K:500K
5K:50K	25K:250K	100K:1 Meg

B - T912 with R_1: R_2 where $R_2 = 9R_1$

1K:9K	10K:90K	40K:360K
2K:18K	20K:180K	50K:450K
5K:45K	25K:225K	100K:900K

No Letter - T912 with $R_1 = R_2$

No Letter - T914 with $R_1 = R_2 = R_3 = R_4$

Standard Resistance Values: * (R_1)

1K	10K	40K	200K	500K
2K	20K	50K	250K	1 Meg
5K	25K	100K	400K	

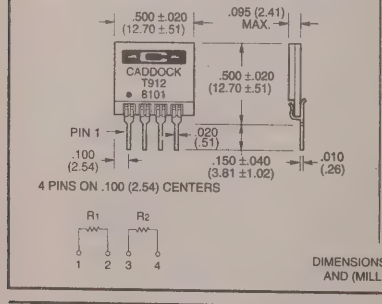
Special or mixed resistance values are available as custom networks. See the custom section at the bottom of this page.

Ratio Tolerance: * -100 = 0.1% -020 = 0.02% -050 = 0.05% -010 = 0.01%

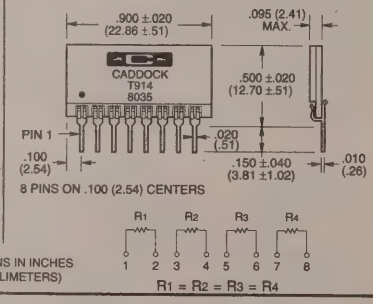
Ratio Temperature Track (0°C to 70°C): * -10 = 10 ppm/°C -05 = 5 ppm/°C -02 = 2 ppm/°C

* (This information appears on the back side of the network)

Type T912
Ratios Available: 1:1, 9:1, 10:1 and Custom.



Type T914
Ratios Available: 1:1 and Custom.



DIMENSIONS IN INCHES AND (MILLIMETERS)

R1 = R2 = R3 = R4

Specifications:

Absolute Tolerance: ±0.1% for all resistors.

Absolute Temperature Coefficient: ±25 ppm/°C referenced to 25°C, ΔR taken at 0°C and 70°C.

Voltage Rating: 30 volts DC or RMS AC applied to R_1, R_2, R_3 and R_4.

Power Rating: 0.10 watt applied to R_1, R_2, R_3 and R_4 (not to exceed rated voltage).

Package Power Rating: Type T912, 0.200 watt. Type T914, 0.400 watt.

Storage Temperature: -55°C to +105°C.

Insulation Resistance Between Isolated Pins: Pin 2 to Pin 3, Pin 4 to Pin 5, or Pin 6 to Pin 7, 1,000 Megohms, minimum.

Dielectric Strength Between Isolated Pins: 50 volts RMS AC.

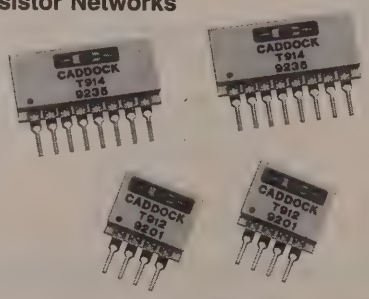
Ratio Stability Under Load: Ratio change between any two resistors in the network under full load for 2,000 hours at 70°C, 0.01% maximum.

Shelf Stability of Ratio: Six months at shelf conditions, 50 ppm maximum.

Custom Model T912 and T914 Precision Resistor Networks

For applications requiring non-standard resistance values, the T912 and T914 custom configurations can include these special features:

- Mixed resistance values with a maximum ratio of 250-to-1. (Example: 1.0 Megohm and 4 K)
- Absolute TC as low as 15 ppm/°C.
- Ratio TC as low as 2 ppm/°C.
- Custom voltage ratings.
- Matched resistors of any special value between 1 K and 2 Megohms.



Call or write our Applications Engineering for performance, price and availability of these custom resistor networks.

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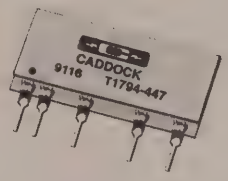
Precision Resistor Networks Overview

CADDOCK
HIGH PERFORMANCE FILM RESISTORS

Custom Precision SIP Resistor Networks Engineered to your Application...Fast

FAST Custom Precision Networks within 8 weeks

- Resistance Values from 100 ohms to 50 Meg
- Absolute Tolerance from ±0.025% to ±0.25%
- Ratio Tolerance as tight as 0.01%
- Absolute TC of 15 ppm, 25 ppm or 50 ppm/°C
- Ratio TC of 5 ppm, 10 ppm, 25 ppm or 50 ppm/°C



Standard Precision SIP Resistor Networks

For Precision Analog Designs

Type T912 Two Resistor Networks
Type T914 Four Resistor Networks

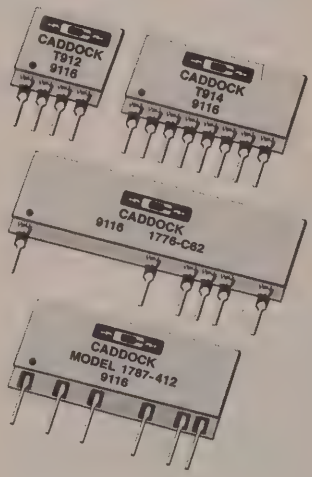
- **Ratio Tolerance 0.01%** to 0.10%
- **Ratio TC 2 ppm**, 5 ppm or 10 ppm/°C

Type 1776 Decade Voltage Dividers

- Ratios of 10:1, 100:1, 1000:1 and 10000:1
- Ratio Tolerance 0.02%, 0.05%, 0.10% to 0.50%
- Ratio TC 5 ppm, 10 ppm, 25 ppm or 50 ppm/°C
- 1200V Input Voltage Rating

Type 1787 Current Shunts

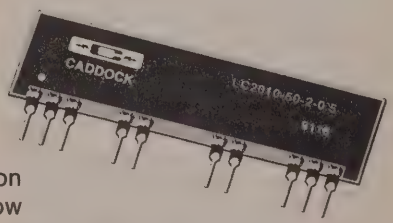
- Resistance Values from 0.9 ohm to 100 ohms
- 0.1Ω Available in a Custom Network
- Absolute Tolerance from ±0.05% to ±0.25%
- Absolute TC of 25 ppm to 100 ppm/°C

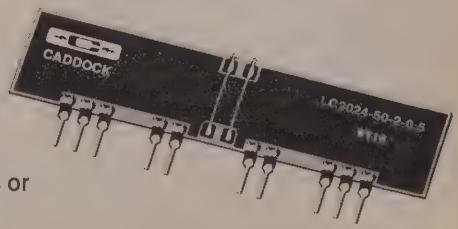


Transient Tolerant Precision SIP Networks

For Telecom Applications and Voltage / Power Monitoring Applications

- Lightning Transient Handling while maintaining Precision Tolerance.
- Quick Fail-Safe Performance when exposed to Cold Start Voltages of 120 VAC, 240 VAC or 600 VAC. Protects Telephone System Wiring from damage or ignition.
- Available with Thermal Cut Off Protection mounted on the Resistor Network substrate. When excessive Low Voltage Power Cross causes excessive heating in the Resistor Network, the Thermal Cut Off opens the circuit and protects the circuit board from heat damage or ignition.
- Resistance: 50Ω Pair, 100Ω Pair, 150Ω Pair or 200Ω Pair
- Precision Ratio Tolerance of 0.1%, 0.25%, 0.5% or 1.0%





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CARBORUNDUM® NON-INDUCTIVE POWER RESISTORS

Choose Type SP for great A-C power handling capability, whether it be at power frequency or many megahertz.

Choose Type A when high resistance is required in a high power non-inductive resistor.

Choose Type AS for its ability to absorb huge amounts of energy and for its non-inductive property at high voltage.

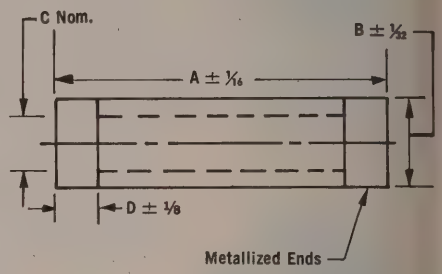
CHARACTERISTICS	Type SP	Type AS	Type A
Maximum Operating Temperature: °C	350	230 150*	230
Temperature Coefficient: Percent per degree C, -55°C to maximum rated temperature	+0.2 -0.08	+0.0 -0.08	+0.0 -0.2
Voltage Coefficient: Maximum percent per kilovolt per inch active length (overall length less termination)	1.0	1.0	—
Short Time Overload: Maximum percent change after 5 cycles 10 times rated power, 5 seconds on, 90 seconds off	2.0	2.0	—
Moisture Resistance: Maximum percent change when tested per MIL-STD-202 method 103	2.5	2.5	2.5

*With epoxy insulation for use in oil.

STANDARD SIZES

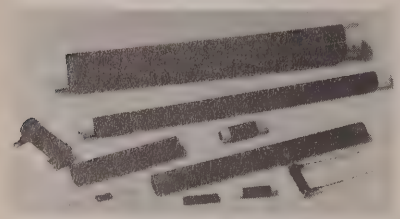
(Special sizes are also available: consult factory.)

Type	A	B	C (SP & AS)	C (A)	D
884 SP	2.0	0.50	0.22	—	0.25
885 SP, AS, & A	2.5	0.75	0.50	0	0.50
886 SP, AS, & A	5.0	0.75	0.50	0	0.62
887 SP, AS, & A	6.0	1.00	0.75	0.5	0.50
888 SP, AS, & A	8.0	1.00	0.75	0.5	0.88
889 SP, AS, & A	12.0	1.00	0.75	0.5	0.88
890 SP, AS, & A	18.0	1.00	0.75	0.5	0.88
891 SP	18.0	2.00	1.50	—	1.00
892 SP	24.0	2.00	1.50	—	1.00



SERIES 800 AND 1000

This general line is available in a wide variety of sizes and terminations. They retain the non-inductive and heavy load characteristics of all Carborundum ceramic resistors. These resistors can handle up to 1000 watts, 165 KJ and 165 KV in resistance values from 1 ohm to 1 megohm.



Parts are specified by the four or five character type number (for example 885SP, 888AS, 890A), the first two digits of the resistance, a single digit to indicate the power of ten multiplier, and a "J" for ± 5%, a "K" for ± 10%, or an "L" for ± 20%. Where the resistance is less than ten ohms, the power of ten multiplier is not used, and an "R" replaces the decimal point. Thus R50 = 0.50 ohm, 7R5 = 7.5 ohm, 220 = 22.0 ohm, 152 = 1500 ohm, etc. Standard construction for SP resistors is aluminum metalization. Type A resistors have nickel metalization. Type AS resistors have silver metalization with a dielectric coating. This standard feature is designated by "DS." Radial tab ("G") and axial tab ("H") terminations are available on SP and AS resistors. "No Arc" ("N") butt-end terminations are available on AS resistors for applications requiring high energy or current density performance. Epoxy coating is available on AS and A resistors for use in oil ("O"). Typical part numbers: 889SP501K represents a Type SP, 500 ohm ±10%; 886AS500KDS represents a standard Type AS, 50 ohm ±10%, with dielectric coating and silver terminations. 890A503L represents Type A, 50,000 ohm ±20%. 886AS500NO represents Type AS, 50 ohm ±10% with "No Arc" terminal and epoxy coating. Consult plant for termination dimension details and additional options and part number detail.

ELECTRICAL SPECIFICATIONS

Length and Diameter	Type	Resistance Available (ohms) Min. to Max.	Average Power @ 40°C (watts)	Peak** Energy (joules)	Peak** Voltage*** (volts)
2" x 1/2"	884SP	1.0 200	22.5	250	1,000
2-1/2" x 3/4"	885SP	1.0 130	45	250	1,000
	885AS..DS	6.0 1200	15	2,800	8,000
	885A	1500 220K	15	750	3,750
5" x 3/4"	886SP	1.0 330	90	500	4,000
	886AS..DS	15.0 3300	30	7,000	20,000
	886A	3900 390K	30	1,500	10,000
6" x 1"	887SP	1.0 330	150	1,600	4,000
	887AS..DS	12.0 3300	50	13,000	30,000
	887A	3900 390K	50	6,000	12,000
6" x 1 1/2"	1026AS..DS	5.0 1200	70	37,000	30,000
8" x 1"	888SP	1.0 390	190	2,100	6,000
	888AS..DS	15.0 3900	75	16,500	45,000
	888A	4700 470K	60	7,500	15,000
8" x 1 1/2"	1028AS..DS	6.5 1875	100	46,000	45,000
12" x 1"	889SP	1.0 680	275	3,200	10,000
	889AS...DS	25.00 6800	100	27,000	75,000
	889A	8200 680K	90	12,500	25,000
12" x 1 1/2"	1032AS..DS	9.0 2500	150	75,000	75,000
18" x 1"	890SP	1.0 1000	375	4,200	16,000
	890AS..DS	40.0 10K	150	43,000	120,000
	890A	12K 1M	125	20,000	40,000
18" x 1 1/2"	1038AS..DS	15.0 3800	225	119,000	120,000
18" x 2"	891SP	1.0 450	750	15,000	16,000
24" x 2"	892SP	1.0 600	1000	17,500	22,000
24" x 1 1/2"	1044AS..DS	20.0 4800	300	164,000	165,000

**Allowable peak energy/voltage will depend on the resistance value.

***Derate by 50% with epoxy coating

The Carborundum Company
Electric Products Division
PO Box 664, Niagara Falls, NY 14302
Telephone 716-278-2521
Fax 716-278-6270

CARBORUNDUM

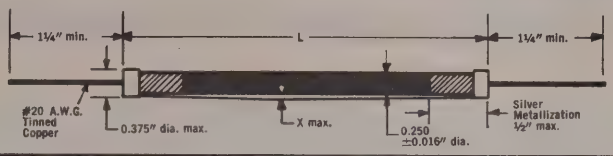
CARBORUNDUM® NON-INDUCTIVE POWER RESISTORS FOR SPECIAL PROBLEM SOLUTIONS

SERIES 102/104/106/109AS & SP PENCIL-TYPE RESISTORS

These 1/4" diameter resistors are available in a variety of lengths. Pencil shaped resistors offer unique non-inductive and high-voltage properties in a compact, easily-wired configuration.

Type AS for high voltage and energy applications.

Type SP for high AC power handling capabilities.



Length	Type No.	Resistance Available (ohms) Min.	Resistance Available (ohms) Max.	Average Power @ 40°C (watts)	Peak** Energy (joules)	Peak ** Voltage (volts)
2"	102AS	30	9,000	5	600	3,000
	102SP	1	700	15	50	1,000
4"	104AS	55	18,000	9	1,200	9,000
	104SP	2	1,500	25	95	3,600
6"	106AS	90	30,000	13	1,900	15,000
	106SP	3	2,400	36	155	5,000
9"	109AS	150	48,000	20	3,000	25,000
	109SP	4	3,800	55	250	8,800

** Allowable peak energy/voltage will depend on the resistance value.

TYPE 234 AND 231 RESISTORS

Carborundum type 234 and 231 resistors are a small size non-inductive bulk type resistor (there are no spirals or windings), capable of dissipating a full 10 watts of power (Type SP) or absorbing 275 Joules of energy (Type AS).

234 — 1/4" x 1"

231 — 5/32" x 3/4"

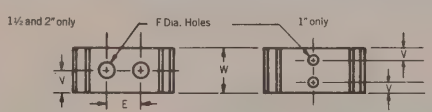
Specifications	234SP	234AS	231SP	231AS
Resistance, ohms ±5% ±10%, ±20%	1-330	12-5000	1-1000	25-6250
Peak Voltage	500 Volts	2.5kv	375 Volts	1.5kv
Power at 40°C	10 Watts	3 Watts	2.5 Watts	1.5 Watts
Derate Linearly to 0 Watts at	350°C	230°C	350°C	230°C
Max operating temperature	350°C	230°C	350°C	230°C
Peak Energy	30 Joules	275 Joules	15 Joules	75 Joules

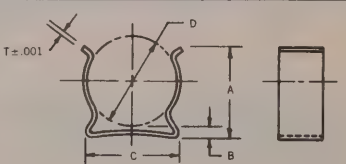
Characteristics	234SP	234AS	231SP	231AS
Short Time Overload • 10 Cycles of 1000% rated power • 5 sec. on, 90 sec. off	5% max.	1% max.	3.5% max.	1% max.
Life test 1000hr rated power	5% max.	5% max.	5% max.	5% max.
Temperature Coefficient	+0.2% -0.08% / °C	+0.0% -0.08% / °C	+0.2% -0.08% / °C	+0.0% -0.08% / °C

TERMINATION AND MOUNTING

Electrical connection to the resistive bodies of resistors is made by flamesprayed metal end bands. The standard metal is aluminum for type SP, nickel or silver for types AS and A. Special terminations of brass or copper overspray or tinned ends are readily available specials. Add "B," "C," or "T" respectively to the part number to designate these special terminations.

In most cases, connections to the resistors may be made by stock clips and connector caps such as these:



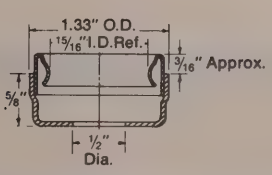


MOUNTING CLIPS DIMENSIONS

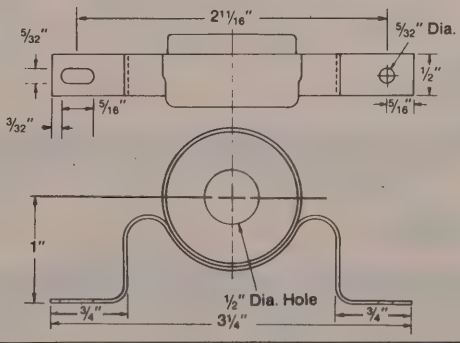
Stock No.	Size	Holes	A	B	C	D	E	F	T	V	W
35370	1/2"	1	0.620	0.090	0.560	0.500		0.093	0.020	0.188	0.375
35267	3/4"	1	0.940	0.155	0.830	0.750		0.144	0.020	0.312	0.625
35268	1"	2	1.230	0.170	1.070	1.000		0.128	0.024	0.156	0.625
35371	1 1/2"	2	1.650	0.100	1.650	1.500	0.925	0.103	0.032	0.250	0.500
35269	2"	2	2.375	0.544	1.080	2.000	0.375	0.125	0.043	0.375	0.750

Material: Beryllium Copper Finish: Electro Tin Plate

CONNECTOR CAPS



Part G-4361
Connector Cap Assembly (without strap)
Material: Copper



Part G-4362
Connector Cap Assembly (with strap)
Material: Copper

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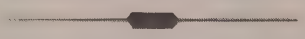
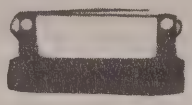
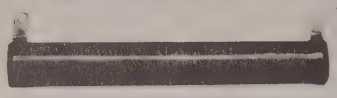
PO Box 664, Niagara Falls, NY 14302
Telephone 716-278-2521
Fax 716-278-6270

CARBORUNDUM

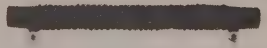
CLAROSTAT

RESISTORS

RESISTORS

Series	Resistive Element	Power Rating (watts)	Resistance Range (ohms)	Tolerance	Terminal Style	Packaging
Vitreous						
 **VC**	Wirewound	VC3D=3-3.25 VC5E=5-6.50 VC10F=10-11	.1-10K .1-25K .1-50K	±5% (±10% below 1 ohm)	Axial lead	50 per box Tape and reel available
 **VPR**	Wirewound	VPR5F=5-8 VPR10F=10-12 VPR20H=20	1-25K .4-50K .4-100K	±5% (±10% below 1 ohm)	Lug and lead	10 per box
VP	Wirewound Fixed	VP25K=25 VP50K=50	1-100K 1-250K	±5%	Radial lug	10 per box
 **VK**	Wirewound Fixed	VK100N=100 VK160W=160-175 VK200W=200-225	1-200K 1-100K 1-100K	±5%	Radial lug	Individually boxed
VPA	Wirewound Adjustable	VP10FA=12 VP25KA=25 VP50KA=50	1-10K 1-25K 1-100K	±10%	Radial lug	10 per box
VKA	Wirewound Adjustable	VK100NA=100 VK160WA=160-175 VK200WA=200-225	1-100K 1-100K 1-100K	±10%	Radial lug	boxed
Silicone						
SC/RW	Wirewound	SC1A/RW70U=1.0 SC3D/RW79U=3.0 SC5E/RW74U=5.0	.1-3K .1-10K .1-25K	±1%	Axial lead	50 per box Tape and reel available
CSC	Wirewound	CSC3D=3.0 CSC5E=5.0 CSC10F=10.0	1-10K 1-25K 1-50K	±3%	Axial lead	50 per box Tape and reel available
Aluminum Housed						
CMC	Wirewound	CMC5=5 CMC10=10 CMC25=25 CMC50=50	.1-2.5K .5-5K .1-10K .1-25K	±1%	Chassis mountable axial lug	10 per box

Rheostats

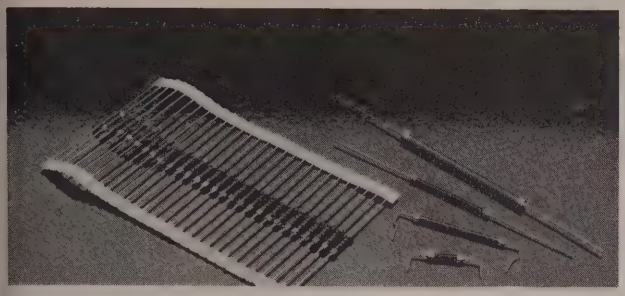
Series	Resistive Element	Power Rating (watts)	Resistance Range (ohms)	Tolerance
CR	Wirewound	CR12.5=12.5 CR25=25 CR50=50	1-10K 1-10K 1-10K	±10%
Oval Stackable				
VMZ/VZR	Wirewound	VMZ=10 and 20 VZR=30 to 55 VZR=65 and 75	1-25K 1-25K 1-65K	±5%
Edgewound, Corrugated Wire, Tubular				
 **EW**	Wirewound	40-1500	0.1-75	±10%

CLAROSTAT, 1600 West Plano Parkway, Plano, TX 75075 (Fax 1-800-223-5138) Phone: (800) 872-0042

the Colber Corporation

Delivery and Quality You Can Trust!

The Colber Corporation
26 Buffington Street
Irvington, NJ 07111
Telephone: 201-371-9500
Fax #: 201-371-0318
To Place an Order Call:
800-221-0647



Wire Wound: Axial Lead – Type AL

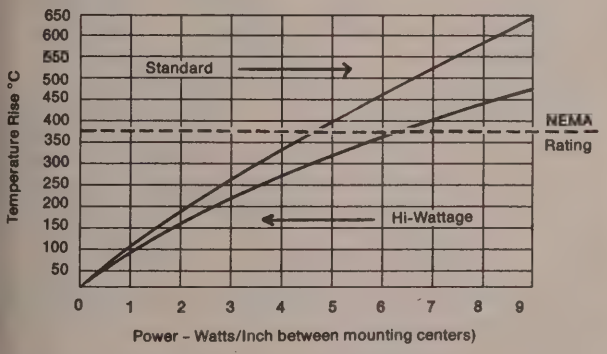
Most economical alternative for your power disipating needs

Features:
- ☐ High quality alloy resistance wire with silicone impregnated, interwoven fiberglass core
- ☐ Variety of core diameters and lengths
- ☐ Variety of temperature coefficients
- ☐ Available coated with proprietory silicone insulation
- ☐ Tape & reel packaging to customer specification
- ☐ U.S. made

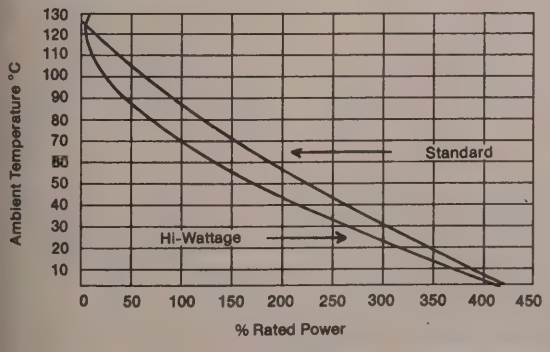
Specifications:
- ☐ Resistance range: .02 ohm min. to 13k (depending on core length)
- ☐ Tolerance: ±10% standard; down to ±2% available
- ☐ Temperature coefficient: to 200 PPM (consult factory)
- ☐ Power rating: 4, 5, or 6 watts per inch available
- ☐ Terminals: oxygen-free, tinned copper leads: .032"-.040", lead lengths up to 3"; 10 lb. minimum pull strength, formed leads available to customer specification

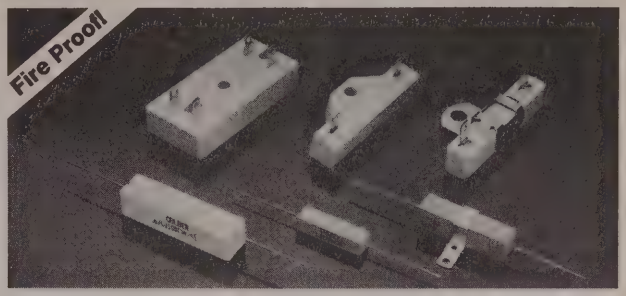
Performance:

Temperature Rise vs. Load Curve



Derating Curve for High Ambient Temperature





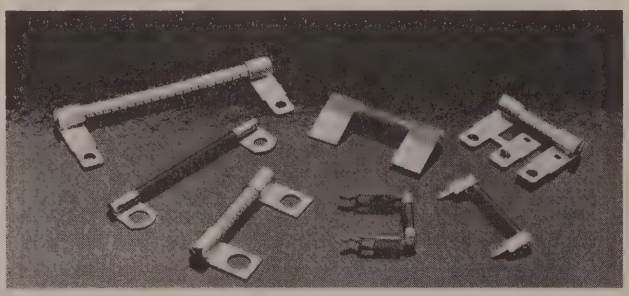
Wirewound Resistors: Commercial Power – Type CW & RU

Electronic and automotive industry standard sizes

Features:
- ☐ Economical, reliable resitors from 2 to 50 watts
- ☐ High quality, fireproof ceramic case and inorganic fill
- ☐ Custom inorganic encapsulant provides high thermal conductivity
- ☐ High quality alloy resistance wire on silicone coated and impregnated, interwoven, fiberglass core
- ☐ Brackets and standoffs available
- ☐ Fusistor styles available
- ☐ Formed leads to customer specification
- ☐ U.S. made

ALSO AVAILABLE: Moisture resistant, fireproof ceramic case and heat-treated, inorganic encapsulant with **silicone base.**

Specifications:
- ☐ Resistance range: .005 ohm min. to 13k (depending on core length)
- ☐ Tolerance: ±10% standard, down to ±2% also available
- ☐ Temperature coefficients: to 200 PPM, consult factory
- ☐ Power rating: 2-50 watts
- ☐ Terminals: brass, tinned brass, or tinned steel; axial lead or radial leads



Wire Wound Radial Terminals (Flag) – Type AW

Standard electronic and auto industry terminals

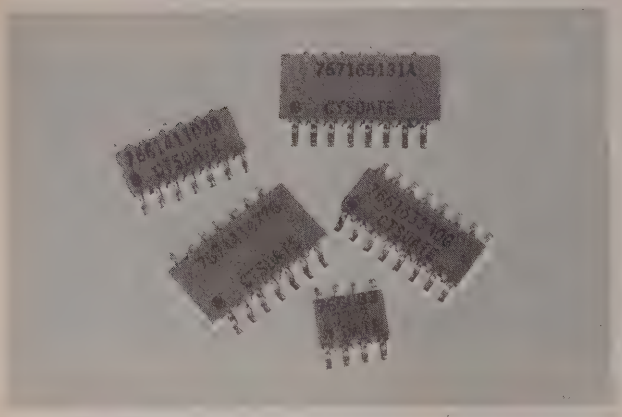
Features:
- ☐ Variety of terminal materials and styles
- ☐ High quality alloy resistance wire with silicone impregnated, interwoven fiberglass core
- ☐ Variety of temperature coefficients available
- ☐ Variety of core diameters & lengths
- ☐ Available coated or uncoated
- ☐ U.S. made

Specifications:
- ☐ Resistance range: to customer specifications
- ☐ Tolerance: ±10% standard, ±5% also available
- ☐ Temperature coefficients: to 300 PPM, consult factory
- ☐ Power rating: 4, 5, 6 watts per inch available
- ☐ Terminals: brass, tinned brass, or tinned steel, silicone base or epoxy coating available, resistance value stamped on terminal

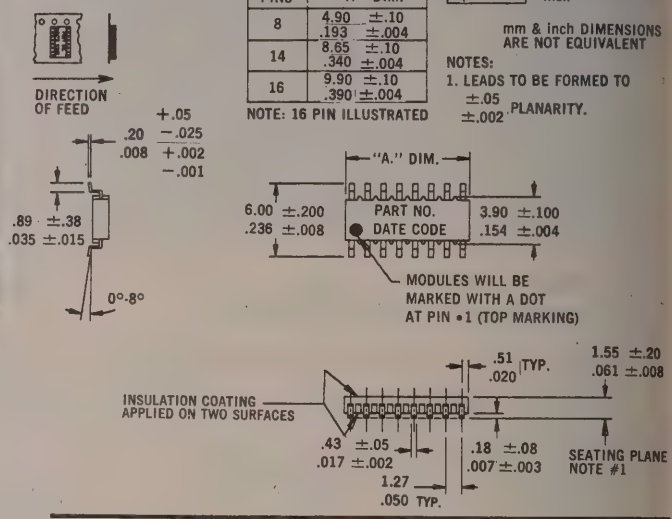
For complete specifications, test data and prints, call for our catalogue.

CTS® CORPORATION
RESISTOR NETWORK DIVISION

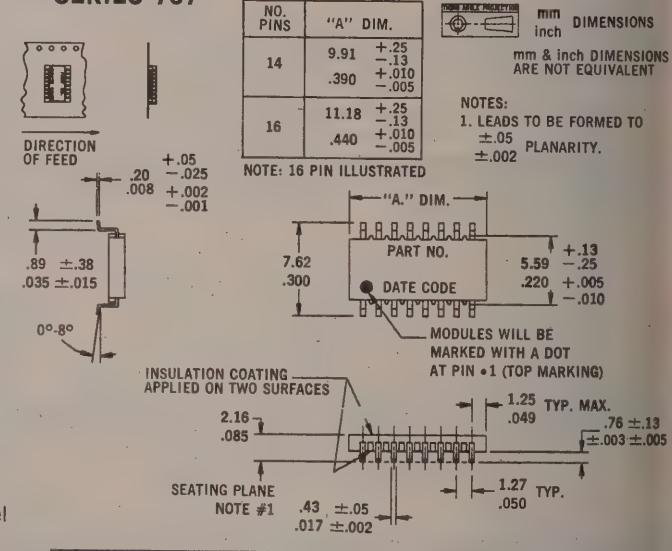
LEADED SURFACE MOUNT RESISTOR NETWORKS



SERIES 766



SERIES 767



SPECIFICATIONS

- **Resistance Range:** Standard 10 ohm to 1.0 Megohm
- **Resistance Tolerance:** Standard ±2%
  Special 0.5% or 0.5 ohm (whichever greater)
- **Max Operating Voltage:** 50V not to exceed rated power
- **Temp. Coefficient:** ±100 PPM typical
- **Operating Temp. Range:** –55°C to +125°C
- **Storage Temp. Range:** –55°C to +125°C
- **Dielectric Strength:** 100V
- **Power Rating:** Total network power

	Series 766			Series 767	
	8 Pin	14 Pin	16 Pin	14 Pin	16 Pin
@ 70°C	0.6w	1.0w	1.2w	1.3w	1.5w
@ 25°C	0.9w	1.6w	1.8w	2.0w	2.3w

*Custom networks can usually be designed to exceed resistance range. Individual resistor power, maximum operating temperature and maximum operating voltage standard. TCR may be affected by some custom network requirements.

How to Order

767 14 3 101 G TR

Series
766
767

Number of Pins
14
16

Schematic
1 Bussed
3 Isolated
5 Dual Terminator

Resistor Code

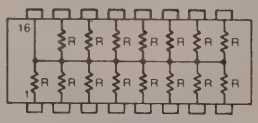
Tolerance
1 & 3
J = ±5%
G = ±2%
A = Circuit 5

Packaging
TR = Tape & Reel
SP = Slide Pack

Resistor Code
Bussed and Isolated
First two digits are significant
Third digit is multiplier
Dual Terminator — Call factory

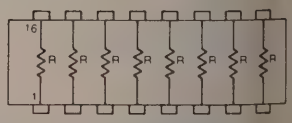
Packaging
TR - Tape and Reel
Series 766, 8 pins - 12 mm wide
Series 766, 14 and 16 pins - 16 mm wide, 7" or 13" reels
Series 767, 14 and 16 pins - 24 mm wide, 13" reels
SP - Slide Pack - All slide packs are 20" length

STANDARD CIRCUITS



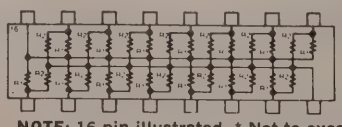
1 Circuit Bussed
Maximum Resistor Power*

	Series 766	Series 767
@ 25°C	.12 w	.15 w
@ 70°C	.08 w	.1 w



3 Circuit Isolated
Maximum Resistor Power*

	Series 766	Series 767
@ 70°C	.16 w	.2 w
@ 25°C	.24 w	.3 w



5 Circuit Dual Terminator
Maximum Resistor Power*

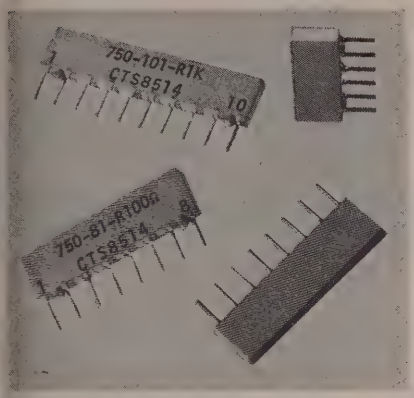
	Series 766	Series 767
@ 70°C	.08 w	.1 w
@ 25°C	.12 w	.15 w

NOTE: 16 pin illustrated. * Not to exceed maximum network power.

ORDERING INFORMATION: Place orders using following address:
RESISTOR NETWORK DIVISION, 406 Parr Road, Berne, IN 46711 • (219) 589-8220 • FAX (219) 589-3243

CTS® CORPORATION*
RESISTOR NETWORK DIVISION

750 SERIES SINGLE-IN-LINE SOLID CERAMIC CERMET RESISTOR NETWORKS



ELECTRICAL SPECIFICATIONS

Temperature Range:
–55°C to +125°C (operating)

Resistance Range:
Standard — 10Ω thru 1 MegΩ
Special — below 10Ω and above 1 MegΩ

Resistance Tolerance:
Standard ±2%
Special ±0.25% or 0.25Ω (whichever is greater)

Matching: (2 like resistors)
10Ω to 100 KΩ — ±0.25% or 0.25Ω (whichever is greater)
100 KΩ to 500 KΩ — 1%
500 KΩ to 3 MegΩ — 2.5%

Ratio Matching:
10Ω to 100Ω — ±0.25% or .25Ω
100Ω to 100 KΩ — ±0.25%
100 KΩ to 1MegΩ — ±2%
Note: Multiple matches available

Temperature Coefficient*:
±100 PPM/°C Typical
Tracking available to 50 PPM/°C

Max. Operating Voltage*:
100V not to exceed rated power

Dielectric Strength:
200V

MECHANICAL SPECIFICATIONS

Substrate Material:
Alumina

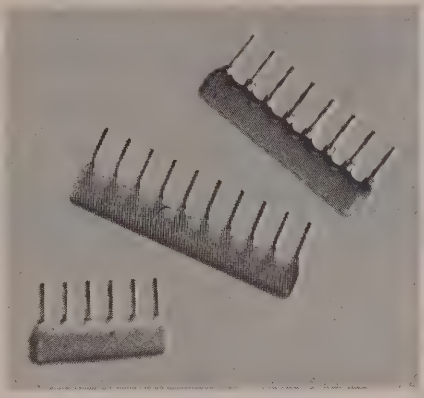
Resistor Material:
Cermet — thick film

Insulation Coating:
Organic — epoxy phenolic

Lead Material:
Solder coated copper alloy

Solder:
60/40 tin/lead

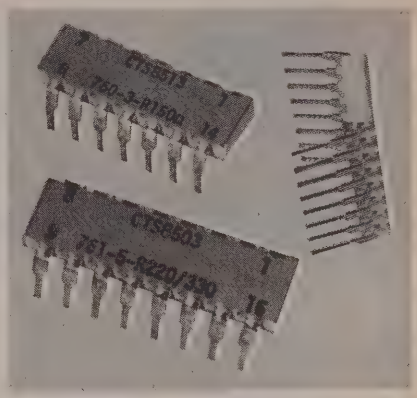
770 SERIES SINGLE-IN-LINE CONFORMAL COATED CERMET RESISTOR NETWORKS



ELECTRICAL AND MECHANICAL SPECIFICATIONS

Resistance Range:	Standard 33Ω to 1.0 MegΩ
Resistance Tolerance:	Standard: ±2% Special: ±1% or 0.5Ω (whichever is greater)
Maximum Operating Voltage:	Series 770: 50V not to exceed rated power.
Temperature Coefficient:	±100 PPM 33Ω to 220 KΩ ±175 PPM above 220 KΩ to 1.0 MegΩ @ –55° to +125°C
Temp. Range:	–55° to +125°C (operating)
Storage Temp. Range:	–55° to +125°C
Dielectric Strength:	100V
Lead Material:	Solder coated copper alloy

760 SERIES DUAL-IN-LINE SOLID CERAMIC CERMET RESISTOR NETWORKS



ELECTRICAL SPECIFICATIONS

Temperature Range:
–55°C to +125°C (operating)

Resistance Range:
Standard — 10Ω thru 1 MegΩ
Special — Below 22Ω and above 1 MegΩ

Resistance Tolerance:
Standard — ±2%
Special — ±0.25% or 0.25Ω (whichever is greater)

Resistance Matching:
(2 like resistors)
10Ω to 100 KΩ — ±0.25% or 0.25Ω (whichever is greater)
100 KΩ to 500 KΩ — 1%
500 KΩ to 3 MegΩ — 2.5%

Ratio Matching:
10Ω to 100K — ±0.25% or 0.25Ω
100K to 1MegΩ — ±2%
Multiple ratio matching available

Temperature Coefficient*:
±100 PPM/°C Typical
Tracking — Available to 50 PPM/°C

Maximum Operating Voltage*:
100V not to exceed rated power

Dielectric Strength:
200V

MECHANICAL SPECIFICATIONS

Substrate Material: Alumina

Resistor Material: Cermet — thick film

Insulation Coating: Organic — epoxy phenolic

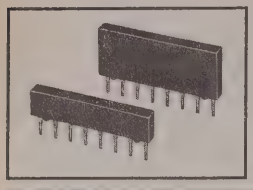
Lead Material: Solder coated copper alloy

Solder:
60/40 tin/lead

ORDERING INFORMATION: Place orders using following address:
RESISTOR NETWORK DIVISION, 406 Parr Road, Berne, IN 46711 • (219) 589-8220 • FAX (219) 589-3243

A COMPANY OF VISHAY DALE®

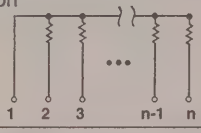
MODEL MSM
Thick Film Resistor Networks
Military, MIL-R-83401 Qualified, Type RZ
Single-In-Line, Molded - 01, 03, 05 Schematics



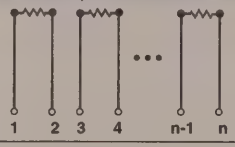
FEATURES
- MIL-R-83401 qualified
- .195" [4.95] "A" and .350" [8.89] "C" maximum seated heights
- Highly stable thick film
- T.C.R. available in "K" (± 100PPM/°C) or "M" (± 300PPM/°C) characteristic
- All device leads are hot-solder dipped
- Rugged molded case construction
- Compatible with automatic insertion equipment
- 100% screen tested per Group A, Subgroup 1 of MIL-R-83401
- All devices are capable of passing the MIL-STD-202, Method 210, Condition E "Resistance to Soldering Heat" test
- Available in tube pack

CIRCUITS

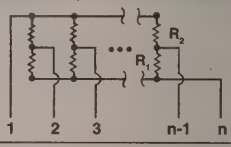
01 Schematic: 5, 7 or 9 resistors with one pin common



03 Schematic: 3, 4 or 5 isolated resistors



05 Schematic: 4, 6 or 8 isolated resistors



ELECTRICAL SPECIFICATIONS

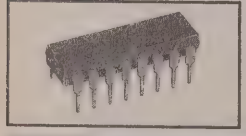
Resistance Range: 01 and 03: 10 ohm to 1 Megohm. 05: Contact factory.
Tolerance: ± 2% standard. ± 1% and ± 5% available.
Temperature Coefficient: (- 55°C to + 125°C) "K" = ± 100PPM/°C, "M" = ± 300PPM/°C.
Resistor Power Rating: (Maximum at 70°C .2 watt) MSMXXA-01, MSMXXC-01 and MSMXXC-03 = .2 watt, MSMXXA-03 = .12 watt, MSMXXC-05 = .11 watt, MSMXXA-05 = .07 watt.
Package Power Rating: (Maximum at 70°C) MSM06A-01 = .60 watt, MSM06A-03 = .36 watt, MSM08A-01 = .84 watt, MSM08A-03 = .48 watt, MSM10A-01 = 1.08 watt, MSM10A-03 = .60 watt, MSM06C-01 = 1.00 watt, MSM06C-03 = .60 watt, MSM08C-01 = 1.40 watt, MSM08C-03 = .80 watt, MSM10C-01 = 1.80 watt, MSM10C-03 = 1.00 watt, MSM06A-05 = .56 watt, MSM06C-05 = .88 watt, MSM08A-05 = .84 watt, MSM08C-05 = 1.32 watt, MSM10A-05 = 1.12 watt, MSM10C-05 = 1.76 watt.
Maximum Operating Voltage: 50 VDC.
Operating Temperature Range: - 55°C to + 125°C.

MECHANICAL SPECIFICATIONS

Body: Molded epoxy.
Terminals: Copper alloy, hot-solder dipped.
Solderability: Per MIL-R-83401.
Weight: "A" Profile: 6 pin = .4 gram, 8 pin = .5 gram, 10 pin = .6 gram. "C" Profile: 6 pin = .7 gram, 8 pin = .9 gram, 10 pin = 1.1 gram.

A COMPANY OF VISHAY DALE®

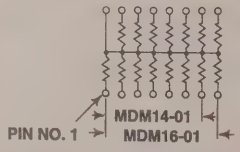
MODELS MDM14 and MDM16
Thick Film Resistor Networks
Military, MIL-R-83401 Qualified, Type RZ
Dual-In-Line Package - 01, 03, 05 Schematics



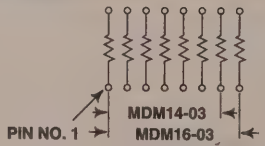
FEATURES
- MIL-R-83401 Qualified
- Epoxy molded construction
- All device leads are hot-solder dipped
- 100% screen tested per Group A, Subgroup 1 of MIL-R-83401
- T.C.R. available in "K" (± 100PPM/°C) or "M" (± 300PPM/°C) depending on style
- All devices are capable of passing the MIL-STD-202, Method 210, Condition E "Resistance to Soldering Heat" test
- Available in tube pack

CIRCUITS

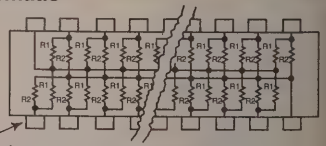
01 Schematic



03 Schematic



05 Schematic



ELECTRICAL SPECIFICATIONS

Resistance Range: 01 and 03: 10 ohm to 1 Megohm. 05: Contact factory. **Tolerance:** ± 1%, ± 2% and ± 5%.
Temperature Coefficient: (- 55°C to + 125°C) "K" = ± 100PPM/°C. "M" = ± 300PPM/°C.
Maximum Operating Voltage: 100 VDC.
Operating Temperature Range: - 55°C to + 125°C.
Resistor Power Rating: (Maximum at 70°C) 01 schematic = 0.1 watt, 03 schematic = 0.2 watt, 05 schematic = 0.05 watt.
Package Power Rating: (Maximum at 70°C) Schematic 01, 14 pin = 1.30 watts, 16 pin = 1.50 watts. Schematic 03, 14 pin = 1.40 watts, 16 pin = 1.60 watts. Schematic 05, 14 pin = 1.20 watts, 16 pin = 1.40 watts.

MECHANICAL SPECIFICATIONS

Marking Resistance to Solvents: Permanency testing per MIL-R-83401.
Solderability: Per MIL-R-83401.
Body: Molded epoxy.
Terminals: Copper alloy, hot-solder dipped.

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MODEL DFM14
Thick Film Resistor Networks
Military, MIL-R-83401 Qualified, Type RZ
01, 02, 05, 11, 12, 15 Schematics

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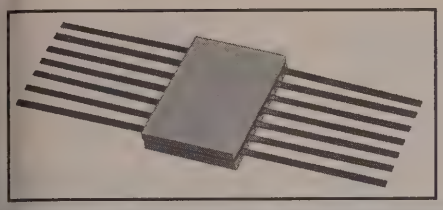
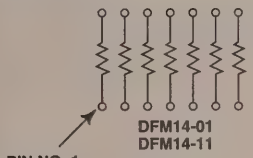
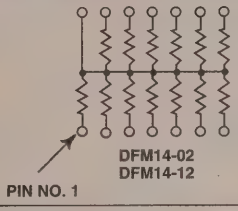


FEATURES
- 01, 02, 05 schematics - gold plated leads
- 11, 12, 15 schematics - hot solder dipped
- MIL-R-83401 qualified
- Highly stable thick film
- T.C.R. available in "K" (± 100PPM/°C) or "M" (± 300PPM/°C) characteristic
- 100% screen tested per Group A, Subgroup 1 of MIL-R-83401
- .065" [1.65] height for high density packaging
- All devices are capable of passing the MIL-STD-202, Method 210, Condition E "Resistance to Soldering Heat" test

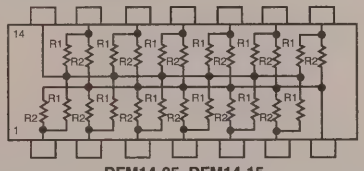
01, 11 Schematic



02, 12 Schematic



05, 15 Schematic



ELECTRICAL SPECIFICATIONS

Resistance Range: 01 and 02: 10 ohm to 1 Megohm. 05: Contact factory.
Tolerance: ± 2% standard. ± 1%, ± 5% available.
Temperature Coefficient: (- 55°C to + 125°C) "K" = ± 100PPM/°C. "M" = ± 300PPM/°C.
Isolation Resistance: 01, 11 = > 100 Megohm.
Resistor Power Rating: (Maximum at 70°C) 01, 11 = 0.050 watt. 02, 12 = 0.025 watt. 05, 15 = 0.015 watt.
Package Power Rating: (Maximum at 70°C) 01, 11 = 0.350 watt. 02, 12 = 0.325 watt. 05, 15 = 0.350 watt.
Maximum Operating Voltage: 50 VDC.
Operating Temperature Range: - 55°C to + 125°C.

MODELS DFP14 and DFP16
Thick Film Resistor Networks
Flat Pack, 01, 02, 11, 12 Schematics

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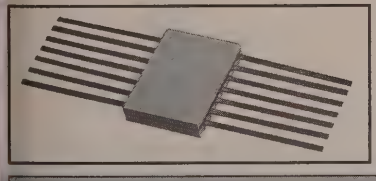
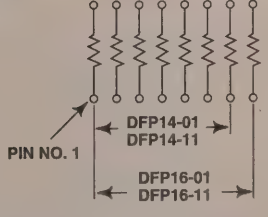


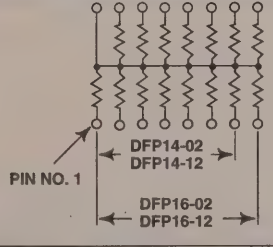
FEATURES
- 01 and 02 schematics - gold plated leads
- 11 and 12 schematics - tin-lead plated leads
- .065" [1.65] height for high density packaging
- Low temperature coefficient (- 55°C to +125°C) ± 100PPM/°C
- Hot-solder dipped or gold-plated leads
- Highly stable thick film
- Wide resistance range
- All devices are capable of passing the MIL-STD-202, Method 210, Condition E "Resistance to Soldering Heat" test

CIRCUITS

01, 11 Schematic



02, 12 Schematic



ELECTRICAL SPECIFICATIONS

Resistance Range: 10 ohm to 1 Megohm.
Tolerance: ± 2% standard. ± 1% and ± 5% available.
Temperature Coefficient: (- 55°C to + 125°C) ± 100PPM/°C typical.
Isolation Resistance: 01 and 11: >100 Megohm.
T.C. Tracking: (- 55°C to + 125°C) 50PPM/°C.
Resistor Power Rating: (Maximum at 25°C) 01, 11 = 0.25 watt. 02, 12 = 0.15 watt.
Package Power Rating: (Maximum at 25°C) 0.65 watt.
Voltage Coefficient of Resistance: < 50PPM/V typical.
Maximum Operating Voltage: 75 VDC.
Operating Temperature Range: - 55°C to + 125°C.
Storage Temperature Range: - 55°C to + 150°C.

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MODEL SOMC
Thick Film Resistor Networks
Dual-in-Line, Small Outline Molded Dip
01, 03, 05 Schematics - 14 or 16 Pins

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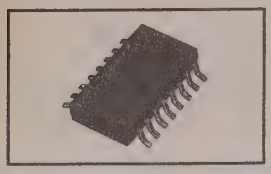
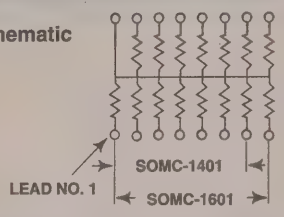


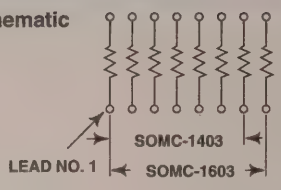
FEATURES
- .090" [2.29] maximum seated height
- Rugged, molded case construction
- Highly stable thick film
- .050" [1.27] lead spacing
- Low temperature coefficient, (- 55°C to + 125°C) ± 100PPM/°C
- Reduces total assembly costs
- Compatible with automatic surface mounting equipment
- Wide resistance range
- Uniform performance characteristics
- Meets EIA PDP100, SOGN-0002 outline dimensions
- Available in tube pack or tape and reel pack

CIRCUITS

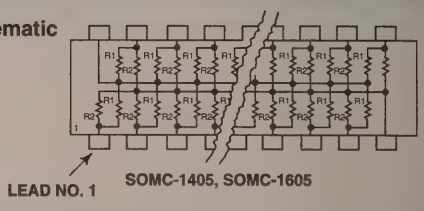
01 Schematic



03 Schematic



05 Schematic



ELECTRICAL SPECIFICATIONS

Resistance Range: 10 ohm to 1 Megohm.
Tolerance: 01 and 03 = ± 2% standard. ± 1%, ± 5%, ± 10% and ± 20% available. 05 = ± 2% standard. ± 5% available.
Temperature Coefficient: (- 55°C to + 125°C) ± 100PPM/°C typical.
Resistor Power Rating: (Maximum at 70°C) 01, 05 = .080 watt. 03 = .160 watt.
Package Power Rating: (Maximum at 70°C) 01, 05 = 14 pin 1.05 watts, 16 pin 1.200 watts. 03 = 14 pin 1.125 watts, 16 pin 1.280 watts.
T.C. Tracking: (- 55°C to + 125°C) 50PPM/°C.
Voltage Coefficient of Resistance: < 50PPM/V typical.
Maximum Operating Voltage: 50 VDC.
Operating Temperature Range: - 55°C to + 125°C.
Storage Temperature Range: - 55°C to + 150°C.

MODEL SOGC
Thick Film Resistor Networks
Dual-In-Line, Small Outline Molded Dip

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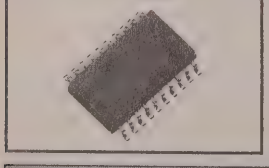
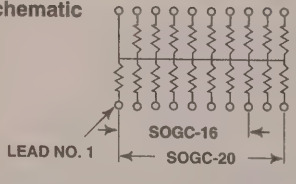


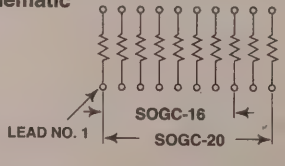
FEATURES
- .110" [2.79] maximum seated height
- Rugged, molded case construction
- Highly stable thick film
- .050" [1.27] lead spacing
- Low temperature coefficient, (- 55°C to + 125°C) ± 100PPM/°C
- Reduces total assembly costs
- Compatible with automatic surface mounting equipment
- Wide resistance range
- Uniform performance characteristics
- Meets EIA PDP 100, SOGN-0003 outline dimensions
- Available in tube pack or tape and reel pack

CIRCUITS

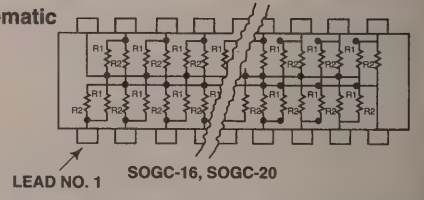
01 Schematic



03 Schematic



05 Schematic



ELECTRICAL SPECIFICATIONS

Resistance Range: 10 ohm to 1 Megohm.
Tolerance: 01 and 03 = ± 2% standard. ± 1%, ± 5%, ± 10% and ± 20% available. 05 = ± 2% standard. ± 5% available.
Temperature Coefficient: (- 55°C to + 125°C) ± 100PPM/°C typical.
T.C. Tracking: (- 55°C to + 125°C) 50PPM/°C .
Maximum Operating Voltage: 50 VDC.
Resistor Power Rating: (Maximum at 70°C) 01, 05 = .10 watt. 03 = .19 watt.
Package Power Rating: (Maximum at 70°C) SOGC-16 = 1.6 watts. SOGC-20 = 2.0 watts.
Voltage Coefficient of Resistance: < 50PPM/V typical.
Operating Temperature Range: - 55°C to + 125°C.
Storage Temperature Range: - 55°C to + 150°C.

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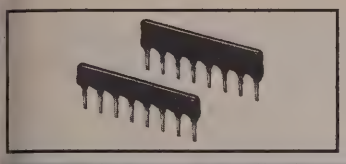
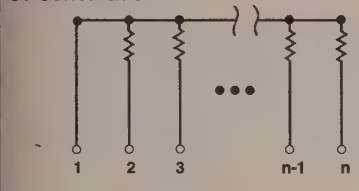
MODEL CSC
Thick Film Resistor Networks
Single-In-Line, Coated - 01, 03, 05 Schematics
4 thru 10 Pins "A" Profile, 4 thru 12 Pins "B" Profile



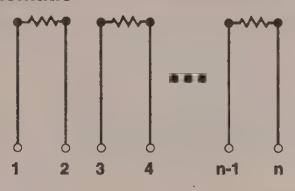
FEATURES
- .195" [4.95] "A" or .250" [6.35] "B" maximum seated height
- Highly stable thick film
- Low temperature coefficient (- 55°C to + 125°C) ± 100PPM/°C
- Reduces total assembly costs
- Resistor elements protected by tough epoxy conformal coating
- Wide resistance range
- Available in bag pack or tube pack

CIRCUITS

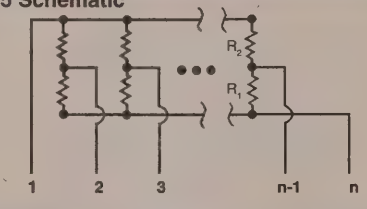
01 Schematic



03 Schematic



05 Schematic



ELECTRICAL SPECIFICATIONS

Resistance Range: 10 ohm to 2.2 Megohm.
Tolerance: 01 and 03: ± 2% standard. ± 1%, ± 5%, ± 10% and ± 20% available. 05: ± 2% standard. ± 5% available.
Temperature Coefficient: (- 55°C to + 125°C) ± 100PPM/°C typical.
Temperature Coefficient of R Tracking: (- 55°C to + 125°C) 01 and 03: 50PPM/°C maximum. 05: 150PPM/°C standard. (Tighter tracking available.)
Isolation Resistance: 03 schematic: > 100 Megohm.
Resistor Power Rating: (Maximum at 70°C)

Schematic	"A" Profile	"B" Profile
01	.20 watt	.25 watt
03	.30 watt	.40 watt
05	.20 watt	.25 watt

Voltage Coefficient of Resistance: < 50PPM/V typical.
Maximum Operating Voltage: 100 VDC.
Operating Temperature Range: - 55°C to + 125°C.

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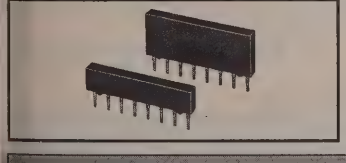
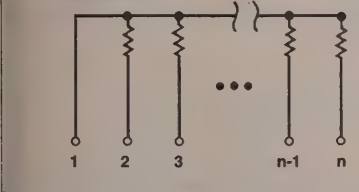
MODEL MSP
Thick Film Resistor Networks
Single-In-Line, Molded - 01, 03, 05 Schematics
6, 8, 9 & 10 Pin "A" Profile - 6, 8 & 10 Pin "C" Profile



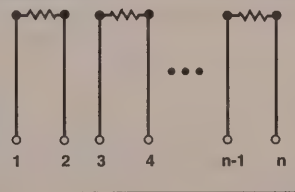
FEATURES
- .195" [4.95] "A" or .350" [8.89] "C" maximum seated height
- Highly stable thick film
- Low temperature coefficient (- 55°C to + 125°C) ± 100PPM/°C
- Rugged, molded case construction
- Reduces total assembly costs
- Compatible with automatic insertion equipment
- Reduces P.C. board space
- Wide resistance range
- Available in tube pack or side-by-side pack

CIRCUITS

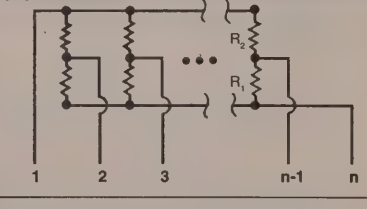
01 Schematic



03 Schematic



05 Schematic



ELECTRICAL SPECIFICATIONS

Resistance Range: 10 ohm to 2.2 Megohm.
Tolerance: 01 and 03: ± 2% standard. ± 1%, ± 5%, ± 10% and ± 20% available. 05: ± 2% standard. ± 5% available.
Temperature Coefficient: (- 55°C to + 125°C) ± 100PPM/°C typical.
Temperature Coefficient of R Tracking: (- 55°C to + 125°C) 01 and 03: 50PPM/°C maximum. 05: 150PPM/°C standard. (Tighter tracking available.)
Isolation Resistance: 03 schematic: > 100 Megohm.
Resistor Power Rating: (Maximum at 70°C)

Schematic	"A" Profile	"C" Profile
01	.20 watt	.25 watt
03	.30 watt	.40 watt
05	.20 watt	.25 watt

Voltage Coefficient of Resistance: < 50PPM/V typical.
Maximum Operating Voltage: 100 VDC.
Operating Temperature Range: - 55°C to + 125°C.
Storage Temperature Range: - 55°C to + 150°C.

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MODELS MDP14, MDP16, MDP18
Thick Film Resistor Networks
Dual-In-Line, Molded
01, 03, 05 Schematics

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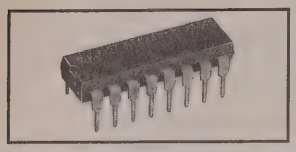
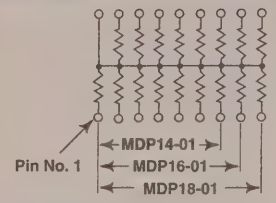


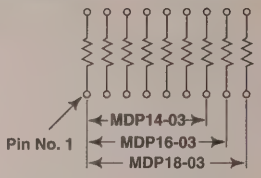
FEATURES
- .160" [4.06] maximum seated height
- Rugged, molded case construction
- Highly stable thick film
- Low temperature coefficient (- 55°C to + 125°C) ± 100PPM/°C
- Reduces total assembly costs
- Compatible with automatic inserting equipment
- Wide resistance range
- Uniform performance characteristics
- Available in tube pack

CIRCUITS

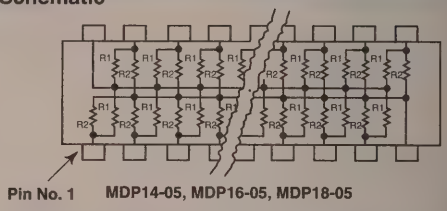
01 Schematic



03 Schematic



05 Schematic



ELECTRICAL SPECIFICATIONS

Resistance Range: 01 and 03 schematics: 10 ohm to 2.2 Megohm.
Tolerance: 01 and 03: ± 2% standard. ± 1% and ± 5% available. 05: ± 2% standard. ± 1% and ± 5% available.
Temperature Coefficient: (- 55°C to + 125°C) ± 100PPM/°C typical.
Temperature Coefficient of T.C. Tracking: (- 55°C to + 125°C) 01 and 03: ± 50PPM/°C. 05: ± 150PPM/°C standard. (Tighter tracking available).
Resistor Power Rating: (Maximum at 70°C) 01 and 05 = .125 watt. 03 = .250 watt.
Voltage Coefficient of Resistance: < 50PPM/V typical.
Maximum Operating Voltage: 100 VDC.
Operating Temperature Range: - 55°C to + 125°C.
Storage Temperature Range: - 55°C to + 150°C.

MODELS MDP16-45 and MDP16-46
Thick Film Resistor Networks
Dual-In-Line, Molded

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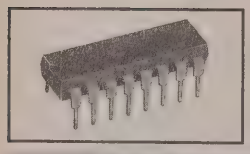


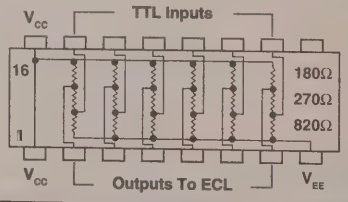
FEATURES
- .190" [4.83] maximum seated height
- Rugged, molded case construction
- Low temperature coefficient (- 55°C to + 125°C) MDP16-45: ± 100PPM/°C. MDP16-46: ± 250PPM/°C
- Compatible with automatic insertion equipment
- Highly stable thick film
- Reduces P.C. board space and total assembly costs
- Available in tube pack

CIRCUITS

-45 Schematic

TTL to ECL translator

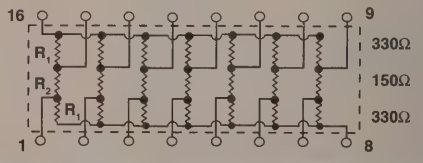
The MDP16-45 network consists of 18 resistors of 3 different values, internally divided into six (6) identical three (3) resistor sections for TTL to ECL translation.



-46 Schematic

SCSI-BUS signal terminator

The MDP16-46 network consists of 21 resistors of 2 different values, internally divided into seven (7) identical three (3) resistor sections for SCSI-BUS terminator applications.



ELECTRICAL SPECIFICATIONS

Resistance Values: MDP16-45: 180 ohm, 270 ohm and 820 ohm in each of six (6) sections. MDP16-46: 330 ohm, 150 ohm and 330 ohm in each of seven (7) sections.
Resistance Tolerance: MDP16-45: ± 2%. MDP16-46: ± 5%.
Resistance Temperature Coefficient: (- 55°C to + 125°C) MDP16-45: ± 100PPM/°C typical. MDP16-46: ± 250PPM/°C typical.
Temperature Coefficient of R Tracking: ± 150PPM/°C.
Resistor Power Rating: (Maximum at 25°C) .125 watt.
Package Power Rating: (Maximum at 25°C) 2.0 watts.
Voltage Coefficient of Resistance: < 50PPM/V typical.
Operating Temperature Range: - 55°C to + 125°C.
Storage Temperature Range: - 55°C to + 150°C.

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MODEL CSRC
Resistor/Capacitor Networks
Single-In-Line, Coated
ECL and Line Terminator Schematics

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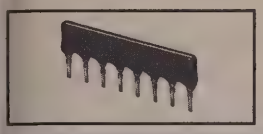
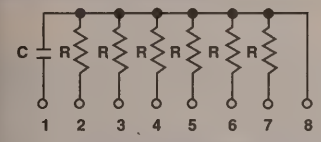


FEATURES
- Highly stable, thick film resistors, ± 150PPM/°C
- X7R type capacitor for ECL terminator
- NPO or X7R capacitors for line terminator
- Wide operating temperature range, - 55°C to + 125°C

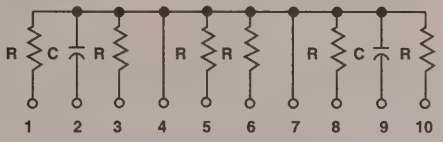
CIRCUITS

CSRC-08B20 Schematic



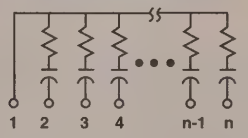
The CSRC-08B20 single-in-line 10k ECL terminator network is used for decoupling and line termination in systems using 10k ECL logic.

CSRC-10B21 Schematic



The CSRC-10B21 single-in-line 100k ECL terminator network is used for decoupling and line termination in systems using 100k ECL logic.

CSRC-XXC30 Schematic



The CSRC-XXC30 single-in-line terminator network is used for line termination and is available in 6, 7, 8, 9, 10, 11 and 12 pin sizes.

RESISTOR SPECIFICATIONS

Resistance Range: CSRC-08B20, CSRC-10B21 = 50 ohm, 68 ohm, 100 ohm, 150 ohm. CSRC-XXC30 = 50 ohm to 1 kilohm.
Tolerance: ± 5% standard. ± 2% available.
Temperature Coefficient: (- 55°C to + 125°C) ± 150PPM/°C.
Operating Voltage: CSRC-08B20, CSRC-10B21 = 8 VDC maximum. CSRC-XXC30 = 50 VDC maximum.

CAPACITOR SPECIFICATIONS

Model: CSRC = 08B20, CSRC-10B21 = X7R. CSRC-XXC30 = NPO or X7R.
Standard Values: CSRC-08B20, CSRC-10B21 = .01 µf. CSRC XXC30: NPO type = 56 pf, 100 pf, 220 pf, 470 pf. X7R type = 1000 pf, .01 µf.
Tolerance: CSRC-08B20, CSRC-10B21 = 20% standard. CSRC-XXC30, NPO type = ± 10%, X7R type = ± 20%.
Voltage Rating: CSRC-08B20, CSRC-10B21 = 25 VDC. CSRC-XXC30 = 50 VDC.

MODEL MDRC
Resistor/Capacitor Networks
Dual-In-Line, Molded, 16 Pin

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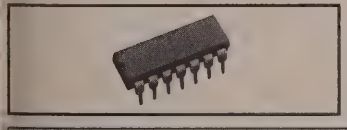


FEATURES
- .190" [4.83] maximum seated height
- Rugged molded case construction
- Highly stable thick film
- Reduces total assembly cost
- Low temperature coefficient (-30°C to + 85°C) ± 100PPM/°C
- Compatible with automatic insertion equipment
- Reduces P.C. board space

CIRCUITS

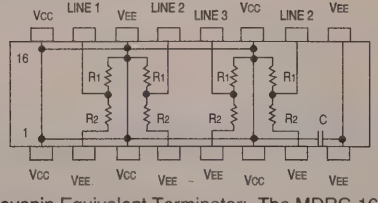
MDRC-1641 Schematic

- 2.0 Volt ECL Terminator: The MDRC-1641 circuit contains 11 resistors of nominally equal value and a .01 microfarad decoupling capacitor.

MDRC-1642 Schematic

- 5.2 Volt ECL Terminator: The MDRC-1642 circuit contains 12 resistors of 510 ohm each and a .01 microfarad decoupling capacitor.

MDRC-1643 Schematic



Thevenin Equivalent Terminator: The MDRC-1643 contains four pairs of series resistors. The circuit is compatible with ECL pin configurations.

ELECTRICAL SPECIFICATIONS

Tolerance: ± 2% or 2 ohm, whichever is greater.
Capacitor Tolerance: .01 microfarad + 40%, - 20%.
Capacitor Voltage Rating: 25 volts maximum.
Capacitor Dissipation Factor: < 3%.
Resistance Temperature Coefficient: (- 30°C to + 85°C) ± 100PPM typical.
Resistor Power Rating: (Maximum at 25°C) MDRC-1641, MDRC-1642 = .15 watt. MDRC-1643 = .20 watt.
Package Power Rating: 2.0 watt maximum at 25°C.
Temperature Coefficient of R Tracking: ± 50PPM/°C.
Voltage Coefficient of Resistance: < 50PPM/V typical.
Operating Temperature Range: - 30°C to + 85°C.
Storage Temperature Range: - 30°C to + 85°C.

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CUSTOM NETWORKS
DIPS, Molded SIPS, Coated SIPS

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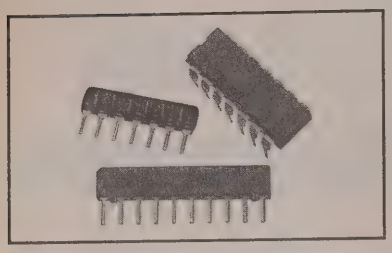
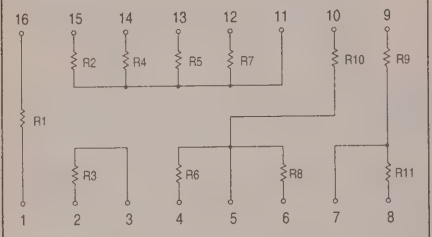


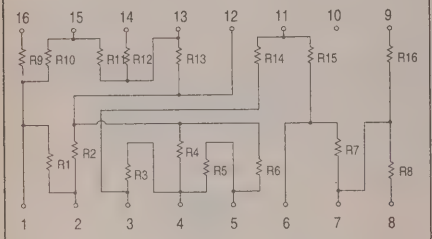
FEATURES

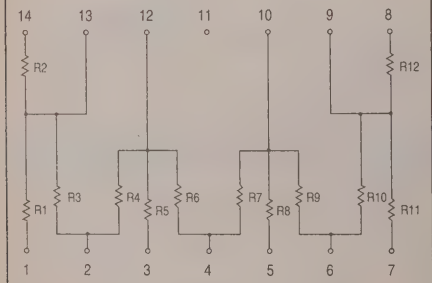
- Fast turnaround time
- Unlimited schematics possible
- Design through production
- Processed to MIL-R-83401
- High temperature solder joints
- Made in the U.S.A.
- Wide resistance range
- Ultra high precision laser trimming
- Double sided printing and through holes/VIAs
- High density circuit designs
- Tighter parameters available
- High power ratings available
- Custom resistor, capacitor, diode and inductor network combinations

SCHEMATICS

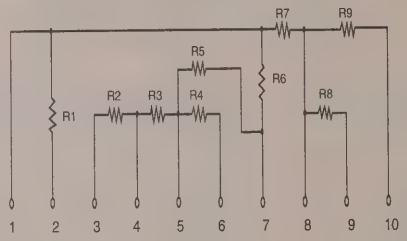
DIPS

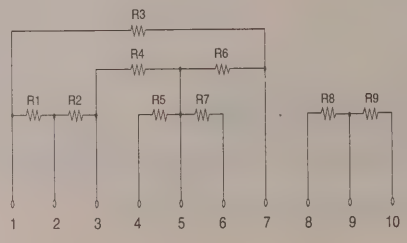


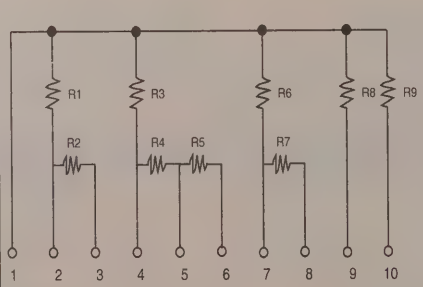




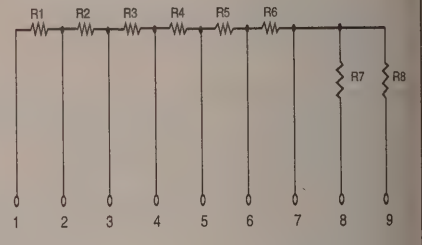
SIPS, Molded

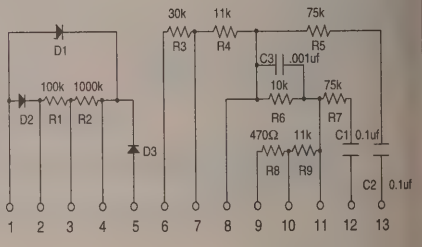


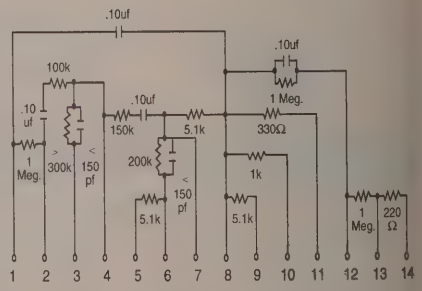




SIPS, Coated







ELECTRICAL SPECIFICATIONS

Resistance Range: 1 ohm to 20 Megohm.
Tolerance: ± 0.5%. Tighter tolerances available.
Temperature Coefficient: ± 50PPM/°C available.
T. C. R. Tracking: ± 50PPM/°C available.
Ratio Matching: ± 0.5% available.
Power Per Resistor: 1/8 watt @ 70°C typical.

MECHANICAL SPECIFICATIONS

Resistive Element: Thick film.
Solder Joints: High temperature SN10.
Encapsulation: Phthalate for molded. Epoxy for conformal coated.
Lead Lengths: .060" [1.52] to .190" [4.83] molded, .060" [1.52] to .290" [7.37] coated.
Substrates: 96% Alumina. Thicknesses: .020" [.508] to .100" [2.54].
Resistor Coatings: Glass passivation, dielectrics for crossovers.

ENVIRONMENTAL SPECIFICATIONS

Temperature Limits: - 65°C to + 125°C.

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MODEL TNPW
Thin Film Chip Resistors
Industrial, Precision

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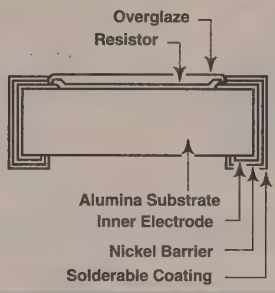
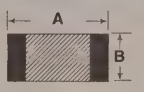
FEATURES
- Internationally standardized size
- Automatic placement compatibility
- Reflow solderable
- Thin film resistance element
- Wraparound termination
- Inner electrode protection
- 8mm reel or bulk packaging
- Operating temperature range is - 55°C to + 125°C



STANDARD ELECTRICAL SPECIFICATIONS

MODEL	RESISTANCE TEMPERATURE COEFFICIENT	RESISTANCE RANGE (Ohms)	TOLERANCE	MAXIMUM OPERATING VOLTAGE	POWER RATING @ 70°C
TNPW-0603	± 25PPM/°C	100-33k	± 0.5%	75	.062W
TNPW-0603	± 50PPM/°C	10-91	± 0.5%	75	.062W
TNPW-0603	± 100PPM/°C	36k-100k	± 0.5%	75	.062W
TNPW-0805	± 25PPM/°C	100-100k	± 0.1%, 0.5%	100	.100W
TNPW-0805	± 50PPM/°C	10-91	± 0.5%	100	.100W
TNPW-1206	± 25PPM/°C	49.9-1M	± 0.1%, 0.5%, 1.0%	100	.125W
TNPW-1206	± 25PPM/°C	22.1-48.7	± 0.5%, 1.0%	100	.125W
TNPW-1206	± 15PPM/°C	1k-1M	± 0.1%, 0.5%, 1.0%	100	.125W
TNPW-1206	± 10PPM/°C	1k-1M	± 0.1%, 0.5%, 1.0%	100	.125W
TNPW-1210	± 25PPM/°C	49.9-1M	± 0.1%, 0.5%, 1.0%	100	.250W

DIMENSIONAL CONFIGURATIONS



[Numbers in brackets indicate millimeters]

MODEL	A	B	C	D	E
TNPW	.063 ± .008	.032 ± .008	.016 ± .004	.012 ± .008	.012 ± .008
-0603	[1.60 ± .203]	[.813 ± .203]	[.406 ± .102]	[.305 ± .203]	[.305 ± .203]
TNPW	.080 ± .008	.049 ± .008	.016 ± .004	.016 ± .010	.016 ± .008
-0805	[2.03 ± .203]	[1.24 ± .203]	[.406 ± .102]	[.406 ± .254]	[.406 ± .203]
TNPW	.126 ± .006	.063 ± .006	.024 ± .006	.018 ± .008	.018 ± .004
-1206	[3.20 ± .152]	[1.60 ± .152]	[.610 ± .152]	[.457 ± .203]	[.457 ± .102]
TNPW	.126 ± .006	.098 ± .006	.024 ± .006	.018 ± .008	.018 ± .004
-1210	[3.20 ± .152]	[2.49 ± .152]	[.610 ± .152]	[.457 ± .203]	[.457 ± .102]

MODEL TNPWM
Thin Film Chip Resistors
Military/Established Reliability
MIL-R-55342/7 Qualified, Type RM, Precision

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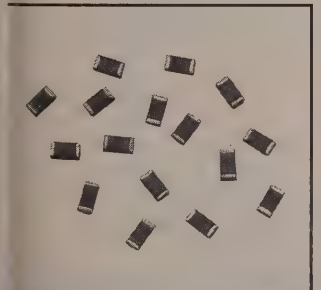
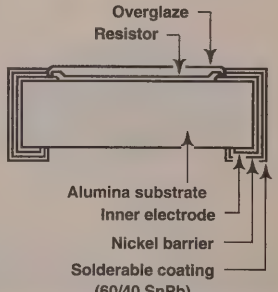


FEATURES
- Internationally standardized size
- Meets requirements of MIL-R-55342
- Established Reliability - Verified failure rate (contact factory)
- 8mm reel, tray or bulk packaging
- Flow solderable • 100% screen tested • Inner electrode protection
- Thin film resistance element and wraparound termination
- Automatic placement compatibility
- Operating temperature range is - 55°C to + 150°C
- Power rating at 70°C is .125 W
- Maximum operating voltage is 100 V
- Termination material is pretinned nickel barrier wraparound



STANDARD ELECTRICAL SPECIFICATIONS

DALE MODEL	MIL-55342 TYPE	MILITARY SHEET NUMBER	CHAR.	RESISTANCE RANGE (Ohms)	TOLERANCE
TNPWM-1206	RM1206	07	H	49.9-1M	1%, 2%, 5%
			E, H	49.9-1M	1%, 2%
			E, H	100-500k	0.1%, 1%, 2%

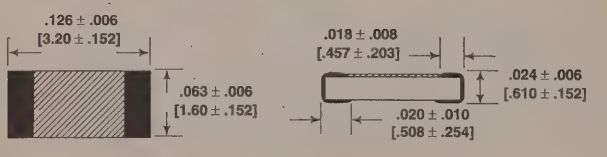
CODE LETTERS FOR TOLERANCE AND MULTIPLIER

± 0.1%	± 1%	± 2%	± 5%	MULTIPLIER	VALUE RANGE (Ohms)
A	D	G	J	1	1-9xx
B	E	H	K	1,000	1k-9xxk
C	F	T	L	1,000,000	1M -9xxM

Examples: 102A = 102Ω ± 0.1%. 49D9 = 49.9Ω ± 1%. 75G0 = 75Ω ± 2%. 68J0 = 68Ω ± 5%.

DIMENSIONAL CONFIGURATIONS

[Numbers in brackets indicate millimeters]



For more information contact:
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MODEL SMM0204
Cylindrical Thin Film Chip Resistors
Industrial, Precision

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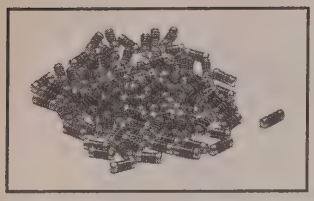


FEATURES

- Cylindrical, leadless body style (MELF)
- Automatic placement compatibility
- Reflow and wave solderable
- Thin film resistance element
- Solderable end cap construction
- Color band marking
- 8mm tape width reel or bulk packaging
- Maximum operating voltage is 200V
- Power rating at 70°C is 0.25W

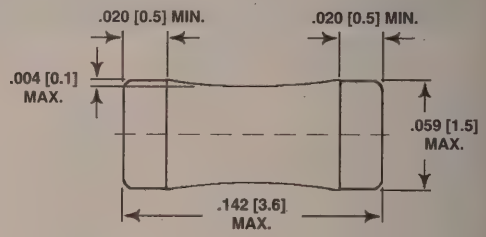
STANDARD ELECTRICAL SPECIFICATIONS

MODEL	TEMPERATURE COEFFICIENT	RESISTANCE RANGE (Ohms)	DECADE VALUES	TOLERANCE
SMM0204	± 15 PPM/°C	43-221k	E24-E192	± 0.1%
		22-221k	E24-E192	± 0.25%
		10-221k	E24-E192	± 0.5%
SMM0204	± 25PPM/°C	43-330k	E24-E192	± 0.1%
		22-330k	E24-E192	± 0.25%
		10-475k	E24-E192	± 0.5%
SMM0204	± 50PPM/°C	10-475k	E24-E192	± 0.5%
		1-2.2M	E24-E96	± 1%
SMM0204	± 100PPM/°C	1-10M	E24	± 2% & 5%
SMM0204 HF*	± 50PPM/°C	10-470	E96	± 1%
OMM0204 = Zero-ohm resistor. Rmax.: 15mΩ. Imax.: 2A				

* HF = High Frequency Version

DIMENSIONAL CONFIGURATIONS

[Numbers in brackets indicate millimeters]



MODEL CRCW0603
Thick Film Chip Resistors
Industrial

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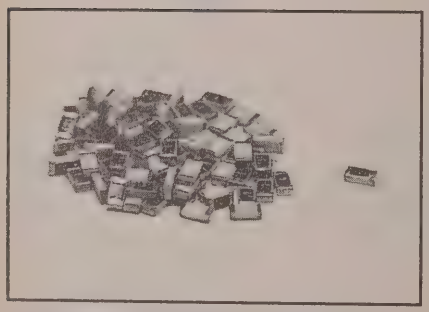
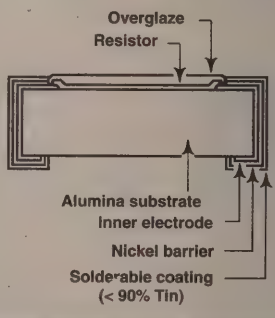


FEATURES

- Internationally standardized size
- Automatic placement compatibility
- Flow solderable
- Inner electrode protection
- Thick film resistance element
- Wraparound termination
- Standard resistance values = E-24
- Operating temperature range is - 55°C to + 125°C



ELECTRICAL SPECIFICATIONS

Maximum RCWV: 50 V. Rated continuous working voltage (RCWV) shall be determined from RCWV = The square root of Rated Power x Resistance Value or from maximum RCWV (50 V) whichever is less.

Resistance Range: 10 ohm to 1 Megohm.

Resistance Tolerance: 1%, 5%.

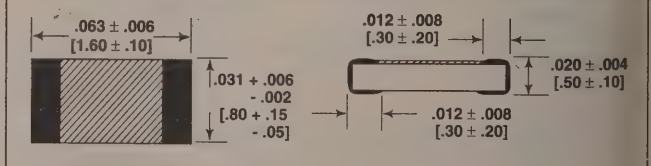
Power Rating at 70°C: 1/16 watt.

Maximum Overload Voltage: 100 V.

Dielectric Withstanding Voltage: 200 V.

DIMENSIONAL CONFIGURATIONS

[Numbers in brackets indicate millimeters]



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MODEL CRCW
Thick Film Chip Resistors
Industrial

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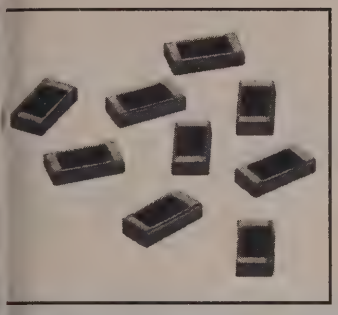
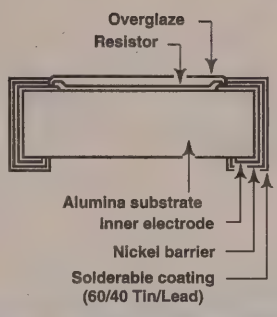


FEATURES

- Internationally standardized size
- Automatic placement compatibility
- Flow solderable
- Thick film resistance element
- Wraparound termination
- Inner electrode protection
- Operating temperature range is - 55°C to + 150°C



STANDARD ELECTRICAL SPECIFICATIONS

DIMENSIONAL CONFIGURATIONS

MODEL	RESISTANCE, TOL. & TEMP. COEFFICIENT RANGE					Power Rating and Max. Operating Voltage (@ 70°C) (See derating curve)	Zero Ohm Jumper	A	B	C	D	E
	E-12 Std. Res. Values	E-24 Std. Res. Values		E-96 Std. Res. Values								
	± 10% & ± 20%	± 5%	± 5%	± 1%	± 1%							
	± 300 PPM/°C	± 300 PPM/°C	± 200 PPM/°C	± 200 PPM/°C	± 100 PPM/°C							
CRCW 0805		5.1Ω to 9.1Ω	10Ω to 1 Meg		10Ω to 1 Meg	1/10 W 100 V	0.05Ω Max. 1 AMP Max.	.079 ± .008 [2.00 ± .20]	.049 ± .008 [1.25 ± .20]	.020 ± .008 [.50 ± .20]	.016 ± .010 [.40 ± .25]	.016 ± .010 [.40 ± .25]
CRCW 1206	3.3Ω to 8.2Ω	3Ω to 9.1Ω	10Ω to 1 Meg		10Ω to 1 Meg	1/8 W 200 V	0.05Ω Max. 2 AMP Max.	.126 ± .006 [3.20 ± .15]	.063 ± .006 [1.60 ± .15]	.022 ± .006 [.56 ± .15]	.020 ± .010 [.50 ± .25]	.020 ± .010 [.50 ± .25]
CRCW 1210			10Ω to 1 Meg		10Ω to 1 Meg	1/4 W 200 V	0.05Ω Max. 4 AMP Max.	.126 ± .008 [3.20 ± .20]	.098 ± .008 [2.50 ± .20]	.022 ± .006 [.56 ± .15]	.020 ± .010 [.50 ± .25]	.020 ± .010 [.50 ± .25]
CRCW 2010		3Ω to 9.1Ω	10Ω to 1 Meg		10Ω to 1 Meg	1/2 W 200 V		.200 + .009 - .006 [5.08 + .23 - .15]	.100 + .009 - .006 [2.54 + .23 - .15]	.022 ± .006 [.56 ± .15]	.020 ± .010 [.50 ± .25]	.020 ± .010 [.50 ± .25]
CRCW 2512		3Ω to 9.1Ω	10Ω to 1 Meg		10Ω to 1 Meg	1 W 200 V		.250 + .009 - .006 [6.35 + .23 - .15]	.126 + .008 - .006 [3.20 + .20 - .15]	.022 ± .006 [.56 ± .15]	.020 ± .010 [.50 ± .25]	.020 ± .010 [.50 ± .25]

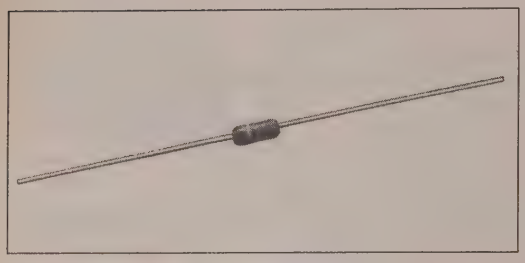
[Numbers in brackets indicate millimeters]

☐ = Factory Stocked Resistance Range ▩ = Contact Factory for Delivery ▨ = Contact Factory for Availability

DALE ELECTRONICS, INC., 2300 Riverside Blvd., Norfolk, NE 68701-2242 • Phone (402) 371-0080 • Fax 402-644-4206

MODEL CCF-07
Metal Film Resistors
Industrial, 2% and 5% Tolerance

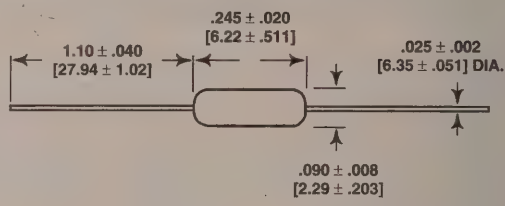
A COMPANY OF VISHAY DALE®



FEATURES
- 1/4 watt at 70°C power rating
- 2% and 5% tolerance
- 100PPM/°C and 200PPM/°C temperature coefficient
- Flame retardant epoxy conformal coating
- Standard 4 band color code marking for ease of identification after mounting
- Tape and reel packaging for automatic insertion. Meets EIA 296-E, Class I.

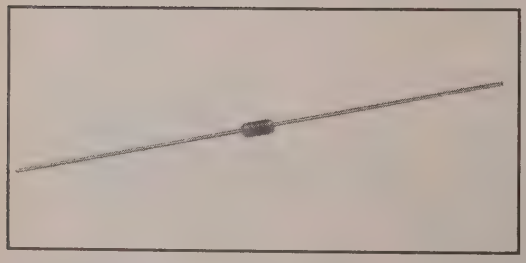
ELECTRICAL SPECIFICATIONS
Resistance Range:
10 ohm to 1 Megohm for ± 2% tolerance.
10 ohm to 2 Megohm for ± 5% tolerance.
Resistance Tolerance: ± 2%, ± 5%.
T. C.: (- 65°C to + 150°C).
± 100PPM/°C for 2% tolerance.
± 200PPM/°C for 5% tolerance.
Power Rating: 1/4 watt at + 70°C.
Maximum Working Voltage: 250 V RMS.
Insulation Resistance: 10,000 Megohm.
Operating Temperature Range: - 65°C to + 150°C.

DIMENSIONAL CONFIGURATIONS
[Numbers in brackets indicate millimeters]



MODELS CCF-50, CCF-55, CCF-60
Metal Film Resistors
Industrial, 1% Tolerance

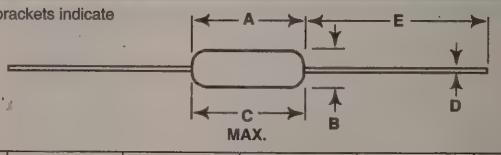
A COMPANY OF VISHAY DALE®



FEATURES
- Power Ratings: 1/4 and 1/2 watt at 70°C
- 100PPM/°C temperature coefficient
- Superior electrical performance
- Flame retardant epoxy conformal coating
- Standard 5 band color code marking for ease of identification after mounting
- Tape and reel packaging for automatic insertion. Meets EIA 296-E, Class I.

ELECTRICAL SPECIFICATIONS
Resistance Range: 10 ohm to 1 Megohm.
Resistance Tolerance: ± 1%.
T. C.: (- 65°C to + 165°C) ± 100PPM/°C.
Power Rating at 70°C:
CCF-50 = 1/4 watt.
CCF-55 = 1/4 watt, 1/2 watt.
CCF-60 = 1/2 watt, 3/4 watt.
Maximum Working Voltage:
200 V RMS for CCF-50.
250 V RMS for CCF-55.
350 V RMS for CCF-60.
Insulation Resistance: 10,000 Megohm.
Operating Temperature Range: - 65°C to + 165°C.

DIMENSIONAL CONFIGURATIONS
[Numbers in brackets indicate millimeters]

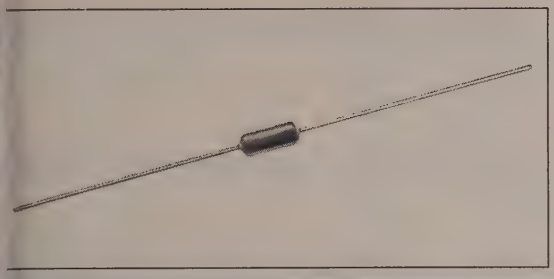


MODEL	A	B	C (Max.)	D	E
CCF-50	.133 ± .010 [3.38 ± .254]	.062 ± .004 [1.57 ± .102]	.143 [3.63]	.020 ± .002 [.508 ± .051]	1.125 ± .040 [28.58 ± 1.02]
CCF-55	.245 ± .020 [6.22 ± .508]	.090 ± .008 [2.29 ± .203]	.265 [6.73]	.025 ± .002 [.635 ± .051]	1.10 ± .040 [27.94 ± 1.02]
CCF-60	.344 ± .031 [8.74 ± .787]	.139 ± .009 [3.53 ± .229]	.400 [10.16]	.025 ± .002 [.635 ± .051]	1.0 ± .040 [25.4 ± 1.02]

For more information contact:
DALE ELECTRONICS, INC., 2300 Riverside Blvd., Norfolk, NE 68701-2242 • Phone (402) 371-0080 • Fax 402-644-4206

MODEL PTF
Metal Film Resistors
Industrial, Precision
Low T.C. - Tight Tolerance

A COMPANY OF VISHAY DALE®



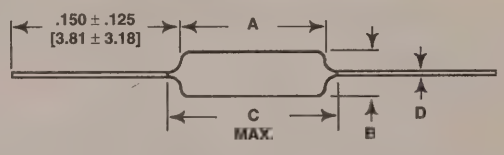
FEATURES
- Extremely low temperature coefficients of resistance
- Standard T. C.: T-10, ± 15PPM/°C. T-13, ± 10PPM/°C. T-16, ± 5PPM/°C.
- Very low noise and voltage coefficient
- Wide precision resistance range in small package
- 100% laser spiralled
- Very good high frequency characteristics
- Acceptance testing available
- Proprietary epoxy coating provides superior moisture protection
- Can replace wirewound bobbins

STANDARD ELECTRICAL SPECIFICATIONS

MODEL	85°C RATING	MAXIMUM WEIGHT (Grams)	MAXIMUM WORKING VOLTAGE	RESISTANCE RANGE (Ohms)	AVAILABLE TOLERANCE RANGE
PTF-51	1/20 W	.11	200	50-100k	± 1% to ± 0.02%
PTF-56	1/8 W	.35	300	50-500k	± 1% to ± 0.01%
PTF-65	1/4 W	.75	500	50-1M	± 1% to ± 0.05%

MATERIAL SPECIFICATIONS
Element: Precision deposited nickel-chrome alloy with controlled annealing
Core: Fire-cleaned high purity ceramic
Encapsulant: Specially formulated epoxy compounds. Coated construction.
Termination: Standard lead material is solder-coated copper. Solderable and weldable per MIL-STD-1276, Type C.

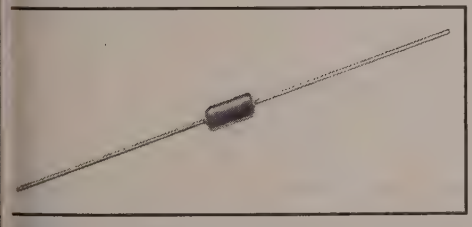
DIMENSIONAL SPECIFICATIONS
[Numbers in brackets indicate millimeters]



MODEL	A	B	C (Max.)	D
PTF-51	.150 ± .020 [3.81 ± .508]	.070 ± .010 [1.78 ± .254]	.200 [5.08]	.016 [.406]
PTF-56	.250 + .031 - .046 [6.35 + .787 -1.17]	.091 ± .009 [2.31 ± .229]	.300 [7.62]	.025 [.635]
PTF-65	.375 ± .062 [9.53 ± 1.57]	.145 ± .016 [3.68 ± .406]	.475 [12.07]	.025 [.635]

MODEL CMH-55-100
Metal Film Resistors
Industrial, High Value

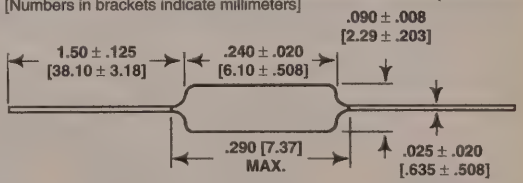
A COMPANY OF VISHAY DALE®



FEATURES
- 1/4 watt at 70°C power rating
- ± 0.5%, ± 1%, ± 2% tolerance
- Tape & reel packaging for automatic insertion available. Meets EIA 296-E.
- Non decade values available
- Flame retardant epoxy conformal coating
- Small dimensional size to value ratio
- 50PPM/°C and 100PPM/°C temperature coefficients

ELECTRICAL SPECIFICATIONS
Resistance Range: 5.01MΩ thru 15MΩ.
Resistance Tolerance:
5.01MΩ - 10MΩ = ± 0.5%, ± 1%, ± 2%. 10.1MΩ - 15MΩ = ± 1%, ± 2%.
Temperature Coefficient: (- 20°C to + 125°C). 5.01MΩ -10MΩ = 0 ± 50PPM/°C, 0 ± 100PPM/°C. 10.1MΩ - 15MΩ = 0 ± 100PPM/°C.
Power Rating: Limited by maximum working voltage.
Maximum Working Voltage: 250 V RMS.
Insulation Resistance: 10,000 Megohm minimum.
Operating Temperature Range: - 65°C to + 165°C.

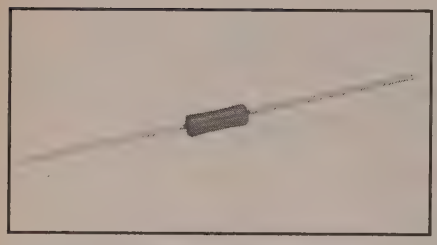
DIMENSIONAL CONFIGURATIONS
[Numbers in brackets indicate millimeters]



For more information contact:
DALE ELECTRONICS, INC., 2300 Riverside Blvd., Norfolk, NE 68701-2242 • Phone (402) 371-0080 • Fax 402-644-4206

MODEL CPF
Metal Film Resistors
Industrial, Power, Flameproof

A COMPANY OF VISHAY DALE®



FEATURES
- High power rating, small size
- Flameproof, high temp. coating
- Special filming and coating processes
- Low noise
- Low voltage coefficient
- Excellent high frequency characteristics

STANDARD ELECTRICAL SPECIFICATIONS

MODEL	WATTAGE RATING (70°C)	VOLTAGE RATING	RESISTANCE RANGE 1% AND ABOVE (Ohms)
CPF-1	1	250 W	0.1-150k
CPF-2	2	350 W	0.1-150k
CPF-3	3	500 W	0.1-150k

Contact factory for resistance range in precision tolerance.

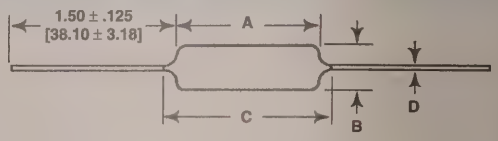
ELECTRICAL SPECIFICATIONS
Resistance Tolerance: .1%, .25%, .5%, 1%, 5%.
T. C.: (-55°C to +125°C) ±100PPM/°C, ±50PPM/°C, ±25PPM/°C.
Dielectric Strength: 900 VAC.
Insulation Resistance: 10,000 Megohm minimum.
Operating Temperature Range: - 65°C to + 230°C.

MATERIAL SPECIFICATIONS
Element: Proprietary nickel-chrome alloy.
Core: Fire-cleaned high purity ceramic.
Coating: Special high temperature conformal coat.
Termination: Standard lead material is solder-coated copper. Solderable and weldable per MIL-STD-1276, Type "C".

MECHANICAL SPECIFICATIONS
Terminal Strength: 2 pound pull test.
Solderability: Continuous satisfactory coverage when tested in accordance with MIL-STD-202, Method 208.

DIMENSIONAL CONFIGURATIONS

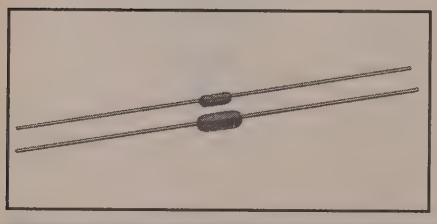
[Numbers in brackets indicate millimeters]



MODEL	A	B	C (Max.)	D
CPF-1	.240 ± .020 [6.10 ± .508]	.090 ± .008 [2.29 ± .203]	.310 [7.87]	.025 ± .002 [.635 ± .051]
CPF-2	.344 ± .031 [8.74 ± .787]	.145 ± .015 [3.68 ± .381]	.425 [10.80]	.032 ± .002 [.813 ± .051]
CPF-3	.555 ± .041 [14.10 ± 1.04]	.180 ± .015 [4.57 ± .381]	.650 [16.51]	.032 ± .002 [.813 ± .051]

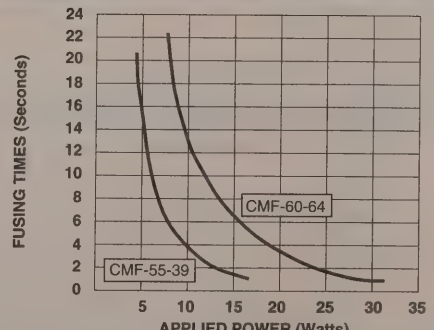
MODELS CMF-55-39 and CMF-60-64
Metal Film Resistors
Special Purpose, Fusible, Flameproof

A COMPANY OF VISHAY DALE®



FEATURES
- Fusible - Circuit protection in case of other component failure
- Flameproof - Meets EIA RS-325, will not flame when overloaded
- Special filming and coating processes

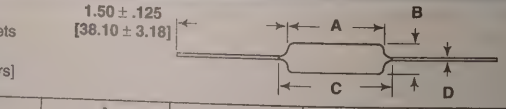
FUSIBLE, FLAMEPROOF (Typical Fusing Times)



ELECTRICAL SPECIFICATIONS
Resistance Range: 5 ohm to 10 kilohm
Resistance Tolerance: ± 1%
T. C.: (- 65°C to + 165°C) ± 100PPM/°C
Power Rating: CMF-55-39 = 1/4 watt and CMF-60-64 = 1/2 watt at + 70°C (Derate linearly from rated power at + 70°C to zero power at + 165°C)
Maximum Flame Test Voltage:
CMF-55-39 = 350 V RMS or DC
CMF-60-64 = 500 V RMS or DC
Insulation Resistance: 10,000 Megohm
Operating Temperature Range: - 65°C to + 165°C

DIMENSIONAL CONFIGURATIONS

[Numbers in brackets indicate millimeters]



MODEL	A	B	C (Max.)	D
CMF-55-39	.240 ± .020 [6.10 ± .508]	.090 ± .008 [2.29 ± .203]	.278 [7.06]	.025 ± .002 [.635 ± .051]
CMF-60-64	.370 ± .035 [9.40 ± .889]	.145 ± .010 [3.68 ± .254]	.425 [10.80]	.032 ± .002 [.813 ± .051]

For more information contact:
DALE ELECTRONICS, INC., 2300 Riverside Blvd., Norfolk, NE 68701-2242 • Phone (402) 371-0080 • Fax 402-644-4206

MODELS HN, HS, HT, HY
Metal Film Resistors
Military/Established Reliability, MIL-R-55182 Qualified
Type RNR and RNN, Hermetically Sealed

A COMPANY OF VISHAY DALE®

FEATURES

- Qualified to MIL-R-55182 Characteristics C and E
- Terminal Type RNR shall be used as a substitute for RNC for Characteristics C and E
- Performance exceeds requirements of MIL-R-55182
- Excellent high frequency performance and long term stability
- Hermetic glass enclosure is impervious to harmful environments
- Inert gas filled, very low noise and high reliability

STANDARD ELECTRICAL SPECIFICATIONS

ANGSTROHM MODEL	MIL-R-55182 TYPE	MILITARY POWER RATING 125°C	MILITARY POWER RATING 70°C	MAXIMUM WORKING VOLTAGE	QUALIFIED RESISTANCE RANGE (Ohms) MIN.	QUALIFIED RESISTANCE RANGE (Ohms) MAX.
HT/HS/HY55 HN55	RNR55 RNN55	1/10	1/8	200	10.0	1.21M
HS/HN57 HN57	RNR57 RNN57	1/8	1/4	250	49.9	200k
HT/HS/HN60 HN60	RNR60 RNN60	1/8	1/4	250	10.0	2.49M
HT/HS/HY65 HN65	RNR65 RNN65	1/4	1/2	300	24.9	4.99M
HS/HY70 HN70	RNR70 RNN70	1/2	3/4	350	24.9	7.5M

ELECTRICAL SPECIFICATIONS

Resistance Tolerance: ± 1.0%, ± 0.5%, ± 0.1%.

Temperature Coefficient: Military Code C = 0 ± 50PPM/°C. Military Code E = 0 ± 25PPM/°C.

Failure Rate: M = 1.0%. P = 0.1%. R = 0.01%. S = 0.001%.

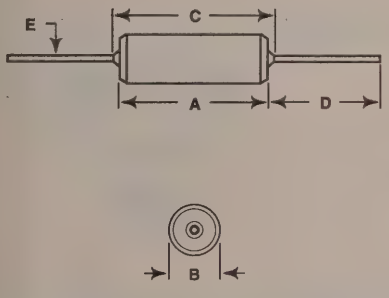
Operating Temperature Range: - 65°C to + 175°C.

MECHANICAL SPECIFICATIONS

Termination: RNR = Solderable leads. RNN = Weldable leads.

DIMENSIONAL CONFIGURATIONS [Numbers in brackets indicate millimeters]

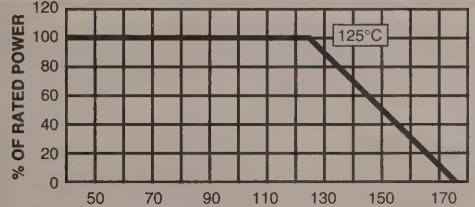
Dimensions shown are maximum allowable per MIL-R-55182.



MILITARY STYLE	A LENGTH	B DIAMETER	C CL to CL* (Max.)	D LENGTH (± .125 [3.18])	E DIAMETER (± .002 [.051])	APPROX. WEIGHT (Grams)
RNR55 RNN55	.250 + .031 - .046 [6.35 + .787 - 1.17]	.109 ± .031 [2.77 ± .787]	.379 [9.63]	1.50 [38.10]	.025 [.635]	.314
RNR57 RNN57	.281 ± .062 [7.14 ± 1.57]	.155 ± .015 [3.94 ± .381]	.467 [11.86]	1.25 [31.75]	.020 [.508]	.317
RNR60 RNN60	.375 ± .062 [9.53 ± 1.57]	.125 + .040 - .031 [3.18 + 1.02 - .787]	.561 [14.25]	1.50 [38.10]	.025 [.635]	.485
RNR65 RNN65	6.25 + .031 - .094 [15.88 + .787 - 2.39]	.188 + .062 - .031 [4.78 + 1.57 - .787]	.780 [19.81]	1.50 [38.10]	.025 [.635]	.950
RNR70 RNN70	.750 + .125 - .062 [19.05 + 3.18 - 1.57]	.250 + .078 - .031 [6.35 + 1.98 - .787]	.939 [23.85]	1.50 [38.10]	.032 [.813]	1.30

* CL to CL is Clean Lead to Clean Lead.

DERATING



PART MARKING

RNR55, RNR57

— Date Code, Characteristic
— Resistance Code
— Tolerance, FR, Terminal, JAN
— Manufacturer Identification

RNR60, RNR65, RNR70

— Source Code
— Date Code, JAN
— Style, Terminal, (60/65/70) and Characteristic
— Resistance Code, Tolerance, FR

NOTE: ANGSTROHM PRECISION, INC., is marketed through Dale Electronics, Inc., Film Division, Norfolk, Nebraska.

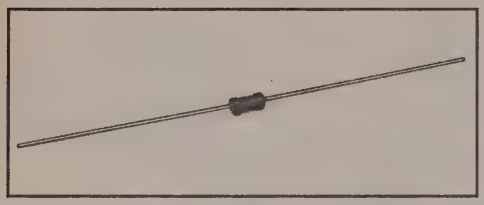
HOW TO ORDER

RNR	55	C or E	2152	B	R
MILITARY STYLE	SIZE	CHARACTERISTIC	RESISTANCE VALUE	TOLERANCE	FAILURE RATE
RNR RNN	55 = 1/10 watt 65 = 1/4 watt 57 = 1/8 watt 70 = 1/2 watt 60 = 1/8 watt	(Hermetically Sealed) Terminal Type RNR shall be used as a substitute for RNC for Characteristics C and E.	First three digits are significant. Last digit specifies the number of zeros to follow.	B = ± 0.1% D = ± 0.5% F = ± 1.0%	

Marketed By: DALE ELECTRONICS, INC., 2300 Riverside Blvd., Norfolk, NE 68701-2242 • Phone (402) 371-0080 • Fax 402-644-4206
Manufactured By: ANGSTROHM PRECISION, INC., P.O. Box 1827, Hagerstown, MD 21742 • Phone (301) 739-8722 • Fax 301-797-6852

MODEL RNX
Metal Oxide Resistors
High Voltage, Special Purpose

A COMPANY OF VISHAY DALE®



FEATURES

- For oil bath or open air operation
- Low T.C.: ± 200PPM/°C standard. ± 100PPM/°C, ± 50PPM/°C available.
- Tolerance: ± 1% standard to 1 Gigohm. ± 5% above 1 Gigohm. ± 0.5% available in 50PPM/°C only. Special tolerances and/or T.C. matching available upon request.

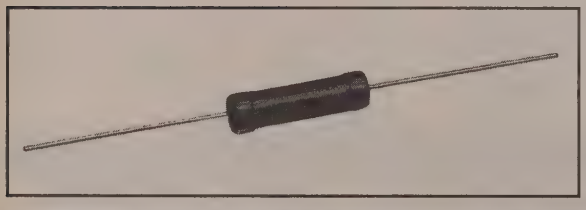
STANDARD ELECTRICAL SPECIFICATIONS

MODEL	WATTAGE RATING* 25°C	70°C	125°C	VOLTAGE RATING	RESISTANCE RANGE (Ohms) T.C. ± 200PPM/°C	T.C. ± 100PPM/°C	T.C. ± 50PPM/°C	NON-INDUCTIVE T.C. ± 200PPM/°C
RNX-1/4	.5	.36	.25	750V	1k-100M	1k-100M	1M-22M	100-100k
RNX-3/8	1.0	.72	.5	1.5KV	1k-1G	1k-100M	1M-50M	100-100k
RNX-1/2	1.2	.86	.6	2.0KV	1k-2.0G	1k-250M	1M-100M	100-100k
RNX-3/4	2.0	1.44	1.0	3.0KV	1k-3G	1k-500M	1M-100M	100-100k
RNX-1	2.5	1.80	1.25	4.0KV	1k-5G	1k-500M	1M-100M	100-1M
RNX-1-1/4	3.0	2.16	1.50	5.0KV	2k-10G	1k-500M	—	100-1M
RNX-1-1/2	4.0	2.88	2.0	6.0KV	2k-10G	1k-500M	—	100-1M
RNX-2	5.0	3.60	2.50	8.0KV	2k-10G	1k-500M	—	100-1M

* Increase wattage by 25% for .032" [.813] diameter leads. ** For resistance values above and below those listed, contact factory.
All resistance readings referenced at 100 VDC. Other voltages upon request.

MODEL ROX
Metal Oxide Resistors
High Voltage, Special Purpose

A COMPANY OF VISHAY DALE®



FEATURES

- Low T.C.: ± 200PPM/°C standard. ± 100PPM/°C, ± 50PPM/°C available.
- Tolerances: ± 10%, ± 5%, ± 2%, ± 1%
- For oil bath or open air operation
- Matched sets available
- Special testing available upon request

STANDARD ELECTRICAL SPECIFICATIONS

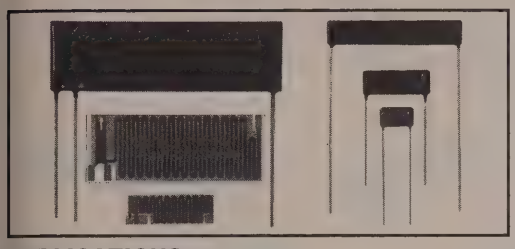
MODEL	WATTAGE RATING* 25°C	70°C	125°C	VOLTAGE RATING	RESISTANCE RANGE (Ohms) T.C. ± 200PPM/°C	T.C. ± 100PPM/°C	T.C. ± 50PPM/°C	NON-INDUCTIVE T.C. ± 200PPM/°C
ROX-1/2	2.0	1.4	1.0	2.0KV	1k-1G	1k-100M	1M-100M	—
ROX-3/4	3.0	2.16	1.5	5.0KV	1k-4G	1k-500M	1M-100M	100-1M
ROX-1	4.0	2.88	2.0	7.5KV	1k-5G	1k-500M	1M-100M	100-1M
ROX-1-1/2	5.0	3.6	2.5	11.0KV	1.5k-7.5G	1.5k-500M	1M-100M	100-1M
ROX-2	6.0	4.32	3.0	15.0KV	2k-10G	2k-1G	1M-500M	100-1M
ROX-3	10.0	7.2	5.0	22.5KV	3k-15G	3k-1G	1M-500M	400-10M
ROX-4	12.0	8.64	6.0	30.0KV	4k-20G	4k-1G	1M-500M	500-10M
ROX-5	16.0	11.52	8.0	37.5KV	5k-25G	5k-1G	1M-500M	500-10M
ROX-6	20.0	14.4	10.0	45.0KV	6k-30G	6k-1G	1M-500M	500-10M

* Wattage increases by 25% with .040" [1.02] lead. All resistance readings referenced at 100 VDC. Other voltages available on request. 1% not available above 10G.

DALE ELECTRONICS, INC., 550 High Street, Bradford, PA 16701-0930 • Phone (814) 362-5600 • Fax 814-362-5635

MODELS TR and TD
Thick Film Resistors and Dividers
Special Purpose, High Voltage

A COMPANY OF VISHAY DALE®



FEATURES
- 0.25 watt to 3.0 watt at + 25°C
- Outstanding stability under adverse conditions
- Stable cermet resistive element bonded to a high-purity alumina substrate
- Tough epoxy-based coating and high voltage stability
- Designs built from customer supplied schematics
- Dividers available leaded or non-leaded
- Typical resistance ratios of 1000:1, 2000:1, etc.
- TCR tracking to ± 10PPM/°C depending on values
- Typical thickness of .055" [1.40] for space preservation

APPLICATIONS
Applications include power supplies, transformers and any application requiring operation within an environment where high voltages are used.

ELECTRICAL SPECIFICATIONS
Resistance Range: 500 ohm to 1000 Megohm.
Resistance Tolerance: ± 1% to ± 20% standard.
Ratio Tolerance: 0.25% to 5% standard.
Temperature Coefficient: < 200PPM/°C; Ratio T. C. to 5PPM/°C.
Maximum Voltage: 25,000 volts.
Insulation Resistance: 10,000 Megohm minimum.
Voltage Coefficient: 2PPM/°C per volt standard, tighter available.
Dielectric Strength: 5,000 volts, $\Delta \leq \pm 1\%$.
Moisture Resistance: 0.5%, 240 hour test.
Load Life: 0.5%, 1000 hours at rated power.

MECHANICAL SPECIFICATIONS
Resistive Element: Thick film.
Substrate: 96% pure alumina.
Encapsulation: Epoxy base, conformal coating.
Terminals: 60/40 solder coated copper.
Terminal Strength: 4.5 pounds for 30 seconds.
Power: Derated from ambient temperature + 25°C.

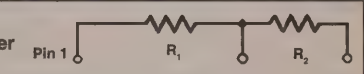
ENVIRONMENTAL SPECIFICATIONS
Temp. Range: - 55°C to + 125°C for resistors, to + 150°C for dividers.
Thermal Shock: .25% (5 cycles, - 55°C to + 125°C).

STANDARD ELECTRICAL SPECIFICATIONS

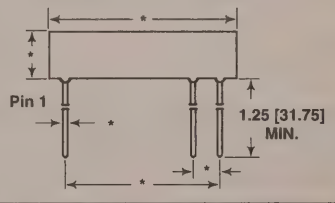
MODEL	RESISTANCE (Ohms) (Min.)	RESISTANCE (Ohms) (Max.)	POWER RATING (Watts)	MAXIMUM VOLTAGE (Volts)
TR03	300	40M	0.25	0.8K
TR05	500	75M	0.5	1.5K
TR10	1000	1000M	1.0	10K
TR15	1500	1000M	1.5	15K
TR20	2000	1000M	2.0	20K
TR30	3000	1500M	3.0	30K

DIMENSIONAL CONFIGURATIONS

Typical Resistor Schematic for Divider

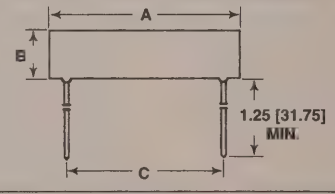


Typical High Voltage Divider



* Specified by application

Standard High Voltage Resistor

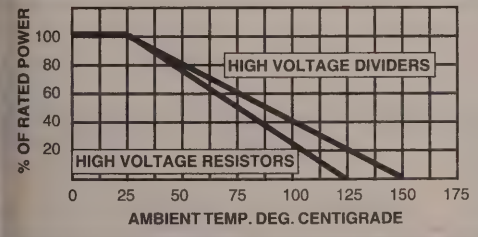


[Numbers in brackets indicate millimeters]

Dimensions (± 10%)

MODEL	A (Length)	B (Height)	C (Lead Spacing)
TR02	.300 [7.62]	.210 [5.33]	.200 [5.08]
TR05	.500 [12.70]	.300 [7.62]	.400 [10.16]
TR10	1.0 [25.40]	.350 [8.89]	.900 [22.86]
TR15	1.50 [38.10]	.350 [8.89]	1.40 [35.56]
TR20	2.0 [50.80]	.350 [8.89]	1.90 [48.26]
TR30	3.0 [76.20]	.400 [10.16]	2.90 [73.66]

DERATING



PART MARKING

— Part number
— Date code
— Resistance value
— Power rating
— Tolerance value

HOW TO ORDER - HIGH VOLTAGE RESISTORS

TR	20	G	1001	H
MODEL	LENGTH (± 10%)	POWER RATING	VALUE	TOLERANCE
	First digit is number of inches, next digit is tenths of an inch.	C = 0.25 D = 0.5 F = 1.0 G = 1.5 H = 2.0 J = 3.0	First three digits are significant. The last digit specifies the number of zeros.	F = ± 1% G = ± 2% H = ± 3% J = ± 5% K = ± 10% M = ± 20%

Shipment on Strip Pack

HOW TO ORDER - HIGH VOLTAGE DIVIDERS

TD	20	S	1006/3300	F	L
MODEL	LENGTH (± 10%)	RATIO TCR (PPM)	VALUE/RATIO	RATIO TOLERANCE	STYLE
	First digit is number of inches, next digit is tenths of an inch.	S = 10 R = 25 H = 50 K = 100 L = 200 M = 300	**Resistance Value of R1:** First three digits are significant. The last digit specifies the number of zeros. **Ratio:** R1/R2.	C = 0.25% D = 0.50% F = 1.0% G = 2.0% H = 3.0% J = 5.0%	L = Leaded N = Non-leaded

TECHNO DIVISION, DALE ELECTRONICS, INC., 7803 Lemona Avenue, Van Nuys, CA 91405-1139 • Phone (818) 781-1642 • Fax 818-781-8647

MODEL WSC
Wirewound Resistors
Precision Power, Surface Mount

A COMPANY OF VISHAY DALE®

FEATURES
- Molded epoxy encapsulation
- Available in non-inductive styles with Aryton-Perry windings for lowest reactive components

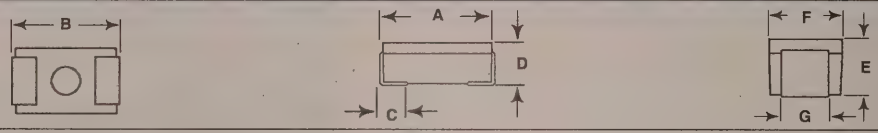
STANDARD ELECTRICAL SPECIFICATIONS

MODEL	POWER RATING	RESISTANCE RANGE (Ohms) ± .5%, ± 1%, ± 3%, ± 5%
WSC-1/2	1/2 W	.05-1.41k
WSC-1	1 W	.05-2.77k
WSC-2	2 W	.005-10.4k

ELECTRICAL & MATERIAL SPECIFICATIONS

Resistance Tolerance: ± .5%, ± 1%, ± 3%, ± 5%.
Temperature Coefficient: (Below 0.1Ω, call factory.)
± 90PPM/°C, 0.1Ω - 0.99Ω.
± 50PPM/°C, 1.0Ω - 9.9Ω.
± 20PPM/°C, 10Ω and up.
Dielectric Strength: 500 VAC.
Insulation Resistance: 1000 MΩ minimum dry, 100 MΩ after moisture test.
Short Time Overload: 5 seconds at 5 times rated power.
Solderability: 60/40 electro tin plated terminals to facilitate soldering.
Element: Copper-nickel or nickel-chrome alloy (depends on resistance value).
End Caps: Nickel silver alloy.
Molding: Epoxy encapsulation.
Standard Terminals: Tinned copper alloy.

DIMENSIONAL CONFIGURATIONS [Numbers in brackets indicate millimeters]



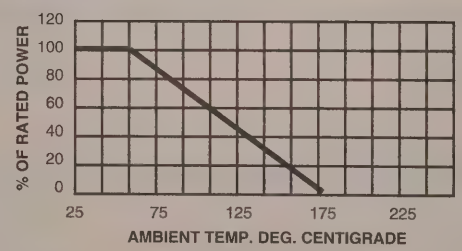
MODEL	A	B	C	D	E	F	G
WSC-1/2	.188 ± .005 [4.77 ± .127]	.200 ± .020 [5.08 ± .508]	.040 ± .010 [1.02 ± .254]	.096 ± .015 [2.44 ± .381]	.090 ± .005 [2.29 ± .127]	.125 ± .005 [3.18 ± .127]	.050 ± .010 [1.27 ± .254]
WSC-1	.238 ± .005 [6.05 ± .127]	.250 ± .020 [6.35 ± .508]	.045 ± .010 [1.14 ± .254]	.110 ± .015 [2.79 ± .381]	.104 ± .005 [2.64 ± .127]	.150 ± .005 [3.81 ± .127]	.098 ± .005 [2.49 ± .127]
WSC-2	.433 ± .005 [11.0 ± .127]	.445 ± .032 [11.30 ± .813]	.100 ± .010 [2.54 ± .254]	.162 ± .015 [4.11 ± .381]	.156 ± .005 [3.96 ± .127]	.275 ± .005 [6.98 ± .127]	.215 ± .005 [5.46 ± .127]

ENVIRONMENTAL PERFORMANCE

TEST	DALE MAXIMUM
Temperature Coefficient	20 to 90PPM/°C
Thermal Shock	± (.2% + .05Ω) ΔR
Short Time Overload	± (.2% + .05Ω) ΔR
Dielectric	± (.1% + .05Ω) ΔR
Low Temp. Storage	± (.2% + .05Ω) ΔR
High Temp. Exposure	± (.5% + .05Ω) ΔR
Moisture Resistance	± (.2% + .05Ω) ΔR
Shock	± (.1% + .05Ω) ΔR
Vibration	± (.1% + .05Ω) ΔR
Load Life	± (.5% + .05Ω) ΔR

NOTE: Environmental specifications referenced @ 25°C.

DERATING



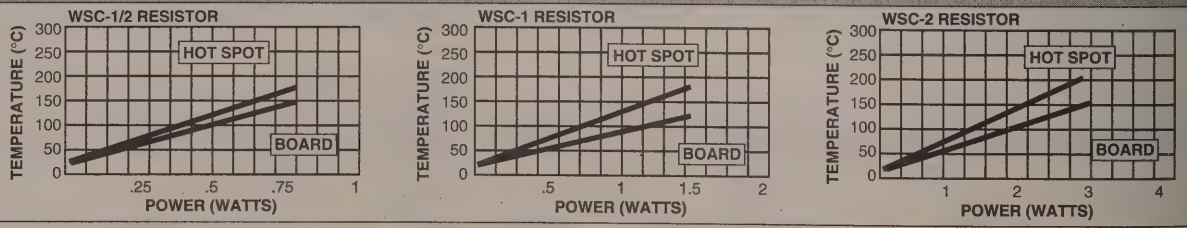
PART MARKING

1/2 WATT STYLE
— Dale logo
— Value

1 WATT STYLE
— Style
— Value and tolerance
— Date code

2 WATT STYLE
— Dale logo
— Style
— Value and tolerance
— Date code

SURFACE TEMPERATURE vs POWER



PACKAGING

Embossed Carrier Tape per EIA-481-1, 2.
Tape Widths:
WSC-1/2 = 12mm/2000 pieces/13" reel.
WSC-1 = 16mm/2000 pieces/13" reel.
WSC-2 = 24mm/1200 pieces/13" reel.

HOW TO ORDER

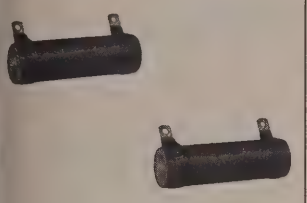
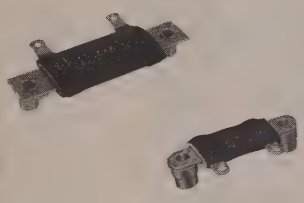
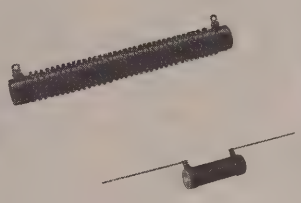
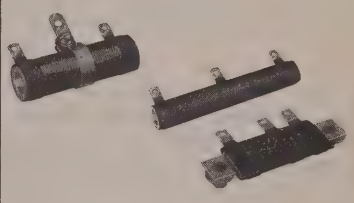
WSC-1	10	± 1%
MODEL	RESISTANCE	TOLERANCE

DALE ELECTRONICS, INC., 1122 23rd Street, Columbus, NE 68601-3647 • Phone (402) 563-6506 • Fax 402-563-6418

MODELS HL, NHL, HLx Wirewound Resistors

Industrial Power

A COMPANY OF VISHAY DALE®

Tubular: MODEL HL MODEL NHL (Non-Inductive)	Flat: MODEL HL MODEL HLM, Miniature	Edgewound: MODEL HLZ Tubular: MODEL HLW	Adjustable: MODEL HLA Tapped: MODEL HLT
			

APPLICATIONS - HL (Tubular)

Dale® HL resistors for inexpensively dissipating larger amounts of power in DC or low frequency AC circuits.

Special applications include grid resistors, voltage dropping resistors, high voltage bleeder resistors in power supplies, bias supply resistors, voltage divider networks, filament dropping resistors, load resistors, shunt resistors.

APPLICATIONS - NHL (Non-Inductive, Tubular)

Dummy antennas, terminating resistors, any resistance function where low effective inductance is needed.

Dale NHL resistors utilize Aryton-Perry winding (two single-layer parallel windings in opposite directions) to cancel most of the inductive effects.

Note: NHL resistors utilize the same cores, terminals and mounting hardware as HL models. However, resistance values are lower because of spacing allowances which must be made in the Aryton-Perry winding.

FEATURES - HL (Flat)

High power-to-size ratio. Mounting accommodations ideally suited to high density packaging. Self-stacking hardware for horizontal or vertical placement. Withstands high vibration without loosening. Mountings function as heat sinks allowing greater heat dissipation and less derating of stacked units.

EXCLUSIVE BRACKET DESIGN FOR HLM

Mounting strap fits snugly through core and is bound tightly against unit by two eccentric spacers. Eliminates expensive replacements and improves heat transfer and power handling capabilities. (Patent 3390367)

FEATURES - HLZ (Edgewound)

Designed to meet heavy-duty requirements where space is at a premium. High thermal capacity for intermittent or short duration. Silicone coating allows maximum heat transfer from wire surface.

Resistance Tolerance: ± 10% standard. ± 5% available.

Dielectric Strength: 1000 V terminals to mounting hardware.

Temperature Rise: 375°C at full power. Slightly higher temperatures will occur in maximum resistance units.

Construction: A ribbon element is edgewound onto a ceramic tube and is coated with silicone. Silicone coating holds ribbon wire firmly against core while allowing maximum exposure of wire surface for heat transfer by radiation and convection.

FEATURES - HLW (Tubular)

Resistance Tolerance: 5% tolerance standard 1 ohm and above. 10% below 1 ohm. Lower tolerances available.

Construction: Identical to Model HL, but with lug-attached leads to facilitate direct electrical connection by soldering.

FEATURES - HLA (Adjustable)

Adjustable resistor or voltage divider. Resistor can be used to quickly obtain odd resistance values. Resistor can be used as multi-tap resistor. One or more adjustable lugs can be provided for voltage-divider applications.

Tolerance: The standard tolerance on the total resistance is ± 5% and is checked with the adjustable terminal removed from the unit, in accordance with MIL-R-19365C.

Wattage Rating: To avoid overloading any section of an adjustable resistor, do not exceed the maximum rated current based on total resistance. The wattage ratings shown on the chart apply only when the entire resistance is in the circuit. The adjustable lug divides the wattage rating in proportion to the divided resistance.

FEATURES HLT (Tapped)

Provides fixed taps for voltage dividers.

Tolerance: ± 10% Standard tolerance for the total resistance.

Power Rating & Maximum Resistance: The winding space is slightly reduced by the additional terminals, resulting in a small reduction of power rating and maximum resistance. Consult the factory for information on specific applications. To insure proper resistor design, the power rating for each section must be specified.

Moving Adjustable Lugs: The coatings protect the resistance wire from shifting and shorting to other turns during adjustment. However, the following three steps should always be taken whenever adjustments are made: (1) Turn off current to avoid possible operator injury and damage to the unit. (2) Loosen adjustable lug until it will slide completely free, without touching the exposed wire. (3) When adjustment point has been selected, retighten lug only enough to assure a firm contact, do not tighten beyond this point. Failure to follow these three steps in order can result in damage to the resistor.

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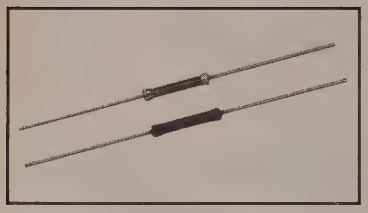
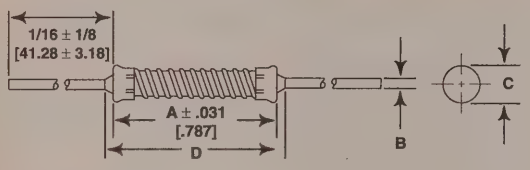
MODEL CA
Wirewound Resistors
Commercial, Power



FEATURES
- Low cost, high performance
- CA-5000 models available with special silicone coating for corrosion and abrasion protection

ELECTRICAL SPECIFICATIONS
Resistance Tolerance: ± 10% standard. ± 5% available.
Temperature Coefficient: Below 1 ohm 0 ± 800PPM. 1 ohm and above 0 ± 400PPM.
Power Rating: CA-4000 Series = 4 watts per inch. CA-5000 Series = 5 watts per inch.
Maximum Working Voltage: $\sqrt{PR}$.

DIMENSIONAL CONFIGURATIONS
[Numbers in brackets indicate millimeters]



(CA-4000 Model shown.)

MODEL	A	B ± .001 [.025]	C ± .140 [3.56]	D ± 1/32 [.794]
CA-4000	See Table	.032 [.813]	.140 [3.56]	A + .062 [1.57]
CA-5000	at Right.	.036 [.914]	.160 [4.06]	*A + .093 [2.36]

* Dimension "D" on CA-5000 Model is clean lead to clean lead length.

STANDARD ELECTRICAL SPECIFICATIONS / DIMENSION A

MODEL	POWER RATING	OHMIC VALUE (Min.)	OHMIC VALUE (Max.)	A ± .031 [.787]
CA-4050	2.0 W	.10	270	.50 [12.70]
CA-4055	2.2 W	.10	300	.55 [13.97]
CA-4060	2.4 W	.11	350	.60 [15.24]
CA-4070	2.8 W	.13	430	.70 [17.78]
CA-4080	3.2 W	.16	510	.80 [20.32]
CA-4090	3.6 W	.18	590	.90 [22.86]
CA-4100	4.0 W	.20	670	1.00 [25.40]
CA-4150	6.0 W	.33	1,080	1.50 [38.10]
CA-4200	8.0 W	.45	1,480	2.00 [50.80]
CA-4220	8.8 W	.50	1,640	2.20 [55.88]
CA-5050	2.5 W	.10	2,400	.50 [12.70]
CA-5055	2.75 W	.10	2,700	.55 [13.97]
CA-5060	3.0 W	.11	3,100	.60 [15.24]
CA-5070	3.5 W	.13	3,900	.70 [17.78]
CA-5080	4.0 W	.16	4,600	.80 [20.32]
CA-5090	4.5 W	.18	5,300	.90 [22.86]
CA-5100	5.0 W	.20	6,000	1.00 [25.40]
CA-5150	7.5 W	.33	9,700	1.50 [38.10]
CA-5200	10.0 W	.45	13,300	2.00 [50.80]
CA-5220	11.0 W	.50	14,800	2.20 [55.88]

NOTE: CA-4000 Models available with silicone coating. Maximum resistance value will be the same as CA-5000 Models. Consult factory.

APPLICATIONS
Kitchen appliances: percolators, blenders, mixers, ranges, toasters, deep fryers. Automotive devices: horns, ignitions, windshield wipers, voltage regulators, instrument gauges. Entertainment devices: radios, televisions. Also computer and power supplies.

CONSTRUCTION
High quality, premium resistance wire is wound on a woven fiberglass core impregnated and coated with a special grade silicone.

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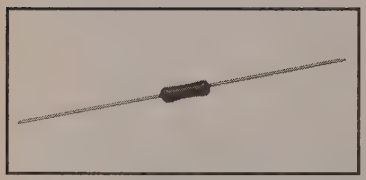
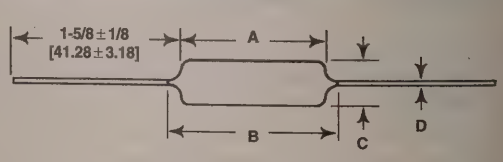
MODELS CA-1 and CA-2
Wirewound Resistors
Commercial, Power



FEATURES
- High performance for low cost
- Axial leads
- Special grade silicone for additional environmental protection
- Auto insertable
- Value and tolerance printed

ELECTRICAL SPECIFICATIONS
Resistance Range: CA-1 = .1Ω to 1000Ω. CA-2 = .1Ω to 2400Ω.
Resistance Tolerance: ± 10% standard. ± 5% available.
T. C.: ± 600PPM/°C below 1Ω. ± 300PPM/°C 1Ω and above.
Power Rating: CA-1 = 1 watt. CA-2 = 2 watt.
Maximum Working Voltage: $\sqrt{PR}$.
Dielectric Withstanding Voltage: 600 V RMS.

DIMENSIONAL CONFIGURATIONS
[Numbers in brackets indicate millimeters]



MODEL	A Typical	B Maximum	C Maximum	D ± .001 [.025]
CA-1	.400 [10.16]	.460 [11.68]	.170 [4.32]	.032 [.813]
CA-2	.570 [14.48]	.630 [16.00]	.170 [4.32]	.032 [.813]

APPLICATIONS: Kitchen appliances: percolators, blenders, mixers, ranges, toasters, deep fryers. Automotive devices: horns, ignitions, windshield wipers, voltage regulators, instrument gauges. Entertainment devices: radios, televisions. Also computer and power supplies

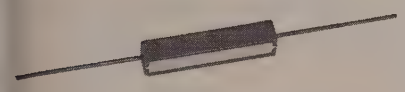
CONSTRUCTION: High quality, premium resistance wire is wound on a woven fiberglass core impregnated and coated with a special grade silicone.

For more information contact:
DALE ELECTRONICS, INC., 1122 23rd Street, Columbus, NE 68601-3647 • Phone (402) 563-6506 • Fax 402-563-6418

COMMERCIAL, POWER Wirewound Resistors

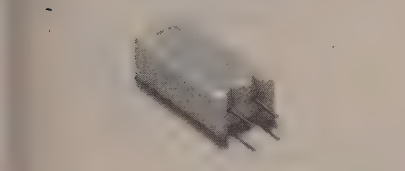
Axial Lead, Vertical Mount, Four Lead Radial Terminals, Surface Mount

A COMPANY OF VISHAY DALE®



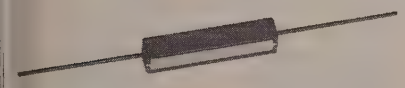
MODEL CP
Wirewound Resistors
Commercial, Power, Axial Lead, Fireproof Inorganic Construction, Meets or Exceeds EIA Standard RS-344

ELECTRICAL SPECIFICATIONS
Resistance Tolerance: ± 10% std. ± 5% available.
Resistance Range: .1Ω to 30kΩ.
T. C.: Below 1Ω = 0 ± 800PPM/°C, typical.
1Ω and above = 0 ± 400PPM/°C, typical.
Maximum Working Voltage: $\sqrt{PR}$.
Operating Temperature: - 55°C to + 275°C.
Wattage Rating: 2, 3, 5, 7, 10, 15, 20 and 22.
Note: Models with mounting pads available.



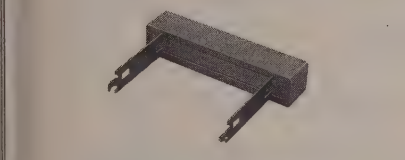
MODELS CPCL, CPCC, CPCP, CPCF
Wirewound Resistors
Commercial, Power, Vertical Mount, Fireproof Inorganic Construction, Space Saving, Models Vary by Construction, Contact Factory for All Details

ELECTRICAL SPECIFICATIONS
*** Resistance Tolerance:** ± 1%, ±3%, ± 5%, ± 10%.
*** Resistance Range:** .1Ω to 150kΩ.
T. C.: Depends on model.
Dielectric Strength: 1000 VAC.
Maximum Working Voltage: $\sqrt{PR}$.
Operating Temperature: - 55°C to + 275°C.
Wattage Rating: 2, 3, 5 and 10.
* Depends on model, models vary by construction.



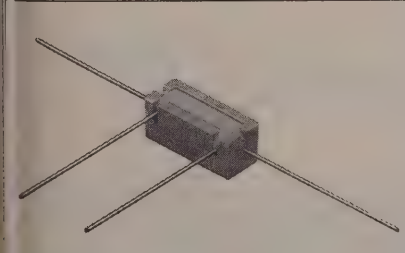
MODEL CPL
Wirewound Resistors
Military, MIL-R-49465, Type RLV & Commercial Models, Power, Axial Lead, Fireproof Inorganic Construction

ELECTRICAL SPECIFICATIONS
Resistance Tolerance: ± 5% std. Lower available. Military Tolerance, Characteristic L: ± 5%, ± 10%.
Resistance Range: .01Ω to .10Ω. Resistance is measured 3/8" [9.50] from resistor body.
T. C.: Varies by resistance values. ± 550PPM/°C maximum. Consult factory.
Dielectric Strength: 1000 VAC.
Terminal Strength: 5 pounds minimum.



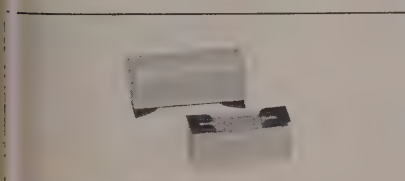
MODEL CPR
Wirewound Resistors
Commercial, Power, Circuit Board Lock-In Mounting Tabs, Radial Terminals, Fireproof Inorganic Construction

ELECTRICAL SPECIFICATIONS
Resistance Tolerance: ± 5%, ± 10%.
Resistance Range: .1Ω to 2000Ω. .
T. C.: Below 1Ω = 0 ± 800PPM/°C.
1Ω and above = 0 ± 400PPM/°C.
Power Rating: 3 watt to 20 watt.
Maximum Working Voltage: $\sqrt{PR}$.
Operating Temperature: - 55°C to + 275°C.
Wattage Rating: 3, 5, 7, 10, 15 and 20.



MODEL CPSL
Wirewound Resistors
Military, MIL-R-49465 Type RLV & Commercial Models, Power, Four Lead, Fireproof Inorganic Construction

ELECTRICAL SPECIFICATIONS
Resistance Tolerance: ± 5% std. ± 3% available. Military Tolerance, Characteristic L: ± 5%, ± 10%.
Resistance Range: .01Ω to .10Ω. .
T. C.: ± 100PPM/°C maximum.
Operating Temperature: - 55°C to + 275°C.
Wattage Rating: 3, 5, 7, 10 and 15.
Dielectric Strength: 1000 VAC.
Terminal Strength: 5 pounds minimum.



MODEL CPSM
Wirewound Resistors
Commercial, Power, Surface Mount, Fireproof Inorganic Construction

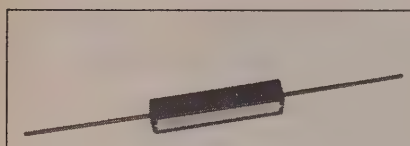
ELECTRICAL SPECIFICATIONS
Resistance Tolerance: ± 5%, ± 10%.
Resistance Range: .1Ω to 700Ω. .
T. C.: Below 1Ω = 0 ± 800PPM/°C.
1Ω and above = 0 ± 400PPM/°C.
Power Rating: 3 watt and 5 watt.
Operating Temperature: - 55°C to + 275°C.

For more information contact:
DALE ELECTRONICS, INC., 1122 23rd Street, Columbus, NE 68601-3647 • Phone (402) 563-6506 • Fax 402-563-6418

COMMERCIAL, POWER Wirewound Resistors

Axial Lead, Vertical Mount, Four Lead Radial Terminals, Surface Mount

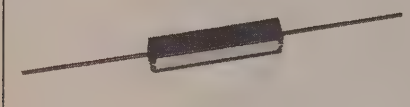
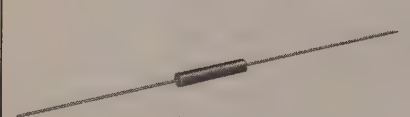
A COMPANY OF VISHAY DALE®

	**MODEL CPW** **Wirewound Resistors** Commercial, Power, Axial Lead, Fireproof Inorganic Construction, High Surge Capabilities, Non-inductive Models Available	**ELECTRICAL SPECIFICATIONS** **Resistance Tolerance:** ± 1%, ± 2%, ± 3%, ± 5%. **Resistance Range:** .1Ω to 45kΩ. **T.C.:** Below 9.9Ω, ± 50PPM/°C. 10Ω & up, ± 30PPM/°C. **Maximum Working Voltage:** $\sqrt{PR}$. **Operating Temperature:** - 55°C to + 275°C. **Wattage Rating:** 2, 3, 5, 7, 10, 15 and 20.

COMMERCIAL, POWER Wirewound Fuse Resistors

Axial Lead, Radial Terminals Custom Designed Molded Models Available

A COMPANY OF VISHAY DALE®

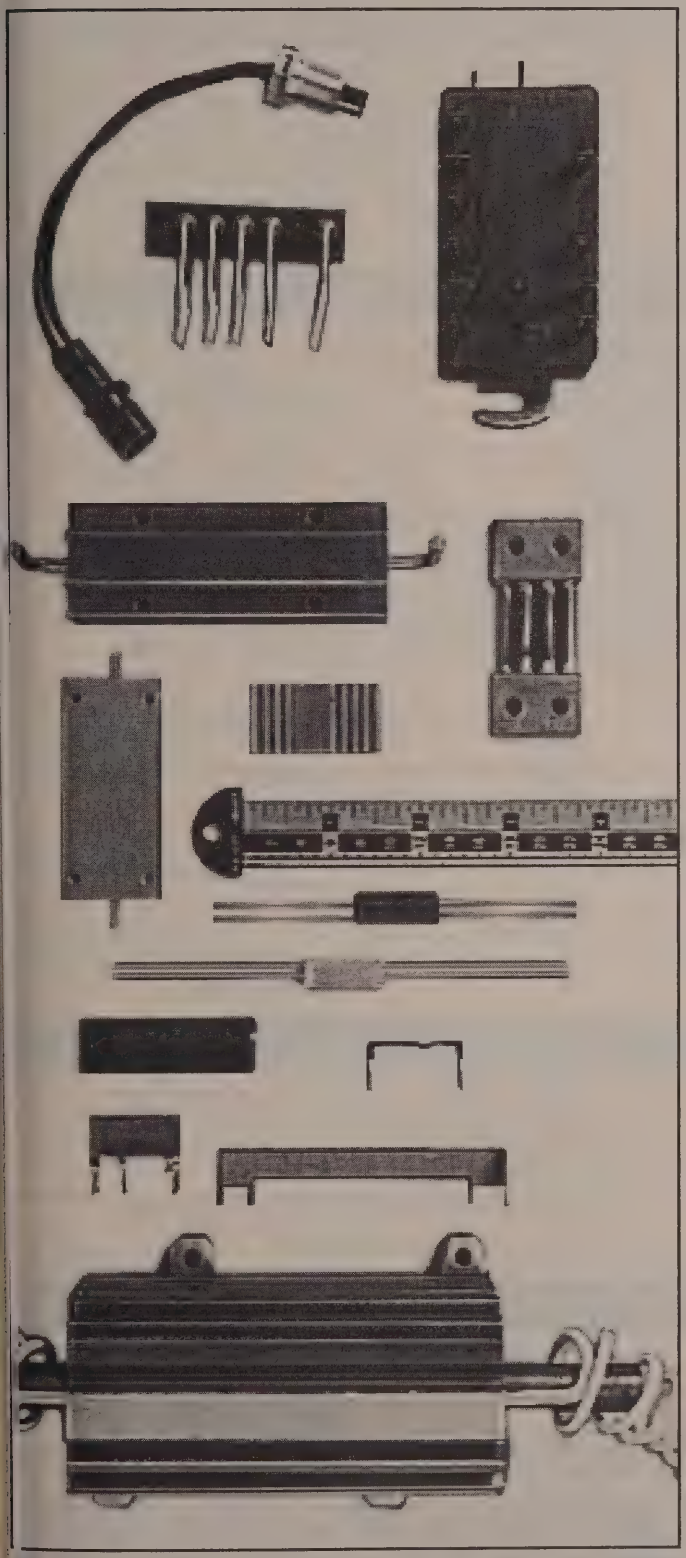
	MODEL CA-(X)F **Wirewound** **Fuse Resistors** Commercial, Power, Axial Lead, Multiple Physical Configurations Available	**ELECTRICAL SPECIFICATIONS** **Resistance Tolerance:** ± 10% std. ± 5% available. **Maximum Working Voltage:** $\sqrt{PR}$. **Power Rating:** Model 4000, 4 watts per inch. Note: Generally standard processed units will fuse before 60 seconds when subjected to 12 x rated power minimum. By combining special alloys, materials and other techniques, faster fusing times may be accomplished. **Applications:** Kitchen appliances, automotive and entertainment devices, computers and power supplies.
	**MODEL CP-(X)F** **Wirewound** **Fuse Resistors** Commercial, Power, Axial Lead, Fireproof Inorganic Construction, Multiple Physical Configurations Available	**ELECTRICAL SPECIFICATIONS** **Resistance Tolerance:** ± 5% minimum. **Resistance Range:** .05Ω to 1200Ω. **Operating Temperature:** - 55°C to + 275°C. **Terminal Strength:** 7 pound pull test. **Wattage Rating at 25°C:** 2, 3, 5, 7, 10, 15, 20 and 22. Note: Generally standard processed units will fuse before 60 seconds when subjected to 15 x rated power minimum. By combining special alloys, materials and other techniques, faster fusing times may be accomplished.
	MODEL CPR-(X)F **Wirewound** **Fuse Resistors** Commercial, Power, Circuit Board Lock-In Mounting Tabs, Radial Terminals, Multiple Phyical Configurations Available	**ELECTRICAL SPECIFICATIONS** **Resistance Tolerance:** ± 5% minmum. **Resistance Range:** .1Ω to 1100Ω. **Operating Temperature:** - 55°C to + 275°C. **Terminal Strength:** 7 pound pull test. **Wattage Rating at 25°C:** 5, 7, 10, 15 and 20. Note: Generally standard processed units will fuse before 60 seconds when subjected to 15 x rated power minimum. By combining special alloys, materials and other techniques, faster fusing times may be accomplished.
	**MODEL RS-1F** **Wirewound** **Fuse Resistors** High Temperature Silicone Molded, Low T. C., Fast Acting, Custom Designed For Your Application	**ELECTRICAL SPECIFICATIONS** **Resistance Tolerance:** ± 3%, ± 5% ± 10%. **Resistance Range:** .12Ω to 500Ω. **T.C.:** ±50PPM/°C, 1Ω thru 9.9Ω. ±30PPM/°C, 10Ω & up. **Power Rating:** 1.0 watt std. Higher ratings available. **Dielectric Strength:** 750 VAC. **Fusing Times:** 1 millsecond to 1 second. **Minimum Fusing Current:** Approximately 4 times the continuous operating current obtainable on some designs. Larger ratios produce better designs.

For more information contact:
DALE ELECTRONICS, INC., 1122 23rd Street, Columbus, NE 68601-3647 • Phone (402) 563-6506 • Fax 402-563-6418

SPECIAL PURPOSE Wirewound Resistors

Engineered to Your Special Requirements

A COMPANY OF VISHAY DALE®



The photo at left illustrates only a few of the many special purpose wirewound resistors built by the Dale Special Products Section in the Wirewound Division.

Full-time engineers assigned to this section draw on the industry's largest file of non-standard resistor design and production information. Often, in a matter of minutes, these engineers determine a fast, practical route to the production of your non-standard part.

The list below shows some of the options and combinations which can be achieved:

WIREWOUND OPTIONS

Construction: Heat sink, silicone coated, epoxy or silicone molded (single or multi-element), hermetic seal (ceramic tube or metal can encapsulated), clip mounted or fireproof inorganic construction.

Leads: Radial and axial type, special materials and dimensions, spaded, threaded, insulated, quick-disconnect eyelet, printed circuit, ferrule.

Matching: T. C. by pairs, value and set, close tolerance, resistance ratio.

Special Types: Extended low or high resistance range, adjustable, low reactance, special wire alloys, very low or high T. C., high stability, special tolerances, tapped, water cooled, temperature sensitive, inductive.

Pre-conditioning: Power aging, temperature cycling, temperature and power, short-time overload, thermal shock, X-ray, temperature aging.

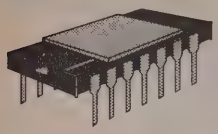
Shunts: Low value, 4-terminal resistors built to customer specifications or designed by our engineers to meet your current sensing requirements.

Fuse Resistors: Our hybrid components designed to act as an ordinary resistor under normal circuit conditions, and as a fuse under fault conditions. Dale offers a variety of standard types, physical sizes and basic styles. Each application should be referred to Dale for an individual design to insure optimum performance in any particular circuit. See our special pages on fuse resistors.

For Fast Attention to Your Special Resistor Requirements, Call or Write:

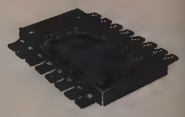
Special Products Section
Wirewound Division
DALE ELECTRONICS, INC.
1122 23rd Street, Columbus, NE 68601-3647
Phone (402) 563-6506

PRECISION THIN - FILM RESISTOR


HERMETIC DIP

MOLDED SIP

COATED SIP

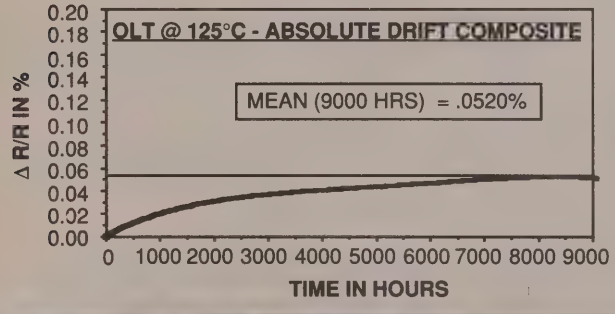
SOIC 

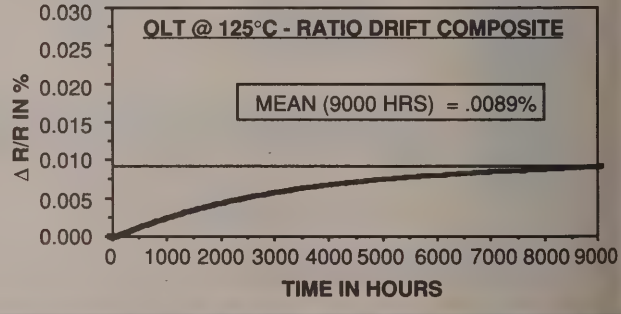
Electro - Films Inc. is a leading supplier of thin-film resistive components offering the broadest line of products in the industry. The products range from hybrid substrates, unpackaged resistor networks and chip resistors to a wide variety of packaged resistor networks including surface mount components.

Both NiCr and TaN resistor material can be sup - plied depending upon the application. Parts can be produced to MIL STD 883C level B or S, 83401 or 55342 as appropriate for the particular product. The table below illustrates the range of parameters attainable. All tolerances and values are not available in every type package or configuration. EFI Application Engineering looks forward to discussing your particular application and suggesting appropriate packaging solutions.

GENERAL PRODUCT CAPABILITY CHART

PARAMETER	NiCr	TaN
Resistance Values	1 ohm to 2 Megohm	1 ohm to 25 Megohm
Absolute Tolerance	±0.05%	±0.1%
Absolute TCR	10 PPM/ °C to 50 PPM/ °C	10 PPM /°C to 100 PPM / °C
Ratio Tolerance	±0.003%	±0.02%
Ratio TCR	±0.5 PPM / °C	±2.0 PPM / °C
Stability: 1000 Hrs. @ 125°C	0.020% Absolute; 0.005% Ratio	0.080% Absolute; 0.02% Ratio
Stability: 1 Yr. @ 125°C	0.052% Absolute; 0.010% Ratio	0.015% Absolute; 0.04% Ratio
Stability: 1000 Hrs. @ 200°C	0.15% Absolute	





HYBRID CIRCUIT SUBSTRATES

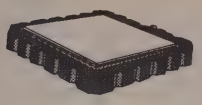
* Patterned and etched
* With / without resistors
* Sizes to 3" x 4"
* Conductors: Au standard, Cu available
* Ni barrier for solderability
* Sputtered metals available: NiCr, TaN, TiW, TaW,Ti, Mo, Ni, Pd
* Plated metals: Au, Cu, Ni
* Overcoat for wirebond crossovers available
* MIL STD 883C, 2032 visual

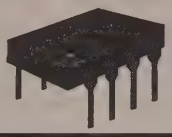
UNPACKAGED RESISTOR NETWORKS

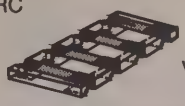
* Wide range of values on same chip
* Silicon or alumina substrates
* NiCr or TaN resistors
* MIL STD 883C, 2032 visual
* Tight ratio tolerance, to 0.003%
* Tight TCR tracking to ±0.5 PPM / °C

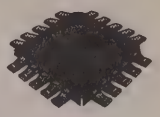
ELECTRO-FILMS INCORPORATED
111 GILBANE STREET, WARWICK CENTRAL INDUSTRIAL PARK, WARWICK, RI 02886
Tel. (401) 738-9150 ● FAX 401-738-4389

COMPONENTS & PACKAGED NETWORKS

LLCC 

MOLDED DIP 

SLRC 

VERSA - CHIP 

PACKAGE TYPES AVAILABLE

Electro-Films, Inc. supplies standard and custom precision resistor networks in most standard packages in addition to several proprietary packages. Both industrial and military versions, including MIL STD 883C level H and K and MIL STD 83401 are available.

Ratio tolerances to 0.01% can be achieved in most package styles. Performance characteristics are summarized on the facing page.

EFI also manufactures R/C networks for use in EMI/RFI filtering applications. High volume, cost competitive thin film versions of thick film networks in both 50 mil and 25 mil lead spaced SOIC's are also available.

SURFACE MOUNT

LLCC: Leadless Chip Carrier

- 16, 18, 20, 28 leads
- MIL STD 83401
- MIL STD 883C level H or K

FLAT-PAKS

- Hermetic: 14, 16, 24 lead std.
- MIL STD 883C level H or K
- MIL STD 83401

PLCC: Plastic Leadless Chip Carrier

- 16, 18, 20, 28, 44 pads
- Industrial, MIL STD 83401
- Mixed Values and Tolerance

SOIC: Small Outline Leaded

8, 14, 16, lead narrow body
16, 18, 20, 24, 28 lead wide body
Industrial, MIL STD 83401

SLRC: Single Layer Resistor Carrier

- 4 to 36 pads
- Industrial
- Mixed Values and Tolerances

SOT-23 Microdivider

- Smallest Divider available
- Wide range of ratios
- Industrial

Wrap Around Chip Resistors

- Std. 402, 805, 1206 Series
- Tolerances to 0.05%
- TCR's 10, 25, 50 ppm/ c
- Solder Coated or Gold Terminals
- Nickel Barrier for Solderability

PLUG-IN

Dual In-Line

Hermetic:
8, 14, 16, 20, 24 leads
MIL STD 883C level H or K, MIL STD 83401

Molded:
8, 14, 16, 20, 24 leads
MIL STD 83401; Industrial

Single In-Line

Molded:
- 4, 7, 8, 9, 10 leads
- Industrial; MIL STD 83401

Coated:
- 3 to 10 leads
- Industrial

ELECTRICAL CONFIGURATIONS

The standard electrical configurations that are available in the above packages are isolated resistor, common bus, series connected, and R/2R ladders. In general the values and tolerances can be mixed within a given network for these configurations without incurring an artwork charge.

EFI also specializes in custom networks providing rapid delivery.

NEW PRODUCTS

R/C Networks:

- FMI/RFI Filters
- Capacitance to 1000pf
- Resistance to 1 megohm
- Tolerances 5, 10, 20 %
- 50 and 25 mil lead spaced SOIC's
- Molded SIP, DIP and PLCC's

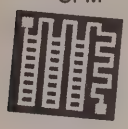
Low Cost Resistor Networks:

Miniature thin film networks in previous thick film applications at low prices.

- Tolerance 5, 10, 20 %
- 50 and 25 mil lead spaced SOIC
- Pull Up and Line and MECL term.

ELECTRO-FILMS INCORPORATED
111 GILBANE STREET, WARWICK CENTRAL INDUSTRIAL PARK, WARWICK, RI 02886
Tel. (401) 738-9150 • FAX 401-738-4389

THIN - FILM CHIP RESISTORS

SFM 

CBB

CTR

CBC

This is the broadest line of thin-film chip resistors available - silicon or alumina substrates, TaN or NiCr resistive material, wire bond or solder attach, tight absolute and center-tap ratio tolerances, low TCR and excellent long term stability. (For Microwave Chip Resistors, see our ad under Microwave Components.)

SILICON CHIP RESISTORS

TYPE	SIZE (Mils)	FEATURE	RESISTOR MATERIAL	* POWER
CTR	30 X 20	Center Tap - 1 Ω to 1MΩ	TaN or NiCr	250 mw
SFM	20 X 20	Single Value - 4.3 Ω to 1MΩ	TaN or NiCr	250 mw
BCR	20 X 20	Single Value, Back Contact	TaN	250 mw
SFX	40 X 40	Single Value - 1M to 2.5 MΩ	TaN	20 mw
MTR	33 X 33	Multi-Tap, 11 Taps 400 Ω to 240 KΩ	TaN	250 mw
PWA	30 X 45	Single Value - High Power	TaN or NiCr	500 mw
NET	30 X 30	(2) Resistors, series or isolated	TaN or NiCr	125 mw

* Power @70°C derated to 0 @ 175°C (100V max.)

ELECTRICAL SPECIFICATIONS	
TCR	± 100 PPM / °C STD ± 10, ±25, ±50 Special
Stability	< 0.2% Type dependent (1000 Hrs. @ 125°C)
Tolerance	0.1% to 10 %

MATERIAL SPECIFICATIONS		
Substrate	Silicon	10 ± 2 Mils
Dielectric	SiO2	10 KÅ Min.
Metalization	Aluminum	10 KÅ Min.
	Gold	15 KÅ Min.

ALUMINA CHIP RESISTORS

TYPE	SIZE** (Mils)	FEATURE	RESISTOR MATERIAL	POWER @ 125°C
1	20 X 40	20Ω to 24KΩ	TaN or NiCr	40 mw
2	30 X 30	25Ω to 40 KΩ	TaN or NiCr	40 mw
3	50 X 50	20Ω to 125 KΩ	TaN or NiCr	100 mw
4	50 X 100	40Ω to 400 KΩ	TaN or NiCr	175 mw
5	100 X 100	20Ω to 1 MΩ	TaN or NiCr	400 mw
6	30 X 45	20Ω to 59 KΩ	TaN or NiCr	60 mw

** All sizes available in Center Tapped versions.

ELECTRICAL SPECIFICATIONS		
TCR	±10, 25, 50 PPM / °C ± 100, 200 PPM / °C	NiCr TaN
Stability	< 0.05% / 1000 Hrs.@125°C	NiCr
Tolerance	±0.05% to 10 % C.T. Ratio to 0.01%	NiCr

MATERIAL SPECIFICATIONS		
Substrate	Alumina 99.6%	10 ± 2 Mils
Metalization	Gold	15 KÅ Min.
	Ni Barrier	5 KÅ Min.
	Solder	———

CHIP CAPACITORS

Thin Film MOS / MNOS Capacitor Chips

TYPE	SIZE (Mils)	FEATURE	Working Voltage (DC)
NCA	20 X 20	0.5 pf - 51 pf	100 V - 40 V
NCB	30 X 30	33 pf - 100 pf	100 V - 50 V
NCC	40 X 40	50 pf - 220 pf	100 V - 50 V
NCD	55 X 55	150 pf - 510 pf	100 V - 50 V
NCE	60 X 60	500 pf - 1000 pf	40 V - 25 V
CBA	20 X 30	0.25, 0.50, 1.0, 2.0 pf ±25% 1, 2, 4, 8 pf ±10%	100 V, 30 V
CBB	20 X 50	Binary 1, 2, 4, 8, 16 pf	75 V
CBC	46 X 46	Binary 3, 6, 12, 24, 48 pf	75 V

MATERIAL SPECIFICATIONS		
Substrate	Silicon	10 ±2 Mils
Dielectric	MOS / MNOS	———
Metalization	Aluminum	10 KÅ Min.
	Gold	15 KÅ Min.

ELECTRO - FILMS INCORPORATED
SEMI E FILMS DIVISION
P.O. BOX 188, WEST HURLEY, NY, 12491 Tel. (914) 338-7714 FAX 914-338-6329

PRECISION WIREWOUND RESISTORS

GENERAL RESISTANCE

A PRIME TECHNOLOGY COMPANY

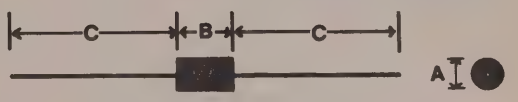
1,500,000 resistors in stock — all manufactured to meet the most exacting standards of accuracy, stability and reliability.

General Resistance has been engaged in the development and manufacture of precision wirewound resistors for over 30 years. The widest possible range of form factors is available, including axial and PC mounting types, in resistance values and accuracies to meet virtually any requirement.

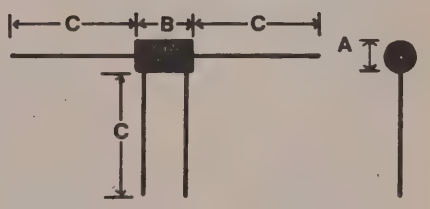
"Standard values" are normally available from stock. And *any* resistance value from 1Ω to 1,100,000Ω, as well as accuracies other than the "standard" ±0.1%, ±0.025% and ±0.01%, are available.

All General Resistance resistors are manufactured to the exacting standards typified by military specifications such as MIL-R-93/MIL-R-39005 (RB and RBR styles).

ECONISTOR, MINI-OHM, AND MAXI-OHM



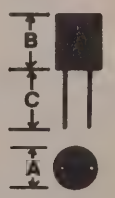
CURRISTOR



Type		Basic Resistance Range	Standard Accuracies	Stability	Tempco	Power Δ Rating ±0.1%@ +85°C	Max. Voltage	A Dia.	B Length	C Length of Wire	D† Wire Gauge
ECONISTOR (Axial-Leads)	8E16	1Ω to 1.1 Meg	±0.01% ±0.025% ±0.1% (others available)	±35ppm/year	±5ppm/°C max. −55°C to +125°C (others available)	8E16, 0.33W	200VDC or AC pk.	1/4" 6.4 mm	1/2" 12.7 mm	1-1/2" typ. 38 mm	22 AWG 0.6 mm
	8E24					8E24, 0.40W		1/4" 6.4 mm	3/4" 19.1 mm	1-1/2" typ. 38 mm	20 AWG 0.8 mm
SQUARISTOR (PC Mounting)	GR102	1Ω to 100K				0.30W	150VDC or AC pk.	N/A	0.32" 8.1 mm	1" typ. 25 mm	22 AWG 0.6 mm
MAXI-OHM (Axial-Leads)	12E32	1Ω to 3.5M				12E32, 0.75W	600VDC or AC pk.	3/8" 9.5 mm	1" 25.4 mm	1-1/2" typ. 38 mm	20 AWG 0.8 mm
	16E32	1Ω to 5M				16E32, 1.00W		1/2" 12.7 mm	1" 25.4 mm	1-1/2" typ. 38 mm	20 AWG 0.8 mm
PLUGISTOR (PC Mounting)	8P13	1Ω to 200K				0.30W	150VDC or AC pk.	1/4" 6.4 mm	13/32" 10.3 mm	1" typ. 25mm	22 AWG 0.6 mm
MINI-OHM (Axial Leads)	5E10	1Ω to 80K		±50ppm/year		0.2W	175VDC or AC pk.	5/32" 4 mm	5/16" 0.5 mm	1-1/2" typ. 38 mm	24 AWG 0.4 mm
CURRISTOR	8C24	0.01Ω to 100Ω			±10ppm/°C std. (others available)	0.50W*		1/4" 6.4 mm	3/4" 19.1 mm	1" 25 mm	22 or 20 AWG 0.6 or 0.8 mm
	12C20					0.75W*		3/8" 9.5 mm	5/8" 15.9 mm	1" 25 mm	20 AWG 0.8 mm
	16C32					1.50W*		1/2" 12.7 mm	1" 25.4 mm	1" 25 mm	20 AWG or Terminals
	16C64					2.50W*		1/2" 12.7 mm	2" 51 mm	1" 25 mm	20 AWG or Terminals
	32C64					6.00W*		1" 25.4 mm	2" 51 mm	N/A	Terminals

SQUARISTOR

PLUGISTOR



ΔFor other tolerances consult factory

*Power ratings for Curristor are at + 100°C

†All leads are tinned copper

GENERAL RESISTANCE
P.O. Box 185, North Branford, Connecticut 06471
TWX: 710-452-3092/FAX: (203) 481-8937
CALL 203 481-5721

HUNTINGTON ELECTRIC, INC.

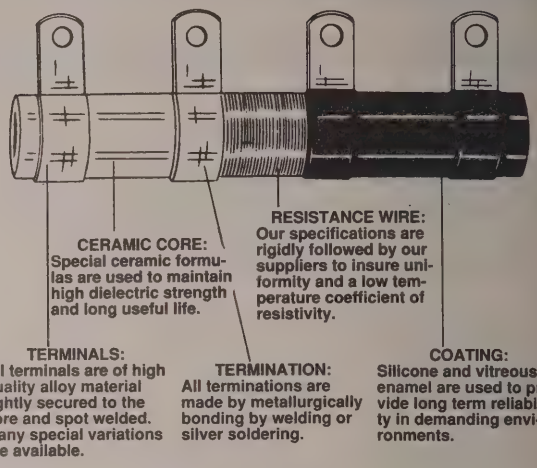
RESISTORS

About the Company

Huntington Electric, Inc. has been in business since 1950. Our products are designed and manufactured to the highest degree of reliability and quality in the industry. Our practice of blending quality, price, delivery and flexibility has given us the reputation and responsibility necessary to qualify as a quality vendor for major electrical and electronic manufacturers throughout the world.

Our on-time, as promised, delivery schedules, coupled with our process quality controls, insure you of getting what you want when you want it. Why go any where else?

FAST LANE SERVICE -
TWO (2) WEEK DELIVERY GUARANTEED

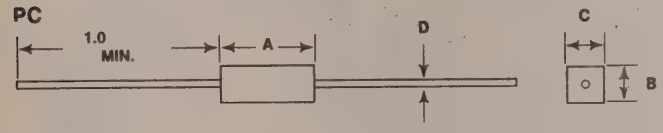

CERAMIC CORE:
Special ceramic formulas are used to maintain high dielectric strength and long useful life.
RESISTANCE WIRE:
Our specifications are rigidly followed by our suppliers to insure uniformity and a low temperature coefficient of resistivity.
TERMINALS:
All terminals are of high quality alloy material tightly secured to the core and spot welded. Many special variations are available.
TERMINATION:
All terminations are made by metallurgically bonding by welding or silver soldering.
COATING:
Silicone and vitreous enamel are used to provide long term reliability in demanding environments.

Ceramic Housed Wirewound - *Axial Leaded Standard/Tab Mount*

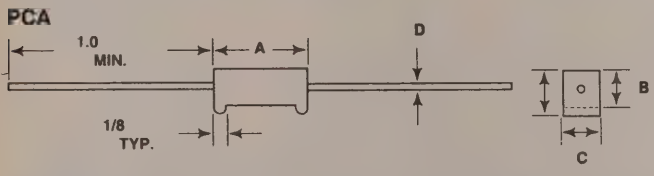
Standard Features

- Ceramic housing
- Axial leads
- 3 watts to 50 watts
- 5% or 10%
- 1 ohm to 40K ohm
- Solvent Resistant
- Temperature Coefficient 800 ppm below 1 ohm 300 ppm above 1 ohm
- Fireproof construction
- High temperature potting compound

Standard Configuration- PC Style

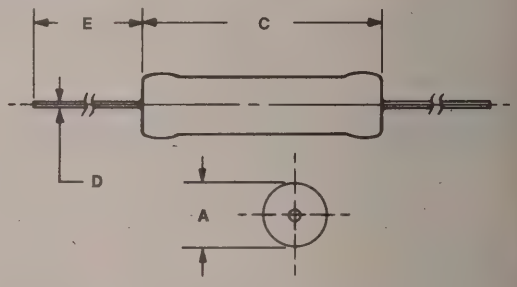


Alternate Configuration- PCA Style



Type	Watts	A	B	C	D	Resistance Range
PC-3	3	.875	.3125	.3125	.032	1 ohm 10K ohm
PC-5	5	.875	.375	.375	.032	1 ohm 10K ohm
PC-7	7	1.400	.375	.375	.032	1 ohm 27K ohm
PC-10	10	1.875	.375	.375	.032	1 ohm 30K ohm
PC-15	15	1.875	.500	.500	.036	ohm 40K ohm
PC-22	22	2.500	.500	.500	.036	ohm 40K ohm
PC-25	25	2.531	.625	.625	*	1 ohm 30K ohm
PC-50	50	3.500	.75	.75	*	1 ohm 40K ohm

Axial Lead Vitreous or Silicone - *1Watt thru 10 watt*



Watt	A ±.032	C ±.032	D	E (Type.)
1	.125	.437	.020	1 1/2
1	.110	.385	.020	1 1/2
3	.218	.563	.032	1 1/2
3	.200	.563	.032	1 1/2
5	.218	1.031	.032	1 1/2
5	.200	.937	.032	1 1/2
5/7	.343	1.031	.032	1 1/2
5/7	.312	.937	.032	1 1/2
10	.343	1.843	.032	1 1/2
10	.312	1.800	.032	1 1/2

Note: The above chart applies to both vitreous and silicone coated resistors. The "type" nomenclature shown is for vitreous coating. When ordering silicone, Substitute the letter "S" for the letter "V" in the type.
Example: FVT= Vitreous FST= Silicone

\+ Standard sizes

* Mounting centers shown are nominal dimensions when using HEI standard friction-grip mounting brackets. Built-in "spring" allows for minor variations in these dimensions.

Ordering Information

FVT-10-250-1%-NI-QC-BKTS

Type
V=Vitreous
S=Silicone

Resistance Value

Add for Special Tolerance

Add For Standard Brackets

Add for Quick Connect

Add For Non Inductive

Optional Features:

Resistance Tolerance
Non-Inductive
Quick Connect Terminals
Mounting Brackets

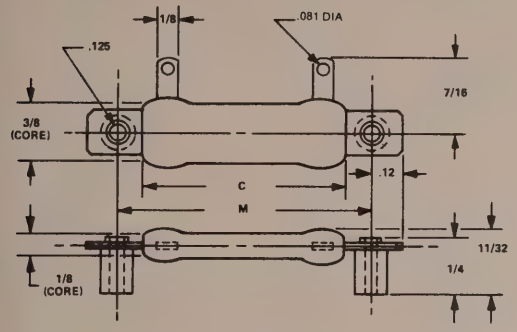
For your custom requirements, contact manufacturer.

Huntington Electric, Inc. • P.O. Box 366 • Huntington, In 46750 • (219) 356-0756 • FAX: (219) 356-7891

HUNTINGTON ELECTRIC, INC.

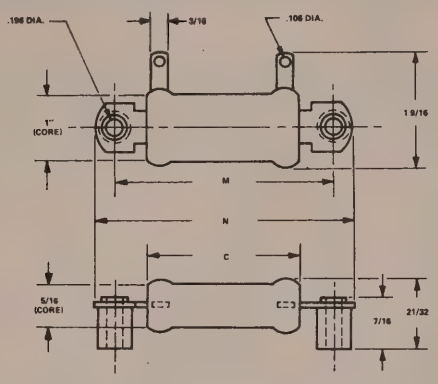
RESISTORS

Miniature Oval Vitreous or Silicone - *10 Watt thru 20 Watts*



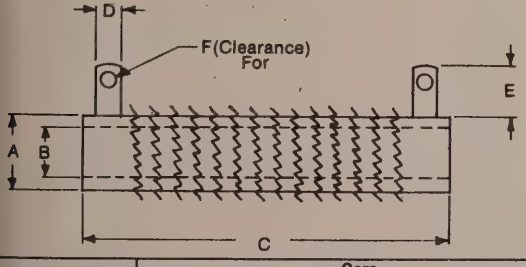
Watt	C	M
10	3/4	1
15	1	1 1/4
20	2	2 5/16

Standard Oval Vitreous or Silicone- *30 Watt thru 95 Watts*



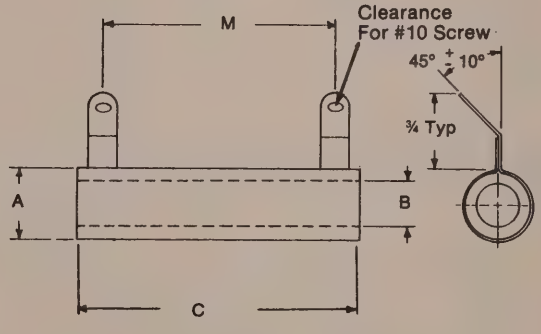
Watts	Core		
	A	B	C
30	1 1/4	2	2 1/2
40	2	2 3/4	3 1/4
55	3 1/2	4 1/4	4 3/4
70	4 3/4	5 1/2	6
95	6	6 3/4	7 1/4

Edgewound Fixed and Adjustable Vitreous and Silicone- *40 Watt thru 1500 Watts*



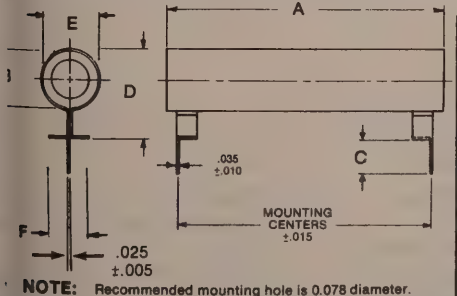
Watts	Core		
	A	B	C
40	9/16	5/16	2
50	3/4	1/2	2
90	9/16	5/16	4
100	3/4	1/2	3 1/2
110	3/4	1/2	4
120	3/4	35/64	4 1/2
155	1 1/8	3/4	4 1/4
240	1 1/8	3/4	6 1/2
300	1 1/8	3/4	8 1/2
375	1 1/8	3/4	10 1/2
420	1 1/8	3/4	11 3/4
500	1 5/8	1 1/8	10 1/2
750	2 1/2	1 3/4	12
1000	2 1/2	1 3/4	15
1500	2 1/2	1 3/4	20

Capacitor Mount Vitreous or Silicone- *16 Watt thru 22 Watts*



Watts	Core			
	A	B	C	M
16	9/16	5/16	1 1/4	7/8
20	9/16	5/16	1 3/4	1 1/8
22	9/16	5/16	1 3/4	1 1/4

Printed Circuit Board Mount Vitreous or Silicone--*3 Watt thru 20 Watts*



NOTE: Recommended mounting hole is 0.078 diameter.

Watts	Mounting Ctrs		Core		Type	Max	Max	Max
	Standard	Maximum	A	B	C	D	E	F
3	0.600	0.846	1	0.200	0.125	0.450	.281	.400
5/3	0.900	0.971	1 1/8	0.200	0.125	0.450	.281	.400
7/4	0.600	0.846	1	5/16	0.150	0.600	.410	.500
8/5	0.900	0.971	1 1/8	5/16	0.150	0.600	.410	.500
10	1.300	1.596	1 3/4	5/16	0.150	0.600	.410	.500
12/10	1.700	1.971	2 1/8	5/16	0.150	0.600	.410	.500
20/15	1.700	1.846	2	7/16	0.200	0.725	.531	.531
20	2.200	2.221	2 3/8	7/16	0.200	0.725	.531	.531

For your custom requirements, contact manufacturer.

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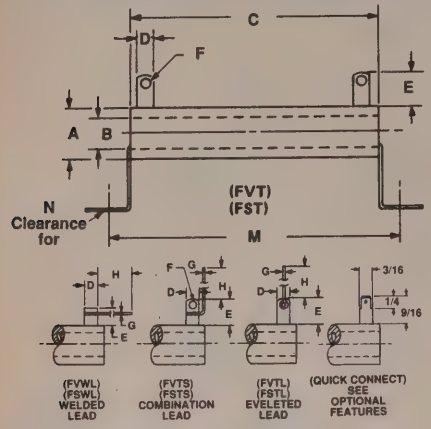
HUNTINGTON ELECTRIC, INC.

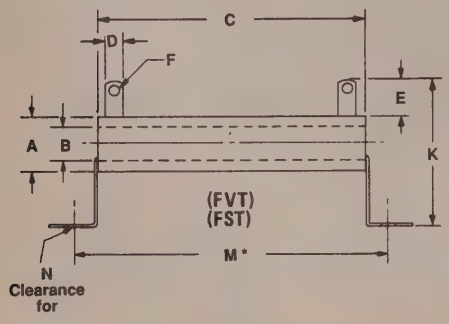
RESISTORS

Fixed Vitreous or Silicone - *5 Watt thru 20 watts*



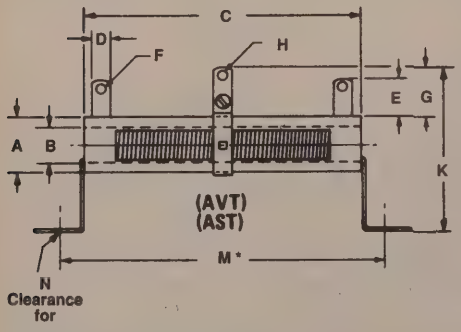
Watt	Core			Leads		Mounting	
	A	B	C	G	H	M	N
5	5/16	3/16	1	-	-	17/16	6-32
5	5/16	3/16	1	.032	-	17/16	6-32
5	5/16	3/16	1	.032	2	17/16	6-32
8	5/16	3/16	1	.032	2	17/16	6-32
12	5/16	3/16	1 3/4	-	-	2 3/16	6-32
12	5/16	3/16	1 3/4	.032	2	2 3/16	6-32
12	5/16	3/16	1 3/4	.032	2	2 3/16	6-32
12	5/16	3/16	1 3/4	.032	2	2 3/16	6-32
20	7/16	1/4	2	-	-	2 1/2	6-32
20	7/16	1/4	2	.040	2	2 1/2	6-32
20	7/16	1/4	2	.040	2	2 1/2	6-32
20	7/16	1/4	2	.040	2	2 1/2	6-32

Fixed Vitreous or Silicone - *25 Watt thru 225 watts*



Watt	Core				
	A	B	C	M	N
12	5/16	3/16	1 3/4	2 3/16	6-32
25	9/16	5/16	2	2 3/4	8-32
30	3/4	1/2	2	2 7/8	10-32
30	5/8	29/64	2	2 5/8	8-32
50	9/16	5/16	4	4 3/4	8-32
60	3/4	1/2	4	4 7/8	10-32
70	3/4	35/64	4 1/2	5 3/8	10-32
75	9/16	5/16	6	6 3/4	8-32
90	3/4	1/2	6	6 7/8	10-32
100	3/4	1/2	6 1/2	7 3/8	10-32
130	1 1/8	3/4	6 1/2	7 3/8	10-32
175	1 1/8	3/4	8 1/2	9 3/8	10-32
225	1 1/8	3/4	10 1/2	11 3/8	10-32

Adjustable Fixed Vitreous or Silicone - *12 Watt thru 225 watts*



Watt	Core			Leads		Mounting		
	A	B	C	G	H	K	M	N
12	5/16	3/16	1 3/4	1/2	.104	15/16	2 3/16	6-32
25	9/16	5/16	2	11/16	.166	1 11/16	2 3/4	8-32
30	3/4	1/2	2	11/16	.166	2 5/16	2 7/8	10-32
30	5/8	29/64	2	11/16	.166	1 11/16	2 5/8	8-32
50	9/16	5/16	4	11/16	.166	1 11/16	4 3/4	8-32
60	3/4	1/2	4	11/16	.166	2 5/16	4 7/8	10-32
70	3/4	35/64	4 1/2	11/16	.166	2 5/16	5 3/8	10-32
75	9/16	5/16	6	11/16	.166	1 11/16	6 3/4	8-32
90	3/4	1/2	6	11/16	.166	2 5/16	6 7/8	10-32
100	3/4	1/2	6 1/2	11/16	.166	2 5/16	7 3/8	10-32
130	1 1/8	3/4	6 1/2	7/8	.166	2 13/16	7 3/8	10-32
175	1 1/8	3/4	8 1/2	7/8	.166	2 13/16	9 3/8	10-32
225	1 1/8	3/4	10 1/2	7/8	.166	1 13/16	11 3/8	10-32

Ordering Information

FVT-10-250-1%-NI-QC-BKTS

Type
V=Vitreous
S=Silicone

Resistance Value

Add for Special Tolerance

Add For Non-Inductive

Add for Quick Connect

Add For Standard Brackets

Optional Features:
Resistance Tolerance
Non-Inductive
Quick Connect Terminals
Mounting Brackets

For your custom requirements, contact manufacturer.

Huntington Electric, Inc. • P.O. Box 366 • Huntington, In 46750 • (219) 356-0756 • FAX: (219) 356-7891

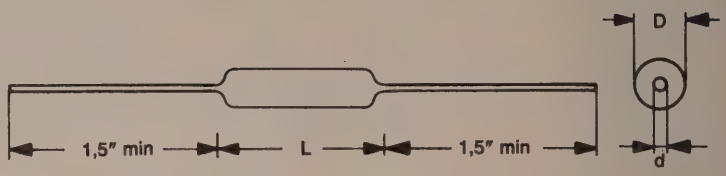
CHARACTERISTICS OF BATTERIES AND FUEL CELLS

System	Anode	Cathode	Theoretical battery		Practical battery		
			Voltage, V	Capacity, Ah/kg	Typical voltage, V	Capacity[a]	
						Wh/kg	Wh/dm³
Primary:							
Leclanche	Zn	MnO_2	1.6	230	1.2	65	175
Magnesium	Mg	MnO_2	2.0	270	1.5	100	195
Organic cathode	Mg	*m*-DNB	1.8	1,400	1.15	130	180
Alkaline MnO_2	Zn	MnO_2	1.5	230	1.15	65	200
Mercury	Zn	HgO	1.34	185	1.2	80	370
Mercad	Cd	HgO	0.9	165	0.85	45	175
Silver oxide	Zn	AgO	1.85	285	1.5	130	310
Zinc-air	Zn	Air (O_2)	1.6	815	1.1	200	190
Li-organic electrolyte	Li	[b]	2.1-5.4	130-660	1.8-3.2	250	400
Secondary:							
Lead-acid	Pb	PbO_2	2.1	55	2.0	37	70
Edison	Fe	Ni oxides	1.5	195	1.2	29	65
Nickel-cadmium	Cd	Ni oxides	1.35	165	1.2	33	60
Silver-zinc	Zn	AgO	1.85	285	1.5	100	170
Silver-cadmium	Cd	AgO	1.4	230	1.05	55	120
Zinc-nickel oxide	Zn	Ni oxides	1.75	185	1.6	55	110
Zinc-air[c]	Zn	Air (O_2)	1.6	815	1.1	150	155
Cadmium-air[c]	Cd	Air (O_2)	1.2	475	0.8	90	90
Zinc-O_2	Zn	O_2	1.6	610	1.1	130	120
H_2-O_2	H_2	O_2	1.23	3,000	0.8	45	65
Reserve:							
Cuprous chloride	Mg	CuCl	1.5	240	1.4	45	65[d]
Silver-chloride	Mg	AgCl	1.6	170	1.5	60	95[d]
Zinc-silver oxide	Zn	AgO	1.85	285	1.5	30	75[e]
Thermal	Ca	[b]	2.8	240	2.6	10	20[f]
Ammonia-activated	Mg	*m*-DNB	2.2	1,400	1.7	22	60[g]
High-	NA	S	2.1	685	1.8	200	[h]
temperature	Li	S	2.2	1,150	1.8	200	[i]
Solid electrolyte	Ag	Polyiodide	0.66	. . .	0.6	180	75[j]
Fuel cell:							
Hydrogen[c]	H_2	Air	1.23	26,000	0.7		[k]
Hydrazine[c]	N_2H_4	Air	1.5	2,100	0.7	800[b]	[l]
Methanol[c]	CH_2OH	Air	1.3	1,400	0.9	175[b]	185[m]

[a] Delivered capacity when discharged at normal temperatures (20°C) at normal discharge rates.
[b] Based on fuel consumption only.
[c] Weight of air not considered in computation of watt hours.
[d] Water-activated
[e] Automatically activated; high rate discharge; 2- to 10-min rate.
[f] Fused salt; heat-activated; high rate discharge; 2- to 10-min rate.
[g] Four-minute discharge rate.
[h] β-alumina electrolyte, 300°C operation.
[i] Fused salt; 350°C operation.
[j] Solid $RbAg_4I_5$ electrolyte.
[k] Several different cathode materials used.
[l] Fuel consumption is based on source of H_2.
[m] Based on methanol battery-fuel supply in situ.

Power Precision Wirewound Resistors

- ❑ 0.4W to 10.0W at 275°C
- ❑ Space efficient
- ❑ Welded Construction
- ❑ High temperature conformal coating
- ❑ Radial leads available
- ❑ Tolerances to ±.01%
- ❑ Meets MIL-R-26 requirements



Imperial Type	MIL-R-24/ MIL-R-39007	Wattage Rating	Maximum Resistance		Dimensions (inches)		Lead Diameter "d"
			Imp.	Mil.	Length "L" ±.067"	Diameter "D" ±.03"	A
PA ½ A		.4	2.5 K		.250	.078	#22/#24
PA ½		.75	7.5 K		.330	.078	#24
PA 1 A	RW-70	1.6	10 K	3.16 K	.406	.094	#22/#24
PA 2 A	RW-69	2.5	2.2 K	2 K	.500	.187	#20
PA 2		1.5	12.5 K	10.5 K/	.350	.156	#22/#20
PA 2 B	RW-79 RWR-89	3.0	2,2 K	4.12 K	.560	.187	#20
PA 2 C		3.0	40 K		.500	.250	#20/#18
PA 3		4.0	45 K	38.3 K/	.625	.250	#20/#18
PA 5	RW-74 RWR-74	5.0	91 K	12,1 J	.875	.312	#18
PA 5 A		5.0	65 K		.970	.203	#20/#18
PA 6	RW-67	5.0	95 K	8.2 K	1.094	.312	#18
PA 7 A		7.0	150 K		1.375	.375	#18
PA 10	RW-78 RWR-78	10.0	200 K	90.0 K	1.780	.375	#18

STANDARD TOLERANCES (±): 0.05%, 0.10%, 0.25%, 1.0%, 3.0%, 5.0%

STANDARD TEMPERATURE COEFFICIENTS:

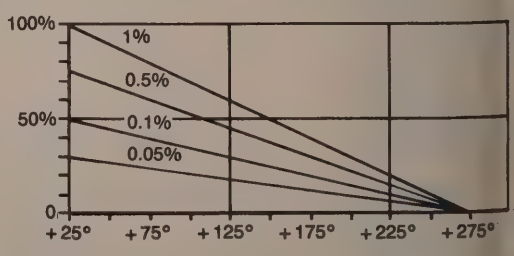
1 to 9 Ω ±50 PPM/°C
10 Ω and above ±20 PPM/°C
below 1 Ω ±90 PPM/°C

Consult factory for special temperature coefficient requirements.

CONSTRUCTION:

Alumina Oxide Core. Coppernickel alloy or nickel chrome alloy resistance wire. Leads are copperweld, tinned, solderable and weldable.
Lead diameter: AWG#18 (.040"), #20 (.032"), #22 (.025"), #24 (.020").

Non-inductive winding available: Divide maximum resistance by two; multiply maximum voltage by 0.707. Specify Imperial type "NPA.



POWER RATING:

Maximum continuous operating temperature is 275°C per MIL-R-26.

IMPERIAL ASTRONICS
An ANDIG Company
19151-J Parthenia Street, Northridge, California 91324 • (818) 886-7672 - Fax: (818) 886-4658

Aluminum Housed Power Precision Wirewound Resistors

- 6.0W to 50.0W at 275°C
- Designed to provide maximum heat dissipation
- Ideal high power to size ratio
- Aluminum housing allows chassis mounting and heat sink capabilities
- Meets or exceeds MIL-R-18546 and MIL-R-39009

PL5

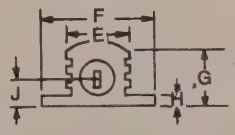
PL10

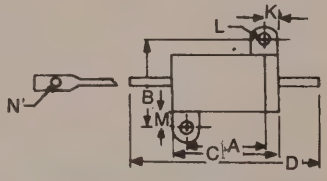
PL25

PL50

Imperial Type Standard	MIL-R-39009 MIL-R-18546D	Wattage Rating PL	Wattage Rating MIL	Maximum Resistance PL	Max. Weights (Grams)
PL5	RER-60/RE-60	7.5	5	22K	3
PL10	RER-65/RE-65	12.5	10	47K	7
PL25	RER-70/RE-70	25	20	90K	14
PL50	RER-75/RE-75	50	30	250K	29

CHASSIS DIMENSIONS: (inches).
4×6×2×.040 PL5, PL10
5×7×2×.040 PL25, PL50





Imperial Type Standard	A	B	C	D	E	F	G	H	J	K	L	M	N
PL5	444 ±.005	.490 ±.005	.600 ±0.31	1.125 ±.062	.334 ±.015	.646 ±.015	.320 ±.015	.065 ±.010	.140 ±.010	.078 ±.020	.093 ±.005	.078 ±.015	.050 ±.005
PL10	.562 ±.005	.625 ±.005	.750 ±0.31	1.375 ±.062	.430 ±.015	.800 ±.015	.400 ±.015	.075 ±.010	.190 ±.010	.093 ±.010	.093 ±.005	.102 ±.015	.086 ±.005
PL25	.719 ±.005	.781 ±.005	1.062 ±0.31	1.938 ±.062	.530 ±.015	1.080 ±.015	.560 ±.015	.085 ±.010	.260 ±.010	.172 ±.010	.125 ±.005	.125 ±.015	.086 ±.005
PL50	1.563 ±.005	.844 ±.005	1.968 ±0.31	2.781 ±.062	.615 ±.015	1.140 ±.015	.615 ±.015	.085 ±.010	.300 ±.031	.196 ±.010	.125 ±.005	.125 ±.015	.086 ±.005

STANDARD TOLERANCES: ±0.05% to ±3.0%

STANDARD TEMPERATURE COEFFICIENTS: ±20 PPM/°C. Other temperature coefficients available. Higher T.C. on low Ω values.

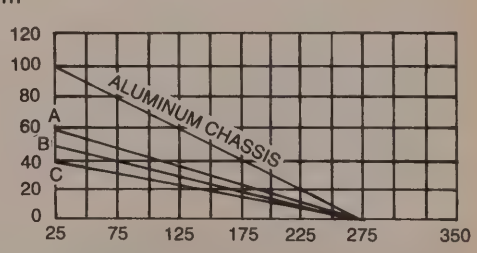
CONSTRUCTION: Steatite or Alumina core. Completely welded.

Non-Inductive Winding: Divide maximum resistance by two; multiply working voltage by .707. Specify Imperial Type "NPL".

POWER RATING: Operating temperature range: −55°C to +275°C Maximum hotspot under full rated power at ±25°C ambient per MIL-R-18546.

Derating is required for reduced chassis mounting area and for high ambient temperatures.

A = PL5, PL10
B = PL25
C = PL50



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An ANDIG Company
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IMPERIAL ASTRONICS
An ANDIG Company

Precision Resistors

Axial Subminiature Precision Wirewound Resistors

Features:

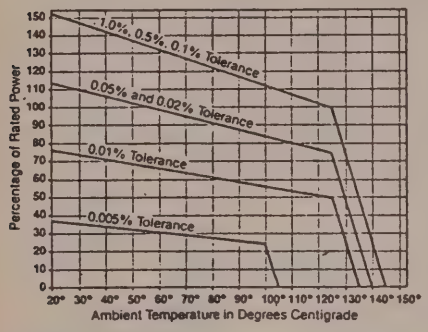
- 0.06W to 0.175W at 125°C
- Ultra-precision for critical applications
- Ideal for miniaturized circuitry
- Long term stability
- Complete Traceability
- Tolerances to ±.005%

Standard Temperature Coefficient:

-55°C to +125°C

<10Ω ±30 PPM/°C
10 to 99Ω ±20 PPM/°C
100 Ωand above ±10 PPM/°C

Lower T.C's available over a limited temperature range



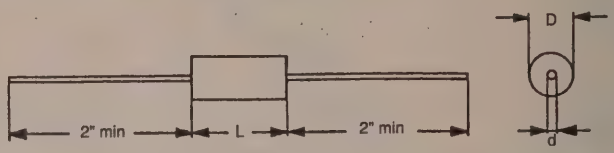
Power Rating:

*Based on continuous full-load operation at 125°C
<125°C Load derated to zero at 145°C >125°C Load may be increased

To insure maximum stability, power should be derated, depending on the tolerance required.

Power dissipation is affected by altitude, and derating at the rate of 10%/10,000 feet is recommended.

*This rating curve is intended to serve only as a guide.



Imperial Type	Commercial Wattage	Max. Volt	Max* Resistance	Min. ±Tolerance	Diameter "D" ±.005"	Length "L" ±.025"	Lead "d" AWG
M02	.06	75	50 K	.1%	.100	.210	24
M03	.08	100	150 K	.05%	.125	.260	24
M04	.10	100	250 K	.05%	.125	.375	24
M05	.125	150	400 K	.01%	.187	.250	22
M06	.15	150	500 K	.01%	.187	.295	22
M07	.25	250	1.0 M	.005%	.210	.465	22
M012	.20	200	750 K	.005%	.187	.450	22
M013	.10	100	250 K	.05%	.156	.312	24
M015	.175	200	750 K	.005%	.187	.375	22

RESISTANCE RANGE: Minimum resistance of the above series at minimum Tolerance is 100Ω

Axial Miniature Precision Wirewound Resistors

Features:

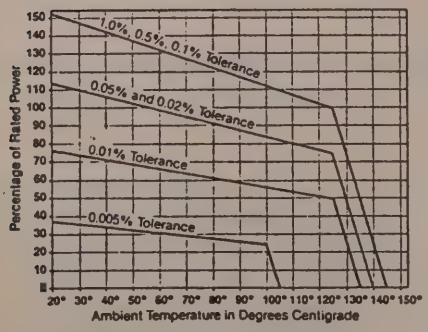
- 0.20W to 2.0W at 125°C
- Higher resistance values-small size
- Variety of circuit applications
- More economical than subminiaturized
- Complete Traceability
- Tolerances to ±.005%

Standard Temperature Coefficient:

-55°C to +125°C

<10Ω ±30 PPM/°C
<10Ω to 99Ω ±20 PPM/°C
100Ω and above ±10 PPM/°C

Lower T.C's available over a limited temperature range



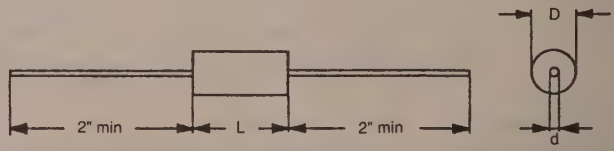
Power Rating:

*Based on continuous full-load operation at 125°C
<125°C Load derated to zero at 145°C >125°C Load may be increased

To insure maximum stability, power should be derated,depending on the tolerance required.

Power dissipation is affected by altitude, and derating at the rate of 10%/10,000 feet is recommended.

*This rating curve is intended to serve only as a guide.



Imperial Type	Commercial Wattage	Max. Voltage	Max.* Resistance	Min. + Tolerance	Diameter "D" +.025"	Length "L" +.025"	Lead "d" AWG
A00	.20	200	800K	.005%	.250	.375	20/22
A01	.25	300	1.2 MEG	.005%	.250	.500	20/22
A02	.33	400	2.5 MEG	.005%	.250	.750	20/22
A03	.50	400	7.5 MEG	.005%	.375	.885	20
A04	.50	400	7.0 MEG	.005%	.500	.500	20
A05	.60	400	7.0 MEG	.005%	.500	.625	20
A06	1.00	800	12 MEG	.005%	.500	1.000	20
A07	1.50	900	15 MEG	.005%	.500	1.500	20
A08	2.00	1000	25 MEG	.005%	.500	2.000	20
A20	.40	300	3.0 MEG	.005%	.375	.500	20
A21	.50	400	6.0 MEG	.005%	.375	.750	20
A29	.75	600	10 MEG	.005%	.375	1.000	20

RESISTANCE RANGE: Minimum resistance of the above series at minimum Tolerance is 50Ω

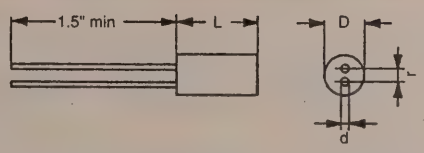
IMPERIAL ASTRONICS ■ *19151-J PARTHENIA STREET, NORTHRIDGE, CALIFORNIA 91324* ■ *TEL: (818) 886-7672* ■ *FAX: (818) 886-4656*

IMPERIAL ASTRONICS
An ANDIG Company

Precision Resistors

Printed Circuit Precision Wirewound Resistors

Features:
- 0.125W to 0.5W at 125°C
- Single ended rugged resistor
- Molded construction
- Easily mounted
- Complete traceability



Power Rating: Please refer to power rating below for information pertaining to both printed circuit styles.

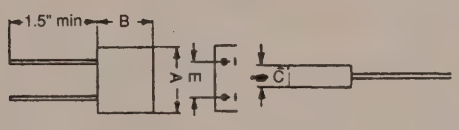
Imperial Type	Commercial Wattage	Max. Voltage	Max.* Resistance	Min. ±Tolerance	Diameter "D" ±.005"	Length "L" ±.025"	Lead"d" Diameter	Lead "r" Spacing ±.010"
A00PC	.125	150	500K	.01%	.250	.375	AWG 22	.150
A01PC	.25	150	600 K	.005%	.250	.500	AWG 22	.150
A04PC	.540	400	1 MEG	.005%	.500	.500	AWG 20	.300
A20PC	.50	300	800 K	.005%	.375	.500	AWG 20	.200
A30PC	.125	150	500 K	.01%	.250	.312	AWG 22	.150
A31PC	.125	150	500 K	.01%	.250	.312	AWG 22	.200

RESISTANCE RANGE: Minimum resistance of the above series at minimum Tolerance is 50Ω

Features:
- For space limitation, where the cylindrical cannot be used
- Long term stability
- 0.25W to 0.5W at 125°C
- Wafer thin

Standard Temperature Coefficient: -55°C to +125°C

<10	+30PPM/°C
10 to 99	+20 PPM/°C
100Ω up	±10 PPM/°C



Imperial Type	Commercial Wattage	Max. Volt	Max. Resistance	Min. Tolerance	Dimensions ±.025			Lead Diameter	Lead Spacing "E" ±.010
					A	B	C		
M085	.125	150	500 K	.05%	.295	.320	.100	AWG 20	.125
M018	.125	400	1 MEG	.05%	.875	.520	.180	AWG 20	.800

RESISTANCE RANGE: Minimum resistance of the above series at minimum Tolerance is 50Ω

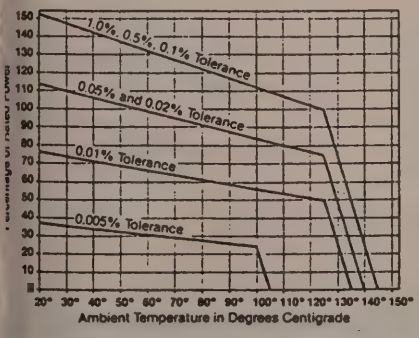
Radial Lead and Lug Precision Wirewound Resistors

Features:
- 0.25W to 1.0W at 125°C
- Long term stability
- Convenience of wiring-easy installation
- Lug style terminals eliminate need for heat sinks. (In most applications)
- Built to withstand severe vibration and shock

Standard Temperature Coefficient:
-55°C to +125°C

<10Ω	±30 PPM/°C
10 to 99Ω	±20 PPM/°C
100Ω and above	±10 PPM/°C

Lower T.C's available over a limited temperature range


1.0%, 0.5%, 0.1% Tolerance
0.05% and 0.02% Tolerance
0.01% Tolerance
0.005% Tolerance
Rated Power in Percent
160 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
20° 30° 40° 50° 60° 70° 80° 90° 100° 110° 120° 130° 140° 150°
Ambient Temperature in Degrees Centigrade

Power Rating:

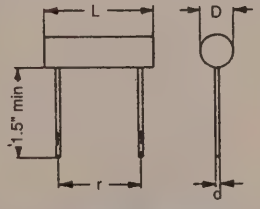
*Based on continuous full-load operation at 125°C
<125°C Load derated to zero at 145°C >125°C Load may be increased

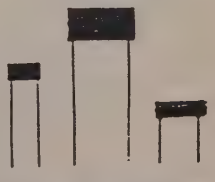
To insure maximum stability, power should be derated, depending on the tolerance required.

Power dissipation is affected by altitude, and derating at the rate of 10%/10,000 feet is recommended.

*This rating curve is intended to serve only as a guide.

Construction: Radial lugs are made of heavily tinned copper with a clearance hole to accomodate up to #14 wire. The axial mounting hole will accomodate standard hardware.





Imperial Type	Commercial Wattage	Max. Voltage	Max.* Resistance	Min. ± Tolerance	Diameter "D" ±.025"	Length "L" ±.025"	Type Terminal	Terminal Spacing ±.015"	Mounting Hole
A01RL	.25	150	750 K	0.005%	.250	.500	AWG 22	.400	NONE
A04RL	.50	400	4 MEG	0.005%	.500	.500	AWG 20	.400	#6 Screw
A06RL	1.00	800	8 MEG	0.005%	.500	1.000	AWG 20	.850	#6 Screw
A21RL	.50	300	1.0 MEG	0.005%	.375	.750	AWG 20	.600	#6 Screw
A39RL	.125	100	500 K	.01%	.250	.250	AWG 22	.200	NONE
A04L	.50	400	4 MEG	0.005%	.500	.500	LUG	.325	#6 Screw

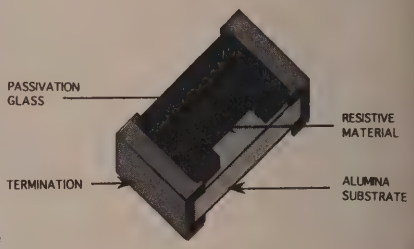
RESISTANCE RANGE: Minimum resistance of the above series at minimum Tolerance is 50Ω

THICK FILM
Chip Resistors

Manufacturer of Quality Chip Resistors Since 1974

Same Day Shipment of Stock Values — See Back of Page.

IMS No.	Nom. Length (in.)	Nom. Width (in.)	Max. Height (in.)	Rated Power at 70°C	Max. Working Voltage	Resistance Range	Available Tolerances (±%)
SURFACE MOUNT WRAPAROUND TERMINATIONS							
Nickel Barrier/Tinned.							
RC-I-0402	0.039	0.020	0.016	63mW	50	4.7 Ω – 2.2M Ω	5
RC-I-0603	0.063	0.031	0.022	63mW	50	3.9 Ω – 3.3M Ω	1, 2, 5, 10
RC-I-0805	0.079	0.049	0.022	175mW	150	1 Ω – 10M Ω	1, 2, 5, 10
RC-I-1206	0.122	0.061	0.026	250mW	200	0.22 Ω – 22M Ω	1, 2, 5, 10
RC-I-2010	0.196	0.098	0.026	500mW	200	1 Ω – 100K Ω	1, 2, 5, 10
RT-I-2010	0.196	0.098	0.026			Untrimmed	+0/–30
RC-I-2512	0.248	0.124	0.026	1W	350	1 Ω – 100K Ω	1, 2, 5, 10
RT-I-2512	0.248	0.124	0.026			Untrimmed	+0/–30
RC-I-2512S	0.248	0.124	0.026	2W	350	10 Ω – 500 Ω	1, 2, 5



Made in Japan Packaging: Taped or tape/reel except RC/RT-I-2512 Bulk Jumpers available
Operating Temperature –55°C to +125°C

PtAu (Platinum gold): or PtAu w/solder: or PtAg (Platinum silver): or PtAg w/solder.

RC-4-0302	0.030	0.020	0.020	63mW	50	10 Ω – 20M Ω	5
RC-4-0402	0.045	0.025	0.020	125mW	60	1 Ω – 50M Ω	2, 5
RC-4-0504	0.050	0.040	0.020	125mW	40	10 Ω – 80M Ω	2, 5, 10
RC-C-0805	0.078	0.050	0.020	175mW	150	10M Ω – 1 Gigohm	10, 15, 35
HC-C-0805	0.078	0.050	0.020	175mW	150	1 Gigohm-1,000 Gigohm	15, 35

Single Wraparound Termination with Backplane: Au (Gold).

RC-1-0302SG	0.030	0.020	0.020	63mW	50	25 Ω – 1K Ω	5, 10

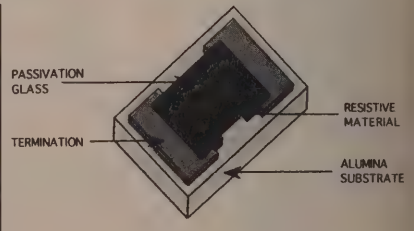
Operating Temperature –55°C to +150°C

SINGLE SIDED TERMINATIONS

Au (Gold): or PdAg (Palladium silver): or PdAg w/solder: or PtAg (Platinum silver) w/solder.

000	0.045	0.030	0.016	125mW	60	1 Ω – 2,000 Gigohm	1, 2, 5, 10
001	0.050	0.050	0.016	125mW	45	0.1 Ω – 100M Ω	1, 2, 5, 10
002	0.075	0.050	0.016	175mW	100	0.5 Ω – 470M Ω	1, 2, 5, 10
003	0.100	0.050	0.016	250mW	160	1 Ω – 25M Ω	1, 2, 5, 10
004	0.150	0.050	0.016	350mW	350	1 Ω – 25M Ω	1, 2, 5, 10
005	0.100	0.100	0.016	500mW	160	0.1 Ω – 25M Ω	1, 2, 5, 10
007	0.025	0.030	0.016	30mW	40	1 Ω – 100M Ω	1, 2, 5, 10
008	0.100	0.025	0.016	100mW	175	1 Ω – 2,000 Gigohm	1, 2, 5, 10
009	0.080	0.050	0.016	175mW	150	10 Ω – 1,000 Gigohm	1, 2, 5, 10
010	0.125	0.050	0.016	250mW	230	0.1 Ω – 500M Ω	1, 2, 5, 10
012	0.035	0.035	0.016	63mW	50	10 Ω – 25 MΩ	2, 5, 10
024	0.240	0.120	0.021	1W	350	1 Ω – 20M Ω	1, 2, 5, 10
026	0.120	0.240	0.035	1W	200	0.05 Ω – 1 Ω	10
202	0.360	0.140	0.035	2W	800	1 Ω – 100K Ω	1, 2, 5, 10
204	0.440	0.180	0.035	4W	1100	1 Ω – 100K Ω	1, 2, 5, 10
206	0.520	0.215	0.035	6W	1400	1 Ω – 100K Ω	1, 2, 5, 10
208	0.560	0.240	0.035	8W	1500	1 Ω – 100K Ω	1, 2, 5, 10
210	0.620	0.270	0.035	10W	1800	1 Ω – 100K Ω	1, 2, 5, 10

Operating Temperature –55° to +150°C



Tolerances listed might not apply to Low Ohm; High M Ohm and Gig Ohm Values. Check factory for tolerances available.

Testing to MIL-R-55342 and MIL-STD-883 is available.

Certificate of Compliance can be provided.

SEE INDIVIDUAL LITERATURE FOR COMPLETE SPECIFICATIONS

International Manufacturing Services, Inc.
50 Schoolhouse Lane, Portsmouth, RI 02871-2418 • Tel: (401) 683-9700 • Fax: (401) 683-5571

SURFACE MOUNT
Chip Resistors

Manufacturer of Quality Chip Resistors Since 1974

High Megohm, Wraparound Terminations

Features

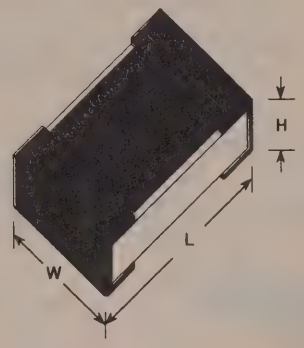
- 10 MΩ to 1,000 MΩ
- Wraparound PtAg (Platinum silver) terminations
- RC-C-0805-XXXX-X PtAg with 62/36/2 solder coated terminations for superior solder attachment
- RC-3-0805-XXXX-X PtAg terminations for epoxy or wire bonding.
- Testing to MIL-R-55342 is available

Dimensions

- Length: 0.078" ±0.005"
- Width: 0.050" ±0.005"
- Height: 0.020" max.

Specifications

- Operating temperature: –55°C +150°C
- Rated power at 70°C: 175 MW
- Resistance range: 10 MΩ to 1,000 MΩ
- Resistance tolerances: ±15%, ±35%
- Max. working voltage: 150V
- VCR measured from 0.1 to 10V:
  10 MΩ to 220 MΩ = 0.02%/V typ.
  240 MΩ to 1,000 MΩ = 0.08%/V typ.
- TCR measured from +25°C to +125°C:
  10 MΩ to 500 MΩ = ±75 PPM/°C typ.
  560 MΩ to 1,000 MΩ = ±200 PPM/°C typ.



Gigohm, Wraparound Terminations

Features

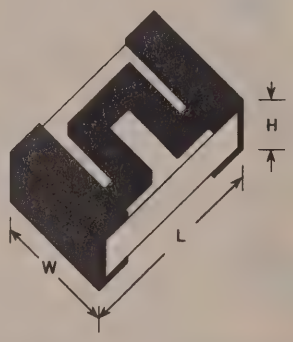
- 1.2 Gigohm to 1,000 Gigohm
- Wraparound PtAg (Platnum silver) terminations
- HC-C-0805-XXXX-X PtAg with 62/36/2 solder coating terminations for superior solder attachment
- HC-3-0805-XXXX-X PtAg terminations for epoxy or wire bonding.
- Testing to MIL-R-55342 is available

Dimensions

- Length: 0.078" ± 0.005"
- Width: 0.050" ± 0.005"
- Height: .0.020" max.

Specifications

- Operating temperature: –55°C +150°C
- Rated power at 70°C: 175 MW
- Resistance range:
  1.2×10^9 Ω to 1×10^{12} Ω
- Standard resistance tolerances:
  ±15%, ±35%
- Max. working voltage: 150V
- VCR measured from 0.1V to 10V:
  1.2×10^9 to 2×10^{10} Ohms = 0.03%/V typ.
  2.2×10^{10} to 2×10^{11} Ohms = 0.33%/V typ.
- TCR measured from +25°C to +125°C:
  1.2×10^9 to 2×10^{10} Ω = ±250 PPM/°C typ.
  2.2×10^{10} to 2×10^{11} Ω = ±600 PPM/°C typ.



Subminiature, Wraparound Terminations

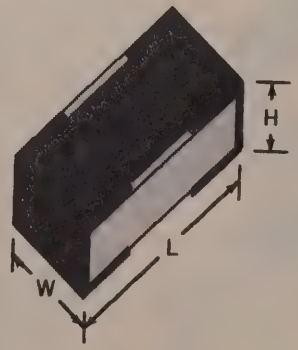
Features

- Subminiature thick film chip resistors
- Designed for higher frequency and micro miniature size applications
- Termination of PtAu (platinum gold) for all types of attachments: solder, wire bonding or conductive epoxy
- Testing to MIL-R-55342 is available

Dimensions	RC-4-0302	RC-4-0402
Length	.030" ± .005"	.045" ± .003"
Width	.020" ± .003"	.025" ± .003"
Height	.015" ± .005"	.015" ± .005"

Specifications	RC-4-0302	RC-4-0402
Operating Temperature	–55°C to +150°C	–55°C to +150°C
Max. Working Voltage	50V	60V
Rated Power at 70°C	63mW	125mW
Resistance Range	10Ω to 20MΩ	*1Ω to 50 MΩ
Standard Resistance Values	E24	E24
Resistance Tolerances	5%, 10%	2%, 5%
Temperature Coefficient of Resistance	250 ppm/C° typ.	250 ppm/C° typ.

*Note: 1Ω to 9.1Ω available in RC-D-0402 style ±10%.



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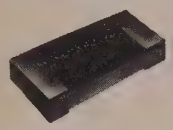
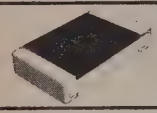
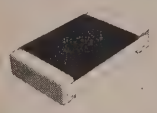
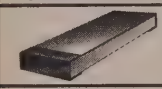
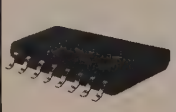
RESISTOR SOLUTIONS FOR TOUGH APPLICATIONS

IRC is more than just another resistor supplier. We've been providing resistor solutions to customers for more than 60 years. Our proven resistive technology gives you the edge, whether your application calls for thick film, thin film or wirewound resistors. If your tough application is waiting for the right resistor solution, call the resistor people at IRC: 1-800-IRC-OHMS.

SURFACE MOUNT COMPONENTS

SERIES REF.	TYPE	POWER (WATTS)	RES RANGE (OHMS)	TOLERANCE ±	DIMENSIONS L	H	W	S	MAX VOLTS	TCR [ppm/°C]	OPERATING TEMP. °C
CHF SERIES GLASS-COATED THICK FILM CHIP RESISTORS											
	0603	0.0625	10-2.2M		0.062	0.020	0.031		100	200	
	0805	0.10	1-10	1%	0.079	0.020	0.049		200		-55°C
	1206	0.125	1-10	2%	0.126	0.024	0.063		400	100	to
	1210	0.25	1-10	5%	0.126	0.024	0.098		400	200	+125°C
	2010	0.5	1-10		0.200	0.024	0.098		400		
	2512	1.0	1-1		0.256	0.024	0.126		400		
LRC SERIES LOW RESISTANCE VALUE CHIP RESISTORS											
	2010	0.5	0.2-1	1%	0.200	0.024	0.098		50	150	-55°C to
	2512	1.0	0.2-1	2%	0.256	0.024	0.126		50	300	+125°C
CR SERIES GENERAL PURPOSE CHIP RESISTORS											
	CR0503	0.063	1-10	5%	0.049	0.027	0.024		50	100	
	CR0805	0.1	1-100M	2%	0.079	0.027	0.049		100	(over range	-55°C
	CR1005	0.125	1-100M	1%	0.097	0.027	0.049		150	100R - 1M)	to
	CR1206	0.25	1-100M	0.25%	0.126	0.027	0.063		200		+125°C
HR SERIES ULTRA-HIGH RESISTANCE VALUE CHIP RESISTORS (1)											
	HR0805	Determined	100M-50G	25%,50%	0.079	0.027	0.049		100	0 to 2000	
		by		>1G-50G							-55°C
	HR1005	voltage	100M-50G	100M-1G	0.097	0.027	0.049		150	0 to 1500	to
		consideration		5%,10%							+125°C
	HR1206		100M-50G		0.126	0.027	0.063		200	0 to 1000	
PFC SERIES TANFILM® PRECISION CHIP RESISTORS (MIL-R-55342)											
	W0805	0.100	10-50K	1%	0.082	0.024	0.054			100	-55°C
				0.5%					200	50	to
	W1206	0.125	10-200K	0.1%	0.128	0.024	0.064			25	+150°C
CHP SERIES METAL GLAZE® CYLINDRICAL SURFACE-MOUNT RESISTORS											
	CHP 1/8	0.125	0.1-1M		0.128		0.057		200	100	
		0.25	20-350K	0.5%						50	
	CHP 1/2	0.5	0.1-1.6K	1%	0.198		0.078		300	100	-55°C
	CHP 1	0.5	0.1-2.2M	2.5%	0.251		0.079		350	100	to
		1.0	20-350K							50	+150°C
	CHP 2	1.33	0.3-2.2M		0.367		0.105		500	50,100	
	CHP T	0.0125	500-10K	2%,5%,10%	0.128		0.057		400	-2500	

RESISTOR NETWORKS

CCN SERIES CHIP CARRIER RESISTOR NETWORKS											
	7900	1		2%	0.35	0.75	0.35				
	7907	1	10-300K	1%	0.35	0.75	0.35		200	100	-55°C
	7908	1		0.5%	0.35	0.75	0.35			50	to
	7909	1		0.1%	0.35	0.75	0.35			25	+150°C
GULLWING SERIES PRECISION RESISTOR NETWORKS											
	GM8A	0.48	10-100K		0.44	0.08	0.22				
	GM8B	0.48	10-100K		0.44	0.08	0.22				
	GS8A	0.48	10-100K	2%	0.39	0.06	0.15			100	
	GS8B	0.48	10-50K	1%	0.39	0.06	0.15		100	50	-55°C
	GS7A	0.45	10-100K	0.5%	0.34	0.06	0.15			25	to
	GS7B	0.45	10-50K	0.1%	0.34	0.06	0.15				+125°C
	GS4A	0.40	10-100K	0.05%	0.19	0.06	0.15				
	GS4B	0.40	10-50K		0.19	0.06	0.15				

(1) HR Series Resistance Range – Ohmic values measured at 10V.
Power ratings @ 70°C unless otherwise indicated. For available network schematic configurations, consult data sheet.
L = Length H = Height above printed circuit board in case of rectangular cross section or radial leaded devices. W = Width for rectangular devices or diameter for cylindrical types. S = Lead wire diameter.

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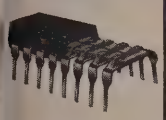
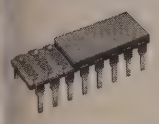
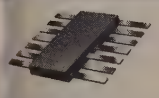
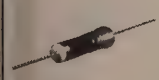
RESISTOR NETWORKS (cont.)

SERIES REF.	TYPE	POWER (WATTS)	RES RANGE (OHMS)	TOLERANCE ±	DIMENSIONS L	H	W	S	MAX VOLTS	TCR [ppm/°C]	OPERATING TEMP. °C
4700 SERIES TANFILM® SIP PRECISION RESISTOR NETWORKS											
	4701	1.08	49.9-100K		1.03	0.25	0.10				
	4781	0.84	49.9-100K		0.80	0.25	0.10			100	
	4761	0.6	49.9-100K	2%	0.60	0.25	0.10			50	
	4708	1.08	20-200K	1%	1.03	0.25	0.10			25	-55°C
	4788	0.84	20-200K	0.5%	0.80	0.25	0.10		100		to
	4768	0.6	20-200K	0.1%	0.60	0.25	0.10			TRACKING	+150°C
	4709	0.6	20-200K	0.25%	1.03	0.25	0.10			5ppm	
	4789	0.48	20-200K		0.80	0.25	0.10				
	4769	0.36	20-200K		0.60	0.25	0.10				
M900 SERIES TANFILM® MOLDED DIP PRECISION RESISTOR NETWORKS											
	M954	0.6	50-50K		0.47	0.20	0.26				
	M987	1.3	50-50K	1.0%	0.77	0.20	0.26			100	-55°C
	M998	1.5	50-50K	0.5%	0.86	0.20	0.26		100	50	to
	M959	0.6	50-100K	0.1%	0.47	0.20	0.26			25	+150°C
	M989	1.4	50-100K		0.77	0.20	0.26				
	M999	1.6	50-100K		0.86	0.20	0.26				
1900 SERIES TANFILM® CERAMIC DIP PRECISION RESISTOR NETWORKS											
	1989	1.4	100-100K	2%	0.72	0.13	0.26			100	
	1999	1.6	100-100K	1%	0.82	0.13	0.26		100	50	-55°C
	1987	1.3	100-70K	0.5%	0.72	0.13	0.26			25	to
	1998	1.5	100-70K	0.1%	0.82	0.13	0.26			TRACKING	+150°C
										5ppm	
8900 SERIES TANFILM® FLATPACK PRECISION RESISTOR NETWORKS											
	8987	0.5		0.02%	0.37	0.075	0.25			100	-55°C
	8989		49.9 to	through	0.37	0.075	0.25			50	to
	8998		121K	2%	0.39	0.075	0.25			25	+150°C
	8999				0.39	0.075	0.25				

GENERAL PURPOSE RESISTORS

FA SERIES FLAMEPROOF METAL FILM SAFETY RESISTORS											
	FA025	0.5	0.1-1M		0.244		0.91	0.024	350	150	
	FA05	1.0	0.1-1M	5%	0.354		0.134	0.031	350	400	-55°C
	FA1	1.5	0.1-1M	2%	0.570		0.201	0.031	500	150	to
	FA94	2.0	2.6-1M	1%	0.516		0.224	0.031	700	150	+235°C
RG SERIES HIGH POWER METAL GLAZE RESISTORS (1)											
	RG 1/8	0.25	4.3-1.5M	5%	0.150		0.066	0.016	200	200	
	RG 1/4	0.50	4.3-5.1M	2%	0.250		0.090	0.025	250	100	175°C
	RG 1/2	1.0	4.3-5.1M	0.5%	0.390		0.140	0.032	500	50	MAX
	RG 1	1.0	4.3-5.1M	0.1%	0.562		0.190	0.040	500	25	
	GS - 3	2.0	1 - 3M	1,2,5%	0.530		0.225	0.032	1000	50,100	
SPH /SP20 SERIES MOLDED FAILSAFE WIREWOUND RESISTORS (2)											
	SPH	2.0	0.05-2.4K	5%,10%	0.560		0.220	0.031	√PR	150	160°C
	SP20	0.75	0.1-1.2K	5%,10%	0.390		0.140	0.031	√PR	150	MAX
SPP SERIES CONFORMALLY COATED WIREWOUND RESISTORS* POWER RATED @85°C											
	SPP1	1.0	0.1-1.2K		0.400		0.148	0.032	√PR	Depends on	
	SPP2	2.0	0.1-2.4K	5%	0.570		0.170	0.032	√PR	resistance	
	SPP3	3.0	0.1-2.4K	10%	0.570		0.170	0.032	√PR	value.	
GP SERIES PRECISION METAL FILM RESISTORS											
	GP50(T0)	0.125	10-1M	1%	0.130		0.07	0.018	200	100	
	GP50(T2)	0.125	10-1M	1%	0.130		0.07	0.018	200	50	
	GP50(T9)	0.125	10-499K	1%	0.130		0.07	0.018	200	25	
	GP55(T0)	0.25	10-499K	1%	0.240		0.09	0.022	250	100	
	GP55(T2)	0.25	10-1M	0.5%	0.240		0.09	0.022	250	50	
	GP55(T9)	0.25	10-499K	1%	0.240		0.09	0.022	250	25	
	GP60(T0)	0.5	10-10M	0.5%	0.330		0.11	0.026	350	100	
	GP60(T2)	0.5	10-1M	1%	0.330		0.11	0.026	350	50	
	GP60(T9)	0.5	10-499K	1%	0.330		0.11	0.026	350	25	

1) RG Series: Available in RL, RN, and RNC MIL styles (2) SPH Series: Drop-in replacement for BWH * For fusing characteristics see data sheet.
P20 Series: Drop-in replacement for BW20 Power ratings @ 70°C unless otherwise indicated. For available network schematic configurations, consult data sheet.
= Length H = Height above printed circuit board in case of rectangular cross section or radial leaded devices. W = Width for rectangular devices or diameter for cylindrical types. S = Lead wire diameter.

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GENERAL PURPOSE RESISTORS (cont.)

SERIES REF.	TYPE	POWER (WATTS)	RES RANGE (OHMS)	TOLERANCE ±	DIMENSIONS L	H	W	S	MAX VOLTS	TCR [ppm/°C]	OPERATING TEMP. °C
RGT SERIES THICK FILM TEMPERATURE COMPENSATION RESISTORS POWER RATED @25°C											
	RGT-2	0.81		2%,5%,10%	0.150		0.066	0.016		-3000	-55°C to
	RGT-1	0.47			0.250		0.09	0.025			+175°C
RNC SERIES ESTABLISHED RELIABILITY METAL GLAZE RESISTORS (MIL-R-55182)											
	RNC55	0.1	10-2M	0.1,0.5,1%	0.150		0.066	0.016	200	50	
	RNC60	0.125	10-3.01M	0.1,0.5,1%	0.390		0.14	0.025	250	50	
	RNC65	0.25	10-3.01M	0.1,0.5,1%	0.562		0.19	0.025	300	50	
MOM SERIES METAL OXIDE MINIATURE RESISTORS											
	MOM 1/2	0.5	0.1-47K	5%,1%	0.260		0.090	0.024	250		-55°C
	MOM 1	1	0.1-75K	5%,1%	0.350		0.110	0.028	350		to
	MOM 2	2	0.1-100K	5%,1%	0.430		0.160	0.031	350		+200°C
	MOM 3	3	0.1-120K	5%,1%	0.610		0.220	0.031	350		
	MOM 5	5	0.1-150K	5%,1%	0.970		0.340	0.031	500		
RWR SERIES SEMI-PRECISION POWER WIREWOUND RESISTORS (MIL-R-39007)											
	RWR81	1	0.499-1K		0.250		0.085	0.020	31.6	±20 (10Ω up)	-50°C
	RWR82	1.5	0.499-1.3K		0.312		0.078	0.020	44.2	±50 (1Ω-9.9Ω)	to
	RWR71	2	0.499-16.2K	0.1%	0.812		0.188	0.032	180	±400 (.5Ω-.999Ω)	+350°C
	RWR80	2	0.499-3.16K	to	0.406		0.094	0.020	79.5	±650 (.1Ω-.499Ω)	
	RWR89	3	0.499-4.12K	1%	0.560		0.187	0.032	111.2		
	RWR74	5	0.499-12.1K		0.875		0.312	0.040	246	Special TC from	
	RWR84	7	0.499-12.4K		0.875		0.312	0.040	294.6	-30 to +6000	
	RWR78	10	0.499-39.2K		1.780		0.375	0.040	626.1		
RW SERIES SEMI-PRECISION POWER WIREWOUND RESISTORS (MIL-R-26)											
	RW81	1	0.1-1K		0.250		0.085	0.020	31.6	±20 (10Ω-up)	-55°C
	RW70	1	0.1-3.16K		0.406		0.094	0.020	56.2	±50 (1Ω-9.9Ω)	to
	RW80	2	0.1-3.16K	0.1%	0.406		0.094	0.020	79.4	±400 (.5Ω-.999Ω)	+350°C
	RW69	3	0.1-2K	to	0.500		0.188	0.032	77.5	±650 (.1Ω-.499Ω)	
	RW79	3	0.1-10.5K	1%	0.560		0.187	0.032	177.5		
	RW74	5	0.1-38.3K		0.875		0.312	0.040	437.6	Special TC from	
	RW67	5-6.5	0.1-8.2K		1.000		0.313	0.032	230.9	-30 to +6000	
	RW55	7	0.1-3.4K		1.370		0.469	0.032	188.9		
	RW78	10	0.1-90.9K		1.780		0.375	0.040	953.4		
	RW68	11	0.1-20K		1.875		0.344	0.032	469		
T SERIES SEMI-PRECISION POWER WIREWOUND RESISTORS (COMMERCIAL)											
	T-1/2-A81	1	0.1-2K		0.250		0.085	0.020	31.6	±20 (10Ω-up)	-55°C
	T-1/2-S	1	0.1-2.8K		0.280		0.078	0.020	77.4	±50 (1Ω-9.9Ω)	to
	T-1A-70	1	0.1-6.5K	0.1%	0.406		0.094	0.020	56.2	±400 (.5Ω-.999Ω)	+350°C
	T-1-80	2	0.1-10K	to	0.406		0.094	0.020	79.4	±650 (.1Ω-.499Ω)	
	T-2A-69	3	0.1-18K	1%	0.500		0.188	0.032	77.5		
	T-2B-79	3	0.1-22K		0.560		0.187	0.032	177.5	Special TC from	
	T-3	4	0.1-25K		0.625		0.250	0.040	370.8	-30 to +6000	
	T-5	5	0.1-45K		0.875		0.312	0.040	540.8		
	T-5-74	5	0.1-45K		0.875		0.312	0.040	437.6		
	T-6-67	5	0.1-65K		1.000		0.313	0.032	230.9		
	T-7A-55	7	0.1-120K		1.375		0.469	0.032	188.9		
	T-10	10	0.1-150K		1.812		0.375	0.040	1396.0		
	T-10-78	10	0.1-150K		1.780		0.375	0.040	953.5		
	T-10-68	11	0.1-150K		1.875		0.344	0.032	469.0		

SPECIAL PURPOSE RESISTORS

Precision Resistors

RC SERIES CONFORMALLY COATED PRECISION METAL FILM RESISTORS											
	RC50	0.125	1-150K	1%	0.180		0.070	0.020	200	50	
	RC55	0.25	1-1M	0.5%	0.280		0.090	0.024	200	25	-55°C
	RC65	0.5	1-1.5M	0.25%	0.390		0.140	0.024	250	15	to
	RC70	1.0	1-4.7M	0.1%	0.610		0.210	0.031	350	10	+155°C
	RC75	1.5	1-5M	0.05%	0.690		0.320	0.031	500	5	
MAR40/42 SERIES ULTRA-PRECISION METAL FILM RADIAL LEAD RESISTORS											
	MAR40	0.3	20-400K	1%,0.5%	0.295	0.340	0.110	0.025	250	±5 and ±2	
				0.25%,0.1%						0°C-60°C	150°C
	MAR42	0.3	20-400K	0.05%,0.02%	0.295	0.340	0.110	0.025		±10 and ±5	MAX
		@85°C		0.01%,0.005%						55°C-125°C	

Power ratings @ 70°C unless otherwise indicated.

L = Length H = Height above printed circuit board in case of rectangular cross section or radial leaded devices. W = Width for rectangular devices or diameter for cylindrical types. S = Lead wire diameter.

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CALL 1-800-IRC-OHMS

SPECIAL PURPOSE RESISTORS (cont.)
Precision Resistors (cont.)

SERIES REF.	TYPE	POWER (WATTS)	RES RANGE (OHMS)	TOLERANCE ±	DIMENSIONS L	H	W	S	MAX VOLTS	TCR [ppm/°C]	OPERATING TEMP. °C
PR4 SERIES PRECISION METAL FILM RESISTORS											
	PR4	0.25	100-240K	0.1% 0.25%	0.244		0.091	0.024	250	25	-55°C to +155°C
MAR SERIES ULTRA-PRECISION METAL FILM RESISTORS											
	MAR5	0.1	10-3M	0.50% 0.25% 0.2%	0.281		0.102	0.025	200 250	100 50	150°C
	MAR6	0.125	10-5M	0.1% 0.05%	0.425		0.155	0.025	300 500	25 15	MAX
	MAR7	0.25 @85°C	10-10M	0.02% 0.01%	0.650		0.195	0.025		10 5	
RB SERIES PRECISION WIREWOUND RESISTORS [MIL-R-93] (ROUND)											
	RB/RBR-71	0.125	150K	to	0.312		0.250	0.025	300	2	-55°C
	RB-71	0.125	100K	0.01%	0.312		0.250	0.025	300	to	to
	RB-70	0.250	301K		0.500		0.375	0.032	150	6000	+145°C
PC SERIES PRECISION WIREWOUND RESISTORS (ROUND)											
	PC/HR-8	0.125	150K	to	0.312		0.250	0.025	300	2	-55°C
	PC-3	0.500	250K	0.01%	0.359		0.265	0.025	300	to	to
	PC-4	0.500	500K		0.375		0.375	0.032	300	6000	+145°C
4000 SERIES PRECISION WIREWOUND RESISTORS (ROUND)											
	4060	0.250	500K	to	0.312		0.250	0.025	300	2	-55°C
	4065	0.250	1.5M	0.01%	0.500		0.375	0.032	150	to	to
	4061	0.250	800K		0.375		0.250	0.025	300	6000	+145°C
	4062	0.250	800K		0.437		0.250	0.025	300		
	4063	0.500	1M		0.375		0.375	0.032	300		
	4064	0.500	1.3M		0.437		0.375	0.032	300		
	4066	0.500	2M		0.375		0.437	0.032	300		
	4067	0.600	3M		0.437		0.437	0.032	300		
	4068	0.600	3.5M		0.500		0.437	0.032	300		
RBR SERIES PRECISION WIREWOUND RESISTORS [MIL-R-39005] (RADIAL)											
	RBR-81	0.100	250K	to	0.500		0.160	0.020	300	2	-55°C
	RBR-80	0.100	120K	0.01%	0.325		0.160	0.020	150	to 6000	to +145°C
RBR SERIES PRECISION WIREWOUND RESISTORS [MIL-R-39005] (AXIAL)											
	RB-56	0.125	0.1-127K	to	0.343		0.250	0.032	200	to	
	RB/RBR-56	0.125	0.1-127K	0.01%	0.343		0.250	0.032	200	±2	
	RB/RBR-75	0.125	0.1-316K		0.295		0.250	0.025	150		
	RB-55	0.150	0.1-226K		0.500		0.250	0.032	300		-65°C
	RB/RBR-55	0.150	0.1-332K		0.500		0.250	0.032	300		to
	RB-54	0.250	0.1-511K		0.750		0.250	0.032	300		+145°C
	RB/RBR-54	0.250	0.1-562K		0.750		0.250	0.032	300		
	RB-53	0.330	0.1-750K		0.750		0.375	0.032	500		
	RB/RBR-53	0.330	0.1-1.1M		0.750		0.375	0.032	500		
	RB-52	0.500	0.1-1,5M		1.000		0.375	0.032	750		
	RB/RBR-52	0.050	0.1-1.2M		1.000		0.375	0.032	750		
7000 SERIES AXIAL LEAD PRECISION WIREWOUND RESISTORS											
	7008	0.150	1M	to	0.250		0.250	0.025	300	to	
	7009	0.250	1.5M	0.01%	0.343		0.250	0.032	200	±2	-65°C
	7010	0.330	3M		0.500		0.250	0.032	300		to
	7020	0.500	4.4M		0.750		0.250	0.032	300		+145°C
	7030	0.660	8M		0.750		0.375	0.032	500		
	7040	1.000	12M		1.000		0.375	0.032	750		

Power ratings @ 70°C unless otherwise indicated.

L = Length H = Height above printed circuit board in case of rectangular cross section or radial leaded devices. W = Width for rectangular devices or diameter for cylindrical types. S = Lead wire diameter.

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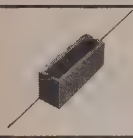
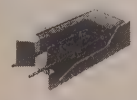
Low Ohm Resistors

SERIES REF.	TYPE	POWER (WATTS)	RES RANGE (OHMS)	TOLERANCE ±	DIMENSIONS L	H	W	S	MAX VOLTS	TCR [ppm/°C]	OPERATING TEMP. °C
LO-OHM SERIES LOW RESISTANCE MOLDED METAL ELEMENT RESISTORS (LOB Series available – operating temperature -55°C to +175°C)											
	LO-3	3.0	0.005-0.1	5%	0.560		0.210	0.032	√3R	Depends on	-55°C
	LO-5	5.0		to	0.930		0.330	0.040	√5R	resistance	to
		@25°C		0.5%						value	+275°C
PLO SERIES LOW RESISTANCE FLAMEPROOF CERAMIC WIREWOUND RESISTORS											
	PLO 3	3.0	0.005-0.18	10%	0.890	0.310	0.31	0.040		Depends on	
	PLO 5	5.0	0.005-0.18	5%	0.890	0.350	0.380	0.040		resistance	250°C
	PLO 7	7.0	0.01-0.18	3%	1.397	0.350	0.380	0.040		values	MAX
	PLO 10	10.0	0.01-0.18	2%	1.890	0.350	0.380	0.040			
	PLO 15	15.0	0.01-0.18	1%	1.890	0.500	0.500	0.040			
		@25°C									
LPW SERIES LOW RESISTANCE FLAMEPROOF CERAMIC POWER WIREWOUND RESISTORS (1)											
	LPW-3	3	0.005-1	1%	0.88	0.31	0.31	0.36			250°C
	LPW-5	5	0.005-1	2%	0.88	0.38	0.38	0.36			MAX
	LPW-7	7	0.01-1	3%	1.39	0.38	0.38	0.36		40	
	LPW-10	10	0.01-1	5%	1.88	0.38	0.38	0.36			
	LPW-15	15	0.01-1	10%	11.88	0.5	0.5	0.36			
PWRL SERIES LOW RESISTANCE FLAMEPROOF CERAMIC RADIAL POWER WIREWOUND RESISTORS											
	PWRL-3	3	0.01-0.18	1%,2%	0.475	1.000	0.320	0.040		50	250°C
	PWRL-5	5		3%,5%	0.500	1.000	0.350	0.040		to	MAX
	PWRL-7	7		10%	0.500	1.500	0.350	0.4040		500	
	PWRL-10	10			0.630	1.390	0.520	0.040			

Fusible Resistors*

FA8025 SERIES CONFORMALLY COATED FLAMEPROOF FUSIBLE METAL ELEMENT RESISTORS											
	FA8225	0.25	0.1-10K	5%	0.275		0.090	0.024	250	250	-55°C
	FA8325	0.5	0.1-27K		0.394		0.134	0.031	350	250	to
	FA8425	1.5	0.15-22K		0.571		0.201	0.031	500	250	+155°C
F500 SERIES U,L, APPROVED DUAL-FUNCTION FUSE RESISTORS											
	F501 thru		0.2 to	10%	0.400		0.140	0.020		±150	-55°C too
	F528		200	STD						<1Ω	+150°C
SPF/SP20F SERIES MOLDED FAILSAFE WIREWOUND FUSING RESISTORS (2)											
	SPF	2.0	0.1-1K	10%	0.562		0.255	0.032	√PR	Depends on	160°C
	SP20F	0.75		5%	0.390		0.140	0.032	√PR	resistance value	MAX
LFR SERIES TELECOMMUNICATIONS LINE FEED RESISTORS											
	LFR-2	2	1-1.6K	1,2,3,5%	1.045	0.45	.265	0.032	1000	50	180°C MAX

High Voltage/High Value Resistors

T SERIES HIGH VOLTAGE PRECISION THICK FILM RESISTORS @20°C											
	T43D	1.5	1-4G		1.000		0.330	0.031	4KV	Values	
	T44D	3.5	1-15G		2.000		0.330	0.031	14KV	≤1G	
	T48D	10.0	1-45G		5.910		0.330	0.031	50KV	25, 50	
	T43KU	1.5	1-4G	5%	1.190		0.335	0.031	4KV	100	-55°C
	T44KU	3.5	1-15G	2%	2.000		0.335	0.031	14KV	Values	to
	T48KU	10.0	1-45G	1%	6.000		0.335	0.031	50KV	>1G	+150°C
	T43TU	1.5	1-4G		1.280		0.335		4KV	250	
	T44TU	3.5	1-15G		2.190		0.335		14KV		
	T48TU	10.0	1-45G		6.090		0.335		50KV		
R B SERIES THICK FILM HIGH VOLTAGE BLEEDERS											
	RB-1	1	10K-1000M		1.03	0.28	0.15	0.032	10KV		
	RB-2	2	10K-1000M	1%	1.03	0.53	0.15	0.032	10KV		
	LRB-2	2	10K-1000M	2%	2.03	0.28	0.15	0.032	20KV		-55°C
	RB-3	3	10K-1000M	5%	1.53	0.53	0.15	0.032	15KV	150	to
	RB-4	4	10K-1000M	10%	2.03	0.53	0.15	0.032	20KV		+150°C
	RB-5	5	10K-1000M	20%	2.53	0.53	0.15	0.032	25KV		
	RB-10	10	10K-1000M		2.53	1.28	0.15	0.032	25KV		

(1) LPW Series: Also available as four-leaded version (4LPW) (2) SPF/SP20F Series: Drop-in replacement for BW20F Power ratings @ 70°C unless otherwise indicated.

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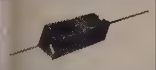
High Voltage/High Value Resistors (cont.)

SERIES REF.	TYPE	POWER (WATTS)	RES RANGE (OHMS)	TOLERANCE ±	DIMENSIONS L	H	W	S	MAX VOLTS	TCR [ppm/°C]	OPERATING TEMP. °C
R D SERIES THICK FILM HIGH VOLTAGE DIVIDERS											
	RD-2	3	100K-1000M		1.03	1.03	0.15	0.032	10KV		
	RD-3	4	100K-1000M		1.53	1.03	0.15	0.032	15KV		
	RD-5	7	100K-1000M	1%	2.03	1.03	0.15	0.032	20KV	150	-55°C
	XRD-2	3	100K-1000M	5%	1.00	1.00	0.05		10KV		to
	XRD-3	4	100K-1000M		1.50	1.00	0.05		15KV		+150°C
	XRD-5	7	100K-1000M		2.00	1.00	0.065		20KV		
CGH SERIES THICK FILM HIGH VOLTAGE PRECISION RESISTORS											
	CGH-1/4	0.25	100K-100M		0.275		0.088	0.032	750	50,100	
	CGH-1/2	0.5	100K-400M	0.5%	0.400		0.138	0.032	1.5K	50,100	
	CGH-1	1	50K-750M	1%	0.690		0.297	0.032	3K	50,100	-55°C
	CGH-2	2	100K-1200M	2%	1.062		0.297	0.032	5K	50,100	to
	CGH-3	3	200K-4000M	5%	2.062		0.297	0.032	10K	50,100	+175°C
	CGH-5	5	300K-5000M		3.062		0.297	0.032	20K	50,100	
CGX SERIES THICK FILM HIGH VOLTAGE PRECISION RESISTORS											
	CGX-1/4	0.25	101M-5000M	1%	0.400		0.140	0.032	2K	250	-55°C
	CGX-1/2	0.5	500K-10,000M	2%	0.680		0.140	0.032	3K	50,100,250	to
	CGX-1	1	1M-15,000M	5%	1.060		0.140	0.032	5K	50,100,250	+175°C
CMH SERIES THICK FILM HIGH VOLTAGE HIGH RELIABILITY RESISTORS (MIL-R-49462)											
	CMH-1/4	0.25	330K-100M		0.275		0.088	0.025	750	330K-100M±100	-55°C
	CMH-1/2	0.5	330K-392M		0.400		0.138	0.032	1.5K	101M-499M±200	to
	CMH-1	1	330K-499M	1%	0.690		0.297	0.032	3K	500M-above±500	+175°C
	CMH-2	2	330K-499M	2%	1.062		0.297	0.032	5K		
	CMH-3	3	330K-1000M	5%	2.062		0.297	0.032	10K		
	CMH-5	5	330K-1000M		3.062		0.297	0.032	20K		

Power Resistors (power rating specified at 25°C unless otherwise noted)

PW SERIES GENERAL PURPOSE CERAMIC WIREWOUND POWER RESISTORS (2 thru 50 watts available. Power ratings @ 70°C unless otherwise indicated.)											
	PW-2	2	0.15-2.4K	5	0.690	0.250	0.250	0.032	√ PR	300-5500	250°C
	PW20E	20	0.1-2K	5	2.500	0.500	0.500				MAX
	PW50E	50	0.8-1.5K		3.625	0.750	0.750				
	PW20H	20									
PPW SERIES SEMI-PRECISION FLAMEPROOF CERAMIC WIREWOUND POWER RESISTORS (2 thru 15 watts available.)											
	PPW-2	2	1-1.6K		0.690	0.275	0.275	0.032		±20	250°C
	PPW-15	15	1-5K		1.880	0.500	0.500	0.032			MAX
PWR SERIES GENERAL PURPOSE CERAMIC RADIAL WIREWOUND POWER RESISTORS											
	PWR-3	3	0.18-7.5K	5%	0.475	1.000	0.320	0.032	√ PR	300	250°C
	PWR-5	5	0.18-8.5K	10%	0.500	1.000	0.350	0.032		to	MAX
	PWR-7	7	0.18-18K		0.500	1.390	0.350	0.032		+5500	
	PWR-10	10	0.18-18K		0.630	1.500	0.520	0.032			
PWRG SERIES GENERAL PURPOSE CERAMIC RADIAL METAL GLAZE POWER RESISTORS											
	PWRG-3	3	1-100K	1%,2%	0.475	1.00	0.320	0.032		100	250°C
	PWRG-5	5	1-100K	5%,10%	0.500	1.00	0.350	0.032			MAX
AS SERIES SEMI-PRECISION WIREWOUND RESISTORS											
	AS-1/4	0.500	0.1-1K	.5%, 1%,	0.250	0.094		0.020	100	±20	275°C
	AS-1/2	0.500	0.1-6K	3%, %5	0.312	0.094		0.020	100	to	MAX
	AS-1	1	0.1-7.5K		0.367	0.125		0.020	130	+5500	
	AS-1C	1	0.05-2K		0.256	0.115		0.025	110		
	AS-2	2	0.1-20K		0.480	0.250		0.032	140		
	AS-2B	3	0.1-24K		0.540	0.219		0.032	185		
	AS-2C	2	0.1-18K		0.489	0.157		0.032	160		
	AS-3	3	0.1-30K		0.687	0.282		0.040	200		
	AS-5	5	0.1-60K		0.875	0.344		0.040	400		
	AS-7	7	0.1-90K		0.125	0.344		0.040	600		
	AS-10	10	0.1-175K		1.812	0.385		0.040	1000		

L = Length H = Height above printed circuit board in case of rectangular cross section or radial leaded devices. W = Width for rectangular devices or diameter for cylindrical types. S = Lead wire diameter.

eem MINIGLOSSARY CONNECTORS

Connector terminology is often quite confusing. This confusion starts with the very names of connectors. The name of a connector may derive from its shape, application, type of conductor or even method of termination.

Shape—Circular, cylindrical, and rectangular.

Electrical application—High voltage, RF, microwave, input/output, etc.

Mechanical application—Printed circuit, rack & panel, cable, etc.

Conductor type—Coaxial, flat cable, ribbon cable, flex circuit, etc.

Termination method—Wirewrap, soldercup, solderless, etc.

Hardware such as clamps, hoods, and adapters are frequently used to convert cable connectors to rack and panel types. This adds to the name confusion. A very common telephone connector, for example (the "C" type) got its name from the model number of the original maker.

Contact: The part(s) of the connector that actually provides circuit continuity between its two sections—the parts which are normally mated. The back end of the connector should properly be called the *termination.* This is the point where the wires or PC board is attached to the connector.

Contact alignments: Often called *contact float.* Describes the amount of allowable contact movement within the connector body. Permits self-alignment.

Male vs. female: In the U.S. this describes the contact construction. In Europe this term is more often used to describe the outer shell mating action which may be the reverse of the contacts.

Closed entry: A female contact which prevents entry of a male contact larger than a specific size.

Open entry: A female contact designed for a specific size of male contact but which will allow entry of larger male contacts by spring action.

Hermaphrodite: Contacts or connector bodies which are the same configuration. Male/female designations do not apply. Bodies usually have some mechanical means for maintaining polarity.

Hermetic seal: Glass-to-metal seals at terminations. Often used improperly to describe vacuum-tight seals.

Waterproof seal: May or may not be truly *waterproof.* May prevent easy entrance of casual water by means of a rubber or other boot.

Printed circuit connector: Connectors which are used in conjunction with printed circuit boards. There are two distinctly different styles.

Edgeboard. May be called *edge* or *card.* The printed circuit (PC) board edge enters the connector.

Two-piece: One part of the connecting pair is physically attached to the PC board itself. The other part is attached to something else such as a cable or a motherboard.

Readout: Describes the arrangement at the terminating edge of a PC board. May be single or double. A double readout PC board has termination strips on each side not usually interconnected.

Ribbon connectors: A type of connector which allows flat "ribbon" cable to be attached to a round or rectangular connector but also used interchangeably for flat connectors to flat cable.

Ribbon contact connector: Describes the contacts in a rectangular connector which have a self-wiping mating action. Not the same as ribbon connector.

Solderless terminal: Any style of termination which does not require solder for a permanent connection. See *crimp* and *insulation displacement.*

Crimp termination: A stripped wire is inserted into a barrel or trough which is then crimped to the conductor with a suitable tool.

Insulation displacement: Unstripped insulated wire is fitted into a channel containing metal teeth which are forced through the insulation to make contact with the conductor.

Service rating: The maximum rated voltage and/or current which may be applied continuously. May be called *working voltage.* Can be confused with the term used to describe how many times a connector may be mated and separated.

Withstanding voltage: Also called *test voltage.* The voltage a connector must withstand for one minute without breakdown. Applied between connectors and between connectors and shell and any grounding devices of the connector.

ISOTEK CORPORATION
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ISA-PLAN® Precision Current Sensing Resistors

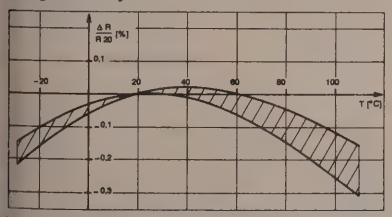
Mounting	Model	Power	Resistance Range	Terminals	Page
BUS BAR	PVG	5 W	0.5mΩ-1Ω	4	2
BUS BAR	BSH	30 W	0.5mΩ-100mΩ	4	2
THRU-HOLE	PS	0.5 W	5mΩ-100Ω	2	2
THRU-HOLE	PL	0.5 W	5mΩ-100Ω	2	2
THRU-HOLE	C-N	1 W	2.5mΩ-100Ω	2	2
THRU-HOLE	A-N	1 W	0.5mΩ-100Ω	4	2
THRU-HOLE/HS	PBH	10 W	2.5mΩ-100Ω	2	2
THRU-HOLE/HS	PBV	10 W	1mΩ-100Ω	4	2
THRU-HOLE/HS	A-H1	10 W	2.5mΩ-100Ω	4	2
THRU-HOLE/HS	A-H2	10 W	2.5mΩ-100Ω	4	2
SMD	SMR	1 W	8mΩ-100Ω	2	3
SMD	SMV	1 W	3mΩ-100Ω	4	3
HYBRID	PMA-Cu	1 W	3mΩ-500mΩ	4	3
HYBRID	PMB-Cu	2.5 W	1mΩ-1Ω	4	3
THRU-HOLE	IWN-A-N	1 W	Network	4	3
THRU-HOLE	IWN-A-H	4 W	Network	4	3
BASE/HS	RTO	50 W	0.2mΩ-100Ω	2 & 4	3
BASE/HS	RUG	100 W	1mΩ-100Ω	4	3
BASE/HS	REG	250 W	1Ω-1500Ω	2	3

ISA-PLAN® precision resistors are ideal for sensing and controlling current. ISA-PLAN® resistor elements are are etched from rolled Manganin or optional Zeranin® foil. The foil is then laminated to a substrate resulting in a planar geometry which is ideal for high power dissipation and low inductance. Special annealing and manufacturing processes guarantee low temperature coefficient of resistance and excellent long-term stability.

Manganin, Zeranin® and Temperature Coefficient of Resistance

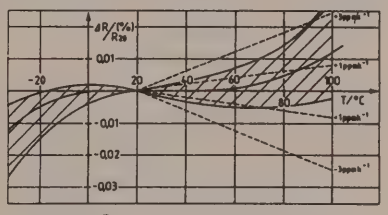
All conducting materials change resistance in response to temperature. This is typically nonlinear, but but it is usually approximated by a straight line between two temperatures. The slope of the line is known as the temperature coefficient of resistance, or "TCR."

Manganin was first developed by ISABELLENHUTTE about 100 years ago, and is the standard resistance material in the ISA-PLAN® family. Its resistance response to temperature is given in the shaded region in the figure below. From 20 to 60°C it is 10 ppm/°C. From 60 to 100°C it is 25 ppm/°C. Unless otherwise noted, tcr values for resistors are for Manganin alloys.



Manganin's resistive response to temperature. Shaded area denotes DIN 46460 allowable tolerance. Variations may result due to different design and nominal values.

Zeranin® was first produced in 1965 by ISABELLENHUTTE and is available as an option on the ISA-PLAN® product line. Its resistance response to temperature is shown in the following graph. It is approximately one order of magnitude less responsive to temperature than Manganin. It offers a tcr of 3 ppm/°C from 20 to 100°C, and on the RUG resistor, it is available with a tcr of 1 ppm/°C over this temperature range.

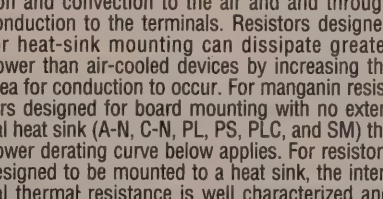


Zeranin's® resistive response to temperature.

Power Rating

Resistors convert electrical energy to thermal energy according to Ohm's law:P=EI=I²R where P is power in watts, E is the voltage drop across the resistor, I is the current and R is the resistance. The resistor must dispose of the heat generated. Equilibrium is achieved when the heat generated is equal to the heat disposed and a stable internal temperature results. This temperature must not exceed a limit that varies depending on resistor technology. If this temperature is exceeded, the stability will be compromised, or the resistor could be destroyed. For ISA-PLAN® technology, the maximum recommended continuos foil temperature is 125°C. The resistors are burned in at 140°C during manufacturing to assure stable long-term resistance when operating at 125°C.

From the foil, the heat flows away through radiation and convection to the air and and through conduction to the terminals. Resistors designed for heat-sink mounting can dissipate greater power than air-cooled devices by increasing the area for conduction to occur. For manganin resistors designed for board mounting with no external heat sink (A-N, C-N, PL, PS, PLC, and SM) the power derating curve below applies. For resistors designed to be mounted to a heat sink, the internal thermal resistance is well characterized and given in this literature for thermal analysis. Isotek can provide technical support if required.



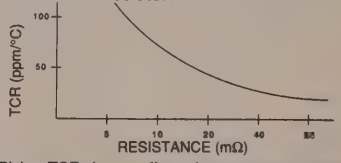
Power derating curves for air cooled resistors of different tolerances.

Pulse Power

The unique laminated construction makes ISA-PLAN® particularly adept at handling pulsed power by increasing the effective thermal mass of the resistance element. A factor of 10 times the continuos power rating is generally acceptable for pulses up to one second in duration. This varies somewhat with the specific resistor package and with the duty cycle of the pulse.

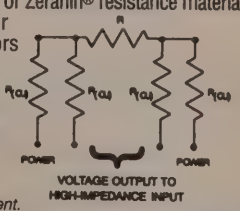
Kelvin Connection

Kelvin or four terminal connection is recommended for low-ohmic current sensing resistors. The lower in ohmic value, the more strongly it is advised.This is because the copper terminals become an ever increasing part of the overall resistance as the value decreases. The tcr of copper is around 4000 ppm/°C. This produces a large variation in effective resistance as the temperature of the resistor changes. This influence is illustrated by the graph below, which shows how the benefit of 10 ppm/°C Manganin is diminished by the copper when the resistance drops below about 80mΩ in a two terminal resistor.



Rising TCR due to effect of copper with decreasing resistance.

This problem is eliminated with Kelvin connections where the voltage drop is measured on the resistor itself and directed to a high impedance source. The tcr is only a function of the Manganin or Zeranin® resistance material. ISA-PLAN® four terminal resistors have the Kelvin connections etched directly to the resistive element.



Kelvin measurement.

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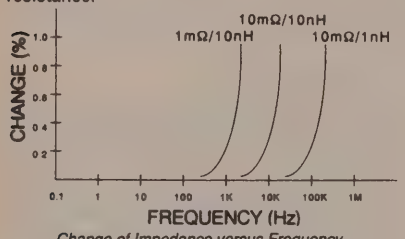
Reactance, Impedance & Inductance

The presence of capacitance or inductance in an AC circuit produces a phase shift between the current and voltage known as reactance. Impedance is the ratio of effective voltage divided by effective current in an AC circuit. In low ohmic resistors, the effect of inductive reactance dominates. While the inductance of the resistors described in this literature are typically less than 10 nH, mounting and wiring or trace layout can increase the effective inductance. The total impedance (which determines the resulting measured voltage drop) is given by:

$$Z=[R^2 = (2\pi fL)^2]^{0.5}$$

A 1 mΩ resistor with a net inductance of 10 nH produces an error in measurement of 1% at a frequency of 2.23 kHz. The figure below illustrates the relationship between frequency, inductance and resistance. The error increases with increasing frequency and decreasing resistance.



Change of Impedance versus Frequency.

Thermal EMF

Dissimilar metals in contact produce a voltage. This voltage varies with temperature and is known as "thermal emf." This emf must be considered in low value resistors in DC circuits. Copper, the terminal material, is used as the reference metal. Manganin and Zeranin® have low thermal emfs of <2μV/°C with copper. One side of the resistor is a =2μV/°C generator and the other side is a -2μV/°C generator. Ideally, both ends of the resistor are at the same temperature, and the thermal emfs cancel. The low terminal emfs of Manganin and Zeranin® minimize this influence on the measurement, but it is up to the user to assure that the resistor is not being non-uniformly heated by other components in the application. Since measurements are generally above 50 mV, a few degrees of differential temperature will not affect the accuracy materially.

Noise

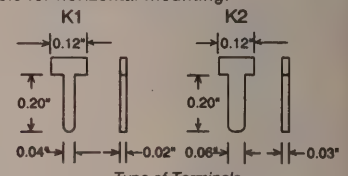
Noise is an undesired signal from the resistor. Noise in ISA-PLAN® metal foil resistors is primarily due to thermal effects. Thermal noise comes from random electron motion in the resistive material, resulting in a small and fluctuating potential difference across the terminals. This is given by the equation:

$$E=[4KTR\ (f2-f1)]^{0.5}$$

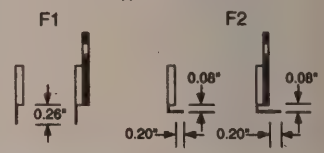
where K is Boltzmann's constant, T is the absolute temperature in Kelvin, R is the resistance and (f2-f1) is the bandwidth in Hertz. Typically, this noise is less than a few μV and can be ignored in most applications.

Terminals and Current Limits

For through-hole resistors, the standard terminal is shown as K1 below. For applications over 35 amps, the optional K2 is recommended up to 80 amps. (PBH and PBV have K2 power terminals as standard.) For over 80 amps, the high-power packages with screw terminals or buss bar mounting are recommended. Type F2 terminals are available for horizontal mounting.



Type of Terminals



Connection Types

Ordering Notes:

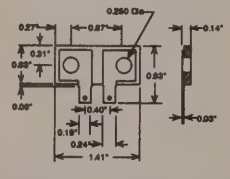
1. An "R" is used in place of the decimal to avoid its loss.
2. Manganin is the standard resistance material. To specify Zeranin® material, place a "Z" after the package designation.

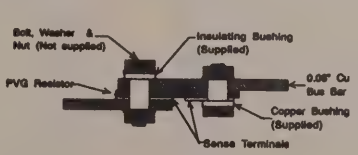
EXAMPLE: BSH-Z-R001-1.

BUS-BAR MOUNTED

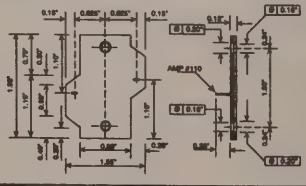
The PVG and BSH resistors are ideal for use in high-power supplies, UPS equipment and motor drives. Both packages are designed to be integrally mounted into the current-bus structure. This results in a mechanically rigid construction as well as space savings and assembly convenience. This unique design enables the current bus to also serve as heat-sink.

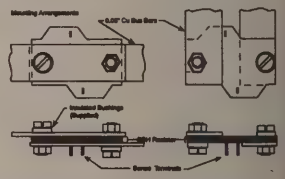
MODEL PVG 10 WATT/FOUR-TERMINAL (50 ppm/°C)





MODEL BSH 30 WATT/FOUR-TERMINAL (50 ppm/°C)

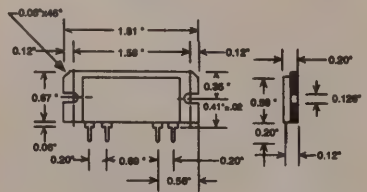




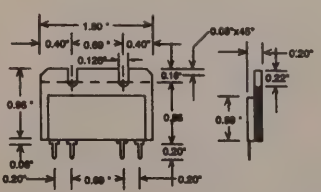
THROUGH-HOLE

Through-hole resistors are available in packages ranging from 0.5 watts to 10 watts of power dissipation. The PBH/PBV resistors are recommended for general purpose use while the A-series is recommended where exceptional accuracy and tcr performance is required.

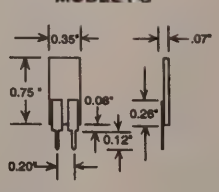
MODEL A-H1



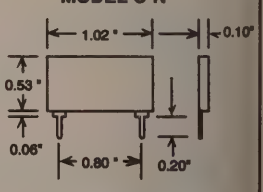
MODEL A-H2



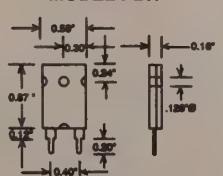
MODEL PS



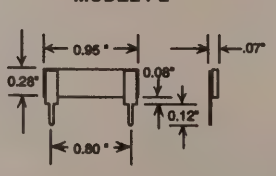
MODEL C-N



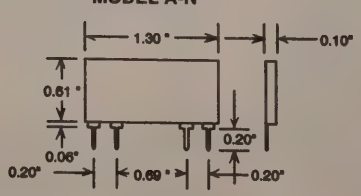
MODEL PBH



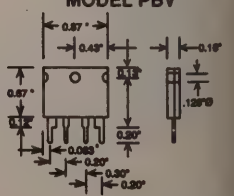
MODEL PL



MODEL A-N



MODEL PBV



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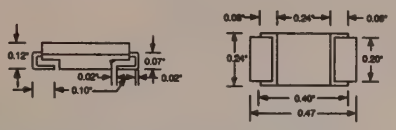
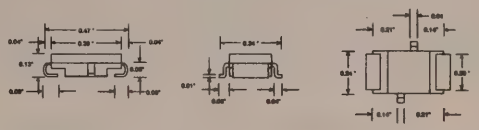
SURFACE MOUNT

These are the first low-ohmic resistors fully compatible with surface mounting and soldering equipment. Both are supplied in embossed 24 mm carrier tape per EIA-481 for automatic mounting.

MODEL SMR

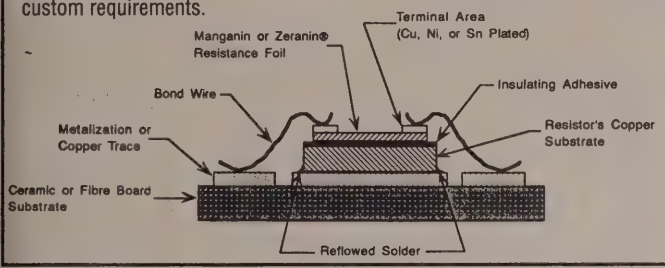


MODEL SMV

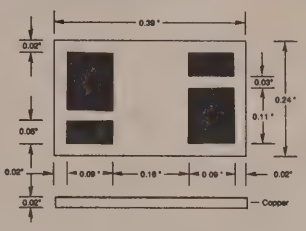


WIRE-BONDABLE

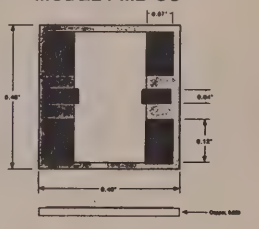
ISOTEK has developed sense resistors for use with hybrid circuit technology. two examples appear here. The substrate is thin copper to maximize heat conduction to the ceramic or cold-plate. Extremely high currents have been measured in small areas with this technology. Consult Isotek with custom requirements.



MODEL PMA-Cu



MODEL PMB-CU

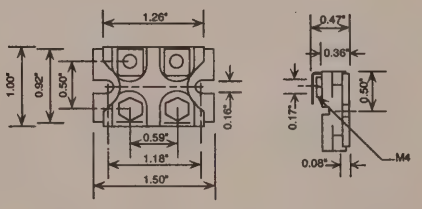


HIGH-POWER SCREW TERMINAL BASE MOUNT

MODEL RTO- 50 Watt

The RTO is identical to the SOT227B "ISOTOP" package (TO-238). With 2500 VAC isolation to the base, the resistor can be operated at the high side of the AC line.Ideal for use as a current sense resistor or as a power resistor in snubber RC-bypass for protection of transistors and thyristors. The heavy copper terminals allow continuous currents up to 200 A and short pulse currents to 1500 A. The RTO is available in 2,3, and 4 terminal configurations with single, double or triple resistors.

Resistance Range: 0.2 mΩ-100Ω
Inductance: 6 nH (R010);
Tolerance: 1.0, 2.0, 5.0%
Weight: 1 oz;
Internal Heat Resistance: 1.5°C/Watt
TCR: 50 ppm/°C Manganin; 20 Zeranin®
Ordering Example: RTO-A-R010-1(10mΩ/1.0%)for 2 or 4 term.; RTO-G-(1-3)R001-(3-4)R010-(4-2)R001-1 for separate 2 term., double resistor, resistor network, triple resistor and triple network.



AVAILABLE CONFIGURATIONS

A — Two-terminal Resistor

B — Four-terminal Resistor

C — Two-separate Two-terminal Resistors

D — Double Resistor

E — Resistor Network (Low ohmic resistor in four-terminal

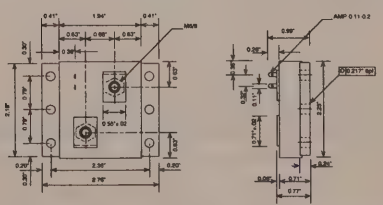
F — Triple Resistor Ideal for sense resistors, or as power resistors in smubber RC-bypass

G — Triple Network

MODEL RUG- 100 Watt

Designed for high DC and low frequency AC current, the RUG's package geometry is common to high power transistor modules. In this package, Zeranin® can be specified at a 3 ppm/°C or 1 ppm/°C tcr. Manganin is standard at 10 ppm/°C.

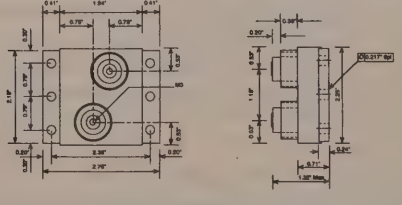
Resistance Range: 1 mΩ-1Ω
Inductance: 9 nH (R010)
Tolerance: 0.1, 0.2, 1.0%
Weight: 9.3 ounces
Internal Heat Resistance: 0.3°C/Watt
Ordering Example:
RUG-R050-1 (50 mΩ/1.0%)



MODEL REG- 250 Watt

The REG is a high power, high isolation (5000 Volts AC to base) resistor that has been specially developed for RC snubber protection. It can withstand instantaneous pulse power up to 2 kW. The resistive element is directly bonded to a ceramic plate that is again bonded to the copper base plate. This construction guarantees a very low internal heat resistance of less than 0.1°C/Watt and high isolation.

Resistance Range: 1 Ω-1500 Ω
Inductance: 400nH (22R0)
Tolerance: 0.1, 0.2, 5.0%
Weight: 9.5 ounces
Ordering Example:
REG-100R-1 (100Ω/1.0%)



ISA-PLAN® PRECISION CURRENT SHUNT NETWORKS

ISA-PLAN® resistor networks were specially designed for application in digital and analog current measuring and regulation devices in which the current must be measured over a range of several orders of magnitude. Since each resistor element is etched from the same physical section of metal foil, the matching of the resistors to each other is unsurpassed in the industry.

JULIE RESEARCH LABORATORIES INCORPORATED

PRECISION WIREWOUND RESISTORS

PRECISION RESISTORS FOR EVERY APPLICATION

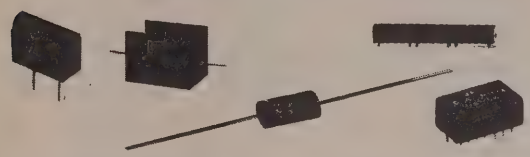
Precision Resistors for every application imaginable; high quality, low priced precision resistors are available for your every design need and at delivery schedules even distributors can't beat!! JULIE RESEARCH resistors are guaranteed for a lifetime performance in almost every value, tolerance and stability.

Available as individual, ratio or network assemblies, these expertly manufactured and trimmed resistors assist you in eliminating countless hours of Production Test time from your design. In addition, the use of these very stable resistors contribute to reliable design and reduced component count. Specify a Julie Resistor. Better yet, call us and we will assist in helping you get the best price-performance unit your application and budget will allow.

JUST A FEW OF THE PROVEN APPLICATIONS FOR THESE LOW REACTANCE HIGH PERFORMANCE RESISTORS ARE:

- Transducer Calibrating Networks
- Current Metering
- Gyro Torquing
- AC and DC Precision Bridge Elements
- Amplifier Summing Elements
- D/A Converters
- Reference Divider
- Precision Multiplier
- Resistive Divider Networks
- Shunting
- AC or DC Ratio
- High Performance MIL Spec
- Zener Trimming Networks

RESISTOR STYLES



SPECIFICATIONS

Precision wirewound resistor accuracy and stability available in standard DIP styles.

Range: 100Ω to 100 KΩ per resistor.

Ratio Accuracy: To .001% for ratio 1:1.

Stability: Network .002% for standard ranges.

Temperature Coefficient: 1 ppm/°C to 20 ppm/°C.

Custom designs available — contact factory for other package styles.

SPECIFICATIONS

Range: Individual Resistors, 1 ohm to 5 megohms. Ratio Sets, 1:1 to 10^4:1 depending on total resistance required.

Accuracy: Standard accuracy of resistors, 0.005% for values from 1000 ohms to 5 megohm. Standard accuracy of ratio sets, 0.0025% for ratios near 1:1. Accuracies from 0.002% to 0.1% are available (at corresponding prices) on special order.

Stability: Resistors, 0.002% per year for standard ranges.

Accuracy Over Military Temperature Range: ±0.02% from −45°C to +85°C.

Matching Over Military Temperature Range: ±0.005% from −45°C to +85°C.

Retrace Over Military Environmental Conditions: 0.002%.

Temperature Coefficient: Resistors, 5 ppm/°C standard. (Available as low as 1.0 ppm/°C). Ratio sets, 2.5 ppm/°C standard.

Note: Temperature Coefficient can be altered, in manufacture, over wide ranges.

Thermal Transients: All thermal-induced transient effects, e.g.: self-heating, Seebeck and Peltier effects, are less than 0.0015% at rated power dissipation. Self-heating and time constants of thermal transients are reduced to 10% of normal values in air.

Current Capability: To 2 amperes.

Voltage: Between Terminals, 300 volts maximum, Terminals to Case, 500 volts maximum.

SPECIFICATIONS

Range: Individual Resistors, 1 ohm to 10 megohms. Ratios, 1:1 to 10^4:1, depending on total resistance required.

Accuracy: Standard accuracy of resistors, 0.01%, for values from 100 ohms to 5 megohm. Standard accuracy of ratios, 0.005%, for ratios near 1:1. Intermediate accuracies of 0.05% and up and higher accuracies to .0025% are available on special order.

Stability: Resistors 0.003% per year for standard ranges.

Accuracy Over Military Temperature Range: 0.02% from −30°C to +85°C.

Retrace Over Military Environmental Conditions: 0.003%.

Temperature Coefficient: Resistors, 5 ppm/°C standard, (available as low as 1.0 ppm/°C). Ratios, 2.5 ppm/°C standard.

Note: Temperature Coefficient can be altered, in manufacture, over wide ranges.

SPECIFICATIONS

Range: Individual Resistors, 0.1 ohm to 100 ohms.

Accuracy: Standard accuracy of resistors, 0.01%, for values from 1.0 ohm to 100 ohms. (R_1 x G) .005% (CH).

Stability: Resistors 0.003% per year for standard ranges.

Accuracy Over Military Temperature Range: 0.02% fom −30°C to +85°C.

Retrace Over Military Environmental Conditions: 0.003%.

Temperature Coefficient: Resistors, 5 ppm/°C standard, (available as low as 2.5 ppm/°C).

Note: Temperature Coefficient can be altered, in manufacture, over wide ranges.

Voltage and Power Ratings: See chart.

Construction: See charts.

Group Encapsulation: Special techniques permit group encapsulation of high-accuracy units on a high-yield basis, enabling better accuracies at competitive costs. (See JRL Bulletin B-11.)

HIGH LOAD-LIFE STABILITY, PRECISION NETWORKS

Type	Construction Dual In-Line	Resistor Configuration	Dimensions (Inches) L x W x H	Max Res Per Resistor	Max Volt Per Resistor	Max Power Per Resistor
RNX-14	14 pin	3 max.	.740 x .39 x .43	100K	125V	1/10W
RNX-16	16 pin	4 max.	.840 x .39 x .43	100K	125V	1/10W

LOWEST, LOW REACTANCE OIL FILLED AND ENCAPSULATED THA-H, CH, HCH, RESISTORS AXIAL WIRE LEAD CONSTRUCTION

Style	Size Inches	Size MM	AWG Leads	Max. Res.	Volt	Power	MIL R-93
H-32	⅜ x ½	9.5 x 12.7	20	250 K	250	½ W	—
H-33	⅜ x ¾	9.5 x 19.1	20	350 K	450	½ W	RB 53
H-34	⅜ x 1	9.5 x 25.4	20	500 K	500	½ W	RB 52
H-42	½ x ½	12.7 x 12.7	18	750 K	250	½ W	—
H-44	½ x 1	12.7 x 25.4	18	2 Meg	500	1 W	RB 57
H-46	½ x 1½	12.7 x 38.1	18	3 Meg	750	1½	RB 58
H-48	½ x 2	12.7 x 50.8	18	5 Meg	1000	2 W	RB 59
HCH-32	⅜ x ½	9.5 x 12.7	20	150 K	—	¾ W*	—
HCH-33	⅜ x ¾	9.5 x 19.1	20	250 K	—	1 W*	—
HCH-34	⅜ x 1	9.5 x 25.4	20	350 K	—	1.5 W*	—
HCH-35	⅜ x 1¼	9.5 x 31.8	20	500 K	—	1.8 W*	—
HCH-42	½ x ½	12.7 x 12.7	18	375 K	—	1.5 W*	—
HCH-44	½ x 1	12.7 x 25.4	18	750 K	—	3 W*	—
HCH-46	½ x 1½	12.7 x 38.1	18	1 M	—	4.5 W*	—
HCH-48	½ x 2	12.7 x 50.8	18	1.5 M	—	6 W*	—
CH-32	⅜ x ½	9.5 x 12.7	20	300 K	—	¾*	—
CH-33	⅜ x ¾	9.5 x 19.1	20	500 K	—	1 W*	—
CH-34	⅜ x 1	9.5 x 25.4	20	700 K	—	1.5*	—
CH-35	⅜ x 1¼	9.5 x 31.8	20	1 Meg	—	1.8*	—
CH-42	½ x ½	12.7 x 12.7	18	750 K	—	1.5*	—
CH-44	½ x 1	12.7 x 25.4	18	1.5 M	—	3.0*	—
CH-46	½ x 1½	12.7 x 38.1	18	2 M	—	4.5*	—
CH-48	½ x 2	12.7 x 50.8	18	5 M	—	6 W*	—
THA-35	⅜ x ½	9.5 x 12.7	18	1 M	100	—	RB 53
THA-38	⅜ x ¾	9.5 x 19.1	18	1 M	100	—	RB 53

* When mounted on heat sink.

SUPER ACCURATE, SUPER STABLE ENCAPSULATED, MINIATURE PRECISION R, XG, RS, L, GL RESISTORS

TYPE R AND C — AXIAL WIRE LEAD-CONSTRUCTION

R-21A	¼ x ⅜	6.4 x 9.5	22	250 K	125	⅛ W	—
R-22	¼ x 9/16	6.4 x 14.3	22	500 K	125	⅛ W	—
R-23	¼ x ¾	6.4 x 19.1	22	750 K	125	⅛ W	RB 54
R-24	5/16 x 1	7.9 x 25.4	20	1 Meg	350	¼ W	—
R-32	⅜ x ½	9.5 x 12.7	20	750 K	350	¼ W	—
R-33	⅜ x ¾	9.5 x 19.1	20	1 Meg	350	⅓ W	RB 53
R-34	⅜ x 1	9.5 x 25.4	20	1.5 Meg	250	½ W	RB 52
R-35	⅜ x 1¼	9.5 x 31.8	20	2 Meg	250	⅝ W	—
R-42	½ x ½	12.7 x 12.7	18	1.5 Meg	125	½ W	—
R-44	½ x 1	12.7 x 25.4	18	4 Meg	250	1 W	RB 57
R-46	½ x 1½	12.7 x 38.1	18	7.5 Meg	250	1½ W	RB 58
R-48	½ x 2	12.7 x 50.8	18	10 Meg	250	2 W	RB 59

TYPE L AND RB — RADIAL LUG CONSTRUCTION

L-10A	⅝ x 5/16	15.9 x 14.3	Solder Lug	1.5 Meg	125	½ W	RB 16
L-HB	⅝ x 1¼	15.9 x 31.8	Solder Lug	4 Meg	250	1 W	RB 18

TYPE XG — RADIAL WIRE LEAD CONSTRUCTION

R-32XG	⅜ x 5/16	9.5 x 14.3	22	500 K	125	¼ W	—
R-42XG	½ x 9/16	12.7 x 14.3	20	1 Meg	125	½ W	—
R-44XG	½ x 1 5/32	12.7 x 29.3	20	3.5 Meg	250	1 W	—
R-46XG	½ x 1⅜	12.7 x 34.9	20	5 Meg	250	1½ W	—
R-48XG	½ x 2 1/16	12.7 x 52.4	20	10 Meg	250	2 W	—
R-52XG	⅝ x 1 5/32	15.9 x 15.1	20	1 Meg	125	¾ W	—

TYPE RS — TOP HAT CONSTRUCTION

RS-36	1/32 x ½	10.3 x 12.7	22	750 K	125	¼ W	—
RS-26	5/32 x ½	7.1 x 12.7	22	250 K	125	⅛ W	—

TYPE PRS-1 AND PRSH-1—BANANA PLUG CONSTRUCTION

PRS-1	1 5/16 x ⅝ x 1 3/16	Banana Plug	2 megohms	125	½ W	—
PRSH-1	1 5/16 x ⅝ x 1 3/16	Banana Plug	2 megohms	250	½ W	—

LOW OHM, LONG TERM STABILITY, OIL FILLED AND ENCAPSULATED 4-TERMINAL CH46-T4, R-46-T4, R46xG-T4 AXIAL AND RADIAL CONSTRUCTION

Style	Size	MM	AWG Leads	Max. Res.	Current	Power
R-46T4	½x1½	12.7×38.1	18	100 Ohms	2 Amps	1½ W
R-46XG-T4	½x1½	12.7×38.1	20	100 Ohms	2 Amps	1½ W
CH-46T4	½x1½	12.7×38.1	18	100 Ohms	2 Amps	3 W*
CH-48T4	½x2	12.7×50.8	18	100 Ohms	4 Amps	6 W*
CH-48T4HK	2×1.5×1.5	50.8×38.1×38.1	18	100 Ohms	4 Amps	6 W

* When mounted on heat sink.

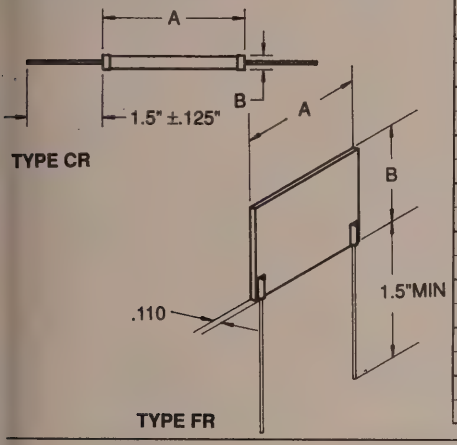
JULIE RESEARCH LABORATORIES, INC. • 508 W 26 ST., NEW YORK, NY 10001 • (212) 633-6625 • TWX 710-581-5138 • FAX 212-691-3320

K and M electronics, inc

• PRECISION HIGH VOLTAGE RESISTORS
• CERAMIC CAPS • VOLTAGE DIVIDERS
• RC NETWORKS • CUSTOM HYBRIDS

PRECISION METAL OXIDE HIGH VOLTAGE RESISTORS

- **Coatings:** Epoxy varnish standard for cylindrical resistors; conformal epoxy for flat. Consult factory for silicon, glass, or other coatings.
- **Leads:** Tinned copper .032" standard on all styles except CR1040 (which has .020" leads standard). 0.020 leads available on CR12XX Series; 0.020 nickel cap and lead standard with glass-encapsulated resistors (not available with Type CR1040 or CR25XX Series). Consult factory for other sizes and materials.
- **Tolerances:** 10%, 5%, 2%, and 1% standard (above 500G, 10% only). Tolerances to .5% available for some types.



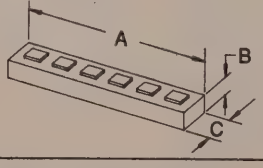
- **Maximum Surface Temperature:** 220°C for cylindrical styles (CR1040, CR12XX, CR25XX Series); 150°C for flat styles (FRXXXX and FDXXXX Series).
- **Voltage Coefficient:** Typically less than 5 ppm/V in mid-resistance values.
- **TCR:** Tighter temperature coefficients than those tabulated available on some models.
- Burn-in and other specialized testing to high reliability specifications (e.g. MIL-R-49462) available. Consult factory.

RESISTANCE RANGE (Ω)	TCR (PPM/°C) 25-125°C	MAX OPR VOLTAGE	WATTS @ 70°C	MAX DIMENSIONS A	MAX DIMENSIONS B	TYPE
10K - 100M	100	2,000	0.75	0.460	0.145	CR1040
100M - 2G	200					
10K - 100M	100	2,500	1.00	0.500	0.170	CR1243
100M - 10G	200					
10K - 200M	100	5,000	1.50	0.750	0.170	CR1268
200M - 50G	200					
10K - 400M	100	10,000	2.00	1.500	0.170	CR1213
400M - 100G	200					
100G - 1T	1,000					
10K - 500M	100	8,000	4.00	1.125	0.325	CR2510
500M - 5G	200					
10K - 1G	100	16,000	7.00	2.125	0.325	CR2520
1G - 10G	200					
10K - 1.5G	100	24,000	10.00	3.125	0.325	CR2530
1.5G - 15G	200					
10K - 2G	100	32,000	12.00	4.125	0.325	CR2540
2G - 20G	200					
10K - 500M	100	12,000	2.00	1.550	0.350	FR0315
500M - 5G	250					
10K - 500M	100	10,000	2.00	1.050	0.550	FR0510
500M - 5G	250					
10K - 500M	100	20,000	4.00	2.050	0.550	FR0520
500M - 5G	250					
10K - 1G	100	30,000	6.00	2.050	1.050	FR1020
1G - 10G	250					

MINIATURE HIGH VOLTAGE CERAMIC CAPACITORS

NO. SEC.	CAPACITANCE PER SEC (pF)	MAX VOLTAGE	DIMENSIONS (IN.) A	B	C	PART NUMBER
6	40 - 65	6,000	.500	.100	.050	102-123
3	40 - 65	6,000	.340	.100	.050	102-124
4	40 - 65	6,000	.500	.100	.050	102-126
3	80 - 130	2,500	.310	.150	.032	102-127
1	250	6,000	.500	.100	.050	102-129
2	70 - 120	2,500	.235	.155	.030	102-135
2	30 - 55	6,000	.210	.100	.050	102-150

- Electrodes solder-coated for ease of soldering
- High mechanical and dielectric strength
- Custom desigh to customer requirements
- Easy to Install



PRECISION VOLTAGE DIVIDER RESISTOR NETWORKS AND RESISTOR-CAPACITOR NETWORKS

- Fast delivery! Typical turn-around time: 10 days
- Custom designed; divider ratios to 1000:1
- Coating: conformal epoxy
- Burn-in and other specialized testing to high reliability specifications (e.g. MIL-R-49462) available. Consult factory
- Dividers and networks are available in the following packages: (1) flat design (like Type FR resistors); (2) Surface Mount design, both Single and Dual In-Line Package; and (3) custom design
- TCR tracking as low as 25 ppm/°C

CHIP AND WIRE HYBRID CIRCUITS CUSTOM DESIGNED AND MANUFACTURED

We've had plenty of experience designing and manufacturing thick film hybrids to the most demanding customer specifications. K and M Electronics' SMT hybrids are standard components of the world's finest miniature high voltage power supplies.

Your circuit will receive personal attention from the initial concept, through computer-aided design and manufacture, until the final product is tested and delivered to you – – in less time than you might think.

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You Can't Resist KOA!

FIXED RESISTORS

Parameter	METAL FILM						CARBON FILM			
	Ultra Precision	Precision	Semi Precision	MIL	Dual-Rated		Gen. Purp.	Flameproof	Dual-Rated	
Type Designation	H	MF	ML	RN	SN2C	MS50	CF	CFP	RDS	RDS/FP
Wattage	1/8, 1/4, 1/2, 1	1/8, 1/4, 1/2, 1	1/8, 1/4, 1/2	1/10, 1/8, 1/4, 1/2	1/8, 1/4	1/4, 1/2	1/8, 1/4, 1/2,	1/8, 1/4, 1/2	1/8/1/4, 1/4/1/2	1/8/1/4, 1/4/1/2
Temp. Coefficient (ppm/°C)	5, 10, 15	25, 50, 100	200	50, 100	50, 100	50, 100	250~3000	250~3000	300~1000	300~1000
Resistance Tol. (%)	0.05, 0.10, 0.25	0.1, 0.25, 0.50, 1	2, 5	0.50, 1	1	1	2, 5	2, 5	2, 5	2, 5
Oper. Temp. Range	−55°C~+175°C	−55°C~+155°C	−55°C~+155°C	−55°C~+175°C	−55°C~+155°C	−55°C~+155°C	−55°C~+155°C	−55°C~+155°C	−55°C~+155°C	−55°C~+155°C
Short Time Overload (%)	≤0.10	≤0.30	0.30	≤0.10	0.25	0.15	≤0.50	≤0.50	≤0.20	≤0.20
Temp Cycling (%)	≤0.10	0.30	0.50	0.10	0.15	0.15	0.50	0.50	0.15	0.15
Load Life (%)	≤1.0	≤1.0	1.5	≤1.0	0.25	0.50	≤2.0	≤2.0	≤1.5	≤1.5
Moisture Resistance (%)	≤1.0	≤1.0	1.5	≤1.0	0.30	0.30	≤2.0	≤2.0	<1.0	1.0
Voltage Coefficient (ppm/v)	<5	<5	<10	<5	<5	<5	≤10	≤10	<10	<10
Failure Rate (1000 hrs)	$<10^{-8}$	$<10^{-8}$	$<10^{-8}$	$<10^{-8}$	$<10^{-8}$	$<10^{-8}$	$<10^{-8}$	$<10^{-8}$	$<10^{-8}$	$<10^{-8}$
Marking	Alpha-Num	Clr. Band (5)	Clr. Band (4)	Alpha-Num	Clr. Band (5)	Clr. Band (5)	Clr. Band (4)	Clr. Band (4)	Clr. Band (4)	Clr. Band (4)

FIXED POWER RESISTORS

Parameter	METAL OXIDE		CARBON	CERAMIC
	Standard	Reduced Size	Reduced Size	Pulse Application
Type Designation	MO	RSS	SPR	HPC
Wattage	1/2, 1, 2, 3	1/2, 1, 2, 3, 5	1/2, 1, 2, 3, 5	1/2, 1, 2, 3, 4, 5
Temperature Coefficient (ppm/°C)	200	200	150~600	300~1800
Resistance Tolerance (%)	2, 5	1, 2, 5	2, 5	10, 20
Operating Temperature Range	-55°C~+200°C	-55°C~+200°C	-55°C~+200°C	-40°C~+200°C
Short Time Overload (%)	0.50	0.50	1.0	2.0
Temperature Cycling (%)	0.50	0.50	1.0	2.0
Load Life (%)	2.0	2.5	3.0	5.0
Moisture Resistance (%)	2.0	2.5	3.0	5.0
Voltage Coefficient (ppm/v)	<10	<10	<10	<2000
Failure Rate (1000 hrs)	$<10^{-4}$	$<10^{-3}$	$<10^{-3}$	$<10^{-5}$

SEE OUR AD IN CAPACITOR SECTION.

KOA SPEER ELECTRONICS, INC.

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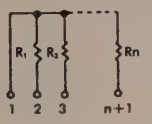
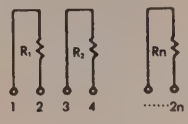
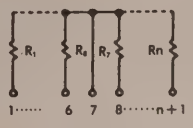
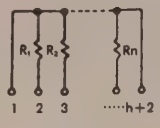
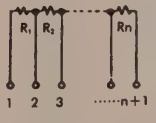
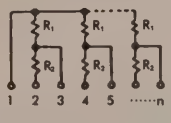
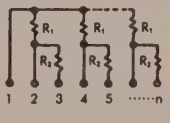
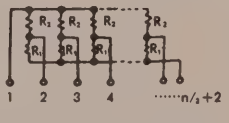
SIP RESISTOR NETWORKS

CIRCUIT SYMBOL			S	C	D
CIRCUIT CONSTRUCTION		 $R_1=R_2\cdots=Rn$ (n=3 to 13)	 $R_1=R_2\cdots+Rn$ (n=2 to 7)	 $R_1=R_2\cdots+Rn$ (n=4 to 12)	 $R_1=R_2\cdots=Rn$ (n=3 to 12)
MARKING	RKC	10KΩJ	4 S10KΩJ	10KΩJ ●	10KΩJ
	RKL	103J	S103J	C103J	D103J
	RKH	103J	4 S103J	6 C103J	6 D103J
CIRCUIT SYMBOL		A	T	E	R
CIRCUIT CONSTRUCTION		 $R_1=R_2\cdots=Rn$ (n=3 to 13)	 (n=4 to 12)	 (n=4 to 12)	 (n=6 to 18)

Parameter	TYPE		
	RKL	RKC	RKH
Seated Height (mm)	5.0	6.5	10.70
Element Power (watts)	0.125 ex "s" 0.200 "s"	0.125 ex "s" 0.250 "s"	0.250 ex "s" 0.500 "s"
Maximum Working Voltage	100	200	250
Operating Temperature Range	−55°C∼+155°C	−55°C∼+155°C	−55°C∼+155°C
Resistance Range	22Ω∼1.0M	22Ω∼10M	56Ω∼10M
Resistance Tolerance (%)	2, 5	1, 2, 5	1, 2, 5
Temperature Coefficient (ppm/°C)	200	100∼200	100∼200
Short Time Overload (%)	0.50	≤0.50	≤0.50
Resistance to Solder Heat (%)	0.50	≤0.50	≤0.50
Temperature Cycling (%)	0.50	≤0.50	≤0.50
Moisture Resistance (%)	<2.0	<1.5	<1.5
Load Life	<2.0	<1.0	<1.0

• Custom SIP Networks - R/2R Ladders, Attenuators, Op Amp Feedbacks, Matched & Tracking, User defined.

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SPECIALTY RESISTORS

JUMPER (Zero Ohm)

KSE PT#	Form	Size	Resistance	Amperage
Z12	Axial	3.7 x 1.6	20mΩmax	1.5A
Z16	Axial	3.4 x 1.7	20mΩmax	1.5A
Z25	Axial	6.3 x 2.4	20mΩmax	2.5A
Z33	Axial	8.5 x 3.0	20mΩmax	3.0A
J-1/6	Axial	3.4 x 1.7	10mΩmax	10.0A
J-1/4	Axial	5.0 x 2.3	10mΩmax	15.0A
RM73Z2A	SM	2.0 x 1.25	50mΩmax	1.5A
RM73Z2B	SM	3.2 x 1.6	50mΩmax	2.0A
CC10	MELF	2.0 x 1.25	10mΩmax	2.0A
CC12	MELF	3.5 x 1.45	10mΩmax	2.0A
CC20	MELF	3.2 x 1.55	10mΩmax	2.0A
CC25	MELF	5.9 x 2.2	10mΩmax	5.0A

LINEAR POSITIVE TEMP. COEFFICIENT RESISTORS

KSE PT#	Form	Size (mm)	Power	TC Range	Res. Range	Res. Tolerance
LT1/8	Axial	3.7 x 1.7	0.125W	150~4,500ppm	0.51Ω~51KΩ	2%, 5%
LT1/4	Axial	6.5 x 2.3	0.250W	150~4,500ppm	0.51Ω~110KΩ	2%, 5%
MLT2B	MELF	3.50 x 1.45	0.125W	150~4,500ppm	0.51Ω~51KΩ	2%, 5%
MLT2E	MELF	5.9 x 2.2	0.250W	150~4,500ppm	0.51Ω~100KΩ	2%, 5%

RESISTOR LAB KITS

Type	Wattages	# of Values	Tolerance	# pcs/value	Drawers/Kit
Carbon Film	1/8, 1/4, 1/2	60	5%	100	15
Flameproof CF	1/4, 1/2	60	5%	100	15
Metal Film	1/8, 1/4, 1/2	126	1%	10	18
SM Chip	1206 (1/8)	60	5%	50	15
SM Chip	1206 (1/8)	126	1%	25	24

KOA SPEER ELECTRONICS, INC.

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KOA SPEER ELECTRONICS, INC.

FLAT CHIP RESISTORS

RM73 GENERAL PURPOSE 5% & 2% TOLERANCE

- 90/10 Solder Plated Terminations, Standard
- Ru02 Thick Film Resistive Element
- Anti-Leaching Nickel Barrier Termination
- White 3 Digit Marking on Black Protective Coat. No Marking on 1E Size.

STANDARD APPLICATIONS

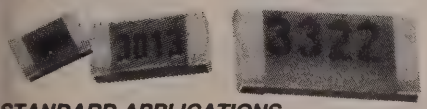
Part Designation*	Power Rating @ 70°C*	TCR (ppm/°C) MAX	Resistance Range E-24 (G ± 2%)	Resistance Range E-24 (J ± 5%)	Maximum Working Voltage	Maximum Overload Voltage	Operating Temperature Range
RM73B1E (0402)	63mW	±200	—	10Ω~1MΩ	25V	50V	-55°C | +125°C
		±500	—	2.0Ω~9.1Ω 1.1MΩ~5.6MΩ			
RM73B1J (0603)	100mW (63mW)	±200	—	10Ω~5.6MΩ	50V	100V	-55°C | 150°C
		±400	—	1.0Ω~9.1Ω			
RM73B2A (0805)	125mW (100mW)	±200	10Ω~1MΩ	10Ω~1MΩ	100V	200V	-55°C | +175°C
		±400	—	1.0Ω~9.1Ω 1.1MΩ~20MΩ			
RM73B2B (1206)	250mW (125mW)	±200	10Ω~5.6MΩ	10Ω~5.6MΩ	200V	400V	
		±400	—	1.0Ω~9.1Ω 6.2MΩ~22MΩ			
RM73B2E (1210)	330mW (250mW)	±200	—	10Ω~1.0MΩ			
		±400	—	1.0Ω~9.1Ω 1.1MΩ~22MΩ			
RM73B2H (2010)	750mW (500mW)	±200	—	10Ω~1.0MΩ			-55°C | -150°C
		±400	—	1.0Ω~9.1Ω 1.1MΩ~22MΩ			
RM73B3A (2512)	1000mW	±200	—	10Ω~1MΩ			
		±400	—	1.0Ω~9.1Ω 1.1MΩ~22MΩ			

* Parenthesis indicate EIA package size codes and power ratings

ORDERING & SPECIFYING INFORMATION

RM73	B	2B	T	103	J
Type	TCR	Size Code	Packaging	Nominal Resistance	Tolerance
	B: 200~500 ppm/°C (see above)	1E: 0402 2E: 1210 1J: 0603 2H: 2010 2A: 0805 3A: 2512 2B: 1206	None: Bulk T: Punched Paper TE: Embossed Plastic	2 Significant Figures & 1 Multiplier R Indicates Decimal on Values <10Ω	G: 2% J: 5%

RK73 PRECISION 1% & 0.5% TOLERANCE



- Ru02 Thick Film Resistive Element
- Anti-Leaching Nickel Barrier Termination
- 90/10 Solder Plated Terminations, Standard
- 4 Digit, Black Marking on Blue Protective Coat

STANDARD APPLICATIONS

Part Designation*	Power Rating @ 70°C*	TCR (ppm/°C) MAX	Resistance Range **E-96 (D ± 0.5%)	Resistance Range **E-96 (F ± 1%)	Maximum Working Voltage	Maximum Maximum Overload Voltage	Operating Temperature Range
RK73H1J **(0603)	100mW (63mW)	±200	—	10Ω~1.0MΩ	50V	100V	-55°C | +150°C
RK73H2A (0805)	125mW (100mW)	±100	100Ω~511KΩ	10Ω~499KΩ	100V	200V	-55°C | +175°C
		±200		511KΩ~1.0MΩ			
		±400	—	1.0Ω~9.76Ω 1.02MΩ~10MΩ			
RK73H2B (1206)	250mW (125mW)	±100	100Ω~511KΩ	10.0Ω~1.0MΩ	200V	400V	
		±200	—	1.02MΩ~5.62MΩ			
		±400		1.0Ω~9.76Ω 5.76MΩ~10.0MΩ			
RK73H2E (1210)	330mW (250mW)	±100	100Ω~511KΩ	10Ω~1MΩ			-55°C | -150°C
RK73H2H (2010)	750mW (500mW)	±100		10Ω~1MΩ			
RK73H3A (2512)	1000mW	±100		10Ω~1MΩ			

* Parenthesis indicate EIA package size codes and power ratings **The RK73H1J (0603) is available in E24 series (marked) & E96 series (unmarked)

ORDERING & SPECIFYING INFORMATION

RK73	H	2B	T	1003	F
Type	TCR	Size Code	Packaging	Nominal Resistance	Tolerance
	H: 100~400 ppm/°C (see above)	1J: 0603 2E: 1210 2A: 0805 2H: 2010 2B: 1206 3A: 2512	None: Bulk T: Punched Paper TE: Embossed Plastic	3 Significant Figures & 1 Multiplier R Indicates Decimal on Values <100Ω	F: 1% D: 0.5%

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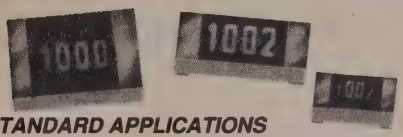
KOA SPEER ELECTRONICS, INC.

FLAT CHIP RESISTORS

RN73 ULTRA PRECISION 0.1% TO 1% TOLERANCE



- NiCr Thin Film Resistor Element
- Anti-Leaching Nickel Barrier Terminations
- 90/10 Solder Plated Terminations, Standard
- Also Available with Bondable Terminations
- Meets or Exceeds EIA 576, MIL-R-55342D, UL 94V-0
- Four (4) Digit Marking, Distinctive Color Identifiers

STANDARD APPLICATIONS

Part Designation	Power Rating @ 70°C	TCR (ppm/°C) MAX	E-24 / E-96 Resistance Range - Tolerance B(±0.1%)	C(±0.25%)	D(±0.5%)	F(±1.0 %)	Absolute Maximum Working Voltage	Absolute Maximum Overload Voltage	Operating Temperature Range
RN73T2A	100mW (1/10W)	±10	100Ω~100KΩ			—	100V	200V	-55°C to +150°C
RN73E2A		±25	100Ω~100KΩ	51Ω~100KΩ	10Ω~100KΩ				
RN73C2A		±50	—	—	10Ω~150KΩ				
RN73T2B	125mW (1/8W)	±10	100Ω~100KΩ			—	150V	300V	
RN73E2B		±25	100Ω~100KΩ	51Ω~100KΩ	10Ω~100KΩ				
RN73C2B		±50	—	—	10Ω~300KΩ				
RN73T2E	250mW (1/4W)	±10	100Ω~200KΩ			—	200V	400V	
RN73E2E		±25	100Ω~200KΩ	51Ω~200KΩ	10Ω~200KΩ				
RN73C2E		±50	—	—	10Ω~510KΩ				

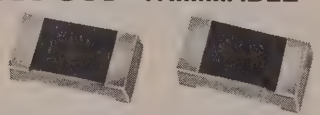
Low Ohmic Value Chip Resistors			F(±1%)	J(±5)	Note: Below Values Based On 10Ω Resistor		
RN73*2A	100mW	±100 (1%) ±200 (5%)	0.2Ω~10Ω	0.2Ω~10Ω	1.0V	2.5V	-55°C to +150°C
RN73*2B	125mW				1.1V	2.8V	
RN73*2E	250mW				1.6V	4.0V	
RN73*2H	500mW				2.2V	5.6V	
RN73*3A	1000mW				3.2V	7.9V	

*H: 100 ppm/°C, K: 200 ppm/°C

ORDERING & SPECIFYING INFORMATION

RN73	E	2B	T	1002	B
Type	TCR	Size Code	Packaging	Nominal Resistance	Tolerance
	T: 10 ppm/°C E: 25 ppm/°C C: 50 ppm/°C H: 100 ppm/°C K:200 ppm/°C	2A: 0805 2H: 2010 2B: 1206 3A: 2512 2E: 1210	None: Bulk T: Punched Paper TE: Embossed Plastic	3 Significant Figures & 1 Multiplier R Indicates Decimal on Values <100Ω	B: +0.1% C: ±0.25% D: ±0.50% F: ±1.0% J: ±5.0%

RK73N TRIMMABLE



- Same Quality Thick Film Construction as Type RM
- Glass Passivated, Supplied Without Protective Coat
- Anti-Leaching Nickel Barrier Terminations
- 90/10 Solder Plated Termination, Standard
- Also Available with Bondable Terminations
- Trimmable in Circuit to 2X Original Value
- Replaces Trimmer in Critical Circuit Adjustments

STANDARD APPLICATIONS

Part Designation*	Power Rating @ 70°C	TCR (ppm/°C) MAX	Resistance Range	Resistance Tolerance	Maximum Working Voltage	Maximum Overload Voltage	Operating Temperature Range
RK73N2A (0805)	125mW	±200	10Ω~1MΩ	K(+0%/-30%) M(±20%)	100V	200V	-55°C ~ +150°C
RK73N2B (1206)	250mW				200V	400V	
RK73N2E (1210)	330mW						
RK73N2H (2010)	750mW						
RK73N3A (2512)	1000mW						

ORDERING & SPECIFYING INFORMATION

RK73N	2B	T	103	K
Type	Size Code	Packaging	Resistance Value	Tolerance
	2A: 0805 2E: 1210 2B: 1206 2H: 2010 3A: 2512	None: Bulk T: Punched Paper TE: Embossed Plastic	2 Significant Figures & 1 Multiplier	K: +0% / -30% M: ±20%

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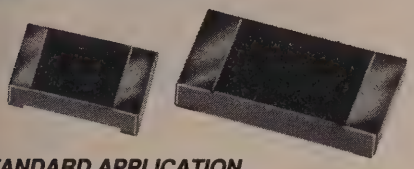
KOA SPEER ELECTRONICS, INC.

FLAT CHIP RESISTORS

RF73 FUSING



- Reflow & Wave Solderable
- Performs Like "RM" Under Normal Conditions
- Fuses When Overloaded More Than 18x Rated Power
- Anti-Leaching Nickel Barrier & 90/10 Solder Plated Terminations
- Also Available with Bondable Terminations
- Three Digit Black Marking on Brown Protective Coat

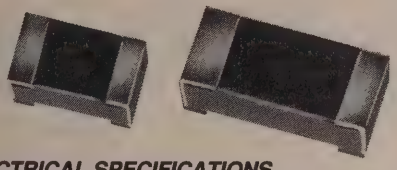
STANDARD APPLICATION

Part Designation	Power Rating @ 70°C	TCR (ppm/°C)	Resistance Range E-24	Resistance Tolerance	Fusing Characteristics X Power Rating				Operating Temperature Range	Maximum Fusing Time
					30X	22X	20X	18X		
RF73B2A	100mW	±500 ±1000 (See Below)	0.2Ω~510Ω	J(5%)	0.2Ω~0.47Ω	0.51Ω~20Ω	22Ω~510Ω		-55°C ~ + 125°C	60 sec.
RF73B2B	125mW				0.2Ω~0.47Ω	0.51Ω~10Ω	12Ω~24Ω	27Ω~510Ω		

ORDERING & SPECIFYING INFORMATION

RF73	B	2A	T	100	J
Type	TCR	Size Code	Packaging	Nominal Resistance	Tolerance
	±1000 ppm/°C (0.2Ω~4.3Ω) ±500 ppm/°C (4.7Ω~510Ω)	2A: 0805 2B: 1206	None: Bulk Figures & 1 T: Punched Paper TE: Embossed Plastic	2 Significant Figures & 1 Multiplier. R Indicates Decimal on Value <10Ω	J: 5%

LT73 LINEAR POSITIVE TEMPCO



- Anti-Leaching Nickel Barrier Terminations
- 90/10 Solder Plated Terminations Standard
- Also Available with Bondable Terminations
- 25 Specific Temperature Characteristics
- Black 3 Digit Marking on Bronze Body Color
- 0805 & 1206 Size Option

ELECTRICAL SPECIFICATIONS

Part Designation	Power Rating @70°C	Maximum Working Voltage	Maximum Overload Voltage	Operating Temperature Range
LT73 (2A)	100mW	50V	100V	-40°C~+125°C
LT73 (2B)	125mW	75V	150V	

RESISTANCE RANGE & TEMPERATURE COEFFICIENT

Resistance Range (Ω) E-24		Resistance Tolerance	T.C.R. (ppm/°C)	T.C.R. Tolerance
LT73 (2A)	LT73 (2B)			
2K~24K	2K~51K	G (±2%)	150•250•350•450•500	±100ppm/°C
1K~20K	1K~43K	J (±5%)	600•700•800•900	±150ppm/°C
1K~13K	1K~27K		1000•1200•1400	±15%
510~4.7K	1K~10K		1600•1800	
510~4.3K	510~9.1K		2000•2200•2400	±10%
510~3.0K	510~6.2K		2600•2800	
510~3.0K	510~6.2K		3000•3300•3600	
510~3.0K	510~6.2K		3900	
100~1K	100~2.0K		4200	
51~510	51~510		4500	

NOTE: T.C.R. is factory tested from 25°C to 75°C

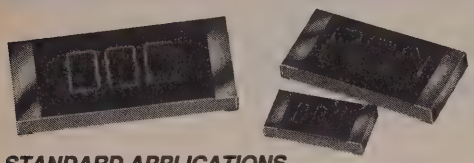
ORDERING & SPECIFYING INFORMATION

LT73	1000	2B	T	103	J
Type	TCR	Size Code	Packaging	Resistance Value	Tolerance
	See Above Chart	2A: 0805 2B: 1206	None: Bulk T: Punched Paper TE: Embossed Plastic	2 Significant Figures & 1 Multiplier	G: 2% J: 5%

KOA SPEER ELECTRONICS, INC.

FLAT CHIP JUMPERS/CHIP INDUCTORS TANTALUM CHIP CAPACITORS

RM73Z ZERO OHM JUMPER



- Silver Element
- Anti-Leaching Nickel Barrier Terminations
- 90/10 Solder Plated Terminations, Standard
- Also Available with Bondable Terminations
- White 000 Marking on Black Protective Coat; No Marking on 1E

STANDARD APPLICATIONS

Part Designation	Maximum Current (Amps)	Maximum Resistance
RM73Z1E	1.0	50mΩ
RM73Z1J	5.0 Maximum Surge	
RM73Z2A	1.5 5.0 Maximum Surge	
RM73Z2B	2.0	
RM73Z2E	5.0 Maximum Surge	
RM73Z2H		
RM73Z3A	3.0 5.0 Maximum Surge	

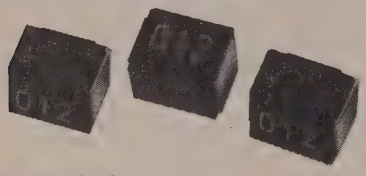
TYPE DESIGNATION

RM73Z
Type

2B
Size Code
1E: 0402
1J: 0603
2A: 0805
2B: 1206
2E: 1210
2H: 2010
3A: 2512

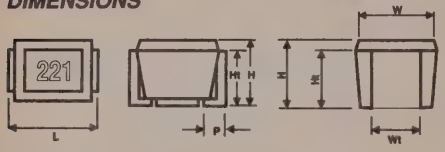
T
Packaging
None: Bulk
T: Punched Paper
TE: Embossed Plastic

KL32 CHIP INDUCTOR *(SEE LISTING IN SECTION 1800)*



- UL94V-0 Molded Epoxy Case
- Suitable for Reflow & Wave Solder
- 1210 Size - Surface Mount Type
- E - 12 Series of Values
- Wound Coil Type

DIMENSIONS



Dimensions	L	W	Wt	H	Ht	P
MM	3.2 ±0.2	2.5 ±0.2	1.7 ±0.1	2.2 ±0.2	1.9 ±0.1	0.5 nominal
INCH	.126 ±.008	.098 ±.008	.067 ±.004	.087 ±.008	.075 ±.004	.02 nominal

MARKING ON INDUCTOR CHIP

THE MARKING CONSISTS OF THREE CHARACTERS AS DETAILED BELOW:

Value	Code
0.005µH to 0.082µH	005 to 082
0.10µH to 8.2µH	R10 to 8R2 "R" indicates decimal pt.
10µH to 220µH	100 to 221 1st two figures are significant, the last figure indicates the number of zeros to follow

ORDERING & SPECIFYING INFORMATION

KL
Type
Wound Coil

32
Size Code
3.2 x 2.5 x 2.2(mm)
1210 Size

TE
Packaging
TE: Embossed Taping, 2000 pcs.
No Suffix: Bulk, 1000 pcs.

221
Nominal Inductance
Value designation same as marking on inductor chip

K
Tolerance
J: ±5%
K: ±10%
M: ±20%

TMC, TMC-M *(SEE LISTING IN SECTION 1500)*

- Epoxy Molded Body, UL94V-0 Flammability
- EIA-U.S. and EIA-Japan Compatible Sizes
- 100% Burn-in and End-of-Line Testing
- Extended Values Per Case Size
- Excellent Humidity and Solder Heat Resistance

ORDERING & SPECIFYING INFORMATION

TMC
Type

1E
Voltage Code
0G: 4V
0J: 7V
1A: 10V
1C: 16V
1D: 20V
1E: 25V
1V: 35V
1H: 50V

C
Case Size
A: 3216
B: 3528
C: 6032
D: EIA-J
E: EIA-D

475
Nominal Capacitance
See Cap Code Table 1a Or 1b

M
Tolerance
M: 20%
K: 10%

L
Packaging
L - Tape/Reel Plastic
A, B, Case: 2000 pcs.
C, D, E, Case: 500 pcs.

R
Polarity Orientation
R (Std - Taping)
–
+

H
Leader Length Cover/Carrier
H
200mm Min (Std)

KOA SPEER ELECTRONICS, INC.

MELF RESISTORS

RD41B CARBON FILM

- 90/10 Solder Plated End Caps
- Color Coded for Easy Identification
- Suitable for Reflow & Wave Soldering
- Ivory Body Color
- Meets or Exceeds EIAJ - 8009, EIA - PDP - 100

STANDARD APPLICATIONS

Part Designation	Power Rating @ 70°C	Resistance Range (E-24)	Maximum Working Voltage	Maximum Overload Voltage	Resistance Tolerance	Operating Temperature Range
RD41B 2A	100mW	2.2Ω~1.0MΩ	150V	200V	J (±5%)	-55°C ~ +155°C
RD41B 2B	125mW	2.2Ω~1.0MΩ	200V	400V		
RD41B 2D	250mW	1.0Ω~1.0MΩ	200V	400V		
RD41B 2E	250mW	1.0Ω~2.2MΩ	300V	600V		

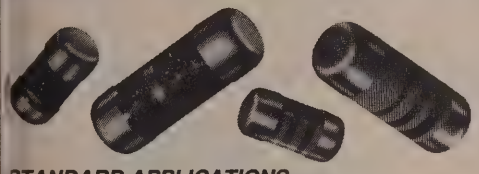
RESISTANCE RANGE & TEMPERATURE COEFFICIENT

Part \ ppm/°C	Resistance Ranges				
	±350	-450	-700	-1000	-1300
RD41B2A	2.2Ω~9.1Ω	10Ω~47KΩ	51KΩ~100KΩ	110KΩ~330KΩ	360KΩ~1.0MΩ
RD41B2B	2.2Ω~9.1Ω	10Ω~47KΩ	51KΩ~100KΩ	110KΩ~330KΩ	360KΩ~1.0MΩ
RD41B2D	1.0Ω~9.1Ω	10Ω~47KΩ	51KΩ~220KΩ	240KΩ~470KΩ	510KΩ~1.0MΩ
RD41B2E	1.0Ω~2.0Ω	2.2Ω~100KΩ	110KΩ~330KΩ	360KΩ~1.0MΩ	1.1MΩ~2.2MΩ

ORDERING & SPECIFYING INFORMATION

RD41	B	2B	TE	103	J
Type	TCR	Size Code	Packaging	Nominal Resistance	Tolerance
	(See Above) B-350~1300	(See Page 24) 2A: 0805 2B:1406 2D: 1206 2E: 2309	(See Page 31) None: Bulk TE: Embossed Plastic Tape	2 Significant Figures & 1 Multiplier "R" Indicates Decimal on Values <10Ω	J: 5%

RN41 & RM41 METAL FILM



- 90/10 Solder Plated End Caps
- Color Coded for Easy Identification
- Suitable for Reflow & Wave Soldering
- Blue Body Color for "RN", Green for "RM"
- Meets or Exceeds EIAJ - 8009, EIA - PDP - 100

STANDARD APPLICATIONS

Part Designation	Power Rating @ 70°C	TCR (ppm/°C)	C(±0.25%) E24, E96	D(±0.5%) E24, E96	F(±1%) E24, E96	J(±5%) E12	Maximum Working Voltage	Maximum Overload Voltage	Operating Temperature Range
RN41K2A	125mW	±100	—	—	100Ω~100KΩ	—	150V	200V	-55°C~155°C
RN41C2B		±50	—	—	10Ω~604KΩ	—		300V	
RN41E2B		±25	100Ω~100KΩ	100Ω~604KΩ	—	—			
RN41C2D	200mW	±50	—	—	10Ω~604KΩ	—			
RN41C2E	250mW	±50	—	—	10Ω~1.0MΩ	—	250V	500V	
RN41E2E		±25	100Ω~100KΩ	100Ω~1.0MΩ	—	—			
RN41L2H	500mW	±200	—	—	—	0.2Ω~100KΩ			
RM41B2D	200mW	±350	—	—	—	0.2Ω~8.2Ω	200V	400V	
RM41B2H	500mW		—	—	—		350V	500V	

ORDERING & SPECIFYING INFORMATION

RM41 RN41	C	2B	TE	1001	F
Type	TCR	Size Code	Packaging	Nominal Resistance Value	Tolerance
	K: ±100 C: ±50 E: ±25 B: ±350 L: ±200	2A: 0805 2B:1406 2D: 1206 2E: 2309 2H: 2309	None: Bulk TE: Embossed Plastic Tape	E12 & E24: 2 Significant Figures & Multiplier E96: 3 Significant Figures & Multiplier	C: ±0.25% D: ±0.50% F: ±1.0% J: ±5.0%

KOA SPEER ELECTRONICS, INC.

MELF RESISTORS

MLT POSITIVE TEMPERATURE COEFFICIENT

- 90/10 Solder Plated End Caps
- Gray Body Color for Quick Identification
- 25 Specific Temperature Coefficients
- Standard Resistance Sizes
- Meets or Exceeds EIAJ - 8011, EIA PDP - 100

STANDARD APPLICATIONS

Part Designation	TCR (ppm°C)	TCR Tolerance	Resistance Range E-24		Resistance Tolerance	Ambient Temperature Rating	Tempco Rating	Operating Temperature Range
			2B (125mW)	2E (250mW)				
MTL	150 • 250 • 350 450 • 500	±100ppm/°C	510Ω~51KΩ	1KΩ~10KΩ	G (±2%)	70°C	25°C ~ 75°C	-40°C~+125°C
	600 • 700	±150ppm/°C	1KΩ~43KΩ	2KΩ~82KΩ	J (±5%)			
	800 • 900		2KΩ~43KΩ	3.9KΩ~82KΩ				
	1000 • 1200 • 1400	±15%	3KΩ~27KΩ	6.2KΩ~51KΩ				
	1600 • 1800		1KΩ~10KΩ	3KΩ~27KΩ				
	2000 • 2200 • 2400	±10%	820Ω~9.1KΩ	1KΩ~22KΩ				
	2600 • 2800		820Ω~6.2KΩ	1KΩ~18KΩ				
	3000 • 3300		10Ω~5.1KΩ	10Ω~7.5KΩ				
	3600 • 3900 • 4200 4500	15%	0.51Ω~10Ω	0.51Ω~10Ω				
	3600	±10%	11Ω~5.1KΩ	11Ω~7.5KΩ				
	3900		11Ω~3.3KΩ	11Ω~6.2KΩ				
	4200		11Ω~680KΩ	11Ω~1.3KΩ				
	4500		11Ω~330KΩ	11Ω~680Ω				

ORDERING & SPECIFYING INFORMATION

MLT	3600	2B	TE	101	J
Type	TCR	Size Code	Packaging	Nominal Resistance	Tolerance
	See Above	2B: 1406 2E: 2309	None: Bulk TE: Embossed Plastic Tape	2 Significant Figures & 1 Multiplier	G: 2% J: 5%

CC ZERO OHM

- 90/10 Solder Plated End Caps
- Brown Body Color for Quick Identification
- Extremely Low Resistance
- Meets or Exceeds EIAJ - 8011, EIA - PDP - 100

STANDARD APPLICATIONS

Part	Maximum Current	Maximum Resistance	Operating Temperature
CC-10	2 Amps	10 Milliohms	-55°C ~ +155°C
CC-12			
CC-20			
CC-25	5 Amps		

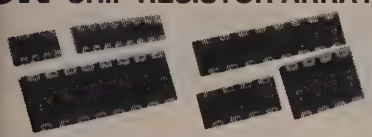
ORDERING & SPECIFYING INFORMATION

CC	10	TE
Type	Size Code	Packaging
	10: 2A (0805) 12: 2B (1406) 20: 2D (1206) 25: 2E (2309)	None: Bulk TE Embossed Plastic:

KOA SPEER ELECTRONICS, INC.

OTHER SMC

CN CHIP RESISTOR ARRAY



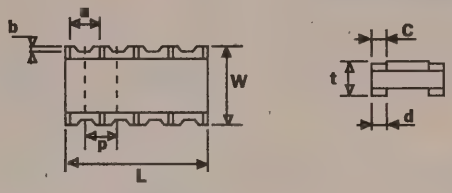
- Manufactured to Type RM Standards
- Marked with Resistance Value
- Less Board Space than Individual Chips
- Available in Isolated or Bussed Configurations

STANDARD APPLICATIONS

Type	*Power Rating @ 70°C	TCR (ppm/°C)	Resistance Range (E-24)	Resistance Tolerance	Maximum Working Voltage	Maximum Overload Voltage	Operating Temperature Range
CN 1J	63 mW	±300	10Ω - 1MΩ	J (±5%)	50V	100V	-55°C - +125°C
CN 2A	100 mW				100V	200V	
CN 2B	125 mW				200V	400V	
CNB2B	63 mW				50V	100V	

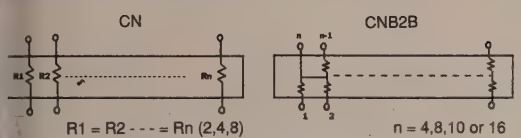
* PER ELEMENT

DIMENSIONS



Size Code	Dimensions							
	*L	W	C	d	t	a	b	p Ref.
1J	0.031 x N ± 0.008 0.8 x N ± 0.2	0.063 ± 0.008 1.6 ± 0.2	0.012 ± 0.008 0.3 ± 0.2	0.016 ± 0.006 0.4 ± 0.15	0.020 ± 0.004 0.5 ± 0.1	0.016 ± 0.006 0.4 ± 0.15	0.008 ± 0.004 0.2 ± 0.1	0.031 0.8
2A	0.050 x N ± 0.008 1.27 x N ± 0.2	0.080 ± 0.008 2.0 ± 0.2	0.016 ± 0.012 0.4 ± 0.3	0.022 ± 0.006 0.55 ± 0.15	0.020 ± 0.004 0.5 ± 0.1	0.028 ± 0.006 0.7 ± 0.15	0.006 ± 0.004 0.15 ± 0.1	0.050 1.27
**2B	0.050 x N ± 0.008 1.27 x N ± 0.2	0.126 ± 0.008 3.2 ± 0.2	0.020 ± 0.012 0.5 ± 0.3	0.022 ± 0.006 0.55 ± 0.15	0.024 ± 0.004 0.6 ± 0.1	0.028 ± 0.006 0.7 ± 0.15	0.006 ± 0.004 0.15 ± 0.1	0.050 1.27

CIRCUIT CONSTRUCTION



R1 = R2 - - - = Rn (2,4,8) n = 4,8,10 or 16

*N = 2,4, or 8
** FOR CNB2B L = $\frac{(0.050 \times 0.5N \pm 0.008)}{(1.27 \times 0.5N \pm 0.2)}$

ORDERING & SPECIFYING INFORMATION

CN	2A	4	TE	101	J
Type	**Code Size**	**Number of Resistors**	**Packaging**	**Nominal Resistance**	**Tolerance**
CN CNB	(See Above) 1J 2A *2B	2, 4 or 8 *4, 8, 10 or 16	*TE: Embossed Plastic Tape T: Paper Tape	2 Significant Figures & 1 Multiplier	J ± 5%

* Indicates CNB Size, # of Terminals and Packaging

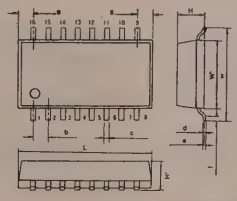
HM16 SOP THICK FILM RESISTOR NETWORK

- .050" (1.27mm) Lead Space
- UL94V-0 Molded Epoxy Case
- Operating Voltage up to 50V
- .087" (2.2mm) Maximum Seated Height
- Available Tape/Reel & Magazine Packaging

STANDARD APPLICATIONS

Part Designation	Circuit	Power Rating @ 70°C	TCR ppm/°C Max	Resistance Range	Resistance Tolerance E - 24	Maximum Working Voltage	Operating Temperature Range
HM16	B	80mW / element 1.2W / package	±200	100Ω ~ 2.2MΩ	G (± 2%) J (± 5%)	50V	-55°C
HM16	S	160mW / element 1.28W / package					
HM16	R	50mW / element 1.2W / package	±250	100Ω ~ 100KΩ	J (± 5%)		
HM16	B	80mW / element 1.2W / package		22Ω ~ 91Ω			
HM16	S	160mW / element 1.28W / package					+125°C

DIMENSIONS



L	H[1]	H	W[1]	w	a	b	c	d	e	f
0.433±0.012 11.0±0.3	0.087 max. 2.2 max.	0.079 max. 2.0 max.	0.224 max. 5.7 max.	0.303±0.012 7.7±0.3	0.049 max. 1.25 max.	0.050±0.005 1.27±0.12	0.016±0.002 0.40±0.05	0.004 min. 0.10 min.	0.006±0.002 0.15±0.05	0.012±0.002 0.30±0.05

* Controlling Dimension In Millimeters

ORDERING & SPECIFYING INFORMATION

HM 16	B	TE	473	J
Type	**Circuit**	**Packaging**	**Nominal Resistance Value**	**Tolerance**
	B: Bussed S: Isolated R: Pull-up	TE: Embossed Tape ST: Magazine	2 Significant Figures & 1 Multiplier	G: ±2% J: ±5%

KOA SPEER ELECTRONICS, INC.

OTHER SMC

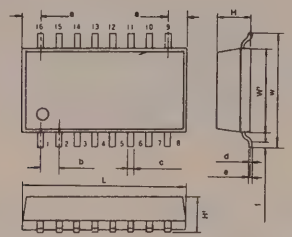
HN16 SOP THIN FILM RESISTOR NETWORK

- .050" (1.27mm) Lead Space
- UL94V - 0 Molded Epoxy Case
- Operating Voltage up to 50V
- .087" (2.2mm) Maximum Seated Height
- Available Tape/Reel & Magazine Packaging

STANDARD APPLICATIONS

Part Designation	Circuit	Power Rating @ 70°C	Available TCR ppm / °C	Resistance Range E-24, E-96	Available Resistance Tolerance	Maximum Working Voltage	Operating Temperature Range
HN16	B	31.25 mW / element 470 mW / package	>10KΩ:T(10) >1KΩ:E(25) ALL:C(50) ALL:D(100)	100Ω ~ 49.9KΩ	>10KΩ:B(±0.1%) >1KΩ:C(±0.25%) ALL:D(±0.5%) ALL:F(±1.0%)	50V	-55°C | +125°C
HN16	S	62.5 mW / element 500 mW / package		100Ω ~ 100KΩ			

DIMENSIONS



L	H¹	H	W¹	w	a	b	c	d	e	f
0.433±0.012 11.0±0.3	0.087 max. 2.2 max.	0.079 max. 2.0 max.	0.224 max. 5.7 max.	0.303±0.002 7.7±0.3	0.049 max. 1.25 max.	0.050±0.005 1.27±0.12	0.016±0.002 0.40±0.05	0.004 min. 0.10 min.	0.006±0.002 0.15±0.05	0.012±0.002 0.30±0.05

*Controlling Dimension in Millimeters

ORDERING & SPECIFYING INFORMATION

HN16	C	S	TE	1001	F
Type	TCR	Circuit	Packaging	Nominal Resistance Value	Tolerance
	T: 10 ppm/°C E: 25 C: 50 D: 100	B: Bussed S: Isolated	TE: Tape ST: Magazine	2 (E24) or 3 (E96) Significant Figures & 1 Multiplier	B: ±0.10% C: ±0.25% D: ±0.50% F: ±1.0%

C4000 CERMET SINGLE TURN TRIMMER POTENTIOMETERS

- Miniature Size 3.8mm x 4.6mm
- Eleven Different Types/Configurations
- Available on Tape & Reel

SPECIFICATIONS

Resistance Values (ohms): 100 to 2.2 meg
100, 150, 220, 330, 470, 680
1K, 1.5K, 2.2K, 3.3K, 4.7K, 6.8K
10K, 15K, 22K, 33K, 47K, 68K
100K, 150K, 220K, 330K, 470K, 680K
1M, 1.5M, 2.2MΩ
Standard Tolerance: ±30%
Standard Taper: (B) Linear

Residual Resistance: ≤10Ω 100Ω To 1000Ω, inc.; ≤ 1% of nominal > 1000Ω
Power Rating: 0.2 Watts at 70°C
Maximum Working Voltage: 100 Volts
Operating Temperature Range: -30°C to +100°C
Temperature Coefficient: ±250ppm/°C

STANDARD APPLICATIONS

Part Designation	Power Rating @ 70°C	TCR	Resistance Change Characteristics	Resistance Range E-6	Resistance Tolerance	Maximum Working Voltage	Operating Temperature Range	Operation Torque
All Styles Except C4315	0.2W	±250ppm/°C	B (LINEAR)	100Ω ~ 2.2MΩ	±30%	100V	–30°C ~ +100°C	20 ~ 200 gm cm
C4315	0.1W (C4315)				±25%	50V		

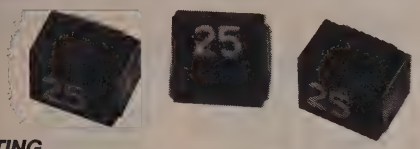
ORDERING & SPECIFYING INFORMATION

C	4212	TE	102
Type	Style	Packaging	Nominal Resistance
		None: Bulk TE: Embossed Plastic	2 Significant Figures & 1 Multiplier

KOA SPEER ELECTRONICS, INC.

OTHER SMC

CCP CHIP CIRCUIT PROTECTORS



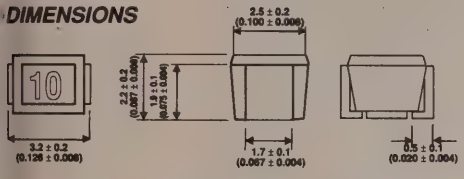
- Immediate Cut-Off of Excessive Current
- No Generation of Heat
- UL94V - 0 Epoxy Case
- Suitable for Reflow & Wave Solder
- CCP2E10, CCP2E20 and CCP2E25 are UL 198G Recognized. File No. E131375

RATING

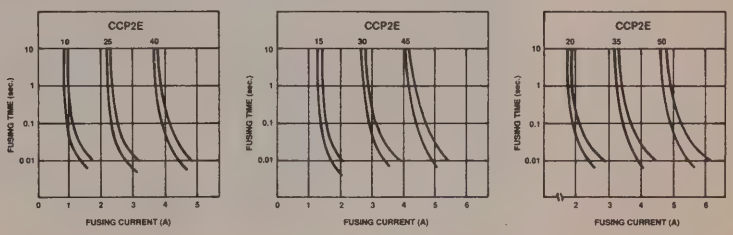
Type	Current Rating	Internal R. Max. (mΩ)	Max. Open Circuit Voltage	Rating Ambient Temp.	Operating Temp. Range	Definition of Fusing Characteristics		
						A x 2.0	A x 2.5	A x 6.0
CCP2E10	0.4A	200	50V	+70°C	-40°C ~ +125°C	No Fusing Within 20 msec.	Fusing Within 1 sec.	Fusing Within 20 msec.
CCP2E15	0.6A	150						
CCP2E20	0.8A	100						
CCP2E25	1.0A	75						
CCP2E30	1.2A							
CCP2E35	1.4A	50						
CCP2E40	1.6A							
CCP2E45	1.8A	40						
CCP2E50	2.0A							

A = CURRENT RATING

DIMENSIONS



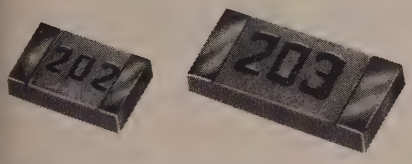
FUSING CHARACTERISTICS



ORDERING & SPECIFYING INFORMATION

CCP	2E	10	TE
Type	Size	Current Rating	Packaging
		10: 400mA 15: 600mA 20: 800mA Etc.	None: Bulk TE: Embossed Plastic Tape

NT73 NEGATIVE TEMPCO THERMISTOR



- Anti-Leaching Nickel Barrier Terminations
- 90/10 Solder Plating
- Also Available with Bondable Terminatons
- 12 Standard Resistance Values
- Suitable for Reflow & Wave Soldering
- Thermal Time Constant 2 Seconds

STANDARD APPLICATIONS

Resistance at 25°C (Ω)	Resistance Tolerance	B Constant (K)	B Constant Tolerance	Thermal Dissipation Constant (mW)	Thermal Time Constant (Seconds)	Power Dissipation (mW)	Operating Temp. Range
470	±15%	3200	10%	≈2.8 (0805) ≈3.0 (1206)	≈2	5	-55°C to +125°C
1.0K							
2.2K		3500					
3.3K							
4.7K							
6.8K	±10% ±15%	3800					
10K							
22K							
33K							
47K							
68K							
100K							

ORDERING & SPECIFYING INFORMATION

NT73	32	K	2B	T	102	L
Type	B Constant	B Tolerance	Size Code	Packaging	Nominal Resistance	Tolerance
NT73	32 : 3200 35 : 3500 38 : 3800	K: 10%	(See Page 3) 2A: 0805 2B: 1206	(See Page 16) None: Bulk T: Punched Paper TE: Embossed Plastic	2 Significant Figures & 1 Multiplier	K: 10% L: 15%

KOA
SPEER ELECTRONICS, INC.

Speer Electronics

Engineering Lab Kits

A Sturdy compact cabinet that contains a wide selection of the most commonly used values for design and experimentation.

LEADED DEVICES

Carbon / Metal Film
- 1/8 Watt 5%
- 1/4 Watt 5%
- 1/2 Watt 5%

Carbon Film Flame Proof
- 1/4 Watt 5%
- 1/2 Watt 5%

SURFACE MOUNT DEVICES

Chip Resistors
- General Purpose 5%
- Precision 1%
- In 0603, 0805, 1206, 1210 and 2010 Sizes

Tantalum
- A, B, C, D(EIA J) and E(EIA D) Case Sizes
- 20 and 10%

Inductors
- 1210 Wire Wound
- .005µH - 220µH 5 and 10%

For more information contact your local KOA Distributor or contact us directly at 814-362-5536

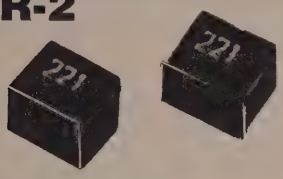
KOA Speer Electronics
PO Box 547, Bolivar Drive
Bradford, Pa. 16701

Phone 814-362-5536
Fax 814-362-8883

KOA SPEER ELECTRONICS, INC.

CHIP RESISTORS

2 WATT POWER NPR-2



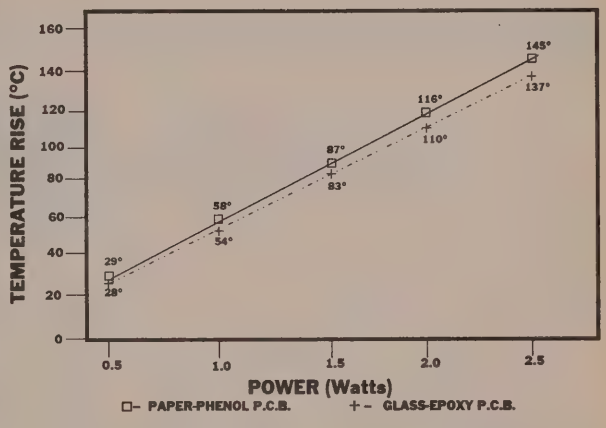
FEATURES:

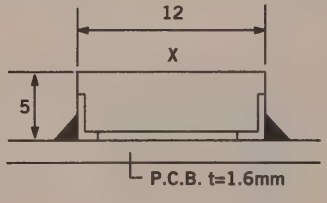
- Small size
- Flameproof
- Withstands vibration
- Surface Mountability
- Wide Resistance Range
- Low Surface Temperature Rise at Rated Wattage

CHARACTERISTICS

No.	Parameter	Maximum △ R	Test Method
1	Resistance to soldering heat	±(0.5%+0.05Ω)	MIL-R-55342D π4.7.7 260±5°C 10±1 sec
2	Vibration	±(0.5%+0.05Ω)	MIL-STD-202F, Method 201 10-55-10Hz Each Direction / 2 hrs
3	Resistance Temperature Coefficient	±200 ppm/°C	MIL-R-55342D π4.7.9 -55°C/125°C
4	Short Time Overload	±(1.0%+0.05Ω)	MIL-R-55342D π4.7.5 2.5 x RCWV* for 5 secs
5	Load Life in Humidity	±(2%+0.05Ω)	MIL-STD-202F,Method 103 40±2°C, 90 ~ 95%RH 1000 hrs
6	Load Life	±(2%+0.05Ω)	MIL-STD-202F, Method 108 70±2°C 1000 hrs
7	Temperature Cycling	±(1%+0.05Ω)	-40°C/25°C/155°C/25°C 30 minute dwell times 5 cycles

*RCWV=Rated Continuous Working Voltage

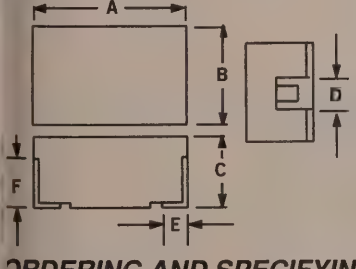




X=IC Thermocouple Placement

DIMENSIONS

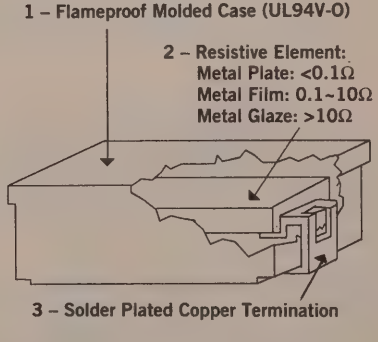
	(mm)	(inches)
A	12.0±1.0	0.472±0.040
B	8.0±0.3	0.315±0.012
C	4.0±0.5	0.157±0.020
D	4.0±0.3	0.157±0.012
E	1.5±0.5	0.059±0.020
F	3.0±0.5	0.118±0.020



RATINGS

Power Rating @70°C		2 W
R. Range	K (±10%)	(E-12) 0.01Ω~0.2Ω
	J (±5%)	(E-12) 0.22Ω~1.0Ω (E-24) 1.1Ω~1MΩ
Operating Temp. Range		-55°C~+180°C
Rated Continuous Working Voltage		RCWV $=\sqrt{2R}$ (R=Ohmic Value in Ohms)
Maximum Working Voltage		350V
Maximum Overload Voltage		700V
Dielectric Withstanding Voltage		500VAC

CONSTRUCTION:



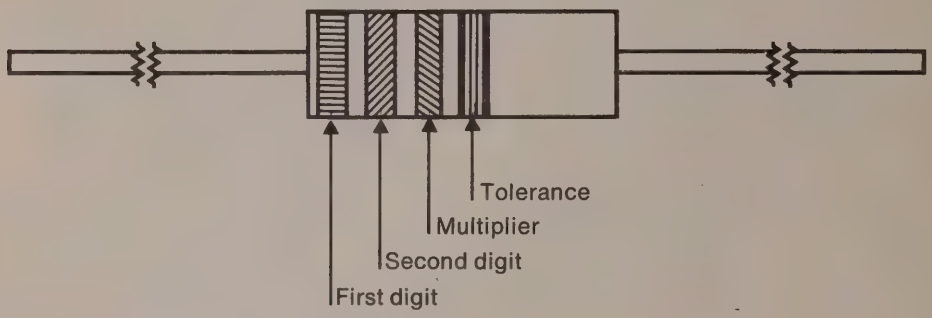
ORDERING AND SPECIFYING INFORMATION

NPR	2	TE	103	J
Type	Power Rating	Packaging	Nominal Resistance	Tolerance
		None: Bulk TE: Embossed Plastic Taping	2 Significant Figures and 1 Multiplier. R Indicates Decimal on Values <10Ω	J: 5% K: 10%

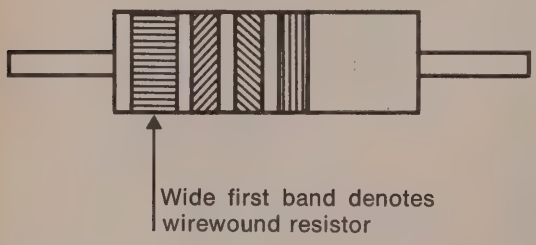
eem

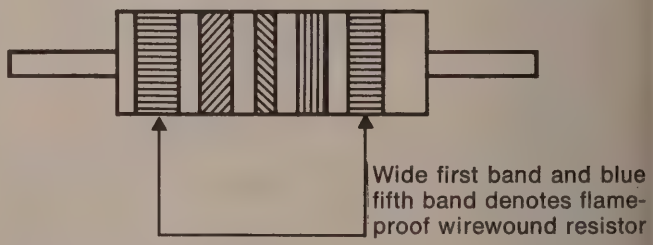
MINIGLOSSARY
RESISTOR COLOR CODES

EIA/MIL Resistor Color Codes



Color code for general-purpose industrial resistors

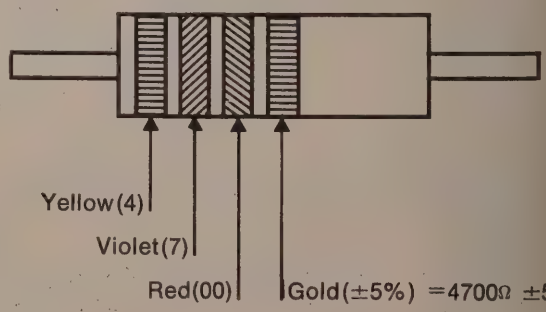




Color code for general-purpose wirewound resistors

Color	Significant digit	Multiplier	Tolerance
Black	0	1	—
Brown	1	10	± 1%
Red	2	100	± 2%
Orange	3	1000	± 3%
Yellow	4	10,000	± 4%
Green	5	100,000	—
Blue	6	1,000,000	—
Violet	7	10,000,000	—
Gray	8	—	—
White	9	—	—
Gold	—	0.1	± 5%
Silver	—	0.01	±10%
No color	—	—	±20%

Example:



Bantry Components, Inc.

KRL's complete product line is now available in Surface Mount Packaging, including: Precision wirewound resistors with temperature coefficients from ±1 PPM to ±10 PPM with tolerances from ±.005% to ±1%; Power Resistors from 1 to 3.5 watts with Wirewound or Metal Oxide elements; Linear Response Temperature Compensating resistors; and Specialty Fuse resistors. While other manufacturers rely on mechanical terminations and connections, KRL has chosen to utilize standard Manufacturing techniques for thru-hole resistors, including Mil-R-93 and Mil-R-26 standards for wirewound resistors and applied them to the production of a surface mountable device. As always, KRL's Application Specialists are available to assist with design criteria for any Surface Mount or Thru-Hole resistive component need.

GENERAL SPECIFICATIONS

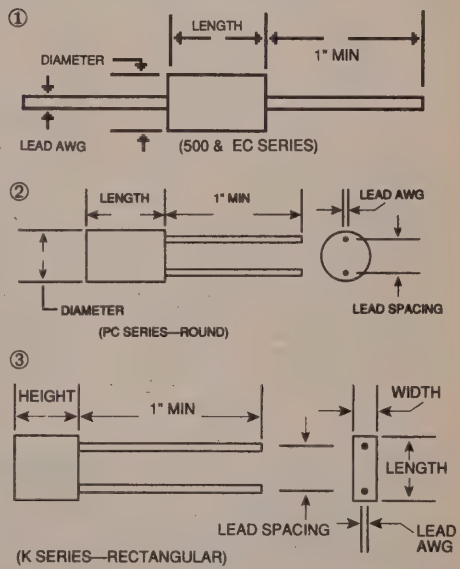
- Standard Tolerances: .005%, .01%, .02%, .05%, .1%, 0.2%, 0.5%, & 1%
- Standard Temperature Coefficient ±5 PPM to ±10 PPM (±1 PPM avail)
- Temperature Compensating TC's from +80 through +6000 PPM
- Custom Designs Welcome
- TC Matching to ±0.5 PPM/°C @25°C
- Stability: 0.0025% (1st Year), 0.005% (2nd Year). 0.001% is available

KRL STYLE	MIL-R-93	MIL-R-39005	DIMENSIONS[1] LENGTH ±.015	DIAMETER ±.015	LEAD AWG	POWER in WATTS MIL 125°C	COMM 125°C	MAXIMUM VOLTAGE	MAXIMUM RESISTANCE
532			.200	.100	24	.025	.050	100	100 K
†533			.260	.100	24	.050	.100	100	150 K
†534			.300	.100	22	.050	.100	100	150 K
†535			.250	.125	22	.065	.125	150	300 K
536			.312	.125	22	.075	.150	200	400 K
†537			.375	.125	22	.100	.200	200	500 K
†538			.375	.187	22	.125	.250	300	1 Meg
539			.250	.187	22	.115	.225	250	550 K
†540		RBR-74	.500	.187	22	.175	.350	300	1.5 Meg
550		RBR-75	.295	.250	22	.125	.250	200	1.5 Meg
†555	RB-56	RBR-56	.375	.250	20	.175	.350	300	1.5 Meg
†560	RB-55	RBR-55	.500	.250	20	.250	.500	400	2 Meg
†565	RB-54	RBR-54	.750	.250	20	.375	.750	500	3.5 Meg
570	RB-53	RBR-53	.750	.375	20	.450	.900	600	4 Meg
575	RB-52	RBR-52	1.00	.375	20	.750	1.50	750	5 Meg
578			.500	.500	20	.330	.660	400	2 Meg
580	RB-57	RBR-57	1.00	.500	20	.850	1.75	850	10 Meg
585	RB-58		1.50	.500	20	1.00	2.00	1.5KV	15 Meg

KRL STYLE	MIL-R-10509 EQUIVALENT	LENGTH ±.062	DIAMETER ±.032	LEAD AWG	POWER in WATTS	MAXIMUM VOLTAGE	MAXIMUM RESISTANCE
EC-10	RN-55	.250	.125	22	0.5	200	100 K
EC-20	RN-60	.375	.125	22	1.0	300	150 K
EC-25		.375	.187	22	1.0	325	175 K
EC-30	RN-65	.500	.187	22	1.0	350	200 K
EC-40	RN-70	.750	.250	20	1.0	400	300 K
EC-50	RN-75	1.00	.375	20	1.0	600	500 K

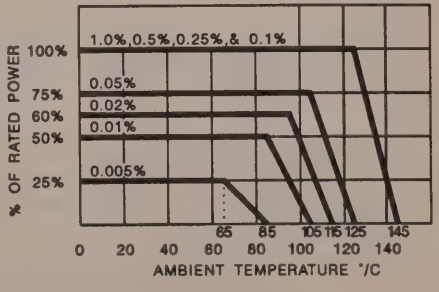
KRL STYLE	MIL-R-93	DIMENSIONS[2] LENGTH ±.032	DIAMETER ±.015	LEAD SPACING ±.010	LEAD AWG	POWER in WATTS MIL 125°C	COMM 125°C	MAXIMUM VOLTAGE	MAXIMUM RESISTANCE
†PC-50	RB-71	.312	.250	.200	22	.125	.250	300	500 K
PC-51		.375	.250	.200	22	.125	.250	300	650 K
PC-52		.500	.250	.200	22	.250	.500	300	700 K
PC-53		.375	.375	.200	20	.250	.500	300	1 Meg
PC-55	RB-70	.500	.375	.200	20	.350	.700	300	1.5 Meg

KRL STYLE	DIMENSIONS[3] HEIGHT ±.032	WIDTH ±.020	LENGTH ±.020	LEAD SPACING ±.010	LEAD AWG	POWER in WATTS MIL 125°C	COMM 125°C	MAXIMUM VOLTAGE	MAXIMUM RESISTANCE
K-250	.250	.125	.250	.125	20	.125	.250	150	500 K
K-300	.300	.125	.300	.150	20	.150	.300	150	1 Meg
K-500	.300	.150	.500	.250	20	.250	.500	150	1.5 Meg



PERCENT OF RATED POWER

KRL PRECISION WIRE WOUND RESISTOR DERATING CHART—500, EC, PC & K series resistors must be derated for tolerances below 0.1%. Use the chart below to select tolerance vs. operating temperature to determine the percent of rated power for operations. No derating is required for operations below +20°C.



KRL/BANTRY COMPONENTS, INC. 160 Bouchard St., Manchester, NH 03103-3399
Phone: 603-668-3210 FAX: 603-624-0634 TLX: 80-4294 SPEDEX

♣KRL SMT Wirewound/Film Resistors S SERIES

- UL94V0 MOLDED CHIP DESIGN
- LOW OHM CURRENT SENSING
- LOW TC'S & TIGHT TOLERANCES
- TEMPERATURE SENSING

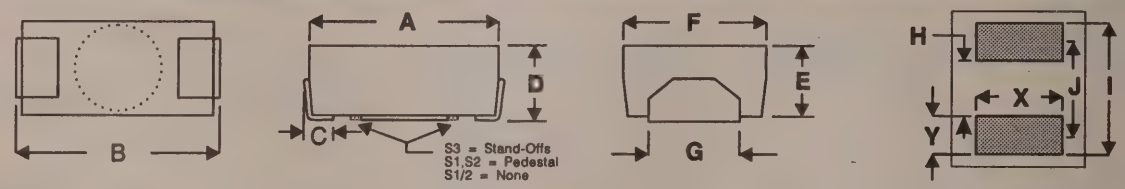
KRL STYLE	WATTS	STD TOL	OHMIC RANGE	WORKING VOLTAGE
SP-1/2	0.75	±0.1% thru ±5%	0.1Ω-1.4kΩ	25
SP-1	1.5		0.1Ω-5kΩ	35
SP-2	2.5		0.1Ω-18kΩ	79
SP-3	4.5		0.1Ω-45kΩ	250

KRL STYLE	WATTS	STD TOL	OHMIC RANGE	TYPICAL INDUCTANCE
SL-1/2	0.5	±1.0% thru ±5%	.01Ω-.05Ω	<7 Nanohenries
SL-1	1.0		.01Ω-.075Ω	
SL-2	2.0		.005Ω-.01Ω	
SL-3	4.0		.005Ω-.1Ω	

KRL STYLE	WATTS	STD TOL	OHMIC RANGE	TEMP.COEF. (PPM/°C)
SU-1/2	.025	±.005% thru ±1.0%	1.0Ω-100kΩ	+5 & +10 Std +1 to +3 Opt. +80 to +6000 Available
SU-1	.125		1.0Ω-300kΩ	
SU-2	.250		1.0Ω-1MΩ	
SU-3	.500		1.0Ω-2MΩ	

KRL STYLE	WATTS	OHMIC RANGE	STD TOL = ±5% TYP FUSING	
			32 TIMES	
			Min	Max
SF-1/2	0.125	1Ω-50kΩ	5 SEC	15 SEC
SF-1	0.5	1Ω-100kΩ		
SF-2	1.0	1Ω-200kΩ		
S-3	2.0	1Ω-200kΩ		

Dimensions & Suggested Land Patterns (Per ANSI/IPC-SM-782 Guidelines)



KRL STYLE	A ±.005"	B ±.010"	C ±.010"	D ±.015"	E ±.005"	F ±.005"	G ±.010"	H	I	J	X	Y
S-1/2	.190	.215	.040	.100	.093	.125	.050	.125	.275	.185	.075	.060
S-1	.250	.272	.060	.140	.130	.138	.080	.145	.337	.240	.112	.096
S-2	.435	.478	.100	.210	.200	.230	.100	.230	.530	.420	.150	.205
S-3	.775	.811	.110	.280	.273	.273	.140	.611	1.00	.806	.155	.195

Packaging

S1/2 - 12mm
750 pcs = 7" Reel
2000 pcs = 13" Reel

S1 - 16mm
500 pcs = 7" Reel
1500 pcs = 13" Reel

S2 - 24mm
1000 pcs = 13" Reel

S3 - 32mm
750 pcs = 13" Reel

Environmental Performance (KRL Typ. Change)

Solder Immersion	± 0.1% +.01Ω
Load Life	± 0.2% +.05Ω
Moisture Resistance	± 0.2% +.05Ω
Thermal Shock	± 0.2% +.05Ω
Dielectric Withstand	1000 VAC
Short Term Overload	± 0.1% +.05Ω
Solderability	95% Coverage
Flamability	UL94V/ASTM Needle Flame

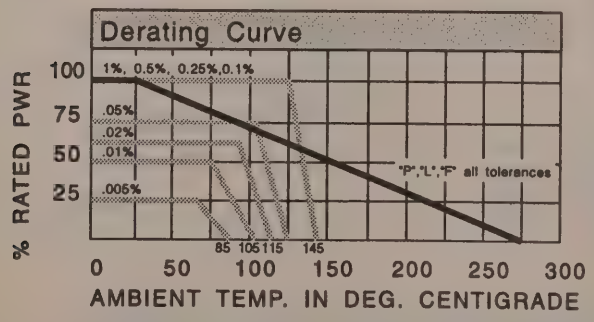
Part Marking

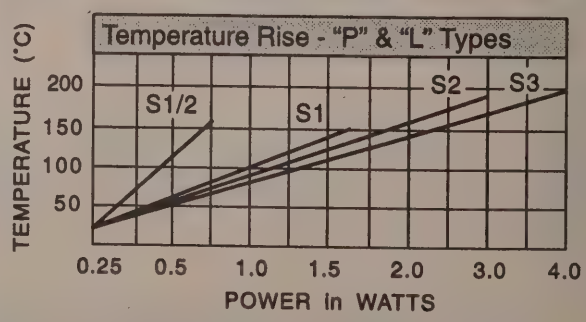
Example:

♣SP1/2
0.1Ω±1%

All Parts Have:

KRL Logo & P/N
Ohm Value & Tol.
Date Code (Opt.)





♣KRL/Bantry Components, Inc. 160 Bouchard Street, Manchester, NH 03103-3399
Phone: 603-668-3210 FAX: 603-624-0634

♣ KRL Temperature Compensating WIRE WOUND RESISTORS

KRL High T.C. Resistors are available in any of the packages listed in this Catalog

RESISTANCE RANGE—10Ω to 5MegΩ

TOLERANCE—Standard from 10%, 5%, 3% and 1%. Accuracies to 0.1% are available. Consult factory for special requirements.

TEMPERATURE RANGE—From −55°C to +145°C

TEMPERATURE COEFFICIENTS—Available from +80PPM/°C to +6000PPM/°C (See Table Right). Use Order Code A thru T for standard T.C.'s shown.

SPECIAL TEMPERATURE COEFFICIENTS—If you need a special...non-standard T.C., use Order Code X and specify the exact T.C. required and temperature range of operation with +25°C as reference temperature. (Factory must approve all non-standard T.C.)

APPLICATIONS—Since there are many packages that a High T.C. Resistor can accommodate, it is impossible to show all types. Most often a customer will have a unique situation and our engineering department will gladly aid in any design and development of customer requirements. KRL High T.C. Resistors have found their way into Power Supplies, Motor Controllers, Computers, Electronic Circuits for D to A and A to D Converters, Temperature Sensors for the Medical Electronics Field, Aircraft Systems, Aerospace Flight Modules, and in Automotive Electronic Ignition Systems.

KRL Order Code	TEMPERATURE COEFFICIENT		Maximum (2) Resistance In Percent
	Cold Range In PPM/°C −55°C to +25°C	Heat Range In PPM/°C +25°C to +125°C	
A	+80±20	+80±20	80
B	+100±10	+100±10	80
C	+120±10	+120±10	80
D	+140±30	+140±30	80
E	+180±30	+180±30	80
G	+290±30	+290±30	25
H	+380±40	+400±40	70
J	+450±50	+450±50	60
K	+700±200	+700±200	60
L	+850±80	+850±80	50
M	+1000±100	+1000±100	50
N	+1500±200	+1400±200	50
P	+2600±200	+2600±200	50
Q	+3500±300	+3500±300	40
R	+4000±400	+4500±400	10
T	+5000±300	+6000±300	10
X (1)	SPECIAL T.C., SPECIFY EXACT TCR. SUBJECT TO FACTORY APPROVAL		

(1) KRL will manufacturer to any T.C.R. to meet customer specifications.
(2) Maximum resistance in percent should be applied to the style chosen in the normal catalog listing column marked Maximum Resistance.

♣ KRL Nonflame Fusible Metal Film Resistors FPR SERIES

FPR Nonflame Fusible Metal Film Resistors

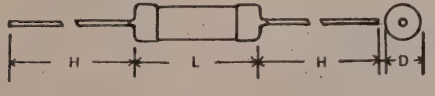
The FPR Nonflame Fusible Metal Film Resistors were designed to limit thermal surge and resulting circuit damage due to excessive voltage. FPR Resistors provide reliable and accurate blow characteristics. The FPR resistors fail in an open mode. These resistors are available in ohmic values from .22 to 100k ohms, and wattage sizes from ¼ to 3 watts.

Various telephone power line, and tip & ring circuits utilize the FPR resistor to protect sensitive parts from lightning strike surges. Other circuits that would benefit from these fusible resistors are inputs that may be exposed to line voltage faults, or power supplies that need current limiting with a safe, nonflame failure mode. Since each circuit has different and custom requirements, KRL/Bantry will work with your engineering staff to choose the correct part for your application.

FEATURES

- Small package size.
- Noncombustible insulating coating.
- Coating resists freon cleaning solvents.
- Temperature coefficients less than ±200 PPM.
- Uniform fusing characteristics.

DIMENSIONS:



TYPE	L±.04	D±.024	H±.25	Lead Awg	Resistance Range
FPR-¼W	.276	.104	1.25	24	0.22Ω—100K Ω
½W	.360	.120	1.25	22	0.22Ω—100K Ω
1W	.400	.160	1.25	22	0.22Ω—100K Ω
2W	.480	.180	1.25	20	0.3Ω—100K Ω
3W	.640	.220	1.25	20	0.3Ω—100K Ω

FUSING CHARACTERISTICS:

POWER	FUSING TIME	
	Typical	Maximum
16 x Wattage	30 Sec.	1 Min.
20	20 Sec.	40 Sec.
24	10 Sec.	30 Sec.
28	8 Sec.	20 Sec.
32	5 Sec.	15 Sec.

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♣ KRL Multi-Purpose Resistors

OX, OXH, CB, LB, LB4 & V SERIES

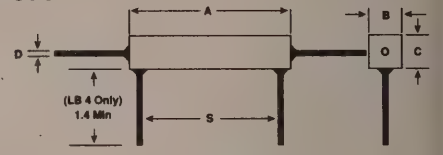
Miniature and Standard Metal Oxide Resistors

- Non Inductve Design
- Non-Flammable Coating
- Standard Temperature Coefficient ±300 PPM/°C

KRL STYLE		WATTAGE RATING @75°C		MAXIMUM VOLTAGE		DIELECTRIC WITHSTANDING VOLTAGE	RESISTANCE RANGE		DIMENSIONS		
OXH	OX	OXH	OX	WORKING	OVERLOAD		MIN	MAX	L ±.040	D ±.020	AWG ±.005
	OX-05		0.5	350V	600V	350V AC	.5Ω	120KΩ	.352	.128	24
OXH-10	OX-10	1.0	1.0	350V	600V	350V AC	.5Ω	120KΩ	.420	.140	22
OXH-20	—	2.0	—	350V	650V	500V AC	.5Ω	150KΩ	.480	.180	20
OXH-30	OX-20	3.0	2.0	350V	700V	600V AC	.5Ω	150KΩ	.640	.200	20
OXH-50	OX-30	5.0	3.0	350V	700V	1000V AC	.5Ω	150KΩ	1.00	.340	20
OXH-60	OX-40	6.0	4.0	450V	800V	1000V AC	1Ω	180KΩ	1.28	.340	20
OXH-70	OX-50	7.0	5.0	500V	1000V	1000V AC	1Ω	200KΩ	1.64	.340	20
OXH-100	OX-60	10.0	6.0	600V	1200V	1000V AC	1Ω	250KΩ	2.16	.340	20

Ceramic Boat Axial Lead Wirewound & Ultra Low Ohm Ceramic Boat

- Fireproof Construction
- Controlled Atmosphere Processing Technique (LB (4) Only)
- Six Sided Crimped Terminals (CB Only)
- Low TC & Noninductive Design (LB (4) Only)



KRL TYPE	Power @ 25°C	Maximum Current Amps	Resistance Range (Higher custom Ohm values available)	Typical TC (PPM)		A ±.03	B ±.03	C ±.03	D ±.005	S ±.062
				<1 Ohm	>1 Ohm					
LB-1	1	10	.003 to .2 Ohm	±100	—	.580	.250	.250	.032	.490
LB-2	2	10	.003 to .5 Ohm	±100	—	.690	.250	.250	.032	.563
CB-3/LB-3	3	10	.003 to 500 Ohm	±100	±400	.875	.312	.312	.032	.563
CB-5/LB-5	5	10	.003 to 500 Ohm	±100	±400	.875	.375	.375	.040	.563
CB-7/LB-7	7	20	.003 to 1K Ohm	±100	±400	1.40	.375	.375	.040	1.013
CB-10/LB-10	10	20	.003 to 1K Ohm	±100	±400	1.88	.375	.375	.040	1.388
CB-15/LB-15	15	20	.003 to 1K Ohm	±100	±400	1.88	.500	.500	.040	1.388
CB-25/LB-25	25	40	.003 to 1K Ohm	±100	±400	2.50	.500	.500	.040	2.00

Vertical Mount Resistors

- Tolerances from 1%-10%
- Space Saving Design

STYLE	POWER @25°C	A .039	B .059	C .039	D .015	Resistance Range	Temperature Coefficient
V-2	2	.275	.800	.435	.197	.01-20K Ohms	±30 PPM (TYP)
V-3	3	.320	1.00	.475	.197	.01-22K Ohms	±30 PPM (TYP)
V-5	5	.350	1.00	.520	.197	.01-22K Ohms	±30 PPM (TYP)
V-10	10	.365	1.50	.520	.197	.01-100K Ohms	±30 PPM (TYP)
V-15	15	.500	1.40	.640	.297	.01-100K Ohms	±30 PPM (TYP)

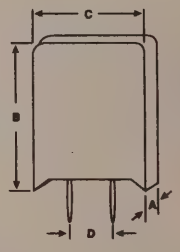
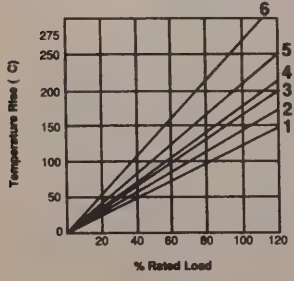


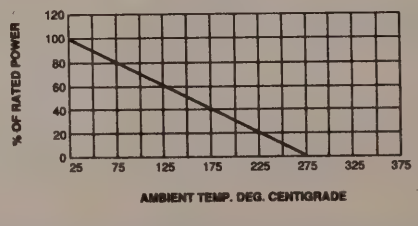
Diagram 1 (Temperature Rise)



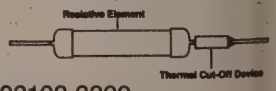
1) LB-3, CB-3, V2 & V3
2) LB-5, CB-5, & V-5
3) LB-7, & CB-7
4) LB-10, CB-10, & V-10
5) LB-15, CB-15, & V-15
6) LB-25 & CB-25

Diagram 2 (Derating)

Line A = OX & OXH Series
Line B = LB, CB, & V Series



Note: Most of the above styles may be ordered with the following options: (F) for custom fusing action; and (TF) for Failsafe Thermal Fuse Applications (see below for TF construction).



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Phone: 603-668-3210 FAX: 603-624-0634 TLX: 80-4294 SPEDEX

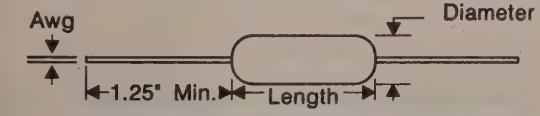
♣KRL Wirewound Power Resistors P & C SERIES

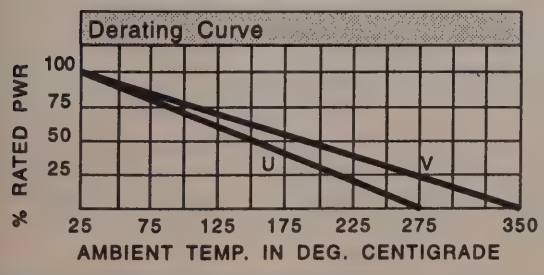
KRL STYLE		MIL-R-26	MIL-R-39007	WATTAGE RATING U	WATTAGE RATING V	WORKING VOLTAGE U	WORKING VOLTAGE V	MAXIMUM RESISTANCE IN OHMS	DIMENSIONS LENGTH ±.062	DIMENSIONS LENGTH (±.010)	DIMENSIONS DIAMETER ±.032	DIMENSIONS DIAMETER (±.010)	LEAD AWG
	C-1/4			.5	1.0	18	20	3.4KΩ	.250		.094		24
(P-1/2)	C-1/2			.75	1.2	30	35	4.5KΩ	.280	(.300)	.094	(.120)	24
(P-1A)	C-1A	RW-70		1.0	1.5	50	55	10KΩ	.406	(.425)	.094	(.120)	22
	C-1B			1.1	1.6	62	67	12KΩ	.530		.094		22
(P-1C)	C-1C			1.0	1.5	28	33	5KΩ	.330	(.360)	.094	(.120)	22
	C-1D			3.25	4.5	175	200	38KΩ	.700		.110		22
(P-2)	C-2			1.5	2.0	72	79	10KΩ	.385	(.420)	.187	(.190)	20
(P-2A)	C-2A	RW-79		3.0	3.75	135	148	22KΩ	.560	(.600)	.187	(.210)	20
	C-2B		RWR-71	3.25	4.75	185	220	42KΩ	.812		.187		20
(P-2C)	C-2C			3.0	3.5	138	157	32KΩ	.500	(.535)	.250	(.265)	20
(P-2D)	C-2D	RW-69		2.5	3.0	135	148	20KΩ	.500	(.535)	.210	(.210)	20
(P-2E)	C-2E			3.0	3.75	135	148	22KΩ	.560	(.600)	.158	(.173)	20
(P-2F)	C-2F			2.5	3.0	135	148	20KΩ	.490	(.530)	.158	(.190)	20
(P-3)	C-3			4.0	5.5	210	250	45KΩ	.625	(.680)	.250	(.265)	20
	C-4			5.0	6.0	300	350	65KΩ	.875		.250		18
(P-5)	C-5	RW-74	RWR-74	5.0	6.0	325	375	90KΩ	.875	(.925)	.312	(.335)	18
(P-6)	C-6	RW-67		6.0	6.5	360	400	100KΩ	1.00	(1.080)	.312	(.335)	18
	C-7			7.0	8.0	360	400	100KΩ	1.20	±.094	.312	±.062	18
	C-7A	RW-55		7.5	9.0	510	580	150KΩ	1.375	±.094	.375	±.062	18
	C-10A	RW-78	RWR-78	10.0	12.0	800	930	275KΩ	1.78	±.094	.375	±.062	18

P = Molded ( ) ; C = Coated

♣KRL Space Miser Power Resistors AK SERIES

KRL STYLE	MIL-R-26E	WATTAGE RATING U	WATTAGE RATING V	WORKING VOLTAGE	DIELECTRIC WITHSTAND	MAXIMUM RESISTANCE IN OHMS	DIMENSIONS LENGTH ±.062	DIMENSIONS DIAMETER ±.032	LEAD AWG
AK-1	RW-81	1	--	33	1KV	4KΩ	.250	.094	24
AK-2		2	--	42	1KV	7.5KΩ	.312	.094	24
AK-3	RW-80	3	--	60	1KV	10KΩ	.406	.094	22
AK-5		4	5	157	1KV	25KΩ	.560	.158	20/18
AK-5C		5	6.5	175	1KV	32KΩ	.500	.250	18
AK-6		6	7	210	1KV	45KΩ	.625	.250	18
AK-10		7	10	400	1KV	90KΩ	.875	.312	18





ELECTRICAL SPECIFICATIONS:

Resistance Tolerance: 5% , 3%, 1% Std (Accuracies available to .01%)

Temperature Coefficient: 90 PPM/°C Less than 1Ω; 50 PPM/°C 1Ω to 10Ω; 30 PPM/°C 10Ω to 100Ω; 20 PPM/°C 100Ω and above.

Short Term Overload: 5 Seconds at 5 times rated power.

Operating Range: -55°C to +275°C (U Rating) or +350°C (V Rating).

Covering: Flame Retardent Silicone (Molded & Coated)

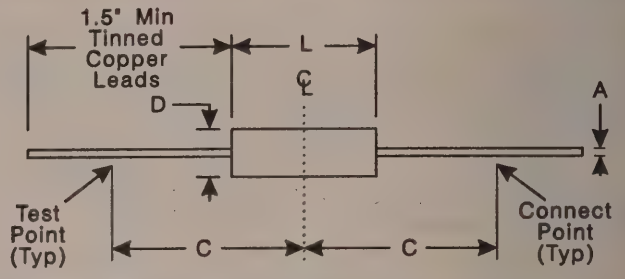
Windings: Space wound on Ceramic or Alumina Oxide Cores. Noninductive windings are available & identified by adding an "N" in front of the style number.

♣KRL/Bantry Components, Inc. 160 Bouchard Street, Manchester, NH 03103-3399
Phone: 603-668-3210 FAX: 603-624-0634

♣KRL LOW-OHM Power Resistors NP SERIES

Features:

- Zero Micro Henries Inductance
- Low Temperature Coefficients
- High Power to Size Ratio.



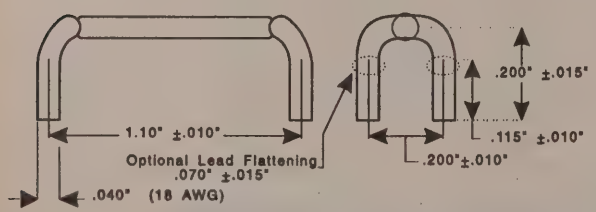
STYLE	WATTS	"L" LENGTH ±0.010"	"D" DIA. ±0.010"	"C" TST PNT	"A" AWG ±0.003"
NP-1A	1	.430	.120	.590	22 (.025")
NP-2A	3	.600	.210	.675	20 (.032")
NP-3	4	.680	.265	.715	20 (.032")
NP-5A	5	.925	.275	.838	18 (.040")

♣KRL Four Terminal Shunt Resistors FTS SERIES

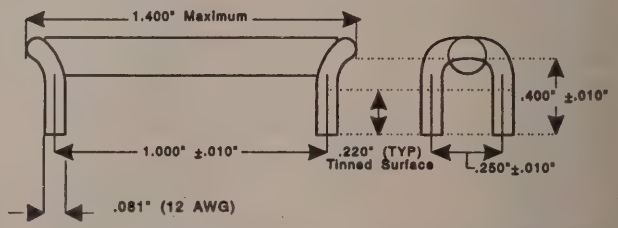
Features:

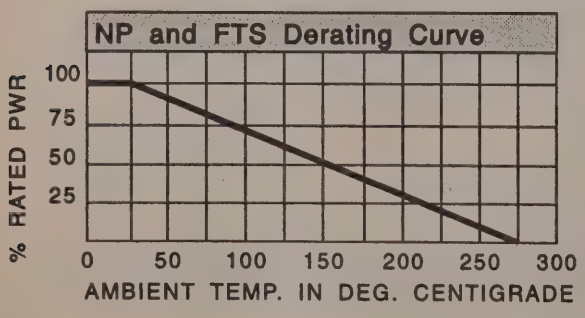
- Radial, Self-Supporting, PC Board Mounting
- High Power to Size Ratio
- Min. Wattage: FTS-1=1W; FTS-2=5W
- Decimal Marked, Silicone Coated Body (FTS-2 Only)
- Std. Tolerances: ±0.5% to ±10%
- Operating Range: -55˚C to +275˚C

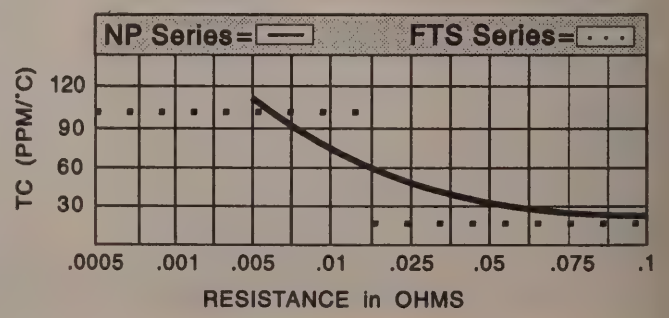
FTS-1 .002Ω to .05Ω



FTS-2 .0005Ω to .002Ω







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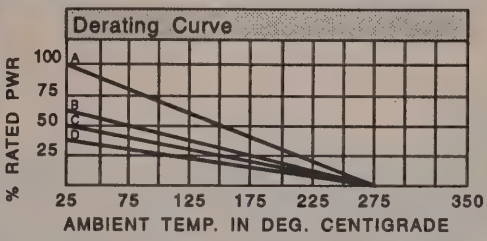
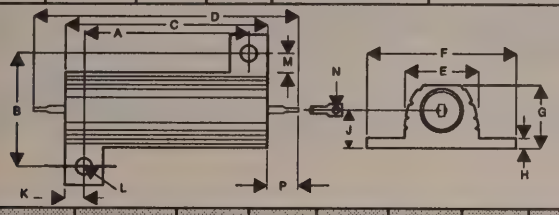
♣KRL Heat Sink Power Resistors AT SERIES

KRL STYLE	MIL-R-18546	POWER in WATTS KRL	MIL	MAXIMUM RESISTANCE	MAXIMUM WORKING VOLTAGE	DIELECTRIC RMS
AT-5	RE-60	7.5	5	25KΩ	160	1500
AT-10	RE-65	12.5	10	45KΩ	265	1500
AT-25	RE-70	25	20	95KΩ	550	2500
AT-50	RE-75	50	30	275KΩ	1250	2500





A = All units mounted to chassis

B = AT-10 Unmounted

C = AT-25 Unmounted

D = AT-50 Unmounted

Proper Heat Sinks:

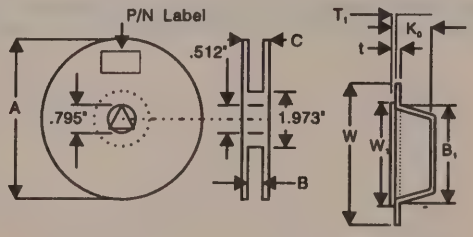
4"x6"x2"x.040" Aluminum chassis for AT-5 and AT-10.

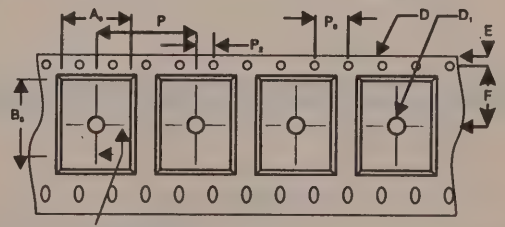
5"x7"x2"x.040" Aluminum chassis for AT-25 and AT-50.

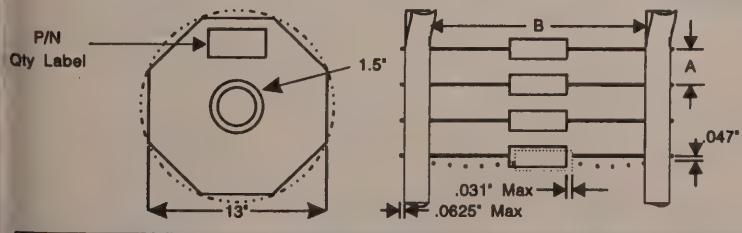
KRL STYLE	MIL	A ±.005	B ±.005	C ±.031	D ±.062	E ±.015	F ±.015	G ±.015	H ±.010	J ±.010	K ±.010	L ±.005	M ±.015	N ±.005	P ±.062
AT-5	RE-60	.444	.490	.600	1.125	.334	.646	.320	.065	.133	.078	.093	.078	.050	.262
AT-10	RE-65	.562	.625	.750	1.375	.420	.800	.390	.075	.165	.093	.093	.102	.086	.312
AT-25	RE-70	.719	.781	1.062	1.938	.550	1.08	.546	.075	.231	.172	.125	.115	.086	.438
AT-50	RE-75	1.563	.844	1.968	2.781	.630	1.140	.610	.088	.260	.196	.125	.107	.086	.406

EIA-481-A	S1/2(12mm)	S1(16mm)	S2(24mm)	S3(32mm)
A_0	.138 +.004	.150 +.004	.245 +.004	.295 +.004
B_0	.248 +.004	.274 +.004	.465 +.004	.856 +.004
K_0	.114 +.004	.145 +.004	.222 +.004	.310 +.004
P	.315 +.004	.315 +.004	.472 +.004	.472 +.004
P_2	.079 +.002	.079 +.002	.079 +.002	.079 +.002
P_0	.157 +.004	.157 +.004	.157 +.004	.157 +.004
D	.059 +.004	.059 +.004	.059 +.004	.059 +.004
D_1	.059 Min	.059 Min	.059 Min	.079 Min
E	.069 +.004	.069 +.004	.069 +.004	.069 +.004
F	.217 +.004	.295 +.004	.453 +.004	.559 +.004
W	.472 +.012	.630 +.012	.645 +.012	1.26 +.012
W_1	.365 Max	.532 Max	.852 Max	1.008 Max
T_1	.004 Max	.004 Max	.004 Max	.004 Max
t	.016 Max	.016 Max	.016 Max	.016 Max
B_1	.323 Max	.476 Max	.791 Max	.908 Max

TAPE	A NOM	B	C MAX
12mm	13" 7"	.550" +.078"	.750"
16mm	13" 7"	.646" +.078"	.882"
24mm	13" n/a	.961" +.078	1.2"
32mm	13" n/a	1.276" +.078"	1.5"







COMPONENT BODY DIAMETER	COMPONENT PITCH "A" [+.020" (0.50mm)]	TAPE SPACING "B" MIN: 1.75" (44.45mm) MAX: 3.312" (84.12mm)		
		CLASS I	CLASS II	CLASS III
.000" (000mm) to .200" (5.090mm)	.200" (5.080mm)	2.062" (52.4mm)	2.50" (63.5mm)	2.874" (73mm)
.201" (5.105mm) to .400" (10.00mm)	.400" (10.00mm)			
.401" (10.20mm) to .600" (15.24mm)	.600" (15.24mm)			

♣KRL/Bantry Components, Inc. 160 Bouchard Street, Manchester, NH 03103-3399
Phone: 603-668-3210 FAX: 603-624-0634

METAL OXIDE VARISTORS & CERAMIC CAPACITORS

MAIDA DEVELOPMENT COMPANY
"DOMESTIC MANUFACTURERS SINCE 1947"

90,000 square foot manufacturing facilities located in Hampton, Virginia

Maida

See our Ceramic Capacitor Listings - Section 1500.

serving the electronics industry as partners in progress for more than forty-five years

Maida Development Company is a domestically owned and operated manufacturer of a wide variety of electronic ceramic components. Since 1947, we have specialized in the custom design and fabrication of ceramic disc capacitors - from ceramic dielectric powder formulation through finished devices - to meet the specific requirements of our customers. Maida's major capacitor products include (1) Class I, Class II, and Class III high voltage disk capacitors, 1 KDVC thru 30 KDVC; (2) capacitors safety- recognized by UL, CSA, and VDE. for across-the-line, line-by-pass, and antenna-coupling applications; (3) close tolerance adjusted NPO disk capacitors; (4) low-inductance leadless disks; (5) slot-mountable "trapezoids" for printed circuits; (6) trimmer capacitors; (7) post insulators/capacitors; (8) radial tubular capacitors; (9) feedthrus and (10) sparkgaps.

Maida Development Company also produces a complete line of metal oxide varistors (MOV's) designed for transient voltage suppression and surge energy absorption. We are now the only U.S. manufacturer of these components, with ceramic formulation, powder preparation, fabrication and assembly facilities all located in this country. Maida's varistors are recognized by UL, CSA and VDE. Please contact Maida's Sales Department to request our full-line varistors catalog.

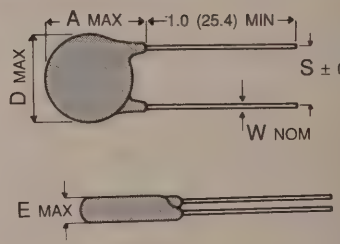
Delivery is both timely and reliable - with either bulk or tape and reel packaging.

Our sales representatives are strategically located throughout the USA and world. Maida welcomes the opportunity to discuss and bid on requirements not covered by this catalog. Please contact our Engineering Department.

MAXIMUM TRANSIENT POWER RATINGS (Pm)

Series	PM-watts	Series	PM-watts
D58	0.15	D63	0.8
D73	0.25	D65	1.0
D61	0.4	D78	1.2
D69	0.6	D75	1.4

STANDARD DIMENSIONS: inches (mm)



Style Designation: (typical)

D69--ZOV511RA110

Style Designation: (typical)
D69--ZOV511RA110

WHERE:

- **D-** Coating identification, D means standard flame-retardent fluid bed epoxy.
- **69-** Size code, 2 numbers. See Dimensions Table.
- **--** Lead Configuration code, 1 or 2 numbers used for non-standard leads. Standard leads use no code.
- **ZOV-** Material identifier, zinc oxide varistor.
- **511-** AC Voltage Rating code, 2 significant figures plus number of zeroes that follow, I.e. 511 is 510 VAC.
- **RA-** Special instructions code, RA is standard.
- **110-** Energy Rating code, up to 4 numbers. See Ratings Tables

Size Code	A	D	S	W VAC	E 50–95	E 120–180	E 230–320	E 420–580	E 620–1000
D58	.394 (10)	.276 (7)	.197 (5)	.025 (.63)	.197 (5)	.236 (6)	NA	NA	NA
D73	.472 (12)	.354 (9)	.197 (5)	.025 (0.63)	.197 (5)	.236 (6)	.276 (7)	NA	NA
D61	.590 (15)	.472 (12)	.296 (7.5)	.032 (.81)	.197 (5)	.236 (6)	.276 (7)	.354 (9)	NA
D69	.770 (19.5)	.650 (16.5)	.296 (7.5)	.032 (.81)	.197 (5)	.236 (6)	.276 (7)	.354 (9)	.472 (12)
D63	.912 (23)	.787 (20)	.296 (7.5)	.032 (.81)	NA	.236 (6)	NA	NA	NA
D65	1.020 (26)	.905 (23)	.296 (7.5)	.032 (.81)	.197 (5)	.236 (6)	.276 (7)	.354 (9)	.472 (12)
D78	1.8 (45.7)	1.57 (40)	NA	NA	NA	.236 (6)	.276 (7)	.354 (9)	.472 (12)
D75	2.1 (53.3)	1.89 (48)	NA	NA	NA	.236 (6)	.276 (7)	.354 (9)	.472 (12)

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METAL OXIDE VARISTORS

MAIDA DEVELOPMENT COMPANY
"DOMESTIC MANUFACTURERS SINCE 1947"

ZINC OXIDE VARISTORS FOR SURGE VOLTAGE PROTECTION - ZOV RATINGS

	MDC STYLE	NOM. SIZE MM	GE/ HARRIS CROSS REF.	MINIMUM MARKING	MAXIMUM CONTINUOUS RATINGS		MAXIMUM ENERGY SINGLE PULSE	PEAK CURRENT SINGLE PULSE	VARISTOR VOLTAGE VDC@1mA		CLAMPING VOLTAGE @ CURRENT SHOWN		CAPACITANCE pF 1KHz@25C +/- 30%
					VAC	VDC	10x1000 usec	8x20 usec	Vmin	Vmax	VCLmax	ICL	
	D58Z0V110RA00	5	V18ZA05	Z110-00	11	14	.3	100	16	20	40	1.0	1600
	D73Z0V110RA01	7	V18ZA1	Z110-01	11	14	.8	250	16	20	36	2.5	3500
	D6121Z0V110RA02	10	V18ZA2	Z110-02	11	14	1.5	500	16	20	36	5.0	7500
	D6921Z0V110RA04	14	V18ZA3	Z110-04	11	14	3.5	1000	16	20	36	10.0	18000
	D6521Z0V110RA10	20		Z110-10	11	14	10.0	2000	16	20	36	20.0	37000
	D58Z0V140RA00	5	V22ZA05	Z140-00	14	18	.4	100	20	24	48	1.0	1300
	D73Z0V140RA01	7	V22ZA1	Z140-01	14	18	.9	250	20	24	43	2.5	2800
	D6121Z0V140RA02	10	V22ZA2	Z140-02	14	18	2.0	500	20	24	43	5.0	6000
	D6921Z0V140RA04	14	V22ZA3	Z140-04	14	18	4.0	1000	20	24	43	10.0	15000
	D6521Z0V140RA13	20		Z140-13	14	18	13.0	2000	20	24	43	20.0	30000
	D58Z0V170RA00	5	V27ZA05	Z170-00	17	22	.5	100	24	30	60	1.0	1050
	D73Z0V170RA01	7	V27ZA1	Z170-01	17	22	1.0	250	24	30	53	2.5	2000
	D6121Z0V170RA03	10	V27ZA2	Z170-03	17	22	2.5	500	24	30	53	5.0	4000
	D6921Z0V170RA05	14	V27ZA4	Z170-05	17	22	5.0	1000	24	30	53	10.0	10000
	D6521Z0V170RA15	20		Z170-15	17	22	15.0	2000	24	30	53	20.0	22000
	D58Z0V200RA00	5	V33ZA05	Z200-00	20	26	.6	100	30	36	73	1.0	900
	D73Z0V200RA01	7	V33ZA1	Z200-01	20	26	1.2	250	30	36	65	2.5	1500
	D6121Z0V200RA03	10	V33ZA2	Z200-03	20	26	3.0	500	30	36	65	5.0	3000
	D6921Z0V200RA06	14	V33ZA5	Z200-06	20	26	6.0	1000	30	36	65	10.0	7500
	D6521Z0V200RA20	20		Z200-20	20	26	20.0	2000	30	36	65	20.0	17000
	D58Z0V250RA01	5	V39ZA05	Z250-01	25	31	.8	100	35	43	86	1.0	500
	D73Z0V250RA02	7	V39ZA1	Z250-02	25	31	1.5	250	35	43	77	2.5	1350
	D6121Z0V250RA04	10	V39ZA3	Z250-04	25	31	3.5	500	35	43	77	5.0	2600
	D6921Z0V250RA07	14	V39ZA6	Z250-07	25	31	7.0	1000	35	43	77	10.0	6500
	D6521Z0V250RA24	20		Z250-24	25	31	24.0	2000	35	43	77	20.0	15000
	D58Z0V300RA01	5	V47ZA05	Z300-01	30	38	1.0	100	42	52	104	1.0	450
	D73Z0V300RA02	7	V47ZA1	Z300-02	30	38	1.8	250	42	52	93	2.5	1150
	D6121Z0V300RA05	10	V47ZA3	Z300-05	30	38	4.5	500	42	52	93	5.0	2200
	D6921Z0V300RA09	14	V47ZA7	Z300-09	30	38	8.5	1000	42	52	93	10.0	5500
	D6521Z0V300RA30	20		Z300-30	30	38	30.0	2000	42	52	93	20.0	13000
	D58Z0V350RA01	5	V56ZA05	Z350-01	35	45	1.0	100	50	62	123	1.0	400
	D73Z0V350RA02	7	V56ZA2	Z350-02	35	45	2.2	250	50	62	110	2.5	950
	D6121Z0V350RA06	10	V56ZA3	Z350-06	35	45	5.5	500	50	62	110	5.0	1800
	D6921Z0V350RA10	14	V56ZA8	Z350-10	35	45	10.0	1000	50	62	110	10.0	4500
	D6521Z0V350RA35	20		Z350-35	35	45	35.0	2000	50	62	110	20.0	11000
	D58Z0V400RA01	5	V68ZA05	Z400-01	40	56	1.2	100	61	75	150	1.0	350
	D73Z0V400RA03	7	V68ZA2	Z400-03	40	56	2.5	250	61	75	135	2.5	700
	D6121Z0V400RA07	10	V68ZA3	Z400-07	40	56	6.5	500	61	75	135	5.0	1600
★	D6921Z0V400RA12	14	V68ZA10	Z400-12UL	40	56	12.0	1000	61	75	135	10.0	3300
★	D6521Z0V400RA40	20		Z400-40UL	40	56	40.0	2000	61	75	135	20.0	7000
	D58Z0V500RA01	5	V82ZA05	Z500-01	50	66	2.0	400	74	90	165	5.0	250
	D73Z0V500RA02	7	V82ZA2	Z500-02	50	66	4.0	1200	74	90	157	10.0	550
★	D6121Z0V500RA03	10	V82ZA4	Z500-03UL	50	66	6.0	2500	74	90	147	25.0	1500
★	D6921Z0V500RA06	14	V82ZA12	Z500-06UL	50	66	15.0	1000	74	90	147	50.0	2900
★	D6521Z0V500RA42	20		Z500-42UL	50	65	42.0	6500	74	90	135	100.0	5500
	D58Z0V600RA01	5	V100ZA05	Z600-01	60	85	2.0	400	90	110	190	5.0	200
	D73Z0V600RA02	7	V100ZA3	Z600-02	60	81	5.0	1200	90	110	180	10.0	500
★	D6121Z0V600RA03	10	V100ZA4	Z600-03UL	60	81	7.0	2500	90	110	175	25.0	1400
★	D6921Z0V600RA06	14	V100ZA15	Z600-06UL	60	81	20.0	1000	90	110	175	50.0	2400
★	D6521Z0V600RA45	20		Z600-45UL	60	85	45.0	6500	90	110	165	100.0	4800
	D58Z0V750RA01	5	V120ZA05	Z750-01	75	102	2.5	400	108	132	245	5.0	170
	D73Z0V750RA02	7	V120ZA1	Z750-02	75	102	6.0	1200	108	132	230	10.0	450
★	D6121Z0V750RA03	10	V120ZA4	Z750-03UL	75	102	8.0	2000	108	132	210	25.0	1100
★	D6921Z0V750RA06	14	V120ZA6	Z750-06UL	75	102	22.0	4500	108	132	210	50.0	1900
★	D6521Z0V750RA55	20		Z750-55UL	75	100	55.0	6500	108	132	200	100.0	3800
	D58Z0V950RA01	5	V150ZA05	Z950-01	95	127	3.0	400	135	165	300	5.0	140
	D73Z0V950RA02	7	V150ZA1	Z950-02	95	127	8.0	1200	135	165	255	10.0	350
★	D6121Z0V950RA03	10	V150ZA4	Z950-03UL	95	127	10.0	2000	135	165	255	25.0	900
★	D6921Z0V950RA06	14	V150ZA8	Z950-06UL	95	127	30.0	4500	135	165	255	50.0	1500
★	D6521Z0V950RA65	20		Z950-65UL	95	125	65.0	6500	135	165	250	100.0	3000

★=UL 1449 File E86730 - Transient Voltage Surge Suppression
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□=CSA C22.2 File LR33468
†=VDE/CECC 42000/42201 File 58819

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METAL OXIDE VARISTORS

MAIDA DEVELOPMENT COMPANY
"DOMESTIC MANUFACTURERS SINCE 1947"

ZINC OXIDE VARISTORS FOR SURGE VOLTAGE PROTECTION - ZOV RATINGS

MDC STYLE	NOM. SIZE MM	GE/ HARRIS CROSS REF.	MINIMUM MARKING	MAXIMUM CONTINUOUS RATINGS		MAXIMUM ENERGY SINGLE PULSE	PEAK CURRENT SINGLE PULSE	VARISTOR VOLTAGE VDC@1mA		CLAMPING VOLTAGE @ CURRENT SHOWN		CAPACITANCE pF IKHz@25C +/- 30%
				VAC	VDC	10x1000 usec	8x20 usec	Vmin	Vmax	VCLmax	ICL	
† D58Z0V131RA02	5		Z131-02	130	175	4.0	400	184	224	380	5	80
★ □ † D73Z0V131RA03	7	V130LA2	Z131-03UL	130	175	11.0	1200	184	224	340	10	250
★ ● □ † D6121Z0V131RA04	10	V130LA5	Z131-04UL	130	175	14.0	2000	184	224	340	25	500
★ ● □ † D6921Z0V131RA09	14	V130LA10A	Z131-09UL	130	175	38.0	4500	184	224	340	50	1100
★ □ D6321Z0V131RA70	18		Z131-70UL	130	175	70.0	6500	184	224	340	100	2300
★ ● □ † D6521Z0V131RA20	20	V130LA20A	Z131-20UL	130	175	70.0	6500	184	224	340	100	2000
★ □ D7877Z0V131RA210	32		Z131-210UL	130	175	210.0	25000	184	224	340	200	4700
★ □ D7577Z0V131RA310	40		Z131-310UL	130	175	310.0	40000	184	224	340	300	10000
† D58Z0V141RA02	5		Z141-02	140	180	4.5	400	198	242	410	5	70
★ □ † D73Z0V141RA03	7	V140LA2	Z141-03UL	140	180	12.0	1200	198	242	360	10	220
★ ● □ † D6121Z0V141RA04	10	V140LA5	Z141-04UL	140	180	16.0	2000	198	242	360	25	450
★ ● □ † D6921Z0V141RA09	14	V140LA10A	Z141-09UL	140	180	42.0	4500	198	242	360	50	1000
★ □ D6321Z0V141RA75	18		Z141-75UL	140	180	75.0	6500	198	242	360	100	2150
★ ● □ † D6521Z0V141RA20	20		Z141-20UL	140	180	75.0	6500	198	242	360	100	1900
★ □ D7877Z0V141RA225	32		Z141-225UL	140	180	225.0	25000	198	242	365	200	4300
★ □ D7577Z0V141RA330	40		Z141-330UL	140	180	330.0	40000	198	242	365	300	9000
† D58Z0V151RA02	5		Z151-02	150	200	5.0	400	212	259	430	5	70
★ □ † D73Z0V151RA03	7	V150LA2	Z151-03UL	150	200	13.0	1200	212	259	395	10	200
★ ● □ † D6121Z0V151RA04	10	V150LA5	Z151-04UL	150	200	17.0	2000	212	259	395	25	400
★ ● □ † D6921Z0V151RA09	14	V150LA10A	Z151-09UL	150	200	45.0	4500	212	259	395	50	900
★ □ D6321Z0V151RA80	18		Z151-80UL	150	200	80.0	6500	212	259	395	100	2000
★ ● □ † D6521Z0V151RA20	20	V150LA20A	Z151-20UL	150	200	80.0	6500	212	259	395	100	1800
★ □ D7877Z0V151RA240	32		Z151-240UL	150	200	240.0	25000	212	259	395	200	4000
★ □ D7577Z0V151RA360	40		Z151-360UL	150	200	360.0	40000	212	259	395	300	8000
† D58Z0V181RA02	5		Z181-02	180	230	6.0	400	255	311	510	5	65
★ □ † D73Z0V181RA03	7	V175LA2	Z181-03UL	180	230	15.0	1200	255	311	470	10	170
★ ● □ † D6121Z0V181RA04	10	V175LA5	Z181-04UL	180	230	20.0	2000	255	311	465	25	350
★ ● □ † D6921Z0V181RA09	14	V175LA10A	Z181-09UL	180	230	55.0	4500	255	311	465	50	750
★ ● □ † D6521Z0V181RA20	20		Z181-20UL	180	230	100.0	6500	255	311	465	100	1600
★ □ D7877Z0V181RA250	32		Z181-250UL	180	230	250.0	25000	255	311	470	200	3500
★ □ D7577Z0V181RA390	40		Z181-390UL	180	230	390.0	40000	255	311	470	300	7100
D58Z0V231RA08	5		Z231-08	230	300	7.5	400	326	397	620	5	50
★ □ † D73Z0V231RA20	7	V230LA4	Z231-20UL	230	300	20.0	1200	326	397	595	10	150
★ ● □ † D61Z0V231RA35	10	V230LA10	Z231-35UL	230	300	35.0	2000	326	397	595	25	300
★ ● □ † D69Z0V231RA70	14	V230LA20A	Z231-70UL	230	300	70.0	4500	326	397	595	50	550
★ ● □ † D65Z0V231RA115	20		Z231-115UL	230	300	115.0	6500	326	397	595	100	1200
★ □ D7877Z0V231RA300	32		Z231-300UL	230	300	300.0	25000	326	397	595	200	2800
★ □ D7577Z0V231RA460	40		Z231-460UL	230	300	460.0	40000	326	397	595	300	5600
D58Z0V251RA08	5		Z251-08	250	320	8.0	400	354	432	675	5	50
★ □ † D73Z0V251RA21	7	V250LA4	Z251-21UL	250	330	21.0	1200	354	432	650	10	130
★ ● □ † D61Z0V251RA40	10	V250LA10	Z251-40UL	250	330	40.0	2000	354	432	650	25	270
★ ● □ † D69Z0V251RA72	14	V250LA20A	Z251-72UL	250	330	72.0	4500	354	432	650	50	500
★ ● □ † D65Z0V251RA130	20	V250LA40A	Z251-130UL	250	330	130.0	6500	354	432	650	100	1000
★ □ D7877Z0V251RA330	32		Z251-330UL	250	330	330.0	25000	354	432	650	200	2500
★ □ D7577Z0V251RA490	40		Z251-490UL	250	330	490.0	40000	354	432	650	300	5000
D58Z0V271RA09	5		Z271-09	270	350	9.0	400	382	466	745	5	45
★ □ † D73Z0V271RA23	7	V275LA4	Z271-23UL	270	360	23.0	1200	382	466	710	10	110
★ ● □ † D61Z0V271RA43	10	V275LA10	Z271-43UL	270	360	43.0	2000	382	466	710	25	250
★ ● □ † D69Z0V271RA75	14	V275LA20A	Z271-75UL	270	360	75.0	4500	382	466	710	50	450
★ ● □ † D65Z0V271RA140	20	V275LA40A	Z271-140UL	270	360	140.0	6500	382	466	710	100	950
★ □ D7877Z0V271RA360	32		Z271-360UL	270	360	360.0	25000	382	466	710	200	2200
★ □ D7577Z0V271RA550	40		Z271-550UL	270	360	550.0	40000	382	466	710	300	4500
D58Z0V301RA10	5		Z301-10	300	385	10.0	400	425	518	810	5	40
★ □ † D73Z0V301RA25	7	V300LA4	Z301-25UL	300	390	25.0	1200	425	518	790	10	100
★ ● □ † D61Z0V301RA45	10		Z301-45UL	300	390	45.0	2000	425	518	790	25	230
★ ● □ † D69Z0V301RA80	14		Z301-80UL	300	390	80.0	4500	425	518	790	50	400
★ ● □ † D65Z0V301RA150	20		Z301-150UL	300	390	150.0	6500	425	518	790	100	900
★ □ D7877Z0V301RA380	32		Z301-380UL	300	390	380.0	25000	425	518	790	200	2000
★ □ D7577Z0V301RA600	40		Z301-600UL	300	390	600.0	40000	425	518	790	300	4000
D73Z0V321RA27	7		Z321-27	320	420	27.0	1200	453	533	850	10	85
★ ● □ † D61Z0V321RA45	10		Z321-45UL	320	420	45.0	2000	453	533	850	25	200
★ ● □ † D69Z0V321RA90	14	V320LA20A	Z321-90UL	320	420	90.0	4500	453	533	850	50	350
★ ● □ † D65Z0V321RA160	20	V320LA40B	Z321-160UL	320	420	160.0	6500	453	533	850	100	820
★ □ D7877Z0V321RA430	32		Z321-430UL	320	420	430.0	25000	453	533	840	200	1900
★ □ D7577Z0V321RA640	40		Z321-640UL	320	420	640.0	40000	453	533	840	300	3800

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MAIDA DEVELOPMENT COMPANY
"DOMESTIC MANUFACTURERS SINCE 1947"

ZINC OXIDE VARISTORS FOR SURGE VOLTAGE PROTECTION - ZOV RATINGS

MDC STYLE	NOM. SIZE MM	GE/ HARRIS CROSS REF.	MINIMUM MARKING	MAXIMUM CONTINUOUS RATINGS		MAXIMUM ENERGY SINGLE PULSE	PEAK CURRENT SINGLE PULSE	VARISTOR VOLTAGE VDC@1mA		CLAMPING VOLTAGE @ CURRENT SHOWN		CAPACITANCE pF IKHz@25C +/- 30%
				VAC	VDC	10x1000 usec	8x20 usec	Vmin	Vmax	VCLmax	ICL	
★ □ D7877Z0V391RA550	32		Z391-550UL	390	505	550	25000	552	674	1025	200	1600
★ □ D7577Z0V391RA800	40		Z391-800UL	390	505	800	40000	552	674	1025	300	3300
★ ● □ † D61Z0V421RA45	10	V420LA10	Z421-45UL	420	560	45	2000	594	725	1120	25	130
★ ● □ † D69Z0V421RA90	14	V420LA20A	Z421-90UL	420	560	90	4500	594	725	1120	50	250
★ ● □ † D65Z0V421RA160	20	V420LA40B	Z421-160UL	420	560	160	6500	594	725	1120	100	470
★ □ D7877Z0V421RA600	32		Z421-600UL	420	560	600	25000	594	725	1120	200	1500
★ □ D7577Z0V421RA910	40		Z421-910UL	420	560	910	40000	594	725	1120	300	3000
★ □ D7877Z0V461RA520	32		Z461-520UL	460	615	520	25000	651	795	1240	200	1400
★ □ D7577Z0V461RA780	40		Z461-780UL	460	615	780	40000	651	795	1240	300	2600
★ □ † D61Z0V481RA50	10		Z481-50UL	480	640	50	2000	679	829	1290	25	120
★ ● □ † D69Z0V481RA105	14	V480LA40A	Z481-105UL	480	640	105	4500	679	829	1240	50	220
★ ● □ † D65Z0V481RA180	20	V480LA80B	Z481-180UL	480	640	180	6500	679	829	1240	100	400
★ □ D7877Z0V481RA550	32		Z481-550UL	480	640	550	25000	679	829	1300	200	1300
★ □ D7577Z0V481RA820	40		Z481-820UL	480	640	820	40000	679	829	1300	300	2700
★ ● □ † D61Z0V511RA55	10		Z511-55UL	510	675	55	2000	722	881	1350	25	110
★ ● □ † D69Z0V511RA110	14	V510LA40A	Z511-110UL	510	675	110	4500	722	881	1350	50	200
★ ● □ † D65Z0V511RA190	20	V510LA80B	Z511-190UL	510	675	190	6500	722	881	1350	100	380
★ □ D7877Z0V511RA580	32		Z511-580UL	510	675	580	25000	722	881	1390	200	1200
★ □ D7577Z0V511RA900	40		Z511-900UL	510	675	900	40000	722	881	1390	300	2500
★ ● □ † D61Z0V551RA60	10		Z551-60UL	550	700	60	2000	778	950	1400	25	100
★ ● □ † D69Z0V551RA115	14		Z551-115UL	550	700	115	4500	778	950	1400	50	180
★ ● □ † D65Z0V551RA200	20		Z551-200UL	550	700	200	6500	778	950	1400	100	350
★ □ D7877Z0V551RA620	32		Z551-620UL	550	700	620	25000	778	950	1500	200	1150
★ □ D7577Z0V551RA960	40		Z551-960UL	550	700	960	40000	778	950	1500	300	2300
★ ● □ † D61Z0V581RA65	10		Z581-65UL	580	735	65	2000	821	1002	1500	25	95
★ ● □ † D69Z0V581RA120	14	V575LA40A	Z581-120UL	580	735	120	4500	821	1002	1500	50	170
★ ● □ † D65Z0V581RA220	20	V575LA80B	Z581-220UL	580	735	220	6500	821	1002	1500	100	340
★ □ D7877Z0V581RA650	32		Z581-650UL	580	735	650	25000	821	1002	1575	200	1100
★ □ D7577Z0V581RA1000	40		Z581-1000UL	580	735	1000	40000	821	1002	1575	300	2200
★ ● □ † D69Z0V621RA130	14		Z621-130UL	620	800	130	4500	877	1071	1620	50	160
★ ● □ † D65Z0V621RA230	20		Z621-230UL	620	800	230	6500	877	1071	1620	100	320
★ □ D7877Z0V621RA680	32		Z621-680UL	620	800	680	25000	877	1071	1670	200	1000
★ □ D7577Z0V621RA1040	40		Z621-1040UL	620	800	1040	40000	877	1071	1670	300	2100
★ ● □ † D69Z0V681RA150	14		Z681-150UL	680	860	150	4500	962	1175	1800	50	150
★ ● □ † D65Z0V681RA260	20		Z681-260UL	680	860	260	6500	962	1175	1800	100	300
★ □ D7877Z0V681RA760	32		Z681-760UL	680	860	760	25000	962	1175	1815	200	900
★ □ D7577Z0V681RA1100	40		Z681-1100UL	680	860	1100	40000	962	1175	1815	300	2000
★ □ D7877Z0V751RA800	32		Z751-800UL	750	970	800	25000	1062	1300	2000	200	800
★ □ D7577Z0V751RA1200	40		Z751-1200UL	750	970	1200	40000	1062	1300	2000	300	1800
★ □ D7877Z0V881RA850	32		Z881-850UL	880	1150	850	25000	1245	1520	2290	200	680
★ □ D7577Z0V881RA1300	40		Z881-1300UL	880	1150	1300	40000	1245	1520	2290	300	1500
★ ● □ † D69Z0V102RA220	14	V1000LA80A	Z102-220UL	1000	1200	220	4500	1414	1728	2700	50	100
★ ● □ † D65Z0V102RA360	20	V1000LA160B	Z102-360UL	1000	1200	360	6500	1414	1728	2700	100	200
★ □ D7877Z0V102RA900	32		Z102-900UL	1000	1200	900	25000	1414	1728	2550	200	600
★ □ D7577Z0V102RA1400	40		Z102-1400UL	1000	1200	1400	40000	1414	1728	2550	300	1300

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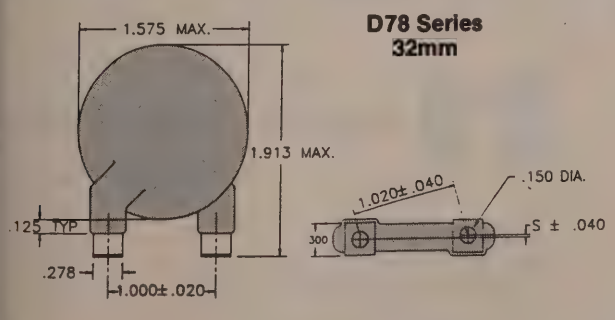

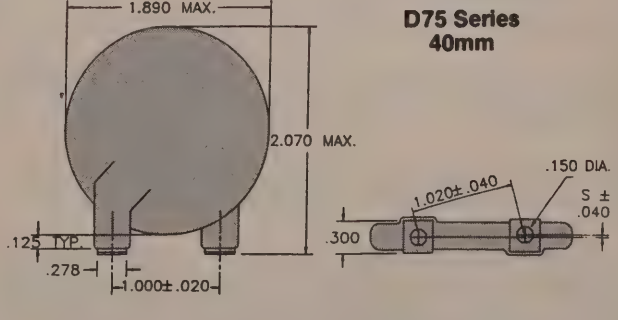

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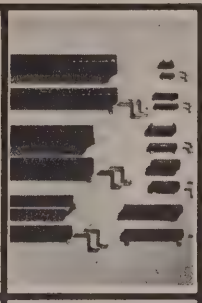
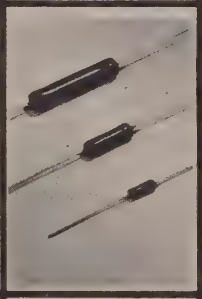
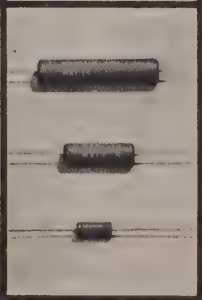
MEMCOR-TRUOHM INC.

WIRE WOUND RESISTORS

TYPE		Power Rating (Watts)	Max. Res. (Ohms)	Core Size (Inch.)
FR VITREOUS ENAMEL FIXED TUBULAR WITH TABS		5	25K	1 x 5/16
		10	50K	1 3/4 x 5/16
		20	100K	2 x 7/8
		25	100K	2 x 5/16
		50	250K	4 x 5/16
		100	100K	6 1/2 x 3/4
		160	100K	8 1/2 x 1 1/8
		200	100K	10 1/2 x 1 1/8
AR VITREOUS ENAMEL ADJUSTABLE TUBULAR WITH TABS		10	10K	1 3/4 x 5/16
		25	25K	2 x 5/16
		50	50K	4 x 5/16
		75	50K	6 x 5/16
		100	100K	6 1/2 x 3/4
		160	100K	8 1/2 x 1 1/8
		200	100K	10 1/2 x 1 1/8
VL VITREOUS ENAMEL AXIAL LEADS		3	10K	7/32 x 17/32
		5	25K	5/16 x 1 1/64
		10	50K	3/8 x 1 25/32
SL SILICONE AXIAL LEADS		1	2500	.100 × .383
		2	3500	.205 × .352
		3	10K	.205 × .475
		5	50K	.305 × .917
		10	100K	.24 × 1.72

TYPE		Power Rating (Watts)	Max. Res. (Ohms)	Core Size (Inch.)
FR w/LEADS VITREOUS ENAMEL FIXED TUBULAR		5-8	25K	1 x 5/16
		10-12	50K	1 3/4 x 5/16
		20	100K	2 x 7/16
MZ VITREOUS ENAMEL MIDGET OVALS WITH TABS		10	5000	3/8 x 5/32 x 3/4
		20	25K	3/8 x 5/32 x 2
ZR VITREOUS ENAMEL OVALS TAB TERMINAL		30	10K	5/16 x 1 x 1 1/4
		40	15K	5/16 x 1 x 2
		55	25K	5/16 x 1 x 3 1/2
		75	25K	5/16 x 1 x 6
RR VITREOUS ENAMEL EDGEWOUND WITH TABS		40	1.8	2 x 5/16
		90	3	4 x 5/16
		100	2.5	3 1/2 x 3/4
		160	5.5	6 x 3/4
		150	6.0	5 x 1
		300	13	8 1/2 x 1 1/8
		500	36	10 1/2 x 1 5/8
		750	40	12 x 2 1/2
		1500	100	20 x 2 1/2

MEMCOR-TRUOHM represent the cumulative design and production knowledge gained during 30 years experience in the industry.

Let MEMCOR-TRUOHM sales engineers aid you with your special design and application requirements.

For price, quality, and delivery look to MEMCOR-TRUOHM. Immediate delivery on stock value resistors. Typical 3-5 week delivery on other standard values and special requirements. These products are available from MEMCOR-TRUOHM's Nationwide Authorized Distributor Network.

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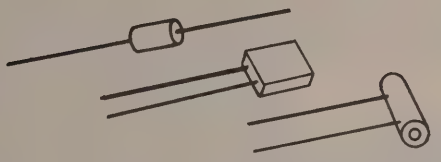
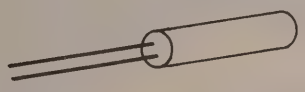
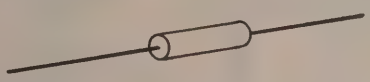
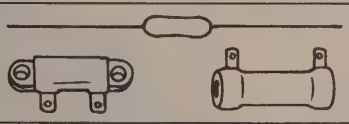
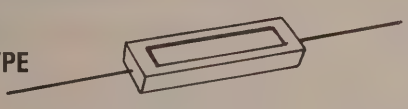
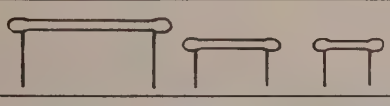
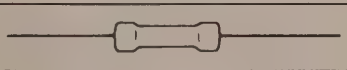
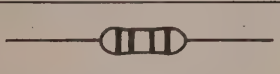
Fax No. 356-7376

MICRO-OHM CORPORATION

YOUR FULL LINE RESISTOR MANUFACTURER

	POWER RANGE (WATTS)	RESISTANCE RANGE (OHMS)	TEMPERATURE COEFFICIENT (PPM/°C)	RESISTANCE TOLERANCE (%)	DELIVERY (WEEKS)
PRECISION WIREWOUND MIL R-93 EQUIV. 	.01 to 2	.05 to 20M	±1 to +6000	.005 to 5	stock 4
WIREWOUND TEMP. SENSORS RTD'S 	1	40 to 1K	+3850 to +6720	1 to 5	4-6
WIREWOUND PRECISION FUSE 	.3 to 1	.2 to 200	+30 to +50	3 to 10	4-6
POWER WIREWOUND MIL R-26 EQUIV. 	.25 to 100	.002 to 265K	± 10 to +6000	.05 to 10	stock 4
POWER WIREWOUND MIL R 18546 EQUIV. CHASSIS MOUNT	5 to 250	.05 to 200K	±5 to +90	.025 to 5	4
POWER WIREWOUND "BATHTUB" TYPE 	2 to 50	.01 to 40K	±300 to ±800	5 & 10	4-6
KP SERIES POWER WIREWOUND 	2 to 8	.2 to 36K	+260 to +800	5 & 10	8-10
METAL FILM RN 50, 55, 60, & 65	.1 to 1	.5 to 10M	+25 to +200	.1 to 1	stock 8
METAL OXIDE 	.5 to 7	.2 to 240K	±200	2 & 5	stock 8
METAL GLAZE 	.25 to 4	1M to 10G	±100 to +350	.5, 1, 2 & 5	8
CARBON FILM RC 05, 07, 20, 32 & 42	.125 to 2	.5 to 22 M	-200 to -800	2 & 5	stock 8
TYPE CRZ PT. THIN FILM ELEMENTS	(CURRENT) 1MA-2MA	100 & 1K	+3850	.06 to .50	4-6
METAL FILM TEMP. SENSITIVE LPTC 12 POSITIVE LINEAR TC	.125	5 to 15K	+2500 to +4000	2 & 5	8
ZERO OHM	.125 & .250	—	—	—	stock

Catalog available on request

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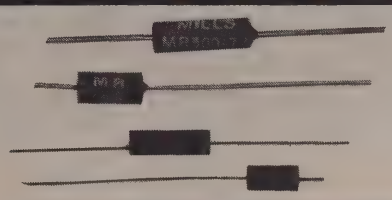
STANDARDS

Part No.	Watt	Max. R	Dia.	Length	Lead
MR100-1	.15	100K	.187	.375	#22
MR100-2	.25	1.5M	.250	.500	#22
MR100-3	.30	2.75M	.250	.750	#22
MR100-4	.35	3.0M	.375	.625	#20
MR100-5	.50	4.0M	.375	.828	#20
MR100-6	.50	5.0M	.50	.50	#20

Many other sizes available

- Lead Configuration:
  "A" after Part No. for Axial Leads
  "R" for Radial Leads
  "L" for Lugs
- For high speed applications (minimum distributed L and C) specify MR200 Series.
- For high stability applications specify MR300 Series.

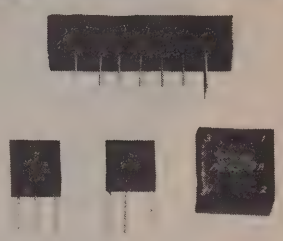
MINIATURE PARTS



Part No.	Watt	Max. R	Dia.	Length	Lead
MR500-1	.04	100K	.080	.210	#20
MR500-2	.05	125K	.080	.375	#24
MR500-3	.04	100K	.125	.125	#24
MR500-4	.05	125K	.100	.210	#24
MR500-5	.10	125K	.125	.187	#24
MR500-6	.10	125K	.125	.250	

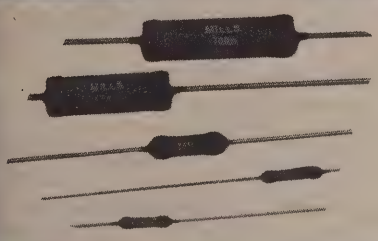
- Tolerance: .005% and up; to .002% in some cases.
- Ask for our Precision Resistor Catalogue.

NETWORKS



- Any configuration you desire.
- Matched 2, 3 or 4 Network configurations available in standard sizes.
- Standard R, 2R, 4R types, etc. available.
- Tolerances: To .005%, closer in some cases; Temperature Coefficient tracking to 1 PPM; Ratio matches to .001%.
- Ask for our Network Flyer.

PRECISION POWER WIREWOUND RESISTORS



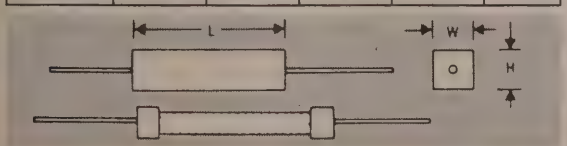
Part No.	Watt	Max. R	Dia.	Length	Lead
MRP-½	½	4.9K	.093	.343	#24
MRP-1	1	10.4K	.093	.406	#24
MRP-3	3	18K	.187	.562	#20
MRP-5	5	90K	.312	1.032	#18
MRP-10	10	370K	.344	1.719	#18

Many other sizes available

- To 15 watts.
- Silicone covered for maximum heat transfer.
- Tolerance: 5%, 1% standard, available to .05%.
- Non-Inductive winding available.
- Ask for our Power Resistor Catalogue.

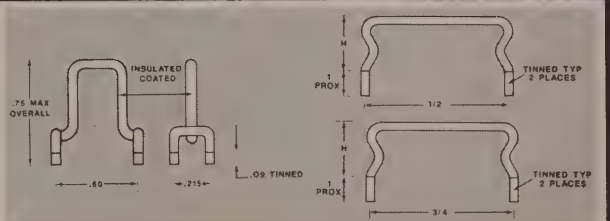
FIBERGLASS CORE WIREWOUND RESISTORS

Part No.	Watt	Dimensions W	H	L	Leads
MRW-5	5	⅜	⅜	⅞	#20
MRW-7	7	⅜	⅜	1⅜	#20
MRW-10	10	⅜	⅜	1⅞	#20
MRW-15	15	½	½	1⅞	#18
MRW-22	22	½	½	2½	#18



AVAILABLE CASED OR UNCASED

SHUNTS



FOUR-LEAD SHUNTS

- Best for close-tolerance sensing.
- Resistance values from .005 to .500.
- Tolerance ±.5% standard.
- Silicone coated body for good insulation and maximum heat transfer.

TWO-LEAD SHUNTS

- Resistance values per your requirements.
- ½", 1", 1½" centers are standard.
- Tinned for convenient insertion.
- Ask us about any configuration to suit your needs.

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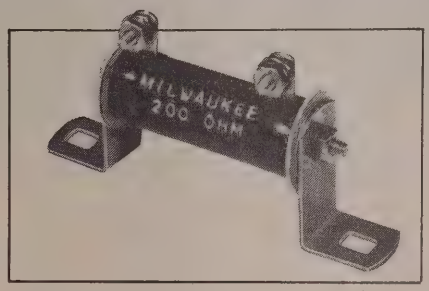
SACRAMENTO, CA 95823
(916) 422-5461
FAX (916) 422-1409

CUSTOM ROUNDWIRE POWER RESISTORS

BASIC CONSTRUCTION

MRC can build a resistor to your specifications on any of the basic cores shown. If these do not fit your needs, engineering assistance is available for 32 additional cores. Ratings based on 325°C above 25°C ambient. Consider the following options to meet your requirements, special applications, and size limitations.

- **Special Tolerance**
  Resistance tolerances to ±1%
- **Special Coatings**
  Silicone-cement



- **Special Taps**
  Most any to fit your specifications
- **Special Windings**
  Aryton-Perry (non-inductive round-wire only)
  Bifilar (non-inductive)

- **Special T.C.**
  Temperature coefficient to 20 ppm/°C
- **Special Terminals**
  Single and double ¼" quick connect
  Metal sleeve ferrule
  Live-bracket
- **Hardware**
  Terminal hardware
  L-bracket mounting
  Spring clip mounting
  Vertical mounting hardware

LOAD BANKS

MRC will custom design and build load banks to your requirements.

AVAILABLE WATTAGE RATINGS by core size. Ratings based on 325°C above 25°C ambient.

	Core Size	Ohmic Range				
Watts	O.D.xI.D.xL.	Fixed †		Adjustable †		Part No.*
		Min Ω	Max Ω	Min Ω	Max Ω	
8(5)†	5/16x3/16x1	.82	13.5K	N.A.	N.A.	5-16-Ω
12(10)†	5/16x3/16x1¾	.12	49K	0.27	10.6K	5-28-Ω
11(8)	7/16x5/16x1	1.39	7.2K	N.A.	N.A.	7-16-Ω
15(10)	7/16x5/16x1½	.16	28.7K	N.A.	N.A.	7-24-Ω
20(15)†	7/16x5/16x2	.13	53.2K	N.A.	N.A.	7-32-Ω
26	7/16x5/16x3	.11	122K	N.A.	N.A.	7-48-Ω
25(20)†	9/16x5/16x2	.22	35K	0.50	19K	9-32-Ω
31(25)	9/16x5/16x2½	.11	55K	0.71	28K	9-40-Ω
50(35)†	9/16x5/16x4	.21	119K	1.34	54K	9-64-Ω
75	9/16x5/16x6	.33	207K	2.18	89K	9-96-Ω
24	¾x½x1½	.33	13K	N.A.	N.A.	12-24-Ω
30(25)	¾x½x2	.28	29K	0.66	26K	12-32-Ω
45(35)	¾x½x3	.18	63K	1.21	49K	12-48-Ω
51(40)	¾x½x3½	.22	83K	1.49	61K	12-56-Ω
61(45)	¾x½x4	.27	97K	1.77	73K	12-64-Ω
65(50)	¾x½x4½	.31	122K	2.04	84K	12-72-Ω
75(60)	¾x½x5	.35	134K	2.32	96K	12-80-Ω
90	¾x½x6	.43	172K	2.87	119K	12-96-Ω
100†	¾x½x6½	.47	186K	3.15	131K	12-104-Ω
40(33)	1⅛x¾x2	.48	7.9K	N.A.	N.A.	18-32-Ω

	Core Size	Ohmic Range				
Watts	O.D.xI.D.xL.	Fixed †		Adjustable †		Part No.*
		Min Ω	Max Ω	Min Ω	Max Ω	
80	1⅛x¾x4	.06	53K	0.40	48K	18-64-Ω
95	1⅛x¾x5	.08	79K	.56	79K	18-80-Ω
120	1⅛x¾x6	.11	100K	.71	100K	18-96-Ω
130(115)	1⅛x¾x6½	.12	111K	.78	111K	18-104-Ω
160	1⅛x¾x8	.15	144K	1.00	144K	18-128-Ω
175(160)†	1⅛x¾x8½	.16	156K	1.08	156K	18-136-Ω
225†	1⅛x¾x10½	.21	200K	1.38	200K	18-168-Ω
235	1⅛x¾x11¼	.22	216K	1.49	216K	18-180-Ω
240	1⅛x¾x11¾	.24	227K	1.56	227K	18-188-Ω
220	1⅝x1½x8½	.21	69K	1.38	69K	26-136-Ω
275	1⅝x1½x10½	.27	90K	1.81	90K	26-168-Ω
300	1⅝x1½x11¾	.31	104K	2.07	104K	26-188-Ω
500‡	2½x1¾x12	.49	34K	3.24	34K	40-192-Ωc
750‡	2½x1¾x15	.63	44K	4.22	44K	40-240-Ωc
1000‡	2½x1¾x20	.89	62K	5.85	62K	40-320-Ωc
1150‡	3¼x1¾x20	1.140	41K	7.58	41K	52-320-Ωc

† Resistors shown are standard wattages
* Add "A" after part number for adjustable types.
† For resistance values outside the limits shown, consult MRC.
‡ Cement coating standard — Silicone available.
• Unable to find what you need above? The same cores can be wound with ribbon wire for higher wattage capability--See the ribwound **A•1989.**

MRC MILWAUKEE RESISTOR CORPORATION
700 WEST VIRGINIA STREET • MILWAUKEE, WI 53204-0219
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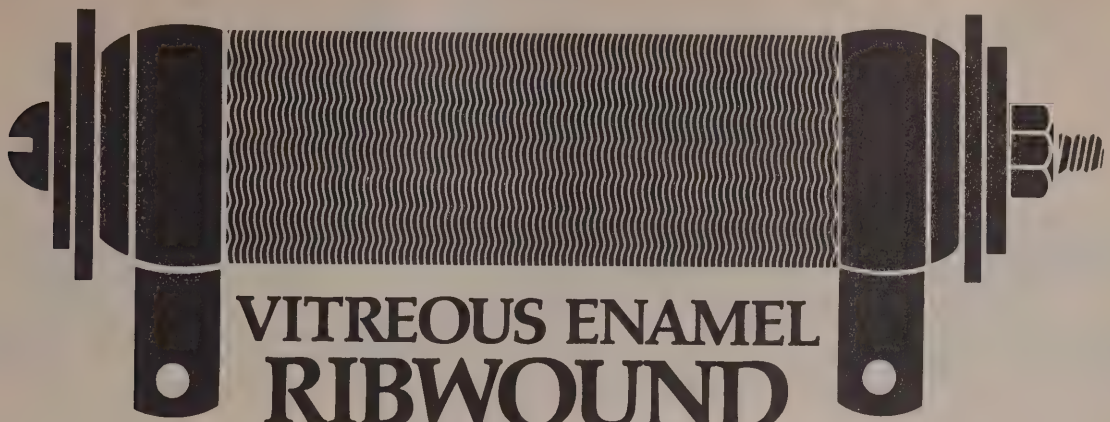

VITREOUS ENAMEL RIBWOUND RESISTORS

BASIC CONSTRUCTION

Crimped ribbon resistance wire is edgewound and then locked to the ceramic core with vitreous enamel. The resistance wire is spot welded to the terminal bands. MRC Ribwounds can be supplied in fixed, adjustable, or tapped styles. Cement or silicone coatings are optional.

HI-OHM RIBWOUNDS AN EXCLUSIVE WITH MRC

In the chart below, note that the maximum ohmic value shown for each wattage is 3 to 4 times higher than that normally available. This development is the result of precision rib winding machines designed specifically by MRC. Unique in the industry, these precision machines produce a winding with extreme uniformity. This allows much closer turns providing significantly higher resistance. Hi-Ohm Ribwounds can replace lower ohmic value roundwire power resistors with savings in size.

OHMS	OHMS	OHMS
0.1	1.25	10.0
0.15	1.5	12.0
0.2	2.0	15.0
0.25	2.5	16.0
0.375	3.0	20.0
0.5	4.0	25.0
0.6	5.0	33.0
0.75	6.0	50.0
1.0	8.0	100.0

Many 300 watt units are stocked in both fixed and adjustable styles. Listed are the more popular 300 watt ohmic values. All other wattage ratings and styles are made to order.

APPLICATIONS

Recommended for use where high energy is to be dissipated in the lower ohmic ranges. With its ability to dissipate greater heat, the ribwound resistor is almost one half the physical size of an equally rated roundwire.

Ribwound wattage ratings are based on a temperature rise of 375°C above an ambient of 40°C.

They can be mounted with spring clips (thru 1⅛" dia.); thrubolt hardware, individual or multiple-stacked bracket assemblies or live-bracket assemblies.

WATTS	CORE SIZE	OHMIC RANGE #		PART NUMBER	
	O.D. x I.D. x L.	FIXED	ADJ.	FIXED	ADJ.
40	9/16x5/16x2	.010-10.6	N.A.	9-32-ΩR	USE SAME PART NUMBER BUT SUBSTITUTE "AR" FOR "R".
50	¾x½x2	.020-8.2	N.A.	12-32-ΩR	
60	¾x½x2½	.010-13.7	N.A.	12-40-ΩR	
75	¾x½x3	.010-19.3	N.A.	12-48-ΩR	
90	9/16x5/16x4	.015-28.3	.014-25.3	9-64-ΩR	
100	¾x½x3½	.012-24.5	.011-20.7	12-56-ΩR	
110	¾x½x4	.015-30.6	.014-26.8	12-64-ΩR	
120 (110)	¾x½x4½	.018-36.8	.017-32.9	12-72-ΩR	
135	¾x½x5	.021-42.9	.020-39.0	12-80-ΩR	
150	1⅛x¾x4	.019-44.8	.018-39.0	18-64-ΩR	
160	¾x½x6	.027-55.0	.027-51.3	12-96-ΩR	
160 (155)	1⅛x¾x4¼	.021-49.2	.020-43.6	18-68-ΩR	
175	1⅛x¾x4½	.023-53.7	.022-48.1	18-72-ΩR	
180	¾x½x6½	.030-61.3	.030-57.4	12-104-ΩR	
220	1⅛x¾x6	.035-80.6	.035-75.0	18-96-ΩR	

WATTS	CORE SIZE	OHMIC RANGE #		PART NUMBER	
	O.D. x I.D. x L.	FIXED	ADJ.	FIXED	ADJ.
225 (220)	1⅛x¾x6⅛	.036-82.8	.036-77.2	18-98-ΩR	USE SAME PART NUMBER BUT SUBSTITUTE "AR" FOR "R".
240 (240)	1⅛x¾x6½	.038-89.5	.039-83.9	18-104-ΩR	
300 (300)†	1⅛x¾x8½	.054-125	.055-120	18-136-ΩR	
375	1⅛x¾x10½	.069-161	.072-156	18-168-ΩR	
400	1⅛x¾x11¼	.075-175	.078-169	18-180-ΩR	
400 (400)	1⅝x1⅛x8½	.061-159	.062-149	26-136-ΩR	
420	1⅛x¾x11¾	.079-184	.082-178	18-138-ΩR	
500 (500)	1⅝x1⅛x10½	.081-210	.083-200	26-168-ΩR	
550 (550)	1⅝x1⅛x11¾	.093-242	.097-232	26-188-ΩR	
750‡	2½x1¾x12	.128-166	.130-158	40-192-ΩRC	
1000‡	2½x1¾x15	.168-217	.176-209	40-240-ΩRC	
1500‡	2½x1¾x20	.234-303	.248-294	40-320-ΩRC	
2000‡	3¼x1¾x20	.281-391	.300-380	52-320-ΩRC	

Standard resistance tolerance is ±10%—closer on request.
† Stock wattage—see stock list above.
‡ Cement coating is standard rather than vitreous enamel.
Wattages in parenthesis are Navy ratings per Mil-R-15109, Form EW.

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700 WEST VIRGINIA STREET • MILWAUKEE, WI 53204-0219
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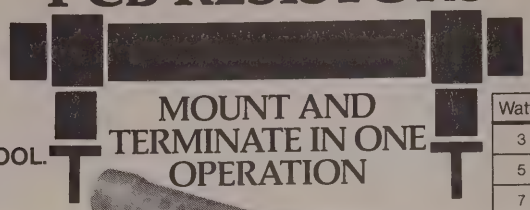
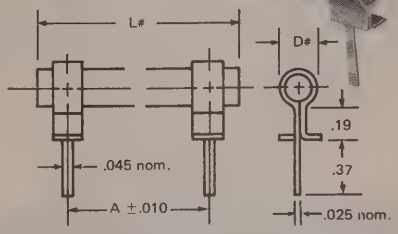
PCB RESISTORS



- **Built-in Standoffs Keep Board COOL.**
- Mounting feet prevent rocking.
- Power ratings 3 to 20 watts.
- Wide ohmic range.
- One-piece welded terminals.
- Standard pin spacing: 1/10″ cc multiples, special spacing on request.
- Rectangular pins .025 x .045 in. (mount in .078″ dia. PCB holes).
- Silicone-Quartz coating.
- Standard tolerances ±5% over 1 ohm, ±10% under 1 ohm & adjustable.
- 20 PPM upon request.
- Wattages based on 275° C rise above an ambient of 25° C.

* U.S. Patent 3,462,651.



FIXED

Watts	L#	A	D#	Min.Ω‡	Max.Ω‡	Part Number
3	1 1/32	0.6	5/16	.86	10K	3.5-13-Ω PCB
5	1 5/16	0.9	5/16	.181	19K	3.5-18-Ω PCB
7	1 27/32	1.3	5/16	.29	31K	3.5-24-Ω PCB
10	2 1/8	1.7	5/16	.4	43K	3.5-30-Ω PCB
15	2 1/8	1.7	13/32	.106	65K	5-32-Ω PCB
20	2 5/8	2.2	13/32	.142	88K	5-40-Ω PCB

ADJUSTABLE

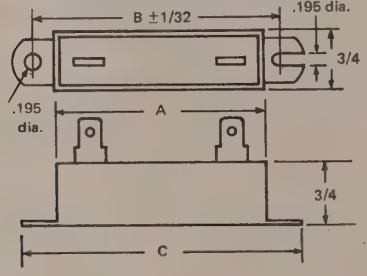
Watts†	L#	A	D#	Min.Ω‡	Max.Ω‡	Part Number
15	2 1/8	1.7	13/32	.69	14K	5-32-Ω A PCB
20	2 5/8	2.2	13/32	.93	19K	5-40-Ω A PCB

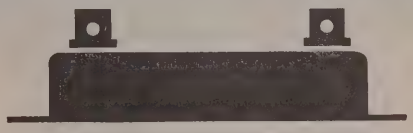
† Non-standard wattages in the range of 3-29 watts are possible—contact M.R.C.
‡ For resistances above or below the limits shown, contact M.R.C.
# Maximum measurements.

METAL CASE RESISTORS

For Motor Starting, Speed Control, Solid State Ignition Systems, Shunts, Potted Circuits, and Voltage Dropping

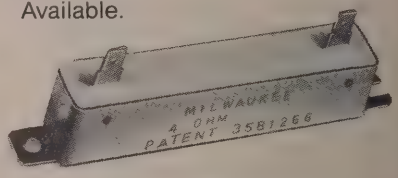
- High Heat Sink Capability—Flush Mounted Metal Case dissipates heat faster.
- Rugged—Shock Resistant.
- Wattage Rating-20 to 100 Watts-based on 275°C ambient.
- Resistance Range 0.2 ohm to 66,000 ohms (depending on voltage).





- Dielectric Strength—1500 Volts RMS (must be specified).
- Terminals—quick connect—screw/solder lugs.

- Additional Mounting Configurations Available.

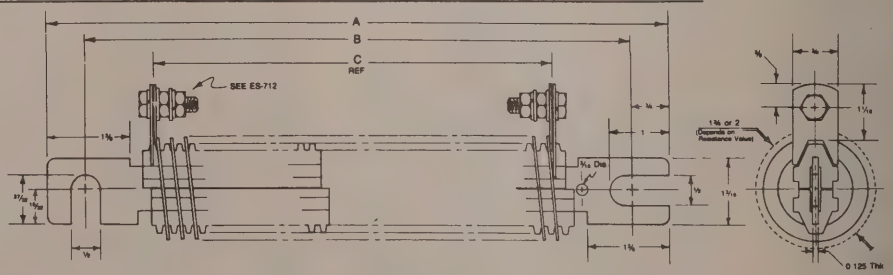


Watts Ratings at 275° C rise showing benefit of mounting flush for full heat sink.††		Dimensions			Ohmic Range		Part Number
Without Heat Sink	With Heat Sink	A	B	C	Min.Ω	Max.Ω	(Specify Terminal)
20	45	1	1 7/16	1 7/8	1.1	2750	12M16-Ω†
40	70	2 1/2	3	3 3/8	0.2	22K	12M40-Ω‡
50	100	3 11/16	4 1/8	4 9/16	0.2	66K	12M59-Ω‡

†† Ratings based on mounting on steel panel 10″ x 10″ x .040″; (heat transfer to heat sink is improved by the use of thermal conductive grease or epoxy).
† Standard terminal is 3/16″ wide with hole, Type AB.
‡ Standard terminal is single quick connect, Type H.

PAT. 3,581,266

EDGEWOUND POWER RESISTORS



Form 3			Form 4			Form 5			Form 6			Form 7			Form 8		
600 Watt			800 Watt			1,000 Watt			1,200 Watt			1,400 Watt			1,600 Watt		
A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
12¼	11	8¼	15¼	14	11¼	18¼	17	14¼	21¼	20	17¼	24¼	23	20¼	27¼	26	23¼

Wattage rating based on 375°C rise above an ambient of 40°C

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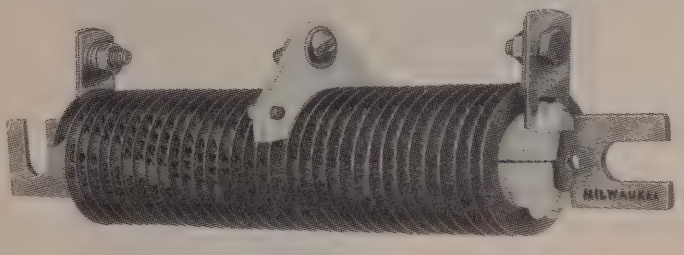
EDGEWOUND POWER RESISTORS

EDGE·POWER



HIGH CAPACITY GOOD WEIGHT/WATTAGE RATIO

EDGE-POWER resistors complement Milwaukee Resistor's roundwire, ribwound and grid resistors which have been the industry's workhorse of electrical power dissipation for many years.

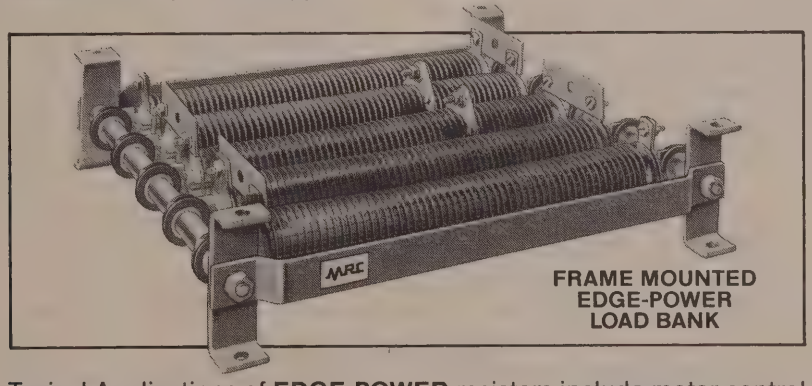
A continuous range of resistor types are now available for your high current applications. EDGE-POWER falls naturally between MRC's ribwound and grid resistors and allows full design versatility from one source.

Because of the open coil construction of EDGE-POWER resistors, heat dissipation is efficient, and reasonable surges/overloads are easily accommodated.

The heavy duty resistance-alloy coil is supported on specially designed porcelain insulators which provide insulation and proper turn-to-turn spacing. The end-slot/side-slot support bar provides versatility in mounting and adapts easily to many existing installations.

Movable tap terminals are available as an option. Terminal hardware for cable attachment is provided as a standard item on all terminals and taps.

Frame mounted load banks (as shown below) can be furnished with taps and jumpers to meet your circuit specifications (series, parallel or combination). Your load bank inquiries are invited.



FRAME MOUNTED EDGE-POWER LOAD BANK

Typical Applications of **EDGE-POWER** resistors include motor control (starting, plugging, speed control and braking), load dumping, ballast, current limiting, and voltage dropping. Edgewound resistors are commonly found in:

- Overhead Cranes
- Locomotives
- Lift Trucks
- Plating Baths
- Elevators
- Power Supplies
- Arc and Spot Welders
- Battery Lines/Chargers
- Many Industrial Controls

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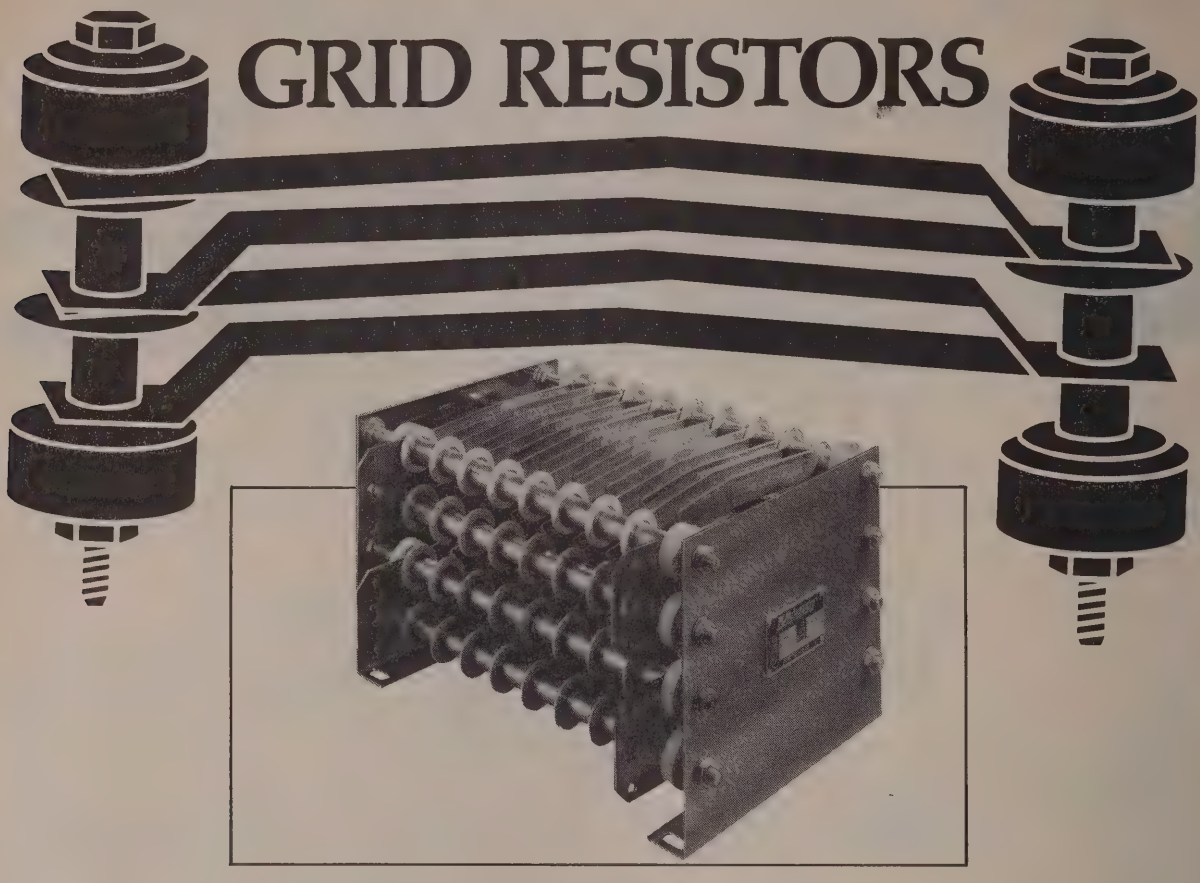
GRID RESISTORS



...For High Current and High Power Circuits

Milwaukee Grid Resistors are among the most versatile grid resistors developed. They are custom designed with the aid of a computer for specific applications.

Special features that assure longer life include: a patented* grid design that withstands overloads that would destroy conventional grids. Corrosion resistant stainless steel or special alloy elements. All-welded construction to eliminate hot spots and resistance fluctuations. Vibration-proof insulation that allows extended operation at higher voltages.

Taps and independent sections can be easily incorporated into the design to provide added flexibility. MRC grid units can be designed for use with natural convection cooling or with forced ventilation if size reduction is necessary.

They are competitively priced and incorporate more life and greater dependability than usually provided by conventional grid resistors.

*U.S. Patent 3,212,045

Typical Characteristics:

- 375° C temperature rise above an ambient of 40° C.
- Temperature coefficient of 150 ppm/° C.
- Hi potential test at 1500 VRMS—Higher on request.
- Resistances available to approximately 2 Ohms maximum.

Typical Applications:

- Motor starting
- Braking
- Power systems
- Crane controls
- Dummy loads
- Grounding resistors
- Speed controls
- Feedback resistors
- Heaters
- Industrial controls

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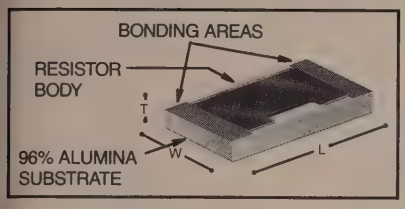
PRECISION THICK/THIN FILM CHIP RESISTORS

MINI-SYSTEMS, INC.
20 David Road, P.O. Box 69, North Attleboro, MA 02761
TELEPHONE: (508) 695-0203 • TWX 710-348-0564
FAX (508) 695-6076



MINI-SYSTEMS, INC., thick/thin film chip resistor components are ideally suited for the fabrication of microelectronic circuits where tight resistance tolerance, wide range of resistance values, or short production runs make the conventional screening and firing of thick/thin film resistance networks too costly. MINI-SYSTEMS, INC., chip resistors are made from a carefully engineered selection of materials. Geometries are mechanically precise and uniform. Careful testing and inspection result in the highest quality resistors.

STANDARD "MSR" SERIES

- Sizes available: .020″×.040″ up to .661″×.494″.
- PDIS Rating: 40mW to 15W.
- Resistors manufactured with palladium silver or platinum gold with or without nickel plating.
- Tolerances available: ±.5%, 1%, 2%, 5%, 10%, and 20% for most resistance values.
- All types available in untinned versions for conductive epoxy attachment.
- Hi-Rel screening available on all resistor types.
- Backside metallization available upon request.
- "Flip Chip" resistors are solder tinned (SN-62, SN-60, SN-63).
- Wire bond resistors have gold metallization optimized for wire bonding.
- Sandwich metallization standard on all wraparound resistors.
- Over 150 styles readily available.
- Also available untrimmed for in-circuit trimming.

***Wraparound Terminations**

WA-	Size (L × W)	PDIS Rating (Milliwatts)	Ohmic Range
56	.045×.030	.125	1Ω to 75MΩ
4	.054×.052	.125	1Ω to 100MΩ
13	.083×.052	.200	1Ω to 100MΩ
9	.110×.052	.250	1Ω to 100MΩ
7	.110×.102	.5	1Ω to 100MΩ
24	.160×.052	.3	1Ω to 100MΩ

*Other standard sizes available.
Write for free literature with detailed resistor chart.

ESTABLISHED RELIABILITY QPL MIL-R-55342 CHIP RESISTORS FOR ALL CRITICAL APPLICATIONS

- Sizes 55342/1 through /9
- Terminations Available: B, R, S, W, T and U
- Tolerances Available: 1.0, 2.0, 5.0, and 10.0%
- Meet or exceed Characteristic K
- Life Failure Rates: M, P, and R
- Delivery: Typically stock to 4 weeks
- Anti-Static Tape & Reel Available

THIN FILM

STANDARD AND CUSTOM HIGH RELIABILITY RESISTORS

MSTF SERIES - Standard Chip Resistors, 20×20 mils, 30×30 mils, and 40×40 mils.

CUSTOM NETWORKS - Designed and Fabricated to Customer Specifications

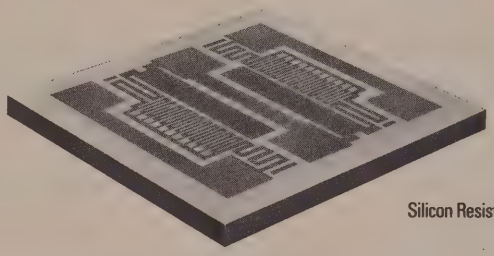
WRAPAROUND RESISTORS - Surface Mountable

METALLIZED SUBSTRATES - Photoetchable Blanks

MOS CAPACITORS - Compact, High Performance

ATTENUATORS - T, π, and Surface Mount Styles

MICROWAVE RESISTORS - Superior Frequency Response



Silicon Resistor

- Resistors - Nichrome, Tantalum Nitride or Sichrome
- Substrates - 99.6% Alumina Ceramic, Silicon, Quartz, Glass, Beryllia, or Aluminum Nitride (all with Gold Back option)
- Resistance Values - RETMA series and 1Ω to 1GΩ (style dependent)
- Tolerances - To 0.01% ΔR/R with Ratio Matching to 0.01%
- Temperature Coefficient of Resistance - To 10ppm for NiCr on Silicon, 25ppm for TaN on Silicon. TC Ratio Matching to 2ppm
- Bonding Pads - Wire Bondable Gold (20KAngstroms typ) or Aluminum (15KAngstroms), also Solder Tinned configurations
- Power Rating - 250mW standard, Higher power designs available
- Stability - 0.25% ΔR/R typical on 1000hr., 125C, 25mW performance
- Current Noise - -20dB typical
- Frequency - To 20GHz, (resistor geometry dependent)
- Stray Distributed Capacitance - Material dependent, <0.08pF with Alumina/TaN to 0.02pF for Quartz/NiCr
- Microwave Attenuators - 1dB to 24dB, Surface Mount Style available
- MOS Capacitors Values - From 4.7pF to 1000pF with TCC 25ppm
- Metallized Substrates - For optimum photopatterning, TaN/TiW/Au standard, other metallizations available
- Trimmable - Designed for customer active Xenon or YAG laser trim
- Visual Inspection - Mil-Std-883 with full lot traceability. Consult factory for technical and custom assistance

THICK/THIN MULTILAYER SUBSTRATES/ HYBRID MICROCIRCUITS

MINI-SYSTEMS, INC. has the latest materials technology processing capabilities for thick film and thin film multilayer substrates/monolithic substrates, and custom resistor networks coupled with complete facilities for hybrid assembly, packaging, and testing. Fully automatic wire bonders and fully automatic laser trim systems give substantial production quantity capabilities.

Check our other divisions for hermetic packages, custom hybrids, and multi-chip modules.

SUNBELT MICROELECTRONIC DIVISION
237 ENTERPRISE RD., DELTONA, FL 32725 407-574-0208 FAX: 407-574-8262

ELECTRONIC PACKAGE DIVISION
168 E. BACON ST., PLAINVILLE, MA 02762 508-695-2000 FAX: 508-695-8758

PRODUCT SELECTION GUIDES

TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 93/94 EDITION OF EEM

AC Power Supplies, Product Selection Guide **D•2221**

Batteries, Product Selection Guide **D•1419**

Cabinets, Enclosures, Racks & Chassis, Product Selection Guide **C•1003**

Capacitors, Product Selection Guide **A•1003**

Coils, Chokes, Inductors, Product Selection Guide **A•1179**

Connectors, Terminals & Sockets, Product Selection Guide **C•1139**

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DC-DC Converters **D•2049**

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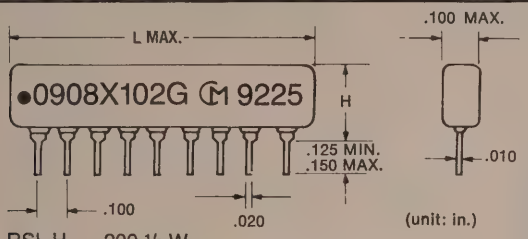
sip resistor networks

MURATA ERIE NORTH AMERICA



RSL H = .200 1/8 W
RSC H = .256 1/8 W
RSH H = .355 1/4-1/2 W

X-CIRCUIT

No. Pins	No. of Elements	L
4	3	.398
5	4	.496
6	5	.594
7	6	.693
8	7	.795
9	8	.894
10	9	.996
11	10	1.094
12	11	1.201
13	12	1.299
14	13	1.398

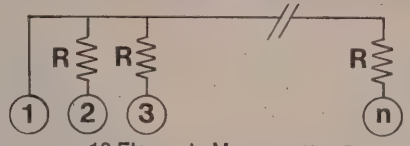
Y-CIRCUIT

No. Pins	No. of Elements	L
6	3	.594
8	4	.795
10	5	.996
12	6	1.201
14	7	1.398

Z-CIRCUIT

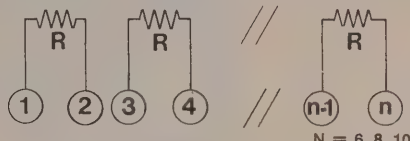
No. Pins	No. of Elements	L
6	8	.594
7	10	.693
8	12	.795
9	14	.894
10	16	.996

X-Circuit — Parallel



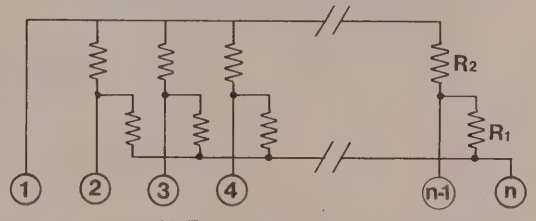
13 Elements Max. N = Pins 4 through 14

Y-Circuit — Discrete



7 Elements Max. N = 6, 8, 10, 12 and 14 Pins

Z-Circuit — Double Termination



16 Elements Max. N = 6, 7, 8, 9 and 10 Pins

7 other circuits are std. plus custom design circuits available upon request.

SPECIFICATIONS

Electrical

Temp. Range: −55°C to +125°C

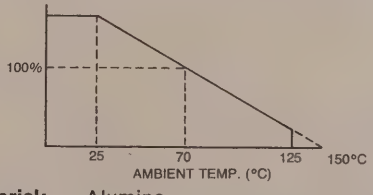
Resistance Range: 22Ω to 1MΩ

Resistance Tolerance: ±1%(F), ±2%(G), ±5%(J)

Temp. Coefficient: ±200 ppm/°C max. (±100 ppm/°C max. on special order)

Power: 100% at 70°C. Maximum ambient temperature at 0 Watt is 125°C.

Power Derating Characteristics:



Mechanical

Substrate Material: Alumina

Resistor Material: Cermet, thick film

Lead Pull Strength: 2 lbs.

STANDARD RESISTANCES

Res. (ohms)	Code	Res. (ohms)	Code
100	101	1K	102
150	151	1.5K	152
220	221	2.2K	222
330	331	3.3K	332
470	471	4.7K	472
680	681	6.8K	682

Res. (ohms)	Code	Res. (ohms)	Code
10K	103	100K	104
15K	153	150K	154
22K	223	220K	224
33K	333	330K	334
47K	473	470K	474
68K	683	680K	684

TYPICAL RESISTANCE COMBINATIONS*

R_1/R_2	R_1/R_2	R_1/R_2
160/240	330/390	330/390
180/390	330/470	1.5K/3.3K
220/330	330/680	3K/6.2K

*** Note 1:** In addition to $R_1=R_2$ resistance combinations, the typical resistor combinations shown in the chart are available on special order.

2: RC networks also available. Contact Murata Erie for technical details.

MARKING: Pin 1 Location, No. of Pins/Resistors, Circuit Type, Resistance Value, Tolerance, Mfr. Logo/Date Code

PART NUMBERING SYSTEM RSL 06 X 102 G

SINGLE IN-LINE RESISTOR NETWORK	NO. OF PINS	CIRCUIT TYPE	RESISTANCE CODE	RESISTANCE TOLERANCE
RSL (Low Profile) = 1/8 W RSC (Medium Profile) 1/4 W (Y), 1/32 W (L) RSH (High Profile) = 1/4 W (X,Z)	4 pins thru 14 pins standard	X = Parallel Y = Discrete Z = Double Termination, etc.	First two digits are significant. Last digit specifies number of zeros to follow	J = ±5% G = ±2% F = ±1%

MURATA ERIE NORTH AMERICA 220 Lake Park Dr., Smyrna, Georgia 30080 Tel: 1-800-831-9172 Telex: 26-1301 FAX: 1-404-684-1541

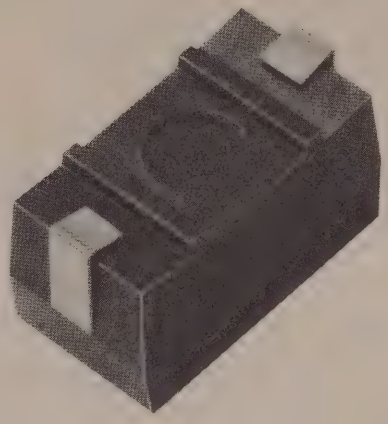
Surface Mount Resistors

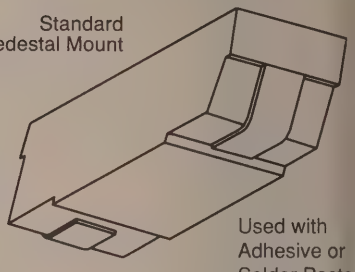
Wide variety of wattages available in two mounting designs

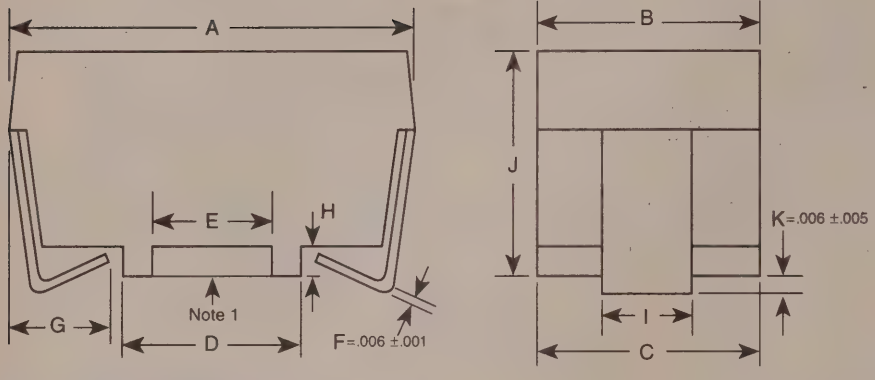
OHMITE® Manufacturing Company

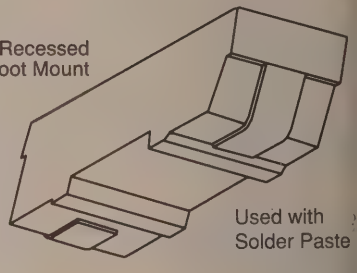
Features

- Six wattage sizes
- Five package sizes
- Wide ohmic range
- Three resistor technologies
- Two mounting designs
- Tape and reel 7" and 13"









Performance Specifications

Part Number	RF0S8BA	RW1S0BA	RF1S0CA	RP1S3CA	RW1S5CA	RP1S5CB RP1R5CB	RW2S0CB RW2R0CB	RP2S0DA RP2R0DA	RW2S0DA RW2R0DA	RP3R0EA	RW3R0EA
Power at 25°C ambient	.8 watts	1.0 watts	1.0 watts	1.25 watts	1.5 watts	1.5 watts	2.0 watts	2.0 watts	2.0 watts	3.0 watts	3.0 watts
Maximum voltage	200	50	350	350	75	350	100	500	100	750	350
Resistance range (1% tol.)	1–5M	0.1–1K	10–1M	N/A	0.1–1.5K	N/A	.1–5K	N/A	.01–5K	N/A	.01–25K
Resistance range (5% tol.)	.3–10M	.005–1K	1.0–10M	1–1M	.005–1.5K	1–1M	.005–5K	1–1M	.005–5K	1–1M	.005–25K
Temp. Coefficient 0.1 to 1 ohm	N/A	±90	N/A	N/A	±90	N/A	±90	N/A	±90	N/A	±90
PPM/°C 1 to 10 ohms	±100	±50	±200	±250	±50	±250	±50	±250	±50	±250	±50
10 ohms and over	±100	±20	±100	±250	±20	±250	±20	±250	±20	±250	±20
Dielectric Withstanding	1000V	1000V	1000V	1000V	1000V	1000V	1000V	1000V	1000V	1000V	1000V
Tape Size, 13" reels	12mm	12mm	16mm	16mm	16mm	16mm	16mm	24mm	24mm	32mm	32mm
Quantity per reel	2000	2000	1500	1500	1500	1000	1000	1000	1000	750	750
Package Modifier	A	A	A	A	A	B	B	A	A	A	A

Package Outline Dimensions

Packages		A	B	C	D	E	G	H	I	J
BA	(in.)	.246±.010	.136±005	.133 REF	.110±010	—	.047 NOM.	.018±.005	.054±.005	.136±.005
	(mm)	6.248±.254	3.454±.127	3.378 REF	2.794±.254	—	1.194 NOM.	.457±127	1.372±.127	3.454±.127
CA	(in.)	.394±.010	.159±.005	.156 REF	.220±.010	—	.062 NOM.	.018±.005	.078±.007	.159±.005
	(mm)	10.008±.254	4.039±.127	3.962 REF	5.588±.254	—	1.575 NOM.	.457±.127	1.981±.178	4.038±.127
CB	(in.)	.407±.010	.226±.005	.222 REF	.260±.005	.160±.020	.062 NOM.	.018±.005	.084±.013	.222±.005
	(mm)	10.338±.254	5.74±.127	5.639 REF	6.604±.127	4.064±.508	1.575 NOM.	.457±.127	2.134±.330	5.639±.127
DA	(in.)	.455±.010	.240±.005	.236 REF	.260±.005	.160±.020	.062 NOM.	.018±.005	.143±.012	.226±.005
	(mm)	11.557±.254	6.096±.127	5.994 REF	6.604±.127	4.064±.508	1.575 NOM.	.457±.127	3.632±.305	5.740±.127
EA	(in.)	.811±.010	.273±.005	.268 REF	.572±.010	.448±.020	.093 NOM.	.030±.005	.143±.012	.273±.005
	(mm)	20.599±.254	6.93±.127	6.807 REF	14.529±.254	11.379±.508	2.362 NOM.	.762±.127	3.632±.305	6.934±.127

Note 1: Packages BA and CA are only available with a standard base.
Packages CB and DA are available in either standard or recessed base.
Package EA is only available in a recessed base.

Ohmite Manufacturing Company, 3601 Howard St., Skokie, Illinois 60076, Tel. 708/675-2600, FAX 708/675-1505

POWER RESISTORS

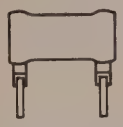
OHMITE®

Manufacturing Company

Lug Series

PC-58 Series

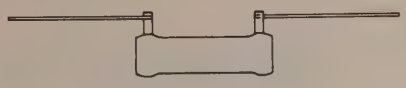
- 5% Tolerance
- Lead free vitreous enamel/silicone
- PC Board Mounting
- Ohmic Ranges:
  3W 1.Ω to 10kΩ
  5W 1.Ω to 20kΩ



3 & 5¼ Watts

Power Rating Watts	A ±.010	B ±1/32	C Max.	E Min.	L ±1/64
3	0.30 in.	0.469 in.	0.313 in.	0.031 in.	0.438 in.
	7.62 mm	11.91 mm	7.95 mm	.79 mm	11.13 mm
5¼	0.50 in.	0.516 in.	0.344 in.	0.031 in.	0.625 in.
	12.70 mm	13.11 mm	8.74 mm	.79 mm	15.88 mm

200 Series

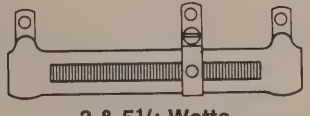


5¼ — 20 Watts

- 5% Tolerance
- Lead free vitreous enamel
- Radial Lugs/Axial Leads
- Ohmic Ranges:
  5W 1Ω to 10kΩ 12W .5Ω to 50kΩ
  8W 1Ω to 25kΩ 20W .5Ω to 100kΩ

Power Rating Watts	Length		O.D.		I.D.		Leads Ga.
	in.	mm	in.	mm	in.	mm	
5¼	.625	15.88	0.250	6.35	0.135	3.43	20
8	1.000	25.40	0.313	7.94	0.188	4.76	18
12	1.750	44.45	0.313	7.94	0.188	4.76	18
20	2.000	50.80	0.438	11.11	0.250	6.35	18

210 Series



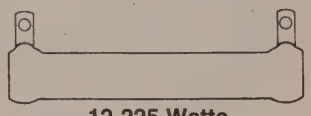
3 & 5¼ Watts

- 10% Tolerance
- Lead free vitreous enamel
- Radial Lugs
- Ohmic Ranges:
  12W 1.Ω to 10k
  25W 1.Ω to 25k
  50W 1.Ω to 100k
  750W 1.Ω to 100k
  100W 1.Ω to 100k
  175W 1.Ω to 100k
  225W 1.Ω to 100k

Power Rating Watts	Length		O.D.		I.D.	
	in.	mm	in.	mm	in.	mm
12	1.75	44.4	.313	7.94	.188	4.76
25	2.0	50.8	.562	14.3	.313	7.94
50	4.0	101.6	.562	14.3	.313	7.94
75	6.0	152.4	.562	14.3	.313	7.94
100	6.5	165.1	.75	19.1	.50	12.7
175	8.5	215.9	1.125	28.6	.75	19.1
225	10.5	266.7	1.125	28.6	.75	19.1

270 Series

- 5% Tolerance
- Lead free vitreous enamel
- Radial Lugs
- Ohmic Ranges:
  12W .51Ω to 51kΩ 150W 1.Ω to 8.2k 100W 1.Ω to 250kΩ
  25W 1.Ω to 100kΩ 225W 1.Ω to 8.2k 50W 1.Ω to 250kΩ

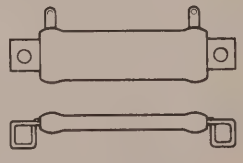


12-225 Watts

Power Rating Watts	Length		O.D.		I.D.	
	in.	mm	in.	mm	in.	mm
12	1.75	44.4	.313	7.94	.188	4.76
25	2.0	50.8	.562	14.3	.313	7.94
50	4.0	101.6	.562	14.3	.313	7.94
100	6.5	165.1	.75	19.1	.50	12.7
175	8.5	215.9	1.125	28.6	.75	19.1
225	10.5	266.7	1.125	28.6	.75	19.1

250 Series

- 5% Tolerance
- Lead free vitreous enamel
- Stackable Radial Lug
- Ohmic Ranges:
  10W 1.Ω to 5k
  20W 1.Ω to 50k
  30W 1.Ω to 10k
  40W 1.Ω to 25k
  55W 1.Ω to 30k



12-225 Watts

Power Rating Watts	Fig. No.	Length (L)		Width (W)		Thickness (Th)	
		in.	mm	in.	mm	in.	mm
10	1	.750	19.050	.375	9.525	.125	3.175
20	1	2.000	50.800	.375	9.525	.125	3.175
30	2	1.250	31.750	1.000	25.400	.250	6.350
40	2	2.000	50.800	1.000	25.400	.250	6.350
55	2	3.500	88.900	1.000	25.400	.250	6.350

Corrib Series

- 10% Tolerance
- Fixed, Adjustable
- Lead free vitreous enamel
- High Current Lug
- Ohmic Ranges:
  35W .02Ω to 1.25kΩ
  300W 1.Ω to 20kΩ

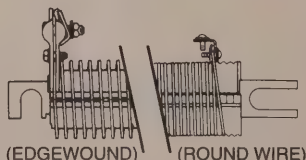
35 & 300 Watts

Watts	Style
35	Fixed
300	Fixed/Adj.

Powr-Rib Series

- 10% Tolerance
- Clamp Terminals
- High Current
- Ohmic Ranges:
  PF E5 .1Ω to 8.5Ω
  PF R5 11Ω to 25Ω

Adj. terminals available



(EDGEWOUND) (ROUND WIRE)

700-1000 Watts

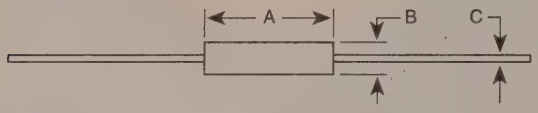
OHMS	H ±.125 (3.175)		D ±.125 (3.175)	
	in.	mm	in.	mm
.10—.22	3.313	84.150	2.125	53.975
.25—1.00	3.125	79.375	1.875	47.625
1.30—1.60	2.563	65.100	1.875	47.625
2.20, 2.80, 4.50, 5.40	2.500	63.100	1.750	44.450
3.50, 6.80, 8.50	2.438	61.925	1.625	41.275

Ohmite Manufacturing Company, 3601 Howard St., Skokie, Illinois 60076, Tel. 708/675-2600, FAX 708/675-1505

Axial Resistors - Low Ohm - Fusible - Economical

OHMITE® Manufacturing Company

Axial Lead
WP Series
Phenolic Molded Axial Lead
Wirewound Resistors
5% Tolerance



FEATURES

- Molded construction
- Hot-clamp termination
- Dense packaging
- Insulated

Ideal for automatic insertion. Molded jacket allows direct PCB contact.

IEC Color Code Markings.

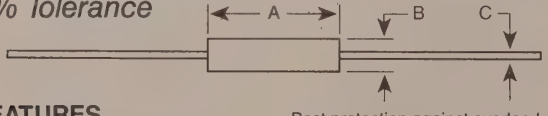
SPECIFICATIONS

MATERIAL
Coating: Thick phenolic
Core: Fiberglass
Terminals: Solder coated axial lead
DERATING:
Linearly from 100% @ 50°C to 0% at 185°C.

ELECTRICAL
Tolerance: ±5% (10% available)
Power Rating: Based on 50°C free air rating
Overload: 10 times rated power for five secs.
Dielectric withstanding voltage: 700 VAC (VRMS): 1.0 watt rating
1000 VAC: 2.0 watt rating

Power rating (watts)	1.0	2.0
5% tolerance	WP1J	WP2J
Ohmic range	.10 ohms-1K2	.10 ohms-2K4
Maximum volts	30	50
Dimensions		
Length A (in.)	.039	0.56
(mm)	9.9	14.3
Diameter B (in.)	0.14	0.22
(mm)	3.6	5.7
Diameter C (in.)	0.03	0.04
(mm)	0.8	1.0

Axial Lead Fusible
WF Series
Phenolic Molded Axial Lead
Wirewound Resistors
5% Tolerance



FEATURES

- Failsafe and flame retardant
- Molded construction
- Hot-clamp termination
- Insulated

Best protection against overload circuits.
IEC Color Code Markings with 5th band (blue) indicating flame retardant type.

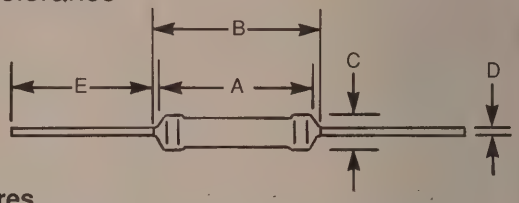
SPECIFICATIONS

MATERIAL
Coating: Thick phenolic
Core: Fiberglass
Terminals: Solder coated axial lead
DERATING:
Linearly from 100% @ 50°C to 0% at 185°C.

ELECTRICAL
Tolerance: ±5% (10% available)
Power Rating: Based on 50°C free air rating
Dielectric withstanding voltage: 700 VAC (VRMS): 1.0 watt rating
1000 VAC: 2.0 watt rating

Power rating (watts)	1.0	2.0
5% tolerance	WF1J	WF2J
Ohmic range	.10 ohms-1K	.10 ohms-1K
Maximum volts	38.73	27.386
Dimensions		
Length A (in.)	.039	0.56
(mm)	9.9	14.3
Diameter B (in.)	0.14	0.22
(mm)	3.6	5.7
Diameter C (in.)	0.03	0.04
(mm)	0.8	1.0

PowrFilm® Metal Alloy Film Resistors 5% Tolerance



Features

- High power to size ratio.
- Economical.
- Endures continuous full loading with very little change in value over time.
- Excellent applications where compact, space saving resistors are required.

Specifications

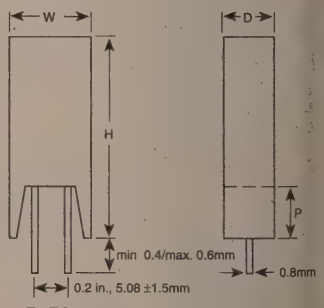
MATERIAL
Coating: Non-flammable silicone.
Core: High grade ceramic.
Terminals: Solder coated axial lead.
Weight: PFI .40 gms; PF2 .91 gms.

ELECTRICAL
Tolerance: ±5%
Power Rating:

Series Number	PF1		PF2	
	Watts	Ohms	Watts	Ohms
Power At 25C° Ambient	2.0	≤27K	3	≤51K
	1.5	>27K	2.4	>51K
Power At 70C° Ambient	1.6	≤27K	2.5	≤51K
	1.2	>27K	2.0	>51K

Type	A Max Length	B Clean Lead To Clean Lead	C Max Diameter	D Lead Diameter	E Lead Length
PF1	.394" (10mm)	.433" (11mm)	.154" (3.9mm)	.024" (.6mm)	1.5" (38mm)
PF2	.657" (17mm)	.704" (18mm)	.205" (5.2mm)	.024" (.6mm)	1.5" (38mm)

Vertical Mount
TW Series
Ceramic Housed
Wirewound Resistors
5% Tolerance



FEATURES

- Radial leads for PC Mounting
- 2.5 to 7W power ratings
- 0.1 to 15K ohm resistance range

SPECIFICATIONS

MATERIAL
Terminals: Solder coated radial lead.
Core: Fiberglass
Coating: Ceramic
DERATING:
Linearly from 100% @ 25°C to 0% at 250°C.

ELECTRICAL
Tolerance: ±5% (10% available)
Power Rating: Based on 25°C free air rating
Max, continuous voltage: $\sqrt{P_N \cdot R}$

Power rating (watts)	2.5	4	5	7
5% tolerance	TW3	TW4	TW5	TW7
Ohmic range	R10-1K2	R120-2K4	R10-9K1	R10-15K

Power rating (watts)	2.5	4	5	7
Dimensions	TW3	TW4	TW5	TW7
Length H (in.)	0.79	0.98	1.18	1.46
(±1mm)	20	25	30	37
Length W (in.)	0.47	0.47	0.47	0.47
(±0.5mm)	12	12	12	12
Width D (inc.)	0.24	0.28	0.31	0.35
(±0.4mm)	6	7	8	9
Width P (in.)	0.16	0.24	0.31	0.39
(±.02mm)	4	6	8	10

Ohmite Manufacturing Company, 3601 Howard St., Skokie, Illinois 60076, Tel. 708/675-2600, FAX 708/675-1505

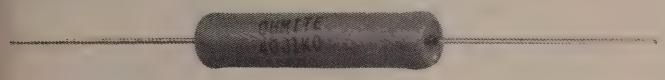
AXIAL LEAD RESISTORS

OHMITE®
Manufacturing Company

40 Series

Ohmicone® Silicone-Ceramic Conformal Axial Lead Wirewound Resistors 1% and 5% Tolerances

- **Economical**
- **Applications** include commercial, industrial and communications equipment.
- **Stability** under high temperature conditions.
- **All**-welded construction.



Power rating (watts)	1	2	3	4	10
1% tolerance	41F	42F	43F	45F	40F
5% tolerance	41J	42J	43J	45J	40J
Resistance range	.5-3K	.1-4K	.1-20K	.1-60K	.1-150K
Dimensions					
Max. length A (in.)	.437	.406	.563	.937	1.843
(mm)	11.1	10.3	14.3	23.8	46.8
Max. diam.: B (in.)	.125	.219	.250	.343	.406
(mm)	3.2	5.6	6.4	8.7	10.3
Leads gauge	24	20	20	18	18

80 Series 1% Tolerance

Acrasil® Silicone-Ceramic Conformal Axial Lead Wirewound Resistors MIL-R-26 Specifications 1% and 5% Tolerances

- **High Stability** ±1%Δ R.
- **Designed** for precision power applications.
- **Resistors** marked with "Mil" designation and Ohmite stock part number.
- **In accordance** with MIL-R-26 specifications.

Power rating (watts)	1	2	3	5	6.5	10	11
1% tolerance	81F	83F	—	85F	—	80F	—
5% tolerance	—	—	83J	—	85J	—	80J
Mil Designation	RW70U	RW79U	RW69V	RW74U	RW67V	RW78U	RW68V
Resistance range	.1-5K	.1-25K	.1-34K	.1-100K	.1-150K	.1-200K	.1300K
Dimensions							
Max. length A (in.)	.437	.597	.563	.937	.937	1.842	1.842
(mm)	11.1	15.2	14.3	23.8	23.8	46.8	46.8
Max. diam.: B (in.)	.125	.218	.250	.343	.343	.406	.406
(mm)	3.2	5.5	6.4	8.7	8.7	10.3	10.3
Leads gauge	24	20	20	18	18	18	18

20 Series

Vitreous Enamel Conformal Axial Lead Wirewound Resistors 5% Tolerance

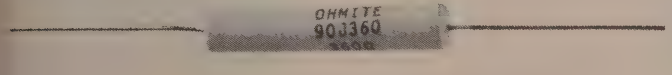
- **Rugged** vitreous enamel coating withstands high humidity and temperature cycling.
- **Durable** construction, recommended for industrial applications where reliability is paramount.
- **All**-welded construction.
- **Flame resistant** vitreous enamel coating.

Power rating (watts)	1	2	3	5	7	10
5% tolerance	21J	22J	23J	25J	27J	20J
Resistance range	.1-3K	.1-5K	.1-20K	.1-50K	.1-100K	.1-150K
Dimensions						
Max. length A (in.)	.406	.406	.562	1.000	1.250	1.797
(mm)	10.3	10.3	14.3	25.4	31.8	45.6
Max. diam.: B (in.)	.156	.219	.250	.250	.343	.343
(mm)	4.0	5.6	6.4	6.4	8.7	8.7
Leads gauge	24	20	20	20	20	20

90 Series

Vitreous Enamel Molded Axial Lead Wirewound Resistors 5% Tolerance

- **Molded** construction provides consistent shape and size (Permits mounting in clips which extends power rating).
- **Meets** MIL-R-26 requirements for insulated resistors.
- **All**-welded construction.
- **Flame resistant** vitreous enamel coating.

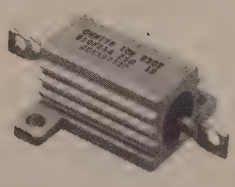


Power rating (watts)	1½	2¼	3¼	5	11
5% tolerance	91J	92J	93J	95J	90J
Resistance range	.1-3K	.1-5K	.1-20K	.1-50K	.1-150K
Dimensions					
Max. length A (in.)	.437	.390	.562	.953	1.796
(mm)	11.1	9.9	14.3	24.2	45.6
Max. diam.: B (in.)	.140	.219	.234	.234	.343
(mm)	3.6	5.6	5.9	5.9	8.7
Leads gauge	24	20	20	20	20

89 Type

Metal-Mite® Aluminum Housed Axial Lead Wirewound Resistors 1% Tolerance

- **1% and 5% Tolerance**
- **Aluminum Housed**
- **Military Approved**



Features

- **High Stability** ±0.5%Δ R.
- **High power** to size ratio.
- **Metal** housing allows chassis mounting and provides heat sink capability.
- **In accordance** with MIL-R-18546 specifications.
- **Resistors** marked with "MIL" designation and Ohmite stock part number.

MIL-R-type	Watts	Ohmic Range
RE60G	5†	1.0-25K
RE65G	10†	1.0-50K
RE70G	20††	1.0-75K
RE75G	30††	1.0-100K

† Can be rated 7.5 and 12.5 watts respectively.
†† Rated 25 and 50 watts, respectively, by Ohmite.

Ohmite Manufacturing Company, 3601 Howard St., Skokie, Illinois 60076, Tel. 708/675-2600, FAX 708/675-1505

Rheostats (Potentiometers)

Wirewound

OHMITE® Manufacturing Company

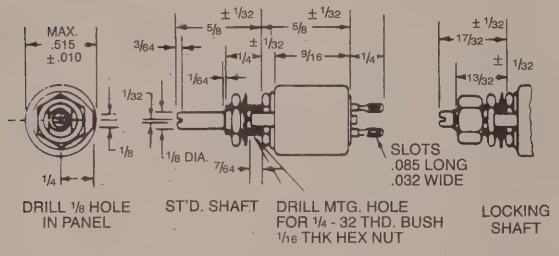
Features

- **Potentiometer** and Rheostat applications.
- **Linear** windings on stock models; tapered windings available on a special order basis.
- **Windings** secured to prevent shifting.
- **Fine** graduation of control.

Model C • 7½ Watt

Model C

7.5 Watt Standard and Locking Shaft


MAX. .515 ±.010
1/8 DIA.
SLOTS .085 LONG .032 WIDE
DRILL 1/8 HOLE IN PANEL
ST'D. SHAFT
DRILL MTG. HOLE FOR 1/4 - 32 THD. BUSH 1/16 THK HEX NUT
LOCKING SHAFT

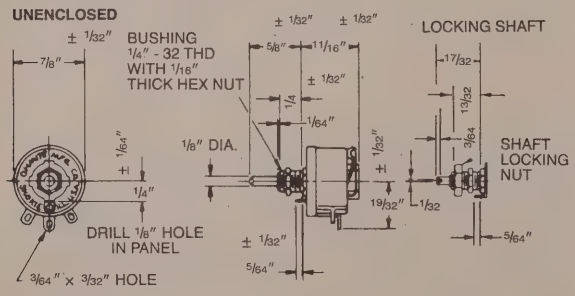
Shaft: Torque .25–3 oz. in.
Rotation 300° (±5°)
Weight: .27 oz.

Model E • 12½ Watt

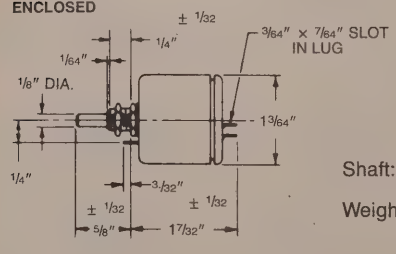
Model E

12.5 Watt Enclosed and Unenclosed
(Standard and Locking Shaft)

UNENCLOSED



ENCLOSED



Shaft: Torque 1-6 oz. in
Rotation 300° (±5°)
Weight: Unenclosed .6 oz.
Enclosed .85 oz.

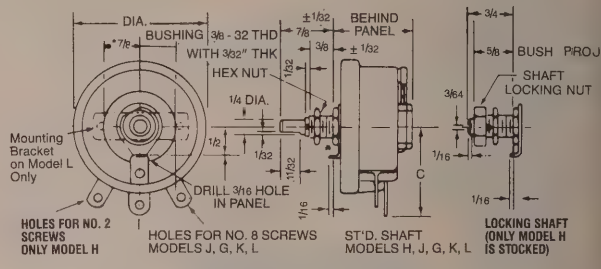
Models H, J, G, K, L

Models	Watts	Diameter
H	25	1 9/16 in.
J	50	2 5/16 in.
G	75	2 3/4 in.
K	100	3 1/8 in.
L	150	4 in.

Models H, J, G, K, L*

25, 50, 75, 100, 150 Watt

* No non-turn on Model L. Mounting Bracket on Model L only: (2) 10-32 screw mounting holes. 7/8" each side of shaft center.


DIA.
BUSHING
3/8 - 32 THD WITH 3/32" THK
HEX NUT
1/4 DIA.
BEHIND PANEL
BUSH PROJ
SHAFT LOCKING NUT
Mounting Bracket on Model L Only
DRILL 3/16 HOLE IN PANEL
HOLES FOR NO. 2 SCREWS ONLY MODEL H
HOLES FOR NO. 8 SCREWS MODELS J, G, K, L
ST'D. SHAFT MODELS H, J, G, K, L
LOCKING SHAFT (ONLY MODEL H IS STOCKED)

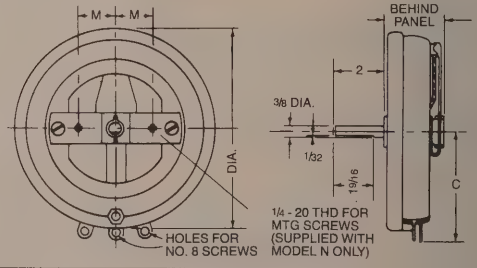
Models	H	J	G	K	L
Dia. (in.)	1 9/16	2 5/16	1 3/4	3 1/8	4
C Dim. (in.)	15/16	1 9/16	1 25/32	1 25/32	2 9/32
Behind Panel (in.)	1 3/8	1 3/8	1 3/4	1 3/4	2
Shaft Torque (lb. in.)	.25-5	.25-2	.5-2	.5-2	.5-3
Rotation (±5°)	300°				
Weight (lbs.)	.19	.32	.52	.64	1.1

Models P, N, R, T, U

Models	Watts	Diameter
P	225	5 in.
N	300	6 in.
R	500	8 in.
T	750	10 in.
U	1000	12 in.

Models P, N, R, T, U

225, 300, 500, 750, 1000 Watt



Models	P	N	R	T	U
Dia. (in.)	5	6	8	10	12
M Dim. (in)	7/8	1 3/16	1 1/2	1 7/8	3
C Dim. (in.)	2 31/32	3 7/16	4 5/16	5 9/16	6 3/8
Behind Panel (in.)	2 1/8	2 3/8	2 1/8	3	3
Shaft Torque (lb. in.)	2.5-4	2.5-5	4.5-7	3.5-7	3.5-7
Rotation (±5°)	310°	320°	325°	330°	335°
Weight (lbs.)	2	2.6	4	7.6	10

Standard Mounting

Model	Description
C, E	Panels to 1/8" (max.) thickness with 1/4—32 bushing and hex nut. Non turn lug requires 1/8" hole 1/4" below shaft center.
H, J, G, K, L	Panels to 1/4" (max.) thickness with 3/8—32 bushing and hex nut, (or with 10-32 × 3/4" F.H. screws for Model L only. Non turn lug requires 3/16" hole 1/2" below center of shaft, does not apply to model L.
P, N, R, T, U	Panels to 1 1/4" (max.) thickness with 1/4—20 flat head screws.

Ohmite Manufacturing Company, 3601 Howard St., Skokie, Illinois 60076, Tel. 708/675-2600, FAX 708/675-1505

A COMPANY OF VISHAY OHMTEK

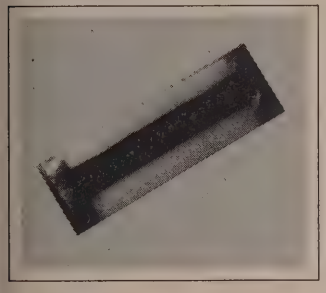
Surface Mount Resistors Chips/Networks

THICK FILM WRAPAROUND CHIP RESISTORS
Mil-R-55342, Char. "K"
TCR to ±100 ppm/°C

- Greater design flexibility
- Resistance range: 10 Ω to 10M Ω
- Tolerances to 1%
- Several standard sizes (including 1206)
- Customs available
- Wave or reflow mounting
- Auto placement compatibility
- Tape and reel or bulk packaging

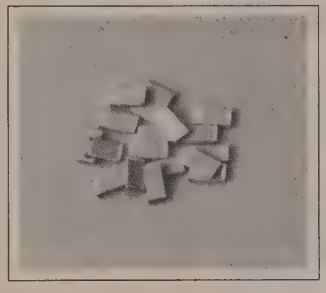
PRECISION THIN FILM WRAPAROUND CHIP RESISTORS
Mil-R-55342, Char. "E"
TCR to ±25 ppm/°C

- Resistance range: 100 Ω to 1M Ω
- Tolerances to 0.1%
- Standard sizes (including 1206)
- Ideal for high frequency, low noise, and tight TCR applications requiring good stability



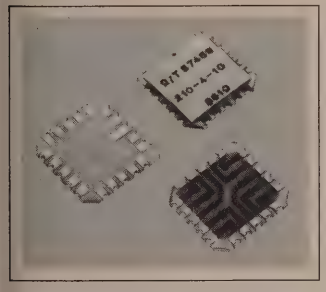
ULTRA-HIGH VALUE CERMET WRAPAROUND CHIP RESISTORS

- High ohm resistance range: 10M Ω to 500M Ω
- Tolerances: 5%, 10%, 20%
- Standard sizes available
- Bulk or tape and reel packaging
- Economically priced industrial grade features



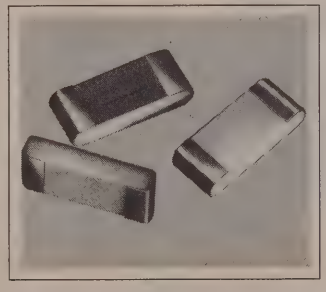
PRECISION THIN FILM WRAPAROUND CHIP RESISTORS

- TCR ±25 ppm/°C and ±50 ppm/°C
- Resistance range: 10 Ω to 1M Ω
- Tolerances: 0.1% to 10%
- Standard sizes: 0505, 0705, 1005, 1206, 1505, 2205, 2010, 2512
- Pre-tinned or gold over nickel barrier
- Tantalum nitrite resistor film available



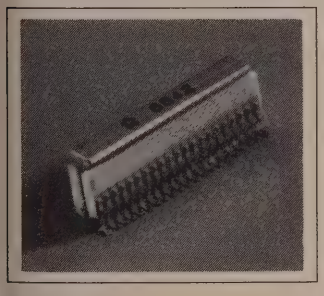
LEADLESS CHIP CARRIERS
Designed to meet Mil-R-83401
Characteristic "K", "M"
TCR to ±100 ppm/°C

- Saves board space and reduces assembly costs
- Wide resistance range: 10 Ω to 1M Ω
- Tolerances to 1%
- 14 thru 28 terminals (20 standard)
- JEDEC standard "A" & "B" schematics or custom circuits
- Glazed overcoat or ceramic cover
- Auto placement compatability



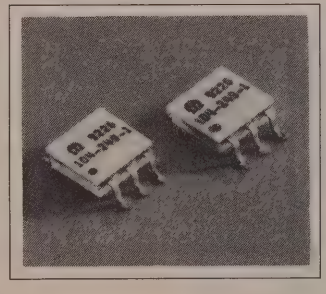
ULTRA-LOW VALUE WRAPAROUND CHIPS

- Low ohm resistance range: 0.05 Ω to 10 Ω
- Precision tolerances for current sensing applications
- Good stability— TCR better than ± 100 ppm/°C
- High power: up to 0.5 watt/+75°C
- Standard sizes: 0505, 0705, 1005, 1206, 1505, 2205, 2010, 2512
- Wave or reflow mounting
- Solder coating with nickel barrier



CUSTOM SURFACE MOUNT NETWORK

- Thermal compression bonded lead attachment
- 42 leads per package
- 25 mil pitch
- Unique intergrated construction



PRECISION SMALL OUTLINE RESISTOR NETWORK
TCR ±25 ppm/°C

- Wide resistance range 100 Ω to 100K Ω
- Tracking ±5 ppm/°C
- Rugged molded case construction
- Tolerances to 0.05%
- Maximum voltage 100 V
- Compatible with auto-placement equipment
- Standard circuits available

Features

- All wraparound connections feature a thin film adhesion layer covered with a leach-resistant nickel barrier layer and solder coated for +150°C applications.
- Ruthenium-based cermet thick film yields dependable performance and low cost.
- Hi-Rel screening available on all resistor types with all Mil-Spec Qualification testing in-house.
- Special metalization and custom sizes available upon request.
- Tape and Reel or static free waffle pack packaging is standard.
- Non inductive.
- Glass fired passivation as standard adds reliability and stability to the resistor elements.

Performance/Design Characteristics

- Tolerances: ±0.1% to ±20%
- Resistance values: 0.1 ohm to 500 megohms
- TCR: Thin Film: ±50 ppm/°C (standard)
  Thick Film: ±100 ppm/°C (standard)
- Operating temperature range: –55°C to +150°C

2160 Liberty Drive ■ Niagara Falls, NY 14304 ■ (716) 283-4025 ■ FAX (716) 283-5932

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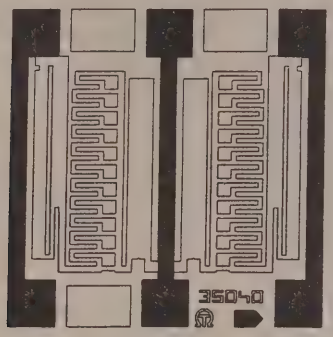
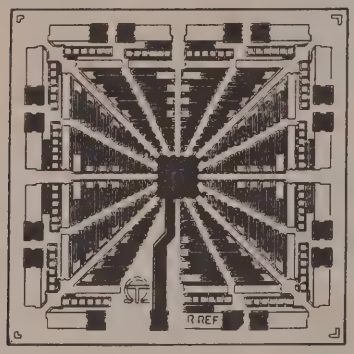
Hybrid Microelectronic Resistor Wire Bondable Products

Thin Film Wire Bondable Chip Resistors



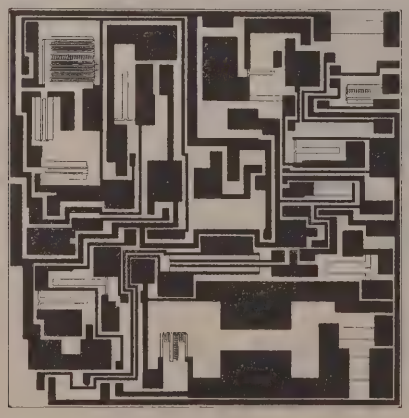
- Standard single value and center tap style
- Gold or aluminum terminations
- 4.7 Ω to 1M Ω resistance range
- Silicon or alumina substrates
- Off the shelf availability
- Custom values available

Thin Film Resistor Networks



- Custom resistor design
- Standard schematic available
- Tantalum and Nichrome based films
- Silicon and alumina substrates
- User trimmable networks available

Thin Film Hybrid Substrates



- Custom layouts
- 15 and 25 mil alumina substrates
- Nickle barrier metalization available
- Resistor/conductor or conductor only
- Back side metalization available
- User trimmable substrate available

- **Visual inspection per MIL-S-833, method 2032 class B**
- **Testing per MIL-S-883, method 5008 class B**
  MIL-R-55342 group A, B and C
- **Quality system per MIL-S-790**

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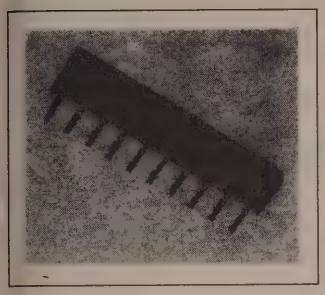
Precision Resistor Networks

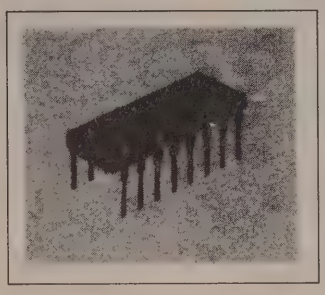
Close Tracking — Tight Ratio Tolerance

Rugged Construction Provides Dependable Performance at Minimum Cost



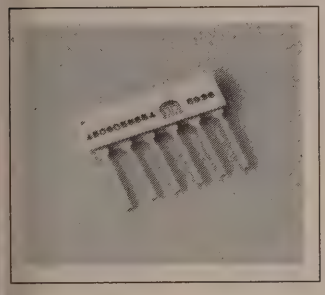
SINGLE-IN-LINE MOLDED

- Meets MIL-R-83401 characteristics "V" and "H"
- 6, 8 and 10 lead molded construction
- High and low profile available
- Thermal compression bonded lead attach



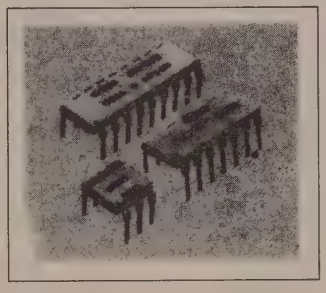
DUAL-IN-LINE HERMETIC

- Meets MIL-R-83401 characteristic "C"
- 8, 14, 16, 18 and 20 lead packages available
- Chip and wire construction



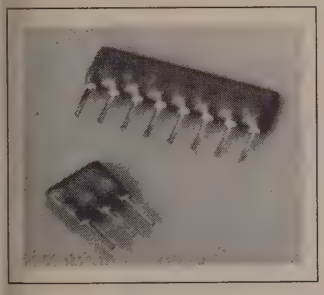
SINGLE-IN-LINE CERAMIC SANDWICH

- 3 – 10 lead packages
- Thermal compression bonded lead attach
- High and low profiles



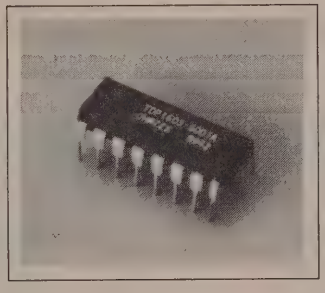
DUAL-IN-LINE CERAMIC SANDWICH

- Rugged monolithic construction
- 4 – 20 leads available
- Thermal compression bonded lead attach
- Wide resistance offering



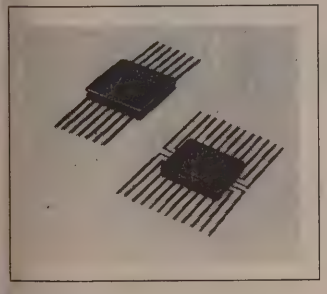
SINGLE-IN-LINE CONFORMAL

- 3 – 13 lead packages available
- Standard and custom circuits
- Off the shelf standards available
- Low cost precision circuits available



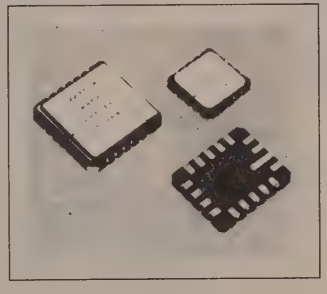
DUAL-IN-LINE MOLDED

- Low cost standard circuits avalable
- 14 and 16 lead packages standard
- Off the shelf delivery



FLATPACKS

- Hermetic and ceramic sandwich construction
- 14 and 16 terminal packages standard
- Meets MIL-R-83401 characteristics "C", "V" or "H"



LEADLESS CHIP CARRIERS HERMETIC

- Hermetic JEDEC packages
- 16, 20 and 24 terminal packages standard
- Standard and custom circuits available
- Meets MIL-R-83401 characteristic "C"

Features

- Standard and custom circuits as required for demanding military and commercial applications
- Tracking less than 1 ppm
- Operating temperature range: –55°C to +125°C
- Low Noise: –35 dB
- Full mil-spec screening available in-house
- Tolerances: 0.005% to 1%
- Resistance values: 10 ohms to 10 megohm
- Low TCR: 25 ppm/°C typical
- Nichrome or Tantalum based films optional

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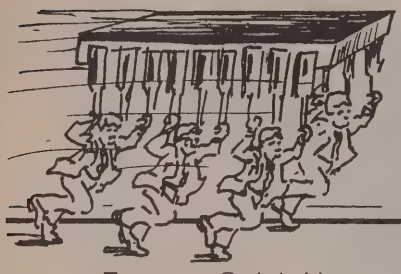
Custom Thin Film Networks in 2 weeks with no NRE charges.



Our superior engineering capabilities enable us to provide the industry's shortest delivery time for prototypes. Let the Ohmtek Quick-Net team help you speed your prototypes to qualification. Quick-Net high quality networks are available in a variety of package formats including Single-In-Line, hermetic DIP, flatpack, and leadless chip carriers.

Quick-Net Prototypes

For your Quick-Net prototype, fill out this form and **FAX** to Ohmtek at **(716) 283-5932** or call and talk to an Ohmtek engineer at (716) 283-4025.

DATE: _____ **FROM:** _____

NUMBER ____ **OF** ____ **PAGES**

TO: Ohmtek Quick-Net Team
2160 Liberty Drive
Niagara Falls, NY 14304 USA

PHONE: _____

FAX NO.: (716) 283-5932 **FAX:** _____

YOUR PART NUMBER: _____ **OHMTEK P.N.:** _____

PACKAGE TYPE: Package	Max. Resistors per Package*	Resistor Count	Package Choice ✓
Single-In-Line	2 thru 9	_____	☐
8 Pin Hermetic DIP	12	_____	☐
14 Pin Hermetic DIP	12	_____	☐
16 Pin Hermetic DIP	15	_____	☐
18 Pin Hermetic DIP	12	_____	☐
14 Lead Flatpack 1/4 x 3/8	18	_____	☐
14 Lead Flatpack 3/8 x 3/8	16	_____	☐
16 Lead Flatpack 1/4 x 3/8	18	_____	☐
16 Lead Flatpack 3/8 x 3/8	16	_____	☐
20 Terminal Leadless Chip Carrier	8	_____	☐
24 Terminal Leadless Chip Carrier	16	_____	☐

SPECIFICATIONS*: Quick-Net's Best*	Your Requirements
Best Ratio Tolerance (over 1K): 0.01%	_____
Best Absolute Tolerance: 0.1%	_____
Best TCR Tracking (–55°C to +125°C): ±5 ppm/°C	_____
Best Absolute TCR (–55°C to +125°C): ±25 ppm/°C	_____
Maximum Wattage: 25 mW/element	_____

SCHEMATIC:
Hand draw your schematic here or attach your drawing. Identify the reference resistor and ohmic value of each resistor

REFERENCE RESISTOR IS: _____ **TO:** _____

*** These specifications are based on quick turn around and do not necessarily reflect the technical capabilities available. For values outside these specifications contact the factory at (716) 283-4025.**

OHMTEK ■ 2160 Liberty Drive ■ Niagara Falls, NY 14304 ■ (716) 283-4025 ■ FAX (716) 283-5932

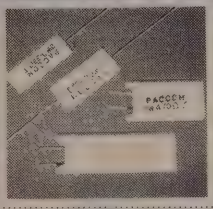
PACCOM™
ELECTRONICS

1-800-848-6983.
3928 148th Ave. NE, Redmond, WA 98052-5350
Please Fax: (206) 881-6959 For Our Full Line Catalog.

Resistors

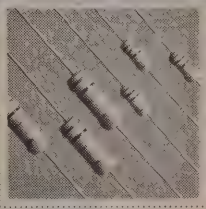
WRH/WRP
SILICON COATED WIRE WOUND

Resistance Range: 0.5Ω to 6.8KΩ
Rated Power: 1W to 20W
Temp. Coefficient: ±260 PPM/°C
Operating Temp: +70°C to +250°C
Max Overload Voltage: 10 X Rated Power for 5 Sec.
Tolerance: ±2% (G), ±5% (J)
Construction: Silicon Coated Wire Wound
Tape & Reel/ Ammo Pack: Available



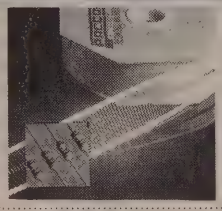
WCR/WCRR
WIRE WOUND CEMENT

Resistance Range: 0.15Ω to 2KΩ
Rated Power: 2W to 20W
Temp. Coefficient: ±250 PPM/°C to ±400 PPM/°C
Operating Temp: –25°C to +275°C
Max Overload Voltage: 1000V
Tolerance: ±2% (G), ±5% (J)
Construction: Wire WOund Cement
Tape & Reel/ Ammo Pack: Not Normally Available



MOR/MOF
METAL OXIDE FILM

Resistance Range: 0.5Ω to 500KΩ
Rated Power: 0.5W to 7W
Temp. Coefficient: ±350 PPM/°C
Operating Temp: –25°C to +235°C
Max Overload Voltage: 400V to 1000V
Tolerance: ±2% (G), ±5% (J)
Construction: Metal Film
Tape & Reel/ Ammo Pack: Available



RN
METAL FILM

Resistance Range: 5Ω to 100 MegΩ
Rated Power: 125W to 2.0W
Temp. Coefficient: ±50 PPM/°C or ±100 PPM/°C
Max Overload Voltage: 300V to 1000V 5 Sec.
Tolerance: ±2% (G), ±5% (J)
Construction: Metal Film & Metal Glaze
Tape & Reel/ Ammo Pack: Available

SRD
CARBON FILM

Resistance Range: 1Ω to 22 MegΩ
Rated Power: 125W to 2.0W
Temp. Coefficient: –350 to +1000 PPM/°C
Operating Temperature: –55°C to +155°C
Max Overload Voltage: 400V to 1000V
Tolerance: ±2% (G), ±5% (J),
Construction: Carbon Film
Tape & Reel/ Ammo Pack: Available

RA
NETWORKS

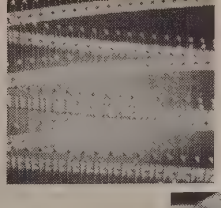
Resistance Range: 1Ω to 10 MegΩ
Rated Power: 125W per element
Temp. Coefficient: ±200 PPM/°C
Operating Temp: –55°C to +125°C
Max Overload Voltage: 200W
Tolerance: ±1% (F), ±2% (G)
Construction: Conformal Coated Networks
Tape & Reel/ Ammo Pack: Not Available

Surface Mount (SMT)

RM
RESISTOR SURFACE MOUNT

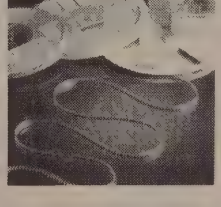
Resistance Range: 4.7Ω to 1 MegΩ
Rated Power: 0.100W to 0.25W
Temp. Coefficient: ±300 PPM/°C to ±500 PPM/°C
Operating Temp: –55°C to +125°C
Maximum Overload Voltage: 200V to 300V
Tolerance: ±1% (F), ±2% (G), ±5% (J)
Construction: Thick Film
Tape & Reel: Standard

Packaging

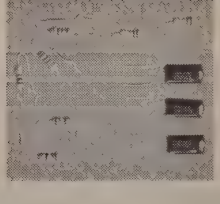


AMMO PACK

TAPE & REEL



Special Services



LEAD FORMING

BRIDGING

Leaded Passives Selection Guide

Please call OR Fax for our Free, 84-page, Full-Line Passives Selection Guide of Leaded Resistors and Capacitors. Full specifications are included.

"We make things work right"

For Information On Our Capacitors, Please See Our Data Pages In Section 1500.

POWER WIREWOUND RESISTORS
AXIAL LEAD - MIL QUALIFIED

PACIFIC RESISTOR CO.

PHONE (818) 345 - 7811 (800) 835 - 3355 FAX (818) 345 - 1507

These Superbly Reliable Resistors meet and exceed MIL - R - 26. Their ALL MOLDED construction provides for exceptional strength and moisture resistance! Resistors are available in any resistance value up to the maximum lisited. FAST DELIVERY TIMES! PACIFIC HAS BUILT QUALITY WIREWOUNDS FOR 40 YEARS!

Type A Molded
1 to 13 Watts

PACIFIC N1A 15.4 1%

Electrical

- **Non Inductive Styles Available**
- **Matched Sets Available**
- **Tolerances:** 5%,3%,1%,.5%,.25% .1%,.05%,.02%
- **Temperature Coefficient:**
  90 PPM< 1 ohms
  50 PPM< 10 ohms
  20 PPM> 10 ohms
- **Special TC's Available**
- **Dielectric Strength:**
  1000VRMS - all except listed below
  500 VRMS-04A,05A,B1,B3
- **Insulation Resistance:** not<1000 Meg

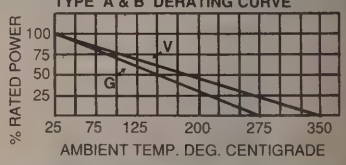
Mechanical

- **Encapsulation:** Molded High Temp. Silicone
- **Core:** Type A-Ceramic
  Type B - Beryllium or Alumina
- **End Caps:** Stainless Steel
- **Leads:** Tinned Copperweld (others available)
- **Construction:** Completely Welded
- **Marking:** Alpha Numeric

Type A SPECIFICATIONS

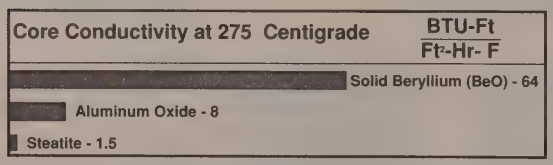
RESISTOR STYLE		POWER RATING		DIMENSIONS				MAX. RES. VAL.	MAX. Work Volts
PACIFIC	MIL	G 275	V 350	LENGTH ±.010	DIA. ±.010	LEADS AWG	LEADS Inch		
04A	-	.4	.75	.250	.090	24	.020	3.5K	30
05A	-	.75	1	.330	.110	24	.020	6.OK	50
15A	RW70	1.25	2	.412	.115	24	.020	7.5K	75
20A	-	1.25	2	.550	.115	24	.020	10K	100
S1A	-	1.75	2.5	.490	.162	22	.025	15K	150
N1A	-	3	3.75	.535	.220	20	.032	20K	200
1A	RW79	3	3.75	.610	.210	20	.032	20K	200
25A	-	4	4.5	.890	.210	20	.032	28K	200
2A	-	3.25	4.5	.535	.270	18	.040	20K	200
3A	-	4	5.5	.656	.270	18	.040	30K	200
5A	RW74	5.5	7.5	.900	.312	18	.040	75K	400
7A	-	7	9	1.187	.312	18	.040	100K	600
10A	RW78/68	10	13	1.825	.405	18	.040	200K	1000
55AC	RW55	7	9	1.250	.470	18	.040	100K	600
56AC	RW56	10	12	2.000	.470	18	.040	200K	1000

TYPE A & B DERATING CURVE



Type B Molded - Exceptional Power to Size Ratio
.4 to 10 Watts

These Resistors feature from 1.4 to 4 times HIGHER POWER RATINGS than conventional resistors of equivalent size. In addition to having all of the features of our Type A resistors, Type B resistors have Solid Beryllium or Alumina cores to provide exceptional power dissipation.



Type B SPECIFICATIONS

RESISTOR STYLE		POWER RATING		DIMENSIONS				MAX. RES. VAL.	MAX. Work Volts
PACIFIC	MIL	G 275	V 350	LENGTH ±.010	DIA. ±.010	LEADS AWG	LEADS Inch		
B1	-	1	1.5	.250	.090	24	.020	3.5K	35
B1A	RW81	1		.250	.090	24	.020	3.5K	35
B2	-	1.5	2	.325	.090	24	.020	4.9K	48
B3	-	2.25	3	.412	.115	24	.020	10.4K	85
B3A	RW80	2		.412	.115	24	.020	10.4K	85
B5	-	4	5	.610	.210	20	.032	24.5K	172
B5C	-	5	7	.540	.240	18	.040	32.3K	260
B6	-	6	8	.656	.270	18	.040	47.1K	300
B10	-	7	10	.900	.312	18	.040	96K	470

HOW TO ORDER: (sample part no.) N1A - 15.4 - 1% - 3W

Style — N1A
Resistance — 15.4
Tolerance — 1%
Watts — 3W

N1AN - 15.4 - 1% - 3W

To order **Non Inductive** styles, add suffix **N** to style (e.g.:**N1AN**)

Pacific Resistor Co.

18300 OXNARD ST.
TARZANA, CA 91356

PRECISION POWER RESISTORS

CHASSIS MOUNT - ALUMINUM FINNED HEAT SINK - MIL QUALIFIED

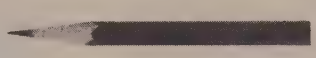
PACIFIC RESISTOR CO.

PHONE (818) 345 - 7811 (800) 835 - 3355 FAX (818) 345 - 1507

Pacific's Chassis Mount type CH Resistors are designed for maximum heat dissapation by mounting to metal chassis surfaces for maximum heat transfer. These Superbly RELIABLE resistors are outstanding for their high power dissipation with precision tolerances in minimum physical sizes. FAST DELIVERY TIMES! MIL-R-18546 Qualified. PACIFIC HAS BUILT QUALITY WIREWOUNDS FOR 40 YEARS!

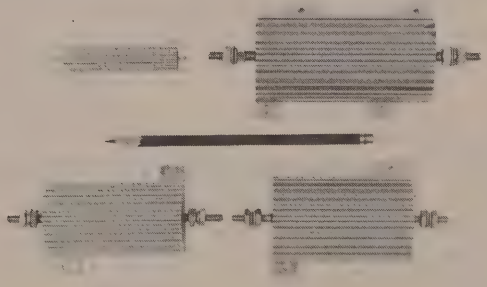
Type CH Chassis Mount
5 to 250 Watts - MIL-R-18546

Type BCH - Exceptional Power to Size Ratio
15 to 35 Watts - Solid Beryllium Core



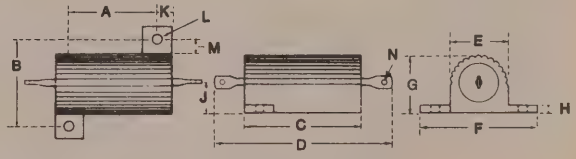
Electrical

- **Long Stable Load Life**
- **Non Inductive Styles Available**
- **Tolerances:** 5%,3%,1%,.5%,.25%, .1%,.05%
- **Temperature Coefficient:**
  90 PPM< 1 ohms, 50 PPM<10 ohms, 20 PPM>10 ohms
- **Special TC's Available**
- **Dielectric Strength:**
  1000 VRMS-5CH,10CH,B5CH,B10CH
  2500 VRMS-25CH,50CH,100CH,B25CH
  5500 VRMS-ALL OTHERS
- **Insulation Resistance:** not<1000 Meg



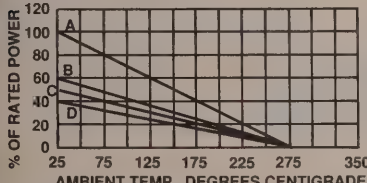
Mechanical

- **Body:** Anodized-Aluminum finned
- **Core:** Type CH- Ceramic, Type BCH - Beryllium
- **End Caps:** Stainless Steel
- **Leads:** Heavy Spaded Lugs - 5 to 70 Watts
  Threaded Stud Terminals- 100 to 250 Watts
- **Construction:** Completely Welded

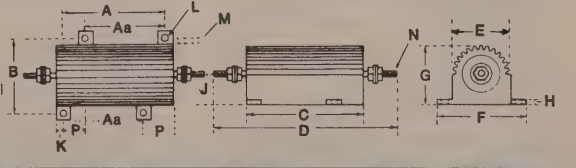


5CH, 10CH, 25CH, 50CH, 100CH, B5CH, B10CH, B25CH

Derating Curves



Derating is required for reduced chassis mounting area and high ambient temps.
A - When Mounted on proper alum. chassis
5CH,B5CH,10CH,B10CH - 4x6x2x.040 alum.
25CH,B25CH - 5x7x2x.040 alum. chassis
50CH,100CH - 12x12x.059 alum. panel
110CH,180CH,250CH - 12x12x.125 alum. panel
B - Unmounted 5CH, B5CH, 10CH, B10CH
C - Unmounted 25CH, B25CH, 100CH, 110CH
D - Unmounted 50CH, 180CH, 250CH



PACIFIC STYLE	MIL-R 18546	COM. WATTS	MAX. RES.	A	Aa	B	C	D	E	F	G	H	J	K	L	M	N	P	Mtg. Screw
5CH	RE60	5	20K	.444	-	.490	.500	1.125	.334	.646	.317	.075	.145	.078	.093	.078	.050	-	2-#2
B5CH	RE60	15	20K	.444	-	.490	.500	1.125	.334	.646	.317	.075	.145	.078	.093	.078	.050	-	2-#2
10CH	RE65	10	30K	.562	-	.625	.750	1.375	.438	.812	.406	.100	.203	.093	.093	.094	.086	-	2-#2
B10CH	RE65	20	30K	.562	-	.625	.750	1.375	.438	.812	.406	.100	.203	.093	.093	.094	.086	-	2-#2
25CH	RE70	25	75K	.719	-	.781	1.062	1.938	.500	1.094	.563	.094	.250	.171	.125	.125	.086	-	2-#2
B25CH	RE70	35	75K	.719	-	.781	1.062	1.938	.500	1.094	.563	.094	.250	.171	.125	.125	.086	-	2-#2
50CH	RE75	50	200K	1.563	-	.844	1.968	2.781	.625	1.156	.625	.094	.281	.196	.125	.125	.086	-	2-#4
100CH	-	70	275K	2.625	-	.844	2.968	3.781	.625	1.156	.625	.094	.281	.196	.125	.125	.086	-	2-#4
110CH	RE77	100	50K	2.750	-	2.250	3.500	5.478	1.800	2.813	1.750	.188	.800	.375	.188	.250	12-24	-	2-#8
180CH	-	180	50K	2.750	-	2.500	3.500	5.478	2.125	3.000	2.188	.250	.950	.375	.188	.200	12-24	-	2-#8
250CH	RE80	250	50K	3.875	3.000	2.500	4.500	7.000	2.125	3.000	2.188	.250	1.000	.312	.188	.200	1/4-20	.875	4-#8

HOW TO ORDER: (sample part no.) 5CH - 21.3 - 1% - 5W

- Style
- Resistance
- Tolerance
- Watt

5CHN - 21.3 - 1% - 5W

To order **Non Inductive** styles, add suffix **N** to style (e.g.:**5CHN**)

Pacific Resistor Co.

18300 OXNARD ST.
TARZANA, CA 91356

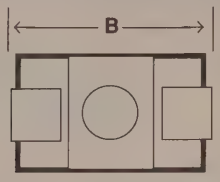
WIREWOUND RESISTORS
SPECIAL PURPOSE DESIGNS

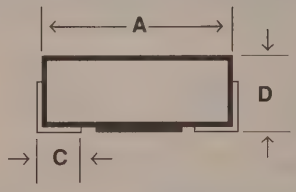
PACIFIC RESISTOR CO.

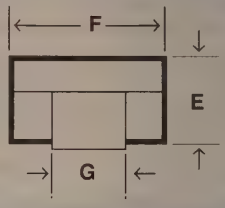
PHONE (818) 345 - 7811 (800) 835 - 3355 FAX (818) 345 - 1507

Surface Mount Wirewounds -1/2 to 4.5 Watt

POWER, PRECISION POWER, LOW TC, TEMPERATURE SENSING, LOW OHM CURRENT SENSING







Electrical

- **Non Inductive Styles Available**
- **Tolerances:** 5%,3%,1%,.5%,.25 .1%,.05%,.02%,.01%,.005%
- **Standard Temperature Coefficient:**
  90 PPM/C° >.1<1 ohms
  50 PPM/C° >1<10 ohms
  20 PPM/C° >10 ohms

SURFACE MOUNT Specifications (Per ANSI/IPC-SM-72)

TYPE	WATTS	A ±.005"	B ±.010"	C ±.010"	D ±.015"	E ±.005"	F ±.005"	G ±.010"
PSM-1/2	.5 -.75	.190	.215	.040	.100	.093	.125	.050
PSM-1	1 - 1.5	.250	.272	.060	.140	.130	.138	.080
PSM-2	2 - 2.5	.435	.478	.100	.210	.200	.230	.100
PSM-3	3 - 4.5	.775	.811	.110	.280	.273	.273	.140

Four - Terminal Molded Resistors

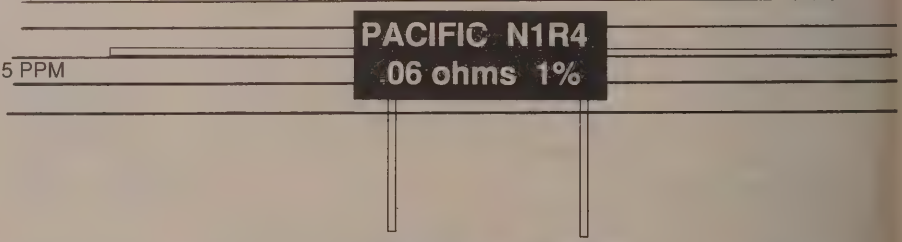
Available in a wide range of values and wattages, these resistors are extremely useful in Low Resistance Current-Shunting and Current-Sensing applications where Voltage - Current relationships(i.e.resistance) needs to be accurately specified and be independant of leads resistance effects. PACIFIC'S ALL MOLDED Construction provides for Exceptional moisture resistance and strenght! *CUSTOM DESIGNS AVAILABLE*

Electrical

- **Non Inductive Styles Available**
- **Matched Sets Available:** Tracking to .5 PPM
- **Tolerances:** 5%,3%,1%,.5%,.25% .1%,.05%,.02%,.01%
- **Temperature Coefficient:**
  50 PPM/C° < 1 ohms
  10 PPM/C° >1 ohms
- **Special TC's Available**

Mechanical

- **Encapsulation:** Molded High Temp. Silicone
- **Leads:** Tinned Copper or Tinned Copperweld
- **Marking:** Alpha Numeric



Ultra Low Ohm Molded Power Resistors

These Superbly Reliable resistors meet and exceed MIL - R - 26 and extend to values below it's range. Resistors are made to order and available in any resistance within their range. FAST DELIVERY TIMES!

- **Wattages:** 1,3,4,5
- **Tolerances:** 5%,3%,1%,.5%,.25%
- **Inductance:** 0 micro henries
- **Ideal for Power Amps, Test Equip., Power Supplies** (Switching & Linear)**, & Current Sensing.**

- **Current Shunts**
- **High Precision Resistors**
- **Fusing Resistors**
- **Temperature Sensors**
- **Custom Coils**
- **Networks - To Customer Specs.**
- **Matched Sets**
- **High TCR Resistors**
- **Toroids**
- **Delay Lines**

Pacific Resistor Co.

18300 OXNARD ST.
TARZANA, CA 91356

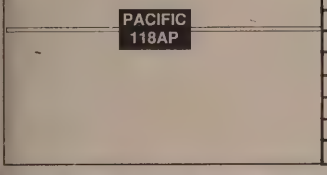
PRECISION WIREWOUND RESISTORS

PACIFIC RESISTOR

PHONE (818) 345 - 7811 (800) 835 - 3355 FAX (818) 345 - 1507

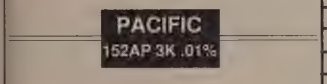
- Superbly RELIABLE and ACCURATE
- 40 YEARS of Building Quality Resistors
- Meet or Exceed MIL-R-93 and MIL-R-9444
- TC Matching to ± .5 PPM
- Matched Sets
- Tolerances 0.005% to 1%
- Excellent Long-Term Stability
- Resistance Range .1Ω to 30 MegΩ
- Custom Designs Welcome

AXIAL PRECISION Subminiature Series



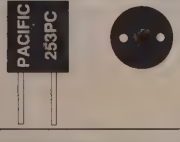
RESISTOR STYLE		COMMERCIAL WATTAGE	MAXIMUM OHMS	MAXIMUM VOLTAGE	DIMENSIONS					
PACIFIC	MIL				LENGTH ±.010	DIAMETER ±.010	LENGTH MM	DIAMETER MM	LEADS AWG	LEADS Inch
112AP	-	.06	50K	75	.210	.100	5.3	2.5	24	.020
118AP	-	.08	250K	100	.260	.125	6.6	3.2	24	.020
122AP	-	.10	500K	100	.375	.125	9.5	3.2	24	.020
124AP	-	.10	500K	100	.312	.156	7.9	4.0	24	.020
128AP	-	.125	600K	150	.250	.187	6.3	4.7	22	.025
130AP	-	.15	1.2 MEG	150	.295	.187	7.5	4.7	22	.025
134AP	-	.175	1.3 MEG	200	.375	.187	9.5	4.7	22	.025
142AP	-	.175	750K	150	.260	.260	6.5	6.5	20	.032
144AP	-	.2	1 MEG	200	.450	.187	11.4	4.7	22	.025
148AP	-	.25	1.2 MEG	250	.465	.210	11.8	5.3	22	.025

AXIAL PRECISION Miniature Series



RESISTOR STYLE		COMMERCIAL WATTAGE	MAXIMUM OHMS	MAXIMUM VOLTAGE	DIMENSIONS					
PACIFIC	MIL				LENGTH ±.010	DIAMETER ±.010	LENGTH MM	DIAMETER MM	LEADS AWG	LEADS Inch
152AP	RB56	.20	2 MEG	200	.375	.250	9.5	6.3	20	.032
154AP	RB56	.20	2 MEG	200	.375	.250	9.5	6.3	22	.025
156AP	-	.25	2.5 MEG	300	.500	.250	12.7	6.3	22	.025
160AP	RBR55	.25	2.5 MEG	300	.500	.250	12.7	6.3	20	.032
164AP	RBR54	.35	4.5 MEG	400	.750	.250	19.1	6.3	20	.032
168AP	RBR53	.50	8 MEG	400	.750	.375	19.1	9.5	20	.032
172AP	-	.50	4 MEG	300	.500	.375	12.7	9.5	20	.032
176AP	-	.50	8 MEG	400	.500	.500	12.7	12.7	20	.032
178AP	-	.50	8 MEG	400	.885	.375	22.4	9.5	20	.032
180AP	-	.60	9 MEG	400	.625	.500	15.9	12.7	20	.032
184AP	RBR52	.75	10 MEG	600	1.000	.375	25.4	9.5	20	.032
188AP	RBR57	1.00	18 MEG	800	1.000	.500	25.4	12.7	20	.032
192AP	RB58	1.50	30 MEG	900	1.500	.500	38.1	12.7	20	.032
196AP	-	2.00	30 MEG	900	2.000	.500	50.8	12.7	20	.032

PRINTED CIRCUT Precision Series



RESISTOR STYLE		COMMERCIAL WATTAGE	MAXIMUM OHMS	MAXIMUM VOLTAGE	DIMENSIONS					
PACIFIC	MIL				LENGTH ±.025	DIAMETER ±.025	LEAD SPACING		LEADS AWG	LEADS Inch
231PC	-	.25	500K	300	.312	.250	.150	-	22	.025
253PC	RB71	.25	500K	300	.312	.250	.200	-	22	.025
325PC	-	.25	500K	300	.375	.250	.150	-	22	.025
525PC	-	.50	600K	300	.500	.250	.150	-	22	.025
550PC	-	.70	1 MEG	400	.500	.500	.300	-	22	.025
575PC	RB70	.70	800K	300	.500	.375	.200	-	20	.032

RADIAL PRECISION Lead & Lug Series

RESISTOR STYLE		COMMERCIAL WATTAGE	MAXIMUM OHMS	MAXIMUM VOLTAGE	DIMENSIONS				
PACIFIC	MIL				LENGTH ±.025	DIAMETER ±.025	SPACING ±..015	TERMINAL TYPE	MOUNTING HOLE
200RP	-	.125	500K	100	.250	.250	.200	AWG 22	NONE
214RP	-	.25	1 MEG	150	.425	.250	.277	AWG 22	#2 SCREW
250RP	-	.25	1 MEG	150	.500	.250	.400	AWG 22	NONE
275RP	-	.50	4 MEG	400	.500	.500	.400	AWG 20	#6 SCREW
285RP	-	.50	1 MEG	300	.750	.375	.600	AWG 20	#6 SCREW
324RP	RB08	.50	4 MEG	400	.500	.500	.325	LUG	#6 SCREW
350RP	-	1.00	8 MEG	800	1.00	.500	.850	AWG 20	#6 SCREW
372RP	RB18	2.00	10 MEG	1000	1.250	.750	1.000	LUG	#6 SCREW

FAST RISE SERIES

RESISTOR STYLE		COMMERCIAL WATTAGE	MAXIMUM OHMS	MAXIMUM VOLTAGE	DIMENSIONS					
PACIFIC	MIL				LENGTH ±.010	DIAMETER ±.010	LENGTH MM	DIAMETER MM	LEADS AWG	LEADS Inch
F134AP	-	.175	500K	200	.375	.187	9.5	4.7	22	.025
F160AP	RBR55	.25	1.0 MEG	300	.500	.250	12.7	6.3	20	.032
F164AP	RBR54	.35	1.25 MEG	400	.750	.250	19.1	6.3	20	.032
F168AP	RBR53	.50	5 MEG	400	.750	.375	19.1	9.5	20	.032
F188AP	RBR57	1.00	10 MEG	800	1.000	.500	25.4	12.7	20	.032

PACIFIC RESISTOR CO. 18300 OXNARD ST. TARZANA, CA 91356

Philips Components

Discrete Products Division

A North American Philips Company

Airport Road, P.O. Box 760 Mineral Wells, TX 76067 (817) 325-7871 FAX: (817) 325-1052, (817) 325-8397

FILM RESISTORS

General Purpose, Carbon Film, SFR, Precision Film, Mil-R-10509 (RN), Mil-R-22684 (RL), Mil-R-39017 (RLR), UPR, Mil-R-55182 (RCN), Mil-R-55182 (RNR)

INDUSTRIAL/CONSUMER GROUP

Philips Components Series	Category	Body Type	Resistance Range (ohms)	Tolerance Range (±%)	Temperature Coefficient Range (PPM/°C)	Power Range @ 70°C (watts)	Max. Voltage Range (watts)
SPACE MISER®	GENERAL PURPOSE	METAL FILM Conformal-Coated	.22Ω-10 Meg 1Ω-10 Meg	5% 1%	±100 ±100	1/3 1/3	200 200
CR	GENERAL PURPOSE	CARBON FILM Conformal-Coated	1Ω-10 Meg	5%	−200 to +500, ±300	1/4 1/2	250-350
SFR	GENERAL PURPOSE	METAL FILM Conformal-Coated	1Ω-10 Meg	1%-2% 5%	±200 and ±100	1/4 1/2	250-350
SPR 5000Y	STANDARD PRECISION	METAL FILM Conformal-Coated	1Ω-250 Meg	0.5%-5%	±50 to ±150	1/4-1	250-500
UPR & MATCHED SETS	ULTRA PRECISION	METAL FILM Conformal-Coated	51.1Ω-511 K	.01%-1%	±2 to ±25	@ 85°C 1/20 1/8-1/4, 1/3	200-300
MIL Style	**MIL Specs**	**INDUSTRIAL/STANDARD MILITARY STYLE**					
RL	MIL-R-22684	METAL FILM Conformal-Coated	4.3Ω-470K	2% 5%	±100	1/4-1/2	250-350
RN	MIL-R-10509	METAL FILM Conformal-Coated	1Ω-4 Meg	0.1%-1%	±25 to ±100	1/10-1/2	200-350

SERIES 9B PRECISION MELF RESISTORS

Airport Road, P.O. Box 760 Mineral Wells, TX 76067 (817) 325-7871 FAX: 817-325-1052 Telex: GPR-881857; SPR-820545

Philips Components Series	Resistance Range	Tolerance	Temperature Coefficient (ppm/°C)	Power Rating (70°C)	Maximum Voltage	Dimensions (Inches)	
						Length	Dia.
9B1406	.22-10M	.1-5%	15, 25, 50	.25W	200V	.142 Max.	.055 Max.
9B0805	.22-220K	.1-5%	50 ppm	.125W	200V	.087 Max.	.043 Max.

SMD® RESISTORS

Airport Road, P.O. Box 760 Mineral Wells, TX 76067 (817) 325-7871

SERIES 9C COMMERCIAL CHIP RESISTORS

SMD (chip) resistors consist of a ceramic body (alumina) on which is deposited resistive paste. Variations in the composition of the paste result in different resistant values. A wrap around termination is deposited at each end of the resistor to allow reflow or wave soldering. The resistive layer is covered with a protective coating to assure mechanical and environmental integrity.

Philips Components
Discrete Products Division
A North American Philips Company

Airport Road, P.O. Box 760 Mineral Wells, TX 76067 (817) 325-7871 FAX: (817) 325-1052, (817) 325-8397

SERIES 9C COMMERCIAL CHIP RESISTORS

GENERAL SPECIFICATIONS

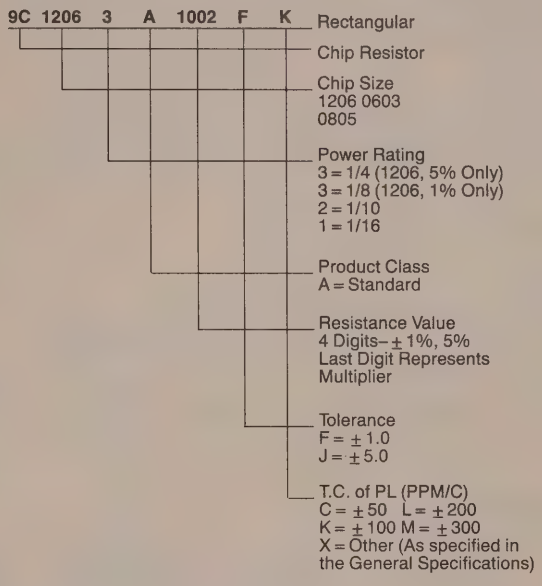
Chip Size	Wattage	Tolerance	T.C.	Max. Volts (RMS)	Voltage Range
1206	1/8,1/4	±5%	200	200	1R0-10M
1206	1/8	±1%	100	200	10R0-1M
1206	1/8	±1%	50	200	100R-1M
0805	1/10	±5%	500	150	1R0-9R1
0805	1/10	±5%	300	150	10R0-91R
0805	1/10	±5%	200	150	100R-91K
0805	1/10	±5%	300	150	100K-10M
0805	1/10	±1%	100	150	10R0-1M
0603	1/16	±5%	500	50	1R1-9R1
0603	1/16	±5%	200	50	10R0-1M
0603	1/16	±5%	300	50	1M1-6M8
0603*	1/16	±1%	100	50	100R-1M

NOTE: 0603, 1%, to be available 4th Quarter 1992
Zero OHM jumper available in 1206 and 0805 Series
** 9C1206 available in ± .5%, TC = 50 PPM — Consult Factory **

TEST PERFORMANCE PERFORMANCE CHARACTERISTICS PER IEC 115

TEST	REQUIREMENTS (+0.5 OHMS)	
	9C1206 1%, 100 PPM	**5%, 200 PPM**
THERMAL SHOCK	+/−0.5%	+/−1.5%
S.T.O.L.	+/−0.5%	+/−2.0%
HIGH TEMPERATURE	+/−0.5%	+/−1.0%
STEADY STATE MOISTURE	+/−1.0%	+/−1.5%
EFFECTS OF SOLDERING	+/−0.5%	+/−1.0%
VIBRATION	+/−0.5%	+/−0.5%
LIFE	+/−0.5%	+/−1.0%
SOLDERABILITY	95% MINIMUM COVERAGE	95% MINIMUM COVERAGE
	9C1206 1%, 50 PPM	
THERMAL SHOCK	+/−0.25%	
S.T.O.L.	+/−0.25%	
HIGH TEMPERATURE	+/−0.50%	
STEADY STATE MOISTURE	+/−1.00%	
EFFECTS OF SOLDERING	+/−0.25%	
VIBRATION	+/−0.25%	
LIFE	+/−0.5%	
SOLDERABILITY	95% MINIMUM COVERAGE	
	9C0805 1%, 100 PPM	**5%, 200, 300, 500 PPM**
THERMAL SHOCK	+/−1.0%	+/−1.0%
S.T.O.L.	+/−1.0%	+/−1.0%
HIGH TEMPERATURE	+/−1.5%	+/−1.0%
STEADY STATE MOISTURE	+/−1.5%	1R0-1M0 = +/−3% 1M1-10M = +/−5%
EFFECTS OF SOLDERING	+/−1.0%	+/−1.0%
VIBRATION	+/−1.0%	+/−1.0%
LIFE	+/−2.0%	1R0-1M0 = +/−3% 1M1-10M = +/−5%
SOLDERABILITY	95% MINIMUM COVERAGE	95% MINIMUM COVERAGE
	9C0603 1%, 100 PPM	**5%, 200, 300, 500 PPM**
THERMAL SHOCK	N/A	+/−1.0%
S.T.O.L.	N/A	+/−1.0%
HIGH TEMPERATURE	N/A	+/−3.0%
STEADY STATE MOISTURE	N/A	1R0-9R1 = +/−5% 10R0-1M0 = +/−3% 1M1-10M = +/−5%
EFFECTS OF SOLDERING	N/A	+/−1.0%
VIBRATION	N/A	+/−1.0%
LIFE	N/A	1R0-9R1 = +/−5% 10R0-1M0 = +/−3% 1M1-10M = +/−5%
SOLDERABILITY	N/A	95% MINIMUM COVERAGE

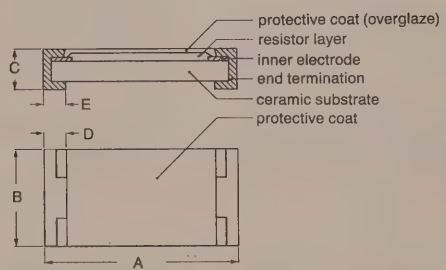
Part Number Designation



STANDARD PACKAGING

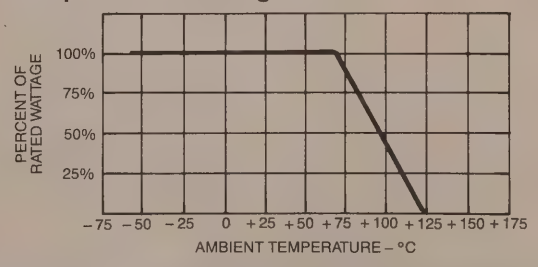
Tape and Reel packaging in Quantities of 5000 per reel; Reel diamenter 180 mm

Mechanical Parameters



		A	B	C	D	E
1206	IN.	.126 + .006/.008	.063 ± .006	.024 ± .010	.018 ± .010	.020 ± .010
	(MM)	(3.2 + .15/.20)	(1.6 ± .15)	(.60 ± .10)	(.45 ± .25)	(.50 ± .2)
0805	IN.	.079 ± .006	.049 ± .004	.020 ± .004	.016 ± .008	.016 ± .008
	(MM)	(2.0 ± .15)	(1.25 ± .10)	(.50 ± .10)	(.40 ± .20)	(.40 ± .20)
0603	IN.	.063 ± .004	.031 + .006/−.002	.018 ± .004	.012 ± .008	.012 ± .008
	(MM)	(1.6 ± .10)	(.80 + .15/−.05)	(.45 ± .10)	(.30 ± .20)	(.30 ± .20)

Temperature Derating Curve:



Philips Components

Discrete Products Division

A North American Philips Company

Airport Road, P.O. Box 760 Mineral Wells, TX 76067 (817) 325-7871 FAX: (817) 325-1052, (817) 325-8397

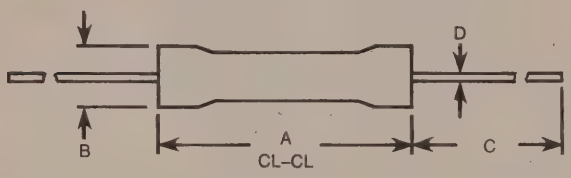
PRECISION POWER FILM RESISTOR METAL FILM

.05% to 5% Tolerances
1, 2, 3 and 5 Watt
(25°C) Power Rating

DESCRIPTION

The PPR5000 series is a precision power film that achieves the inherently low inductance and reliability of metal film resistors and the stability and power handling capability of wirewound resistors.

DIMENSIONS



FEATURES

- **Low Inductance**
- **Excellent Stability**
- **Small Size**
- **Tight Tolerances**
- **Low TC's**

PERFORMANCE SPECIFICATIONS

	Max. % Delta R
Thermal Shock	.2%
Terminal Strength	.1%
Dielectric Withstanding Voltage	
Atmospheric	.1%
Barometric	.1%
S.T.O.L.	.2%
Moisture Resistance (Load)	.5%
Life (1000 hr @ rated power)	.5%
Vibration	.1%
Effect of Solder	.1%
Shock	.1%

SPECIFICATIONS

Philips Style	Resistance Range (OHMS)	Resistance Tolerance (%)	Temperature Coefficient (PPM/°C)	25°C Power Rating	Maximum Voltage (Volts)	Dimensions			
						A Max	B Max	C Max	D Max
5073P	5R->25K	.05, .1,(1) .25, .5, 1	±20->100(2)	1 Watt	160	.265″	.098″	1.5″	.025″
5083P	5R->25K	.05, .1,(1) 25, .5, 1	±20->100(2)	2 Watts	225	.365″	.150″	1.5″	.025″
5093P	5R->25K	.05, .1,(1) .25, .5, 1	±20->100(2)	3 Watts	275	.550″	.225″	1.5″	.032″
50A3P	5R->100K	.05, .1,(1) 25, .5, 1	±20->100(2)	5 Watts	500	.800″	.225″	1.5″	.032″(3)

NOTES: (1) .05% and .1% available 100 ohms and higher only. Also available in 2% and 5% over the entire range.
(2) Value below 10 ohms will have TC of ± 50 PPM.
(3) .040″ wire available upon request.

PICONICS THICK AND THIN FILM RESISTOR CHIPS

Piconics manufactures high quality Thick and Thin Film Resistor chips and custom networks.
Our products are produced utilizing the latest in automatic lasers, fast cycle sputter and E-Beam equipment, precision photolithographic machinery and dicing tools all under environmentally controlled conditions. Both NICHROME AND TANTALUM NITRIDE resistors are available using various conductor combinations with both suitable for wire bonding or soldering (SMD). Piconics specializes in products on BERYLLIA and Aluminum Nitride. Custom layouts, designs, test requirements, and non-standard performance specifications are welcome. All products are manufactured to meet the requirements of MIL-STD-883, MIL-R-55342, MIL-Q-9858, and all other pertinent military specifications. Our Specialties are Wraparound Thick/Thin Film Resistors and high power chips up to 20 watts dissipation. Group A, Group B and Group C testing available.

Thick/Thin Film Product Codes

CR-	XXX	-XXXX	-XX	-X	-X	-X
SR						
CR- Thin Film SR- Thick Film	Value in [1] Ohms	Size Code [2]	Thickness Code	Tolerance Code	Termination Code	Substrate Code
Sizes: 0302 Avail- 0304 able 0303 0402 0403 0404 0502 0504 0505 0604 0703 0705 0202 0503 0705		0805 1005 1008 1010 1206 1510 1612 2010 2512 3725 Custom	Standard 05=.005 10=.010 25=.025 40=.040 Others Available	M=±20% K=±10% J=± 5% G=± 2% F=± 1% B=± .1% Others Available C=± .25% D=± .5%	**Thin Film:** W-Gold One Side 2W-Gold Two Sides S-Solder (SN 62) R-Wraparound 2R-Half Wrap **Thick Film:** D-Palladium Silver T-Platinum Palladium Gold W-Gold 2-Metal Two Sides R-Wraparound S-Solder (SN62)	**Substrate** A-Aluminum B-Beryllia S-Silicon G-Glass N-Aluminum Nitride (Thin Film Only) Q-Quartz (Special Order Only)

Note: Other Sizes Available.

Available

1. Nichrome or Tantalum Nitride Thin Film
2. Passivation or Glassivation
3. Aluminum conductor
4. Tolerances below ± 1%
5. Specific TCR's
6. High Temp Operating Capabilities
7. Custom Testing
8. Nickel Barrier on all wraparounds

CUSTOM THIN FILM COATINGS

Piconics is equipped to provide custom THIN FILM coatings as a product or service. Our Cryo Pumped In Line Auto Sputter and Fast Cycle E-Beam capability together with peripheral controls gives Piconics a broad range of Film Capabilities. We provide coated substrates of Alumina, Beryllia, Quartz, Aluminum Nitride, Glass with materials such as Gold, Aluminum, Nichrome, Tantalum, Nickel, Chrome, Titanium/Tungsten, Silicon Nitride, Silicon Dioxide, Palladium, Titanium, Copper, and others upon request.
NOTE: Tantalum and Nichrome coating to your Specified Sheet Resistivity and TCR. Process assistance provided.

General Performance Specifications

Property	Conditions	Thin Film	Thick Film
Temp Coefficient	—55°C to + 150°C	Nichrome 0 - 50 PPM Tantalum 0 to 59 ppm	0± 100 ppm Typ.
Temp Track (Networks)	—55°C to + 150°C	1 - 2 ppm typ.	5 - 10 ppm typ.
Noise*	MIL-STD-202 M 308	−20 dB to −35 dB	+10 dB to −30 dB
Voltage Coefficient	—	<.1 microvolt/volt	0.1% / volt typ. (depending on value)
Value Range	—	0.1 ohm - 5 meg. (Higher as Custom)	.1 ohm - 100 meg.
Operating Voltage	Typical 100 V.	Layout/Value dependent	Layout/Value dependent
Stability	1000 hours +125°C w/Power	±0.3% Max. Δ R	±0.5% Max. Δ R
Short Term Overload	2.5x Max Rated Current	.2% Max	±.25% Max.
Moisture Resistance	MIL-STD-202 M106	.2% Max.	±.25% Max.
Thermal Shock	MIL-STD-202 M107	±.15% Max.	±.25% Max.
Solder Exposure	300°C−30 sec.	±0.4% Max. ±.25% Max.	±.25% Max.
High Frequency	Layout/Film dependent	to 20 GHz	To 5 GHz
Power Rating: ** Alumina Berylia+Aluminum Nitride Silicon	Size Dependent	50mw to 5w 200mw − 20w 200mw − 20w	50mw to 15w 200mw to 20w N.A.
High Temp Exposure	150°C, 100 hours	±.25% Max.	±0.25% Max.
Resistance to Bonding	—	±.1% Max.	±.25% Max.

Notes: 1. TCR may be "tailored" at times to meet needs to ± 5ppm.
2. High Temperature Resistors available to operate at up to +300°C.
3. Operating Voltage may be custom designed to 1200V.
4. Parts inspected to MIL-STD-883 Method 2010/2017/2032 Level B.
5. Testing meets MIL-R-55342 Requirements.
6. Custom Requirements Welcomed.
7. Wraparounds available on most sizes for Surface Mounting.
8. Silicon Dioxide Passivation available on Thin Film and Glassivation on Thick Film (Moisture Barrier).

*The Johnson Noise level is dependent on Resistor value and film sheet resistivity with lower noise levels found on lower resistivity Films.
**Derate Power from Max at 70°C to zero at 150°C

CUSTOM LASER SERVICES

Our In-House Tooling/Probe Card assembly and YAG Laser Systems provide customers with resistor trimming of THICK AND THIN FILM circuits on a rapid turn-around basis. We can process prototype quantities or large production runs rapidly to provide our customers with a "panic" turnaround or back-up to their own shop. Piconics is equipped for passive or active trimming of thin or thick film materials automatically, semi-automatically or manually. In addition our CO_2 laser provides custom ceramic machining and hole drilling. (Including Beryllia)
Piconics provides low impedance plated through holes in Thick or Thin Film products.

PICONICS, INC. 26 CUMMINGS ROAD, TYNGSBORO, MA 01879 • TEL: (508) 649-7501 • FAX: 508-649-9643

PRECISION RESISTIVE PRODUCTS, INC.
HIGHWAY 61 SOUTH, MEDIAPOLIS, IOWA 52637
(319) 394-9131 • TWX: 510-100-8039 • FAX: (319) 394-9280

METAL FILM RESISTORS

PR-SERIES

ULTRA PRECISION METAL FILM RESISTORS

- **Low Temperature Coefficients**
- **Tight Tolerance** • **High Stability** • **Low Noise**

DIMENSIONS

Style	Max. L.	Max. Dia.	CL to CL	Dim. A
PR-/20	0.170	0.072	0.200	AWG #26
PR1/10	0.280	0.102	0.300	AWG #22
PR1/8A	0.280	0.102	0.300	AWG #22
PR1/8	0.400	0.150	0.450	AWG #22
PR1/4A	0.416	0.161	0.450	AWG #22
PR1/4	0.600	0.200	0.685	AWG #22

SPECIFICATIONS

Style	Resistance Range (Ohms)	Wattage Rating @ 85°C	Voltage Rating
PR-/20	10R-300K	1/20	200
PR1/10	10R-5ooK	1/10	300
PR1/8A	10R-500K	1/8	250
PR1/8	10R-1M	1/8	400
PR1/4A	10R-500K	1/4	300
PR1/4	10R-1M	1/4	500

TYPICAL PERFORMANCE	%ΔR
1000 Hr. Load Life 85°C	0.02
Humidity	0.04
Thermal Shock	<0.01
Short Time Overload	<0.01
Dielectric Withstanding	<0.01
Noise	<–30dB
Insulation Resistance	>10000 M. Ohm
Shelf Life	<50 PPM/YR.

TEMPERATURE COEFFICIENTS
TC25 = 0 ±25 PPM/°C –20 to +85°C
TC20 = 0 ±20 PPM/°C –20 to +85°C
TC15 = 0 ±15 PPM/°C –20 to +85°C
TC10 = 0 ±10 PPM/°C –20 to +85°C
TC5 = 0 ± 5 PPM/°C –20 to +85°C

RESISTANCE TOLERANCES
±1.0%, ±0.5%, ±.25%, & ±0.1%, ±0.5%, ±.02%, ±.01%

LEAD MATERIAL
OFHC with 60/40 Tin/Lead Coating.

RL-SERIES

ULTRA PRECISION METAL FILM RESISTORS

- **Radial Leads** • **Small Size**
- **Low TC** • **High Stability**

DIMENSIONS (INCHES)

H	Height	0.365
L	Length	0.260
W	Width	0.140
LS	Lead Spacing Lead Gage #22	0.150

SPECIFICATIONS

Style	Temperature Coefficient	Resistance Range (Ohms)	Standard Tolerance	Wattage @ 85°C
RL 1	20 PPM/°C 15 10 5	20 thru 100K	1%, 5%, .25%, .10%, .05%, & .02% .01%	0.1
RL 3	20 PPM/°C 15 10 5 2	20 thru 100K	1%, 5%, .25%, .1% .05%, & .02% .01%	0.3

TYPICAL ENVIRONMENTAL PERFORMANCE	
	% ΔR
1000 Hr. Load Life	±0.02%
Humidity	±0.04%
Temperature Cycling	±0.01%
Short Time Overload	±0.01%
Insulation Resistance	>100 Megohms
Noise Index	<–30dB
Voltage Coefficient	<0.05 PPM/Volt
1 Year Shelf Life	±50 PPM

TEMPERATURE COEFFICIENTS
TC20 = 0 ± 20 PPM/°C – 20 to + 85°C
TC15 = 0 ± 15 PPM/°C – 20 to + 85°C
TC10 = 0 ± 10 PPM/°C – 20 to + 85°C
TC 5 = 0 ± 5 PPM/°C – 20 to + 85°C
TC 2 = 0 ± 2 PPM/°C – 0 to + 60°C

CUSTOMIZED RESISTORS

SETS AND NETWORKS

- **Custom Designed** • **Cost Effective**
- **Low TCR** • **High Stability**

CUSTOMIZED RESISTOR SETS AND NETWORKS

Because of the high consistency and uniformity of the film deposition process and the high, repeatable accuracy of automated trimming equipment, descrete film resistors are available in matched pairs, multivalue sets and discrete networks with high precision and very dependable performance at reasonable cost. Resistance values, tolerances, temperature coefficients, as well as the matching and/or tracking of these parameters, can be specified and meet to exceptionally high degrees. The optimum range for the tightest requirements is 100 ohms thru 100,000 ohms, but 10 ohms thru 1 megohms is a practical range for less stringent requirements.

NOTE:
Cost savings can be realized when relatively tight matching requirements are specified while permitting the absolute parameters of the discrete resistor to have more relaxed specifications.

Application engineers are available to assist you in specifying your requirements in the most economical way possible.

Please contact the factory for complete information.

GENERAL SPECIFICATIONS	
Nominal Resistance	10 ohms thru 1 megohm
Resistance Tolerance	±1% thru ±0.01%
Wattage	1/20 watt thru 1 watt
Temperature Coefficient	±100 PPM thru ±5 PPM
Resistance Matching	±1% to ±.005%
Temperature Coef. Tracking	±50 PPM/°C to ±1 PPM/°C

PACKAGING

Matched sets are individually packaged in coin envelopes and identified by customer part number.

Discrete resistor networks are available in S.I.P. and D.I.P. configurations and can be customized in an infinite variety of shapes and sizes to meet customer requirements.

PRECISION RESISTIVE PRODUCTS, INC.
HIGHWAY 61 SOUTH, MEDIAPOLIS, IOWA 52637
(319) 394-9131 • TWX: 510-100-8039 • FAX: (319) 394-9280

METAL FILM RESISTORS

SGP¼-SERIES

GENERAL PURPOSE MINIATURE ¼ WATT RESISTORS

- **Small Size** • **¼ Watt Rating**
- **Conformal Coating** • **Metal Film Performance**

DIMENSIONS

Style	Max. L.	Max. Dia.	Dim. A	Lead L.
SGP¼	0.170	0.072	0.020	1.0 ±0.062

SPECIFICATIONS

Style	Resistance Tolerance	Resistance Range (Ohms)	Wattage Rating @ 70°C	Voltage Rating
SGP¼	1%, 5%	10R-500K	¼	200

NOTE:
The SPG¼ is suitable for high density applications and is capable of being auto inserted. Standard metal film performance has been enhanced by using a ceramic core, .020 leads, in line testing and a state of the art coating system for environmental protection. Marking is alpha-numeric.

TYPICAL PERFORMANCE	% ΔR
1000 Hr. Load Life @ 70°C	±0.25
Temperature Cycling	0.25
Noise	<−30dB
Shelf Life	<100 PPM
Humidity	0.40
Short Time Overload	0.25
Insulation Resistance	>1000 M

TEMPERATURE COEFFICIENTS
50 PPM/°C & 100 PPM/°C

RESISTANCE TOLERANCES
±5.0%, ±2.0% ±1.0%

LEAD MATERIAL
The core material is OFHC and is electroplated with a 200 micro inch coating of 60/40 tin/lead.

GP-SERIES

GENERAL PURPOSE PRECISION METAL FILM RESISTORS

- **Economical** • **High Performance**
- **Very Stable** • **Low Noise**

DIMENSIONS

Style	Max. L.	Max. Dia.	CL to CL	Dim. A
GP⅛	0.170	0.072	0.200	AWG #26
GP¼	0.280	0.102	0.325	AWG #22
GP½	0.400	0.150	0.450	AWG #22
GP¾	0.600	0.200	0.685	AWG #22
GP1	0.600	0.200	0.685	AWG #20

SPECIFICATIONS

PRP Style	Mil. Style	Resist. Range (Ohms)	Wattage Rating @ 70°C	Wattage Rating @ 125°C	Voltage Rating
GP⅛	RN50	10—500K	⅛	1/20	200
GP¼	RN55	2.5—500K	¼	1/10	300
GP½	RN60	2.5—1 M	½	⅛	500
GP¾	RN65	10—1.5M	¾	¼	500
GP1	RN70	10—1.5M	1	½	500

NOTE:
The GP-Series of resistors is conformally coated and fully protected against moisture by a multi-paint coat system and a hard epoxy outer coating.
Marking is alpha-numeric and meets the most demanding marking requirements. Special marking is available upon request.
Consult the factory concerning failsafe, flameproof, and fusing requirements.

TYPICAL PERFORMANCE	%ΔR
Thermal Shock	0.05
Low Temperature Operation	0.03
Terminal Strength, 5 Lb. Load	0.02
Resistance To Soldering Heat	0.04
Dielectric Withstanding Voltage	0.02
Short Time Overload	0.05
Humidity	0.20
1000 Hour Load Life @ 125°C	0.15

TEMPERATURE COEFFICIENTS
TC25 = 0 ± 25 PPM/°C −20 to +85°C
TC50 = 0 ± 50 PPM/°C −20 to +85°C
TC100 = 0 ±100 PPM/°C −20 to +85°C
TC250 = 0 ±250 PPM/°C −20 to +85°C
1010

RESISTANCE TOLERANCES
±5.0%, ±2.0%, ±1.0%, ±0.5%, ±.25%, & ±0.1%

LEAD MATERIAL
OFHC with 60/40 Tin/Lead Coating

LCR¼-SERIES

GENERAL PURPOSE PRECISION METAL FILM RESISTORS

- **Low Cost** • **Taped and Reel Package**
- **Color Band Marking** • **Exceeds Mil-R-22684B & Mil-R-10509F Performance Requirements**

DIMENSIONS

Max. L.	Max. Dia.	Lead L.	Lead Dia.
0.270″	0.098″	1¼″	0.025

GENERAL SPECIFICATIONS

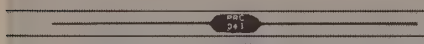
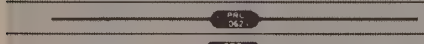
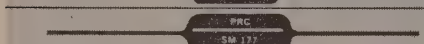
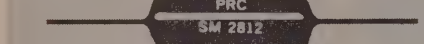
Resist. Tolerance	Resist. Range	Temp. Coef. of Resist.	Power Rating	Max. Volt.
1% 2% 5%	10Ω through 1M	50 & 100 PPM/°C	¼W (70°C)	250 VRMS

Performance Characteristics		PRP	Mil-R-22684B	Mil-10509F
Type No. (Style)		LCR¼	RL07	RN55D
Size: Inch	Body Length	.270	.243 ±.038	.250 ±.031
	Body Dia.	.098 Max.	.090 ±.008	.109 ±.031
	Lead Dia.	.024 ±.002	0.23 ±.004	.025 ±.002
Power Rating		0.25W at 70°C 0.125W at 125°C	0.25W at 70°C 0.078W at 125°C	0.125W at 70°C 0.0625W at 25°C

Performance Characteristics	PRP	Mil-R-22684B	Mil-10509F
Max. Rated Continuous Working Voltage	250V	250V	200V
Max. Ambient Temperature	165°C	150°C	165°C
TCR	±50 & ±100 PPM/°C	±200 PPM/°C	+200 −500 PPM/°C
Nominal Resistance Range	10Ω to 1MΩ	47Ω to 150kΩ	10Ω to 301kΩ
Standard Tolerances	1%, 2% & 5%	5% & 2%	1%
Dielectric Withstanding Voltage ΔR	0.25%	0.5%	0.5%
Insulation Resistance	10,000 MΩ	1,000 MΩ	10,000 MΩ
Temperature Cycling ΔR	0.25%	1.0%	0.5%
Short-Time Overload ΔR	0.25%	0.5%	0.5%
Moisture Resistance ΔR	0.5%	1.5%	1.5%
Load Life ΔR	1.0%	2.0%	1.0%
Terminal Strength ΔR	0.2%	0.5%	0.2%
Resistance to Soldering Heat ΔR	0.5%	0.5%	0.5%
Shock ΔR	0.2%	0.5%	0.5%
Vibration ΔR	0.2%	0.5%	0.5%
Low Temperature Operation ΔR	0.25%	0.5%	0.5%
Shelf Life ΔR	0.2%	0.2%	N.A.

POWER

TYPE SM AXIAL LEAD

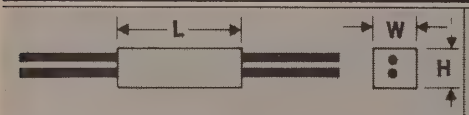
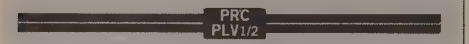
ALL DRAWINGS ILLUSTRATE ACTUAL SIZE	PRC Type	RW styles Mil. R-26	Max. Power Rating (Watts)	Min. Allowable Resist. (Ohms)	Max. Allowable Resist. (Ohms)	Max. Voltage Rating	Body Dimensions ± .787mm (.031") Length mm	Length (ins.)	Diameter mm	Diameter (ins.)	1.5"L. Lead Diam. Tinned Copper
	SM041	—	1/8W	1.0	10K	25V	6.35	(.250")	1.52	(.060")	.020"
	SM062	—	1/4W	1.0	30K	65V	6.35	(.250")	2.03	(.080")	.020"
	SM063	—	1/2W	0.1	50K	110V	7.92	(.312")	2.03	(.080")	.020"
	SM094	RW70	1W	0.1	80K	200V	10.31	(.406")	2.92	(.115")	.025"
	SM156	—	1 1/2W	0.1	400K	375V	13.49	(.531")	4.47	(.176")	.028"
	SM1711	—	2W	0.1	900K	670V	20.62	(.812")	4.83	(.190")	.028"
	SM186	RW69	3W	0.025	480K	500V	12.7	(.500")	5.26	(.207")	.028"
	SM177	RW79	3W	0.1	540K	500V	14.27	(.562")	4.83	(.190")	.028"
	SM2812	RW74	5W	0.02	1 MEG	1000V	22.23	(.875")	7.92	(.312")	.032"
	SM3114	RW67	6 1/2W	0.1	1.5 MEG	1000V	25.4	(1.000")	7.92	(.312")	.032"
	SM3726	RW78	10W	0.07	4 MEG	1250V	45.21	(1.780")	10.03	(.395")	.032"

"Profit from PRECISION" Power 2-terminal Type SM Resistors:

- For "hard-to-find" power applications.
- 0.02 ohm to 4 Megs (tols. to ±0.05%).
- TCR char: 0±10ppm/°C. (100 ohms and above).
- Stability: To ±0.005%/yr. (Shelf Life)
- 0.125W to 10Watts at 25°C.
- Voltage ratings: To 1250V.
- Temperature span: –65°C. to +275°C.
- Low EMF vs. copper lead construction.
- No minimum quantities required.
- Purchasing information - please specify: Quantity, PRC type, resistance value, tolerance, TCR char. - delivery and special features that may apply.
- Ask about SM-4 four terminal designs.

SHUNTS

TYPE PLV FOUR TERMINAL

	PRC Type	Max. Rating Watts / Amps	Body Dimensions ±.787mm (.031") (H) mm / ins.	(L) mm / ins.	(W) mm / ins.	1" L Lead Diam. Tinned Copper	Std. Min. Res. @ Max. Watts / Special Min. Res. @ Derated Power
	PLV½	0.5W / 3A	4.95 / .195"	8.64 / .340"	3.18 / .125"	.020" #24 AWG	.055Ω @0.5W / .005Ω @ 0.05W
	PLV1	1W / 5A	5.97 / .235"	9.53 / .375"	4.32 / .170"	.020" #24 AWG	.04Ω @1W / .005Ω @ .125W
	PLV2	2W / 8A	6.35 / .250"	9.78 / .385"	5.72 / .225"	.025" #22 AWG	.03Ω @2W / .005Ω @0.3W
	PLV3	3W / 15A	6.35 / .250"	12.7 / .500"	6.35 / .250"	.032" #20 AWG	.013Ω @ 3W / .005Ω @ 1.125W
	PLV5	5W / 15A	7.87 / .310"	15.88 / .625"	7.87 / .310"	.032" #20 AWG	.022Ω @ 5W / .005Ω @ 1.125W

"Profit from PRECISION" Type PLV Shunts: Perfect for current-sensing by voltage drop method.

- 0.5W to 10Watts at 25°C.
- 0.005 ohm to 100 ohms (tols. to ±0.005%).
- TCR char: 0±15ppm/°C. (Std.)
- Stability: To ±0.005%/yr. (Shelf Life)
- Temperature span: –65°C to +275°C.
- Request a free engineering sample.

Request General Resistor Catalog/Handbook for complete engineering and purchasing information.

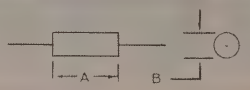
PRC **PRECISION RESISTOR CO., INC.**

10601 75th STREET NO. • LARGO, FL 34647 U.S.A. • TEL: (813) 541-5771 • TELEX: 821788 • FAX: (813) 546-9515

AXIAL LEAD TYPE HR

ULTRA

PRC Types	Meets or Exceeds Environmental Conditions of: MIL- R-39005	MIL- R-93	Max. Watts 1% Res. Tol.	Max. Watts 0.01% Res. Tol.	Max Volts	Body Dimensions (A) Length (±.031")	Body Dimensions (B) Diam. (±.062)	Leads Diam. Max.	Resistance (Ohms) Min.	Resistance (Ohms) Max.
HR175N	—	—	.2W	.100W	100V	.312"	.156"	.020"	0.1	100K
HR186N	—	—	.2W	.100W	150V	.375"	.187"	.025"	0.1	150K
HR188N	RBR74	—	.25W	.125W	150V	.500"	.193"	.025"	0.1	200K
HR255N	RBR75	—	.25W	.125W	150V	.295"	.250"	.025"	0.1	316K
HR256N	RBR56	RB56	.25W	.125W	200V	.375"	.250"	.032"	0.1	200K
HR258N	RBR55	RB55	.33W	.150W	300V	.500"	.250"	.032"	0.1	500K
HR2512N	RBR54	RB54	.5W	.25W	300V	.750"	.250"	.032"	0.1	1 MEG
HR3114N	RBR76	—	.5W	.25W	300V	.812"	.312"	.032"	0.1	1.5 MEG
HR3712N	RBR53	RB53	.66W	.33W	300V	.750"	.375"	.032"	0.1	2 MEG
HR3716N	RBR52	RB52	1W	.5W	600V	1.000"	.375"	.032"	0.1	3 MEG
HR5016N	RBR57	RB57	1.5W	.75W	600V	1.000"	.500"	.032"	0.1	5 MEG
HR5024N	—	RB58	2W	1W	900V	1.500"	.500"	.032"	0.1	7.5 MEG
HR5032N	—	RB59	2.5W	1.25W	1200V	2.000"	.500"	.032"	0.1	10 MEG



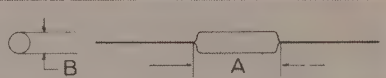
"Profit from PRECISION"
Ultra Wire Wound Type HR Resistors:

- Ideal for precise DC measurements.
- 0.1 ohm to 10 Megs (tols. to ±0.005%).
- TCR: 0±5ppm/°C. Special: To ±1ppm/°C.
- Stability: To ±0.001%/yr. (Shelf Life)
- Temperature span: –65°C to +125°C.
- 100% testing to NIST standards.

TYPE SX (SILICONE PROTECTION)

PRECISION

PRC TYPE SX Inductive	PRC TYPE SX Non-Inductive	$P=\frac{E^2}{R}$ Max. Watts	$E=\sqrt{PR}$ Max. Volts	Body Dimensions (±.031") A Length	Body Dimensions (±.031") B Diameter	Leads Max. Diam.	Resistance (Ohms) Min.	Resistance (Ohms) Max. Standard	Resistance (Ohms) Max. Special
SX062	SX062N	.04W	35V	.270"	.080"	.020"	1.0	17K	30K
SX063	SX063N	.05W	50V	.332"	.080"	.020"	0.1	20K	50K
SX072	SX072N	.06W	45V	.270"	.090"	.020"	0.1	25K	35K
SX073	SX073N	.07W	65V	.332"	.090"	.020"	0.1	30K	65K
SX093	SX093N	.1W	85V	.332"	.115"	.025"	0.1	35K	75K
SX095	SX095N	.125W	125V	.457"	.115"	.025"	0.1	60K	180K
SX105	SX105N	.166W	165V	.457"	.130"	.025"	0.1	75K	210K
SX106	SX106N	.2W	200V	.520"	.130"	.025"	0.1	100K	280K
SX143	SX143N	.2W	200V	.332"	.160"	.028"	0.1	50K	130K
SX154	SX154N	.25W	250V	.395"	.176"	.028"	0.1	100K	200K
SX155	SX155N	.25W	250V	.457"	.176"	.028"	0.1	100K	300K
SX156	SX156N	.33W	330V	.520"	.176"	.028"	0.1	140K	400K
SX175	SX175N	.33W	330V	.457"	.190"	.028"	0.1	135K	350K
SX158	SX158N	.5W	500V	.645"	.176"	.028"	0.1	450K	600K
SX186	SX186N	.5W	500V	.520"	.207"	.028"	0.01	150K	480K
SX3110	SX3110N	1W	1000V	.770"	.332"	.032"	0.1	750K	1.6 MEG
SX2812	SX2812N	1.25W	1000V	.895"	.300"	.032"	0.1	1 MEG	1.8 MEG
SX3712	SX3712N	1.5W	1000V	.895"	.437"	.032"	0.25	1.5 MEG	2.5 MEG
SX3716	SX3716N	2W	1250V	1.145"	.437"	.032"	0.5	2 MEG	3.5 MEG
SX3724	SX3724N	3W	1250V	1.645"	.437"	.032"	0.5	3 MEG	5 MEG
SX3730	SX3730N	5W	1500V	2.020"	.437"	.032"	0.5	4 MEG	6 MEG



"Profit from PRECISION"
Best-Selling Type SX Resistors:

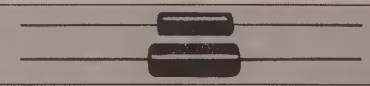
- Ideal for special-purpose applications.
- 0.01 ohm to 6 Megs (tols. to ±0.05%).
- TCR char: 0±10ppm/°C. (Std.)
- Temperature span: –55°C to +125°C.
- Operating voltage ratings: To 1500V.
- Hot-tinned copper wire leads.
- Stability: To ±0.005%/yr. (Shelf Life)

"The quality to resist permanent change is designed in from the start... even if you specify ±1% tolerances."

- Every design engineer should have PRECISION's 12 PAGE RESISTOR GUIDE... Did you request your copy?

1K 3500 ppm "off-the-shelf" compensators

PLUS TCR

Type PT094	0-.1W	.395" L.	.125" D.	.025" Lead Dia.	1K±1% TCR+3500ppm/°C.	
Type PT146	0-.25W	.520" L.	.187" D.	.028" Lead Dia.		

PRC100 LABORATORY SERIES

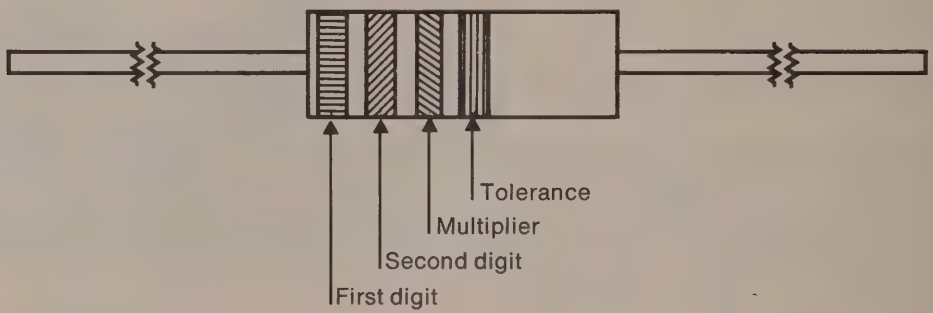
SENSORS

(AXIAL)	Type PRC100 (Std)	0-.25W	.550" L.	.188" D.	100 ohms ±0.12%	TCR+3850ppm/°C.
(PROBE)	Type PRC100.12	0-.1W	.450" L.	.188" D.		

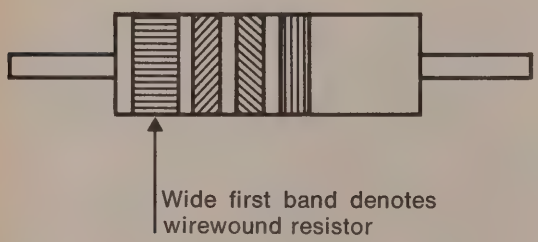
PRC PRECISION RESISTOR CO., INC.
10601 75th STREET NO. • LARGO, FL 34647 U.S.A. • TEL: (813) 541-5771 • TELEX: 821788 • FAX: (813) 546-9515

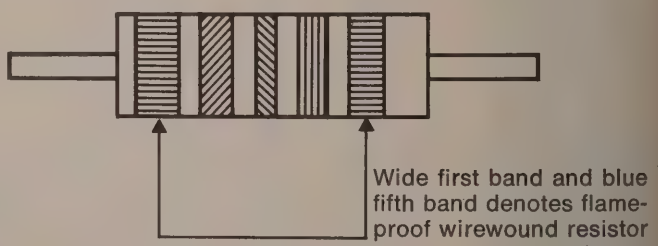
MINIGLOSSARY
RESISTOR COLOR CODES

EIA/MIL Resistor Color Codes



Color code for general-purpose industrial resistors





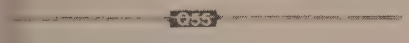
Color code for general-purpose wirewound resistors

Color	Significant digit	Multiplier	Tolerance
Black	0	1	—
Brown	1	10	± 1%
Red	2	100	± 2%
Orange	3	1000	± 3%
Yellow	4	10,000	± 4%
Green	5	100,000	—
Blue	6	1,000,000	—
Violet	7	10,000,000	—
Gray	8	—	—
White	9	—	—
Gold	—	0.1	± 5%
Silver	—	0.01	±10%
No color	—	—	±20%

Example:

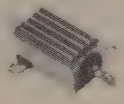
RCD RESISTORS • COILS • DELAY LINES

WORLD'S WIDEST RANGE OF RESISTORS: 0.0002Ω TO 2×10^{14}, TO ±0.0005% ¼ PPM/°C, UP TO 1000W 300KV!
APPROXIMATELY ½ BILLION PIECES IN STOCK! CONTACT FACTORY FOR NEW 78 PAGE CATALOG.
MOST PRODUCTS AVAILABLE ON EXCUSIVE "SWIFT™" PROGRAM (1-week delivery) IF UNAVAILABLE FROM STOCK!

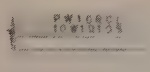


Precision Wirewound Resistors
SA: .05Ω-25M, ⅛-2W, to ±0.005%, 2ppm
MA: Mini sizes, 1/20-½W, .05Ω-1.2M
Q: Economy .01% to .5%, 1/10-1W
PC: Radial lead, .15W-1W, .05Ω-2M

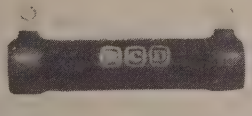
Power Wirewound Resistors
100: ½-50W, .01%-10%, .005Ω-1M
200: Mini sizes, 1W-10W
RW: Economy 1W-3W



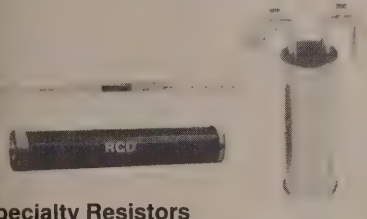
Chassis Mount Wirewound
600: 5W-1000W, .005Ω-250K, .01%-5%
600L: Insulated leadwires, 10W-50W



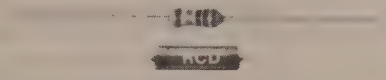
Ceramic Encased Resistors
PW: Axial lead, 2W-25W, low cost
PWB: Mini sizes, 3W-10W
PV: Radial lead, 2W-10W
PWV: Vertical mount, 5W-25W
ULV: Ultra low value, to .005Ω 0.5%
LVF: Four terminal, as low as .0005Ω



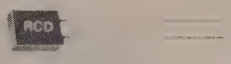
Tubular Power WW Resistors
TL: 5-500W, 0.1Ω-500K, 1%-10%
TLA/TLR: Axial or Radial lead
TLV/TLT: Adjustable & tapped versions



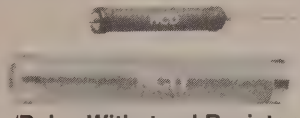
Specialty Resistors
A: Resistance standards to ±0.0005%
RG: Metal glaze, up to 20KV, 1M-10GΩ
RH: Precision high-megohm, to 0.1% 10ppm
UHV: Ultra high value to $2 \times 10^{14}\Omega$
SR: High power thick film, to 250W 300KV
HF: High frequency to 10GHZ
ZJ: Zero-ohm jumpers, 2A-20Amp



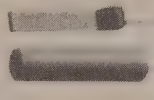
Carbon & Metal Film Resistors
CF/CFS: Carbon film ⅛-3W & mini sizes
MF/PMF: Precision 1Ω-22M, to .01% 5ppm
HM: Hermetic sealed MF, 1/20W-5W
GP/GPS: Low cost MF, mini sizes, ⅛-2W



Precision Radial Resistors
HP: Ultra precision foil to .01% ¼ppm
VS: .3W-2W, .005%-1%, 10Ω-10M
BC: High megohm up to 1000M



Surge/Pulse Withstand Resistor
PCN: Ceramic comp., 2-270W, 14-30Kjoule
P: Low cost, lightning/cap discharge, failsafe



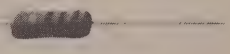
Temp. Sensitive Resistors/RTD'S
PTF: Platinum thin film, 100/500/1K, 640°C
PTC: Wirewound RTD elements, Pt/Ni/Nife
PTS: RTD probes with metal sheaths, 500°C
ATB/ATS: WW, +80 to 6000ppm, .1Ω-1M
LP: Econ. film, +150 to 7000ppm, 1Ω-100K
LPT: Economy platinum, 10Ω-500Ω, 300°C

Inductor Chokes/Coils
AL: Economy, 3 sizes, .1µH-2.2mH
P/PF: Molded or shielded, .1µH-10mH
CA/CH: High current chokes, 1A-20A
HVI: High values 1mH to 2H
LE/ST: Ethernet, starlan pulse transformer
T: Toroidal inductors, transformers

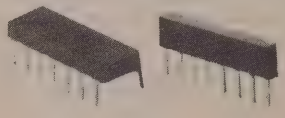
Delay Lines
SA: Active SIP, 20-1000ns
A: Active DIP, 10-1000ns
SP: Passive SIP, 5-500ns
P: Passive DIP, 0.1-2000ns
E: ECL Active DIP, 10-200ns
TT: Programmable TTL, 3-8 Bit
EC: Programmable ECL, 3-8 Bit

Flameproof Fuse Resistors
BW: Economy film, ¼-3W, .1Ω-100K
FR: Wirewound, ½-50W, .05Ω-25K
TF: Thermal fuse, axial & radial, 1W-60W
TFP: Failsafe pulse withstanding

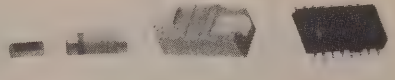
Microminiature Resistors
MFA: World's smallest, axial, 1Ω-4.7M
MR: Microsize, radial, 4.7Ω-1000M
MG: Mini ½W & 1W are ⅛W & ¼W size



Metal Oxide Resistors
RSF: ½W-10W, 0.1Ω-510K, 1%-5%
RMF: Mini sizes, ½W-7W, .2Ω-150K



Networks/Hybrids
C/CL: Std & low profile thick film SIPs
CLL: Super low profile SIP, .100" Max.
CLL-50/-25: 50-mil & 25-mil pin spacing
CP: Precision thin film SIP
CDN/CSN: Custom DIP & SIP networks
H: SIP, DIP, SM Hybrids, Active & Passive



Surface Mount Products
MC: Thick-film chips, 1/20-3W, 1Ω-22M
MCT: Thick-film chips, Military-grade
BLU: Thin-film chips, to 0.05% 5ppm/°C
MW: Wirewound, 1-5W, .01Ω-25K, .01-5%
MGP/MCF: 1/10-½W, MF & CF MELF's
MHM: Hermetically sealed metal film
HR: High-megohm to $10^{12}\Omega$
SRH: High voltage, 1KV to 5KV
MLP: Temp. sensitive, +450 to 5000ppm
MBW: Flameproof fusible resistors
SF: 4-terminal, 0.001Ω to 25KΩ
SMN/SMTF: Thick- and thin-film networks
SMM: SM thick-film SIP networks
SMN25: Fine pitch, 25-mil networks
SMN2010: Leadless chip networks
CI/MCI: Chip inductors, 5 sizes
MSI: Molded shielded chip inductors
SMA/SMP: Active & passive delay lines
STT: Programmable 3-bit delay lines
SPT: Pulse transformers
SM Kits: 0805 & 1206, thick & thin chips

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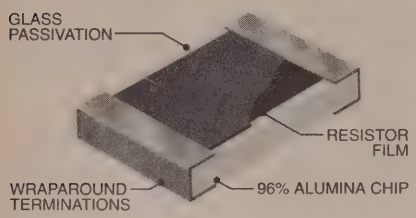
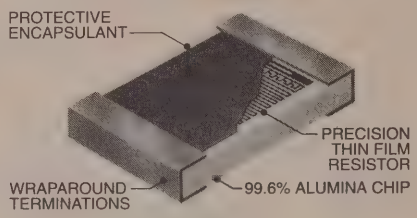
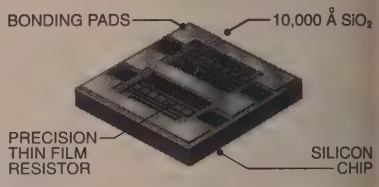
Thick & Thin Film Chip Resistors

State of the Art manufactures the industry's most comprehensive selection of thick and thin film chip resistors for your circuit designs. Regardless of your application, you can readily match type, size, value, tolerance, TCR, and reliability requirements to a SOTA chip. For special applications, we offer 4-pad Kelvin resistors, jumpers, untrimmed resistors, silicon back contact resistors, and multi-tap resistors. Our engineering expertise and advanced manufacturing capabilities ensure exceptional chip performance.

Request our full line catalog for detailed technical and product information.







Thick Film Chip Resistors on 96% Alumina Substrates

- 13 sizes, 0Ω to 30MΩ (standard)
- Tolerances to 0.5%
- TCRs to ±100 ppm
- Power dissipation to 2 watts
- Solderable wraparound, epoxy and wire bondable terminations
- MIL-R-55342 qualified to S level
- Custom designs available

Thin Film Chip Resistors on 99.6% Alumina Substrates

- 12 sizes, 5Ω to 5.6MΩ
- Tolerances to .05%
- TCRs to ±25 ppm
- Power dissipation to 1.5 watts
- Solderable wraparound, epoxy and wire bondable terminations
- MIL-R-55342 qualified to R level
- Custom designs available

Thin Film Chip Resistors on Silicon Substrates

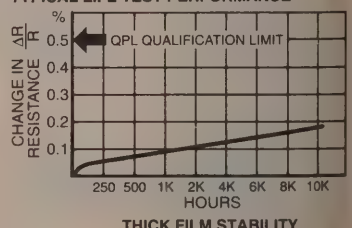
- 4 sizes, 5Ω to 15MΩ
- Tolerances to .05%
- TCRs to ±25 ppm
- Small size, high power dissipation
- Wire bondable or back contact terminations
- High reliability screening
- Custom designs available

The table below summarizes the comparative performance characteristics for our standard and MIL-R-55342 qualified chip resistors. Because all chips are manufactured using the same processes, standard and military specifications for a given test condition are often very close or identical. The distinction between standard and military is made by the rigid screening and testing done to establish that all military qualified parts meet the performance characteristics below. Optional high reliability screening of standard chips is also available.

TEST CONDITION	STANDARD		MIL-R-55342			
	THICK FILM	THIN FILM	E*	H*	K	M
Resistance Range	0Ω-30MΩ	5Ω-15MΩ	5.6Ω-1MΩ	5.6Ω-1MΩ	5.6Ω-15MΩ	5.6Ω-15MΩ
TCR (-55 to +125°C) in ppm/°C	to ±100	to ±25	±25	±50	±100	±300
Max. Ambient Temperature, Full Power	70°C	70°C	70°C	70°C	70°C	70°C
Max. Temperature, Zero Wattage	150°C	150°C	150°C	150°C	150°C	150°C
Thermal Shock (max. % change)	±0.5	±0.1	±0.1	±0.25	±0.5	±0.5
Low Temperature Operation (max. % change)	±0.25	±0.1	±0.1	±0.25	±0.25	±0.5
Short-time Overload (max. % change)	±0.25	±0.1	±0.1	±0.1	±0.25	±0.5
Resistance to Bonding Exposure (max. % change)	±0.25	±0.2	±0.2	±0.25	±0.25	±0.25
Moisture Resistance (max. % change)	±0.5	±0.2	±0.2	±0.4	±0.5	±0.5
Life, 2000 Hours (max. % change)	±0.5	±0.5	±0.5	±0.5	±0.5	±2.0
High Temperature Exposure (max. % change)	±0.5	±0.1	±0.1	±0.2	±0.5	±1.0

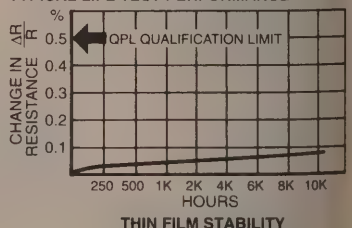
** Characteristics E and H are available in thin film only.*

TYPICAL LIFE TEST PERFORMANCE



THICK FILM STABILITY

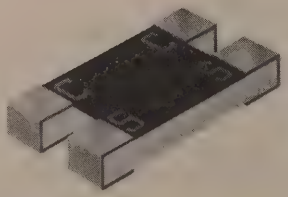
TYPICAL LIFE TEST PERFORMANCE



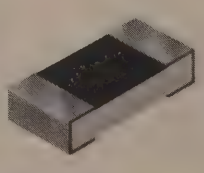
THIN FILM STABILITY

SPECIAL APPLICATION CHIP RESISTORS

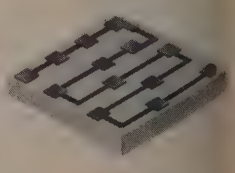
- Untrimmed thick film chip resistors which can be user trimmed to any resistance value up to approximately double their initial value;
- Four-terminal thick film Kelvin resistors with two input (source) terminals and two sense terminals for current sensing applications;
- Thick film zero ohm jumper chips with wraparound terminations for crossover applications;
- 30 x 30 mil thin film alumina and silicon multitap resistors.



4-TERMINAL KELVIN CHIP



ZERO OHM JUMPER



MULTI-TAP CHIP

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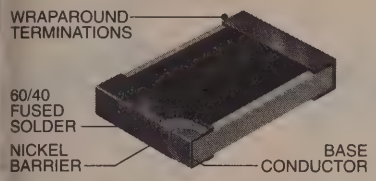
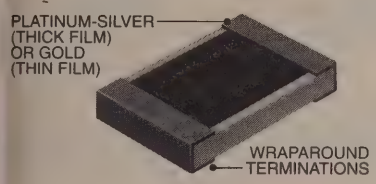
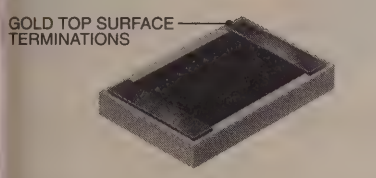
Thick & Thin Film Chip Resistors



Style C
Solderable Wraparound



Style C
Epoxy Bondable Wraparound



Style A
Wire Bondable

These three standard termination styles accommodate the majority of chip resistor applications.

The Style C pretinned solderable wraparound termination provides an exceptionally strong and reliable solder joint for wave solder, vapor phase, reflow, and other solder-based surface mount applications. After attachment, the resistor element is away from the solder joint, face up for easy post-attachment inspection and/or trimming. Three layers make up the termination. The base layer is a high adhesion conductor covered by a nickel barrier to prevent solder joint degradation, such as leaching and diffusion. The outer finish is fused 60/40 tin/lead solder.

The Style C untinned epoxy bondable wraparound termination provides excellent adherence and compatibility with conductive epoxy mounting. After attachment, the resistor element is face up for easy post-attachment inspection and/or trimming. The termination material typically consists of a high conductivity layer of untinned platinum/silver (thick film) or gold (thin film). Other thick film termination materials such as platinum/gold or gold are available by special order. These untinned terminations are *not* intended for use in solder applications.

The Style A wire bondable top surface termination provides strong, high conductivity connections for wire bond applications. Attachment to a circuit board is typically made using epoxy, although bottom metallized chips for solder attachment are available by special order. After attachment, the resistor element is face up for easy post-attachment inspection and/or trimming. The termination pads are gold with an optional aluminum finish available on thin film silicon only. Other termination materials are available by special order.

The table below shows how to specify each of these three standard termination styles and their availability according to chip type. State of the Art also offers variations to these terminations and custom finishes. Please consult the factory for more information.

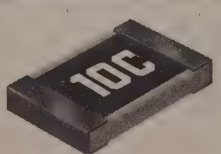
TERMINATION	STANDARD			MIL-R-55342	
	THICK FILM ON CERAMIC	THIN FILM ON CERAMIC	THIN FILM ON SILICON	THICK FILM ON CERAMIC	THIN FILM ON CERAMIC
SOLDERABLE WRAPAROUND (PRETINNED)	S0504 **CPX** 150J (solder over nickel)	S0505 **CA** 1001FH **B** (solder over nickel)	—	M55342K06 **B** 110DS (solder over nickel)	M55342H06 **B** 110DR (solder over nickel)
EPOXY BONDABLE WRAPAROUND (UNTINNED)	S0504 **CP** 150J (platinum/silver)	S0505 **CA** 1001FH **W** (gold)	—	M55342K06 **C** 110DS (platinum/silver)	—
WIRE BONDABLE TOP SURFACE	S0505 **AP** 150J (gold)	S0505 **AA** 1001FH **W** (gold)	S0505 **AS** 1001FH **W** (gold) or S0505 **AS** 1001FH **A** (aluminum)	M55342K06 **W** 110DS (gold over nickel)	M55342H06 **W** 110DR (gold)

The table below shows the standard resistance values for the 100 to 988 ohm decade for the most commonly used thick and thin film resistance tolerances (0.1% available in thin film only). Do not hesitate to ask for any value that you need.

TOLERANCE

0.1	1.0	2.0 5.0	10	0.1	1.0	2.0 5.0	10	0.1	1.0	2.0 5.0	10	0.1	1.0	2.0 5.0	10	0.1	1.0	2.0 5.0	10	0.1	1.0	2.0 5.0	10	0.1	1.0	2.0 5.0	10
100	100	100	100	137	137	---	---	187	187	---	---	252	---	---	---	332	332	---	---	437	---	---	---	583	---	---	---	777	---	---	---
101	---	---	---	138	---	---	---	189	---	---	---	255	255	---	---	336	---	---	---	442	442	---	---	590	590	---	---	787	787	---	---
102	102	---	---	140	140	---	---	191	191	---	---	258	---	---	---	340	340	---	---	448	---	---	---	597	---	---	---	796	---	---	---
104	---	---	---	142	---	---	---	193	---	---	---	261	261	---	---	344	---	---	---	453	453	---	---	604	604	---	---	806	806	---	---
105	105	---	---	143	143	---	---	196	196	---	---	264	---	---	---	348	348	---	---	459	---	---	---	612	---	---	---	816	---	---	---
106	---	---	---	145	---	---	---	198	---	---	---	267	267	---	---	352	---	---	---	464	464	---	---	619	619	---	---	---	---	820	820
107	107	---	---	147	147	---	---	200	200	200	---	---	---	270	270	357	357	---	---	470	---	470	470	---	---	620	---	825	825	---	---
109	---	---	---	149	---	---	---	203	---	---	---	271	---	---	---	---	---	360	---	475	475	---	---	626	---	---	---	835	---	---	---
110	110	110	---	150	150	150	150	205	205	---	---	274	274	---	---	361	---	---	---	481	---	---	---	634	634	---	---	845	845	---	---
111	---	---	---	152	---	---	---	208	---	---	---	277	---	---	---	365	365	---	---	487	487	---	---	642	---	---	---	856	---	---	---
113	113	---	---	154	154	---	---	210	210	---	---	280	280	---	---	370	---	---	---	493	---	---	---	649	649	---	---	866	866	---	---
114	---	---	---	156	---	---	---	213	---	---	---	284	---	---	---	374	374	---	---	499	499	---	---	657	---	---	---	876	---	---	---
115	115	---	---	158	158	---	---	215	215	---	---	287	287	---	---	379	---	---	---	505	---	---	---	665	665	---	---	887	887	---	---
117	---	---	---	160	---	160	---	218	---	---	---	291	---	---	---	383	383	---	---	---	---	510	---	673	---	---	---	898	---	---	---
118	118	---	---	162	162	---	---	---	---	220	220	294	294	---	---	388	---	---	---	511	511	---	---	---	---	680	680	909	909	---	---
120	---	120	120	164	---	---	---	221	221	---	---	298	---	---	---	---	---	390	390	517	---	---	---	681	681	---	---	---	---	910	---
121	121	---	---	165	165	---	---	223	---	---	---	---	---	300	---	392	392	---	---	523	523	---	---	690	---	---	---	920	---	---	---
123	---	---	---	167	---	---	---	226	226	---	---	301	301	---	---	397	---	---	---	530	---	---	---	698	698	---	---	931	931	---	---
124	124	---	---	169	169	---	---	229	---	---	---	305	---	---	---	402	402	---	---	536	536	---	---	706	---	---	---	942	---	---	---
126	---	---	---	172	---	---	---	232	232	---	---	309	309	---	---	407	---	---	---	542	---	---	---	715	715	---	---	953	953	---	---
127	127	---	---	174	174	---	---	234	---	---	---	312	---	---	---	412	412	---	---	549	549	---	---	723	---	---	---	965	---	---	---
129	---	---	---	176	---	---	---	237	237	---	---	316	316	---	---	417	---	---	---	556	---	---	---	732	732	---	---	976	976	---	---
130	130	130	---	178	178	---	---	240	---	240	---	320	---	---	---	422	422	---	---	---	---	560	560	741	---	---	---	988	---	---	---
132	---	---	---	180	---	180	180	243	243	---	---	324	324	---	---	427	---	---	---	562	562	---	---	750	750	750	---				
133	133	---	---	182	182	---	---	246	---	---	---	328	---	---	---	---	---	430	---	569	---	---	---	759	---	---	---	TOTAL/DECADE			
135	---	---	---	184	---	---	---	249	249	---	---	---	---	330	330	432	432	---	---	576	576	---	---	768	768	---	---	192	96	24	12

STANDARD 3-DIGIT CODE
Value = 22 kΩ



EIA-96 3-DIGIT CODE
Value = 12.4 kΩ

PART MARKING — Optional chip resistor marking is available for 0705 and larger alumina substrate chips. The most popular method of marking is the standard three-digit code, where the first two digits represent the resistance value and the last digit is the multiplier. An alternate method gaining popularity in the industry is the three-digit EIA-96 method. The first two digits correspond to one of the 96 standard resistance values and the last digit is the multiplier.

Markings are screen printed on the top side of the chip with a polymer based, non-outgassing, fungus resistant ink. Custom coding is available when the chip's size can accommodate it. Laser marking of silicon chips is available on a limited basis.

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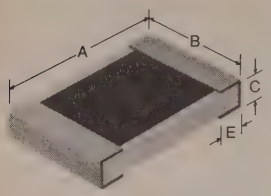
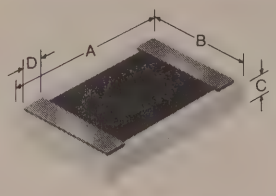
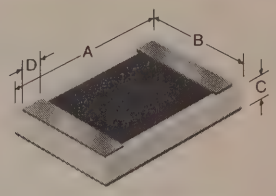
Standard Thick Film Chip Resistors



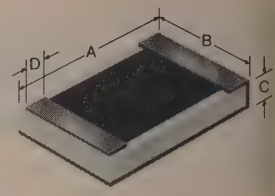
STYLE CP TERMINATION
WRAPAROUND



STYLE AP TERMINATION
GOLD WIRE BONDABLE



STYLE DP TERMINATION
METALLIZED BOTTOM



STYLE EP TERMINATION
ONE SIDE WRAPAROUND

OTHER SIZES AVAILABLE

0403
0703
1002
1507
3818

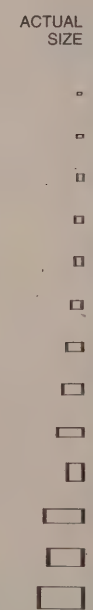
CHECK WITH FACTORY FOR FULL DETAILS

THICK FILM SIZE CODE TABLE

MEASUREMENT IN INCHES
MEASUREMENT IN mm (1 mm = .03937 inch)

SIZE CODE	LENGTH A	WIDTH B	THICKNESS C	TOP TERMINATION D	BOTTOM TERMINATION E	MAXIMUM POWER (mW)	MAXIMUM VOLTAGE (volts)
0302	.030 $^{+.007}_{-.002}$ .76 $^{+.18}_{-.05}$	.020 $^{+.003}_{-.003}$ .51 $^{+.08}_{-.08}$	.012 - .017 .30 - .43	.004 - .015 .10 - .38	.006 - .015 .15 - .38	35	15
0402	.040 $^{+.007}_{-.002}$ 1.02 $^{+.18}_{-.05}$	.020 $^{+.003}_{-.003}$ .51 $^{+.08}_{-.08}$	.015 - .022 .38 - .56	.005 - .015 .13 - .38	.008 - .016 .20 - .41	50	30
0404	.035 $^{+.007}_{-.002}$ .89 $^{+.18}_{-.05}$	.035 $^{+.003}_{-.003}$ .89 $^{+.08}_{-.08}$	.015 - .022 .38 - .56	.004 - .015 .10 - .38	.008 - .016 .20 - .41	50	25
0504	.050 $^{+.007}_{-.002}$ 1.27 $^{+.18}_{-.05}$	.040 $^{+.005}_{-.005}$ 1.02 $^{+.13}_{-.13}$	.015 - .022 .38 - .56	- -	.007 - .020 .18 - .51	125	40
0505	.050 $^{+.007}_{-.002}$ 1.27 $^{+.18}_{-.05}$	.050 $^{+.005}_{-.005}$ 1.27 $^{+.13}_{-.13}$	.015 - .022 .38 - .56	.005 - .015 .13 - .38	.007 - .020 .18 - .51	125	40
0705	.075 $^{+.007}_{-.003}$ 1.91 $^{+.18}_{-.08}$	.050 $^{+.005}_{-.005}$ 1.27 $^{+.13}_{-.13}$	.015 - .022 .38 - .56	.010 - .020 .25 - .51	.010 - .025 .25 - .64	200	50
1005	.100 $^{+.008}_{-.003}$ 2.54 $^{+.20}_{-.08}$	.050 $^{+.005}_{-.005}$ 1.27 $^{+.13}_{-.13}$	.015 - .022 .38 - .56	.010 - .020 .25 - .51	.010 - .025 .25 - .64	250	75
1206	.125 $^{+.010}_{-.005}$ 3.18 $^{+.25}_{-.13}$	.065 $^{+.005}_{-.005}$ 1.65 $^{+.13}_{-.13}$	.015 - .022 .38 - .56	.010 - .020 .25 - .51	.010 - .030 .25 - .76	250	100
1505	.150 $^{+.008}_{-.008}$ 3.81 $^{+.20}_{-.08}$	.050 $^{+.005}_{-.005}$ 1.27 $^{+.13}_{-.13}$	.015 - .022 .38 - .56	.010 - .020 .25 - .51	.010 - .025 .25 - .64	330	125
1010	.100 $^{+.010}_{-.005}$ 2.54 $^{+.25}_{-.13}$	.100 $^{+.005}_{-.005}$ 2.54 $^{+.13}_{-.13}$	.015 - .022 .38 - .56	.010 - .025 .25 - .64	.010 - .025 .25 - .64	500	75
2208	.225 $^{+.010}_{-.005}$ 5.72 $^{+.25}_{-.13}$	.075 $^{+.005}_{-.005}$ 1.91 $^{+.13}_{-.13}$	.025 - .032 .64 - .81	.010 - .020 .25 - .51	.010 - .030 .25 - .76	750	175
2010	.200 $^{+.010}_{-.005}$ 5.08 $^{+.25}_{-.13}$	.100 $^{+.008}_{-.005}$ 2.54 $^{+.20}_{-.13}$	.025 - .032 .64 - .81	.009 - .029 .23 - .74	.009 - .029 .23 - .74	1000	150
2512	.250 $^{+.010}_{-.005}$ 6.35 $^{+.25}_{-.13}$	.125 $^{+.008}_{-.008}$ 3.18 $^{+.20}_{-.20}$	.025 - .032 .64 - .81	.009 - .029 .23 - .74	.009 - .029 .23 - .74	2000	200

ACTUAL SIZE



Notes

Size 0705 is usually the most economical. Its use is recommended except where its size is excessive or where power and/or voltage ratings may be exceeded.

Size 0504 is available in Styles CP and EP only.

PART NUMBERING SYSTEM

To order standard grade or high reliability thick film chip resistors, follow the part numbering format at the right. **S0504CPX150J** specifies a standard production .050 x .040 inch, 15 ohm ± 5% resistor with pretinned nickel barrier wraparound terminations.

S 0504 CP X 150 J

SPECIAL TERMINATION
G: Gold **PS:** Platinum/silver
Z: Gold over Nickel **PG:** Platinum/gold

TCR CERTIFICATION
10: ±100 ppm **20:** ±200 ppm **30:** ±300 ppm

TOLERANCE
D: 0.5% **F:** 1% **G:** 2% **J:** 5% **K:** 10% **M:** 20%

RESISTANCE VALUE
Three or four digits are used with all leading digits significant. Four digits are used for 1% tolerance or lower, otherwise three digits are used. The last digit specifies the number of zeros to add. The letter "R" is used to represent the decimal for fractional ohmic values. Example: 5R6 is 5.6 ohms; 10R0 is 10 ohms; 16R9 is 16.9 ohms, etc.

X: Pretinned Solder over Nickel
U: Untrimmed resistor (see page 11)

TERMINATION STYLE
AP: Top-side termination with Bottom Isolated
CP: Wraparound
DP: Top-side termination with Bottom Metallized
EP: Single Wraparound with Bottom Metallized

SIZE CODE
See Physical and Mechanical Data

PREFIX
C: Commercial/Industrial (please consult factory)
S: Standard Production
H: High Reliability/Custom Screening

HIGH RELIABILITY SCREENING

We provide optional high reliability screening and testing. Any size or style that we manufacture can be processed and/or tested to meet your reliability requirements. Unless otherwise specified, our standard high reliability program consists of 100% screening and special batch testing according to the Group A and Group B tests established by MIL-R-55342.

PACKAGING

Standard grade individual lot quantities are bulk packed in anti-static self-sealing bags. High reliability (H) resistors are packed in chip tray carriers ("waffle packs"). Tape and reel packaging to EIA RS481 can be specified on a standard 7 inch reel or an optional 13 inch reel for the following sizes:

- 8 mm tape — 0504, 0505, 0705, 1005, 1206, 1010
- 12 mm tape — 1505, 2208, 2010, 2512

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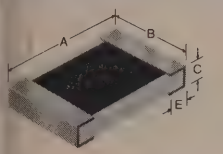
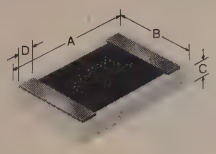
Standard Thin Film Chip Resistors

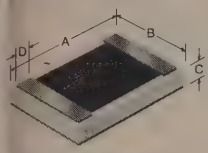
Thin Film on Alumina



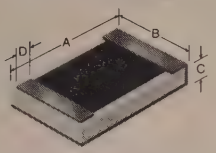
STYLE C TERMINATION
WRAPAROUND



STYLE A TERMINATION
GOLD WIRE BONDABLE

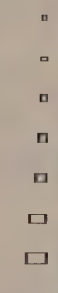


STYLE D TERMINATION
METALLIZED BOTTOM

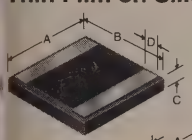


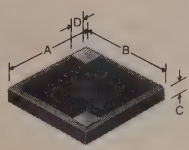
STYLE E TERMINATION
ONE SIDE WRAPAROUND

ACTUAL SIZE



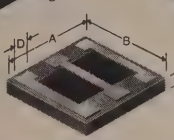
Thin Film on Silicon





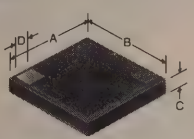
LOW VALUE FORMAT

HIGH VALUE FORMAT



MID-RANGE VALUE FORMAT &
CENTER-TAP STYLES

STYLE A TERMINATION LAPPED SILICON BOTTOM
STYLE D TERMINATION METALLIZED BOTTOM (ISOLATED)



STYLE F TERMINATION
BACK CONTACT

ACTUAL SIZE

THIN FILM ON ALUMINA SIZE CODE TABLE

MEASUREMENT IN INCHES
MEASUREMENT IN mm (1 mm = .03937 inch)

SIZE CODE	LENGTH A	WIDTH B	THICKNESS C	TOP TERMINATION D	BOTTOM TERMINATION E	MAXIMUM POWER (mW)	MAXIMUM VOLTAGE (volts)	MAXIMUM RESISTANCE (ohms)
0303	.030 +.002 −.002 .76 +.05 −.05	.030 +.002 −.002 .76 +.05 −.05	.009 - .012 .23 - .30	.005 - .012 .13 - .30	- -	50	30	100K
0402	.040 +.002 −.002 1.02 +.05 −.05	.020 +.002 −.002 .51 +.05 −.05	.009 - .012 .23 - .30	.005 - .015 .13 - .38	- -	50	40	90K
0404	.040 +.002 −.002 1.02 +.05 −.05	.040 +.002 −.002 1.02 +.05 −.05	.009 - .012 .23 - .30	.005 - .012 .13 - .30	- -	75	40	200K
0505	.050 +.003 −.001 1.27 +.08 −.03	.050 +.002 −.001 1.27 +.05 −.03	.015 - .020 .38 - .51	.005 - .015 .13 - .38	.005 - .020 .13 - .51	125	40	470K
0705	.075 +.005 −.000 1.91 +.13 −.00	.050 +.002 −.001 1.27 +.05 −.03	.015 - .020 .38 - .51	.010 - .020 .25 - .51	.010 - .025 .25 - .64	200	50	1M
1005	.100 +.006 −.000 2.54 +.15 −.00	.050 +.002 −.001 1.27 +.05 −.03	.015 - .020 .38 - .51	.010 - .020 .25 - .51	.010 - .025 .25 - .64	250	75	1M
1206	.125 +.006 −.000 3.18 +.15 −.00	.065 +.002 −.001 1.65 +.05 −.03	.015 - .020 .38 - .51	.009 - .019 .23 - .48	.010 - .030 .25 - .76	300	100	1.5M
1505	.150 +.006 −.000 3.81 +.15 −.00	.050 +.002 −.001 1.27 +.05 −.03	.015 - .020 .38 - .51	.010 - .020 .25 - .51	.010 - .025 .25 - .64	350	125	1.5M
1010	.100 +.006 −.000 2.54 +.15 −.00	.100 +.002 −.001 2.54 +.05 −.03	.015 - .020 .38 - .51	.009 - .025 .23 - .64	.009 - .025 .23 - .64	500	75	1.5M
2208	.225 +.006 −.001 5.72 +.15 −.03	.075 +.003 −.002 1.91 +.08 −.05	.025 - .030 .64 - .76	.010 - .020 .25 - .51	.010 - .030 .25 - .76	750	175	3.5M
2010	.205 +.006 −.001 5.21 +.15 −.03	.098 +.003 −.002 2.49 +.08 −.05	.025 - .030 .64 - .76	.008 - .018 .20 - .46	.009 - .029 .23 - .74	800	150	3.5M
2512	.250 +.006 −.001 6.35 +.15 −.03	.124 +.003 −.002 3.15 +.08 −.05	.025 - .030 .64 - .76	.008 - .018 .20 - .46	.009 - .029 .23 - .74	1500	200	5.6M

Sizes 0303, 0402, and 0404 are available in styles A and D only.

THIN FILM ON SILICON SIZE CODE TABLE

MEASUREMENT IN INCHES
MEASUREMENT IN mm (1 mm = .03937 inch)

SIZE CODE	LENGTH A	WIDTH B	THICKNESS C	TERMINATION D	MAXIMUM POWER (mW)	MAXIMUM VOLTAGE (volts)	MAXIMUM RESISTANCE (ohms)
0202	.020 +.002 −.002 .51 +.05 −.05	.020 +.002 −.002 .51 +.05 −.05	.009 - .012 .23 - .30	.004 - .006 .10 - .15	100	100	1M
0303	.030 +.002 −.002 .76 +.05 −.05	.030 +.002 −.002 .76 +.05 −.05	.009 - .012 .23 - .30	.004 - .006 .10 - .15	250	100	4M
0404	.040 +.002 −.002 1.02 +.05 −.05	.040 +.002 −.002 1.02 +.05 −.05	.009 - .012 .23 - .30	.004 - .006 .10 - .15	350	100	8M
0505	.050 +.002 −.002 1.27 +.05 −.05	.050 +.002 −.002 1.27 +.05 −.05	.009 - .012 .23 - .30	.004 - .012 .10 - .30	500	100	15M

S 0505 C A 1001 F H B — OPTIONS

TERMINATION MATERIAL
B: Pretinned Solder over Nickel
W: Gold
A: Aluminum

TEMPERATURE COEFFICIENT
E: ±25 ppm **H:** ±50 ppm **K:** ±100 ppm

TOLERANCE
B: 0.1% **C:** 0.25% **D:** 0.5% **F:** 1% **G:** 2% **J:** 5% **K:** 10% **M:** 20%

RESISTANCE CODE
Three or four digits are used with all leading digits significant. Four digits are used for 1% tolerance or lower, otherwise three digits are used. The last digit specifies the number of zeros to add. The letter "R" is used to represent the decimal for fractional ohmic values. Example: 5R6 is 5.6 ohms; 10R0 is 10 ohms.

SUBSTRATE MATERIAL
A: Alumina Ceramic **S:** Silicon

TERMINATION STYLE
A: Top-side termination with Bottom Isolated
C: Wraparound termination
D: Top-side termination with Bottom Metallized
E: Single Wraparound with Bottom Metallized
F: Bottom-side Electrical Contact (Silicon chips only)

SIZE CODE
See Physical and Mechanical Data

PREFIX
S: Standard Production
H: High Reliability/Custom Screening

OPTIONS AVAILABLE:
- **CTx =** Center-Tapped, x = ratio tolerance. For S0303AS1001JKW-CTF, total R = 1000Ω ±5%, ratio = 1%.
- **MT1 =** Multi-Tap silicon with 7 R1 and 5 R2 configuration, where R1 = 5xR2.
- **MT2 =** Multi-Tap silicon with 10 R1 and 10 R2 configuration, where R1 = 10xR2.

PART NUMBERING SYSTEM

To order standard grade or high reliability thin film chip resistors on alumina or silicon, follow the part numbering format below. The part number **S0505CA1001FHB** specifies a standard production .050 x .050 inch, 1000 ohm ± 1% resistor on alumina with a TCR of ±50 ppm and pretinned solder over nickel wraparound terminations.

HIGH RELIABILITY SCREENING

We provide optional high reliability screening and testing. Any size or style that we manufacture can be processed and/or tested to meet your reliability requirements. Unless otherwise specified, our standard high reliability program consists of 100% screening and special batch testing according to the Group A and Group B tests established by MIL-R-55342.

PACKAGING

Thin film on alumina individual lot quantities are bulk packed in anti-static self-sealing bags. Thin film on silicon and high reliability (H) resistors are packed in chip tray carriers ("waffle packs"). Tape and reel packaging can be specified for the following sizes:

- 8 mm tape — 0505, 0705, 1005, 1206, 1010
- 12 mm tape — 1505, 2208, 2010, 2512

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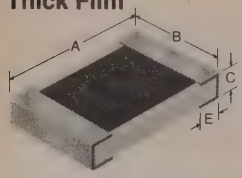
2470 FOX HILL ROAD, STATE COLLEGE, PA 16803-1797
SOURCE CODE: 56235, PHONE: 814-355-8004

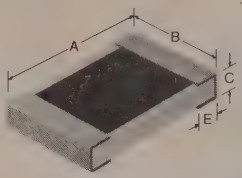
CALL TOLL FREE
800-458-3401
FAX: 814-355-2714

MIL-R-55342 Chip Resistors

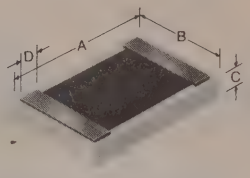
Thick Film



STYLE B TERMINATION
SOLDERABLE NICKEL BARRIER

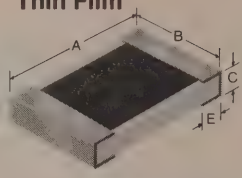


STYLE C TERMINATION
EPOXY BONDABLE

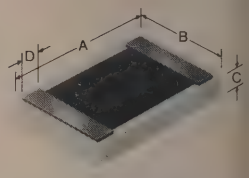


STYLE W TERMINATION
GOLD WIRE BONDABLE

Thin Film



STYLE B TERMINATION
SOLDERABLE NICKEL BARRIER



STYLE W TERMINATION
GOLD WIRE BONDABLE

- **S Failure Rate Level**
- **Industry's Broadest Selection**
- **Thick Film to 100 ppm TCR**
- **Thick Film to 1% Tolerance**
- **Thin Film to 25 ppm TCR**
- **Thin Film to 0.1% Tolerance**
- **Extensive Stocking Program**

ACTUAL SIZE

MIL-R-55342 qualified resistors must have an established reliability with life failure rates of 1% to 0.001% per 1000 hours. SOTA thick film resistors in all sizes, styles, and terminations for all standard resistance values have been qualified to the S level (0.001% failures per 1000 hours). SOTA thin film resistors are currently qualified to the R level (0.01% failures per 1000 hours).

MIL-R-55342 SIZE CODE TABLE | MEASUREMENT IN INCHES
MEASUREMENT IN mm (1 mm = .03937 inch)

SIZE CODE	LENGTH A	WIDTH B	THICKNESS C	TOP TERMINATION D	BOTTOM TERMINATION E
M55342/02	.050 +.010 −.005	.050 +.005 −.005	.015 - .022	.005 - .015	.005 - .020
RM0505	1.27 ±.25	1.27 ±.13	.38 - .56	.13 - .38	.13 - .51
M55342/06	.075 +.010 −.005	.050 +.005 −.005	.015 - .022	.010 - .020	.010 - .025
RM0705	1.91 ±.25	1.27 ±.13	.38 - .56	.25 - .51	.25 - .64
M55342/03	.100 +.010 −.005	.050 +.005 −.005	.015 - .022	.010 - .020	.010 - .025
RM1005	2.54 ±.25	1.27 ±.13	.38 - .56	.25 - .51	.25 - .64
M55432/04	.150 +.010 −.005	.050 +.005 −.005	.015 - .022	.010 - .020	.010 - .025
RM1505	3.81 ±.25	1.27 ±.13	.38 - .56	.25 - .51	.25 - .64
D55342/07*	.126 +.010 −.005	.065 +.005 −.005	.015 - .022	.009 - .019	.010 - .030
RM1206	3.20 ±.25	1.65 ±.13	.38 - .56	.23 - .48	.25 - .76
M55342/10**	.100 +.010 −.005	.100 +.005 −.005	.015 - .022	.009 - .025	.009 - .025
RM1010	2.54 ±.25	2.54 ±.13	.38 - .56	.23 - .64	.23 - .64
M55342/05	.225 +.010 −.005	.075 +.005 −.005	.025 - .032	.010 - .020	.010 - .030
RM2208	5.72 ±.25	1.91 ±.13	.64 - .81	.25 - .51	.25 - .76
M55342/08	.200 +.025 −.005	.100 +.008 −.005	.025 - .032	.008 - .018	.009 - .029
RM2010	5.08 ±.25	2.54 ±.20	.64 - .81	.20 - .46	.23 - .74
M55342/09	.250 +.010 −.005	.125 +.008 −.005	.025 - .032	.008 - .018	.009 - .029
RM2512	6.35 ±.25	3.18 ±.20	.64 - .81	.20 - .46	.23 - .74

**RM1206 is specified in MIL-R-55342 as D55342/07 rather than M55342/07.*
***RM1010 available in thick film only.*

PART NUMBERING SYSTEM

To order MIL-R-55342 chip resistors, follow the part numbering format at the right. The part number **M55342K06B100DS** specifies a .075 x .050 inch, 100Ω ± 1%, ±100 ppm S-level resistor with pretinned nickel barrier wraparound terminations.

M55342 K 06 B 100D S

LIFE FAILURE RATE
M: 1% per 1000 hrs **R:** 0.01% per 1000 hrs
P: 0.1% per 1000 hrs **S:** 0.001% per 1000 hrs

RESISTANCE AND TOLERANCE CODE
Three significant digits, with a letter indicating the decimal location, the tolerance, and the value range (Ω, KΩ, MΩ)

A: 0.1%Ω	**D:** 1%Ω	**G:** 2%Ω	**J:** 5%Ω	**M:** 10%Ω
B: 0.1%KΩ	**E:** 1%KΩ	**H:** 2%KΩ	**K:** 5%KΩ	**N:** 10%KΩ
C: 0.1%MΩ	**F:** 1%MΩ	**T:** 2%MΩ	**L:** 5%MΩ	**P:** 10%MΩ

TERMINATION TYPE
R: Pretinned, Wraparound Style
B: Pretinned, Wraparound Barrier (Ni) Style
C: Untinned, wraparound (for epoxy bonding)
W: Gold Wire Bondable

SIZE CODE
02: RM0505 **04:** RM1505 **06:** RM0705 **08:** RM2010 **10:** RM1010
03: RM1005 **05:** RM2208 **07:** RM1206 **09:** RM2512

TEMPERATURE CHARACTERISTIC
E: ±25 ppm **H:** ±50 ppm **K:** ±100 ppm **M:** ±300 ppm

MILITARY ESTABLISHED RELIABILITY SPECIFICATION MIL-R-55342

PACKAGING

MIL-R-55342 individual lot quantities are packed in chip tray carriers ("waffle packs"). Tape and reel packaging to EIA-RS481 can be specified on a standard 7 inch reel or an optional 13 inch reel for the following sizes:

- 8 mm tape — RM0505, RM0705, RM1005, RM1206, RM1010
- 12 mm tape — RM1505, RM2208, RM2010, RM2512

Individual resistors are not marked. Each package carries a non-corrosive label indicating the source code, lot number, military part number, quantity, date code, resistance value, and tolerance. Unit packages are heat sealed in water/vapor-proof conductive bags in conformance with MIL-B-81705 (type 1) and are labeled per MIL-STD-129.

MIL-R-55342 PRODUCTION TESTING

The tables at the right summarize MIL-R-55342 production testing. Each production batch is subjected to Group A screening. Subgroup 1 is performed on 100% of the product. Subgroups 2, 3, and 4 are performed on a sampling basis with no failures permitted. After the completion of Group A inspection, 13 units are selected from each inspection lot and subjected to the Group B tests, with no failures permitted in either subgroup.

GROUP A INSPECTION

SUBGROUP 1 (100%)
THERMAL SHOCK
DC RESISTANCE

SUBGROUP 2 (SAMPLING)
DC RESISTANCE — PPM VERIFICATION
MECHANICAL INSPECTION — PPM VERIFICATION

SUBGROUP 3 (SAMPLING)
VISUAL INSPECTION

SUBGROUP 4 (SAMPLING)
SOLDERABILITY

GROUP B INSPECTION

SUBGROUP 1 (SAMPLING)
RESISTANCE TO BONDING EXPOSURE
RESISTANCE TEMPERATURE CHARACTERISTIC
LOW TEMPERATURE OPERATION
SHORT TIME OVERLOAD

SUBGROUP 2 (SAMPLING)
ADHESION

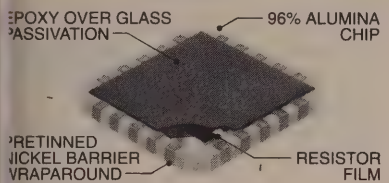
CALL TOLL FREE
800-458-3401
FAX: 814-355-2714

State of the Art, Inc.
2470 FOX HILL ROAD, STATE COLLEGE, PA 16803-1797
SOURCE CODE: 56235, PHONE: 814-355-8004

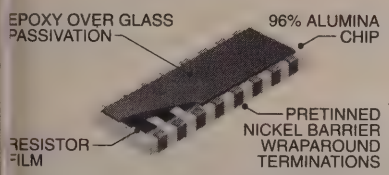
Surface Mount Resistor Networks

State of the Art's thick and thin film surface mount (SMT) resistor networks provide proven reliability in a compact package. Since the introduction of these devices to the electronics industry, State of the Art has been a leader in SMT network technology. Now, as the first manufacturer to qualify to the MIL-R-914 standard, State of the Art has also established itself as the leader in SMT network reliability.

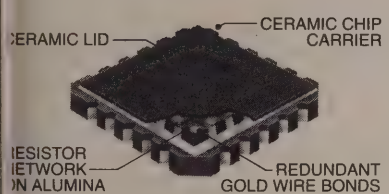
Available in thick film JEDEC and SLAMDIP styles and high precision thin film JEDEC styles, SOTA's SMT resistor networks deliver outstanding performance in high density commercial, industrial, and military applications. Their leadless design and low profile height make these devices ideal for circuits with minimal head space and limited surface area. Use the tables and charts presented on these pages to make your selection. Or, request our full line catalog for detailed technical and product information.



Thick Film JEDEC Construction



Thick Film SLAMDIP Construction



Thin Film JEDEC Construction

Thick Film Resistor Networks on 96% Alumina Substrate

- Monolithic construction
- JEDEC & SLAMDIP styles, 5Ω to 2.2MΩ
- Tolerances to 1%
- TCRs to ±100 ppm
- Power dissipation to 1.4 watt/package
- Pretinned nickel barrier terminations
- Slotted wraparound design provides flat surface for stronger solder joints
- Custom designs available
- MIL-R-914 qualified

Thin Film Resistor Networks on 99.6% Alumina Substrate

- Die & wire bond construction
- JEDEC style, 10Ω to 390kΩ
- Tolerances to 0.1%
- TCRs to ±25 ppm
- Ultra-low noise, -35 dB
- Power dissipation to 0.5 watts/package
- Gold or pretinned nickel barrier terminations
- Custom designs available

The table below summarizes the performance characteristics for our standard and MIL-R-914 resistor networks. The distinction between standard and military is made by the rigid screening and testing done to establish that all military qualified parts meet these performance characteristics.

TEST CONDITION	STANDARD		MIL-R-914			
	THICK FILM	THIN FILM	H*	V, C*	K	M
Resistance Range	5Ω-2.2MΩ	10Ω-300kΩ	10Ω-300kΩ		10Ω-2.2MΩ	10Ω-2.2MΩ
TCR (-55 to +125°C) in ppm/°C	to ±100	to ±25	≤ ±50**		≤ ±100	≤ ±300
Max. Ambient Temperature, Full Power	70°C	70°C	70°C		70°C	70°C
Max. Temperature, Zero Wattage	150°C	150°C	125°C		125°C	125°C
Thermal Shock & Power Conditioning (max. % change)	±0.5	±0.5	±0.5	±0.25	±0.7	±0.7
Low Temperature Operation (max. % change)	±0.5	±0.1	±0.1		±0.25	±0.5
Short-time Overload (max. % change)	±0.5	±0.1	±0.1		±0.25	±0.5
Resistance to Bonding Exposure (max. % change)	±0.25	±0.25	±0.25		±0.25	±0.25
Moisture Resistance (max. % change)	±0.5	±0.4	±0.4	±0.2	±0.5	±0.5
Shock, Specified Pulse (max. % change)	±0.25	±0.25	±0.25		±0.25	±0.25
Vibration, High Frequency (max. % change)	±0.25	±0.25	±0.25		±0.25	±0.25
Life, 2000 Hours (max. % change)	±0.5	±0.5	±0.5	±0.1	±0.5	±2.0
High Temperature Exposure (max. % change)	±0.5	±0.2	±0.2	±0.1	±0.5	±1.0
Steady State Humidity, 85°C-85% R.H. (max. % change)	±0.5	±0.4	±0.4	±0.2	±0.5	±0.5

**Characteristics H, V, and C are available in thin film only.*
***Characteristics H, V, and C are differentiated by the required TCR tracking ratio: H = ±50 ppm, no tracking specified; V = ±50 ppm, ±5 ppm tracking; C = ±50 ppm, ±5 ppm tracking, hermetically sealed.*

MIL-R-914, Characteristics V and C, specifies a resistance value tracking ratio for tight tolerance networks. These ratios are: ±0.1% tolerance, ±0.1% ratio; ±0.5% tolerance, ±0.1% ratio; ±1.0% tolerance, ±0.5% ratio.

HIGH RELIABILITY SCREENING

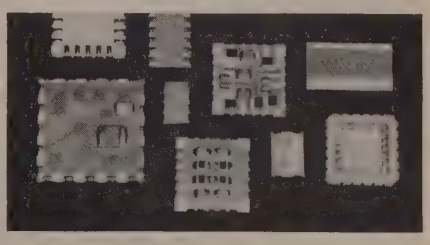
We provide optional high reliability screening and testing. Any size or style that we manufacture can be processed and/or tested to meet your specific reliability requirements. Unless otherwise specified, our standard high reliability program consists of 100% screening and special batch testing according to the Group A and Group B tests below. Alternately, testing may be specified to be in accordance with MIL-R-914, MIL-R-55342, MIL-R-83401, or any combination thereof.

GROUP A INSPECTION
SUBGROUP 1 (100%)
THERMAL SHOCK
POWER CONDITIONING
DC RESISTANCE
SUBGROUP 2 (SAMPLING)
SOLDERABILITY

GROUP B INSPECTION
SUBGROUP 1 (SAMPLING)
RESISTANCE TO BONDING EXPOSURE
TEMPERATURE COEFFICIENT OF RESISTANCE
LOW TEMPERATURE OPERATION
SHORT TIME OVERLOAD

CUSTOM DESIGNS

Surface mount resistor networks may be customized for special applications. Custom designs include modified schematic configurations, mixed resistor values in a single package, and package configurations such as modified length, width, I/O count, or pitch. The leadless, low profile construction of our thick film networks allows the mounting of passive components, such as chip capacitors, on the SMT package to form low profile RC networks.



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SOURCE CODE: 56235, PHONE: 814-355-8004
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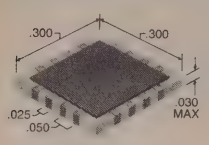
Standard Surface Mount Resistor Networks

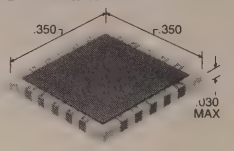
Thick Film JEDEC & SLAMDIP



JEDEC CA16

A
Watts/resistor 0.1
Watts/package 0.8
Max Vdc 50

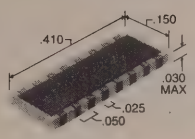
B
Watts/resistor .05
Watts/package .75
Max Vdc 50



JEDEC CB20

A
Watts/resistor 0.1
Watts/package 1.0
Max Vdc 50

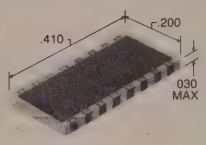
B
Watts/resistor .05
Watts/package .95
Max Vdc 50



SLAMDIP 1516

A
Watts/resistor 0.1
Watts/package 0.8
Max Vdc 50

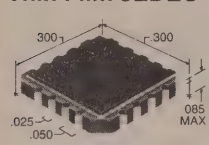
B
Watts/resistor .055
Watts/package 0.8
Max Vdc 50



SLAMDIP 2016

THICK FILM PART MARKING — Standard networks are marked with a five-digit code. The first three digits are the resistance value, with two significant digits and a multiplier. The fourth character is the resistance tolerance, and the last character is the schematic configuration. A dot is used to mark the pin 1 location.

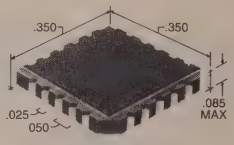
Thin Film JEDEC



JEDEC 16 I/O

A
Watts/resistor .05
Watts/package 0.4
Max Vdc 50

B
Watts/resistor .025
Watts/package 0.4
Max Vdc 50



JEDEC 20 I/O

A
Watts/resistor .05
Watts/package 0.5
Max Vdc 50

B
Watts/resistor .05
Watts/package 0.5
Max Vdc 50

THIN FILM PART MARKING — Standard networks are marked with a seven-digit code. The first four digits are the resistance value, with three significant digits and a multiplier. The fifth character is the resistance tolerance, the sixth character is the temperature characteristic, and the last character is the schematic configuration. A dot is used to mark the pin 1 location.

To order standard grade or high reliability SMT resistor networks, follow the part number format below.* The part number **SJCB20L1001FA** specifies a standard production 20-pin JEDEC network on a .350 x .350 carrier, 1000Ω ± 1%, ±200 ppm TCR, in schematic A.

S J CB 20 L 1001 F A

SCHEMATIC CONFIGURATION
A: Isolated **B:** Common Connection

TOLERANCE
B: 0.1% **D:** 0.5% **F:** 1% **G:** 2% **J:** 5%

RESISTANCE CODE
Three or four digits are used with all leading digits significant. Four digits are used for 1% tolerance or lower, otherwise three digits are used. The last digit specifies the number of zeros to add. The letter "R" is used to represent the decimal for fractional ohmic values. Example: 10R0 is 10 ohms; 16R9 is 16.9 ohms, etc.

TEMPERATURE CHARACTERISTIC
E: ±25 ppm **H:** ±50 ppm **K:** ±100 ppm **L:** ±200 ppm **M:** ±300 ppm

TOTAL I/O COUNT
(20 indicates a 20 lead package, etc.)

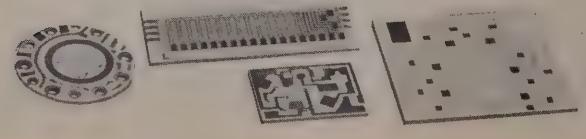
DEVICE SIZE
JEDEC STYLES
CA: .300 x .300 **CH:** .400 x .400 **CS:** .350 x .550
CB: .350 x .350 **CC:** .450 x .450
SLAMDIP STYLES
15: .150 x .410
20: .200 x .410

PACKAGE TYPE
J: Indicates SOTA JEDEC Type 'C' leadless network
D: Indicates SOTA SLAMDIP leadless network
N: Indicates SOTA non-hermetic leadless network
H: Indicates SOTA hermetic seal leadless network

PREFIX
S: Standard Production
H: High Reliability Screening

Thick Film Custom Networks

State of the Art produces a variety of custom conductor networks, resistor networks, and resistor/capacitor networks in low and high volume. We can quote and manufacture from a complete network layout or from a schematic with size, component, and output pad location requirements. Our design staff will be glad to assist you in developing your network.



NETWORK CONSTRUCTION CAPABILITIES

- SUBSTRATE: 96% Alumina std — 99% Alumina optional
- THICKNESS: .025 inch std — .012 .015 .020 .040 inch optional
- LINEAR TOOLING: Laser scribed, green scored, diamond saw cut
- HOLE TOOLING: Laser drilled, green punched
- CONDUCTORS: Silver, palladium silver, platinum silver, gold, platinum gold, etc.
- NICKEL BARRIER is available on some types of networks.
- RESISTORS: Screened on substrate or thick film chip
- PASSIVATION: Glass or silicone based
- TINNING: Solder dip or solder paste
- CAPACITORS: Screened on thick film or multilayer ceramic chip
- COMPONENT MOUNTING: Conductive epoxy or solder reflow. Other components: consult factory.

CALL TOLL FREE
800-458-3401
FAX: 814-355-2714

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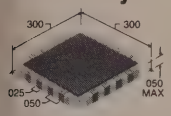
MIL-R-914 Surface Mount Resistor Networks

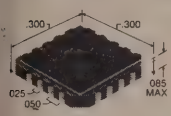
JEDEC Styles

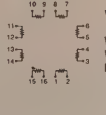


E	H, V, C	K, M
Watts/resistor	.05	0.1
Watts/package	0.4	0.8
Max Vdc	50	50

03 Thick Film (16 I/O)

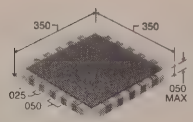
M	H, V, C	K, M
Watts/resistor	.025	.05
Watts/package	0.4	0.75
Max Vdc	50	50





W	H, V, C	K, M
Watts/resistor	.05	0.1
Watts/package	0.4	0.8
Max Vdc	50	50

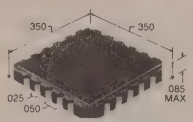
06 Thin Film (16 I/O)



E	H, V, C	K, M
Watts/resistor	.05	0.1
Watts/package	0.5	1.0
Max Vdc	50	50

04 Thick Film (20 I/O)

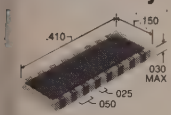
M	H, V, C	K, M
Watts/resistor	.025	.05
Watts/package	0.5	0.95
Max Vdc	50	50



P	H, V, C	K, M
Watts/resistor	.05	0.1
Watts/package	0.5	1.0
Max Vdc	50	50

07 Thin Film (20 I/O)

SLAMDIP Style



A	K, M
Watts/resistor	0.1
Watts/package	0.8
Max Vdc	

B	K, M
Watts/resistor	.055
Watts/package	0.8
Max Vdc	50

C	K, M
Watts/resistor	0.1
Watts/package	0.8
Max Vdc	50

05 Thick Film (16 I/O)

PART MARKING — MIL-R-914 networks are marked with a three-line code with four digits in each line, as shown in the example above. The code is defined as follows:

Line 1 — Digits 1-3: Date code. Digit 1 = year, digits 2 & 3 = week. Digit 4: TCR.

Line 2 — Digits 1-4: Resistance value. Three significant digits & multiplier.

Line 3 — Digit 1: Tolerance. Digit 2: Schematic configuration. Digit 3: Failure rate. Digit 4: Military JAN certification.

A dot is used to mark the pin 1 location.

MIL-R-55342 PRODUCTION TESTING

MIL-R-914 qualified thick and thin film networks must meet the established reliability criteria for fixed film resistor networks as defined in the MIL-R-914 specification. The tables below summarize MIL-R-914 production testing. Production testing in the form of Group A and Group B inspection is performed on all MIL-R-914 products prior to delivery.

GROUP A INSPECTION

SUBGROUP 1 (100%)
THERMAL SHOCK
POWER CONDITIONING
DC RESISTANCE

SUBGROUP 2 (TO 100%)
DC RESISTANCE — PPM VERIFICATION
MECHANICAL INSPECTION — PPM VERIFICATION

SUBGROUP 3 (SAMPLING)
SOLDERABILITY

GROUP B INSPECTION

SUBGROUP 1 (SAMPLING)
TEMPERATURE COEFFICIENT OF RESISTANCE
DIELECTRIC WITHSTANDING VOLTAGE
INSULATION RESISTANCE

SUBGROUP 2 (SAMPLING)
SHORT TIME OVERLOAD

SUBGROUP 3 (SAMPLING)
RESISTANCE TO SOLVENTS

To order MIL-R-914 networks, follow the part numbering format below. The part number **M914D04K1002FMM** specifies a 10 kilohms ±1%, 20-pin thick film network with fused tin/lead terminations, ±100 TCR, schematic M configuration, and 1% per 1000 hours failure rate.

M914 D 04 K 1002 F M M

LIFE FAILURE RATE
M: 1% per 1000 hrs

SCHEMATIC
See diagrams above

TOLERANCE
B: 0.1% **D:** 0.5% **F:** 1% **G:** 2% **J:** 5%

RESISTANCE VALUE
Three or four digits are used with all leading digits significant. Four digits are used for 1% tolerance or lower, otherwise three digits are used. The last digit specifies the number of zeros to add. The letter "R" is used to represent the decimal for fractional ohmic values. Example: 10R0 is 10 ohms; 16R9 is 16.9 ohms, etc.

TEMPERATURE CHARACTERISTIC
C: ±50 ppm (±5 ppm tracking), hermetically sealed
V: ±50 ppm (±5 ppm tracking), non-hermetically sealed
H: ±50 ppm **K:** ±100 ppm **M:** ±300 ppm

SIZE CODE
03: .300 x .300 inch **05:** .410 x .150 inch **07:** .350 x .350 inch
04: .350 x .350 inch **06:** .300 x .300 inch

TERMINATION TYPE
A: Gold (thin film only)
D: Fused Tin/Lead Plated
G: Hot Solder Dip

MILITARY ESTABLISHED RELIABILITY SPECIFICATION MIL-R-914

Thin Film Custom Networks

State of the Art's thin film custom circuits provide the flexibility needed to meet today's high density, low TCR, close thermal tracking, and high stability requirements for microwave and other microelectronic applications. Our wide variety of packaging options, styles, and sizes, with in-process screening and quality control, provide the optimum solution to your design challenges. Our design staff will be glad to assist you in developing your network.

■ SUBSTRATE TYPES

ALUMINA CERAMIC (99.6% Al_2O_3):
10, 15, 25 mils thick standard
As-fired & polished
Surface finish < 1 microinch
Sizes to 4 x 4 inches

SILICON:
10, 18 mils thick
3 inch diameter, standard
10,000 angstroms oxide layer
Ultra fine line etching (2.5 microns)

BERYLLIUM OXIDE (99.5% BeO):
10, 15, 25 mils thick
Surface finish < 5 microinches
Sizes up to 4 x 4 inches
(standard 2 x 2 inches)

■ RESISTORS

TANTALUM NITRIDE (20-200Ω/square)
NICHROME (20-200Ω/square)
LASER TRIMMING TO 0.1% TOLERANCE
RATIO MATCHING TO 0.05%
TCRs TO ±25 PPM
TCR TRACKING TO 2 PPM

■ CONDUCTORS

GOLD
PALLADIUM
TITANIUM/TUNGSTEN
NICKEL
ALUMINUM

■ DIELECTRICS

POLYIMIDE & EPOXY OVERCOATS

ELECTRO TECHNIK TEPRO
2608 Enterprise Road, Clearwater FL 34623
(800) 346-5164 • Fax # (813) 791-7425

ESTABLISHED RELIABILITY POWER RESISTORS MIL-R-39007 (RWR) STYLES
TYPE "RWR"/"TE"

APPLICABLE MIL-SPECIFICATION

MIL-R-39007: This is the military specification covering axial lead established reliability power wirewound resistors. TEPRO TYPE "TE" resistors meet or exceed the electrical, environmental and dimensional requirements of this specification.

SPECIFICATIONS

ELECTRICAL

Tolerance: These types are available in .1%, .5% and 1% tolerances.
Dielectric Strength: 500 VAC for 2-watt size and smaller. 1000 VAC for 3-watt size and larger.
Insulation Resistance: 1000 Megohms minimum.
Short Time Overload: 5 seconds at 5 times rated power for 3-watt size and smaller. 5 seconds at 10 times rated power for 5-watt size and larger.

MECHANICAL

Terminal Strength: 5 lb. pull for 2-watt size and smaller. 10 lb. pull for 3-watt size and larger.
Solderability: Meets requirements of MIL-STD-202.
Solvent Resistance: Meets requirements of MIL-STD-202.

MATERIAL

Core: Beryllium oxide, alumina and steatite are used, depending on the size and power requirement.
Element: Copper-nickel alloy or nickel-chromium alloy, depending on resistance value.
End Caps: Stainless steel or alloy #46.
Coating: Special high temperature silicone.
Leads: Both solderable and weldable lead materials are available and are designated by the letters "S" or "W" in the Mil. type number. "S" material is tinned copperweld. "W" designates bare nickel per MIL-STD-1276.

FEATURES

- Miniature size
- Maximum power: size ratio
- High stability
- Optimum heat dissipation
- High-temperature silicone protected
- Non-inductive windings available
- Tolerance to ±0.01%

VARIATIONS

- Special tolerance
- Special TC
- Lead length and diameter
- Weldable leads
- Molded types available

POWER RATING

Power ratings are based on a maximum 2000 hours at rated power and at an ambient of +25°C.

Established reliability - documented failure rate - 100% screening.

All MIL-R-39007 styles available.

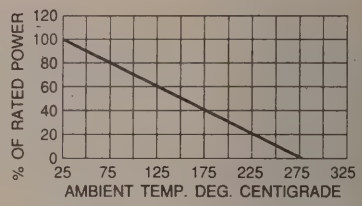
Type TE established reliability wirewound resistors are an extention of the quality and reliability that has been the hallmark of TEPRO products for in excess of thirty years. They are manufactured and tested in accordance with MIL-R-39007 standards. Standard Group A Acceptance Testing includes 100 hour burn-in at 25° C ambient plus a visual and mechanical inspection. Qualification test data, failure rate test and traceability records are maintained at TEPRO for a period of five years. The TE series is available with or without reliability documentation and also with tolerances and temperature coefficients in excess of MIL-R-39007 requirements.

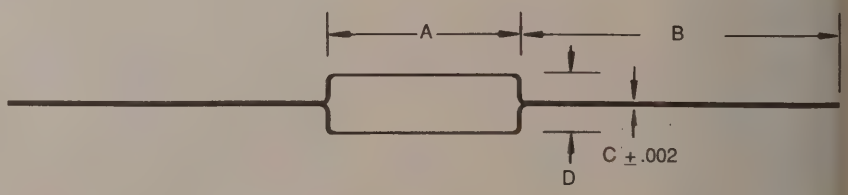
MIL-R-39007 DESCRIPTIVE CODE

RWR	S	49R9	F	R
(established reliability power resistor) TEPRO TYPE "TE"	Terminal S = Solderable W = Weldable N = Non inductive Solderable Z = Non inductive Weldable	Resistance	Resistance Tolerance T = ±.01% F = ±1% B = ±.1% A = ±.05% Q = ±.02% D = ±.5%	Failure Rate Code

DERATING

These units have an operating temperature range of −55°C, to +275°C. For ambient temperatures above +25°C, they must be derated according to the following curve.





TEPRO TYPE	MIL TYPE	RATING (WATTS)	A ±.031	B MIN	C ±.002	D ±.031	MIN. VALUE		MAX. VALUE	
							TEPRO	MIL	TEPRO	MIL
TE.125		.125	.219	1.50	.020	.078	.01	N/A	3K	N/A
TE.25		.25	.312	1.50	.020	.078	.01	N/A	6K	N/A
TE.5		.5	.406	1.50	.025	.093	.01	N/A	10K	N/A
TE1	RWR81	1	.250	1.50	.020	.085	.01	0.1	3.5K	1K
TE1A		1	.406	1.50	.025	.093	.01	N/A	10K	N/A
TE1.5	RWR82	1.5	.312	1.50	.020	.078	.01	0.1	5K	1.3K
TEA2		2	.500	1.50	.032	.187	.01	N/A	28K	N/A
TE2	RWR80	2	.406	1.50	.020	.094	.01	0.1	10K	3.16K
TE3B	RWR71	2	.812	1.50	.032	.187	.01	0.1	16K	12.1K
TE2B	RWR89	3	.560	1.50	.032	.187	.01	0.1	32K	4.12K
TE5	RWR74	5	.875	1.50	.040	.312	.01	0.1	90K	12.1K
TE5C		5	1.00	1.50	.040	.312	.01	N/A	115K	N/A
TE7	RWR84	7	.875	1.50	.040	.312	.01	0.1	90K	12.4K
TE10	RWR78	10	1.78	1.50	.040	.375	.01	0.1	275K	39.2K
TE10C		10	2.00	1.50	.040	.468	.01	N/A	450K	N/A

ELECTRO TECHNIK TEPRO

2608 Enterprise Road, Clearwater FL 34623
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PRECISION POWER WIREWOUND ALUMINUM HOUSED, CHASSIS MOUNT RESISTORS MIL-R-18546(RE) STYLES

TYPE "TM"

FEATURES

Chassis mount for heat sink effect
Silicone protected windings
miniature size
Non-inductive windings
High stability
Optimum power: size ratio
Higher ambients
Withstand severe environments

VARIATIONS

Special TC on request
Closer tolerances to .01%
Special terminals
Dual, tapped, single-ended windings
Kelvin 4 terminal sensing types
Flexible leads

GENERAL SPECIFICATIONS

Applicable Mil spec: Mil-R-18546
Standard tolerances: 0.05 to 5%
Dielectric strength: 1000VAC TM-5, TM-10, TM-25
2000VAC TM-50
4500 VAC TM-100, TM-250
Insulating resistance: 10000 megohms minimum
Temperature Coefficients: 10 ohms and above: ±20 PPM
1 ohm to 9.9 ohms: ±50 PPM
Below 1 ohm: ±90 PPM
Terminal strength: 5-lb. pull test TM-5, TM-10
10-lb. pull test all others

ELECTRICAL SPECIFICATIONS

TEPRO TYPE	MIL. TYPE	POWER TEPRO	RATING MIL.	RESISTANCE IN OHMS
TM 5	RE 60	7.5	5	0.05 - 20K
TM 10	RE 65	12.5	10	0.05 - 40K
TM 25	RE 70	25	20	0.05 - 90K
TM 50	RE 75	50	30	0.05 - 250K
TM 100	RE 77	100	75	0.01 - 500K
TM 250	RE 80	250	120	0.01 - 700K

Recommended heat sink:
Aluminum chassis:

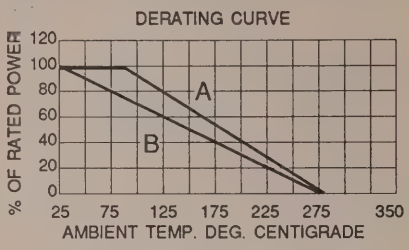
6 × 4 × 2 × .040	TM-5, TM-10
7 × 5 × 2 × .040	TM-25
12 × 12 × .050	TM-50
12 × 12 × .125	TM-100, TM-250

ENVIRONMENTAL SPECIFICATIONS

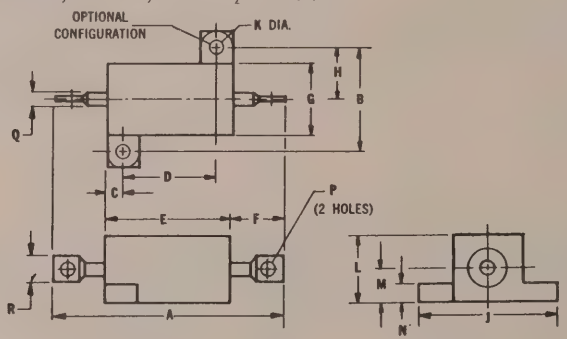
TEST	MIL-R-18546
Load Life	± (1% + .05Ω) △ R
Moisture Resistance	± (1% + .05Ω △ R
Resistance Temperature Characteristic	±50 PPM TO 2000Ω ±30 PPM over 2000Ω
Thermal Shock	± (.5% + .05Ω) △ R
Momentary Overload	± (.5% + .05Ω) △ R
Dielectric	± (.2% + .05Ω) △ R
High Temp. Storage	± (.5% + .05Ω) △ R
Shock	± (.2% + .05Ω) △ R
Vibration	± (.2% + .05Ω) △ R
Terminal Strength	± (.2% + .05Ω) △ R

DERATING

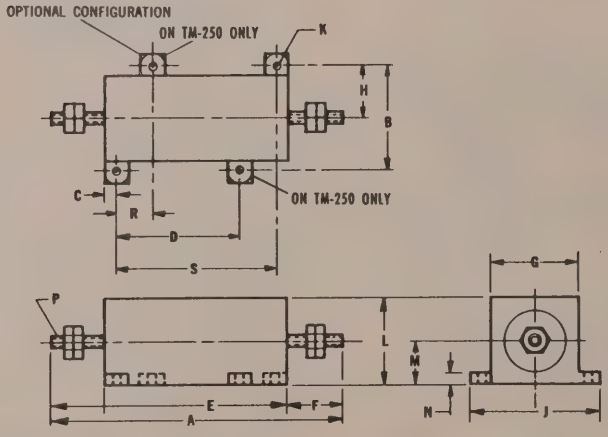
Operation in high ambients or on reduced chassis areas requires derating in accordance with the accompanying curve. TM-5 and TM-10 types may be operated in ambients to 75°C without derating. (Curve A)



TM-5, TM-10, TM-25, TM-50



TM-100, TM-250



DIMENSIONS INCHES

TEPRO TYPE	A +.062	B +.01	C +.031	D +.010	E +.062	F +.062	G +.062	H +.031
TM 5	1.12	.490	.078	.444	.600	.266	.334	.245
TM 10	1.37	.625	.094	.562	.750	.312	.438	.312
TM 25	1.94	.781	.172	.719	1.062	.438	.531	.391
TM 50	2.78	.844	.188	1.562	1.938	.438	.594	.422
TM 100	5.48	2.25	.375		3.5	.989	1.812	1.125
TM 250	7.0	2.5	.312	3.0	4.5	1.25	2.125	1.25

TEPRO TYPE	J +.031	K +.005	L +.031	M +.062	N +.031	P +.005	Q MIN.	R MIN.	S +.010
TM 5	.646	.093	.320	.133	.065	.050	16	.085	
TM 10	.812	.094	.406	.203	.094	.085	12	.140	
TM 25	1.094	.125	.562	.281	.094	.085		.140	
TM 50	1.156	.125	.625	.312	.094	.085	12	.140	
TM 100	2.812	.188	1.75	.770	.188	12-24			2.75
TM 250	3.0	.188	2.188	1.0	.250	1/4-20		.875	3.875

ELECTRO TECHNIK
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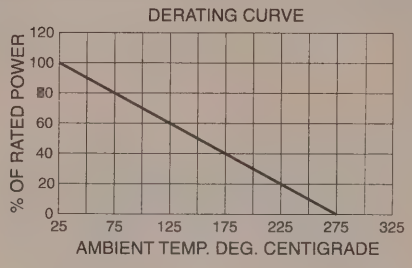
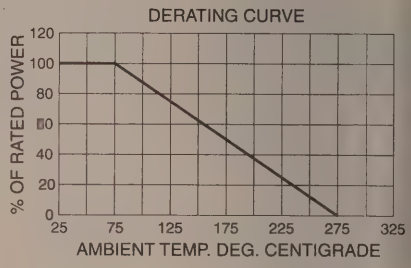
SURFACE MOUNT RESISTORS
TYPE "TKW" / "TKF"





GENERAL SPECIFICATIONS

Standard temperature coefficients:
- ±90 PPM / °C Below 1.0 Ohm
- ±50 PPM / °C 1.0 Ohm - 9.9 Ohm
- ±20 PPM / °C 10 Ohm and beyond

Electrical: Power .125 - 3 watts
Resistance: 0.01 - 1 Meg Ohms
Tolerance: 0.01 to 5%
Dielectric strength: 500 VAC
Insulation resistance:
- 1000 megohms minimum dry
- 100 megohms after moisture test

Short time overload:
- 5 seconds at 5 times rated power

Solderability: Continuous satisfactory coverage when tested in accordance with MIL-R-26E
Types:
- TKW - Wirewound
- TKF - Metal Film

MATERIALS

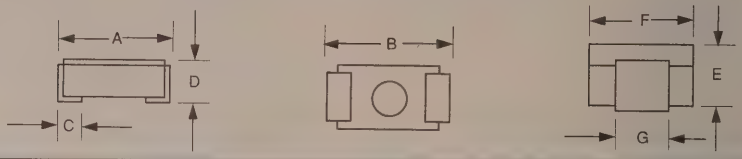
Core: Alumina
Element: Copper-nickel alloy or nick-chrome alloy, depending on resistance value
End caps: Stainless steel
Molding: Special high temperature silicone
Standard terminals: Tinned copperweld

FEATURES

Temperature coefficient to ±2 PPM / °C
Wirewound or Metal Film available
Non Inductive windings available

HOW TO ORDER

Sample Part No: TKW 1 .10 ±1%
- Type
- Wattage
- Resistance
- Tolerance



MODEL	A	B	C	D	E	F	G
TKW-1/2	.188±.005 (4.77±.127)	.200±.020 (5.08±.508)	.040±.010 (1.02±.254)	.096±.015 (2.44±.381)	.090±.005 (2.29±.127)	.125±.005 (3.18±.127)	.050±.010 (1.27±.254)
TKW-1	.238±.005 (6.05±.127)	.250±.020 (6.35±.508)	.045±.010 (1.14±.254)	.110±.015 (2.79±.381)	.104±.005 (2.64±.127)	.150±.005 (3.81±.127)	.065±.005 (2.49±.127)

TYPE "TSR"/"TSK"

TYPE "TSR" - RADIAL LEAD
TYPE "TSK" - KELVIN 4 TERMINAL

FEATURES

Miniature size
Continuous full power operation
High-temperature silicone protected
Radial lead for PC boards
4 terminal for shunts and sensing
High stability

VARIATIONS

Tolerances to .01%
Lead length and diameter
Special temperature coefficient on request
Non-inductive (Ayrton-Perry) windings
Molded types available

GENERAL SPECIFICATIONS

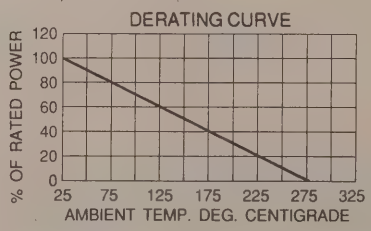
Applicable Mil spec: Mil-R-26 (performance only)
Standard tolerances: 0.05 to 5%
Dielectric strength: 500 VAC 1 watt size 1000 VAC all others
Insulation resistance: 1000 megohms minimum
Temperature Coefficients:
- 10 ohms and above: ±20 PPM
- 1 ohm to 9.9 ohms: ±50 PPM
- Below 1 ohm: ±90 PPM

Short time overload: 5 sec. at 5 × rated power 3 watts and less
5 sec. at 10 × rated power all others

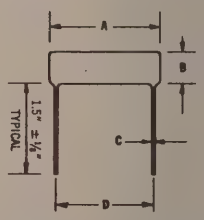
Power rating: Based on:
- (a) full power operation at 25°C ambient
- (b) maximum hotspot 275°C
- (c) 1% maximum Δ R in 1000-hour load life

DERATING

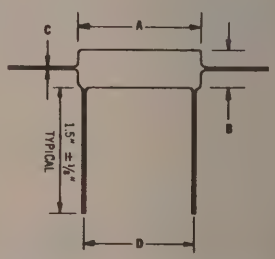
Operation in ambients above 25°C requires derating in accordance with the accompanying curve.



TSR



TSK



STANDARD CONFIGURATIONS AND ELECTRICAL SPECIFICATIONS

TEPRO TYPE	DIMENSIONS IN INCHES A +.032	B +.032	C +.002	D +.015	POWER RATING (WATTS)	RESISTANCE RANGE IN OHMS
TSR1A	.406	.093	.025	.335	1	0.1-10K
TSR1	.500	.156	.032	.406	1	0.05-20K
TSR3	.609	.250	.040	.500	3	0.05-42K
TSR5	.875	.312	.040	.719	5	0.05-95K
TSR10	1.812	.375	.040	1.612	10	0.05-275K
TSK1A	.406	.093	.025	.335	1	0.1-10K
TSK1	.500	.156	.032	.406	1	0.05-20K
TSK3	.609	.250	.040	.500	3	0.05-42K
TSK5	.875	.312	.040	.719	5	0.05-95K
TSK10	1.812	.375	.040	1.612	10	0.05-275K

TEPRO
ELECTRO TECHNIK
2608 Enterprise Road, Clearwater FL 34623
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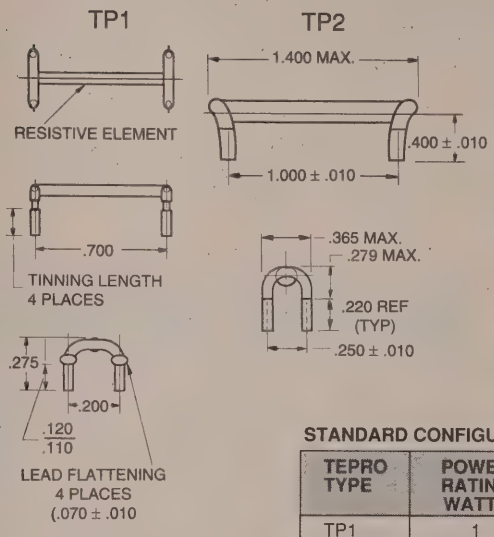
PRECISION LOW OHM, FOUR TERMINAL CURRENT SHUNT RESISTORS

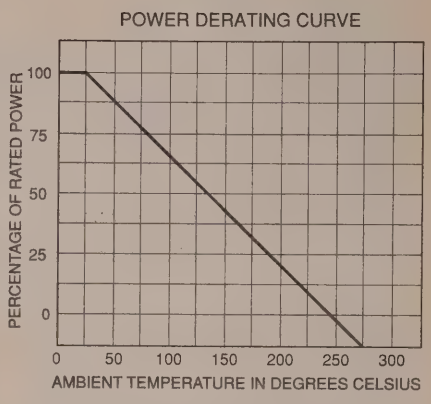
TYPE "TP"

FEATURES
Miniature size
Continuous full power operation
Radial lead for PC boards
Four terminals for current sensing
High stability

VARIATIONS
Tolerance to .05%
Special TC
Lead length and diameter
Body and lead configurations

GENERAL SPECIFICATIONS
Standard tolerances
0.05 to 5%
Temperature coefficients:
±90 PPM
Resistor element:
Copper-nickel or nickel-chrome alloy as required by resistance
Short time overload:
5 sec. at 5 x rated power
Standard terminals:
Tinned copper





For ambient temperature above 25°C derate according to the above curve

STANDARD CONFIGURATIONS AND ELECTRICAL SPECIFICATIONS

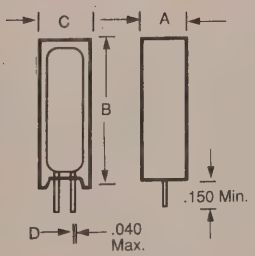
TEPRO TYPE	POWER RATING WATTS	MIN VALUE	MAX VALUE	LEAD WIRE
TP1	1	.002	.05	.040, .051
TP2	5	.001	.002	.081

TYPE "TC"

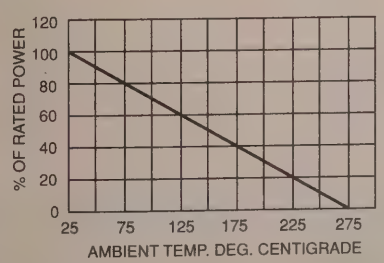
VERTICAL MOUNT POWER RESISTORS

FEATURES
Radial leads for PC Mount
Space saving design
Ceramic Encased
Continuous full power operation
Fire proof construction
All welded wirewound assembly or high grade Metal Film element depending on application

VARIATIONS
Tolerance to .01%
Temperature coefficients to +5 PPM
Fusing applications



DERATING CURVE



DIMENSIONS (Inches)

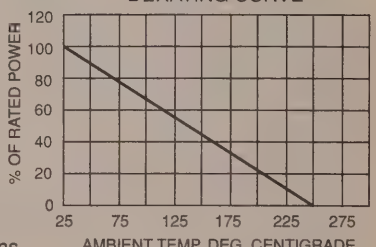
TEPRO TYPE	POWER @ 25°C	A ±.040	B ±.062	C ±.032	D ±.015	Resistance Range
TCV2	2	.275	.80	.435	.200	.01-20K Ohm
TCV3	3	.320	1.0	.475	.200	.01-20K Ohm
TCV5	5	.350	1.0	.520	.200	.01-40K Ohm
TCV10	10	.475	1.375	.630	.300	.2-100K Ohm

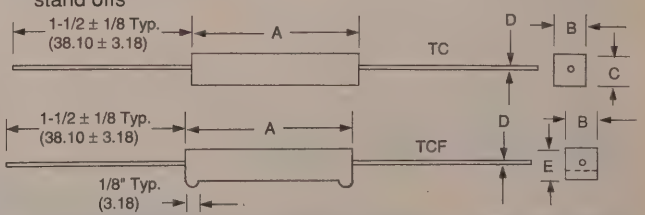
PRECISION POWER WIREWOUNDS FOR PULSE AND SURGE APPLICATIONS

FEATURES
Ceramic Encased
Flame proof construction
Continuous full power operation
All welded construction

VARIATIONS
Tolerance to .01%
Temperature coefficients to +5 PPM
Special fusing for fuse designs
Available with or without stand offs

DERATING CURVE





STANDARD CONFIGURATIONS AND ELECTRICAL SPECIFICATIONS

TEPRO TYPE	POWER @ 25°C	Resistance Range	DIMENSIONS (mm) A ±.03(.8)	B ±.03(.8)	C ±.03(.8)	D Diameter	E ±.03 (.8)
TC2	2	.001 - 20K	.69(17.5)	.275(6.99)	.275(6.99)	.032(.8)	.32(8.13)
TC3	3	.001 - 20K	.88(22.3)	.310(7.87)	.310(7.87)	.032(.8)	38(9.65)
TC5	5	.001 - 40K	.88(22.3)	.380(9.65)	.350(8.89)	.040(.8)	.41(10.4)
TC7	7	.001 - 45K	.139(35.3)	.380(9.65)	.350(8.89)	.040(.8)	.47(11.9)
TC10	10	.001 - 50K	1.88(47.7)	.380(9.65)	.350(8.89)	.040(.8)	.47(11.9)

TEPRO
2608 Enterprise Road, Clearwater FL 34623
(800) 346-5164 • Fax # (813) 791-7425

HIGH PRECISION RESISTORS
MIL-R-93 (RB) STYLES

TYPE "TB"

FEATURES

Meets specifications of MIL-R-93
Standard accuracies to ± .005%
Standard TCR ± 20ppm, available to ± 1ppm
All welded construction
Epoxy encapsulated, superior moisture protection
Exceptional resistance stability

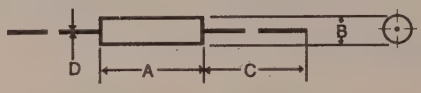
VARIATIONS

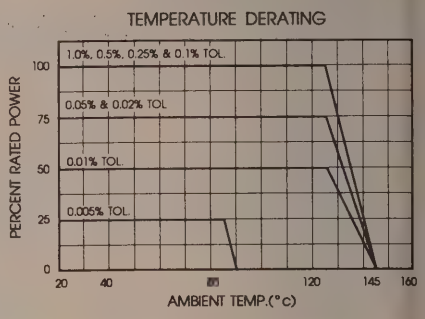
Matched tolerances and T.C. tracking
Positive temperature coefficients
Pre-conditioning, temp. cycling, burn-in
Improved rise times
Four-terminal and radial lead construction

STANDARD SPECIFICATIONS

Resistance Range - 1Ω to 15 Meg. Ω's
Tolerances - Standard from 1%, to .01%
Accuracies to .0025% are available
Temperature Coefficient - (TCR)
0 ± 10ppm/°C - 100Ω and over
0 ± 15ppm/°C - 10Ω to 100Ω
0 ± 25ppm/°C - 1Ω to 10Ω
0 ± 90ppm/°C - Less than 1Ω
Temperature Range - −55°C to +145°C

T.C. Tracking - Available to ± 1ppm/°C
Ratio Matching - Resistors are available with tolerance and temperature coefficient matching and tracking over a wide temperature range.
Environmental requirements: meet or exceed the applicable requirements of MIL-R-93.





TEPRO TYPE	MIL-R-93	DIMENSIONS (Inches) A ±.031	B ±.015	C ±.002	MAXIMUM VOLTAGE (VOLTS)	MAXIMUM RESISTANCE (OHMS)	POWER (watts) TEPRO	MIL
TB-34		.300	.100	.025	100	150K	.100	.050
TB-35		.250	.125	.025	150	300K	.125	.065
TB-40		.500	.187	.025	300	1 Meg.	.350	.175
TB-55	RB-56	.345	.250	.032	300	1 Meg.	.350	.175
TB-60	RB-55	.500	.250	.032	400	2 Meg.	.500	.250
TB-65	RB-54	.750	.250	.032	500	3.5 Meg.	.750	.375
TB-70	RB-53	.750	.375	.032	600	4 Meg.	.900	.450
TB-75	RB-52	1.000	.375	.032	750	5 Meg.	1.500	.750
TB-80	RB-57	1.000	.500	.032	850	10 Meg.	1.750	.850
TB-58	RB-58	1.500	.500	.032	950	15 Meg.	2.000	1.000

ULTRA PRECISION METAL FILM RESISTORS
MEETS OR EXCEEDS MIL-R-10509/MIL-R-55182
MIL-R-55182 (RNC) STYLES

TYPE "RNF"/"REF"

FEATURES

- Temperature Coefficients to ±2 ppm/°C
- Tolerances to ± 0.01%
- Superior environmental performance
- Extremely low noise
- Tailored or standard values
- Matched sets and networks
- Highest stability metal film available

MATCHED SETS AND NETWORKS

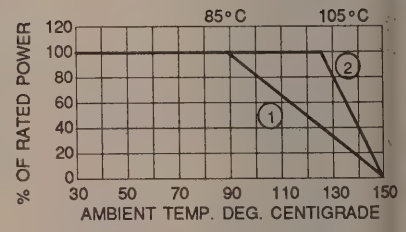
Resistance matching to ±.005% and temperature coefficient tracking as low as ± 1 ppm/°C are available in matched sets.

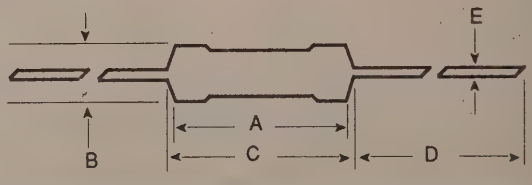
PERFORMANCE CHARACTERISTICS

Test per Mil-R-55182 (Exceptions noted)	1 Typical ΩR*	Specification
Thermal Shock (−55 to + 150°)	0.02%	MIL-STD-202
Moisture	0.08%	MIL-STD-202
Resistance to Solder Heat	0.02%	MIL-STD-202
Short Time Overload	0.01%	MIL-R-10509
Life (1000 hrs, full power)	0.02%	MIL-R-55182
Shelf Life (max. per year)	30 PPM	

DERATING

① RNF & ② REF resistors have an operating temperature range of −55°C to +150°C and must be derated as follows:





TEPRO TYPE	MIL TYPE	POWER RATING (WATTS) 85°C	125°C	MAXIMUM VOLTAGE (VDC)	DIMENSIONS IN INCHES A +.020	B +.010	C MAX.	D MIN.	E +.002	RESISTANCE RANGE IN OHMS
RNF50	RN50	.05	—	200	.15	.070	.20	.125	.16	100-50K
REF50	RNC50	—	.04	200	.15	.070	.20	.125	.16	25-301K
RNF55	RN55	.125	—	250	.261	.093	.30	.150	.25	50-301K
REF55	RNC55	—	.1	200	.261	.093	.30	.150	.25	10-1M
RNF60	RN60	.25	—	300	.393	.152	.43	.150	.25	100-499K
REF60	RNC60	—	.125	250	.393	.152	.43	.150	.25	25-3M
RNF65	RN65	.333	—	300	.393	.152	.43	.150	.25	100-499K
REF65	RNC65	—	.25	300	.595	.163	.637	.150	.25	30-3M

ELECTRO TECHNIK TEPRO

2608 Enterprise Road, Clearwater FL 34623
(800) 346-5164 • Fax # (813) 791-7425

THE ULTRA PRECISION METAL FILM RESISTOR MIL STYLE RNC90

TYPE "S," "C" & "X"

FEATURES

- High power ultra-precision resistor to 2W
- Temperature Coefficients to ± 1 ppm
- Tolerances to ±.005%
- Improved Stability ± 25 ppm/Year
- T.C. Tracking to 1 ppm avail.

The TEPRO Ultra Precision Resistor offers the user the benefits of extremely tight tolerance, very low T.C. and high stability. The resistor is a vacuum deposited, metal film resistive element, combined with a highly protective packaging system.

Precision calibration offers tolerances as tight as 0.005% while design features and manufacturing controls yield temperature coefficients as low as 1 ppm/°C absolute. Inherent in the metal film design is extremely high speed response with switching speeds less than 1 nanosecond.

The precision resistor is available in a variety of package configurations and power ratings.

PERFORMANCE DATA

Long term stability: 25 ppm/year
Temperature coefficient: 1 ppm/°C to 10 ppm/°C
Temperature coefficient track: To 0.5 ppm/°C
Tolerance: 0.005% to 1.0%
Tolerance Match: To 0.005%
Inductance: Less than 0.05μh
Capacitance: Less than 0.05pf
Rise Time (without ringing): Less than 1 ns
Voltage coefficient: Less than 2 ppm/Volt
Thermoelectric effect: Less than 0.1μ V/°C
Noise factor: Below −30db

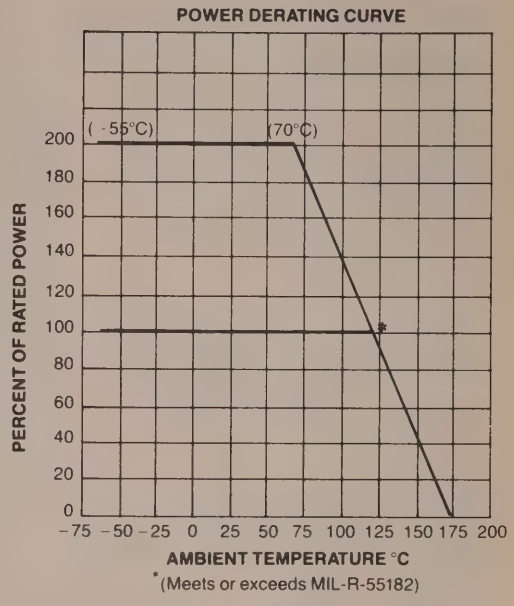
HOW TO ORDER

Sample Part No:

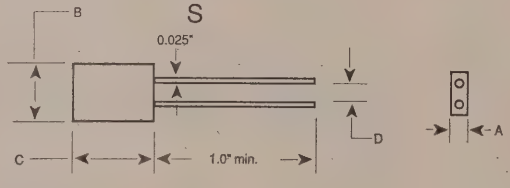
S - 40 - 1 - 91K - 0.02%

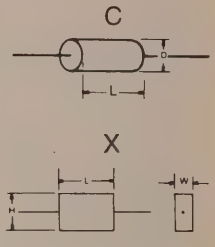
- Tepro Type
- Temperature Coefficient (ppm)
- Resistance Range
- Tolerance

±1%, ±.5%, ±.25%, ±.1%
±.05%, ±.02%, ±.01%, ±.005%*



*(Meets or exceeds MIL-R-55182)





STANDARD CONFIGURATIONS AND ELECTRICAL SPECIFICATIONS

TEPRO TYPE	MIL. TYPE	DIMENSIONS IN INCHES				VOLTAGE RATING (VOLTS)	POWER RATING (WATTS)	RESISTANCE RANGE IN OHMS
		A MAX.	B MAX.	C MAX.	D MAX.			
S-40		.120	.250	.250	.125	200	.125	5-100K
S-50		.120	.320	.200	.150	250	.125	10-100K
S-100	RNC90Y	.120	.320	.350	.150	250	.300	10-150K
S-120		.160	.585	.365	.400	300	.300	30-700K
S-300		.160	.585	.540	.400	300	.500	30-1M
S-302		.160	.810	.540	.650	350	.750	50-7M
S-303		.160	1.10	.540	.900	500	1.00	100-10M
S-350		.260	1.20	.525	.900	500	2.00	100-100M
X-100		.140	.375	.325	—	250	.250	10-150K
C-200		.125	—	.260	—	200	.125	10-50K
C-201		.125	—	.260	—	200	.125	10-75K
C-202		.260	—	.510	—	250	.250	10-200K

TEPRO RESISTOR PERFORMANCE TESTED PER MIL-R-55182/9

TESTS	TEPRO AVERAGE CHANGE	MIL-R-55182/9
Temperature Cycling: −55°C +25°C +150°C (5 cycles)	0.01%	.05%
Overload: One hour @ room temperature 5 times rated power	0.005%	.05%
Insulation Resistance:	Better than 700,000 Megohm	10,000 Megohm
Terminal Strength:	0.005%	.02%
Effect of Soldering:	0.005%	.02%
Moisture Resistance: 10 days humidity	0.03%	.05%
Life Test: @ 125°C	0.05%	.05%
Shock:	0.005%	.01%
Vibration: High frequency	0.005%	.02%

ELECTRO TECHNIK TEPRO

2608 Enterprise Road, Clearwater FL 34623
(800) 346-5164 • Fax # (813) 791-7425

ULTRA PRECISION THIN FILM DIP NETWORKS

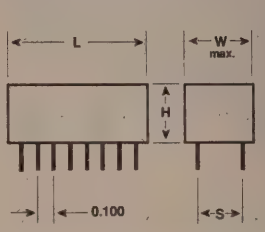
TYPE "DN"

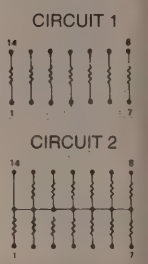
FEATURES

- Temperature Coefficients to ±1 ppm/°C
- Tolerances to ±0.01%
- Superior TCR tracking to ±.5ppm/°C
- Ratios available to .0025%
- Custom circuit schematics available

SPECIFICATIONS

- Elements: Vacuum deposited Nickel-Chrome alloy
- Terminals: Tinned copper leads, which are solderable/weldable (per Mil-Std-1276, Type "C" #22 AWG. (.025") std., .016" × .012" × .250" Gold Plated optional)
- Solderability: Meets requirements of Mil-Std-202-Method 208
- Operating Temperature Range: −55°C to + 125°C
- Power rating per element: .05 watts to .250 watts at +125°C
- Insulating Resistance: greater than 10^4 MΩ
- Dielectric Strength: 300 VRMS (Min.)
- Voltage Coefficient: 5 ppm/volt (Max.), typical less than 2 ppm/volt
- Noise factor: Below −20 db





TEPRO TYPE	NUMBER PINS	DIMENSIONS (Inches) L ±.01	W ±.01	H ±.01	S MAX.
DN-708-1	8	0.530	0.410	0.250	0.300
DN-714-1	14	0.790	0.410	0.250	0.300
DN-716-1	16	0.890	0.410	0.250	0.300
DN-808-2	8	0.530	0.480	0.460	0.300
DN-814-2	14	0.760	0.480	0.460	0.300
DN-816-2	16	0.860	0.480	0.460	0.300

ULTRA PRECISION THIN FILM SIP NETWORKS

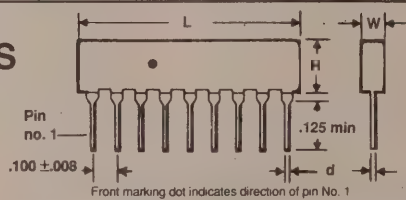
TYPE "SN"

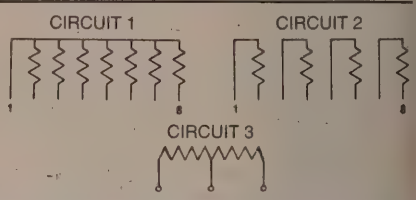
FEATURES

- Temperature Coefficients to ± 1 ppm/°C
- Tolerances to ±0.01%
- Superior tracking to ±.5 ppm/°C
- Ratios available to .0025%
- Custom circuit schematics available
- 3 through 11-pin packages

SPECIFICATIONS

- Elements: Vacuum deposited Nickel-Chrome alloy
- Terminals: Tinned copper leads, solderable/weldable per Mil-Std-1276, Type C
- Operating Temperature Range: −55°C to +125°C
- Insulation Resistance: greater than 10^6 MΩ
- Dielectric Strength: 300 VRMS (Min.)
- Voltage Coefficient: 5 ppm/volt (Max.)
- Noise factor: Below −20 db





TEPRO TYPE	NUMBER PINS	DIMENSIONS (Inches) L ±.01	W ±.01	H ±.01	D ±.002
SN-603-3	3	.320	.120	.350	.016
SN-604-1	4	.420	.120	.350	.025
SN-605-1	5	.520	.120	.350	.025
SN-606-1	6	.620	.120	.350	.025
SN-607-1	7	.720	.120	.350	.025
SN-608-1	8	.820	.120	.350	.025
SN-609-1	9	.920	.120	.350	.025
SN-610-1	10	1.020	.120	.350	.025
SN-611-1	11	1.120	.150	.400	.025

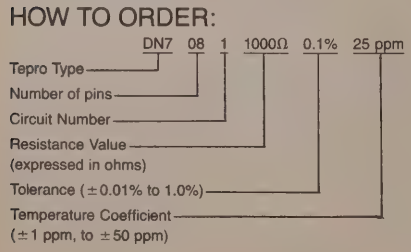
RESISTOR/CAPACITOR NETWORK

TYPE "RC"

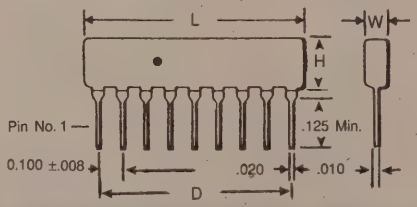
FEATURES

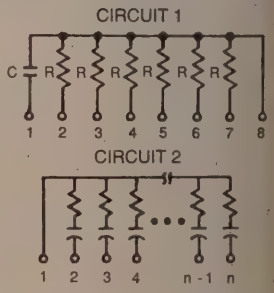
- Standard resistance range: 10Ω to 2.2 Meg.
- Standard tolerances: ±1%, 2%, 5%
- Standard TC: ±200 ppm (10 ppm available)
- Single resistor wattage ratings up to 0.5 Watt
- Multiple resistance values available within a single pack

HOW TO ORDER:



- Capacitors available:
  NPO: 10 pf - 4700pf, ±5% & ±10%
  X7R: 500 pf - 0.1μf, ±10 & 20%
- Diodes available





TEPRO TYPE	NUMBER PINS	DIMENSIONS (Inches) L MAX.	W ±.01	H ±.01	D ±.01
RC-04	4	.400	.130	.350	.300
RC-05	5	.500	.130	.350	.400
RC-06	6	.600	.130	.350	.500
RC-07	7	.700	.130	.350	.600
RC-08	8	.800	.130	.350	.700
RC-09	9	.900	.130	.350	.800
RC-10	10	1.000	.130	.350	.900
RC-11	11	1.100	.130	.350	1.000
RC-12	12	1.200	.130	.350	1.100

ELECTRO TECHNIK TEPRO
2608 Enterprise Road, Clearwater FL 34623
(800) 346-5164 • Fax # (813) 791-7425

DC AMMETER SHUNTS

TEPRO has been producing high quality DC Ammeter Shunts since 1959. Over the years we have produced and developed many "Industry Standard" shunts, along with an extensive line of custom application shunt devices.

If you have a need for a custom shunt please consult the factory and we will be happy to help engineer the proper shunt for your application.

TEPRO Shunts are designed for use with standard 50 or 100 millivolt movement switchboard indicating or recording instruments, calibrated in terms of the ampere rating of the Shunt. The millivolt drop of the Shunt is adjusted at the factory to within 1/2% accuracy.

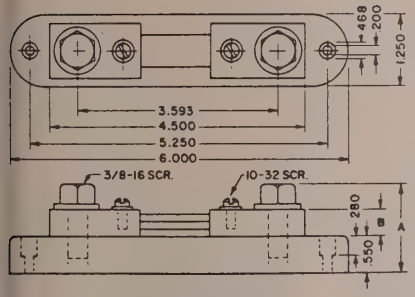
All of our Current Shunts use the highest grade of Shunt Manganin for the resistive elements, allowing for negligible temperature coefficient and thermo-electric effect, thus avoiding errors due to heating. See chart.

TO ORDER PLEASE SPECIFY:

XXX	—	OOO	—	XXX
TEPRO STYLE		AMPERAGE RATINGS		MILLIVOLT RATINGS

DIMENSIONS in inches.
TOLERANCES ±.015 for hole diameters.
Other tolerances ±.030 unless otherwise noted.

TYPE SM - 50 MV 1 through 500 amperes
TYPE SCM - 100 MV 1 through 500 amperes



50 MV

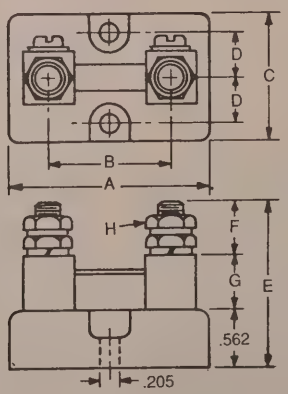
Catalog Number	AMP	A	B
SM-1-50	1	1.38	.500
SM-2-50	2	1.38	.500
SM-5-50	5	1.38	.500
SM-10-50	10	1.38	.500
SM-20-50	20	1.38	.500
SM-50-50	50	1.38	.500
SM-100-50	100	1.38	.500
SM-150-50	150	1.38	.500
SM-200-50	200	1.38	.500
SM-250-50	250	1.63	.750
SM-300-50	300	1.63	.750
SM-400-50	400	1.63	.750
SM-500-50	500	1.63	.750

100 MV

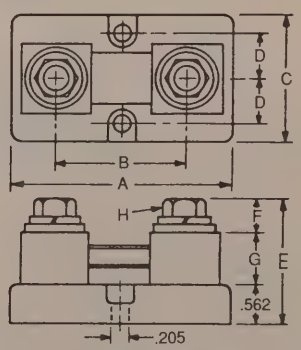
Catalog Number	AMP	A	B
SCM-1-100	1	1.38	.500
SCM-2-100	2	1.38	.500
SCM-5-100	5	1.38	.500
SCM-10-100	10	1.38	.500
SCM-15-100	15	1.38	.500
SCM-20-100	20	1.38	.500
SCM-25-100	25	1.43	.500
SCM-50-100	50	1.38	.500
SCM-75-100	75	1.38	.500
SCM-100-100	100	1.38	.500
SCM-200-100	200	1.38	.500
SCM-300-100	300	1.63	.750
SCM-500-100	500	1.53	.750

TYPE MTA
TYPE MTB
TYPE MTC

MTA/5 through 150 amperes
MTB/170 through 600 amperes
MTC/800 through 1200 amperes



MTA



MTB/MTC

Catalog Number	AMP	A	B	C	D	E	F	G	H
MTA 10-50	10	2.00	1.00	1.25	.437	1.688	.625	.500	1/4 - 28
MTB 100-50	100	3.25	1.50	1.75	.625	1.750	.438	.750	3/8 - 16 × 5/8
MTC 1200-50	1200	4.50	2.16	2.50	1.00	2.125	.562	1.00	1/2 - 13 × 7/8

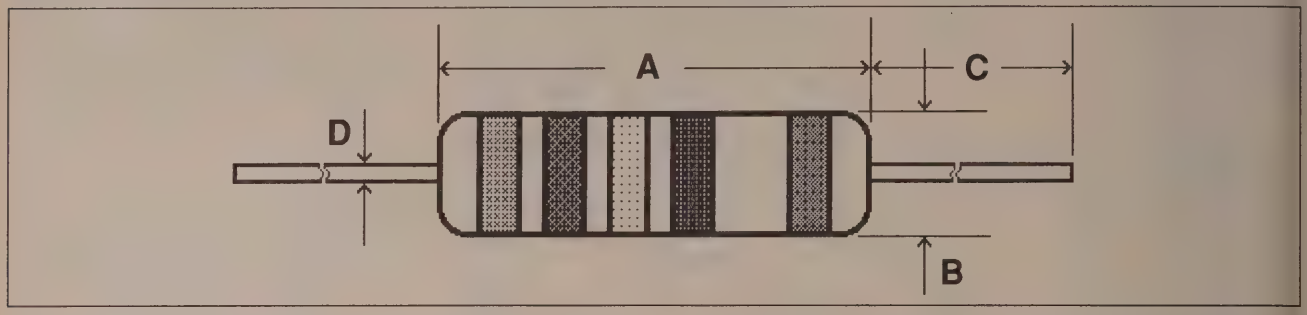
DIMENSIONS in inches. TOLERANCES ±.015 for hole diameters. Other tolerances ±.030 unless otherwise noted.

VPR
A Division of Codeco Corp.

CODECO CORPORATION/VPR

Precision Resistors from 1/10 watt to 250 watts

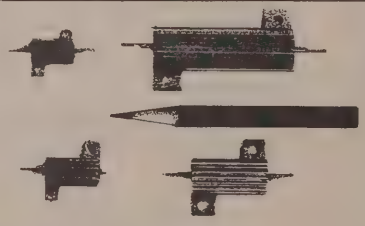
MICRO-MINIATURE METAL FILM RESISTORS



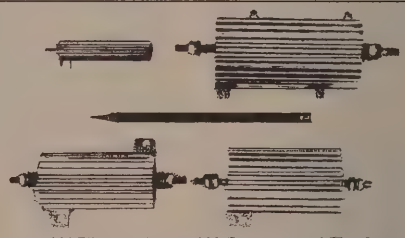
The VPR MML series resistor offers a general purpose metal film resistor which is suitable for any type of micro-miniature application. It is ideal for usage in hearing aids, pace makers, etc. This part offers the outstanding electrical characteristics of a truly superior metal film resistor, such as low noise, low reactance, long term stability and tight temperature coefficients, in an extremely small package. The MML features a high alumina core for superior mechanical strength and heat dissipation, welded leads and an effective coation system for solvent and environmental protection.

Codeco Type	Power (Watts)	Resistance Range	Min. Tol.	TC (PPM)	A (in.)	B (in.)	C (in.)	D (in.)
MML-1	1/8	10Ω - 220K	0.1%	50	.087	.044	.50	.010*
MML-2	1/3	.22Ω - 10M	1%	100	.142	.063	1.1	.020*

PRECISION POWER RESISTORS 5 through 250 Watts



5W Through 50W Compared To A Normal Pencil



70W Through 250W Compared To A Normal Pencil

The KAL series resistors are designed for high power dissipation with precision tolerances in a minimum of physical size. They provide extremely efficient heat dissipation by mounting solidly to a metal chassis surface for maximum heat transfer.

GENERAL SPECIFICATIONS:

• Low hot spot ratings due to exclusive complete encapsulation of the resistive element within the anodized aluminum body. • Welded construction throughout assures long stable load life. • Copper-weld leads are hot tin dipped for solderability. Heavy spade lug type leads are used on the 5 through 70 watt sizes, threaded stud terminals are used on the 100 through 250 watt sizes. • Extruded aluminum housings are used for maximum heat dissipation. • Cores are centerless ground for uniformity.

ELECTRICAL SPECIFICATIONS:

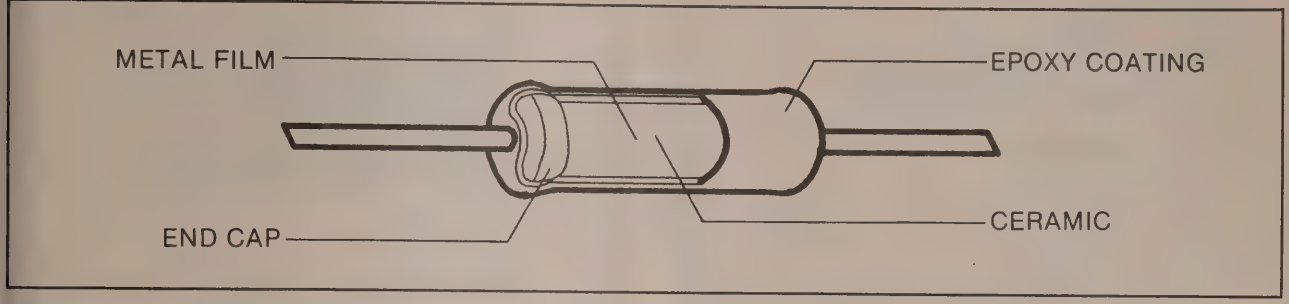
• Resistance Range — .05Ω to 275KΩ • Tolerances — from 5% to .05%. • Temperature Coefficient — 20PPM, slightly higher on low value resistors. Different TCs are available on special order. • Minimum Dielectric Strength — 1,000 VAC through 10 watts, 2,500 VAC through 70 watts, 5,500 VAC through 250 watts. • Operating Temperature Range — -55°C to +275°C • Stability — as low as .001% per annum.

Codeco Corporation West Hill Road P.O. Box 1207 Phone: 802-253-8567 Fax: 802-253-8019

CODECO CORPORATION/VPR

VPR
A Division of Codeco Corp.

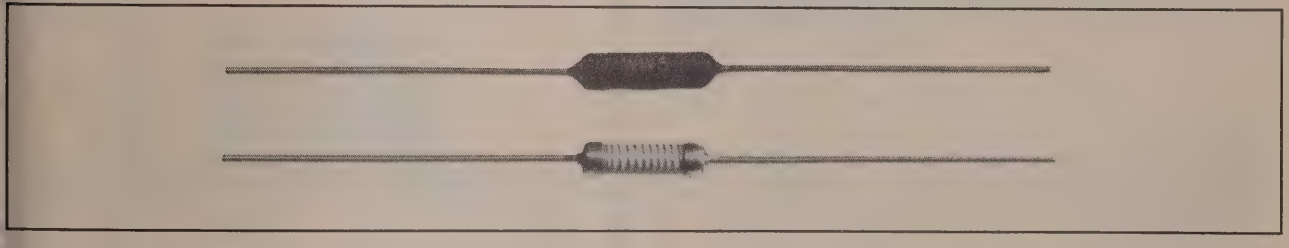
METAL FILM RESISTORS TYPE-LM EPOXY COATED



VPR type-LM Epoxy Coated Metal Film Resistors have been designed not only to meet but also surpass the specifications of MIL-R-10509 characteristics C, E, and F. The resistors feature a high evaporation of metal alloy on ceramic substrate with gold end bands. These resistors are then finished with coatings of exclusive silicon epoxy coating and paint. Special techniques and methods are used in every step of the process to ensure the lasting reliability of the type-LM Metal Film Resistors with built-in low noise and low failure rate characteristics.

VPR Type-LM Metal Film Resistors are available in 1/8, 1/4, 1/2, watt size; with 0.1%, 1/4%, 1/2% or 1% tolerance; and temperature coefficient ±2, ±5, ±10, ±25, ±50 or ±100 parts per million per degree centigrade.

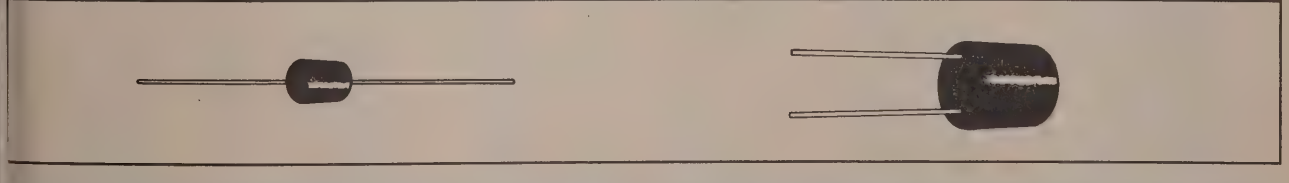
WIREWOUND RESISTORS TYPE WW SILICONE COATED



The VPR WW Series are axial lead, silicone coated precision resistors. These parts are controlled stress wound on centerless ground cores of high quality alumina. The caps are welded to the resistive element, then copper-weld leads are welded to the caps. The body of the resistor is conformally covered with an exceptionally high temperature silicone coating. Modern production equipment allows competitive pricing and superior quality.

Tolerances of the WW Series range through all the standard groupings from 5% down to .05%. Our standard temperature coefficients are ±90 PM on Values up to 1 ohm and ±20 PM on values above 1 ohm. These parts meet & exceed MIL R-26E.

ULTRA-PRECISION WIRE-WOUND RESISTORS



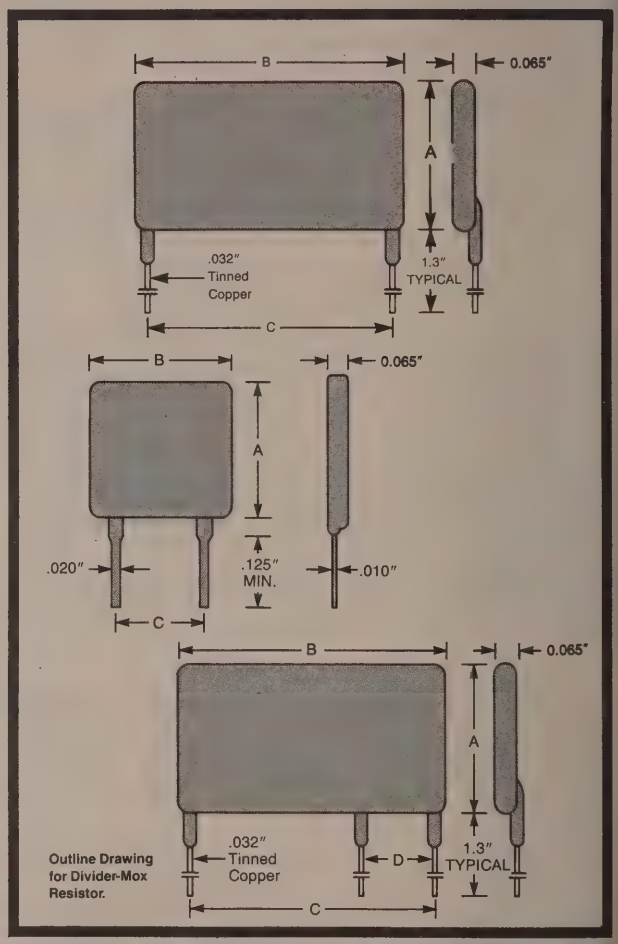
VPR's ultra-precision resistors should be used wherever there is a requirement for extremely tight tolerances, temperature coefficients or a combination of both. These resistors are wound on bobbins of molded epoxy with a single strand of nickel-chromium wire. This wire has no soldered or welded splices that will cause problems after the circuit is in the field. All parts are wound on reversed pi segmented bobbins to eliminate any inductance.
Tension is controlled and kept to a minimum while the winding process takes place to keep out any possible fatigue problems. The windings are then relieved of stresses by extensive aging before calibration and termination operations.
The resistors are given a silicon buffer coat before the final epoxy molding occurs, resulting in a case size that is extremely consistent from part to part. Available in axial or radial leads.

Resistance Tolerances (Most Sizes): 1%; 0.5%; 0.25%; 0.1%; 0.05%; 0.025%; 0.01%.
Temperature Coefficient: 100 ohms and up: 10 PPM/°C; 10 to 100 ohms: 20 PPM/°C; below 10 ohms: 30 PPM/°C.

Codeco Corporation West Hill Road P.O. Box 1207 Phone: 802-253-8567 Fax: 802-253-8019

VICTOREEN SLIM-MOX Resistors

- Wide resistance range to 5,000 megohms.
- Voltage rating to 20KV.
- Low voltage coefficient.
- Noninductive resistor design
- Low capacitance.
- High dielectric and low outgassing epoxy coating.
- Optional silicone and glass frit coating available.
- Resistance tolerances range from 0.5, 1, 5, 10, and 20%.



Outline Drawing for Divider-Mox Resistor.

SLIM-MOX RESISTOR DIVIDER SERIES

Type	Resistance Range (ohms)	Power @25°C	Maximum Voltage Rating	Max Ratio	Dimension D(Inches) ±.032"
SLIM-MOX104RD	1 Meg - 1,000 Meg	1.0W	3,750V	1,000:1	.2
SLIM-MOX108RD	1 Meg - 3,000 Meg	2.0W	7,500V	1,000:1	.6
SLIM-MOX204RD	1 Meg - 3,000 Meg	1.5W	7,500V	1,000:1	.2
SLIM-MOX208RD	1 Meg - 5,000 Meg	2.5W	12,000V	4,000:1	.4
SLIM-MOX308RD	2 Meg - 5,000 Meg	3.0W	15,000V	4,000:1	.3
SLIM-MOX408RD	5 Meg - 5,000 Meg	4.0W	20,000V	5,000:1	.3

Ratio tolerances available 0.5, 1, 3%

SLIM-MOX SERIES

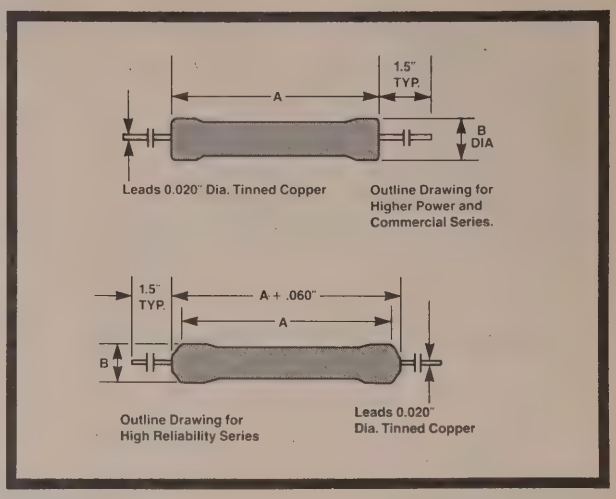
Type	Resistance Range (ohms)	Power @25°C	Maximum Voltage Rating	Dimensions (inches) A (max)	B (max)	C ±.032"
SLIM-MOX100	1 K to 100 Meg	0.25W	1.5KV	0.30"	0.30"	0.10"
SLIM-MOX101	100Ω to 250 Meg	0.5W	2.0KV	0.34"	0.33"	0.2"
SLIM-MOX102	200Ω to 1,000 Meg	1.0W	5.0KV	0.34"	0.58"	0.4"
SLIM-MOX104	500Ω to 1,200 Meg	1.5W	10.0KV	0.34"	1.08"	0.9"
SLIM-MOX108	1 K to 5,000 Meg	2.5W	20.0KV	0.34"	2.08"	1.9"
SLIM-MOX202	500Ω to 1,200 Meg	1.0W	5.0KV	0.59"	0.58"	0.4"
SLIM-MOX204	1 K to 5,000 Meg	2.0W	10.0KV	0.59"	1.08"	0.9"
SLIM-MOX208	2 K to 5,000 Meg	3.0W	20.0KV	0.59"	2.08"	1.9"
SLIM-MOX308	4 K to 5,000 Meg	4.0W	20.0KV	0.84"	2.08"	1.9"
SLIM-MOX408	5 K to 5,000 Meg	5.0W	20.0KV	1.09"	2.08"	1.9"

STANDARD TEMPERATURE COEFFICIENT

Type	100 PPM/°C	250 PPM/°C	500 PPM/°C
SLIM-MOX100	1 K - 25 Meg	26 Meg - 100 Meg	Not available
SLIM-MOX101	100Ω - 25 Meg	26 Meg - 100 Meg	101 Meg - 250 Meg
SLIM-MOX102	200Ω - 200 Meg	201 Meg - 250 Meg	251 Meg - 1,000 Meg
SLIM-MOX104	500Ω - 300 Meg	301 Meg - 500 Meg	501 Meg - 1,200 Meg
SLIM-MOX202	500Ω - 300 Meg	301 Meg - 500 Meg	501 Meg - 1,200 Meg
SLIM-MOX108	1 K - 700 Meg	701 Meg - 1,000 Meg	1,001 Meg - 5,000 Meg
SLIM-MOX204	1 K - 700 Meg	701 Meg - 1,000 Meg	1,001 Meg - 5,000 Meg
SLIM-MOX208	2 K - 1,000 Meg	1,001 Meg - 2,000 Meg	2,001 Meg - 5,000 Meg
SLIM-MOX308	4 K - 2,000 Meg	2,001 Meg - 3,000 Meg	3,001 Meg - 5,000 Meg
SLIM-MOX408	5 K - 2,000 Meg	2,001 Meg - 3,000 Meg	3,001 Meg - 5,000 Meg

VICTOREEN MINI-MOX Resistors

- Wide resistance range 1K Ohm to 100,000 Megohms
- Voltage rating to 6 KV
- Power rating to 1.5 watt
- Available with silicone or epoxy coatings
- Metal Oxide Resistive Element



VICTOREEN MINI-MOX TYPE NUMBER

TYPE MOX – 400 – 2 3
SIZE
COATING
LEAD

LEAD:
0 = MOX-200, MOX-300
2 = 0.020″ Tinned copper
3 = 0.020″ Tinned dumet
7 = 0.032″ Tinned copper
9 = Other

COATING:
0 = MOX-200, MOX-300
2 = High temperature
3 = High reliability
9 = Other

Please call or write:
VICTOREEN, INC.
6000 Cochran Road
Cleveland, Ohio 44139-3395 U.S.A.
(216) 248-9300 FAX: (216) 248-9301
Customer Service Bulletin Board: (216) 248-9043

HIGHER POWER SERIES *(silicone coated)*

Type	Resistance Range (ohms)	Power @70°C	Maximum Voltage Rating	Avail** Tol (%)	Dimensions (inches) A (max)	Dimensions (inches) B (max)
MOX-400-22	1K to 10,000 Meg	0.35W	1000V	1,2,5	0.520″	0.140″
MOX-750-22	1K to 10,000 Meg	0.70W	2000V	1,2,5	0.820″	0.140″
MOX1125-22	1K to 10,000 Meg	1.40W	5000V	1,2,5	1.210″	0.140″

**Not all tolerances are available over entire resistance range, contact Victoreen, Inc. for details.

COMMERCIAL SPECIFICATIONS *(epoxy coated)*

Type	Resistance Range (ohms)	Power @25°C	Maximum Voltage Rating	Avail* Tol (%)	Dimensions (inches) A (max)	Dimensions (inches) B (max)
MOX-200	1 Meg to 1,000 Meg	0.25W	500V	0.5,1,2,5	0.275″	0.105″
MOX-300	1 Meg to 1,000 Meg	0.50W	1000V	0.5,1,2,5	0.435″	0.145″
MOX-400-23	1K to 30,000 Meg	0.75W	2500V	0.5,1,2,5	0.540″	0.165″
MOX-750-23	1K to 70,000 Meg	1.00W	4000V	0.5,1,2,5	0.860″	0.165″
MOX-1125-23	1K to 100,000 Meg	1.50W	6000V	0.5,1,2,5	1.250″	0.165″

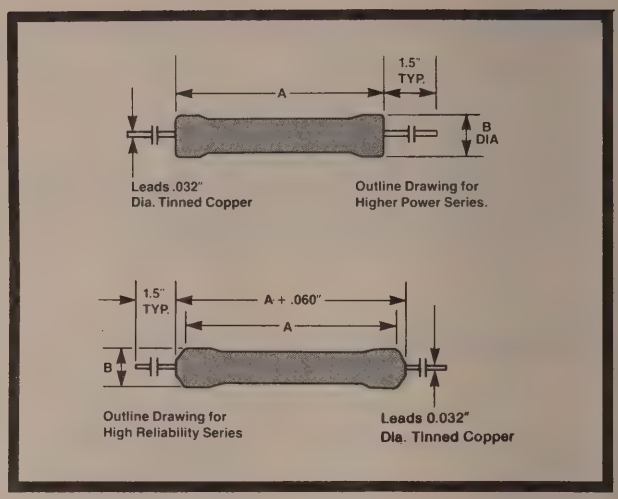
*Values beyond 10,000 Meg are available in 5% and 10% tolerance.

STANDARD TEMPERATURE COEFFICIENT

Type	100 PPM/°C	250 PPM/°C	500 PPM/°C
MOX-200	1 Meg - 1,000 Meg	—	—
MOX-300	1 Meg - 1,000 Meg	—	—
MOX-400	1K - 500 Meg	501 Meg - 1,000 Meg	1,001 Meg - 30,000 Meg
MOX-750	1K - 1,000 Meg	1,001 Meg - 2,000 Meg	2,001 Meg - 70,000 Meg
MOX1125	1K - 1,500 Meg	1,501 Meg - 3,000 Meg	3,001 Meg - 100,000 Meg

VICTOREEN MAXI-MOX Resistors

- Wide resistance range 1K Ohms to 10,000 Megohms
- Voltage rating to 37.5 KV
- Power rating to 12.5 watts
- Available with silicone or epoxy coatings
- Metal Oxide Resistive Element



VICTOREEN MAXI-MOX TYPE NUMBER

MOX – 2 – 1 3
SIZE — COATING — LEAD

TYPE

LEAD:
1 = 0.032" Tinned copper
5 = 0.032" Tinned dumet
6 = 6-32 Threaded Ferrule*
9 = Other

COATING:
2 = High temperature
3 = High reliability
9 = Other

*Available with the High Temperature coating only.

Please call or write:
VICTOREEN, INC.
6000 Cochran Road
Cleveland, Ohio 44139-3395 U.S.A.
(216) 248-9300
FAX: (216) 248-9301
Customer Service Bulletin Board: (216) 248-9043

HIGH RELIABILITY SERIES *(epoxy coated)*

Type	Resistance Range (ohms)	Power @25°C	Maximum Voltage Rating	Avail** Tol (%)	Dimensions (inches) A (max)	Dimensions (inches) B (max)
MOX-1-13	1K to 10,000 Meg	2.0W	7.5KV	0.5,1,2,5	1.140"	0.345"
MOX-2-13	1K to 10,000 Meg	3.0W	15.0KV	0.5,1,2,5	2.140"	0.345"
MOX-3-13	1K to 10,000 Meg	4.0W	22.5KV	0.5,1,2,5	3.140"	0.345"
MOX-4-13	1K to 10,000 Meg	5.0W	30.0KV	0.5,1,2,5	4.140"	0.345"
MOX-5-13	1K to 10,000 Meg	6.0W	37.5KV	0.5,1,2,5	5.140"	0.345"

**0.5% tolerances are available over a limited resistance range, contact Victoreen, Inc. for details.

HIGHER POWER SERIES *(silicone coated)*

Type	Resistance Range (ohms)	Power @25°C	Power @70°C	Maximum Voltage Rating	Avail Tol (%)	Dimensions (inches) A (max)	Dimensions (inches) B (max)
MOX-1-12	1K to 10,000 Meg	5.0W	2.5W	7.5KV	1,2,5	1.120"	0.310"
MOX-2-12	1K to 10,000 Meg	8.0W	5.0W	15.0KV	1,2,5	2.120"	0.310"
MOX-3-12	1K to 10,000 Meg	11.0W	7.5W	22.5KV	1,2,5	3.120"	0.310"
MOX-4-12	1K to 10,000 Meg	14.0W	10.0W	30.0KV	1,2,5	4.120"	0.310"
MOX-5-12	1K to 10,000 Meg	17.0W	12.5W	37.5KV	1,2,5	5.120"	0.310"

STANDARD TEMPERATURE COEFFICIENT

Type	100 PPM/°C	250 PPM/°C	500 PPM/°C
MOX-1	1K - 300 Meg	301 Meg - 1,000 Meg	1,001 Meg - 10,000 Meg
MOX-2	1K - 600 Meg	601 Meg - 2,000 Meg	2,001 Meg - 10,000 Meg
MOX-3	1K - 900 Meg	901 Meg - 3,000 Meg	3,001 Meg - 10,000 Meg
MOX-4	1K - 1,200 Meg	1,201 Meg - 4,000 Meg	4,001 Meg - 10,000 Meg
MOX-5	1K - 1,500 Meg	1,501 Meg - 5,000 Meg	5,001 Meg - 10,000 Meg

A COMPANY OF VISHAY

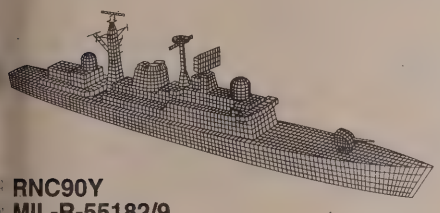
Bulk Metal® Foil Military Resistors

VISHAY RESISTORS

Established Reliability

At the cutting edge of today's advanced technology, military programs (such as the space shuttle and the sky lab, satellites, SDI, the Aegis, MK48, missiles and military aviation like the F18) often require established-reliability precision resistors beyond the level of existing military specifications. VISHAY can take the basic generic military resistor, and, with specific testing, offer improved performance specifications such as are detailed here below.

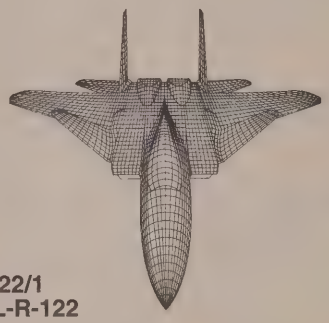
- TCR: ±2.5 ppm/°C (–55°C to +125°C)
- Load Life Stability: 0.015% (150 ppm) Δ R for 10,000 hrs.
- Shelf Life: 0.0025% (25 ppm) for 3 yrs.
- Voltage Coefficient: <0.1 ppm/V
- Current Noise: –32 dB
- Thermal EMF: 0.05 µV/°C



RNC90Y
MIL-R-55182/9

(See Catalog VMF-2000)

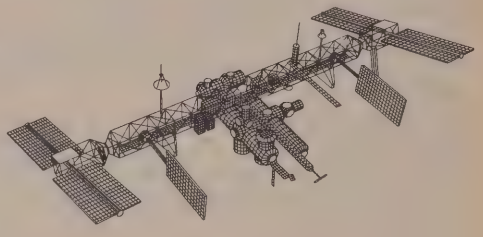
The VISHAY RNC90Y (S555) resistor is qualified to Mil-R-55182/9 for resistance values from 4.99 Ω through 121K Ω and for tolerances from ±0.005% to ±1.0%. VISHAY has accumulated over 300 million unit hours of testing on the RNC90Y resistor. The VISHAY RNC90Y high-performance resistors are designed for both the critical military systems market and for demanding industrial applications. The same resistors are also available as a non-qualified product (S555) for customers desiring extended resistance range. Both the qualified and the non-qualified version are manufactured on the same product line facilities and are subjected to the same process, lot control, conditioning, and basic QPL testing requirements. The VISHAY RNC90Y resistor is approved to MIL-STD-975D (NASA). It is also manufactured and packaged to comply with ESD requirements.



M122/1
MIL-R-122

(See Data Sheet VMF-300)

The VISHAY M122/1 (S22-1) resistor is qualified to Mil-R-122 for resistance values from 4.99 Ω through 50K Ω and for tolerances from ±0.005% to ±1.0%. VISHAY M122/1 high-performance resistors are designed for both the critical military systems market and for demanding industrial applications. The same resistors are also available as a non-qualified product (S22-1) for customers desiring extended resistance range. Both the qualified and the non-qualified version are manufactured on the same product line facilities and are subjected to the same process, lot control, conditioning, and basic QPL testing requirements. The VISHAY M122/1 resistor is manufactured and packaged to comply with ESD requirements.



VISHAY
Improved Performance Testing (IPT)

(Contact Application Engineering Dept.)

VISHAY also provides the basic MIL resistors with specific conditioning to ensure improved long term stability. This specific conditioning could include:

Thermal Shock
Specific Burn In Cycles
Short Time Overload

The guaranteed level of the Improved Performance Testing (IPT) Specifications are shown below.

Comparison of Specifications

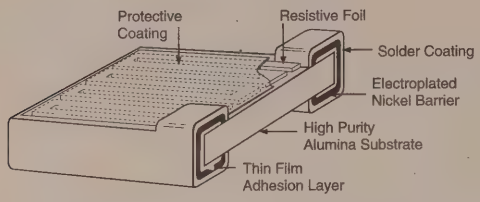
Specification	MIL-R-55182/9 Characteristic Y Limits	MIL-R-122 Characteristic A Limits	VISHAY Improved Performance Testing (IPT) Limits
Temperature Coefficient of Resistance—Maximum TCR	±5 ppm/°C (–55°C to +125°C) ±10 ppm/°C (+125°C to +175°C)	±2.5 ppm/°C (–55°C to +125°C) ±3.5 ppm/°C (+125°C to +150°C) ±4.5 ppm/°C (+150°C to +175°C)	±2.5 ppm/°C (–55°C to +25°C) ±2.5 ppm/°C (+25°C to +125°C) ±2.5 ppm/°C (0°C to +25°C) ±2.5 ppm/°C (+25°C to +60°C)
Selected TCR Tracking	Not Specified	Not Specified	3.0 ppm/°C, Standard Spread
Load-Life Stability (0.3 W @ +125°C) at 2,000 hours at 10,000 hours	 0.05% Maximum Δ R (500 ppm) 0.5% Maximum Δ R (5,000 ppm)	 0.05% Maximum Δ R (500 ppm) 0.2% Maximum Δ R (2,000 ppm)	 0.005% Maximum Δ R (50 ppm) 0.015% Maximum Δ R (150 ppm)
Current Noise (Not Specified)	–32 dB	–32 dB	–32 dB
High Frequency Operation Rise-Decay Time Inductance (L) Capacitance (C) Reactance	 Not Specified Not Specified Not Specified Not Specified	 Not Specified Not Specified Not Specified ≤ 10%	 1.0 ns for 1K Ω 0.1 µH Maximum, 0.08 µH Typical 1.0 pF Maximum, 0.05 pF Typical <1%
Voltage Coefficient	0.0005%/V (5 ppm/V)	0.0001% /V (1 ppm/V)	<0.00001% /V (<0.1 ppm/V)
Working Voltage	300 Volts Maximum	300 Volts Maximum	300 Volts Maximum
Thermal EMF	Not Specified	1 µV/°C	0.1 µV/°C Maximum

VISHAY Chips

A COMPANY OF VISHAY

VISHAY RESISTORS

Bulk Metal® Foil Ultra Precision Surface Mount Chip Resistors



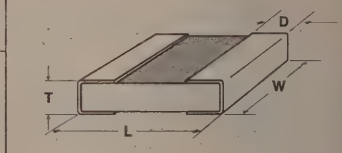
VISHAY Bulk Metal® Foil surface mount resistors offer an order-of-magnitude improvement in performance over other surface mount chip resistors. Until now, the best chips available had a Temperature Coefficient (–55°C to +125°C) of 25 ppm/°C.

The maximum TCR of VISHAY surface mount chip resistors is 5 ppm/°C over the full temperature range (selected TCR tracking is available to 0.5 ppm/°C).

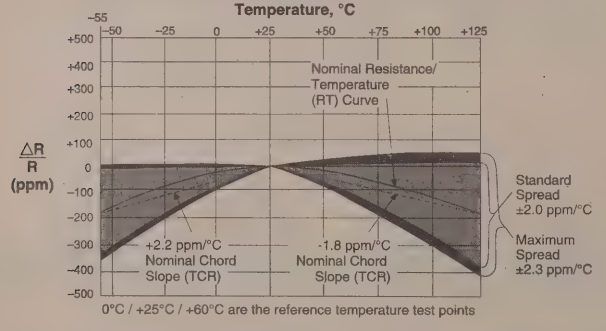
Where other chip resistors are supplied only as close as ±0.1% resistance tolerance, VISHAY surface mount resistors have standard resistance tolerances to 0.01%. VISHAY ultra precision surface mount chip resistors are designed to exceed the requirements of MIL-R-55342.

- Designed to Exceed Requirements of MIL-R-55342, Char. Y
- User Trimmable
- Temperature Coefficient of Resistance:
  Nominal TCR: +0.6 ppm/°C (0°C to +25°C)
  -0.6 ppm/°C (+25°C to +60°C)
  +2.2 ppm/°C (-55°C to +25°C)
  -1.8 ppm/°C (+25°C to +125°C)
  TCR Tracking: to 0.5 ppm/°C available
- Resistance Range: 5 Ω to 150K Ω
- Tolerance to 0.01% (Soldering temperature during installation may cause resistors to shift up to 0.05%)
- Load Life Stability: 0.01% Max Δ R under full rated power @ +70°C for 2,000 hrs
- Shelf Life Stability: 50 ppm/yr (0.005%) Max Δ R non-hermetically sealed
- Voltage Coefficient: <0.00001%/volt (<0.1 ppm/V)
- Current Noise: <0.025 μV(rms)/volt of applied voltage
- Non Inductive: <0.08 μH

Chip Size	L Inches (mm) ±0.005 (±0.13)	W Inches (mm) ±0.005 (±0.13)	T Inches (mm) Max	D Inches (mm) ±0.005 (±0.13)	Power Rating (mW)	Max Voltage (V)	Resistance Range (Ω)
1505	0.150 (3.81)	0.050 (1.27)	0.025 (0.64)	0.015 (0.38)	100	60	5 - 33K
1510	0.150 (3.81)	0.100 (2.54)	0.025 (0.64)	0.015 (0.38)	150	100	33K - 80K
2110	0.210 (5.33)	0.098 (2.49)	0.025 (0.64)	0.015 (0.38)	200	140	5 - 100K
2018	0.200 (5.08)	0.180 (4.57)	0.025 (0.64)	0.015 (0.38)	300	200	5 - 150K

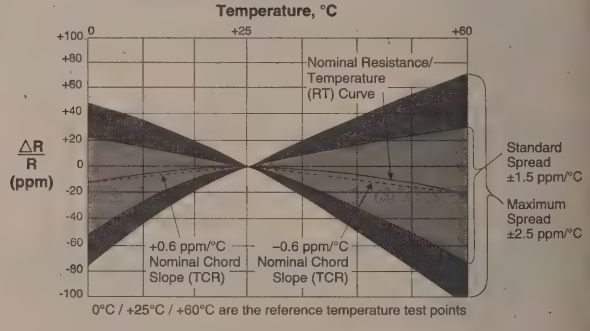


MILITARY TEMPERATURE RANGE



0°C / +25°C / +60°C are the reference temperature test points

INSTRUMENT TEMPERATURE RANGE



0°C / +25°C / +60°C are the reference temperature test points

Microchip (V5X5) and Minichips (V15X5, V15X10) Resistors for Hybrid Microcircuits

Model Number	Resistance[1] (Ohms)	Trim Range	Tolerance To	Power at +70°C	Max. Working Voltage	Nominal Chip Dimensions Inch (mm) L x W x T	Shelf-Life Stability (Max. Δ R)	Load-Life Stability (Max. Δ R)	Nominal TCR
V5X5	5 - 10K	0 to 1.2x the nominal prevalue	±0.01%	0.05 W	22 V	0.050 x 0.050 x 0.020 (1.27) x (1.27) x (0.508)	0.005% /Yr. 0.0005% /Yr. Hermetically Packaged	0.05% 2,000 Hrs. @ +70°C	0°C to +25°C +0.6 ppm/°C ±1.5 ppm/°C +25°C to +60°C -0.6 ppm/°C ±1.5 ppm/°C -55°C to +25°C +2.2 ppm/°C ±2.0 ppm/°C +25°C to +125°C -1.8 ppm/°C ±2.0 ppm/°C
V15X5	5 - 33K	0 to 1.3x the nominal prevalue		0.1 W	54 V	0.150 x 0.050 x 0.020 (3.81) x (1.27) x (0.508)			
V15X10	33K - 80K	0 to 1.5x the nominal prevalue		0.15 W	100 V	0.150 x 0.100 x 0.020 (3.81) x (2.54) x (0.508)			

1. Higher resistance ranges and larger size chips available.

A COMPANY OF VISHAY

VISHAY RESISTORS

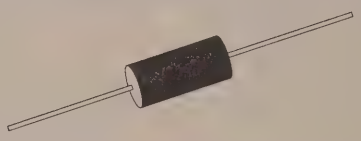
Fixed Resistors

Precision Resistors
High Performance Industrial & Aerospace Group

Model Number	Resistance (Ohms)	Tolerance[1] Available Best	Power at +70°C	Power at +125°C	Maximum Working Voltage	Maximum Dimensions Inch (mm) W x L x H	Shelf-Life Stability (Max. Δ R)[3]	Load-Life Stability (Max. Δ R)[3]	Temperature Coefficient of Resistance (TCR)
S102C™[4] S102K (1 chip)	1 - 100K >100K - 250K	±0.005%	0.6 W 0.4 W	0.3 W 0.2 W	300	0.115 x 0.310 x 0.336 (2.92) x (7.87) x (8.53) Dim. Tol. ±0.010 (0.25) Lead Spacing 0.150 (3.81) Nom.	25 ppm after 1 year and 50 ppm after 3 years	0.005% 2,000 hrs. 0.1 W per chip @ +70°C 0.015% 2,000 hrs. 0.3 W per chip @ +125°C 0.05% 10,000 hrs. 0.3 W per chip @ +125°C	***S102C, S104D, S105D, S106D*** **Nominal[2]** / **Max. Spread[2]** 0°C to +25°C / +0.6 ppm/°C / ±2.5 ppm/°C +25°C to +60°C / –0.6 ppm/°C / ±2.5 ppm/°C –55°C to +25°C / +2.2 ppm/°C / ±2.3 ppm/°C +25°C to +125°C / –1.8 ppm/°C / ±2.3 ppm/°C ***S102K, S104K, S105K, S106K*** 0°C to +60°C –55°C to +125°C ±2.5 ppm/°C Maximum
S104D S104K (2 chips)	1 - 200K >200K - 500K	±0.005%	1.0 W 0.6 W	0.5 W 0.3 W	350	0.160 x 0.575 x 0.413 (4.06) x (14.61) x (10.49) Lead Spacing 0.400 (10.16) Nom.			
S105D S105K (3 chips)	1 - 300K >300K - 750K	±0.005%	1.5 W 0.8 W	0.75 W 0.4 W	350	0.160 x 0.820 x 0.413 (4.06) x (20.83) x (10.49) Lead Spacing 0.650 (16.51) Nom.			
S106D S106K (4-6 chips)	0.5 - 400K >400K - 1M	±0.005%	2.0 W 1.0 W	1.0 W 0.5 W	500	0.260 x 1.200 x 0.413 (6.60) x (30.48) x (10.49) Lead Spacing 0.900 (22.86) Nom.			

1, 2, 3, 4 For numerical footnote information, refer to VISHAY's Short Form Catalog or contact VISHAY at the number listed below.

Fixed Axial Leaded Resistors



Value Engineered and
Standard Stock Axial Leaded Precision Resistors

Model Number	Resistance (Ohms)	Tolerance[1] To	Power at +70°C	Power at +125°C	Maximum Working Voltage	Nominal Dimensions Inch (mm) D x L	Shelf-Life Stability (Max. Δ R)[3]	Load-Life Stability (Max. Δ R)[3]	Temperature Coefficient of Resistance (TCR) Limits
VTA52 (RBR52)	5 - 750K 25 - 750K	±0.1 ±0.01	1.0 W	0.5 W	300	0.375 x 1.00 (9.53) x (25.4)	25 ppm after 1 year	0.05% 2,000 hrs. @ +125°C	0°C to +60°C ±4 ppm/°C –55°C to +125°C ±8 ppm/°C
VTA53 (RBR53)	5 - 500K 25 - 500K	±0.1 ±0.01	0.66 W	0.33 W	300	0.375 x 0.750 (9.53) x (19.05)			
VTA54 (RBR54)	5 - 500K 25 - 500K	±0.1 ±0.01	0.5 W	0.25 W	300	0.260 x 0.750 (6.60) x (19.05)			
VTA55 (RBR55)	5 - 250K 25 - 250K	±0.1 ±0.01	0.3 W	0.15 W	300	0.260 x 0.500 (6.60) x (12.70)			
VTA56 (RBR56)	5 - 250K 25 - 250K	±0.1 ±0.01	0.25 W	0.125 W	300	0.260 x 0.356 (6.60) x (9.04)			
VMTA55 (RNC55)	5 - 30K 50 - 30K	±0.1 ±0.01	0.2 W	0.1 W	200	0.120 x 0.270 (3.05) x (6.86)			
VMTB60 (RNC60)	5 - 60K 50 - 60K	±0.1 ±0.01	0.25 W	0.125 W	250	0.160 x 0.375 (4.06) x (9.53)			
VSA100	5 - 150K 50 - 150K	±0.1 ±0.01	0.6 W	0.3 W	300	L: 0.305 (7.75) max. T: 0.102 (2.59) max. H: 0.260 (6.60) max.			

1, 3 For numerical footnote information, refer to VISHAY's Short Form Catalog or contact VISHAY at the number listed below.

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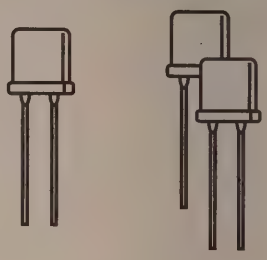
Ultra Precision Low TCR Resistors

VISHAY RESISTORS

VHP-100, the New Improved VISHAY Resistor with Self-Correcting Resistance versus Temperature Performance



VISHAY has achieved an essentially zero temperature coefficient resistor. By combining equal and opposite temperature effects, resistance changes due to temperature are kept to a minimum, to the extent that the resistance deviation of the Model VHP100 resistor remains within a 60 ppm window over the military temperature range from –55°C to +125°C.

Specifications

TCR VHP-100 VHP-101	60 ppm window (–55°C to +125°C) 10 ppm window (+15°C to +45°C)
Resistance Range	100 Ω to 150K Ω
Tolerance at +25°C[1]	±0.005% to ±1.0%
Power at +70°C at +125°C	 0.3 watts 0.15 watts
Load-Life Stability[2] (For 2,000 hours)	0.3 W @ +70°C; 0.015% (150 ppm) Max Δ R 0.15 W @ +125°C; 0.015% (150 ppm) Max Δ R
Shelf-Life Stability[3]	0.0005% (5 ppm) Max Δ R after 1 yr.; 0.0010% (10 ppm) Max Δ R after 3 yrs.
Thermal EMF Due to temperature difference bt. leads Due to self-heating under 0.1 watts	 0.05 μV/°C 0 to 2 μV
High-Frequency Operation Rise/Decay Time Inductance (L) Capacitance (C)	 1.0 ns for 1K Ω 0.1 μH Max.; 0.08 μH typical 1.0 pF Max.; 0.5 pF typical
Maximum Working Voltage	300 V
Voltage Coefficient	<0.1 ppm/V (non-measurable)
Current Noise	<0.025 μV (RMS)/volt (–32 dB)
Hermeticity	10^{-7} atmospheric cc/second Max
Nominal Dimensions— Inch (mm) Width Length Height Lead Spacing	 0.185 ±0.020 (4.70 ±0.51) 0.435 ±0.020 (11.05 ±0.51) 0.430 ±0.020 (10.92 ±0.51)[4] 0.150 (3.81) nominal[5]

Essentially Zero TCR

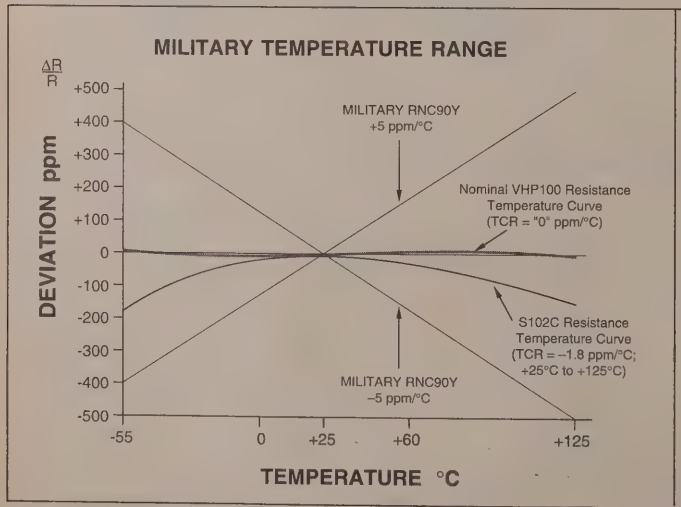
No Humidity Effect

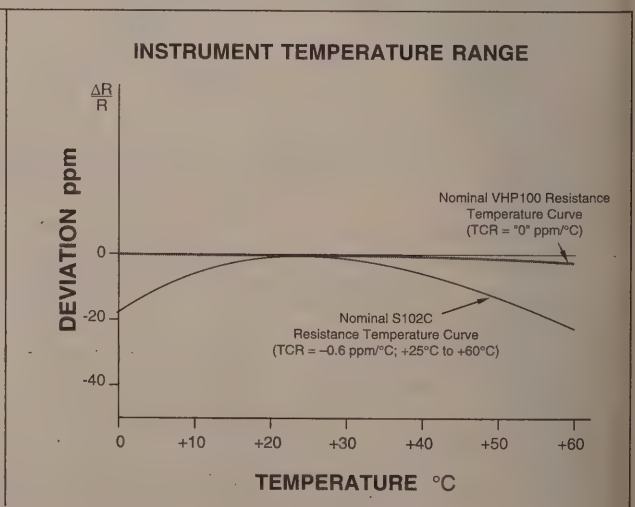
Lowest Thermal EMF in the Industry

Excellent Stability

Essentially Non-Inductive Performance

1, 3 Refer to VISHAY's Short Form catalog or contact VISHAY at the number listed below.
2 Load-life stability is considerably improved by reducing the temperature, power, or by "burn-in."
4 0.375H (9.53) available on special order.
5 0.200 lead spacing available.





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Power Resistors and Plates

VISHAY RESISTORS

Precision Power and Current Sensing Resistors

VISHAY Model	Resistance Range (Ω)	Resistance Tolerance[1]	TCR	Load Life Stability[3]	Shelf Life Stability[3]	Power	Current Noise	Inductance	Capacitance	Maximum Dimensions W x L x H (mm)
VHP3	0.1 to 80K	To 0.01%	±5 ppm/°C (50 Ω to 80K Ω)	0.05% Max Δ R under full rated power at +25°C on heat sink	0.0005% (5 ppm) Max Δ R/yr	10 watts on heat sink at +25°C	<0.025 μV (RMS)/Volt	0.1 μH Max 0.08 μH typical	1.0 pF Max 0.5 pF typical	1.000 x 1.530 x 0.335 (25.4) x (38.86) x (8.51) (std. TO-3 case)
VHP4	0.05 to 500		±5 ppm/°C (10 Ω to 500 Ω)							1.000 x 1.530 x 0.375 (25.4) x (38.86) x (9.53)
VPR5	1 to 100K	To 0.01%	±5 ppm/°C (10 Ω & above) and ±10 ppm°C (below 10 Ω)	—	0.0025% (25 ppm) Max Δ R/yr	5 watts on heat sink	—	<0.08 μH	—	0.450 x 0.630 x 0.315 (11.43) x (16.00) x (8.00)
VPR7						7 watts on heat sink at +25°C				0.450 x 1.030 x 0.315 (11.43) x (26.16) x (8.00)
VPR247	0.05 to 500K	To 0.01%	±5 ppm/°C (10 Ω to 500 Ω)	0.01% Max Δ R 3 watts at +25°C on heat sink	0.0005% (5 ppm) Max Δ R/yr	10 watts on heat sink at +25°C	<0.025 μV (RMS)/Volt	0.1 μH Max 0.08 μH typical	1.0 pF Max 0.5 pF typical	0.215 x 0.695 x 0.825 (5.46) x (17.65) x (20.96)
VCS2516 (Surface Mount)	0.1 to 1.0*	To 1.0%	10 ppm/°C†	—	0.0025% (25 ppm) Max Δ R/yr	1 watt at +85°C	—	—	—	0.040 x 0.260 x 0.170 (1.02) x (6.60) x (4.32)
	0.01 to <0.1*	To 5.0%								

1, 3 For numerical footnote information, refer to VISHAY's Short Form Catalog or contact VISHAY at the number listed below.
* 0.038 Ω, 0.05 Ω, 0.40 Ω and 0.50 Ω currently available, other values can be designed— consult Vishay Applications Engineering at the number listed below.
† Available to 5 ppm/°C on special orders.

Precision Power Plate Resistors for Current Sensing & Power Surge Applications

Model Number	Resistance (Ohms)	Tolerance[1] To	Power at +25°C	Nominal Plate Dimensions Inch (mm) H x L x T	Shelf-Life Stability/Yr. (Max. Δ R)[3]	Load-Life Stability/Yr. (Max. Δ R)[3]	Resistance Element Area Sq. In.	Nominal TCR[2]
V3PR-300589	10 to 5K	±0.005%	3 W in air; 10 W on heat sink	1.000 x 1.000 x 0.025 (25.4) x (25.4) x (0.635)	25 ppm after 1 year	0.03% 2,000 hrs. @ +125°C	0.98	±2 ppm/°C
V3PR-300586 (2 R's)	0.25	±15%	25 W*	1.600 x 1.700 x 0.025 (40.64) x (43.18) x (0.635)			0.98	±10 ppm/°C +25°C to +70°C
V3PR-300338	0.5	±0.5%						
V3PR-300571	1.0	±0.25%	20 W*	1.750 x 1.120 x 0.025 (44.45) x (28.45) x (0.635)			0.658	
V3PR-300572	2.0	±0.25%	20 W*	1.750 x 1.120 x 0.025 (44.45) x (28.45) x (0.635)			0.658	
V3PR-300610 (4 R's)[7]	2.0	±15%	>100 W*	4.000 x 5.000 x 0.025 (101.6) x (127.0) x (0.635)			11.20	

*Power is 10 W/sq. in. when mounted on a heat sink, which keeps the foil temperature below 100°C.
1, 2, 3, 7 For numerical footnote information, refer to VISHAY's Short Form Catalog or contact VISHAY at the number listed below.

Molded Precision Power and Current Sensing Resistors

Model Number	Resistance (Ohms)	Tolerance[1] To	Power at 25°C	Maximum Working Voltage	Nominal Dimensions Inch (mm) W x L x H	Shelf-Life Stability/Yr. (Max. ΔR)[3]	Load-Life Stability/Yr. (Max. ΔR)[3]	Nominal TCR[2]	Standard Spread
VFP-3	0.10 - 80K	±0.01% tightest to ±5.0% loosest	3 W in air; 10 W on heat sink	350 V	0.276 x 1.575 x 0.787 (7.0) x (40.0) x (20.0)	0.0025% (25 ppm)	0.05% under full rated power of 3 watts @ +25°C (10 watts on heat sink)	0°C to +0.6 ppm/°C	25°C ±1.5 ppm/°C
VFP-4	0.05 - 500							+25°C to –0.6 ppm/°C	+60°C ±1.5 ppm/°C
VPR220 TO220 2 leads	5.0 - 10K		1.5 W in air; 8 W chassis mounted	300 V	0.150 x 0.400 x 0.615 (3.81) x (10.16) x (15.62)		0.05% maximum ΔR at rated power at +25°C	–55°C to +2.2 ppm/°C	+25°C ±2.0 ppm/°C
VPR221 TO220 4 leads	0.5 - 500							+25°C to –1.8 ppm/°C	+125°C ±2.0 ppm/°C

1, 2, 3 For numerical footnote information, refer to VISHAY's Short Form Catalog or contact VISHAY at the number listed below.

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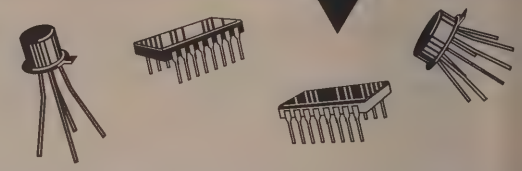
VISHAY RESISTORS

Resistor Networks Through Hole & Surface Mount

Precision, Hermetically-Sealed, Miniature TOs, DIPs and Other Packages



- Ratio tolerance to 0.0025%
- TCR tracking to 0.5 ppm/°C combined with absolute TCR of 1.0 ppm/°C— virtually not affected by temperature gradients
- Ratio stability under load-life conditions better than 10 ppm
- Rise time to 1 nanosecond, no ringing
- Noise better than –32 dB
- Hermetically sealed

The Precision Resistor Network Division of VISHAY manufactures products that add a new dimension of performance to Bulk Metal® Foil technology.

Smaller package sizes, tighter resistance matches, closer tracking and high stability are all achieved when foil chip resistors are bonded into a ceramic DIP or metal enclosure and hermetically sealed.

Model Number	Type Package	Max Quantity of Resistors V5 x 5	(V15x5)	Max R Value Each Resistors V5 x 5	(V15x5)	Tolerance Ratio Bt. Resistors @ +25°C To	Max. Dimensions Excluding leads Inch, H x D – pin circle	TCR (Ref. @ +25°C)
1401	3 pin TO-18	2	(1)	10K	(33K)	N/A	0.200 x 0.230 - 0.100	
1403	4 pin TO-18	5	(1)	10K	(33K)	0.0025%	0.200 x 0.230 - 0.100	
1413	8 pin TO-5	9	(3)	10K	(33K)	0.0025%	0.200 x 0.370 - 0.200	0° to +60°C / –55°C to +125°C
1417	8 pin TO-5	12	(3)	10K	(33K)	0.0025%	0.200 x 0.370 - 0.230	
1419	10 pin TO-5	12	(3)	10K	(33K)	0.0025%	0.200 x 0.370 - 0.230	Nominal: ±0.6 ppm/°C / +2.2 ppm/°C (–55°C to +25°C) –1.8 ppm/°C (+25°C to +125°C)
1421	12 pin TO-8	49	(16)	10K	(33K)	0.0025%	0.150 x 0.610 - 0.400*	
1422	16 pin TO-8	49	(16)	10K	(33K)	0.0025%	0.200 x 0.610 - 0.375*	
1442	8 pin DIP	12	(4)	10K	(33K)	0.0025%	H x L x W - Lead Spacing 0.200*** x 0.540 x 0.310 - 0.300	Standard Spread: ±1.5 ppm/°C / ±2.0 ppm/°C
VSM42	8 pin DIP Gull Wing	12	(4)	10K	(33K)	0.0025%	0.160 x 0.540 x 0.450	
1445	14 pin DIP	30	(10)	10K	(33K)	0.0025%	0.200*** x 0.785 x 0.310 - 0.300	Maximum Spread: ±2.5 ppm/°C / ±2.3 ppm/°C
VSM45	14 pin DIP Gull Wing	30	(10)	10K	(33K)	0.0025%	0.180 x 0.785 x 0.450	
1446	16 pin DIP	36	(12)	10K	(33K)	0.0025%	0.200*** x 0.810 x 0.310 - 0.300	Tracking Available To: ±0.5 ppm/°C / ±0.5 ppm/°C
VSM46	16 pin DIP Gull Wing	36	(12)	10K	(33K)	0.0025%	0.180 x 0.810 x 0.450	
1457	18 pin DIP	80	(25)	10K	(33K)	0.0025%	0.200*** x 1.020 x 0.510 - 0.300	
1460	20 pin 1" x 1" Plug-in	221	(73)	10K	(33K)	0.0025%	0.230*** x 1.020 x 0.910 - 0.900	
1461	6 pin SIP	9	(3)	10K	(33K)	0.0025%	0.300 x 0.586 x 0.100 - 0.100†	
1462	7 pin SIP	36	(12)	10K	(33K)	0.0025%	0.425 x 0.425 x 0.130 - 0.050†	
1463	7 pin SIP	30	(10)	10K	(33K)	0.0025%	0.360 x 0.785 x 0.130 - 0.100†	
1464	8 pin SIP	36	(12)	10K	(33K)	0.0025%	0.360 x 0.810 x 0.130 - 0.100†	
1465	11 pin SIP	15	(5)	10K	(33K)	0.0025%	0.250 x 0.900 x 0.130 - 0.050†	
1476	30 pin 1" x 1" Flat Pack	225	(75)	10K	(33K)	0.0025%	0.125 x 1.148 x 0.960 - 0.050**	
1485 VSM85	16 pin Leadless Chip Carrier	12	(4)	10K	(33K)	0.0025%	0.090 x 0.295 x 0.360 - 0.050†	
VSM86	20 pin Leadless Chip Carrier	12	(4)	10K	(33K)	0.0025%	0.090 x 0.360 x 0.360 - 0.050†	
VSM87	24 pin Leadless Chip Carrier	16	(5)	10K	(33K)	0.0025%	0.090 x 0.345 x 0.345 - 0.050†	
VSM88	28 pin Leadless Chip Carrier	25	(10)	10K	(33K)	0.0025%	0.080 x 0.460 x 0.460 - 0.050†	
VSM89	32 pin Leadless Chip Carrier	35	(14)	10K	(33K)	0.0025%	0.090 x 0.460 x 0.560 - 0.050†	

Shaded areas denote surface mount networks.

* pin square ** axial lead pin spacing *** height from standoff † spacing between adjacent pins

VISHAY's Precision Resistor Network products are based on fabrication from a standing inventory of packages and resistor chips. This permits quick delivery of prototypes since there are no masks to design or trial processings to be made. Further, it allows any combination of values, tolerances and circuits. There are normally no engineering or setup charges, and no minimum quantities are required. Delivery can be in as few as five days.

The sequence of fabrication includes selection of chips, die attachment, wirebonding, value trimming, and hermetic sealing. The finished product provides the stability associated with foil resistors in a hermetically sealed miniature package.

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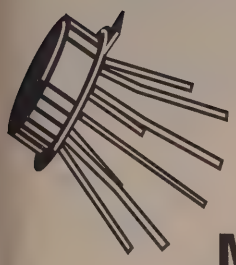
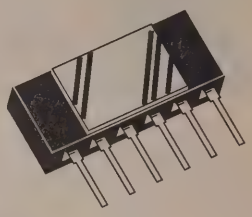
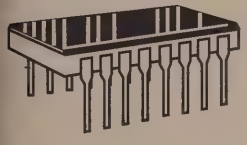


VISHAY
Bulk Metal® Resistors
of VISHAY Intertechnology, Inc.

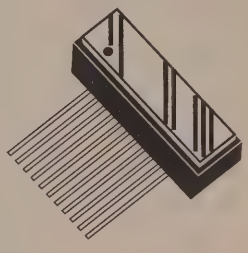


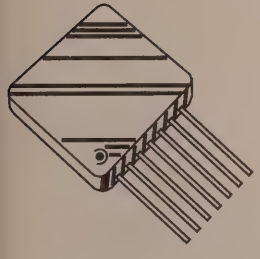
Precision, Hermetically-Sealed
Miniature Resistor Networks



Prototypes In 10 Working Days

No N.R.E., Setup or Front End Design Costs





Ratio tolerance to 0.005%

Resistance Range: 5 Ω to 30K and beyond

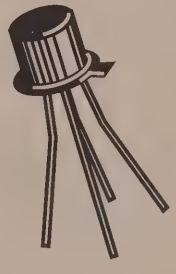
TCR: ±5 ppm/°C (–55°C to +125°C, ref +25°C)

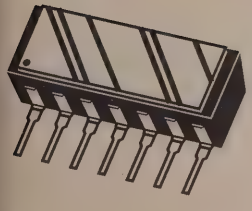
TCR tracking: to 0.5 ppm/°C

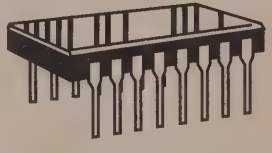
Ratio stability under load-life conditions < 0.01%

Rise time to 1 nanosecond, no ringing

Noise less than –32 dB







To place your prototype order, contact applications engineering at (215) 644-1300.
Tighter specifications* are available, see Catalog VPN-2500.

*Longer delivery for prototypes may be required.

Using an inventory of DIPs, SIPs, LCCs, TOs and flatpack packages, coupled with a comprehensive inventory of wire-bondable chips in Bulk Metal® Foil and Thin Film, we can help you design your network, manufacture and ship it within 10 working days of design finalization! Should your application call for thick film, these prototype networks will allow you to test your design easily and efficiently in its early stages.

Technologies: Bulk Metal® Foil, Thin Film

Packages: DIPs, SIPs, LCCs, TOs, Flatpacks

63 Lincoln Hwy. Malvern, PA 19355 (215) 644-1300 FAX (215) 296-0657 Sales FAX (215) 640-9081 TWX 510-668-8944

A COMPANY OF VISHAY RESISTIVE SYSTEMS

Surface Mount Resistor Products

VISHAY RESISTIVE SYSTEMS can supply a wide variety of surface mount resistors and resistor networks in the following technologies; Bulk Metal® Foil, thin film and thick film. Individual resistor configurations include chips, molded packages and hermetically sealed units. Resistor networks are available in leadless chip carriers, small outline chip carriers and gull-wing formed lead packages.

Utilizing state-of-the-art materials and processes, the products offer excellent life stability. If your requirements are low temperature coefficient of resistance, tight tolerance and fast rise time; or small size coupled with high power and low cost, VISHAY has the resistor or network to meet your needs.

Product selection should be based upon application performance requirements. The availability of multiple technologies, for different product styles, permits optimization of performance at the most economical level. For example chip resistors and leadless chip carrier networks are available in Bulk Metal® foil, thin film and thick film.

Product Capabilities

- Temperature Coefficient of Resistance: to ±5 ppm/°C (–55°C to +125°C)
- Life Stability: to 0.05%, 2,000 hours at + 70°C
- Shelf Life Stability: to 0.0005% (5 ppm) hermetically sealed
- Resistance Value: 5 Ω to 25M Ω
- Resistance Tolerance: to 0.005%
- Rise Time: to 1 ns

Surface Mount Resistors

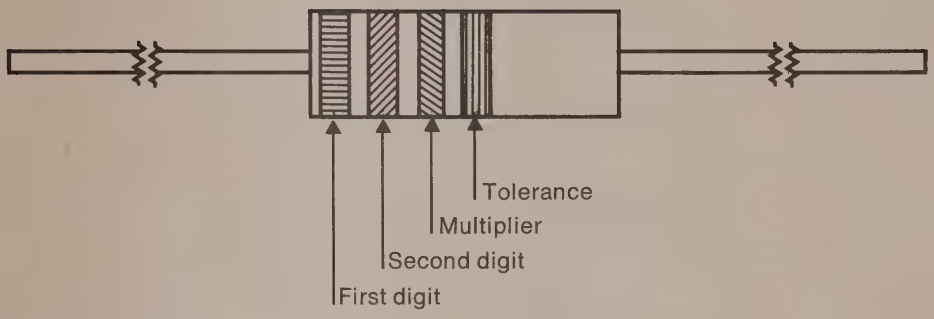
Product Type	Manufacturing Division Data Sheet or Catalog	Model	Element Type	Resistance Range (Ω)	Nominal Dimensions (Inches)
Chip Resistor	VISHAY Bulk Metal® Resistors Data Sheet VMF-1650	VSM1505 VSM1510 VSM2110 VSM2018	Bulk Metal® Foil	5 - 33K 33K - 80K 5 - 100K 5 - 150K	0.150 x 0.050 x 0.025 0.150 x 0.100 x 0.025 0.210 x 0.100 x 0.025 0.200 x 0.180 x 0.025
	OHMTEK Surface Mount Resistors	P0505 P0705 P1005 P1206 P1505 P2208	Thin Film	10 - 260K 10 - 300K 10 - 600K 10 - 1M 10 - 500K 100 - 1M	0.050 x 0.050 x 0.020 0.075 x 0.050 x 0.020 0.100 x 0.050 x 0.030 0.126 x 0.063 x 0.030 0.150 x 0.050 x 0.030 0.225 x 0.075 x 0.030
	OHMTEK Surface Mount Resistors	M0303 M0502 M0504 M0505 M0705 M1002 M1005 M1010 M1206 M1505 M2208 M2010 M2512	Thick Film	10 - 25M 10 - 25M 10 - 25M 10 - 25M 10 - 25M 10 - 25M 10 - 25M 10 - 25M 10 - 25M 10 - 25M 10 - 25M 10 - 25M 10 - 25M	0.035 x 0.035 x 0.020 0.050 x 0.025 x 0.020 0.050 x 0.040 x 0.020 0.050 x 0.050 x 0.020 0.075 x 0.050 x 0.020 0.100 x 0.025 x 0.020 0.100 x 0.050 x 0.030 0.100 x 0.100 x 0.030 0.126 x 0.063 x 0.030 0.150 x 0.050 x 0.030 0.225 x 0.075 x 0.030 0.200 x 0.100 x 0.030 0.250 x 0.125 x 0.030
Current Sensing Resistor	VISHAY Bulk Metal® Resistors Data Sheet VMF-1700	VCS	Bulk Metal® Foil	0.01 - 1.0	0.250 x 0.160 x 0.040

Surface Mount Networks

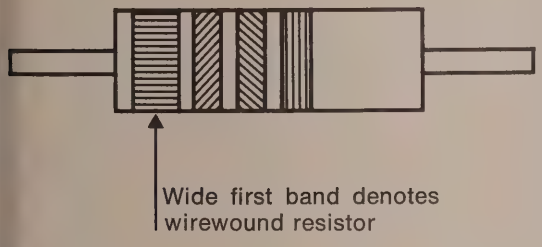
Product Type	Manufacturing Division Data Sheet or Catalog	Model	Element Type	Resistance Range (Ω)	Number of Leads	Lead Spacing
Leadless Chip Resistor Networks	OHMTEK Surface Mount Resistors	LC16 LC20 LC24 LC28	Thick Film and Thin Film	10 - 1M 10 - 1M 10 - 1M 10 - 1M	16 20 24 28	0.050 0.050 0.050 0.050
	OHMTEK Surface Mount Resistors	Small Outline (SO)	Thick Film and Thin Film	10 - 1M	4 - 20	0.050
	VISHAY Bulk Metal® Resistors Data Sheet VPN-300	VSM85 VSM86 VSM87 VSM88 VSM89	Bulk Metal® Foil and Thin Film	5 - 500K 5 - 500K 5 - 500K 5 - 500K 5 - 500K	16 20 24 28 32	0.050 0.050 0.050 0.050 0.050
Gull Wing Networks	VISHAY Bulk Metal® Resistors Data Sheet VPN-300	VSM42 VSM45 VSM46	Bulk Metal® Foil and Thin Film	5 - 500K 5 - 500K 5 - 500K	8 14 16	0.100 0.100 0.100
	OHMTEK TOMC Series	TOMC14 TOMC16	Thin Film	100 - 100K 100 - 100K	14 16	0.050 0.050

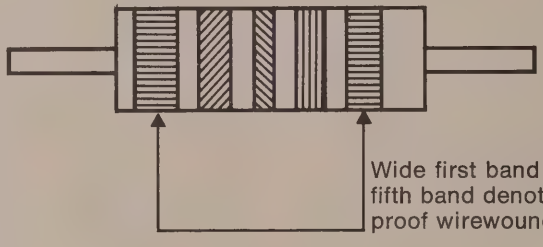
MINIGLOSSARY
RESISTOR COLOR CODES

EIA/MIL Resistor Color Codes



Color code for general-purpose industrial resistors

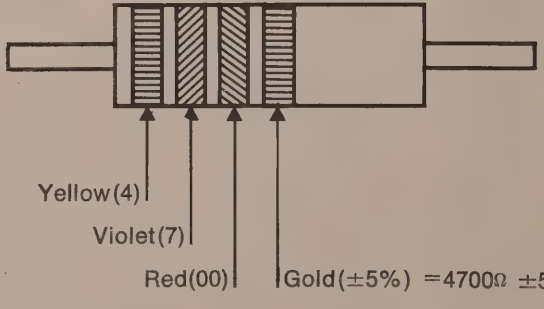




Color code for general-purpose wirewound resistors

Color	Significant digit	Multiplier	Tolerance
Black	0	1	—
Brown	1	10	± 1%
Red	2	100	± 2%
Orange	3	1000	± 3%
Yellow	4	10,000	± 4%
Green	5	100,000	—
Blue	6	1,000,000	—
Violet	7	10,000,000	—
Gray	8	—	—
White	9	—	—
Gold	—	0.1	± 5%
Silver	—	0.01	±10%
No color	—	—	±20%

Example:



W O R L D P R O D U C T S

SAMHWA METAL OXIDE VARISTORS–SVC SERIES

Part Number	Disc Size	Rated Voltage		Rated Single Pulse Transient Energy (Joules)			Transient		Varistor Voltage (1mADC) Tolerance			Max Clamping Voltage at Current 8/20 µs		Typical Capacitance f=1kHz
		RMS Vacm	DC Vdcm				Average Power Dissipation	Peak at Current 8/20 µs	V nom	Min	Max			
	mm	(Volts)	(Volts)	8/20 µs	10/1000µs	2 ms	(Watts)	(Amps)	(Volts)	(Volts)	(Volts)	(Volts)	(Amps)	(pF)
SVC080D-05B	5	4	5.5	0.05	0.2	0.2	0.1	50	8	6	11	22	1	2000
SVC080D-07B	7			0.1	0.4	0.4	0.25	125				20	2.5	5000
SVC080D-10B	10			0.2	0.8	0.8	0.4	250				20	5	9500
SVC120D-05B	5	6	8	0.07	0.3	0.3	0.1	50	12	9	16	32	1	1500
SVC120D-07B	7			0.15	0.6	0.6	0.25	125				30	2.5	3500
SCV120D-10B	10			0.25	1.2	1.2	0.4	250				30	5	9500
SVC180D-05B	5	11	14	0.15	0.3	0.3	0.1	100	18	15	20	40	1	1000
SVC180D-07B	7			0.4	0.8	0.8	0.25	250				36	2.5	2300
SVC180D-10B	10			0.8	1.5	1.5	0.4	500				36	5	5500
SVC180D-14B	14			1.6	3.5	3.5	0.6	1000				36	10	9500
*SVC180D-20B(x)	20				80¤	80¤	1.0	2000				36	20	2800
SVC220D-05B	5	14	**18	0.2	0.4	0.4	0.1	100	+22	20	24	48	1	950
SVC220D-07B	7			0.5	0.9	0.9	0.25	250				43	2.5	2000
SVC220D-10B	10			1	2	2	0.4	500				43	5	4500
SVC220D-14B	14			2	4	4	0.6	1000				43	10	8000
*SVC220D-20B(x)	20				100¤	100¤	1.0	2000				43	20	22000
SVC270D-05B	5	17	22	0.25	0.5	0.5	0.1	100	27	24	30	60	1	930
SVC270D-07B	7			0.65	1	1	0.25	250				53	2.5	1800
SVC270D-10B	10			1.3	2.5	2.5	0.4	500				53	5	3500
SVC270D-14B	14			2.7	5	5	0.6	1000				53	10	6700
*SVC270D-20B(x)	20				120¤	120¤	1.0	2000				53	20	18000
SVC330D-05B	5	20	27	0.3	0.6	0.6	0.1	100	33	30	36	73	1	800
SVC330D-07B	7			0.8	1.2	1.2	0.25	250				65	2.5	1500
SVC330D-10B	10			1.6	3	3	0.4	500				65	5	3000
SVC330D-14B	14			3.4	6	6	.06	1000				65	10	5800
*SVC330D-20B(x)	20				150¤	150¤	1.0	2000				65	20	16000
SVC390D-05B	5	25	31	0.3	0.8	0.8	0.1	100	39	35	43	86	1	600
SVC390D-07B	7			0.95	1.5	1.5	0.25	250				77	2.5	1300
SVC390D-10B	10			1.9	3.5	3.5	0.4	500				77	5	2500
SVC390D-14B	14			3.8	7.2	7	0.6	1000				77	10	5000
*SVC390D-20B(x)	20				24	24	1.0	2000				77	20	13000
SVC470D-05B	5	30	38	0.4	1	1	0.1	100	47	42	52	104	1	450
SVC470D-07B	7			1.1	1.8	1.8	0.25	250				93	2.5	1100
SVC470D-10B	10			2.3	4.5	4.5	0.4	500				93	5	2200
SVC470D-14B	14			4.5	8.8	8.5	0.6	1000				93	10	4000
*SVC470D-20B(x)	20				30	30	1.0	2000				93	20	11000
SVC560D-05B	5	35	45	0.45	1	1	0.1	100	56	50	62	123	1	350
SVC560D-07B	7			1.25	2.3	2.2	0.25	250				110	2.5	950
SVC560D-10B	10			2.8	5.5	5.5	0.4	500				110	5	1900
SVC560D-14B	14			5.5	10	10	0.6	1000				110	10	3800
*SVC560-20B(x)	20				35	35	1.0	2000				100	20	10000
SVC680D-05B	5	40	56	0.6	1.2	1.2	0.1	100	68	61	75	150	1	320
SVC680D-07B	7			1.6	3	2.5	0.25	250				135	2.5	850
SVC680D-10B	10			3.5	6.5	6.5	0.4	500				135	5	1600
SVC680D-14B	14			6.9	13	12	0.6	1000				135	10	3400
*SVC680D-20B(x)	20				40	40	1.0	2000				135	20	8000
SVC820D-05A	5	50	66	1.9	1.7	1.7	0.1	400	82	74	90	143	5	150
SVC820D-07A	7			6.8	4	3.5	0.25	1200				135	10	400
SVC820D-10A	10			15	8	8	0.4	2500				135	25	800
SVC820D-14A	14			27	15	14	0.6	4500				135	50	1600
*SVC820D-20A(x)	20				27	27	1.0	6500				135	100	6000
SVC101D-05A	5	60	85	2.3	2	2	0.1	400	100	90	110	172	5	130
SVC101D-07A	7			8.4	5	4	0.25	1200				165	10	320
SVC101D-10A	10			20	10	10	0.4	2500				165	25	700
SVC101D-14A	14			30	20	18	0.6	4500				165	50	1400
*SVC101D-20A(x)	20				30	30	1.0	6500				165	100	6000
SVC121D-05A	5	75	102	2.8	2.5	2.5	0.1	400	120	108	132	210	5	110
SVC121D-07A	7			10	6	5	0.25	1200				200	10	280
SVC121D-10A	10			24	12	12	0.4	2500				200	25	550
SVC121D-14A	14			38	22	20	0.6	4500				200	50	1200
*SVC121D-20A(x)	20				40	40	1.0	6500				200	100	5200
SVC151D-05A	5	95	127	3.5	3	3	0.1	400	150	135	165	260	5	95
SVC151D-07A	7			12	8	6	0.25	1200				250	10	230
SVC151D-10A	10			26	15	16	0.4	2500				250	25	470
SVC151D-14A	14			45	30	25	0.6	4500				250	50	950
*SVC151D-20A(x)	20				50	50	1.0	6500				250	100	4000
SVC201D-05A	5	130	175	4.2	4	4	0.1	400	200	185	225	355	5	70
SVC201D-07A	7			15	11	10	0.25	1200				340	10	170
SVC201D-10A	10			32	20	20	0.4	2500				340	25	350
SVC201D-14a	14			55	38	35	0.6	4500				340	50	700
*SVC201D-20A(x)	20			80	70	70	1.0	6500				340	100	1250

¤ Energy rating for impulse duration of 30ms min to 1/2 peak current value
*(x) = 7.5 ± 1mm lead spacing

**SVC220D-20B will withstand 24VDC for 5 min
+Varistor voltage measured at 10ma for 20mm diameter parts

WP® WORLD PRODUCTS INC.
19654 8TH ST. EAST, SONOMA, CA 95476 PHONE (707) 996-5201 FAX (707) 996-3380

SEE OUR OTHER DATA PAGES IN SECTIONS 1500, 2450, 4300 AND 4800.

W O R L D P R O D U C T S

SAMHWA METAL OXIDE VARISTORS–SVC SERIES

Part Number	Disc Size	Rated Voltage		Rated Single Pulse Transient Energy (Joules)			Transient		Varistor Voltage (1mADC) Tolerance			Max Clamping Voltage at Current 8/20 µs		Typical Capacitance f=1kHz
		RMS Vacm	DC Vdcm				Average Power Dissipation	Peak at Current 8/20 µs	V nom	Min	Max			
	mm	(Volts)	(Volts)	8/20 µs	10/1000µs	2 ms	(Watts)	(Amps)	(Volts)	(Volts)	(Volts)	(Volts)	(Amps)	(pF)
SVC221D-05A	5			4.6	4.5	4.5	0.1	400				375	5	60
SVC221D-07A	7			16	12	10	0.25	1200				360	10	150
SVC221D-10A	10	140	185	36	22	23	0.4	2500	220	198	242	360	25	310
SVC221D-14A	14			60	42	40	0.6	4500				360	50	650
*SVC221D20-A(x)	20			90	75	75	1.0	6500				360	100	1150
SVC241D-05A	5			5	5	5	0.1	400				415	5	60
SVC241D-07A	7			17	13	10	0.25	1200				395	10	140
SVC241D-10A	10	150	200	40	25	25	0.4	2500	240	216	264	395	25	290
SVC241D-14A	14			65	45	40	0.6	4500				395	50	600
*SVC241D-20A(x)	20			95	80	80	1.0	6500				395	100	1050
SVC271D-05A	5			6	6	6	0.1	400				475	5	55
SVC271D-07A	7			19	15	12	0.25	1200				455	10	120
SVC271D-10A	10	175	225	43	30	30	0.4	2500	270	247	303	455	25	270
SVC271D-14A	14			68	55	50	0.6	4500				455	50	540
*SVC271D-20A(x)	20			110	90	90	1.0	6500				455	100	950
SVC361D-05A	5			7.5	7.5	7.5	0.1	400				620	5	50
SVC361D-07A	7			25	20	15	0.25	1200				595	10	100
SVC361D-10A	10	230	300	50	35	35	0.4	2500	360	324	396	595	25	250
SVC361D-14A	14			85	70	65	0.6	4500				595	50	450
*SVC361D-20A(x)	20			140	120	120	1.0	6500				595	100	740
SVC391D-05A	5			8	8	8	0.1	400				675	5	50
SVC391D-07A	7			26	21	17	0.25	1200				650	10	90
SVC391D-10A	10	250	330	55	40	40	0.4	2500	390	351	429	650	25	190
SVC391D-14A	14			92	72	70	0.6	4500				650	50	360
*SVC391D-20A(x)	20			140	130	130	1.0	6500				650	100	680
SVC431D-05A	5			9	9	9	0.1	400				745	5	45
SVC431D-07A	7			29	23	20	0.25	1200				710	10	85
SVC431D-10A	10	275	370	60	45	45	0.4	2500	430	387	473	710	25	180
SVC431D-14A	14			100	75	75	0.6	4500				710	50	350
*SVC431D-20A(x)	20			150	140	140	1.0	6500				710	100	620
SVC471D-05A	5			10	10	10	0.1	400				810	5	40
SVC471D-07A	7			32	25	20	0.25	1200				775	10	80
SVC471D-10A	10	300	405	65	45	45	0.4	2500	470	423	517	775	25	170
SVC471D-14A	14			110	80	80	0.6	4500				775	50	320
*SVC471D-20A(x)	20			160	150	150	1.0	6500				775	100	580
SVC511D-14A	14	320	420	120	90	90	0.6	4500	514	462	565	850	50	300
*SVC511D-20A (x)	20			180	160	160	1.0	6500				850	100	600
SVC561D-10A	10			69	45	45	0.4	2500				910	25	170
SVC561D-14A	14	350	460	140	85	85	0.6	4500	560	504	616	910	50	280
*SVC561D-20A(x)	20			215	150	150	1.0	6500				910	100	500
SVC621D-10A	10			80	45	45	0.4	2500				1025	25	150
SVC621D-14A	14	385	505	150	85	85	0.6	4500	620	558	682	1025	50	250
*SVC621D-20A(x)	20			230	150	150	1.0	6500				1025	100	450
SVC681D-10A	10			85	45	45	0.4	2500				1120	25	120
SVC681D-14A	14	420	560	150	90	90	0.6	4500	680	612	748	1120	50	230
*SVC681D-20A(x)	20			230	160	160	1.0	6500				1120	100	420
SVC751D-10A	10			100	50	50	0.4	2500				1240	25	120
SVC751D-14A	14	460	615	175	100	100	0.6	4500	750	675	825	1240	50	220
*SVC751D-20A(x)	20			270	175	175	1.0	6500				1240	100	380
SVC781D-10A	10			105	50	50	0.4	2500				1290	25	110
SVC781D-14A	14	485	640	185	108	105	0.6	4500	780	702	858	1290	50	210
*SVC781D-20A(x)	20			285	185	180	1.0	6500				1290	100	310
SVC821D-10A	10			110	55	55	0.4	2500				1355	25	100
SVC821D-14A	14	510	675	185	110	110	0.6	4500	820	738	902	1355	50	200
*SVC821D-20A(x)	20			280	190	190	1.0	6500				1355	100	350
SVC911D-10A	10			125	63	60	0.4	2500				1500	25	95
SVC911D-14A	14	550	745	215	125	120	0.6	4500	910	819	1001	1500	50	190
*SVC911D-20A(x)	20			335	220	215	1.0	6500				1500	100	320
SVC921D-14A	14	575	730	215	120	120	0.6	4500	923	830	1015	1520	52	180
*SVC921D-20A(x)	20			320	220	220	1.0	6500				1520	100	380
SVC102D-10A	10			135	68	65	0.4	2500				1650	25	90
SVC102D-14A	14	625	825	240	136	130	0.6	4500	1000	900	1100	1650	50	180
*SVC102D-20A(x)	20			360	235	230	1.0	6500				1650	100	290
SVC112D-10A	10			155	75	70	0.4	2500				1815	25	85
SVC112D-14A	14	680	895	262	152	140	0.6	4500	1100	990	1210	1815	50	170
*SVC112D-20A(x)	20			405	259	250	1.0	6500				1815	100	270
SVC182D-14A	14	1000	1465		240	240	0.6	4500	1800	1620	1980	2970	50	200
*SVC182D-20A(x)	20				400	400	1.0	6500				2970	100	400

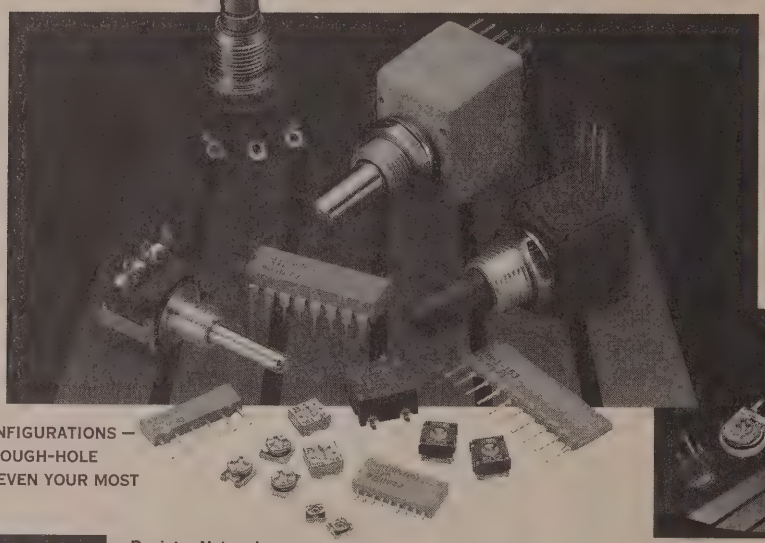
¤ Energy rating for impulse duration of 30ms min to 1/2 peak current value
*(x) = 7.5 ± 1mm lead spacing

**SVC220D-20B will withstand 24VDC for 5 min
+Varistor voltage measured at 10ma for 20mm diameter parts

WORLD PRODUCTS INC.
19654 8TH ST. EAST, SONOMA, CA 95476 PHONE (707) 996-5201 FAX (707) 996-3380

SEE OUR OTHER DATA PAGES IN SECTIONS 1500, 2450, 4300 AND 4800.

RESISTIVE TECHNOLOGY SOLUTIONS



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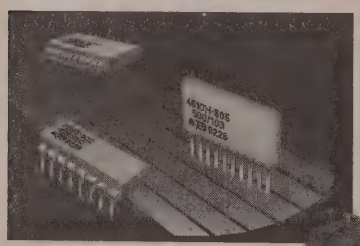

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There's no equivalent. Select from thick and thin film products to meet your specific design parameters. Surface mount packages in gull wing styles. Through-hole devices in conformal and molded SIP, and molded DIP packages. Application specific devices for EMI/RFI filters and ECL circuits. All popular pin counts.

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Choose from the industry's widest assortment of surface mount and through-hole models. Sealed and open frame styles. Multiturns and single-turns. A complete assortment of sizes, packaging, pin styles and adjustments. For any commercial, industrial or military application.

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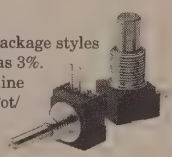
Wide variety of turns, element types and package styles available. Resistance tolerance as low as 3%. Resistance range of 20 to 200K. Slimline version available for tight designs. Pot/switch combinations offered for added design flexibility.



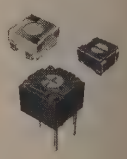
Panel Controls
Single- and multiturn styles with cermet, conductive plastic, Hybritron® and wire-wound elements. ±5% tolerance available. Complete assortment of terminal styles, tapers and package sizes.

Dials
Compact designs with simplified mounting. An assortment of turns and configurations.

Encoders
Rotary optical and digital contacting styles available with quadrature outputs. EN Series offers 5.0 VDC supply voltage. EC/EL Series provides 5 ohms maximum closed circuit resistance.

And More
Your supply of Bourns resistive solutions is available from your local Bourns authorized distributor now.

Switches
Now there are ultra-miniature styles available in rotary, coded and key switch versions. Pot/switch combinations in a variety of package sizes.



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POTENTIOMETERS/RHEOSTATS

Manufacturer	Starting EEM Page No.	Features: Resistive Element Material: Carbon Film	Carbon Comp.	Conductive Plastic	Hybrid	Wirewound	Mechanical Adjustment: Single turn	Multi-turn	Slider Motion	Non-linear Tapers	High Power >5 W	Precision	Mounting: Linear Thru Panel	PCB	Servo Adj.	Surface	Switch	Multi-section	Other Features
Beckman Industrial Corp.	A•2056			√	√	√	√	√	√	√		√			√			√	
Bourns	A•2059			√		√	√	√		√		√	√	√	√		√	√	Custom sensors.
Clarostat Sensors and Controls	A•2070	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*		√*	√*	
Dale Electronics	A•2072					√	√	√	√	√		√	√	√		√			
Duncan Electronics	A•2078			√*	√*	√*	√*	√*	√	√		√*	√*		√*		√	√	
Dynamation Transducers Corp.	A•2081						√	√	√		√	√	√		√				Linear motion position sensors.
ETI Systems	A•2084			√	√	√	√	√	√	√	√	√	√	√	√		√	√	
ISL Products International Ltd.	A•2087	√	√	√		√	√	√		√		√		√	√		√	√	
JDK Controls	A•2088			√*			√*			√*		√*	√*		√*			√*	Element and mating wiper assemblies.
Mallory Controls	A•2092	√	√	√	√	√	√	√	√	√		√	√	√					
Maurey Instrument	A•2095			√		√*	√*		√				√		√			√*	
Memcor Truohm	A•2105					√*		√*		√*	√*								
Mepcopal	A•2106	√				√	√	√				√	√	√					
Midori America Corp.	A•2109			√			√	√		√		√	√		√				Contactless potentiometers for both linear and angular motion.
Murata Erie North America	A•2110	√§	√§				√§							√§		√§			
Noble U.S.A.	A•2113	√	√	√					√			√	√	√					
Novotechnik U.S. Inc.	A•2114			√*			√	√*	√			√	√		√*				
Penny & Giles	A•2115			√*	√*	√*	√	√	√	√		√							
Precision Control Manufacturing Inc.	A•2116					√*	√*	√*				√*	√*	√§*					Decade, precision, MIL Spec.
RDI Electronics	A•2117	√§				√§	√§		√	√				√			√	√	
Shokai Far East	A•2118	√	√			√	√	√		√			√	√			√		
Spectrol Electronics	A•2119			√	√	√*	√	√		√	√	√	√	√	√		√	√	
Vernitron/ International	A•2124			√*	√	√*	√	√	√	√		√		√	√		√	√	
Waters Manufacturing/ Talley Industries	A•2128			√		√	√	√	√			√			√				Torque watch gauges
Wilbrecht Electronics	A•2094			√			√			√				√			√		

* MIL Spec. § Surface Mount.

TRIMMERS

Manufacturer	Starting EEM Page No.	Resistive Element Material						Features									
								Mechanical Adjustment		Motion			Mounting				
		Carbon Film	Carbon Comp.	Cermet	Conductive Plastic	Metal Film	Wirewound	Single Turn	Multi-turn	Linear	Non-linear	Precision	Thru Panel	PCB	Surface	Multi-section	Other Features
Beckman Industrial Corp.	A•2056			√§				√§	√§	√§	√§		√	√	√		
Bourns	A•2059	√		√§*			√*	√§*	√§*	√§*			√*	√*	√§*		
Clarostat Sensors and Controls	A•2070	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*		√*	
Dale Electronics	A•2072			√	√	√	√	√	√	√	√	√		√	√		
ISL Products International Ltd.	A•2087	√		√				√		√							
Maurey Instrument	A•2095						√*	√*		√		√*	√*			√*	
Mepcopal	A•2106	√		√§*			√	√§	√§*	√				√	√		
Murata Erie North America	A•2110	√§	√§	√§				√§	√					√§	√§		
Noble USA Inc.	A•2113			√§		√§									√§		
Shokai Far East	A•2118	√	√	√				√	√	√	√		√	√			
Spectrol Electronics Corp.	A•2119			√*			√	√	√				√	√	√		
Tocos America Inc.	A•2122	√§	√§	√§	√§		√§	√§	√§	√§	√§	√§	√§	√§	√§		
Vernitron International	A•2124			√§*			√*	√§*	√§*				√	√§*	√		
Vishay Resistors	A•2127								√§*			√	√§*	√§*			Bulk metal foil.*

* MIL Spec. § Surface Mount.

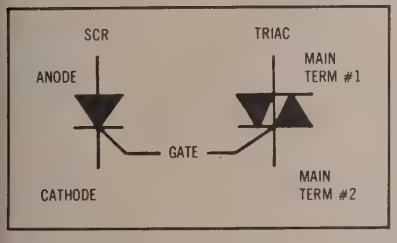
MINIGLOSSARY THYRISTORS/ HIGH POWER DIODES

THYRISTORS

A thyristor is a four-layer semiconductor (pnpn) that can be switched from an OFF to an ON state. This is usually done by a voltage or current pulse to the gate terminal. The device will then continue to conduct so long as the principal current of the device flows through the thyristor's two main terminals.

In many respects a thyristor is analogous to an electromechanical latching relay. In fact, thyristors have largely replaced these relays in newer equipment designs. But, misapplications and/or failure to fully understand the parameters of these and other solid state devices often leads to catastrophic field failures.

The terminology shown on this page has been condensed from common industry data books and is intended to be a guide for the engineer.



di/dt: *Critical rate of rise of ON state current* is the user's maximum design limit (Fig. 1).

di_R/dt: *Rate of decay of ON state current* (Fig. 1 & 2).

dv/dt (critical): *Rate of rise of OFF state voltage*. Lowest voltage rate of rise to cause a thyristor to turn ON.

dv/dt (reapplied) : *Rate of rise of reapplied OFF state voltage.*

I_{FSM}: *Nonrepetitive ON state surge current in diodes.* Maximum peak value of ½ cycles (60 Hz) a diode can withstand up to 100 times in its lifetime.

I_{TSM}: *Nonrepetitive ON state surge current in thyristors*. Maximum peak value of 60 Hz cycles a thyristor can withstand up to 100 times in its lifetime.

I_{DRM}/I_{RRM}: *Maximum peak forward/ reverse leakage current* at specified temperature and repetitive conditions.

I_{GDM}: *Continuous gate current not to trigger*. Highest dc gate current that will *not* cause thyristor to switch from OFF to ON at a specific temperature.

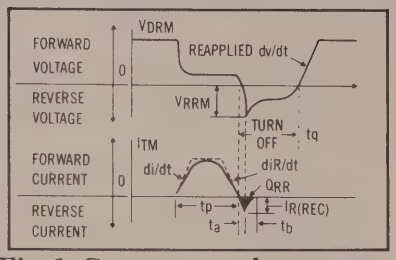


Fig. 1. Concurrent voltage and current waveforms

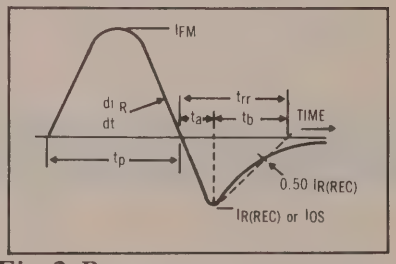


Fig. 2. Recovery current waveform

I_{GT}: *Continuous gate trigger current.* Absolute minimum gate current required to switch thyristor from OFF to ON.

I_H: *Holding Current*. Minimum current required to hold thyristor ON.

I_L: *Latching current*. Minimum current required to hold thyristor ON after removal of gate drive.

$I_{(REC)}$; *Recovery current*. Peak value of reverse current during recovery or turn OFF (Fig. 1 & 2).

I_{OS}: *Overshoot current*. See $I_{R(REC)}$.

I^2t: Maximum ON state, short time thermal capacity of the silicon element for operations less than ½ cycle of 180° conduction angle.

$I_{T(AV)}$: *Average ON state current* (max.)

Q_{RR}: *Reverse recovered charge* (Fig. 1).

$R_{\theta JC}$: *Junction-to-case thermal resistance* in degrees C per watt.

$T_{C(MAX)}$: *Max. allowable case temperature.*

$T_{J(MAX)}$: *Maximum allowable junction temp.*

t_d: *Delay time*. Interval between a specified point at beginning of gate pulse and the instant at which the principal voltage drops to a specified value. (OFF-ON) (Fig. 3)

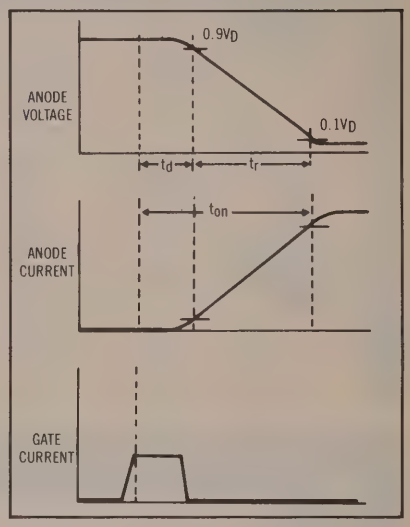


Fig. 3. Turn-on time waveforms

t_{on}: *Turn-on time*. The sum of delay time and rise time. (OFF-ON) (Fig. 3)

t_q: *Turn-off time.* Time between principal current reaching zero and the instant thyristor can block forward voltage without turning ON. (Fig. 1)

t_r: *Rise time*. Time between principal voltage dropping from one value to a second lower value when thyristor turns from OFF to ON. (Fig. 3)

t_{rr}: *Reverse recovery time*. (Fig. 2)

V_{DRM}/V_{RRM}: *Maximum repetitive peak OFF state/reverse voltage* excluding non-repetitive transients.

V_{DSM}/V_{RSM}: *Maximum nonrepetitive peak OFF state/reverse voltage*.

V_{FM}/V_{TM}: *Maximum forward voltage drop* at a specific forward current and case temp.

V_{GDM}: *Gate nontrigger voltage*. Highest dc voltage that will *not* cause thyristor to switch from OFF to ON.

V_{LATCH}: *Latching voltage*. Voltage required for thyristor to latch ON at a given gate current and junction temp.

$V_{TM(DYN)}$: *Dynamic ON state voltage*. Transient ON state voltage of thyristor when triggered into conduction for a given load and time.

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HELIPOT®
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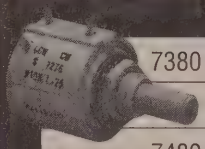
SINGLE TURN

Model	Element Type	Diameter	Standard Linearity	Resistance Tolerance	Servo Mount	Bushing Mount
6173	Conductive Plastic	7/8"	±0.5%	±10%	●	
6163	Conductive Plastic	7/8"	±1.0%	±10%	●	
6180 Series	Conductive Plastic	7/8"	±1.0%	±10%		●
5100 Series	Wirewound	7/8"	±0.5%	±5%	●	●
6273	Conductive Plastic	1-1/16"	±0.5%	±10%	●	
3381	Conductive Plastic	1-5/16"	±0.5%	±10%		●
5311	Wirewound	1-5/16"	±0.5%	±3%		●
6670 Series	Conductive Plastic	2"	±0.25%	±10%	●	●
5610 Series	Wirewound	2"	±0.50%	±5%	●	●



MULTI-TURN

Model	Element Type	# of Turns	Diameter	Standard Linearity	Resistance Tolerance	Servo Mount	Bushing Mount
7380 Series	Wirewound	3	7/8"	±0.25%	±5%	●	●
C	Wirewound	3	1-13/16"	±0.50%	±3%		●
7480 Series	Wirewound	5	7/8"	±0.25%	±5%	●	●
7200 Series	Wirewound	10	7/8"	±0.25%	±3%	●	●
7246	Wirewound	10	7/8"	±0.25%	±5%		●
7276*	Wirewound	10	7/8"	±0.25%	±5%		●
7280 Series	Wirewound	10	7/8"	±0.25%	±5%	●	●
8136*	Hybrid	10	7/8"	±0.25%	±5%		●
8140 Series	Hybrid	10	7/8"	±0.25%	±10%	●	●
A	Wirewound	10	1-13/16"	+0.25%	+3%		●
7600 Series	Wirewound	10	1-13/16"	±0.15%	±5%	●	●

DIALS

Model	Type	# of Turns	Size	For Bushing Diameter	For Shaft Diameter
2600 Series	Analog	20	7/8" Dia.	1/4", 3/8"	1/8" & 1/4"
RB Series	Analog	15	1-13/16" Dia.	1/4", 3/8", 1/2"	1/8" & 1/4"
2126	Digital	10	1" Dia.	3/8"	1/4"
2100/2200	Digital	10, 100	1" x 2"	3/8"	1/4"

* All plastic potentiometer.

A full range of high quality precision components are available for standard and custom applications. Please contact the factory for further information.

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Trimming Potentiometers

THROUGH HOLE DEVICES

	Model	Size	Resistance Range Ω	Resistance Tolerance	CRV	Power Rating Watts	Seal: 85°C Fluorinert®	Adjustment Option Top	Adjustment Option Side	Tape & Reel
SINGLE TURN	24	4mm Dia.	10 to 1 Meg	±20%	±2%	0.5 at 70°C	●	●	●	●
	25	1/4" Sq.	10 to 2 Meg	±20%	±1%	0.5 at 70°C	●	●	●	●
	62	1/4" Dia.	10 to 1 Meg	±10%	±1%	0.5 at 70°C	●	●		
	82	1/4" Dia.	10 to 1 Meg	±10%	±1%	0.5 at 70°C	●	●	●	●
	72	3/8" Sq.	10 to 2 Meg	±10%	±1%	0.5 at 70°C	●	●	●	●
	91	3/8" Dia.	10 to 2 Meg	±20%	±1%	0.5 at 70°C	Dust Cover	●	●	
	93	1/2" Dia.	20 to 2 Meg	±10%	±1%	1.0 at 70°C	●	●		

	Model	Size	Resistance Range Ω	Resistance Tolerance	CRV	Power Rating Watts	Seal: 85°C Fluorinert®	Adjustment Option Top	Adjustment Option Side	Tape & Reel
MULTI-TURN	64	1/4" Sq.	10 to 1 Meg	±10%	±1%	0.25 at 85°C	●	●	●	●
	66	3/8" Sq.	10 to 2 Meg	±10%	±1%	0.5 at 85°C	●	●	●	●
	67	3/8" Sq.	10 to 2 Meg	±10%	±1%	0.5 at 70°C	●	●	●	●
	68	3/8" Sq.	10 to 2 Meg	±10%	±1%	0.5 at 70°C	●	●	●	
	89	3/4" Rect.	10 to 2 Meg	±10%	±1%	0.75 at 70°C	●		●	
	78	$1^1/_4$" Rect.	10 to 2 Meg	±10%	±1%	1.0 at 70°C	●		●	

SURFACE MOUNT DEVICES

	Model	Size	Resistance Range Ω	Resistance Tolerance	CRV	Power Rating Watts	Seal: 85°C Fluorinert®	Adjustment Option Top	Adjustment Option Side	Tape & Reel
SINGLE TURN	21	4mm Chip	500 to 500K	±30%	±3%	0.1 at 70°C	Dust Cover	●		●
	22	3mm Sq.	100 to 1 Meg	±20%	±3%	0.125 at 70°C	●	●		●
	23	4mm Sq.	100 to 2 Meg	±20%	±2%	0.25 at 70°C	●	●	●	●
	83	1/4" Dia.	10 to 1 Meg	±10%	±1%	0.5 at 70°C	●	●	●	●

	Model	Size	Resistance Range Ω	Resistance Tolerance	CRV	Power Rating Watts	Seal: 85°C Fluorinert®	Adjustment Option Top	Adjustment Option Side	Tape & Reel
MT	84	1/4" Sq.	10 to 1 Meg	±10%	±1%	0.25 at 85°C	●	●	●	●

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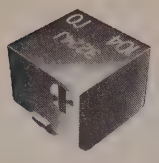
SURFACE MOUNT TRIMMERS



Model 3224
4mm Square SMD Package Multiturn Cermet Sealed

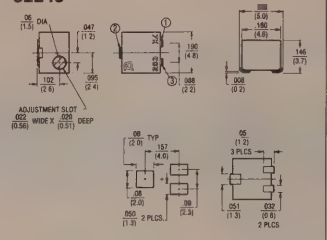
- **J-hook, and gull-wing and pinned configurations**
- **Compatible with all surface mount processes**
- **Low CRV – 1%**
- **Pick and place centering design, with flush adjustment**
- **4mm design meets EIA/EIAJ/IPC/VRCI/SMD standard trimmer footprint**

Electrical Characteristics
Standard Resistance Range
.....10 to 2 megohm
(see standard resistance table)
Resistance Tolerance .....±10% std.
Absolute Minimum Resistance
.....1% or 2.0 ohms
(whichever is greater)
Contact Resistance Variation
.....1% or 3 ohms max.
Resolution .....Essentially Infinite
Insulation Resistance .....500 vdc.
100 megohms min.
Dielectric Strength
Sea Level .....600 vac (1 minute)
Adjustment Angle .....11 turns nom.

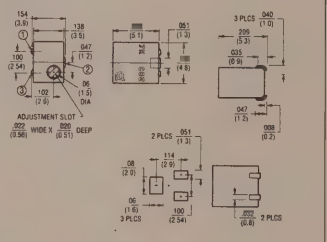
Environmental Characteristics
Power Rating (300 volts max.)
85°C.....0.25 watt
150°C.....0 watt
Temperature Range
.....-65°C to +150°C
Temperature Coefficient
.....±100ppm/°C
Humidity .....MIL-STD 202 Method 106
TRS ±2%; IR 10 megohms
Vibration .....20G TRS ±1%; VRS ±1%
Shock.....100G TRS ±1%; VRS ±1%
Load Life
....@ 85°C rated power 1,000 hours
TRS 3 ohms or 3%
(whichever is greater)
Rotational Cycling .....200 cycles
TRS 3 ohms or 3%
(whichever is greater)
Thermal Shock.....5 cycles
TRS ±2%; VRS ±1%

Physical Characteristics
Mechanical Stop.....Wiper idles
Torque.....180g-cm max.
Weight .....Approximately 0.01 oz.
Marking.....Manufacturer's code
resistance code and date code

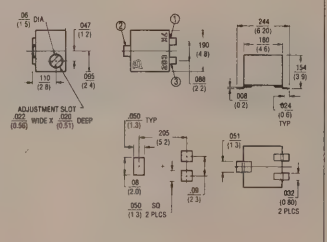
3224J



3224W



3224G



STANDARD RESISTANCE TABLE

Resistance (Ohms)	Resistance Code
10	100
20	200
50	500
100	101
200	201
500	501
1,000	102
2,000	202
5,000	502
10,000	103
20,000	203
50,000	503
100,000	104
200,000	204
500,000	504
1,000,000	105
2,000,000	205

Special resistances available.

HOW TO ORDER

3224 J - 1 - 502 E

Model
Style
Standard or Modified
Product Indicator
-1 = Standard Product
-2 = Wave Solderable
Resistance Code
Embossed Tape Designator
Style J, G: E = 500 pcs./7" reel (standard)
Style W: E = 250 pcs./7" reel (standard)

Consult factory for other available options.
Specifications are subject to change without notice.

Model 3364
SMD 4mm Square Single-turn Cermet Industrial Open Frame

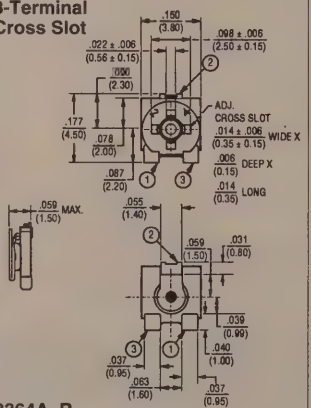
- **Cross-slot rotor designs suitable for automatic adjustment equipment**
- **Supplied in 12mm embossed tape, compatible with automatic pick-and-place assembly equipment**
- **Front and rear adjust versions available**

Electrical Characteristics
Standard Resistance Range
.....100 ohms to 1 megohm
(see standard resistance table)
Resistance Tolerance .....±25% std.
End Resistance
<1K .....20 ohms max.
≥1K.....2%
Contact Resistance Variation
(Voltage Divider) .....5% max.
Resolution.....Infinite
Adjustment Angle .....260°± 20°

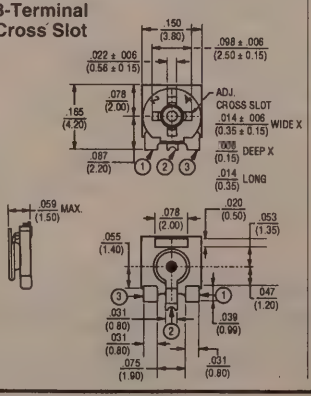
Environmental Characteristics
Power Rating (50 volts max.)
70°C.....0.2 watt
Temperature Range
.....-40°C to +100°C
Temperature Coefficient
.....±250ppm/°C
Humidity .....500 hours (5% ΔTR)
Load Life .....500 hours
0.2 watt @ 70°C (5% ΔTR)
Rotational Life
.....20 cycles (15% ΔTR)

Physical Characteristics
Torque .....20 to 200g-cm
Mechanical Angle.....Continuous
Marking.....Resistance code,
manufacturer's full part number
and date code on packaging
Terminals .....Solder coated
Standard Packaging
.....1000 pcs./7" reel
Reflow solder processing
recommended

3364W, X 3-Terminal Cross Slot



3364A, B 3-Terminal Cross Slot



STANDARD RESISTANCE TABLE

Resistance (Ohms)	Resistance Code	Part Marking
100	101	12
200	201	22
500	501	52
1,000	102	13
2,000	202	23
5,000	502	53
10,000	103	14
20,000	203	24
50,000	503	54
100,000	104	15
200,000	204	25
500,000	504	55
1,000,000	105	16

Popular values listed in boldface.Special resistances available.

HOW TO ORDER

3364 X - 1 - 103 E

Model
Style
Orientation of parts in tape:
Styles W, A, C, U, K
Terminals toward sprocket holes
Styles X, B, D, V, J
Terminals away from sprocket holes
Standard Product
Resistance Code
Embossed Tape Designator
E = 1000 pcs./ 7" reel (-1 standard)
G = 5000 pcs./ 14.5" reel (-1 optional)

Consult factory for other available options.
Specifications are subject to change without notice.

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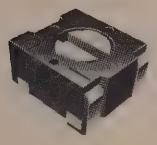
SURFACE MOUNT TRIMMERS

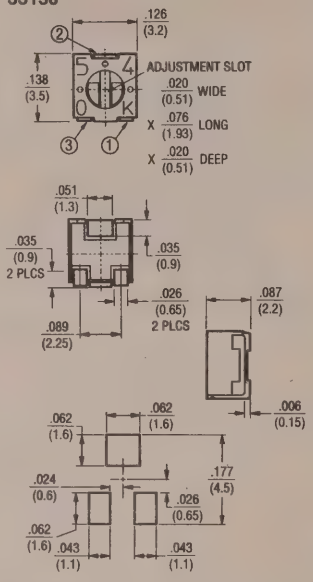


Model 3313
3mm Square SMD Package Single-turn Cermet Sealed

- **100 cycle rotational and seal life**
- **Rotor stop for "in-circuit" adjustment**
- **Low CRV – 1% typical, 2% max.**
- **Compatible with all surface mount manufacturing processes**

Electrical Characteristics
Standard Resistance Range
.....10 ohms to 2 megohms
(see standard resistance table)
Resistance Tolerance .....±20% std.
(tighter tolerance available)
End Resistance
.....1% or 3 ohms max.
(whichever is greater)
Contact Resistance Variation
.....2% or 3 ohms
(whichever is greater)
Adjustability
Voltage Divider .....±0.1%
Rheostat .....±0.2%
Resolution.....Infinite
Insulation Resistance .....500 vdc.
100 megohms min.
Dielectric Strength
Sea Level.....500 vac
70,000 Feet .....350 vac
Adjustment Angle.....220° nom.
Environmental Characteristics
Power Rating (200 volts max.)
70°C.....0.125 watt
125°C.....0 watt
Operating Temperature Range
.....-55°C to +125°C
Temperature Coefficient
.....≤100 ohms ± 150ppm/°C;
>100 ohms ± 100ppm/°C
Seal Test .....85°C Fluorinert*
Humidity ....MIL-STD 202, Method 106
(no vibration) TRS ±3%; IR 10 megohms
Vibration 20G
TRS ±1%; VRS ±1%
Shock 100G
TRS ±1%; VRS ±1%
Load Life .....1000 hours
@ 70°C Rated Power; TRS ±3%
Rotational Life .....100 cycles
TRS ±3%
Thermal Shock.....5 cycles
TRS ±2%; VRS ±1%
Physical Characteristics
Mechanical Angle .....250° nom.
Torque .....50g-cm max.
Stop Strength .....200g-cm min.
Flammability.....U.L. 94V-0
Weight.....Approx. 0.01 oz.
Marking.....Resistance code
and date code
Standard Packaging ...1000 pcs./7" reel
*Fluorinert™ is a registered trademark of 3M Co.

3313J



TOLERANCES: ± .010 (.25) EXCEPT WHERE NOTED
DIMENSIONS: ± IN. (MM)

Rotor positioned at approximate resistance mid-point

STANDARD RESISTANCE TABLE

Resistance (Ohms)	Part Marking Code	Resistance Code
10	A1	100
20	21	200
50	51	500
100	A2	101
200	22	201
500	52	501
1,000	A3	102
2,000	23	202
5,000	53	502
10,000	A4	103
20,000	24	203
50,000	54	503
100,000	A5	104
200,000	25	204
500,000	55	504
1,000,000	A6	105
2,000,000	26	205

Special resistances available.

HOW TO ORDER

3313 J - 1 - 502 E

Model
Style
Standard or Modified Product Indicator
-1 = Standard Product
Resistance Code
Embossed Tape
E = 1000 pcs./7" Reel (Standard)
G = 3000 pcs./13" Reel (Optional)
8mm embossed tape packaging available

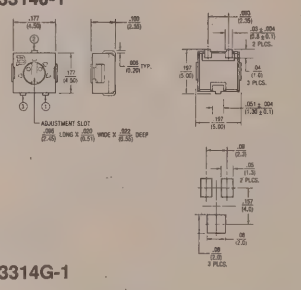
Consult factory for other available options.
Specifications are subject to change without notice.

Model 3314
4mm Square SMD Package Single-turn Cermet Sealed

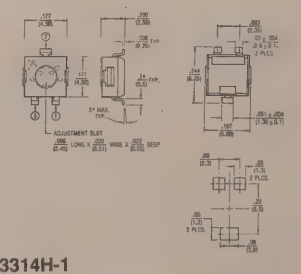
- **J-hook, gull-wing and pinned configurations**
- **Very low CRV – 1%**
- **Compatible with all surface mount soldering processes**

Electrical Characteristics
Standard Resistance Range
.....10 ohms to 2 megohms
(see standard resistance table)
Resistance Tolerance .....±20% std.
(tighter tolerance available)
End Resistance
.....1% or 2 ohms max.
(whichever is greater)
Contact Resistance Variation
.....1% or 3 ohms
(whichever is greater)
Resolution.....Infinite
Insulation Resistance .....500 vdc.
10 megohms min.
Dielectric Strength
Sea Level .....500 vac (1 minute)
Adjustment Angle.....210° nom.
Environmental Characteristics
Soldering Heat
.....260° C, 10 seconds, TRS ±1%
Power Rating (300 volts max.)
70°C.....0.25 watt
125°C.....0 watt
Temperature Range...-55°C to +125°C
Temperature Coefficient
.....±100ppm/°C
Humidity.....90-98% RH,
10 cycles, 240 hours
TRS ±2%; IR 10 megohms
Vibration .....20G TRS ±1%; VRS ±1%
Shock.....100G TRS ±1%; VRS ±1%
Load Life
..(@ 70°C Rated Power 1000 Hours)
TRS ±3%
Rotational Life .....100 cycles
TRS ±3%
Thermal Shock.....5 cycles
TRS ±2%; VRS ±1%
Physical Characteristics
Mechanical Angle .....240° nom.
Torque.....180g-cm typical
Stop Strength .....300g-cm typical
Pushover Strength (S Style)
.....2 kilograms (4.4 lbs.) minimum
Weight .....Approximately 0.01 oz.
Marking.....Manufacturer's code,
resistance code and date code
Standard Packaging
J & G .....500 pcs./7" reel
S.....200 pcs./7" reel
H.....50 pcs./tube

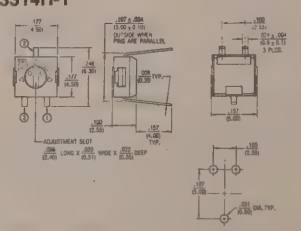
3314J-1



3314G-1



3314H-1



STANDARD RESISTANCE TABLE

Resistance (Ohms)	Resistance Code
10	100
20	200
50	500
100	101
200	201
500	501
1,000	102
2,000	202
5,000	502
10,000	103
20,000	203
50,000	503
100,000	104
200,000	204
500,000	504
1,000,000	105
2,000,000	205

Special resistances available from 10 ohms to 2 megohms.

HOW TO ORDER

3314 G - 1 - 502 E

Model
Style
Standard or Modified Product Indicator
-1 = Standard Product
-2 = Cross Slot Rotor (Styles J, G & H)
Resistance Code
Embossed Tape Designator
(Applicable to Styles J, G and S only)
Style J & G:
E = 500 pcs./7" reel (standard)
G = 3000 pcs./13" reel (optional)
Style S:
E = 200 pcs./7" reel (standard)
G = 1000 pcs./13" reel (optional)

Consult factory for other available options.
Specifications are subject to change without notice.

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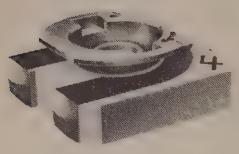
SURFACE MOUNT TRIMMERS



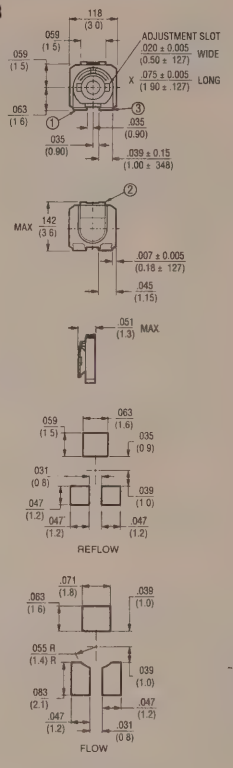
Model 3363
3mm Square SMD Package Single-turn Cermet Open Frame

- **Recommended for reflow and wave soldering processing**
- **3mm size meets EIA/EIAJ standard trimmer footpint**
- **Rotor design compatible with pick and place and automatic adjustment equipment**
- **Supplied in 8mm embossed tape, compatible with automatic assembly equipment**

Electrical Characteristics
Standard Resistance Range
.....100 to 1 megohm
(see standard resistance table)

Resistance Tolerance .....±25% std.
Absolute Minimum Resistance
.....2% or 20 ohms
(whichever is greater)
Contact Resistance Variation
.....5% max.
Resolution.....Infinite
Adjustment Angle.....220° ±20°
Environmental Characteristics
Resistance to Soldering Heat
....260°C, 10 seconds, TRS max. 5%
Power Rating (50 VDC max.)
70°C.....0.1 watt
Temperature Range
.....-55°C to +125°C
Temperature Coefficient
.....±250 ppm/°C
Humidity.....95%RH
.....1,000 hours
TRS max.....±5%
Load Life
.....@70°C rated power 1,000 hours
TRS ±5%
Rotational Cycling .....20 turns
TRS ±15%
Physical Characteristics
Torque.....20-200g-cm max.
Mechanical Angle.....Continuous
Marking .....Part marking code
Standard Packaging
.....2000 pcs./7" reel

3363



All dimensional tolerances are:
±0.010 in., ± (0.25mm),
unless otherwise noted

STANDARD RESISTANCE TABLE

Resistance (Ohms)	Part Marking Code	Resistance Code
100	A2	101
200	22	201
500	52	501
1,000	A3	102
2,000	23	202
5,000	53	502
10,000	A4	103
20,000	24	203
50,000	54	503
100,000	A5	104
200,000	25	204
500,000	55	504
1,000,000	A6	105

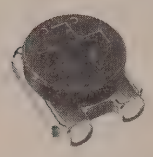
E9 resistance code available as standard.

HOW TO ORDER

3363 X - 1 - 103 E

Model
Style
Standard or Modified Product Indicator
-1 = Standard Product
Resistance Code
Embossed Tape Designator

Consult factory for other available options.
Specifications are subject to change without notice.



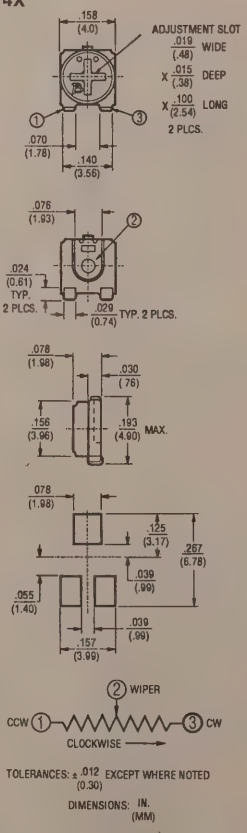
Model 3374
4mm Square SMD Package Single-turn (5-turn) Cermet

- **Seal allows multiple adjustments while maintaining environmental protection**
- **Recommended for reflow and wave solder processing**
- **Cross-slot rotor design suitable for automatic adjustment equipment**
- **Supplied in 12mm embossed tape, compatible with automatic pick-and-place assembly equipment**

Electrical Characteristics
Standard Resistance Range
.....10 to 2 megohms
(see standard resistance table)

Resistance Tolerance .....±20% std.
End Resistance
.....1% or 2 ohms max.
(whichever is greater)
Contact Resistance Variation
.....3% or 3 ohms max.
(whichever is greater)
Resolution.....Infinite
Adjustment Angle.....240° nom.
Maximum Voltage.....200V
Environmental Characteristics
Power Rating
70°C.....0.25 watt
125°C.....0 watt
Operating Temperature Range
.....-55°C to +125°C
Temperature Coefficient
<500K ohms.....±100 ppm/°C
≥500K ohms.....±150 ppm/°C
Seal.....5 Turns min.
Humidity.....MIL-STD 202 Method 103
Vibration 20G
TRS ±1%, VRS ±1%
Shock 100G
TRS ±1%, VRS ±1%
Load Life
(@70°C Rated Power, 1,000 hours)
.....TRS ±3%
Rotational Life.....100 cycles
TRS ±3%
Thermal Shock.....5 cycles
TRS ±2%, VRS ±1%
Physical Characteristics
Torque.....18-180gm/cm
Mechanical Angle.....Continuous
Marking ..Manufacturer's trademark and part making code
Standard Packaging
.....750 pcs./7" reel

3374X



STANDARD RESISTANCE TABLE

Resistance (Ohms)	Part Marking Code	Resistance Code
10	A1	100
20	21	200
50	51	500
100	A2	101
200	22	201
500	52	501
1,000	A3	102
2,000	23	202
5,000	53	502
10,000	A4	103
20,000	24	203
50,000	54	503
100,000	A5	104
200,000	25	204
500,000	55	504
1,000,000	A6	105
2,000,000	26	205

Special resistances available from 10 ohms to 2 megohms.

HOW TO ORDER

3374 X - 1 - 502 E

Model
Style
Standard or Modified Product Indicator
-1 = Standard Product
Resistance Code
Embossed Tape

Consult factory for other available options.
E = 750 pcs./7" reel (standard)

Consult factory for other available options.
Specifications are subject to change without notice.

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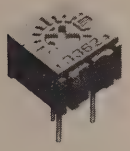
TRIMMERS

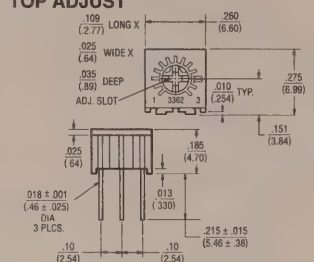


Model 3362
1/4" Square Single-turn Cermet Sealed

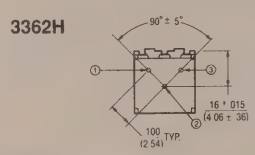
- **Multi-wire wiper to minimize CRV**
- **Withstands harsh environments and immersion cleaning processes**
- **Rotor designed for automatic machine adjust interface**
- **Miniature package**

Electrical Characteristics
Standard Resistance Range
.....20 to 2 megohms
(see standard resistance table)
Resistance Tolerance .....±20% std.
(tighter tolerance available)
Absolute Minimum Resistance
.....1% or 2 ohms
(whichever is greater)
Contact Resistance Variation
.....1.0% or 3 ohms max.
(whichever is greater)
Adjustability
Voltage.....±0.05%
Resistance .....±0.15%
Resolution.....Infinite
Insulation Resistance .....500 vdc.
1,000 megohms min.
Dielectric Strength
Sea Level.....900 vac
80,000 Feet .....350 vac
Adjustment Angle.....240° nom.
Environmental Characteristics
Power Rating (300 volts max.)
70°C.....0.50 watt
125°C.....0 watt
Temperature Range ...-55°C to +125°C
Temperature Coefficient ....±100 ppm/°C
Seal Test .....85°C Fluorinert*
Humidity....MIL-STD-202 Method 103
96 hours (2% ΔTR; 10 Megohms IR)
Vibration ...30G (1% ΔTR; 1% ΔVR)
Shock .....100G (1% ΔTR; 1% ΔVR)
Load Life...1,000 hours 0.5 watt @ 70°C
(3% ΔTR; 3% or 3 ohms,
whichever is greater, CRV)
Rotational Life .....200 cycles
(4% ΔTR; 3% or 3 ohms,
whichever is greater, CRV)
Physical Characteristics
Mechanical Angle.....270°C
Torque .....3.0 oz.-in. max.
Stop Strength.....7.0 oz.-in. min.
Terminals.....Solderable pins
Weight .....0.02 oz.
Marking...Manufacturer's trademark, resistance code, terminal numbers, manufacturer's model number, style and date code
Standard Packaging ...50 pcs. per tube
*Fluorinert™ is a registered trademark of 3M Co.

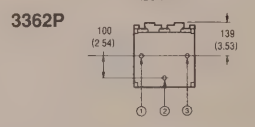
COMMON DIMENSIONS
TOP ADJUST



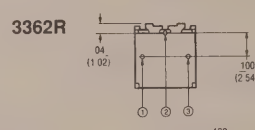
3362H



3362P



3362R



3362U

STANDARD RESISTANCE TABLE

Resistance (Ohms)	Resistance Code
20	200
50	500
100	101
200	201
500	501
1,000	102
2,000	202
5,000	502
10,000	103
20,000	203
25,000	253
50,000	503
100,000	104
200,000	204
250,000	254
500,000	504
1,000,000	105
2,000,000	205

Special resistances available from 20 to 2 megohms.

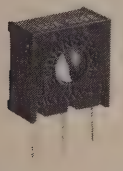
HOW TO ORDER

3362 U - 1 - 502

- Model: 3362
- Style: U
- Standard or Modified Product Indicator: -1 = Standard Product
- Resistance Code: 502

Consult factory for other available options.

Specifications are subject to change without notice.

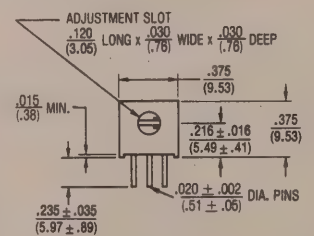


Model 3386
3/8" Square Single-turn Cermet Sealed

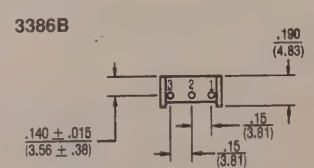
- **Top and side adjust types**
- **12 standard terminal styles**
- **High voltage type HV2 available**

Electrical Characteristics
Standard Resistance Range
.....10 to 2 megohms
(see standard resistance table)
Resistance Tolerance .....±10% std.
(tighter tolerance available)
Absolute Minimum Resistance
.....2 ohms max.
Contact Resistance Variation
..... 2% or 3 ohms
(whichever is greater)
Adjustability
Voltage.....±0.05%
Resistance .....±0.15%
Resolution.....Infinite
Insulation Resistance .....500 vdc.
1,000 megohms min.
Dielectric Strength
Sea Level.....900 vac
70,000 Feet .....350 vac
Adjustment Angle.....280° nom.
Environmental Characteristics
Power Rating (300 volts max.)
85°C.....0.5 watt
125°C.....0 watt
Temperature Range
.....-55°C to +125°C
Temperature Coefficient
.....±100 ppm/°C
Seal Test .....85°C Fluorinert*
Humidity....MIL-STD-202 Method 103
96 hours
(2% ΔTR; 10 Megohms min.)
Vibration ...30G (1% ΔTR; 1% ΔVR)
Shock .....100G (1% ΔTR; 1% ΔVR)
Load Life
.....1,000 hours 0.5 watt @ 70°C
(3% ΔTR; 1% or 1 ohm,
whichever is greater, CRV)
Rotational Life .....200 cycles
(4% ΔTR; 1% or 1 ohm,
whichever is greater, CRV)
Physical Characteristics
Mechanical Angle .....310° nom.
Torque .....5.0 oz.-in. max.
Stop Strength.....15.0 oz.-in. min.
Terminals.....Solderable pins
Weight .....0.03 oz.
Marking .....Manufacturer's trademark, resistance code, wiring diagram, date code, manufacturer's model number and style
Standard Packaging
.....50 pcs. per tube
*Fluorinert™ is a registered trademark of 3M Co.

COMMON DIMENSIONS
SIDE ADJUST



3386B



STANDARD RESISTANCE TABLE

Resistance (Ohms)	Resistance Code
10	100
20	200
50	500
100	101
200	201
500	501
1,000	102
2,000	202
5,000	502
10,000	103
20,000	203
25,000	253
50,000	503
100,000	104
200,000	204
250,000	254
500,000	504
1,000,000	105
2,000,000	205

Special resistances available from 10 to 2 megohms.

HOW TO ORDER

3386 P - 1 - 103 T

- Model: 3386
- Style: P
- Standard or Modified Product Indicator: -1 = Standard Product
- Resistance Code: 103
- Optional Suffix Letter: T = Knob

Consult factory for other available options.

Specifications are subject to change without notice.

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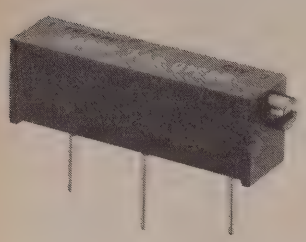
TRIMMERS

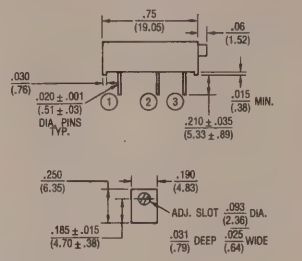


Model 3006
3/4" Rectangular 15-Turn Cermet Sealed

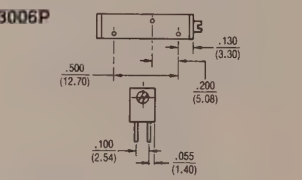
- **Low PC board profile – only 1/4" high**
- **Panel mount option available**
- **Transparent housing available**

Electrical Characteristics
Standard Resistance Range
.....10 to 5 megohms
(see standard resistance table)
Resistance Tolerance .....±10% std.
(tighter tolerance available)
Absolute Minimum Resistance
.....1.0% or 2 ohms max.
(whichever is greater)
Contact Resistance Variation
.....1.0% or 1 ohm max.
(whichever is greater)
Adjustability
Voltage.....±0.01%
Resistance .....±0.05%
Resolution.....Infinite
Insulation Resistance .....500 vdc.
1,000 megohms min.
Dielectric Strength
Sea Level.....1,000 vac
80,000 Feet .....250 vac
Adjustment Angle .....15 turns nom.
Environmental Characteristics
Power Rating (400 volts max.)
70°C.....0.75 watt
150°C.....0 watt
Temperature Range ...-55°C to +125°C
Temperature Coefficient ....±100 ppm/°C
Seal Test .....85°C Fluorinert*
Humidity....MIL-STD-202 Method 103
96 hours (3% ΔTR; 20 Megohms IR)
Vibration ...20G (2% ΔTR; 2% ΔVR)
Shock .....50G (2% ΔTR; 2% ΔVR)
Load Life .....
1,000 hours 0.75 watt 70°C (4% ΔTR)
Rotational Life .....200 cycles
(3% ΔTR; 1% or 1 ohm,
whichever is greater, CRV)
Physical Characteristics
Torque .....5.0 oz.-in. max.
Mechanical Stops .....Wiper idles
Terminals.....Solderable pins
Weight .....0.04 oz.
Marking....Manufacturer's trademark,
resistance code, terminal numbers,
date code, manufacturer's model
number and style
Standard Packaging
P&Y Style .....25 pcs. per tube
W Style .....50 pcs. per tray
*Fluorinert™ is a registered trademark of 3M Co.

COMMON DIMENSIONS



3006P



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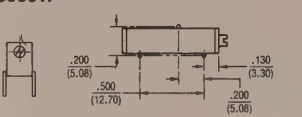
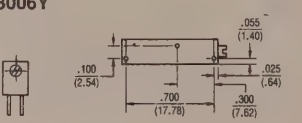


3006Y



STANDARD RESISTANCE TABLE

Resistance (Ohms)	Resistance Code
10	100
20	200
50	500
100	101
200	201
500	501
1,000	102
2,000	202
5,000	502
10,000	103
20,000	203
25,000	253
50,000	503
100,000	104
200,000	204
250,000	254
500,000	504
1,000,000	105
2,000,000	205

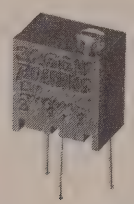
Special resistances available from 10 to 5 megohms.

HOW TO ORDER

3006 P - 1 - 103 Z

Model
Style
Standard or Modified Product Indicator
-1 = Standard Product
-7 = Transparent Housing
Resistance Code
Optional Suffix Letter
Z = Panel Mount (Factory Installed)

Consult factory for other available options.
Specifications are subject to change without notice.

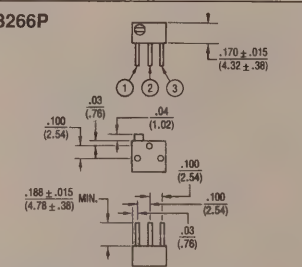


Model 3266
1/4" Square 12-Turn Cermet Sealed

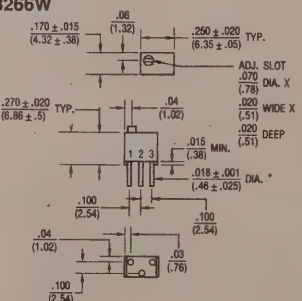
- **Plasma etched body seal**
- **Standoffs allow thorough PC board washing**
- **Double chevron shaft seal**
- **Tape and reel packaging available**

Electrical Characteristics
Standard Resistance Range
.....10 to 1 megohm
(see standard resistance table)
Resistance Tolerance .....±10% std.
Absolute Minimum Resistance
.....1% or 2 ohms max.
(whichever is greater)
Contact Resistance Variation
.....3.0% or 3 ohms max.
(whichever is greater)
Adjustability
Voltage.....±0.02%
Resistance .....±0.05%
Resolution.....Infinite
Insulation Resistance .....500 vdc.
1,000 megohms min.
Dielectric Strength
Sea Level.....600 vac
80,000 Feet .....250 vac
Effective Travel .....12 turns nom.
Environmental Characteristics
Power Rating (300 volts max.)
70°C.....0.25 watt
150°C.....0 watt
Temperature Range
.....-55°C to +125°C
Temperature Coefficient
.....±100 ppm/°C
Seal Test .....85°C Fluorinert*
Humidity....MIL-STD-202 Method 103
96 hours
(2% ΔTR; 10 Megohms IR)
Vibration ...30G (1% ΔTR; 1% ΔVR)
Shock .....100G (1% ΔTR; 1% ΔVR)
Load Life
.....1,000 hours 0.25 watt 70°C
(3% ΔTR; 3% CRV)
Rotational Life .....200 cycles
(4% ΔTR; 3% or 3 ohms,
whichever is greater, CRV)
Physical Characteristics
Torque .....3.0 oz.-in. max.
Mechanical Stops .....Wiper idles
Terminals.....Solderable pins
Weight .....0.015 oz.
Marking .....Manufacturer's
trademark, resistance code,
wiring diagram, date code,
manufacturer's model
number and style
Standard Packaging....50 pcs. per tube
*Fluorinert™ is a registered trademark of 3M Co.

3266P



3266W



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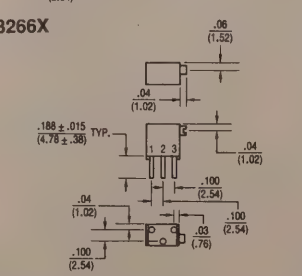

STANDARD RESISTANCE TABLE

Resistance (Ohms)	Resistance Code
10	100
20	200
50	500
100	101
200	201
500	501
1,000	102
2,000	202
5,000	502
10,000	103
20,000	203
25,000	253
50,000	503
100,000	104
200,000	204
250,000	254
500,000	504
1,000,000	105

Special resistances available from 10 ohms to 1 megohm.

HOW TO ORDER

3266 W - 1 - 103

Model
Style
Standard or Modified Product Indicator
-1 = Standard Product
Resistance Code

Consult factory for other available options.

Specifications are subject to change without notice.

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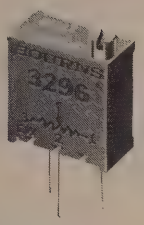
TRIMMERS



Model 3296

3/8" Square 25-Turn Cermet Sealed

- **5 terminal styles**
- **Thin body profile**
- **Tape and reel packaging available**

Electrical Characteristics

Standard Resistance Range .....10 to 5 megohms (see standard resistance table)
Resistance Tolerance .....±10% std. (tighter tolerance available)
Absolute Minimum Resistance .....1% or 2 ohms max. (whichever is greater)
Contact Resistance Variation .....1.0% or 3 ohms max. (whichever is greater)
Adjustability
Voltage.....±0.01%
Resistance .....±0.05%
Resolution.....Infinite
Insulation Resistance .....500 vdc. 1,000 megohms min.
Dielectric Strength
Sea Level.....900 vac
70,000 Feet .....350 vac
Effective Travel .....25 turns nom.

Environmental Characteristics

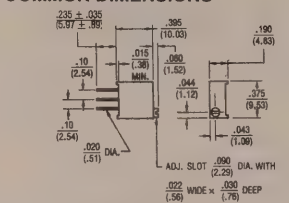
Power Rating (300 volts max.)
70°C.....0.5 watt
125°C.....0 watt
Temperature Range ...-55°C to +125°C
Temperature Coefficient ....±100 ppm/°C
Seal Test .....85°C Fluorinert*
Humidity....MIL-STD-202 Method 103 96 hours (2% ΔTR; 10 Megohms IR)
Vibration ...20G (1% ΔTR; 1% ΔVR)
Shock .....100G (1% ΔTR; 1% ΔVR)
Load Life ..... 1,000 hours 0.5 watt @ 70°C (3% ΔTR; 3% or 3 ohms, whichever is greater, CRV)
Rotational Life .....200 cycles (4% ΔTR; 3% or 3 ohms, whichever is greater, CRV)

Physical Characteristics

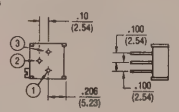
Torque .....3.0 oz.-in. max.
Mechanical Stops .....Wiper idles
Terminals.....Solderable pins
Weight .....0.03 oz.
Marking....Manufacturer's trademark, resistance code, wiring diagram, date code, manufacturer's model number and style
Standard Packaging ...50 pcs. per tube

*Fluorinert™ is a registered trademark of 3M Co.

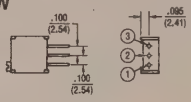
COMMON DIMENSIONS



3296P



3296W



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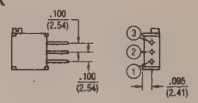

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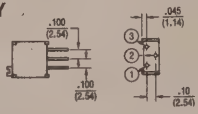

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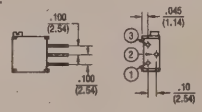

STANDARD RESISTANCE TABLE

Resistance (Ohms)	Resistance Code
10	100
20	200
50	500
100	101
200	201
500	501
1,000	102
2,000	202
5,000	502
10,000	103
20,000	203
25,000	253
50,000	503
100,000	104
200,000	204
250,000	254
500,000	504
1,000,000	105
2,000,000	205

Special resistances available from 10 ohms to 5 megohms.

HOW TO ORDER

3296 W - 1 - 103

Model
Style
Standard or Modified Product Indicator
-1= Standard Product
Resistance Code

Consult factory for other available options.
Specifications are subject to change without notice.

Model 3329

1/4" Round Single-turn Cermet Sealed

- **5 standard terminal styles**
- **Vertical and horizontal adjust types available**
- **Tape and reel packaging available**

Electrical Characteristics

Standard Resistance Range .....10 to 1 megohm (see standard resistance table)
Resistance Tolerance .....±10% std. (closer tolerance available)
Absolute Minimum Resistance .....1% or 2 ohms (whichever is greater)
Contact Resistance Variation .....3.0% or 3 ohms max. (whichever is greater)
Adjustability
Voltage.....±0.05%
Resistance .....±0.15%
Resolution.....Infinite
Insulation Resistance .....500 vdc. 1,000 megohms min.
Dielectric Strength
Sea Level.....600 vac
80,000 Feet .....250 vac
Adjustment Angle.....240° nom.

Environmental Characteristics

Power Rating (300 volts max.)
85°C.....0.5 watt
150°C.....0 watt
Temperature Range .....-55°C to +150°C
Temperature Coefficient .....±100 ppm/°C
Seal Test .....85°C Fluorinert*
Humidity (Commercial Model) .....MIL-STD-202 Method 103 96 hours (3% ΔTR; 10 Megohms IR)
Vibration ...30G (1% ΔTR; 1% ΔVR)
Shock .....100G (1% ΔTR; 1% ΔVR)
Load Life .....1,000 hours 0.5 watt @ 85°C (3% ΔTR; 3% CRV)
Rotational Life .....200 cycles (4% ΔTR; 4% CRV)

Physical Characteristics

Mechanical Angle .....260° nom.
Torque .....5.0 oz.-in. max.
Stop Strength.....5.0 oz.-in. min.
Terminals.....Solderable pins
Weight .....0.02 oz.
Marking .....Manufacturer's trademark, resistance code, date code, manufacturer's model number and style
Standard Packaging....50 pcs. per tube

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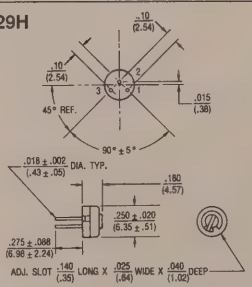
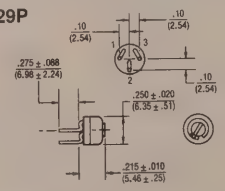
3329H



3329P



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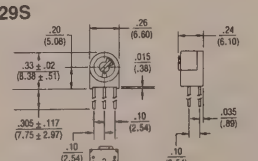
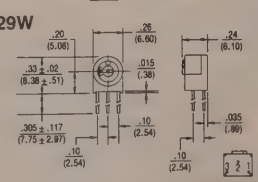


3329W



STANDARD RESISTANCE TABLE

Resistance (Ohms)	Resistance Code
10	100
20	200
50	500
100	101
200	201
500	501
1,000	102
2,000	202
5,000	502
10,000	103
20,000	203
25,000	253
50,000	503
100,000	104
200,000	204
250,000	254
500,000	504
1,000,000	105

Special resistances available from 10 ohms to 1 megohm.

HOW TO ORDER

3329 P - 1 - 103

Model
Style
Standard or Modified Product Indicator
-1 = Standard Product
Resistance Code

Consult factory for other available options.
Specifications are subject to change without notice.

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MINIATURE PANEL CONTROLS

NEW!

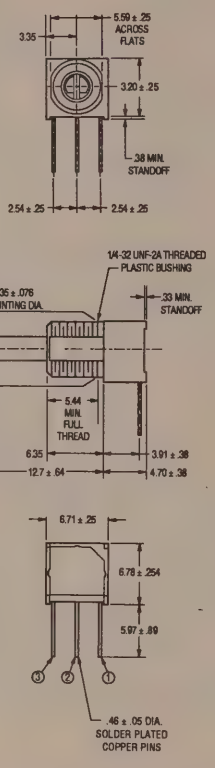
Model 3370
1/4" (6mm) Square Sealed Panel Control

- Conductive plastic
- PC board and bushing mount
- Plastic bushing and plastic shaft
- Withstands typical industrial washing processes
- Compact package saves board and panel space

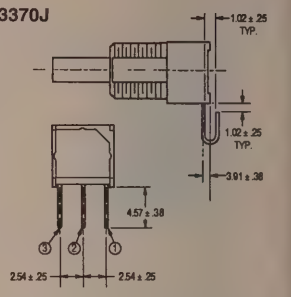
Electrical Characteristics
Standard Resistance Range
Linear .....100 ohms to 1 megohm
Total Resistance Tolerance
Linear Tapers.....±20%
Independent Linearity .....±5%
Absolute Minimum Resistance
.....2 ohms maximum
Effective Electrical Angle ....280° nominal
Contact Resistance Variation.....1%
Dielectric Withstanding Voltage
Sea Level .....900 VAC minimum
70,000 .....350 VAC minimum
Insulation Resistance
.....1,000 megohms minimum
Power Rating At 70°C.... .125 watts
(Derate to 0 at 125°C)
(Voltage Limited By Power Dissipation or 200 VAC, Whichever is Less)
Environmental Characteristics
Storage Temperature ....-55°C to +125°C
TCR (Over Storage Temperature Range)....±1,000ppm/°C
Vibration 30G
Total Resistance Shift....±1% maximum
Voltage Ratio Shift....±1% maximum
Shock 100G
Total Resistance Shift....±1% maximum
Voltage Ratio Shift....±1% maximum
Load Life (1,000 Hours)
.....10% TRS maximum
Rotational Life-No Load
(10,000 Cycles)...±5% TRS maximum
CRV @ 5,000 Cycles.....±2%
Moisture Resistance .....5% TRS
Seal Test .....85° Fluorinert*
Mechanical Characteristics
Stop Strength .....8 in-oz.
Mechanical Angle.....310° nominal
Torque
Running .....0.2 to 2.0 oz-in.
Starting .....0.5 to 2.0 oz-in.
Weight .....4.5 grams
Flammability ...Conforms to UL94V-0
Epoxy.....Conforms to UL94V-1
Terminals.....Solderable pins
Marking .....Manufacturer's symbol and model number, terminal style, date code and resistance code.

*Fluorinert™ is a registered trademark of 3M Co.

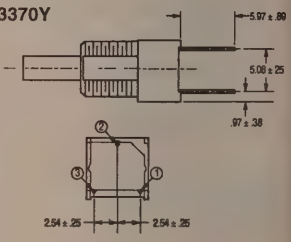
COMMON DIMENSIONS
3370C



3370J



3370Y



HOW TO ORDER

3370 C - 1 - 103

Model
Style
Standard or Modified Product Indicator
-1 = Standard Product
Resistance Code

Consult factory for other available options.
Specifications are subject to change without notice.

NEW!

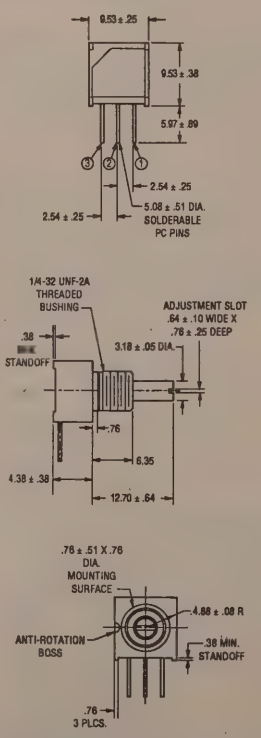
Model 3310
3/8" Square Sealed Panel Control

- 1/8" diameter plastic shaft
- Bushing or PC board mount
- Available with metal or plastic bushing
- Ultra-miniature package for maximum design flexibility

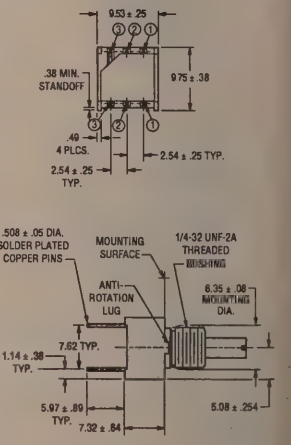
Electrical Characteristics
Standard Resistance Range
Linear.....1K ohms to 1 megohm
Total Resistance Tolerance
Linear Tapers.....±20%
Independent Linearity .....±5%
Absolute Minimum Resistance
.....2 ohms maximum
Effective Electrical Angle.....270° ±15°
Contact Resistance Variation
.....1% or 1 Ω W.I.G.
Dielectric Withstanding Voltage
Sea Level .....900 VAC minimum
70,000 .....350 VAC minimum
Insulation Resistance
.....1,000 megohms minimum
Power Rating At 70°C.....0.25 watts
(Derate to 0 at 125°C)
(Voltage Limited By Power Dissipation or 300 VAC, Whichever is Less)
Environmental Characteristics
Storage Temperature ....-55°C to +125°C
TCR (Over Storage Temperature Range)....±1,000ppm/°C
Vibration 30G
Total Resistance Shift....±1% maximum
Voltage Ratio Shift....±1% maximum
Shock 100G
Total Resistance Shift....±1% maximum
Voltage Ratio Shift....±1% maximum
Load Life (1,000 Hours)
.....±10% TRS maximum
Rotational Life-No Load
(10,000 Cycles)...±5% TRS maximum
CRV .....3% or 1 Ω W.I.G.
Moisture Resistance .....0.1% TRS
Seal Test .....85° Fluorinert*
Mechanical Characteristics
Stop Strength .....15 in-oz.
Mechanical Angle.....300° nominal
Torque .....5.0 oz-in. max.
Weight .....4.5 grams
Flammability ...Conforms to UL94V-0
Epoxy.....Conforms to UL94V-1
Terminals.....Solderable pins
Marking .....Manufacturer's symbol and model number, terminal style, date code and resistance code.

*Fluorinert™ is a registered trademark of 3M Co.

COMMON DIMENSIONS
3310



3310H-003



HOW TO ORDER

3310 C - 1 - 103

Model
Style
Standard or Modified Product Indicator
-1 = Standard Product
Resistance Code

Consult factory for other available options.
Specifications are subject to change without notice.

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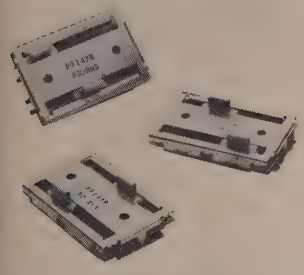
SURFACE MOUNT SLIDE POTENTIOMETER

NEW!



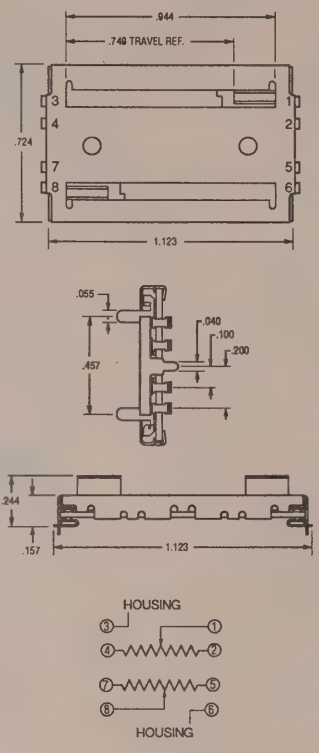
Model 3722
SMD Package

- I.R. reflow capable
- Surface mount technology
- Wide resistance range
- Linear taper
- ESD protection

Electrical Characteristics
Resistance Taper .....linear
Resistance...150 ohms to 1 megohm
Independent Linearity .....±5%
Absolute Minimum Resistance
....1% or 100 ohms, whichever is less
Continuity.....Continuous for full stroke
Effective Electrical Travel
.....100% of mechanical
Contact Resistance Variation (CRV)..2%
Theoretical Resolution
.....essentially infinite
Dielectric Strength
Sea Level.....500 VAC 1 minute
between lever and terminals
Insulation Resistance (500 VDC)
.....1,000 megohms minimum
between lever and terminals
Power Rating
@ 70°C.....0.05 watt
@ 125°C.....0 watt
Maximum Operating Voltage
.....Power Dissipation or 350 VAC,
whichever is less

Environmental Characteristics
Storage Temperature....150°C maximum
Temperature Coefficient Of Resistance
.....±500ppm
Slide Life (No Load)....25,000 cycles
ESD Protection....Steel Housing with
bright tin plate 0.0001-0.0003 thick
(100 milliohms maximum resistance)

Mechanical Characteristics
Operating Force ....15 to 150 grams
Stop Strength .....1.5 Kg minimum
Stroke.....19mm
Terminals.....Surface mount (shown)
Marking .....Trademark, date code,
and resistance value.



OUTPUT FUNCTION MODIFIED Z TAPER	
MECHANICAL TRAVEL	VR
(MM)	(%)
1.5	0.1 MAX.
2.5	0.0 MIN.
16.5	100.0 MAX.
17.5	99.9 MIN.

HOW TO ORDER

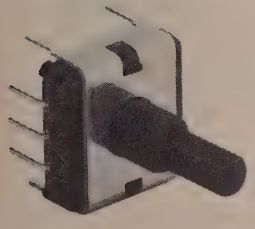
3372P - 002 - 102

RESISTANCE VALUES	
CODE	VALUE
151	150 OHM
501	500 OHM
102	1K OHM
152	1.5K OHM
502	5K OHM
103	10K OHM
203	20K OHM
253	25K OHM
503	50K OHM
104	100K OHM
504	500K OHM
105	1M OHM

Specifications are subject to change without notice.

SLIMLINE POTENTIOMETERS

NEW!



PC Series
Slimline Potentiometers

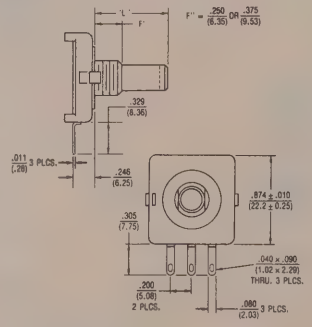
- Space saving design
- PC pin or solder lug terminals
- Linear or audio taper versions
- Wide range of resistance values
- Metric shaft and bushing options

Electrical Characteristics
Standard Resistance Range
Linear Tapers
.....500 ohms to 1.5 megohms
Audio Tapers
.....1K ohms to 500K ohms
Resistance Tolerance (All Tapers)
.....±20%
Independent Linearity
.....±5% (linear taper)
Effective Electrical Angle
.....270° ±5%
Power Rating @ 70° C
(Voltage Limited by Power
dissipation or 350 VAC,
whichever is less)
Linear..... .75 watt
Audio ..... .25 watt

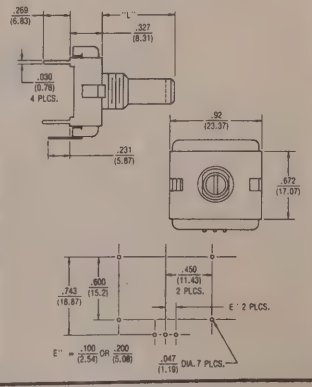
Environmental Characteristics
Rotational Life .....50,000 cycles
Total Resistance Shift
Linear.....±10 ohms or 12%,
whichever is greater
Audio .....±20% maximum

Mechanical Characteristics
Mechanical Angle.....300° ±5°
Detents.....Center, 10, 20, 30, none

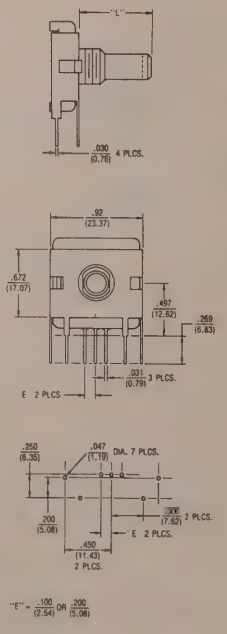
SOLDER LUGS
Dimensions not given are the same as PC pins (Rear Facing)



PC PINS
(Rear Facing)
With Rear Mounting Bracket



PC PINS (Side Exit)
With Side Mounting Bracket



Consult factory for other available options.
Specifications are subject to change without notice.

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Bourns® Dials; Pushbutton and Knobpot® Potentiometers

PUSH-BUTTON POTENTIOMETERS

3680 Series
Cermet

Decades	Model	Resistance	Resolution
1	3681	50 to 100k	10%
2	3682	500 ohms to 1 megohm	1.0%
3	3683	1k ohms to 1 megohm	0.1%
4	3684	10k ohms to 1 megohm	0.01%
5	3685	100k ohms to 1 megohm	0.001%

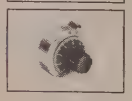
KNOBPOT® POTENTIOMETERS

		Resistance	Power Rating	Dia.
3600 Wirewound		100 to 100k ohms	1.5 watts @ 25°C	3/4"
3610 Wirewound		100 to 100k ohms	1.5 watts @ 25°C	7/8"
3640 Wirewound		100 to 100k ohms	2.5 watts @ 25°C	1 1/4"
3650 Wirewound		100 to 100k ohms	2.5 watts @ 25°C	1 1/4"

DIALS

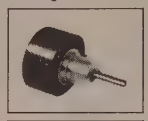
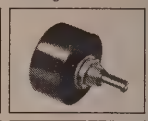
H-507-6 7/8" dia.

CT23 1 1/16" dia.

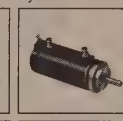
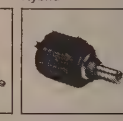
H-490 1" dia. 

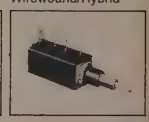
CT26 1 1/4" dia.

Bourns® Single-Turn Precision Potentiometers

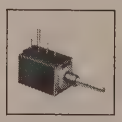
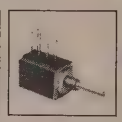
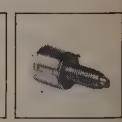
	6534 Conductive Plastic Servo Mount	6637/6638 Conductive Plastic Bushing Mount	6538 Conductive Plastic Servo Mount	6657 Conductive Plastic Bushing Mount	6574 Conductive Plastic Servo Mount
					
Resistance	1k to 100k ohms	1k to 100k ohms	1k to 100k ohms	1k to 100k ohms	1k to 100k ohms
Power Rating @ 70°C	1.0 watt	1.0 watt	1.0 watt	1.5 watts	2.0 watts
Independent Linearity	±0.5%	±1.0%	±1.0%	±1.0%	±.25%
Rotational Life	25 × 10⁶ revolutions	**6637** 10 × 10⁶ revolutions **6638** 20 × 10⁶ revolutions	20 × 10⁶ revolutions	10 × 10⁶ revolutions	25 × 10⁶ revolutions
Size	7/8" diameter × 15/32"	7/8" diameter × 7/16"	7/8" diameter × 19/32"	15/16" diameter × 5/8"	2" diameter × 19/32"

Bourns® Multiturn Precision Potentiometers

	3543 3-Turn Wirewound	3545 5-Turn Wirewound	3700/3701 10-Turn Wirewound/ Hybrid	3750/3751 10-Turn Wirewound/ Hybrid	3500/3501 10-Turn Wirewound/ Hybrid	3540 10-Turn Wirewound
						
Resistance	20 to 50k ohms	50 to 50k ohms	**3700** 100 to 100k ohms **3701** 1k to 100k ohms	**3750** 100 to 100k ohms **3751** 1k to 50k ohms	**3500** 50 to 200k ohms **3501** 1k to 100k ohms	100 to 100k ohms
Power Rating @ 70°C	1.0 watt	1.5 watts	1.0 watt	1.0 watt	2.0 watts	2.0 watts
Independent Linearity	±0.25%	±0.25%	±0.25%	±0.25%	**3500** ±0.2% **3501** ±0.25%	±0.25%
Rotational Life	0.3 × 10⁶ revolutions	0.5 × 10⁶ revolutions	**3700** 1 × 10⁶ revolutions **3701** 4 × 10⁶ revolutions	**3750** 1 × 10⁶ revolutions **3751** 10 × 10⁶ revolutions	**3500** 2 × 10⁶ revolutions **3501** 4 × 10⁶ revolutions	1 × 10⁶ revolutions
Size	7/8" diameter	7/8" diameter	1/2" diameter	1/2" diameter	7/8" diameter	7/8" diameter

	3541 10-Turn Hybrid	3550/3551 10-Turn Wirewound/Hybrid	3590 10-Turn Wirewound	3400 10-Turn Wirewound	83/84 10-Turn Wirewound/Hybrid
					
Resistance	1k to 100k ohms	**3550** 100 to 200k ohms **3551** 1 k to 100k ohms	200 to 100k ohms	100 to 500k ohms	**Wirewound** 200 to 100k ohms **Hybrid** 1k to 100k ohms
Power Rating @ 70°C	2.0 watts	**3550** 2.5 watts **3551** 2.0 watts	2.0 watts @40°C 0 watts @125°C	5.0 watts @40°C	1.0 watts
Independent Linearity	±0.25%	**3550** ±0.2% **3551** ±0.25%	±0.25%	±0.15%	±0.25%
Rotational Life	5 × 10⁶ revolutions	**3550** 1 × 10⁶ revolutions **3551** 10 × 10⁶ revolutions	1 × 10⁶ revolutions	2 × 10⁶ revolutions	**Wirewound** 1 × 10⁶ revolutions **Hybrid** 4 × 10⁶ revolutions
Size	7/8" diameter × 3/4"	7/8" diameter × 19/16"	7/8" diameter × 3/4"	1 13/16" diameter x 1 3/4"	5/8" square × 3/4"

Bourns® Panel Controls

	81/82	87/88	85/86*	91/92/93/ 94/95/96	97/98/99*	3851/3852	3862
							
	5/8" square Modular construction	5/8" square Modular construction	5/8" square Modular construction	5/8" square Modular construction	5/8" square Modular construction	3/4" diameter 1/4" depth	1/2" diameter Rear terminals
	Single or multiple sections	Single or multiple sections	Multiple sections	Single or dual sections	Dual section	Single section	Single section
	Linear or audio tapers	Semi-precision linear tapers	DPST and DPDT rotary switches*	Linear or audio tapers	DPST and DPDT rotary switches	Linear or audio tapers	Linear taper
	Concentric or single shafts, metal	Concentric or single shafts, metal	Concentric or single shafts, metal	Single shaft, plastic Sealed (96 only)	Single shaft, plastic	Single shaft, metal	Single shaft, metal
	Cermet or Conductive plastic	Cermet or Conductive plastic	Cermet or Conductive plastic	Cermet or Conductive plastic	Cermet or Conductive plastic	Cermet or Conductive plastic	Cermet

Specifications are subject to change without notice.

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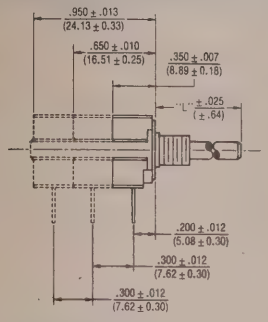
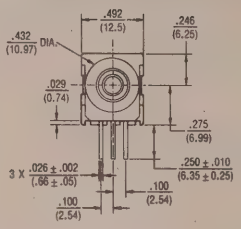
PANEL CONTROLS

Model 50 Series
Sealed

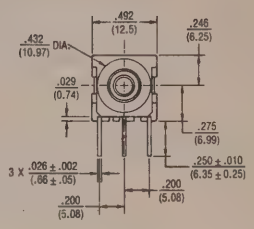
PACKAGE DIMENSIONS



[SINGLE, DUAL AND TRIPLE MODULE SHOWN]



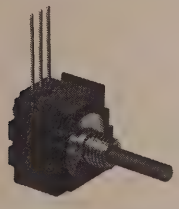
[.100" (2.54) TERMINAL SPACING]



[.200" (5.08) TERMINAL SPACING]

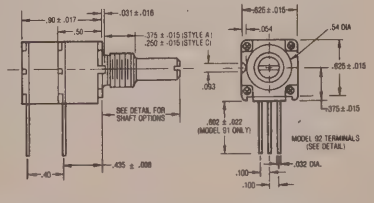
	Conductive Plastic	Cermet
Electrical Characteristics[1]		
Standard Resistance Range		
Linear	1K ohms to 1 megohm	150 ohms to 1 megohm
Audio	1K ohms to 1 megohm	1K ohms to 1 megohm
Total Resistance Tolerance		
Linear Tapers	±10% OR ±20%	±10% OR ±5%
Audio Tapers	±10% OR ±20%	±10%
Independent Linearity	±5%	±5%
Power Rating At 70°C (Derate To 0 At 125°C) (Voltage Limited By Power Dissipation or 350 VAC, Whichever Is Less)		
Linear Tapers	.5 watt	1.0 watt
Audio Tapers	.25 watt	.5 watt
Tracking (Multiple Sections)	3 db	3 db
Environmental Characteristics[1]		
Rotational Life—No Load (50,000 Cycles)[2]	±10% TRS maximum	±10% TRS maximum
Mechanical Characteristics		
Stop Strength	5 in-lb.	5 in-lb.
Mechanical Angle	295° ±5°	295° ±5°

[1]At room ambient: +25°C nominal and 50% relative humidity nominal, except as noted.
[2]Conductive plastic, 25,000 cycles for cermet elements.

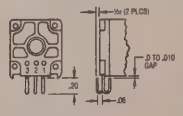


Models 91, 92, 93, 94, 95, 96
Sealed

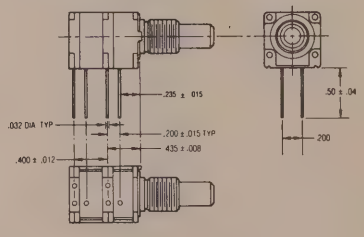
MODEL 91 PC PIN TERMINALS, IN-LINE



MODEL 92 J-HOOKED TERMINALS, IN-LINE



MODEL 93 PC PIN TERMINALS, "L" PATTERN



	Conductive Plastic Element	Cermet Element
Initial Electrical Characteristics[1]		
Standard Resistance Range		
Linear Tapers	150 ohms to 5 megohms	50 ohms to 5 megohms
Audio Tapers	1K ohms to 5.0 megohms	1K ohms to 5.0 megohms
Resistance Tolerance	±20% ~ ±10%	±10% ~ ±5%
Independent Linearity	±5%	±5%
Power Rating (Voltage Limited by Power Dissipation or 350 VAC, Whichever is Less)		
+70°C Single Section Assembly	Linear 1 watt Log 0.5 watt	Linear 2 watts Log 1 watt
+70°C Multiple Section Assembly	Linear 0.5 watt/section Log 0.25 watt/section	1 watt/section 0.5 watt/section
+125°C	0 watt	0 watt
Environmental Characteristics[1]		
Rotational Life (No Load)	100,000 cycles	100,000 cycles
Mechanical Characteristics[1]		
Mechanical Angle	300° ±5°	

NOTE: All Model 90 performance specifications do not apply to units subjected to printed circuit board cleaning procedures, except for the sealed version (Model 96).
[1]At room ambient: +25°C nominal and 50% relative humidity nominal, except as noted.

Specifications are subject to change without notice.

SI UNITS

RELATIVE QUANTITY SYMBOLS

$\neq$	not equal to
$\approx$	approximately equal to
$\propto$	proportional to
$<$	smaller than
$\leq$	smaller than or equal to
$\ll$	much smaller than
$>$	larger than
$\geq$	larger than or equal to
$\gg$	much larger than
$\equiv$	identical to or equivalent
$\uparrow$	increases
$\downarrow$	decreases

PREFIXES FOR SI UNITS

Multiple	Prefix	Symbol
10^{12}	tera	T
10^{9}	giga	G
10^{6}	mega	M
10^{3}	kilo	k
10^{-3}	milli	m
10^{-6}	micro	μ
10^{-9}	nano	n
10^{-12}	pico	p

Quantity	Symbol	SI Unit	Symbol	Derivation
acceleration	a	m s^{-2}	—	velocity/time
acceleration due to gravity	g	m s^{-2}	—	velocity/time
amount of substance	n	mole	mol	mole fraction (n) used
amplification factor	μ	*a ratio*	—	—
angle	$\theta_1, \varphi_1, \alpha_1$	—	—	—
angle of incidence	i	degree or radian	°	—
angle of refraction	r	degree or radian	°	—
angle, Bragg	θ	number	—	—
angle, critical	c	degree or radian	°	—
anode slope resistance	R_A	ohm	Ω	$\Delta V_a / \Delta I_a$
area	A	metres squared	m^2	$l \times b$
atomic number	Z	a number	—	number of protons
Avogadro constant	L, N_A	number	—	—
breadth	b	metre	m	fundamental unit
capacitance	C	farad	F	charge/p.d.
charge, electric	Q	coulomb	C	current × time
charge on electron	e	coulomb	C	$1{\cdot}6 \times 10^{-19}$ C
conductance	G	ohm^{-1}	Ω^{-1}	reciprocal of resistance
current, electric	I	ampere	A	fundamental unit
decay constant	λ	*a ratio*	—	—
density	ρ	kg m^{-3}	—	m/V
distance along path	s	metre	m	fundamental unit
efficiency	η	*a ratio*	—	work output/work input
electrochemical equiv.	z	g C^{-1}	—	mass/charge
electromotive force	E	volt	V	energy/charge
electron	e	—	—	—
energy	E	joule	J	N m
energy, kinetic	E_k	joule	J	N m. $E_k = 1/2mv^2$
energy, potential	E_p	joule	J	N m. $E_p = mgh$
Faraday constant	F	coulomb mol^{-1}	C mol^{-1}	96,500 C mol^{-1}
field strength, electric	E	V m^{-1}	—	potential gradient: p.d./dist.
field-strength magnetic	H	ampere-turns	—	current × no. of turns
flux, magnetic	Φ	weber	Wb	e.m.f/rate of change of flux
flux density	B	tesla	T	flux/area
focal length	f	metre	m	—
force	F	newton	N	kg m s^{-2}
free energy	ΔG	joule	J	—
frequency	f	hertz	Hz	oscillations/time
gas constant	r	joule	J	energy
half-life,radioactivity	$t_{1/2}$	second	s	fundamental unit
heat capacity	C	J K^{-1}	—	quantity of heat/temp. rise
heat of reaction	ΔH	joule	J	heat energy
heat capacity, specific	c	J K^{-1} kg^{-1}	—	heat capacity/mass
heat, quantity of	q	joule	J	energy

SI UNITS

Quantity	Symbol	SI Unit	Symbol	Derivation
height	h	metre	m	fundamental unit
image distance	υ	metre	m	fundamental unit
inductance, mutual	M	henry	H	induced e.m.f./rate of change of current
inductance, self	L	henry	H	—
intensity of radiation	I	*a number*	—	—
latent heat	L	joule	J	quantity of heat
latent heat, specific	l	J kg^{-1}	—	quantity of heat
latent heat, molar	L_m	joule mol^{-1}	J	quantity of heat
length	l	metre	m	fundamental unit
magnetizing force	H	ampere-turns	—	—
magnetic moment	m	Wb m	—	torque in unit magnetic field
magnification, linear	m	*a ratio*	—	—
mass	m	kilogramme	kg	fundamental unit
mass number	A	*a number*	—	number of neutrons + protons
molar volume	V_m	(dm^3)	—	volume of 1 mole
molar solution	M	*a ratio*	—	moles/dm^3
moment of force	—	N m	—	force × perp. distance
neutron number	N	*a number*	—	number of neutrons
number	n	—	—	—
number of molecules	N	—	—	—
number turns on coil	n	*a number*	—	—
number order spectrum	p	*a number*	—	—
object distance	u	metre	m	fundamental unit
peak current	I_o	ampere	A	see current
peak e.m.f.	E_o	volt	V	see e.m.f.
period	T	second	s	fundamental unit
permeability	μ	H m^{-1}	—	henry/metre
permeability, vacuum	μ_o	H m^{-1}	—	—
permeability, relative	μ_r	*a ratio*	—	$\mu = \frac{\mu}{\mu_o}$
permittivity	ε	F m^{-1}	—	farad/metre
permittivity, vacuum	ε_o	F m^{-1}	—	farad/metre
permittivity, relative	ε_r	*a ratio*	—	$\varepsilon_r = \frac{\varepsilon}{\varepsilon_o}$
potential, electric	V	volt	V	energy/charge
potential difference	V	volt	V	energy/charge
power	P	watt	W	J s^{-1}
pressure	p	pascal	Pa	N m^{-2}: force/area
radius	r	metre	m	fundamental unit
reactance	X	ohm	Ω	E_o/I_o
refractive index	n	*a ratio*	—	—
resistance	R	ohm	Ω	p.d./current
resistivity, electrical	ρ	ohm-metre	—	resistance × length
relative density	d	*a ratio*	—	ρ_{sub}/ρ_{water}
r.m.s. current	$I_{r.m.s}$	ampere	A	see current
r.m.s. voltage	$V_{r.m.s}$	volt	V	see e.m.f.
slit separation	s	metre	m	fundamental unit
tension	T	newton	N	see force
temperature, Celsius	θ	degree C	°C	from kelvin
temp. interval	θ	degree	° or K	—
temp. absolute	T	kelvin	K	fundamental unit
thickness	d	metre	m	fundamental unit
time	t	second	s	fundamental unit
torque	T	Nm	—	see moment
turns ratio	T	*a ratio*	—	n_{sec}/n_{prim}
(unit of electricity)	—	kW h	—	kilowatt × hour
velocity	u,υ	ms^{-1}	—	distance/time
velocity, angular	ω	$second^{-1}$	s^{-1}	angle/time
velocity, e.m.waves	c	m s^{-1}	—	—
velocity of sound	υ	m s^{-1}	—	—
volume	V	metre cubed	m^3	l × b × h
wavelength	λ	metre	m	fundamental unit
work	w	joule	J	force x distance (Nm)
weight	W	newton	N	kg m s^{-2} or mg

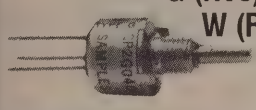
CLAROSTAT

POTENTIOMETERS

Series	Resistive Element	Power (watts)	Resistance Range (ohms)	Tolerance	Taper	Body Dimensions	Shaft	Bushing	Terminals
Modular									
388 **389**	Conductive plastic Cermet	0.5 1.0	100-5 meg	±10%	S Z RZ	1/2" sq.	Slotted Flatted	Plain Locking	Solder hook PC
	Note: can be used with AJ, BJ, BJM, CJ, DJ, and shadow switches.								
388/389MP	Same as 388 and 389 with 1/2" diameter gear motor.								
308 **309**	Conductive plastic Cermet	0.5 1.0	100-5 meg	±10%	S Z RZ	1/2" sq.	Slotted Flatted	Plain Locking	Solder hook PC
	Note: can be used with AL, BL, BLM and DJ switches								
Mod Pot 70	Cermet Carbon composition Conductive plastic	2.0 1.0 0.5	100-5 meg 50-10 meg 100-1 meg	±5, ±10% ±10, ±20% ±10, ±20%	Linear*	0.625" sq.	Plain Slotted Flatted	Plain Locking	Solder lug PC
	Note: available as L and Straight-T attenuator. *Consult factory for other tapers.								
Mod Pot 72	Cermet Carbon composition Conductive plastic	1.0 0.5 0.25	100-5 meg 50-10 meg 100-1 meg	±5, ±10% ±10, ±20% ±10, ±20%	Linear*	0.625" sq.	Plain Slotted Flatted	Plain Locking	Solder lug PC
	Note: available as L and Straight-T attenuator. *Consult factory for other tapers.								
Board Washable									
408 **409**	Conductive plastic Cermet	0.5 1.0	100-5 meg	±10, ±20%	S Z RZ	1/2" sq.	Slotted Flatted	Plain Locking	Solder hook PC
392 **(RV6)** **(RV8)**	Conductive plastic	0.5	100-5 meg	±10, ±20%	S Z RZ	1/2" diameter	Slotted	Plain Split locking	PC Solder lug
2000	Conductive plastic	0.5	250-1 meg	±10, ±20%	Linear*	0.625" sq.	Plain Slotted	Threaded Unthreaded	PC
	Note: Available as a Straight-T attenuator. *Consult factory for other tapers								
Industrial									
381	Conductive plastic	2.0	100-5 meg	±10, ±20%	S Z RZ	5/8" dia.	Slotted Flatted	Plain Locking	Solder lug
53 (RV4) **380**	Conductive plastic	2.0	50-10 meg	±10, ±20%	S Z RZ	1" dia.	Slotted Flatted	Plain Locking	Solder lug
	Like Series 53, except 100,000 life and stainless steel shaft								
	Note: can be used with AE switches								

CLAROSTAT POTENTIOMETERS

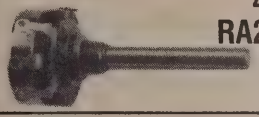
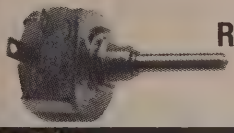
Industrial (continued)

Series	Resistive Element	Power (watts)	Resistance Range (ohms)	Tolerance	Taper	Body Dimension	Shaft	Bushing	Terminals
J (RV4) (2RV7) EJ	Carbon composition EJ= Long Life	2.25	50-5 meg	±10, ±20%	Linear*	1.156 dia. ×0.625 dp.	Plain Slotted Flatted	Plain Locking Panel Watertight	Solder lug
	Note: Available as Bridged-T, Bridged-H, L and Straight-T attenuators. *Consult factory for other tapers.								
 G (RV6) GS W (RV6) WR GD	Carbon composition	0.5	100-5 meg	±10, ±20%	Linear*	0.500″ dia.	Plain Slotted Flatted	Plain Locking Panel Watertight	lug PC
	Note: Available WITH SPST rotary switch (GS) (WR) *Consult factory for other tapers. GD=Dual								

Special Trimmer

Series	Resistive Element	Number of Turns	Power Rating (watts)	Resistance Range (ohms)	Tolerance	Body Dimension L×W×H (inches)	Terminal Configuration
BT	Carbon composition	Single	0.25	75 Consult factory for other values	±15, ±20%	0.500 dia.× 0.535 dp.	PC Solder lug
	Note: Bridged-T Attenuator						

Wirewound

Series	Resistive Element	Power Rating (watts)	Resistance Range (ohms)	Tolerance	Inde-pendent Linearity	Taper	Size	Shaft	Bushing	Terminal
 43 RA20	Wirewound	2.0	5-50K For RA20: 5-15K	±5% For RA20: ±10%	±2% For RA20: ±5%	S Z RZ	1 1/8″ dia.	Plain Slotted Flatted	Plain Locking	Solder lug
	Note: can be used with certain rotary AE switches.									
58 RA30	Wirewound	4.0	1-50K For RA30: 3-25K	±5% For RA30: ±10%	±1% For RA30: ±5%	S Z RZ	1 11/16″ dia.	Plain Slotted Flatted	Plain Locking	Solder lug
	Note: can be used with certain rotary AE switches.									
 49 RA10	Wirewound	1.5	5-20K	±5% For RA10: ±10%		S Z RZ	3/4″ dia.	Plain Slotted	Plain Locking	Solder lug

Precision

73	Wirewound 10 turn	2.0	100-100K	±5%	±0.25% (inde-pendent)	S	.875″ dia.	Slotted: –metal –plastic	Plain	Solder lug

DIALS

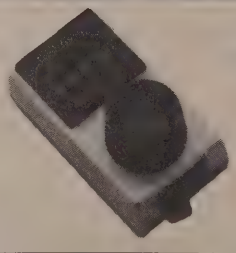
Concentric Scale

10-turn, 1 inch diameter, accepts 1/4″ diameter shaft.

Series	Housing	Brake lever
411	Black anodized	No
1411	Black plastic	No
412	Black anodized	Yes
1412	Black plastic	Yes
461	Clear anodized	No
1461	Gray plastic	No
462	Clear anodized	Yes
1462	Gray plastic	Yes

Digital Read-out

1.75 inch long× 1 inch wide, brake lever, accepts 1/4″ diameter shaft.

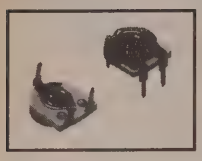


Series	Number of Turns
DR300	10
DR400	100

CLAROSTAT, 1600 West Plano Parkway, Plano, TX 75075 (Fax 1-800-223-5138) Phone: (800) 874-1874

MODELS E08C, E10C, E15C
Cermet Trimmers
Miniature, Industrial Grade, Singleturn
Open Frame, Ceramic Construction

A COMPANY OF VISHAY DALE®



FEATURES

- Adjustable - top + bottom or front + back
- Durable ceramic and metal construction
- Low profile

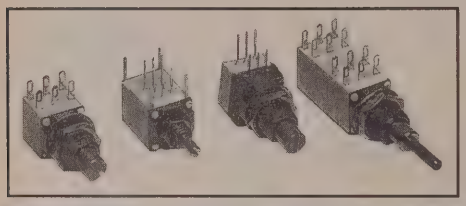
MECHANICAL SPECIFICATIONS			
MODEL	E08C	E10C	E15C
Mechanical Travel	240	240	260
Operating Torque	.3-1.5 cmN	.4-2 cmN	.5-2.5 cmN
Weight (Grams)	.4	.8	2.3

STANDARD ELECTRICAL SPECIFICATIONS

MODEL	RESISTANCE RANGE (Ohms)	TOLERANCE 10Ω-47Ω	TOLERANCE 22Ω-47Ω	TOLERANCE 47Ω-1M	TOLERANCE 47Ω-2.2M	POWER RATING @70°C	TEMPERATURE COEFFICIENT 10Ω-47Ω	TEMPERATURE COEFFICIENT 47Ω-100Ω	TEMPERATURE COEFFICIENT 100Ω-1M	TEMPERATURE COEFFICIENT 100Ω-2.2M	TEMPERATURE LIMITS
E08C	10-1M	± 30%	—	± 20%	—	.33W	± 250PPM	± 150PPM	± 100PPM	—	- 55°C - + 110°C
E10C	10-2.2M	± 30%	—	—	± 20%	.5W	± 250PPM	± 150PPM	—	± 100PPM	- 55°C - + 110°C
E15C	22-2.2M	—	± 30%	—	± 20%	1W	± 250PPM	± 150PPM	—	± 100PPM	- 55°C - + 110°C

MODELS P11 and PA11
Modular Potentiometers
Cermet/Conductive Plastic Element

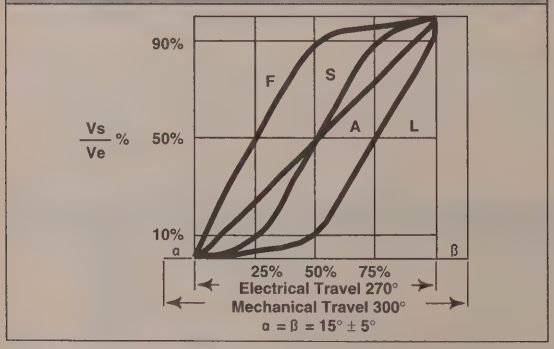
A COMPANY OF VISHAY DALE®



FEATURES

- Miniature module size - .5" [12.7] x .5" [12.7] x .2" [5.08]
- Shaft diameters - 1/4", 1/8", 3mm, 4mm, 6mm
- Up to seven modules as standard
- P.C. pins or solder lugs
- P.C. mounting brackets
- Up to twenty-one detents
- Rotary switch modules
- Concentric shafts
- Motorized designs
- Custom designs

TAPERS



MECHANICAL SPECIFICATIONS

Mechanical Travel: 300° ± 5°.

Operating Torque - Single and dual assemblies: 1/8", 3mm, 4mm D shafts = 0.7 - 1.4 ounce inch maximum. 1/4", 6mm D shafts = 1 - 1.9 ounce inch maximum. 3 to 7 modules = 0.3 - 0.45 ounce inch maximum per module.

End Stop Torque: 1/8", 3mm, 4mm D shafts = 3 pound inch minimum. 1/4", 6mm D shafts = 6.8 pound inch minimum.

Tightening Torque: 1/4", 6mm, 7mm D bushings = 13 pound inch minimum. 3/8", 10mm D bushings = 21 pound inch minimum.

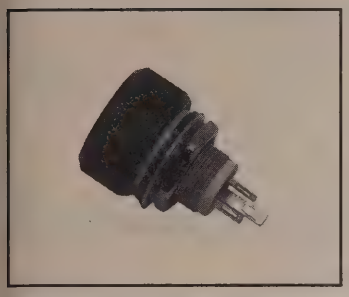
STANDARD ELECTRICAL SPECIFICATIONS

	P11 (Cermet)	PA11 (Conductive Plastic)
Electrical Travel	270° ± 10°	270° ± 10°
Resistance Range	20Ω to 2MΩ - Linear 1kΩ to 1MΩ - Non-linear	500Ω to 200kΩ - Linear 1kΩ to 1MΩ - Non-linear
Resistance Tolerance		
Standard	± 10%	± 20%
On Request	± 5%	± 10%
Power Rating		
Linear Taper	1 W at 70°C	0.5 W at 70°C
Non-linear Tapers	0.5 W at 70°C	0.5 W at 70°C
Multiple Assemblies	0.5 W per element	0.5 W per element
Temperature Coefficient	± 100PPM if R > = 100Ω	± 500PPM typical/C°
Limiting Element Voltage	350 V	350 V
Contact Res. Variation	2% or 3Ω linear taper	1% linear taper
End Resistance	2Ω	2Ω
Independent Linearity	± 5% linear taper	± 5% maximum linear taper
Insulation Resistance	100,000MΩ minimum	100,000MΩ minimum
Dielectric Strength	1500 V RMS minimum	1500 V RMS minimum
Attenuation		90 dB maximum 0.05 dB minimum
Rotational Life	50,000 cycles	100,000 cycles

MODELS P16 and PA16 Panel Controls

Miniature, "Pot in the Knob" Cermet/Conductive Plastic

A COMPANY OF VISHAY DALE®



FEATURES

- Compact, minimum clearance, low profile design
- Fully sealed and panel sealed
- Easy to specify part type for ordering
- Metal bushing
- Available through distribution
- Simple, compact, reliable, available
- Bushing mounted panel control built inside a knob rather than behind a panel

STANDARD ELECTRICAL SPECIFICATIONS

	CERMET ELEMENT	CONDUCTIVE PLASTIC ELEMENT
Resistance Range		
Linear Taper	22Ω-10M	500Ω-100k
Non-Linear Taper	1k-1M	500Ω-100k
Tolerance		
Standard	± 10%	± 20%
Optional	± 5%	± 10%
Power Rating		
Linear Taper	1 W @ 40°C	.5W @ 40°C
Non-Linear Taper	.5W @ 40°C	.25W @ 40°C
Temperature Coefficient	± 100PPM if R > 100	± 1000PPM/°C Max.
Contact Resistance Variation	3% or 3	1% Linear Taper 3% Non-Linear

ELECTRICAL SPECIFICATIONS

Electrical Travel: 270° ± 10°.

Dielectric Strength: 2500 V.

Limiting Element Voltage: 350 V linear taper.

Insulation Resistance: > 10 Megohm, 500 VDC.

End Resistance: 1 typical.

MECHANICAL SPECIFICATIONS

Mechanical Travel: 300° ± 5°.

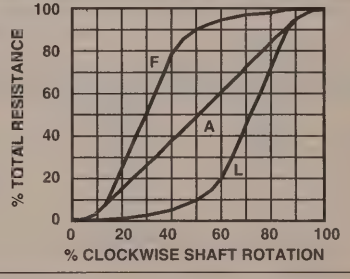
Operating Torque: 2.8 ounce/inch typical.

End Stop Torque: 2 pound/inch typical.

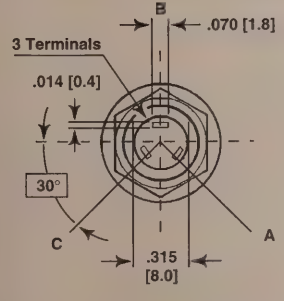
Unit Weight: Plastic knob .17 ounces typical.
Metal knob .20 ounces typical.

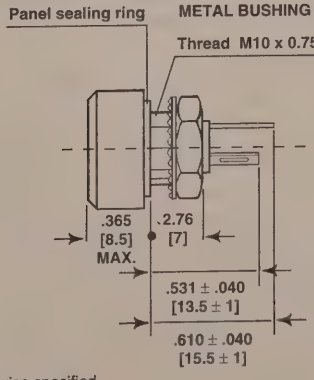
CIRCUIT DIAGRAM

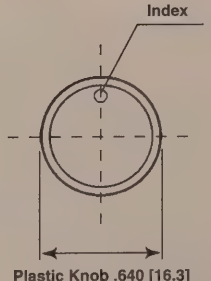
RESISTANCE TAPERS



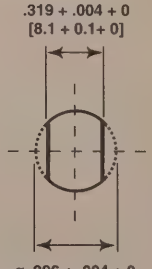
DIMENSIONAL CONFIGURATIONS [Numbers in brackets indicate millimeters]







Mounting Hole



NOTE: General tolerance is .020 [0.5] unless otherwise specified.

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MODELS ST22 and ST23 Chip Potentiometers

Surface Mounted, Single Turn Open Frame, 4mm Square

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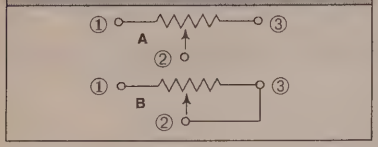
EQUIVALENT CIRCUIT



FEATURES

- Designed for efficient, accurate miniaturization
- Can be wave or dip soldered without rotor problems
- Coded marking for easy identification of resistance value
- Models for standard, automatic or reverse adjustment
- 12mm tape and reel packaging

ELECTRICAL SPECIFICATIONS

Resistance Values: 100Ω to 1 MΩ.
Resistance Tolerance: ± 30%.
Rated Power: 0.2 watts at 70°C.
Rated Voltage: 100 VDC.
Rotation Life: 20 rotations.
Torque: 20 to 200 g/cm.
Rotation Angle: 270° ± 20° total.
Operating Temp. Range: - 40°C to + 100°C.
TCR: ± 250PPM/°C.
CRV: 5% maximum.

MODELS ST53YJ and ST53YL Cermet Trimmers

Surface Mount, Miniature, Single Turn, Fully Sealed

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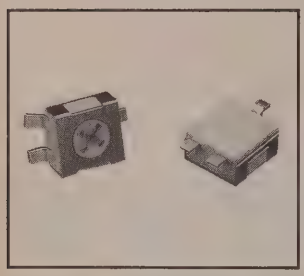

FEATURES

- 0.2 watts at 85°C
- Excellent stability
- Wide ohmic range
- Fully sealed
- Low temperature coefficient
- Low contact resistance variation
- Manual or automatic operations
- Small size for optimum packing density

STANDARD RESISTANCE ELEMENT DATA

STANDARD RESISTANCE VALUES (Ohms)	LINEAR LAW			T. C. - 55°C + 125°C PPM/°C
	MAXIMUM POWER AT 85°C (Watts)	MAXIMUM WORKING VOLTAGE (Volts)	MAX. CURRENT THROUGH WIPER (mA)	
10	0.20	1.41	141.0	0 + 200
20	0.20	2.00	100.0	
50	0.20	3.16	63.0	
100	0.20	4.47	45.0	± 100
200	0.20	6.32	32.0	
500	0.20	10.0	20.0	
1k	0.20	14.1	14.0	
2k	0.20	20.0	10.0	
5k	0.20	31.6	6.3	
10k	0.20	44.7	4.5	
20k	0.20	63.2	3.2	
50k	0.20	100.0	2 .0	
100k	0.10	100.0	1.0	
200k	0.05	100.0	0.5	
500k	0.02	100.0	0.2	
1M	0.01	100.0	0.1	

APPLICATIONS

The ST53 trimming potentiometers have been designed for surface mount applications. They offer volumetric efficiency and have dimensions of .197" x .197" x .106" [5.0 x 5.0 x 2.7] with high performance and stability. The ST53 models are suitable for both manual or automatic operation and can with-stand wave, vapor phase and reflow soldering techniques.

ELECTRICAL SPECIFICATIONS

Electrical Travel: 220° ± 15°.
Standard Series: 1-2-5.
Resistance Range: 10Ω to 1MΩ.
Resistance Tolerance: ± 10% standard.
Temperature Coefficient: (- 55°C to + 155°C). ± 100PPM/°C for Rn ≥ 100Ω.
Power Rating: 0.2 watt at + 85°C.
Limiting Element Voltage: 200 V.
Contact Resistance Variation: 1% Rn or 3Ω.
End Resistance Variation: 1Ω typical.
Dielectric Strength: 1000 V RMS.
Insulation Resistance: 10^6 MΩ.
Specification: In accordance with NFC 83251 or CECC 41100 and VRCI.

ENVIRONMENTAL SPECIFICATIONS

Climatic Category: 55/125/56.
Sealing: Fully Sealed container, solder immersion.
Soldering Cycle (Surface Mounting): 2 minutes at 215°C or 10 seconds at 260°C or 3 seconds at 350°C (according to VRCI). Soldering by wave, reflow and vapor phase.

MECHANICAL SPECIFICATIONS

Mechanical Travel: 270° ± 10°.
Operating Torque: 2.2 ounce inch maximum.
End Stop Torque: 5.0 ounce inch minimum.
Weight: 0.15 grams maximum.

For more information contact:
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MODELS ST63Y and ST63Z Cermet Trimmers

Surface Mount, Miniature

Industrial Grade, Multiturn, Fully Sealed

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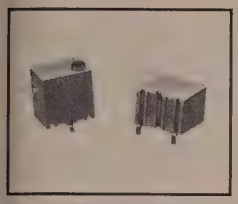

FEATURES

- 1/4" square and fully sealed
- 0.25 watts at 85°C
- Tight tolerance
- Very low T. C.
- Low contact resistance variation
- Low end contact resistance
- Tape & Reel or Tube packaging

STANDARD RESISTANCE ELEMENT DATA

STANDARD RESISTANCE VALUES (Ohms)	LINEAR LAW			T. C. - 55°C + 125°C PPM/°C
	MAXIMUM POWER AT 85°C (Watts)	MAXIMUM WORKING VOLTAGE (Volts)	MAX. CURRENT THROUGH WIPER (mA)	
10	0.25	1.58	158.0	0
20	0.25	2.23	112.0	+ 200
50	0.25	3.53	77.0	
100	0.25	5.00	50.0	
200	0.25	7.07	35.0	
500	0.25	11.2	22.0	
1k	0.25	15.8	15.8	
2k	0.25	22.3	11.2	
5k	0.25	35.3	7.1	
10k	0.25	50.0	5.0	± 100
20k	0.25	70.7	3.5	
50k	0.25	112.0	2.2	
100k	0.25	158.0	1.6	
250k	0.25	250.0	1.0	
500k	0.13	223.0	0.50	
1M	0.06	250.0	0.25	
2M	0.03	250.0	0.12	

APPLICATIONS

The ST63 has dimensions of 6.6 x 6.8 x 4.6mm and is designed for PCB surface mounting. 2 styles are available according to the positioning of the control screw and contact positions. The cermet track gives a high stability performance with an extended ohmic capacity of 10Ω to 2MΩ.

ELECTRICAL SPECIFICATIONS

Electrical Travel: 13 turns ± 2.
Standard Series: 1-2-5.
Resistance Tolerance: ± 10% standard.
Power Rating: 0.25 watt at + 85°C.
Limiting Element Voltage: 250 V.
Contact Resistance Variation: 2% Rn or 2Ω, whichever is greater.
End Resistance Variation: 1Ω typical.
Dielectric Strength: 1000 V RMS.
Insulation Resistance: 10^6 MΩ, 500 VDC.

MECHANICAL SPECIFICATIONS

Mechanical Travel: 15 turns ± 5.
Operating Torque: 2.1 ounce inch maximum.
End Stop Torque: Clutch action.
Weight: 0.5 grams maximum.

ENVIRONMENTAL SPECIFICATIONS

Climatic Category: 55/125/56.
Soldering Cycle (Surface Mounting): 2 minutes at 215°C or 10 seconds at 260°C or 3 seconds at 350°C (according to VRCI). Soldering by wave, reflow and vapor phase.

MODELS T7YA and T7YB Cermet Trimmers

Miniature, Industrial Grade

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FEATURES

- 0.5 watts at 85°C • High stability
- Low T. C. • Wide resistance range
- Easy to read scale

STANDARD RESISTANCE ELEMENT DATA

STANDARD RESISTANCE VALUES (Ohms)	LINEAR LAW			T. C. - 55°C + 125°C PPM/°C
	MAXIMUM POWER AT 85°C (Watts)	MAXIMUM WORKING VOLTAGE (Volts)	MAX. CURRENT THROUGH WIPER (mA)	
10	0.50	2.2	224.0	0
20	0.50	3.2	158.0	+ 200
50	0.50	5.0	100.0	
100	0.50	7.0	70.0	
200	0.50	10.0	50.0	
500	0.50	15.8	32.0	
1k	0.50	22.4	22.0	
2k	0.50	31.6	16.0	
5k	0.50	50.0	10.0	± 100
10k	0.50	70.7	7.0	
20k	0.50	100.0	5.0	
50k	0.50	158.0	3.2	
100k	0.50	224.0	2.2	
200k	0.31	250.0	1.25	
500k	0.12	250.0	0.50	
1M	0.06	250.0	0.25	

APPLICATIONS

The T7 trimmer is only .275" [7.0] in diameter and fits almost anywhere. A sealed plastic case protecting a quality cermet track guarantees high performance and reliability. Adjustments are made easier by the clear scale readings. Competitively priced, the T7 is ideally suited to all industrial applications.

ELECTRICAL SPECIFICATIONS

Electrical Travel: 270° ± 15°.
Standard Series: 1-2-5.
Resistance Tolerance: ± 10% standard.
Power Rating: 0.5 watt at + 85°C.
Limiting Element Voltage: 250 V.
Contact Resistance Variation: 3% or 3Ω, whichever is greater.
End Resistance Variation: 1Ω typical.

MECHANICAL SPECIFICATIONS

Mechanical Travel: 300° ± 15°.
Operating Torque: 3 ounce inch maximum.
End Stop Torque: 5.6 ounce inch minimum.
Weight: 0.02 ounces.

ENVIRONMENTAL SPECIFICATIONS

Climatic Category: 55/100/56.
Sealing: Enables cleaning.

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MODELS TX, TXD, TY (A, D, M, P)
Cermet Trimmers
Miniature, Industrial Grade

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FEATURES
- 0.5 watt at 85°C • Easy to read scale
- Typ. contact resistance variation = 1%
- Fully sealed
- Wide temp. range - 55°C to + 125°C
- Excellent stability owing to multi-contact wiper in precious metal

STANDARD RESISTANCE ELEMENT DATA

STANDARD RESISTANCE VALUES (Ohms)	LINEAR LAW: MAXIMUM POWER AT 85°C (Watts)	LINEAR LAW: MAXIMUM WORKING VOLTAGE (Volts)	LINEAR LAW: MAX. CURRENT THROUGH WIPER (mA)	T. C. - 55°C + 125°C PPM/°C
10	0.50	2.2	224.0	0
20	0.50	3.2	158.0	+ 200
50	0.50	5.0	100.0	
100	0.50	7.0	70.0	
200	0.50	10.0	50.0	
500	0.50	15.8	32.0	
1k	0.50	22.4	22.0	
2k	0.50	31.6	16.0	
5k	0.50	50.0	10.0	± 100
10k	0.50	70.7	7.0	
20k	0.50	100.0	5.0	
50k	0.50	158.0	3.2	
100k	0.50	224.0	2.2	
200k	0.31	250.0	1.25	
500k	0.12	250.0	1.50	
1M	0.06	250.0	0.25	
2M	0.031	250.0	0.12	

APPLICATIONS

This newly designed trimming potentiometer can be mounted on PCBs as an alternative to most of the current 3/8" [9.53] square trimmers with the advantage of a significantly smaller size 9/32" [7.14].

ELECTRICAL SPECIFICATIONS

Electrical Travel: 260° ± 15°.
Standard Series: 1-2-5.
Resistance Tolerance: ± 10% standard. ± 5% available.
Power Rating: 0.5 watt at + 85°C.
Limiting Element Voltage: 250 V.
Contact Resistance Variation: 1% or 2Ω (whichever is greater).
End Resistance Variation: 1Ω typical.
Dielectric Strength: 1000 V RMS.
Insulation Resistance: 10^6 MΩ (500 VDC).

MECHANICAL SPECIFICATIONS

Mechanical Travel: 300° ± 15°.
Operating Torque: 3 ounce inch maximum.
End Stop Torque: 5.7 ounce inch maximum.
Weight: 0.02 ounces maximum.

ENVIRONMENTAL SPECIFICATIONS

Temperature Limits: - 55°C to + 125°C.
Climatic Category: 55/100/56.
Sealing: Fully sealed container.

MODEL T63
Cermet Trimmers
Small Size, 1/4 [6.35], Industrial Grade
Multiturn, Fully Sealed Container

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FEATURES
- 0.25 watts at 85°C • Space saving
- Excellent stability & setting accuracy
- Multi-contact wiper in precious metal
- Wide range of ohmic values

STANDARD RESISTANCE ELEMENT DATA

STANDARD RESISTANCE VALUES (Ohms)	LINEAR LAW: MAXIMUM POWER AT 85°C (Watts)	LINEAR LAW: MAXIMUM WORKING VOLTAGE (Volts)	LINEAR LAW: MAX. CURRENT THROUGH WIPER (mA)	T. C. - 55°C + 125°C PPM/°C
10	0.25	1.58	158.0	0
20	0.25	2.23	112.0	+ 200
50	0.25	3.53	70.0	
100	0.25	5.0	50.0	
200	0.25	7.07	35.0	
500	0.25	11.2	22.0	
1k	0.25	15.8	15.8	
2k	0.25	22.3	11.2	
5k	0.25	35.3	7.1	± 100
10k	0.25	50.0	5.0	
20k	0.25	70.7	3.5	
50k	0.25	112.0	2.2	
100k	0.25	158.0	1.6	
200k	0.25	224.0	1.1	
500k	0.13	250.0	0.50	
1M	0.06	250.0	0.25	
2M	0.031	250.0	0.13	

APPLICATIONS

Due to their square shape and small size (6.6 x 6.8 x 4.7mm), the T63 trimmers are ideally suited for PCB use, enabling high density board mounting with reduced space requirement between cards. 4 styles are available differing by the top or side position of the adjustment screw and the spacing of the terminals. The use of cermet for the resistive track ensures an excellent stability of the nominal specifications throughout life.

ELECTRICAL SPECIFICATIONS

Electrical Travel: 13 turns ± 2.
Standard Series: 1-2-5.
Resistance Tolerance: ± 10% standard. ± 5% available.
Power Rating: 0.25 watt at + 85°C.
Limiting Element Voltage: 250 V.
Contact Resistance Variation: 2% Rn or 2Ω (whichever is greater).
End Resistance: 1Ω typical.
Dielectric Strength: 1000 V RMS.
Insulation Resistance: 10^6 MΩ (500 VDC).

MECHANICAL SPECIFICATIONS

Mechanical Travel: 15 turns ± 5.
Operating Torque: 2.1 ounce inch maximum.
End Stop Torque: Clutch action.
Weight: 0.02 ounces.

ENVIRONMENTAL SPECIFICATIONS

Climatic Category: 55/125/56.

For more information contact:
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MODEL T93
Cermet Trimmers
Small Size, 3/8 [9.53] Square, Industrial Grade, Multiturn, Fully Sealed

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FEATURES
- 0.5 watts at 85°C
- Contact resistance variation < 1%, typ.
- Multi-finger wiper contact in precious metal

STANDARD RESISTANCE ELEMENT DATA

STANDARD RESISTANCE VALUES (Ohms)	LINEAR LAW: MAXIMUM POWER AT 85°C (Watts)	LINEAR LAW: MAXIMUM WORKING VOLTAGE (Volts)	LINEAR LAW: MAX. CURRENT THROUGH WIPER (mA)	T. C. - 55°C + 125°C PPM/°C
10	0.50	2.2	224.0	0
20	0.50	3.2	158.0	+ 200
50	0.50	5.0	100.0	
100	0.50	7.0	70.0	
200	0.50	10.0	50.0	
500	0.50	15.8	32.0	
1k	0.50	22.4	22.0	
2k	0.50	31.6	16.0	
5k	0.50	50.0	10.0	
10k	0.50	70.7	7.0	± 100
20k	0.50	100.0	5.0	
50k	0.50	158.0	3.2	
100k	0.50	224.0	2.2	
200k	0.31	250.0	0.50	
500k	0.12	250.0	0.50	
1M	0.06	250.0	0.25	
2M	0.031	250.0	0.12	

APPLICATIONS
The T93 is a small size trimmer - 3/8" x 3/8" x 3/16" [9.53 x 9.53 x 4.78] for PC board mounting. 5 styles are available which differ by the position of the control screw in relation to the PC board plane and by the spacing of the terminals. Excellent operational stability is provided by the use of a cermet element. The T93 model is ideally suited for all industrial applications.

ELECTRICAL SPECIFICATIONS
Electrical Travel: 19 turns ± 2.
Standard Series: 1-2-5.
Resistance Tolerance: ± 10% standard. ± 5% available.
Power Rating: 0.5 watt at + 85°C.
Limiting Element Voltage: 250 V.
Contact Resistance Variation: 2% Rn or 2Ω (whichever is greater).
End Resistance : 1Ω typical.
Dielectric Strength: 1000 V RMS.
Insulation Resistance: 10^6 MΩ (500 VDC).

MECHANICAL SPECIFICATIONS
Mechanical Travel: 22 turns ± 5.
Operating Torque: 2.1 ounce inch maximum.
End Stop Torque: Clutch action.
Weight: 0.04 ounces.

ENVIRONMENTAL SPECIFICATIONS
Climatic Category: 55/125/56.

MODELS T18 and T18T
Cermet Trimmers
3/4 [19.05] Rectangular, Industrial Grade, Multiturn

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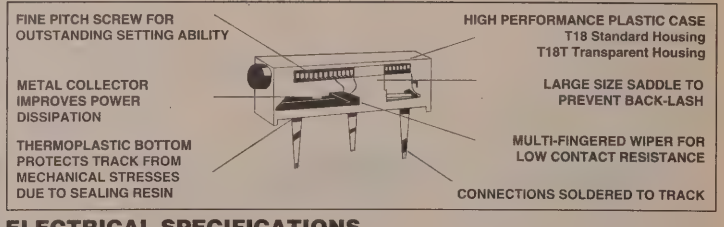
FEATURES
- 3/4" [19.05] rectangular
- T18 normal housing
- T18T transparent housing


FINE PITCH SCREW FOR OUTSTANDING SETTING ABILITY
METAL COLLECTOR IMPROVES POWER DISSIPATION
THERMOPLASTIC BOTTOM PROTECTS TRACK FROM MECHANICAL STRESSES DUE TO SEALING RESIN
HIGH PERFORMANCE PLASTIC CASE T18 Standard Housing T18T Transparent Housing
LARGE SIZE SADDLE TO PREVENT BACK-LASH
MULTI-FINGERED WIPER FOR LOW CONTACT RESISTANCE
CONNECTIONS SOLDERED TO TRACK

STANDARD RESISTANCE ELEMENT DATA

STANDARD RESISTANCE VALUES (Ohms)	LINEAR LAW: MAXIMUM POWER AT 70°C (Watts)	LINEAR LAW: MAXIMUM WORKING VOLTAGE (Volts)	LINEAR LAW: MAX. CURRENT THROUGH WIPER (mA)	T. C. - 55°C + 125°C PPM/°C
10	0.75	2.7	270.0	0
20	0.75	3.9	195.0	+ 200
50	0.75	6.1	122.0	
100	0.75	8.7	87.0	
200	0.75	12.2	61.0	
500	0.75	19.4	39.0	
1k	0.75	27.4	27.0	
2k	0.75	38.7	19.0	
5k	0.75	61.2	12.0	
10k	0.75	86.6	9.0	± 100
20k	0.75	122.0	6.0	
50k	0.75	194.0	4.0	
100k	0.625	250.0	2.5	
200k	0.31	250.0	1.25	
500k	0.12	250.0	0.50	
1M	0.06	250.0	0.25	
2M	0.031	250.0	0.12	

ELECTRICAL SPECIFICATIONS
Electrical Travel: 15 turns ± 1.
Standard Series: 1-2-5.
Resistance Tolerance: ± 10% standard.
T. C.: T18 = (- 55°C to + 125°C), ± 100PPM/°C for Rn ≥ 100Ω.
T18T = (- 55°C to + 105°C), ± 100PPM/°C for Rn ≥ 100Ω.
Power Rating: 0.75 watt at + 70°C.
Limiting Element Voltage: 250 volts.
Contact Resistance Variation: 2% or 2Ω, whichever is greater.
End Resistance Variation: 1Ω typical.
Dielectric Strength: 1000 V RMS.
Insulation Resistance: 10^6 MΩ, 500 VDC.

MECHANICAL SPECIFICATIONS
Mechanical Travel: 18 turns ± 3.
Operating Torque: 2.8 ounce inch maximum.
End Stop Torque: Clutch action.
Weight: .04 ounces maximum.

ENVIRONMENTAL SPECIFICATIONS
Climatic Category: 55/100/56.
Sealing: T18-Fully sealed, T18T-Enables cleaning.

For more information contact:
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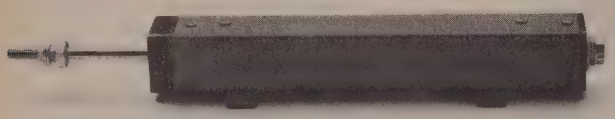
A complete selection of standard products is available for cost-effective solutions to a wide variety of functions. DUNCAN ELECTRONICS is also prepared to respond to special requirements, and offers a host of new, innovative alternatives to position sensing applications.

Linear Motion Infinite Resolution Position Transducers

100 Series 6" (150mm) to 36" (900mm)



Model	106	109	112	118	124	130	136
Total Electrical Travel in. (mm)	6.00 (152)	9.00 (229)	12.00 (305)	18.00 (457)	24.00 (610)	30.00 (762)	36.00 (914)
Active Electrical Travel in. (mm)	5.90 (150)	8.90 (226)	11.90 (302)	17.90 (455)	23.90 (607)	29.90 (759)	35.90 (912)
Resistance KΩ ±20%	5.0	2.4	3.2	4.8	6.4	8.0	9.6
Linearity Over Active Electrical Travel ±%	0.07	0.07	0.07	0.05	0.05	0.05	0.05
Mechanical Travel in. (mm)	6.10 (155)	9.10 (231)	12.10 (307)	18.10 (460)	24.10 (612)	30.10 (765)	36.10 (917)
Dimensions A in. (mm)	8.82 (224)	11.82 (300)	14.82 (377)	20.82 (529)	26.82 (681)	32.82 (834)	38.82 (986)
B in. (mm)	5.00 (127)	8.00 (203)	11.00 (279)	17.00 (432)	23.00 (584)	29.00 (737)	35.00 (899)
Total Weight (gms)	360	460	580	805	1025	1245	1470
Inertia	70	90	105	145	180	220	260

Electrical Specifications

Resistance:
2.4K-9.6KΩ standard (See table)
Special resistances: contact factory

R_T Tolerance:
±20% standard
±10% and less: special

Accuracy (independent linearity):
±0.07% to 0.05% standard (See table)(special linearities: contact factory)

Power Rating:
0.75 watts/inch stroke

Temperature Range:
-55° to +125°C

Resolution:
Infinite (conductive plastic)

Stroke (electrical travel):
6" (150mm) to 36" (900mm) (See table)

Mechanical Specifications

Mechanical Travel:
Electrical travel +0.1" (2.5) min. (See table)

Shaft:
0.250" (6.35) diameter; 1/4-28 threaded end adaptor (furnished)

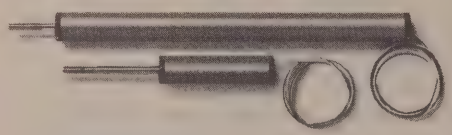
Case Size:
1.25" square x length (See table)

Actuation Force:
1 lb. (4.4 Newtons) maximum — standard

Repeatability:
Within 0.0005" (.013)

Life:
100 x 10^6 traverses (up to 12" stroke — derated proportionately for longer units)

600 Series
1" (25mm) to 12" (305mm)



Model	601	602	603	604	606	610	612
Total Electrical Travel in. (mm)	1.00 (25)	2.00 (51)	3.00 (76)	4.00 (102)	6.00 (152)	10.00 (254)	12.00 (305)
Active Electrical Travel in. (mm)	.90 (23)	1.90 (48)	2.90 (74)	3.90 (99)	5.90 (150)	9.90 (251)	11.90 (302)
Resistance KΩ ±20%	1.00	2.00	3.00	4.00	6.00	10.00	12.00
Linearity Over Active Electrical Travel ±%	0.70	0.35	0.25	0.15	0.12	0.09	0.08
Mechanical Travel in. (mm)	1.10 (28)	2.10 (53)	3.10 (79)	4.10 (104)	6.10 (155)	10.10 (257)	12.10 (307)
Case Dimensions "A" in. (mm)	2.50 (57)	3.50 (89)	4.50 (114)	5.50 (140)	7.50 (190)	11.50 (292)	13.50 (343)

Electrical Specifications

Electrical Travel:
1.00" (25mm) to 12.00" (305mm) (See table)

Resistance Range:
1.0K to 12.0KΩ standard (See table)

Resistance Tolerance:
±20%

Independent Linearity:
±0.70 to 0.08% (See table)

Power Rating at 70°C:
0.25 watts
Per inch of electrical travel derated to 0 watts at 125°C

Output Smoothness:
0.1%

Resolution:
Infinite

Insulation Resistance at 500 VDC:
1000 megohms

Dielectric Strength:
500 VDC

Temperature Range:
-55 to +125°C

Mechanical Specifications

Mechanical Travel:
Electrical travel +0.1 in. (2.5) min.

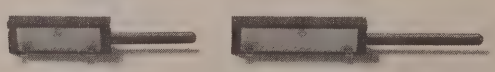
Actuation Force:
2 oz. (.56 Newtons) max.

Repeatability:
Within .0005 in. (.013)

Life:
10 x 10^6 Cycles

Shaft Alignment:
Floating shaft design allows for shaft/interface misalignment up to 0.010" (.25). Shaft rotates freely

9600 Series 0.50" (12.7mm) to 1.50" (38.1mm)
Miniature/Spring Return



Specifications (Typical)*

Model	9605	9610	9615
Total Electrical Travel (A) inches (mm)	0.50 (12.7)	1.00 (25.4)	1.50 (38.1)
Active Electrical Travel	0.40 (10.0)	0.90 (22.8)	1.40 (35.6)
Total DC Resistance ±25%	1.7K	3.4K	5.1K
Linearity Over Active Electrical Travel	±2%	±2%	±2%
Best Practical Linearity	±1.0%	±0.5%	±0.35%
Power Rating At 70°C, Watts	.25	.50	.75
Mechanical Travel ±.015 (±0.4) (B) inches (mm)	0.56 (14.2)	1.06 (26.9)	1.56 (39.6)
Housing Length ±.015 (±0.4) (C) inches (mm)	1.06 (26.9)	1.56 (39.6)	2.06 (52.3)
Terminal Spacing: (D) inches (mm)	0.30 (7.6)	0.50 (12.7)	0.80 (20.3)
(E) inches (mm)	0.20 (5.1)	0.50 (12.7)	0.70 (17.8)
Fully Extended Length ±.015 (0.4) (F) inches (mm)	.810 (20.6)	1.310 (33.3)	1.810 (46.0)
Mechanical Life	2,000,000 Full Cycles, 5,000,000 Dither Cycles		
Stop Strength oz. (Newtons)	360 (100)		
Actuation Force oz. (Newtons)	14.4 (4.0) Maximum, supplied with internal spring to return actuator to extended position.		
Humidity	95% @ 38°C		
Vibration	15Gs, 50 to 1,000Hz, 2hrs, each plane		
Shock	Up to 50Gs		
Temperature Limits	-40°C to +135°C		

*Most specifications may be altered to meet specific requirements.

Industrial Control Sensors
9800 Series

Models 9805-9808
Offset Connector Style

Models 9811-9814
90° Connector Style.

Models 9831-9832
Leadwire Style

Duncan 9800 Series sensors are designed for rugged, continuous under hood or other engine applications. Features include stable materials that withstand high temperatures and an insert molded integral connector/ body design that eliminates weak/stress points and leaks during engine wash-down or water exposure. These sensors typically offer long life at 2,000,000 full cycles (5 million dither cycles) and excellent resistance, voltage and linearity characteristics.

Position Sensing Products

Slideline® Instrumentation Controls
400 Series

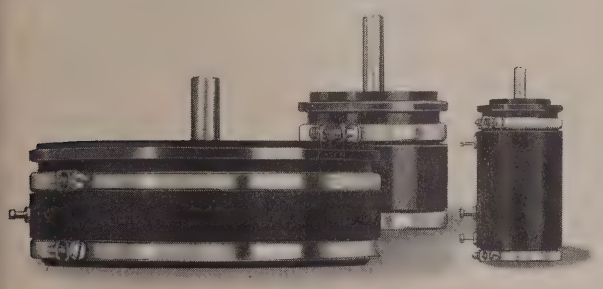
Performance Specifications
L = Linear A = Audio

Electrical	L	A
1. Resistance Range (Ohms)	1K to 100K	600 to 25K
2. Standard Resistance Values* (Ohms)	1K 2K 5K 10K 20K 50K 100K	600 1 5K 10K
3. Resistance Tolerance**%	±20	±20
4. Linearity Tolerance Std. (%)	±2.0	NA
5. Taper Conformity (dB)	NA	0-20 dB: ±2 >20-50 dB: ±4
6. Tracking (Dual Channel Only) (dB)	4%	0-20 dB:4 >20-50 dB:8
7. End Voltage (%)	1.0	NA
8. Maximum Insertion Loss (dB)	NA	1.0
9. Maximum Attenuation (dB) (Three-Terminal Device)	NA	90
10. Resolution	INFINITE	
11. Power Rating at 70°C. (Watts) Model 421/422 Model 441/442	 2.5 4.0	 .25 .40

Mechanical	
1. Travel (Inches mm) Model 421/422 Model 441/442	2 3/4 (70) 4 1/4 (108)
2. Actuating Force, Max. oz. (gm)	3 (85)
3. Stop Strength lbs. (Newtons)	10 (1.1)
4. Number of Channels	Single or Dual in Identical Case
5. Terminals	Model 421/441 Solder Type Flat Lugs (Accepts Quick Connect Receptacles) Model 422/442 Printed Circuit Pins
General	
1. Ambient Temperature	-55°C. to +125°C.
2. Taps	Center Tap Available on Linear Only
3. Dual independent wipers	Available in Linear Only
4. Life	Traverses: 5 million

*Other values available as special. **Tighter tolerances available as special.
Dimensions shown in inches (metric)

Precision Potentiometers
Single & Multi-Turn
Wirewound, Conductive Plastics & Hybrid



COMPARISON OF RESISTIVE CHARACTERISTICS

	Resistive Technology		
PARAMETER	**Wirewound**	**Hybrid**	**Conductive Plastic**
Resistance Range	Full Range	Limited Range	Full Range
Std. Resistance Tolerance	±3%	±5%	±10%
Effective Travel Range	Up To 10-Turns	Up To 10-Turns	360° Maximum
Temp., Coefficient of Resistance	±20 PPM°C	±70 PPM°C	-300 PPM°C
Power Dissipation	High	High	Moderate
Resolution	Finite	Infinite	Infinite
Adjustability/Setability	Fair	Good	Excellent
Linearity/Conformity	Very Good	Good	Excellent
Contact resistance	Low	High	Moderately High
Rotational Life (Rev.)	2×10^6	10×10^6	50×10^6
Moisture Stability	Excellent	Good	Fair
Non-Linear Functions	Excellent	Good	Excellent
Rheostat Applications	Excellent	Poor	Fair
AC Circuit Applications	Poor	Fair	Excellent
Relative Cost	Low	Medium	High

SINGLE-TURN POTENTIOMETERS

Element Type/ Series No.	Dia.	Resistance Range(Ω)	Linearity (%) Standard	Linearity (%) Best Practical	@ 70° (Watts)	Max. Power CMounting Style
WIREWOUND						
1200	7/8"	15-75K	±0.5	±0.2	1.25	Servo/Bushing
1230	7/8"	15-50K	±0.5	±0.25	1.25	Bushing
1300	1 1/16"	25-100K	±0.4	±0.15	2.0	Servo/Bushing
1500	1 7/16"	25-125K	±0.3	±0.12	3.0	Servo/Bushing
1600	1 3/4"	25-150K	±0.25	±0.09	4.0	Servo/Bushing
1630	1 3/4"	25-100K	±0.3	±0.15	4.0	Bushing
1700	2"	25-200K	±0.2	±0.08	5.0	Servo/Bushing
1800	3"	25-250K	±0.15	±0.05	7.0	Servo/Bushing
CONDUCTIVE PLASTIC						
1220	7/8"	400-75K	±0.5	±0.2	0.5	Servo/Bushing
1320	1 1/16"	500-100K	±0.4	±0.15	0.75	Servo/Bushing
1520	1 7/16"	500-125K	±0.3	±0.10	1.0	Servo/Bushing
1620	1 3/4"	500-150K	±0.25	±0.075	1.5	Servo/Bushing
1720	2"	600-200K	±0.2	±0.06	2.0	Servo/Bushing
1820	3"	750-300K	±0.15	±0.04	3.0	Servo/Bushing
5251	7/8"	500-100K	±1.0	±0.25	1.0	Servo
5253	7/8"	500-100K	±2.0	±0.25	1.0	Bushing

MULTI-TURN POTENTIOMETERS

Element Type/ Series No.	Dia.	Resistance # of Range (Ω) Turns	Linearity (% Standard	Linearity (% Best Practical	Max. Power @ 70°C (Watts)	Mounting Style
WIREWOUND						
3200	7/8"	3-250K 3/5/10	±0.5/ 0.35/0.25	±0.1/ 0.07/0.05	1.5/2.0/2.5	Servo/Bushing
3233	7/8"	10-200K10	±0.25	±0.1	2.5	Bushing
3500	1 7/16"	5-500K3/5/10	±0.25/ 0.2/0.15	±0.5/ 0.04/0.03	3.04/4.0/5.0	Servo
3600		5-600K3/10	±0.35/0.25	±0.1/0.05	5.0/7.0	Bushing
3700	2"	5-830K3/10	±0.2/0.1	±0.04/0.02	5.0/7.0	Servo/Bushing
HYBRID						
4200	7/8"	500-100K3/5/10	±0.5/ 0.35/0.25	±0.15/ .1/0.075	1.5/2.0/2.5	Servo/Bushing
4500	1 7/16"	500-200K3/5/10	±0.25/ 0.2/0.15	±0.075/ 0.06/0.05	3.0/4.0/5.0	Servo
4600	1 3/4"	1K-250K3/10±0.35/	0.25	±0.15/0.08	5.0/7.0	Bushing
4700	2"	1K-250K3/10	±0.2/0.1	±0.06/0.03	5.0/7.0	Servo/Bushing

NOTES: 1. All Wirewound models are manufactured to meet or exceed applicable characteristics of MIL-R-12934.
2. All conductive Plastic and Hybrid models are manufactured to meet or exceed applicable characteristics of MIL-R-39023.

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Costa Mesa, CA 92626
(714) 545-8261 FAX (714) 557-6240

DUNCAN ELECTRONICS
A BEI Electronics Company

PRODUCT SELECTION GUIDES

TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 93/94 EDITION OF EEM

AC Power Supplies, Product Selection Guide **D•2221**

Batteries, Product Selection Guide **D•1419**

Cabinets, Enclosures, Racks & Chassis, Product Selection Guide **C•1003**

Capacitors, Product Selection Guide **A•1003**

Coils, Chokes, Inductors, Product Selection Guide **A•1179**

Connectors, Terminals & Sockets, Product Selection Guide **C•1139**

Cores, Magnets & Ferrites **A•1317**

Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide **A•1326**

DC-DC Converters **D•2049**

DC Power Supplies, Product Selection Guide **D•1488**

Delay Lines, Product Selection Guide **A•1513**

Discrete Semiconductors, Product Selection Guide **A•2130**

Displays, Readouts, & CRTs, Product Selection Guide **B•1017**

Fans, Blowers, Cooling Equipment, & Heat Exchangers, Product Selection Guide **C•1557**

Fiber Optics, Product Selection Guide **B•1200**

Filters, Power, Product Selection Guide **A•1584**

Filters, Signal, Product Selection Guide **A•1617**

Instruments, Test & Measuring, Product Selection Guide **D•1215**

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Keyboards & Keypads, Product Selection Guide **B•1818**

Lamps, Lights, & Indicators, Product Selection Guide **B•1131**

Microwave Components, Product Selection Guide **A•1719**

Military Qualified Products List **B•1002**

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Oscilloscopes, Product Selection Guide **D•1402**

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Transformers, Product Selection Guide **A•2229**

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CORPORATION

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LINEAR TRANSDUCERS

Advanced design criteria combined with precise process control manufacturing provide highly reliable transducers for control and measurement of linear position. Seven basic models allow selection of over 1000 standard and option features to best suit your length, accuracy, life, environment and price goals.

- ***Electrical Stroke 1" to 240"***
- ***Accuracy up to +/-0.025%***
- ***Infinite Resolution***
- ***Life 100 Million Cycles (typ.)***
- ***Sealed Construction***
- ***Choice of Mounting***

Special Designs Available on Request

DYNAMATION TRANSDUCERS
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DYNAMATION TRANSDUCERS
CORPORATION

ROTARY POSITION SENSORS

Thirty two precision designed standard models offer the accuracy, size, mounting features, reliability, life and cost effectiveness to fit your demanding applications.

Over two hundred standard design options allow optimized selection in this extensive product offering.

- ***Case Size 1/2" to 3"***
- ***Servo or Bushing Mount***
- ***Accuracy up to +/-0.01%***
- ***Linear Functions***
- ***Nonlinear Functions***

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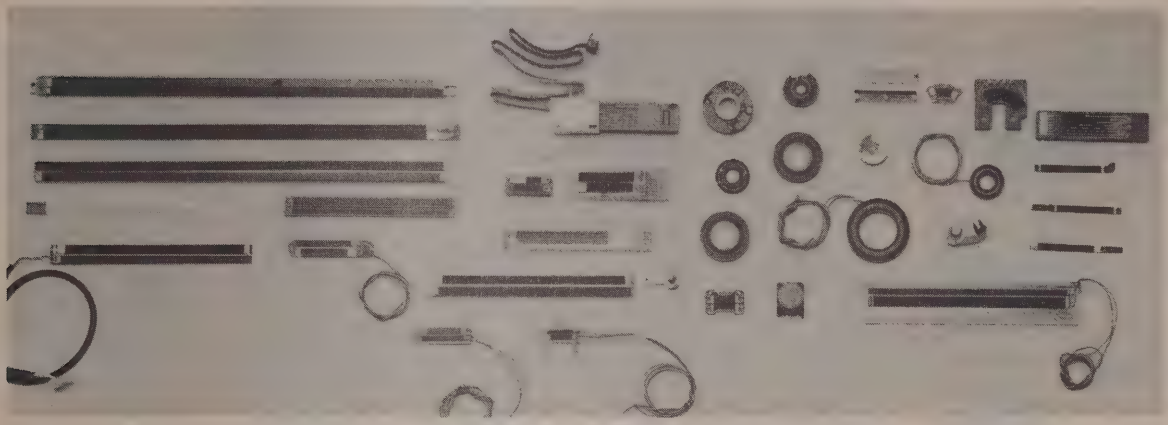
VISHAY SFERNICE

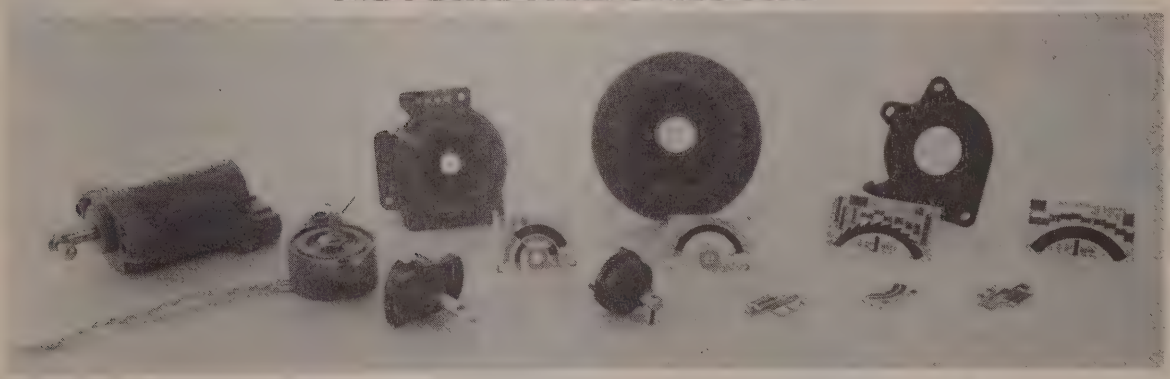
ELEMENTARY POSITION SENSING



When your application calls for the use of reliable, infinite resolution position sensing, select one from our standard line of linears or we'll custom design one specifically for you.

Virtually any size, shape or function can be economically produced in any volume with our application specific instrumentation.

AUTOMOTIVE SENSORS



Precise, unique designs utilizing our extensive experience in high-volume production. Linear and nonlinear functions. From basic element and wiper assemblies to sealed, enclosed designs.

- ***Throttle Position***
- ***Fuel Injection***
- ***Electronic Transmission***
- ***Light Intensity***
- ***Wiper Control***
- ***Wheel Alignment***
- ***Multiaxis Gearshift***
- ***Speed Sensor***

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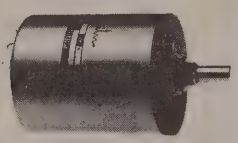
ETI SYSTEMS

Precision Potentiometers & Dials

Multi-Turns

Economical!

Limit Switches!

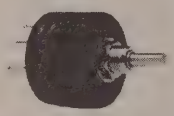


Model	No. of Turns	Resist. Range	Element	Ind. Lin.	Power Rating	Dia.	Features
MW22B	10	100-100K	Wirewnd.	±0.25%	2 W	7/8"	General purpose (many options avail.)
MH22B	10	1K-100K	Hybrid	±0.25%	2 W	7/8"	10 Mil. turns life, 3 & 5 turns available
MW20B	10	100-100K	Wirewnd.	±0.25%	2 W	3/4"	Hi-Rel, 2 Mil. turns life, also 3 & 5 turn
MH20B	10	1K-100K	Hybrid	±0.25%	2 W	3/4"	10 Mil. turns life, 3 & 5 turns available
MR46B	10	0.5-100K	Wirewnd.	±0.25%	5 W	1 13/16"	3-30 turns avail., 2 Mil. turns life
SMR46B	10	0.5-100K	Wirewnd.	±0.25%	5 W	1 13/16"	Internal limit switches, 3-30 turns
MO20B	10	100-100K	Wirewnd.	±0.25%	.75 W	1 1/4"	Fully sealed & oil-filled, hi-rel
MO46B	10	0.5-100K	Wirewnd.	±0.3%	5 W	2 1/2"	Fully sealed & oil-filled, heavy-duty

Single Turns

Economical!

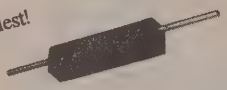
Fully Sealed!



Model	No. of Turns	Resist. Range	Element	Ind. Lin.	Power Rating	Dia.	Features
SP22E	1	1K-10K	Cond.Plas.	±1%	1 W	7/8"	10 Mil. turns life, infinite resolution
SW22E	1	50-10K	Wirewnd.	±.5%	0.5 W	7/8"	General purpose single turn
SP30B	1	1K-10K	Cond.Plas.	±1%	1.5 W	1 1/16"	Hi-Rel, 50 Mil turns life, no stops
SW30B	1	50-20K	Wirewnd.	±.5%	.75 W	1 1/16"	Hi-Rel, metal housing, no stops
SO30B	1	500-10K	Wirewnd.	±1%	.75 W	1 1/4"	Fully sealed, oil-filled, no mech. stops
SOP30B	1	1K-10K	Cond.Plas.	±1%	1 W	1 1/4"	Oil-filled, 10 Mil. turns life, no stops

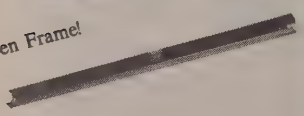
Linear Motions

Smallest!



5 Shaft Styles!

Open Frame!



Model	Stroke Length	Resist. Range	Element	Ind. Lin.	Power Rating	Body Size	Features/Options
LCP8-10	.433"	1K-50K	Cond.Plas.	±2.0%	.2 W	.25"x.31"	Miniature, 20 Mil. strokes life
LCP8-12	.5"	1K-50K	Cond.Plas.	±2.0%	.2 W	.25"x.31"	½" stroke; leadwires for easy hookup
LCP12	.5,1,2,4"	500-20K	Cond.Plas.	±.5-1.5%	.2-1.2 W	.5"x.44"	20 Mil. strokes life, infinite resolution
LW12	.5,1,2,4"	100-50K	Wirewnd.	±.5-1.5%	.25-2 W	.5"x.44"	Spring return & threaded shafts avail.
LCP20	.5,1,2,4"	500-20K	Cond.Plas.	±.5-1.0%	.3-1.25 W	.6"x.8"	20 Mil. strokes life, industrial grade
LW20	.5,1,2,4"	10-20K	Wirewnd.	±.7-2.0%	.5-3 W	.6"x.8"	Precision tolerances, heavy duty unit
LCPL	7.87-39.37"	2K-500K	Cond.Plas.	±5%	2-6 W	.75"x.5"	Open frame, 10 Mil strokes life
LW50	11.8-39.3"	200-200K	Wirewnd.	±.25-.3%	5-10 W	2"x2"	Heavy duty, up to 40" stroke lengths

Joystick Controllers

Series 50JA pictured. Many other features and models available. Contact ETI for more details.

- 2 & 3 dimensional coordinate types
- Operating temp. range: -20°C ~ +65°C
- Vibration: 10 – 55Hz 10G
- Shock: 30G
- Life expectancy: approx. 5,000,000 operations
- Output smoothness: below 0.2%
- Resolution: essentially infinite
- Dielectric strength: 1 min @ 1,000VAC

Turns Counting Dials

All Dials available to fit other shaft sizes - contact ETI for more info.

	Economical	Heavy-duty	1" Size	Easy-to-Read	Digital
Model	MG22	MF46	MB25	DB10	DC27
Size	7/8" Dia.	1-13/16" Dia.	1" Dia.	1" Wide	1-1/16" Dia.
# of Turns	Up to 20	Up to 20	Up to 10	Up to 10	Up to 10
Fits Shaft	1/4"	1/4"	1/4"	1/4"	1/4"
Options	Black or Grey	All Black	W/O Lock	100 turns(DB100)	Pot/Dial Combo

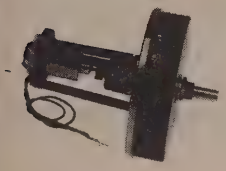
Many other features and models available. Most items in stock, ready for immediate shipment!
Engineering Assistance Available - Non-standards are no problem!

ETI Systems, Inc. 2251 Las Palmas Drive, Carlsbad, CA 92009 Phone: (619) 929-0749 Fax: (619) 929-0748

ETI SYSTEMS

Motorized Potentiometers

DC Motorpots



Model	# of Turns	Input VDC	RPM's	Potent. Element	Other Features
MC20-1	10	6,12	3,5,10,18,35,61	Wirewound	Hi-Rel pot, barrel housing
MC20-2	10	6,12	3,5,10,18,35,61	Wirewound	Dual gang for feedback
MC20-3	10	6,12	3,5,10,18,35,61	Wirewound	Assem. w/turns count. dial
MC4P	1	6,12	3,5,10,18,35,61	Cond. Plastic	Highest Quality, 50 mil. life
M2W	10	12 24	3,5,10,20,25,35,50,65 7,10,15,20,30,45,60	Wirewound	General Purp. Economical
M20	10	12 24	3,5,10,20,25,35,50,65 7,10,15,20,30,45,60	Wirewound	High resolution pot
M20D	10	12 24	3,5,10,20,25,35,50,65 7,10,15,20,30,45,60	Wirewound	M20 with dual gang for feedback
M2WD	10	12 24	3,5,10,20,25,35,50,65 7,10,15,20,30,45,60	Wirewound	M2W with dual gang for feedback
M2E	1	12 24	3,5,10,20,25,35,50,65 7,10,15,20,30,45,60	Wirewound	Single turn, up to 5 gangs
M2P	1	12 24	3,5,10,20,25,35,50,65 7,10,15,20,30,45,60	Cond. Plastic	Single turn up to 5 gangs, long life
M2PS	1	12 24	3,5,10,20,25,35,50,65 7,10,15,20,30,45,60	Cond. Plastic	Same as M2P w/ 5 amp snap action limit switches
M4P	1	12 24	3,5,10,20,25,35,50,65 7,10,15,20,30,45,60	Cond. Plastic	Single turn, 50 million turn life pot, high quality
M4WFS	10	12 24	3,5,10,20,25,35,50,65 7,10,15,20,30,45,60	Wirewound	High rel. pot w/ 5 amp limit switches, dial & cable
M4W	10	12 24	3,5,10,20,25,35,50,65 7,10,15,20,30,45,60	Wirewound	High resolution pot
M4WS	10	12 24	3,5,10,20,25,35,50,65 7,10,15,20,30,45,60	Wirewound	High rel. pot w/ 5 amp limit switches and cable
M4WF	10	12 24	3,5,10,20,25,35,50,65 7,10,15,20,30,45,60	Wirewound	High resolution pot with dial

Features of ETI Motorpots

- Manually adjustable
- Reversible motors
- Slip clutch
- Dynamic braking avail.
- Analog positioning
- Small, compact size
- Driver circuitry avail.

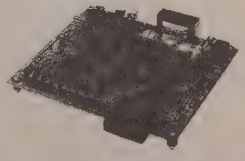
Options

- 1-30 turn pots
- Hybrid elements
- Limit switches
- Multi-ganged pots
- Non-std. RPM's
- Non-std. Res. Values
- AC input available, call factory

Not all options available on all models

Motorpot Driver Circuitry

Analog Proportional output
3 Input Modes to choose from!



Input Signal ..... 0-5 or 0-10 VDC (Model 6501)
4 to 20 mA (Model 6502)
16 bit data (Model 6503)
Power Supply ..... 110/120 VAC
Accuracy ..... Avg 0.1% to 0.2%
Resistance range (ohms) . 100-100KΩ
Output speeds available .. 3, 5, 10, 18, 35
Motorpot Power Rating .. 3 Watts

Series 6500 is a self-contained high performance motorpot driver system with typically better than 0.5% accuracy. Available with voltage, current or 16 bit digital input modes.

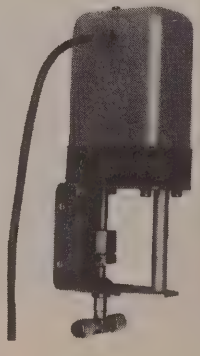
The dual gang pot provides isolated variable output and a feedback pot to null the servo system at the desired position. If specified, the driver allows feedback from your process to null the servo system. The feedback provides an analog position when your circuit is running and enables the system to resume at the correct position in the event of a power outage by use of an inhibit circuit.

Other Motorized Components:

- Motorized Rheostats - 25, 50 and 100 Watts
- Motorized Variable Transformers - 10C, 2¼ amps
- Non-Standard Motorpots and Driver Circuitry

New Advanced Design!

Valve Actuator Electric



New Design Standards:
- Dynamic Braking (prevents coasting)
- Limit Switches
- Pressure shut-off device (protects valve seat)

Options:
- Feedback potentiometer
- Cable connectors
- Non-standard R.P.M's
- Actuator without valve
- 6 VDC motor
- Special cable
- Other o'ring materials
- See us for heavier VA150 or VA400 models

Output torque..... 25 oz. in. (Others available)
RPM ..... Factory Quote
Motor Voltage ..... 12 to 24 VDC
Valve Type ..... Specified or provided by user

Control Circuitry Available. See Series 6500

Many other features and models available. Most items in stock, ready for immediate shipment!
Engineering Assistance Available - Non-standards are no problem!

ETI Systems, Inc. 2251 Las Palmas Drive, Carlsbad, CA 92009 Phone: (619) 929-0749 Fax: (619) 929-0748

MINIGLOSSARY ENCAPSULATION

MATERIALS/HANDLING

Catalyst: A substance which changes the *rate* of chemical reaction. Very small quantities can cause fast change.

Conformal coating Sprayed or dipped. A thin conformal jacket which protects an assembly from moisture or other degrading environments.

Curing agent: See catalyst.

Hardener: See catalyst.

Hermetic: A permanent gas-tight seal.

RTV: Room Temperature Vulcanizing. Associated with silicone rubber sealants which vulcanize at room temperature.

Thermoplastic: Plastic materials which can be made to flow *repeatedly* with the application of heat.

Thermosetting: Plastics which once cured cannot be made to flow again.

Thixotropy: The property of a coating compound which has low viscosity when agitated, but which thickens when the agitation ceases.

Viscosity: Measured in units of *poise* or *centipoise*. The property of a liquid which resists internal flow. Low viscosity equates with thin and vice-versa.

PROCESSING

Casting: Parts or assemblies are placed in a mold. Encapsulating material is added and cured. Part is then removed from the mold.

Dip coating: Part or assembly is dipped into the encapsulating material. Final thickness is determined by number of dips, viscosity, rate of withdrawal, and temperature.

Embedding: Wherein an encapsulant substantially fills all voids in and about an assembly.

Impregnation: A process of encapsulation involving evacuating all air and then allowing the encapsulating material to flow in and fill all voids.

Molding: Similar to casting except this process usually implies multicavity molds and costly machines.

Potting: Wherein the part or assembly is immersed in an encapsulating material contained in a shell which becomes a permanent outer surface after curing.

DIELECTRIC

Arc resistance: An encapsulant's resistance to the formation of a conductive path or track. Measured in time.

Breakdown voltage: The voltage at which an encapsulant fails electrically.

Capacitance: The property of conductors and dielectrics which allows the storage of an electrical charge when the voltage is applied.

Corona: A luminous discharge of electricity due to air ionization when a certain voltage is reached. Can be internal or external. The formation of ozone can cause rapid deterioration of certain materials.

Dielectric: Insulator (Nonconductor.)

Dielectric constant: The property of a material that determines its ability to store electrostatic energy.

Dielectric strength: The ratio of dielectric breakdown to the thickness of insulating material.

Dissipation factor: The ratio of a dielectric material's energy losses.

Flashover: Point at which an electric discharge occurs around an edge or across a surface. Can result in a carbon track and permanent degradation.

Insulation resistance: (IR) An insulating material's total DC leakage.

Surface resistivity: The resistance of the surface of an insulating material to the flow of direct current.

Voltage endurance: Sometimes called corona resistance. The ability of a material to withstand the application of sustained high voltage.

Volume resistivity: The resistance of a material to direct current flow as a measure of volume. Expressed as ohm-centimeters.

ISL PRODUCTS INTERNATIONAL LTD.

800-626-6116

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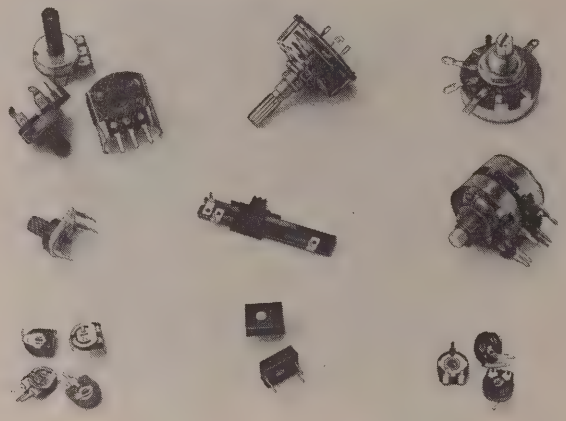
(516) 937-3475 FAX (516) 937-3840

CAPACITORS / SILICON DIODES / CUSTOM CABLE ASSEMBLIES / LEDS / CUSTOM HYBRID CIRCUITS / TRANSFORMERS / ADAPTORS AND POWER SUPPLIES

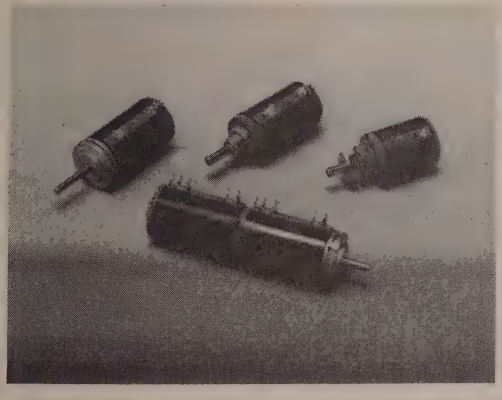
COMMON POTENTIOMETERS

- **Slide Variable Resistors**
  Non Case Slide Pots
  Low Profile Slide Pots
- **Trimmer Potentiometers**
  Carbon Types
  Cermet Types
  SMD Cermet
- **Rotary Variable Potentiometers**
  9mm-17mm
  Insulated Shaft
  Metal Shaft
  Gang Configuration Available
- **Weatherproof Carbon Composition Potentiometers**
  .5w-2w

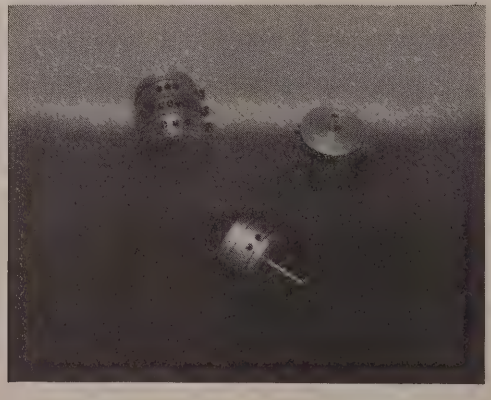


- **Wire Wound Potentiometer** 1W-5W
- **Thumbwheel Pots**
- **Potentiometer Blacks**

PRECISION POTENTIOMETERS



Multiturn Wirewound Pot



Precision Single Twin WW Pot

- **Precision Single Turn Wirewound Pots** .5W-5W
- **Multi-turn Wirewound Pots** 1W-5W
- **Sine-Cosine Wirewound Potentiometer**
- **Linear Motion Wirewound Potentiometer**

SEE OUR PAGES IN SECTIONS 2100, 1300, 5600 & 6000

JDK Controls, Inc.

- Best performance
- Smallest package
- Reduced weight
- Best value

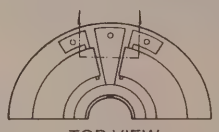
The JDK Co-Molded Conductive Plastic Process

JDK manufactures one type of potentiometer element—co-molded conductive plastic—because, to the designer and builder of systems in critical applications, there is no justification to use less than the best. In the JDK process, the termination and resistance materials are simultaneously molded with the plastic substrate. The result is a flush circuit with a very hard, smooth surface which, when combined with JDK's multifinger precious metal contacts, promotes ultra long life, as well as excellent electrical performance in all environments. The superiority of the JDK flush circuit over the raised circuit elements (i.e., conductive plastic film, screened conductive plastic, cermet, hybrid, and wirewound) is most evident in its long-term consistent performance and reliability.

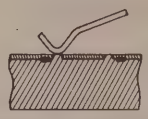
JDK Precision Co-Molded Conductive Plastic Potentiometer Elements And Rotor/Wiper Assemblies

With customer/supplier relationships growing closer and as concurrent engineering becomes a way of life, it is becoming more and more feasible to reduce system packaging costs by designing in JDK Co-molded Conductive Plastic Potentiometer Element and Mating Wiper assemblies and Shaft Insulators. If you are designing for a new application, please consider the reduced size, space, weight and costs associated with JDK Elements/Wipers/Shaft insulators. Listed below are our five standard sizes. However, we offer many custom options ranging from different mechanical shapes to electrical options such as special angles, resistance values, linearities, etc. Please don't hesitate to call or Fax with questions.

JDK CO-MOLDED FLUSH CIRCUIT



TOP VIEW



SIDE VIEW CROSS SECTION

VS.

TYPICAL RAISED CIRCUITS

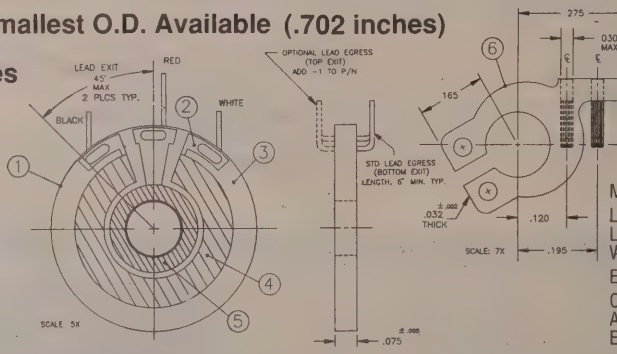
TOP VIEW

SIDE VIEW CROSS SECTION

Model 6909 Series—Smallest O.D. Available (.702 inches)

Features—6909/6911 Series

- Mates with .125 Dia. Shaft
- Working Height .187
- Top or bottom wire exit
- Reduces packaging cost
- Reduces system weight
- Special electrical angles, resistance values, linearities available
- No solder on element
- Low fractional torque



SPECIFICATIONS

ELECTRICAL

Resistance Range: See Tabulation Table Below
Standard Electrical Angle: 320°
Standard Independent Linearity: ±0.5%
Output Smoothness: 0.1% Max
Resistance Temp. Coefficient: ±400 PPM/°C Max
Power Rating At 70°C (watts): 1.0

TABULATION	
Resistance	Part No
1K	6909-1000
2K	6909-1001
5K	6909-1002
10K	6909-1003
20K	6909-1004

1 ELEMENT ASSY.
(6909-XXXX-70)
2 TERMINATION PAD
O.D.: .690 I.D.: .590
3 ELEMENT
O.D.: .702 ± .002
I.D.: .186 ± .002
4 RESISTANCE TRACK
O.D.: .540 I.D.: .340
5 SLIP RING TRACK
O.D.: .300 I.D.: .195
6 ROTOR ASSY.
(6909-0000-60)
7 SHAFT INSULATOR
(7040-0001-15)

MECHANICAL

Lead Wire: 30 AWG
Lead Wire Length: 6 Inches Min. Typical
Weight: (Element Only, Without Wire): .75 grams

ENVIRONMENTAL

Operating Temperature: -65°C To +125°C
All Other Electrical, Mechanical, And Environmental Per MIL-R-39023

MATERIALS

Element: Co-Molded Conductive Plastic, .075 ± .005 Thick
Rotor: Beryllium Copper, .032 ± .002 Thick
Contacts: Multi-Finger Paliney 7
Insulator: Orion Resdel Epoxy Resin
Wires: Teflon Insul., Stranded Ag Coated Cu Cond.

Model 6911 Series—Longer Angle Than 6909

SPECIFICATIONS

ELECTRICAL

Resistance Range: See Tabulation Table Below
Standard Electrical Angle: 340°
Standard Independent Linearity: ±0.5%
Output Smoothness: 0.1% Max
Resistance Temp. Coefficient: ±400 PPM/°C Max
Power Rating At 70°C (watts): 1.25

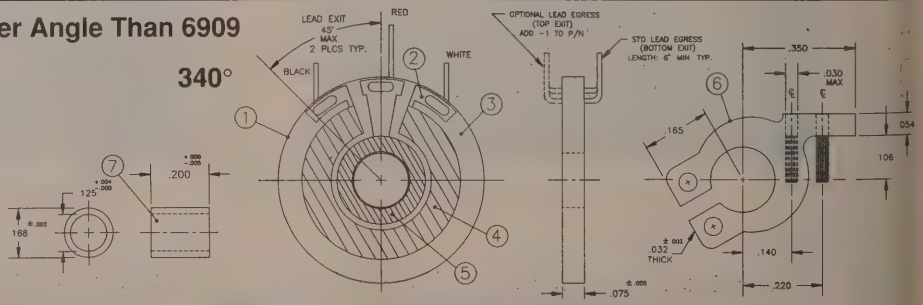
MECHANICAL

Lead Wire: 30 AWG
Lead Wire Length: 6 Inches Min. Typical
Weight: (Element Only, Without Wire): 1.25g

ENVIRONMENTAL

Operating Temperature: -65°C To +125°C
All Other Electrical, Mechanical, And Environmental Per MIL-R-39023

340°



TABULATION	
Resistance	Part No.
1K	6911-1000
2K	6911-1001
5K	6911-1002
10K	6911-1003
20K	6911-1004

1 ELEMENT ASSY.
(6911-XXXX-70)
2 TERMINATION PAD
O.D.: .850 I.D.: .750
3 ELEMENT
O.D.: .888 ± .002
I.D.: .186 ± .002
4 RESISTANCE TRACK
O.D.: .604 I.D.: .392
5 SLIP RING TRACK
O.D.: .332 I.D.: .229
6 ROTOR ASSY.
(6911-0000-60)
7 SHAFT INSULATOR
(7040-0001-15)

MATERIALS

Element: Co-Molded Conductive Plastic, .075 ± .005 Thick
Rotor: Beryllium Copper, .032 ± .002 Thick
Contacts: Multi-Finger Paliney 7
Insulator: Orion Resdel Epoxy Resin
Wires: Teflon Insul., Stranded Ag Coated Cu Cond.

JDK CONTROLS, INC.
WHEN POTENTIOMETER PERFORMANCE IS CRITICAL
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JDK Controls, Inc.

THE JDK CO-MOLDED CONDUCTIVE PLASTIC POTENTIOMETERS ELEMENTS & ROTOR/WIPER ASSEMBLIES

Model 6915 Series—Best Value For Larger Applications

Features—6915/6918/6920

- Same as 6909/6911 except mates with .250 Dia. Shaft

SPECIFICATIONS

ELECTRICAL

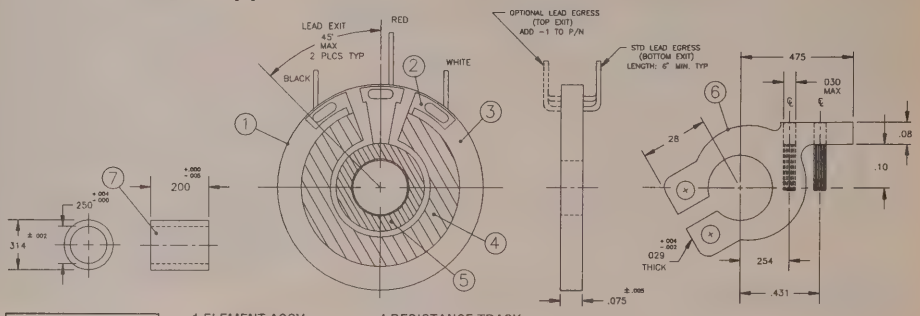
Resistance Range: See Tabulation Table Below
Standard Electrical Angle: 340°
Standard Independent Linearity: ±0.5%
Output Smoothness: 0.1% Max
Resistance Temp. Coefficient: ±400 PPM/°C Max
Power Rating At 70°C (watts): .75

MECHANICAL

Lead Wire: 30 AWG
Lead Wire Length: 6 Inches Min. Typical
Weight: (Element Only, Without Wire): 2.26g

ENVIRONMENTAL

Operating Temperature: -65°C To +125°C
All Other Electrical, Mechanical, And Environmental Per MIL-R-39023



TABULATION	
Resistance	Part No.
1K	6915-1000
2K	6915-1001
5K	6915-1002
10K	6915-1003
20K	6915-1004

1 ELEMENT ASSY. (6915-XXXX-70)
2 TERMINATION PAD O.D.: 1.202 I.D.: 1.102
3 ELEMENT O.D.: 1.252 ± .002 I.D.: .435 ± .002
4 RESISTANCE TRACK O.D.: 1.052 I.D.: .812
5 SLIP RING TRACK O.D.: .570 I.D.: .445
6 ROTOR ASSY. (6915-0000-60)
7 SHAFT INSULATOR (7040-0002-20)

MATERIALS

Element: Co-Molded Conductive Plastic, .075 ± .005 Thick
Rotor: Beryllium Copper, .029 +.004 −.002 Thick
Contacts: Multi-Finger Paliney 7
Insulator: Orion Resdel Epoxy Resin
Wires: Teflon Insul., Stranded Ag Coated Cu Cond.

Model 6918 Series—Longer Angle Than 6915

SPECIFICATIONS

350°

ELECTRICAL

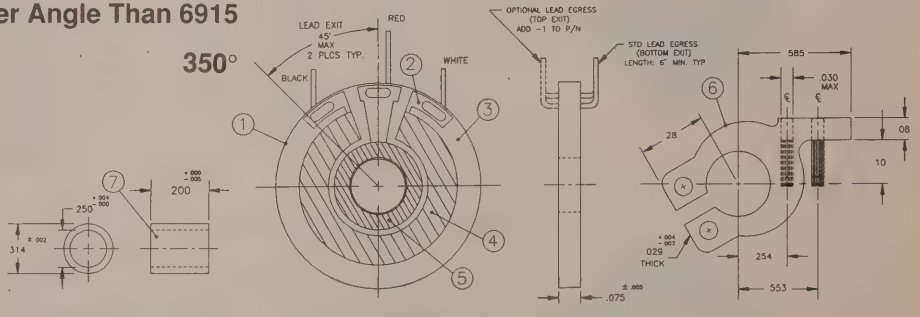
Resistance Range: See Tabulation Table Below
Standard Electrical Angle: 350°
Standard Independent Linearity: ±0.5%
Output Smoothness: 0.1% Max
Resistance Temp. Coefficient: ±400 PPM/°C Max
Power Rating At 70°C (watts): 1.0

MECHANICAL

Lead Wire: 30 AWG
Lead Wire Length: 6 Inches Min. Typical
Weight: (Element Only, Without Wire): 3.65g

ENVIRONMENTAL

Operating Temperature: -65°C To +125°C
All Other Electrical, Mechanical, And Environmental Per MIL-R-39023



TABULATION	
Resistance	Part No
1K	6918-1000
2K	6918-1001
5K	6918-1002
10K	6918-1003
20K	6918-1004

1 ELEMENT ASSY. (6929-XXXX-70)
2 TERMINATION PAD O.D.: 1.507 I.D.: 1.407
3 ELEMENT O.D.: 1.557 ± .002 I.D.: .435 ± .002
4 RESISTANCE TRACK O.D.: 1.297 I.D.: 1.057
5 SLIP RING TRACK O.D.: .570 I.D.: .445
6 ROTOR ASSY. (6918-0000-60)
7 SHAFT INSULATOR (7040-0002-20)

MATERIALS

Element: Co-Molded Conductive Plastic, .075 ± .005 Thick
Rotor: Beryllium Copper, .029 +.004 −.002 Thick
Contacts: Multi-Finger Paliney 7
Insulator: Orion Resdel Epoxy Resin
Wires: Teflon Insul., Stranded Ag Coated Cu Cond.

Model 6920 Series—Largest O.D. Available (1.805 inches)

SPECIFICATIONS

ELECTRICAL

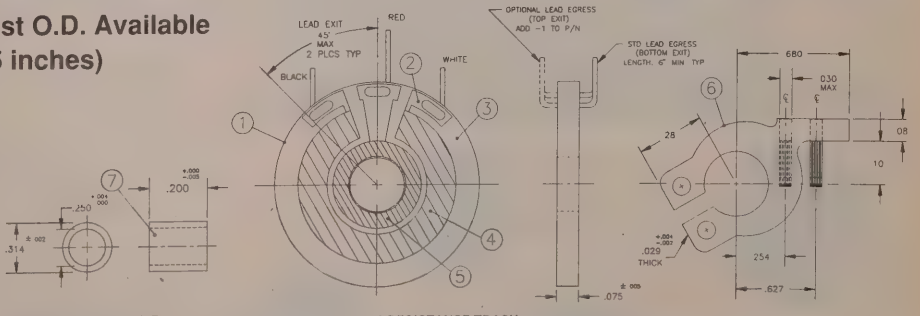
Resistance Range: See Tabulation Table Below
Standard Electrical Angle: 350°
Standard Independent Linearity: ±0.5%
Output Smoothness: 0.1% Max
Resistance Temp. Coefficient: ±400 PPM/°C Max
Power Rating At 70°C (watts): 1.0

MECHANICAL

Lead Wire: 30 AWG
Lead Wire Length: 6 Inches Min. Typical
Weight: (Element Only, Without Wire): 5.20g

ENVIRONMENTAL

Operating Temperature: -65°C To +125°C
All Other Electrical, Mechanical, And Environmental Per MIL-R-39023



TABULATION	
Resistance	Part No
1K	6920-1000
2K	6920-1001
5K	6920-1002
10K	6920-1003
20K	6920-1004

1 ELEMENT ASSY. (6929-XXXX-70)
2 TERMINATION PAD O.D.: 1.755 I.D.: 1.655
3 ELEMENT O.D.: 1.805 ± .002 I.D.: .435 ± .002
4 RESISTANCE TRACK O.D.: 1.445 I.D.: 1.205
5 SLIP RING TRACK O.D.: .570 I.D.: .445
6 ROTOR ASSY. (6929-0000-60)
7 SHAFT INSULATOR (7040-0002-20)

MATERIALS

Element: Co-Molded Conductive Plastic, .075 ± .005 Thick
Rotor: Beryllium Copper, .029 +.004 −.002 Thick
Contacts: Multi-Finger Paliney 7
Insulator: Orion Resdel Epoxy Resin
Wires: Teflon Insul., Stranded Ag Coated Cu Cond.

JDK CONTROLS, INC.
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JDKontrols, Inc.

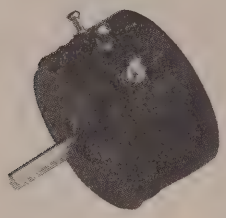
PRECISION CO-MOLDED CONDUCTIVE PLASTIC POTENTIOMETERS & ASSEMBLIES

THE JDK DIFFERENCE

Since the JDK process and systems are foremost in the industry, we are able to offer the following features:

- ULTRA-LONG ROTATIONAL LIFE — 50 million cycles minimum for most applications of 6000 & 6200 models
- STATE-OF-THE-ART OUTPUT SMOOTHNESS — always under 0.05% (standard angles)
- NO INTERNAL SOLDER CONNECTIONS — conductive epoxy and welded connections used for greater reliability
- LOW TORQUE — less than 0.1 in oz. available in most single cup 6000 & 6200 models
- 18 MONTH WARRANTY — standard for most applications of 6000 & 6200 models
- OUTSTANDING VALUE — best "price/performance" ratio in the industry
- ALL UNITS DESIGNED, MANUFACTURED, AND TESTED IN ACCORDANCE WITH MIL-R-39023

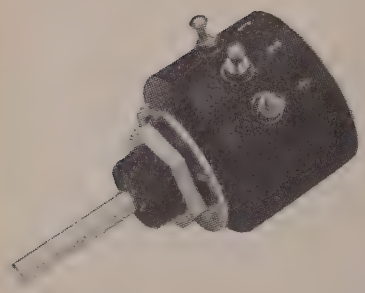
STANDARD PACKAGED POTENTIOMETERS



SERVO MOUNT MODELS

MODEL #	OUTSIDE DIAMETER INCHES	SHAFT DIAMETER INCHES	SHAFT LENGTH	BODY LENGTH MAXIMUM	RESISTANCE RANGE	ELECTRICAL ANGLE	INDEPENDENT LINEARITY	OUTPUT SMOOTHNESS
6005	.500	.1249	.500	.550	1K-50K	325°	1.0%	<0.05%
6008	.750	.1249	.500	.625	1K-50K	340°	.5%	<0.05%
6009	.875	.1249	.500	.625	1K-50K	340°	.5%	<0.05%
6011	1.062	.1249	.500	.625	1K-50K	340°	.5%	<0.05%
6015	1.437	.2498	.625	.750	1K-50K	340°	.5%	<0.05%
6018	1.750	.2498	.625	.750	1K-50K	350°	.5%	<0.05%
6020	2.000	.2498	.625	.750	1K-50K	350°	.5%	<0.05%

Specials available

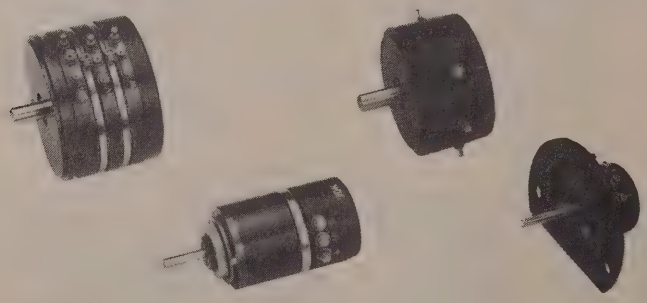


BUSHING MOUNT MODELS

MODEL #	OUTSIDE DIAMETER INCHES	SHAFT DIAMETER INCHES	SHAFT LENGTH	BODY LENGTH MAXIMUM	RESISTANCE RANGE	ELECTRICAL ANGLE	INDEPENDENT LINEARITY	OUTPUT SMOOTHNESS
6205	.500	.1249	.687	.550	1K-50K	325°	1.0%	<0.05%
6208	.750	.1249	.687	.625	1K-50K	340°	.5%	<0.05%
6209	.875	.1249	.687	.625	1K-50K	340°	.5%	<0.05%
6211	1.062	.1249	.687	.625	1K-50K	340°	.5%	<0.05%
6215	1.437	.2498	.875	.750	1K-50K	340°	.5%	<0.05%
6218	1.750	.2498	.875	.750	1K-50K	350°	.5%	<0.05%
6220	2.000	.2498	.875	.750	1K-50K	350°	.5%	<0.05%

Specials available

CUSTOM REQUIREMENTS AND ASSEMBLIES



JDK specializes in custom electrical and/or mechanical requirements for potentiometer in the sizes above as well as the following:

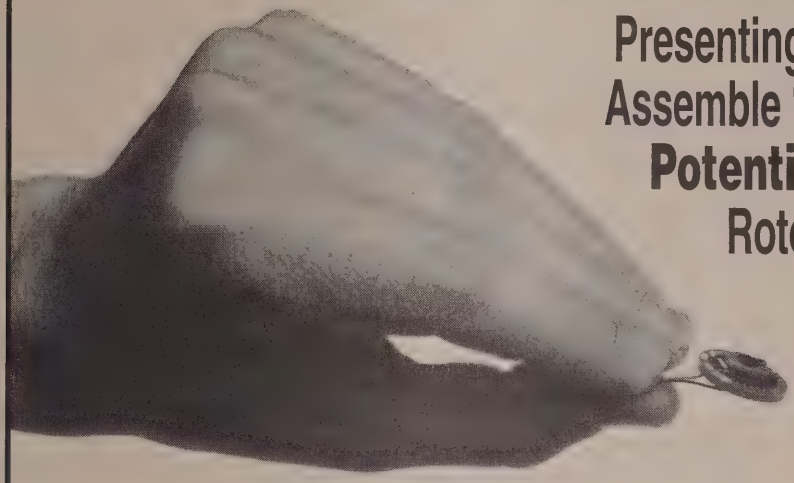
Next Assemblies:

JDK will add to its potentiometers—Flanges, extra cups, connectors, multiple taps, flying leads, special shafts

Motor and/or Gearheads in 16 or 22mm diameters

JDK CONTROLS, INC.
WHEN POTENTIOMETER PERFORMANCE IS CRITICAL
424 Crown Point Circle, Grass Valley, California 95945 • Tel. (916) 273-4608 • Fax (916) 273-0769

Tiny-Tough-Reliable-Low Cost



Presenting: The JDK Easy To Assemble "DO IT YOURSELF" **Potentiometer** Element Rotor/Wiper Kits

Actual Size
.187" Thick

JDK Controls new "DO IT YOURSELF" Potentiometer Element and Rotor Wiper Assemblies provide 100,000,000 revolutions minimum of the smoothest, infinite resolution precision position sensing money can buy. No shaft housings or bearings are needed so they take up only about half the space of standard size units. By reducing this redundant packaging, you reduce your costs significantly. Just slip it over the shaft of your motor, lever, actuator etc.

JDK ELEMENT AND ROTOR/WIPER ASSEMBLIES are the best way for you to increase system reliability while reducing system space, weight and packaging costs, all at the same time.

HOW'S THIS FOR RELIABILITY?

Typical- Run one of our assemblies continuously at 4 RPM, 24 hours per day, 365 days per year and it will last for **50 years minimum.**

STANDARD OR *CUSTOM*-WHAT DO YOU NEED?

JDK offers its "DO IT YOURSELF" assemblies in kit form. Some standard sizes are shown on pages 2088 and 2089 of this EEM volume. In addition, we can customize kits with virtually any diameter, resistance, linearity, thickness or electrical angle you need.

WHAT ABOUT LESS OPERATING SPACE?

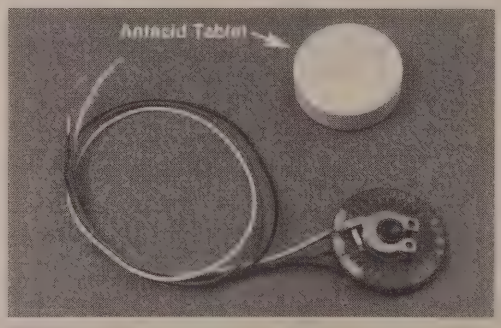
JDK "DO IT YOURSELF" element and rotor/wiper assemblies take up only .187" of working height, about as much as an antacid tablet (throw your antacids away).

EASY TO ASSEMBLE

JDK "DO IT YOURSELF" kits are individually packaged including element, shaft insulator, rotor assembly and assembly instructions. They take only a few minutes to assemble. A spreader tool for attaching the rotor assembly can be found in most hardware stores. However, JDK Offers one as an option. Please specify with your order.

HOW ABOUT LOWER COSTS?

With no housings, bearings or other packaging hardware required, you save at least half over the cost of standard units.



CALL, FAX OR WRITE FOR COMPLETE DETAILS & SAMPLES

Phone (916) 273-4608 FAX (916) 273-0769

When Potentiometer performance is *Critical*

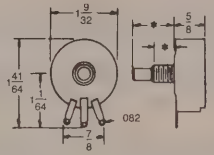
JDKontrols, Inc.

JDK Controls
424 Crown Pt. Circle, Grass Valley, CA 95945
(916) 273-4608 FAX (916) 273-0769

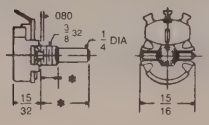
MALLORY *custom wirewound controls*

WIREWOUND POTENTIOMETERS

STYLE R AND QR

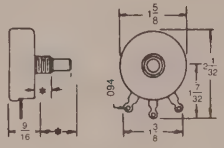


STYLE LW

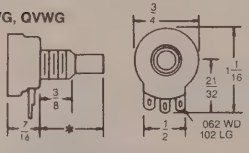


*AS REQUIRED

STYLE M, QM, MG, QMG



STYLE VW, QVW, VWG, QVWG



STYLE SC, QSC, SCG, QSCG
As Above But Smaller Shaft & Bushing Diameter

OTHER WIREWOUND POTENTIOMETER FEATURES AVAILABLE ON SELECTED PRODUCT TYPES:
- — nonlinear resistance tapers,
- — ±5% resistance tolerance,
- — multisection units,
- — twist-tab mounting.

MALLORY MANUFACTURES A COMPLETE LINE OF "T", "L", AND "LL" PAD ATTENUATORS.

In addition to the many types of wire-wound controls carried as stock items, Mallory can supply custom made units tailored to your exact requirements. Specifying Mallory for your custom made control will assure exacting quality for either your prototype or production use.

POTENTIOMETER LINE SWITCHES AVAILABLE

Grade Name	Action	Type	Size	Rating	Available On Control	Approval
OAC-1	Rotary	SPST	15/16"	6 A 125VAC 3 A 125VDC	M, R	UL & CSA
OAC-2	Rotary	DPST	15/16"	6 A 125VAC 6 A 125VDC (3 amps/circuit)	M, R	UL & CSA
OAC-3	Rotary	2XSPST	15/16"	3 amps 125VAC	M, R	UL & CSA
OAC-SPC	Rotary	SPST	15/16"	15A 10VDC	M, R	N.R.
OAC-4	Rotary	SPST	15/16"	5 amps 125VAC	M, R	UL & CSA
OAC-8 Auto-SPL	Rotary	SPST	15/16"	20 amps 15VDC	M, R	Automotive
OAC-5	Rotary	SPST	15/16"	5 amps 125VAC	M, R	UL & CSA
OAC-8	Rotary	SPST	15/16"	5 amps 125VAC	M, R	CSA
OAC-8 AUTO	Rotary	SPST	15/16"	15 amps 10V	M, R	UL & CSA
OAC-6	Rotary	SPST	15/16"	5 amps 125VAC		UL & CSA
OAC-8 AUTO	Rotary	SPST	15/16"	15 amps 20VDC 7.5 amps 10VDC	M, R	
OAC-9	Rotary	SPDT	15/16"	5 amps 125VAC	M, R	CSA
OPP-3	Push-Pull	SPST	15/16"	5 amps 125VAC 1 amp 125VDC	LW	UL & CSA
OPP-5	Push-Return	Momentary SPST	15/16"	1 amp 125VAC	LW	UL
PPSI	Push-Pull Side Mount	DPST (OAC-2) SPDT (OAC-3)				
PPS2	Push-Push Side Mount	DPST (OAC-2) SPDT (OAC-3)				
Dual Switches any pr. of OAC		Side Mounted Rotary switches may be used.				
MOAC-1 MOAC-3	Rotary Rotary	SPST SPDT	1/2" 1/2"	3 amps 125VAC 2 amps 125VAC	NO NO	UL UL

Most of the above switches are available separately for mounting on the customer's control, either by welding or tab mounting.

SPECIFICATION TABLE

						Degrees Of Rotation			Resistance ±10%		Locating Lug Radius (3 and/or 9 o'clock)
Watts	Style	Diameter	Depth	Standard Bushing	Standard Shaft Diameter	Mechanical	Electrical W/Switch	Electrical W/O Switch	Min. OHMS	Max. OHMS	Radius
3	R	1 9/32	5/8	3/8-32	1/4	297	260	290	1	50K	17/32
4	M	1 5/8	9/16	3/8-32	1/4	294	245	275	1/2	100K	17/32
5	SC	3/4	7/16	1/4-32	1/8	305	—	275	1	25K	15/64
5	VW	3/4	7/16	3/8-32	1/4	305	—	275	1	25K	17/32
5	LW	15/16	15/32	3/8-32	1/4	300	—	280	3	25K	7/16
10	SCT	3/4	7/16	1/4-32	1/8	305	—	275	1	25K	15/64
10	VWG	3/4	7/16	3/8-32	1/4	305	—	275	1	24K	17/32
12 1/2	MG	1 5/8	9/16	3/8-32	1/4	294	245	275	1/2	100K	17/32

Style M, MG, R, SC, SCG, VW and VWG also available with "Q" prefix in Military Construction.

Standard Breakdown Voltage test 900 V RMS

The above data is only a guide. This listing of controls does not cover all possible configurations tooled. Please consult Mallory Components Engineering for further details and availability of deviations.

MALLORY CONTROLS, A DIVISION OF EMERSON ELECTRIC CANADA LTD.
P.O. Box 210, 1079 Parkinson Road, Woodstock, Ontario, N4S 7W8, Canada
Phone: (519) 539-4891, Telex: 23:M0Y001, Fax: (519) 539-6684

MALLORY *custom wirewound controls*

WIREWOUND POTENTIOMETERS, ATTENUATORS & SWITCHES

WIREWOUND POTENTIOMETERS

Watts	Style	Diameter	Depth	Standard Bushing	Shaft Diameter	Mechanical Rotation	Resistance Value
3	R	19/32	5/8	3/8-32	1/4	297°	1- 50K
4	M	1 5/8	9/16	3/8-32	1/4	294°	1/2-100K
5	SC	3/4	7/16	1/4-32	1/8	305°	1- 25K
5	VW	3/4	7/16	3/8-32	1/4	305°	1- 25K
5	LW	15/16	15/32	3/8-32	1/4	300°	3- 25K
10	SCG	3/4	7/16	1/4-32	1/8	305°	1- 25K
10	VWG	3/4	7/16	3/8-32	1/4	305°	1- 25K
12.5	MG	1 5/8	9/16	3/8-32	1/4	294°	1/2-100K

ATTENTUATORS

Attenuators available: 10 Watts RR, RL and RT types
15 Watts L, LL and T types
50 Watts MGL, MGLL and MGT types

POTENTIOMETER LINE SWITCHES

Action	Type	Grade Name	Rating	Available on Control
Rotary	SPST	OAC-1	6A 125VAC 3A 125VDC	M, R
		OAC-8	5A 125VAC	M, R
		HD	6A 125VAC (1450W)	M, R
		OAC SPEC.	16A 125VAC (Dimmer)	M, R
	SPDT	OAC-3	3A 125VAC	M, R
		OAC AUTO	15A 10VDC 7.5A 20VDC	M, R
		OAC-9	5A 125VAC	M, R
	DPST	OAC-2	6A 125VAC 2A 125VDC	M, R
Push-Pull	SPST	OPP-2	3A 125VAC 0.5A 125VDC	LW
		OPP-3	5A 125VAC 1A 125VDC	LW
		OPP-4	6A 125VAC 1A 250VDC	LW
Momentary	SPST	OPP-5	1A 125VAC	LW

ROTARY SELECTOR SWITCHES

Circuits	Positions	Terminals	Type
1	2 to 12	2 to 12	Shorting and Non-Shorting
1	2 to 6	4 to 12	
1	2 to 4	6 to 12	
1	2 to 3	8 to 12	

These products are also available with "Q" prefix in Military Construction. In addition to standard wirewound controls, Mallory can supply custom made units tailored to your exact requirements.
The above data is only a guide. This listing of controls does not cover all possible configurations tooled. Please, consult Mallory Controls Engineering for further details and availability of deviations, also for a catalog.

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P.O. Box 210, 1079 Parkinson Road, Woodstock, Ontario, N4S 7W8, Canada
Phone: (519) 539-4891, Telex: 23:M0Y001, Fax: (519) 539-6684

MINIGLOSSARY POWER SUPPLIES

Ambient reference: Refers to the temperature of the still air surrounding the power supply

Case reference: One of the specs that make up the nominal rating. The temperature of the case with the temperature of the surrounding still air at a stated temperature (usually 25°C).

Crowbar circuit: Protects the load. A protective circuit that applies a short circuit across the output immediately upon overload. (See overvoltage).

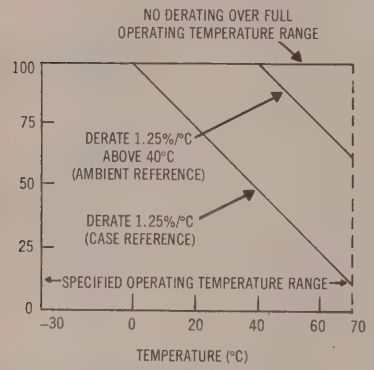


Fig. 1. Power output derating can be referred to ambient or case.

Derating: The degree output is reduced as temperature increases. Usually referenced to ambient case temperature and shown on a graph.

Efficiency: Ratio of the output power to the required input power. Usually expressed as a percentage given nominal environmental temperature.

EMI/RFI: Interference electronic circuitry caused by energy from electromechanical or radio frequency power supplies.

Foldback: Built-in protective circuits that automatically reduce the output voltage and/or current to very low levels in the event of an overload.

Holdover (Holdup): The interval that rated output will continue after input ceases. Usually milliseconds.

Input reflected current: The peak-to-peak alternating current generated by switching transients in DC/DC converters. Should not exceed 1%.

Inrush current limiting: Built-in circuits that monitor high currents through the rectifiers to the capacitors at turn ON. Circuit is usually inhibited as capacitors attain full charge.

Nominal rating: The spec value of the supply at stated conditions of input, output, and temperature.

Overshoot: A transient voltage change occurring during turn ON or OFF or during an abrupt load change.

Overvoltage (Overload) protection: Built-in circuits that protect the load or the supply by shutting it down or providing foldback.

Recovery: The time interval between the termination of an overload and restoration to normal operations.

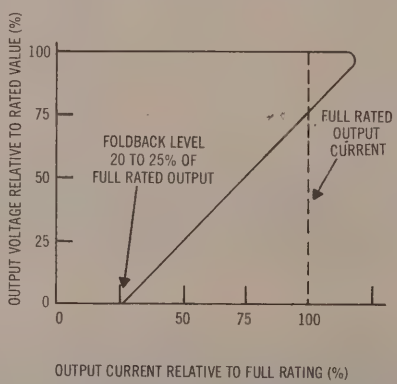


Fig. 2. Current foldback limiting self-resets with removal of fault.

Response: The time interval between a stated step change in input voltage or load current and return of output to normal operating conditions.

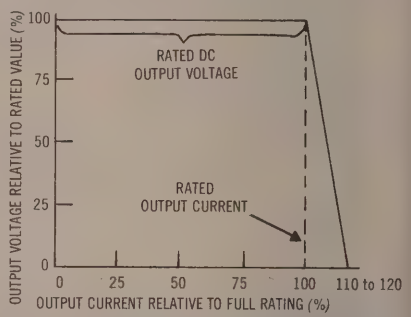


Fig. 3. Current limiting restrictions output current to a valve somewhat greater than full rated output; it resets when fault is removed.

Sensing: Regulation techniques that monitor output voltage and/or current. *Local sensing* refers to the output terminals. *Remote sensing* allows a feedback from the load circuit to the power supply.

Soft start: Allows the supply to start from zero current and/or voltage over a stated period of time during start up to prevent voltage overshoots and current imbalances.

Switchers: Power supplies using switching techniques to achieve high efficiency regulation. These techniques can have attendant EMI/RFI problems.

Tracking: The maintaining of fixed ratios between multiple outlets despite variations in line, load or temperature. Particularly important in supplies with symetrical (+)(−) outputs.

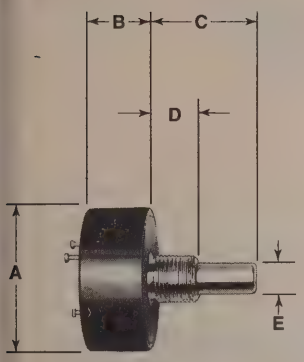
Transient protection: Circuitry designed to protect the supply from high amplitude line transients. Generally expressed in terms of peak voltage and maximum transient time duration.

MAUREY
INSTRUMENT CORP.

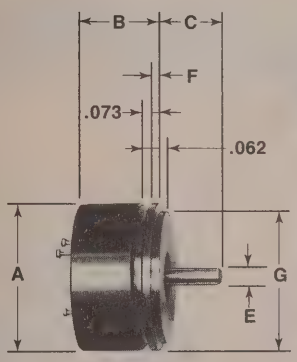
PRECISION CONDUCTIVE-PLASTIC SINGLE TURN POTENTIOMETERS

PST

These conductive plastic potentiometers have been specially designed for severe environmental conditions in mill-factory operations as well as in critical military applications. The molded, raised track maintains itself free from contamination of foreign particles, oil or water. The high gram pressure of the graphite composition contact on the raised track gives excellent resistance to contact bounce under punishing vibration or shock, as well as an exceptional rotational life. Such units are particularly suited for applications where trouble-free maintenance is required.



BUSHING



SERVO

PART NO.	TYPE	A	B	C	D	E	F	G
50-P508	SERVO	.50	.56	.50	—	.125	.062	.437
87-P82	BUSHING	.87	.53	.87	.38	.250	—	—
87-P83	SERVO	.87	.59	.50	—	.125	.032	.750
106-P249	SERVO	1.06	.57	.50	—	.125	.062	.968
112-P16	BUSHING	1.12	.50	.87	.38	.250	—	—
112-P19	SERVO	1.12	.57	.50	—	.125	.062	1.000
143-P93	SERVO	1.43	.63	.50	—	.250	.093	1.312
200-P445	BUSHING	2.00	.50	.87	.38	.250	—	—
200-P446	SERVO	2.00	.75	.75	—	.250	.093	1.875

ELECTRICAL AND MECHANICAL CHARACTERISTICS

	50-P508 SERVO	87-P82 BUSHING	87-P83 SERVO	106-P249 SERVO	112-P16 BUSHING	112-P19 SERVO	143-P93 SERVO	200-P445 BUSHING	200-P446 SERVO
Total Resistance (Ohms)	1K - 25K	1K - 50K	1K - 50K	1K - 100K	1K - 100K	1K - 100K	1K - 100K	1K - 10K	1K - 100K
Total Resistance Tolerance	± 20%	± 20%	± 10%	± 10%	± 20%	± 10%	± 10%	± 20%	± 10%
Theoretical Resolution	.001%	.001%	.001%	.001%	.001%	.001%	.001%	.001%	.001%
Independent Linearity	± 0.5%	± 2%	± 0.5%	± 0.5%	± 2%	± 0.5%	± 0.5%	± 2%	± 0.5%
Theoretical Electrical Travel (Degrees)	340°	340°	340°	340°	340°	340°	340°	340°	340°
Electrical Travel Tolerance (Degrees)	± 5°	± 5°	± 3°	± 2°	± 5°	± 2°	± 2°	± 5°	± 2°
Total Mechanical Travel (Degrees)	360°	360°	360°	360°	360°	360°	360°	360°	360°
Temperature Coefficient (PPM/°C)	400	400	400	400	400	400	400	400	400
Operating Temperature Range (°C)	-55° to 105°C	-55° to 105°C	-55° to 105°C	-55° to 105°C	-55° to 105°C	-55° to 105°C	-55° to 105°C	-55° to 105°C	-55° to 105°C
Power Rating (Watts at 40°C)	5	1	1	1.5	1.5	1.5	2	3	3
Dielectric (Volts, RMS for 60 Sec.)	750	750	750	750	750	750	750	750	750
Terminals, Standard	3	3	3	3	3	3	3	3	3
Taps, Maximum Available	1	4	4	6	6	6	9	9	9
Tap Tolerance	± 5°	± 5°	± 3°	± 2°	± 5°	± 2°	± 2°	± 5°	± 2°
Life Expectance (Rev. at 500 RPM)	20,000,000	20,000,000	100,000,000	100,000,000	20,000,000	100,000,000	100,000,000	20,000,000	100,000,000
Moment of Inertia (gm-cm²)	0.1	0.2	0.2	0.2	0.2	0.2	1.5	1.5	1.5
Starting Torque (ounce-inches)	0.5	*0.6	0.5	0.5	*0.6	0.5	0.3	*0.6	0.3
Running Torque (ounce-inches)	0.5	*0.5	0.4	0.4	*0.5	0.4	0.2	*0.5	0.2
Weight (ounces)	0.4 oz.	0.5 oz.	0.6 oz.	0.6 oz.	0.6 oz.	0.6 oz.	1.7 oz.	2 oz.	4 oz.
*Stop Strength (pound-inches)	—	**2 lb.-in.	—	—	*2 lb.-in.	—	—	*3 lb.-in.	—
Bearings	SS Ball B.	Bronze	SS Ball B.	SS Ball B.	Bronze	SS Ball B.	SS Ball B.	Bronze	SS Ball B.

*Add one ounce-inch for O-ring seal
**For units with mechanical stops
Conforms to MIL - R - 39023 A

Standard Resistance Values Within Range Indicated
500 Ω, 1K, 2K, 5K, 10K, 20K, 50K, 100K

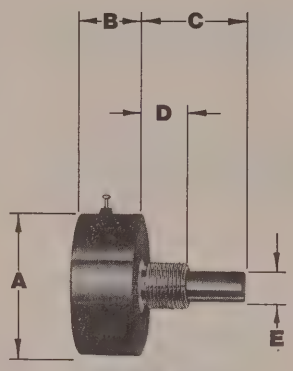
MAUREY
INSTRUMENT CORPORATION
4555 West 60th Street, Chicago, IL 60629 • PHONE (312) 581-4555 • FAX (312) 581-2576

MAUREY INSTRUMENT CORP.

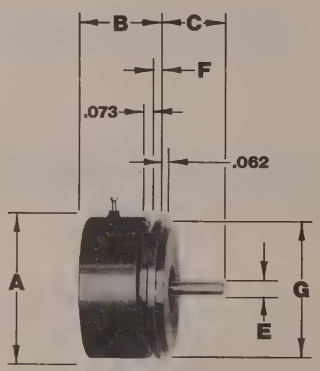
PRECISION WIREWOUND SINGLE TURN POTENTIOMETERS

PST

The wirewound family of precision single turn potentiometers provides a level of quality that has become an industry standard. Designed for applications that require extreme accuracy and high reliability, they meet or exceed most applicable military specifications. They are ideal for laboratory equipment and as standards for test bench applications. The unique design of the wiper assembly provides back-lash free operation.
The housings are machined from aluminum, brass or stainless steel. Shafts are ground and polished 303 stainless steel with either brass sleeve or precision ball bearings.
These combinations provide close linearity tolerances and high repeatability for a relatively moderate environment.



BUSHING



SERVO

	TYPE	A	B	C	D	E	F	G
50-M125	BUSHING	.50	.38	5/8	1/4	.125	—	—
50-M126	SERVO	.50	.56	1/2	—	.125	.062	.437
87-M42	BUSHING	.87	.59	5/8	1/4	.125	—	—
87-M44	SERVO	.87	.68	1/2	—	.125	.062	.750
106-M10	SERVO	1.06	.68	1/2	—	.125	.062	.968
131-M3	BUSHING	1.31	.50	7/8	3/8	.250	—	—
143-M8	SERVO	1.44	.80	3/4	—	.250	.093	1.312
200-M167	SERVO	2.00	.80	3/4	—	.250	.093	1.875
300-M74	SERVO	3.00	.80	3/4	—	.250	.093	2.875

ELECTRICAL AND MECHANICAL CHARACTERISTICS

	50-M125 BUSHING	50-M126 SERVO	87-M42 BUSHING	87-M44 SERVO	106-M10 SERVO	131-M3 BUSHING	143-M8 SERVO	200-M167 SERVO	300-M74 SERVO
Total Resistance (Ohms) ±5%	50Ω - 25K	50Ω - 25K	50Ω - 50K	50Ω - 50K	50Ω - 50K	50Ω - 100K	50Ω - 100K	50Ω - 100K	50Ω - 100K
Independent Linearity ± %	2 to 1	2 to 0.5	1 to 0.5	1 to 0.2	1 to 0.1	0.5	1 to 0.1	1 to 0.1	0.5 to 0.1
Theoretical Electrical Travel (Degrees)	325	354	320	360	353	320	352	356	358
Theoretical Elect. Travel Tol. (Degrees)	3	2	3	2	1	3	3	3	1
Total Mechanical Travel (Degrees)	325	360	330	360	360	330	360	360	360
Power Rating (Wats at 40°C)	1.5	1.5	2	2	2.5	3	3	3	7
Life Expectancy (Rev. at 500RPM)	25,000	1,000,000	25,000	100,000	1,000,000	25,000	1,000,000	1,000,000	1,000,000
Torque (ounce-inches)	.5 to .6	.05 MAX.	.5 to .6	.15 MAX.	.15 MAX.	2 to 8	.6 MAX.	.7 MAX.	1.0 MAX.
Weight (ounces)	.2	.2	.5	.6	.8	1.5	2.5	4	7
Stop Strength (pound-inches)	4	—	4	—	—	6	—	—	—
Bearings	SLEEVE	S. S. BALL	SLEEVE	S. S. BALL	S. S. BALL	SLEEVE	S. S. BALL	S. S. BALL	S. S. BALL

TEMPERATURE COEFFICIENT: 100 PPM°C — OPERATING TEMPERATURE RANGE: −55 to 135°C — DIELECTRIC: 750 VAC

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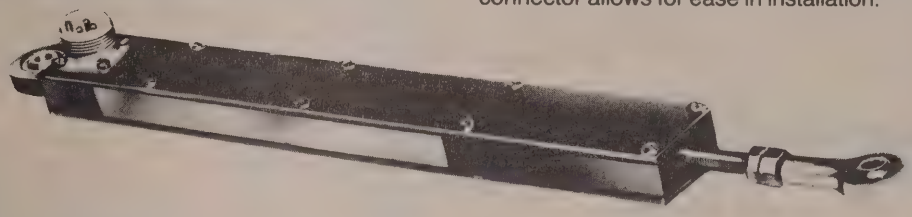
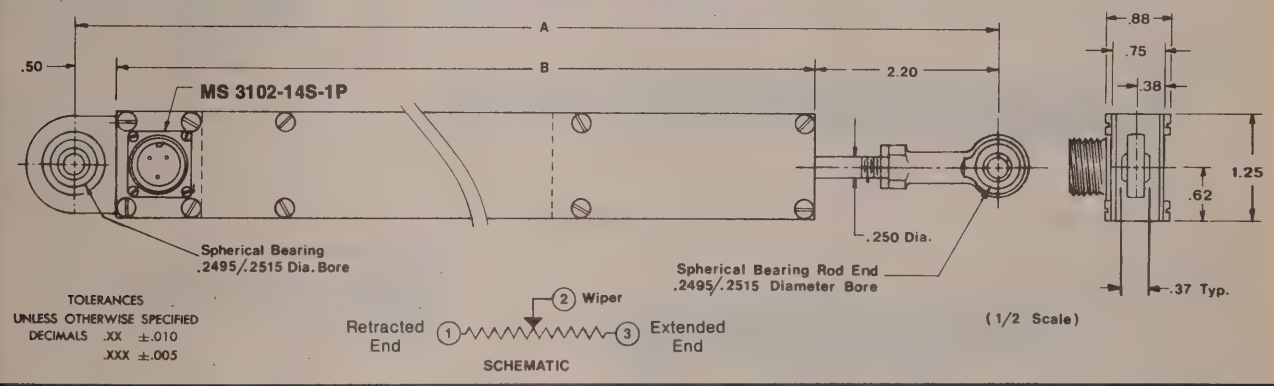
MAUREY INSTRUMENT CORP.

HEAVY DUTY LINEAR MOTION POTENTIOMETERS WIREWOUND AND CONDUCTIVE PLASTIC HDL

WIREWOUND M2028 This transducer combines the inherent accuracy and reliability of a wirewound potentiometer with the physical ruggedness required in industrial applications. They are used with hydraulic and mechanical actuators to measure and control linear motion. The self-aligning spherical ball ends and MS connector simplifies installation. High duty bearings give the ¼ inch shaft stability in the extended position.

CONDUCTIVE PLASTIC P1991 Where severe environmental conditions exist as in mills, factories and power generating plants, this linear motion transducer is practically indestructible. The unit is impervious to dust, oil and moisture. The molded, raised conductive track and graphite composition contacts provide for years of maintenance free service. As with the M2028, the self-aligning spherical ball ends and MS connector allows for ease in installation.





ELECTRICAL AND MECHANICAL CHARACTERISTICS

	M2028 WIREWOUND	P1991 CONDUCTIVE PLASTIC
Total Resistance (Ohms)	See Charts II & III	See Note 5
Total Resistance Tolerance	±5%	±20%
Theoretical Resolution	See Chart III	.001 inch
Independent Linearity	See Note 6	±0.5%
Theoretical Elect. Travel (inches)	See Chart I	See Chart I
Theoretical Elect. Travel Tolerance (inches)	±.010	±.025
Total Mechanical Travel (inches)	See Chart I	See Chart I
Temperature Coefficient	50 PPM/°C	500 PPM/°C
Operating Temperature Range	−55 to 125°C	−55° to 105°C
Power Rating (Watts at 40°C)	1 watt/inch	0.5 watt/inch
Dielectric Strength (Volts, RMS for 60 Sec)	750 volts, RMS	750 volts, RMS
Terminals	3	3
Taps	1/2 inch spacing	1/2 inch spacing
Tap Tolerance (inches)	±.010	±.030
Life Expectancy (Cycles at 60 in./min.)	500,000	50,000,000
Shaft Frictional Force	4 ounces	4 ounces
Weight (ounces)	See Chart I	See Chart I
Bearings	Nylon	Nylon

CHART I

Dash No.	Elect. Travel	Mech. Travel	A	B	Wt. Ozs.
−1	1.00	1.25	13.20	10.50	10
−2	2.00	2.25	13.20	10.50	10
−3	3.00	3.25	13.20	10.50	10
−4	4.00	4.25	13.20	10.50	10
−5	5.00	5.25	13.20	10.50	10
−6	6.00	6.25	18.50	15.80	15
−7	7.00	7.25	18.50	15.80	15
−8	8.00	8.25	18.50	15.80	15
−9	9.00	9.25	18.50	15.80	15
−10	10.00	10.25	18.50	15.80	15
−11	11.00	11.25	23.70	21.00	20
−12	12.00	12.25	23.70	21.00	20
−13	13.00	13.25	23.70	21.00	20
−14	14.00	14.25	23.70	21.00	20
−15	15.00	15.25	23.70	21.00	20

CHART II

DASH NO.	TOTAL RESISTANCE
102	1,000
202	2,000
502	5,000
103	10,000
203	20,000
503	50,000
104	100,000

CHART III

OHMS PER INCH	NUMBER OF TURNS PER INCH
500	270
1,000	370
2,000	415
2,500	450
5,000	550
10,000	660
20,000	1000

PART NUMBER DESIGNATION (EXAMPLE)
M2028-5-502
- M2028 — BASIC TYPE
- 5 — ELECTRICAL TRAVEL (5.00 INCHES)
- 502 — TOTAL RESISTANCE (5000 Ω)

Notes:
1. Mating connector supplied.
2. Stainless steel shaft.
3. Anodized aluminum housing.
4. Terminals available on special request.
5. Ohms per inch for P1991: 500, 1K, 2K, 5K, 10K.
6. With modification, this type is available in strokes greater than 15 inches.
7. Independent linearity for M2028: (100% ÷ Total Turns x 2)

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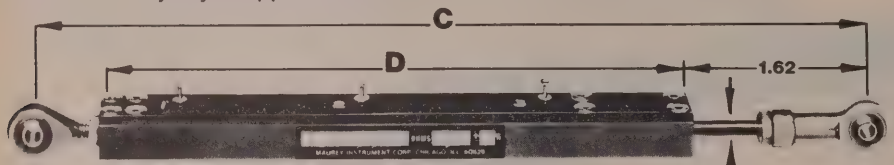
MAUREY INSTRUMENT CORP.

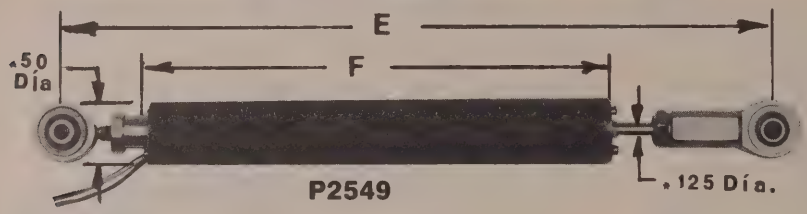
LIGHT DUTY LINEAR MOTION POTENTIOMETERS WIREWOUND AND CONDUCTIVE PLASTIC

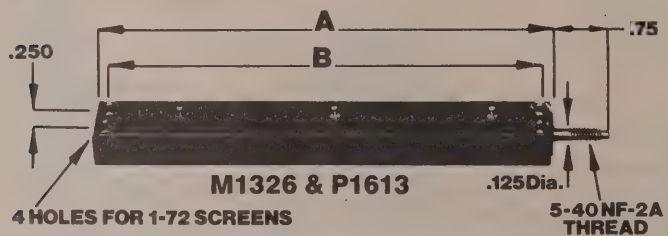
LDL

WIREWOUND (M-Series) These miniature transducers combine the best electrical characteristics in the smallest size at the lowest cost. The units were designed for use in laboratory test equipment, light industrial applications and automation where great accuracy of electrical output is essential. The spherical ball ends add flexibility to mounting. These wirewound, linear motion potentiometers will meet the requirement in the majority of applications.

CONDUCTIVE PLASTIC (P-Series) Where long life in a hostile environment is required, these linear motion transducers with molded, raised tracks and graphite composition contacts have no equal. They are practically impervious to dust, water and oil. The high contact pressure resists the effects of severe vibration and shock. The units are being used in factories and mills where maintenance-free operation is essential.







.125 DIA. SPHERICAL BEARINGS BOTH ENDS

Stroke (Inches)	M1326 / P1613		M2078 / P2080		P2549	
	A	B	C	D	E	F
1	2.00	1.800	5.12	3.00	5.34	3.20
2	3.00	2.800	6.12	4.00	6.34	4.20
3	4.00	3.800	7.12	5.00	7.34	5.20
4	5.00	4.800	8.12	6.00	8.34	6.20
5	6.00	5.800	9.12	7.00	9.34	7.20
6	7.00	6.800	10.12	8.00	10.34	8.20
7	8.00	7.800				
8	9.00	8.800				
9	10.00	9.800				
10	11.00	10.800				
11	12.00	11.800				
12	13.00	12.800				

Shaft shown in fully retracted position.
Shaft is free to rotate.
Body: ½ wide on terminal side x ⅜ deep.

ELECTRICAL AND MECHANICAL CHARACTERISTICS

	P2549 CONDUCTIVE PLASTIC	M1326 WIREWOUND	P1613 CONDUCTIVE PLASTIC	M2078 WIREWOUND	P2080 CONDUCTIVE PLASTIC
Total Resistance (Ohms)	250 Ω to 10K/inch	25 Ω to 20K/inch	250 Ω to 10K/inch	25 Ω to 20K/inch	250 Ω to 10K/inch
Total Resistance Tolerance	±20%	±5%	±20%	±5%	±20%
Theoretical Resolution (inch)	.001	.006 to .001	.001	.006 to .001	.001
Independent Linearity	±2% to ±0.5%	±1.2% to ±0.1%	±2 to ±0.5%	±1.2 to ±0.1%	±2 to ±0.5%
Theoretical Electrical Travel (inches)	1.00 to 8.00	1.000 to 12.000	1.00 to 5.00	1.000 to 6.000	1.00 to 5.00
Theoretical Electrical Travel Tolerance (inches)	±.050	±.010	±.050	±.010	±.050
Total Mechanical Travel (inches)	1.10 to 8.10	1.10 to 12.10	1.10 to 5.10	1.10 to 6.11	1.10 to 5.10
Tempreature Coefficient (PPM/°C)	500	50	500	50	500
Operating Temperature Range	–55° to 125°C	–55° to 125°C	–55° to 105°C	–55° to 125°C	–55° to 105°C
Power Rating (Watts at 40°C)	0.5 watt/inch	1 watt/inch	0.5 watt/inch	1 watt/inch	0.5 watt/inch
Dielectric Strength (Volts, RMS for 60 Sec.)	750	750	750	750	750
Terminals	3	3	3	3	3
Taps	2 taps/inch	4 taps/inch	4 taps/inch	2 taps/inch	2 taps/inch
Tap Tolerance (inches)	±.050	±.010	±.050	±.010	±.050
Life Expectancy (cycles at 60 in./min.)	50,000,000	500,000	50,000,000	500,000	50,000,000
Shaft Frictional Force (ounces max.)	4 oz.	4 oz.	4 oz.	4 oz.	4 oz.
Bearings	Nylon	Nylon	Nylon	Nylon	Nylon

Standard Resistance Values, Ohms/inch: 250Ω, 500Ω, 1K, 2K, 2.5K, 5K, 10K, 20K

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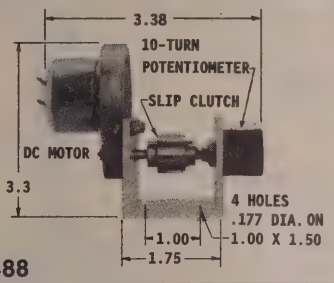
MAUREY INSTRUMENT CORP.

MOTORIZED POTENTIOMETERS AND SWITCHES

MPS

General Description & Applications

A family of single turn and multiturn, motor driven potentiometers and switches has been developed for industrial servo applications. They are used for such applications as variable speed controls on power generating sets, electrical-mechanical remote control, and readouts. They provide excellent accuracy at an economical price. These integrated motor-potentiometers are the result of years of Maurey experience in the manufacture of precision potentiometers and motor assemblies. The potentiometers, gear head, clutch, and motor are precisely matched to perform to exacting specifications. Motor-clutch-pot units are available in a wide range of specifications. A motor of selected speed and voltage may be matched with single, 3, 5, or 10 turn potentiometers, either wirewound or conductive plastic. When multiple voltages are required, single cups may be conveniently ganged with or without clutches. In addition, Maurey engineers can provide multi-tap potentiometers, special shafts and mountings, and a wide range of AC or DC motors to your specification.



H2488

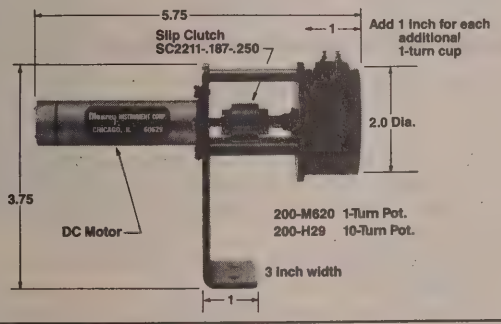
RPM	VOLTS	RPM	VOLTS
16	6	96	28
28	6	120	24
40	12	120	35
60	12	124	28
72	24	148	35

H2488 DC Motorized 10-Turn Potentiometer

This unit utilizes a DC motor, over a wide range of speed and voltages, to operate a precision 10-turn wirewound potentiometer with a ±0.25% linearity.

A slip clutch prevents damage to the potentiometer stops. Unit is suitable for a factory or mill environment.

Potentiometer independent linearity: ±0.25% or better
Power rating: 2.5 watts at 60°C
Resistances available: 500Ω, 1K, 2K, 5K, 10K, 20K, 50K, 100K.



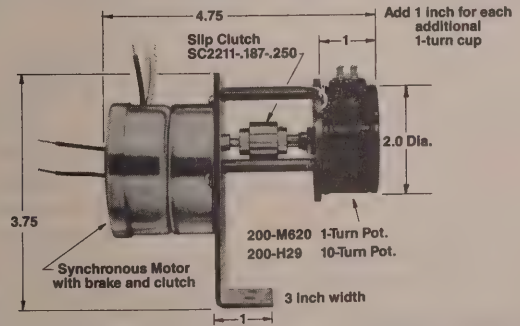
M2391

M2391 DC Motorized Single & 10-Turn Potentiometers

This is a versatile motor-potentiometer assembly. When a single turn wirewound potentiometer is specified, multipole single throw switches may be added. Up to six precision potentiometers with ±0.5% linearity of various resistance values may be ganged. All components are easily assembled or changed. Proven design for factory or mill environment.

A precision 10-Turn high resolution potentiometer with a ±0.25% linearity may be specified. A Slip clutch safeguards the potentiometer stops from being damaged.

Standard resistances available: 250Ω, 500Ω, 1K, 2K, 5K, 10K, 20K, 50K, 100K.



M2261

M2261 AC Motorized Single & 10-Turn Potentiometers

This is a compact AC motor driven wirewound potentiometer with mechanical stops. A slip clutch provides positive protection to the potentiometer mechanical stops. For continuous rotation the slip clutch is replaced by a coupling. When operated with single turn potentiometers, single throw switches are available.

1-Turn Potentiometer: ±0.5% linearity, 4 watts power
10-Turn Potentiometer: ±0.25% linearity, 4 watts power

Standard resistances available: 250Ω, 500Ω, 1K, 2K, 5K, 10K, 20K, 50K, 100K.

Motor: 115 Volts, A.C. 60 Hz; synchronous continuous duty with positive clutch and instantaneous brake; standard RPM: 1, 2, 4, 6, 10, 12, 30, 60.

Standard DC Motor Data:

Speed: (See chart)
Voltage: (See chart)
Current: (See chart)
Torque at 24 volts: 50 oz-in.
Break away voltage: 10 volts DC
Other requirements on request

M2391

Voltage VDC	ma	Speed RPM
12	49	6.0
24	50	16.0
28	51	21.2
35	53	24.5

Special Requirements

The types shown here are representative of a wide range of motor driven mechanisms manufactured by Maurey. AC or DC motors may be used. Single and multicup carbon, wirewound, or conductive plastic potentiometers may be specified, with or without slip clutches or switches. Write or phone for a solution to your requirement.

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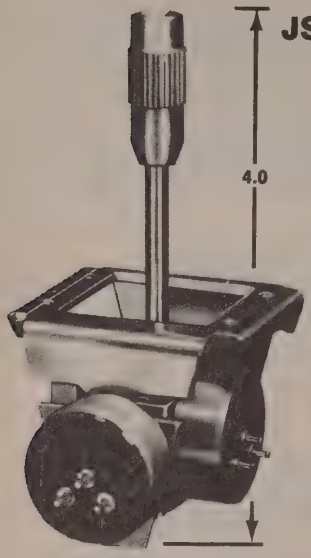
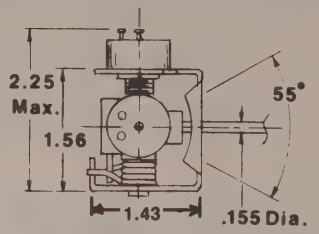
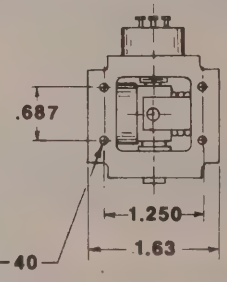
MAUREY INSTRUMENT CORP.

JOYSTICKS JSP/JSE

JSP JOYSTICK CONTROLS WITH POTENTIOMETERS







The Maurey JSP 2302 series precision joystick controls have been proven in a wide variety of applications.

Designed with long life precision potentiometers, the JSP series is available with either single, dual or triple axis control. The compact all metal construction provides a strong, reliable unit.

To better suit your application, the JSP series is available with either internal or external boot, a push button switch in the handle and a variety of knob styles.

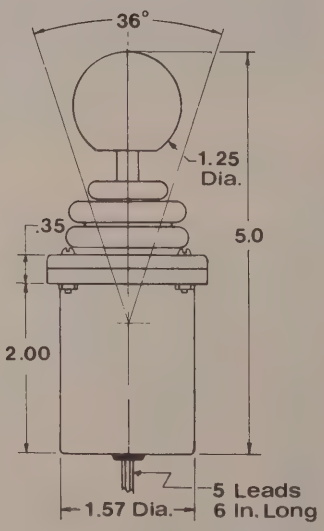
MECHANICAL SPECIFICATIONS

Spring return to center
Knob torque: 12 ounce-inches
Life: 2,000,000 cycles
Limiter Plates available to limit direction of knob.

CONDUCTIVE PLASTIC POTENTIOMETER SPECIFICATIONS

Voltage Repeatability: ±0.2%
Resistance available: (±20%): 1K, 5K, 10K, 20K
Power: 1 Watt at 25°C
Wipers phased at center of resistance.
Temperature Range: —30° to 105°C

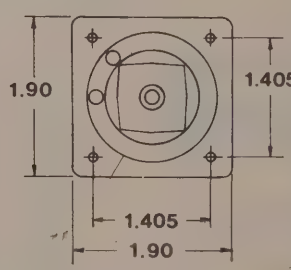
JSE INDUCTION TYPE JOYSTICK CONTROL

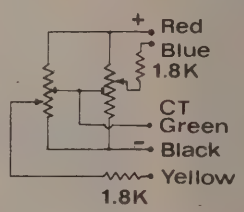


The Maurey JSE 2304 Joystick Control is a non-contacting, inductive device which provides extremely long life, infinite resolution and zero noise. Inherent in the design is a constant output throughout the life of the unit.

A shaft seal boot is supplied on all units to protect the mechanism from moisture and dust.

The electronic circuitry is encapsulated in an anodized aluminum case resulting in an assembly which is compatible to most hostile environments.





Equivalent Circuit

ELECTRICAL SPECIFICATIONS

Operating Voltage:	4.5 to 15.0 Volts, D.C.	Center Tap Voltage:	50% of Input Voltage
Current:	15 ma at 10 Volts, D.C.	Resolution:	Infinite
Output Impedance:	1800 ohms (Signals)	Life:	20,000,000 cycles
Center Tap Impedance:	340 ohms	Leads:	6 inch standard length, color coded
Equivalent Noise Resistance:	None		
Temperature Range:	—30° to 105° C	Knob has spring return to center.	

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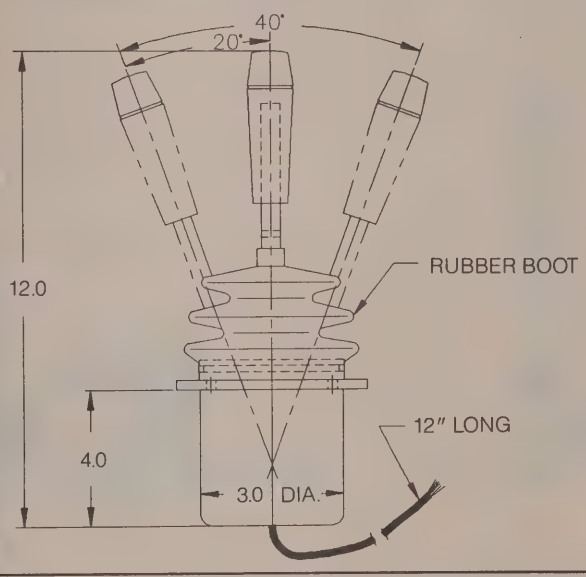
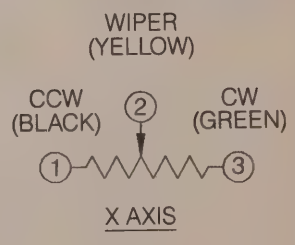
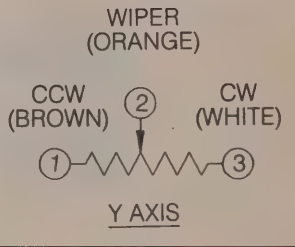
MAUREY INSTRUMENT CORP.

HEAVY DUTY JOYSTICK CONTROL HDJ

The Maurey HDJ series precision industrial joystick fills the need for heavy duty controls. Designed specifically for construction and large industrial equipment, they have been proven in a variety of industries. Overhead crane controls, Marine hoists, Man lifts and Cherry pickers are just a few of the many applications. Constructed of rugged materials, the unit incorporates conductive plastic potentiometers for extremely long life with essentially infinite resolution. A heavy duty shaft boot seals the unit from the environment. Variations are available with single axis control. Special configurations available to your specifications. The HDJ series joystick is ideal for your control requirement and will provide years of trouble free service in a harsh environment.







ELECTRICAL AND MECHANICAL SPECIFICATIONS

MECHANICAL SPECIFICATIONS

Major axis operationing angle: 40° Total
Spring return to center
Life: 5,000,000 cycles
Limiter Plates available to limit direction of knob.

MATERIALS

Case: Molded Glass Filled Nylon
Lever: Stainless steel
Trunnions: Anodized aluminum
Bearings: Brass

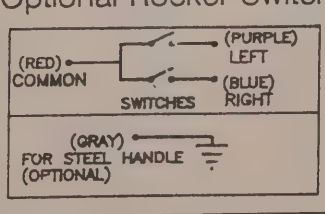
CONDUCTIVE PLASTIC POTENTIOMETER SPECIFICATIONS

Resistances available: 5K, 10K
Resistance tolerance: ±20%
Voltage Repeatability: ±1%
Wipers phased at center of voltage
Output from center: ±6% of applied voltage
Power: 1 Watt at 25° C
Temperature Range: –30° to 85° C

Available with rocker switch in the handle. Specify Knob style J.

DASH NO.	RESISTANCE (ohms)
502	5,000
103	10,000

Optional Rocker Switch



JOYSTICK PART NUMBER DESIGNATION

HDJ2552-2HS-103

- HDJ — Model
- 2 — Axis (2)
- H — Knob Style (Knob H)
- S — Limiter Style (square)
- 103 — Resistance(10,000 Ω)

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MAUREY INSTRUMENT CORP.

SINGLE AXIS JOYSTICK CONTROLS WITH POTENTIOMETER

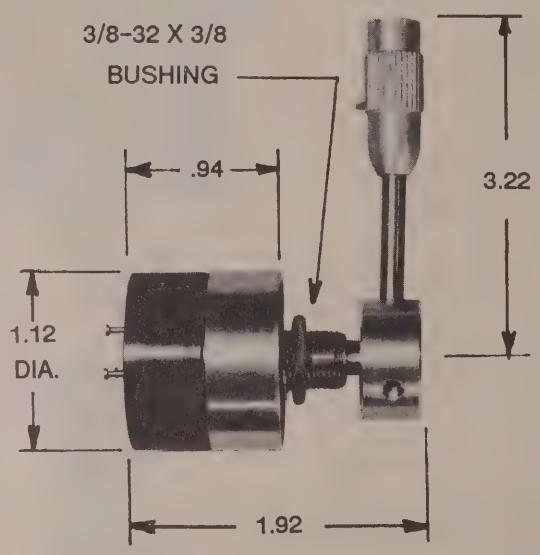
SAJ

The type SAJ single axis joystick control is the ideal choice for those industrial applications where a single plane of travel is to be controlled. Such devices are used to control the speed of a single motor, or to determine the back and forth motion of a hydraulic or pneumatic cylinder.

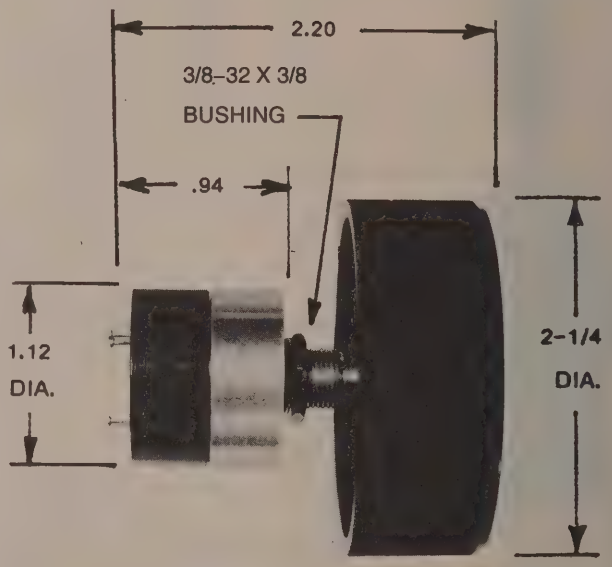
Both units are spring return to center for zero reference. They are available with either lever type or rotary actuator and will adapt to almost any mounting configuration. The bushing type potentiometer facilitates installation.

The precision conductive plastic potentiometer uses the unique Maurey rased molded track, resulting in almost unlimited life. In addition, this design insures that the potentiometer is impervious to moisture, oil, dust and industrial gases.

SAJ 2515–F



SAJ 2515–G



FULL SCALE

MECHANICAL SPECIFICATIONS

Major axis operating angle: ± 70° (140° Total)
Spring return to center tap.
Knob Torque: 12 ounce-inches, nominal
Life: 10,000,000 cycles
Temperature range: -30° to 105° C

CONDUCTIVE PLASTIC POTENTIOMETER SPECIFICATIONS

Standard resistances: 1K, 5K, 10K
Resistance tolerance: ± 20%
Electrical travel: ± 70° (140° Total)
Center tap at center of electrical travel.
Knob phased at center tap.
Linearity: ± 2%
Repeatability: ± 0.2%
Power: 1 watt at 25° C.

DASH NO.	RESISTANCE OHMS
501	500
102	1,000
202	2,000
252	2,500
502	5,000
103	10,000
203	20,000

JOYSTICK PART NUMBER DESIGNATION

SAJ2515 – F – 103
- SAJ2515 = MODEL
- F = KNOB TYPE
- 103 = RESISTANCE (10K)

MAUREY INSTRUMENT CORPORATION
4555 W. 60th St., Chicago, IL 60629 • Phone (312) 581-4555 • FAX (312) 581-2576

SINCE 1952 - MANUFACTURER OF PRECISION COMPONENTS FOR CONTROL.

SLIPRINGS

MAUREY INSTRUMENT CORP.

INSTRUMENTATION AND POWER SLIPRINGS

Current Capacity: 500 ma per ring
Noise level: 50 milliohms
Temperature range: −30° to 105°C

Life 10,000,000 revolutions at rated RPM
Stacking width of both slipring and contact holder: .375
Standard leads: AWG22, vinyl insulated, 12 inches long

SR2300 INSTRUMENTATION PANCAKE SLIPRINGS

	NUMBER OF CONDUCTORS	2	4	6	8	10
A	Diameter of Ring & Contact Holder	2.700	3.400	3.900	4.600	5.500
B	Center Hole in Ring		— See Chart Y —			
C	Center Hole in Contact Holder		— See Chart Y —			
D	Number of .156 Dia. Mounting Holes	3	3	3	6	6
E	Bolt Circle of Mounting Holes	2.325	3.025	3.525	4.225	5.125
	Rated RPM	1000	900	800	700	600

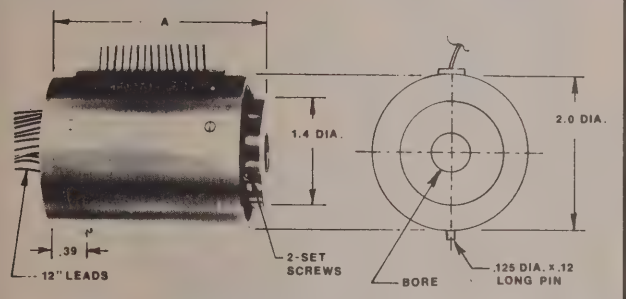
CHART Y

STANDARD BORE SIZES	
1/4	.250
3/8	.375
1/2	.500
5/8	.625

Standard with 2, 4, 6, 8, or 10 conductors. There are 3 sliding contacts per conductor.

The coin silver collector rings and precious metal contacts provide long life and low noise operation for instrumentation use. The collector ring/brush sets can be stacked or "pancaked" for multiple application. These units are particularly useful where there is limited axial width.

With a wide variety of diameter and bore sizes available, the SR2300 is ideal for strain gage and thermocouple measurements where rotating data circuits must be monitored



SR2066 SIGNAL LEVEL SLIPRINGS

RINGS	A
2-5	1.80
6-10	2.30
11-15	2.80
16-20	3.30
21-25	3.80
26-30	4.30

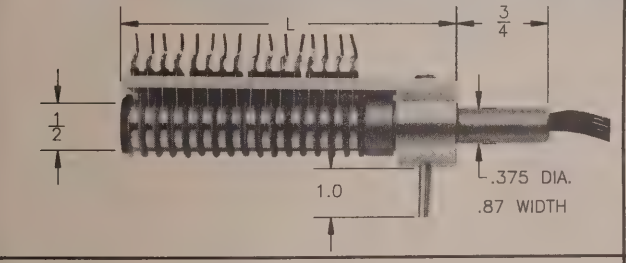
Current capacity per conductor: 250 ma
Dielectic strength: 750 volts, RMS
Temperature range: −55° to 105° C
Leads: Teflon insulated, 12" long.

Maximum speed: 1200 rpm
Life: 25,000,000 Rev.
Noise level: 50 milliohms
Std. bore sizes: 1/2", 5/8", 3/4"

The SR2066 totally enclosed slipring assembly is used for industrial and military applications where low signal noise is essential. Enclosed ball bearings support coin silver rings with gold-platinum alloy brushes.

Aluminum housing with O-ring seals, effectively protects the rings and brushes from the environment

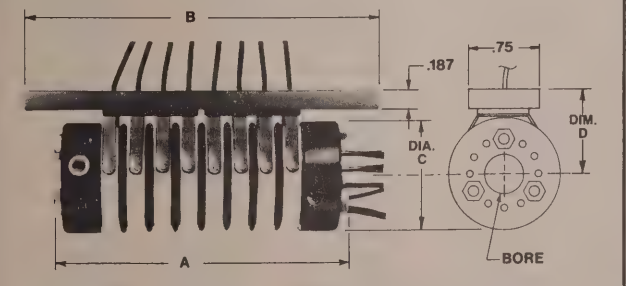
Manufacturers of industrial equipment requiring signal feedback and low current input rely upon this precision slipring for long life and trouble free service. They are used in laboratory instrumentation, fire control, meteorological circuits and for numerous automation applications.



SR2557 ROTARY SIGNAL SLIPRING

The SR2557 is a small unit designed for those applications where it is necessary to couple a slip ring to a rotating shaft. It is a unique design and is installed as a complete one piece unit. The rotating member is supported by dual stainless steel ball bearings. The rings and contacts are precious metal for low noise.
Current: 500 ma. Noise: 50 Miliohms, Speed: 3000 RPM max.

RINGS	L
4	1.77
8	2.32
12	2.87
16	3.42
20	3.97



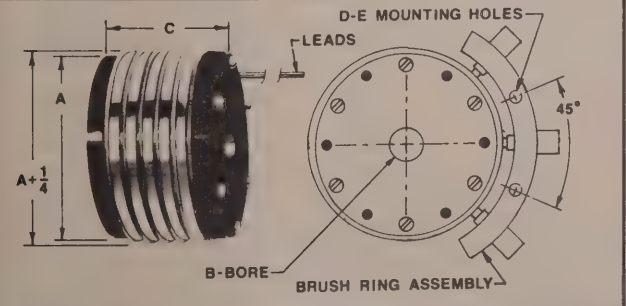
ROTARY TYPE SLIPRINGS

The SR2310 standard sliprings fill a need for a low cost yet highly reliable means of medium power and signal transfer to and from a rotating shaft.
Two standard assemblies are used, a rotary slipring with 4 to 12 conductors and a stationary brush block assembly providing 2 contacts per ring. The slipring assembly is mounted on the rotating shaft. The brush assembly is attached to the machine by 4 screws. Long life precious metal contacts and coin silver rings insure low noise signals and conducts 2 amperes. Noise level: 50 millohms, Dielectric Strength: 750 volts RMS for 60 sec., Leads: AWG 22, PVC. 12" long, Contacts per ring: 2.

MODEL NO.	DIA. C	DIM. D	BORE SIZES
SR2310-1	1.0	.88	1/4, 3/8, 1/2
SR2310-2	2.0	1.38	5/8, 3/4, 1
SR2310-3	3.0	1.88	1-1/4, 1-1/2, 2

NO. RINGS	DIM. A	DIM. B
4	1.88	2.50

ADD 1 INCH TO A & B FOR EACH ADDITIONAL 4 RING MULTIPLE



SR2035 POWER SLIPRINGS

A RING O.D.	B BORE MIN. TO MAX. + .002 − .000	BRUSH RING ASSEMBLY PART NO.	D BOLT CIRCLE	E HOLE
8.00	1.00 to 6.50	2035-60-8	9.625	.375
7.00	1.00 to 5.50	2035-60-7	8.625	.375
6.00	1.00 to 4.50	2035-60-6	7.375	.312
5.00	1.00 to 3.50	2035-60-5	6.375	.312
4.00	.75 to 2.50	2035-60-4	5.500	.250
3.00	.50 to 1.50	2035-60-3	4.500	.250
2.50	.50 to 1.00	2035-60-2.5	4.000	.250
2.00	.50	2035-60-2	3.500	.250

Maurey SR2035 standard power sliprings are designed and built for rugged industrial applications. They are being used in wind power generators, packing machinery, chemical processing equipment and in automated applications.

They are available in eight standard diameters with suitable bores to fit most equipment. The larger units are available with up to 50 rings. All parts are precision machined or molded.

Standard brushes are rated at 7 amps. with a max. of 3 brushes per ring. With 3 heavier brushes and wider rings, current capacity can be increased to 75 amps. per ring
Length (C): 1.25 + .50 per ring.

MAUREY INSTRUMENT CORPORATION
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SINCE 1952 - MANUFACTURER OF PRECISION COMPONENTS FOR CONTROL.

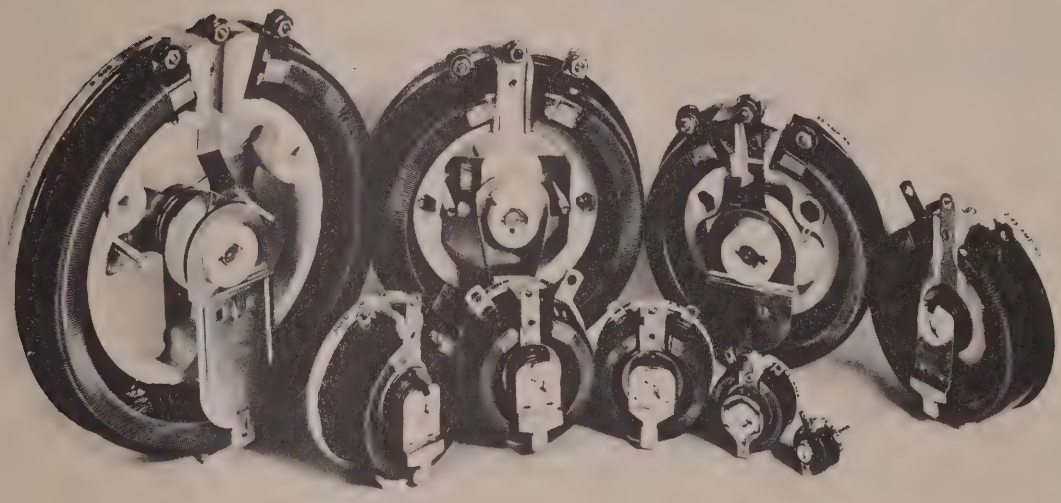
WIRE GAUGES— DIAMETER, AREA AND COPPER WEIGHT

	Diameter at 20°C (68°F)		Area at 20°C (68°F)			Weight at 20°C (68°F), bare copper wire		
Size, AWG	mils	mm	mils	c mils	mm	lb/1,000 ft.	lb/mile	kg/km
4/0	460.0	11.68	166,200	211,600	107.2	640.5	3,382	953.2
3/0	409.6	10.40	131,800	167,800	85.01	507.8	2,681	755.7
2/0	364.8	9.266	104,500	133,100	67.43	402.8	2,127	599.5
1/0	324.9	8.252	82,891	105,600	53.49	319.5	1,687	477.6
1	289.3	7.348	85,730	83,690	42.41	253.3	1,338	337.0
2	257.6	6.543	52,120	66,360	33.62	200.9	1,061	298.9
3	229.4	5.827	41,330	52,620	26.67	159.3	841.1	237.1
4	204.3	5.189	32,780	41,740	21.15	126.3	667.1	188.0
5	181.9	4.620	25,990	33,090	16.77	100.2	528.8	149.0
6	162.0	4.115	20,610	26,240	13.30	79.44	419.4	118.2
7	144.3	3.665	16,350	20,820	10.55	63.03	332.8	93.80
8	128.5	3.264	12,970	16,510	8.367	49.98	263.9	74.38
9	114.4	2.906	10,280	13,090	6.631	39.61	209.2	58.95
10	101.9	2.588	8,155	10,380	5.261	31.43	166.0	46.77
11	90.7	2.304	6,460	8,230	4.17	24.90	131	37.1
12	80	2.05	5,130	6,530	3.310	19.8	104	29.4
13	72.0	1.83	4,070	5,180	2.63	15.7	82.9	23.4
14	64.1	1.63	3,230	4,110	2.08	12.4	65.7	18.5
15	57.1	1.45	2,560	3,260	1.650	9.87	52.1	14.7
16	50.8	1.29	2,030	2,580	1.31	7.81	41.2	11.6
17	45.3	1.150	1,610	2,050	1.040	6.21	32.8	9.24
18	40.3	1.02	1,280	1,620	0.823	4.92	26.0	7.32
19	35.9	0.912	1,010	1,290	0.653	3.90	20.6	5.81
20	32.0	0.813	804.0	1,020	0.519	3.10	16.4	4.61
21	28.5	0.724	638.0	812.0	0.412	2.46	13.0	3.66
22	25.3	0.643	503.0	640.0	0.324	1.94	10.2	2.88
23	22.6	0.574	401.0	511.0	0.259	1.55	8.16	2.30
24	20.1	0.511	317.0	404.0	0.205	1.22	6.46	1.82
25	17.9	0.455	252.0	320.0	0.162	0.970	5.12	1.44
26	15.9	0.404	199.0	253.0	0.128	0.765	4.04	1.14
27	14.2	0.361	158.0	202.0	0.102	0.610	3.22	0.908
28	12.6	0.320	125	159.0	0.0804	0.481	2.54	0.715
29	11.3	0.287	100.0	128.0	0.0647	0.387	2.04	0.575
30	10.0	0.254	78.50	100.0	0.0507	0.303	1.60	0.450
31	8.9	0.226	62.20	79.2	0.0401	0.240	1.27	0.357
32	8.0	0.203	50.30	64.0	0.0324	0.194	1.02	0.288
33	7.1	0.180	39.60	50.40	0.0255	0.153	0.806	0.227
34	6.3	0.160	31.20	39.7	0.0201	0.120	0.634	0.179
35	5.6	0.142	24.60	31.4	0.0159	0.0940	0.501	0.141
36	5.0	0.127	19.60	25.00	0.0127	0.0757	0.400	0.113
37	4.50	0.114	15.90	20.20	0.0103	0.0613	0.324	0.0912
38	4.0	0.102	12.60	16.0	0.00811	0.0484	0.256	0.0721
39	3.5	0.0889	9.62	12.2	0.00621	0.0371	0.196	0.0552
40	3.1	0.0787	7.55	9.61	0.00487	0.0291	0.154	0.0433
41	2.8	0.0711	6.16	7.84	0.00397	0.0237	0.125	0.0353
42	2.5	0.0635	4.91	6.25	0.00317	0.0189	0.0999	0.0282
43	2.2	0.0559	3.80	4.84	0.00245	0.0147	0.0774	0.0218
44	2.0	0.0508	3.14	4.00	0.00203	0.0121	0.0639	0.0180
45	1.8	0.0457	2.54	3.24	0.00164	0.00981	0.0519	0.0146
46	1.6	0.0406	2.01	2.56	0.00130	0.00775	0.0409	0.0115
47	1.4	0.0356	1.54	1.96	0.000993	0.00593	0.0313	0.00883
48	1.2	0.0305	1.13	1.44	0.000730	0.00436	0.0230	0.00649
49	1.1	0.0279	0.950	1.21	0.000613	0.00366	0.0193	0.00545
50	1.0	0.0254	0.785	1.00	0.000507	0.00303	0.0160	0.00450

MEMCOR-TRUOHM INC.

POWER RHEOSTATS

MEET THE MEMCOR FAMILY OF HIGH QUALITY WIRE-WOUND POWER RHEOSTATS



All MEMCOR Power Rheostats are vitreous enamel coated. The core and base are bonded together with vitreous enamel, thereby contributing markedly to the heat dissipation.

Standard tolerance: ±10%, ±5% available as a special.

TYPE	POWER (Watts)	RESISTANCE RANGE	DIAMETER	WEIGHT
R12½	12½ Watt	1 - 5000 Ohms	7/8"	.035 Lbs.
R25	25 Watt	1 - 5000 Ohms	1 1/16"	0.23 Lbs.
R50	50 Watt	0.5 - 10,000 Ohms	2 15/16"	0.45 Lbs.
R75	75 Watt	0.5 - 10,000 Ohms	2¾"	0.60 Lbs.
R100	100 Watt	0.5 - 10,000 Ohms	3⅛"	0.72 Lbs.
R150	150 Watt	0.5 - 10,000 Ohms	4"	1.50 Lbs.
R225	225 Watt	1 - 2500 Ohms	5"	2.18 Lbs.
R300	300 Watt	1 - 2500 Ohms	6"	3.0 Lbs.
R500	500 Watt	1 - 2500 Ohms	8"	3.75 Lbs.
R1000	1000 Watt	1 - 2000 Ohms	12"	10.0 Lbs.

Special Rheostats with Tapered Sections, Locking Devices, Off Positions, Tandem Mountings, Special Shafts on Bushing, and many other variations can be supplied.

Write for FREE Catalog.

MEMCOR-TRUOHM INC.

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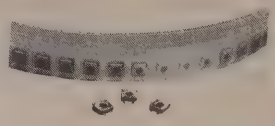
MEPCOPAL

Trimmers & Switches

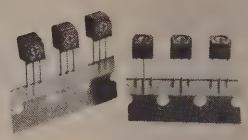
TRIMMER SPECIFICATIONS

RJ-4/ST-4C TRIMMERS

CT-9 TRIMMERS



ST-4 TRIMMERS



CT-6 TRIMMERS

Element	Style	Shape	Number of Turns (Nominal)	Model	Basic Outline Dimen. Inch	Basic Outline Dimen. MM	Resistance Range (Ω)	Power Rating (°C)	Operating Temperature Range (°C)	Adjustment Pin Configurations — Pin Style: Adj. Mode	To-18	To-5	In-Line	Other	Pkg. Bulk	Pkg. Magazine	Pkg. Tape & Reel
CERMET	SINGLE TURN	ROUND	1	RJ-4	.19	4.9	10-2 Meg	.50W @ 70	-55 to +125	TOP	W				•		
										SIDE	WS						
			1	RJ-6	.25	7.0	10-5 Meg	.50W @ 70	-55 to +125	TOP	W	P		F	•		
										SIDE		S,X					
			1	RJ-13	.50	12.6	10-5 Meg	.75W @ 70	-55 to +125	TOP		P,B,PR			•		
										SIDE		S,SR					
		SQUARE	1	CT-6	.25	7.0	10-2 Meg	.50W @ 70	-55 to +125	TOP	W	P,R	V	F	•	•	•
										SIDE		S,X	H				
	MULTI-TURN	ROUND	3	TM-7	.28	7.2	50-2 Meg	.50W @ 70	-55 to +125	TOP	W	P			•		
										SIDE		S,X					
		SQUARE	12	8026*	.25	6.4	10-5 Meg	.25W @ 85	-65 to +150	TOP		W			•		
										SIDE		P,X					
			25	8024*	.38	9.5	10-5 Meg	.50W @ 85	-65 to +150	TOP	Y	W			•		
										SIDE		P	X				
			18	CT-9	.38	9.5	10-5 Meg	.50W @ 70	-55 to +125	TOP			W		•		•
										SIDE		P	X				
		REC-TANGLE	15	CT-20	.75	19.0	10-5 Meg	.75W @ 70	-55 to +125					P,X	•	•	•
										SIDE							
(CERMET) SURFACE MOUNT	SINGLE TURN	SQUARE	1	ST-3	.12	3.0	10-1 Meg	.125W @ 70	-55 to +125	TOP				A	•		•
			1	ST-4	.18	4.5	10-2 Meg	.25W @ 70	-55 to +125	TOP				A,B,C,G	•	•	•
	MULTI-TURN		14	ST-5	.25	6.4	10-2 Meg	.25W @ 85	-55 to +125	TOP				P,R,X,W	•	•	•
										SIDE							
			3	ST-7	.27	7.0	50-1 Meg	.25W @ 70	-55 to +125	TOP				A,B	•		•
WIRE-WOUND	SINGLE TURN	ROUND	1	1106	.25	6.6	10-30 K	.37W @ 70	-55 to +120	TOP		T,B		F	•		
										SIDE		S					
			1	1113	.50	13.5	10-100 K	.75W @ 70	-55 to +120	TOP		T,B,T,R		F,FR	•		
										SIDE		S,SR					
	MULTI-TURN	SQUARE	19	1309	.38	9.5	10-50 K	.50W @ 70	-55 to +120	TOP			W		•		
										SIDE		P	X				
		REC-TANGLE	16	1208	.75	19.0	10-50 K	.50W @ 70	-55 to +120					P	•		
										SIDE							
			22	1211	1.25	31.8	10-100 K	.75W @ 85	-55 to +150					P,L,PB, LB	•		
										SIDE							

Notes:
1. Temperature Coeffient of resistance is 100 ppm/°C maximum. This may vary at high and low resistance values. See catalog for details.
2. All models pass immersion at 85°C.
   *Available in military RJ & RJR versions.

Call 800-JIT1SMD (548-1763) for additional information or technical catalog.

Mepcopal Company, 11525 Sorrento Valley Rd., San Diego, California 92121-1307
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MEPCOPAL
Trimmers and Switches

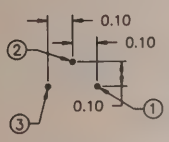
Call 800-JIT1SMD (548-1763) for additional information or technical catalog.

TRIMMER PIN STYLES

TOP ADJUST
1106B*
1106T
1113B*
1113T
1113TR†
8024Y
8026W

SIDE ADJUST
CT-6X
RJ-6X
TM-7X

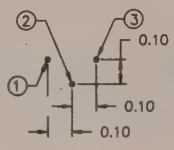
TO-5



TOP ADJUST
CT-6P
RJ-6P
RJ-13B*
RJ-13P
RJ-13PR†
TM-7P

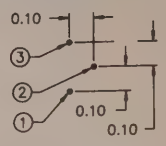
SIDE ADJUST
CT-6S
RJ-6S
RJ-13S
RJ-13SR†
TM-7S
1106S
1113S
1113SR†

TO-5



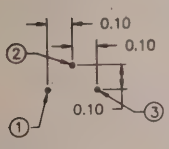
SIDE ADJUST
8026X

TO-5



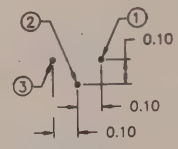
SIDE ADJUST
CT-6N
CT-9P
1309P
8024P
8026P

TO-5



TOP ADJUST
CT-6R

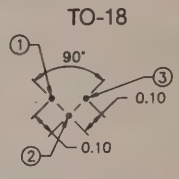
TO-5



TOP ADJUST
CT-6W
RJ-4W
RJ-6W
TM-7W

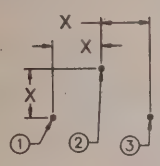
SIDE ADJUST
RJ-4WS

TO-18



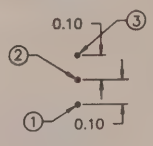
BOTTOM ADJUST

	x dimension
CT-6F	0.17
RJ-6F	0.17
1106F	0.14
1113F	0.30
1113FR†	0.30



SIDE ADJUST
CT-9X
1309X
8024X

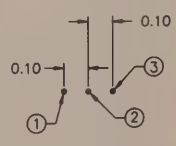
IN-LINE



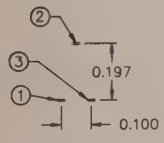
TOP ADJUST
CT-6V
CT-9W
1309W
8024W

SIDE ADJUST
CT-6H

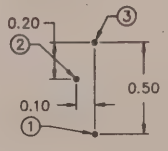
IN-LINE



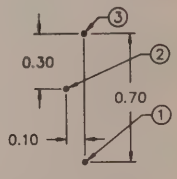
TOP ADJUST
ST-4C



SIDE ADJUST
CT-20P
1208P

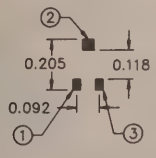


SIDE ADJUST
CT-20X
1211P
1211PB*



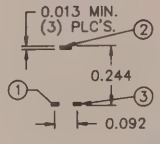
SURFACE MOUNT

TOP ADJUST
ST-4A



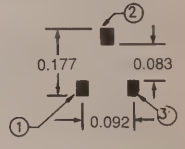
SURFACE MOUNT

TOP ADJUST
ST-4B



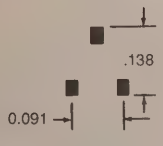
SURFACE MOUNT

SIDE ADJUST
ST-4G



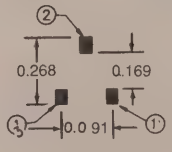
SURFACE MOUNT CHIP

TOP ADJUST
ST-3A



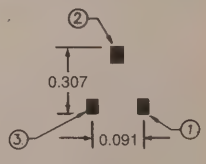
SURFACE MOUNT

TOP ADJUST
ST-7A



SURFACE MOUNT

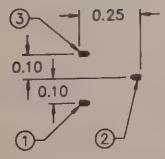
TOP ADJUST
ST-7B



SURFACE MOUNT

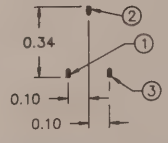
TOP ADJUST
ST-5W

SIDE ADJUST
ST-5X



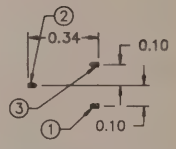
SURFACE MOUNT

SIDE ADJUST
ST-5P

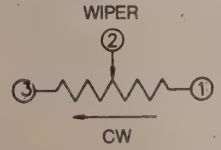


SURFACE MOUNT

SIDE ADJUST
ST-5R



*Bushing
†Knob



- Pin patterns shown are as seen from bottom view of the part.
- For all side adjust pin styles, the shaft points towards the top of the page.
- All dimensions are in inches.

STANDARD RESISTANCE VALUES (in ohms)

10	1K	100K
20	2K	200K
50	5K	500K
100	10K	1M
200	20K	2M
500	50K	5M

Mepcopal Company, 11525 Sorrento Valley Rd., San Diego, California 92121-1307 • 619/481-0210 • FAX: 619/481-1123

PRODUCT SELECTION GUIDES

TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 93/94 EDITION OF EEM

AC Power Supplies, Product Selection Guide **D•2221**

Batteries, Product Selection Guide **D•1419**

Cabinets, Enclosures, Racks & Chassis, Product Selection Guide **C•1003**

Capacitors, Product Selection Guide **A•1003**

Coils, Chokes, Inductors, Product Selection Guide **A•1179**

Connectors, Terminals & Sockets, Product Selection Guide **C•1139**

Cores, Magnets & Ferrites **A•1317**

Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide **A•1326**

DC-DC Converters **D•2049**

DC Power Supplies, Product Selection Guide **D•1488**

Delay Lines, Product Selection Guide **A•1513**

Discrete Semiconductors, Product Selection Guide **A•2130**

Displays, Readouts, & CRTs, Product Selection Guide **B•1017**

Fans, Blowers, Cooling Equipment, & Heat Exchangers, Product Selection Guide **C•1557**

Fiber Optics, Product Selection Guide **B•1200**

Filters, Power, Product Selection Guide **A•1584**

Filters, Signal, Product Selection Guide **A•1617**

Instruments, Test & Measuring, Product Selection Guide **D•1215**

Interconnection Systems, Product Selection Guide **C•1670**

Keyboards & Keypads, Product Selection Guide **B•1818**

Lamps, Lights, & Indicators, Product Selection Guide **B•1131**

Microwave Components, Product Selection Guide **A•1719**

Military Qualified Products List **B•1002**

Motors, Drives, & Rotating Components, Product Selection Guide **B•1231**

Oscilloscopes, Product Selection Guide **D•1402**

Panel Hardware, Product Selection Guide **C•1522**

Panel Meters, Analog & Digital, Product Selection Guide **D•1336**

Potentiometers, Trimmers, Controls, & Rheostats, Product Selection Guide **A•2053**

Power Supplies, AC, Product Selection Guide **D•2221**

Power Supplies, DC, Product Selection Guide **D•1488**

Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide **B•1341**

Relays, Product Selection Guide **B•1401**

Resistors, Product Selection Guide **A•1859**

Solenoids, Product Selection Guide **B•1626**

Switches, Product Selection Guide **B•1658**

Thermal Components, Product Selection Guide **B•1857**

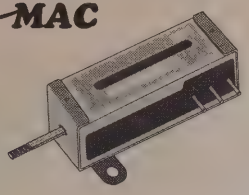
Transducers & Encoders, Product Selection Guide **B•1911**

Transformers, Product Selection Guide **A•2229**

Wire & Cable, Product Selection Guide **C•1701**

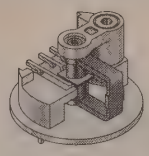
MIDORI MAC

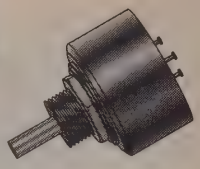
PRECISION POTENTIOMETERS



Blue Pot contactless

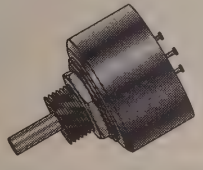
CONTACTLESS POTS





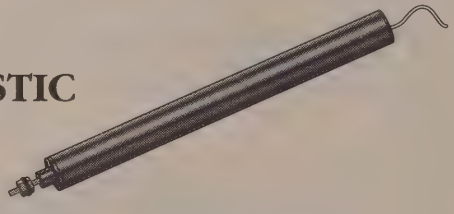
- Virtually Unlimited Life
- No Noise
- Very Low Torque
- Excellent Repeatability & Sensitivity

	MODEL	ANGLE (Stroke)	OUTPUT SENSITIVITY	LINEARITY	INPUT VOLTAGE	INPUT IMPEDENCE (Current)
ROTARY	UV-1	+/–45°	2.5% Vin / 10° Min.	+/–1.5% FS	10 VDC Max	15KΩ+/–30%
	UV-J	+/–45°	2.5% Vin / 10° Min.	+/–1.5% FS	10 VDC Max	15KΩ+/–30%
	CP-2UV	+/–45°	2.5% Vin / 10° Min.	+/–1.5% FS	10 VDC Max	15KΩ+/–30%
	CP-2UT	+/–45°	2.5% Vin / 10° Min.	+/–1.5% FS	10 VDC Max	15KΩ+/–30%
	CP-2UP	+/–45°	2.5% Vin / 10° Min.	+/–1.5% FS	10 VDC Max	15KΩ+/–30%
	CP-2USV	+/–45°	2.5% Vin / 10° Min.	+/–1.5% FS	10 VDC Max	15KΩ+/–30%
	CP-3UY	+/–125°	0.5% Vin / 10° Min.	+/–1% FS	14 VDC Max	30KΩ+/–30%
	CP-5UV	+/–150°	0.5% Vin / 10° Min.	+/–1% FS	14 VDC Max	30KΩ+/–30%
LINEAR	LP-1U	(.6mm)	2.5% Vin / 0.1mm Min .	+/–1% FS	8 VDC Max	7KΩ+/–30%
	LP-3U	(3mm)	8% Vin / 1mm Min.	+/–1.5%FS	14 VDC Max	25KΩ+/–30%
	LP-15UL	(12mm)	1.4% Vin / 1mm Min.	+/–1% FS	7 VDC Max	8KΩ+/–30%
	LP-10UF-R	(10mm)	8% Vin / 1mm Nom.	+/–2% FS	5 – 10 VDC	(5mA Max.)
	LP-20UF-R	(20mm)	4% Vin / 1mm Nom.	+/–2% FS	5 – 10 VDC	(5mA Max.)
	LP-30UF-R	(28mm)	2.9% Vin / 1mm Nom.	+/–2% FS	5 – 10 VDC	(5mA Max.)
INCLINOMETER	PMP-S10T	+/–10°	0.75+/–.15% Vin / 1°	+/–1% FS	8 VDC Max	7KΩ+/–30%
	PMP-S20T	+/–20°	0.37+/–.07% Vin / 1°	+/–1% FS	8 VDC Max	7KΩ+/–30%
	PMP-S30T	+/–30°	0.25+/–.05% Vin / 1°	+/–1% FS	8 VDC Max	7KΩ+/–30%
	PMP-45UV	+/–45°	2.5% Vin / 10° Min.	+/–2.5 % FS	10 VDC Max	15KΩ+/–30%
	PMP-10TA	+/–10°	0.1 V / 1° Nom.	+/–2 % FS	10 – 16 VDC	(25mA Max.)



Green Pot

CONDUCTIVE PLASTIC



- In Stock – No Factory Min.
- Long Life: 10 to 100 Millions Cycles
- High Accuracy
- Excellent Repeatability

	MODEL	ANGLE (Stroke)	RESISTANCE TOTAL (K ohm.)	LINEARITY STD. (Available)	MOUNT. TYPE/ BODY SIZE (mm)
ROTARY	CP-2FB	340°	0.5, 1, 2, 5, 10	+/–1% (.5%)	Bush. / 22mm Dia.
	CP-2FK	340°	0.5, 1, 2, 5, 10	+/–1% (.5%)	Servo / 22mm Dia.
	CP-35B	340°	0.5, 1, 2, 5, 10	+/–1% (.15%)	Bush. / 37mm Dia.
	CPP-45B	350°	0.5, 1, 2, 5, 10, 20	+/–.5% (.1%)	Servo / 45mm Dia.
	CPP-60	355°	1, 2, 5, 10, 20	+/–.05% (.025%)	Servo / 62mm Dia.
LINEAR	LP-20FP	(20mm)	0.5, 1, 2, 5	+/–1%	12mm Dia. x 48mm L.
	LP-100FP	(100mm)	2, 5, 10, 20	+/–1%	12mm Dia. x 128mm L.
	LP-10F	(10mm)	0.1, 0.2, 0.5, 1	+/–1%	20 x 24 x 37mm
	LP-400F	(400mm)	2, 5, 10, 20, 30	+/– 0.1%	22mm Dia. x 438mm L.
	LP-1000FX	(1000mm)	20	+/– 0.1%	32 x 34 x 1070mm

2555 E. Chapman Ave., Suite 400, Fullerton, CA 92631
Tel: (714) 449-0997 • FAX: (714) 449-0139

chip trimming potentiometers

MURATA ERIE NORTH AMERICA

RVG3A

The SMT RVG3A Series of chip trimming potentiometers features an exceptionally low profile—just 1.5 mm above the PC board—allowing higher component densities than possible before. Its alumina substrate and cermet resistance element provide long term reliability and are designed to withstand the stress of both flow and reflow soldering operations.

FEATURES

- Ultra-low profile—just 1.5 mm H.
- Extremely light weight
- Nickel barrier layer terminations for solderability
- Suitable for both flow and reflow soldering
- Offered on 8 mm tape for auto-placement
- Standard screw driver adjustable
- Suitable for auto-tuning (RVG3A08)

SPECIFICATIONS

Resistance Range	200Ω to 2MΩ
Resistance Tolerance	±25%
Taper	Linear
Power Rating	1/10W at 70°C
Maximum Working Voltage	50 VDC
Operating Temperature Range	−55°C to 125°C
Rotational Torque	2.0 to 24.5 mNm
Effective Rotational Angle	270°, ±10°

RVG4

The RVG4 Series has presoldered electrodes to facilitate surface mounted auto-placement and reflow soldering. They are also available with conventional lead type terminals. The wide 200° rotational angle improves performance and resistance range.

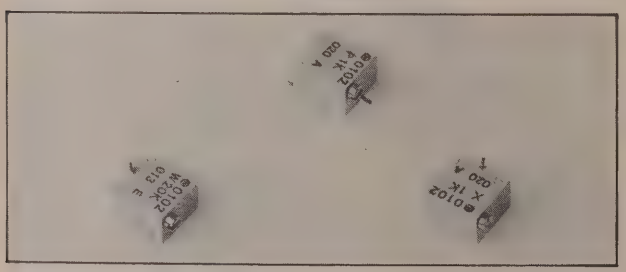
FEATURES

- Miniature size—3.8 × 4.5 × 2.3 mm for close close component spacing
- Easily adjusts with regular screwdriver
- Large, solid axle not affected by vacuum chuck during auto-placement
- Nickel plated, solder coated terminals eliminate solder leaching in reflow soldering operations
- Tape packaging available for auto-placement

SPECIFICATIONS

Resistance Range	100ohms to 2 Megohm
Tolerance	±25%
Temperature Coefficient	±250ppm/°C
Taper	Linear
Power Rating	1/10W (at 70°C) Derated to 0 Watts at 125°C
Max. Working Voltage	50 VDC
Torque	.27 to 2.8 in.-oz.
Effective Rotation	Elec. 200° ±10°

POTO102



FEATURES:

- Miniature size—.250″ × .250″ × .169″
- 12-turn
- Will withstand industrial cleaning processes
- Cermet resistance element
- For surface mount applications
- Reflow solderable

SPECIFICATIONS

Resistance Range	10 ohms to 1 Megohm
Tolerance	±10%
Temperature Coefficient	±100ppm/°C
Residual Resistance	2 ohms max.
Power Rating	0.25W at 85°C. Derated to 0W at +125°C
Working Voltage	200 VDC max.
Operating Temp. Range	−55°C to +125°C
Contact Resistance Variation	3% or 3 ohms max., whichever is greater
Dielectric Strength	600 VAC
Insulation Resistance	1,000 Megohms min. at 500 VDC
Torque	3.0 in.-oz. max.
Effective Electrical Adjust.	12 turns, ±2 turns

MURATA ERIE NORTH AMERICA 220 Lake Park Dr., Smyrna, Georgia 30080 Tel: 1-800-831-9172 Telex: 26-1301 FAX: 1-404-684-1541

sealed precision cermet trimming potentiometers—±100 ppm/°C

MURATA ERIE NORTH AMERICA

3321 Single Turn, 1/2 Watt

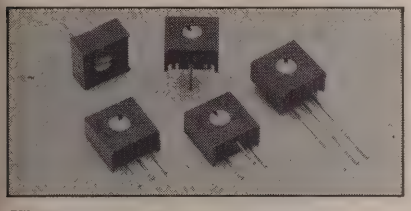
FEATURES

- Flame retardant rotor meets UL94V-0 requirements
- Extremely small size — .260″D. x .181″
- Sealed to withstand wave soldering and immersion cleaning processes
- Can be packaged for auto-insertion

SPECIFICATIONS

Resistance Range	10 ohms to 5 Megohms
Tolerance	±20%
Residual Resistance	1% or 2 ohms max. whichever is greater
Power Rating	0.5W at 70°C. Derated to 0W at +150°C
Working Voltage	300 VDC max.
Operating Temperature Range	−55°C to +150°C
Contact Resistance Variation	3% or 3 ohms max. whichever is greater

3104 Single Turn, 1/2 Watt



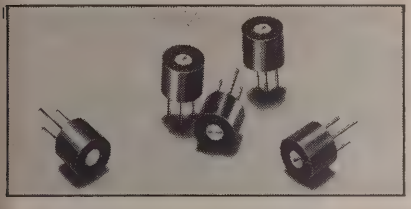
FEATURES

- Low cost
- ⅜″ square

SPECIFICATIONS

Resistance Range	10 ohms to 2 Megohms
Tolerance	±10%
Residual Resistance	2 ohms max.
Power Rating	0.5W at 70°C. Derated to 0W at +125°C
Working Voltage	300 VDC max.
Operating Temperature Range	−55°C to +125°C
Contact Resistance Variation	1% or 1 ohm max. whichever is greater

1102, 4-Turn, 1/2 Watt



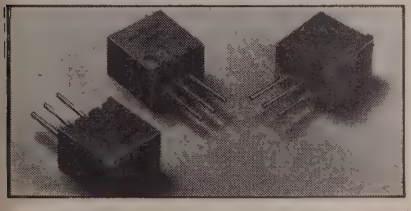
FEATURES

- Unique planetary drive provides the precise setting capability of a multi-turn unit in a small single-turn package
- Just .299″D x .260″
- Sealed to withstand wave soldering and immersion cleaning process

SPECIFICATIONS

Resistance Range	10 ohms to 2 Megohms
Tolerance	±10%
Residual Resistance	1% or 2 ohms max. whichever is greater
Power Rating	0.5W at 70°C. Derated to 0W at +125°C
Working Voltage	300 VDC max.
Operating Temperature Range	−55°C to +125°C
Contact Resistance Variation	3% or 3 ohms max. whichever is greater

3106, 25-Turn, 1/2 Watt



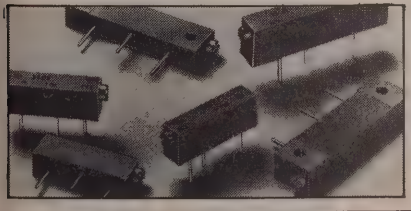
FEATURES

- Small size — .374″ x .394″ x .200″
- Sealed to MIL-R-22097 standards. Will withstand industrial cleaning processes

SPECIFICATIONS

Resistance Range	10 ohms to 2 Megohms
Tolerance	±10%
Residual Resistance	1% or 2 ohms max. whichever is greater
Power Rating	0.5W at 70°C. Derated to 0W at +125°C
Working Voltage	300 VDC max.
Operating Temperature Range	−55°C to +125°C
Contact Resistance Variation	3% or 3 ohms max. whichever is greater

2103, 15-Turn, 3/4 Watt



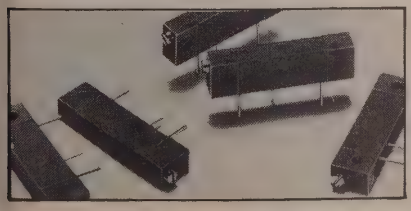
FEATURES

- Small size — .181″ x .252″ x .752″ for close board spacing
- Sealed to MIL-R-22097 standards. Will withstand industrial cleaning processes

SPECIFICATIONS

Resistance Range	10 ohms to 2 Megohms
Tolerance	±10%
Residual Resistance	3% or 1 ohm max. whichever is greater
Power Rating	0.75W at 70°C. Derated to 0W at +125°C
Working Voltage	300 VDC max.
Operating Temperature Range	−55°C to +125°C
Contact Resistance Variation	3% or 3 ohms max. whichever is greater

2102, 22-Turn, 1 Watt



FEATURES

- 22-turn mechanism provides extremely fine adjustment capability
- High power dissipation: 1.0W at 70°C
- Sealed to withstand wave soldering and immersion cleaning processes

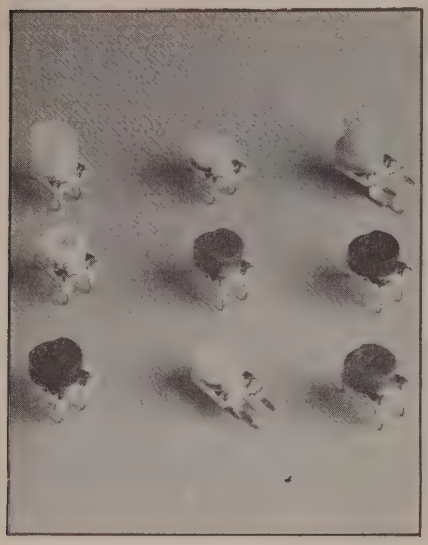
SPECIFICATIONS

Resistance Range	10 ohms to 2 Megohms
Tolerance	±10%
Residual Resistance	1% or 2 ohms max. whichever is greater
Power Rating	1W at 70°C. Derated to 0W at +150°C
Max. Working Voltage	300 VDC max.
Operating Temperature Range	−55°C to +150°C
Contact Resistance Variation	3% or 3 ohms max. whichever is greater

MURATA ERIE NORTH AMERICA 220 Lake Park Dr., Smyrna, Georgia 30080 Tel: 1-800-831-9172 Telex: 26-1301 FAX: 1-404-684-1541

single turn, low cost trimming potentiometers

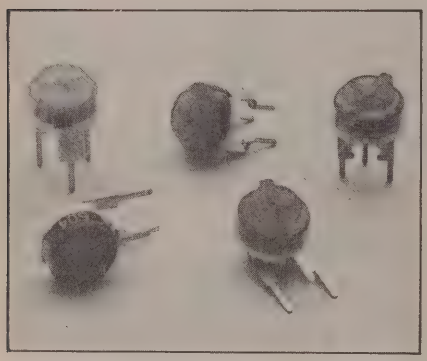
MURATA ERIE NORTH AMERICA



1/5 to 3/4 Watt, Carbon, Plastic & Cermet—0911

Characteristic	RVX (Carbon)	RVG (Cermet)
	0911	0911
Resistance Range:	100– 2 Megohms	100– 1 Megohm
Tolerance:	± 20%	
Residual Resistance:	Less than 500Ω, 5Ω maximum 500Ω and up, less than 1% of nominal rated resistance	
Taper:	Linear	
Power Rating:	1/5W (70°C)	1/2W (70°C)
Max. Working Voltage**:	250 VDC	350 VDC
Torque:	0.56-4.86 in.-oz.	0.56-4.86 in.-oz.
Terminal Strength:	35.27 oz.	
Effective Rotation: Elec.	240°C	240°C
Mech.	260° ± 10°	260° ± 10°
Stop Strength:	13.9 in.-oz.	

*Derated to 0 watts at 100°C (for Carbon), at 125°C (for Cermet)
**Max working V varies with resistance value. Vmax = $\sqrt{\text{Resistance} \times \text{Power}}$



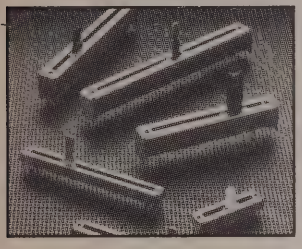
1/3 Watt, Cermet—RVG0707

Resistance Range:	100 ohms to 1 Megohm
Tolerance:	±20%
Temperature Coefficient:	± 250ppm/°C
Residual Resistance:	100 to 500 ohms — 5 ohms max. Over 500 ohms — 1% max.
Taper:	Linear
Power Rating:	1/3 W (at 70°C) Derated to 0 Watts at 125°C
Max. Working Voltage:	100 VDC
Torque:	.27 to 2.8 in.-oz. (20 to 200 g cm)
Terminal Strength:	12.35 oz. (350 gr) when the force is applied in the direction of the axes of the terminal
Effective Rotation:	200° ±10°

NOBLE

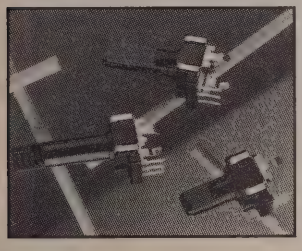
Slide and Rotary Potentiometers Surface Mount Trimmers and Switches

Whatever your application, Noble has the product specifically designed to meet your most demanding performance and quality specifications.



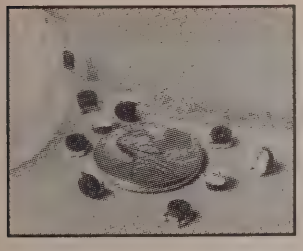
Slide Potentiometers

- Low-Profile Series — Single and dual element available in 15, 20, 30, 45 or 60 mm travel
- High-Profile Series — Single and dual element features 30, 45, or 60 mm travel
  Single element available in 80 and 100 mm travel
- Smooth operation and long life
- Option of insulated or metal levers



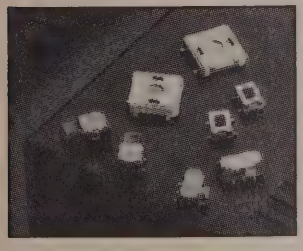
9mm Rotary Potentiometers

- Film base element provides smooth/low noise operation
- Snap-in mounting bracket for vertical or horizontal mounting
- Available with Audio, Linear or Reverse Audio Tapers
- Resistance range of 5KΩ – 500KΩ



Surface Mount Trimmers

- 3 mm and 4 mm cermet trimmer potentiometers
- Metal glaze element provides stability for high operating temperatures
- Designed for reflow soldering techniques
- Available in tape and reel format



Surface Mount Switches

- Miniature surface mount switches in three styles: tactile, push or slide
- Tactile switches feature sharp detent click and sealed construction
- Low-current, 2-circuit push switches have a travel length of 2.5 mm
- 2- or 3-position slide switches designed for reflow soldering

NOBLE U.S.A., INC. 5450 Meadowbrook Industrial Court, Rolling Meadows, IL 60008 USA
Phone: 708/364-6038 • FAX: 708/364-6045

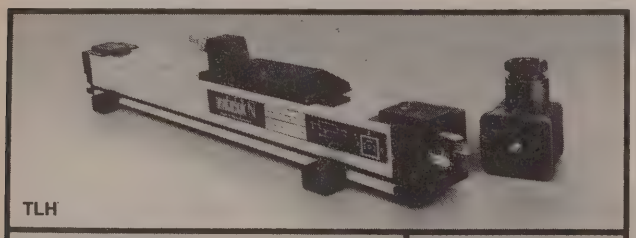
Displacement Transducers • Rotary and Rectilinear

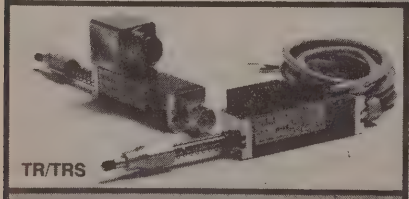
Novotechnik U.S.'s family of rotary and rectilinear displacement transducers features outstanding linearities, high tolerance to environmental extremes, and long operating lifetimes (typically 100 × 10^6 operations).

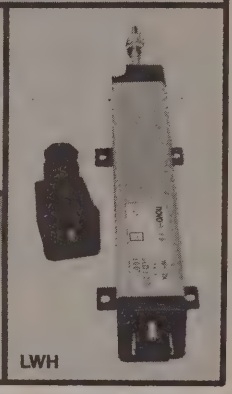
The position transducers and rotary potentiometers have conductive plastic resistance and collector tracks, and use multi-fingered elastometer-damped precious metal wipers.

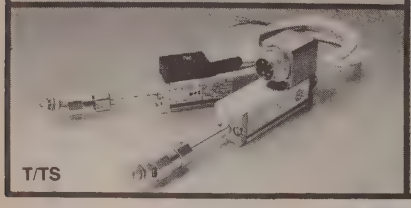
The linear transducers offer a range of electrical strokes from 25mm to 4000mm, with resolution better than .01mm and linearities as low as 0.01%. Operational speeds are typically as high as 10 m/s.

The rotary potentiometers give 360° of mechanical rotation, operational speeds to 10,000 rpm, accelerations to 50,000 rad/s², linearities to 0.02% and resolution better than 0.01°.


TLH


TR/TRS


LWH


T/TS

Linear Position/Displacement Transducers

TLH Series Features side actuation and ball coupling to eliminate offset errors, and twenty-one stroke lengths from 100-4000mm. Independent linearity is between ±.07% and ±.01%; resolution is .01mm.

LWG Series Ruggedized for use in rigorous mechanical testing applications, the LWG can be mounted over swivelling pivot heads with up to ±30° of movement, eliminating side load errors. Eight stroke lengths are available from 150-750mm, with linearity to ±.05%.

LWH Series Features pivoting front bearing and range of connectors: DIN, Binder, or Amphenol. Eleven stroke lengths are available from 75 to 900mm, with independent linearity between ±.07% and ±.01% and resolution of .01mm.

TR/TRS Series Displacement transducer with stroke length of 25, 50, 75 or 100mm, return spring and double bearings. Linearities range from ±.2% to ±.15%; 3-core cable or plug-and-socket connections are available.

T/TS Series Features double precision bearings and anti-rotation mechanism for load-free operation, five stroke lengths from 25 to 150mm, and linearities from ±.2% to ±.075%. Two alternate electrical connections are available: via 3-core cable (type T) or plug-and-socket (type TS).

Resistance Elements Novotechnik U.S. offers resistance elements with stroke lengths between 25 and 4000mm and wipers for integration into a customer's system or device. Special customized versions are available.

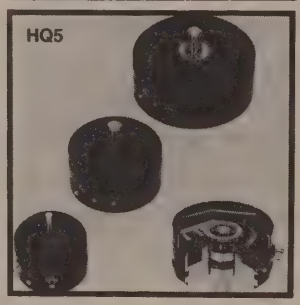
Custom-designed Transducers

Novotechnik U.S. welcomes inquiries from design engineers with special needs for sensing and transmitting motion, position and displacement. We welcome custom designs and the opportunity to quote on any unique requirement you may have. For more information call us at 508-485-2244 (fax: 508-485-2430).

LWG

Integrated Bearing

resistance elements


HQ5

Rotary Potentiometers

Integrated Bearing Series Industry's first rotary potentiometer with a single integrated main bearing. The innovative design improves reliability and performance, giving linearities to ±.02% (servo size 20). Also available are sizes 9, 11, 11 (low torque), and 13.

HQ5 Series Novotechnik's standard units for machinery and instrumentation. Linearities of ±.05% (servo sizes 9, 11 and 13) and ±.025% (size 20) are achieved through final stage trimming of fully assembled potentiometer. Max. operational speed 10,000 rpm; acceleration 50,000 rad/s².

Resistance Elements Rotary potentiometer elements are available with wipers for incorporation into customers' devices as integral potentiometers.

Special-Purpose Potentiometers Novotechnik U.S. offers rotary potentiometers for a wide spectrum of applications:

- Low Torque Potentiometers...for angular measurement without loading
- Industrialized Potentiometers...for use in harsh environments
- Sensor Potentiometers...specially developed for the automobile industry
- Geared Potentiometers...for use in harsh environments with backlash-free gearing for 3, 5 or 10 turns
- Motorized Potentiometers...self-contained units with speeds from 120°/s to 360°/s and output torque from 10Ncm to 100Ncm.

novotechnik
Siedle Group

Novotechnik U.S., Inc.
237 Cedar Hill Street
Marlborough, MA 01752
Tel: 508-485-2244
FAX: 508-485-2430

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- Analog or digital output
- Heavy duty, fully sealed models
- Military approved models

Penny+Giles

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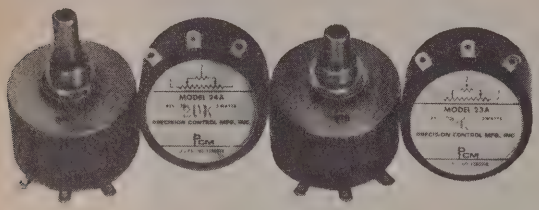
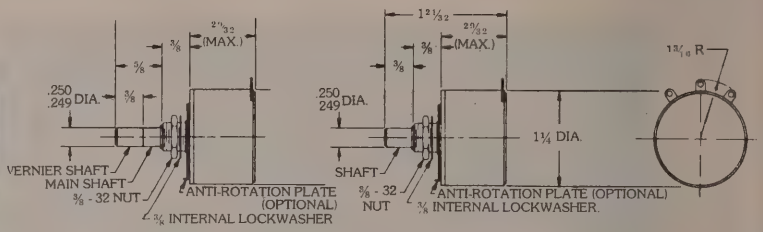
We Specialize in Precision Controls
PRECISION CONTROL MFG. INC.
1509 B QUEEN ANNE AVENUE N., SEATTLE WASHINGTON 98109
(206) 281-9380 FAX: NONE

HIGH RESOLUTION VERNIER POTENTIOMETERS





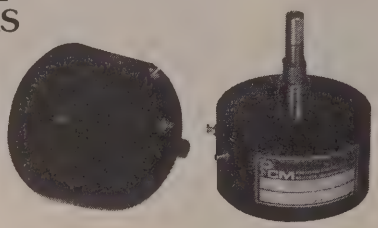
Models 23A and 24A Vernier potentiometers feature high and very high resolution because of their unique design. Coupled both electrically and mechanically, they allow any fixed portion of the coarse element (5% or less) to be expanded over the 270° of shaft rotation on the vernier. Total rotation is 555° (1.5 turns) and a 5% vernier presents a resolution roughly equivalent to a 3600° (10 turn) model; a 2.5% vernier is about equivalent to a 7200° (20 turn) model; a 1% vernier is approximately equivalent to a 18000° (50 turn) model.

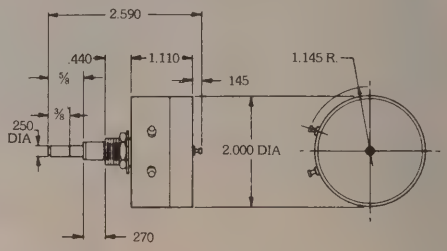
Customized products are available with modified shafts. R_t (total resistance), tolerance, P_v (vernier percentage), and torque. Please consult the factory with your unique requirements.

All PCM potentiometers are wire wound; standard values are from 100 ohms to 100K ohms ±3%.

We sell quality and service and we stand behind what we sell.

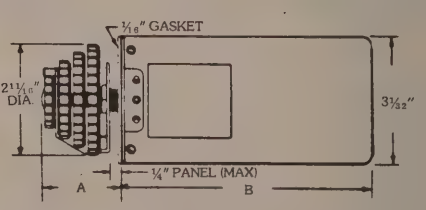
DOUBLE VERNIER POTENTIOMETERS





For applications requiring extremely high resolution, the Model 30A Vernier Potentiometer provides 0.002% or better resolution in less than 2½ turns of the shaft. The 30A does not rely on gear ratios to achieve mechanical resolution, but through a unique patented design, provides true electrical resolution which is roughly equivalent to 40 turn potentiometers. The vernier contacts span any 5% of the main winding and expand it over the 280° rotation of the first vernier. Any 5% segment of the first vernier is in turn expanded over the 270° rotation of the second vernier. Thus extreme resolution is possible in only 830° of total shaft rotation.

HIGH ACCURACY DECADE POTENTIOMETERS AND RHEOSTATS



Precision Control Mfg., Inc. (PCM) produces high quality, coaxial dial decade potentiometers and rheostats for high accuracy applications. The basic design features a positive in-line readout and easy, rapid adjustment made possible by a combination of distinct dials and a parallax free indicator. The unique electrical and mechanical design of PCM decades makes a small and accurate package which is very rugged.

Decade potentiometers provide linearities ranging from ±0.005% in the model 50A to ±0.0025% in the model 60A. All PCM rheostats have an accuracy base of ±0.025%.

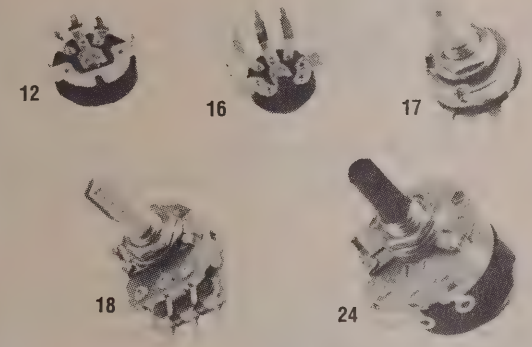
All PCM decades are available in militarized versions which meet or exceed the environmental portions of MIL-E-5272C, Sections 4.2.2, 4.3.1, 4.4, 4.6 through 4.11.2, 4.12, 4.15 and MIL-T-945A, Sections 4.4.1 through 4.6. Resistors used in PCM decades are wound with only premium resistance alloys for low temperature coefficients and are single layer wound, with low inductance making possible precision attenuation over a wide range of frequencies. Switch decks utilize low leakage materials and feature gold plated silver contacts. The case is heavy gauge aluminum to provide shielding and dust protection, shafts are of stainless steel.

RDI ELECTRONICS INCORPORATED

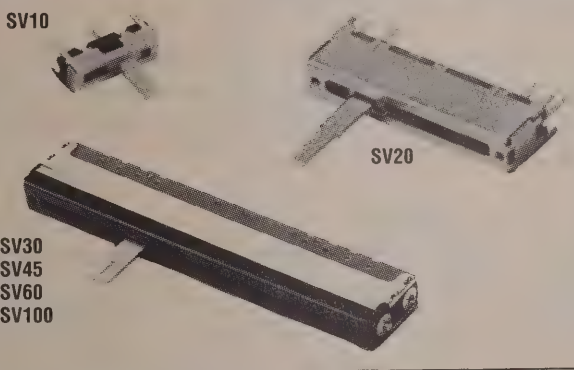
The following information is excerpted from our catalog. Please contact us for your complete guide to the components available from RDI Electronics.

POTENTIOMETERS

RDI Electronics offers both rotary & slide potentiometers in a wide range of sizes and mounting configurations. From our ultra thin low profile rotarys to our 100mm "Easy Glide" slide potentiometer, RDIE can satisfy your requirements. Linear, Log, and Anti-Log resistance tapers available.



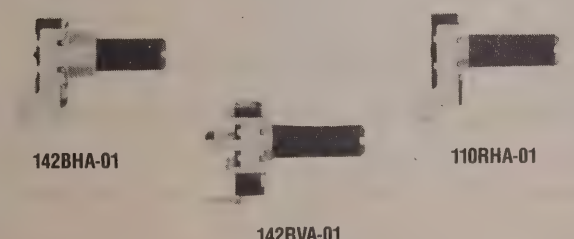
ROTARY TYPE ELECTRICAL SPECIFICATIONS					
	φ12	φ16	φ17	φ18	φ24
Total Resistance	1 to 500KΩ±20%				
Power Rating (Taper B)	0.1W	.2W			0.5W
Power Rating (other)	0.5W	0.1W			0.25W
Operating Volt. Max (B)	DC 200V	DC 250V			DC500V
Operating Volt. (other)	DC 150V	DC 200V			
Sliding Noise	47 mV Max.				
Insulation Resistance	100MΩ Min. at DC 500V				
Withstanding Voltage	1 min. at AC 500V				AC 1,000 V
MECHANICAL SPECIFICATIONS					
Rotation Torque	20 to 200 g.cm				50 to 450 g.cm
Angle of Rotation	230° ± 10°		260° ± 10°		300° ± 10°
Torque at End Stop	3 Kg.cm		4 Kg.cm		5 Kg.cm
Rotational Life	15,000 cycles Min.				
SWITCH SPECIFICATIONS					
Rating	DC 12V 1A		AC 125V 1A		AC 125V 1A,3A
Operating Force	100 to 400 g.cm				1.5 Kg.cm Max.
Operating Angle	45°Max.				60° Max.
Contact Resistance	Less than 50 mΩ				
Life	5,000 cycles Min.				



SLIDE TYPE ELECTRICAL SPECIFICATIONS	
Total Resistance Range	500Ω to 1MΩ ± 20%
Resistance Taper	Any type taper available.
Power Rating	"B" taper:0.25W, Others:0.125W.
Operating Voltage Max.	DC 350V.
Insulation Resistance	100MΩ Min. at DC 500V.
Withstanding Voltage	1 min. at AC 500V
Sliding Noise	56mV.
MECHANICAL SPECIFICATIONS	
Operating Force	50 to 350g.
Shaft Stop Strength	5kg Min.
Shaft Wobble	2L/20mm Max. (L: Shaft Length, Lever Swing)
Sliding Life	15,000 cycles Min.

11 & 14mm ROTARY TYPE

- Horizontal and vertical PC Mount
- With or without threaded bushing
- Flux resistant



		φ 11 Type	φ 14 Type
ELECTRICAL SPECIFICATION			
Total Resistance Range		5kΩ to 500kΩ±20%	
Resistance Taper		A, B, C, D, W etc	
Power Rating		0.05 W	
Operating Voltage Max.		AC 50V, DC 20V	AC 50V for A.C use only
Residual Resistance		R ≦10 kΩ : 20Ω Max. 10kΩ<R<50 kΩ : 30Ω Max. 50kΩ ≦R ≦500kΩ : 0.1% Max. of R	R ≦30 kΩ : 30Ω Max. 30kΩ<R ≦500kΩ : 0.1% Max. of R
Sliding Noise		Within 47 mV	
Insulation Resistance		100MΩ Min. at DC 500V	100MΩ Min. at DC 250V
Withstanding Voltage		Min. 1 minute at AC 500V	Min. 1 minute at AC 300V
Tracking Error	Volume		Within ± 3dB, at −40 to 0dB
	Tone		Within ± 2dB, center position

FROM PROTOTYPE TO PRODUCTION, SPECIFY RDI ELECTRONICS FOR QUALITY, SERVICE AND COMPETITIVE PRICING.

RDI Electronics, Inc.,/ Dept. E, 147 Palmer Ave., Mamaroneck, NY 10543 Tel: 914-777-7000/ Fax: 914-777-7070

FOR THE JAPANESE, *SHOKAI* MEANS INTRODUCTION

WHAT DOES *SHOKAI* MEAN FOR YOU? (HINT: IT MAKES YOUR IDEAS PROFITABLE)

Let's face it. As a source for electronic and electromechanical components, the quality and pricing of the Far East can't be matched on our side of the ocean. But you can't go to the Far East whenever you need to source a product.

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SHOKAI® is an American company, with over 30 years experience manufacturing and importing components from the Far East. We were serving American manufacturers long before everybody with a fax machine and a foreign telephone book could claim to be an overseas supplier. And we will be here long after they are gone.

We speak your language. We understand you - your time frames - your requirements - your problems – the quality and personal attention you and your customers demand. As hundreds of "Top 500" companies have learned, let SHOKAI® be your source for components from Japan, Taiwan, Hong Kong and the rest of the Far East.

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- Crystals, Filters and Oscillators
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- Potentiometers (Carbon, Cermet, Linear & Nonlinear, Single & Multi-turn & Trimmer)
- Transducers
- Transformers (Audio, IF, RF, Switching, Telecommunications, Toroidal)

And many more. Try us. You can start by requesting a catalog. Let us know what product you're looking for. Or better yet, tell us exactly what you want. You won't be disappointed.

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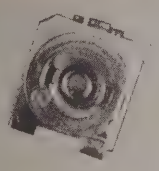
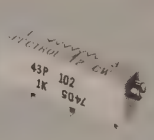
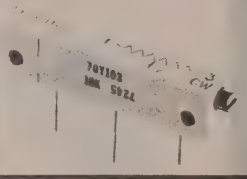
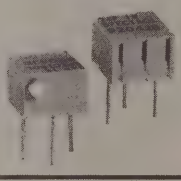
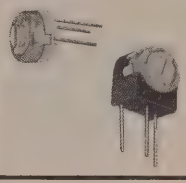
Spectrol®

TRIMMERS



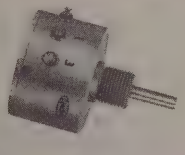
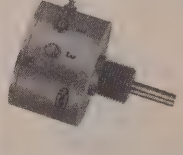
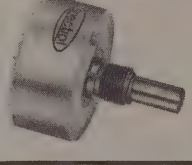


MODEL	4H	4M	43✲	63✲
Description	4mm Square Surface Mount	4mm Square Surface Mount	3/4" Rectangular Multi-Turn	3/8" Square Single Turn
Element Technology	Cermet	Cermet	Cermet	Cermet
Resistance Range	100Ω to 2MΩ	200Ω to 2MΩ	10Ω to 2MΩ	10Ω to 2MΩ
Resistance Tolerance, %	±25%	±25%	±10%	±10%
Power: Watts at °C	1/10 W at 70°C	1/10 W at 70°C	0.75 W at 70°C	0.5 W at 70°C
Electrical Travel	270° ±10%	240° ±10%	20 Turns, Nominal	270°
Operating Temperature	−55°C to +125°C	−55°C to +125°C	−55°C to +125°C	−55°C to +125°C

MODEL	64✲	70✲	74	75✲
Description	3/8" Square Multi-Turn	1-1/4" Rectangular Multi-Turn	1/4" Square Multi-Turn	1/4" Round or Square Single Turn
Element Technology	Cermet	Cermet	Cermet	Cermet
Resistance Range	10Ω to 2MΩ	10Ω to 2MΩ	10Ω to 1MΩ	10Ω to 2MΩ
Resistance Tolerance, %	±10%	±10%	±10%	±10%
Power: Watts at °C	0.5 W at 85°C	1 W at 85°C	0.25 W at 85°C	.5 W at 70°C
Electrical Travel	25 Turns, Nominal	20 Turns, Nominal	12 Turns, Nominal	230° ±5°
Operating Temperature	−55°C to +125°C	−55°C to +150°C	−55°C to +125°C	−55°C to +125°C

POTENTIOMETERS

MODEL	122	128	132✲	138✲
Description	1-1/16" Round 1/8" Shaft	1-1/16" Round 1/8" Shaft	1-5/16" Round 1/4" Shaft	1-5/16" Round 1/4" Shaft
Mounting	Bushing or Servo	Bushing or Servo	Bushing	Bushing
Element Technology	Wirewound	Co-Molded C P	Wirewound	Conductive Plastic
Resistance Range	5Ω to 20KΩ	500Ω to 50KΩ	5Ω to 20KΩ	1KΩ to 50KΩ
Tolerance, %	±3%, 20Ω ≤ Rt ≤ 100KΩ	±10%	±3%, 50Ω ≤ Rt ≤ 35KΩ	±10%
Linearity, %	±0.50%, 200Ω ≤ Rt ≤ 100KΩ	±0.5%	±0.50%, 200Ω ≤ Rt ≤ 35KΩ	±0.5%
Power: Watts at °C	2.3 W at 40°C	1.9 W at 40°C	2.75 W at 40°C	2.0 W at 40°C
Electrical Travel: Continuous	350° ±2°	345° ±4°	352° ±2°	345° ±4°
Stops			336° ±2°	336° ±4°

✲ Standard Distributor Product

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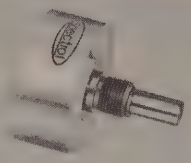
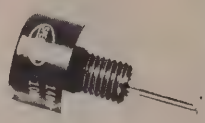
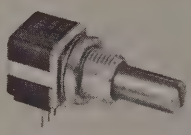
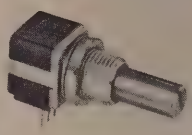
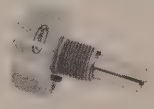
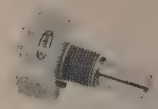
POTENTIOMETERS

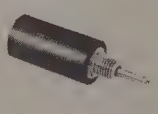





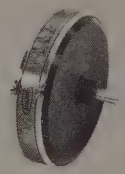
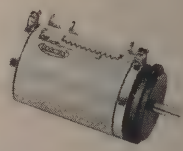
MODEL	139	140 ✡	148	149
Description	1-5/16″ Round 1/4″ Shaft	1/2″ Round 1/8″ Shaft	1/2″ Square, PCB Pins 1/8″ or 1/4″ Shaft	1/2″ Square, PCB Pins 1/8″ or 1/4″ Shaft
Mounting	Bushing	Bushing	Bushing	Bushing
Element Technology	Cermet	Wirewound	Conductive Plastic	Cermet
Resistance Range	500Ω to 2MΩ	50Ω to 50KΩ	100Ω to 1MΩ	100Ω to 2MΩ
Tolerance, %	±20%	±5%	±20%	±10%
Linearity, %	±2.0%	±1%	±5%	±5%
Power: Watts at °C	5.0 W at 40°C	2.0 W at 40°C	0.5 W at 70°C	1.0 W at 85°C
Electrical Travel: Continuous	345° ±4°			
Stops	336° ±4°	320° ±5°	265° ±5°	265° ±5°





MODEL	152	157 ✡	158	159
Description	7/8″ Round 1/8″ or 1/4″ Shaft	7/8″ Round 1/8″ or 1/4″ Shaft	7/8″ Round 1/8″ or 1/4″ Shaft	7/8″ Round 1/8″ or 1/4″ Shaft
Mounting	Bushing or Servo	Bushing or Servo	Bushing or Servo	Bushing or Servo
Element Technology	Wirewound	Conductive Plastic	Co-Molded C P	Cermet
Resistance Range	5Ω to 20KΩ	1KΩ to 50KΩ	500Ω to 50KΩ	500Ω to 2MΩ
Tolerance, %	±3%, 50Ω ≤ Rt ≤ 40KΩ	±20%	±10%	±20%
Linearity, %	±0.5%, 500Ω ≤ Rt < 40KΩ	±2.0%	±0.50%	±2.0%
Power: Watts at °C	2.0 W at 40°C	1.0 W at 40°C	1.0 W at 40°C	3.5 W at 40°C
Electrical Travel	340° ±2°	340° ±4°	340° ±4°	340° ±4°



MODEL	162 ✡	302	308	502
Description	Ten Turn 1/2″ Dia., .0935″ Shaft	2″ Round 1/4″ Shaft	2″ Round 1/4″ Shaft	Ten Turn 7/8″ Dia., 1/8″ Shaft
Mounting	Bushing	Bushing or Servo	Bushing or Servo	Bushing or Servo
Element Technology	Wirewound	Wirewound	Co-Molded C P	Wirewound
Resistance Range	100Ω to 100KΩ	5Ω to 50KΩ	500Ω to 100KΩ	15Ω to 100KΩ
Tolerance, %	±5%	±3%, 50Ω ≤ Rt ≤ 85KΩ	±10%	±3%, 100Ω ≤ Rt ≤ 150KΩ
Linearity, %	±0.30%	±0.25%, 200Ω ≤ Rt ≤ 85KΩ	±0.25%	±0.25%
Power: Watts at °C	2.0 W at 40°C	6.18 W at 40°C	3.09 W at 40°C	3.09 W at 40°C
Electrical Travel	3,600° +15° −0°	350° ±2°	350° ±2°	3,600° +4° −0°

✡ Standard Distributor Product

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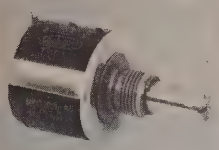
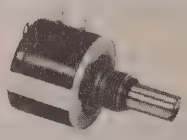
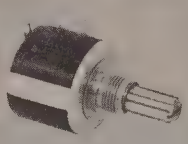
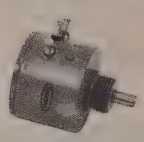
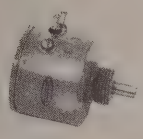
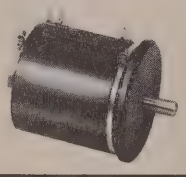
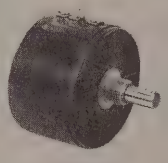
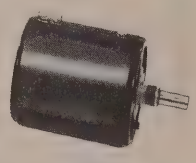
POTENTIOMETERS

MODEL	533 ✲	534 ✲	535 ✲	702
Description	Three Turn 7/8″ Dia., 1/4″ Shaft	Ten Turn 7/8″ Dia., 1/4″ Shaft	Five Turn 7/8″ Dia., 1/4″ Shaft	7/8″ Round 1/8″ Shaft
Mounting	Bushing or Servo	Bushing or Servo	Bushing or Servo	Bushing or Servo
Element Technology	Wirewound	Wirewound	Wirewound	Wirewound
Resistance Range	50Ω to 20KΩ	100Ω to 100KΩ	50Ω to 50KΩ	5Ω to 20KΩ
Tolerance, %	±5%	±5%	±5%	±3%, 20Ω ≤ Rt ≤ 100KΩ
Linearity, %	±0.25%	±0.25%	±0.25%	±0.5%, 500Ω ≤ Rt ≤ 100KΩ
Power: Watts at °C	1.55 W at 40°C	3.09 W at 40°C	2.32 W at 40°C	1.25 W at 70°C
Electrical Travel	1,080° +10° −0°	3,600° +10° −0°	1,800° +10° −0°	350° ±2°

MODEL	708	802	830 ✲	860 ✲
Description	7/8″ Round 1/8″ Shaft	Ten Turn 1-13/16″ Dia., 1/4″ Shaft	Three Turn 1-13/16″ Dia., 1/4″ Shaft	Ten Turn 1-13/16″ Dia., 1/4″ Shaft
Mounting	Bushing or Servo	Bushing or Servo	Bushing	Bushing
Element Technology	Co-Molded C P	Wirewound	Wirewound	Wirewound
Resistance Range	500Ω to 50KΩ	20Ω to 200KΩ	15Ω to 50KΩ	20Ω to 200KΩ
Tolerance, %	±10%	±3%, 200Ω ≤ Rt ≤ 500KΩ	±3%, 200Ω ≤ Rt ≤ 150KΩ	±3%, 200Ω ≤ Rt ≤ 500KΩ
Linearity, %	±0.5%	±0.25%	±0.25%	±0.25%
Power: Watts at °C	1.5 W at 40°C	7.72 W at 40°C	3.0 W at 40°C	8.0 W at 40°C
Electrical Travel	340° ±5°	3,600° +4° −0°	1,080° +4° −0°	3,600° +4° −0°

DIALS

MODEL	11 ✲	15 ✲	16 ✲	21 ✲
Description	Round Vernier Scale	Rectangular Digital Scale	Round Vernier Scale	Round Vernier Scale
Size	1″ Dia.	1″ Wide	7/8″ Dia.	1-13/16″ Dia.
Number of Turns	11	15-1 / 10 15-2 / 100	15	15
Minor Scale Division	1/50 Turn	1/500 Turn	1/50 Turn	1/100 Turn
Shaft Bore	0.250″	0.250″	0.250″	0.250″
Finish: Exposed Metal Knobs	Satin Chrome Plated Black Plastic	Satin Metal Black Plastic	Brushed Metal Black Plastic	Satin Chrome Black Plastic

Trimming Potentiometers

TOCOSAMERICA

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Affiliated With COSMOS TOKYO

Single Turn

Series	Description	Adj. Turns	style	Res. Range (Ω) Res. Tol. (%)	Power Rating (W/°C) Working Vol. Max (V) Operating Temp. Range (°C)	Features Available
GF04 Cermet	Round 4.8mm (0.19″)	1	W U V S UT VT	100Ω~1MΩ ±20%	0.5W/70°C 200V −55°C~+125°C	• Sealed • Flame retardant • Tape & Reel
GF06 Cermet	Square 6.8mm (¼″)	1	P P_1 P_2 W U U_1 Y Y_1 X X_1 S S_1 V V_1 UT VT	10Ω~5MΩ ±10%	0.5W/70°C 250V −55°C~+125°C	• Sealed • Space Saving Size • Tape & Reel • Low Cost • Zero-backlash
G12 Cermet	Round 12.6mm (½″)	1	P X S	10Ω~1MΩ ±20% (±10%)	0.75W/70°C 300V −55°C~+125°C	• Sealed • Excellent Stability • Dial Markings
GF12 Cermet	Square 12.0mm (½″)	1	P X S R	100Ω~1MΩ ±20% (±10%)	0.75W/70°C 300V −55°C~+125°C	• 5,000 cycles • Sealed • Flame retardant
GF12 Cermet	Square 12.0mm (½″)	1	P X S R	100Ω~1MΩ ±20% (±10%)	0.75W/70°C 300V −55°C~+125°C	• With Metal Shaft (5S, 10S) & Mold Shaft (8.2S) • 5,000 cycles • Sealed • Flame retardant
FF-08 Carbon	8mm	1	2V 2VZ2 3V 3VZ2 3H 3HZ2	500Ω~1MΩ ±25%	0.2W/50°C 100V −30°C~+70°C	• Low TCR; ±250ppm/°C • Low Cost • With Dust Proof Cap(Z)
FF-06 Carbon	6mm	1	30HZ 31VZ 30VZ 20VZ	500Ω~1MΩ ±30%	0.1W/50°C 50V −30°C~+85°C	• Low TCR; ±250ppm/°C • Low Cost

Surface Mount

Series	Description	Adj. Turns	style	Res. Range (Ω) Res. Tol. (%)	Power Rating (W/°C) Working Vol. Max (V) Operating Temp. Range (°C)	Features Available
TRG O4 Cermet	4mm ×4.5mm	1	2S1 3S1 3S4	100Ω~1MΩ ±30%	0.1W/70°C 50V −40°C~+100°C	• Surface Mount • Low Cost • Space Saving Size • Rheostat & voltage divider • Supplied in Embossed Tape • Bottom Side Adjust
G4 Cermet	Square 4.5mm ×5mm	1	A, B D, E S C, F	50Ω~2MΩ ±20% (±10%)	0.25W/70°C 200V −50°C~+125°C	• Sealed & Surface Mount • Space Saving Size • Side adjust • Supplied in Embossed Tape • 300°C Max. • With Lead C&F

Trimming, Slide and Rotary Potentiometers

When reliability is critical...

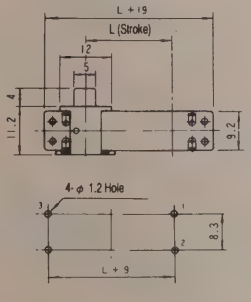
Tocos examines the performance of its products long after their sale, through the widely used FIT, or failure rate in the field methodology. Of the one-hundred million units of our GF06 series produced over a 7-year span, **less than 1ppm failed** for a 0.06 (FIT) failure rate in the field.

Multi-Turn

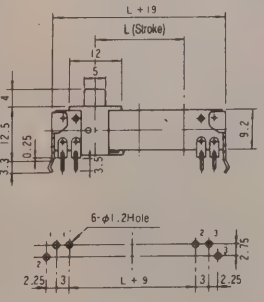
Series	Description	Adj. Turns	style	Res. Range (Ω) Res. Tol. (%)	Power Rating (W/°C) Working Vol. Max (V) Operating Temp. Range (°C)	Features Available
RJCO97 Cermet	Rectilinear 19.0mm (¾" Long)	15	P X	10Ω~2MΩ ±10%	0.75W/70°C 300V −55°C~+125°C	• Sealed • Low Cost • Excellent Stability
RJCO97 Cermet	Rectilinear 19.0mm (¾" Long)	15	PK PK_2	10Ω~2MΩ ±10%	0.75W/70°C 300V −55°C~+125°C	• With Knob • Sealed • Low Cost • Excellent Stability
RJCO7 Cermet	Rectilinear 17.0mm (⅔" High)	13	R	100Ω~2MΩ ±20% (±10%)	0.75W/40°C 300V −55°C~+125°C	• Sealed • Excellent Stability & Adjustability
GV6 Cermet	Square 6.8mm (¼")	2	P S U V UT VT	10Ω~2MΩ ±10%	0.5W/70°C 250V −55°C~+125°C	• Sealed • Space Saving Size • Tape & Reel • Excellent Stability & Adjustability
RJC26 Cermet	Square 6.8mm (¼")	11	W X	100Ω~2MΩ ±10%	0.25W/70°C 300V −55°C~+125°C	• Sealed to MIL-R-22097 • Flame Retardant-Meets UL-94V-0

Slide Potentiometers

SS002N00A
Horizontal type
10mm, 15mm, 20mm, 30mm Stroke
*Single and Dual units available.



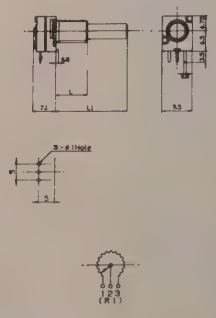
SS002GOOD
Vertical type

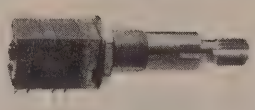


Rotary Potentiometers

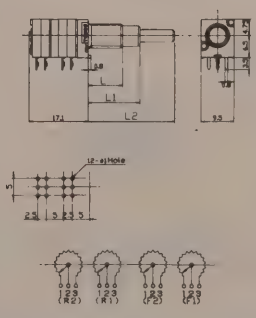
TP96N00
Single unit, single shaft

*With switch available
*Over 100 combinations





TP96H00
Quad unit, dual shaft



TOCOSAMERICA 1177 E. Tower Road, Schaumburg, Illinois 60173
TELEPHONE: 708-884-6664 • FAX: 708-884-6665

*Catalog available on Slide Potentiometers and Rotary Potentiometers.

VERNITRON
CORPORATION

Quality trimmer and precision potentiometers, attenuators and custom resistive devices.

VRN INTERNATIONAL DIVISION
2800 Anvil St. N. • St. Petersburg, FL 33710 • (813) 347-2181 • FAX: (813) 347-3881

VRN MILITARY TRIMMER POTENTIOMETERS

MIL-R-27208/MIL-R-39015* WIREWOUND TRIMMERS

Size	Series	No. Turns	Std. Res. (Ω)	Tol.	Pwr. Rating	Temp. Coeff.	Termination
3/8" Square	RT24 RTR24	23	10-10K	±5%	.75W	±50	3 PC pin styles, flexible leads (top & side adjust)
1/2" Square	RT22 RTR22	24	50-20K	±5%	.75W	±50	3 PC pin styles, flexible leads (top & side adjust)
1 1/4" Rect.	RT12 RTR12	22	10-20K	±5%	.75W	±50	2 PC pin styles, flexible leads (side adjust)

MIL-R-22097/MIL-R-39035** CERMET TRIMMERS

Size	Series	No. Turns	Std. Res. (Ω)	Tol.	Pwr. Rating	Temp. Coeff.	Termination
1/4" Square	RJ50 RJR50	1	100-500K	±10%	.25W	±100	1 PC pin style (top adjust)
1/4" Square	RJ26 RJR26	16	10-1M	±10%	.25W	±100	3 PC pin styles (top & side adjust)
3/8" Square	RJ24 RJR24	24	100-1M	±10%	.5W	±100	3 PC pin styles (top & side adjust)
1/2" Square	RJ22	24	10-1M	±10%	.5W	±100	3 PC pin styles, flexible leads (top & side adjust)
1 1/4" Rect.	RJ12 RJR12	22	100-1M	±10%	.75W	±100	2 PC pin styles, flexible leads (side adjust)

*Failure rate: RTR12 & RTR22 approved to P level; RTR24 approved to R level
**Failure rate: Approved to R level
FOR COMMERCIAL EQUIVALENTS, SEE OUR LISTING IN VOL. A, SECTION 4750

VERNITRON CORPORATION

Quality precision potentiometers.

PRECISION POTENTIOMETER DIVISION
2800 Anvil St. N. • St. Petersburg, FL 33710 • (813) 347-2181 • FAX: (813) 347-3881

VERNITRON PRECISION POTENTIOMETERS

Vernitron manufactures standard and custom precision potentiometers utilizing conductive plastic, cermet and wirewound elements. Call Vernitron to take the mystery out of problem solving.

Rotary Single-Turn Potentiometers Linear-Functional/Sine-Cosine

Multi-Element Assemblies Available (Ganged)

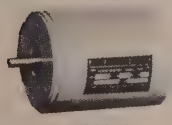
Available From 1/2" to 5" Diameters

SPECIFICATIONS

	Linear	Sine-Cosine
Mechanical Rotation	360° Continuous	
Electrical Function Angle	350° Nominal	360°
Resistance Range	0.5KΩ-2 MegΩ	500Ω-50KΩ/Quad
Best Linearity or Conformity	.1% ÷ Inch of Dia.	.3% P-P ÷ Inch of Dia.
Virtual Resolution	1/250,000	
Wattage	Diameter x 2 Watt(s)	
Temperature Range	–55°C to +125°C	
Taps, Maximum No.	Diameter x 6	
Starting Torque (In.-Oz.)	Diameter x .15	Diameter x .2
Guaranteed Life (at 100 RPM)	To 30 Million Cycles Depending on Circuitry	

Rotary Multi-Turn Potentiometers Linear-Functional

#7810



#20010

Available From 1/2" to 2" Diameters

SPECIFICATIONS

Model	7810†**	7820	7813/7814	20010
Mechanical Rotation	3700° Min.	7200° +100°–0°	3600° +100°–0°	3600° +100°–0°
Electrical Function Angle	3600°±10°	7200°±10°	3600°±5°	3600°±5°
Resistance Range	250Ω-125KΩ		5KΩ-1.5 MegΩ	5KΩ-3MegΩ
Best Linearity or Conformity	.075%	.05%	0.05%	0.01%
Virtual Resolution (Typ.)	1/200,000		1/400,000	
Wattage at 25°C	1		2	4
Temperature Range	–55°C to +125°C			
Taps Maximum No.*	1	2	1	
Starting Torque (In.-Oz.)	1.5		0.5	1.0
Guaranteed Life (at 100 RPM)	100 x 10^6 Revolutions Depending on Circuitry			
Stop Strength	10 In.-Oz.Max.		50 In.-Oz.	160 In.-Oz.

* For voltage reference, specify 0° width taps. For current carrying, specify zero resistance taps.
† Available in Dual Units, same case dimensions.
**Available to 36,000°

DIMENSIONS

Model	7810/ 7820	7813/ 7814	20010
A	.875	.875	2.000
B*	.750	.750	1.875
C	.1875	.125	.250
D*	.750	.800	.750
E	.062	.062	.035
F/G	.062	.062	.035
H	.600	.531	†
J	2.00	1.875	2.625
K	.375	.375	.375

*+ .0000 – .0005 † Axial Rear Terminations

Linear Motion Potentiometers

#111
#110
#113
#120

SPECIFICATIONS

Model	110*	111*	112	113*	116†	119*	120	121	111V*
Electrical Stroke	To 60"	To 28"	To 12"	To 4"	To 12"	To 10"	To 1"	To 12"	To 28"
Cross Section Configuration ¶	RD ○	SQ □	REC □	RD ○	REC □	RD ○	REC □	RD ○	SQ □
Resistance Range	250Ω/In. to 200K Ω/In.	150Ω/In. to 200K Ω/In.	150Ω/In. to 200K Ω/In.	500Ω/In. to 250K Ω/In.	150Ω/In. to 125K Ω/In.	350Ω/In. to 250K Ω/In.	500Ω/In. to 125K Ω/In.	500Ω/In. to 250K Ω/In.	150Ω/In. to 200K Ω/In.
Best Linearity	0.2% ÷ Length of Electrical Stroke								
Virtual Resolution	1/400,000								
Wattage	1 Watt per Inch of Stroke								
Temperature Range	– 55°C to + 125°C								
Taps Maximum No.‡	4	To Suit	To Suit	1	1	1	1	1	To Suit
Starting Force Oz. at 25°C	16	8	4	8	4	8	4	8	8
Life	30 Million Strokes, Depending on Circuitry								
Shaft Misalignment Feature	Available	Available	Available	Not Available	Not Available	Available	Available	Not Available	Available

* Available in Dual Units, same case dimensions.
† Available in Dual Unit providing the resistance and function of both elements is the same.
¶ RD–Round SQ–Square REC–Rectangular
‡ For Voltage reference, specify zero width taps. For current carrying, specify zero resistance taps.
§ Threaded, ball spring-return and other shaft endings available.

VERNITRON
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Quality trimmer and precision potentiometers, attenuators and custom resistive devices.

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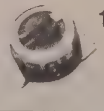
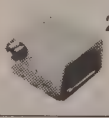
CERMET TRIMMERS

Size	Series	No. Turns	Std. Res. (Ω)	Tol.	Pwr. Rating	Temp. Coeff.	Termination
¼" Round	170	1	10-2M	±10%	.5W	±100 ***	2 PC pin styles (top adjust)
¼" Square	180 *	1	10-2M	±10%	.5W	±100 ***	4 PC pin styles (top & side adjust)
¼" Square	260 *	16	10-2M	±10%	.5W	±100 ***	3 PC pin styles (top & side adjust)
⅜" Square	780	1	10-2M	±10%	.5W	±100 ***	15 PC pin styles (top & side adjust)
⅜" Square	753 *	24	10-2M	±10%	.5W	±100	3 PC pin styles (top & side adjust)
¾" Rect.	960	20	10-2M	±10%	.75W	±100 ***	7 PC pin styles (side adjust)

CERMET SURFACE MOUNT TRIMMERS

¼" Round 	170	1	10-2M	±10%	.5W	±100 ***	Surface mount
¼" Square	180	1	10-2M	±10%	.5W	±100 ***	Surface mount
¼" Square 	260	16	10-2M	±10%	.5W	±100 ***	Surface mount

*Includes military approved versions

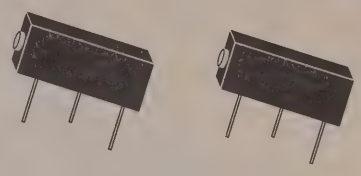
***Tighter specifications available—consult factory

A COMPANY OF VISHAY

VISHAY RESISTORS

Precision Bulk Metal® Foil Trimming Potentiometers

VISHAY Precision Trimmers have the Bulk Metal® foil resistive element which possesses a unique inherent temperature and load-life stability. In addition, their advanced, virtually backlash-free adjustment mechanism makes them easy to set quickly and accurately and keeps the setting exactly on target.



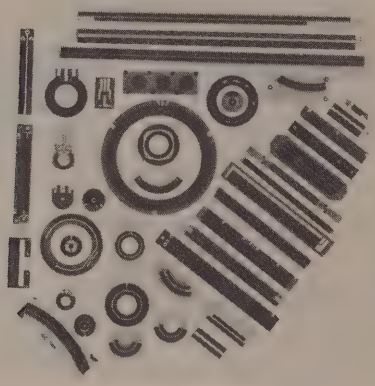
Specifications

Model Number	Resistance (Ohms)	Tolerance[1] Available To	Power	No. of Adjustment Turns	Nominal Dimensions Excluding Leads H x L x W Inch (mm) and Termination Styles	Load-Life Stability (Max Δ R)[3]	TCR (End to End)
1202* (RJ12 Style)	2, 5, 10, 20, 50, 100, 200, 250, 500, 1K, 2K, 5K, 10K, 20K	±10%, ±20%, ±5%, ±10%	0.5 W @ +85°C	25 ±2	0.325 x 1.250 x 0.195 (8.26) x (31.75) x (4.95) Type P: In-line pins Type Y: Staggered pins Type L: Flexible leads Type LB: Panel-mount with flexible leads	0.5% 2,000 hrs. @ +85°C	–55°C to +25°C +10 ppm/°C +25°C to +150°C –10 ppm/°C
1208 (RJ12 Style)	20, 50, 100, 200, 250, 500, 1K, 2K, 5K, 10K	±20% ±10%				0.5% 2,000 hrs. @ +85°C	–55°C to +25°C +20 ppm/°C +25°C to +150°C –20 ppm/°C
1240* (RJ26 Style)	5, 10, 20, 50, 100, 200, 500, 1K, 2K, 5K, 10K	±10% ±5%	0.25 W @ +85°C	21 ±2	0.250 x 0.250 x 0.175 (6.350) x (6.350) x (4.445) Type X: Edge-mount, side-adjust Type W: Edge-mount, top-adjust 0.175 x 0.250 x 0.250 (4.445) x (6.350) x (6.350) Type P: Horizontal mount, side adjust	1.0% 10,000 hrs. @ +85°C	–55°C to +25°C +10 ppm/°C +25°C to +150°C –10 ppm/°C
1242† (RJ26)	50, 100, 200, 500, 1K, 2K, 5K	±10%				1.0% 1,000 hrs. @ +85°C	–55°C to +25°C +10 ppm/°C +25°C to +150°C –10 ppm/°C
1248 (RJ26 Style)	20, 50, 100, 200, 500, 1K, 2K, 5K,	±10%				1.0% 1,000 hrs. @ +85°C	–55°C to +25°C +20 ppm/°C +25°C to +150°C –20 ppm/°C
1260* (RJ24 Style)	5, 10, 20, 50, 100, 200, 500, 1K, 2K, 5K, 10K	±10% ±5%	0.25 W @ +85°C	21 ±2	0.420 x 0.375 x 0.170 (10.67) x (9.53) x (4.32) Type W: Edge-mount, top-adjust Type X: Edge-mount side-adjust	1.0% 10,000 hrs. @ +85°C	–55°C to +25°C +10 ppm/°C +25°C to +150°C –10 ppm/°C
1268 (RJ24 Style)	20, 50, 100, 200, 500, 1K, 2K, 5K	±10%				1.0% 1,000 hrs. @ +85°C	–55°C to +25°C +20 ppm/°C +25°C to +150°C –20 ppm/°C
1280G* (1280)*	10, 20, 50, 100, 200, 500, 1K, 2K, 5K, 10K, 20K	±10%	0.75 W @ +25°C	26 ±2	0.270 x 0.750 x 0.190 (6.86) x (19.05) x (4.83) *Panel mount available*	0.5% 2,000 hrs. @ +25°C	–55°C to +25°C +15 ppm/°C +25°C to +125°C –15 ppm/°C
1285G* (1285)*	10, 20, 50, 100, 200, 500, 1K, 2K, 5K, 10K, 20K	±10% ±5%				0.5% 2,000 hrs. @ +25°C	–55°C to +25°C +5 ppm/°C +25°C to +125°C –5 ppm/°C

* Screening for low noise (CRV) is available.
† Qualified to MIL-R-22097
1, 3 For numerical footnote information, refer to VISHAY's Short Form Catalog or contact VISHAY at the number listed below.

POSITION FEEDBACK

Repeatable to .0005″
Design it in—your way!



Waters built in servo-feedback elements simplify design and cut costs.

Why box yourself in with "packaged pots"—and linear-to-rotary conversions, and linkages, and costly housings, shafts and bearings you don't really need? Design position or motion feedback *your* way—with our long-lasting, low-noise, custom-made feedback elements.

We can supply squares, circles, strips—any geometric shape you need in linear and non-linear plastic elements. You'll save time. Cut costs. And chances are you'll improve performance. Send today for full information. Or call (508) 358-2777.

LONGFELLOW® POSITION TRANSDUCERS

If you have the need to measure and control linear position with high accuracy, reliability and millions of operations, Waters offers an extensive range of sizes, linearities, and stroke lengths for applications ranging from heavy industrial equipment to space satellites.

Controller-compatible, these devices provide accurate position sensing, position feedback or programmable setpoint control with repeatability to .0005".

With built-in features like Myst**R**® conductive plastic elements and collectors, precious metal contacts, precision aluminum extruded housings, and stainless steel shafts, these devices can provide up to 100 million operations.

For the long (96") and short (1/2"), Waters transducers are the buy of the times.

Standard models available from stock. Unique, custom designs are our specialty.

WATERS MANUFACTURING, INC. | Talley™ Industries

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WAYLAND, MASSACHUSETTS 01778-1890
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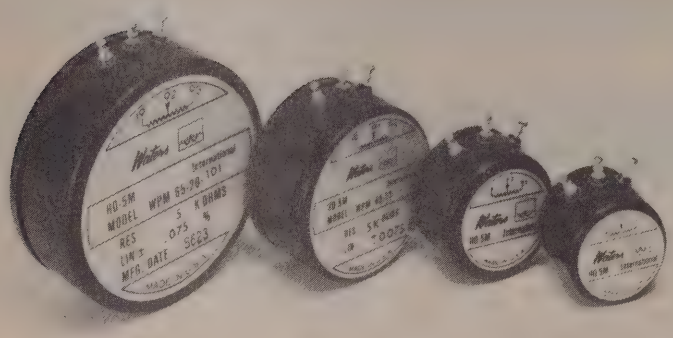
SERVO POTS

True Positional Output



Finally, a line of servo-mount potentiometers with true transducer performance that tells your machine where it really is. Waters' new HQ-5M International Standard Series uses our newly designed "ZB"® zero backlash wipers (patent pending) that provide *true* positional output in high speed, dynamic feedback or measuring systems.

- Long life with Waters' MystR® conductive plastic resistance elements—250x10^6 cycles, minimum
- Dither life 10^9 cycles, minimum
- Hysteresis less than 0.01 degrees
- Accuracy $<$0.1% APA (Absolute Positional Accuracy)
- Meets all applicable MIL-R-39023 specifications

HQ-5M series are available from stock in 4 standard servo sizes 9, 11, 13 & 20 (7/8", 1 1/16", 1 7/16" and 2").

TORQUE WATCH® GAUGE

Waters' Torque Watch Gauge, the world's standard for measurement of low torque values from 0.003 oz. in. to 200 oz. in. Now also available in Metric (gram-cm) and S.I. units. Waters also provides the Torque Watch Gauge Calibrator for on-site calibration and standardization.

Send now for detailed brochure.

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WAYLAND, MASSACHUSETTS 01778-1890
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TRANSISTORS

Manufacturer	Starting EEM Page No.	RF (Incl. Microwave)	Power		Switching	UJT	Darlington	Chip	Germanium	Small Signal	IGBT
			Bipolar	FET							
Collmer Semiconductor	A•2135		√	√§	√		√				√
ITT Components	A•2147				√§					√§	
NTE Electronics Inc.	A•2149	√	√	√	√	√	√	√	√	√	√
Philips Components/ Discrete Products	A•2150	√§	√§	√§	√§		√§			√§	
Philips ECG	A•2172	√	√	√			√		√		
Powerex, Inc.	A•2175		√		√		√				√
QMI/NIEC	A•2176			√§							
Raychem	A•2179	√			√					√	
Semtech	A•2180						√				
Solitron Devices	A•2219		√§*	√§*	√§*		√§*	√§*		√§*	√§*
Zetex Inc.	A•2227	√	√	√	√		√	√		√	√

§ Surface Mount.

THYRISTORS, RECTIFIERS, & DIODES

Manufacturer	Starting EEM Page No.	Thyristors			Rectifiers			Diodes								
		SCRs	TRIACs	DIACs	Silicon	Germanium	Bridges & Assemblies	Zener	Varactor	Silicon	Suppressor	Avalanche	Tunnel	High Voltage	Schottky	Germanium
BKC Semiconductors	A•2131				√			√		√				√	√	√
Collmer Semiconductor	A•2135				√§		√			√§				√	√§	
Crydom Co.	A•2136	√	√				√									
Douglas Randall	A•2144	√			√		√									
Electronic Devices, Inc.	A•2143				√		√			√		√		√		
ISKRA Electronics	A•2145				√		√			√						
ITT Components	A•2147				√§			√§		√§					√§	
NTE Electronics Inc.	A•2149	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Philips Components/ Discrete Products	A•2150	√§	√§		√§			√§	√§	√§		√		√§	√§	
Philips ECG	A•2172		√		√		√	√				√		√		
Powerex, Inc.	A•2175	√§	√§		√		√			√				√		
QMI/NIEC	A•2176				√§		√§	√§		√§				√§	√§	
Semtech	A•2180				√*		√*	√		√*	√*	√*		√*		
Solitron Devices	A•2219	√§*	√§*	√§*	√§*		√§*	√§*		√§*	√§*			√§*	√§*	
Teccor Inc.	A•2220	√	√	√	√											
World Products	A•2224							√		√	√	√		√		
Zetex, Inc.	A•2227							√	√	√					√	

§ Surface Mount.

BKC Semiconductors Incorporated

6 Lake Street • Lawrence, Massachusetts 01841
Telephone 508-681-0392 • TeleFax 508-681-9135

Diode Product Families

Typical Families	Category	Technology	Power Dissipation	Voltage	Current	Switching	Mil Types	Packages	Applications
1N914, 1N4148, 1N4150, etc.,	General Purpose Switching	Planar	To 500mWatts	To 100 Volts	To 200 mA	2 to 10 nanoSecs.	YES	DO-35 SMD LL-34/35 MELF	Circuit Protection, Glue Logic
1N6638 Series	Military/ Aerospace	Mesa	750mWatts	To 150 Volts	300 mA	To 6 nanoSecs.	YES	DO-35 Voidless Hard Glass Tungsten	For use in Hostile Environments
1N658-1N661 1N4938, etc.,	High Voltage	Planar	To 500mWatts	To 250 Volts	To 200 mA	To 300 nanoSecs.	YES	DO-35 SMD LL-34/35 MELF	Circuit Protection
1N458 Series 1N483 Series 1N3595 & 1N5194	Low leakage	Planar	To 500mWatts	To 250 Volts	To 200 mA	———	YES	DO-35 SMD LL-34/35 MELF	Sensitive Equipment Protection
BE110-114 Series	Ultra Low Leakage	Planar	250mWatts	60 Volts	50 mA	250 nanoSecs.	——	DO-35 SMD LL-34/35 MELF	For isolation in Ultra Sensitive Equipment
1N4156-57 Series MDF200 & 300	Stabistors	Planar 2 & 3 Chips	250mWatts	100 Volts	100mA	500 nanoSecs.	——	DO-35	For use as voltage or threshold offsets
1N60, 1N270, 1N3666, & Pro-Elect. types	Germanium	Gold Bonded Junction	To 100mWatts	To 100 Volts	To 200mA	50 to 500 nanoSecs. Typ.	YES	DO-7	ESD Protection
1N5711, 1N6263, BS101 Series	Silicon Schottky	Schottky Barrier	500mWatts	To 70 Volts	To 100mA	1.0 nanoSecs.	——	DO-35 SMD LL-34/35 MELF	Fast Circuit Protection
BS103 Series	Silicon Schottky	Schottky Barrier	500mWatts	To 40 Volts	400 mA	10 nanoSecs.	——	DO-35 SMD LL-34/35 MELF	Transient Protection

Zener Product Families

Typical Families	Power Dissipation	Voltage	Category	Comments	Technology	Mil Types	Packages	Applications
1N746A-759A 1N957B-982B 1N5224B-5281B	To 500mWatts	2.4 to 200 Volts	Gen. Purpose Regulation/ Protection		Planar/ Mesa	YES	DO-35 LL-34/35 MELF	Voltage regulation Circuit Protection
1N4624-4135 1N5522B-5546B	To 500mWatts	4.7 to 200 Volts	Low Noise		Planar/ Mesa	YES	DO-35 SMD LL-34/35 MELF	For use in Sensitive Instrumentation
1N6316-6355	500mWatts	4.7 to 200 Volts	Military/ Aerospace		Mesa	YES	DO-35 Voidless Hard Glass Tungsten	For use in Hostile Environments
1N4728A-4764A	1.0 Watt	3.3 to 100 Volts Internal types to 200 Volts	General Purpose Regulation/ Protection		Planar/ Mesa	——	DO-41 Glass SMD LL-41 MELF	Protection Commercial/ Automotive
1N5918A-5956A	1.5 to 2.0 Watts	4.7 to 200 Volts	Commercial- (Load Dump and Transient Suppression)	New Family Min. Surge @ 1mSec. > 100 Watts	Planar/ Mesa (Hex)	——	DO-41 Glass SMD LL-41 MELF	Commercial Automotive/ Industrial Transient Protection
1N6489-6490 1N4460-4496	1.5 Watts	4.7 to 200 Volts	Military/ Aerospace		Planar/ Mesa	YES	"A" Body Voidless Hard Glass Tungsten	For use in Hostile Environments
1N5967-5969 1N4954-4983	5.0 Watts	5.1 to 200 Volts	Regulation/ Protection Military/ Aerospace	Popular in Jet aircraft for lightening protection	Planar Mesa	YES	"B" Body Voidless Hard Glass Tungsten	Used in Extremely Hostile Environments
1N6461-6468	(5.0 Watts) 1 m.Sec. TSZ 500 Watts	5.6 to 54 Volts	Regulation/ Protection Military/ Aerospace	Uni-directional (TSZ) Transient Suppressor Zeners	Planar/ Mesa	Pending	"B" Body Voidless Hard Glass Tungsten	Used in Extremely Hostile Environments
1N6102,A-6137, A	(5.0 Watts) 1 m.Sec. TSZ 500 Watts	6.1 to 190 Volts	Regulation/ Protection Military/ Aerospace	Bi-directional (TSZ) Transient Suppressor Zeners	Planar/ Mesa	YES	"B" Body Voidless Hard Glass Tungsten	Used in Extremely Hostile Environments

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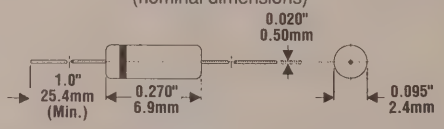
Rectifier Product Families

Typical Families	Category	Average Current	Peak Inverse Voltage	Power Dissipation	Technology	Switching	Mil Types	Packages	Applications
1N645-1N649	General Purpose low power	500 mA	To 600 Volts	To 750 mWatts	Mesa	——	YES	DO-35 SMD LL-34/35 MELF	Rectification & Protection
1N4001-4004 1N4933-4936	General Purpose Switching	1.0 Amp	To •400 Volts	1.0 Watt	Mesa	To 300 nanoSecs.	——	DO-41 Glass SMD LL-41 MELF	Rectification & Protection
1N5817, 18 & 19 MBRL Series	Silicon Schottky	1.0 Amp	To 40 Volts	1.0 Watt	Schottky Barrier	Typ. 20 nanoSecs.	——	DO-41 Glass SMD LL-41 MELF	Circuit Protection Switching Power Supplies
BKC XXX New Product under development	High Surge and/or fast recovery Commercial	1.0 to 2.0 Amps	To *400 Volts	1.5 to 2.0 Watts	Mesa (Hex)	Up To 30 nanoSecs.	——	DO-41 Glass SMD LL-41 MELF	Circuit Protection Switching Power Supplies
1N4245-4249 1N4942-4948 1N5614-5623	General Purpose Switching Aerospace	1.0 to 2.0 Amps	To *1000 Volts	1.5 Watts	Mesa	To 150 nanoSecs.	Pending	"A" Body Voidless Hard Glass Tungsten	Rectification & Circuit Protection in Hostile Environments
BES1001-1003 BES1101-1106 1N5802-5806	Fast Recovery Aerospace	1.0 to 2.5 Amps	To 400 Volts	To 2.5 Watts	Planar	To 25 nanoSecs.	YES	"A" Body Voidless Hard Glass Tungsten	Circuit Protection & Switching Power Supplies for Hostile Environments
1N5186-5190 1N5415-5420 1N5550-5554	General Purpose Switching Aerospace	2.0 to 6.0 Amps	To *1000 Volts	To 5.0 Watts	Mesa	To 150 nanoSecs.	Pending	"B" Body Voidless Hard Glass Tungsten	Rectification & Circuit Protection in Hostile Environments
1N5807-5811 BES1301-1306	Fast Recovery Aerospace	2.0 to 6.0 Amps	To 400 Volts	To 5.0 Watts	Planar	To 30 nanoSecs.	YES	"B" Body Voidless Hard Glass Tungsten	Circuit Protection & Switching Power Supplies for Hostile Environments

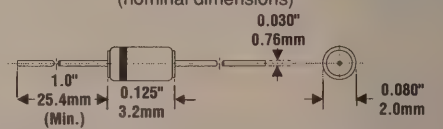
* Processes for voltages or types substantiallly above 400 volts are under development. Those voltages should be available by end of 1stQ 1994.

Package Dimensions

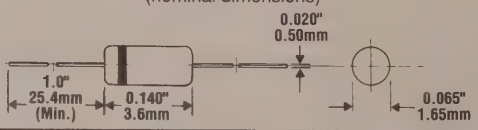
DO-7 Glass Package
(nominal dimensions)



A Body • Voidless Glass Package
(nominal dimensions)

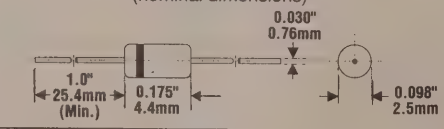


DO-35 Glass Package
(nominal dimensions)

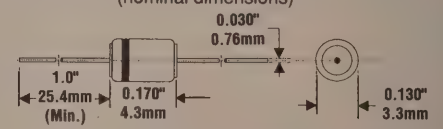


B Body • Voidless Glass Package
(nominal dimensions)

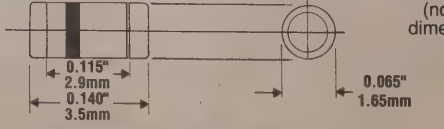
DO-41 Glass Package
(nominal dimensions)



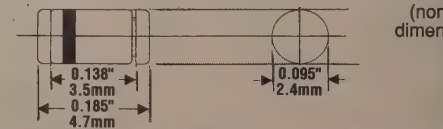
B Body (modified) • Voidless Glass Package
(nominal dimensions)



LL-34/35 MINI-MELF • Surface Mount Package
(nominal dimensions)



LL-41 MELF • Surface Mount Package
(nominal dimensions)



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through S Level

BKC is recognized as a leader in Source Control processing.

Our processes are rigorously controlled from wafer fab to packaging. Stringent control allows us to produce parts to your exact standards.

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For a price and delivery quotation, choose up to six procedures, one from each of the six groups: blocks "1" to "6". Specify any required electrical test from our list on the following page. Furnish your Source Control Drawings if the block 4 group Is "H".

EXAMPLE:

This code set —

1	2	3	4	5	6
A	-	E	H	K	P

Requires these specifications —

Pre Cap Visual Inspection
No High Temp Storage Test
Internal Visual Inspection
Refer to Supplied Document
25°C tests will not require recording
25°C tests performed before and after power burn-in. Mark parts, set aside samples

A — Pre Cap Visual Inspection Required
B — Pre Cap Visual Inspection Not Required
E — Internal Visual Inspection Required
F — Internal Visual Inspection Not Required
J — Read and Record Required
K — Read and Record Not Required

1 2 3 4 5 6

C — HT Storage, Temp Cycle, Gross Leak
D — HT Storage, Temp Cycle, Const Accell, Fine Leak, Gross Leak
G — Standard—Refer to Device Parameters
H — Special—Specify in Source Control Drawings
L — 25°C Test, HTRB Burn-in, 25°C Test, 10% P.D.A., Custom Mark, Group A Sample
N — Custom Mark, Group A. Sample (No 25°C Test Required)
M — 25°C Test, HTRB Burn-in, 25°C Test, Power Burn-in, 25°C Test, Drift Criteria, Custom Mark, Group A Sample
P — 25°C Test, Power Burn-in, 25°C Test, Custom Mark, Group A. Sample

High Reliability Testing

BKC has one of the largest burn-in capacities in discrete semiconductors today. In addition, BKC's test lab has been approved per MIL-S-19500, and is one of the largest in the industry.

We not only test our parts in-house, we provide testing services to customers and other suppliers.

Call for Complete Military QPL Information

COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A
A/D acrylonitrile butadiene-styrene
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AFC audio frequency control
AFT automatic filter test
ALGOL algorithmic language
AM a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
ASIC application specific IC
ATE automatic test equipment
ATG automatic test generation
AWG American wire gauge

B
BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility syste

C
CAD computer-aided design
CAE computer-aided engineering
CAM computer-aided manufacture
CAMAC computer-automated measurement and control
CAPP computer-aided process planning
CAT computer-aided test
CATV cable television or community antenna television
CCC (leaded) ceramic chip carriers
CCD computer-controlled display
CERMET ceramic metal element
CIE computer-integrated engineering
CIM computer-integrated manufacturing
CLCC ceramic leadless chip carriers
CMOS complementary metal-oxide semiconductor
Comm. communications
CPS characters per second
CPU central processing unit

D
D/A digital to analog
DAC digital to analog converter
DBMS data base management system
DC direct current
DFT design for testability
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DRAM dynamic RAM
DTL diode transistor logic

E
EDA electronic design automation
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EIA Electronic Industries Association
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM erasable programmable ROM
ESR equivalent series resistance

F
FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G
GaAsFET gallium arsenide FET
CMIP commn management information protocol
GPIB general purpose interface bus
GPS global positioning system

H
HF high frequency (3 to 30 MHz)
HIPOT test, measurement, and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I
IAB Internet Activities Board
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared
ISDN integrated services digital network
ISO International Standards Organization

J
JEDEC Joint Electronic Device Engineering Council
JFET junction FET
JMOS junction MOS

K
kHz kilohertz (10^3 hertz)
KSR keyboard send /receive

L
LAN local area network
LC (filters) inductance/capacitance
LCC leaded chip carrier
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M
MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
µF microfarad
MHz megahertz
MIC microwave IC
MIPS million instructions per second
MIB microcomputer interface board
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor FET
MOSIGT metal oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N
NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM national instrumentation module
NOR not OR
NTC negative temperature coefficient

O
OCR optical character reader
OEM original equipment manufacturer
OR a logical operator
OSI open systems interconnection

P
PAL programmable array logic
PC printed circuit
PCB printed circuit board
PCM pulse code modulation
PCS plastic clad silica
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLCC plastic leaded chip carrier
PLL phased lock loop
PPI plan position indicator
PROM programmable ROM
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q
QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R
RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S
SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon-controlled switch
SDA source & detector assemblies
SGMP simple gateway monitoring protocol
SIDAC bidirectional voltage-triggered switch
SIMM single in-line memory module
SIP single in-line package
SMD surface mount device
SMT surface mount technology
SNMP simpole network management protocol
SO small outline
SOIC small outline IC
SOT small outline transistor
SSI small scale integration
SSR solid-state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T
TC temperature coefficient
TCE thermal coefficient of expansion
TXCO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U
UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

V
VAC volts (of) alternating current
VAN value-added network
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency (30 kHz to 300 MHz)
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W
WPS word processing software

Y
YIG yttrium iron garnet

Z
ZIF zero insertion force

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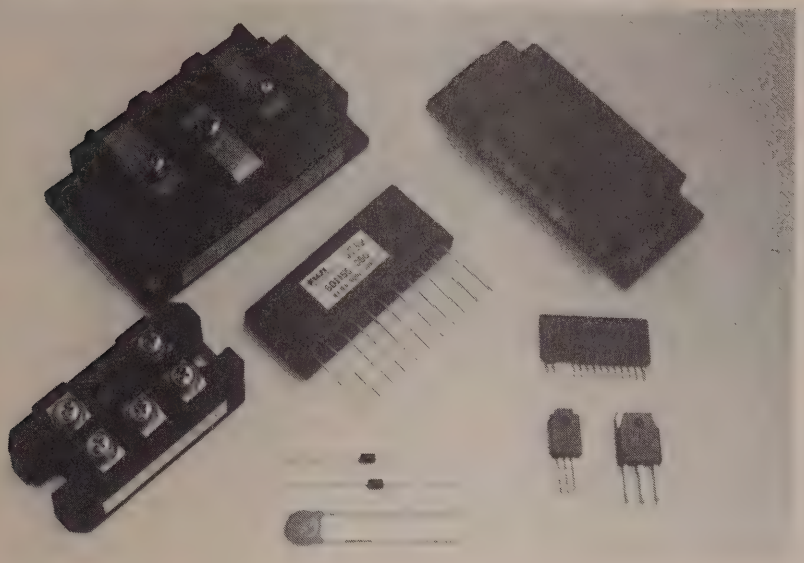
Power Semiconductors



IGBT Modules
Gate-Driver Hybrids
Darlington Modules
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Switching Transistors
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Bridges, All Types
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- **Rectifiers**
- **Silicon Surge Absorbers**

Brief Highlights

IGBT
High frquency capability
1.7 VCE (Sat) available
Rugged RBSOA
Single, dual and 6-pack
600V, 1200V and 1400V
8A to 600A

Darlington Modules
Z-Series - Highest performance available
M-Series - Very high hFE 750-2000
Single, dual and 6-pack
600V to 1400V
30A to 400A

Diode Modules
3-Phase and dual
Fast recovery available
Reliable power design
100V to 1600V
30A to 250A

Discrete MOSFETs TO-3P, TO-220 & Surface Mount Pkg. 30V - 1000V, 2A - 50A
- F-I SERIES, Low $R_{DS(ON)}$
- FAP-I SERIES, Low $R_{DS(ON)}$, High Avalanche Rugged
- FAP-II SERIES, $V_{GS} \pm$ 30V, Reduced Turn-Off Time, High Avalanche Rugged
- F-III SERIES, Logic Level Operation, Low $R_{DS(ON)}$
- FAP-IIIA SERIES, Logic Level Operation, Low $R_{DS(ON)}$, High Avalanche Rugged
- FAP-IIIA SERIES, ***Automotive Types -*** Logic Level Operation, Low $R_{DS(ON)}$, High Avalanche Rugged
- F-V SERIES, FREDFET, Diode Recovery Time (150-200 nsec) Improved Turn-on Loss

Switching Transistors
TO-220AB, TO-220F, TO-3P, TO-3 pkgs.
50V to 1000V; 3A to 30A

High Voltage Diodes
1kV to 30kV

Surface Mount Diodes
Schottky, Ultra-Fast, Fast Recovery, GP
40V to 600V; 500mA to 20A

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0.6A - 60A

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CRYDOM COMPANY

POWER MODULES

SERIES L

15-42.5 AMP, SCR/DIODE MODULES, LOW PROFILE, DESIGNED FOR PRINTED CIRCUIT BOARD CONNECTIONS

Circuit Modules provide ratings up to 42.5 amps in a low profile package designed for printed circuit board connections. Available in three standard bridge circuits and an AC switch version, all models have 2500 Vrms isolation and are UL recognized (file no. E72445).

ELECTRICAL SPECIFICATIONS

SYMBOL	SPECIFICATION	RATINGS		
		L3	L5	L6
I_D	Maximum DC Output Current @ T_C = 85°C (A)	15	25	42.5
V_F	Maximum Voltage Drop @ Amps Peak	2.2V @15A	1.65V @ 25A	1.6V @ 42.5A
T_J	Operating Junction Temperature Range	-40°C to +125°C		
di/dt	Critical Rate of Rise of On-State Current @ TJ=125°C(A/µs)	100		
dv/dt	Critical Rate of Rise of Off-State Voltage @ TJ = 125°C (V/µs)	500		
V_{RMS}	AC Line Input Voltage (Repetitive Peak Reverse Voltage)	120 (400V_{RRM}) 240 (600 V_{RRM}) 280 (800 V_{RRM}) 480 (1200 V_{RRM})		
I_{TSM}	Maximum Non-Repetitive Surge Current (A) [1/2 Cycle, 60Hz]	225	300	600
I^2T	Maximum I^2T for Fusing (A^2sec) [t = 8.3ms]	210	375	1500
I_{GT}	Maximum Required Gate Current to Trigger @ 25°C (mA)	60	60	80
V_{GT}	Maximum Required Gate Voltage to Trigger @ 25°C (V)	2.5	2.5	3.0
$P_{G(AV)}$	Average Gate Power	0.5W		
V_{GM}	Maximum Peak Gate Voltage (Reverse)	5.0V		
$R_{\theta JC}$	Maximum Thermal Resistance Junction to Ceramic Base per Chip	1.25°C/W	0.9°C/W	0.7°C/W
V_{ISOL}	Isolation Voltage	2500V_{RMS}		

PART NUMBER IDENTIFICATION

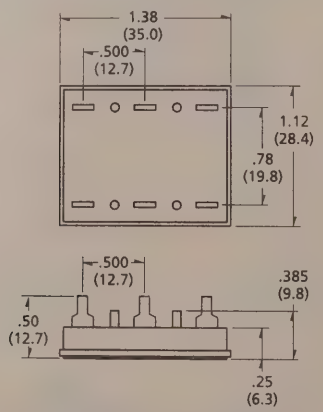
SERIES TYPE	CURRENT	CIRCUIT TYPE	AC LINE VOLTAGE	OPTIONS
L-Case style (Ceramic Base)	**3**- 15 Amps **5**- 25 Amps **6**- 42.5 Amps*	**1-5** (see schematic diagrams)	**1**- 120 Volts **2**- 240 Volts **3**- 280 Volts **4**- 480 Volts	**F**- Free Wheeling Diode

Example: L512F

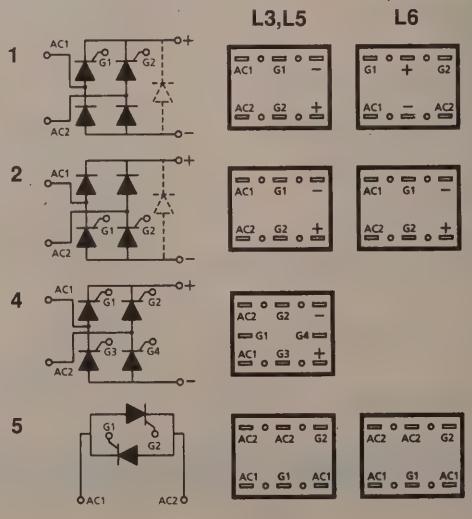
* 42.5 Amp Rating Not Available in Circuit 4

MECHANICAL

All dimensions are in inches (millimeters)



SERIES L CIRCUITS



CRYDOM COMPANY

POWER MODULES

SERIES B-2T, B-2

25-42.5 AMP, SCR/DIODE MODULES, EIGHT STANDARD CIRCUITS, FOR AC OR DC VARIABLE VOLTAGE OUTPUT UP TO 15KW

Modules come in eight standard circuits and are designed to control AC or DC variable voltage output up to 15KW. The package comes with standard .250 quick-connect terminals. All models have 2500 Vrms isolation and are UL- recognized (file no. E72445). Optional isolation barriers are available.

ELECTRICAL SPECIFICATIONS

SYMBOL	SPECIFICATION	RATINGS	
		B5	B6
I_D	Maximum DC Output Current @ T_C = 85°C (A)	25	42.5
V_F	Maximum Voltage Drop @ Amps Peak	1.65V @ 25A	1.6V @ 42.5A
T_J	Operating Junction Temperature Range	-40°C to +125°C	
di/dt	Critical Rate of Rise of On-State Current @ T_J = 125°C(A/µs)	100	
dv/dt	Critical Rate of Rise of Off-State Voltage @ T_J = 125°C (V/µs)	500	
V_{RMS}	AC Line Input Voltage (Repetitive Peak Reverse Voltage)	120 (400V_{RRM}) 240 (600 V_{RRM}) 280 (800 V_{RRM}) 480 (1200 V_{RRM})	
I_{TSM}	Maximum Non-Repetitive Surge Current (A) [1/2 Cycle, 60Hz]	300	600
I^2T	Maximum I^2T for Fusing (A^2sec) [t = 8.3ms]	370	1500
I_{GT}	Maximum Required Gate Current to Trigger @ 25°C (mA)	60	80
V_{GT}	Maximum Required Gate Voltage to Trigger @ 25°C (V)	2.5	3.0
$P_{G(AV)}$	Average Gate Power	0.5W	
V_{GM}	Maximum Peak Gate Voltage (Reverse)	5.0V	
$R_{\theta JC}$	Maximum Thermal Resistance Junction to Ceramic Base per Chip	0.9°C/W	0.7°C/W
V_{ISOL}	Isolation Voltage	2500V_{RMS}	

PART NUMBER IDENTIFICATION

SERIES TYPE
B-Case style (Ceramic Base)

CURRENT
5- 25A
6- 42.5 A

CIRCUIT TYPE
1-8 (see schematic diagrams)

AC LINE VOLTAGE
1- 120 Volts
2- 240 Volts
3- 280 Volts
4- 480 Volts

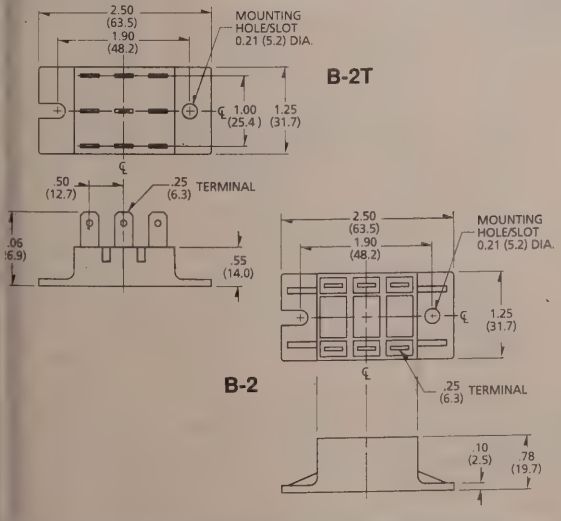
OPTIONS
F- Free Wheeling Diode
SE- External Suppressor (-2T Only)

CASE STYLE
-2T (Std)
-2 With Isolation Barriers

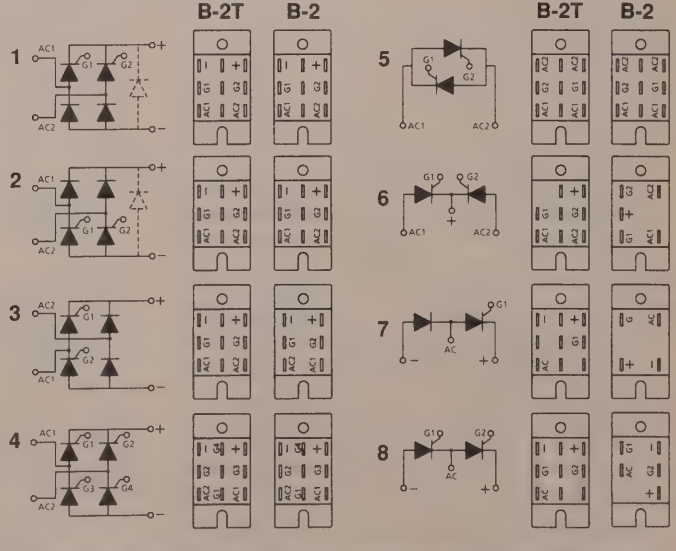
Example:B512FSE-2T

MECHANICAL

All dimensions are in inches (millimeters)



SERIES B-2T, B-2 CIRCUITS



CRYDOM COMPANY

POWER MODULES

SERIES M50

50-100 AMP, SCR/DIODE MODULES, OVER 40KW OUTPUT CAPABILITY

The M50 Series modules utilize highly efficient thermal management of provide high surge capability, long lifetime and reliable performance. Available in eight standard circuits, all models come in an industry standard package, provide 2500 Vrms from all terminals to the baseplate and are UL recognized (file no. E72445).

ELECTRICAL SPECIFICATIONS

SYMBOL	SPECIFICATION	RATINGS	
		M5050	M50100
I_D	Maximum DC Output Current @ T_C = 85°C (A)	50	100
V_F	Maximum Voltage Drop @ Amps Peak	1.7V @ 50A	1.4V @ 100A
T_J	Operating Junction Temperature Range	-40°C to +125°C	
di/dt	Critical Rate of Rise of On-State Current @ T_J = 125°C(A/µs)	100	
dv/dt	Critical Rate of Rise of Off-State Voltage @ T_J = 125°C (V/µs)	500	
V_{RMS}	AC Line Input Voltage (Repetitive Peak Reverse Voltage)	120 (400V_{RRM}) 240 (600 V_{RRM}) 280 (800 V_{RRM}) 380 (1000 V_{RRM}) 480 (1200 V_{RRM})	
I_{TSM}	Maximum Non-Repetitive Surge Current (A) [1/2 Cycle, 60Hz]	600	1500
I^2T	Maximum I^2T for Fusing (A^2sec) [t = 8.3ms]	1500	9350
I_{GT}	Maximum Required Gate Current to Trigger @ 25°C (mA)	150	
V_{GT}	Maximum Required Gate Voltage to Trigger @ 25°C (V)	3.0	
$P_{G(AV)}$	Average Gate Power	0.5W	
V_{GM}	Maximum Peak Gate Voltage (Reverse)	5.0V	
$R_{\theta JC}$	Maximum Thermal Resistance Junction to Ceramic Base per Chip	0.7°C/W	0.36°C/W
V_{ISOL}	Isolation Voltage	2500V_{RMS}	

PART NUMBER IDENTIFICATION

SERIES TYPE
M50- Case style

CURRENT
50- 50 Amps
100- 100 Amps

CIRCUIT TYPE
1-8 (see schematic diagrams)

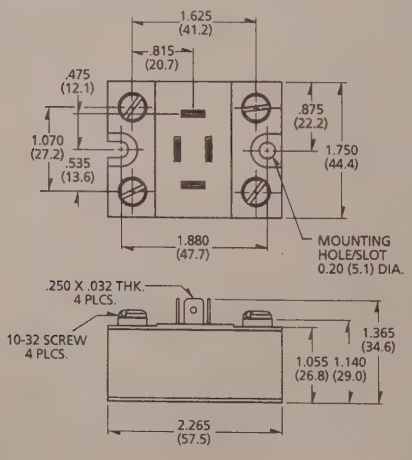
AC LINE VOLTAGE
1- 120 Volts
2- 240 Volts
3- 280 Volts
4- 380 Volts
5- 480 Volts

OPTIONS
F- Free Wheeling Diode
V- External Suppressor

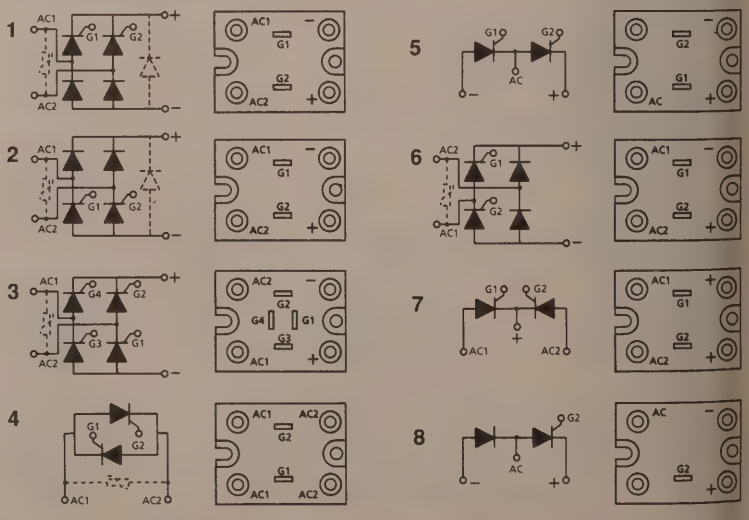
Example: M505012FV

MECHANICAL

All dimensions are in inches (millimeters)



SERIES M50 CIRCUITS



CRYDOM COMPANY : 6015 OBISPO AVE., LONG BEACH, CA 90805 TELEPHONE:(310) 865-3536 FAX: (310) 865-3318 TELEX: 910-250-5756

CRYDOM COMPANY

POWER MODULES

SERIES F18

25-90 AMP DIODE, SCR/DIODE MODULES, INDUSTRY STANDARD PACKAGE AND CIRCUITS, POWER CONTROL BUILDING BLOCKS

Modules come in an industry standard package, offering nine circuits that can be used singly or as power control building blocks. All models feature highly efficient thermal management for greatly extended cycle life and are UL recognized (file no. E72445).

ELECTRICAL SPECIFICATIONS

SYMBOL	SPECIFICATION	RATINGS			
		27	42	57	92
$I_{T(AV)}$	Average Output Current per Device @ T_C = 85°C (A)	25	40	55	90
V_F	Maximum Voltage Drop @ Amps Peak	1.55V@75A	1.4V@120A	1.4V@165A	1.4V@270A
T_J	Operating Junction Temperature Range	-40°C to +125°C			
di/dt	Critical Rate of Rise of On-State Current @ T_J = 125°C(A/µs)	100			
dv/dt	Critical Rate of Rise of Off-State Voltage @ T_J = 125°C (V/µs)	500			
V_{RRM}	Repetitive Peak Reverse Voltage (AC Line)	400 (120 Vac) 600 (240 Vac) 1000 (380 Vac) 1200 (480 Vac) 1400 (530 Vac)			
I_{TSM}	Maximum Non-Repetitive Surge Current (A) [1/2 Cycle, 60Hz]	400	100	1500	1950
I^2T	Maximum I^2T for Fusing (A^2sec) [t = 8.3ms]	670	4150	9350	15800
I_{GT}	Maximum Required Gate Current to Trigger @ 25°C (mA)	150			
V_{GT}	Maximum Required Gate Voltage to Trigger @ 25°C (V)	3.0			
$P_{G(AV)}$	Average Gate Power	0.5W			
V_{GM}	Maximum Peak Gate Voltage (Reverse)	5.0V			
$R_{\theta JC}$	Maximum Thermal Resistance Junction to Baseplate per Module	0.8°C/W	0.55°C/W	0.50°C/W	0.27°C/W
V_{ISOL}	Isolation Voltage	2500V_{RMS}			

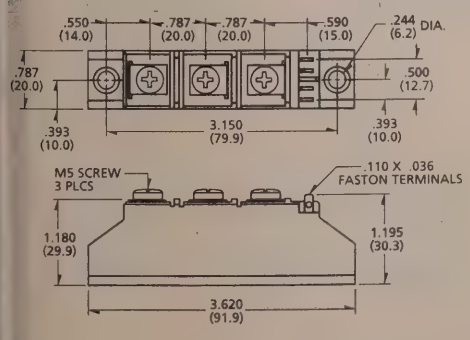
PART NUMBER IDENTIFICATION

SERIES TYPE	CURRENT	CIRCUIT TYPE	VOLTAGE	
F18-Case style	**27-** 25 Amps		**400-** 120 Volts	
	42- 40 Amps	(see schematic	**600-** 240 Volts	Consult Factory
	57- 55 Amps	diagrams)	**1000-** 380 Volts	for Higher
	92- 90 Amps	Example: **SD**	**1200-** 480 Volts	Voltages
			1400- 530 Volts	

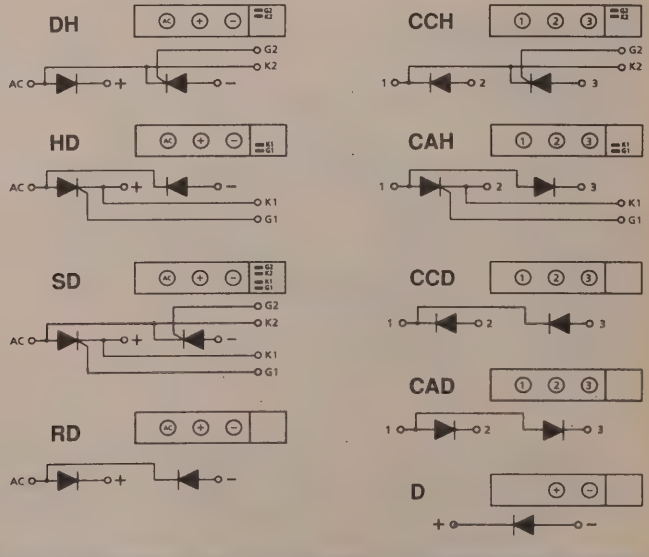
Example: F1892SD1200

MECHANICAL

All dimensions are in inches (millimeters)



SERIES F18 CIRCUITS



CRYDOM COMPANY

POWER MODULES

SERIES EF

50-170 AMP DIODE, SCR/DIODE MODULES, HIGH THERMAL EFFICIENCY, COMPLETE POWER CONTROL CIRCUITS IN A SINGLE PACKAGE

These circuits provide complete power control in a single package, utilizing high thermal efficiency to assure long life and reliable performance. Twelve standard models provide 2500 Vrms isolation from all terminals to ceramic base and are UL recognized (file no. E72445).

ELECTRICAL SPECIFICATIONS

SYMBOL	SPECIFICATION	RATINGS			
		D	E	F	G
I_D	Maximum DC Output Current @ T_C = 85°C (A)	(See Part Number Identification for Ratings of Single Phase, Three Phase and AC Switch Circuits)			
V_F	Maximum Voltage Drop @ Amps Peak	1.7V @50A	1.85V @75A	1.4V@ 100A	1.55V@125A
T_J	Operating Junction Temperature Range	-40°C to +125°C			
di/dt	Critical Rate of Rise of On-State Current @ T_J = 125°C(A/µs)	100			
dv/dt	Critical Rate of Rise of Off-State Voltage @ T_J = 125°C (V/µs)	500			
V_{RRM}	Repetitive Peak Reverse Voltage (AC Line)	400 (120 Vac) 600 (240 Vac) 1000 (380 Vac) 1200 (480 Vac) 1400 (530 Vac)			
I_{TSM}	Maximum Non-Repetitive Surge Current (A) [1/2 Cycle, 60Hz]	400	600	1500	1950
I^2T	Maximum I^2T for Fusing (A^2sec) [t = 8.3ms]	650	1500	9340	15800
I_{GT}	Maximum Required Gate Current to Trigger @ 25°C (mA)	60	80	150	15800
V_{GT}	Maximum Required Gate Voltage to Trigger @ 25°C (V)	2.5	3.0	3.0	3.0
$P_{G(AV)}$	Average Gate Power	0.5W			
V_{GM}	Maximum Peak Gate Voltage (Reverse)	5.0V			
$R_{\theta JC}$	Maximum Thermal Resistance Junction to Ceramic Base per Chip	0.8°C/W	0.7°C/W	0.36°C/W	0.3°C/W
V_{ISOL}	Isolation Voltage	2500V_{RMS}			

PART NUMBER IDENTIFICATION

SERIES TYPE
EF-Case style

CURRENT (Amps)

	1Ø	3Ø	AC SW.
D-	50	70	55
E-	75	100	85
F-	100	135	110
G-	125	170	140

CIRCUIT TYPE
(see schematic diagrams)
Example: **01**

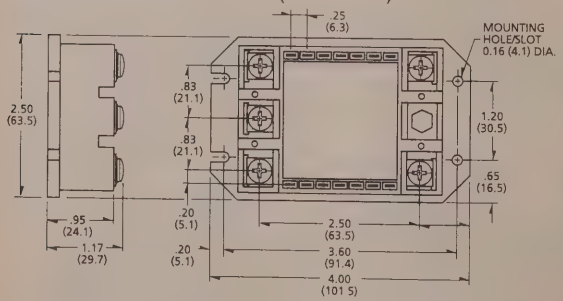
VOLTAGE
B- 400 (120 VAC)
C- 600 (240 VAC)
E- 1000 (380 VAC)
F- 1200 (480 VAC)
G- 1400 (530 VAC)

OPTIONS
F- Free Wheeling Diode

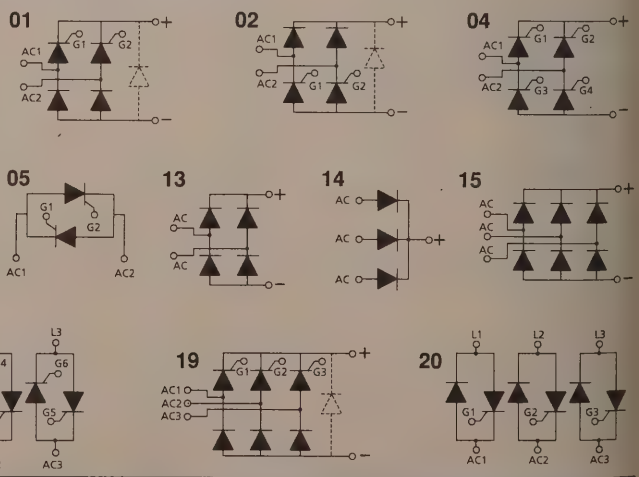
Example: EFD02CF

MECHANICAL

All dimensions are in inches (millimeters)



SERIES EF CIRCUITS



CRYDOM COMPANY

POWER MODULES

SERIES B48-2T, B48-2

35-50 AMP, DIODE MODULES, SINGLE AND THREE PHASE CIRCUITS, UP TO 1600 VOLT BLOCKING STANDARD

Single- and three-phase diode circuits come in a panel mount package that provides 2500 Vrms isolation from the terminals to the ceramic base. Available in ratings up to 1600 Volts, all models are UL recognized (file no. E72445).

ELECTRICAL SPECIFICATIONS

SYMBOL	SPECIFICATION	RATINGS	
		SINGLE PHASE	THREE PHASE
I_D	Maximum DC Output Current @ T_C = 85°C (A)	35	50
V_F	Maximum Voltage Drop @ Amps Peak	1.25V @ 35A	1.35V @ 50A
T_J	Operating Junction Temperature Range	-40°C to +125°C	
V_{RRM}	Repetitive Peak Reverse Voltage (AC Line)	400 (120 Vac) 600 (240 Vac) 1000 (380 Vac) 1200 (480 Vac) 1400 (530 Vac) 1600 (600 Vac)	
I_{TSM}	Maximum Non-Repetitive Surge Current (A) [1/2 Cycle, 60Hz]	600	
I^2T	Maximum I^2T for Fusing (A^2sec) [t = 8.3ms]	1500	
$R_{\theta JC}$	Maximum Thermal Resistance Junction to Ceramic Base per Chip	0.9°C/W	
V_{ISOL}	Isolation Voltage	2500V_{RMS}	

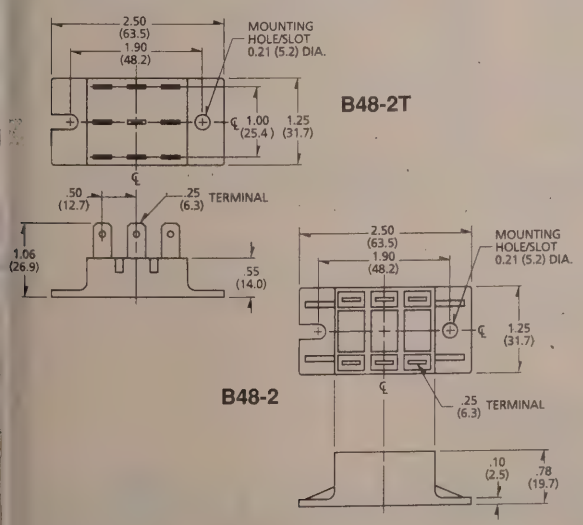
PART NUMBER IDENTIFICATION

SERIES TYPE	CIRCUIT TYPE	VOLTAGE		CASE STYLE
B48	**1-5** (see schematic diagrams)	**B-** 400 (120 Vac)	**F-** 1200 (480 Vac)	**-2T** (Standard)
		C- 600 (240 Vac)	**G-** 1400 (530 Vac)	**-2** With Isolation Barriers
		E- 1000 (380 Vac)	**H-** 1600 (600 Vac)	

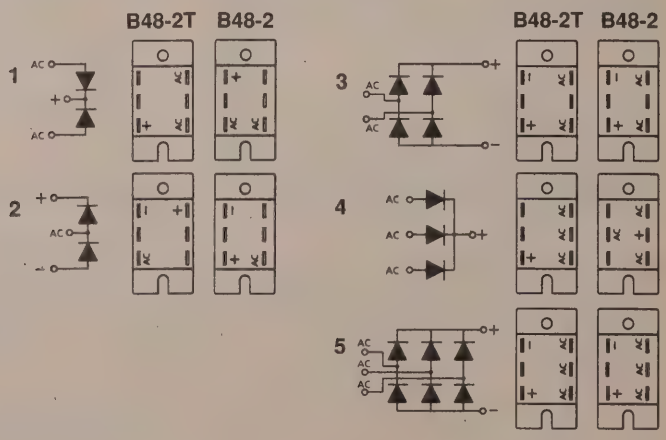
Example: B483C-2T

MECHANICAL

All dimensions are in inches (millimeters)



SERIES B48-2T, B48-2 CIRCUITS



CRYDOM COMPANY

POWER MODULES

SERIES M50

60-100 AMP, DIODE MODULES, HIGH SURGE CURRENT RECTIFIER CIRCUITS, UP TO 1600 VOLT BLOCKING STANDARD

Single- and three- phase diode circuits incorporate highly efficient thermal management to provide high surge capability, extended life, and reliable performance. Available in five circuits, all models come in an industry standard package, provide 2500 Vrms from all terminals to the baseplate, and are UL recognized (file no. E72445).

ELECTRICAL SPECIFICATIONS

SYMBOL	SPECIFICATION	RATINGS	
		M5060	M50100
I_D	Maximum DC Output Current @ T_C = 85°C (A)	60	100
V_F	Maximum Voltage Drop @ Amps Peak	1.35V @60A	1.2V @ 100A
T_J	Operating Junction Temperature Range	-40°C to +125°C	
V_{RRM}	Repetitive Peak Reverse Voltage (AC Line)	400 (120 Vac) 600 (240 Vac) 1000 (380 Vac) 1200 (480 Vac) 1400 (530 Vac) 1600 (600 Vac)	
I_{TSM}	Maximum Non-Repetitive Surge Current (A) [1/2 Cycle, 60Hz]	800	1500
I^2T	Maximum I^2T for Fusing (A^2sec) [t = 8.3ms]	2650	9350
$R_{\theta JC}$	Maximum Thermal Resistance Junction to Ceramic Base per Chip	0.45°C/W	0.3°C/W
V_{ISOL}	Isolation Voltage	2500V_{RMS}	

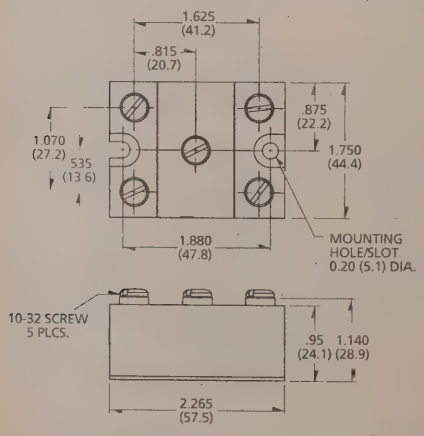
PART NUMBER IDENTIFICATION

SERIES TYPE	CURRENT	CIRCUIT TYPE	VOLTAGE	
M50	**60-** 60 Amps	(see schematic	400 (120 Vac)	1200 (480 Vac)
	100- 100 Amps	diagrams	600 (240 Vac)	1400 (530 Vac)
		Example: **TB**	1000 (380 Vac)	1600 (600 Vac)

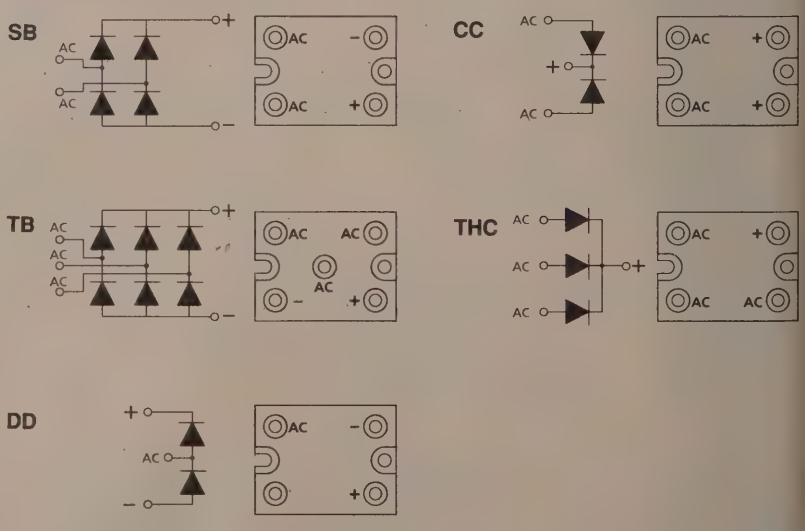
Example: M50100TB1200

MECHANICAL

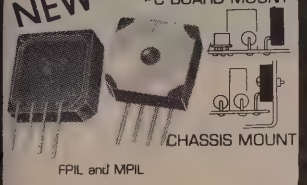
All dimensions are in inches (millimeters)



SERIES M50 CIRCUITS



NEW

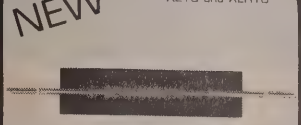


40 A IN-LINE RECTIFIERS

Space-saving design
Low thermal impedance
Standard, fast, and ultrafast
UL Recognized

SPACE SAVING

NEW

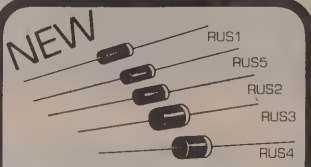


HV X-RAY DIODES

XL10	9KV	220mA	standard
XLR10	9KV	200mA	175ns
XLU12	11KV	100mA	50ns
XMU10	9KV	300mA	150ns
XMR5	5KV	500mA	150ns

HIGH VOLT & AMP

NEW



ULTRA-FAST, 1KV MINIATURE DIODES

PRV to 1KV
Current to 5A.
Low forward characteristic
High surge current
Recoveries to 50 ns

STATE OF ART

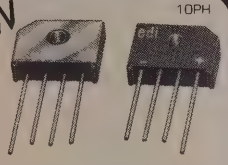
NEW

100 A RECTIFIERS

Rugged compact module
Patented "Porcelainized" heat sink
Low thermal impedance
UL Recognized

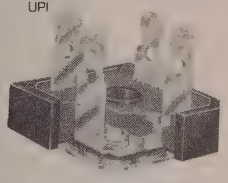
LOWER COSTS

NEW



10 A IN-LINE RECTIFIERS

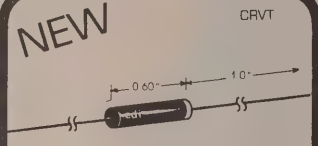
PC or chassis mount
Integral heat sink for low thermal impedance
300 A surge
UL Recognized
Standard, fast, and ultrafast



50 A RECTIFIERS

Integral heat sink
Quick connect or wire leads
1,000A surge
Also available in fast recovery
UL Recognized

NEW



FAST RECOVERY, 20KV MINIATURE DIODES

15 & 20 KV models
25 mA forward current
Low leakage
Recovery less than 100 ns

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INNOVATIVE RECTIFIER DESIGNS...

and an extensive line of standard types

bridges

- ☐ 36 different models
- ☐ Broad range of package types
- ☐ 2 to 100 amps
- ☐ PRV to 1,200V

Standard, fast, and ultrafast, recovery

hv diodes

- ☐ Up to 250KV
- ☐ Current up to 6A
- ☐ Ultra-miniature packaging
- ☐ General purpose diodes

Standard, fast, and ultrafast, recovery

hv assemblies

- ☐ Standard products; blocks, packs, cylinders, night vision, CRT
- ☐ Custom designs
- ☐ PIV to 300KV
- ☐ To 25 amps

Standard, fast, and ultrafast, recovery

EDI has specialized in rectifier devices for over 42 years. Our fully integrated manufacturing facilities perform all operations from silicon diffusion to packaging. Stringent testing for quality control is performed at every step to provide customers the most reliable high performance rectifiers available today. We will be pleased to provide all the help and technical information you want. Catalogs are available, please give us a call at

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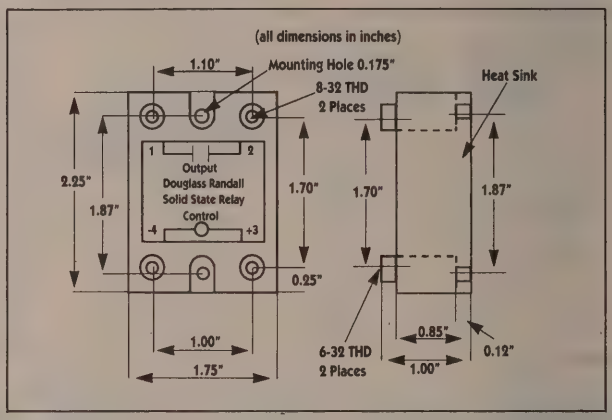
DOUGLAS RANDALL, INC

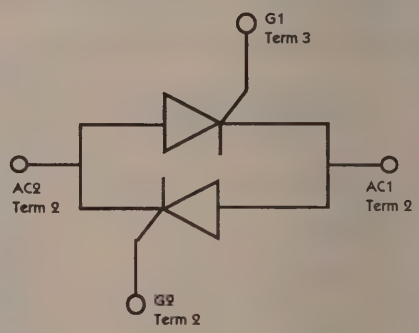
SCR Diode Module - 40B

Features & General Specifications

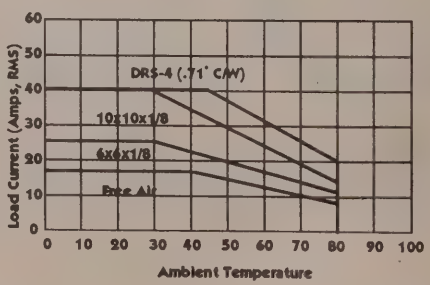
- Low profile hockey puck design.
- Epoxy molded case with aluminium baseplate for easy mounting on industry standard panel.
- Appropriate heat sink and thermal compound required.
- Screw terminals standard

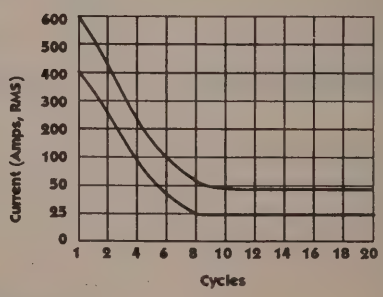


Output Data	40A
Rated Current (Amps)	40
Voltage	20-300 Vrms.
Voltage Drop at Rated Load	1.6 Vpk
Typical Turn On Current	20MA
Response Time	.5 Cycle MAx.
Off State DV/DT (V/u Sec.)	200
Off State Leakage Current	20mA
Maximum Non-reptitive Single Cycle Surge Current (Amps.)	600
IT for Fusing (T=8.3mS) (A S)	1500
Peak Inverse Voltage	



SURGE CURRENT VS. TIME





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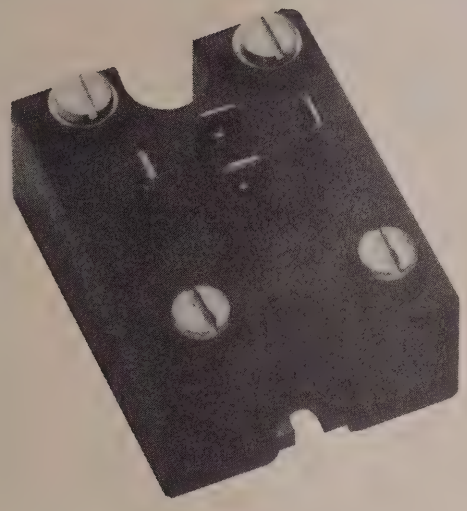
See our additional data pages in sections 2200 D•1154 and 4500 B•1473

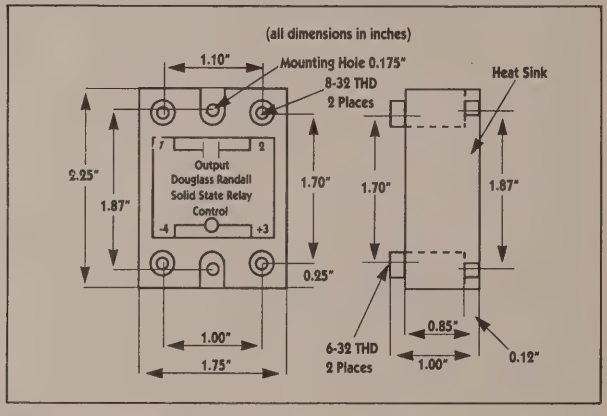
DOUGLAS RANDALL, INC

SCR Diode Module (70 Amp)



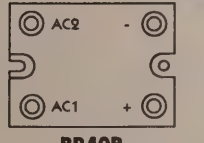
Features & General Specifications

- Low profile hockey puck design.
- Epoxy molded case with aluminium baseplate for easy mounting on industry standard panel.
- Appropriate heat sink and thermal compound required.
- Screw terminals standard

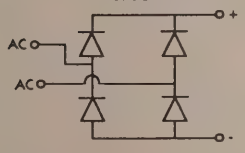


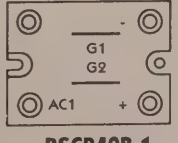
We custom design Power SCR/Diode modules to your specifications. Please contact our factory with your requirements.

Output Data	40A	70B
Maximum Current (Amps)	40	70
Voltage Range (RMS)	20-300	20-300
Voltage Drop at 100% ON (V Max)	1.6	1.6
Minimum Holding Current (Amps)	.10	.15
Off State DV/DT (V/uSec.)	200	500
On State DI/DT (A/uSec.)	150	150
Off State Leakage Current (ma)	20	30
Maximum Non-Repetitive Single Cycle Surge Current(Amps.)	400	1000
I^2T for Fusing (T=8.3mS) (A^2/Sec.)	1000	7000
Isolation, Out to Gnd (Vrms)	2500	2500
Power Factor (minimum)	.5	.5

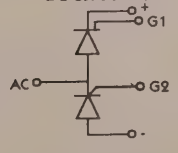


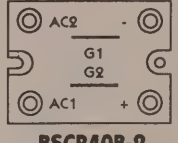
BR40B





BSCR40B-1





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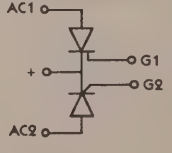

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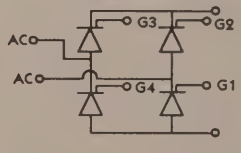

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See our additional data pages in sections 2200 D•1154 and 4500 B•1473

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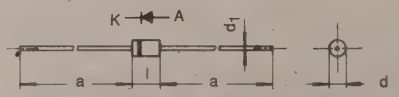
SILICON RECTIFIER DIODES

- Δ Plastic Rectifiers
- Δ Low Forward Voltage Drop
- Δ High Surge Current Capability
- Δ JEDEC Numbered
- Δ Polarity Indicated By Cathode Band
- Δ Lead: MIL-STD202F

Type	V_{RRM} Repetitive Peak Reverse Voltage (V)	V_{DC} DC Blocking Voltage (V)	I_{FAV} Maximum Average Forward Rectified Current (A)	I_{FSM} Peak Forward Surge Current 1 Cycle (A)	Maximum Forward Voltage at I_{FAV} (V)	Maximum Reverse Current at V_{DC} T_A 25°C (μA)	T_{STG} T_{OP} Storage and Operating Temperature (°C)	Case
1N4001	50	50	1.0	50	1.1	10	-65 to +175	DO-41
1N4002	100	100	1.0	50	1.1	10	-65 to +175	DO-41
1N4003	200	200	1.0	50	1.1	10	-65 to +175	DO-41
1N4004	400	400	1.0	50	1.1	10	-65 to +175	DO-41
1N4005	600	600	1.0	50	1.1	10	-65 to +175	DO-41
1N4006	800	800	1.0	50	1.1	10	-65 to +175	DO-41
1N4007	1000	1000	1.0	50	1.1	10	-65 to +175	DO-41
1N5400	50	50	3.0	200	1.3	20	-40 to +175	DO-27
1N5401	100	100	3.0	200	1.3	20	-40 to +175	DO-27
1N5402	200	200	3.0	200	1.3	20	-40 to +175	DO-27
1N5403	300	300	3.0	200	1.3	20	-40 to +175	DO-27
1N5404	400	400	3.0	200	1.3	20	-40 to +175	DO-27
1N5405	500	500	3.0	200	1.3	20	-40 to +175	DO-27
1N5406	600	600	3.0	200	1.3	20	-40 to +175	DO-27
1N5407	800	800	3.0	200	1.3	20	-40 to +175	DO-27
1N5408	1000	1000	3.0	200	1.3	20	-40 to +175	DO-27

DIMENSIONS: (mm)



	a	d	l	d_1
1N400X	25.4	Max. 3.1	5.1	.86
1N540X	25.4	5	9.5	1.32

BRIDGE RECTIFIERS

0.8 — 1.5 AMPERES RECTIFIER BRIDGES

Series
BxxC 800
BxxC 1000
BxxC 1500

GENERAL PURPOSE

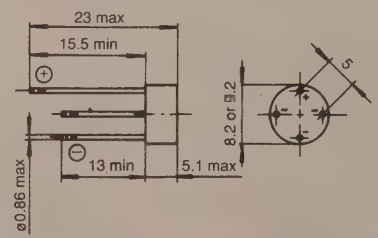
Δ Single-phase full-wave bridges for general purpose low-power applications.

FEATURES:

- Δ High current
- Δ High surge current capability
- Δ Low forward voltage drop
- Δ Economical plastic package

MECHANICAL DATA

Case: Potted epoxy encapsulated
Lead: MIL-STD-202 — method 208C
Dimensions: (mm)



Note: Available in either 8.2 or 9.2mm Diameter. Please specify.

ELECTRICAL CHARACTERISTICS

Characteristics and Conditions	Symbol	Unit	Value
Max. reverse current at U_{RRM} (Øj = 25°C)	I_R	μA	10
Max. reverse current at U_{RRM} (Øj = 100°C)	I_R	μA	50
Max. forward voltage drop at 25°C, 1 A:			
C 800 type			1.3
C 1000 type	U_F	V	1.2
C 1500 type			1.1

Ratings and characteristics hold for every diode in the bridge structure.

Type	Symbol	Unit	C 800						C 1000						C 1500					
			B 40	B 80	B 125	B 250	B 380	B 500	B 40	B 80	B 125	B 250	B 380	B 500	B 40	B 80	B 125	B 250	B 380	B 500
Non-repetitive peak reverse voltage	U_{RSM}	V	120	240	350	720	1000	1200	120	240	350	720	1000	1200	120	240	350	720	1000	1200
Repetitive peak reverse voltage	U_{RRM}	V	100	200	300	600	800	1000	100	200	300	600	800	1000	100	200	300	600	800	1000
Average forward current at 45°C (C load)	I_{FAV}	A	0.8						1.0						1.5					
Surge forward current (1 cycle, 10 ms, sine wave) Øj = 25°C	I_{FSM}	A	50						50						50					
Typical thermal resistance, junction to lead (lead length 5 mm, mounted on infinite heat sink)	R_{thjl}	K/W	52						45						31					
Operating and storage temperature	Øop	°C	— 40 to +175						— 40 to +175						— 40 to +175					

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General Purpose and Switching Diodes in DO-34 Package.
Using the type designations **LL4148, LL4448,** and so on, these Silicon Diodes are available in the MiniMELF package with the same electrical characteristics.

Type	Peak Inv. Voltage PIV	Max. Aver. Rectified Current I_O	Power Dissipation at 25°C	Junction Temperature T_j	Forward Voltage Drop V_F		Reverse Current I_R		Reverse Recovery Time	
	Volts	mA	max. mW	max. °C	max. V	at IF mA	max. nA	at V_R Volts	T_r ns	Conditions
1N914	100	75	500	200	1.0	10	25	20	max. 4.0	I_F = 10 mA, V_R = 6V, R_L = 100Ω, to I_R = 1 mA
1N4148	100	150	500	200	1.0	10	25	20	max. 4.0	I_F = 10 mA, V_R = 6V, R_L = 100Ω, to I_R = 1 mA
1N4150	50	200	500	200	1.0	200	100	50	max. 4.0	I_F = I_R = 10 to 200 mA, to 0.1 I_F
1N4152	40	150	400	175	0.55	0.10	50	30	max. 2.0	I_F = 10mA, V_R = 6V, R_L = 100Ω, to I_R = 1 mA
1N4154	35	150	500	200	1.0	30	100	25	max. 2.0	I_F = 10mA, V_R = 6V, R_L = 100Ω, to I_R = 1 mA
1N4448	100	150	500	200	1.0	100	25	20	max. 4.0	I_F = 10mA, V_R = 6V, R_L = 100Ω, to I_R = 1 mA
1N4450	40	150	400	175	0.54	0.50	50	30	max. 4.0	I_F = I_R = 10mA, to I_R = 1 mA
1N4454	75	150	400	175	1.0	10	100	50	max. 4.0	I_F = I_R = 10mA, to I_R = 1 mA

Silicon Schottky Barrier Diodes in DO-35 Package for general purpose applications with low forward voltage drop and very fast switching times.
Using the type designations LL101A, LL103A, and so on, these Schottky Barrier diodes are available in the MiniMELF package with the same electrical characteristics.

Type	Peak Inv. Voltage PIV	Power Dissipation at 25°C	Junction and Storage Temp.	Forward Voltage Drop V_F at I_F				Reverse Current I_R at V_R		Capacitance at V_F = V_R =0, f = 1 MHz	Reverse Recovery Time t_{rr}	
	Volts	mW	max. mW	max. V	at mA	max. V	at mA	Max. µA	at V	max. pF	max. ns	Conditions
SD101A*	60	400	200	0.41	1	1.0	15	0.2	50	2.0	1	I_F = I_R = 5 mA to 0.1 I_R
SD101B	50	400	200	0.40	1	0.95	15	0.2	40	2.1	1	I_F = I_R = 5 mA to 0.1 I_R
SD101C	40	400	200	0.39	1	0.90	15	0.2	30	2.2	1	I_F = I_R = 5 mA to 0.1 I_R
SD103A	40	400	125	0.37	20	0.6	200	5.0	30	50	10	I_F = I_R = 200 mA to 0.1 I_R
SD103B	30	400	125	0.37	20	0.6	200	5.0	20	50	10	I_F = I_R = 200 mA to 0.1 I_R
SD103C	20	400	125	0.37	20	0.6	200	5.0	10	50	10	I_F = I_R = 200 mA to 0.1 I_R

1N5225 Series 500 mW Glass Zener Diodes, in DO-35 Package (T_A=25°C)
Replaces 1N746 and IN957 Series (See Note):
Using the type designations **ZMM5225, ZMM5226,** and so on, these Zener diodes are available in the MiniMELF package with the same electrical characteristics. Also available in DO-34 Package.

Type	Nominal Zener Voltage V_Z at I_{ZT}*	Test Current I_{ZT}	Maximum Zener Impedance		Typical Temperature Coefficient	Maximum Reverse Leakage Current		Maximum Regulator Current
			Z_{ZT} at I_{ZT}	Z_{ZK} at I_{ZK} = 0.5 mA		I_R	Test-Voltage Suffix B	IZM
	Volts	mA	Ohms	Ohms	%/°C	µA	Volts	mA
1N5225 B	3.0	20	29	1600	–0.075	50	1.0	152
1N5226 B	3.3	20	28	1600	–0.070	25	1.0	138
1N5227 B	3.6	20	24	1700	–0.065	15	1.0	126
1N5228 B	3.9	20	23	1900	–0.060	10	1.0	115
1N5229 B	4.3	20	22	2000	–0.055	5	1.0	106
1N5230 B	4.7	20	19	1900	+0.030	5	2.0	97
1N5231 B	5.1	20	17	1600	+0.030	5	2.0	89
1N5232 B	5.6	20	11	1600	+0.038	5	3.0	81
1N5233 B	6.0	20	7	1600	+0.038	5	3.5	76
1N5234 B	6.2	20	7	1000	+0.045	5	4.0	73
1N5235 B	6.8	20	5	750	+0.050	3	5.0	67
1N5236 B	7.5	20	6	500	+0.058	3	6.0	61
1N5237 B	8.2	20	8	500	+0.062	3	6.5	55
1N5238 B	8.7	20	8	600	+0.065	3	6.5	52
1N5239 B	9.1	20	10	600	+0.068	3	7.0	50
1N5240 B	10	20	17	600	+0.075	3	8.0	45
1N5241 B	11	20	22	600	+0.076	2	8.4	41
1N5242 B	12	20	30	600	+0.077	1	9.1	38
1N5243 B	13	9.5	13	600	+0.079	0.5	9.9	35
1N5244 B	14	9.0	15	600	+0.082	0.1	10	32
1N5245 B	15	8.5	16	600	+0.082	0.1	11	30
1N5246 B	16	7.8	17	600	+0.083	0.1	12	28
1N5247 B	17	7.4	19	600	+0.084	0.1	13	27
1N5248 B	18	7.0	21	600	+0.085	0.1	14	25
1N5249 B	19	6.6	23	600	+0.086	0.1	14	24
1N5250 B	20	6.2	25	600	+0.086	0.1	15	23
1N5251 B	22	5.6	29	600	+0.087	0.1	17	21
1N5252 B	24	5.2	33	600	+0.087	0.1	18	19.1
1N5253 B	25	5.0	35	600	+0.089	0.1	19	18.2
1N5254 B	27	4.6	41	600	+0.090	0.1	21	16.8
1N5255 B	28	4.5	44	600	+0.091	0.1	21	16.2
1N5256 B	30	4.2	49	600	+0.091	0.1	23	15.1
1N5257 B	33	3.8	58	700	+0.092	0.1	25	13.8
1N5258 B	36	3.4	70	700	+0.093	0.1	27	12.6
1N5259 B	39	3.2	80	800	+0.094	0.1	30	11.6
1N5260 B	43	3.0	93	900	+0.095	0.1	33	10.6
1N5261 B	47	2.7	105	1000	+0.095	0.1	36	9.7
1N5262 B	51	2.5	125	1100	+0.096	0.1	39	8.9

Standard Voltage Tolerance is ±5%.

Note: 1N746 and 1N957 Series are 400 mW Glass Zener Diodes.

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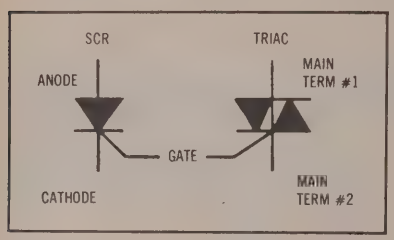
MINIGLOSSARY THYRISTORS/ HIGH POWER DIODES

THYRISTORS

A thyristor is a four-layer semiconductor (pnpn) that can be switched from an OFF to an ON state. This is usually done by a voltage or current pulse to the gate terminal. The device will then continue to conduct so long as the principal current of the device flows through the thyristor's two main terminals.

In many respects a thyristor is analogous to an electromechanical latching relay. In fact, thyristors have largely replaced these relays in newer equipment designs. But, misapplications and/or failure to fully understand the parameters of these and other solid state devices often leads to catastrophic field failures.

The terminology shown on this page has been condensed from common industry data books and is intended to be a guide for the engineer.



di/dt: *Critical rate of rise of ON state current* is the user's maximum design limit (Fig. 1).

di_R/dt: *Rate of decay of ON state current* (Fig. 1 & 2).

dv/dt (critical): *Rate of rise of OFF state voltage*. Lowest voltage rate of rise to cause a thyristor to turn ON.

dv/dt (reapplied) : *Rate of rise of reapplied OFF state voltage.*

I_{FSM}: *Nonrepetitive ON state surge current in diodes.* Maximum peak value of ½ cycles (60 Hz) a diode can withstand up to 100 times in its lifetime.

I_{TSM}: *Nonrepetitive ON state surge current in thyristors*. Maximum peak value of 60 Hz cycles a thyristor can withstand up to 100 times in its lifetime.

I_{DRM}/I_{RRM}: *Maximum peak forward/reverse leakage current* at specified temperature and repetitive conditions.

I_{GDM}: *Continuous gate current not to trigger*. Highest dc gate current that will *not* cause thyristor to switch from OFF to ON at a specific temperature.

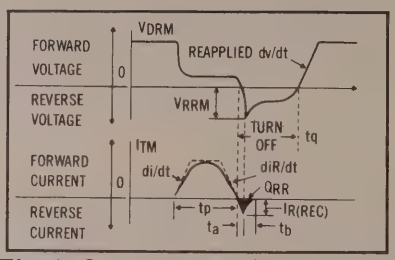


Fig. 1. Concurrent voltage and current waveforms

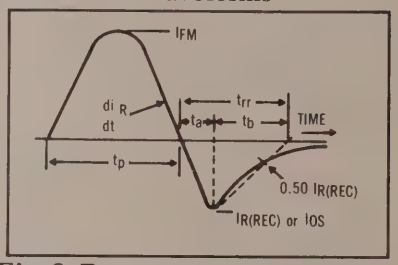


Fig. 2. Recovery current waveform

I_{GT}: *Continuous gate trigger current.* Absolute minimum gate current required to switch thyristor from OFF to ON.

I_H: *Holding Current*. Minimum current required to hold thyristor ON.

I_L: *Latching current*. Minimum current required to hold thyristor ON after removal of gate drive.

$I_{(REC)}$; *Recovery current*. Peak value of reverse current during recovery or turn OFF (Fig. 1 & 2).

I_{OS}: *Overshoot current*. See $I_{R(REC)}$.

I^2t: Maximum ON state, short time thermal capacity of the silicon element for operations less than ½ cycle of 180° conduction angle.

$I_{T(AV)}$: *Average ON state current* (max.)

Q_{RR}: *Reverse recovered charge* (Fig. 1).

$R_{\theta JC}$: *Junction-to-case thermal resistance* in degrees C per watt.

$T_{C(MAX)}$: *Max. allowable case temperature.*

$T_{J(MAX)}$: *Maximum allowable junction temp.*

t_d: *Delay time*. Interval between a specified point at beginning of gate pulse and the instant at which the principal voltage drops to a specified value. (OFF-ON) (Fig. 3)

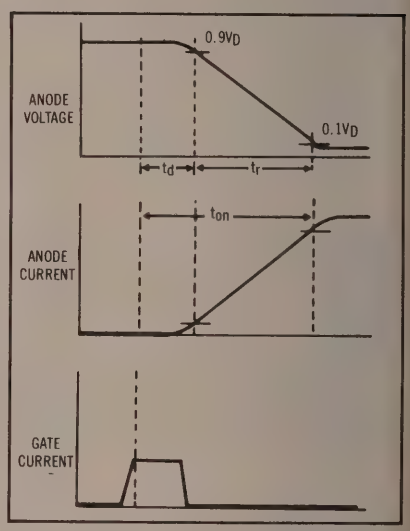


Fig. 3. Turn-on time waveforms

t_{on}: *Turn-on time*. The sum of delay time and rise time. (OFF-ON) (Fig. 3)

t_q: *Turn-off time.* Time between principal current reaching zero and the instant thyristor can block forward voltage without turning ON. (Fig. 1)

t_r: *Rise time*. Time between principal voltage dropping from one value to a second lower value when thyristor turns from OFF to ON. (Fig. 3)

t_{rr}: *Reverse recovery time*. (Fig. 2)

V_{DRM}/V_{RRM}: *Maximum repetitive peak OFF state/reverse voltage* excluding non-repetitive transients.

V_{DSM}/V_{RSM}: *Maximum nonrepetitive peak OFF state/reverse voltage.*

V_{FM}/V_{TM}: *Maximum forward voltage drop* at a specific forward current and case temp.

V_{GDM}: *Gate nontrigger voltage*. Highest dc voltage that will *not* cause thyristor to switch from OFF to ON.

V_{LATCH}: *Latching voltage*. Voltage required for thyristor to latch ON at a given gate current and junction temp.

$V_{TM(DYN)}$: *Dynamic ON state voltage*. Transient ON state voltage of thyristor when triggered into conduction for a given load and time.

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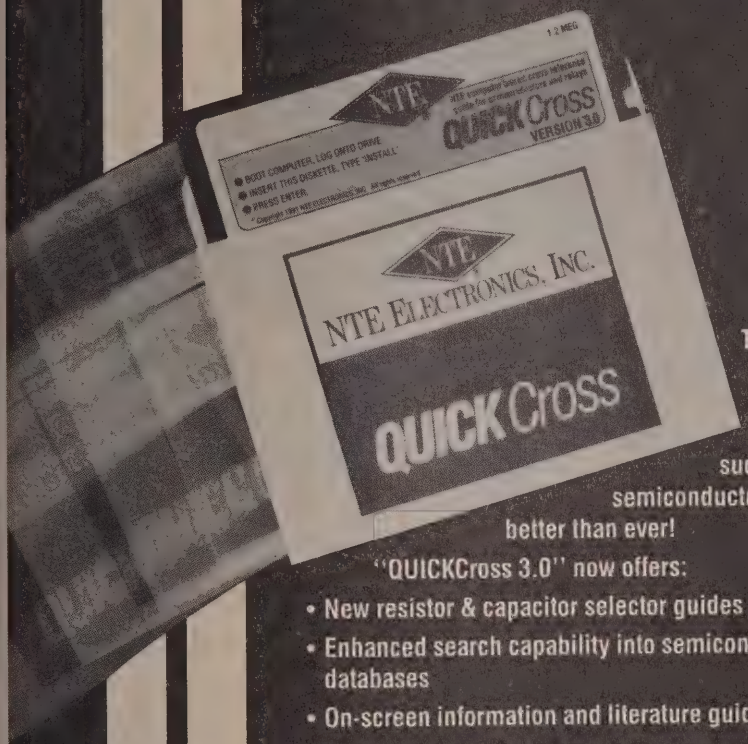

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PHILIPS POWER SEMICONDUCTORS

RECTIFIERS

General Purpose Silicon Rectifiers

Type	Pkg	$I_{F(AV)}$ Max A	V_{RRM} Max V	V_F @ I_F Max V @ A
BYD11D	SOD-91	0.58	200	1.2 @1
BYD11G			400	
BYD11J			600	
BYD11K			800	
BYD11M			1000	
BYD13D	SOD-81	1.4	200	1.05 @ 1
BYD13G			400	
BYD13J			600	
BYD13K			800	
BYD13M			1000	
BY627	SOD-84	2	1250	1.65 @ 10
BYW54	SOD-57	2	600	1.15 @ 2.5
BYW55			800	
BYW56			1000	
IN5059	SOD-57	2	200	1.15 @ 2.5
IN5060			400	
IN5061			600	
IN5062			800	
BYM56A	SOD-64	3.5	200	0.95 @ 3
BYM56B			400	
BYM56C			600	
BYM56D			800	
BYM56E			1000	
BY249-300	TO-220AC	7	300	1.6 @ 20
-600			600	
-800			800	
1N4001ID	SOD-81	1A	50V	1.1v @ 1A
1N4002ID			100V	
1N4003ID			200V	
1N4004ID			400V	
1N4005ID			600V	
1N4006ID			800V	
1N4007ID			1000V	
PRLL4001	SOD-87	1.5A	50V	0.8V @ 1A
PRLL4002			100V	0.8V @ 1A
BYD17D			200V	1.05V @ 1A
BYD17G			400V	1.05V @ 1A
BYD17J			600V	1.05V @ 1A
BYD17K			800V	1.05V @ 1A
BYD17M			1000V	1.05V @ 1A

Schottky Rectifiers

Type	Pkg	$I_{F(AV)}$ Max A	V_{RRM} Max V	V_F @ I_F Max V @ A
BYV10-20	DO-41	1	20	0.4 @ 1
-30			30	
-40			40	
IN5817	SOD-81	1	20	0.45 @ 1
IN5818			30	0.55 @ 1
IN5819			40	0.60 @ 1
PRLL5817	SOD-87	1A	20V	0.45V @ 1A
PRLL5818			30V	0.55V @ 1A
PRLL5819			40V	0.60V @ 1A
PBYR235CT	SOT-223	2A	35V	0.45 @ 1A
PBYR240CT			40V	
PBYR245CT			45V	
PBYR280CT	SOT-223	2	80	0.69 @ 1
PBYR290CT			90	
PBYR2100CT			100	
IN5820ID	SOD-84	3	20	0.475 @ 3
IN5821ID			30	0.50 @ 3
IN5822ID			40	0.525 @ 3
PBYR735	TO-220AC	7.5	35	0.57 @ 7.5
PBYR740			40	
PBYR745			45	
PBYR735F	SOT-186	7.5A	35V	0.57V @ 7.5A
PBYR740F			40V	
PBYR745F			45V	
PBYR1035	TO-220AC	10	35	0.57 @ 10
PBYR1040			40	
PBRY1045			45	
PBYR1035F	SOT-186	10A	35V	0.57V @ 10A
PBYR1040F			40V	
PBYR1045F			45V	
PBYR1060	TO-220AC	10	60	0.70V @ 10
PBYR1080			80	
PBYR10100			100	
BYV118	TO-220AB	10		0.6 @ 5
-35			35	
-40			40	
-45			45	
BYV118F-35	SOT-186	*10A	35V	0.6 @ 5A
-40			40V	
-45			45V	
PBYR1535CT	TO-220AB	15	35	0.57 @ 7.5
PBYR1540CT			40	
PBYR1545CT			45	
PBRY1535CTF	SOT-186	15A	35V	0.57V @ 7.5A
PBYR1540CTF			40V	
PBYR1545CTF			45V	
PBYR1635	TO-220AC	16	35	0.57 @ 16
PBYR1640			40	
PBYR1645			45	
PBYR1635F	SOT-186	16A	35V	0.57V @ 16A
PBYR1640F			40V	
PBYR1645F			45V	
PBYR2035CT	TO-220AB	20	35	0.57 @ 10
PBYR2040CT			40	
PBYR2045CT			45	
PBYR2035CTF	SOT-186	20A	35V	0.57V @ 10A
PBYR2040CTF			40V	
PBYR2045CTF			45V	
PBYR2060CT	TO-220AB	20	60	0.70 @ 10
PBYR2080CT			80	

Schottky Rectifiers (Cont.)

Type	Pkg	$I_{F(AV)}$ Max A	V_{RRM} Max V	V_F @ I_F Max V @ A
PBYR20100CT			100	
BYV133-35	TO-220AB	20	35	0.67 @ 7
BYV133-40			40	
BYV133-45			45	
BYV133F-35	SOT-186	20A	35V	0.6V @ 7A
-40			40V	
-45			45V	
BYV143	TO-220AB	30		0.6 @ 15
-35			35	
-40			40	
-45			45	
BYV143F-35	SOT-186	30A	35V	0.6V @ 15A
-40			40V	
-45			45V	
PBYR2535CT	TO-220AB	30	35	0.73 @ 15
PBYR2540CT			40	
PBYR2545CT			45	
PBYR2535CTF	SOT-186	30A	35V	0.73V @ 15A
PBYR2540CTF			40V	
PBYR2545CTF			45V	
PBYR3035PT	SOT-93	30	35	0.6 @ 20
PBYR3040PT			40	
PBYR3045PT			45	
PBYR3035PTF	SOT-199	30A	35V	0.6V @ 20A
PBYR3040PTF			40V	
PBYR3045PTF			45V	
PBYR3060PT	SOT-93	30	60	0.70 @ 15
PBYR3080PT			80	
PBYR30100PT			100	
PBYR12035TV	SOT-227B2	120	35	0.67 @ 60
PBYR12040TV			40	
PBYR12045TV			45	
PBYR16035TV	SOT-227B2	160	35	0.69 @ 160
PBYR16040TV			40	
PBYR16045TV			45	

Ultra-Fast Recovery Epitaxial Rectifiers

Type	Pkg	$I_{F(AV)}$ Max A	V_{RRM} Max V	V_F @ I_F Max V @ A
BYD71A	SOD-91	0.56	50	0.84 @ 0.5
B		0.56	100	0.84 @ 0.5
C		0.56	150	0.84 @ 0.5
D		0.56	200	0.84 @ 0.5
E		0.54	250	0.9 @ 0.5
F		0.54	300	0.9 @ 0.5
G		0.54	400	0.9 @ 0.5
BYV99	SOD-57	1	600	1.5 @ 1
BYV26A	SOD-57	1	200	1.3 @ 1
B			400	
C			600	
D			800	
E			1000	
BYD57J	SOD-87	1	600	2.1 @ 1
M				
BYV40-100	SOT-223	1.5A	100V	1V at 1.5A
-150			150V	
-200			200V	
BYV36A			200	
B		1.6	300	1.0 @ 1
C	SOD-57		600	
D		1.5	800	1.05 @ 1
E			1000	
BYD73A	SOD-81		50	
B			100	
C		1.75	150	0.74 @ 1
D			200	
F		1.7	300	0.83 @ 1
G		1.7	400	0.83 @ 1
BYD77A	SOD-87	2A	50V	0.95V @ 1A
B		2A	100V	0.95V @ 1A
C		2A	150V	0.95V @ 1A
D		2A	200V	0.95V @ 1A
E		1.85A	250V	1.05V @ 1A
F		1.85A	300V	1.05V @ 1A
G		1.85A	400V	1.05V @ 1A
BYV27-50	SOD-57		50	0.88 @ 3
-100			100	
-150			150	
-200			200	
BYV28-50	SOD-64	3.5	50	0.75 @ 3
-100			100	
-150			150	
-200			200	
BYR29-600	TO-220AC	8	600	1.3 @ 10
BYW29E-100	TO-220AC	8	100	0.8 @ 8
-150			150	
-200			200	
BYW29F-50	SOT-186	8	50	0.8 @ 8
-100			100	
-150			150	
-200			200	
BYR29F-600	SOT-186	8	600	1.3 @ 10
BYV29F-300	SOT-186	9	300	1.05 @ 5
-400			400	
-500			500	
BYV29-300	TO-220AC	9	300	1.05 @ 5
-400			400	
-500			500	
BYQ28E-100	TO-200AB	10	100	0.85 @ 5
-150			150	
-200			200	
BYV32F-50	SOT-186	12	50	0.85 @ 5
-100			100	
-150			150	

Ultra-Fast Recovery Epitaxial Rectifiers (Cont.)

Type	Pkg	$I_{F(AV)}$ Max A	V_{RRM} Max V	V_F @ I_F Max V @ A
BYV32F-200			200	
BYT79-300	TO-220AC	14	300	1.05 @ 10
-400			400	
-500			500	
BYV79E-100	TO-220AC	14	100	0.83 @ 14
-150			150	
-200			200	
BYV74F-300	SOT-199	20	300	1.05 @ 15
-400			400	
-500			500	
BYV32E-100	TO-200AB	20	100	0.85 @ 5
-150			150	
-200			200	
BYV34-300	TO-220AB	20	300	1.1 @ 10
-400			400	
-500			500	
BYV42E-100	TO-2200AB	30	100	0.85 @ 15
-150			150	
-200			200	
BYV44-300	TO-220AB	30	300	1.1 @ 15
-400			400	
-500			500	
BYV72E-100	SOT-93	30	100	0.83 @ 14
-150			150	
-200			200	
BYV74-300	SOT-93	30	300	1.1 @ 15
-400			400	
-500			500	
BYM26A	SOD-64	2.3A	200V	1.34V @ 2A
B			400V	
C			600V	
D			800V	
E			1000V	
BYM36A	SOD-64	3A	200V	1.22V @ 3A
B			400V	
C			600V	
D			800V	
E			1000V	1.28V @ 3A
*BYT28-300	TO-220AB	*10A	300V	1.05V @ 5A
-400			400V	
-500			500V	
*BYT230PIV-200	SOT-227B2	*60A	200V	1.4V @ 30A
-300			300V	
-400			400V	
-600			600V	
-800			800V	1.8V @ 30A
*BYV54V-50	SOT-227B2	*100A	50V	0.8V @ 50A
-100			100V	
-150			150V	
-200			200V	

Fast Recovery Rectifiers—Double Diffused Very Fast Types

Type	Pkg	$I_{F(AV)}$ Max A	V_{RRM} Max V	V_F @ I_F Max V @ A
BYD31D	SOD-91	0.5A	200V	1.6V @ 1A
G			400V	
J			600V	
BYD43-20	SOD-81	0.64	2000	2.05 @ 1
BYV98	SOD-57	1.1	2000	2.2 @ 2
BYD33D	SOD-81	1.3	200	1.3 @ 1
G			400	
J			600	
K			800	
M			1000	
BYD37D	SOD-87	1.5A	200V	1.3V @ 1A
G			400V	
J			600V	
K			800V	
M			1000V	
BYV95A	SOD-57	1.5	200	1.6 @ 3
B			400	
C			600	
BYV96D	SOD-57	1.5	800	1.6 @ 3
E			1000	
BYW95A	SOD-64	3	200	1.5 @ 3
B			400	
C			600	
BYW96D	SOD-64	3	800	1.5 @ 3
E			1000	
BY329-1000	TO-220AC	8A	1000	1.85 @ 20
-1200			1200	

Fast Types

Type	Pkg	$I_{F(AV)}$ Max A	V_{RRM} Max V	V_F @ I_F Max V @ A
BY527	SOD-57	2	1250	1 @ 1
BY458	SOD-57	4	1200	1.6 @ 3
BY448			1500	
BY428	SOD-64	4	1400	1.95 @ 4
BY438	SOD-64	5	1200	1.5 @ 5
BY228			1500	
BY328	SOD-64	4.5A (I_{FWM} max.)	1400	1.4 @ 5
BY359-1500	TO-220AC	10	1500	1.5 @ 10

High Voltage Rectifier Diodes

Type	Pkg	$I_{F(AV)}$ Max A	V_{RRM} Max V	V_F @ I_F Max V @ A
BY584	SOD-61	85mA	1800	
BY614	SOD-61H	50mA	2200	
BY505	SOD-61	85mA	2200	
BY705	SOD-61	20mA	5000	
BY715	SOD-61	20mA	5000	
BY706	SOD-61	20mA	6000	
BY716	SOD-61	20mA	6000	
BY646	SOD-61	5mA	8000	
BY656	SOD-61	5mA	8000	
BY617	SOD-61	4mA	9000	
BY707	SOD-61	3mA	9000	
BY717	SOD-61	4mA	10000	
BY647	SOD-61	5mA	10000	
BY657	SOD-61	5mA	10000	
BY648	SOD-61	5mA	12000	

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High Voltage Rectifier Diodes (Cont.)

Type	Pkg	$I_{F(AV)}$ Max A	V_{RRM} Max V	V_F @ I_F Max V @ A
BY658	SOD-61	5mA	12000	
BY718	SOD-61	4mA	12000	
BY708	SOD-61	3mA	12000	
BY709	SOD-61	3mA	14000	
BY719	SOD-61	4mA	14000	
BY609	SOD-61	4mA	15000	
BY619	SOD-61	4mA	15000	
BY610	SOD-61	4mA	17000	
BY620	SOD-61	4mA	17000	
BY710	SOD-61	3mA	17000	
BY720	SOD-61	3mA	17000	
BY611	SOD-61	4mA	19000	
BY721	SOD-61	3mA	19000	
BY711	SOD-61	3mA	19000	
BY722	SOD-61	3mA	22000	
BY723	SOD-61	3mA	24000	
BY713	SOD-61	3mA	24000	
BY714	SOD-61	3mA	30000	
BY724	SOD-61	3mA	30000	

Power Zeners (Voltage Regulator)

Type	Pkg	Polarity	P_{TOT} Max W	Reg V V_Z
BZD27	SOD-87	—	2.3W	3.6 to 270
BZD23	SOD-81	Norm	2.5W	7.5 to 270
BZT03	SOD-57	Norm	3.25W	7.5 to 510
BZW03	SOD-64	Norm	6W	7.5 to 510

Power Zeners (Transient Suppressor)

Type	Pkg	Polarity	P_{RSM} Max W	Stand off VR
BZD27	SOD-87	—	300W	11.3 to 707
BZD23	SOD-81	Norm	300W	3.0 to 220
BZT03	SOD-57	Norm	600W	5.6 to 220
BZW03	SOD-64	Norm	1000W	6.2 to 220

General Purpose Thyristors

Type	Pkg	$I_{T(AV)}$ Max A	V_{DRM} Max V	V_{GT} Min V	I_{GT} Min A
BT148W-400R	SOT-223	0.6A	400V	1.5V	200µA
-500R			500V		
-600R			600V		
BT148-400R	SOT-82	2.5	400	1.5	0.2mA
-500R			500		
-600R			600		
BT151F-500	SOT-186	5.7	500	1.5	15mA
-650			650		
-800			800		
BT151-500R	TO-220AB	7.5	500	1.5	15mA
-650R			650		
-800R			800		
BT152-400R	TO-220AB	13	400	1.5	32mA
-600R			600		
-800R			800		

TRIACs

Type	Pkg	$I_{T(RMS)}$ Max A	V_{DRM} Max V	V_{GT} Min V
BT134W-500	SOT-223	1A	500V	1.5
-600			600V	
-700			700V	
-800			800V	
BT134W-500D	SOT-223	1	500	1.5
-600D			600	
BT134W-500E	SOT-223	1	500	1.5
-600E			600	
BT134-500	SOT-82	4A	500V	1.5
-600			600V	
-800			800V	
BT136-500	TO-220AB	4	500	1.5
-600			600	
-800			800	
BT136-500D	TO-220AB	4	500	1.5
BT136-500E	TO-220AB	4	500	1.5
-600E			600	
-800E			800	
BT136-500F	TO-220AB	4	500	1.5
-600F			600	
-800F			800	
BT136-500G	TO-220AB	4	500	1.5
BT136-600G			600	
-800G			800	
BT136F-500	SOT-186	4	500	1.5
-600			600	
-800			800	
BT136F-500D	SOT-186	4	500	1.5
BT136F-500E	SOT-186	4	500	1.5
-600E			600	
BT137-500	TO-220AB	8	500	1.5
-600			600	
-800			800	
BT137-500D	TO-220AB	8	500	1.5
BT137-500E	TO-220AB	8	500	1.5
BT137-600E			600	
-800E			800	
BT137-500F	TO-220AB	8	500	1.5
-600F			600	
-800F			800	

TRIACs (Cont.)

Type	Pkg	$I_{F(AV)}$ Max A	V_{RRM} Max V	V_F @ I_F Max V @ A
BT137-500G	TO-220AB	8	500	1.5
-600G			600	
-800G			800	
BT137F-500	SOT-186	8	500	1.5
BT137F-500D	SOT-186	8	500	1.5
BT137F-500E	SOT-186	8	500	1.5
BT137F-500F	SOT-186	8	500	1.5
BT138-500	TO-220AB	12	500	1.5
-600			600	
-800			800	
BT138-500E	TO-220AB	12	500	1.5
-600E			600	
-800E			800	
BT138-500F	TO-220AB	12	500	1.5
-600F			600	
-800F			800	
BT138-500G	TO-220AB	12	500	1.5
-600G			600	
-800G			800	
BT138F-500	SOT-186	12	500	1.5
-600			600	
-800			800	
BTW43-600G	TO-64	12	600	2.5
-1000G			1000	(5V with
-1200G			1200	T, G+)
BTW43-600H	TO-64	12	600	2.5
-1000H			1000	(5V with
-1200H			1200	T, G+)
BTA212-600B	TO-220AB	12	600	0.2
-800B			800	
BT139-500	TO-220AB	16	500	1.5
-600			600	
-800			800	
BT139-500E	TO-220AB	16	500	1.5
-600E			600	
-800E			800	
BT139-500F	TO-220AB	16	500	1.5
-600F			600	
-800F			800	
BT139-500G	TO-220AB	16	500	1.5
-600G			600	
-800G			800	
BT139-500H	TO-220AB	16	500	0.25
-600H			600	
-700H			700	
-800H			800	
BT139F-500	SOT-186	16	500	1.5
-600			600	
-800			800	
BTA216-600B	TO-220AB	16	600	0.2
-800B			800	
BTA140-500	TO-220AB	25	500	1.5
-600			600	
-800			800	

Power Mosfet Transistors General Purpose (in order of Voltage/R_{DS} on)

V_{DS} MAX (V)	TYPE NO.	PACKAGE OUTLINE	I_D MAX (A)	P_{TOT} MAX (W)	R_{DS} ON MAX (Ω)
60	BUK452-60A	TO-220AB	15	60	0.13
60	BUK452-60B	TO-220AB	14	60	0.15
60	BUK453-60B	TO-220AB	20	75	0.10
60	BUK443-60B	SOT-186*	12	25	0.1
60	BUK483-60A	SOT-223	3.2	1.8	0.1
60	BUK453-60A	TO-220AB	22	75	0.08
60	BUK443-60A	SOT-186*	13	25	0.08
60	BUK455-60B	TO-220AB	38	125	0.045
60	BUK445-60B	SOT-186*	20	30	0.045
60	BUK455-60A	TO-220AB	41	125	0.038
60	BUK445-60A	SOT-186*	21	30	0.038
60	BUK436-60B	SOT-93	46	125	0.033
60	BUK456-60B	TO-220AB	51	150	0.03
60	BUK456-60A	TO-220AB	52	150	0.028
60	BUK436-60A	SOT-93	50	125	0.028
100	BUK451-100B	TO-220AB	3.0	40	1.1
100	BUK441-100B	SOT-186*	2.8	20	1.1
100	BUK451-100A	TO-220AB	3.0	40	0.85
100	BUK441-100A	SOT-186*	3.0	20	0.85
100	BUK452-100B	TO-220AB	10	60	0.3
100	BUK452-100A	TO-220AB	11	60	0.25
100	BUK453-100B	TO-220AB	13	75	0.20
100	BUK443-100B	SOT-186*	8	25	0.2
100	BUK453-100A	TO-220AB	14	75	0.16
100	BUK443-100A	SOT-186*	9	25	0.16
100	BUK455-100B	TO-220AB	23	125	0.1
100	BUK445-100B	SOT-186*	12	30	0.1
100	BUK455-100A	TO-220AB	26	125	0.08
100	BUK445-100A	SOT-186*	14	30	0.08
100	BUK456-100B	TO-220AB	32	150	0.065
100	BUK436-100B	SOT-93	31	125	0.065
100	BUK456-100A	TO-220AB	34	150	0.057
100	BUK436-100A	SOT-93	33	125	0.057
100	BUK416-100BE	ISOTOP	100	310	0.016
100	BUK416-100AE	ISOTOP	110	310	0.013
200	BUK454-200B	TO-220AB	8.2	90	0.5
200	BUK444-200B	SOT-186*	4.7	25	0.5
200	BUK454-200A	TO-220AB	9.2	90	0.4
200	BUK444-200A	SOT-186*	5.3	25	0.4
200	BUK455-200B	TO-220AB	13	125	0.28
200	BUK445-200B	SOT-186*	7	30	0.28

Power Mosfet Transistors General Purpose (in order of Voltage/R_{DS} on) (Cont.)

V_{DS} MAX (V)	TYPE NO.	PACKAGE OUTLINE	I_D MAX (A)	P_{TOT} MAX (W)	R_{DS} ON MAX (Ω)
200	BUK455-200A	TO-220AB	14	125	0.23
200	BUK445-200A	SOT-186*	7.6	30	0.23
200	BUK456-200B	TO-220AB	17	150	0.2
200	BUK436-200B	SOT-93	17	125	0.2
200	BUK456-200A	TO-220AB	19	150	0.16
200	BUK436-200A	SOT-93	19	125	0.16
200	BUK416-200BE	ISOTOP	63	310	0.045
200	BUK416-200AE	ISOTOP	63	310	0.035
400	BUK454-400B	TO-220AB	4.2	75	1.8
400	BUK444-400B	SOT-186*	2.4	25	1.8
400	BUK455-400B	TO-220AB	6.5	100	1.0
400	BUK445-400B	SOT-186*	3.8	30	1
400	BUK457-400B	TO-220AB	11	150	0.5
400	BUK437-400B	SOT-93	12	180	0.5
500	BUK453-500B	TO-220AB	1.6	50	7.0
500	BUK454-500B	TO-220AB	3.3	75	2.8
500	BUK444-500B	SOT-186*	1.9	25	2.8
500	BUK455-500B	TO-220AB	5.3	100	1.5
500	BUK445-500B	SOT-186*	2.9	30	1.5
500	BUK457-500B	TO-220AB	9	150	0.8
500	BUK437-500B	SOT-93	10	180	0.8
500	BUK438-500B	SOT-93	13.5	220	0.5
500	BUK417-500BE	ISOTOP	28	310	0.16
500	BUK417-500AE	ISOTOP	32	310	0.13
600	BUK454-600B	TO-220AB	2.6	75	4.5
600	BUK444-600B	SOT-186*	1.5	25	4.5
600	BUK455-600B	TO-220AB	4.0	100	2.5
600	BUK445-600B	SOT-186*	2.2	30	2.5
600	BUK457-600B	TO-220AB	7.1	150	1.2
600	BUK437-600B	SOT-93	7.8	180	1.2
800	BUK454-800B	TO-220AB	2.0	85	8
800	BUK444-800B	SOT-186*	1.2	30	8
800	BUK454-800A	TO-220AB	2.4	85	6
800	BUK444-800A	SOT-186*	1.4	30	6
800	BUK456-800B	TO-220AB	3.5	125	4
800	BUK436-800B	SOT-93	3.5	125	4
800	BUK446-800B	SOT-186*	1.7	30	4
800	BUK456-800A	TO-220AB	4	125	3
800	BUK436-800A	SOT-93	4	125	3
800	BUK446-800A	SOT-186*	2	30	3
800	BUK438-800B	SOT-93	6.6	220	2.0
800	BUK438-800A	SOT-93	7.6	220	1.5
1000	BUK456-1000B	TO-220AB	3.1	125	5
1000	BUK436-1000B	SOT-93	3.1	125	5
1000	BUK446-1000B	SOT-186*	1.5	30	5

Power Mosfet Transistors Logic Level FET's (in order of Voltage/R_{DS} on)

V_{DS} MAX (V)	TYPE NO.	PACKAGE OUTLINE	I_D MAX (A)	P_{TOT} MAX (W)	R_{DS} ON MAX (Ω)
60	BUK542-60B	SOT-186	8.4	22	0.18
60	BUK552-60B	TO-220AB	13	60	0.18
60	BUK552-60A	TO-220AB	14	60	0.15
60	BUK542-60A	SOT-186	9.2	22	0.15
60	BUK553-60B	TO-220AB	20	75	0.10
60	BUK543-60B	SOT-186*	12	25	0.1
60	BUK583-60A	SOT-223	3.2	1.8	0.1
60	BUK553-60A	TO-220AB	21	75	0.085
60	BUK543-60A	SOT-186*	13	25	0.085
60	BUK555-60B	TO-220AB	35	125	0.055
60	BUK545-60B	SOT-186*	18	30	0.055
60	BUK555-60A	TO-220AB	39	125	0.042
60	BUK545-60A	SOT-186*	20	30	0.042
60	BUK556-60A	TO-220AB	50	150	0.026
100	BUK551-100B	TO-220AB	3.0	40	1.1
100	BUK541-100B	SOT-186*	2.8	20	1.1
100	BUK551-100A	TO-220AB	3.0	40	0.85
100	BUK541-100A	SOT-186*	3.0	20	0.85
100	BUK552-100B	TO-220AB	8.5	60	0.35
100	BUK542-100B	SOT-186*	5.6	22	0.35
100	BUK542-100A	SOT-186*	6.3	22	0.28
100	BUK552-100A	TO-220AB	10	60	0.28
100	BUK553-100B	TO-220AB	12	75	0.22
100	BUK543-100B	SOT-186*	7.5	25	0.22
100	BUK553-100A	TO-220AB	13	75	0.18
100	BUK543-100A	SOT-186*	8.3	25	0.18
100	BUK555-100B	TO-220AB	22	125	0.11
100	BUK545-100B	SOT-186*	12	30	0.11
100	BUK555-100A	TO-220AB	25	125	0.085
100	BUK545-100A	SOT-186*	13	30	0.085
200	BUK554-200B	TO-220AB	8.2	90	0.5
200	BUK554-200A	TO-220AB	9.2	90	0.4
200	BUK555-200B	TO-220AB	13	125	0.28
200	BUK545-200B	SOT-186*	7	30	0.28
200	BUK555-200A	TO-220AB	14	125	0.23
200	BUK545-200A	SOT-186*	7.6	30	0.23
400	BUK637-400B	SOT-93	12	180	0.6
400	BUK657-400B	TO-220AB	11	150	0.6
500	BUK655-500B	TO-220AB	5.3	100	1.5
500	BUK657-500B	TO-220AB	9	150	0.8
500	BUK637-500B	SOT-93	10	180	0.8
500	BUK638-500B	SOT-93	12.5	220	0.6
500	BUK617-500B	ISOTOP	27	310	0.18
500	BUK617-500A	ISOTOP	29	310	0.15

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PHILIPS POWER SEMICONDUCTORS

TRANSISTORS, DIODES, DARLINGTONS

Protected MOSFET Switches (TOPFET) (in order of Voltage/R_{DS} on)

V_{DS} (V)	Type No.	Package Outline	R_{DS} ON (Ω)	at Vis (V)	Drive (V)	Supply (V)
50	BUK100-50GL	TO-220AB	0.125	5	5	—
50	BUK104-50L	SOT-263	0.125	5	5-10	5
			0.100	7		
50	BUK104-50S	SOT-263	0.125	5	5-10	10
			0.100	7		
50	BUK100-50GSS	TO-220AB	0.100	10	10	—
50	BUK101-50GL	TO-220AB	0.060	5	5	—
50	BUK105-50L	SOT-263	0.060	5	5-10	5
			0.050	7		
50	BUK105-50S	SOT-263	0.060	5	5-10	10
			0.050	7		
50	BUK101-50GS	TO-220AB	0.050	10	10	—
50	BUK102-50GL	TO-220AB	0.035	5	5	—
50	BUK106-50L	SOT-263	0.035	5	5-10	5
			0.028	7		
50	BUK106-50S	SOT-263	0.035	5	5-10	10
			0.028	7		
50	BUK102-50GS	TO-220AB	0.028	10	10	—

Type	Pkg	I_C (DC) Max A	V_{CEO}	V_{CE} (Sat) Max I_C/I_B R/R
High Speed, High Voltage Transistors				
BUX86	TO-126	0.5	400	1.5@0.1
BUX87			450	
BUX99	TO-126	1.5	300	1@0.2
BUX84	TO-220A	2	400	1@1/0.2
BUX85			450	
BUX84F	SOT-186	2	400	1@1/0.2
BUX85F			450	
BUT11	TO-220AB	5	400	1.5@3/0.6
BUT11A			450	1.5@2.5/0.5
BUT11F	SOT-186	5	400	1.5@3/0.6
BUT11AF			450	1.5@2.5/0.5
BUW11	SOT-93	5	400	1.5@3/0.6
BUW11A			450	1.5@2.5/0.5
BUT211	TO-220AB	5	400	2@3/0.3
BUT18	TO-220AB	6	400	1.5@4/0.8
BUT18A			450	
BUT18F	SOT-186	6	400	1.5@4/0.8
BUT18AF			450	
BUT12	TO-220AB	8	400	1.5@6/1.2
BUT12A			450	1.5@5/1
BUW12	SOT-93	8	400	1.5@6/1.2
BUW12A			450	1.5@5/1
BUW12AF	SOT-199	8	450	1.5V@5A
BU1708X	SOT-186A	8	850	1@25/0.5
BUW13	SOT-93	15	400	1.5@10/2
BUW13A			450	1.5@8/1.5
BUV98V	SOT-227B1	30	450	1.5@20A/4A
BUV98AV			450	1.5V@16A/3.2A
High Speed, High Voltage Darlingtons				
BU826	SOT-93	6	375	2@2.5
BU826A			400	
ESM3045DV	SOT-227B2	24	450	2@15A
ESM4045AV	SOT-227B2	42	450	2@25A
ESM4045DV				
ESM5045DV	SOT-227B2	60A	450	2@35A
High Speed, Medium Voltage Transistors				
BU406	TO-220AB	7	200	1@5
BU407			100	
BUV28	TO-220AB	12	200	1.5@6
BUV28A			225	1.5@4
BUV27	TO-220AB	13	120	1.5@8
BUV27A			150	1@7
BUV26	TO-220AB	14	90	1.5@12
BUV26A			100	1@10
Very High Voltage Transistors				
BU505	TO-220AB	2.5	700	5@2
BU506	TO-220AB	3.0	700	5@3
BU506D	TO-220AB	3.0	700	5@3
BU706	SOT-93A	3.0	700	5@3
BU706D	SOT-93A	3.0	700	5@3
BUV89	SOT-93A	8.0	800	1@4.5
BU508A	SOT-93	8	700	1@4.5
BU508AF	SOT-199	8	1500	1@4.5A
BU508D	SOT-93A	8.0	700	1@4.5
BU508DF	SOT-199	8	1500	1@4.5A
BU603	TO-220AB	5	550	2@2A
BU2506DF	SOT-199	5	700	1@3
BU903	SOT-93	6	550	2@3.2A
BU2508A	SOT-93	8A	700V	1V@4.5A
BU2508A	SOT-199	8	1500	1V@4.5A
BU2508D	SOT-93	8	1500	1V@4.5A
BU2508DF	SOT-199	8	1500	1V@4.5A
BU2520A	SOT-93	10	800	5@6
BU2520AF	SOT-199	10	800	5@6
BU2520D	SOT-93	10	800	5@6
BU2520DF	SOT-199	10	800	5@6
BU2525A	SOT-93	12	800	5@8
BU2525AF	SOT-199	12	800	5@8

Type NPN	PNP	Pkg	I_C (DC) Max A	V_{CEO} V	h_{FE} @ I_C Min mA	V_{CE} (Sat) Max I_C/I_B A/mA	f_T MHz
High Frequency, Video, Transistors							
BF469	BF470	TO-126	0.1	250	50@25	—	60
BF471	BF472			300			
BF869	BF870	TO-202	0.1	250	50@25	—	60
BF871	BF872			300			
BF591		TO-202	0.15	170	30@100	—	—
BF593				210			
BF419	—	TO-126	0.3	250	45@20	11@ 0.2/ 20mA	90
BF457	—	TO-126	0.3	160	26@30	1@	90
BF458				250		0.03/	
BF459				300		6mA	
BF819	—	TO-202	0.3	250	45@20	11@ 0.2/ 20mA	90
BF857	—	TO-202	0.3	160	26@30	1@	90
BF858				250		0.03/	
BF859				300		6mA	

Type	Pkg	V_R V	I_F mA	V_F @ I_F V	mA	t_{RR}
Switching Diodes						
1N914	DO-35	75	75	1.00	10	4
1N914A	DO-35	75	75	1.00	20	4
1N914B	DO-35	75	75	0.72	5	4
1N916	DO-35	75	75	1.00	10	4
1N9164B	DO-35	75	75	0.73	5	4
1N4148	DO-35	75	200	1.00	10	4
1N4149	DO-35	75	200	1.00	10	4
1N4150	DO-35	50	200	0.74	10	4
1N4151	DO-35	75	200	1.00	50	2
1N4153	DO-35	75	200	0.88	20	2
1N4446	DO-35	75	200	1.00	20	4
1N4448	DO-35	75	200	0.72	5	4
1N4449	DO-35	75	200	0.73	5	4
1N4531	DO-34	75	200	1.00	10	4
1N4532	DO-34	75	200	1.00	10	2
BAS11	DO-35	300	350	1.10	300	1000
BAV10	DO-35	60	300	1.00	200	6
BAV18	DO-35	50	250	1.00	100	50
BAV19	DO-35	100	250	1.00	100	50
BAV20	DO-35	150	250	1.00	100	50
BAV21	DO-35	200	250	1.00	100	50

Type	Pkg	V_R V	I_F mA	C_D @ V_R pF	V
Bandswitch Diodes					
BA223	DO-34	20	50	3.5	6
BA423	DO-34	20	50	2.5	3
BA482	DO-34	35	100	1.2	3
BA483	DO-34	35	100	1.0	3
BA484	DO-34	35	100	1.6	3

Type	Pkg	V_R V	I_F mA	V	V_F @ I_F mA
Schottky Barrier Diodes					
BA480	DO-34	4	30	280	1
BA481	DO-34	4	30	450	1
BAT81	DO-34	40	30	410	1
BAT82	DO-34	50	30	410	1
BAT83	DO-34	60	30	410	1
BAT85	DO-34	30	200	320	1
BAT86	DO-34	50	200	380	1
BYV10-20	DO-41	20	1000	550	1000
BYV10-30	DO-41	30	1000	550	1000
BYV10-40	DO-41	40	1000	550	1000

Type	Pkg	V_R V	I_F mA	C_D @ V_R @ f pF	V	MHz
Variable Capacitance Diodes						
BB119	DO-35	15	200	20-25	4.0	1.0
BB417	DO-34	20	20	8-11	4.0	0.5
BB112	SOD-69	12	50	440-540	1.0	1.0
BB130	SOD-69	30	50	450-550	1.0	1.0
BB212	TO-92	12	100	500-620	0.5	1.0
BB204B	TO-92	30	100	37-42	3.0	1.0
BB204G	TO-92	30	100	34-39	3.0	1.0
BB405B	DO-34	30	20	18 MAX	1.0	0.5
BB809	DO-34	28	20	39-46	1.0	0.5
BB909A	DO-34	30	20	31 MIN	1.0	0.5
BB909B	DO-34	30	20	33.5 MIN	1.0	0.5
BB910	DO-34	28	20	28 MIN	0.5	1.0
BB911	DO-34	30	20	63 MIN	0.5	1.0

Type	V_Z @ I_{ZT} V	Z_{ZT} @ I_{ZT} Ω	I_{ZT} mA
Zener Diodes-500mW, 5%, DO-35			
1N5225B	3.0	29	20
1N5226B	3.3	28	20
1N5227B	3.6	24	20
1N5228B	3.9	23	20
1N5229B	4.3	22	20
1N5230B	4.7	19	20

Type	V_Z @ I_{ZT} V	Z_{ZT} @ I_{ZT} Ω	I_{ZT} mA
Zener Diodes-500mW, 5%, DO-35 (Cont.)			
1N5231B	5.1	17	20
1N5232B	5.6	11	20
1N5233B	6.0	7	20
1N5234B	6.2	7	20
1N5235B	6.8	5	20
1N5236B	7.5	6	20
1N5237B	8.2	8	20
1N5238B	8.7	8	20
1N5239B	9.1	10	20
1N5240B	10	17	20
1N5241B	11	22	20
1N5242B	12	20	20
1N5243B	13	13	9.5
1N5244B	14	15	9.0
1N5245B	15	16	8.5
1N5246B	16	17	7.8
1N5247B	17	19	7.4
1N5248B	18	21	7.0
1N5249B	19	23	6.6
1N5250B	20	25	6.2
1N5251B	22	29	5.6
1N5252B	24	33	5.2
1N5253B	25	35	5.0
1N5254B	27	41	4.6
1N5256B	30	49	4.2
1N5257B	32	58	3.8
1N5258B	36	70	3.4
1N5259B	39	80	3.2
1N5260B	43	93	3.0
1N5261B	47	105	2.7
1N5262B	51	125	2.5
1N5263B	56	150	2.2
1N5264B	60	170	2.1
1N5265B	62	185	2.0
1N5266B	68	230	1.8
1N5267B	75	270	1.7
Zener Diodes-1.0W, 5%, DO-41			
1N4728A	3.3	10	76
1N4729A	3.6	10	69
1N4730A	3.9	9.0	64
1N4731A	4.3	9.0	58
1N4732A	4.7	8.0	53
1N4733A	5.1	7.0	45
1N4734A	5.6	5.0	45
1N4735A	6.2	2.0	41
1N4736A	6.8	3.5	37
1N4737A	7.5	4.0	34
1N4738A	8.2	4.5	31
1N4739A	9.1	5.0	28
1N4740A	10	7.0	25
1N4741A	11	8.0	23
1N4742A	12	9.0	21
1N4743A	13	10	19
1N4744A	15	14	17
1N4745A	16	16	15.5
1N4746A	18	20	14
1N4747A	20	22	12.5

Type	Pkg	V_R V	I_F mA	I_R @ V_R A	V	V_R @ I_F V	mA
Low Leakage Diodes							
BAV45A	TO-18	20	50	5pA	5	1.00	10
BAS45	DO-34	125	225	1nA	125	0.80	5

Type	Pkg	Ref. V	△V ref mV	T_C %/°C	r_{DIFF} Ω
Temp. Compensated Ref. Diodes					
1N821	DO-34	6.2	96	0.01	15
1N823	DO-34	6.2	48	0.005	15
1N825	DO-34	6.2	19	0.002	15
1N827	DO-34	6.2	9	0.001	15
Temp. Compensated Ref. Diodes					
1N829	DO-34	6.2	5	0.0005	15
1N821A	DO-34	6.2	96	0.01	10
1N823A	DO-34	6.2	48	0.005	10
Temp. Compensated Ref. Diodes					
1N825A	DO-34	6.2	19	0.002	10
1N827A	DO-34	6.2	9	0.001	10
1N829A	DO-34	6.2	5	0.0005	10

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PHILIPS SMALL SIGNAL LEADED SEMICONDUCTORS

TRANSISTORS, DARLINGTONS

Type	kg	BV_{CES} V	I_C mA	h_{FE} @ I_C	mA	V_{CE}(Sat) @ I_C @ I_B V	mA	mA	f_T @ I_C MHz	mA
Darlington Transistors–NPN										
MPSA12	TO-92	20	300	20,000	10	1.0	10	0.01	—	—
MPSA13	TO-92	30	500	10,000	100	1.5	100	0.10	125	10
MPSA14	TO-92	30	500	20,000	100	1.5	100	0.10	125	10
MPSA25	TO-92	40	500	10,000	100	1.5	100	0.10	125	10
—PNP										
MPSA62	TO-92	20	500	20,000	10	1.0	10	0.01	—	—
MPSA63	TO-92	30	500	10,000	100	1.5	100	0.10	125	10
MPSA64	TO-92	30	500	20,000	100	1.5	100	0.10	125	10
MPSA75	TO-92	40	500	10,000	100	1.5	100	0.10	125	10
MPSA76	TO-92	50	500	10,000	100	1.5	100	0.10	125	10
MPSA77	TO-92	60	500	10,000	100	1.5	100	0.10	—	—

Type	Pkg	BV_{CBO} V	I_C mA	h_{FE} @ I_C min	max	mA	f_T @ I_C MHz	mA
General Purpose & Switching Transistors–NPN								
2N1613	TO-39	50	500	40	120	150	60	50
2N1711	TO-39	50	1000	100	300	150	70	50
2N1893	TO-39	80	500	40	120	150	—	—
2N2219	TO-39	60	800	100	300	150	250	20
2N2219A	TO-39	75	800	100	200	150	300	20
2N2222	TO-18	30	800	100	300	150	250	20
2N2222A	TO-18	40	800	100	300	150	300	20
2N2297	TO-39	35	1000	40	120	150	60	50
2N2368	TO-18	15	200	20	60	10	400	10
2N2369	TO-18	15	200	40	120	10	500	10
2N2369A	TO-18	15	200	40	120	10	500	10
2N3019	TO-39	80	1000	100	200	150	100	50
2N3020	TO-39	80	1000	40	120	150	80	50
2N3053	TO-39	40	700	50	250	150	80	50
2N3904	TO-92	40	200	100	300	10	250	10
2N4123	TO-92	30	200	50	150	2	250	10
2N4124	TO-92	25	200	120	360	2	300	10
2N4400	TO-92	40	600	50	150	150	200	20
2N4401	TO-92	40	600	100	300	150	250	20
2N5088	TO-92	30	50	300	900	0.1	50	.5
2N6428	TO-92	50	200	250	650	0.1	100	1
2N6428A	TO-92	50	200	250	650	0.1	100	1
2PC945	TO-92	60	100	200	—	1.0	250	1
2PC1815	TO-92	60	150	250	—	1.0	8	1
2PC1815L	TO-92	60	150	140	—	1.0	8	1
JC337	TO-92	45	500	100	600	100	100	10
JC500	TO-92	25	100	90	600	1	130	10
JC501	TO-92	45	90	—	—	1.0	150	1
JC546	TO-92	65	100	110	450	2	300	10
JC547	TO-92	45	100	110	800	2	300	10
JC548	TO-92	30	100	110	800	2	300	10
MPS3704	TO-92	30	600	100	300	50	100	50
MPS3904	TO-92	60	200	100	300	10	300	10
MPS5172	TO-92	25	100	100	500	10	120	2
MPS6513	TO-92	30	100	90	180	2	(330)	10
MPS6514	TO-92	25	100	150	300	2	(480)	10
MPS6515	TO-92	25	100	250	500	2	(480)	10
MPS6520	TO-92	25	100	200	600	2	(390)	2
MPS6521	TO-92	25	100	300	—	2	(390)	2
MPS6530	TO-92	40	600	40	120	100	—	—
MPS6531	TO-92	40	600	90	270	200	(390)	50
MPS6532	TO-92	30	600	30	—	100	—	—
MPS6560	TO-92	25	500	50	200	500	60	10
MPS8098	TO-92	60	500	100	300	1.0	150	10
MPSA05	TO-92	60	500	50	—	100	100	10
MPSA06	TO-92	80	500	50	—	100	100	10
PN2222	TO-92	30	800	100	300	150	250	20
PN2222A	TO-92	40	800	100	300	150	300	20
PN2369	TO-92	15	500	40	120	10	500	10
PN2369A	TO-92	15	600	40	120	10	500	10

Type	Pkg	BV_{CBO} V	I_C mA	min	h_{FE} @ I_C max	mA	f_T @ I_C MHz	mA
General Purpose & Switching Transistors–PNP								
2N2904A	TO-39	60	600	40	120	150	200	50
2N2905	TO-39	40	600	100	300	150	200	50
2N2905A	TO-39	60	600	100	300	150	200	50
2N2906	TO-18	60	600	35	—	10	200	50
2N2906A	TO-18	60	600	40	120	150	200	50
2N2907	TO-18	40	600	100	300	150	200	50
2N2907A	TO-18	60	600	100	300	150	200	50
2N3906	TO-92	40	200	100	300	10	300	10
2N4030	TO-39	60	1000	40	120	100	100	50
2N4031	TO-39	80	1000	40	120	100	100	50
2N4032	TO-39	60	1000	100	300	100	150	50
2N4033	TO-39	80	1000	100	300	100	150	50
2N4125	TO-92	30	200	50	150	2	200	10
2N4126	TO-92	25	200	120	360	2	250	10
2N4402	TO-92	40	600	50	150	150	150	20
2N4403	TO-92	40	600	100	300	150	200	20
2N5086	TO-92	50	50	150	500	0.1	40	.5
2N5087	TO-92	50	50	250	800	0.1	40	.5
2PA733	TO-92	50	100	205	—	1	180	—
2PA1015	TO-92	50	150	70	—	2	80	—
2PA1015L	TO-92	50	150	140	—	2	80	—
JA100	TO-92	25	100	90	600	1	130	10
JA101	TO-92	45	100	90	600	1	130	10
JC327	TO-92	45	500	100	600	100	100	10
JC328	TO-92	25	500	100	600	100	100	10
JC556	TO-92	65	100	75	475	2	200	10
JC557	TO-92	45	100	75	800	2	200	10
JC558	TO-92	30	100	75	800	2	200	10
MPS3640	TO-92	12	80	30	120	10	500	10
MPS3702	TO-92	40	600	60	300	50	100	50
MPS3703	TO-92	50	600	30	150	50	100	50
MPS3906	TO-92	40	200	100	300	10	250	10
MPS6516	TO-92	40	100	50	100	2	—	—

Type	Pkg	BV_{CBO} V	I_C mA	min	h_{FE} @ I_C max	mA	f_T @ I_C MHz	mA
General Purpose & Switching Transistors–PNP (Cont.)								
MPS6517	TO-92	40	100	90	180	2	(330)	10
MPS6518	TO-92	40	100	150	300	2	(480)	10
MPS6519	TO-92	25	100	250	500	2	(480)	10
MPS6522	TO-92	25	100	200	600	2	(340)	2
MPS6523	TO-92	25	100	300	—	2	(340)	2
MPS8533	TO-92	40	600	40	120	100	—	—
MPS6534	TO-92	40	600	90	270	100	(390)	50
MPS8598	TO-92	60	500	100	300	1	150	10
MPS8599	TO-92	80	500	100	300	1	150	10
MPSA55	TO-92	60	500	50	—	150	50	100
MPSA56	TO-92	80	500	50	—	150	50	100
PN2907	TO-92	40	600	100	300	150	200	50
PN2907A	TO-92	60	600	100	300	100	200	50

Type	Pkg	BV_{CEO} V	I_C mA	h_{FE} @ I_C min	mA	V_{CE} (Sat) @ I_C V	mA	f_T @ I_C MHz	mA
High Voltage Transistors–NPN									
2N3439	TO-39	350	1000	40	20	0.50	50	4	10
2N3440	TO-39	250	1000	40	20	0.50	50	4	10
2N5550	TO-92	140	600	80	10	0.25	50	100	10
2N5551	TO-92	160	600	80	10	0.20	50	10	10
MPSA42	TO-92	300	500	40	10	0.50	20	50	10
MPSA43	TO-92	200	500	40	10	0.50	20	50	10
PN3439	TO-92	350	1000	40	20	0.50	50	4	10
PN3440	TO-92	250	1000	40	20	0.50	50	4	10

Type	Pkg	BV_{CEO} V	I_C mA	h_{FE} @ I_C min	mA	V_{CE} (Sat) @ I_C V	mA	f_T @ I_C MHz	mA
—PNP									
2N5400	TO-92	120	600	40	10	0.50	50	100	10
2N5401	TO-92	150	600	60	10	0.50	50	100	10
2N5415	TO-39	200	1000	30	50	2.50	50	15	10
2N5416	TO-39	350	1000	30	50	2.00	50	15	10
MPSA92	TO-92	300	500	40	10	0.50	20	50	10
MPSA93	TO-92	200	500	40	10	0.50	20	50	10
PN5415	TO-92	200	1000	30	50	2.50	50	15	10
PN5416	TO-92	350	1000	30	50	2.50	50	15	10

Type	Pkg	Mode	V_{DS} V	I_D mA	r_{DS}on Ω	yfs mA/V	V_{GS}(th) V
Field Effect Transistors, D-MOS, FET, N-Channel							
2N7000	TO-92	ENH	60	500	2.5	200	1-2.5
BS107	TO-92	ENH	200	120	15	—	—
BS170	TO-92	ENH	60	500	3.5	200	0.8-3.0
BSD12	TO-72	DPL	20	50	15	15	<2.0
BSD212	TO-72	ENH	10	50	25	15	0.1-2.0
BSD213	TO-72	ENH	10	50	25	15	0.1-2.0
BSD214	TO-72	ENH	20	50	25	15	0.1-2.0
BSD215	TO-72	ENH	20	50	25	15	0.1-2.0
BSN10	TO-92	ENH	50	175	10	60	0.4-1.8
BSN10A	TO-92	ENH	50	175	10	60	0.4-1.8
BSN204	TO-92	ENH	200	250	5	400	0.4-1.8
BSN204A	TO-92	ENH	200	250	5	400	0.4-1.8
BSN205	TO-92	ENH	200	300	4.5	350	0.8-2.8
BSN205A	TO-92	ENH	200	300	4.5	350	0.8-2.8
BSN254	TO-92 VAR.	ENH	250	300	5	400	0.8-2.0
BSN254A	TO-92 VAR.	ENH	250	300	5	400	0.8-2.0
BSN274	TO-92 VAR.	ENH	270	250	6.5	400	0.8-2.0
BSN274A	TO-92 VAR.	ENH	270	250	6.5	400	0.8-2.0
BST70A	TO-92	ENH	80	500	2	300	1.5-3.5
BST72A	TO-92	ENH	80	300	7	150	1.5-3.5
BST74A	TO-92	ENH	200	250	6	250	0.8-2.8
BST76A	TO-92	ENH	180	300	6	250	0.7-2.7
BST78	TO-126	ENH	450	750	10	400	2.0-4.0
BST97	TO-18	ENH	180	300	6	250	0.7-2.7
VN2406L	TO-92 VAR	ENH	240	210	<6	400	0.8-2.0
VN2410L	TO-92 VAR	ENH	240	150	<10	400	0.8-2.0

Type	Pkg	Mode	V_{DS} V	I_D mA	r_{DS}on Ω	yfs mA/V	V_{GS}(th) V
P-Channel							
BST100	TO-92	ENH	60	300	4.5	200	1.5-3.5
BST110	TO-92	ENH	50	250	7.5	125	1.5-3.5
BST250	TO-92	ENH	45	250	9.0	125	1.0-3.5

Type	Pkg	$\pm V_{DS}$ V	I_{DSS} mA	$-V_{P}$ V_{GS} V	r_{DS}on Ω	C_{RS} @ V_{GS} pF	V
J-FET							
2N3822	TO-72	50	2-10	<6	—	3.0	0
2N3823	TO-72	30	4-20	<8	—	2.0	0
2N3966	TO-72	30	>2	4-6	220	1.5	7
2N4091	TO-18	40	>30	5-10	30	5.0	20
2N4092	TO-18	40	>15	2-7	50	5.0	20
2N4093	TO-18	40	>8	1-5	80	5.0	20
2N4391	TO-18	40	50-150	4-10	30	3.5	12
2N4392	TO-18	40	25-75	2-5	60	3.5	7
2N4393	TO-18	40	5-30	0.5-3	100	3.5	5
2N4416	TO-72	30	5-15	—	—	0.8	—
2N4856	TO-18	40	>50	4-10	25	8.0	10
2N4857	TO-18	40	25-100	2-6	40	8.0	10
2N4858	TO-18	40	8-80	0.8-4	60	8.0	10
2N4859	TO-18	30	>50	4-10	25	8.0	10
2N4860	TO-18	30	25-100	2-6	40	8.0	10
2N4861	TO-18	30	8-80	0.8-4	60	8.0	10
BF245A/0	TO-92	30	0.5-2.1	<8	—	1.1typ	1
BF245A	TO-92	30	2-6.5	<8	—	1.1typ	1
BF245B	TO-92	30	6-15	<8	—	1.1typ	1
BF245C	TO-92	30	12-25	<8	—	1.1typ	1
BF247A	TO-92	25	30-80	<14.5	—	3.5typ	—

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Philips Components
Discrete Products Division
A North American Philips Company

PHILIPS SMALL SIGNAL LEADED SEMICONDUCTORS
TRANSISTORS, FETs, SURFACE MOUNT SEMICONDUCTORS

Type	Pkg	±V_{DS} V	I_{DSS} mA	$-V_{(P)GS}$ V	r_{DS}on Ω	C_{RS} @ V_{GS} pF	V
J-FET (Cont.)							
BF247B	TO-92	25	60-140	<14.5	—	3.5typ	—
BF247C	TO-92	25	110-250	<14.5	—	3.5typ	—
BF256A	TO-92	30	3-7	—	—	0.7typ	0
BF256B	TO-92	30	6-13	—	—	0.7typ	0
BF256C	TO-92	30	11-18	—	—	0.7typ	0
BF410A	TO-92	20	0.7-3	0.8	—	0.5	0
BF410B	TO-92	20	2.5-7	1.5	—	0.4	0
BF410C	TO-92	20	6-12	2.2	—	0.4	—
BF410D	TO-92	20	10-18	3	—	0.4	—
BFU308	TO-92	25	12-60	—	—	2.5typ	—
BFU309	TO-92	25	12-30	—	—	2.5typ	—
BFU310	TO-92	25	24-60	—	—	2.5typ	—
BFW10	TO-72	30	8-20	<8	—	0.8	0
BFW11	TO-72	30	4-10	<6	—	0.8	0
BFW12	TO-72	30	1-5	<2.5	—	0.8	0
BFW13	TO-72	30	0.2-1.5	<1.2	—	0.8	0
J108	TO-92	25	>80	3-10	8	15	10
J109	TO-92	25	>40	2-6	12	15	10
J110	TO-92	25	>10	0.5-4	18	15	10
J111	TO-92	35	20	3-10	30	5.0	10
J112	TO-92	35	5	1-5	50	5.0	10
J113	TO-92	35	2	0.5-3	100	5.0	10
J174	TO-92	30	20-135	5-10	85	4.0	10
J175	TO-92	30	7-70	3-6	125	4.0	10
J176	TO-92	30	2-35	1-4	250	4.0	10
J177	TO-92	30	1.5-20	0.8-2.25	300	4.0	10
J308	TO-92	25	12-60	—	—	2.5typ	—
J309	TO-92	25	12-60	—	—	2.5typ	—
J310	TO-92	25	24-60	—	—	2.5typ	—
PN4391	TO-92	40	50-150	4-10	30	3.5	12
PN4392	TO-92	40	25-75	2-5	60	3.5	7
PN4393	TO-92	40	5-30	0.5-3	100	3.5	5
PN4416	TO-92	30	5-15	—	—	0.8typ	—

Type	Pkg	±V_{DS} V	I_{DSS} mA	$-V_{(P)GS-S}$ V	y_{fs} mA/V	N_F & G_P @ f dB	dB	MHz	C_{RS} f_F
Dual Gate MOSFET									
BF960	SOT-103	20	2-20	3.5	12	2.8	16.5	800	25
BF964	SOT-103	20	2-20	2.5	17	1.5	25	200	25
BF964S	SOT-103	20	4-20	2.5	18	1.0	25	200	25
BF965	SOT-103	20	2-20	2.5	18min.	1	25	200	25
BF966	SOT-103	20	2-20	2.5	17	2.8	18	800	25
BF966S	SOT-103	20	4-20	2.5	18	1.8	18	800	25
BF980	SOT-103	18	—	1.3	19	2.8	—	800	25
BF980A	SOT-103	18	—	20	19	2	—	800	25
BF981	SOT-103	20	4-25	2.5	14	1.0	26	200	25
BF982	SOT-103	20	—	1.3	25	1.2	—	200	30
BF988	SOT-103	12	2-18	2.5	24	1	—	—	—

Type	Pkg	BV_{CEO} V	I_C mA	f_T @ I_C GHz	mA	N_F @ f @ I_C dB	MHz	mA
High Frequency Transistors–NPN								
2N2857	TO-72	15	40	>1	2	<4.5	450	1.5
2N5053	TO-72	15	25	1.2	2	<3.5	200	2
2N5054	TO-72	15	25	1.5	2	<3.5	200	2
2N6595	TO-72	15	25	>3.5	14	<3.2	200	2
2N6596	TO-72	15	25	>4	14	<2	200	2
2N6597	TO-72	12	35	>3.5	30	<3.2	200	2
2N6598	TO-72	12	35	>4	30	<2	200	2
2N6599	TO-72	15	75	>3.5	50	<4	200	5
2N6600	TO-72	15	75	>3.5	50	4	200	50
2N6601	TO-72	10	50	1.8	30	<4	200	2
BF496	TO-92	20	?	>0.3	2	—	—	—
BF498	TO-92	20	20	0.55	—	2.5	200	—
BF748	TO-92	20	50	1.2	—	4.5	200	—
MPSH10	TO-92	25	40	>0.65	4	—	100	—
BF506	TO-92	20	25	0.35	—	5	—	—
BF926	TO-92	20	25	0.35	1	5	800	1
BF970A	SOT-37	35	30	0.9	3	4.5	200	3
BF979	SOT-37	20	30	1.35	10	4.5	800	10
MPSH81	TO-92	20	—	>0.6	—	—	800	—

WIDEBAND TRANSISTORS

Type	Package	V_{CEO} V	I_C mA	h_{FE} min./max. at I_C/V_{CE} mA/V		NF typ. at I_C dB	mA	f_T typ. GHz
NPN								
BF689K	TO-92	15	25	35/70	20/5	3	2	1.8
BF751	TO-92	14	35	50/200	20/10	2.7	5	6.5
BF763	TO-92	15	25	25/250	5/10	5	5	1.8
BFG34	SOT-103	18	150	25/-	10/10	2.3	20	3.7
BFG65	SOT-103	10	50	60/-	15/5	3	15	7.5
BFG90A	SOT-103	15	25	40/-	14/10	2.4	14	5
BFG91A	SOT-103	12	35	40/-	30/5	2.3	30	6
BFG96	SOT-103	15	75	25/-	50/10	4	70	5
BFG134	SOT-103	15	150	80/-	100/10	—	—	7
BFG195	SOT-103	10	100	40/-	50/5	1.4	15	7.5
BFP90A	SOT-173	15	30	40/-	14/10	1.7	4	5
BFP91A	SOT-173	12	50	40/-	30/5	1.6	4	6
BFP96	SOT-173	15	100	25/-	50/10	3.7	50	5
BFP505	SOT-173	15	18	60/250	20/6	1.2	1.25	9
BFP520	SOT-173	15	70	60/250	20/6	1.1	5	9
BFP540	SOT-173	15	120	60/250	20/8	1.3	10	9
BFQ22S	TO-72	12	35	50/150	10/5	1.9	2	5
BFQ33C	SOT-173	7	20	50/-	14/5	3	5	12
BFQ34	SOT-122	18	150	25/-	75/15	8	120	3.5
BFQ34T	SOT-37	18	150	25/-	100/10	—	—	3.7
BFQ53	TO-72	15	25	25/-	14/10	2.4	2	5
BFQ63	TO-72	15	75	50/150	20/5	3	10	4.5
BFQ65	SOT-37	10	50	60/-	15/5	3	15	7.5
BFQ66	SOT-173	10	50	60/-	15/5	2.5	5	7.5
BFQ68	SOT-122	18	300	25/-	240/15	—	—	4

Type	Package	V_{CEO} V	I_C mA	h_{FE} min./max. at I_C/V_{CE} mA/V		NF typ. at I_C dB	mA	f_T typ. GHz
NPN (Cont.)								
BFQ135	SOT-172A2	19	150	55/-	120/18	—	—	6.5
BFQ136	SOT-122	18	600	25/-	500/15	—	—	4
BFQ161	TO-92	20	10	25/-	—	—	—	1
BFQ162	TO-126	10	500	25/-	300/5	—	—	>1
BFQ163	TO-39	10	500	25/-	300/5	—	—	>1
BFQ231	TO-92	65	300	20/-	—	—	—	>1
BFQ231A	TO-92	95	300	20/-	—	—	—	>0.8
BFQ232	TO-126	65	300	20/-	50/10	—	—	1.4
BFQ232A	TO-126	95	300	20/-	—	—	—	>0.8
BFQ233	TO-39	65	300	20/-	50/10	—	—	1.4
BFQ233A	TO-39	95	300	20/-	—	—	—	>0.8
BFQ234	SOT-172A1	65	300	20/-	50/10	—	—	1.4
BFQ235	SOT-128B	65	300	20/-	50/10	—	—	1
BFQ235A	SOT-128	95	300	20/-	—	—	—	>0.8
BFQ262	TO-126	65	100	400	15/-	100/10	—	—
BFQ262A	TO-126	95	115	400	15/-	—	—	—
BFQ263	TO-39	65	100	400	15/-	100/10	—	—
BFQ263A	TO-39	95	115	400	15/-	—	—	—
BFQ265	SOT-128B	65	100	400	15/-	100/10	—	—
BFQ265A	SOT-128	95	115	400	15/-	—	—	—
BFQ268	SOT-172A1	65	100	400	15/-	100/10	—	—
BFQ270	SOT-172	18	—	270	—	—	—	—
BFQ621	SOT-172	19	150	120typ	120/18	—	—	8
BFQ741	SOT-172	19	300	120typ	200/18	—	—	7
BFR90A	SOT-37	15	20	25	40/-	14/10	2.4	2
BFR91A	SOT-37	12	15	35	40/-	30/5	1.6	4
BFR94A	SOT-122E	25	150	—	—	8	90	3.5
BFR95	TO-39	25	30	150	30/-	50/20	9	80
BFR96S	SOT-37	15	20	100	25/-	70/10	4	70
BFR134	SOT-37	18	25	150	80/-	100/10	—	—
BFR521	SOT-103	15	70	60/250	20/6	1.1	5	9
BFR541	SOT-103	15	120	60/250	40/8	1.3	10	9
BFR591	SOT-103	15	200	60/250	90/10	—	—	8
BFT24	SOT-37	5	8	2.5	20/-	1/1	3.8	1
BFW16A	TO-39	25	40	150	25/-	50/5	<6	30
BFW17A	TO-39	25	40	150	25/-	50/5	—	—
BFW30	TO-72	10	20	50	25/-	25/5	<5	2
BFW92	SOT-37	15	25	25	20/150	2/1	4	2
BFW92A	SOT-37	15	25	25	20/150	2/1	2.5	2
BFW93	SOT-37	10	18	50	25/-	25/5	<5	2
BFY90	TO-72	15	30	25	25/150	2/1	<3.5	2
PNP								
BFG32	SOT-103	15	20	75	20/-	50/10	4.3	50
BFQ23	SOT-37	12	15	35	20/-	30/5	2.4	2
BFQ23C	SOT-173	12	15	50	20/-	30/5	2.3	4
BFQ24	TO-72	12	15	35	20/-	30/5	2.4	2
BFQ32	SOT-37	15	20	75	20/-	50/10	—	—
BFQ32C	SOT-173	15	20	100	20/-	50/10	4.3	50
BFQ32M	TO-72	15	20	75	20/-	20/5	1.9	10
BFQ32S	SOT-37	15	20	100	20/-	70/10	4.3	50
BFQ51	SOT-37	15	20	25	20/-	14/10	2.4	4
BFQ52	TO-72	15	20	25	20/-	14/10	2.7	2
BFQ54T	SOT-37	18	25	150	25/-	100/10	—	—
BFQ108	SOT-122	18	300	25min.	240/15	—	—	4
BFQ251	TO-92	65	100	300	20/-	—	—	—
BFQ251A	TO-92	95	115	300	20/-	—	—	—
BFQ252	TO-126	65	100	300	20/-	50/10	—	—
BFQ252A	TO-126	95	115	300	20/-	50/10	—	—
BFQ253	TO-39	65	100	300	20/-	50/10	—	—
BFQ253A	TO-39	95	115	300	20/-	—	—	—
BFQ254	SOT-172A1	65	100	300	20/-	50/10	—	—
BFQ255	SOT-128B	65	100	300	20/-	50/10	—	—
BFQ255A	SOT-128	95	115	300	20/-	—	—	—

SURFACE MOUNT SEMICONDUCTORS

Type	Pkg	V_{CEO} V	I_C mA	h_{FE} @ I_C/V_{CE} min/max	mA/V	$t_{(MAX)}$ on/off @ I_C/I_S ns	mA
Switching Transistors–NPN							
BSR13	SOT-23	30	800	100/300	150/10	35/285	150/—
BSR14	SOT-23	40					
BSR17	SOT-23	40	200	50/150	10/1	70/225	10/1
BSR17A	SOT-23	40	200	100/300	10/1	70/250	10/1
BSR40	SOT-89	60	1000	40/120	100/5	250/1000	100/5
BSR41	SOT-89			100/300			
BSR42	SOT-89	80	1000	40/120	100/5	250/1000	100/5
BSR43	SOT-89			100/300			
BSS64	SOT-23	80	100	20/80	10/1	/1000	15/1
BSV52	SOT-23	12	100	40/120	10/1	12/18	10/3
PMBT2369	SOT-23	15	500	40/120	10/1	12/18	10/3
PMBT2222	SOT-23	40	600	100/300	150/10	35/285	150/15
PMBT2222A	SOT-23	40	600	100/300	150/10	35/285	150/15
PMBT4401	SOT-23	40	600	100/300	150/1	35/255	150/15
PXT2222A	SOT-89	40	600	100/300	150/10	35/285	150/15
PXT4401	SOT-89	40	600	100/300	150/1	35/255	150/15
PZT2222A	SOT-223	40	600	100/300	150/10	35/285	150/15
BSP40	SOT-223	60	1000	40/120	100/5	250/1000	100/5
BSP41	SOT-223	60	1000	100/300	100/5	250/1000	100/5
BSP42	SOT-223	80	1000	40/120	100/5	250/1000	100/5
BSP43	SOT-223	80	1000	100/300	100/5	250/1000	100/5

Type	Pkg	V_{CEO} V	I_C mA	h_{FE} @ I_C/V_{CE} min/max	mA/V	$t_{(MAX)}$ on/off @ I_C/I_S ns	mA
–PNP							
PMBT3640	SOT-23	12	80	20/—	50/1	25/35	10/5
BSR12	SOT-23	15	100	30/120	50/1	20/30	30/3
BSR15	SOT-23	40	600	100/300	150/10	45/100	150/15
BSR16	SOT-23	60	600	100/300	150/10	45/100	150/15
BSR18	SOT-23	40	200	50/150	10/1	70/250	10/1
BSR18A	SOT-23	40	200	100/300	10/1	70/300	10/1
PMBT4403	SOT-23	40	600	100/300	150/2	35/225	150/15
PXT4403	SOT-89	40	600	100/300	150/2	35/225	150/15

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Discrete Products Division
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PHILIPS SMALL SIGNAL SEMICONDUCTORS

SURFACE MOUNT SEMICONDUCTORS

SURFACE MOUNT SEMICONDUCTORS

Type	Pkg	V_{CEO} V	I_C mA	h_{FE} @ I_C/V_{CE} min/max	mA/V	$t_{(MAX)}$ on/off @ I_C ns	I_C mA
-PNP (Cont.)							
BSR30	SOT-89	60	1000	40/120	100/5	500/650	100/5
BSR31	SOT-89	60		100/300			
BSR32	SOT-89	80		40/120			
BSR33	SOT-89	80		100/300			
BSS63	SOT-23	100	100	30/—	25/1	—	—
PMBT2907	SOT-23	40	600	100/300	150/10	45/100	150/15
PMBT2907A	SOT-23	60	600	100/300	150/10	45/100	150/15
PXT2907A	SOT-89	60	600	100/300	150/10	45/100	150/15
PZT2907A	SOT-223	80	1000	40/120	100/5	500/650	100/5
BSP30	SOT-223	60	1000	40/120	100/5	500/650	100/5
BSP31	SOT-223	60	1000	100/300	100/5	500/650	100/5
BSP32	SOT-223	80	1000	40/120	100/5	500/650	100/5
BSP33	SOT-223	80	1000	100/300	100/5	500/650	100/5

Type	Pkg	V_{CEO} V	I_C mA	h_{FE} @ I_C/V_{CE} min/max	mA/V	f_T MHz
General Purpose Transistors, NPN						
BC817	SOT-23	45	500	100/600	100/1	100
BC818	SOT-23	25	500	100/600	100/1	100
BC846	SOT-23	65	200	125/450	2/5	300
BC847	SOT-23	45	200	110/800	2/5	300
BC848	SOT-23	30	200	110/800	2/5	300
BC868	SOT-89	20	1000	85/375	500/1	60
BC817W	SOT-323	45	500	100/600	100/1	100
BC818W	SOT-323	25	500	100/600	100/1	100
BC846W	SOT-323	65	200	125/500	2/5	300
BC847W	SOT-323	45	200	125/900	2/5	300
BC848W	SOT-323	30	200	125/900	2/5	300
BC849W	SOT-323	30	100	240/900	2/5	300
BC850W	SOT-323	45	100	240/900	2/5	300
BC860W	SOT-323	45	100	125/900	2/5	150
BCP68	SOT-223	20	1000	85/375	500/1	60
BCV61	SOT-143	30	100	100/800	2/5	300
PMBT2222	SOT-23	30	600	100/300	150/10	>250
BCV71	SOT-23	60	100	125/220	2/5	300
BCV72	SOT-23	60	100	200/450	2/5	300
BCW31	SOT-23	32	100	110/220	2/5	300
BCW32	SOT-23	32	100	220/450	2/5	300
BCW33	SOT-23	32	100	420/800	2/5	300
BCW60A	SOT-23	32	200	120/220	2/5	250
BCW60B	SOT-23	32	200	180/310	2/5	250
BCW60C	SOT-23	32	200	250/460	2/5	250
BCW60D	SOT-23	32	200	380/630	2/5	250
BDS77	SOT-223	80	3000	30/—	2000/2	>7
BDS201	SOT-223	45	3000	30/—	3000/2	>7
BDS203	SOT-223	60	3000	30/—	2000/2	>7
BDS933	SOT-223	45	3000	40/250	150/2	>3
BDS935	SOT-223	60	3000	40/250	150/2	>3
BDS937	SOT-223	80	3000	40/250	150/2	>3
BDS939	SOT-223	100	3000	40/250	150/2	>3
BDS941	SOT-223	120	3000	40/250	150/2	>3
BDS943	SOT-223	22	3000	85/475	500/1	>3
BDS945	SOT-223	32	3000	85/475	500/1	>3
BDS947	SOT-223	45	3000	85/475	500/1	>3
BDS949	SOT-223	60	3000	40/—	500/4	>3
BDS951	SOT-223	80	3000	40/—	500/4	>3
BDS953	SOT-223	100	3000	40/—	500/4	>3
BDS955	SOT-223	120	3000	40/—	500/4	>3
PMBTA20	SOT-23	40	100	40/400	5/10	>125
BCW71	SOT-23	45	100	110/220	2/5	300
BCW72	SOT-23	45	100	200/450	2/5	300
BCW81	SOT-23	45	100	420/800	2/5	300
BCX19	SOT-23	45	500	100/600	100/1	200
BCX20	SOT-23	25	500	100/600	100/1	200
BCX54	SOT-89	45	1000	40/250	150/2	130
BCX55	SOT-89	60	1000	40/250	150/2	130
BCX56	SOT-89	80	1000	40/250	150/2	130
BCX70G	SOT-23	45	200	120/220	2/5	250
BCX70H	SOT-23	45	200	180/310	2/5	250
BCX70J	SOT-23	45	200	250/460	2/5	250
BCX70K	SOT-23	45	200	380/630	2/5	250
PMBTA05	SOT-23	60	500	50/	100/1	>100
PMBTA06	SOT-23	80	500	50/	100/1	>100
PMBT3903	SOT-23	40	200	50/150	10/1	>250
PMBT3904	SOT-23	40	200	100/300	10/1	>300
PXT3904	SOT-89	40	200	100/300	10/1	>300
PXT4401	SOT-89	40	600	100/300	150/1	>250
PMBT2222A	SOT-23	40	600	100/300	150/10	>300
PXT2222A	SOT-89	40	600	100/300	150/10	>300
PZT2222A	SOT-223	40	600	100/300	150/10	>300
PZT3904	SOT-223	40	200	100/300	10/1	>300
PZT4401	SOT-223	40	600	100/300	150/1	250
BCP54	SOT-223	45	1000	40/250	150/2	130
BCP55	SOT-223	60	1000	40/250	150/2	130
BCP56	SOT-223	80	1000	40/250	150/2	130
-PNP						
BC807	SOT-23	45	500	100/600	100/1	100
BC808	SOT-23	25	500	100/600	100/1	100
BC856	SOT-23	65	100	75/475	2/5	150
BC857	SOT-23	45	100	75/475	2/5	150
BC858	SOT-23	30	100	75/800	2/5	150
BC869	SOT-89	20	1000	85/375	500/1	60
BC807W	SOT-323	45	500	100/600	100/1	100
BC808W	SOT-323	25	500	100/600	100/1	100
BC856W	SOT-323	65	100	75/900	2/5	150
BC857W	SOT-323	45	100	75/900	2/5	150
BC858W	SOT-323	30	100	75/900	2/5	150
BC859W	SOT-323	30	100	125/800	2/5	150
BCP69	SOT-223	20	1000	85/375	500/1	60
BCV62	SOT-143	30	100	100/800	2/5	150
BCW29	SOT-23	32	100	120/260	2/5	150
BCW30	SOT-23	32	100	215/500	2/5	150
BCW61A	SOT-23	32	200	120/220	2/5	180
BCW61B	SOT-23	32	200	180/310	2/5	180
BCW61C	SOT-23	32	200	250/460	2/5	180
BCW61D	SOT-23	32	200	380/630	2/5	180
BDS78	SOT-223	80	3000	30/—	3000/2	>7
BDS202	SOT-223	45	3000	30/—	3000/2	>7
BDS204	SOT-223	60	3000	30/—	3000/2	>7
BDS934	SOT-223	45	3000	40/250	150/2	>3
BDS936	SOT-223	60	3000	40/250	150/2	>3
BDS938	SOT-223	80	3000	40/250	150/2	>3
BDS940	SOT-223	100	3000	40/250	150/2	>3
BDS942	SOT-223	120	3000	40/250	150/2	>3
BDS944	SOT-223	22	3000	85/475	500/1	>3
BDS946	SOT-223	32	3000	85/475	500/1	>3
BDS948	SOT-223	45	3000	85/475	500/1	>3
BDS950	SOT-223	60	3000	40/—	500/4	>3
BDS952	SOT-223	80	3000	40/—	500/4	>3
BDS954	SOT-223	100	3000	40/—	500/4	>3
BDS956	SOT-223	120	3000	40/—	500/4	>3
PMBTA70	SOT-23	40	100	40/100	5/10	>125
BCW69	SOT-23	45	100	120/260	2/5	150
BCW70	SOT-23	45	100	215/500	2/5	150
BCW89	SOT-23	60	100	120/260	2/5	150
BCX17	SOT-23	45	500	100/600	100/1	100
BCX18	SOT-23	25	500	100/600	100/1	100
BCX51	SOT-89	45	1000	40/250	150/2	50
BCX52	SOT-89	60	1000	40/250	150/2	50
BCX53	SOT-89	80	1000	40/250	150/2	50
BCX71G	SOT-23	45	200	120/220	2/5	180
BCX71H	SOT-23	45	200	180/310	2/5	180
BCX71J	SOT-23	45	200	250/460	2/5	180
BCX71K	SOT-23	45	200	380/630	2/5	180
PMBTA55	SOT-23	60	500	50/	100/1	>50
PMBT2907A	SOT-23	60	600	100/300	150/10	>200
PXT2907A	SOT-89	60	600	100/300	150/10	>200
PZT2907A	SOT-223	60	600	100/300	150/10	>200
PZT3906	SOT-223	40	200	100/300	10/1	>250
PZT4403	SOT-223	40	600	100/300	150/2	200
PMBTA56	SOT-23	80	500	50/	100/1	>50
BCP53	SOT-223	80	1000	40/250	150/2	50
PMBT3906	SOT-23	40	200	100/300	10/1	>250
PMBT4403	SOT-23	40	600	100/300	150/2	>200
PXT3906	SOT-89	40	200	100/300	10/1	>250
PXT4403	SOT-89	40	600	100/300	150/2	>200
PMBT2907	SOT-23	40	600	100/300	150/10	200
BCP51	SOT-223	45	1000	40/250	150/2	50
BCP52	SOT-223	60	1000	40/250	150/2	50

Type	Pkg	V_{CEO} V	I_C mA	h_{FE} @ I_C/V_{CE} min/max	mA/V	N_F @ I_C dB	mA	f_T MHz
High Freq. Transistors-NPN								
BFS18	SOT-23	10	30	35/125	1/10	4	1	200
BFS19	SOT-23	20	30	65/225	1/10	4	1	260
BFS20	SOT-23	20	25	40/—	7/10	—	—	450
BF747	SOT-23	20	50	4/250	2/10	—	—	1200
BF840	SOT-23	40	25	—	—	1.5	1	380
BF841	SOT-23	40	25	—	—	2.0	1	380

Type	Pkg	V_{CEO} V	I_C mA	h_{FE} @ I_C/V_{CE} min/max	mA/V	N_F @ I_C dB	mA	f_T MHz
-PNP								
BF536	SOT-23	30	25	25/—	1/10	5	1	350
BF550	SOT-23	40	25	50/—	1/10	1	1	325
BF569N	SOT-23	35	30	25/—	3/10	4.5	3	900
BF579	SOT-23	20	25	20/—	10/10	4.5	10	1350
BF660	SOT-23	30	25	30/—	3/10	—	—	650
BF767	SOT-23	30	20	15/—	3/10	4	3	900
BF824	SOT-23	30	25	—	—	3	2	440

WIDEBAND TRANSISTORS

Type	Pkg	V_{CEO} (V)	I_C (mA)	f_T (GHz)	NF @ f (dB)	(MHz)	Gum @ f (dB)	(MHz)
-NPN								
BF547	SOT-23	20	50	1.2	4.5	100	20	100
BF547W	SOT-323	20	50	1.6	—	—	20	100
BF747	SOT-23	20	50	1.2	—	—	13	500
BF747W	SOT-323	20	50	1.6	—	—	20	100
BFG16A	SOT-223	25	150	1.5	—	—	10	500
BFG17A	SOT-143	15	25	2.8	2.5	800	15.5	800
BFG25A/X	SOT-143	5	6.5	5	1.8	2000	—	—
BFG33	SOT-143	7	20	12	3	2000	12	2000
BFG33/X	SOT-143	7	20	12	3	2000	12	2000
BFG33/XR	SOT-143R	7	20	12	3	2000	12	2000
BFG35	SOT-223	18	150	4	—	—	12	800
BFG67	SOT-143	10	50	8	2.2	2000	10.9	2000
BTG67/X	SOT-143	10	50	8	2.2	2000	10.9	2000
BFG67/XR	SOT-143R	10	50	8	2.2	2000	10.9	2000
BFG92A	SOT-143	15	25	5	2.4	800	17.5	800
BFG92A/X	SOT-143	15	25	5	2.4	800	17.5	800
BFG92A/XR	SOT-143R	15	25	5	2.4	800	17.5	800
BFG93A	SOT-143	12	35	6	2.3	800	17	800
BFG93A/X	SOT-143	12	35	6	2.3	800	17	800
BFG93A/XR	SOT-143R	12	35	6	2.3	800	17	800
BFG94	SOT-223	12	60	6	2.3	800	15	800
BFG97	SOT-223	15	150	5	3.7	800	12	800
BFG135	SOT-223	18	150	7.5	—	—	12	800
BFG197	SOT-143	10	100	7.5	1.4	800	11	2000
BFG197/X	SOT-143	10	100	7.5	1.4	800	11	2000
BFG197/XR	SOT-143R	10	100	7.5	1.4	800	11	2000
BFG198	SOT-223	10	100	7.5	—	—	15	800
BFG505	SOT-143	15	18	9	1.9	2000	13	2000
BFG505/X	SOT-143	15	18	9	1.9	2000	13	2000
BFG505/XR	SOT-143R	15	18	9	1.9	2000	13	2000
BFG520	SOT-143	15	70	9	1.9	2000	13	2000
BFG520/X	SOT-143	15	70	9	1.9	2000	13	2000
BFG520/XR	SOT-143R	15	70	9	1.9	2000	13	2000
BFG540	SOT-143	15	120	9	2.1	2000	11	2000
BFG540/X	SOT-143	15	120	9	2.1	2000	11	2000

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SURFACE MOUNT SEMICONDUCTORS

Type	Pkg	V_{CEO} (V)	I_C (mA)	f_T (GHz)	NF @ f (dB)	(MHz)	Gum @ f (dB)	(MHz)
-NPN (Cont.)								
BFG540/XR	SOT-143R	15	120	9	2.1	2000	11	2000
BFG541	SOT-223	15	120	9	2.1	2000	9	2000
BFG590	SOT-143	15	200	8	—	—	—	—
BFG590/X	SOT-143	15	200	8	—	—	—	—
BFG590/XR	SOT-143R	15	200	8	—	—	—	—
BFG591	SOT-223	15	200	8	—	—	—	—
BFG621	SOT-223	15	150	8	—	—	—	—
BFG741	SOT-223	15	300	7	—	—	—	—
BFQ17	SOT-143	15	25	2.8	2.5	800	15.5	800
BFQ18A	SOT-89	15	150	3.6	—	—	—	—
BFQ19	SOT-89	15	75	5	3.3	500	11.5	500
BFQ67	SOT-23	10	50	8	2.2	2000	8	2000
BFQ67W	SOT-323	10	50	8	—	—	—	—
BFR53	SOT-23	10	50	2	5	500	22	200
BFR92	SOT-23	15	25	5	2.4	800	15	800
BFR92A	SOT-23	15	25	5	2.4	800	15	800
BFR92AW	SOT-323	15	25	5	2.1	1000	14	1000
BFR93	SOT-23	12	35	5	2.3	800	14	800
BFR93A	SOT-23	12	35	5	2.3	800	14	800
BFR93AW	SOT-323	12	35	6	1.9	1000	16	1000
BFR106	SOT-23	15	100	4	3.6	800	11.5	800
BFR505	SOT-23	15	18	9	1.9	2000	10	2000
BFR520	SOT-23	15	70	9	1.9	2000	9	2000
BFR540	SOT-23	15	120	9	—	—	—	—
BFS17	SOT-23	15	25	1.3	4.5	500	—	—
BFS17A	SOT-23	15	25	2.8	2.5	800	13.5	800
BFS17W	SOT-323	15	50	1.6	—	—	—	—
BFS25A	SOT-323	5	6.5	5	—	—	—	—
BFS505	SOT-323	15	18	9	—	—	—	—
BFS520	SOT-323	15	70	9	—	—	—	—
BFS540	SOT-323	15	120	9	—	—	—	—
BFT25	SOT-23	5	6.5	2.3	3.8	500	18	500
BFT25A	SOT-23	5	6.5	5	1.8	2000	—	—
PNP								
BFG31	SOT-223	15	100	5	—	—	12	800
BFG55	SOT-223	18	150	4	—	—	11	800
BFQ149	SOT-89	15	75	5	3.75	500	12	500
BFT92	SOT-23	15	25	5	2.7	500	18	500
BFT92AW	SOT-323	15	35	5	2.5	500	18	500
BFT93	SOT-23	12	35	5	2.4	500	16.5	500
BFT93AW	SOT-323	12	50	5	2.4	500	16.5	500

Type	Pkg	V_{CEO} V	I_C mA	h_{FE} @ I_C/V_{CE} min/max	mA/V	N_F @ I_C dB	mA	f_t MHz
Low Noise Transistors–NPN							µA	MH_z
PMBT5089	SOT-23	25	50	1.2	100	400/—	10/5	100
PMBT5088	SOT-23	30	50	1.0	100	300/—	10/5	100
PMBT6429	SOT-23	45	200	0.5	100	250/—	10/5	100
PMBT6428	SOT-23	50	200	0.5	100	250/—	10/5	100
BC849	SOT-23	30	200	200/900	2/5	1.2	200	300
BC850	SOT-23	45	200	200/900	2/5	1.0	200	300
BCF32	SOT-23	32	100	200/450	2/5	1.2	200	300
BCF33	SOT-23	32	100	420/800	2/5	1.2	200	300
BCF81	SOT-23	45	100	420/800	2/5	1.2	200	300

Type	Pkg	V_{CEO} V	I_C mA	h_{FE} @ I_C/V_{CE} min/max	mA/V	N_F @ I_C dB	mA	f_t MHz
-PNP								
BC859	SOT-23	30	100	125/800	2/5	1.0	200	150
BC860	SOT-23	45	100	125/800	2/5	1.0	200	150
BCF29	SOT-23	32	100	120/260	2/5	1.0	200	150
BCF30	SOT-23	32	100	215/500	2/5	1.0	200	150
BCF70	SOT-23	45	100	215/500	2/5	1.0	200	150

Type	Pkg	V_{CEO} V	I_C mA	h_{FE} @ I_C/V_{CE} min/max	mA/V	N_F @ I_C dB	mA	f_t MHz
High Voltage Transistors–NPN								
BSR19	SOT-23	140	600	60/250	10/5	—	—	100
PMBT5550	SOT-23	140	600	60/250	10/5	—	—	200
BSR19A	SOT-23	160	600	80/250	10/5	—	—	100
PMBT5551	SOT-23	160	600	80/250	10/5	—	—	200
PMBTA43	SOT-23	200	500	40/—	30/10	—	—	50
PZTA43	SOT-223	200	500	40/—	30/10	—	—	50
BF622	SOT-89	250	20	50/—	25/20			60
BF722	SOT-223	250	50	50/—	25/20			60
BF822	SOT-23	250	50	50/—	25/20			
BSP20	SOT-223	250	1000	40/160	30/10			50
BST39	SOT-89	350	1000	40/160	20/10	15		
PXTA42	SOT-89	300	500	40/1	30/10	50		
BST40	SOT-89	250	1000	40/160	20/10	15		
PMBTA42	SOT-23	300	500	40/—	30/10	50		
PZTA42	SOT-223	300	500	40/—	30/10	50		
BSP19	SOT-223	350	1000	40/160	20/10	15		
BF620	SOT-89	—	20	50/—	25/20	—	—	60
BF720	SOT-223	—	50	50/—	25/20	—	—	60
BF820	SOT-23	—	50	50/—	25/20	—	—	60

Type	Pkg	V_{CEO} V	I_C mA	h_{FE} @ I_C/V_{CE} min/max	mA/V	N_F @ I_C dB	mA	f_t MHz
-PNP								
BF621	SOT-89	—	20	50/—	25/20	60		
BF721	SOT-223	—	50	50/—	25/20	60		
BF623	SOT-89	250	20	50/—	25/20	60		
BF821	SOT-23	—	50	50/—	25/20	60		
BF823	SOT-23	250	50	50/—	25/20	60		
BSP16	SOT-223	300	1000	30/120	50/10	—	—	15
BSR20	SOT-23	120	600	40/180	10/5	100		
BSR20A	SOT-23	150	600	60/240	10/5	100		
BST15	SOT-89	200	1000	30/150	50/10	15		
BST16	SOT-89	300	1000	30/120	50/10	15		
PMBTA92	SOT-23	300	500	25/—	30/10	50		
PXTA92	SOT-89	300	500	25/—	30/10	50		
PZTA92	SOT-223	300	500	25/—	30/10	50		
PZTA93	SOT-223	200	500	25/—	30/10	—	—	50

Type	Pkg	V_{CEO} V	I_C mA	h_{FE} @ I_C/V_{CE} min/max	mA/V	N_F @ I_C dB	mA	f_t MHz
-PNP (Cont.)								
PMBTA93	SOT-23	200	500	25/—	30/10	50		
PMBT5401	SOT-23	150	600	60/240	10/5	200		
BF723	SOT-223	200	50	50/—	25/20	60		
BSP15	SOT-223	200	1000	30/150	50/10	15		

Type	Pkg	$\pm V_{DS}$ V	$-V_{GSO}$ V	I_D mA	I_{DSS} nA	I_{DSS} mA min/max	$-V_{(P)GS}$ V	Y_{fs} mA/V	C_{rs} pF	V_N µV
Field Effect Transistors, J-FETs										
BF510	SOT-23	20	—	30	10	0.7/3.0	0.8	2.5	0.4	—
BF511	SOT-23	20	—	30	10	2.5/7.0	1.5	4	0.4	—
BF512	SOT-23	20	—	30	10	6/12	2.2	6	0.4	—
BF513	SOT-23	20	—	30	10	10/18	3	7	0.4	—
BF545A/0	SOT-23	30	—	—	—	0.5/2.1	—	—	1.1 typ	—
BF545A	SOT-23	30	—	—	—	2/6.5	—	—	1.1 typ	—
BF545B	SOT-23	30	—	—	—	6/15	—	—	1.1 typ	—
BF545C	SOT-23	30	—	—	—	12/25	—	—	1.1 typ	—
BFR30	SOT-23	25	25	10	0.2	4/10	5	1	1.5	0.5
BFR31	SOT-23	25	25	20	0.2	1/5	2.5	1.5	1.5	0.5
BFT46	SOT-23	25	25	10	0.2	0.2/1.5	1.0	1.0	1.5	0.5
BSR56	SOT-23	40	40	—	1	50/—	10	—	5	—
BSR57	SOT-23	40	40	—	1	20/100	6	—	5	—
BSR58	SOT-23	40	40	—	1	8/80	4	—	5	—
PMBF4391	SOT-23	40	40	—	1	50/150	4-10	—	3.5	—
PMBF4392	SOT-23	40	40	—	1	25/75	2-5	—	3.5	—
PMBF4393	SOT-23	40	40	—	1	5/30	0.53	—	3.5	—
PMBFJ108	SOT-23	25	25	—	—	8/—	10	—	15	—
PMBFJ109	SOT-23	25	25	—	—	40/—	6	—	15	
PMBFJ110	SOT-23	25	25	—	—	10/—	4	—	15	—
PMBFJ111	SOT-23	40	40	—	—	20/—	10	—	3	—
PMBFJ112	SOT-23	40	40	—	—	5/—	5	—	3	—
PMBFJ113	SOT-23	40	40	—	—	2/—	3	—	3	—
PMBFJ174	SOT-23	—	30			20/135	10	—		
PMBFJ175	SOT-23	—	30			7/70	6	—		
PMBFJ176	SOT-23	—	30			2/35	4	—		
PMBFJ177	SOT-23	—	30			1.5/20	2.25	—		
PZFJ108	SOT-223	25	25	—	—	80/—	10	—	15	—
PZFJ109	SOT-223	25	25	—	—	40/—	6	—	15	—
PZFJ110	SOT-223	25	25	—	—	10/—	4	—	15	—
PMBFJ308	SOT-23	25	—	—	—	12/60	—	—	2.5 typ	—
PMBFJ309	SOT-23	25	—	—	—	12/30	—	—	2.5 typ	—
PMBFJ310	SOT-23	25	—	—	—	24/60	—	—	2.5 typ	—
PMBF4416	SOT-23	30	—	—	—	5/15	—	—	0.8 typ	—
PMBF4416A	SOT-23	35	—	—	—	5/15	6	—	0.8 typ	—

Type	Pkg	Polarity	V_{DS} V	V_{GS} V	I_D mA	Y_{fs} mA/V	$V_{GS}(th)$ V	$R_{DS}on$ Ω	mA/V
Vertical D-MOS FETs									
BSP103	SOT-223	N	35	20	750	170	0.8-2.0	5	300/5
BSN20	SOT-23	N	50	20	100	60	2.0	15	100/10
BSP105	SOT-223	N	60	20	500	170	0.8-2.0	5	300/5
BSP106	SOT-223	N	60	15	500	200	0.8-3.0	5	200/10
BSP108	SOT-223	N	80	20	500	300	1.5-3.5	3	500/10
BSP109	SOT-223	N	90	20	500	170	0.8-2.0	5.3	300/5
BSP110	SOT-223	N	80	20	325	150	0.8-2.8	7	200/10
BSP120	SOT-223	N	200	20	250	250	0.8-2.8	12	250/10
BSP121	SOT-223	N	200	20	300	350	0.8-2.8	6	400/10
BSP126	SOT-223	N	250	20	300	400	0.8-2.0	6	300/10
BSP205	SOT-223	P	50	20	250	150	1.5-3.5	10	200/10
BSP206	SOT-223	P	60	20	300	200	1.5-3.5	6	200/10
BSP220	SOT-223	P	200	20	250	200	0.8-2.24	12	200/10
BSP225	SOT-223	P	250	20	250	200	0.8-2.8	15	200/10
BSS84	SOT-23	P	50	20	130	70	0.8-2.0	10	100/5
BSS123	SOT-23	N	100	20	150	140	0.8-2.8	6	120/10
BSS192	SOT-89	P	200	20	150	200	0.8-2.8	20	200/10
BST80	SOT-89	N	80	20	500	300	1.5-3.5	4	500/10
BST82	SOT-23	N	80	20	175	150	1.6-3.5	10	150/5
BST84	SOT-89	N	200	20	250	250	0.8-2.8	12	250/10
BSP107	SOT-223	N	200	20	200	180	0.8-2.4	28	20/2.6
BSP128	SOT-223	N	200	20	350	400	0.4-1.8	8	100/2.8
BSP145	SOT-223	N	450	20	250	200	2.0-4.0	14	100/10
BSP152	SOT-223	N	200	40	550	400	1.5-3.5	2.5	750/10
BSP89	SOT-223	N	240	20	350	350	0.8-2.0	6	340/10
BSP92	SOT-223	P	240	20	180	200	0.8-1.8	18	100/5
BST86	SOT-89	N	180	20	300	250	0.7-2.7	10	15/3
BST120	SOT-89	P	60	20	300	200	1.5-3.5	10	200/10
BST122	SOT-89	P	50	20	250	125	1.5-3.5	6	200/10
2N7002	SOT-23	N	60	40	180	200	0.8-3.0	5	500/10

Type	Pkg	Mode	V_{GS} V	I_D mA	g_{FS} mA/V	$V_{(P)GS}$ V	$R_{DS}on$ Ω	mA
N-Channel MOSFET Switching Transistors								
BSD20	SOT-143	Dpl	10	50	15	-2.0	30	1/10
BSD22	SOT-143	Dpl	20	50	15	-2.0	30	1/10
BSS83	SOT-143	Enh	10	50	15	2.0	45	0.1/10

Type	Package	V_{DS} V	I_D mA	NF typ dB	$-I_{GSS}$ max. nA	I_{DSS} min./max. mA	$-V_{(P)GS}$ max. V	Y_{fs} min. mS	C_{rs} typ pF
N-Channel Dual Gate MOSFET's									
BF998	SOT-143	12	30	0.6	50	4/20	2.0	21	.025
BF990	SOT-143	18	30	2.8	—	—	1.3	17	0.25
BF990A	SOT-143	18	—	2	—	—	1.3	18 min.	25
BF991	SOT-143	20	20	0.7	50	4/25	2.5	10	0.20
BF989	SOT-143	20	30	2.8	50	2/20	2.7	9.5	0.25
BF992	SOT-143	20	40	1.2	25	—	1.3	20	.04
BF994S	SOT-143	20	40	1.2	25	—	1.3	20	.04
BF996S	SOT-143	20	40	1.2	25	—	1.3	20	.04
BF997	SOT-143	20	30	1.0	50	2/20	2.0	15	.025

Type	Pkg	V_{CBO} V	V_{CER} V	I_C mA	h_{FE} @ I_C/V_{CE} min	mA/V	V_{CE}(Sat) @ I_C/I_B V	mA	f_t MHz
Darlington Transistors–NPN									
BST50	SOT-89	60	45	500	2000	500/10	1.3	500/0.5	—
BST51	SOT-89	80	60	500	2000	500/10	1.3	500/0.5	—
BSP52	SOT-223	90	80	500	2,000	500/5	1.3	500/0.5	—

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Philips Components
Discrete Products Division
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PHILIPS SMALL SIGNAL SEMICONDUCTORS

SURFACE MOUNT SEMICONDUCTORS

Type	Pkg	V_{CBO} V	V_{CER} V	I_C mA	h_{FE} @ I_C/V_{CE} min	mA/V	V_{CE}(Sat) @ I_C/I_B V	mA	f_T MHz
Darlington Transistors–NPN									
BST52	SOT-89	90	80	500	2,000	500/10	1.3	500/0.5	—
PMBTA13	SOT-23	30	30	500	10,000	100/5	1.5	100/0.1	125
PZTA13	SOT-223	20	30	300	10,000	100/5	1.5	100/0.1	125
PMBTA14	SOT-23	30	30	500	20,000	100/5	1.5	100/0.1	125
PXTA14	SOT-89	30	30	300	20,000	100/5	1.5	100/0.1	125
PZTA14	SOT-223	30	30	300	20,000	100/5	1.5	100/0.1	125
BCV27	SOT-23	30	40	300	20,000	100/5	1.0	100/0.1	100
PMBT6427	SOT-23	40	40	500	14,000	500/5	1.5	500/0.5	—
BSP50	SOT-223	60	45	500	2,000	500/10	1.3	500/0.5	—
Type	**Pkg**	**V_{CBO} V**	**V_{CER} V**	**I_C mA**	**h_{FE} @ I_C/V_{CE} min**	**mA/V**	**V_{CE}(Sat) @ I_C/I_B V**	**mA**	**f_T MHz**
–PNP									
BST60	SOT-89	60	45	500	2000	500/10	1.3	500/0.5	—
BSP61	SOT-223	80	60	500	2,000	500/10	1.3	500/0.5	—
BST61	SOT-89	80	60	500	2000	500/10	1.3	500/0.5	—
BSP62	SOT-223	90	80	500	2,000	500/10	1.3	500/0.5	—
BST62	SOT-89	90	80	500	2000	500/10	1.3	500/0.5	—
PMBTA63	SOT-23	30	30	500	10,000	100/5	1.3	100/0.1	125
PMBTA64	SOT-23	30	30	500	20,000	100/5	1.5	100/0.1	125
PXTA64	SOT-89	30	30	300	20,000	100/5	1.5	100/0.1	125
PZTA63	SOT-223	30	30	300	10,000	100/5	1.5	100/0.1	
PZTA64	SOT-223	30	30	300	20,000	100/5	1.5	100/0.1	
BCV26	SOT-23	30	40	300	20,000	100/5	1.0	100/0.1	100
BSP60	SOT-223	60	45	500	2,000	500/10	1.3	500/0.5	—

Type	Pkg	V_{GA} V	I_A mA	I_P µA	I_V µA
Triggers, PNPN					
BRY61	SOT-23	70	175	5/1	30/50
BRY62	SOT-143	70	175	—	—

Type	Pkg	V_R V	I_F mA	t_{RR} nS	V_FmV @ I_F 10/100/150/200 mA
General Purpose Diodes					
BA582	SOD-123	35	100	—	—
BA682	SOD-80C	35	100	—	—
BA683	SOD-80C	35	100	—	—
BAS16	SOT-23	75	250	6	855/—/1250/—
BAS16W	SOT-323	75	250	6	—/—/1240/—
BAS17	SOT-23	—	—		830/960/—/—
BAS19	SOT-23	100	200	50	—/1000/—/—
BAS20	SOT-23	150	200	50	—/1000/—/—
BAS21	SOT-23	200	200	50	—/1000/—/—
BAS28	SOT-143	75	250	6	855/—/1250/—
BAS29	SOT-23	90	250	50	—/900/—/1000
BAS31	SOT-23	90	250	50	—/900/—/1000
BAS32L	SOD-80C	75	200	4	—
BAS35	SOT-23	90	250	50	—/900/—/1000
BAS56	SOT-143	60	200	6	—/—/—/1000
BAS70	SOT-23	70	15	—	410 @ 1mA
BAS70-04	SOT-23	70	15	—	410 @ 1mA
BAS70-05	SOT-23	70	15	—	410 @ 1mA
BAS70-06	SOT-23	70	15	—	410 @ 1mA
BAS86	SOD-80C	50	200	—	—
BAT17	SOT-23	4	30	—	600/—/—/—
BAT18	SOT-23	35	100	—	—/1200/—/—
BAT54	SOT-23	30	200	5	400/1000/—/—
BAT54A	SOT-23	30	200	—	—
BAT54C	SOT-23	30	200	—	—
BAT54S	SOT-23	30	200	—	—
PBYR235CT	SOT-223	35	2000	—	—
PBYR240CT	SOT-223	40	2000	—	—
PBYR245CT	SOT-223	45	2000	—	—
PBYR280CT	SOT-223	80	2000	—	690 @ 1000 mA
PBYR290CT	SOT-223	90	2000	—	690 @ 1000 mA
PBYR2100CT	SOT-223	100	2000	—	690 @ 1000 mA
BAT74	SOT-143	30	300	5	400/1000/—/—
BAV23	SOT-143	200	200	50	—/1000/—/1250
BAV23S	SOT-23	200	200	50	—/1000/—/—
BAV70	SOT-23	70	250	6	855/—/1250/—
BAV70W	SOT-323	70	250	6	—/—/1250/—
BAV74	SOT-23	50	200	4	—/1000/—/—
BAV99	SOT-23	70	250	6	855/—/1250/—
BAV99W	SOT-323	70	250	6	—/—/1250/—
BAV100	SOD-80C	50	250	50	—
BAV101	SOD-80C	100	250	50	—
BAV102	SOD-80C	150	250	50	—
BAV103	SOD-80C	200	250	50	—
BAV105	SOD-80C	60	600	1000	200 6
BAW56	SOT-23	70	250	6	855/—/1250/—
BAW56W	SOT-323	70	250	6	—/—/1250/—
PMBD914	SOT-23	100	200	1000	10 15
PMBD353	SOT-23	4	10	—	600/—/—/—
PMBD2835*	SOT-23	35	100	1200	100 15
PMBD2836*	SOT-23	75	100	1200	100 15
PMBD2837*	SOT-23	35	100	1200	100 15
PMBD2838*	SOT-23	75	100	1200	100 15
PMBD6050	SOT-23	70	200	1100	100 15
PMBD6100*	SOT-23	70	200	1100	100 15
PMBD7000*	SOT-23	100	200	1100	100 15
PMLL4148	SOD-80C	75	200	1000	100 4
PMLL4150	SOD-80C	50	300	920	100 4
PMLL4151	SOD-80C	75	200	1000	50 2
PMLL4153	SOD-80C	75	200	880	20 2
PMLL4446	SOD-80C	75	200	1000	100 4
PMLL4448	SOD-80C	75	200	1000	100 4
BA423L	SOD-80C	20	50		
PMBD101	SOT-23	4	10		600 10
PMBD352*	SOT-23	4	10		600 10
PRLL5817	SOD-87	20	1000	—	—
PRLL5818	SOD-87	30	1000	—	—
PRLL5819	SOD-87	40	1000	—	—
BAS85	SOD-80C	30	200		400 10
BA314L	SOD-80C	0.85-0.94	100		
BZV80	SOD-80C	5.89-6.51	7.5		
BZV81	SOD-80C	5.89-6.51	7.5		

Type	Pkg	V_R V	I_F mA	Cd @ V_R p_F	V
Variable Capacitance Diodes					
BB131	SOD-323	30	20	8 min	0.5
BB132	SOD-323	30	20	60 min	0.5
BB133	SOD-323	30	20	38 min	0.5
BB134	SOD-323	30	20	17.5 min	0.5
BB215	SOD-80C	30	20	18 min	1
BB219	SOD-80C	30	20	31 min.	1
BB240	SOD-80C	—	—	2.3-2.7	28
BB241	SOD-80C	—	—	2.6-3.0	28
BB249	SOD-80C	—	—	4.0-5.0	28
BB515	SOD-123	—	—	1.85-2.25	28
BB619	SOD-123	—	—	2.4-2.9	28
BB620	SOD-123	—	—	2.9-3.4	28
BB804	SOT-23	18	50	44.5 typ.	2
BB811	SOD-123	—	—	0.85-1.2	28
BBY31	SOT-23	28	20	1.8-2.8	25
BBY39*	SOT-23	30	20	1.8-2.0	28
BBY40	SOT-23	28	20	4.3-6	25
BBY42	SOT-23	32	50	31 min.	1
BBY62	SOT-143	30	50	17.5 typ.	1

Type	Pkg	$I_{T(AV)}$ MAX A	V_{RRM} MAX V	V_{GT} MIN V	I_{GT} MIN A
General Purpose Thyristors					
BT148W-400R	SOT-223	0.6	400	1.5	200µA
-500R			500		
-600R			600		

Type	Pkg	$I_{T(RMS)}$ Max A	V_{DRM} Max V	V_{GT} Min V
TRIACs				
BT134W-500	SOT-223	1	500	1.5
-600			600	
-700			700	
-800			800	
BT134W-500D	SOT-223	1	500	1.5
-600D			600	
BT134W-500E	SOT-223	1	500	1.5
-600E			600	

Type	Pkg	$I_{F(AV)}$(MAX) (A)	V_{RRM} (V)	V_F(MAX) (V)	@ I_F (A)	t_{rr}(MAX) (ns)
Rectifier Diodes General Purpose						
BYD17D	SOD-87	1.5	200	1.05	1	—
BYD17G	SOD-87	1.5	400	1.05	1	—
BYD17J	SOD-87	1.6	600	1.05	1	—
BYD17K	SOD-87	1.5	800	1.05	1	—
BYD17M	SOD-87	1.5	1000	1.05	1	—
PRLL4001	SOD-87	1.5	50	0.8	1	—
PRLL4002	SOD-87	1.5	100	0.8	1	—
Type	**Pkg**	**$I_{F(AV)}$(MAX) (A)**	**V_{RRM} (V)**	**V_F(MAX) (V)**	**@ I_F (A)**	**t_{rr}(MAX) (ns)**
Fast Recovery						
BYD37D	SOD-87	1.5	200	1.3	1	250
BYD37G	SOD-87	1.5	400	1.3	1	250
BYD37J	SOD-87	1.5	600	1.3	1	250
BYD37K	SOD-87	1.5	800	1.3	1	300
BYD37M	SOD-87	1.5	1000	1.3	1	300
Very Fast Recovery						
BYD57J	SOD-87	1	600	2.1	1	—
BYD57M	SOD-87	1	600	2.1	1	—
BYD77A	SOD-87	2	50	0.95	1	25
BYD77B	SOD-87	2	100	0.95	1	25
BYD77C	SOD-87	2	150	0.95	1	25
BYD77D	SOD-87	2	200	0.95	1	25
BYD77E	SOD-87	1.85	250	1.05	1	50
BYD77F	SOD-87	1.85	300	1.05	1	50
BYD77G	SOD-87	1.85	400	1.05	1	50
BYV40-100	SOT-223	1.5	100	1	1.5	50
BYV40-150	SOT-223	1.5	150	1	1.5	50
BYV40-200	SOT-223	1.5	200	1	1.5	50

Type SOT-23	Type SOD-80C	Suffix	V_Z @ I_Z ±5% mA		R_{DIFF} @ $I_Z\Omega$	S_Z @ I_Z mV/°C	I_R @ V_R µA	V
Zener Diodes								
BZX84	BZV55	C2V4	2.4	5	100	0	50	1
BZX84	BZV55	C2V7	2.7	5	100	0	20	1
BZX84	BZV55	C3V0	3.0	5	95	0	10	1
BZX84	BZV55	C3V3	3.3	5	95	0	5	1
BZX84	BZV55	C3V6	3.6	5	90	0	5	1
BZX84	BZV55	C3V9	3.9	5	90	0	3	1
BZX84	BZV55	C4V3	4.3	5	90	0	3	1
BZX84	BZV55	C4V7	4.7	5	80	.2	3	2
BZX84	BZV55	C5V1	5.1	5	60	1.2	2	2
BZX84	BZV55	C5V6	5.6	5	40	2.5	1	2
BZX84	BZV55	C6V2	6.2	5	10	3.7	3	4
BZX84	BZV55	C6V8	6.8	5	15	4.5	2	4
BZX84	BZV55	C7V5	7.5	5	15	5.3	1	5
BZX84	BZV55	C8V2	8.2	5	15	6.2	.7	5
BZX84	BZV55	C9V1	9.1	5	15	7.0	.5	6
BZX84	BZV55	C10	10.0	5	20	8.0	.2	7
BZX84	BZV55	C11	11	5	20	9.0	.1	8
BZX84	BZV55	C12	12	5	25	10.0	.1	8
BZX84	BZV55	C13	13	5	30	11.0	.1	8
BZX84	BZV55	C15	15	5	30	13.0	.05	
BZX84	BZV55	C16	16	5	40	14.0	.05	
BZX84	BZV55	C18	18	5	45	16.0	.05	
BZX84	BZV55	C20	20	5	55	18.0	.05	
BZX84	BZV55	C22	22	5	55	20.0	.05	
BZX84	BZV55	C24	24	5	70	22.0	.05	
BZX84	BZV55	C27	27	2	80	25.3	.05	
BZX84	BZV55	C30	30	2	80	29.4	.05	
BZX84	BZV55	C33	33	2	80	33.4	.05	
BZX84	BZV55	C36	36	2	90	37.4	.05	

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PHILIPS DISCRETE SEMICONDUCTORS

SURFACE MOUNT SEMICONDUCTORS

Type SOT-23	Type SOD-80C	Suffix	V_Z @ I_Z ±5%	mA	R_{DIFF} @ I_Z Ω	S_Z @ I_Z mV/°C	I_R @ V_R µA	V
Zener Diodes (Cont.)								
BZX84	BZV55	C39	39	2	130	41.2	.05	
BZX84	BZV55	C43	43	2	150	46.6	.05	
BZX84	BZV55	C47	47	2	170	51.8	.05	
BZX84	BZV55	C51	51	2	180	57.2	.05	
BZX84	BZV55	C56	56	2	200	63.8	.05	
BZX84	BZV55	C62	62	2	215	71.6	.05	
BZX84	BZV55	C68	68	2	240	79.8	.05	
BZX84	BZV55	C75	75	2	255	88.6	.05	

Type	V_Z at I_{ZT} ±5%	mA	Z_{ZK} @ I_{ZK} =0.25mA Ω	Ω	Θvz %/°C	I_R at V_R µA	V
Zener Diodes, SOD-80C (MELF)							
PMLL5225B	3.0	20	29	1600	−0.75	50	1.0
PMLL5226B	3.3	20	28	1600	−0.70	25	1.0
PMLL5227B	3.6	20	24	1700	−0.65	15	1.0
PMLL5228B	3.9	20	23	1900	−0.60	10	1.0
PMLL5229B	4.3	20	22	2000	±.055	5.0	1.0
PMLL5230B	4.7	20	19	1900	±.030	5.0	2.0
PMLL5231B	5.1	20	17	1600	±.030	5.0	2.0
PMLL5232B	5.6	20	11	1600	+.038	5.0	3.0
PMLL5233B	6.0	20	7.0	1600	+.038	5.0	3.5
PMLL5234B	6.2	20	7.0	1000	+.045	5.0	4.0
PMLL5235B	6.8	20	5.0	750	+.050	3.0	5.0
PMLL5236B	7.5	20	6.0	500	+.058	3.0	6.0
PMLL5237B	8.2	20	8.0	500	+.062	3.0	6.5
PMLL5238B	8.7	20	8.0	600	+.065	3.0	6.5
PMLL5239B	9.1	20	10	600	+.068	3.0	7.0
PMLL5240B	10	20	17	600	+.075	3.0	8.0
PMLL5241B	11	20	22	600	+.076	2.0	8.4
PMLL5242B	12	30	30	600	+.077	1.0	9.1
PMLL5243B	13	9.5	13	600	+.079	0.5	9.9
PMLL5244B	14	9.0	15	600	+.082	0.1	10
PMLL5245B	15	8.5	16	600	+.082	0.1	11
PMLL5246B	16	7.8	17	600	+.083	0.1	12
PMLL5247B	17	7.4	19	600	+.084	0.1	13
PMLL5248B	18	7.0	21	600	+.085	0.1	14
PMLL5249B	19	6.6	23	600	+.086	0.1	14
PMLL5250B	20	6.2	25	600	+.086	0.1	15
PMLL5251B	22	5.6	29	600	+.087	0.1	17
PMLL5252B	24	5.2	33	600	+.088	0.1	18
PMLL5253B	25	5.0	35	600	+.089	0.1	19
PMLL5254B	27	4.6	41	600	+.090	0.1	21
PMLL5255B	28	4.5	44	600	+.091	0.1	21
PMLL5256B	30	4.2	49	600	+.091	0.1	23
PMLL5257B	33	3.8	58	700	+.092	0.1	25
PMLL5258B	36	3.4	70	700	+.093	0.1	27
PMLL5259B	39	3.2	80	800	+.094	0.1	30
PMLL5260B	43	3.0	93	900	+.095	0.1	33
PMLL5261B	47	2.7	105	1000	+.095	0.1	36
PMLL5262B	51	2.5	125	1100	+.096	0.1	39
PMLL5263B	56	2.2	150	1300	+.096	0.1	43
PMLL5264B	60	2.1	170	1400	+.097	0.1	46
PMLL5265B	62	2.0	185	1400	+.097	0.1	47
PMLL5266B	68	1.8	230	1600	+.097	0.1	52
PMLL5267B	75	1.7	270	1700	+.098	0.1	56

Type		V_Z (V) Min	Max	mA	r_{dif} @ I_Z Ω	mA	S_Z @ I_Z %/°C	mA	I_R @ V_R µ	V
Zener Diodes, SOD-87 (2.3W)										
BZD27	C7V5	7.0	7.9	100	2	100	0.07	100	50	3
BZD27	C8V2	7.7	8.7	100	2	100	0.08	100	10	3
BZD27	C9V1	8.5	9.6	50	4	50	0.08	50	5	5
BZD27	C10	9.4	10.6	50	4	50	0.09	50	7	7.5
BZD27	C11	10.4	11.6	50	7	50	0.10	50	3	8.2
BZD27	C12	11.4	12.7	50	7	50	0.10	50	2	9.1
BZD27	C13	12.4	14.1	50	10	50	0.10	50	2	10
BZD27	C15	13.8	15.6	50	10	50	0.10	50	1	11
BZD27	C16	15.3	17.1	25	15	25	0.11	25	1	12
BZD27	C18	16.8	19.1	25	15	25	0.11	25	1	13
BZD27	C20	18.8	21.2	25	15	25	0.11	25	1	15
BZD27	C22	20.8	23.3	25	15	25	0.11	25	1	16
BZD27	C24	22.8	25.6	25	15	25	0.11	25	1	18
BZD27	C27	25.1	28.9	25	15	25	0.11	25	1	20
BZD27	C30	28	32	25	15	25	0.11	25	1	22
BZD27	C33	31	35	25	15	25	0.11	25	1	24
BZD27	C36	34	38	10	40	10	0.11	10	1	27
BZD27	C39	37	41	10	40	10	0.11	10	1	30
BZD27	C43	40	46	10	45	10	0.12	10	1	33
BZD27	C47	44	50	10	45	10	0.12	10	1	36
BZD27	C51	48	54	10	60	10	0.12	10	1	39
BZD27	C56	52	60	10	60	10	0.12	10	1	43
BZD27	C62	58	66	10	80	10	0.13	10	1	47
BZD27	C68	64	72	10	80	10	0.13	10	1	51
BZD27	C75	70	79	10	100	10	0.13	10	1	56
BZD27	C82	77	87	10	100	10	0.13	10	1	62
BZD27	C91	85	96	5	200	5	0.13	5	1	68
BZD27	C100	94	106	5	200	5	0.13	5	1	75
BZD27	C110	104	116	5	250	5	0.13	5	1	82
BZD27	C120	114	127	5	250	5	0.13	5	1	91
BZD27	C130	124	141	5	300	5	0.13	5	1	100
BZD27	C150	138	156	5	300	5	0.13	5	1	110
BZD27	C160	153	171	5	350	5	0.13	5	1	120
BZD27	C180	168	191	5	400	5	0.13	5	1	130
BZD27	C200	188	212	5	500	5	0.13	5	1	150
BZD27	C220	208	233	2	750	2	0.13	2	1	160
BZD27	C240	228	256	2	850	2	0.13	2	1	180
BZD27	C270	251	289	2	1000	2	0.13	2	1	200

Type	V_Z(V) at 1_{Ztest} = 5 mA min.	max.	Differential Resistance r_{dif} (.ωρ) at 1_{Ztest} = 5 mA typ.	max.	Termperature Coefficient S_Z(mV/K) at 1_{Ztest} = 5 mA min.	typ.	max.	Diode Capacitance C_d(pF); f = 1 MHz V_R = 0 typ.	max.
Zener Diodes, SOT-223 (1.3W)									
BZV90C2V4	2.2	2.6	70	100	-3.5	-1.6	0	375	450
BZV90C2V7	2.5	2.9	75	100	-3.5	-2.0	0	350	450
BZV90C3V0	2.8	3.2	80	95	-3.5	-2.1	0	350	450
BZV90C3V3	3.1	3.5	85	95	-3.5	-2.4	0	325	450
BZV90C3V6	3.4	3.8	85	90	-3.5	-2.4	0	300	450
BZV90C3V9	3.7	4.1	85	90	-3.5	-2.5	0	300	450
BZV90C4V3	4.0	4.6	80	90	-3.5	-2.5	0	275	450
BZV90C4V7	4.4	5.0	50	80	-3.5	-1.4	0.2	130	180
BZV90C5V1	4.8	5.4	40	60	-2.7	-0.8	1.2	110	160
BZV90C5V6	5.2	6.0	15	40	-2.0	1.2	2.5	95	140
BZV90C6V2	5.8	6.6	6	10	0.4	2.3	3.7	90	130
BZV90C6V8	6.4	7.2	6	15	1.2	3.0	4.5	85	110
BZV90C7V5	7.0	7.9	6	15	2.5	4.0	5.3	80	100
BZV90C8V2	7.7	8.7	6	15	3.2	4.6	6.2	75	95
BZV90C9V1	8.5	9.6	6	15	3.8	5.5	7.0	70	90
BZV90C10	9.4	10.6	8	20	4.5	6.4	8.0	70	90
BZV90C11	10.4	11.6	10	20	5.4	7.4	9.0	65	85
BZV90C12	11.4	12.7	10	25	6.0	8.4	10.0	65	85
BZV90C13	12.4	14.1	10	30	7.0	9.4	11.0	60	80
BZV90C15	13.8	15.6	10	30	9.2	11.4	13.0	55	75
BZV90C16	15.3	17.1	10	40	10.4	12.4	14.0	52	75
BZV90C18	16.8	19.1	10	45	12.4	14.4	16.0	47	70
BZV90C20	18.8	21.2	15	55	14.4	16.4	18.0	36	60
BZV90C22	20.8	23.3	20	55	16.4	18.4	20.0	34	60
BZV90C24	22.8	25.6	25	70	18.4	20.4	22.0	33	55
	at 1_{Ztest} = 2 mA		at I_{Ztest} = 2 mA			at I_{Ztest} = 2 mA			
BZV90C27	25.1	28.9	25	80	21.4	23.4	25.3	30	50
BZV90C30	28.0	32.0	30	80	24.4	26.6	29.4	27	50
BZV90C33	31.0	35.0	35	80	27.4	29.7	33.4	25	45
BZV90C36	34.0	38.0	35	90	30.4	33.0	37.4	23	45
BZV90C39	37.0	41.0	40	130	33.4	36.4	41.2	21	45
BZV90C43	40.0	46.0	45	150	37.6	41.2	46.6	21	40
BZV90C47	44.0	50.0	50	170	42.0	46.1	51.8	19	40
BZV90C51	48.0	54.0	60	180	46.6	51.0	57.2	19	40
BZV90C56	52.0	60.0	70	200	52.2	57.0	63.8	18	40
BZV90C62	58.0	66.0	80	215	58.8	64.4	71.6	17	35
BZV90C68	64.0	72.0	90	240	65.6	71.7	79.8	17	35
BZV90C75	70.0	79.0	95	255	73.4	80.2	88.6	16.5	35

Type	V_Z (V)	@ I_Z (mA)	Z_{zt} (MAX) µ	@ I_{ZT} (mA)	I_R (MAX) (µA)	@ V_R (V)
Zener Diodes, SOT-23 (350mW), Pinout H						
PMBZ5226B	3.3	20	28	20	25	1.0
PMBZ5227B	3.6	20	24	20	15	1.0
PMBZ5228B	3.9	20	23	20	10	1.0
PMBZ5229B	4.3	20	22	20	5.0	1.0
PMBZ5230B	4.7	20	19	20	5.0	2.0
PMBZ5231B	5.1	20	17	20	5.0	2.0
PMBZ5232B	5.6	20	11	20	5.0	3.0
PMBZ5233B	6.0	20	7	20	5.0	3.5
PMBZ5234B	6.2	20	7	20	5.0	4.0
PMBZ5235B	6.8	20	5	20	3.0	5.0
PMBZ5236B	7.5	20	6	20	3.0	6.0
PMBZ5237B	8.2	20	8	20	3.0	6.5
PMBZ5238B	8.7	20	8	20	3.0	6.5
PMBZ5239B	9.1	20	10	20	3.0	7.0
PMBZ5240B	10	20	17	20	3.0	8.0
PMBZ5241B	11	20	22	20	2.0	8.4
PMBZ5242B	12	20	30	20	1.0	9.1
PMBZ5243B	13	9.5	13	9.5	0.5	9.9
PMBZ5244B	14	9.0	15	9.0	0.1	10
PMBZ5245B	15	8.5	16	8.5	0.1	11
PMBZ5246B	16	7.8	17	7.8	0.1	12
PMBZ5247B	17	7.4	19	7.4	0.1	13
PMBZ5248B	18	7.0	21	7.0	0.1	14
PMBZ5249B	19	6.6	23	6.6	0.1	14
PMBZ5250B	20	6.2	25	6.2	0.1	15
PMBZ5251B	22	5.6	29	5.6	0.1	17
PMBZ5252B	24	5.2	33	5.2	0.1	18
PMBZ5253B	25	5.0	35	5.0	0.1	19
PMBZ5254B	27	4.6	41	4.6	0.1	21
PMBZ5255B	28	4.5	44	4.5	0.1	21
PMBZ5256B	30	4.2	49	4.2	0.1	23
PMBZ5257B	33	3.8	58	3.8	0.1	25

Type	V_Z min	typ	max.	@ I_Z µA	maximum differential resistance R_Z @ I_Z Ω	µA	typical temperature coefficient S_Z @ I_Z mV/K	µA	typical reverse current I_R @ V_R µA	V
Zener Diodes, SOT-23 (250mW, Low Voltage Avalanche										
PLVA650A	4.8	5.0	5.2	250	700	250	0.2	250	21	4.5
PLVA653A	5.1	5.3	5.5	250	250	250	1.6	250	3.5	4.77
PLVA656A	5.4	5.6	5.8	250	100	250	1.9	250	1.3	5.04
PLVA659A	5.7	5.9	6.1	250	100	250	2.4	250	1.0	5.31
PLVA662A	6.0	6.2	6.4	250	100	250	2.65	250	0.05	5.58
PLVA665A	6.3	6.5	6.7	250	100	250	2.9	250	0.04	5.85
PLVA668A	6.6	6.8	7.0	250	100	250	3.4	250	0.006	6.12

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PHILIPS SMALL SIGNAL LEADED SEMICONDUCTORS

RF/MICROWAVE DEVICES

RF DIODES VARIABLE CAPACITANCE DIODES

Type	Package Outline	C_d (pF)	@ V_R (V)	C_d over ratio	tuning range voltage range V_1 to V_2 (V)	r_s max (Ω)	matched sets $\Delta\frac{Cmax}{Cmin}$ < 3%
Automatic Frequency Control							
BB119	DO-35	15.3-19.0	10	>1.3	4 to 10	1.5	no
BB417	DO-34	2.2-2.4	15	2-5	4 to 15	1.2	no
AM Radio Tuning							
BB112	SOD-69	17-29	8.5	>18	1 to 8.5	1.5	yes
BB130	SOD-69	12-21	28	>23	1 to 28	2	yes
BB212[1]	TO-92	<22	8.0	>22.5	0.5 to 8	2.5	no
FM Radio Tuning							
BB204B[1]	TO-92	typ. 14.0	30	2.5-2.8	3 to 30	0.4	no
BB804[1]	SOT-23	42-47.5	8	1.65-1.75	2 to 8	typ. 0.25	no
VHF Tuning							
BB219	SOD-80C	2.6-3.2	28	12-15	1 to 28	0.9	yes
BB240	SOD-80C	2.3-2.7	28	>14	0.5 to 28	1.0	yes
BB241	SOD-80C	2.6-3.0	28	>21	0.5 to 28	2.0	yes
BB249	SOD-80C	4.0-5.0	28	8-10	1 to 28	0.6	yes
BB619	SOD-123	2.4-2.9	28	>12.5	1 to 28	typ. 0.7	yes
BB620	SOD-123	2.9-3.4	28	19.5-25	1 to 28	typ. 1.3	yes
BB809	DO-34	4.0-5.0	28	8-10	1 to 28	0.6	yes
BB909A	DO-34	2.6-3.0	28	12-15	1 to 28	0.9	yes
BB909B	DO-34	2.8-3.2	28	12-15	1 to 28	0.9	yes
BB910	DO-34	2.3-2.7	28	>14	0.5 to 28	1.0	yes
BB911	DO-34	2.6-3.0	28	>21	0.5 to 28	2.0	yes
BBY40	SOT-23	3.8-4.8	28	8-12	1 to 28	0.7	no
BBY42	SOT-23	2.4-3.0	28	12-16	1 to 28	1.0	no
UHF Tuning							
BB215	SOD-80C	1.8-2.2	28	>7.6	1 to 28	typ. 0.63	yes
BB405B	DO-34	1.8-2.2	28	>7.6	1 to 28	0.75	yes
BBY31	SOT-23	1.8-2.8	25	typ. 9.7	1 to 28	1.2	no
BBY62[1]	SOT-143	1.8-2.8	28	9.7	1 to 28	1.2	no
BB515	SOD-123	1.85-2.25	28	8-9.6	1 to 28	typ. 0.5	yes
SHF/SAT-TV Tuning							
BBY39[2]	SOT-23	1.6-2.0	28	>8.0	1 to 28	1.2	no
BB811	SOD-123	0.85-1.2	28	7.8-9.5	1 to 28	typ. 1.0	yes

1) double diode 2) common cathode double diode

SCHOTTKY-BARRIER DIODES

Type	Package Outline	V_R (mV)	@ I_F (mA)	r_s (Ω)	@ I_F (mA)	and f (kHz)	C_d (pF)	@ V_R (V)	max V_R (V)	max I_F (mA)
BA480	DO-34	280	1	15	5	1	1.2	0.2	4	30
BA481	DO-34	450	1	13	5	1	1.1	0	4	30

RF BAND-SWITCHING DIODES

Type	Package Outline	r_s (Ω)	@ I_F (mA)	and f (MHz)	C_d (pF)	@ V_R (V)	and f (MHz)	max V_R (V)	max I_F (mA)
AM Radio									
BA223	DO-34	1.5	10	1	3.5	6	1	20	50
BA423	DO-34	1.2	10	1	2.5	3	1	20	50
BA423L	SOD-80C	1.2	10	1	2.5	3	1	20	50
VHF Applications									
BA482	DO-35	0.7	3	200	1.2	3	100	35	100
BA483	DO-35	1.2	3	200	1.0	3	100	35	100
BA484	DO-35	1.2	3	200	1.6	3	100	35	100
BA582	SOD-123	0.55	3	200	0.85	3	100	35	100
BA682	SOD-80C	0.7	3	200	1.5	3	1	35	100
BA683	SOD-80C	1.2	3	200	1.2	3	1	35	100
BAT18	SOT-23	0.7	5	200	1.0	20	1	35	100

DETECTION DIODE

Type	Package Outline	V_F (mV)	@ I_F (μA)	C_d (pF)	@ V_R (V)	and f (MHz)	max V_R (V)	max I_F (mA)
BA231	DO-35	360-420	10	1.2	0	1	50	200

SMALL SIGNAL FIELD-EFFECT TRANSISTORS JUNCTION FET'S

Type	Package Outline	Ratings V_{DSS} max (V)	Ratings I_G max (mA)	Characteristics I_{DSS} min (mA)	Characteristics I_{DSS} max (mA)	Characteristics g_{os} typ @ 1 kHz (μS)	Characteristics y_{fs} min @ 1 kHz (mS)	Characteristics C_{rss} typ (pF)	Characteristics C_{iss} typ (pF)	Characteristics F typ (dB)	Remarks
N-Channel Junction Field-Effect Transistors											
BF245A/0	TO-92	30	10	0.5	2.1	25	3.0	1.1	4	1.5	DC, LF and HF appl.
BF245A	TO-92	30	10	2	6.5	25	3.0	1.1	4	1.5	DC, LF and HF appl.
BF245B	TO-92	30	10	6	15	25	3.0	1.1	4	1.5	DC, LF and HF appl.
BF245C	TO-92	30	10	12	25	25	3.0	1.1	4	1.5	DC, LF and HF appl.
BF247A	TO-92	25	10	30	80		8.0	3.5	11		VHF and UHF appl.
BF247B	TO-92	25	10	60	140		8.0	3.5	11		VHF and UHF appl.
BF247C	TO-92	25	10	110	250		8.0	3.5	11		audio switching

Type	Package Outline	Ratings V_{DSS} max (V)	Ratings I_G max (mA)	Characteristics I_{DSS} min (mA)	Characteristics I_{DSS} max (mA)	Characteristics g_{os} typ @ 1 kHz (μS)	Characteristics y_{fs} min @ 1 kHz (mS)	Characteristics C_{rss} typ (pF)	Characteristics C_{iss} typ (pF)	Characteristics F typ (dB)	Remarks
N-Channel Junction Field-Effect Transistors (Cont.)											
BF256A	TO-92	30	10	3	7	25	4.5	0.7	2	7.5	VHF and UHF appl.
BF256B	TO-92	30	10	6	13	25	4.5	0.7	2	7.5	VHF and UHF appl.
BF256C	TO-92	30	10	11	18	25	4.5	0.7	2	7.5	VHF and UHF appl.
BF410A	TO-92	20	10	0.7	3	60[1]	2.5	0.4[1]	5[1]	1.5	RF stages FM portables
BF410B	TO-92	20	10	2.5	7	80[1]	4.0	0.4[1]	5[1]	1.5	RF stages car radios
BF410C	TO-92	20	10	6	12	100[1]	6.0	0.4[1]	5[1]	1.5	RF stages mains radios
BF410D	TO-92	20	10	10	18	120[1]	7.0	0.4[1]	5[1]	1.5	mixer stages
BF510	SOT-23	20	10	0.7	3	60[1]	2.5	0.4	5	1.5	RF stages FM portables
BF511	SOT-23	20	10	2.5	7	80[1]	4.0	0.4	5	1.5	RF stages car radios
BF512	SOT-23	20	10	6	12	100[1]	6.0	0.4	5	1.5	RF stages mains radios
BF513	SOT-23	20	10	10	18	120[1]	7.0	0.4	5	1.5	mixer stages
BF545A/0	SOT-23	30	10	0.5	2.1	25	3.0	1.1	4	1.5	DC, LF and HF appl.
BF545A	SOT-23	30	10	2	6.5	25	3.0	1.1	4	1.5	DC, LF and HF appl.
BF545B	SOT-23	30	10	6	15	25	3.0	1.1	4	1.5	DC, LF and HF appl.
BF545C	SOT-23	30	10	12	25	25	3.0	1.1	4	1.5	DC, LF and HF appl.
J308	TO-92	25	10	12	60	200[1]	8	2.5	5	1.5	VHF/UHF amplifiers
J309	TO-92	25	10	12	60	150[1]	10	2.5	5	1.5	VHF/UHF amplifiers
J310	TO-92	25	10	24	60	200[1]	8	2.5	5	1.5	VHF/UHF amplifiers
PMBFJ308	SOT-23	25	10	12	60	200[1]	8	2.5	5	1.5	VHF/UHF amplifiers
PMBFJ309	SOT-23	25	10	12	30	150[1]	10	2.5	5	1.5	VHF/UHF amplifiers
PMBFJ310	SOT-23	25	10	24	60	200[1]	10	2.5	5	1.5	VHF/UHF amplifiers
BFW10	TO-72	30	10	8	20	85[1]	3.5	0.8	5	2.5	broad band up to
BFW11	TO-72	30	10	4	10	50[1]	3.0	0.8	5	2.5	300 MHz and
BFW12	TO-72	30	10	1	5	30[1]	2.0	0.8	5		differential
BFW13	TO-72	30	10	0.2	1.5	10[1]	1.0	0.8	5		amplifiers
2N3822	TO-72	50	10	2	10		3.0	3.0	6	5	general purpose VHF appl.
2N3823	TO-72	30	10	4	20		3.2	2.0	6	2.5	industrial IF/RF VHF appl.
BRF30	SOT-23	25	5	4	10	40[1]	1.0	1.5[1]	4		low-level general
BFR31	SOT-23	25	5	1	5	20[1]	1.5	1.5[1]	4		purpose amplifiers
BFT46	SOT-23	25	5	0.2	1.5	10[1]	1.0	1.5[1]	4		general purpose amplifiers
BFU308	TO-18	25	10	12	60	200[1]	8	2.5	5	1.5	VHF/UHF amplifiers
BFU309	TO-18	25	10	12	30	150[1]	10	2.5	5	1.5	VHF/UHF amplifiers
BFU310	TO-18	25	10	24	60	200[1]	10	2.5	5	1.5	VHF/UHF amplifiers
2N4416	TO-72	30	10	5	15	50[1]	4.5	0.8	4	2	VHF/UHF amplifiers
PMBF4416	SOT-23	30	10	5	15	50[1]	4.5	0.8	4	2	VHF/UHF amplifiers
PN4416	TO-92	30	10	5	15	50[1]	4.5	0.8	4	2	VHF/UHF amplifiers

1) max value

SMALL SIGNAL FIELD-EFFECT TRANSISTORS MOSFETS

Type Number	Package Outline	Ratings V_{DS} (V)	Ratings I_D (mA)	Characteristics I_{DSS} min (mA)	Characteristics I_{DSS} max (mA)	Characteristics $-V_{(P)G1-S}$ max (V)	Characteristics y_{fs} min @ 1 kHz (mS)	Characteristics C_{rs} typ (pF)	Characteristics C_{os} typ (pF)	Characteristics F typ (dB)	Remarks
DUAL-GATE N-CHANNEL MOSFETS											
BF960	SOT-103	20	20	2	20	2.7	9.5	1.8	0.9	2.8	UHF
BF964S	SOT-103	20	30	4	20	2.5	15	2.5	1.0	1.0	VHF
BF965	SOT-103	20	30	2	20	2.5	15	2.5	1.0	1.0	VHF
BF966S	SOT-103	20	30	4	20	2.5	15	2.3	0.8	1.8	UHF
BF980A	SOT-103	18	30	—	—	1.3	18	2.6	1.1	2.0	UHF
BF981	SOT-103	20	20	4	25	2.5	10	2.1	1.1	1.0	VHF
BF982	SOT-103	20	40	—	—	1.3	20	4.0	2.0	1.2	VHF
BF988	SOT-103	12	30	2	18	2.5	24[1]	2.1	1.05	1.0	VHF/UHF
BF989	SOT-143	20	20	2	20	2.7	9.5	1.8	0.9	2.8	UHF
BF990A	SOT-143	18	30	—	—	1.3	18	2.6	1.1	2.0	UHF
BF991	SOT-143	20	20	4	25	2.5	10	2.1	1.1	0.7	VHF
BF992	SOT-143	20	40	—	—	1.3	20	4.0	2.0	1.2	VHF
BF994S	SOT-143	20	30	4	20	2.5	15	2.5	1.0	1.0	VHF
BF996S	SOT-143	20	30	4	20	2.5	15	2.3	0.8	1.8	UHF
BF997	SOT-143	20	30	2	20	2.5	15	2.5	1.0	1.0	VHF
BF998	SOT-143	12	30	2	18	2.5	24[1]	2.1	1.05	1.0	VHF/UHF

1) typical value

TUNER TRANSISTORS

Type No.	Pkg.	Ratings V_{CEO} (V)	Ratings I_C (mA)	Ratings P_{tot} (mW)	Ratings f_T (MHz)	Characteristics F @ f (dB) @ (MHz)	Characteristics G_{UM} @ f (dB) @ (MHz)
NPN							
BF496	TO-92	20	20	300	300	— —	— —
BF498	TO-92	20	20	300	550	2.5 200	30 100
BF747	SOT-23	20	50	150	1200	4.5 100	20 100
BF748	TO-92	20	50	500	1200	4.5 100	20 100
BFG67	SOT-143	10	50	300	7500	2.5 2000	11 2000
BFG67X	SOT-143	10	50	300	7500	2.5 2000	11 2000
BFR92A	SOT-23	15	25	300	5000	1.8 800	15.5 800
BFR93A	SOT-23	12	35	300	5000	1.6 800	14 800
BFS17	SOT-23	15	50	300	1300	4.5 500	— —
BFS17A	SOT-23	15	25	300	2800	2.5 800	13.5 800
PNP							
BF506	TO-92	20	25	250	350	5 200	17.5 200
BF569N	SOT-23	35	30	250	900	4.5 800	16.7 800
BF579	SOT-23	20	25	300	1350	4.5 800	16 800
BF660	SOT-23	30	25	300	650	— —	— —
BF926	TO-92	20	25	250	350	5 200	17.5 200
BF970A	SOT-37	35	30	—	900	4.5 800	16.7 800
BF979	SOT-37	20	30	140	1350	4.5 800	16 800

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PHILIPS SMALL SIGNAL LEADED SEMICONDUCTORS

RF/MICROWAVE DEVICES

WIDEBAND TRANSISTORS

Type No.	Pkg.	Ratings V_{CEO} (V)	Ratings I_C (mA)	Ratings P_{tot} (mW)	Ratings f_T (GHz)	Characteristics F @ f (dB) @ (MHz)	Characteristics G_{UM} @ f (dB) @ (MHz)
General, NPN							
BF547	SOT-23	20	50	150	1.2	4.5	100	20	100
BF547W	SOT-323	20	50	300	1.6	—	—	20	100
BF698K	TO-92	15	25	360	1.8	3	200	16	200
BF747	SOT-23	20	50	150	1.2	4.5	100	20	100
BF747W	SOT-323	20	50	300	1.6	—	—	20	100
BF748	TO-92	20	50	500	1.2	4.5	100	20	100
BF751	TO-92	14	35	600	6.5	2.7	1000	11	1000
BF763	TO-92	15	25	500	1.8	5	800	—	—
BFG16A	SOT-223	25	150	1000	1.5	—	—	10	500
BFG17A	SOT-143	15	25	300	2.8	2.5	800	15.5	800
BFG25AX	SOT-143	5	6.5	50	5	1.8	800	—	—
BFG33(X)	SOT-143	7	20	140	12	3	2000	12	2000
BFG33/XR	SOT-143R	7	20	140	12	3	2000	12	2000
BFG34	SOT-103	18	150	1000	4	2.3	800	14.5	800
BFG35	SOT-223	18	150	1000	4	—	—	12	800
BFG65	SOT-103	10	50	300	7.5	3	2000	10.5	2000
BFG67	SOT-143	10	50	300	7.5	2.5	2000	11	2000
BFG92A(X)	SOT-143	15	25	300	5	2.4	800	17.5	800
BFG92AXR	SOT-143R	15	25	300	5	2.4	800	17.5	800
BFG93A(X)	SOT-143	12	35	300	6	2.3	800	17	800
BFG93AXR	SOT-143R	12	35	300	6	2.3	800	17	800
BFG94	SOT-223	12	60	700	6	2.3	800	15	800
BFG67(X)	SOT-143	10	50	300	7.5	2.5	2000	11	2000
BFG67/XR	SOT-143R	10	50	300	8	2.2	2000	10.9	2000
BFG90A	SOT-103	15	25	180	5	2.4	800	19	800
BFG91A	SOT-103	12	35	300	6	2.3	800	17.5	800
BFG96	SOT-103	15	150	700	5	3.7	800	15	800
BFG97	SOT-223	15	150	700	5	3.7	800	12	800
BFG134	SOT-103	18	150	1000	7.5	—	—	8	2000
BFG135	SOT-223	18	150	1000	7.5	—	—	12	800
BFG195	SOT-103	10	100	700	7.5	1.4	800	11	2000
BFG197(X)	SOT-143	10	100	300	7.5	1.4	800	11	2000
BFG197XR	SOT-143R	10	100	300	7.5	1.4	800	11	2000
BFG198	SOT-223	10	100	700	7.5	—	—	15	800
BFG505(X)	SOT-143	15	18	150	9	1.9	2000	13	2000
BFG505/XR	SOT-143R	15	18	150	9	1.9	2000	13	2000
BFG520(X)	SOT-143	15	70	300	9	1.9	2000	13	2000
BFG520/XR	SOT-143R	15	70	300	9	1.9	2000	13	2000
BFG540(X)	SOT-143	15	120	500	9	2.1	2000	11	2000
BFG540/XR	SOT-143R	15	120	500	9	2.1	2000	11	2000
BFG541	SOT-223	15	120	650	9	2.1	2000	9	2000
BFG590(X)	SOT-143	15	200	520	8	—	—	—	—
BFG590/XR	SOT-143R	15	200	520	8	—	—	—	—
BFG591	SOT-223	15	200	1200	8	—	—	—	—
BFG621	SOT-223	15	150	1000	8	—	—	—	—
BFG741	SOT-223	15	300	2000	7	—	—	—	—
BFP90A	SOT-173	15	30	250	5	2.4	800	19.5	800
BFP91A	SOT-173	12	50	350	6	2.3	800	18.5	800
BFP96	SOT-173	15	100	500	5	3.7	800	15	800
BFP505	SOT-173	15	18	250	9	—	—	13	2000
BFP520	SOT-173	15	70	500	9	—	—	12	2000
BFP540	SOT-173	15	120	750	9	—	—	11	2000
BFQ17	SOT-89	25	150	1000	1.2	—	—	6.5	800
BFQ18A	SOT-89	15	150	1000	3.6	—	—	—	—
BFQ19	SOT-89	15	75	500	5	3.3	500	11.5	500
BFQ22S	TO-72	12	35	150	5	1.9	500	16	500
BFQ33C	SOT-173	7	20	140	12	3	2000	12.5	2000
BFQ34	SOT-122	18	150	2250	4	8	500	16.5	500
BFQ34T	SOT-37	18	150	1000	3.7	—	—	19.5	300
BFQ53	TO-72	15	25	150	5	2.4	500	18	500
BFQ63	TO-72	15	75	250	4.5	2.3	500	11.5	500
BFQ65	SOT-37	10	50	300	7.5	3	2000	8	2000
BFQ66	SOT-173	10	50	350	7.5	3	2000	11.5	2000
BFQ67	SOT-23	10	50	300	7.5	3	2000	8	2000
BFQ67W	SOT-323	10	50	300	8	—	—	—	—
BFQ68	SOT-122	18	300	4500	4	—	—	13	800
BFQ135	SOT-172	18	150	2250	7.5	—	—	14	800
BFQ136	SOT-122	18	600	9000	4	—	—	12.5	800
BFQ270	SOT-172	18	270	5400	6	—	—	—	—
BFQ0621	SOT-172	19	150	2000	8	—	—	15	800
BFQ741	SOT-172	19	300	4000	7	—	—	14	800
BFR53	SOT-23	10	50	250	2	5	500	10.5	800
BFR90A	SOT-37	15	25	180	5	2.4	800	15	800
BFR91A	SOT-37	12	35	300	6	2.3	800	14	800
BFR92A	SOT-23	15	25	200	5	2.4	800	15	800
BFR92AW	SOT-323	15	25	300	5	2.1	1000	14	1000
BFR93A	SOT-23	12	35	250	5	2.3	800	14	800
BFR93AW	SOT-323	12	35	300	6	1.9	1000	16	1000
BFR94A	SOT-122E	25	150	3500	3.5	5	500	13.5	500
BFR95	TO-39	25	150	1500	3.5	9	200	13.5	500
BFR96S	SOT-37	15	100	700	5	4	800	11.5	800
BFR106	SOT-23	15	100	350	4	3.6	800	11.5	800
BFR134	SOT-37	18	150	7.5	—	—	14	800	
BFR505	SOT-23	15	18	150	9	1.9	2000	10	2000
BFR520	SOT-23	15	70	300	9	1.9	2000	9	2000
BFR521	SOT-103	15	70	300	9	—	—	—	—
BFR540	SOT-23	15	120	350	9	—	—	—	—
BFR541	SOT-103	15	120	650	9	—	—	—	—
BFR591	SOT-103	15	200	1200	8	—	—	—	—
BFS17	SOT-23	15	25	250	1.3	4.5	500	—	—
BFS17A	SOT-23	15	25	300	2.8	2.5	800	13.5	800
BFS17W	SOT-323	15	50	300	1.6	—	—	—	—
BFS25A	SOT-323	15	6.5	32	5	—	—	—	—
BFS505	SOT-323	15	18	150	9	—	—	—	—
BFS520	SOT-323	15	70	300	9	—	—	—	—
BFS540	SOT-323	15	120	350	9	—	—	—	—
BFT24	SOT-37	5	2.5	30	2.3	3.8	500	17	500
BFT25	SOT-23	5	6.5	50	2.3	3.8	500	18	500
BFT25A	SOT-23	5	6.5	50	5	1.8	800	—	—
BFW16A	TO-39	25	150	1500	1.2	<6	200	—	—
BFW17A	TO-39	25	50	1500	1.1	—	—	—	—
BFW30	TO-72	10	50	250	1.6	<5	500	7.5	800
BFW92	SOT-37	15	25	190	1.6	4	500	—	—
BFW92A	SOT-37	15	25	200	2.8	2.5	800	13	800
BFW93	SOT-37	10	50	190	1.7	<5	500	10.5	800
BFX89	TO-72	15	50	200	1.2	3.3	200	22	200
BFY90	TO-72	15	25	200	1.4	2.5	200	—	—
GENERAL, PNP							
BFG31	SOT-223	15	100	1000	5	—	—	12	800
BFG32	SOT-103	15	75	700	4.5	4.3	800	13.5	800
BFG55	SOT-223	18	150	1000	4	—	—	11	800
BFQ23	SOT-37	12	35	180	5	2.4	500	16.5	500
BFQ23C	SOT-173	12	50	350	5	3.7	800	15	800
BFQ24	TO-72	12	35	150	5	2.4	500	15	500
BFQ32	SOT-37	15	75	500	4.2	3.8	500	14	500
BFQ32C	SOT-173	15	100	500	4.5	4.3	800	13	800
BFQ32M	TO-72	15	75	250	4.5	2.3	500	11	500
BFQ32S	SOT-37	15	100	700	4.5	4.3	800	10	800
BFQ51	SOT-37	15	25	180	5	2.4	800	18	500
BFQ52	TO-72	15	25	150	5	2.7	500	17	500
BFQ54T	SOT-37	18	150	1000	4	—	—	18	300
BFQ108	SOT-122	18	300	4000	4	—	—	—	—
BFQ149	SOT-89	15	75	500	5	3.75	500	12	500
BFT92	SOT-23	15	25	200	5	2.7	500	18	500
BFT92AW	SOT-323	15	35	300	5	2.5	500	18	500
BFT93	SOT-23	12	35	200	5	2.4	500	16.5	500
BFT93AW	SOT-323	12	50	300	5	2.4	500	16.5	500

VIDEO TRANSISTORS

Type. No.	Pkg.	Ratings $-V_{CBO}$ max (V)	Ratings $-V_{CEO}$ max (V)	Ratings I_C max (mA)	Ratings h_{FE} min	Characteristics C_{CB} max (pF)	Characteristics T_j (°C)	Characteristics f_T min (MHz)
VIDEO, NPN								
BFQ161	TO-92	20	10	500	25	4	175	1000
BFQ162	TO-126	20	10	500	25	4.2	175	1000
BFQ163	TO-39	20	10	500	25	4.5	200	1000
BFQ166	SOT-223	20	10	500	50	3.2	175	1000
BFQ231	TO-92	100	65	300	20	1.7	175	1000
BFQ231A	TO-92	115	95	300	20	2	175	800
BFQ232	TO-126	100	65	300	20	2	175	1000
BFQ232A	TO-126	115	95	300	20	2	175	800
BFQ233	TO-39	100	65	300	20	2	200	1000
BFQ233A	TO-39	115	95	300	20	2	200	800
BFQ234	SOT-172A1	100	65	300	20	2	200	1000
BFQ235	SOT-128	100	65	300	20	2	175	800
BFQ235A	SOT-128	115	95	300	20	2	175	800
BFQ236	SOT-223	100	65	300	20	1.8	175	1000
BFQ236A	SOT-223	115	95	300	20	1.8	175	800
BFQ262	TO-126	100	65	400	15	2	175	1000
BFQ262A	TO-126	115	95	400	15	2	175	800
BFQ263	TO-39	100	65	400	15	2	200	1000
BFQ265	SOT-128	100	65	400	15	2.5	175	800
BFQ265A	SOT-128	115	95	400	15	2.5	175	800
BFQ268	SOT-172A1	100	65	400	15	2	200	1000
VIDEO, PNP								
BFQ251	TO-92	100	65	300	20	1.7	175	1000
BFQ251A	TO-92	115	95	300	20	1.7	175	800
BFQ252	TO-126	100	65	300	20	2.5	175	1000
BFQ252A	TO-126	115	95	300	20	2.5	175	800
BFQ253	TO-39	100	65	300	20	2.5	200	1000
BFQ253A	TO-39	115	95	300	20	2.5	200	800
BFQ254	SOT-172A1	100	65	300	20	2.5	200	1000
BFQ255	SOT-128	100	65	300	20	2	175	800
BFQ255A	SOT-128	115	95	300	20	2	175	800
BFQ256	SOT-223	100	95	300	20	1.6	175	1000
BFQ256A	SOT-223	115	110	300	20	1.6	175	800

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RF/MICROWAVE DEVICES

BIPOLAR RF TRANSMITTING TRANSISTORS HF SINGLE SIDEBAND 1.6-30MHz

Type No.	Package Outline	Load Power Pep (W)	Power Gain (dB)	Supply Voltage (V)
Class A, intermodulation distortion: d_3, $d_5 < -40$ dB				
BLV10	SOT-123	1	18	12
BLY87C	SOT-120	1	18	12
BLV20	SOT-123	1.3	20	26
BLY91A	SOT-48/2	1.3	20	26
BLY91C	SOT-120	1.3	20	26
BLV11	SOT-123	2	18	12
BLY88C	SOT-120	2	18	12
BLV21	SOT-123	2.5	20	26
BLY92A	SOT-48/2	2.5	20	26
BLY92C	SOT-120	2.5	20	26
BLW87	SOT-123	6	18	12
BLY89C	SOT-120	6	18	12
BLX13	SOT-56	8	18	26
BLX13C	SOT-120	8	20	26
BLW83	SOT-123	10	20	26
BLX39	SOT-120	15	20	26
BLW50F	SOT-123	16	19.5	45
BLW86	SOT-123	17	22	26
BLW78	SOT-121	35	19.5	26
BLW96	SOT-121	50	19	40
Class AB, intermodulation distortion: d_3, $d_5 < -30$ dB				
BLV11	SOT-123	10	18	13.5
BLY88C	SOT-120	10	18	13.5
BLV21	SOT-123	10	20	28
BLY92A	SOT-48/2	10	20	28
BLY92C	SOT-120	10	20	28
BLW87	SOT-123	15	18	13.5
BLY89C	SOT-120	15	18	13.5
BLW83	SOT-123	25	20	28
BLX13C	SOT-120	25	20	28
BLW85	SOT-123	30	19.5	12.5
BLW60	SOT-56	30	19.5	12.5
Class AB, intermodulation distortion: d_3, $d_5 < -30$ dB (Cont.)				
BLW60C	SOT-120	30	19.5	12.5
BLX39	SOT-120	37.5	19	28
BLW86	SOT-123	42.5	19	28
BLX14	SOT-55	50	13	28
BLW50F	SOT-123	65	18	50
BLW99	SOT-121	80	12.5	12.5
BLW76	SOT-121	80	13	28
BLW78	SOT-121	100	19	28
BLW77	SOT-121	130	12	28
BLX15	SOT-55	150	14	50
BLW95	SOT-121	160	14	50
BLW97	SOT-121	175	11.5	28
BLW96	SOT-121	200	13.5	50

BIOPOLAR RF TRANSMITTING TRANSISTORS VHF 25-175MHz

Type No.	Package Outline	Load Power Pep (W) @ 175MHz	Power Gain (dB) @ 175MHz	Supply Voltage (V)
Class B, 7.5-9.6V Supply Voltage (Portable Mobile)				
2N4427	TO-39	0.7	8	7.5
BFQ42	TO-39	1.5	8.4	7.5
BFQ43	TO-39	3	9.4	7.5
BLW29	SOT-120	9	7.4	7.5
Class B, 12.5-13.5V Supply Voltage (Car Mobile)				
2N4427	TO-39	1	10	12.5
BFQ42	TO-39	2	11	13.5
BLW79	SOT-122	2	13.5	12.5
BFQ43	TO-39	4	12	13.5
BFQ43S	TO-39	4	12	13.5
BFS22A	TO-39	4	8	13.5
BLW80	SOT-122	4	25	12.5
Class B, 12.5-13.5V Supply Voltage (Car Mobile) (Cont.)				
BLV10	SOT-123	8	9	13.5
BLY87C/01	SOT-122	8	9	13.5
BLY87C	SOT-120	8	12	13.5
BLW81	SOT-122	10	13.5	12.5
BLV11	SOT-123	15	8	13.5
BLW29	SOT-120	15	10	13.5
BLY88C/01	SOT-122	15	8	13.5
BLY88C	SOT-120	15	8	13.5
BLW87	SOT-123	25	6	13.5
BLY89C	SOT-120	25	6	13.5
BLW31	SOT-120	28	9	13.5
BLV30/12	SOT-119	30	8.2	13.5
BLW30	SOT-120	30	10	12.5
BLV12	SOT-123	30	9	12.5
BLV13	SOT-123	40	8.5	12.5
BLW40	SOT-120	40	10	12.5
BLW60C	SOT-120	45	5	12.5
BLW85	SOT-123	45	4.5	12.5
BLV45/12	SOT-119	45	6.5	12.5
BLV75/12	SOT-119	75	6.5	12.5
Class B, 28V Base Stations				
2N3866	TO-39	1	10	28
2N3553	TO-39	2.5	10	28
BFS23A	TO-39	4	10	28
BLV20	SOT-123	8	12	28
BLY91A	SOT48/2	8	12	28
BLY91C	SOT-120	8	12	28
BLY91C/01	SOT-122F	8	12	28
BLV21	SOT-123	15	10	28
BLY92A	SOT-48/2	15	10	28
BLY92C	SOT-120	15	10	28
BLY92C/01	SOT-122F	15	10	28
BLW84	SOT-123	25	9	28
BLY93A	SOT-56	25	9	28
BLY93C	SOT-120	25	9	28
BLW86	SOT-123	45	7.5	28
BLX39	SOT-120	45	7.5	28
BLY94	SOT-55	50	7	28
BLV80/28	SOT-121	80	6.5	28
BLW78[1)]	SOT-121	100	6	28
BLW77[2)]	SOT-121	130	7.5	28

1) Load power and power gain measured at 150 MHz.
2) Load power and power gain measured at 87.5 MHz.

BIPOLAR RF TRANSMITTING TRANSISTORS UHF 400-512MHz

Type No.	Package Outline	Load Power (W) @ 400MHz	Power Gain (dB) @ 400MHz	Supply Voltage (V)
Class B 7.5V Supply Voltage (Portable Mobile)				
BLT50	SOT-223	1.2	10.5	7.5
BLT53	SOT-122D	8	6	7.5
Class B, 12.5V Supply (Car Mobile)				
2N4427	TO-39	0.4	10	12.5
BLU56	SOT-223	1	12	12.5
BLX65	TO-39	2	6	12.5
BLX65E	TO-39	2	9	12.5
BLX65ES	TO-39/3	2	6	12.5
BLW79	SOT-122	2	9	12.5
BLU11/SL	SOT-122D	2.5	10	12.5
BLW80	SOT-122	4	8	12.5
BLU99	SOT-122	5	10.5	12.5
BLU97	SOT-122	7	9	12.5
BLU10/12	SOT-122	10	8	12.5
BLW81	SOT-122	10	6	12.5
BLU15/12	SOT-122	15	7.8	12.5
BLU20/12	SOT-119	20	6.5	12.5
BLU30/12	SOT-119	30	5.7	12.5
BLU45/12	SOT-119	45	4.8	12.5
BLU60/12	SOT-119	60	4.4	12.5
Class B, 28V (Base Stations)				
2N3866	TO-39	1	10	28
BLX91A	SOT-48/3	1	11	28
BLW89	SOT-122	2	12	28
BLX92A	SOT-48/3	2.5	11	28
BLW90	SOT-122	4	11	28
BLX93A	SOT-48/3	7	8.5	28
BLW91	SOT-122	10	9	28
BLX94A	SOT-48/2	25	6	28
BLX94C	SOT-122	25	6.5	28
BLU30/28	SOT-119	30	8	28
BLX95	SOT-56	40	4.5	28
BLU60/28	SOT-119	60	7	28

BIPOLAR RF TRANSMITTING TRANSISTORS SHF 900 MHz

Type No.	Package Outline	Load Power (W) @ 900MHz	Power Gain (dB) @ 900MHz	Supply Voltage (V)
Class B, 7.5-9.6 Supply (portable mobile)				
BRF90A	SOT-37	0.075	7.5	7.5
BFG90A	SOT-103	0.075	9.5	7.5
BFR91A	SOT-37	0.16	7	7.5
BFG91A	SOT-103	0.16	9	7.5
BLU98	SOT-103	0.4	6.8	7.5
BLV90	SOT-172	0.75	5.3	7.5
BLT80	SOT-223	0.8	6	7.5
BLT81	SOT-223	1.2	6	7.5
BLV90/SL	SOT-172D	1	7	9.6
BLV91/SL	SOT-172D	1.5	7	9.6
BLV91	SOT-172	1.5	4.3	7.5
BLV92	SOT-171	3	5.8	7.5
Class B 7.5V Supply Voltage (Portable Mobile)				
BLT90/SL	SOT-172	0.75	7	7.5
BLT91/SL	SOT-172	1.5	7.5	7.5
BLT92/SL	SOT-122D	3	7	7.5
BLT93/SL	SOT-122D	6	5.5	7.5
Class B, 12.5V (car mobile)				
BLU98	SOT-103	0.5	8.5	12.5
BLU86	SOT-223	1	7	12.5
BLV90	SOT-172	1	7.5	12.5
BLV90/SL	SOT-172D	1	7.5	12.5
BLV91	SOT-172	2	6.5	12.5
BLV91/SL	SOT-172D	2	6.5	12.5
BLU99	SOT-122	4	7	12.5
BLU99/SL	SOT-122D	4	7	12.5
BLV92	SOT-171	4	7.5	12.5
BLV93	SOT-171	8	6.5	12.5
BLV193	SOT-171	12	6.5	12.5
BLV94	SOT-171	15	6	12.5
BLV194	SOT-171	16	6	12.5
BLV95	SOT-171	22	5.5	12.5

BIPOLAR RF TRANSMITTING TRANSISTORS SHF 900-960MHz

Type No.	Package Outline	Load Power (W) @ 900MHz	Power Gain (dB) @ 900MHz	Supply Voltage (V)
Class AB and Class B, 24-26V (base stations)				
BLV99	SOT-172	2	9	24
BLV99/SL	SOT-172D	2	8	24
ON4612	SOT-172D	2	8	24
BLV103	SOT-171	4	11.5	24
BLV100	SOT-171	8	8	24
BLV98	SOT-171	14	8.5	24
BLV98CE	SOT-171	15	7.5	24
BLV97	SOT-171	30	7	24
BLV945A	SOT-324	30	10	25
BLV97CE	SOT-171	35	7	24
BLV101A	SOT-273	50	8.5	26
BLV101B	SOT-273	50	8.1	26
BLV948	SOT-262A2	150	7.5	26

BIPOLAR RF TRANSMITTING TRANSISTORS FM BROADCAST 87-108MHz

Type No.	Package Outline	Load Power (W) @ 108MHz	Power Gain (dB) @ 108MHz	Supply Voltage (V)
Class B				
2N3866	TO-39	1.8	10	28
BLW90	SOT-122	4	20	28
BLV21	SOT-123	15	10	28
BLW86	SOT-123	45	7.5	28
BLX39	SOT-120	45	7.5	28
BLV80/28	SOT-121	80	10	28
BLW76	SOT-121	80	8	28
BLW78	SOT-121	100	8	28
BLV25	SOT-119	175	10	28
BLV37	SOT-179	250	10.5	28

BIPOLAR RF TRANSMITTING TRANSISTORS TV TRANSPOSERS/TRANSMITTERS

Type No.	Package Outline	Output Power @ d_{im} SYNC (W)	(dB)	Output Power P_o-1dB (W)	Power Gain (dB)	Supply Voltage (V)
CLASS A, BANDS I (41-68 MHz) and III (174-230 MHz)						
BLV30	SOT-122	1.5	−60	—	18	25
BLV31	SOT-122	5	−58	—	15	25

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RF MICROWAVE DEVICES

Type No.	Package Outline	Output Power @ d_{im} SYNC (W)	(dB)	Output Power P_o-1dB (W)	Power Gain (dB)	Supply Voltage (V)
CLASS A, BANDS I (41-68 MHz) and III (174-230 MHz) (Cont.)						
BLV32F	SOT-160	10	−55	—	16	25
BLV33F	SOT-119	16	−55	—	13.5	25
BLV33	SOT-147	19	−55	—	9	25
CLASS AB, BANDS I (41-68 MHz) and III (174-230 MHz)						
BLV30	SOT-122	—	—	10	15	28
BLV31	SOT-122	—	—	20	12	28
BLV32F	SOT-160	—	—	30	13	28
BLV33F	SOT-119	—	—	85	10.5	28
BLV33	SOT-147	—	—	90	6.5	28
BLV36	SOT-161	—	—	115	11	28
BLV38	SOT-179	—	—	225	9.0	35
CLASS A, BANDS IV and V (470-860 MHz)						
BFR96S	SOT-37	0.12	−60	—	10	25
BFQ34	SOT-122	0.3	−60	—	11	25
BLW32	SOT-122	0.5	−60	—	11	25
BLX96	SOT-48	0.5	−60	—	6	25
BFQ68	SOT-122	0.7	−60	—	10	25
BLW33	SOT-122	1	−60	—	10	25
BLX97	SOT-48	1	−60	—	5.5	25
BLW34	SOT-122	1.8	−60	—	9	25
BLW98	SOT-122	3.5	−60	—	6.5	25
BLX98	SOT-48/2	3.5	−60	—	5	25
BLV57	SOT-161	6	−60	—	8	25
BLV58	SOT-289	25	−45	—	10	25

Type No.	Package Outline	Output Power @ d_{im} SYNC (W)	(dB)	Output Power P_o-1dB (W)	Power Gain (dB)	Supply Voltage (V)
CLASS AB, BANDS IV and V (470-860 MHz)						
BLV59	SOT-171	—	—	30	7	25
BLV57	SOT-161	—	—	38	6.5	25
BLV62	SOT-262	—	—	150	8.5	45

RF POWER MOS TRANSISTORS

Type No.	Package Outline	Load Power (W)	V_{DS} (V)	Source Gain (dB)
HF SSB CLASS AB (f = 28 MHz, d3/d5 < −30 dB)				
BLF145	SOT-123	30	28	20 typ
BLF175	SOT-121	30	50	23
BLF246	SOT-121	80	28	20 typ
BLF147	SOT-121	150	28	17
BLF177	SOT-121	150	50	20
HF SSB CLASS A (f = 1.5-30 MHz, d3/d5 < −40 dB)				
BLF242	SOT-123	2	28	23 typ
BLF244	SOT-123	4	28	23 typ
BLF145	SOT-123	8	28	24
BLF175	SOT-123	8	50	24
BLF246	SOT-121	20	28	23 typ

RF POWER MOS TRANSISTORS

Type No.	Package Outline	Load Power (W)	V_{DS} (V)	f (MHz)	Source Gain (dB)
VHF BASE STATIONS (f = 25-175 MHz, Class B Operation)					
BLF241	SOT-5/11	3	28	175	14 typ
BLF242	SOT-123	5	28	175	13
BLF244	SOT-123	15	28	175	13
BLF245	SOT-123	30	28	175	13
BLF245B	SOT-279	30	28	175	14
BLF175	SOT-121	30	50	108	19 typ
BLF246B	SOT-161	60	28	175	14
BLF246	SOT-121	80	28	108	16
BLF276	SOT-119D3	100	50	108	18
BLF147	SOT-121	150	28	108	13 typ
BLF177	SOT-121	150	50	108	20 typ
BLF247B	SOT-161	150	28	175	13
BLF277	SOT-119	150	50	108	20 typ
BLF248	SOT-262	300	28	175	15 typ
BLF278	SOT-262	300	50	108	20
VHF MOBILE TRANSMITTERS (f = 25-175 MHz, Class B Operation)					
BLF221	T0-39/3	2	12.5	175	10
BLF241	SOT-5/11	2	12.5	175	10
BLF244	SOT-123	6	12.5	175	15 typ
BLF245	SOT-123	12	12.5	175	12 typ
BLF225	SOT-123	30	12.5	175	8.5
UHF BASE STATIONS (f = 100-500 MHz, Class B Operation)					
BLF521	SOT-172D	2	12.5	500	10
BLF522	SOT-171	5	12.5	500	10
BLF542	SOT-171	5	28	500	10
BLF543	SOT-171	10	28	500	12
BLF544	SOT-171	20	28	500	11
BLF544B	SOT-268	20	28	500	11
BLF545	SOT-268	40	28	500	11
BLF546	SOT-268	80	28	500	11
BLF547	SOT-262	100	28	500	10
BLF548	SOT-262	150	28	500	9
UHF BASE STATIONS (f = 225-400 MHz, Class B Operation)					
BLF242	SOT-123	5	28	400	13 typ
BLF244	SOT-123	15	28	400	11 typ
BLF245	SOT-123	30	28	400	10 typ
UHF BASE STATIONS (f = 860-960 MHz, Class B Operation)					
BLF543	SOT-171	10	28	960	8 typ
BLF544	SOT-171	20	28	960	7 typ

RF POWER MOS TRANSISTORS

Type No.	Package Outline	Output Power Sync (W)	V_{DS} (V)	f (MHz)	Power Gain (dB)	d_{im} (dB)	I_D (mA)
TV TRANSPOSERS (band 3, f = 174-230 MHz, Class A Operation)							
BLF346	SOT-119	27	28	225	13	−52	3000
BLF348	SOT-262	67	28	225	11	−52	2×4600
TV TRANSMITTERS (band 3, f = 174-230 MHz, Class AB Operation)							
BLF276	SOT-119D3	100	50	225	13	—	50
BLF278	SOT-262	250	50	225	14	—	2×500
BLF248	SOT-262	300	28	225	10	—	2×250
BLF368	SOT-262	300	32	225	12	—	2×250
BLF378	SOT-262	250	50	225	14	—	2×500

RF POWER AMPLIFIER MODULES

Type No.	Package Outline	Frequency Band (MHz)	Output Power (W)	Power Gain (dB)	Supply Voltage (V)
VHF (portable)					
BGY112A	—	68-88	7	38.5	7.2
BGY112B	—	132-156	7	38.5	7.2
BGY112C	—	146-174	7	38.5	7.2
VHF (car mobile)					
BGY43	SOT-132B	148-174	13	19.4	12.5
BGY32	SOT-132B	68-88	18	22.6	12.5
BGY33	SOT-132B	80-108	18	22.6	12.5
BGY35	SOT-132B	132-156	18	20.8	12.5
BGY36	SOT-132B	148-174	18	20.8	12.5
BGY145B	SOT-183	146-174	28	19.7	12.5
BGY145A	SOT-183	68-88	29	22.0	12.5
UHF (portable)					
BGY46A	SOT-181	400-440	1.4	15.0	9.6
BGY46B	SOT-181	430-470	1.4	15.0	9.6
BGY47A	SOT-181	400-470	2	16.0	7.5
BGY47A	SOT-181	400-470	3.2	18.0	9.6
BGY113A	SOT-288D	400-440	7	38.5	7.5
BGY113B	SOT-288D	430-470	7	38.5	7.5
SHF (portable)					
BGY115A	SOT-321	824-849	1.2	27.8	6.0
BGY115B	SOT-321	872-905	1.2	27.8	6.0
BGY115C	SOT-321	890-915	1.6	29	6.0
BGY118A	SOT-321	824-849	1.2	27.8	4.8
BGY118B	SOT-321	872-905	1.2	27.8	4.8
BGY110D	SOT-246	824-849	1.7	32.3	7.2
BGY110E	SOT-246	872-905	1.7	32.3	7.2
BGY110F	SOT-246	890-915	1.7	32.3	7.2
BGY110G	SOT-246	902-928	1.7	32.3	7.2
BGY95A	SOT-200	824-849	2.2	20.4	7.5
BGY95B	SOT-200	890-915	2.2	20.4	7.5
BGY96A	SOT-200	824-849	2.5	21.0	9.6
BGY96B	SOT-200	890-915	2.5	21.0	9.6
SHF (car mobile)					
BGY114A	SOT-278A	824-849	6	33	12.5
BGY114B	SOT-278A	872-905	6	37.8	12.5
BGY114C	SOT-278A	890-915	8	39	12.5
BGY114D	SOT-278A	800-870	6	37.8	12.5
BGY114E	SOT-278A	890-950	6	37.8	12.5
BGY116A	SOT-278B	824-849	6	37.8	12.5
BGY116B	SOT-278B	872-905	6	37.8	12.5
BGY116C	SOT-278B	890-915	8	39	12.5
BGY116D	SOT-278B	800-870	6	37.8	12.5
BGY116E	SOT-278B	890-950	6	37.8	12.5

MICROWAVE TRANSISTORS, PULSED POWER

Type No.	Package Outline	f (GHz)	V_{CC} (V)	t_p @ (µs)	Duty Cycle (%)	P_L (W)	G_p (dB)	η_C (%)
RADAR PULSED, L-BAND								
RZ1214B35U	F0-57C	1.2-1.4	28	200	10	35	8	45
RZ1214B35Y	F0-57C	1.2-1.4	50	150	5	35	7	30
		1.2-1.4	50	300	10	40	7	35
RZ1214B65Y	F0-57C	1.2-1.4	50	150	5	70	7	35
		1.2-1.4	50	300	10	80	7	30
RX1214B80W	F0-91	1.2-1.4	40	500	10	80	7	40
RX1214B130Y	F0-91	1.2-1.4	50	150	5	130	7	40
RX1214B170Y	F0-91	1.2-1.4	50	150	5	190	6.7	42
RX1214B150W	F0-91	1.2-1.4	50	1000	10	135	6.5	35
		1.2-1.4	50	150	5	220	8	45
RX1214B170W	F0-91	1.2-1.4	42	500	10	170	6.5	40
RX1214B300Y	F0-91	1.2-1.4	50	300	10	300	7.5	35
		1.2-1.4	50	150	5	250	7	35
RX1214B350Y	F0-91	1.2-1.4	50	130	6	280	7	40
RADAR PULSED, S-BAND								
RZ2731B16W	F0-57D	2.7-3.1	40	100	10	15	6	32
RZ3135B14W	F0-57D	3.1-3.5	40	100	10	13	5.5	30
RZ2731B32W	F0-57D	2.7-3.1	40	100	10	30	6	32
RZ3135B28W	F0-57D	3.1-3.5	40	100	10	27	5.5	30
RZ2731B48W	F0-57D	2.7-3.1	40	100	10	45	6	32
RZ3135B42W	F0-57D	3.1-3.5	40	100	10	40	5.5	30
RZ2731B60W	F0-57D	2.7-3.1	40	100	10	60	6	35
RZ3135B50W	F0-57D	3.1-3.5	40	100	10	50	5.2	30
RV3135B5X	F0-83	3.1-3.5	24	100	10	4	4.3	30
RX2731B90W	F0-125A	2.7-3.1	40	100	10	90	6	35
RX3034B70W	F0-125A	3.0-3.4	40	100	10	70	5.4	30

Type No.	Package Outline	f (GHz)	V_{CC} (V)	t_p @ (µs)	Duty Cycle (%)	P_L (W)	G_p (dB)	η_C (%)
AVIONICS PULSED								
MTB10010U	F0-41B	1.03	24	10	1	9.5	9.5	50
MRB11040W	F0-67	1.03	50	1	1	60	10	35
MX1011B430W	F0-91	1.03	45	30	1	480	6.7	45
MRB11175Y	F0-67	1.09	50	10	1	175	7.5	35
MRB11350Y	F0-67	1.09	50	10	1	350	7	30
MSB11900Y	F0-96	1.09	50	10	1	800	7	30
MX1011B200Y	F0-91	1.09	50	10	1	200	7	48
MX1011B700Y	F0-91	1.09	50	10	1	650	6	48
RZB12050Y	F0-57C	1.09	50	100	10	35	7	30
RZB12100Y	F0-57C	1.09	50	100	10	80	7	30
RZB12250Y	F0-57C	1.09	50	100	10	200	7	30
RXB12350Y	F0-91	1.09	50	100	10	300	7	30
MZ0912B50Y	F0-91	0.96-1.215	50	10	10	50	7	42
MZ0912B100Y	F0-91	0.96-1.215	50	10	10	100	7	42
MX0912B250Y	F0-91	0.96-1.215	50	10	10	235	7	42
MX0912B350Y	F0-91	0.96-1.215	50	10	10	325	7	40

*May also be used for 2.6-3.1 GHz.

MICROWAVE, TRANSISTORS, CONTINUOUS POWER

Type No.	Package Outline	f (GHz)	V_{CE} (V)	I_C (mA)	P_{L1} (W)	G_{p0}(2) (dB)
CLASS A, MEDIUM POWER						
LEE1015T	SOT-122	1	20	200	1.5 typ	14 typ
LTE1015T	F0-41B	1	20	200	1.5 typ	14 typ
LBE2003S	F0-45	2.0	18	30	.200	—
LCE2003S	F0-46	2.0	18	30	.200	—
LBE2009S	F0-45	2.0	18	110	.700	9.8
LCE2009S	F0-46	2.0	18	110	.700	9.8
LUE2003S	F0-163	2.0	18	30	.200	11
LUE2009S	F0-163	2.0	18	110	.700	9.8
LTE21009R	F0-41B	2.1	16	150	1 typ	8.5
LTE21015R	F0-41B	2.1	16	250	1.5	8.1
LTE21025R	F0-41B	2.1	16	400	2.0	8.8
LWE2010S	F0-93	2.3	18	110	0.800	8
LWE2015R	F0-93	2.3	16	250	1.2	8.1
LWE2025R	F0-93	2.3	16	400	2.0	7.8
LAE4001R	SOT-100	4.0	15	25	.085	9.5
LAE4002S	SOT-100	4.0	18	30	.126	8
LTE4002S	F0-41B	4.0	18	30	.200 typ	8
LTE42005S	F0-41B	4.2	18	110	.550	7.2
LTE42008R	F0-41B	4.2	16	250	.940	7.5
LTE42012R	F0-41B	4.2	16	400	1.250	7
CLASS A, HIGH POWER						
LZ1418E100R	F0-57C	1.4-1.8	16	2	9	10
LV1721E50R	F0-83	1.7-2.1	16	1.1	5	7
LV2024E45R	F0-83	2.0-2.4	16	1.1	4	6
LVE21050R	F0-83	2.1	16	1.1	5.5 typ	8 typ
LV2327E40R	F0-83	2.3-2.7	16	1	4	7
LV2931E50S	F0-83	2.9-3.1	18	1	4.5	6

(1) Load power for 1 dB compressed power gain.
(2) Low-level power gain associated with P_{L1}.

Type No.	Package Outline	f (GHz)	V_{CE} (V)	I_C (mA)	P_{L1} (W)	G_{p0}(2) (dB)
CLASS AB						
LLE18010X	F0-229	1.85	24	10	1.5	10
LLE16045X	F0-229	1.65	24	50	5.0	10
LLE18040X	F0-229	1.85	24	50	4.5	10
LLE16120X	F0-229	1.65	24	100	11	10
LLE18100X	F0-229	1.85	24	100	13	10.8
LLE16350X	F0-229	1.65	24	100	35	8
LLE18300X	F0-229	1.85	24	100	30	9
LXE16350X	F0-91	1.65	24	300	35	10
LXE18300X	F0-91	1.85	24	300	30	9

Type No.	Package Outline	f (GHz)	V_{CE} (V)	P_L (W)	G_p (dB)	η_C (%)
CLASS B, MEDIUM POWER						
PLB16004U	F0-229	1.65	28	4	10	45
PTB23001X	F0-41B	2	24	1	7	45
PTB23002U	F0-41B	2.3	28	2	9	45
PTB23003X	F0-41B	2	24	3	8.75	45
PTB23005X	F0-41B	2	24	5	9.2	50
PTB32001X	F0-41B	3	24	1.3	8	35
PTB32003X	F0-41B	3	24	2.5	8	35
PTB32005X	F0-41B	3	24	4.5	8	35
PTB42001X	F0-41B	4.2	24	0.8	5	28
PTB42002X	F0-41B	4.2	24	1.6	5	28
PTB42003X	F0-41B	4.2	24	2.5	5	28
PVB42004X	F0-83	1	24	13	11	60
		2	24	10	10	48
		3	24	7.5	8.8	30
		4	24	4	6	25
CLASS B, HIGH POWER						
PZ1418B15U	F0-57C	1.4-1.8	28	12.5	7	38
PZ1418B30U	F0-57C	1.4-1.8	28	27	7.3	38
PZB16035U	F0-57C	1.6	28	35	8	45
PXB16050U	F0-91	1.6	28	45	8.5	45
PLB16012U	F0-229	1.6	28	10	8	45
PZ1721B12U	F0-57C	1.7-2.1	28	12	6.8	35
PZ1721B25U	F0-57C	1.7-2.1	28	25	7	35
PZ2024B10U	F0-57C	2.0-2.4	28	9	5.6	35
PZ2024B20U	F0-57C	2.0-2.4	28	20	6	35
PZ2327B15U	F0-57C	2.3-2.7	28	15	7	40

OSCILLATOR POWER TRANSISTORS

Type No.	Package Outline	f (GHz)	V_{CE} (V)	I_C (mA)	P_L (mW)
PTC400IT	F0-41B	3	20	200	550
PPC50011	F0-102	5	20	200	450
PQC50011	F0-85	5	20	200	450

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CATV AMPLIFIER MODULES
WIDEBAND HYBRID MODULES

CATV AMPLIFIER MODULES

Type Number	Package Outline	Power Gain (dB)	Composite Triple Beat (dB)	Noise Figure (dB)	Total DC Current Consumption (mA)
Reverse amplifiers 5 to 200 MHz range					
		@ 10 MHz	max 22 chs[2]	max @ 200 MHz	max
BGY61	SOT-115	13	−68	7.0	230
BGY65	SOT-115	18.5	−68	5.5	230
BGY67	SOT-115	22	−67	5.5	230
BGY67A	SOT-115	24	−67	5.5	230
Forward amplifiers 40 to 450 MHz range					
		@ 50 MHz	max 60 chs[5]	max @ 450 MHz	max
BGE85A	SOT-115	18.4	—	7.0	230
BGE88	SOT-115	34.5	—	6.0	330
BGY80	SOT-115	12.5	−54	7.5	200
BGY81	SOT-115	12.5	−58	8.0	240
BGY82	SOT-115	14	−55	7.0	200
BGY83	SOT-115	14	−59	8.0	240
BGY84	SOT-115	17	−55	6.5	200
BGY85	SOT-115	17	−58	7.0	240
BGY84A	SOT-115	18.4	−55	6.5	200
BGY85A	SOT-115	18.4	−59	7.0	240
BGY85H/01[7]	SOT-115	14.8–16.4	−65[5]	6.8	230
BGY86	SOT-115	22	−54	6.0	200
BGY87	SOT-115	22	−58	6.5	240
BGY87B	SOT-115	27	−58	6.0	340
BGY88	SOT-115	34.5	−58	6.0	340
BGY89	SOT-115	38	−58	5.5	340
40 to 450 MHz range power doublers					
BGD102	SOT-115	18.5	−65	7.0	435
BGD104	SOT-115	20	−64	7.0	435
BGD106	SOT-115	22	−63	6.5	435
BGD108	SOT-115	36	−64	7.0	625
Forward amplifiers 40 to 550 MHz range					
		@ 50 MHz	max 77 chs[9]	max @ 550 MHz	max
BGY580	SOT-115	12.5	−52	8.5	200
BGY581	SOT-115	12.5	−56	9.0	240
BGY582	SOT-115	14	−55	7.5	200
BGY583	SOT-115	14	−59	8.5	240
BGY584	SOT-115	17	−56	7.0	200
BGY585	SOT-115	17	−59	8.0	240
BGY584A	SOT-115	18.2	−56	7.0	200
BGY585A	SOT-115	18.2	−59	8.0	240
BGY586	SOT-115	22	−53	6.5	200
BGY587	SOT-115	22	−57	7.0	240
BGY587B	SOT-115	27	−57	6.5	340
BGY588	SOT-115	34.5	−57	6.5	340

CATV AMPLIFIER MODULES *(continued)*

Type Number	Package Outline	Power Gain (dB)	Composite Triple Beat (dB)	Noise Figure (dB)	Total DC Current Consumption (mA)
40 to 550 MHz range power doublers					
		@ 50 MHz	max 77 chs[9]	max @ 550 MHz	max
BGD502	SOT-115	18.5	−65	8.0	435
BGD504	SOT-115	20	−64	8.0	435
BGD506	SOT-115	22	−62	7.0	435
BGD508	SOT-115	36	−62	7.5	625
Forward amplifiers 40 to 600 MHz range					
		@ 50 MHz	max 85 chs[11]	max @ 600 MHz	max
BGY681	SOT-115	12.5	−52	9.5	240
BGY683	SOT-115	14	−55	9.0	240
BGY685	SOT-115	17	−55	8.5	240
BGY685A	SOT-115	18.2	−55	8.5	240
BGY685AD[1]	SOT-115	18.5	−62	6.0	250
BGY685AL	SOT-115	18.5	−56	5.0	260
BGY687	SOT-115	21.5	−54	6.5	240
BGY687B	SOT-115	27	−53	7.0	340
40 to 600 MHz range power doublers					
BGD601	SOT-115	12.5	−62	9.5	435
BGD602	SOT-115	18.5	−62	8.0	435
BGD602D[1]	SOT-115	18	−68	7.0	440
Forward amplifiers 40 to 750 MHz range					
		@ 50 MHz	max 110 chs[13]	max @ 750 MHz	max
BGY785A	SOT-115	18.5	−53	8.0	235
BGY787	SOT-115	21.5	−51	8.0	235
40 to 750 MHz range power doublers					
BGD702	SOT-115	18	−58	9.0	435
BGD704[1]	SOT-115	20	−57	9.0	435
Forward amplifiers 40 to 860 MHz range					
		@ 50 MHz	max	max @ 860 MHz	max
BGE884[1]	SOT-115	17	—	8.0	150
BGE885	SOT-115	17	—	8.0	240
BGE887[17]	SOT-115	23[17]	—	8.5	280
BGX881	SOT-115	12.5	—	9.0	240
BGX885N	SOT-115	17	—	8.0	240
BGY885A	SOT-115	18.5	[18]	8.0	240
40 to 860 MHz range power doublers					
BGD885	SOT-115	17	—	8.0	450
Forward amplifiers 40 to 1000 MHz range					
				max @ 1000 MHz	
BGY1085	SOT-115	18.5	[18]	7.5	240

Notes

1) provisional data/advance information.
2) measured at 175.25 MHz (ch 7) with V_o=50 dBmV
3) intermodulation distortion= −60 dB (DIN 45004, para. 6.3 :tone), V_p=V_o, f_p=35.25 MHz, V_q=V_o−6 dB, f_q=42.25 MHz, measured at f_{p+q-r}=33.25 MHz
4) as 3) but with f_p=187.25 MHz, f_q=194.25 MHz, f_r=196.25 MHz, f_{p+q-r}=185.25 MHz
5) measured at 445.25 MHz (ch H22) with V_o=46 dBmV
6) as 3) but with f_p=440.25 MHz, f_q=447.25 MHz, f_r=449.25 MHz, f_{p+q-r}=438.25 MHz
7) high slope pre-amphasis, for details see data sheet
8) 36 channels; measured at 433.25 MHz (ch H20) with V_o=46 dBmV
9) measured at 547.25 MHz (ch 27) with V_o=44 dBmV
10) as 3) but with f_p=540.25 MHz, f_q=547.25 MHz, f_r=549.25 MHz, f_{p+q-r}=538.25 MHz
11) measured at 595.25 MHz (ch 35) with V_o=44 dBmV
12) as 3) but with f_p=590.25 MHz, f_q=597.25 MHz, f_r=599.25 MHz, f_{p+q-r}=588.25 MHz
13) measured at 745.25 MHz with V_o=44 dBmV
14) as 3) but with f_p=740.25 MHz, f_q=747.25 MHz, f_r=749.25 MHz, f_{p+q-r}=738.25 MHz
15) as 3) but with f_p=341.25 MHz, f_q=348.25 MHz, f_r=350.25 MHz, f_{p+q-r}=339.25 MHz
16) as 3) but with f_p=851.25 MHz, f_q=858.25 MHz, f_r=860.25 MHz, f_{p+q-r}=849.25 MHz
17) frequency range: 470 - 860 MHz, gain measured at 470 MHz
18) see specific date sheet for preliminary data

GENERAL-PURPOSE HYBRID AMPLIFIERS

type number	supply current (mA)	stages	gain (dB)	noise figure (dB)	output at 1 dB gain comp (dBm)	third-order intercept point (dBm)	$V_o$rms[1] (dBμV)	V_{out} d_{im} = −60 dB (DIN45004A1) (dBμV)	max VSWR[2] input	max VSWR[2] output
12 V supply-"low noise"-CECC, 40–860 MHz										
OM2045	11.5	1	12	3.6	+5.4	+17.2	99	76	2.0	1.4
OM2050	18	2	18	5.2	+6.7	+18.2	100	81	1.5	1.9
OM2052	42	2	28	4.5	+13.4	+25.2	107	—	2.2	2.1
OM2060	56	3	23	5.4	+13.4	+25.2	107	87	1.4	1.6
OM2061	51	3	28	4.4	+13.4	+25.2	107	86	1.5	1.7
OM2063	52	3	29	3.6	—	+23.2	105	85	2.3	1.4
OM2064	52	3	28	4.0	—	+23.2	105	—	1.3	1.5
OM2070	100	3	28	4.8	+20.8	+30.2	112	95	2.3	1.9
12 V supply-"high level"-40–860 MHz										
OM2046	61	1	10	8.4	—	+32.2	114	—	1.5	1.5
OM2070B	100	3	30	4.8	—	+30.2	112	95	2.3	1.9
OM2081[4]	85	1	10	7.5	—	+33.2	115	105	1.4	1.4
OM2082[6]	135	2	20	7.5	—	+33.2	115	105	1.4	1.4
OM2083[6]	165	3	27	7.5	—	+33.8	115	105	1.4	1.4
24 V supply, 40–860 MHz										
OM320*	33	2	15.5	5.5	—	—	92	—	2.2	2.5
OM321*	33	2	15.5	6.0	—	—	98	—	2.5	2.0
OM335*	35	3	27	5.5	—	—	99	—	1.9	3.2
OM322*	60	2	15	7.0	—	—	103	—	1.7	1.7
OM336*	65	3	22	7.0	—	—	105	—	1.4	1.6
OM339*	66	3	28	6.0	—	—	107	—	1.5	1.5
OM323[3]*	100	2	15	9.0	—	—	111	—	1.9	2.3
OM337*	115	3	26	9.8	—	—	113	—	2.3	1.8

12 V supply "satellite IF band"

type number	supply current (mA)	stages	gain (dB)	noise figure (dB)	frequency range	$V_o$rms[5] (dBμV)	max VSWR[2] input	max VSWR[2] output
OM926	28	2	15-18	6.5	10-1750	111	1.7	1.7
OM926E	37.5	2	15-20	6.5	10-2050	113	2.2	1.9
OM926ESM	40	2	15-20	4.5	950-2050	115	1.7	1.7
OM956/16[6]	45	3	20-24	4.5	950-2050	111	1.7	1.7

*CONTACT FACTORY FOR AVAILABILITY
1) measured at −60 dB intermodulation distortion to DIN45004B, par.6.3, 3-tone
2) the typical maximum VSWR occuring in the frequency range for a sample connected to a 75Ω line
3) also available as A version without internal collector coil and blocking capacitor
4) for 40-600 MHz frequency range
5) measured at −35 dB intermodulation distortion to DIN45004B, par.6.3, 3-tone
6) under development

VIDEO PREAMPLIFIERS (DIRECT DRIVE OF VIDEO AMPLIFIERS)

type number	supply (V)	input signal peak-peak (V)	max gain (V_o/V_i)	gain control (dB)	clamping	rise & fall times (ns)	output DC load (mA)	remarks
OM3016	12	0.7 (+video)	4	>40 dB (non-linear)	internal	≤1.8	limited by 0.47μF output capacitor	B & W high resolution
OM3026	12	0.7 (+video)	5	>40 dB (linear)	external DC input for feedback clamp	≤1.8	up to 20	colour high resolution

VIDEO OUTPUT AMPLIFIERS

type number	supply (V)	total power dissipation (W)	voltage gain[3] (V_o/V_i)	external load resistance (Ω)	output signal[3] peak-peak (V)	rise & fall times[1] (ns)	remarks
CR2424	70		12.4		40	2.3	mono/colour, 1 channel
CR2425	70		12.4		40	2.3	
CR2427	70		12.4		40	2.3	
CR3424	90		12.4		50	2.5	mono/colour, 1 channel
CR3425	90		12.4		50	2.5	
CR3427	90		12.4		50	2.5	
CR4424[2]	90		12.4		50	1.9	1 channel
CR4425[2]	90		12.4		50	1.9	
CR4427[2]	90		12.4		50	1.9	
CR5527[2]	90		12.4		50	3.0	3 channels
OM925	105	≤4.5	20	400	50	≤4	for 64kHz line frequency monitors
OM975	100	≤10	20	—	50	≤2.5	for highest resolution monitors
OM976	90	≤8	16	—	40	≤2.7	for highest resolution monitors
OM977	80	≤14	90 max	—	50	≤1.6	0.7 V_{p-p} @ 50Ω in, linear gain control, top resolution
OM978	95	≤20	18	—	50	≤2.8	triple amp in style of OM976

1) with 8.5 pF load at 40V_{p-p} 2) subject to modification 3) typical value

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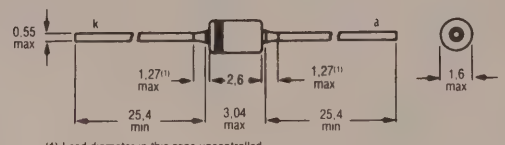
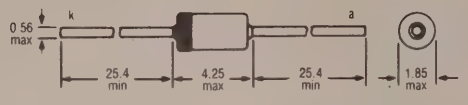
PHILIPS DISCRETE SEMICONDUCTORS

DO-34



(1) Lead diameter in this zone uncontrolled

DO-35



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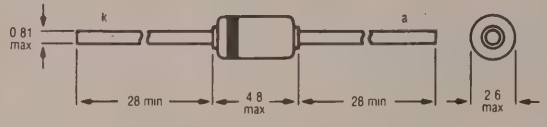
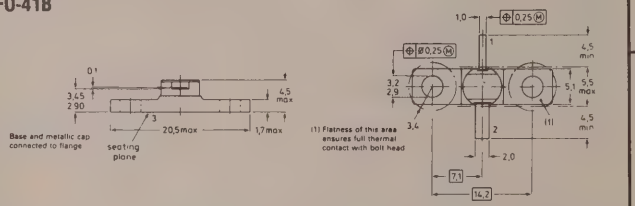
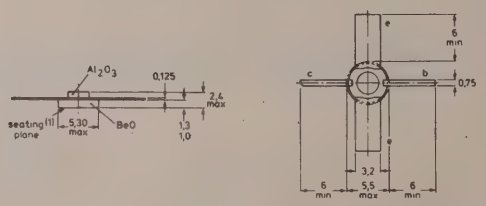


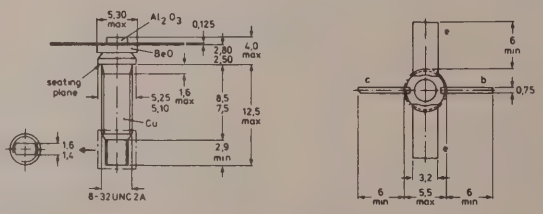
FO-41B


Base and metallic cap connected to flange
seating plane
20,5 max
1,7 max
(1) Flatness of this area ensures full thermal contact with bolt head

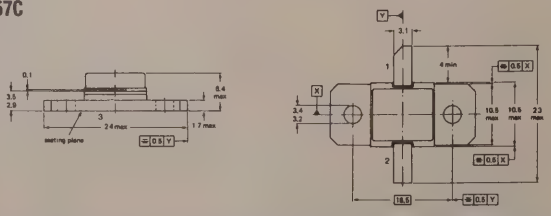
FO-45



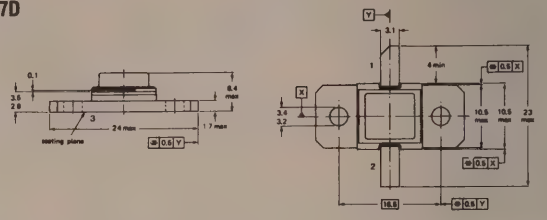
FO-46



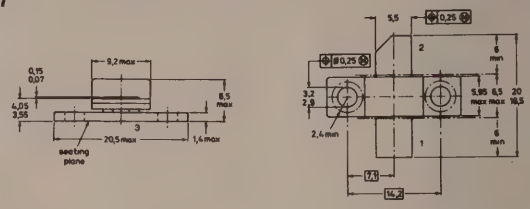
FO-57C



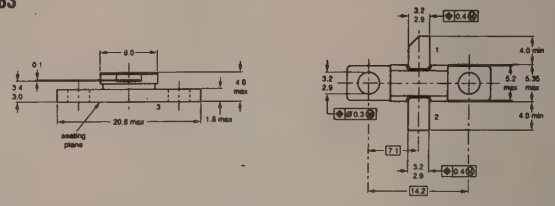
FO-57D



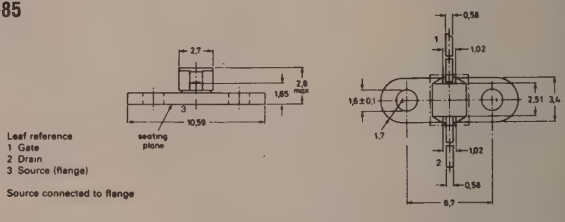
FO-67



FO-83



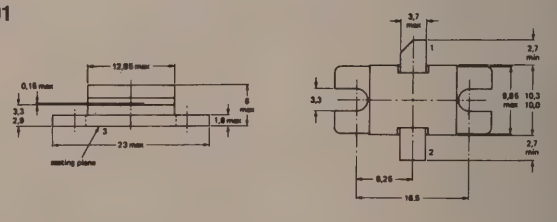
FO-85



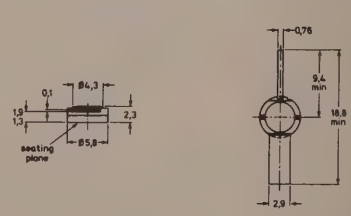
Leaf reference
1 Gate
2 Drain
3 Source (flange)

Source connected to flange

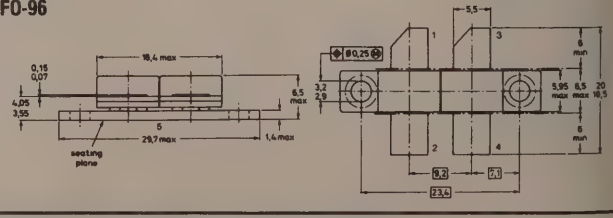
FO-91



FO-93



FO-96



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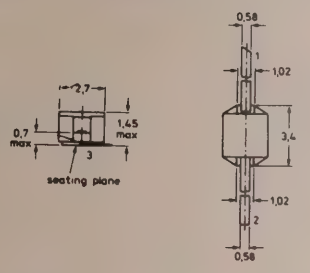
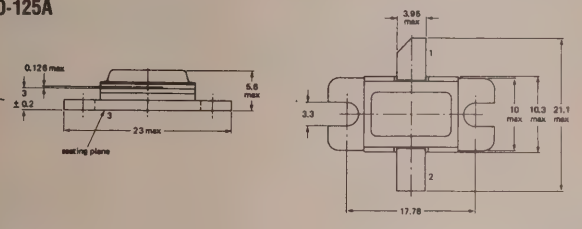
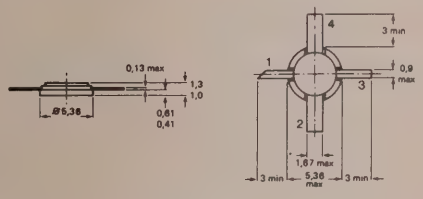
FO-102



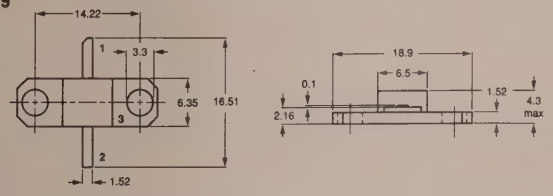
FO-125A



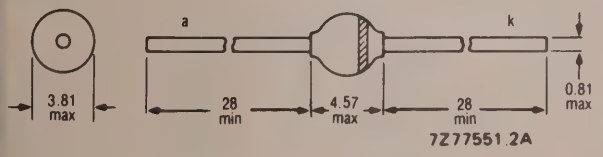
FO-163



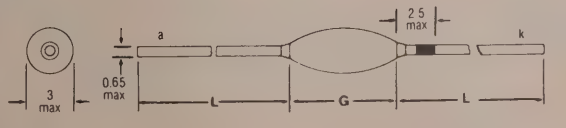
FO-229



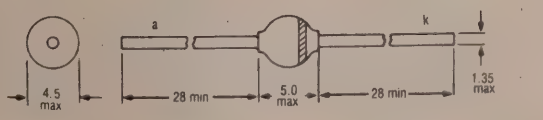
SOD-57



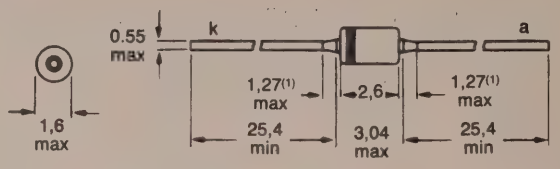
SOD-61



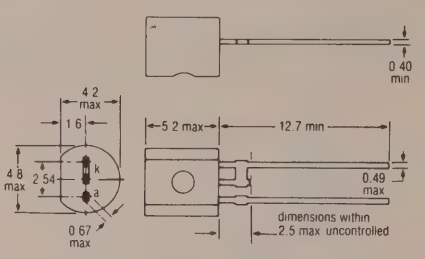
SOD-64



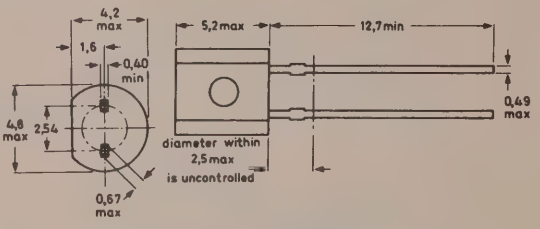
SOD-68



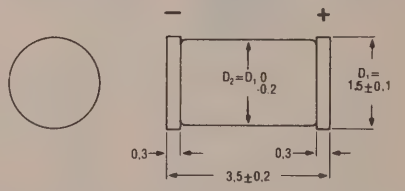
SOD-69



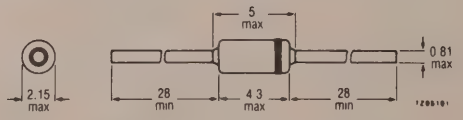
SOD-70



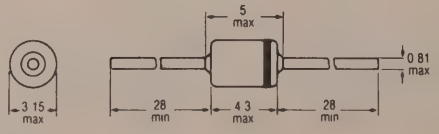
SOD-80C



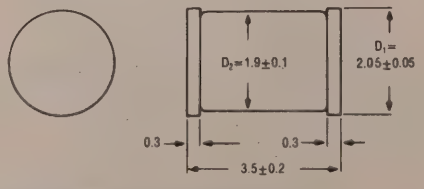
SOD-81



SOD-84



SOD-87



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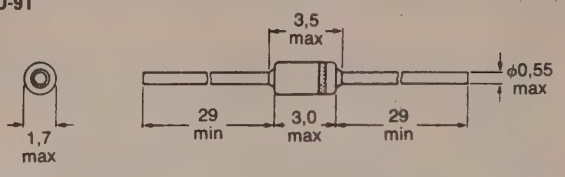
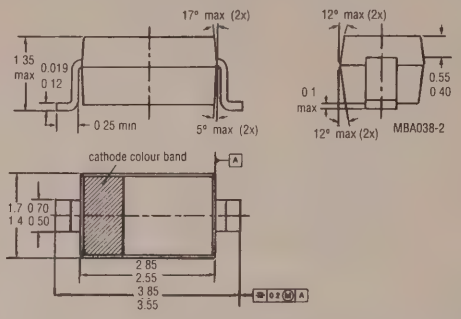
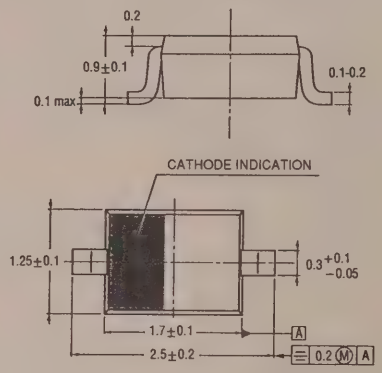
SOD-91



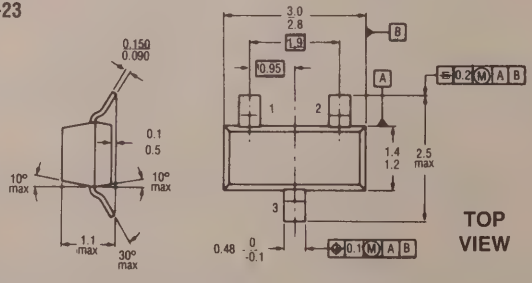
SOD-123



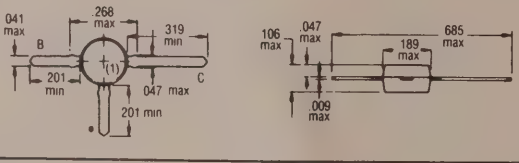
SOD-323



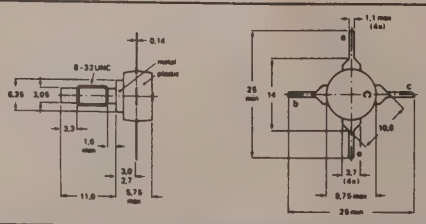
SOT-23



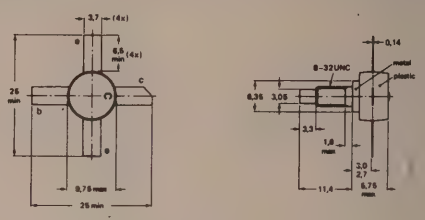
SOT-37



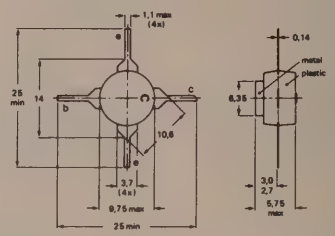
SOT-48



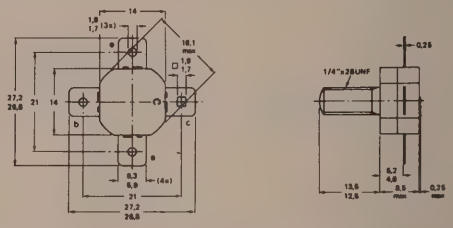
SOT-48(2)



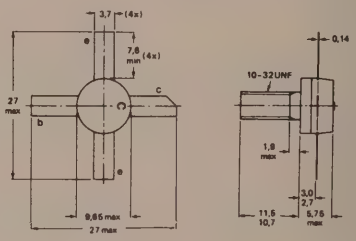
SOT-48(3)



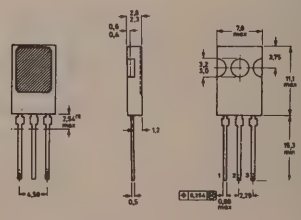
SOT-55



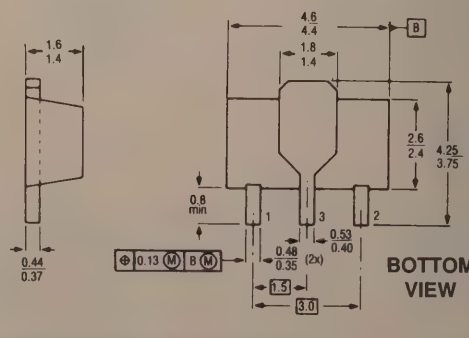
SOT-56



SOT-82



SOT-89



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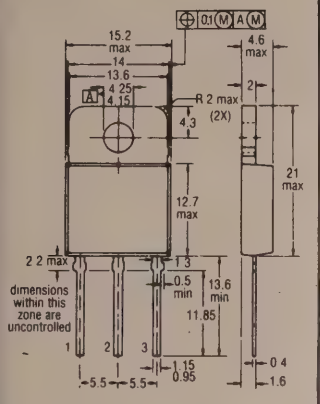
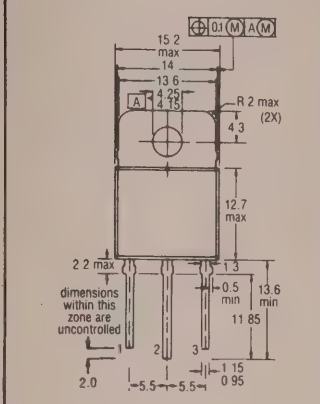
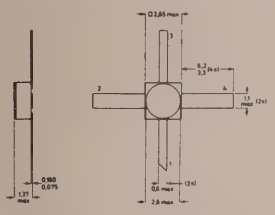
SOT-93



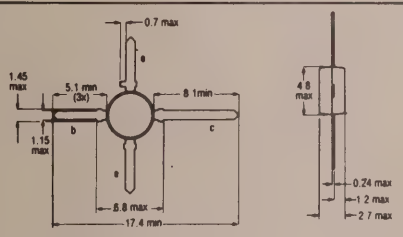
SOT-93A



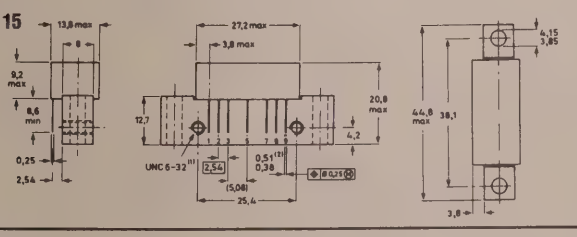
SOT-100



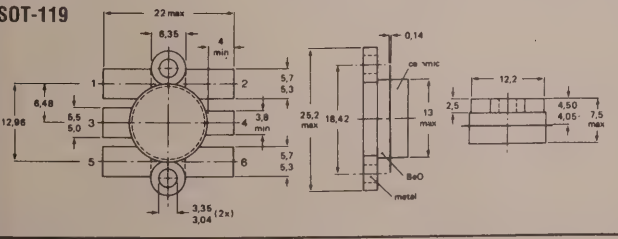
SOT-103



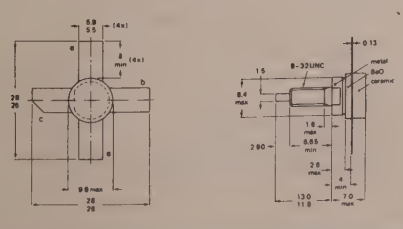
SOT-115



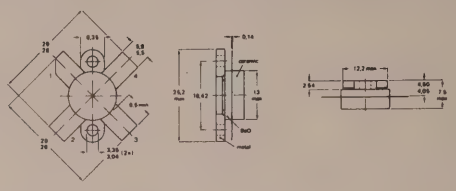
SOT-119



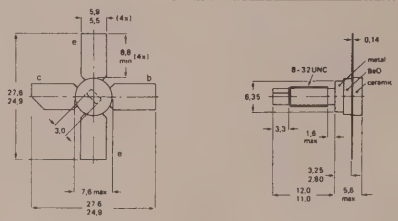
SOT-120



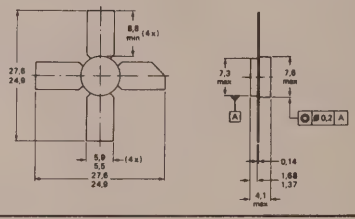
SOT-121



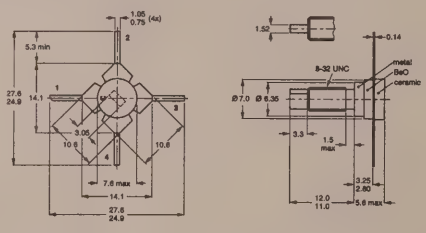
SOT-122



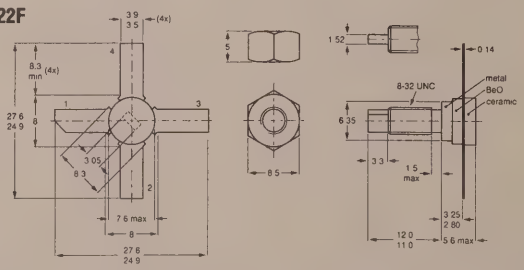
SOT-122D



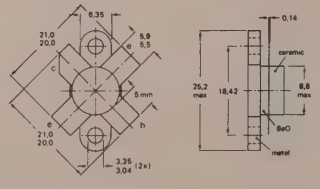
SOT-122E



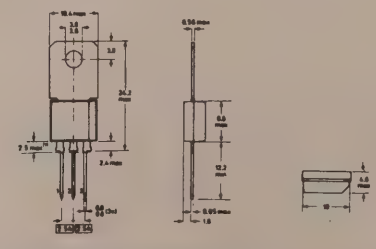
SOT-122F



SOT-123



SOT-128B



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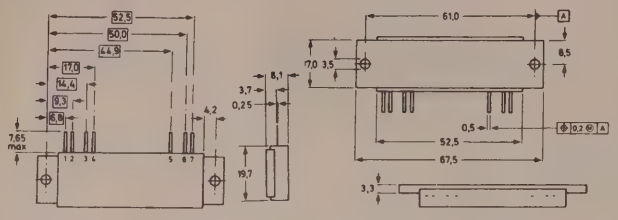
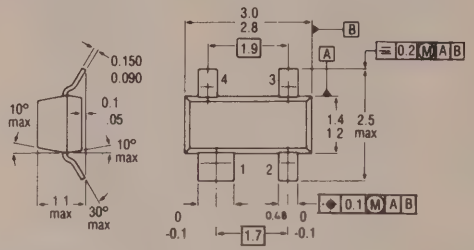
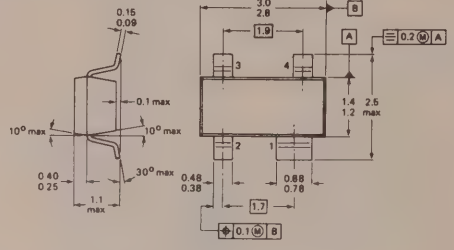
SOT-132B



SOT-143



SOT-143R



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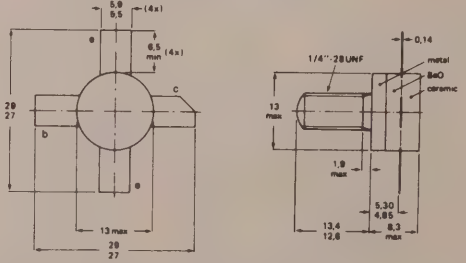

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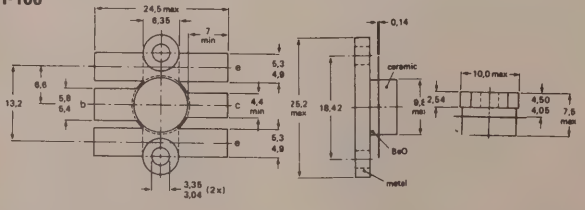

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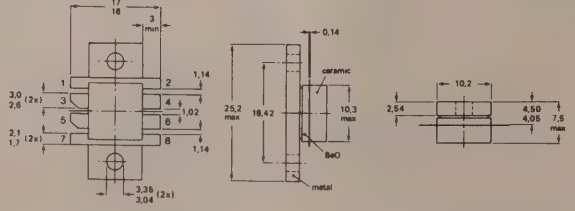

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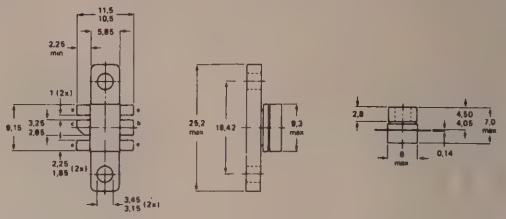

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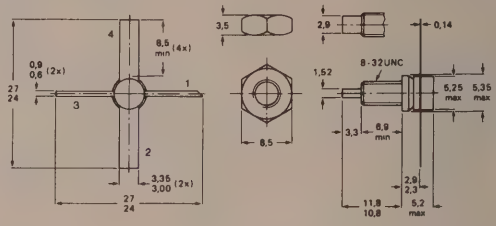

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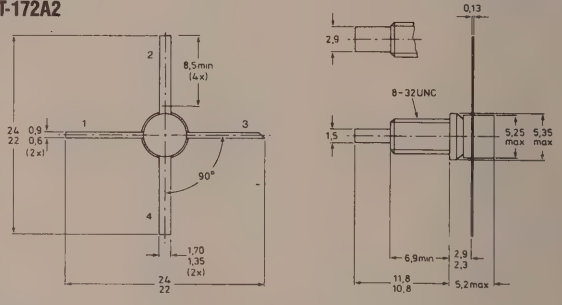

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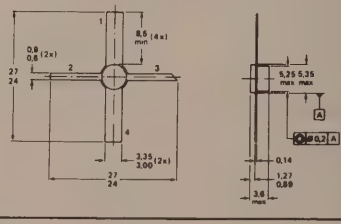

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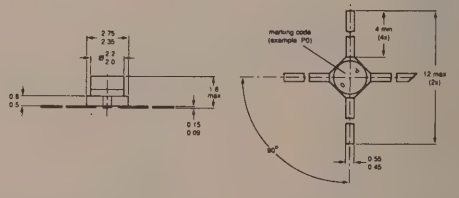

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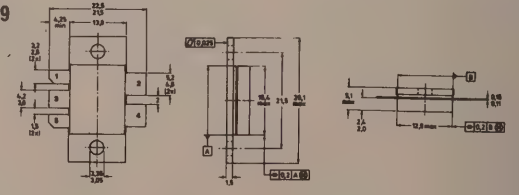

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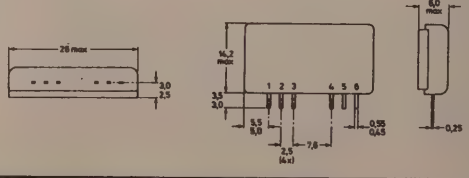

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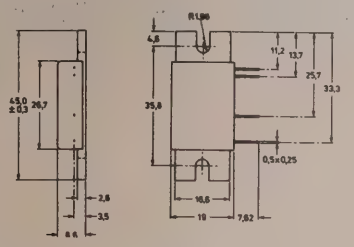

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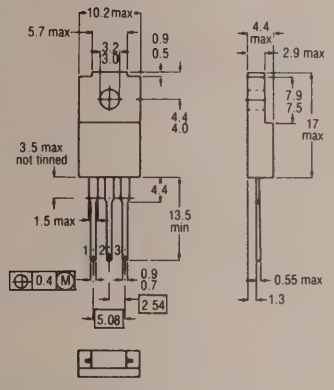

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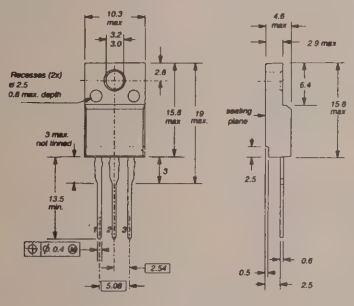

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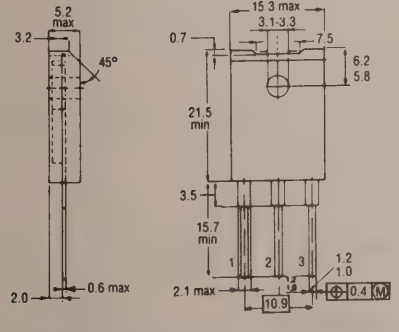

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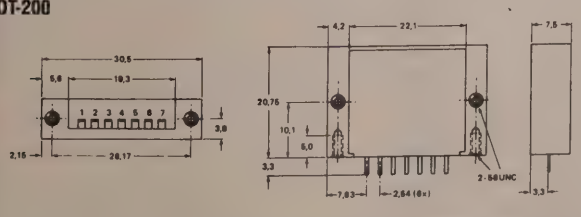

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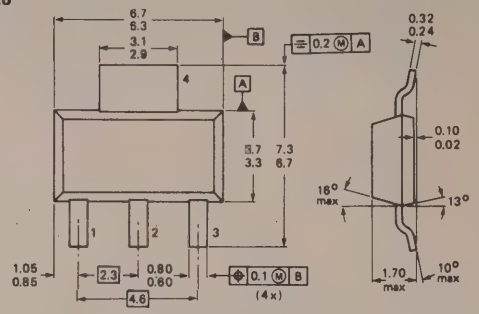

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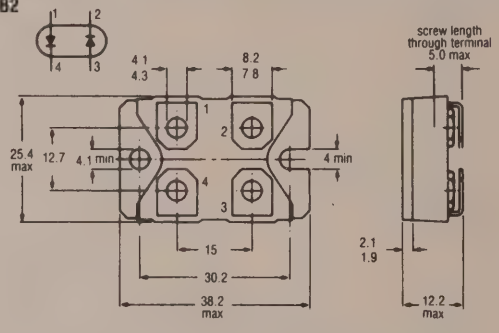

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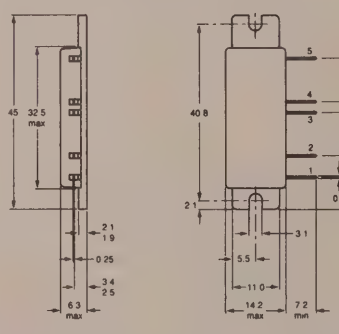

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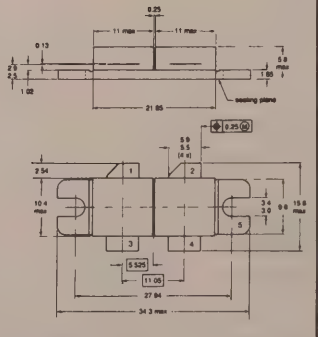

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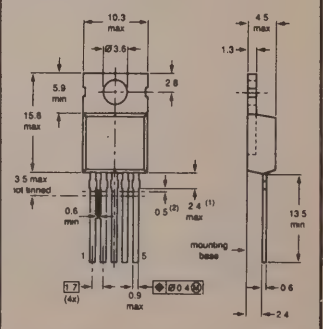

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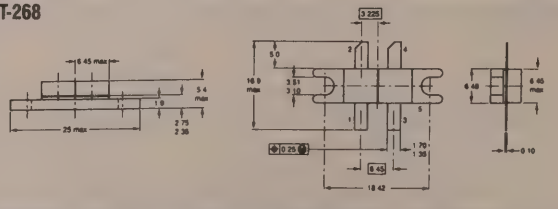

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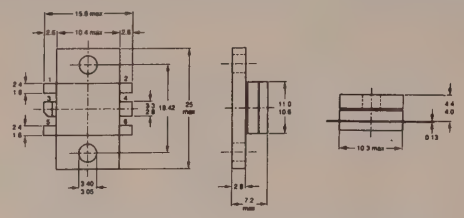

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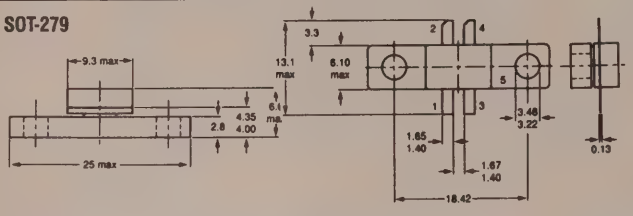

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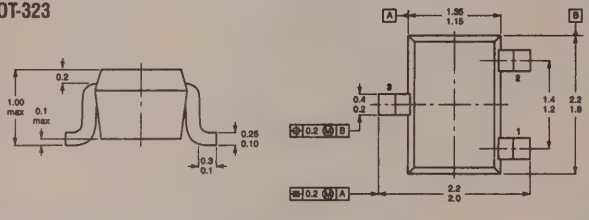

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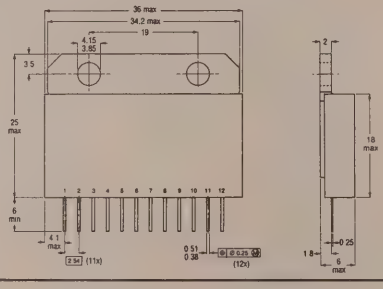

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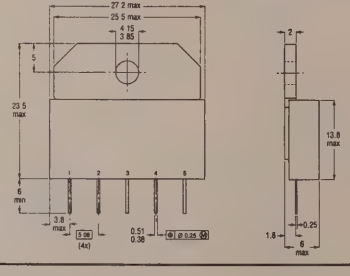

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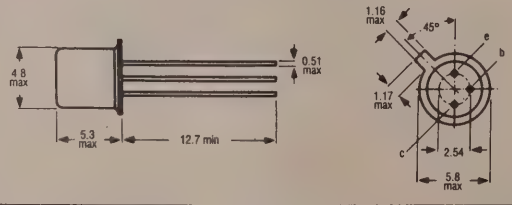

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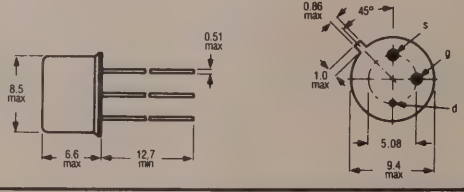

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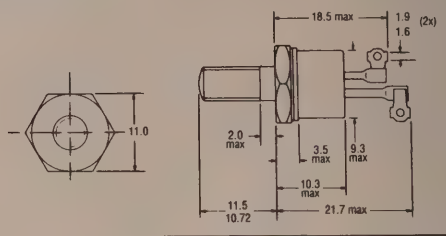

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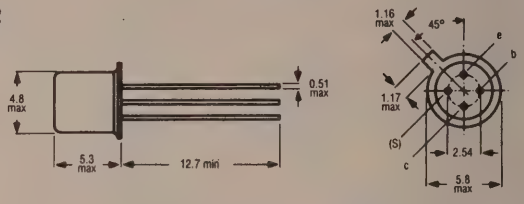

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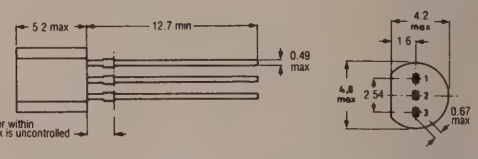

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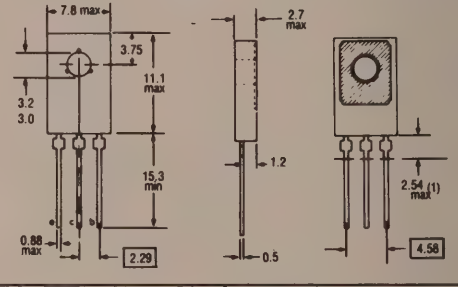

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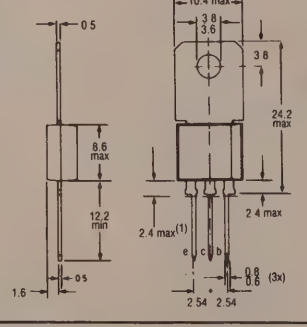

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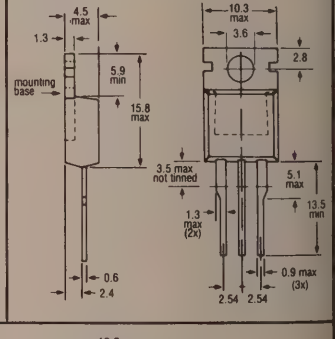

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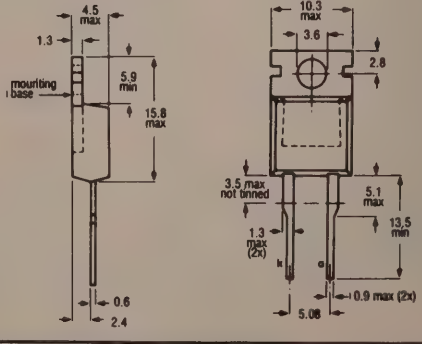

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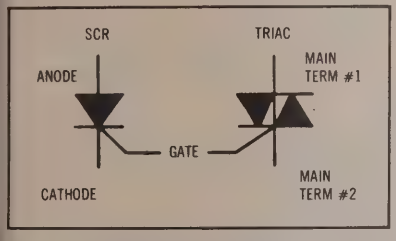
MINIGLOSSARY THYRISTORS/ HIGH POWER DIODES

THYRISTORS

A thyristor is a four-layer semiconductor (pnpn) that can be switched from an OFF to an ON state. This is usually done by a voltage or current pulse to the gate terminal. The device will then continue to conduct so long as the principal current of the device flows through the thyristor's two main terminals.

In many respects a thyristor is analogous to an electromechanical latching relay. In fact, thyristors have largely replaced these relays in newer equipment designs. But, misapplications and/or failure to fully understand the parameters of these and other solid state devices often leads to catastrophic field failures.

The terminology shown on this page has been condensed from common industry data books and is intended to be a guide for the engineer.



di/dt: *Critical rate of rise of ON state current* is the user's maximum design limit (Fig. 1).

di_R/dt: *Rate of decay of ON state current* (Fig. 1 & 2).

dv/dt (critical): *Rate of rise of OFF state voltage.* Lowest voltage rate of rise to cause a thyristor to turn ON.

dv/dt (reapplied) : *Rate of rise of reapplied OFF state voltage.*

I_{FSM}: *Nonrepetitive ON state surge current in diodes.* Maximum peak value of ½ cycles (60 Hz) a diode can withstand up to 100 times in its lifetime.

I_{TSM}: *Nonrepetitive ON state surge current in thyristors.* Maximum peak value of 60 Hz cycles a thyristor can withstand up to 100 times in its lifetime.

I_{DRM}/I_{RRM}: *Maximum peak forward/ reverse leakage current* at specified temperature and repetitive conditions.

I_{GDM}: *Continuous gate current not to trigger.* Highest dc gate current that will *not* cause thyristor to switch from OFF to ON at a specific temperature.

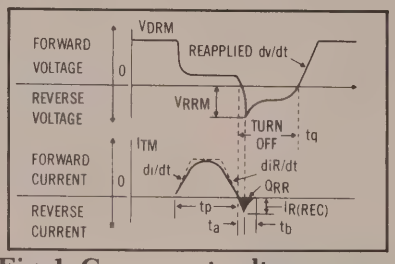


Fig. 1. Concurrent voltage and current waveforms

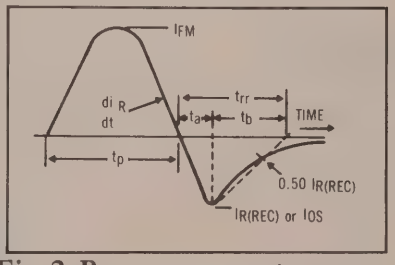


Fig. 2. Recovery current waveform

I_{GT}: *Continuous gate trigger current.* Absolute minimum gate current required to switch thyristor from OFF to ON.

I_H: *Holding Current.* Minimum current required to hold thyristor ON.

I_L: *Latching current.* Minimum current required to hold thyristor ON after removal of gate drive.

$I_{(REC)}$; *Recovery current.* Peak value of reverse current during recovery or turn OFF (Fig. 1 & 2).

I_{OS}: *Overshoot current.* See $I_{R(REC)}$.

I^2t: Maximum ON state, short time thermal capacity of the silicon element for operations less than ½ cycle of 180° conduction angle.

$I_{T(AV)}$: *Average ON state current* (max.)

Q_{RR}: *Reverse recovered charge* (Fig. 1).

$R_{\theta JC}$: *Junction-to-case thermal resistance* in degrees C per watt.

$T_{C(MAX)}$: *Max. allowable case temperature.*

$T_{J(MAX)}$: *Maximum allowable junction temp.*

t_d: *Delay time.* Interval between a specified point at beginning of gate pulse and the instant at which the principal voltage drops to a specified value. (OFF-ON) (Fig. 3)

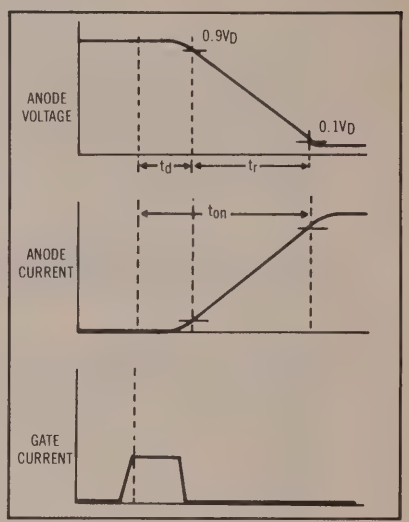


Fig. 3. Turn-on time waveforms

t_{on}: *Turn-on time.* The sum of delay time and rise time. (OFF-ON) (Fig. 3)

t_q: *Turn-off time.* Time between principal current reaching zero and the instant thyristor can block forward voltage without turning ON. (Fig. 1)

t_r: *Rise time.* Time between principal voltage dropping from one value to a second lower value when thyristor turns from OFF to ON. (Fig. 3)

t_{rr}: *Reverse recovery time.* (Fig. 2)

V_{DRM}/V_{RRM}: *Maximum repetitive peak OFF state/reverse voltage* excluding non-repetitive transients.

V_{DSM}/V_{RSM}: *Maximum nonrepetitive peak OFF state/reverse voltage.*

V_{FM}/V_{TM}: *Maximum forward voltage drop* at a specific forward current and case temp.

V_{GDM}: *Gate nontrigger voltage.* Highest dc voltage that will *not* cause thyristor to switch from OFF to ON.

V_{LATCH}: *Latching voltage.* Voltage required for thyristor to latch ON at a given gate current and junction temp.

$V_{TM(DYN)}$: *Dynamic ON state voltage.* Transient ON state voltage of thyristor when triggered into conduction for a given load and time.

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Varistors (Voltage Compensating Diodes)	
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TRIACS	0.8 to 45 amperes, with voltages up to 1000 volts in a variety of case styles to accommodate most applications
MICROPROCESSORS/RAM's	Seven popular microprocessors and their peripherals, SRAM, DRAM & PROMs in various size configurations
MECHANICAL ACCESSORIES	
IC Sockets	Standard low profile, wire wrap and shrink type (.070 ctrs)
Insulator (Mica/Rubber)	
Transistor Sockets	
Heat Sinks/Clamps	
Transistor Mounting Kits	

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Philips ECG

A North American Philips Company

PRODUCT SELECTION GUIDES

TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 93/94 EDITION OF EEM

AC Power Supplies, Product Selection Guide D•2221
Batteries, Product Selection Guide D•1419
Cabinets, Enclosures, Racks & Chassis, Product Selection Guide C•1003
Capacitors, Product Selection Guide A•1003
Coils, Chokes, Inductors, Product Selection Guide A•1179
Connectors, Terminals & Sockets, Product Selection Guide C•1139
Cores, Magnets & Ferrites A•1317
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide A•1326
DC-DC Converters D•2049
DC Power Supplies, Product Selection Guide D•1488
Delay Lines, Product Selection Guide A•1513
Discrete Semiconductors, Product Selection Guide A•2130
Displays, Readouts, & CRTs, Product Selection Guide B•1017
Fans, Blowers, Cooling Equipment, & Heat Exchangers, Product Selection Guide C•1557
Fiber Optics, Product Selection Guide B•1200
Filters, Power, Product Selection Guide A•1584
Filters, Signal, Product Selection Guide A•1617
Instruments, Test & Measuring, Product Selection Guide D•1215
Interconnection Systems, Product Selection Guide C•1670
Keyboards & Keypads, Product Selection Guide B•1818
Lamps, Lights, & Indicators, Product Selection Guide B•1131
Microwave Components, Product Selection Guide A•1719
Military Qualified Products List B•1002
Motors, Drives, & Rotating Components, Product Selection Guide B•1231
Oscilloscopes, Product Selection Guide D•1402
Panel Hardware, Product Selection Guide C•1522
Panel Meters, Analog & Digital, Product Selection Guide D•1336
Potentiometers, Trimmers, Controls, & Rheostats, Product Selection Guide A•2053
Power Supplies, AC, Product Selection Guide D•2221
Power Supplies, DC, Product Selection Guide D•1488
Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide B•1341
Relays, Product Selection Guide B•1401
Resistors, Product Selection Guide A•1859
Solenoids, Product Selection Guide B•1626
Switches, Product Selection Guide B•1658
Thermal Components, Product Selection Guide B•1857
Transducers & Encoders, Product Selection Guide B•1911
Transformers, Product Selection Guide A•2229
Wire & Cable, Product Selection Guide C•1701

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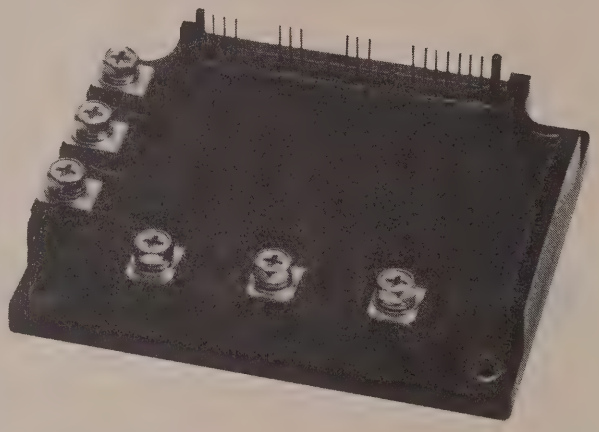
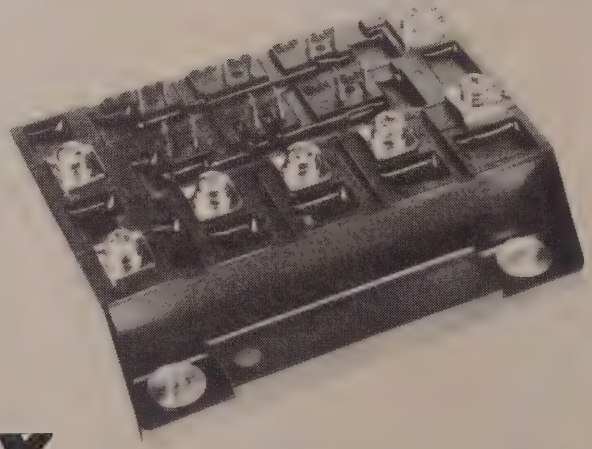
Then there's our family of IGBT isolated modules. Powerex IGBTs outperform the competition by 10-15% in even the harshest environments. Features like square switching, large safe-operating area, reduces steady-state switching, and increased short circuit withstand time, make Powerex IGBT's the natural choice for applications that call for maximum durability. Designed for 20 Khz operation with rating to 15-600A/600-1400V or our genuine low Vce (SAT) G-Series™ for ≤ 5 Khz.

To choose from lead, stud, disc or modular packages in product lines listed below, or for additional product information and technical support, contact Powerex Marketing Department or Applications Department.

INTELLIMOD™
Design Friendly



IGBT
Performance Tough



- **Standard Rectifiers** 1.5-4800A, 50-4400V
- **Fast Recovery Rectifiers** 1.5-1500A, 50-3500V, 3-25 μsec
- **Phase Control Thyristors** .5-2750A, 25-4500V
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TWX: 510/468-2840, Rapifax: 412/925-4393,
Literature request, call Toll Free: 1-800-451-1415.

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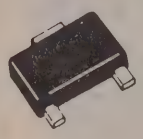
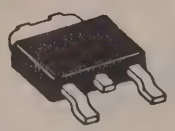
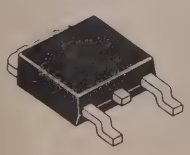
Twin Oaks, CA 93518
TEL: (805) 867-2555
FAX: (805) 867-2698

Case Style	Type	Circuit	Type No.	Io (A)	V_{FM} (V)	V_{RRM} (V)										
						20	30	40	50	60	90	100	200	300	400	600
D-64	Rectifier Diode	Single Chip	EC10DS1	1.0	1.1							•				
			EC10DS2										•			
			EC10DS4												•	
			EC10DS6													•
	Schottky Barrier Diode (S.B.D.)		EC10QS03		.55		•									
			EC10QS04					•								
			EC10QS05		.58				•							
			EC10QS06							•						
			EC10QS09		.85						•					
			EC10QS10									•				
			EC10QS02L		.30	•										
			EC15QS03	1.5	.55		•									
			EC15QS04					•								
	Fast Recovery Diode (F.R.D.)		EC11FS1	1.0	.98							•				
			EC11FS2										•			
			EC11FS3		1.3									•		
			EC11FS4												•	
			EC8FS6	.8												•
SOT-89 	Rectifier Diode	Single Chip	E10DS1	1.0	1.0							•				
			E10DS2										•			
			E10DS4												•	
	Schottky Barrier Diode (S.B.D.)		E10QS03	1.0	.55		•									
			E10QS04					•								
			E10QS05		.58				•							
			E10QS06							•						
			E10QS09		.85						•					
			E10QS10									•				
	Fast Recovery Diode (F.R.D.)		E11FS1	1.0	.98							•				
			E11FS2										•			
			E11FS3		1.2									•		
			E11FS4												•	
TO-252AA 	Schottky Barrier Diode (S.B.D.)	Single Chip	30VQ03(F)	3.0	.62		•									
			30VQ04(F)					•								
			30VQ05(F)		.71				•							
			30VQ06(F)							•						
			30VQ09(F)		.92						•					
			30VQ10(F)									•				
			50VQ03(F)	5.0	.67		•									
			50VQ04(F)					•								
			50VQ05(F)		.72				•							
			50VQ06(F)							•						
			50VQ09(F)		.95						•					
			50VQ10(F)									•				
		Center Tap	4VQ03CT(F)	4.0	.55		•									
			4VQ04CT(F)					•								
			4VQ05CT(F)		.60				•							
			4VQ06CT(F)							•						
			4VQ09CT(F)		.85						•					
			4VQ10CT(F)									•				
			6VQ03CT(F)	6.0	.55		•									
			6VQ04CT(F)					•								
			6VQ05CT(F)		.60				•							
			6VQ06CT(F)							•						
			6VQ09CT(F)		.85						•					
			6VQ10CT(F)									•				
SQUARE-PAK TO-263AB 	Schottky Barrier Diode (S.B.D.)	Center Tap	C10T04Q	10	.55			•								
			C10T06Q		.58					•						
			C10T10Q		.85							•				
			C16T06Q	16	.62					•						
			C25T04Q	25	.55			•								
			C25T06Q		.62					•						
			C25T10Q		.85							•				
	Fast Recovery Diode (F.R.D.)		C10T10F	10	.98							•				
			C10T20F										•			
			C10T30F		1.2									•		
			C10T40F												•	
			C16T10F	16	.98							•				
			C16T20F										•			
			C16T30F		1.2									•		
			C16T40F												•	

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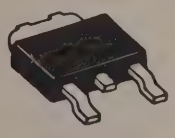
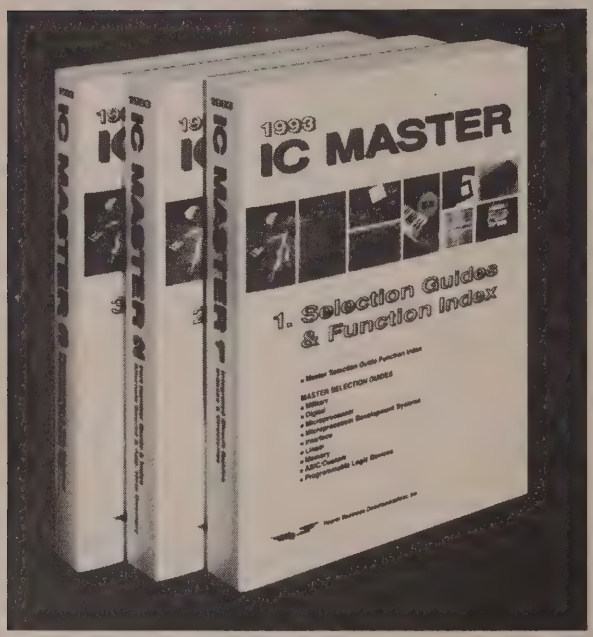
Case Style	Type	Circuit	Type No.	Io (A)	V_{FM} (V)	V^{RRM}(V)									
						20	30	40	50	60	90	100	200	300	400	600
FLAT-PAK	Rectifier Diode	Single Chip	NSD03A10	3.0	1.0							•				
			NSD03A20										•			
			NSD03A40												•	
	Shottky Barrier Diode (S.B.D.)		NSQ03A02L	3.0	0.45	•										
			NSQ03A03		0.5		•									
			NSQ03A04		0.525			•								

Case Style	Type	Type No.	BV_{dds} (V)	R_{ds} (Ω)	I_d (A)	Note
TO-252AA 	MOSFET (N-CHANNEL)	ME4N20	200	0.70	4.0	
		ME6N10	100	0.25	6.0	
		ME8N06E	60	0.15	8.0	
		ME12NO6EL	60	0.18	12.0	Logic Level
		ME13NO6E	60	0.12	13.0	
TO-251/TO-252AA (Add suffix "F" for TO-252AA)	MOSFET (P-CHANNEL)	ME4PO6	-60	0.60	-4.0	
		ME8PO6	-60	0.30	-8.0	

Case Style	0.9W SMD Zener Diodes					NZF Series			
	Part Number		V_Z (V)			r_d(Ω)		I_s(MA)	
	Type	Suffix	Min	Max	Iz(MA)	Max	Iz(MA)	Max	VR(V)
D-64	NZF6.2	BP CP	5.8 6.2	6.6 7.0	40	6	40	20	3.0
	NZF6.8	BP CP	6.4 6.8	7.2 7.7	40	6	40	20	3.5
	NZF7.5	BP CP	7.0 7.5	7.9 8.4	40	4	40	20	4.0
	NZF8.2	BP CP	7.7 8.2	8.7 9.3	40	4	40	20	5.0
	NZF9.1	BP CP	8.5 9.1	9.6 10.2	40	6	40	20	6.0
	NZF10	BP CP	9.4 10.0	10.6 11.2	40	6	40	10	7.0
	NZF11	BP CP	10.4 11.0	11.6 12.3	20	8	20	10	8.0
	NZF12	BP CP	11.4 12.0	12.6 13.5	20	8	20	10	9.0
	NZF13	BP CP	12.4 13.3	14.1 15.0	20	10	20	10	10.0
	NZF15	BP CP	13.8 14.7	15.6 16.5	20	10	20	10	11.0
	NZF16	BP CP	15.3 16.2	17.1 18.3	20	12	20	10	12.0
	NZF18	BP CP	16.8 18.0	19.1 20.3	20	12	20	10	13.0
	NZF20	BP CP	18.8 20.0	21.2 22.4	20	14	20	10	15.0
	NZF22	BP CP	20.8 22.0	23.3 24.5	10	14	10	10	17.0
	NZF24	BP CP	22.8 24.0	25.6 27.6	10	16	10	10	19.0
	NZF27	BP CP	25.1 27.0	28.9 30.8	10	16	10	10	21.0
	NZF30	BP CP	28.0 30.0	32.0 34.0	10	18	10	10	23.0
	NZF33	BP CP	31.0 33.0	35.0 37.0	10	18	10	10	25.0
	NZF36	BP CP	34.0 36.0	38.0 40.0	10	20	10	10	27.0

SSSUPER TTIME SSSAVER!



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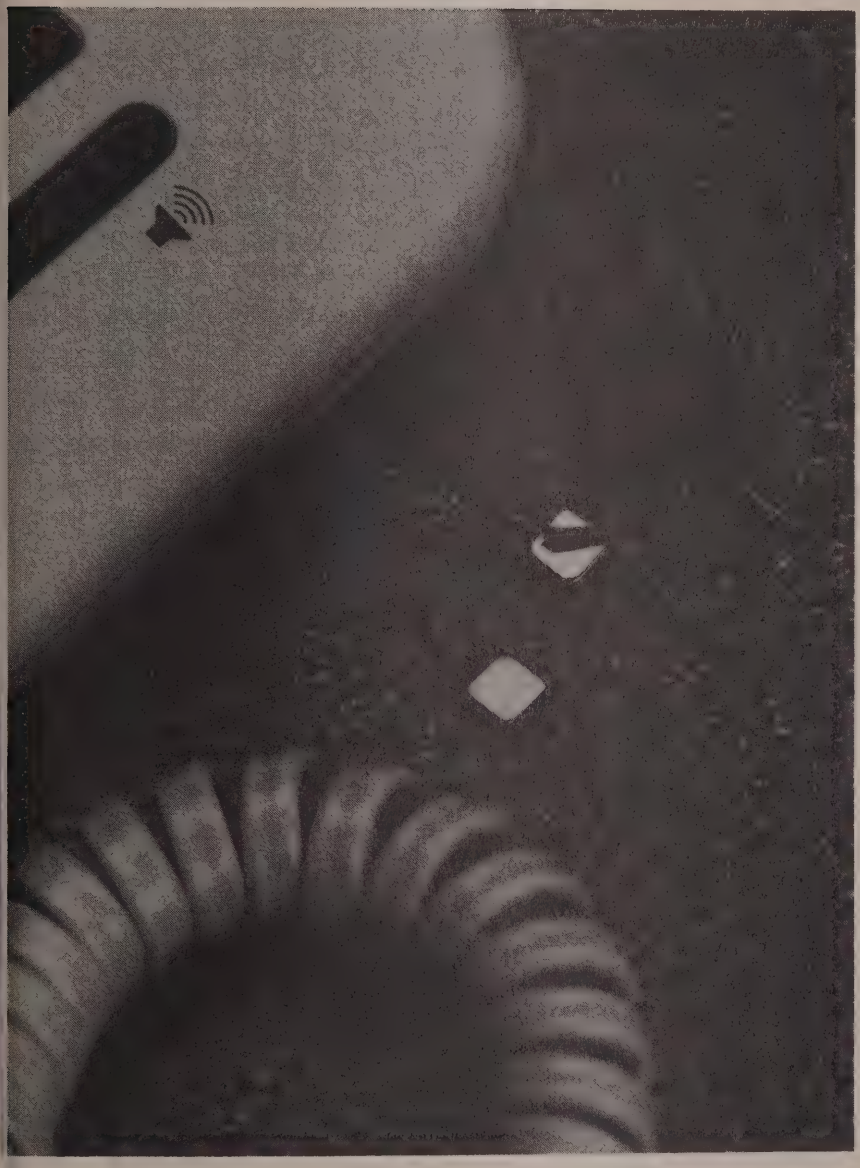

PolySwitch overcurrent protector TR600-150 is a positive temperature coefficient (PTC) device that acts like a resettable fuse to protect sensitive phone circuits from fault conditions. When a fault occurs, the PolySwitch device increases in resistance several orders of magnitude from its base resistance. When the resistance is increased, current is typically reduced to a few millamps. Unlike a fuse, once the fault condition is removed, the PolySwitch device will reset so normal circuit operation can resume.

The PolySwitch TR600-150 is "hold current" or "carry current" rated at .150 amps. It will "trip" at approximately .225 amps, shutting down the fault current before damage to the interface can occur. This is an important point, because most protection devices that are lightning robust will not trip until an overcurrent fault of >.500 amps exists.

The PolySwitch advantage: resettable protection

As mentioned before, PolySwitch protection devices reset themselves after an overcurrent fault is removed. This means that for the majority of overcurrent faults, the PolySwitch device (like a fuse) shut down the current and protect the circuit, but (unlike a fuse) restore the circuit to operative status once the fault is removed. This resettability eliminates service calls and loss of telecommunications system availability.

Many prominent equipment manufacturers use PolySwitch devices

PolySwitch devices have been in use for years as resettable overcurrent protection elements used by PBX, KTS, and other CPE primary protection module manufacturers, and central office switch manufacturers all over the world. More than 35 million phone line connections are protected by PolySwitch devices worldwide.

Part Number	Maximum Voltage	Rated Current (20°) (amps)		Nominal R (ohms)	Recognized By	Dimensions (inches)			Diagram
		Hold	Max			A	B	C	
TR250-120	250	.120	3	6.0	UL	.25	.25	.18	
TR250-145	250	.145	3	4.5	UL	.25	.25	.18	
TR600-150	600	.150	3	9.0	UL	.53	.35	.23	

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Corporate Profile

Semtech Corporation, headquartered in Newbury Park, California, manufactures high quality semiconductor products consisting of silicon rectifiers, rectifier assemblies, transient voltage suppressors, high voltage monolithic capacitors, commercial power hybrids and related devices. These products are mainly used to convert alternating current into direct current and are also used in electrical circuits to limit or regulate voltage or protect other devices or systems absorbing or diverting electrical energy. Semtech focuses its efforts on producing such high-quality, high-precision components for military and commercial customers. With the acquisition of its wholly owned subsidiary, Semtech Corpus Christi, the Company has extended its product line to include linear and switching voltage regulators of both monolithic and hybrid designs, darlington transistors, interface drivers, pulse width modulators, overvoltage protection devices, rectifiers and a wide selection of semiconductor die for hybrid circuit applications. Traditionally, these products have been manufactured for commercial, industrial and telecommunications power supply customers.

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AXIAL LEADED DISCRETE RECTIFIERS

ABSOLUTE MAXIMUM RATINGS (@25°C UNLESS OTHERWISE SPECIFIED)

Device Type	Reverse Voltage		Forward Current @ 55°C		Reverse Recovery Time	Repetitive Surge Current	1 Cycle Surge Current tp=8.3ms	Forward Voltage Drop		Reverse Current		Junction Cap	Thermal Impedance		Operating & Storage Temp Range		Case Outline
	V_{RWM}	V_{RRM}	I_F (AV)		Trr	I_{FRM}	I_{FSM}	V_F @ I_F		I_R @ V_{RWM}		Cj @ 5V 1MHz	θj-L		Top & T_{STG}		
			-pcb mtd	L=3/8"						25°C	100°C		3/8" 3/4"	0"	Min	Max	
	Volts	Volts	Amps	Amps	nS	Amps	Amps	Volts	Amps	µA	µA	pF	°C/W	°C/W	°C	°C	
SUPERFAST RECOVERY DISCRETE RECTIFIERS																	
1N6073	**50**	**50**	**0.9**	**1.8**	**30**	**14**	**35**	**1.20**	**1.5**	**1.0**	**50**	**28**	**46**	**13**	**-65**	**150**	**G5**
1N6074 F	**100**	**100**	**0.9**	**1.8**		**14**	**35**	**1.20**	**1.5**	**1.0**	**50**	**28**	**46**	**13**			**G5**
1N6075 F	**150**	**150**	**0.9**	**1.8**		**14**	**35**	**1.20**	**1.5**	**1.0**	**50**	**28**	**46**	**13**			**G5**
1N6079	**50**	**50**	**2.1**	**5.0**		**24**	**175**	**0.97**	**5.0**	**10.0**	**500**	**230**	**23.5**	**5**			**G4**
1N6080 F	**100**	**100**	**2.1**	**5.0**		**24**	**175**	**0.97**	**5.0**	**10.0**	**500**	**230**	**23.5**	**5**			**G4**
1N6081 F	**150**	**150**	**2.1**	**5.0**		**24**	**175**	**0.97**	**5.0**	**10.0**	**500**	**230**	**23.5**	**5**			**G4**
FF05	50	50	0.9	1.8		14	35	1.20	1.5	1.0	50	28	46	13			G5
FF10	100	100	0.9	1.8		14	35	1.20	1.5	1.0	50	28	46	13			G5
FF15	150	150	0.9	1.8		14	35	1.20	1.5	1.0	50	28	46	13			G5
5FF05	50	50	2.0	5.0		24	175	0.97	5.0	10.0	500	230	23.5	5			G4
5FF10	100	100	2.0	5.0		24	175	0.97	5.0			230	23.5				G4
5FF15	150	150	2.0	5.0	30	24	175	0.97	5.0			230	23.5				G4
3FF30	300	300	1.1	3.4	50	15	70	1.40	3.0			125	20				G63
3FF40	400	400	1.1	3.4		15	70	1.40	3.0			125	20				G63
3FF50	500	500	1.1	3.4		15	70	1.40	3.0			125	20				G63
3FF60	600	600	1.1	3.4		15	70	1.40	3.0		500	125	20	5	-65		G63
USC1104	200	200	1.0	2.0		9	20	1.25	1.0		200	25	38	7	-55		G2
USC1105	300	300	1.0	2.0		9	20		1.0		200	25	38	7	-55		G2
USC1106	400	400	1.0	2.0		9	20		1.0	10.0	200	25	38	7	-55		G2
USC1304	200	200	3.0	5.0		16	70		3.0	20.0	500	50	20	5	-55		G4
USC1305	300	300	3.0	5.0		16	70		3.0	20.0	500	50	20	5	-55		G4
USC1306	400	400	3.0	5.0	50	16	70	1.25	3.0	20.0	500	50	20	5	-55	150	G4
1N5802 F	**50**	**50**	**1.4**	**3.3**	**25**	**14**	**35**	**0.875**	**1.0**	**1.0**	**50**	**25**	**59[1]**	**—**	**-65**	**175**	**G111**
1N5804 F	**100**	**100**	**1.4**	**3.3**	**25**	**14**	**35**		**1.0**	**1.0**	**50**	**25**	**59[1]**	**—**			**G111**
1N5806 F	**150**	**150**	**1.4**	**3.3**	**25**	**14**	**35**		**1.0**	**1.0**	**50**	**25**	**59[1]**	**—**			**G111**
1N5807 F	**50**	**50**	**1.8**	**6.0**	**30**	**25**	**125**		**4.0**	**5.0**	**150**	**60**	**35.5[1]**	**11**			**G112**
1N5809 F	**100**	**100**	**1.8**	**6.0**	**30**	**25**	**125**		**4.0**	**5.0**	**150**	**60**	**35.5[1]**	**11**			**G112**
1N5811 F	**150**	**150**	**1.8**	**6.0**	**30**	**25**	**125**	**0.875**	**4.0**	**5.0**	**150**	**60**	**35.5[1]**	**11**			**G112**
PFF2	200	200	0.75	1.25	30	4.25	22	2.50	1.0	1.0	10	30	47	19			G88
PFF4	400	400	0.75	1.25	30	4.25	22	2.50	1.0	1.0			47	19			G88
PFF6 FX	600	600	0.75	1.25	30	4.25	22	2.50	1.0	1.0			47	19			G88
PFF8 FX	800	800	0.75	1.25	75	4.25	22	2.50	1.0	1.0			47	19			G88
PFF0 FX	1000	1000	0.75	1.25	75	4.25	22	2.50	1.0	1.0			47	19			G88
2PFF2	200	200	0.9	2.0	30	9	45	2.65	2.0	2.0			26	12			G83
2PFF4	400	400	0.9	2.0	30	9	45	2.65	2.0	2.0			26	12			
2PFF6	600	600	0.9	2.0	30	9	45	2.65	2.0	2.0			26	12			
2PFF8	800	800	0.9	2.0	75	9	45	2.65	2.0	2.0			26	12			
2PFF0	1000	1000	0.9	2.0	75	9	45	2.65	2.0	2.0		30	26	12			
2PFT05	50	50	1.4	2.6	25	15	50	0.97	2.0	1.0		45	47	19			G83
2PFT1	100	100	1.4	2.6	25	15	50	0.97	2.0			45	47	19			G88
2PFT15	150	150	1.4	2.6	25	15	50	0.97	2.0			45	47	19			G88
2PFT2 FX	200	200	1.4	2.6	25	15	50	0.97	2.0			45	47	19			G88
3PFT05	50	50	1.9	4.0	30	25	90	1.05	3.5			92	26	12			G83
3PFT1	100	100	1.9	4.0	30	25	90		3.5			92	26	12			G83
3PFT15	150	150	1.9	4.0	30	25	90		3.5			92	26	12			G83
3PFT2 FX	200	200	1.9	4.0	30	25	90		3.5			92	26	12			G83
IPFF4	400	400	1.1	1.7	50	13	27	1.05	1.0	1.0		20	60	—			G89
2IPFF4	400	400	1.1	2.1	50	12	50	1.05	2.0	1.0	10	35	50	18			G90

Devices in **BOLD** type available to JAN, JANTX, and JANTXV levels.
NOTE: (A) Not available to JANTXV. (F) Available in Europe to F and FX levels. (FX) Available in Europe to FX level only.

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AXIAL LEADED DISCRETE RECTIFIERS (cont.)

ABSOLUTE MAXIMUM RATINGS (@25°C UNLESS OTHERWISE SPECIFIED)

FAST RECOVERY DISCRETE RECTIFIERS

Device Type	Reverse Voltage		Forward Current @ 55°C		Reverse Recovery Time	Repetitive Surge Current	1 Cycle Surge Current tp=8.3ms	Forward Voltage Drop		Reverse Current		Junction Cap	Thermal Impedance		Operating & Storage Temp Range		Case Outline
	V_{RWM}	V_{RRM}	I_F (AV)		T_{rr}	I_{FRM}	I_{FSM}	V_F @ I_F		I_R @ V_{RWM}		C_j @ 5V 1MHz	θj-L		Top & T_{STG}		
			-pcb mtd	L=3/8"						25°C	100°C		3/8"	0"	Min	Max	
	Volts	Volts	Amps	Amps	nS	Amps	Amps	Volts	Amps	µA	µA	pF	°C/W	°C/W	°C	°C	
1N5415	**50**	**50**	**3.0**	**4.5**	**150**	**25**	**150**	**1.1**	**3.0**	**1.0**	**20**	**120**	**20**	**4**	**-65**	**175**	**G4**
1N5416[F]	**100**	**100**			**150**							**120**					
1N5417[F]	**200**	**200**			**150**							**120**					
1N5418[F]	**400**	**400**			**150**							**120**					
1N5419[F]	**500**	**500**	▼	▼	**250**	▼	▼	▼	▼	▼	▼	**170**	▼	▼			▼
1N5420[F]	600	600	3.0	4.5	400	25	150	1.1	3.0	1.0	20	170	20	4			G4
1N5615[F]	**200**	**200**	**1.0**	**2.0**	**150**	**6.0**	**25**	**1.2**	**1.0**	**0.5**	**25**	**27**	**38**	**7**			**G2**
1N5617[F]	**400**	**400**	**1.0**	**2.0**	**150**			**1.2**		**0.5**		**27**		**7**			
1N5619[F]	**600**	**600**	**1.0**	**2.0**	**250**			**1.2**		**0.5**		**27**		**7**			
1N5621[F]	**800**	**800**	**1.0**	**2.0**	**300**			**1.2**		**0.5**		**18**		**7**			
1N5623[F]	**1000**	**1000**	**1.0**	**2.0**	**500**			**1.2**		**0.5**		**18**		**7**			
SFR0	1000	1000	0.8	1.6	150			1.5		1.0		20		14			
S2F	200	200	1.0	2.0	150			1.2		0.5		27		7			
S4F	400	400	1.0	2.0	150			1.2		0.5		27		7			
S6F	600	600	1.0	2.0	250			1.2		0.5		27		7			
S8F	800	800	1.0	2.0	300	▼	▼	1.2	▼	0.5	▼	18	▼	7			▼
S0F	1000	1000	1.0	2.0	500	6.0	25	1.2	1.0	0.5	25	18	38	7			G2
3SFR0	1000	1000	1.3	3.25	150	15	80	1.5	3.0	1.0	80	80	20	4			G4
3SF05	50	50	3.0	4.5	150	25	150	1.1			20	120	20	4			
3SF1	100	100			150							120					
3SF2	200	200			150							120					
3SF4	400	400			150							120					
3SF5	500	500	▼	▼	250	▼	▼	▼	▼		▼	170	▼	▼			▼
3SF6	600	600	3.0	4.5	400	25	150	1.1	3.0		20	170	20	4			G4
PFR0	1000	1000	0.9	1.60	150	11	32	1.45	1.0		25	22	47	19			G88
PF8	800	800	1.0	1.80	300	10	38	1.35	1.5	▼	10	18	47	19			G88
PF0[FX]	1000	1000	1.0	1.80	300	10	38	1.35	1.5	1.0	10	18	47	19			G88
3PFR0	1000	1000	1.2	2.70	150	21	70	1.50	2.0	5.0	25	70	26	12			G83
3PF8	800	800	1.5	3.25	300	27	76	1.30	3.0	1.0	10	30	26	12	▼	▼	G83
3PF0[FX]	1000	1000	1.5	3.25	300	27	76	1.30	3.0	1.0	10	30	26	12	-65	175	G83

Devices in **BOLD** type available to JAN, JANTX, and JANTXV levels.
NOTE: (A) Not available to JANTXV (F) Available in Europe to F and FX levels. (FX) Available in Europe to FX level only.

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AXIAL LEADED DISCRETE RECTIFIERS (cont.)

ABSOLUTE MAXIMUM RATINGS (@25°C UNLESS OTHERWISE SPECIFIED)

STANDARD RECOVERY DISCRETE RECTIFIERS

Device Type	Reverse Voltage		Forward Current @ 55°C		Reverse Recovery Time	Repetitive Surge Current	1 Cycle Surge Current tp=8.3ms	Forward Voltage Drop		Reverse Current		Junction Cap	Thermal Impedance		Operating & Storage Temp Range		Case Outline
	V_{RWM}	V_{RRM}	I_F (AV)		Trr	I_{FRM}	I_{FSM}	V_F @ I_F		I_R @ V_{RWM}		Cj @ 5V 1MHz	θj-L		Top & Tstg		
			-pcb mtd	L=3/8"						25°C	100°C		3/8"	0"	Min	Max	
	Volts	Volts	Amps	Amps	nS	Amps	Amps	Volts	Amps	µA	µA	pF	°C/W	°C/W	°C	°C	
1N5550F	**200**	**200**	**3.0**	**5.0**	**2000**	**25**	**150**	**1.00**	**3.0**	**1.0**	**20**	**92**	**20**	**4**	**-65**	**175**	**G4**
1N5551F	**400**	**400**	**3.0**	**5.0**	↓	**25**	**150**	**1.00**	**3.0**	**1.0**	**20**	**92**	**20**	**4**	↓	↓	**G4**
1N5552F	**600**	**600**	**3.0**	**5.0**	↓	**25**	**150**	**1.00**	**3.0**	**1.0**	**20**	**92**	**20**	**4**	↓	↓	**G4**
1N5553F	**800**	**800**	**3.0**	**5.0**	↓	**25**	**150**	**1.00**	**3.0**	**1.0**	**20**	**92**	**20**	**4**	↓	↓	**G4**
1N5554F	**1000**	**1000**	**3.0**	**5.0**	↓	**25**	**150**	**1.00**	**3.0**	**1.0**	**20**	**92**	**20**	**4**	↓	↓	**G4**
1N5614F	**200**	**200**	**1.0**	**2.0**	↓	**10**	**30**	**1.10**	**1.0**	**0.5**	**25**	**23**	**38**	**7**	↓	↓	**G2**
1N5616F	**400**	**400**	↓	↓	↓	↓	↓	↓	↓	**0.5**	↓	↓	↓	↓	↓	↓	↓
1N5618F	**600**	**600**	↓	↓	↓	↓	↓	↓	↓	**0.5**	↓	↓	↓	↓	↓	↓	↓
1N5620F	**800**	**800**	↓	↓	↓	↓	↓	↓	↓	**0.5**	↓	↓	↓	↓	↓	↓	↓
1N5622F	**1000**	**1000**	↓	↓	↓	↓	↓	↓	↓	**0.5**	↓	↓	↓	↓	↓	↓	↓
S2M	200	200	↓	↓	↓	↓	↓	↓	↓	1.0	↓	↓	↓	↓	↓	↓	↓
S4M	400	400	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
S6M	600	600	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
S8M	800	800	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
S0M	1000	1000	↓	↓	↓	↓	↓	1.10	1.0	↓	25	23	38	7	↓	↓	G2
3SM2	200	200	3.0	5.0	↓	25	150	1.00	3.0	↓	20	92	20	4	↓	↓	G4
3SM4	400	400	3.0	5.0	↓	25	150	↓	3.0	↓	20	92	20	4	↓	↓	G4
3SM6	600	600	3.0	5.0	↓	25	150	↓	3.0	↓	20	92	20	4	↓	↓	G4
3SM8	800	800	3.0	5.0	↓	25	150	↓	3.0	↓	20	92	20	4	↓	↓	G4
3SM0	1000	1000	3.0	5.0	2000	25	150	↓	3.0	↓	20	92	20	4	↓	↓	G4
PM6	600	600	1.1	2.0	2500	12	50	↓	1.0	↓	10	20	47	19	↓	↓	G88
PM8	800	800	1.1	2.0	↓	12	50	↓	1.0	↓	10	20	47	19	↓	↓	G88
PM0	1000	1000	1.1	2.0	↓	12	50	1.00	1.0	↓	10	20	47	19	↓	↓	G88
3PM2	200	200	1.5	3.5	↓	20	80	1.15	3.0	↓	10	33	26	12	↓	↓	G83
3PM4	400	400	1.5	3.5	↓	20	80	1.15	3.0	↓	10	33	26	12	↓	↓	G83
3PM6	600	600	1.5	3.5	↓	20	80	1.15	3.0	↓	10	33	26	12	↓	↓	G83
3PM8	800	800	1.5	3.5	↓	20	80	1.15	3.0	↓	10	33	26	12	↓	↓	G83
3PM0	1000	1000	1.5	3.5	2500	20	80	1.15	3.0	1.0	10	33	26	12	-65	175	G83

NOTES: See page A•2142.

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AXIAL LEADED DISCRETE RECTIFIERS (cont.)

ABSOLUTE MAXIMUM RATINGS (@25°C UNLESS OTHERWISE SPECIFIED)

Device Type	Reverse Voltage		Forward Current @ 55°C		Reverse Recovery Time	Repetitive Surge Current	1 Cycle Surge Current tp=8.3ms	Forward Voltage Drop		Reverse Current		Junction Cap	Thermal Impedance		Operating & Storage Temp Range		Case Outline
	V_{RWM}	V_{RRM}	I_F (AV)		T_{rr}	I_{FRM}	I_{FSM}	V_F @ I_F		I_R @ V_{RWM}		Cj @ 5V 1MHz	θj-L		Top & Tstg		
			-pcb mtd	L=3/8"						25°C	100°C		3/8"	0"	Min	Max	
	Volts	Volts	Amps	Amps	nS	Amps	Amps	Volts	Amps	μA	μA	pF	°C/W	°C/W	°C	°C	
SUPERFAST RECOVERY HIGH VOLTAGE																	
SFF30	3000	3000	0.17	0.36	50	1	10	7.0	0.175	1.0	25	6.5	30	18	-65	175	G12
PFF50[FX]	5000	5000	0.15	0.36	30	5	22	12.5	0.20	0.1	5	4.5	24	18	-65	175	G84
FAST RECOVERY HIGH VOLTAGE																	
F15	1500	1500	0.20	0.35	250	1.25	5.0	5.0	0.10	0.25	10	2.5	48	30	-65	175	G66
F20	2000	2000	0.20	0.35	250	1.25	5.0	↓	↓	0.25	10	2.5	48	30	↓	↓	G66
F25	2500	2500	0.20	0.35	250	1.25	5.0	↓	↓	0.25	10	2.5	48	30	↓	↓	G66
F30[F]	3000	3000	0.20	0.35	250	1.25	5.0	↓	↓	0.25	10	2.5	48	30	↓	↓	G66
S15F	1500	1500	0.24	0.50	300	2.5	10	↓	↓	1.00	25	4.0	30	18	↓	↓	G12
S20F	2000	2000	0.24	0.50	300	2.5	10	↓	↓	1.00	25	4.0	30	18	↓	↓	G12
S25F	2500	2500	0.24	0.50	300	2.5	10	5.0	0.10	1.00	25	4.0	30	18	↓	↓	G12
F40A	4000	4000	0.13	0.25	300	0.75	2.5	8.0	0.05	1.0	10	2.0	40	26	↓	↓	G42
F50A	5000	5000	0.13	0.25	300	0.75	2.5	8.0	0.05	1.0	10	2.0	40	26	↓	↓	G42
F60A[F]	6000	6000	0.13	0.25	300	0.75	2.5	8.0	0.05	1.0	10	2.0	40	26	↓	↓	G42
F50	5000	5000	0.065	0.18	300	0.25	2.0	10.0	0.01	1.00	5	1.7	44	33	↓	↓	G10
F75	7500	7500	0.065	0.18	300	0.25	2.0	10.0	0.01	0.25	5	1.7	44	33	↓	↓	G10
SM75F	7500	7500	0.12	0.29	300	1.0	14	12.0	0.10	1.0	20	3.0	28	20	↓	↓	G43
SM100F	10000	10000	0.12	0.29	300	1.0	14	12.0	0.10	1.0	20	3.0	28	20	↓	175	G43
PF20	2000	2200	0.065	0.10	200	0.5	1.0	11.0	0.05	0.25	3	1.1	75	55	↓	150	G87
11PF25	2500	2750	0.34	0.80	350	10	27	6.5	2.00	1.0	10	9.5	25	19	↓	165	G91
8PF37	3750	4200	0.26	0.625	350	9.0	22	7.0	0.80	0.25	50	6.3	25	19	↓	165	G85
PFM50	5000	5650	0.05	0.092	250	1.0	2.0	12.5	0.025	0.03	3	0.75	64	48	↓	150	G82
PFM75	7500	8500	0.05	0.092	250	1.0	2.0	12.5	0.025	0.03	3	0.75	64	48	↓	150	G82
PF75	6000	7500	0.185	0.500	350	5.0	22	11.2	0.55	5.0	50	4.0	24	18	↓	165	G84
PF100	9000	10000	—	0.004	200	0.5	—	39.0	0.02	0.1	1	4.0	—	—	↓	120	G92
PF120	10000	12000	—	0.004	200	0.5	—	39.0	0.02	0.1	1	4.0	—	—	↓	120	G92
PF140	12000	14000	—	0.003	200	0.5	—	52.0	0.02	0.1	1	4.0	—	—	↓	120	G92
PF170	14000	17000	—	0.003	200	0.5	—	52.0	0.02	0.1	1	4.0	—	—	↓	120	G92
PF190	16000	19000	—	0.003	200	0.5	—	52.0	0.02	0.1	1	4.0	—	—	↓	120	G92
2PF140	12000	14000	.225[1]	—	350	5.0	16.0	25.0	1.0	5.0	50	0.23	40	30	-65	165	G86
STANDARD RECOVERY HIGH VOLTAGE																	
1N3644[A]	**1500**	**1500**	**0.26**	**0.6**	**2500**	**2.5**	**14**	**5.0**	**0.25**	**1.0**	**20**	**8.0**	**30**	**18**	**-65**	**175**	**G12**
1N3645[A]	**2000**	**2000**	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
1N3646[A]	**2500**	**2500**	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
1N3647[AF]	**3000**	**3000**	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
SM20	2000	2000	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
SM25	2500	2500	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
SM30	3000	3000	↓	↓	↓	2.5	14	5.0	0.25	↓	↓	8.0	30	18	↓	↓	G12
SM40	4000	4000	0.13	0.30	↓	1.0	25	10.0	0.10	↓	↓	3.2	28	20	↓	↓	G43
SM50	5000	5000	0.13	0.30	↓	1.0	25	10.0	0.10	↓	↓	3.2	28	20	↓	↓	G43
SM75	7500	7500	0.13	0.30	↓	1.0	25	10.0	0.10	↓	↓	3.2	28	20	↓	↓	G43
SM100	10000	10000	0.13	0.30	↓	1.0	25	10.0	0.10	1.0	20	3.2	28	20	↓	↓	G43
M20	2000	2000	0.175	0.33	2000	1.3	7	5.0	0.125	0.25	10	1.7	48	30	↓	↓	G66
M30	3000	3000	0.175	0.33	2000	1.3	7	5.0	0.125	0.25	10	1.7	48	30	↓	↓	G66
M50A	5000	5000	0.145	0.26	5000	1.0	5	6.0	0.05	0.25	10	1.6	40	26	↓	↓	G10
M60A	6000	6000	0.145	0.26	5000	1.0	5	6.0	0.05	0.25	10	1.6	40	26	-65	175	G10

Devices in **BOLD** type available to JAN, JANX, and JANTXV levels.

NOTE: (A) Not available to JANTXV. (F) Available in Europe to F and FX levels. (FX) Available in Europe to FX level only.

(1) 55°C Stirred oil.

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BI-POLARITY SILICON TRANSIENT VOLTAGE SUPPRESSORS (TVS)

ELECTRICAL SPECIFICATIONS (@25°C UNLESS OTHERWISE SPECIFIED)

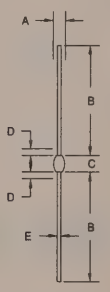
Device Type	Minimum Breakdown Voltage V_{BR} @ $I_{(BR)}$	Test Current $I_{(BR)}$	Working Pk. Reverse Voltage V_{RWM}	Max. Reverse Current I_R	Maximum Clamping Voltage V_C @ I_P	Maximum Pk. Pulse Current I_P t_P=1.0mS	Temp. Coeff of $V_{(BR)}$ αV_Z	Maximum Reverse Current I_R @ 150°C	Outline
	Volts	mA	Volts	µA	Volts	Amps	%/°C	µA	
500 WATT									
1N6102	6.12	175	5.2	100	11.0	45.4	.05	4000	G95
1N6103	6.75	175	5.7	50	11.8	42.4	.06	750	
1N6104	7.38	150	6.2	20	12.7	39.4	.06	500	
1N6105	8.19	150	6.9	20	14.0	35.7	.06	300	
1N6106	9.00	125	7.6	20	15.2	32.9	.07	200	
1N6107	9.90	125	8.4	20	16.3	30.7	.07	200	
1N6108	10.8	100	9.1	20	17.7	28.2	.07	150	
1N6109	11.7	100	9.9	20	19.0	26.3	.08	150	
1N6110	13.5	75	11.4	20	21.9	22.8	.08	100	
1N6111	14.4	75	12.2	20	23.4	21.4	.08		
1N6112	16.2	65	13.7	1	26.3	19.0	.085		
1N6113	18.0	65	15.2		29.0	17.2	.085		
1N6114	19.8	50	16.7		31.9	15.7	.085		
1N6115	21.6	50	18.2		34.8	14.4	.09		
1N6116	24.3	50	20.6		39.2	12.8	.09		
1N6117	27.0	40	22.8		43.6	11.5	.09		
1N6118	29.7	40	25.1		47.9	10.4	.095		
1N6119	32.4	30	27.4		52.3	9.6			
1N6120	35.1	30	29.7		56.2	8.9			
1N6121	38.7	30	32.7		62.0	8.1			
1N6122	42.3	25	35.8		67.7	7.4			
1N6123	45.9	25	38.8		73.5	6.8			
1N6124	50.4	20	42.6		80.7	6.2	.095		
1N6125	55.8	20	47.1		89.3	5.6	.100		
1N6126	61.2	20	51.7		98.0	5.1			
1N6127	67.5	20	56.0		108.1	4.6			
1N6128	73.8	15	62.2		118.2	4.2			
1N6129	81.9	15	69.2		131.1	3.8			
1N6130	90.0	12	76.0		144.1	3.5			
1N6131	99.0	12	83.6		158.5	3.2			
1N6132	108.0	10	91.2		172.9	2.9			
1N6133	117.0	10	98.8		187.3	2.7			
1N6134	135.0	8	114.0		216.2	2.3			
1N6135	144.0	8	121.6		228.8	2.2			
1N6136	162.0	5	136.8		257.4	1.9			
1N6137	180.0	5	152.0	1	286.0	1.7	.100	100	G95
1500 WATT									
1N6138	6.12	175	5.2	500	11.0	136.4	.05	12000	G96
1N6139	6.75	175	5.7	300	11.8	127.1	.06	3000	
1N6140	7.38	150	6.2	100	12.7	118.1	.06	2000	
1N6141	8.19	150	6.9	100	14.0	107.1	.06	1200	
1N6142	9.00	125	7.6	100	15.2	98.7	.07	800	
1N6143	9.90	125	8.4	20	16.3	92.0	.07	800	
1N6144	10.8	100	9.1	20	17.7	84.7	.07	600	
1N6145	11.7	100	9.9	20	19.0	78.9	.08	600	
1N6146	13.5	75	11.4	20	21.9	68.5	.08	400	
1N6147	14.4	75	12.2	20	23.4	64.1	.08		
1N6148	16.2	65	13.7	10	26.3	57.0	.085		
1N6149	18.0	65	15.2	5	29.0	51.7	.085		
1N6150	19.8	50	16.7		31.9	47.0	.085		
1N6151	21.6	50	18.2		34.8	43.1	.09		
1N6152	24.3	50	20.6		39.2	38.3	.09		
1N6153	27.0	40	22.8		43.6	34.4	.09		
1N6154	29.7	40	25.1		47.9	31.3	.095		
1N6155	32.4	30	27.4		52.3	28.7			
1N6156	35.1	30	29.7		56.2	26.7			
1N6157	38.7	30	32.7		62.0	24.2			
1N6158	42.3	25	35.8		67.7	22.2			
1N6159	45.9	25	38.8		73.5	20.4			
1N6160	50.4	20	42.6		80.7	18.6	.095		
1N6161	55.8	20	47.1		89.3	16.8	.100		
1N6162	61.2	20	51.7		98.0	15.3			
1N6163	67.5	20	56.0		108.1	13.9			
1N6164	73.8	15	62.2		118.2	12.7			
1N6165	81.9	15	69.2		131.1	11.4			
1N6166	90.0	12	76.0		144.1	10.4			
1N6167	99.0	12	83.6		158.5	9.5			
1N6168	108.0	10	91.2		172.9	8.7			
1N6169	117.0	10	98.8		187.3	8.0			
1N6170	135.0	8	114.0		216.2	6.9			
1N6171	144.0	8	121.6		228.8	6.6			
1N6172	162.0	5	136.8		257.4	5.8			
1N6173	180.0	5	152.0	5	286.0	5.2	.100	400	G96

Available as JAN, JANTX and JTXV versions to MIL-S-19500/516. Available as F or FX versions to DEF STAN 59-61/80/046.

G95

DIM	DIMENSIONS MM MIN	MM MAX	INCHES MIN	INCHES MAX	NOTE
A	2.1	3.6	.085	.140	–
B	25.4	33.0	1.00	1.30	–
C	3.5	4.7	.140	.185	–
D	–	.80	–	.030	1
E	.66	.84	.026	.033	–

NOTES:
1. LEAD DIAMETER UNCONTROLLED OVER THIS REGION.

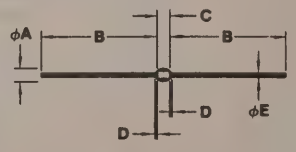


Available as JAN, JANTX and JTXV versions to MIL-S-19500/516. Available as F or FX versions to DEF STAN 59-61/80/046.

DRAWING G96

Dim	mm Min	mm Max	Inches Min	Inches Max	Note
ϕA	3.43	4.57	.135	.185	–
B	22.8	27.9	.90	1.30	–
C	3.56	4.19	.140	.195	–
D	–	.76	–	.030	1
ϕE	.92	1.02	.036	.042	2

NOTES: Lead diameter uncontrolled over this region.



NOTE:
Parts listed are 10% tolerance.
5% tolerance can be ordered by placing an "A" suffix on part numbers, e.g. IN6110A.

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500 WATT AXIAL LEAD - HERMETIC

FEATURES:

- Low dynamic impedance.
- Hermetically sealed glass package.
- Metallurgically bonded.
- High surge capacity.
- Available in JAN, JTX, and JTXV versions per MIL-S-19500/551.

MAXIMUM RATINGS:

- Operating Temperature: -65°C to +175°C.
- Storage Temperature: -65°C to +175°C.
- **Surge Power: 500W.**

ELECTRICAL SPECIFICATIONS @ 25°C (Unless otherwise specified)

Device Type	Reverse Stand-off Voltage V_{RWM}	Reverse Leakage Current Ir	Minimum Breakdown Voltage Vbr @ Ibr	Test Current Ibr	Maximum Clamping Voltage Vc @ Ipp	Peak Pulse Current Ipp Tp = 1mS	Peak Pulse Current Ipp Tp = 20µS	Temperature Coefficient Of Vbr αVz
	(V)	(µA)	(V)	(mA)	(V)	(A)	(A)	%/°C
1N6461	5	3000	5.6	25	9.0	56	315	0.040
1N6462	6	2500	6.5	20	11.0	46	258	0.040
1N6463	12	500	13.6	5	22.6	22	125	0.050
1N6464	15	500	16.4	5	26.5	19	107	0.060
1N6465	24	50	27.0	2	41.4	12	69	0.084
1N6466	30.5	3	33.0	1	47.5	11	63	0.093
1N6467	40.3	2	43.7	1	63.5	8	45	0.094
1N6468	51.6	2	54.0	1	78.5	6	35	0.096

1500 WATT AXIAL LEAD - HERMETIC

FEATURES:

- Low dynamic impedance.
- Hermetically sealed glass package.
- Metallurgically bonded.
- High surge capacity.
- Available in JAN, JTX, and JTXV versions per MIL-S-19500/552.

MAXIMUM RATINGS:

- Operating Temperature: -65°C to +175°C.
- Storage Temperature: -65°C to +175°C.
- **Surge Power: 1500W.**

ELECTRICAL SPECIFICATIONS @ 25°C (Unless otherwise specified)

Device Type	Reverse Stand-off Voltage V_{RWM}	Reverse Leakage Current Ir	Minimum Breakdown Voltage Vbr @ Ibr	Test Current Ibr	Maximum Clamping Voltage Vc @ Ipp	Peak Pulse Current Ipp Tp = 1mS	Peak Pulse Current Ipp Tp = 20µS	Temperature Coefficient Of Vbr αVz
	(V)	(µA)	(V)	(mA)	(V)	(A)	(A)	%/°C
1N6469	5	5000	5.6	50	9.0	167	945	0.040
1N6470	6	5000	6.5	50	11.0	137	775	0.040
1N6471	12	1000	13.6	10	22.6	66	374	0.050
1N6472	15	1000	16.4	10	26.5	57	322	0.060
1N6473	24	100	27.0	5	41.4	36.5	206	0.084
1N6474	30.5	5	33.0	1	47.5	32	190	0.093
1N6475	40.3	5	43.7	1	63.5	24	136	0.094
1N6476	51.6	5	54.0	1	78.5	19	106	0.096

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500 WATT AXIAL LEAD - TRANSIENT VOLTAGE SUPPRESSOR

FEATURES:
- 500 watts peak pulse power.
- Response time: 1 x 10^{-12}.
- Each device 100% Surge Tested to Ipp.
- Voltage range: 5v to 170v.
- Protects sensitive semiconductor circuits.
- Solid state silicon avalanche technology.

MAXIMUM RATINGS:
- Operating & Storage Temp: -65°C to +150°C.
- Forward surge rating: 70A, 1/120sec half cycle @ 25°C.
- Steady state power dissipation: 1 watt @ T_L = 75°C.

MECHANICAL CHARACTERISTICS:
- Molded epoxy case: DO-41.
- Body marking: P/N, date code, polarity band (cathode).

ELECTRICAL CHARACTERISTICS @ 25°C

Semtech Part Number See Note 1	Reverse Stand-off Voltage (V)	Breakdown Voltage (V) Min Max	Test Current (It) (mA)	Maximum Clamping Voltage @ Ipp (Vc) (V)	Peak Pulse Current (Ipp) (A)	Reverse Leakage (Ir) (µA)	Max Voltage Temperature Variation Of BV (mV/°C)
SA5.0	5.0	6.40 - 7.30	10	9.6	52.0	600	5.0
SA5.0A	5.0	6.40 - 7.00	10	9.2	54.3	600	5.0
SA6.0	6.0	6.67 - 8.15	10	11.4	43.9	600	5.0
SA6.0A	6.0	6.67 - 7.37	10	10.3	48.5	600	5.0
SA6.5	6.5	7.22 - 8.82	10	12.3	40.7	400	5.0
SA6.5A	6.5	7.22 - 7.98	10	11.2	44.7	400	5.0
SA7.0	7.0	7.78 - 9.51	10	13.3	37.8	150	6.0
SA7.0A	7.0	7.78 - 8.60	10	12.0	41.7	150	6.0
SA7.5	7.5	8.33 - 10.2	1	14.3	35.0	50	7.0
SA7.5A	7.5	8.33 - 9.21	1	12.9	38.8	50	7.0
SA8.0	8.0	8.89 - 10.9	1	15.0	33.3	25	7.0
SA8.0A	8.0	8.89 - 9.83	1	13.6	36.7	25	7.0
SA8.5	8.5	9.44 - 11.5	1	15.9	31.4	10	8.0
SA8.5A	8.5	9.44 - 10.4	1	14.4	34.7	10	8.0
SA9.0	9.0	10.0 - 12.2	1	16.9	29.5	5	9.0
SA9.0A	9.0	10.0 - 11.1	1	15.4	32.5	5	9.0
SA10	10	11.1 - 13.6	1	18.8	26.6	3	10
SA10A	10	11.1 - 12.3	1	17.0	29.4	3	10
SA11	11	12.2 - 14.9	1	20.1	24.9	3	11
SA11A	11	12.2 - 13.5	1	18.2	27.4	3	11
SA12	12	13.3 - 16.3	1	22.0	22.7	3	12
SA12A	12	13.3 - 14.7	1	19.9	25.1	3	12
SA13	13	14.4 - 17.6	1	23.8	21.0	3	13
SA13A	13	14.4 - 15.9	1	21.5	23.2	3	13
SA14	14	15.6 - 19.1	1	25.8	19.4	3	14
SA14A	14	15.6 - 17.2	1	23.2	21.5	3	14
SA15	15	16.7 - 20.4	1	26.9	18.8	3	16
SA15A	15	16.7 - 18.5	1	24.4	20.6	3	16
SA16	16	17.8 - 21.8	1	28.8	17.6	3	19
SA16A	16	17.8 - 19.7	1	26.0	19.2	3	17
SA17	17	18.9 - 23.1	1	30.5	16.4	3	20
SA17A	17	18.9 - 20.9	1	27.6	18.1	3	19
SA18	18	20.0 - 24.4	1	32.2	15.5	3	21
SA18A	18	20.0 - 22.1	1	29.2	17.2	3	20
SA20	20	22.2 - 27.1	1	35.8	13.9	3	25
SA20A	20	22.2 - 24.5	1	32.4	15.4	3	23
SA22	22	24.4 - 29.8	1	39.4	12.7	3	28
SA22A	22	24.4 - 26.9	1	35.5	14.1	3	25
SA24	24	26.7 - 32.6	1	43.0	11.6	3	31
SA24A	24	26.7 - 29.5	1	38.9	12.8	3	28
SA26	26	28.9 - 35.3	1	46.6	10.7	3	31
SA26A	26	28.9 - 31.9	1	42.1	11.9	3	30
SA28	28	31.1 - 38.0	1	50.0	9.9	3	35
SA28A	28	31.1 - 34.4	1	45.4	11.0	3	31
SA30	30	33.3 - 40.7	1	53.5	9.3	3	39
SA30A	30	33.3 - 36.8	1	48.4	10.3	3	36
SA33	33	36.7 - 44.9	1	59.0	8.5	3	42
SA33A	33	36.7 - 40.6	1	53.3	9.4	3	39
SA36	36	40.0 - 48.9	1	64.3	7.8	3	46
SA36A	36	40.0 - 44.2	1	58.1	8.6	3	41
SA40	40	44.4 - 54.3	1	71.4	7.0	3	51
SA40A	40	44.4 - 49.1	1	64.5	7.8	3	46
SA43	43	47.8 - 58.4	1	76.7	6.5	3	55
SA43A	43	47.8 - 52.8	1	69.4	7.2	3	50
SA45	45	50.0 - 61.1	1	80.3	6.2	3	58
SA45A	45	50.0 - 55.3	1	72.7	6.9	3	52
SA48	48	53.3 - 65.1	1	85.5	5.8	3	63
SA48A	48	53.3 - 58.9	1	77.4	6.5	3	56
SA51	51	56.7 - 69.3	1	91.1	5.5	3	66
SA51A	51	56.7 - 62.7	1	82.4	6.1	3	61
SA54	54	60.0 - 73.3	1	96.3	5.2	3	71
SA54A	54	60.0 - 66.3	1	87.1	5.7	3	65
SA58	58	64.4 - 78.7	1	103.0	4.9	3	78
SA58A	58	64.4 - 71.2	1	93.6	5.3	3	70
SA60	60	66.7 - 81.5	1	107.0	4.7	3	80
SA60A	60	66.7 - 73.7	1	96.8	5.2	3	71
SA64	64	71.1 - 86.9	1	114.0	4.4	3	86
SA64A	64	71.1 - 78.6	1	103.0	4.9	3	76
SA70	70	77.8 - 95.1	1	125	4.0	3	94
SA70A	70	77.8 - 86.0	1	113	4.4	3	85
SA75	75	83.3 - 102.0	1	134	3.7	3	101
SA75A	75	83.3 - 92.1	1	121	4.1	3	91
SA90	90	100 - 122	1	160	3.1	3	121
SA90A	90	100 - 111	1	146	3.4	3	110
SA100	100	111 - 136	1	179	2.8	3	135
SA100A	100	111 - 123	1	162	3.1	3	123
SA110	110	122 - 149	1	196	2.6	3	148
SA110A	110	122 - 135	1	177	2.8	3	133
SA120	120	133 - 163	1	214	2.3	3	162
SA120A	120	133 - 147	1	193	2.0	3	146
SA130	130	144 - 176	1	231	2.2	3	175
SA130A	130	144 - 159	1	209	2.4	3	158
SA150	150	167 - 204	1	268	1.9	3	203
SA150A	150	167 - 185	1	243	2.1	3	184
SA160	160	178 - 218	1	287	1.7	3	217
SA160A	160	178 - 197	1	259	1.9	3	196
SA170	170	189 - 231	1	304	1.6	3	230
SA170A	170	189 - 209	1	275	1.8	3	208

NOTE 1: "A" = 5%, standard tolerance is 10%. Order with "C" or "CA" suffix for bidirectional types.

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600 WATT AXIAL LEAD - TRANSIENT VOLTAGE SUPPRESSOR

FEATURES:
- 600 watts peak pulse power.
- Response time: 1 x 10^{-12}.
- Each device 100% Surge Tested to Ipp.
- Voltage range: 6.8v to 440v.
- Protects sensitive semiconductor circuits.
- Solid state silicon avalanche technology.

MAXIMUM RATINGS:
- Operating & Storage Temp: -65°C to +150°C.
- Forward surge rating: 100A, 1/120sec half cycle @ 25°C.
- Steady state power dissipation: 5 watt @ T_L = 75°C.

MECHANICAL CHARACTERISTICS:
- Molded epoxy case: DO-15.
- Body marking: P/N, date code, polarity band (cathode).

ELECTRICAL CHARACTERISTICS @ 25°C

Semtech Part Number See Note 1	Reverse Stand-off Voltage V_{RWM} (V)	Reverse Leakage Current I_D (µA)	Breakdown Voltage BV (Volts) Min	Max	Test Current I_T	Maximum Clamping Voltage @ Ipp V_C (V)	Peak Pulse Current Ipp (A)	Bv Temperature Coefficient mV/°C
P6KE6.8	5.50	1000	6.12	7.48	10	10.8	56.0	5
P6KE6.8A	5.80	1000	6.45	7.14	10	10.5	57.0	5
P6KE7.5	6.05	500	6.75	8.25	10	11.7	51.0	5
P6KE7.5A	6.40	500	7.13	7.88	10	11.3	53.0	5
P6KE8.2	6.63	200	7.38	9.02	10	12.5	48.0	6
P6KE8.2A	7.02	200	7.79	8.61	10	12.1	50.0	6
P6KE9.1	7.37	50	8.19	10.00	1	13.8	44.0	7
P6KE9.1A	7.78	50	8.65	9.50	1	13.4	45.0	7
P6KE10	8.10	10	9.00	11.00	1	15.0	40.0	8
P6KE10A	8.55	10	9.50	10.50	1	14.5	41.0	8
P6KE11	8.92	5	9.90	12.10	1	16.2	37.0	9
P6KE11A	9.40	5	10.50	11.60	1	15.6	38.0	9
P6KE12	10.26	5	10.80	13.20	1	17.3	35.0	10
P6KE12A	10.83	5	11.40	12.60	1	16.7	36.0	10
P6KE13	11.12	5	11.70	14.30	1	19.0	32.0	11
P6KE13A	11.78	5	12.40	13.70	1	18.2	33.0	11
P6KE15	12.83	5	13.50	16.50	1	22.0	27.0	13
P6KE15A	13.59	5	14.30	15.80	1	21.2	28.0	12
P6KE16	13.68	5	14.40	17.60	1	23.5	26.0	16
P6KE16A	14.44	5	15.20	16.80	1	22.5	27.0	14
P6KE18	15.39	5	16.20	19.80	1	26.5	23.0	17
P6KE18A	16.25	5	17.10	18.90	1	25.2	24.0	19
P6KE20	17.64	5	18.00	22.00	1	29.1	21.0	20
P6KE20A	18.62	5	19.00	21.00	1	27.7	22.0	19
P6KE22	19.40	5	19.80	24.20	1	31.9	19.0	21
P6KE22A	20.48	5	20.90	23.10	1	30.6	20.0	20
P6KE24	21.17	5	21.60	26.40	1	34.7	17.0	25
P6KE24A	22.34	5	22.80	25.20	1	33.2	18.0	23
P6KE27	23.81	5	24.30	29.70	1	39.1	15.0	28
P6KE27A	25.19	5	25.70	28.40	1	37.5	16.0	25
P6KE30	26.46	5	27.00	33.00	1	43.5	14.0	31
P6KE30A	27.93	5	28.50	31.50	1	41.4	14.4	28
P6KE33	29.11	5	29.70	36.30	1	47.7	12.6	31
P6KE33A	30.77	5	31.40	34.70	1	45.7	13.2	30
P6KE36	31.75	5	32.40	39.60	1	52.0	11.6	35
P6KE36A	33.52	5	34.20	37.80	1	49.9	12.0	31
P6KE39	34.40	5	35.10	42.90	1	56.4	10.6	39
P6KE39A	36.36	5	37.10	41.00	1	53.9	11.2	36
P6KE43	37.93	5	38.70	47.30	1	61.9	9.6	46
P6KE43A	40.08	5	40.90	45.20	1	59.3	10.1	44
P6KE47	41.45	5	42.30	51.70	1	67.8	8.9	50
P6KE47A	43.81	5	44.70	49.40	1	64.8	9.3	48
P6KE51	44.98	5	45.90	56.10	1	73.5	8.2	55
P6KE51A	47.53	5	48.50	53.60	1	70.1	8.6	51
P6KE56	49.39	5	50.40	61.60	1	80.5	7.4	58
P6KE56A	52.14	5	53.20	58.80	1	77.0	7.8	56
P6KE62	54.68	5	55.80	58.20	1	89.0	6.8	65
P6KE62A	57.72	5	58.90	65.10	1	85.0	7.1	62
P6KE68	59.98	5	61.20	74.80	1	98.0	6.1	71
P6KE68A	63.31	5	64.60	71.40	1	92.0	6.5	69
P6KE75	66.15	5	67.50	82.50	1	108.0	5.5	80
P6KE75A	69.87	5	71.30	78.80	1	103.0	5.8	76
P6KE82	72.32	5	73.80	90.20	1	118.0	5.1	90
P6KE82A	76.34	5	77.90	86.10	1	113.0	5.3	86
P6KE91	80.26	5	81.90	100.00	1	131.0	4.5	99
P6KE91A	84.77	5	86.50	95.50	1	125.0	4.8	94
P6KE100	88.20	5	90.00	110.00	1	144.0	4.2	109
P6KE100A	93.10	5	95.00	105.00	1	137.0	4.4	104
P6KE110	97.02	5	99.00	121.00	1	158.0	3.8	120
P6KE110A	102.90	5	105.00	116.00	1	152.0	4.0	115
P6KE120	105.84	5	108.00	132.00	1	173.0	3.5	131
P6KE120A	111.72	5	114.00	126.00	1	165.0	3.6	125
P6KE130	114.66	5	117.00	143.00	1	187.0	3.2	142
P6KE130A	121.52	5	124.00	137.00	1	179.0	3.3	136
P6KE150	132.30	5	135.00	165.00	1	215.0	2.8	164
P6KE150A	140.14	5	143.00	158.00	1	207.0	2.9	157
P6KE160	141.12	5	144.00	176.00	1	230.0	2.6	175
P6KE160A	148.96	5	152.00	168.00	1	219.0	2.7	167
P6KE170	149.94	5	153.00	187.00	1	244.0	2.5	186
P6KE170A	158.76	5	162.00	179.00	1	234.0	2.6	188
P6KE180	158.76	5	162.00	198.00	1	258.0	2.3	197
P6KE180A	167.58	5	171.00	189.00	1	246.0	2.4	188
P6KE200	176.40	5	180.00	220.00	1	287.0	2.1	219
P6KE200A	186.20	5	190.00	210.00	1	274.0	2.2	209
P6KE220	194.04	5	198.00	242.00	1	344.0	2.0	240
P6KE220A	204.82	5	209.00	231.00	1	328.0	2.0	230
P6KE250	222.75	5	225.00	275.00	1	360.0	2.0	270
P6KE250A	234.63	5	237.00	263.00	1	344.0	2.0	260
P6KE300	267.30	5	270.00	330.00	1	430.0	2.0	330
P6KE300A	282.15	5	285.00	315.00	1	414.0	2.0	315
P6KE350	311.85	5	315.00	385.00	1	504.0	2.0	385
P6KE350A	328.68	5	332.00	368.00	1	482.0	2.0	368
P6KE400	356.40	5	360.00	440.00	1	574.0	2.0	440
P6KE400A	376.20	5	380.00	420.00	1	548.0	2.0	420
P6KE440	392.04	5	396.00	484.00	1	631.0	2.0	460
P6KE440A	413.82	5	418.00	462.00	1	600.0	2.0	440

NOTE 1: "A" = 5%, standard tolerance is 10%. Order with "C" or "CA" suffix for bidirectional types.

SEMTECH CORPORATION
652 Mitchell Road, Newbury Park, CA 91320 • 805-498-2111 • FAX: 805-498-3804

SEMTECH CORPORATION

The Leader In Power Semiconductor Components

1500 WATT AXIAL LEAD - TRANSIENT VOLTAGE SUPPRESSOR

FEATURES:
- 1500 watts peak pulse power.
- Response time: 1 x 10^{-12}.
- Each device 100% Surge Tested to Ipp.
- Voltage range: 6.8v to 440v.
- Protects sensitive semiconductor circuits.
- Solid state silicon avalanche technology.

MAXIMUM RATINGS:
- Operating & Storage Temp: -65°C to +150°C.
- Forward surge rating: 200A, 1/120sec half cycle @ 25°C.
- Steady state power dissipation: 5 watt @ T_L = 75°C.

MECHANICAL CHARACTERISTICS:
- Molded epoxy case: DO-201.
- Body marking: P/N, date code, polarity band (cathode).

ELECTRICAL CHARACTERISTICS @ 25°C

Semtech Part Number See Note 1	Reverse Stand-off Voltage Vrwm (V)	Reverse Leakage Current ID (µA)	Breakdown Voltage BV (Volts) Min	Max	Test Current IT (mA)	Maximum Clamping Voltage @ Ipp Vc (V)	Peak Pulse Current Ipp (A)	Temperature Coefficient For BV mV/°C
1.5KE6.8	5.50	1000	6.12	7.48	10	10.8	139.0	5
1.5KE6.8A	5.80	1000	6.45	7.14	10	10.5	143.0	5
1.5KE7.5	6.05	500	6.75	8.25	10	11.7	128.0	5
1.5KE7.5A	6.40	500	7.13	7.88	10	11.3	132.0	5
1.5KE8.2	6.63	200	7.38	9.02	10	12.5	120.0	6
1.5KE8.2A	7.02	200	7.79	8.61	10	12.1	124.0	6
1.5KE9.1	7.37	50	8.19	10.00	1	13.8	109.0	7
1.5KE9.1A	7.78	50	8.65	9.50	1	13.4	112.0	7
1.5KE10	8.10	10	9.00	11.00	1	15.0	100.0	8
1.5KE10A	8.55	10	9.50	10.50	1	14.5	103.0	8
1.5KE11	8.92	5	9.90	12.10	1	16.2	93.0	9
1.5KE11A	9.40	5	10.50	11.60	1	15.6	96.0	9
1.5KE12	10.26	5	10.80	13.20	1	17.3	87.0	10
1.5KE12A	10.83	5	11.40	12.60	1	16.7	90.0	10
1.5KE13	11.12	5	11.70	14.30	1	19.0	79.0	11
1.5KE13A	11.76	5	12.40	13.70	1	18.2	82.0	11
1.5KE15	12.83	5	13.50	16.50	1	22.0	68.0	13
1.5KE15A	13.59	5	14.30	15.80	1	21.2	71.0	12
1.5KE16	13.66	5	14.40	17.60	1	23.5	64.0	16
1.5KE16A	14.44	5	15.20	16.80	1	22.5	67.0	14
1.5KE18	15.39	5	16.20	19.80	1	26.5	56.5	17
1.5KE18A	16.25	5	17.10	18.90	1	25.2	59.5	19
1.5KE20	17.64	5	18.00	22.00	1	29.1	51.5	20
1.5KE20A	18.62	5	19.00	21.00	1	27.7	54.0	19
1.5KE22	19.40	5	19.80	24.20	1	31.9	47.0	21
1.5KE22A	20.48	5	20.90	23.10	1	30.6	49.0	20
1.5KE24	21.17	5	21.60	26.40	1	34.7	43.0	25
1.5KE24A	22.34	5	22.80	25.20	1	33.2	45.0	23
1.5KE27	23.81	5	24.30	29.70	1	39.1	38.5	28
1.5KE27A	25.19	5	25.70	28.40	1	37.5	40.0	25
1.5KE30	26.46	5	27.00	33.00	1	43.5	34.5	31
1.5KE30A	27.93	5	28.50	31.50	1	41.4	36.0	28
1.5KE33	29.11	5	29.70	36.30	1	47.7	31.5	31
1.5KE33A	30.77	5	31.40	34.70	1	45.7	33.0	30
1.5KE36	31.75	5	32.40	39.60	1	52.0	29.0	35
1.5KE36A	33.52	5	34.20	37.80	1	49.9	30.0	31
1.5KE39	34.40	5	35.10	42.90	1	56.4	26.5	39
1.5KE39A	36.36	5	37.10	41.00	1	53.9	28.0	36
1.5KE43	37.93	5	38.70	47.30	1	61.9	24.0	46
1.5KE43A	40.08	5	40.90	45.20	1	59.3	25.3	44
1.5KE47	41.45	5	42.30	51.70	1	67.8	22.2	50
1.5KE47A	43.81	5	44.70	49.40	1	64.8	23.2	48
1.5KE51	44.98	5	45.90	56.10	1	73.5	20.4	55
1.5KE51A	47.53	5	48.50	53.60	1	70.1	21.4	51
1.5KE56	49.39	5	50.40	61.60	1	80.5	18.6	58
1.5KE56A	52.14	5	53.20	58.80	1	77.0	19.5	56
1.5KE62	54.68	5	55.80	58.20	1	89.0	16.9	65
1.5KE62A	57.72	5	58.90	65.10	1	85.0	17.7	62
1.5KE68	59.96	5	61.20	74.80	1	98.0	15.3	71
1.5KE68A	63.31	5	64.60	71.40	1	92.0	16.3	69
1.5KE75	66.15	5	67.50	82.50	1	108.0	13.9	80
1.5KE75A	69.87	5	71.30	78.80	1	103.0	14.6	76
1.5KE82	72.32	5	73.80	90.20	1	118.0	12.7	90
1.5KE82A	76.34	5	77.90	86.10	1	113.0	13.3	86
1.5KE91	80.26	5	81.90	100.00	1	131.0	11.4	99
1.5KE91A	84.77	5	86.50	95.50	1	125.0	12.0	94
1.5KE100	88.20	5	90.00	110.00	1	144.0	10.4	109
1.5KE100A	93.10	5	95.00	105.00	1	137.0	11.0	104
1.5KE110	97.02	5	99.00	121.00	1	158.0	9.5	120
1.5KE110A	102.90	5	105.00	116.00	1	152.0	9.9	115
1.5KE120	105.84	5	108.00	132.00	1	173.0	8.7	131
1.5KE120A	111.72	5	114.00	126.00	1	165.0	9.1	125
1.5KE130	114.66	5	117.00	143.00	1	187.0	8.0	142
1.5KE130A	121.52	5	124.00	137.00	1	179.0	8.4	136
1.5KE150	132.30	5	135.00	165.00	1	215.0	7.0	164
1.5KE150A	140.14	5	143.00	158.00	1	207.0	7.2	157
1.5KE160	141.12	5	144.00	176.00	1	230.0	6.5	175
1.5KE160A	148.96	5	152.00	168.00	1	219.0	6.8	167
1.5KE170	149.94	5	153.00	187.00	1	244.0	6.2	186
1.5KE170A	158.76	5	162.00	179.00	1	234.0	6.4	188
1.5KE180	158.76	5	162.00	198.00	1	258.0	5.8	197
1.5KE180A	167.58	5	171.00	189.00	1	246.0	6.1	188
1.5KE200	176.40	5	180.00	220.00	1	287.0	5.2	219
1.5KE200A	186.20	5	190.00	210.00	1	274.0	5.5	209
1.5KE220	194.04	5	198.00	242.00	1	344.0	4.3	240
1.5KE220A	204.82	5	209.00	231.00	1	328.0	4.6	230
1.5KE250	222.75	5	225.00	275.00	1	360.0	5.0	270
1.5KE250A	234.63	5	237.00	263.00	1	344.0	5.0	260
1.5KE300	267.30	5	270.00	330.00	1	430.0	5.0	330
1.5KE300A	282.15	5	285.00	315.00	1	414.0	5.0	315
1.5KE350	311.85	5	315.00	385.00	1	504.0	4.0	385
1.5KE350A	328.68	5	332.00	368.00	1	482.0	4.0	368
1.5KE400	356.40	5	360.00	440.00	1	574.0	4.0	440
1.5KE400A	376.20	5	380.00	420.00	1	548.0	4.0	420
1.5KE440	392.04	5	396.00	484.00	1	631.0	4.0	460
1.5KE440A	413.82	5	418.00	462.00	1	600.0	4.0	440

NOTE 1: "A" = 5%, standard tolerance is 10%. Order with "C" or "CA" suffix for bidirectional types.

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SEMTECH CORPORATION

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HIGH CURRENT HALF WAVE ASSEMBLIES

ABSOLUTE MAXIMUM RATINGS (@25°C UNLESS OTHERWISE SPECIFIED)

Device Type	Reverse Voltage		Average Forward Current (1)		Repetitive Surge Current	1 Cycle Surge Current tp=8.3ms	Reverse Recovery (4)	Forward Voltage		Reverse Current		Thermal Impedance	Operating & Storage Temp Range		Case Outline
	V_{RWM}	V_{RRM}	I_F (AV) @ T_C		I_{FRM}	I_{FSM}	Trr	V_F	@I_F	I_R	I_R	θ_{JC}	Top & T_{STC}		
			55°C	100°C				@25°C		@25°C	@100°C		Min	Max	
	Volts	Volts	Amps	Amps	Amps	Amps	nS	Volts	Amps	µA	µA	°C/W	°C	°C	
ISOPAC™ RANGE															
ISOPAC0103	1000	1000	15	11	25	150	2000	1.2	9	1	20	3.0	-55	175	G45
ISOPAC0104	400	400	15	11	25	150	150	1.5		1	20			175	
ISOPAC0111	150	150	15	10	24	175	30	1.1		10	500			150	
ISOPAC0112	600	600	15	11	25	150	2000	1.2		1	20			175	
ISOPAC0119	1000	1000	10	8	15	150	150	2.2		1	25			175	
ISOPAC0123	500	500	10	8	15	150	50	1.6		10	500			150	G45
ISOPAC0203	1000	1000	15	11	25	150	2000	1.2		1	20			175	G46
ISOPAC0204	400	400	15	11	25	150	150	1.5		1	20			175	
ISOPAC0211	150	150	15	10	24	175	30	1.1		10	500			150	
ISOPAC0212	600	600	15	11	25	150	2000	1.2		1	20			175	
ISOPAC0219	1000	1000	10	8	15	150	150	2.2		1	25			175	
ISOPAC0223	500	500	10	8	15	150	50	1.6		10	500			150	G46
ISOPAC0403	1000	1000	15	11	25	150	2000	1.2		1	20			175	G47
ISOPAC0404	400	400	15	11	25	150	150	1.5		1	20			175	
ISOPAC0411	150	150	15	10	24	175	30	1.1		10	500			150	
ISOPAC0412	600	600	15	11	25	150	2000	1.2		1	20			175	
ISOPAC0419	1000	1000	10	8	15	150	150	2.2		1	25			175	
ISOPAC0423	500	500	10	8	15	150	50	1.6		10	500			150	G47
ISOPAC0603	1000	1000	15	11	25	150	2000	1.2		1	20			175	G49
ISOPAC0604	400	400	15	11	25	150	150	1.5		1	20			175	
ISOPAC0611	150	150	15	10	24	175	30	1.1		10	500			150	
ISOPAC0612	600	600	15	11	25	150	2000	1.2		1	20			175	
ISOPAC0619	1000	1000	10	8	15	150	150	2.2		1	25			175	
ISOPAC0623	500	500	10	8	15	150	50	1.6		10	500			150	G49
ISOPAC1203	1000	1000	15	11	25	150	2000	1.2		1	20			175	G50
ISOPAC1204	400	400	15	11	25	150	150	1.5		1	20			175	
ISOPAC1211	150	150	15	10	24	175	30	1.1		10	500			150	
ISOPAC1212	600	600	15	11	25	150	2000	1.2		1	20			175	
ISOPAC1219	1000	1000	10	8	15	150	150	2.2		1	25			175	
ISOPAC1223	500	500	10	8	15	150	50	1.6		10	500			150	G50
SET01##03	1000	1000	15	11	25	150	2000	1.2		1	20			175	G57
SET01##04	400	400	15	11	25	150	150	1.5		1	20			175	
SET01##11	150	150	15	10	24	175	30	1.1		10	500			150	
SET01##12	600	600	15	11	25	150	2000	1.2		1	20			175	
SET01##19	1000	1000	10	8	15	150	150	2.2		1	25			175	
SET01##23	500	500	10	8	15	150	50	1.6		10	500	3.0		150	G57
SET04##03	1000	1000	30	22	50	250	2000	1.2	18	2	40			175	G58
SET04##04	400	400	30	22	50	250	150	1.5		2	40			175	
SET04##11	150	150	30	20	48	290	30	1.1		20	1000			150	
SET04##12	600	600	30	22	50	250	2000	1.2		2	40			175	
SET04##19	1000	1000	20	16	30	250	150	2.2		2	50			175	
SET04##23	500	500	20	16	30	250	50	1.6		20	1000	1.5	-55	150	G58

NOTES

(1) Rating at Case Temperature T_C
Rating for each leg in multiple diode assemblies

(4) Measured on discrete devices prior to assembly

Add code for configuration # #:

01 = Non-isolated cathode to stud
02 = Isolated cathode to stud
03 = Non-isolated anode to stud
04 = Isolated anode to stud

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HIGH CURRENT HALF WAVE ASSEMBLIES (cont.)

ABSOLUTE MAXIMUM RATINGS (@25°C UNLESS OTHERWISE SPECIFIED)

Device Type	Reverse Voltage		Average Forward Current (1)		Repetitive Surge Current	1 Cycle Surge Current tp=8.3ms	Reverse Recovery (4)	Forward Voltage		Reverse Current		Thermal Impedance	Operating & Storage Temp Range		Case Outline
	V_{RWM}	V_{RRM}	I_F (AV) @ T_C		I_{FRM}	I_{FSM}	Trr	V_F	@I_F	I_R	I_R	θ_{JC}	Top & T_{STC}		
			55°C	100°C				@25°C		@25°C	@100°C		Min	Max	
	Volts	Volts	Amps	Amps	Amps	Amps	nS	Volts	Amps	µA	µA	°C/W	°C	°C	
ISOPAC™ RANGE (cont.)															
SET05##03	1000	1000	60	44	100	500	2000	1.2	36	4	80	0.75	-55	175	G79
SET05##04	400	400	60	44	100	500	150	1.5		4	80			175	
SET05##11	150	150	60	40	96	580	30	1.1		40	2000			150	
SET05##12	600	600	60	44	100	500	2000	1.2		4	80			175	
SET05##19	1000	1000	40	32	60	500	150	2.2		4	320			175	
SET05##23	500	500	40	32	60	500	50	1.6		40	2000	0.75		150	G79
SET10##03	1000	1000	90	66	150	750	2000	1.2	54	6	120	0.5		175	G74
SET10##04	400	400	90	66	150	750	150	1.5		6	120			175	
SET10##11	150	150	90	60	144	870	30	1.1		60	3000			150	
SET10##12	600	600	90	66	150	750	2000	1.2		6	120			175	
SET10##19	1000	1000	60	48	90	750	150	2.2		6	480			175	
SET10##23	500	500	60	48	90	750	50	1.6		60	3000	0.5		150	G74
SET13##03	1000	1000	15	11	25	150	2000	1.2	9	1	20	3.0		175	G76
SET13##04	400	400	15	11	25	150	150	1.5		1	20			175	
SET13##11	150	150	15	10	24	175	30	1.1		10	500			150	
SET13##12	600	600	15	11	25	150	2000	1.2		1	20			175	
SET13##19	1000	1000	10	8	15	150	150	2.2		1	80			175	
SET13##23	500	500	10	8	15	150	50	1.6		10	500	3.0	-55	150	G76

Add code for configuration # #:

01 = Non-isolated cathode to stud
02 = Isolated cathode to stud
03 = Non-isolated anode to stud
04 = Isolated anode to stud

Device Type	Reverse Voltage		Average Forward Current (1)			(2)	(3)	Repetitive Surge Current	1 Cycle Surge Current tp=8.3ms	Reverse Recovery (4)	Forward Voltage		Reverse Current		Thermal Impedance	Case Outline
	V_{RWM}	V_{RRM}	I_F (AV) @ T_C			I_F @ T_S	I_F @ T_I	I_{FRM}	I_{FSM}	Trr	V_F	@I_F	I_R	I_R	θ_{JC}	
			25°C	55°C	100°C	55°C	55°C				@25°C		@25°C	@100°C		
	Volts	Volts	Amps	Amps	Amps	Amps	Amps	Amps	Amps	nS	Volts	Amps	µA	µA	°C/W	
STANDARD RECOVERY																
SCSM05	50	50	150	110	70	95	175	250	1800	2000	1.15	100	12	400	0.28	G17
SCSM1	100	100														
SCSM2	200	200														
SCSM4	400	400														
SCSM6	600	600														
SCSM8	800	800														
SCSM0	1000	1000	150	110	70	95	175	250	1800	2000	1.15	100	12	400	0.28	G17
FAST RECOVERY																
SCSF05	50	50	120	100	65	82.5	150	250	1800	150	1.35	100	12	300	0.28	G17
SCSF1	100	100	120	100	65	82.5	150	250	1800	150	1.35		12	300		
SCSF2	200	200	120	100	65	82.5	150	250	1800	150	1.35		12	300		
SCSF4	400	400	120	100	65	82.5	150	250	1800	150	1.35		12	300		
SCSF0	1000	1000	85	70	50	60.0	105	150	1250	150	2.00		12	300		
SCSFF05	50	50	150	130	85	105	190	240	1800	30	1.10		120	6000		
SCSFF10	100	100	150	130	85	105	190	240	1800	30	1.10		120	6000		
SCSFF15	150	150	150	130	85	105	190	240	1800	30	1.10	100	120	6000	0.28	G17

NOTES:

Operating and Storage Temperature Range -55°C to +150°C
(1) Rating at Case Temperature T_C (2) Rating at Stud Temperature T_S
(3) Rating at Insert Temprature T_I (4) Measured on discrete devices prior to assembly

Add 'R' for Reverse Polarity i.e. Anode to Stud e.g.SCSM0R

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HIGH VOLTAGE HALF WAVE ASSEMBLIES

ABSOLUTE MAXIMUM RATINGS (@25°C UNLESS OTHERWISE SPECIFIED)

Device Type	Reverse Voltage		Average Forward Current (1)			(2)	(3)	Repetitive Surge Current	1 Cycle Surge Current tp=8.3ms	Reverse Recovery (4)	Forward Voltage		Reverse Current		Case Outline	Case Length
	V_{RWM}	V_{RRM}	I_F (AV) @ T_A			I_F @ T_S	I_F @ T_O	I_{FRM}	I_{FSM}	T_{RR}	V_F	@I_F	I_R	I_R		
			25°C	55°C	100°C	25°C	55°C				@25°C		@25°C	@100°C		
	Volts	Volts	Amps	Amps	Amps	Amps	Amps	Amps	Amps	nS	Volts	Amps	µA	µA		Inches
FAST RECOVERY																
SCF2500	2500	2500	—	0.50	0.30	—	1.00	15	25	150	3.45	0.5	1.0	25.0	G21	1.145
SCF5000	5000	5000		0.50	0.30		1.00	15	25		5.75	0.5	1.0		G21	2.020
SCF7500	7500	7500		0.50	0.30		1.00	15	25		9.20	0.5	1.0		G21	2.770
SCF10000	10000	10000		0.50	0.30		1.00	15	25		11.5	0.5	1.0		G21	3.520
SCF12500	12500	12500		0.50	0.30		1.00	15	25		15.0	0.5	1.0		G21	4.270
SCFS2000	2000	2000		1.50	1.00		3.00	10	150		5.4	3.0	5.0		G19	1.53
SCFS4000	4000	4000									9.0					2.53
SCFS6000	6000	6000									12.6					3.53
SCFS8000	8000	8000									16.2					4.53
SCFS10000	10000	10000									19.8					5.53
SCFS12000	12000	12000					3.00	10	150	150	23.4	3.0	5.0		G19	6.53
SCKV30K12F	30000	30000	0.2	—	—		0.80	2.5	10	300	60.0	0.1	1.0		G55	4.53
SCKV4512F	45000	45000	0.2	—	—		0.80	2.5	10	300	95.0	0.1	1.0		G55	6.66
SCKV60K12F	60000	60000	0.2	—	—		0.80	2.5	10	300	125.0	0.1	1.0		G55	8.78
SDHF2.5KM	2500	—	1.0	—	—		1.0	—	25	150	7.2	1.0	1.0		G22A	3.36
SDHF5KM	5000	—	1.0		—		1.0	—	25	150	14.4	1.0	1.0		G22A	4.04
SDHF7.5KM	7500	—	1.0		—		1.0	—	25	150	21.6	1.0	1.0		G22A	6.09
SDHF2.5KS	2500	—	2.5		—		2.50	—	150	150	6.6	3.0	1.0		G22A	3.36
SDHF5KS	5000	—	2.5		—	—	2.50	—	150	150	13.2	3.0	1.0	25.0	G22A	4.04
SHVM2.5F	2500	2500	0.35		0.15	0.35	0.35	8.0	15	350	7.0	0.8	1.0	50.0	G20	—
SHVM5F	5000	5000									14					
SHVM7.5F	7500	7500									21					
SHVM10F	10000	10000									28					
SHVM12.5F	12500	12500									35					
SHVM15F	15000	15000	0.35		0.15	0.35	0.35	8.0	15	350	42					
S2HVM2.5F	2500	2500	2.0		0.80	2.00	2.00	11	32	150	6.0	1.0	1.0	25.0		
S2HVM5F	5000	5000	1.20		0.50	2.00	2.00	11	32	150	12	1.0	1.0	25.0		
S2HVM7.5F	7500	7500	0.80		0.30	1.50	2.00	11	32	150	18	1.0	1.0	25.0		
S3HVM2.5F	2500	2500	2.40		1.00	3.00	3.00	20	70	150	6.0	3.0	5.0	25.0		
S3HVM5F	5000	5000	1.20		0.50	2.50	3.00	20	70	150	12	3.0	5.0	25.0		
S6HVM2.5F	2500	2500	2.40	—	1.00	5.00	6.00	35	130	150	6.0	6.0	10.0	50.0	G20	—
STANDARD RECOVERY																
SCHJ15K	15000	15000	—	0.05	0.03	—	0.10	2.5	25	2500	20.0	0.1	1.0	20.0	G18	1.52
SCHJ22.5K	22500	22500		0.05	0.03		0.10	2.5	25	2500	30.0	0.1			G18	2.02
SCHJ30K	30000	30000		0.05	0.03		0.10	2.5	25	2500	40.0	0.1			G18	2.52
SCHJ37.5K	37500	37500		0.05	0.03		0.10	2.5	25	2500	50.0	0.1			G18	3.02
SCHJ45K	45000	45000		0.05	0.03		0.10	2.5	25	2500	60.0	0.1			G18	3.52
SCH5000	5000	5000		0.50	0.33		1.00	10	50	5000	5.0	1.0			G21	1.145
SCH7500	7500	7500									8.0					1.645
SCH10000	10000	10000									10.0					2.020
SCH12500	12500	12500									13.0					2.395
SCH15000	15000	15000									15.0					2.770
SCH20000	20000	20000									20.0					3.520
SCH25000	25000	25000		0.50	0.33		1.00	10	50	5000	25.0	1.0		20.0	G21	4.270
SCHS2500	2500	2500		2.00	1.20		4.00	31	80	5000	3.45	3.0		10.0	G19	1.53
SCHS5000	5000	5000								2500	5.75					2.53
SCHS7500	7500	7500									9.20					3.53
SCHS10000	10000	10000									11.50					4.53
SCHS12500	12500	12500									14.95					5.53
SCHS15000	15000	15000	—	2.00	1.20	—	4.00	31	80		18.40	3.0	1.0	10.0	G19	6.53

NOTES: Operating and Storage Temperature Range -55°C to +150°C (1) Rating at Ambient Temperature T_A (3) Rating at Oil Temperature T_O
(2) Rating at Stud Temperature T_S (4) Measured on discrete devices prior to assembly

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HIGH VOLTAGE HALF WAVE ASSEMBLIES (cont.)

ABSOLUTE MAXIMUM RATINGS (@ 25°C UNLESS OTHERWISE SPECIFIED)

STANDARD RECOVERY (cont.)

Device Type	Reverse Voltage		Average Forward Current (1)			(2)	(3)	Repetitive Surge Current	1 Cycle Surge Current tp = 8.3ms	Reverse Recovery (4)	Forward Voltage		Reverse Current		Case Outline	Case Length
	V_{RWM}	V_{RRM}	I_F (AV) @ T_A			I_F @ T_S	I_F @ T_O	I_{FRM}	I_{FSM}	T_{RR}	V_F	@ I_F	I_R	I_R		
			25°C	55°C	100°C	25°C	55°C				@25°C		@25°C	@100°C		
	Volts	Volts	Amps	Amps	Amps	Amps	Amps	Amps	Amps	nS	Volts	Amps	µA	µA		Inches
SHVM2.5	2500	2500	0.5	—	0.20	0.50	0.5	8.0	20	2000	7.0	0.8	1.0	50.0	G20	—
SHVM5	5000	5000									14.0					
SHVM7.5	7500	7500									21.0					
SHVM10	10000	10000									28.0					
SHVM12.5	12500	12500									35.0					
SHVM15	15000	15000	0.5		0.20	0.50	0.5	8.0	20	2000	42.0	0.8		50.0		
S2HVM2.5	2500	2500	2.0		0.80	2.00	2.0	12	50	2500	3.5	2.0		20.0		
S2HVM5	5000	5000	2.0		0.80	2.00					5.5					
S2HVM7.5	7500	7500	2.0		0.80	2.00					8.8					
S2HVM10	10000	10000	1.2		0.50	2.00					11.1					
S2HVM12.5	12500	12500	1.0		0.40	2.00					14.4					
S2HVM15	15000	15000	0.8		0.30	1.50	2.0	12			16.6	2.0		20.0		
S3HVM2.5	2500	2500	3.0		1.25	3.00	3.0	11			3.45	3.0		10.0		
S3HVM5	5000	5000	2.4		1.00	3.00	3.0	11			5.75	3.0		10.0		
S3HVM7.5	7500	7500	1.5		0.63	3.00	3.0	11			9.20	3.0		10.0		
S3HVM10	10000	10000	1.2		0.50	2.50	3.0	11	50		11.5	3.0	1.0	10.0		
S6HVM2.5	2500	2500	4.0		1.50	6.00	6.0	22	100		3.45	6.0	2.0	20.0		
S6HVM5	5000	5000	2.4		1.00	6.00	6.0	22	100		5.75	6.0	2.0	20.0		
S9HVM2.5	2500	2500	5.0	—	1.80	7.50	10.0	33	150		3.45	9.0	3.0	30.0	G20	—
SCKV33K12	33000	—	0.3		—	—	1.20	—	14		60.0	1.0	1.0	20.0	G55	4.53
SCKV45K12	45000		0.3				1.20		14		95.0	1.0				6.66
SCKV66K12	66000		0.3				1.20		14		125.5	1.0				8.78
SCKV100K3	100000		0.1				0.30		25		129.0	0.1				4.53
SCKV150K3	150000		0.1				0.30		25		190.0	0.1				6.66
SCKV200K3	200000		0.1				0.30		25	2500	250.0	0.1		200		8.78
SCKV12K30	12000		1.0	0.76			2.00		50	2000	13.2	1.0		25.0		4.53
SCKV18K30	18000						2.00		50		20.9	1.0		25.0		6.66
SCKV25K30	25000						2.00	—	50		27.5	1.0		25.0		8.78
SCKV12K40	12000						3.00		150		12.0	3.0		20.0		4.53
SCKV18K40	18000						3.00		150		19.0	3.0		20.0		6.66
SCK25K40	25000		1.0	0.76			3.00		150	2000	25.0	3.0	1.0	20.0	G55	8.78
SDH7.5K	7500		0.4	—			0.40	—	40	2500	10.0	0.2	2.0	40.0	G22A	3.36
SDH15K	15000		0.4				0.40		40	2500	20.0	0.2	2.0	40.0		4.04
SDH5KM	5000		1.0				1.00		50	2000	6.6	1.0	1.0	25.0		3.36
SDH10KM	10000		1.0				1.00		50		13.2	1.0	1.0	25.0		4.04
SDH15KM	15000		1.0				1.00		50		19.8	1.0	1.0	25.0		4.04
SDH5KS	5000		2.5				2.5		150		6.0	3.0	1.0	20.0		3.36
SDH10KS	10000	—	2.5	—	—	—	2.5	—	150		12.0	3.0	1.0	20.0	G22A	4.04
SCPHN6	6000	6000	—	5.50	3.00	—	—	90	150		6.0	3.0	1.0	20.0	G44	4.21
SCPHN10	10000	10000									10.0					5.53
SCPHN16	16000	16000									16.0					7.51
SCPHN20	20000	20000									20.0					8.83
SCPHN26	26000	26000									26.0					10.81
SCPHN30	30000	30000	—	5.50	3.00		—	90			30.0				G44	12.13
S1KW16KA-1	16000	16000	2.0	1.4[5]	—		5.0	25			16.0				G23	4.78
S1KW32KA-2	32000	32000	1.5	1.0[5]			3.8				32.0					7.98
S1KW48KA-3	48000	48000	1.5	1.0[5]			3.8				48.0					11.18
S1KW64KA-4	64000	64000	1.5	1.0[5]			3.8				64.0					14.38
S1KW80KA-5	80000	80000	1.5	1.0[5]			3.8				80.0					17.58
S1KW96KA-6	96000	96000	1.5	1.0[5]	—	—	3.8	25	150	2000	72.0	3.0	1.0	20.0	G23	20.78
S2KW8KA-1	8000	8000	4.0	2.7[5]	—	—	10.0	45	250	2000	8.0	6.0	2.0	40.0	G23	4.78
S2KW16KA-2	16000	16000	3.0	2.0[5]			7.5				16.0					7.98
S2KW24KA-3	24000	24000	3.0				7.5				24.0					11.18
S2KW32KA-4	32000	32000	3.0				7.5				32.0					14.38
S2KW40KA-5	40000	40000	3.0				7.5				40.0					17.58
S2KW48KA-6	48000	48000	3.0				7.5	45	250		48.0	6.0	2.0	40.0		20.78
S4KW4KA-1	4000	4000	8.0	5.4[5]			20.0	90	500		4.0	12.0	4.0	80.0		4.78
S4KW8KA-2	8000	8000	6.0	4.0[5]			15.0				8.0					7.98
S4KW12KA-3	12000	12000	6.0				15.0				12.0					11.18
S4KW16KA-4	16000	16000	6.0				15.0				16.0					14.38
S4KW20KA-5	20000	20000	6.0				15.0				20.0					17.58
S4KW24KA-6	24000	24000	6.0		—	—	15.0	90	500	2000	24.0	12.0	4.0	80.0	G23	20.78

NOTES:

Operating and Storage Temperature Range -55°C to +150°C

(1) Rating at Ambient Temperature T_A

(2) Rating at Stud Temperature T_S

(3) Rating at Oil Temperature T_O

(4) Measured on discrete devices prior to assembly

(5) At T_A = 65°C

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CENTER TAPS AND DOUBLERS

ABSOLUTE MAXIMUM RATINGS (@25°C UNLESS OTHERWISE SPECIFIED)

Device Type	Reverse Voltage		Average Forward Current (5) (1)			(2)		Repetitive Surge Current	1 Cycle Surge Current tp=8.3ms	Reverse Recovery (3)	Forward Voltage		Reverse Current		Thermal Impedance	Case Outline
	V_{RWM}	V_{RRM}	I_F (AV) @ T_C			I_F @ T_A		I_{FRM}	I_{FSM}	T_{rr}	V_F	@I_F	I_R	I_R	θ_{JC}	
			25°C	55°C	100°C	25°C	55°C				@25°C		@25°C	@100°C		
	Volts	Volts	Amps	Amps	Amps	Amps	Amps	Amps	Amps	nS	Volts	Amps	µA	µA	°C/W	
LOW VOLTAGE (1000V)																
SET03##03[A]	1000	1000	—	30	22	—	—	—	150	2000	1.2	9	1	20	1.5	G51
SET03##04[A]	400	400		30	22				150	150	1.5		1	20	1.5	
SET03##11	150	150		30	20				175	30	1.1		10	500	1.5	
SET03##12[A]	600	600		30	22				150	2000	1.2		1	20	1.5	
SET03##19[A]	1000	1000		20	16					150	2.2		1	25	1.5	
SET03##23	500	500		20	16	—	—			50	1.60		10	500	1.5	G51
SC*A05	50	50		15	10	5.0	4.0	25		2000	1.00	3	1	20	4.0	G24
SC*A1	100	100				5.0	4.0			2000	1.00					
SC*A2	200	200				5.0	4.0			2000	1.00					
SC*A4	400	400				5.0	4.0			2000	1.00					
SC*A6	600	600				5.0	4.0			2000	1.00					
SC*A05F	50	50				3.0	2.3			150	1.10					
SC*A1F	100	100				3.0	2.3			150	1.10					
SC*A2F	200	200				3.0	2.3			150	1.10					
SC*A4F	400	400				3.0	2.3	25	150	150	1.10	3	1	20		
SC*A05FF	50	50				4.5	3.5	24	175	30	0.97	5	10	500		
SC*A10FF	100	100				4.5	3.5	24	175	30	0.97	5	10	500		
SC*A15FF	150	150				4.5	3.5	24	175	30	0.97	5	10	500	4.0	G24
SC*AR05	50	50	45	35	20	—	—	70	375	2000	1.00	9	3	60	1.5	G25
SC*AR1	100	100														
SC*AR2	200	200														
SC*AR4	400	400														
SC*AR6	600	600														
SC*AR8	800	800														
SC*AR10	1000	1000							375	2000	1.00					
SC*AR05F	50	50	40	31	18				450	150	1.10					
SC*AR1F	100	100								150	1.10					
SC*AR2F	200	200								150	1.10					
SC*AR4F	400	400								150	1.10	9	3	60		
SC*AR05FF	50	50	45	35	20					30	0.97	15	30	1500		
SC*AR10FF	100	100	45	35	20					30	0.97	15	30	1500		
SC*AR15FF	150	150	45	35	20			70	450	30	0.97	15	30	1500	1.5	G25
SC*AS05	50	50	85	70	45			120	900	2000	1.00	18	6	120	0.8	G27A
SC*AS1	100	100								2000	1.00			120		
SC*AS2	200	200								2000	1.00			120		
SC*AS4	400	400								2000	1.00			120		
SC*AS6	600	600								2000	1.00			120		
SC*AS05F	50	50	80	65	42					150	1.10			120		
SC*AS1F	100	100								150	1.10			120		
SC*AS2F	200	200								150	1.10			120		
SC*AS4F	400	400						120		150	1.10	18	6	120		
SC*AS05FF	50	50	85	70	45			135		30	0.97	30	60	3000		
SC*AS10FF	100	100	85	70	45			135		30	0.97	30	60	3000		
SC*AS15FF	150	150	85	70	45			135	900	30	0.97	30	60	3000	0.8	G27A
SCS*MOL	1000	1000	150	110	70			—	750	2000	1.00	18	6	200	0.5	G26
SCS*F4L	400	400	120	100	65			—	750	150	1.10	18	6	200	0.5	G26
SCS*FF05L	50	50	150	130	85			—	875	30	0.95	30	60	3000	0.5	G26
SCS*FF10L	100	100	150	130	85			—	875	30	0.95	30	60	3000	0.5	G26
SCS*FF15L	150	150	150	130	85	—	—	—	875	30	0.95	30	60	3000	0.5	G26

NOTES:

Operating and Storage Temp. Range = −55°C to +150°C except where shown
(A) Operating and Storage Temperature Range = −55°C to +175°C
(1) Ratings at Case Temperature Tc
(2) Ratings at Ambient Temperature TA
(3) Measured on discrete devices prior to assembly
(4) Rating at Oil Temperature To
(5) Average Rectified Current = 0.5 × IF (AV) for Doubler

Add code for configuration: ## = 10 or * = D for Doubler
08 N for Negative Center Tap
06 P for Positive Center Tap

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CENTER TAPS AND DOUBLERS (cont.)

ABSOLUTE MAXIMUM RATINGS (@25°C UNLESS OTHERWISE SPECIFIED)

Device Type	Reverse Voltage		Average Forward Current (5) (1)			(2)	Repetitive Surge Current	1 Cycle Surge Current tp=8.3ms	Reverse Recovery (3)	Forward Voltage		Reverse Current		Case Outline	Case Length
	V_{RWM}	V_{RRM}	I_F (AV) @ T_C			I_F (AV) @ T_A	I_{FRM}	I_{FSM}	Trr	V_F	@I_F	I_R	I_R		
			25°C	55°C	100°C	55°C				@25°C		@25°C	@100°C		
	Volts	Volts	Amps	Amps	Amps	Amps	Amps	Amps	nS	Volts	Amps	µA	µA		Inches
HIGH VOLTAGE															
SDH*7.5K	7500	7500	0.8	—	—	—	—	8	2000	10.0	0.2	1	20	G22	4.72
SDH*15K	15000	15000	0.8	—				8		20.0	0.2		20		6.09
SDH*5KM	5000	5000	2.0	—				50		6.6	1		25		4.72
SDH*10KM	10000	10000	2.0	—				50		13.2	1		25		4.72
SDH*15KM	15000	15000	2.0	—				50		19.8	1		25		6.09
SDH*5KS	5000	5000	5.0	—				150		6.0	3		25		4.72
SDH*10KS	10000	10000	5.0	—	—	—	—	150		12.0	3		25	G22	6.09
SCPN*5	5000	5000	—	11	6		25	150		5.0	3		20	G44	5.53
SCPN*10	10000	10000	—	11	6		25	150		10.0	3		20	G44	8.83
SCPN*15	15000	15000	—	11	6		25	150	2000	15.0	3	1	20	G44	12.13
HIGH VOLTAGE HIGH CURRENT															
S1KW8C-1*	8000	8000	4	2.75[6]	—	10[4]	45	150	2000	8.0	3	1	20	G23A	4.78
S1KW16C-2*	16000	16000	3	2.0[6]		7.5[4]				16.0					7.98
S1KW24C-3*	24000	24000	3			7.5[4]				24.0					11.18
S1KW32C-4*	32000	32000	3			7.5[4]				32.0					14.38
S1KW40C-5*	40000	40000	3			7.5[4]				40.0					17.58
S1KW48C-6*	48000	48000	3			7.5[4]		150		48.0	3	1	20		20.78
S2KW4C-1*	4000	4000	8	5.5[6]		20[4]		250		4.0	6	2	40		4.78
S2KW8C-2*	8000	8000	6	4.1[6]		15[4]				8.0					7.98
S2KW12C-3*	12000	12000	6			15[4]				12.0					11.18
S2KW16C-4*	16000	16000	6			15[4]				16.0					14.38
S2KW20C-5*	20000	20000	6			15[4]				20.0					17.58
S2KW24C-6*	24000	24000	6			15[4]	45	250		24.0	6	2	40		20.78
S4KW2C-1*	2000	2000	16	11.0[6]		40[4]	80	500		2.0	12	4	80		4.78
S4KW4C-2*	4000	4000	12	8.0[6]		30[4]				4.0					7.98
S4KW6C-3*	6000	6000	12			30[4]				6.0					11.18
S4KW8C-4*	8000	8000	12			30[4]				8.0					14.38
S4KW10C-5*	10000	10000	12			30[4]				10.0					17.58
S4KW12C-6*	12000	12000	12		—	30[4]	80	500	2000	12.0	12	4	80	G23A	20.78

NOTES:

Add code for configuration: * = D for Doubler, N for Negative Center Tap, P for Positive Center Tap

Operating and Storage Temp. Range = -55°C to +150°C

(1) Ratings at Case Temperature T_C

(2) Ratings at Ambient Temperature T_A

(3) Measured on discrete devices prior to assembly

(4) Rating at Oil Temperature T_O = 25°C

(5) Average Rectified Current = 0.5 x I_F(AV) for Doubler

(6) At T_A = 65°C

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SINGLE PHASE FULL WAVE BRIDGES

ABSOLUTE MAXIMUM RATINGS (@ 25°C UNLESS OTHERWISE SPECIFIED)

Device Type	Reverse Voltage	Average Forward Current (1)			Average Forward Current (2)			Repetitive Surge Current	1 Cycle Surge Current tp = 8.3ms	Reverse Recovery (3)	Forward Voltage		Reverse Current		Thermal Impedance	Case Outline
	V_{RWM}	I_F (AV) @ T_C			I_F (AV) @ T_A			I_{FRM}	I_{FSM}	T_{rr}	V_F	@ I_F	I_R	I_R	θ_{JC}	
		55°C	100°C	125°C	25°C	55°C	100°C				@25°C		@25°C	@100°C		
	Volts	Amps	Amps	Amps	Amps	Amps	Amps	Amps	Amps	nS	Volts	Amps	µA	µA	°C/W	
SET061203[A]	1000	30	22	16	—	—	—	—	150	2000	1.2	9	2	40	0.75	G52
SET061204[A]	400	30	22	16					150	150	1.5		2	40		
SET06121.1	150	30	20	14					175	30	1.1		20	1000		
SET061212[A]	600	30	22	16					150	2000	1.2		2	40		
SET061219[A]	1000	20	16	12					150	150	2.2		2	50		
SET061223	500	20	16	12					150	50	1.6		20	1000		G52
SET121203[A]	1000	30	22	16					150	2000	1.2		2	40		G72
SET121204[A]	400	30	22	16					150	150	1.5		2	40		
SET121211	150	30	20	14					175	30	1.1		20	1000		
SET121212[A]	600	30	22	16					150	2000	1.2		2	40		
SET121219[A]	1000	20	16	12					150	150	2.2		2	50		
SET121223	500	20	16	12	—	—	—		150	50	1.6		20	1000	0.75	G72
SCAJ2	200	5.0	3.5	2.5	2.0	1.5	1.1	10	50	2000	1.10	1.0	2	50	5.00	G28
SCAJ4	400	5.0	3.5	2.5	2.0	1.5	1.1	10	50	2000	1.10					
SCAJ6[F]	600	5.0	3.5	2.5	2.0	1.5	1.1	10	50	2000	1.10					
SCAJ05F	50	4.5	3.0	2.0	1.5	1.0	0.7	—	25	150	1.20					
SCAJ1F	100	4.5	3.0	2.0		1.0			25	150						
SCAJ2F	200	4.5	3.0	2.0		1.0			25	150						
SCAJ4F[F]	400	4.5	3.0	2.0		1.0			25	150						
SCAJ6F	600	4.5	3.0	2.0		1.0			25	250		1.0		50		
SCAJ05FF	50	5.0	3.8	2.9		1.1		13	35	30		1.5		100		
SCAJ10FF	100	5.0	3.8	2.9		1.1		13	35	30		1.5		100		
SCAJ15FF	150	5.0	3.8	2.9	1.5	1.1	0.7	13	35	30	1.20	1.5	2	100	5.00	G28
SCBH2	200	12	9.0	8.5	4.0	3.0	1.7	50	150	2000	1.00	3.0	2	50	3.30	G28
SCBH4	400	12	9.0	8.5						2000	1.00					
SCBH6[F]	600	12	9.0	8.5						2000	1.00					
SCBH05F	50	10	7.5	5.5				25		150	1.10					
SCBH1F	100	10	7.5	5.5						150	1.10					
SCBH2F	200	10	7.5	5.5						150	1.10					
SCBH4F[F]	400	10	7.5	5.5	4.0	3.0	1.7	50	150	150	1.10	3.0	2	50		
SCBH05FF	50	12	9.0	7.5	5.0	3.8	2.0	24	175	30	0.97	5.0	20	1000		
SCBH10FF	100	12	9.0	7.5	5.0	3.8	2.0	24	175	30	0.97	5.0	20	1000		
SCBH15FF	150	12	9.0	7.5	5.0	3.8	2.0	24	175	30	0.97	5.0	20	1000	3.30	G28
SCBA2	200	25	18.5	12.5	6.0	5.0	3.0	—	150	2000	1.00	3.0	2	40	2.00	G29
SCBA4	400	25	18.5	12.5	6.0	5.0	3.0			2000	1.00			40		
SCBA6[F]	600	25	18.5	12.5	6.0	5.0	3.0			2000	1.00			40		
SCBA05F	50	20	15.0	10.0	5.0	4.0	2.5			150	1.10			50		
SCBA1F	100	20	15.0	10.0		4.0	2.5			150	1.10			50		
SCBA2F	200	20	15.0	10.0		4.0	2.5			150	1.10			50		
SCBA4F[F]	400	20	15.0	10.0		4.0	2.5		150	150	1.10	3.0	2	50		
SCBA05FF	50	25	18.5	12.8		3.0	1.8		175	30	0.97	5.0	20	1000		
SCBA10FF	100	25	18.5	12.8		3.0	1.8		175	30	0.97	5.0	20	1000		
SCBA15FF	150	25	18.5	12.8	5.0	3.0	1.8		175	30	0.97	5.0	20	1000	2.00	G29
SCBK05	50	38	24.0	17.5	13.0	10.0	6.0	80	500	2000	1.00	12	8	200	1.20	G30A
SCBK1	100	38	24.0	17.5	13.0	10.0	6.0		500	2000	1.00					
SCBK2	200	38	24.0	17.5	13.0	10.0	6.0			2000	1.00					
SCBK4	400	38	24.0	17.5	13.0	10.0	6.0			2000	1.00					
SCBK6	600	38	24.0	17.5	13.0	10.0	6.0			2000	1.00					
SCBK05F	50	32	20.0	16.0	11.0	8.5	5.0			150	1.10					
SCBK1F	100	32	20.0	16.0	11.0	8.5	5.0			150	1.10					
SCBK2F	200	32	20.0	16.0	11.0	8.5	5.0			150	1.10					
SCBK4F	400	32	20.0	16.0	11.0	8.5	5.0			150	1.10	12	8	200		
SCBK05FF	50	38	28.0	20.0	13.0	9.2	5.5		600	30	0.97	20	80	4000		
SCBK10FF	100	38	28.0	20.0	13.0	9.2	5.5			30	0.97	20	80	4000		
SCBK15FF	150	38	28.0	20.0	13.0	9.2	5.5	80		30	0.97	20	80	4000	1.20	G30A

NOTES: Operating and Storage Temperature Ranges are -55°C to +150°C unless otherwise indicated.
(A) Operating and Storage Temperature -55°C to +175°C.
(F) Available in Europe to F and FX levels.
(1) Ratings at Case Temperature Tc.
(2) Ratings at Ambient Temperature Ta.
(3) Measured on discrete devices prior to assembly.

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SINGLE PHASE FULL WAVE BRIDGES (cont.)

ABSOLUTE MAXIMUM RATINGS (@ 25°C UNLESS OTHERWISE SPECIFIED)

Device Type	Reverse Voltage	Average Forward Current (1)			(2)			Repetitive Surge Current	1 Cycle Surge Current tp = 8.3ms	Reverse Recovery (3)	Forward Voltage		Reverse Current		Thermal Impedance	Case Outline
	V_{RWM}	I_F (AV) @ T_C			I_F (AV) @ T_A			I_{FRM}	I_{FSM}	T_{rr}	V_F	@ I_F	I_R	I_R	θ_{JC}	
		55°C	100°C	125°C	25°C	55°C	100°C				@25°C		@25°C	@100°C		
	Volts	Amps	Amps	Amps	Amps	Amps	Amps	Amps	Amps	nS	Volts	Amps	µA	µA	°C/W	
SCBAR05	50	53	35	25	9.5	7.0	4.50	—	375	2000	1.00	9.0	6	240	0.7	G31
SCBAR1	100	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
SCBAR2	200															
SCBAR4	400															
SCBAR6	600															
SCBAR8	800	↓	↓	↓	↓	↓	↓			↓				↓		
SCBAR10	1000	53	35	25	9.5	7.0	4.50			2000	↓			240		
SCBAR05F	50	50	31	20	9.0	6.7	4.3			150	1.1			150		
SCBAR1F	100	50	31	20	9.0	6.7	4.3			150	↓			150		
SCBAR2F	200	50	31	20	9.0	6.7	4.3			150	↓	↓	↓	150		
SCBAR4F	400	50	31	20	9.0	6.7	4.3	↓	375	150	↓	9.0	6	150	↓	
SCBAR05FF	50	55	37	22	9.0	6.7	4.3	64	450	30	0.97	15	60	3000	0.70	
SCBAR10FF	100	55	37	22	9.0	6.7	4.3	64	450	30	0.97	15	60	3000	0.70	↓
SCBAR15FF	150	55	37	22	9.0	6.7	4.3	64	450	30	0.97	15	60	3000	0.70	G31
SCAS05	50	70	47	33	18.0	14.0	9.0	120	750	2000	1.00	18	12	300	0.40	G27
SCAS1	100	70	47	33	18.0	14.0	9.0	↓	↓	2000	1.00	↓	↓	↓	↓	↓
SCAS2	200	70	47	33	18.0	14.0	9.0			2000	1.00					
SCAS4	400	70	47	33	18.0	14.0	9.0			2000	1.00					
SCAS6	600	70	47	33	18.0	14.0	9.0			2000	1.00					
SCAS05F	50	65	43	30	16.0	11.5	7.2			150	1.10					
SCAS1F	100	65	43	30	16.0	11.5	7.2			150	1.10					
SCAS2F	200	65	43	30	16.0	11.5	7.2	↓	↓	150	1.10	↓	↓	↓		
SCAS4F	400	65	43	30	16.0	11.5	7.2	120	750	150	1.10	18	12	300		
SCAS05FF	50	70	48	35	18.0	12.5	8.0	125	900	30	0.97	30	120	6000		
SCAS10FF	100	70	48	35	18.0	12.5	8.0	125	900	30	0.97	30	120	6000		↓
SCAS15FF	150	70	48	35	18.0	12.5	8.0	125	900	30	0.97	30	120	6000	↓	G27

PCB MOUNTING

SBR05	50	—	—	—	—	1.50	1.0	10	30	2000	1.1	1.0	2	50.0	—	G32
SBR1	100	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
SBR2	200															
SBR4	400															
SBR6	600															
SBR8	800					↓	↓	↓	↓	↓	↓	↓		↓		
SBR10	1000					1.50	1.0	10	50	2000	1.1	1.0				
SBR15	1500					0.36	0.24	2.5	14	2500	5.0	0.25				
SBR20	2000					0.36	0.24	2.5	14	2500	5.0	0.25				
SBR25	2500					0.36	0.24	2.5	14	2500	5.0	0.25				
SBR30	3000					0.36	0.24	2.5	14	2500	5.0	0.25				
SBR05F	50					1.00	0.65	10.0	25	150	1.2	1.0				
SBR1F	100					↓	↓	↓	↓	150	1.2	↓				
SBR2F	200									150	1.2					
SBR4F	400									150	1.2					
SBR6F	600									250	1.2					
SBR8F	800					↓	↓	↓	↓	300	1.5	↓		↓		
SBR10F	1000					1.00	0.65	10.0	25	500	1.5	1.0				
SBR25F	2500					0.36	0.23	2.5	10	300	5.0	0.1		50.0		
SBR05FF	50					1.00	0.30	14.0	35	30	1.2	1.5		100.0		
SBR10FF	150					1.00	0.30	14.0	35	30	1.2	1.5		100.0		↓
SBR15FF	150					1.00	0.30	14.0	35	30	1.2	1.5		100.0		G32
SBM*2	200					1.50	1.0	10	50	2000	1.1	1.0		50.0		G33
SBM*4	400					1.50	1.0	10	50	2000	1.1	↓		↓		↓
SBM*6	600					1.50	1.0	10	50	2000	1.1					
SBM*8	800					1.50	1.0	10	50	2000	1.1					
SBM*0	1000					1.50	1.0	10	50	2000	1.1					
SBM*05F	50					1.5	1.0	10	25	150	1.2					
SBM*1F	100					1.5	1.0	10	25	150	1.2					
SBM*2F	200					1.5	1.0	10	25	150	1.2	↓		↓		↓
SBM*4F	400					1.5	1.0	10	25	150	1.2	1.0		50.0		G33
3SBM*2	200					3.0	1.5	25	150	2000	1.0	3.0		40.0		G34
3SBM*4	400					↓	↓	↓	↓	2000	1.0	↓		↓		↓
3SBM*6	600									2000	1.0					
3SBM*8	800									2000	1.0					
3SBM*0	1000									2000	1.0					
3SBM*05F	50									150	1.1					
3SBM*1F	100									150	1.1					
3SBM*2F	200	↓	↓	↓	↓	↓	↓	↓	↓	150	1.1	↓	↓	↓	↓	↓
3SBM*4F	400	—	—	—	—	3.0	1.5	25	150	150	1.1	3.0	2	40.0	—	G34

NOTES: Operating and Storage Temperature Ranges are -55°C to +150°C unless otherwise indicated.
(F) Available in Europe to F and FX levels.
(*) Add A, B, or C for different pin configurations.

(1) Ratings at Case Temperature T_C.
(2) Ratings at Ambient Temperature T_A.
(3) Measured on discrete devices prior to assembly.

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3 PHASE FULL AND HALF WAVE BRIDGES

ABSOLUTE MAXIMUM RATINGS (@25°C UNLESS OTHERWISE SPECIFIED)

Device Type	Reverse Voltage	Average Forward Current (1)			Average Forward Current (2)			1 Cycle Surge Current tp=8.3ms	Reverse Recovery (3)	Forward Voltage		Reverse Current		Thermal Impedance	Case Outline
	V_{RWM}	I_F (AV) @ T_{CASE}			I_F (AV) @ T_{AMB}			I_{FSM}	Trr	V_F	@I_F	I_R	I_R	θ_{JC}	
		55°C	100°C	125°C	25°C	55°C	100°C			@25°C		@25°C	@100°C		
	Volts	Amps	Amps	Amps	Amps	Amps	Amps	Amps	nS	Volts	Amps	µA	µA	°C/W	
3 PH FULL WAVE BRIDGE															
SET111403[A]	1000	45	33	24	—	—	—	150	2000	1.2	9	3	60	0.5	G56
SET111404[A]	400	45	33	24				150	150	1.5		3	60		
SET111411	150	45	30	21				175	30	1.1		30	1500		
SET111412[A]	600	45	33	24				150	2000	1.2		3	60		
SET111419[A]	1000	30	24	18				150	150	2.2		3	75		
SET111423	500	30	24	18	—	—	—	150	50	1.6		30	1500	0.5	G56
SC3BJ05	50	5.0	3.0	2.0	2.0	1.5	1.0	50	2000	1.10	1.0	3	75	6.0	G36
SC3BJ1	100		3.0	2.0	2.0	1.5	1.0	50	2000	1.10					
SC3BJ2	200		3.0	2.0	2.0	1.5	1.0	50	2000	1.10					
SC3BJ4	400		3.0	2.0	2.0	1.5	1.0	50	2000	1.10					
SC3BJ6[F]	600		3.0	2.0	2.0	1.5	1.0	50	2000	1.10					
SC3BJ05F	50		3.5	2.5	1.5	1.0	0.7	25	150	1.20					
SC3BJ1F	100		3.5	2.5		1.0		25	150						
SC3BJ2F	200		3.5	2.5		1.0		25	150						
SC3BJ4F[F]	400		3.5	2.5		1.0		25	150						
SC3BJ6F	600		3.5	2.5		1.0		25	250		1.0		75		
SC3BJ05FF	50		3.1	1.8		1.1		35	30		1.5		150		
SC3BJ10FF	100		3.1	1.8		1.1		35	30		1.5		150		
SC3BJ15FF	150	5.0	3.1	1.8	1.5	1.1	0.7	35	30	1.20	1.5		150	6.0	G36
SC3BH05	50	10.0	7.0	5.0	4.0	3.0	1.7	150	2000	1.00	3.0		60	4.5	G35
SC3BH1	100	10.0	7.0	5.0	4.0	3.0	1.7		2000						
SC3BH2	200	10.0	7.0	5.0	4.0	3.0	1.7		2000						
SC3BH4	400	10.0	7.0	5.0	4.0	3.0	1.7		2000						
SC3BH6[F]	600	10.0	7.0	5.0	4.0	3.0	1.7		2000						
SC3BH05F	50	9.0	6.3	4.5	3.0	2.2	1.2		150	1.1					
SC3BH1F	100	9.0	6.3	4.5	3.0	2.2	1.2		150						
SC3BH2F	200	9.0	6.3	4.5	3.0	2.2	1.2		150						
SC3BH4F[F]	400	9.0	6.3	4.5	3.0	2.2	1.2	150	150		3.0	3	60		
SC3BH05FF	50	12.0	9.0	7.5	4.0	3.0	1.7	175	30	0.97	5.0	30	1500		
SC3BH10FF	100	12.0	9.0	7.5	4.0	3.0	1.7	175	30	0.97	5.0	30	1500		
SC3BH15FF	150	12.0	9.0	7.5	4.0	3.0	1.7	175	30	0.97	5.0	30	1500	4.5	G35
SC3BA05	50	18.0	12.4	9.0	6.0	5.0	3.0	150	2000	1.00	3.0	3	60	2.5	G37
SC3BA1	100	18.0	12.4	9.0					2000	1.00			60		
SC3BA2	200	18.0	12.4	9.0					2000	1.00			60		
SC3BA4	400	18.0	12.4	9.0					2000	1.00			60		
SC3BA6[F]	600	18.0	12.4	9.0					2000	1.00			60		
SC3BA05F	50	15.0	10.5	7.5					150	1.10			75		
SC3BA1F	100	15.0	10.5	7.5					150	1.10			75		
SC3BA2F	200	15.0	10.5	7.5					150	1.10			75		
SC3BA4F[F]	400	15.0	10.5	7.5				150	150	1.10	3.0	3	75		
SC3BA05FF	50	17.0	10.0	5.0				175	30	0.97	5.0	30	1500		
SC3BA10FF	100	17.0	10.0	5.0				175	30	0.97	5.0	30	1500		
SC3BA15FF	150	17.0	10.0	5.0	6.0	5.0	3.0	175	30	0.97	5.0	30	1500	2.5	G37
SC3B483-1[BC]	200	25.0	18.5	9.25	8	6	4	150	2000	1.30	39	2	200	—	G119
SC3B483-2[BC]	400	25.0	18.5	9.25	8	6	4	150	2000	1.30	39	2	200	—	G119
SC3B483-3[BC]	600	25.0	18.5	9.25	8	6	4	150	2000	1.30	39	2	200	—	G119

NOTES: Operating and Storage Temperature Ranges are -55°C to +150°C unless otherwise indicated.

(A) Operating and Storage Temperature Range -55°C to +175°C.
(B) Operating and Storage Temperature Range -65°C to +150°C.
(C) Available as JTX to MIL-S-19500/483.
(F) These devices are available in Europe to F and FX levels.
(1) Ratings at Case Temperature T_C.
(2) Ratings at Ambient Temperature T_{AMB}.
(3) Measured on discrete devices prior to assembly.

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3 PHASE FULL AND HALF WAVE BRIDGES (cont.)

ABSOLUTE MAXIMUM RATINGS (@ 25°C UNLESS OTHERWISE SPECIFIED)

Device Type	Reverse Voltage	Average Forward Current (1)			Average Forward Current (2)			1 Cycle Surge Current tp = 8.3ms	Reverse Recovery (3)	Forward Voltage		Reverse Current		Thermal Impedance	Case Outline
	V_{RWM}	I_F (AV) @ T_{CASE}			I_F (AV) @ T_{AMB}			I_{FSM}	T_{rr}	V_F	@ I_F	I_R	I_R	θ_{JC}	
		55°C	100°C	125°C	25°C	55°C	100°C			@25°C		@25°C	@100°C		
	Volts	Amps	Amps	Amps	Amps	Amps	Amps	Amps	nS	Volts	Amps	µA	µA	°C/W	
3 PH FULL WAVE BRIDGE (continued)															
SC3BK05	50	38.0	24.0	17.5	13.0	10.0	6.0	375	2000	1.00	9.0	9	180	1.1	G30
SC3BK1	100	38.0	24.0	17.5	13.0	10.0	6.0		2000	1.00					
SC3BK2	200	38.0	24.0	17.5	13.0	10.0	6.0		2000	1.00					
SC3BK4	400	38.0	24.0	17.5	13.0	10.0	6.0		2000	1.00					
SC3BK6	600	38.0	24.0	17.5	13.0	10.0	6.0		2000	1.00					
SC3BK05F	50	42.0	29.0	20.0	11.0	8.5	5.0		150	1.10					
SC3BK1F	100	42.0	29.0	20.0	11.0	8.5	5.0		150	1.10					
SC3BK2F	200	42.0	29.0	20.0	11.0	8.5	5.0		150	1.10					
SC3BK4F	400	42.0	29.0	20.0	11.0	8.5	5.0	375	150	1.10	9.0	9	180		
SC3BK05FF	50	38.0	25.0	14.0	13.0	9.25	5.5	450	30	0.97	15	90	4500		
SC3BK10FF	100	38.0	25.0	14.0	13.0	9.25	5.5	450	30	0.97	15	90	4500		
SC3BK15FF	150	38.0	25.0	14.0	13.0	9.25	5.5	450	30	0.97	15	90	4500	1.1	G30
SC3AS05	50	130.0	95.0	70.0	18.0	14.0	9.0	750	2000	1.00	18	18	360	0.3	G38
SC3AS1	100	130.0	95.0	70.0	18.0	14.0	9.0		2000	1.00			360		
SC3AS2	200	130.0	95.0	70.0	18.0	14.0	9.0		2000	1.00			360		
SC3AS4	400	130.0	95.0	70.0	18.0	14.0	9.0		2000	1.00			360		
SC3AS6	600	130.0	95.0	70.0	18.0	14.0	9.0		2000	1.00			360		
SC3AS05F	50	110.0	80.0	60.0	16.0	11.5	7.2		150	1.10			450		
SC3AS1F	100	110.0		60.0	16.0	11.5	7.2		150	1.10			450		
SC3AS2F	200	110.0		60.0	16.0	11.5	7.2		150	1.10			450		
SC3AS4F	400	110.0		60.0	16.0	11.5	7.2	750	150	1.10	18	18	450		
SC3AS05FF	50	130.0		45.0	18.0	12.5	8.0	900	30	0.97	30	180	9000		
SC3AS10FF	100	130.0		45.0	18.0	12.5	8.0	900	30	0.97	30	180	9000		
SC3AS15FF	150	130.0	80.0	45.0	18.0	12.5	8.0	900	30	0.97	30	180	9000	0.3	G38
3 PH HALF WAVE BRIDGE															
SC3HAS05*	50	135.0	95.0	70.0	19.0	14.5	9.25	750	2000	1.00	18	6	120	0.6	G38A
SC3HAS1*	100	135.0	95.0	70.0	19.0	14.5	9.25		2000	1.00					
SC3HAS2*	200	135.0	95.0	70.0	19.0	14.5	9.25		2000	1.00					
SC3HAS4*	400	135.0	95.0	70.0	19.0	14.5	9.25		2000	1.00					
SC3HAS6*	600	135.0	95.0	70.0	19.0	14.5	9.25		2000	1.00					
SC3HAS05F*	50	110.0	80.0	58.0	16.0	11.5	7.0		150	1.10					
SC3HAS1F*	100	110.0		58.0	16.0	11.5	7.0		150	1.10					
SC3HAS2F*	200	110.0		58.0	16.0	11.5	7.0		150	1.10					
SC3HAS4F*	400	110.0		58.0	16.0	11.5	7.0		150	1.10	18	6	120		
SC3HAS05FF*	50	130.0		45.0	18.0	12.5	8.0		30	0.97	30	60	3000		
SC3HAS10FF*	100	130.0		45.0	18.0	12.5	8.0		30	0.97	30	60	3000		
SC3HAS15FF*	150	130.0	80.0	45.0	18.0	12.5	8.0	750	30	0.97	30	60	3000	0.6	G38A
3 PH P.C.B. MOUNTING															
S3BR2	200	—	—	—	—	2.0	1.2	30	2000	1.1	1.0	3	75	—	G39
S3BR4	400					2.0	1.2	30	2000	1.1	1.0		75		
S3BR6	600					2.0	1.2	30	2000	1.1	1.0		75		
S3BR8	800					2.0	1.2	30	2000	1.1	1.0		75		
S3BR10	1000					2.0	1.2	30	2000	1.1	1.0		75		
S3BR15	1500					0.5	0.3	14	2500	5.0	0.25		60		
S3BR20	2000					0.5	0.3	14	2500	5.0	0.25		60		
S3BR30	3000					0.5	0.3	14	2500	5.0	0.25		60		
S3BR05F	50					2.0	1.2	25	150	1.2	1.0		75		
S3BR1F	100					2.0	1.2	25	150	1.2	1.0		75		
S3BR2F	200					2.0	1.2	25	150	1.2	1.0		75		
S3BR4F	400					2.0	1.2	25	150	1.2	1.0		75		
S3BR6F	600					2.0	1.2	25	250	1.2	1.0		75		
S3BR25F	2500					0.5	0.3	10	300	5.0	0.10		75		
S3BR05FF	50					2.0	1.1	35	30	1.2	1.5		150		
S3BR10FF	100					2.0	1.1	35	30	1.2	1.5		150		
S3BR15FF	150	—	—	—	—	2.0	1.1	35	30	1.2	1.5	3	150	—	G39

NOTES: Operating and Storage Temperature Ranges are -55°C to +150°C unless otherwise indicated.

(F)These devices are available in Europe to F and FX levels.

(*) Add letter for circuit configuration:
P = Positive Center Tap
N = Negative Center Tap

(1) Ratings at Case Temperature Tc.
(2) Ratings at Ambient Temperature T_{AMB}.
(3) Measured on discrete devices prior to assembly.

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VOLTAGE REGULATORS (ZENERS)—METOXILITE

ELECTRICAL SPECIFICATIONS (@25°C UNLESS OTHERWISE SPECIFIED)

Device Type	Breakdown Voltage V_{BR} @ $I_{Z\,TEST}$			Zener Test Current $I_{Z\,TEST}$	Zener Imped. Z_Z	Reverse Current @ $V_{R\,TEST}$		Temp. Coeff of $V_{(BR)}$ αVZ	Maximum Reverse Current	Outline
	nom	min	max			I_R	$V_{R\,TEST}$			
	Volts	Volts	Volts	mA	Ohms	µA	Volts	%/°C	µA	

5 WATT

1N4954	6.8	6.46	7.14	175	0.75	150	5.2	.05	700	G99
1N4955	7.5	7.13	7.87	175	0.75	100	5.7	.06	630	
1N4956	8.2	7.79	8.61	150	0.75	50	6.2	.06	580	
1N4957	9.1	8.65	9.55	150	1.0	25	6.9	.06	520	
1N4958	10	9.50	10.50	125	1.5	25	7.6	.07	475	
1N4959	11	10.45	11.55	125	1.5	10	8.4	.07	430	
1N4960	12	11.40	12.60	100	1.5	10	9.1	.07	395	
1N4961	13	12.35	13.65	100	2.0	10	9.9	.08	365	
1N4962	15	14.25	15.75	75	2.5	5	11.4	.08	315	
1N4963	16	15.20	16.80	75	2.5	5	12.2	.08	294	
1N4964	18	17.10	18.90	65	2.5	5	13.7	.085	264	
1N4965	20	19.0	21.0	65	2.5	2	15.2	.085	237	
1N4966	22	20.9	23.1	50	2.5	↓	17.1	.085	216	
1N4967	24	22.8	25.2	50	3.0		18.2	.09	198	
1N4968	27	25.7	28.3	50	3.0		20.6	.09	176	
1N4969	30	28.5	31.5	40	3.0		22.8	.09	158	
1N4970	33	31.4	34.6	40	4.0		25.1	.095	144	
1N4971	36	34.2	37.8	30	5.0		27.4	↓	132	
1N4972	39	37.1	40.9	30	5.0		29.7		132	
1N4973	43	40.9	45.1	30	6.0		32.7		110	
1N4974	47	44.7	49.3	25	7.0		35.8		100	
1N4975	51	48.5	53.5	25	8.0		38.8	↓	92	
1N4976	56	53.2	58.8	20	9.0		42.6	.095	84	
1N4977	62	58.9	65.1	20	10.0		47.1	.100	76	
1N4978	68	64.6	71.4	20	15.0		51.7	↓	70	
1N4979	75	71.3	78.7	20	20.0		56.0		63	
1N4980	82	77.9	86.1	15	30.0		62.2		58	
1N4981	91	86.5	95.5	15	35.0		69.2		52.5	
1N4982	100	95.0	105.0	12	40.0		76.0		47.5	
1N4983	110	104.5	115.0	12	55.0	↓	83.6	↓	43	↓
1N4984	120	114.0	126.0	10	70.0	2	91.2	.100	39.5	G99

5 WATT

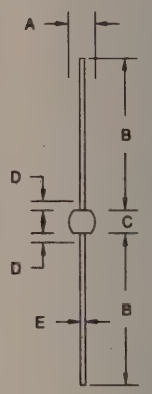
SX6.8	6.8	6.46	7.14	175	0.75	150	5.2	.05	700	G99
SX7.5	7.5	7.13	7.87	175	0.75	100	5.7	.06	630	
SX8.2	8.2	7.79	8.61	150	0.75	50	6.2	.06	580	
SX9.1	9.1	8.65	9.55	150	1.0	25	6.9	.06	520	
SX10	10	9.50	10.50	125	1.5	25	7.6	.07	475	
SX11	11	10.45	11.55	125	1.5	10	8.4	.07	430	
SX12	12	11.40	12.60	100	1.5	10	9.1	.07	395	
SX13	13	12.35	13.65	100	2.0	10	9.9	.08	365	
SX15	15	14.25	15.75	75	2.5	5	11.4	.08	315	
SX16	16	15.20	16.80	75	2.5	5	12.2	.08	294	
SX18	18	17.10	18.90	65	2.5	5	13.7	.085	264	
SX20	20	19.0	21.0	65	2.5	2	15.2	.085	237	
SX22	22	20.9	23.1	50	2.5	↓	16.7	.085	216	
SX24	24	22.8	25.2	50	3.0		18.2	.09	198	
SX27	27	25.7	28.3	50	3.0		20.6	.09	176	
SX30	30	28.5	31.5	40	3.0		22.8	.09	158	
SX33	33	31.4	34.6	40	4.0		25.1	.095	144	
SX36	36	34.2	37.8	30	5.0		27.4	↓	132	
SX39	39	37.1	40.9	30	5.0		29.7		132	
SX43	43	40.9	45.1	30	6.0		32.7		110	
SX47	47	44.7	49.3	25	7.0		35.8		100	
SX51	51	48.5	53.5	25	8.0		38.8	↓	92	
SX56	56	53.2	58.9	20	9.0		42.6	.095	84	
SX62	62	58.9	65.1	20	10.0		47.1	.100	76	
SX68	68	64.6	71.4	20	15.0		51.7	↓	70	
SX75	75	71.3	78.7	20	20.0		56.0		63	
SX82	82	77.9	86.1	15	30.0		62.2		58	
SX91	91	86.5	95.5	15	35.0		69.2		52.5	
SX100	100	95.0	105.0	12	40.0		76.0		47.5	
SX110	110	104.5	115.0	12	55.0	↓	83.6	↓	43	↓
SX120	120	114.0	126.0	10	70.0	2	91.2	.100	39.5	G99

G99

DIM	DIMENSIONS MM MIN	MM MAX	INCHES MIN	INCHES MAX	NOTE
A	2.16	3.56	.085	.140	-
B	25.4	33.0	1.00	1.30	-
C	3.56	4.70	.140	.185	-
D	-	.80	-	.030	1
E	.91	1.07	.036	.042	-

NOTES:

1. LEAD DIAMETER UNCONTROLLED OVER THIS REGION.



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VOLTAGE REGULATORS (ZENERS)—METOXILITE (cont.)

ELECTRICAL SPECIFICATIONS (@ 25°C UNLESS OTHERWISE SPECIFIED)

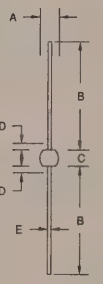
Device Type	Breakdown Voltage V_{BR} @ $I_{Z\ TEST}$			Zener Test Current $I_{Z\ TEST}$	Zener Imped. Z_Z	Reverse Current @ $V_{R\ TEST}$		Temp. Coeff[1] of $V_{(BR)}$ αV_Z	Maximum Reverse Current	Outline
	nom	min	max			I_R	$V_{R\ TEST}$			
	Volts	Volts	Volts	mA	Ohms	µA	Volts	%/°C	mA	
10 WATT										
SY6.8	6.8	6.46	7.14	500	0.4	600	5.2	.05	2.1	G96
SY7.5	7.5	7.13	7.87	500	0.4	400	5.7	.06	1.8	
SY8.2	8.2	7.79	8.61	450	0.4	200	6.2	.06	1.7	
SY9.1	9.1	8.65	9.55	450	0.5	100	6.9	.06	1.5	
SY10	10	9.50	10.50	375	0.7	100	7.6	.07	1.4	
SY11	11	10.45	11.55	375	0.7	50	8.4	.07	1.2	
SY12	12	11.40	12.60	300	0.7	50	9.1	.07	1.1	
SY13	13	12.35	13.65	300	1.0	50	9.9	.08	1.0	
SY15	15	14.25	15.75	225	1.0	25	11.4	.08	0.90	
SY16	16	15.20	16.80	225	1.5	25	12.2	.08	0.80	
SY18	18	17.10	18.90	195	1.5	25	13.7	.085	0.70	
SY20	20	19.0	21.0	195	1.6	10	15.2	.085	0.69	
SY22	22	20.9	23.1	150	1.7		16.7	.085	0.63	
SY24	24	22.8	25.2	150	1.7		18.2	.09	0.59	
SY27	27	25.7	28.3	150	1.8		20.6	.09	0.52	
SY30	30	28.5	31.5	120	1.9		22.8	.09	0.47	
SY33	33	31.4	34.6	120	2.0		25.1	.095	0.43	
SY36	36	34.2	37.8	90	2.5		27.4		0.39	
SY39	39	37.1	40.9	90	2.5		29.7		0.36	
SY43	43	40.9	45.1	90	3.0		32.7		0.33	
SY47	47	44.7	49.3	75	3.5		35.8		0.30	
SY51	51	48.5	53.5	75	4.0		38.8		0.27	
SY56	56	53.2	58.8	60	4.5		42.6	.095	0.25	
SY62	62	58.9	65.1	60	5.0		47.1	.100	0.22	
SY68	68	64.6	71.4	60	7.0		51.7		0.21	
SY75	75	71.3	78.7	60	10		56.0		0.18	
SY82	82	77.9	86.1	45	15		62.2		0.17	
SY91	91	86.5	95.5	45	17		69.2		0.15	
SY100	100	95.0	105.0	36	20		76.0		0.14	
SY110	110	104.5	115.0	36	22		83.6		0.12	
SY120	120	114.0	126.0	30	35	10	91.2	.100	0.11	G96

G96

DIMENSIONS					
DIM	MM		INCHES		NOTE
	MIN	MAX	MIN	MAX	
A	3.4	4.7	.135	.185	-
B	22.9	33.0	.90	1.30	-
C	3.5	5.0	.140	.195	-
D	-	.80	-	.030	1
E	.91	1.07	.036	.042	-

NOTES:

1. LEAD DIAMETER UNCONTROLLED OVER THIS REGION.



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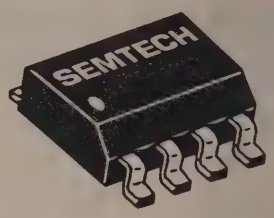
TRANSIENT VOLTAGE SUPPRESSION DIODE ARRAY

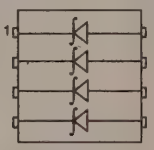


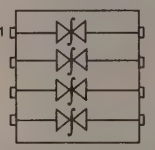
FEATURES:
- 300 watts peak pulse power.
- Data, signal, and Vcc Bus line protection.
- 100% surge tested.
- Unidirectional & Bidirectional.
- Standard SO-8 plastic package.

MAXIMUM RATINGS
- Peak Pulse Power: 300 watts (8x20µs) (see fig. 3).
- Operating & Storage Temperature: -55°C to +150°C.

MECHANICAL CHARACTERISTICS
- Molded SO-8 surface mount package.
- Marking: logo and part number or marking code.
- Pin #1 marked with dot on body.

UNIDIRECTIONAL		BIDIRECTIONAL	
SMDA05	SMDA12	SMDA05C	SMDA12C
SMDA15	SMDA24	SMDA15C	SMDA24C





ELECTRICAL CHARACTERISTICS @ 25°C

Part Number	Marking Code	Reverse Stand-Off Voltage	Min. BV @ 1mA	Max. Clamping @ 1A	Max. Clamping @ 5A	Leakage Current @ V_{RWM}	Cap. @ 0V, 1MHz
		V_{RWM}	BV(min)	Vc	Vc	Ir	C
"c" suffix: bidirectional		Volts	Volts	Volts	Volts	µA	pF
SMDA05	SDA	5	6	9.8	11	100	550
SMDA05C	SDB	5	6	9.8	11	100	400
SMDA12	SDC	12	13.3	19	24	1	185
SMDA12C	SDD	12	13.3	19	24	1	150
SMDA15	SDE	15	16.7	24	30	1	140
SMDA15C	SDF	15	16.7	24	30	1	100
SMDA24	SDG	24	26.7	43	55	1	88
SMDA24C	SDH	24	26.7	43	55	1	63

1500 WATT AXIAL LEAD - PLASTIC IC PROTECTION

FEATURES:
- 1500 watts peak pulse power.
- Response time: 1 x 10^{-12} secs.
- Each device 100% Surge Tested to Ipp
- Very low clamping voltage
- Protection for CMCS. TTL devices.
- Solid state silicon avalanche technology.

MAXIMUM RATINGS:
- Operating & Storage Temp: -65°C to +150°C.
- Forward surge rating: 70A, 1/120sec half cycle @25°C.
- Steady state power dissipation: 1 watt @ T_L = 75°C

MECHANICAL CHARACTERISTICS:
- Molded epoxy case: DO-201.
- Body marking: P/N, date code, polarity band (cathode)

Semtech Part Number	JEDEC Part Number	Reverse Stand-Off Voltage V_{RWM} Volts	Maximum Reverse Leakage @ V_{RWM} ID µA	Minimum Breakdown Voltage @ 1mA BV (min) Volts	Maximum Clamping Voltage @ 1 Amp V_{C1} Volts	Maximum Clamping Voltage @ 10 Amp V_{C2} Volts	Maximum Peak pulse Current (10x1000µS) I_{PP} Amps
	1N5908	5.0	300	6.0	7.6 @ 30A	8 @ 60A	120
ICTE-5	1N6373	5.0	300	6.0	7.1	7.5	160
ICTE-8	1N6374	8.0	25	9.4	11.3	11.5	100
ICTE-10	1N6375	10.0	2	11.7	13.7	14.1	90
ICTE-12	1N6376	12.0	2	14.1	16.1	16.5	70
ICTE-15	1N6377	15.0	2	17.6	20.1	20.6	60
ICTE-18	1N6378	18.0	2	21.2	24.2	25.2	50
ICTE-22	1N6379	22.0	2	25.9	29.8	32.0	40
ICTE-36	1N6380	36.0	2	42.4	50.6	54.3	23
ICTE-45	1N6381	45.0	2	52.9	63.3	70.0	19
ICTE-8C	1N6382	8.0	50	9.4	11.4	11.6	100
ICTE-10C	1N6383	10.0	2	11.7	14.1	14.5	90
ICTE-12C	1N6384	12.0	2	14.1	16.7	17.1	70
ICTE-15C	1N6385	15.0	2	17.6	20.8	21.4	60
ICTE-18C	1N6386	18.0	2	21.2	24.8	25.5	50
ICTE-22C	1N6387	22.0	2	25.9	30.8	32.0	40
ICTE-36C	1N6388	36.0	2	42.4	50.6	54.3	23
ICTE-45C	1N6389	45.0	2	52.9	63.3	70.0	19

"C" = Bidirectional

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600 WATT SURFACE MOUNT - TRANSIENT VOLTAGE SUPPRESSOR

FEATURES:

- 600 watts peak pulse power.
- Response time: 1 x 10^{-12}.
- Each device 100% Surge Tested to Ipp.
- Voltage range: 5v to 170v.
- Protects sensitive semiconductor circuits.
- Solid state silicon avalanche technology.

MAXIMUM RATINGS:

- Operating & Storage Temp: -65°C to +150°C.
- Forward surge rating: 100A, 1/120sec half cycle @ 25°C.
- Steady state power dissipation: 1 watt @ T_L = 75°C.

MECHANICAL CHARACTERISTICS:

- Epoxy molded case: DO-214AA (modified J-bend).
- Body marking: Device code, date code, polarity band (cathode).

ELECTRICAL CHARACTERISTICS @ 25°C

Semtech Part Number*	Reverse Stand-off Voltage V_{RWM} (V)	Breakdown Voltage BV Min @ I_T (V)	Test Current (I_T) (mA)	Maximum Clamping Voltage @ I_{PP} (V_C) (V)	Peak Pulse Current (Ipp) (A)	Reverse Leakage (I_R) µA	Max Voltage Temperature Variation Of BV (mV/°C)
SMBJ5.0	5.0	6.40	10	9.6	62.5	800	5.0
SMBJ5.0A	5.0	6.40	10	9.2	65.2	800	5.0
SMBJ6.0	6.0	6.67	10	11.4	52.6	800	5.0
SMBJ6.0A	6.0	6.67	10	10.3	58.3	800	5.0
SMBJ6.5	6.5	7.22	10	12.3	48.7	500	5.0
SMBJ6.5A	6.5	7.22	10	11.2	53.6	500	5.0
SMBJ7.0	7.0	7.78	10	13.3	45.1	200	6.0
SMBJ7.0A	7.0	7.78	10	12.0	50.0	200	6.0
SMBJ7.5	7.5	8.33	1	14.3	42.0	100	7.0
SMBJ7.5A	7.5	8.33	1	12.9	46.5	100	7.0
SMBJ8.0	8.0	8.89	1	15.0	40.0	50	7.0
SMBJ8.0A	8.0	8.89	1	13.6	44.1	50	7.0
SMBJ8.5	8.5	9.44	1	15.9	37.7	10	8.0
SMBJ8.5A	8.5	9.44	1	14.4	41.7	10	8.0
SMBJ9.0	9.0	10.0	1	16.9	35.5	5	9.0
SMBJ9.0A	9.0	10.0	1	15.4	39.0	5	9.0
SMBJ10	10	11.1	1	18.8	31.9	5	10
SMBJ10A	10	11.1	1	17.0	35.3	5	10
SMBJ11	11	12.2	1	20.1	29.9	5	11
SMBJ11A	11	12.2	1	18.2	33.0	5	11
SMBJ12	12	13.3	1	22.0	27.3	5	12
SMBJ12A	12	13.3	1	19.9	30.2	5	12
SMBJ13	13	14.4	1	23.8	25.2	5	13
SMBJ13A	13	14.4	1	21.5	27.9	5	13
SMBJ14	14	15.6	1	25.8	23.3	5	14
SMBJ14A	14	15.6	1	23.2	25.8	5	14
SMBJ15	15	16.7	1	26.9	22.3	5	16
SMBJ15A	15	16.7	1	24.4	24.0	5	16
SMBJ16	16	17.8	1	28.8	20.8	5	19
SMBJ16A	16	17.8	1	26.0	23.1	5	17
SMBJ17	17	18.9	1	30.5	19.7	5	20
SMBJ17A	17	18.9	1	27.6	21.7	5	19
SMBJ18	18	20.0	1	32.2	18.6	5	21
SMBJ18A	18	20.0	1	29.2	20.5	5	20
SMBJ20	20	22.2	1	35.8	16.7	5	25
SMBJ20A	20	22.2	1	32.4	18.5	5	23
SMBJ22	22	24.4	1	39.4	15.2	5	28
SMBJ22A	22	24.4	1	35.5	16.9	5	25
SMBJ24	24	26.7	1	43.0	14.0	5	31
SMBJ24A	24	26.7	1	38.9	15.4	5	28
SMBJ26	26	28.9	1	46.6	12.4	5	31
SMBJ26A	26	28.9	1	42.1	14.2	5	30
SMBJ28	28	31.1	1	50.0	12.0	5	35
SMBJ28A	28	31.1	1	45.4	13.2	5	31
SMBJ30	30	33.3	1	53.5	11.2	5	39
SMBJ30A	30	33.3	1	48.4	12.4	5	36
SMBJ33	33	36.7	1	59.0	10.2	5	42
SMBJ33A	33	36.7	1	53.3	11.3	5	39
SMBJ36	36	40.0	1	64.3	9.3	5	46
SMBJ36A	36	40.0	1	58.1	10.3	5	41
SMBJ40	40	44.4	1	71.4	8.4	5	51
SMBJ40A	40	44.4	1	64.5	9.3	5	46
SMBJ43	43	47.8	1	76.7	7.8	5	55
SMBJ43A	43	47.8	1	69.4	8.6	5	50
SMBJ45	45	50.0	1	80.3	7.5	5	58
SMBJ45A	45	50.0	1	72.7	8.3	5	52
SMBJ48	48	53.3	1	85.5	7.0	5	63
SMBJ48A	48	53.3	1	77.4	7.7	5	56
SMBJ51	51	56.7	1	91.1	6.6	5	66
SMBJ51A	51	56.7	1	82.4	7.3	5	61
SMBJ54	54	60.0	1	96.3	6.2	5	71
SMBJ54A	54	60.0	1	87.1	6.9	5	65
SMBJ58	58	64.4	1	103.0	5.8	5	78
SMBJ58A	58	64.4	1	93.6	6.4	5	70
SMBJ60	60	66.7	1	107.0	5.6	5	80
SMBJ60A	60	66.7	1	96.8	6.2	5	71
SMBJ64	64	71.1	1	114.0	5.3	5	86
SMBJ64A	64	71.1	1	103.0	5.8	5	76
SMBJ75	75	83.3	1	134	4.5	5	101
SMBJ75A	75	83.3	1	121	4.9	5	91
SMBJ85	85	94.4	1	151	3.9	5	114
SMBJ85A	85	94.4	1	137	4.4	5	103
SMBJ90	90	100	1	160	3.8	5	121
SMBJ90A	90	100	1	146	4.1	5	110
SMBJ100	100	111	1	179	3.4	5	135
SMBJ100A	100	111	1	162	3.7	5	123
SMBJ110	110	122	1	196	3.0	5	148
SMBJ110A	110	122	1	177	3.4	5	133
SMBJ120	120	133	1	214	2.8	5	162
SMBJ120A	120	133	1	193	3.1	5	146
SMBJ130	130	144	1	231	2.6	5	175
SMBJ130A	130	144	1	209	2.9	5	158
SMBJ150	150	167	1	268	2.2	5	203
SMBJ150A	150	167	1	243	2.5	5	184
SMBJ160	160	178	1	287	2.1	5	217
SMBJ160A	160	178	1	259	2.3	5	196
SMBJ170	170	189	1	304	2.0	5	230
SMBJ170A	170	189	1	275	2.2	5	208

* Order with "C" or "CA" suffix for bidirectional types.

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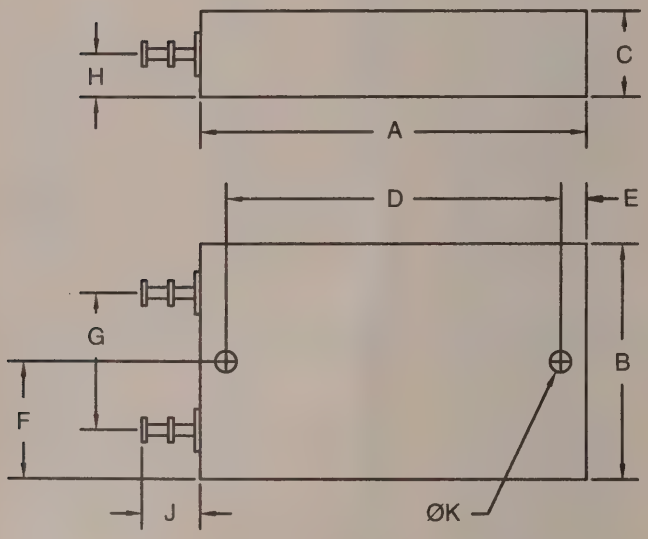
7500 & 15,000 WATT - MODULE

FEATURES:

- Wide voltage range (8.4 to 500 Volts RMS).
- Bidirectional for AC applications.
- **PIP** series designed for industrial applications.
- **PHP** series designed for aerospace, military, and shipboard applications.
- Each device is 100% tested.
- Custom voltages available from factory.



MAXIMUM RATINGS:

- Operating Temperature: -65°C to +150°C.
- Storage Temperature: -65°C to +150°C.
- Surge Power: 7.5KW & 15KW.
- Average steady state power dissipation @ 50°C: 7.5 Watts.

SCREENING:

- 100% TX level screening is available per MIL-S-19500/507, 516. For ordering, use the following suffix:
  H1 - Submodule screening
  H2 - Submodule & module screening
  H3 - Submodule & module screening. Group B & C lot testing.

DIMENSIONS					
DIM	INCHES		MM		NOTE
	MIN	MAX	MIN	MAX	
A	2.22	2.28	56.3	58.0	
B	1.35	1.40	34.2	35.6	
C	.47	.53	11.9	13.5	
D	1.93	1.97	49.0	50.1	
E	.135	.165	3.4	4.2	
F	.66	.72	16.7	18.3	
G	.77	.83	19.5	21.1	
H	.22	.28	5.5	7.2	
J	.325	.365	8.2	9.3	
K	.120	.130	3.0	3.3	DIA.

MILITARY APPLICATIONS: PHP series sub-assemblies are packaged in a hermetically sealed package.

COMMERCIAL APPLICATIONS: PIP series sub-assemblies are packaged in a molded epoxy case.

ELECTRICAL SPECIFICATIONS @ 25°C (Unless otherwise specified)

Part Number (Commercial)	Part Number (Military)	Average RMS Voltage Volts AC (V)	Reverse Stand-off Voltage V_{RWM} (V)	Reverse Leakage Current Ir (μA)	Minimum Breakdown Voltage Vbr @ It (V)	Test Current It (mA)	Maximum Clamping Voltage Vc @ Ipp (V)	Peak Pulse Current Ipp tp = 1ms (A)	Maximum Peak Pulse Power tp = 1ms (kw)
PIP 8.4	PHP 8.4	8.4	12.0	250	14	10	22	341	7.5
PIP 24	PHP 24	24.0	34.0	250	40	10	67	112	7.5
PIP 30	PHP 30	30.0	42.5	250	50	1	84	90	7.5
PIP 60	PHP 60	60.0	85.0	250	100	1	167	90	15.0
PIP 120	PHP 120	120.0	170.0	250	200	1	319	47	15.0
PIP 280	PHP 208	208.0	295.0	250	347	1	536	28	15.0
PIP 250	PHP 250	250.0	354.0	250	418	1	652	23	15.0
PIP 440	PHP 440	440.0	623.0	250	735	1	1138	13.2	15.0
PIP 500	PHP 500	500.0	708.0	250	835	1	1292	11.6	15.0

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15,000 WATT - MODULE

FEATURES:
- 15,000 watts peak pulse power.
- 28 volts power supply protection.
- Each device is 100% tested.
- Molded case.
- For use in airborne equipment
- Custom voltages available from factory.

MECHANICAL:
- Molded case.
- Polarity: Positive terminal indicated.
- Body marked with Logo, part number, & date code.

MAXIMUM RATINGS:
- Operating Temperature: -65°C to +150°C.
- Storage Temperature: -65°C to +150°C.
- Surge Power: 15KW.
- Average steady state power dissipation: 10 Watts.

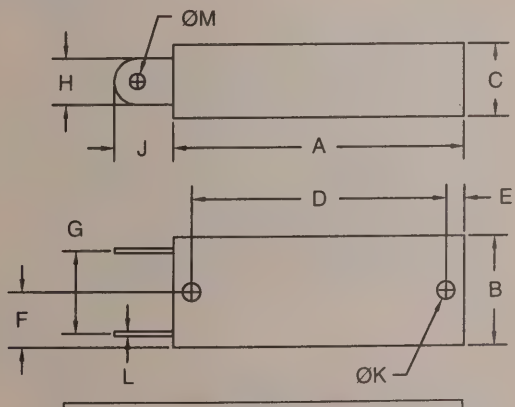
SCREENING:
- 100% TX level screening is available per MIL-S-19500/507, 516. For ordering, use the following suffix:
  H1 - Submodule screening
  H2 - Submodule & module screening
  H3 - Submodule & module screening. Group B & C lot testing.

DESCRIPTION:
The 704-15K36 & 704-15K36T series of transient voltage suppression modules is for use primarily in avionics equipment. This series meets all applicable environmental requirements of MIL-S-19500. In addition, the subassemblies can be 100% TX screened per MIL-S-19500/516 or 507. Although this series has been designed for 28 volt aircraft applications, different voltages may be special ordered for specific applications.

ELECTRICAL SPECIFICATIONS @ 25°C (Unless otherwise specified)

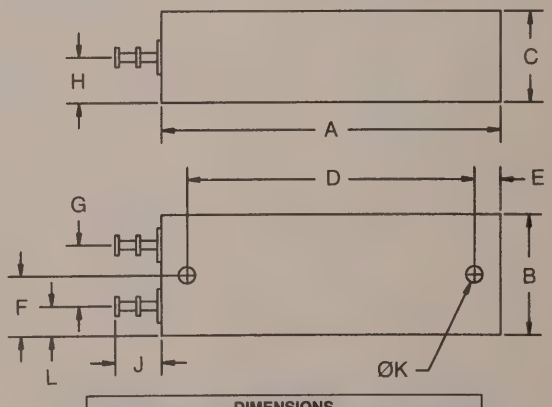
Part Number	Reverse Stand-off Voltage V_{RWM} (V)	Reverse Leakage Current Ir (μA)	Minimum Breakdown Voltage Vbr @ It (V)	Test Current It (mA)	Maximum Clamping Voltage Vc @ Ipp (V)	Peak Pulse Current Ipp Tp = 1ms (A)	Maximum Forward Voltage 8.3ms IF = 100A (V)
704-15K36	31.5	100	36	10	51	300	3.0
704-15K36T	31.5	500	36	10	51	300	15.0

704-15K36



DIM "	DIMENSIONS INCHES MIN	INCHES MAX	MM MIN	MM MAX	NOTE
A	1.97	2.03	50.0	51.6	
B	.72	.78	18.2	19.9	
C	.47	.53	11.9	13.5	
D	1.73	1.77	43.9	45.0	
E	.110	.140	2.7	3.6	
F	.345	.405	8.7	10.3	
G	.532	.592	13.5	15.1	
H	.306	.320	7.7	8.2	
J	.350	.450	8.8	11.5	
øK	.120	.130	3.0	3.3	
L	.027	.037	.68	.94	
øM	.095	.115	2.4	3.0	

704-15K36T



DIM "	DIMENSIONS INCHES MIN	INCHES MAX	MM MIN	MM MAX	NOTE
A	2.47	2.53	62.7	64.3	
B	.86	.92	21.8	23.4	
C	.64	.70	16.2	17.8	
D	2.10	2.14	53.3	54.4	
E	.17	.21	4.3	5.4	
F	.415	.475	10.5	12.1	
G	.42	.48	10.6	12.2	
H	.305	.365	7.7	9.3	
J	.325	.365	8.2	9.3	
øK	.120	.130	3.0	3.3	
L	.19	.25	4.8	6.4	

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60,000 & 90,000 WATT - MODULE

FEATURES:

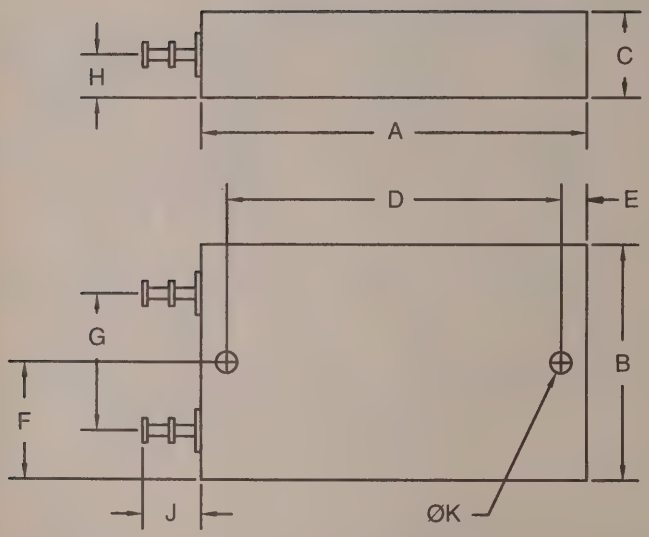
- 60,000 & 90,000 watts peak pulse power.
- 200 volts BIDIRECTIONAL.
- Each device is 100% tested.
- Molded case.
- For use in shipboard & power servicing equipment.
- Custom voltages available from factory.

MAXIMUM RATINGS:

- Operating Temperature: -65°C to +150°C.
- Storage Temperature: -65°C to +150°C.
- Surge Power: 60KW & 90KW.
- Average steady state power dissipation @ 10 Watts.

SCREENING:

- 100% TX level screening is available per MIL-S-19500/507, 516. For ordering, use the following suffix:
  H1 - Submodule screening
  H2 - Submodule & module screening
  H3 - Submodule & module screening. Group B & C lot testing.



60KS200C

DIM "	DIMENSIONS				NOTE
	INCHES		MM		
	MIN	MAX	MIN	MAX	
A	2.22	2.28	56.3	58.0	
B	1.35	1.40	34.2	35.6	
C	.47	.53	11.9	13.5	
D	1.93	1.97	49.0	50.1	
E	.135	.165	3.4	4.2	
F	.66	.72	16.7	18.3	
G	.77	.83	19.5	21.1	
H	.22	.28	5.5	7.2	
J	.325	.365	8.2	9.3	
K	.120	.130	3.0	3.3	DIA.

90KS200C

DIM "	DIMENSIONS				NOTE
	INCHES		MM		
	MIN	MAX	MIN	MAX	
A	2.22	2.50	56.3	63.5	
B	1.35	1.90	34.2	48.3	
C	.47	0.55	11.9	13.9	
D	1.88	1.92	47.8	48.8	
E	.135	0.30	3.4	7.6	
F	.66	0.95	16.7	24.1	
G	.98	1.02	24.9	25.9	
H	.26	.29	6.5	7.5	
J	.325	.365	8.2	9.3	
K	.193	.205	5.35	5.65	DIA.

ELECTRICAL SPECIFICATIONS @ 25°C (Unless otherwise specified)

Part Number	Reverse Stand-off Voltage V_{RWM} (V)	Reverse Leakage Current Ir (μA)	Breakdown Voltage Vbr @ It Min. Max (V)	Test Current It (mA)	Maximum Clamping Voltage Vc @ Ipp (V)	Peak Pulse Current Ipp Tp = 1.5 x 40μS (A)	Maximum Peak Pulse Power Tp = 1.5 x 40μS (kw)
60KS200C	180	10	200 - 225	1	335	180	60
90KS200C	180	0.5	200 - 225	1	280	180	90

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LINEAR VOLTAGE REGULATORS

POSITIVE FIXED VOLTAGE

Device Type	Io Rated Amps	V_{OUT} Volts	V_{OUT} Tolerance %	V_{IN} Min Volts	V_{IN} Max Volts	PD Watts Rated	REG (Line) %	REG (Load) %	T_J °C Rated	T_C % V_O/°C	Outline Drawing
LAS-39A05	8	5	±2	7.6	25	80	2	0.6	125	0.03	A
LAS-39A05K	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	A
LAS-3905K	↓	↓	+5/-3	↓	↓	↓	↓	↓	↓	↓	A
LAS-3905	↓	↓	±5	↓	↓	↓	↓	↓	↓	↓	A
LAS-19A05	5	5	±2	7.6	30	50	1	0.6	125	0.03	C
LAS-19A05P	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	E
LAS-1905B	↓	↓	+5/-3	↓	↓	↓	↓	↓	↓	↓	C
LAS-1905BP	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	E
LAS-1905	↓	↓	±5	↓	↓	↓	↓	↓	↓	↓	C
LAS-1905P	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	E
LAS-19A12	↓	12	±2	14.6	↓	↓	↓	↓	↓	↓	C
LAS-19A12P	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	E
LAS-1912B	↓	↓	+5/-3	↓	↓	↓	↓	↓	↓	↓	C
LAS-1912BP	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	E
LAS-1912	↓	↓	±5	↓	↓	↓	↓	↓	↓	↓	C
LAS-1912P	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	E
LAS-19A15	↓	15	±2	17.6	35	↓	1.0	0.6	↓	0.03	C
LAS-19A15P	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	E
LAS-1915B	↓	↓	+5/-3	↓	↓	↓	↓	↓	↓	↓	C
LAS-1915BP	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	E
LAS-1915	↓	↓	±5	↓	↓	↓	↓	↓	↓	↓	C
LAS-1915P	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	E
LAS-14A05	3	5	±2	7.5	30	30	1.0	0.6	125	0.02	G
LAS-1405B	↓	↓	+5/-3	↓	↓	↓	↓	↓	↓	↓	↓
LAS-1405	↓	↓	±5	↓	↓	↓	↓	↓	↓	↓	↓
LAS-14A12	↓	12	±2	14.5	↓	↓	↓	↓	↓	↓	↓
LAS-1412B	↓	↓	+5/-3	↓	↓	↓	↓	↓	↓	↓	↓
LAS-1412	↓	↓	±5	↓	↓	↓	↓	↓	↓	↓	↓
LAS-14A15	↓	15	±2	17.5	35	↓	↓	↓	↓	↓	↓
LAS-1415B	↓	↓	+5/-3	↓	↓	↓	↓	↓	↓	↓	↓
LAS-1415	↓	↓	±5	↓	↓	↓	↓	↓	↓	↓	↓
LAS-16A05	2	5	±2	7.6	35	20	1.0	0.6	125	0.02	↓
LAS-1605B	↓	↓	+5/-3	↓	↓	↓	↓	↓	↓	↓	↓
LAS-1605	↓	↓	±5	↓	↓	↓	↓	↓	↓	↓	↓
LAS-16A12	↓	12	±2	14.6	↓	↓	↓	↓	↓	↓	↓
LAS-1612B	↓	↓	+5/-3	↓	↓	↓	↓	↓	↓	↓	↓
LAS-1612	↓	↓	±5	↓	↓	↓	↓	↓	↓	↓	↓
LAS-16A15	↓	15	±2	17.6	40	↓	↓	↓	↓	↓	↓
LAS-1615B	↓	↓	+5/-3	↓	↓	↓	↓	↓	↓	↓	↓
LAS-1615	↓	↓	±5	↓	↓	↓	↓	↓	↓	↓	↓
LAS-15A05	1.5	5	±2	7.4	35	15	1.5	0.6	125	0.02	↓
LAS-1505	↓	↓	±5	↓	↓	↓	↓	↓	↓	↓	↓
LAS-15A06	↓	6	±2	8.4	↓	↓	↓	↓	↓	↓	↓
LAS-1506	↓	↓	±5	↓	↓	↓	↓	↓	↓	↓	↓
LAS-15A12	↓	12	±2	14.4	↓	↓	↓	↓	↓	↓	↓
LAS-1512	↓	↓	±5	↓	↓	↓	↓	↓	↓	↓	↓
LAS-15A15	↓	15	±2	17.4	40	↓	↓	↓	↓	↓	↓
LAS-1515	↓	↓	±5	↓	↓	↓	↓	↓	↓	↓	↓

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LINEAR VOLTAGE REGULATORS

POSITIVE HYBRID FIXED VOLTAGE

Device Type	Io Rated Amps	V_{OUT} Volts	V_{IN} Volts Max	PD Watts Max	V_{IN}-V_{OUT} Differential Volts Min	Regulator %V_{OUT} T_A = 25°C Line	Regulator %V_{OUT} T_A = 25°C Load	T_J °C Max	T_C % V_O/°C	Outline Drawing
LAS-2105	5	5	40	85	4.6	0.1	0.2	200	0.015	J
LAS-2112	↓	12	↓	↓	↓	↓	↓	↓	↓	↓
LAS-2115	↓	15	↓	↓	↓	↓	↓	↓	↓	↓
LAS-2124	3	24	↓	↓	↓	↓	↓	↓	↓	↓
LAS-2205	5	5	40	85	2.5	0.1	0.2	200	0.015	K
LAS-2206	↓	6	↓	↓	↓	↓	↓	↓	↓	↓
LAS-2212	↓	12	↓	↓	↓	↓	↓	↓	↓	↓
LAS-2215	↓	15	↓	↓	↓	↓	↓	↓	↓	↓
LAS-2224	3	24	↓	↓	↓	↓	↓	↓	↓	↓
LAS-3205	10	5	40	140	2.5	0.1	0.2	200	0.015	↓
LAS-3212	8.5	12	↓	↓	↓	↓	↓	↓	↓	↓
LAS-3215	8.5	15	↓	↓	↓	↓	↓	↓	↓	↓
LAS-3224	7.5	24	↓	↓	↓	↓	↓	↓	↓	↓
LAS-3228	7.0	28	↓	↓	↓	↓	↓	↓	↓	↓
LAS-5205	20	5	40	270	2.5	0.14	0.2	200	0.015	L
LAS-5212	15	12	↓	↓	↓	↓	↓	↓	↓	↓
LAS-5215	15	15	↓	↓	↓	↓	↓	↓	↓	↓
LAS-5224	14	24	↓	↓	↓	↓	↓	↓	↓	↓
LAS-7205	30	5	40	400	2.5	0.14	0.2	200	0.015	M
LAS-7215	22	15	↓	↓	↓	↓	↓	↓	↓	↓
LAS-7224	21	24	↓	↓	↓	↓	↓	↓	↓	↓

LINEAR VOLTAGE REGULATORS

POSITIVE ADJUSTABLE VOLTAGE

Device Type	Io Rated Amps	V_{OUT} Volts Min	V_{OUT} Volts Max	V_{REF} Tolerance %	V_{IN} Volts Min	V_{IN} Volts Max	PD Watts Rated	REG (Line) %V_{OUT} T_A = 25°C % Max	REG (Line) TA = 25°C %	T_J °C Max	T_C Typ % V_O/°C	Outline Drawing
LAS-1000	↓	↓	38	↓	↓	40	0.8	0.02	0.05	150	0.015	O
LAS-1100	↓	↓	48	↓	↓	50	↓	0.08	↓	↓	Max	O
LAS-1100S	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	P

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SWITCHING REGULATORS

Device Type	I_{OUT} Rated Amps	V_{IN} Volts Min	V_{IN} Volts Max	V_{OUT} Volts Min	V_{OUT} Volts Max	Step Down	Step Up η=70%min	T_J °C	Outline Drawing
LAS-6380	8	6	35	2.4	27	√	√	-25 to 125	S
LAS-6380PI	↓	↓	↓	↓	↓	√	√	↓	T
LAS-6381	↓	↓	↓	↓	↓	√	↓	↓	S
LAS-6381PI	↓	↓	↓	↓	↓	√	↓	↓	T
LSH-6389P	8	9	↓	5	↓	√	↓	-25 to 125	V
LAS-6480	8	6	40	2.4	31	√	√	-55 to 150	S
LAS-6480P	↓	↓	↓	↓	↓	√	√	-25 to 125	T
LAS-6481	↓	↓	↓	↓	↓	√	↓	-55 to 150	S
LAS-6481P	↓	↓	↓	↓	↓	√	↓	-25 to 125	T
LSH-6489	8	9	40	5	31	√	↓	-55 to 150	W
LSH-6489P	↓	9	↓	5	↓	√	↓	-25 to 125	V
LAS-6350	5	6	35	2.4	27	√	√	-25 to 125	S
LAS-6350PI	↓	↓	↓	↓	↓	√	√	↓	T
LAS-6351	↓	↓	↓	↓	↓	√	↓	↓	S
LAS-6351PI	↓	↓	↓	↓	↓	√	↓	↓	T
LSH-6355P	5	9	35	5	27	√	↓	-25 to 125	X
LSH-6355PV	↓	↓	↓	↓	↓	√	↓	↓	Y
LSH-6355PH	↓	↓	↓	↓	↓	√	↓	↓	Z
LAS-6450	5	6	40	2.4	31	√	√	-55 to 150	S
LAS-6450P	↓	↓	↓	↓	↓	√	√	-25 to 125	T
LAS-6451	↓	↓	↓	↓	↓	√	↓	-55 to 150	S
LAS-6451P	↓	↓	↓	↓	↓	√	↓	-25 to 125	T
LSH-6455	5	9	40	5	31	√	↓	-55 to 150	AA
LSH-6455P	↓	↓	↓	↓	↓	√	↓	-25 to 125	X
LSH-6455PH	↓	↓	↓	↓	↓	√	↓	↓	Y
LSH-6455PV	↓	↓	↓	↓	↓	√	↓	↓	Z
LAS-6330A	3	6	35	2.4	27	√	√	-25 to 125	S
LAS-6330PI	↓	↓	↓	↓	↓	√	√	↓	T
LAS-6331A	↓	↓	↓	↓	↓	√	↓	↓	S
LAS-6331PI	↓	↓	↓	↓	↓	√	↓	↓	T
LSH-6335P	3	9	35	5	27	√	↓	-25 to 125	X
LSH-6335PH	↓	↓	↓	↓	↓	√	↓	↓	Y
LSH-6335PV	↓	↓	↓	↓	↓	√	↓	↓	Z
LAS-6430	↓	6	40	2.4	31	√	√	-55 to 150	S
LAS-6430P	↓	↓	↓	↓	↓	√	√	-25 to 125	T
LAS-6431	↓	↓	↓	↓	↓	√	↓	-55 to 150	S
LAS-6431P	↓	↓	↓	↓	↓	√	↓	-25 to 125	T
LSH-6435	↓	9	↓	5	↓	√	↓	-55 to 150	AA
LSH-6435P	↓	↓	↓	↓	↓	√	↓	-25 to 125	X
LSH-6435PH	↓	↓	↓	↓	↓	√	↓	-25 to 125	Y
LSH-6435PV	↓	↓	↓	↓	↓	√	↓	↓	Z

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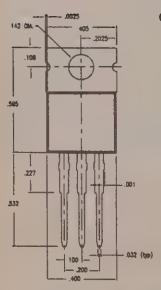
SWITCHING REGULATORS (Cont.)

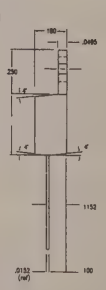
Device Type	I_{OUT} Rated Amps	V_{IN} Volts Min	V_{IN} Volts Max	V_{OUT} Volts Min	V_{OUT} Volts Max	Step Down	Step Up η=70%min	T_J °C	Outline Drawing
LAS-6320P	2	6	35	2.5	27	√	√	-25 to 125	U
LAS-6321P		▼	▼	▼	▼	√	√	▼	U
LSH-6325P		9		5		√			X
LSH-6325PH		▼	▼	▼	▼	√		▼	Y
LSH-6325PV		▼	▼	▼	▼	√		▼	Z
LAS-6420P		6	40	2.5	31	√	√	-25 to 125	U
LAS-6421P		▼	▼	▼	▼	√	√	▼	U
LSH-6425		9		5		√		-55 to 150	AA
LSH-6425P		▼	▼	▼	▼	√		-25 to 125	X
LSH-6425PH		▼	▼	▼	▼	√		▼	Y
LSH-6425PV	▼	▼	▼	▼	▼	√		▼	Z

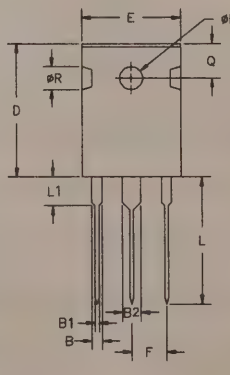
ULTRAFAST RECTIFIERS

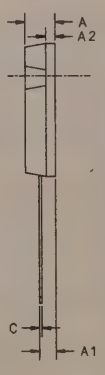
DEVICE TYPE	V_{RWM} (V)	$I_{F(AV)}$ (A@T_C = 25°C)	t_{rr} (ns)	V_F (V @ 25°C)	OUTLINE DRAWING
SUR805	50	8	35	.975 @ 8A	G120
SUR810	100	8	35	.975 @ 8A	G120
SUR815	150	8	35	.975 @ 8A	G120
SUR820	200	8	35	.975 @ 8A	G120
SUR1605	50	16	35	1.1 @ 16A	G120
SUR1610	100	16	35	1.1 @ 16A	G120
SUR1615	150	16	35	1.1 @ 16A	G120
SUR1620	200	16	35	1.1 @ 16A	G120
SUR1605CT	50	16	35	.975 @ 8A	G121
SUR1610CT	100	16	35	.975 @ 8A	G121
SUR1615CT	150	16	35	.975 @ 8A	G121
SUR1620CT	200	16	35	.975 @ 8A	G121
SUR3205CT	50	32	35	1.1 @ 16A	G122
SUR3210CT	100	32	35	1.1 @ 16A	G122
SUR3215CT	150	32	35	1.1 @ 16A	G122
SUR3220CT	200	32	35	1.1 @ 16A	G122



G121

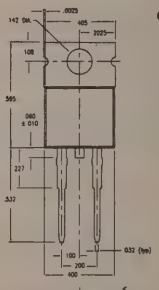




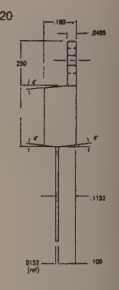


G122

DIM	INCHES MIN	INCHES MAX	MM MIN	MM MAX	NOTE
A	.185	.209	4.70	5.30	
A1	.087	.102	2.20	2.59	
A2	.059	.098	1.50	2.50	
B	.040	.055	1.02	1.40	
B1	.065	.084	1.65	2.13	
B2	.113	.123	2.87	3.13	
C	.016	.031	.40	.79	
D	.819	.845	20.8	21.5	
E	.610	.640	15.5	16.3	
F	.215	–	5.46	–	BSC
L	.780	.800	19.8	20.3	
L1	–	.177	–	4.50	
øP	.140	.144	3.56	3.66	
Q	.212	.244	5.38	6.20	
øR	.140	.216	4.32	5.49	



G120



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INTERFACE DRIVERS

Device Type	Output Current Amps	Peak Output Current Amps	No. Of Channels	V_{IN} Max	Dual H-Bridge	Single 1/2 Bridge	Clamped Output	Outline Drawing
LAS-8500P	3	5	1	40		√		HH
LAS-8501P	↓	↓	↓	↓				↓

OVERVOLTAGE PROTECTORS

Device Type	Continuous Current Amps	Non-Repetitive Peak Surge Current Amps	Nom Supply Voltage (Volts)	Standby Current mA	Outline Drawing
L-35-OV-5	35	350	5	30	LL
L-35-OV-12	↓	↓	12	↓	↓
L-35-OV-15	↓	↓	15	↓	↓
L-20-OV-5	20	260	5	30	LL
L-20-OV-12	↓	↓	12	↓	↓
L-20-OV-15	↓	↓	15	↓	↓
L-20-OV-24	↓	↓	24	↓	↓
LV20-OV-30	↓	↓	30	↓	↓
L-12-OV-5	12	200	5	30	KK
L-12-OV-12	↓	↓	12	↓	↓
L-12-OV-15	↓	↓	15	↓	↓
L-12-OV-20	↓	↓	20	↓	↓
L-12-OV-24	↓	↓	24	↓	↓
L-12-OV-28	↓	↓	28	↓	↓
L-12-OV-30	↓	↓	30	↓	↓
L-6-OV-5	6	70	5	35	JJ
L-6-OV-12	↓	↓	12	↓	↓
L-6-OV-15	↓	↓	15	↓	↓
L-6-OV-24	↓	↓	24	↓	↓
L-2-OV-5	2	20	5	35	II
L-2-OV-12	↓	↓	12	↓	↓
L-2-OV-15	↓	↓	15	↓	↓
L-2-OV-24	↓	↓	24	↓	↓

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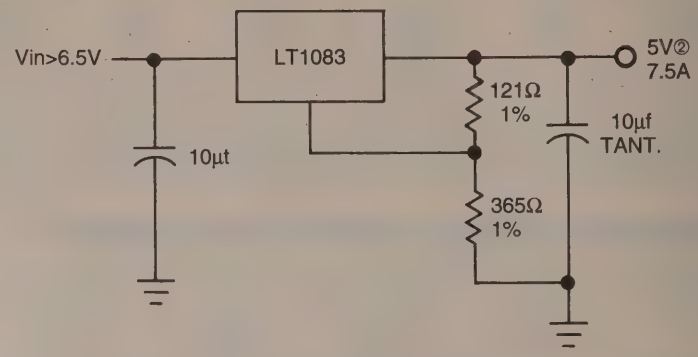
LOW-DROP LINEAR VOLTAGE REGULATORS

POSITIVE LOW-DROPOUT FIXED AND ADJUSTABLE VOLTAGE DEVICES

The LT1083 - LT1086 series of low-dropout regulators provide superb regulation and low output noise for applications demanding higH performance with little dissipated heat. Both fixed and adjustable output versions are available, which deliver 7.5A, 5A, 3A, and 1.5A of regulated output current with only 1.3V input-output differential voltage.



TYPICAL APPLICATION

Device Type	Iout Rated Amps Min	Iout Rated Amps Max	Vout Volts	Vin Volts Max	Power Dissipation (Max)	Vin - Vout Differential Volts	Line Regulation T_a = 25°C	Load Regulation T_a = 25°C	Temp Stability	Package
LT1083K	0.004	7.5	adjustable	N/A	60W	1.3	0.2%	0.3%	0.5%	TO-3
LT1083K-5	0	7.5	5.0	20V						TO-3
LT1083K-12	0	7.5	12.0	25V						TO-3
LT1083P	0.004	7.5	adjustable	N/A						TO-3P
LT1083P-5	0	7.5	5.0	20V						TO-3P
LT1083P-12	0	7.5	12.0	25V						TO-3P
LT1083T	0.004	7.5	adjustable	N/A						TO-220
LT1083T-5	0	7.5	5.0	20V						TO-220
LT1083T-12	0	7.5	12.0	25V						TO-220
LT1084K	0.004	5.0	adjustable	N/A	45W					TO-3
LT1084K-5	0	5.0	5.0	20V						TO-3
LT1084K-12	0	5.0	12.0	25V						TO-3
LT1084P	0.004	5.0	adjustable	N/A						TO-3P
LT1084P-5	0	5.0	5.0	20V						TO-3P
LT1084P-12	0	5.0	12.0	25V						TO-3P
LT1084T	0.004	5.0	adjustable	N/A						TO-220
LT1084T-5	0	5.0	5.0	20V						TO-220
LT1084T-12	0	5.0	12.0	25V						TO-220
LT1085K	0.004	3.0	adjustable	N/A	30W					TO-3
LT1085K-5	0	3.0	5.0	20V						TO-3
LT1085K-12	0	3.0	12.0	25V						TO-3
LT1085P	0.004	3.0	adjustable	N/A						TO-3P
LT1085P-5	0	3.0	5.0	20V						TO-3P
LT1085P-12	0	3.0	12.0	25V						TO-3P
LT1085T	0.004	3.0	adjustable	N/A						TO-220
LT1085T-5	0	3.0	5.0	20V						TO-220
LT1085T-12	0	3.0	12.0	25V						TO-220
LT1086K	0.004	1.5	adjustable	25V	15W					TO-3
LT1086K-5	0	1.5	5.0	20V				0.4%		TO-3
LT1086K-12	0	1.5	12.0	25V				0.3%		TO-3
LT1086T	0.004	1.5	adjustable	25V				0.3%		TO-220
LT1086T-5	0	1.5	5.0	20V				0.4%		TO-220
LT1086T-12	0	1.5	12.0	25V				0.3%		TO-220
LT1086H	0.004	1.5	adjustable	25V				0.3%		TO-39
LT1086H-5	0	1.5	5.0	20V				0.4%		TO-39
LT1086H-12	0	1.5	12.0	25V				0.3%		TO-39

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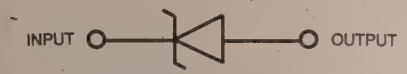
1A 5V TO 3.0, 3.3, ADJ EZ DROPPER™

FEATURES:
- Drops 5V to 3V, 3.3V, ADJ

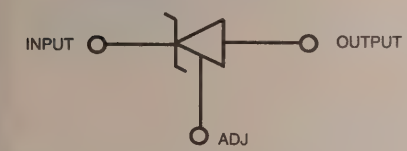
DESCRIPTION

The EZ5Z3 voltage converters are innovative 2 terminal devices that accept a regulated 5.0V input and reduce it to 3.0V or 3.3V over a range of 10mA to 1A. The EZ5Z3- ADJ is an adjustable 3 terminal model allowing output voltage trimming.

BLOCK DIAGRAMS



EZ5Z3-3.0 EZ5Z3-3.3



EZ5Z3-ADJ

ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Minimum	Maximum	Units
Power Dissipation	P_D		2	W
Continuous Current	I_C		1	A
Thermal Resistance Junction to Case	B_{JC}		4	°C/W
Junction to Ambient TO-220/TO-223	O_{JA}		50/156	
Operating Temperature Range	T_J	-40	150	°C
Storage Temperature Range	T_{STG}	-65		
Lead Temperature (Soldering, 10 Sec. Time Limit)	T_{LEAD}		260	

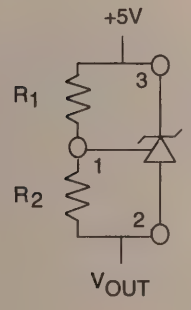
DEVICE SELECTION GUIDE

Device	V_{IN}	V_{OUT}	Package	Device	V_{IN}	V_{OUT}	Package
EZ5Z3-T3.0	5	3.0	TO-220 3 Pin	EZ5Z3-S3.0	5	3.0	TO-223
EZ5Z3-T3.3		3.3		EZ5Z3-S3.3		3.3	
EZ5Z3-TADJ		ADJ		EZ5Z3-SADJ		ADJ	

ELECTRICAL CHARACTERISTICS

Parameters	Symbol	Test Conditions			Test Limits			Units
		V_{IN}	I_O	T_J	Min.	Typ.	Max.	
EZ5Z3-3.0	V_O	5V	500mA	25°C	2.91	3.00	3.09	V
			10mA to 1A	-40 to 125°C	2.85		3.15	
EZ5Z3-3.3			500mA	25°C	3.20	3.30	3.39	
			10mA to 1A	-40 to 125°C	3.13		3.46	
EZ5Z3-ADJ	V_{REF}		500MA	25°C	1.21	1.25	1.28	
			10mA to 1A	-40 to 125°C	1.18		1.31	
REGULATION	REG (LOAD)			25°C		0.5	1.0	$\%V_O$
TEMP. COEFFICIENT	T_C		500mA	25 to 125°C		0.005	0.01	$\%V_O$/°C

ADJUSTING EZ5Z3-ADJ

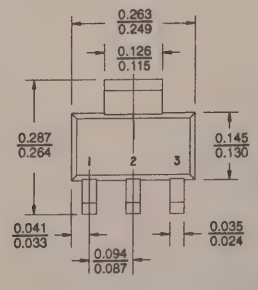


$$V_{DROP} = V_{REF}(1+R_1/R_2)$$

$$V_{OUT} = V_{IN} - V_{DROP}$$

$$R_1 + R_2 \leq \frac{V_{DROP}}{300\mu A}$$

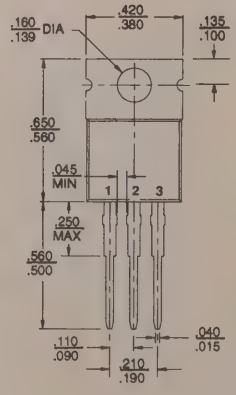
DEVICE OUTLINES



PROFILE .067

EZ5Z3-3.0
EZ5Z3-3.3
PIN OUT

PIN	FUNCTION
1	N.C.
2	OUTPUT
3	INPUT
TAB	OUTPUT



PROFILE .400

EZ5Z3-ADJ
PIN OUT

PIN	FUNCTION
1	ADJ
2	OUTPUT
3	INPUT
TAB	OUTPUT

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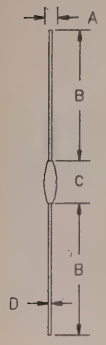
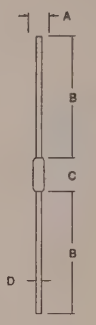


G82

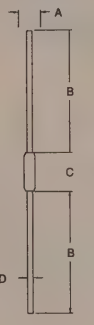
DIM	DIMENSIONS MM MIN	MM MAX	INCHES MIN	INCHES MAX	NOTE
A	–	3.0	–	.118	–
B	29	–	1.14	–	–
C	–	9.5	–	.374	–
D	–	.65	–	.026	–

NOTES:
1. LEAD DIAMETER UNCONTROLLED OVER THIS REGION.



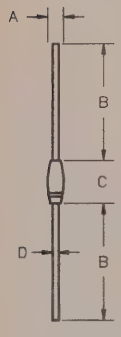
G84

DIM	DIMENSIONS MM MIN	MM MAX	INCHES MIN	INCHES MAX	NOTE
A	–	4.50	–	.177	–
B	26.5	–	1.04	–	–
C	–	7.50	–	.295	–
D	–	1.35	–	.053	–



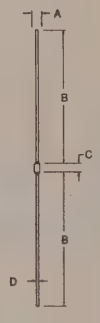
G85

DIM	DIMENSIONS MM MIN	MM MAX	INCHES MIN	INCHES MAX	NOTE
A	–	4.50	–	.177	–
B	26.0	–	1.02	–	–
C	–	8.75	–	.344	–
D	–	1.35	–	.053	–



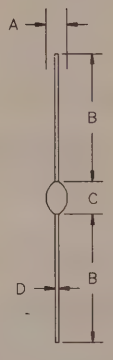
G86

DIM	DIMENSIONS MM MIN	MM MAX	INCHES MIN	INCHES MAX	NOTE
A	–	4.50	–	.177	DIA.
B	26.0	–	1.02	–	–
C	–	9.50	–	.374	–
D	–	1.35	–	.053	DIA.



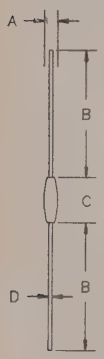
G87

DIM	DIMENSIONS MM MIN	MM MAX	INCHES MIN	INCHES MAX	NOTE
A	–	2.20	–	.087	–
B	32.5	–	1.27	–	–
C	–	3.00	–	118	–
D	–	.65	–	.026	–



G91

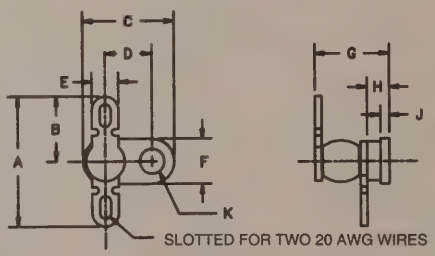
DIM	DIMENSIONS MM MIN	MM MAX	INCHES MIN	INCHES MAX	NOTE
A	–	4.5	–	1.77	–
B	25.4	–	1.00	–	–
C	–	8.5	–	.335	–
D	–	1.35	–	.053	–



G92

DIM	DIMENSIONS MM MIN	MM MAX	INCHES MIN	INCHES MAX	NOTE
A	–	3.0	–	.12	–
B	28	–	1.10	–	–
C	–	9.5	–	.38	1
	–	11.0	–	.43	2
D	–	.66	–	.026	–

NOTES:
1. FOR PF100, PF120
2. FOR PF140, PF170, PF190

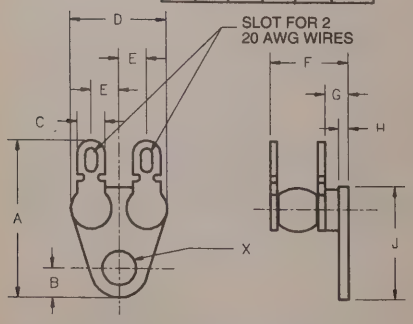


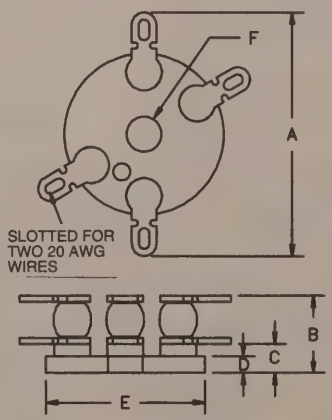
G45

DIM	DIMENSIONS MM MIN	MM MAX	INCHES MIN	INCHES MAX	NOTE
A	14.2	15.0	.53	.59	–
B	6.8	7.4	.28	.29	–
C	9.6	11.2	.38	.44	–
D	4.5	6.1	.18	.24	–
E	3.0	3.3	.12	.13	–
F	4.8	5.3	.19	.21	–
G	7.9	10.2	.31	.40	–
H	2.2	3.0	.09	.12	–
J	.78	1.3	.03	.05	–
K	2.8	3.1	.111	.121	DIA.

G46

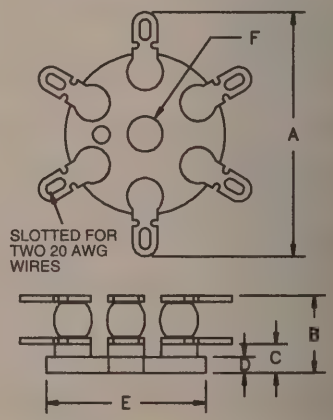
DIM	DIMENSIONS MM MIN	MM MAX	INCHES MIN	INCHES MAX	NOTE
A	–	17.3	–	.68	–
B	2.9	3.4	.115	.135	–
C	3.0	3.3	.12	.13	–
D	10.0	10.4	.39	.41	–
E	2.8	3.0	.11	.12	–
F	–	10.7	–	.42	–
G	2.3	3.0	.09	.12	–
H	1.0	1.3	.04	.05	–
J	11.2	11.9	.44	.47	–
X	3.5	3.8	.139	.149	DIA.





G47

DIM	DIMENSIONS MM MIN	MM MAX	INCHES MIN	INCHES MAX	NOTE
A	29.7	30.5	1.17	1.20	–
B	8.6	10.2	.34	.40	–
C	3.3	4.1	.13	.16	–
D	1.7	2.3	.07	.09	–
E	19.5	20.1	.77	.79	–
F	4.2	4.4	.167	.171	DIA.



G49

DIM	DIMENSIONS MM MIN	MM MAX	INCHES MIN	INCHES MAX	NOTE
A	29.7	30.5	1.17	1.20	–
B	8.6	10.2	.34	.40	–
C	3.3	4.1	.13	.16	–
D	1.7	2.3	.07	.09	–
E	19.5	20.1	.77	.79	–
F	4.2	4.4	.167	.171	DIA.

NOTE: Painted band indicates cathode end.

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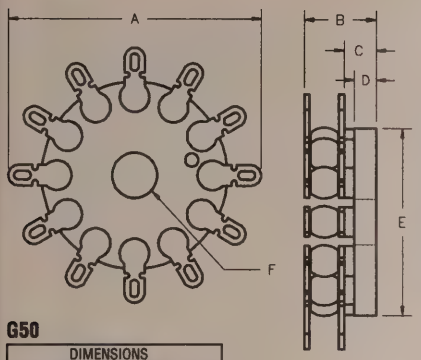
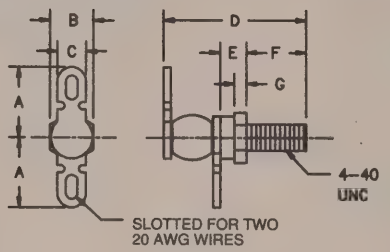


G50

DIM	DIMENSIONS MM MIN	MM MAX	INCHES MIN	INCHES MAX	NOTE
A	38.3	39.2	1.51	1.54	–
B	10.1	10.9	.39	.43	–
C	4.3	5.1	.17	.20	–
D	3.0	3.3	.12	.13	–
E	27.6	28.4	1.09	1.12	–
F	6.7	6.8	.264	.268	DIA.

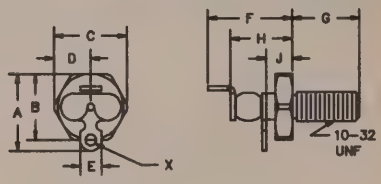
G57

DIM	DIMENSIONS MM MIN	MM MAX	INCHES MIN	INCHES MAX	NOTE
A	5.8	7.4	.23	.29	–
B	4.5	4.8	.18	.19	–
C	3.0	3.3	.12	.13	–
D	14.2	16.5	.56	.65	–
E	2.7	3.3	.11	.13	–
F	6.0	6.6	.24	.26	–
G	1.2	1.5	.05	.06	–



G58

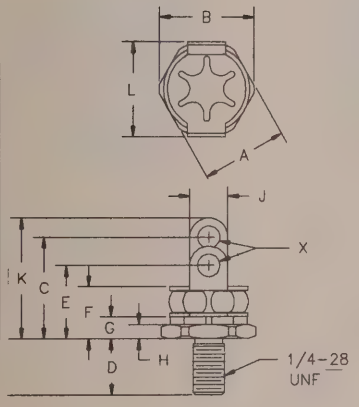
DIM	DIMENSIONS MM MIN	MM MAX	INCHES MIN	INCHES MAX	NOTE
A	12.4	13.2	.49	.52	–
B	10.6	11.2	.42	.44	–
C	11.4	12.2	.45	.48	–
D	5.5	6.1	.22	.24	–
E	3.3	3.6	.13	.14	–
F	13.7	14.8	.54	.57	–
G	10.6	11.4	.42	.45	–
H	9.1	9.9	.36	.39	–
J	4.0	4.6	.16	.18	–
X	1.6	1.9	.065	.075	DIA.



G74

DIM	DIMENSIONS MM MIN	MM MAX	INCHES MIN	INCHES MAX	NOTE
A	17.0	17.6	.67	.69	–
B	18.7	19.3	.74	.76	–
C	19.5	20.6	.77	.81	–
D	10.6	11.7	.42	.46	–
E	13.9	15.0	.55	.59	–
F	–	11.0	–	.43	–
G	4.3	–	.17	–	–
H	2.5	3.1	.10	.12	–
J	7.3	7.9	.29	.31	–
K	–	25.4	–	1.0	–
L	–	19.1	–	.75	–
X	4.3	4.6	.170	.180	DIA.

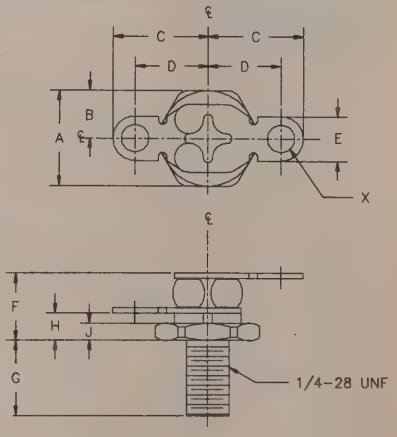
NOTES:
1. POLARITY – RED DOT DENOTES CATHODE TERM.



G79

DIM	DIMENSIONS MM MIN	MM MAX	INCHES MIN	INCHES MAX	NOTE
A	14.0	14.3	.55	.56	–
B	6.6	7.4	.26	.29	–
C	14.2	15.3	.56	.60	–
D	10.4	11.5	.41	.45	–
E	6.0	6.6	.24	.26	–
F	8.8	9.7	.35	.38	–
G	10.9	11.5	.43	.45	–
H	3.5	4.1	.14	.16	–
J	2.0	2.6	.08	.10	–
X	3.8	4.1	.15	.16	DIA.

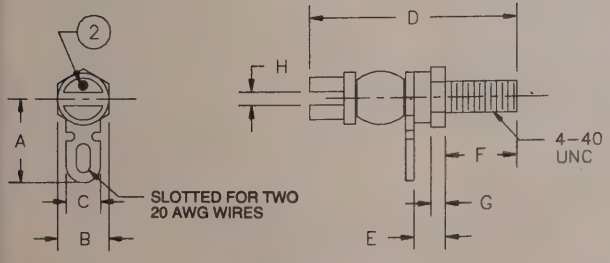
NOTES:
1. POSITIVE TERMINAL DENOTED BY RED DOT



G76

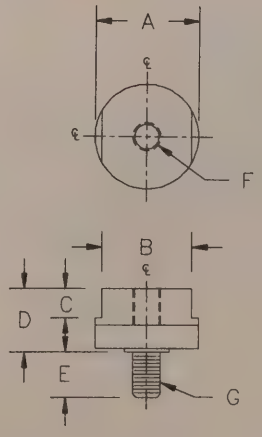
DIM	DIMENSIONS MM MIN	MM MAX	INCHES MIN	INCHES MAX	NOTE
A	5.8	7.4	.23	.29	–
B	4.5	4.8	.18	.19	–
C	3.0	3.3	.12	.13	–
D	17.7	20.4	.70	.80	–
E	2.7	3.3	.11	.13	–
F	6.0	6.6	.24	.26	–
G	1.2	1.5	.05	.06	–
H	1.0	1.3	.04	.05	1

NOTES:
1. TERMINAL ORIENTATION NOT DEFINED.
2. RED DOT DENOTES CATHODE TERMINAL, BLACK DOT DENOTES ANODE TERMINAL



G17

DIM	DIMENSIONS MM MIN	MM MAX	INCHES MIN	INCHES MAX	NOTE
A	27.7	29.2	1.09	1.15	–
B	–	25.4	–	1.00	–
C	8.1	–	.32	–	–
D	–	17.8	–	.70	–
E	11.9	13.5	.47	.53	–
F	TAP'D 5/16–18UNC				–
G	STUD 5/16–18UNC				–



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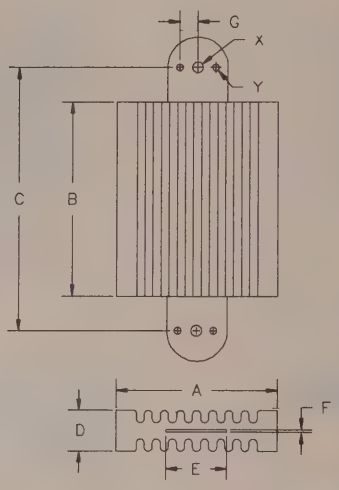
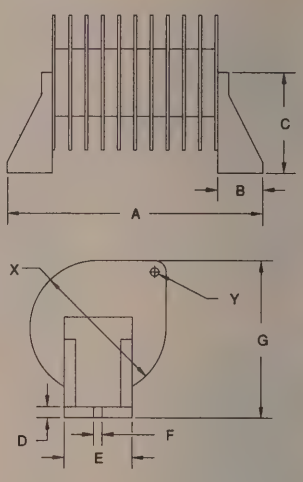
G23

DIM	DIMENSIONS MM MIN	MM MAX	INCHES MIN	INCHES MAX	NOTE
A	–	102	–	4.0	–
B	SEE TABLE				
C	SEE TABLE				
D	–	25.4	–	1.0	–
E	36.8	39.4	1.45	1.55	–
F	1.2	2.3	.047	.090	–
G	10.5	12.1	.415	.475	–
øX	6.2	7.2	.245	.285	DIA
øY	3.8	4.8	.149	.189	DIA



G44

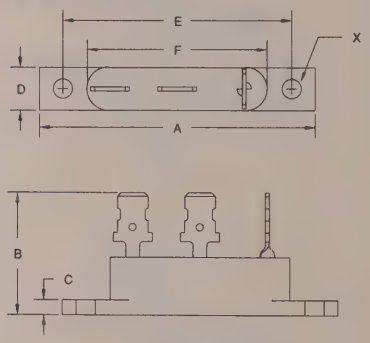
DIM	DIMENSIONS MM MIN	MM MAX	INCHES MIN	INCHES MAX	NOTE
A	SEE TABLE				
B	24.6	26.2	.97	1.03	–
C	56.4	57.9	2.22	2.28	–
D	6.1	6.4	.24	.25	–
E	37.3	38.9	1.47	1.53	–
F	4.1	5.6	.16	.22	–
G	88.1	89.7	3.47	3.53	–
X	75.4	77.0	2.97	3.03	DIA
Y	4.7	5.0	.185	.195	DIA



G24

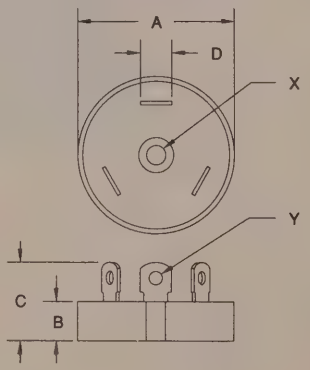
DIM	DIMENSIONS MM MIN	MM MAX	INCHES MIN	INCHES MAX	NOTE
A	56.4	57.9	2.22	2.28	–
B	–	25.4	–	1.00	–
C	2.5	3.8	.10	.15	–
D	8.1	9.6	.32	.38	–
E	46.7	48.3	1.84	1.90	–
F	36.8	37.8	1.45	1.49	–
X	3.8	4.3	.149	.171	–

NOTES:
1. TERMINAL LAYOUT SHOWN FOR DOUBLER. CATHODE TERMINALS PERPENDICULAR TO UNIT AXIS.
2. TERMINALS SUITABLE FOR .25" "FASTON" CONNECTORS OR SOLDERING



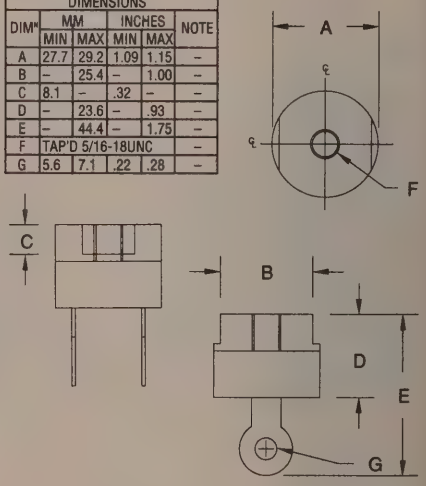
G25

DIM	DIMENSIONS MM MIN	MM MAX	INCHES MIN	INCHES MAX	NOTE
A	–	51.6	–	2.03	–
B	–	13.5	–	.53	–
C	–	26.2	–	1.03	–
D	8.6	10.2	.34	.40	–
X	5.6	7.1	.22	.28	DIA
Y	3.6	5.1	.14	.20	DIA



G26

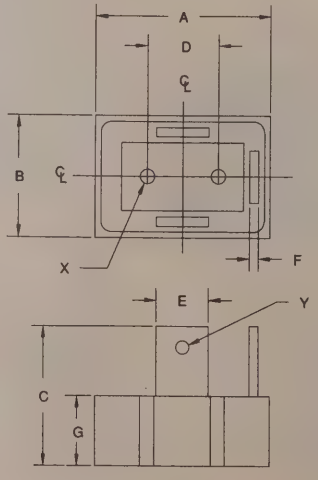
DIM	DIMENSIONS MM MIN	MM MAX	INCHES MIN	INCHES MAX	NOTE
A	27.7	29.2	1.09	1.15	–
B	–	25.4	–	1.00	–
C	8.1	–	.32	–	–
D	–	23.6	–	.93	–
E	–	44.4	–	1.75	–
F	TAP'D 5/16-18UNC				–
G	5.6	7.1	.22	.28	–



G27A

DIM	DIMENSIONS MM MIN	MM MAX	INCHES MIN	INCHES MAX	NOTE
A	–	64.3	–	2.53	–
B	–	45.5	–	1.78	–
C	–	51.6	–	2.03	–
D	24.6	26.2	.97	1.03	–
E	–	19.8	–	.78	–
F	–	3.31	–	.13	–
G	24.6	26.2	.97	1.03	–
X	4.3	5.9	.171	.231	1
Y	4.0	5.5	.159	.219	2

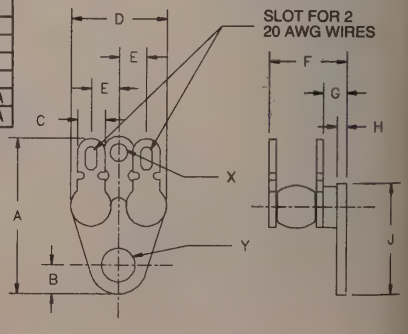
NOTES:
1. TWO PLACES
2. THREE PLACES



G51

DIM	DIMENSIONS MM MIN	MM MAX	INCHES MIN	INCHES MAX	NOTE
A	–	17.3	–	.68	–
B	2.9	3.4	.115	.135	–
C	3.0	3.3	.12	.13	2 PL
D	10.0	10.4	.39	.41	–
E	2.8	3.0	.11	.12	–
F	–	10.7	–	.42	–
G	2.3	3.0	.09	.12	–
H	1.0	1.3	.04	.05	–
J	11.2	11.9	.44	.47	–
X	1.8	2.0	.072	.077	DIA
Y	3.5	3.8	.139	.149	DIA

NOTES:
CONFIGURATION AND POLARITY SHOWN BY COLORED DOTS
POSITIVE CENTER TAP – RED DOT ON POSITIVE TERMINAL
NEGATIVE CENTER TAP – BLACK DOT ON NEGATIVE TERMINAL
DOUBLER – RED, POSITIVE; BLACK, NEGATIVE; YELLOW, AC.



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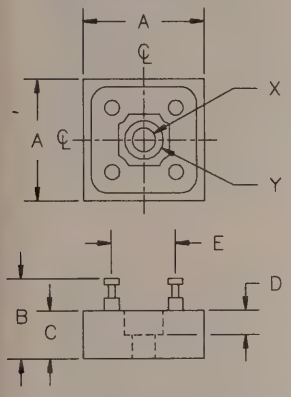
G28

DIM*	DIMENSIONS MM MIN	MM MAX	INCHES MIN	INCHES MAX	NOTE
A	18.7	19.4	.735	.765	–
B	–	12.7	–	.50	–
C	–	7.6	–	.30	–
D	3.4	4.2	.135	.165	–
E	9.6	10.7	.38	.42	–
X	3.4	4.1	.132	.165	DIA
Y	5.6	6.4	.22	.25	DIA

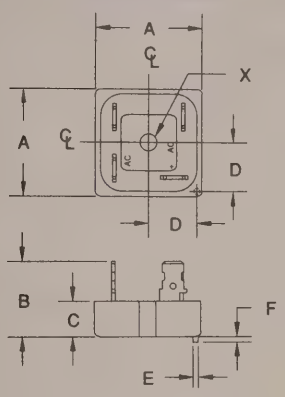
NOTES:
1. TERMINAL IDENTIFICATION MARKED ON CASE



G29

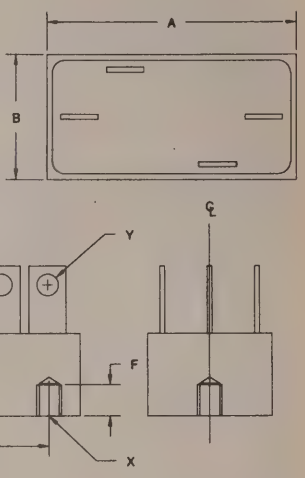
DIM*	DIMENSIONS MM MIN	MM MAX	INCHES MIN	INCHES MAX	NOTE
A	28.1	28.6	1.11	1.14	–
B	–	25.4	–	1.00	–
C	–	10.6	–	.416	–
D	12.4	13.0	.49	.51	–
E	1.3	1.8	.052	.072	DIA
F	–	1.6	–	.062	–
X	4.6	5.4	.183	.213	DIA

NOTES:
1. TERMINALS SUITABLE FOR .25" "FATON" OR SOLDERING



G30A

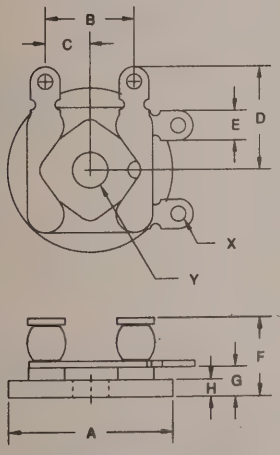
DIM*	DIMENSIONS MM MIN	MM MAX	INCHES MIN	INCHES MAX	NOTE
A	–	51.6	–	2.03	–
B	–	26.2	–	1.03	–
C	–	16.8	–	.66	–
D	–	30.5	–	1.20	–
E	37.8	38.4	1.49	1.51	–
F	6.4	–	.25	–	–
X	10-32 UNF				
Y	3.6	5.1	.14	.20	DIA



G52

DIM*	DIMENSIONS MM MIN	MM MAX	INCHES MIN	INCHES MAX	NOTE
A	19.3	20.1	.76	.79	DIA
B	10.4	11.2	.41	.44	–
C	5.0	5.6	.20	.22	–
D	12.1	13.0	.48	.51	–
E	3.3	3.8	.13	.15	–
F	9.3	10.2	.32	.40	–
G	3.3	4.1	.13	.16	–
H	2.0	2.3	.07	.09	–
X	1.7	2.0	.067	.077	DIA
Y	4.2	4.4	.167	.172	DIA

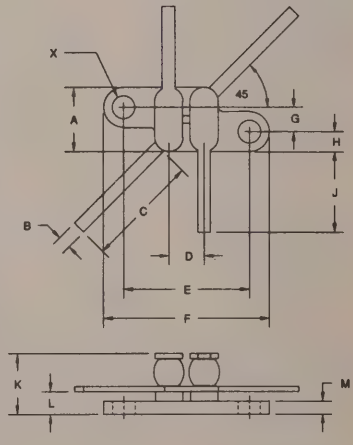
NOTES:
1. TERMINAL MARKING
   RED DOT, POSITIVE
   BLACK DOT, NEGATIVE
   YELLOW DOT, A.C.



G72

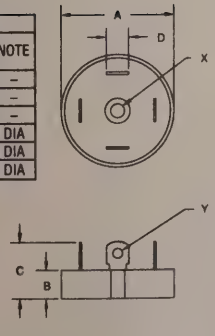
DIM*	DIMENSIONS MM MIN	MM MAX	INCHES MIN	INCHES MAX	NOTE
A	9.9	10.5	.39	.41	–
B	1.7	2.1	.07	.08	–
C	17	–	.68	–	–
D	5.3	6.1	.21	.24	–
E	19.6	20.0	.775	.785	–
F	–	26.5	–	1.04	–
G	3.68	3.94	.145	.155	–
H	3.0	3.3	.12	.13	–
J	11.9	–	.47	–	–
K	–	10.7	–	.40	–
L	3.3	–	.13	–	–
M	1.7	2.3	.07	.09	–
X	3.53	3.79	.139	.149	DIA

NOTES:
1. POLARITY INDICATED BY COLORED DOTS
   TOP TERMINALS:-
   RED DOT - POSITIVE
   BLACK DOT - NEGATIVE
   BOTTOM TERMINALS:-
   YELLOW DOTS - AC



G31

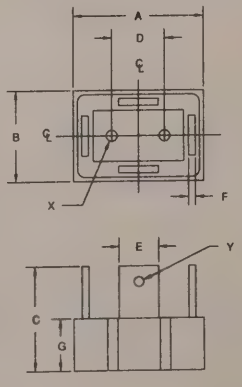
DIM*	DIMENSIONS MM MIN	MM MAX	INCHES MIN	INCHES MAX	NOTE
A	–	51.6	–	2.03	–
B	–	13.5	–	.53	–
C	–	26.2	–	1.03	–
D	8.6	10.2	.34	.40	DIA
X	5.6	7.1	.22	.28	DIA
Y	3.6	5.1	.14	.20	DIA



G27

DIM*	DIMENSIONS MM MIN	MM MAX	INCHES MIN	INCHES MAX	NOTE
A	–	64.3	–	2.53	–
B	–	45.5	–	1.78	–
C	–	51.6	–	2.03	–
D	24.6	26.2	.97	1.03	–
E	–	19.8	–	.78	–
F	–	3.31	–	.13	–
G	24.6	26.2	.97	1.03	–
X	4.3	5.9	.171	.231	1
Y	4.0	5.5	.159	.219	2

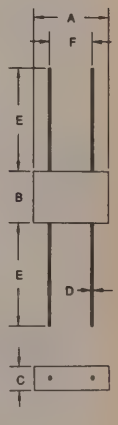
NOTES:
1. TWO PLACES
2. FOUR PLACES



G32

DIM*	DIMENSIONS MM MIN	MM MAX	INCHES MIN	INCHES MAX	NOTE
A	–	16.5	–	.65	–
B	–	11.2	–	.44	–
C	–	5.3	–	.21	–
D	.66	.84	.026	.033	DIA
E	22.2	–	.875	–	–
F	8.6	10.2	.34	.40	–

NOTES:
1. TERMINAL IDENTIFICATION IS MARKED ON CASE



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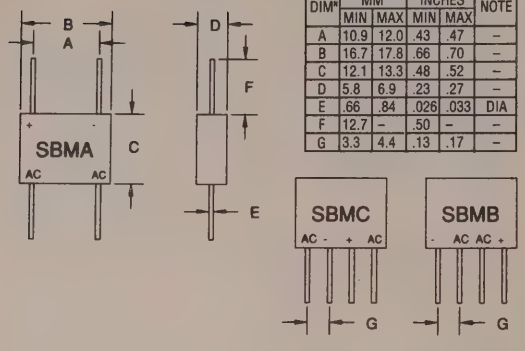
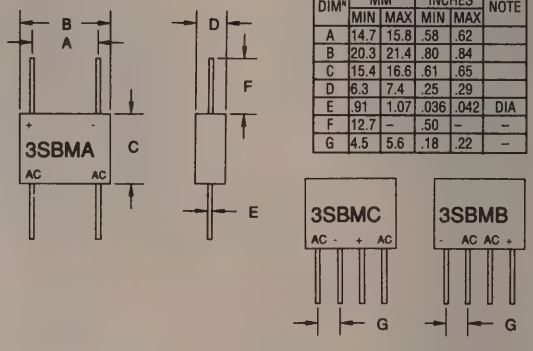


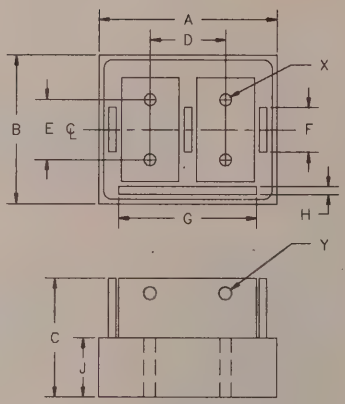
DIM	DIMENSIONS MM MIN	MM MAX	INCHES MIN	INCHES MAX	NOTE
A	10.9	12.0	.43	.47	–
B	16.7	17.8	.66	.70	–
C	12.1	13.3	.48	.52	–
D	5.8	6.9	.23	.27	–
E	.66	.84	.026	.033	DIA
F	12.7	–	.50	–	–
G	3.3	4.4	.13	.17	–

G34



DIM	DIMENSIONS MM MIN	MM MAX	INCHES MIN	INCHES MAX	NOTE
A	14.7	15.8	.58	.62	
B	20.3	21.4	.80	.84	
C	15.4	16.6	.61	.65	
D	6.3	7.4	.25	.29	
E	.91	1.07	.036	.042	DIA
F	12.7	–	.50	–	–
G	4.5	5.6	.18	.22	–

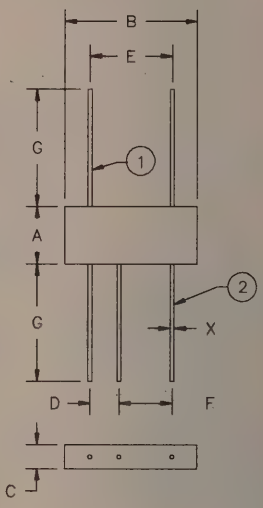
G38A



DIM	DIMENSIONS MM MIN	MM MAX	INCHES MIN	INCHES MAX	NOTE
A	–	73.8	–	2.90	–
B	–	64.3	–	2.53	–
C	–	51.6	–	2.03	–
D	27.8	29.3	1.10	1.15	–
E	24.6	26.2	.97	1.03	–
F	–	19.8	–	.78	–
G	–	54.7	–	2.16	–
H	1.8	3.3	.07	.13	–
J	24.6	26.2	.97	1.03	–
X	4.3	5.9	.171	.231	1
Y	4.0	5.6	.159	.219	2

NOTES:
1. 4 PLACES
2. 5 PLACES

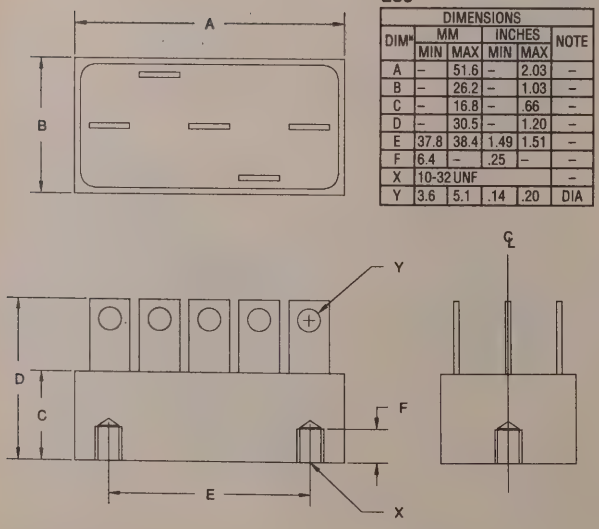
G39



DIM	DIMENSIONS MM MIN	MM MAX	INCHES MIN	INCHES MAX	NOTE
A	10.2	11.7	0.40	0.46	–
B	24.6	26.2	0.97	1.03	–
C	3.8	5.3	0.15	0.21	–
D	5.6	7.1	0.22	0.28	–
E	15.0	16.5	0.59	0.65	–
F	9.14	11.2	0.36	0.44	–
G	22.2	–	.875	–	–
X	0.66	0.84	.026	.033	3

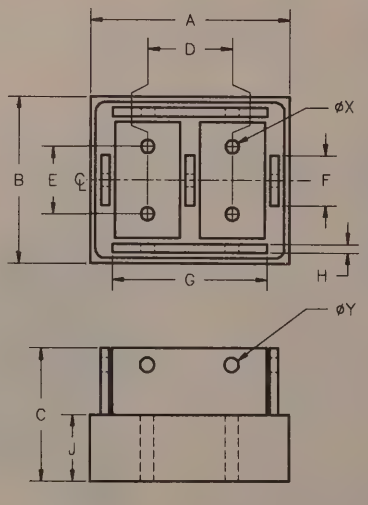
NOTES:
1. POSITIVE LEAD
2. A.C. LEAD 3 PLCS
3. LEADS ARE PLATED COPPER

G30



DIM	DIMENSIONS MM MIN	MM MAX	INCHES MIN	INCHES MAX	NOTE
A	–	51.6	–	2.03	–
B	–	26.2	–	1.03	–
C	–	16.8	–	.66	–
D	–	30.5	–	1.20	–
E	37.8	38.4	1.49	1.51	–
F	6.4	–	.25	–	–
X	10-32 UNF				–
Y	3.6	5.1	.14	.20	DIA

G38



DIM	DIMENSIONS MM MIN	MM MAX	INCHES MIN	INCHES MAX	NOTE
A	–	73.8	–	2.90	–
B	–	64.3	–	2.53	–
C	–	51.6	–	2.03	–
D	27.8	29.3	1.10	1.15	–
E	24.6	26.2	.97	1.03	–
F	–	19.8	–	.78	–
G	–	54.7	–	2.16	–
H	1.8	3.3	.07	.13	–
J	24.6	26.2	.97	1.03	–
øX	4.3	5.9	.171	.231	1
øY	4.0	5.6	.159	.219	2

NOTES:
1. 4 PLACES
2. 7 PLACES

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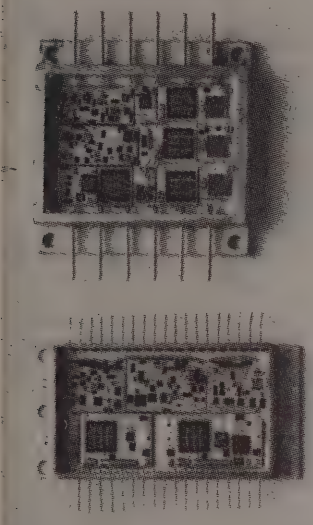

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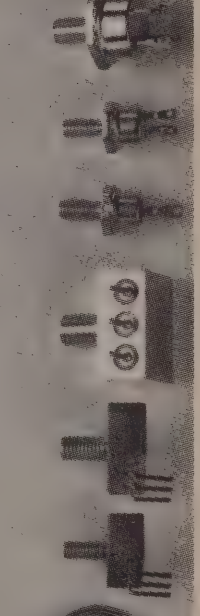

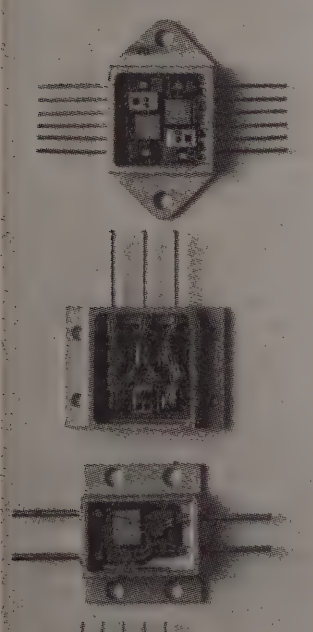

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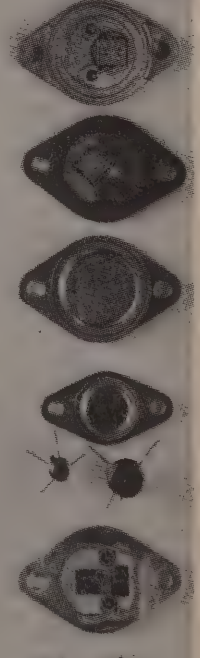

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HT/HS	F	R	M	W	S	E	B	A	L	K	J	P	

LOGIC TRIACS

IT(RMS)	PART NUMBER	VDRM	**IGT(µA)	PKG TYPE
1.0 Amp	L201E3	200	3	E
	L401E3	400	3	
	L601E3	600	3	
	L201E5	200	5	
	L401E5	400	5	
	L601E5	600	5	
	L201E6	200	10	
	L401E6	400	10	
	L601E6	600	10	
	L201E8	200	20	
	L401E8	400	20	
	L601E8	600	20	
4.0 Amp	L2004L3	200	3	L
	L4004L3	400	3	
	L6004L3	600	3	
	L2004L5	200	5	
	L4004L5	400	5	
	L6004L5	600	5	
	L2004L6	200	10	
	L4004L6	400	10	
	L6004L6	600	10	
	L2004L8	200	20	
	L4004L8	400	20	
	L6004L8	600	20	
	L2004F31	200	3	F
	L4004F31	400	3	
	L6004F31	600	3	
	L2004F51	200	5	
	L4004F51	400	5	
	L6004F51	600	5	
	L2004F61	200	10	
	L4004F61	400	10	
	L6004F61	600	10	
	L2004F81	200	20	
	L4004F81	400	20	
	L6004F81	600	20	
6.0 Amp	L2006L5	200	5	L
	L4006L5	400	5	
	L6006L5	600	5	
	L2006L6	200	10	
	L4006L6	400	10	
	L6006L6	600	10	
	L2006L8	200	20	
	L4006L8	400	20	
	L6006L8	600	20	
8.0 Amp	L2008L6	200	10	L
	L4008L6	400	10	
	L6008L6	600	10	

** IGT in Quadrants I, II, III, &IV

LOGIC TRIACS

IT(RMS)	PART NUMBER	VDRM	**IGT(µA)	PKG TYPE
8.0 Amp	L2008L8	200	20	L
	L4008L8	400	20	
	L6008L8	600	20	

** IGT in Quadrants I, II, III, & IV

GATED TRIACS

IT(RMS)	PART NUMBER	VDRM	**IGT(mA)	PKG TYPE
1.0 Amp	Q201E3	200	10	E
	Q401E3	400	10	
	Q501E3	500	10	
	Q601E3	600	10	
	Q201E4	200	25	
	Q401E4	400	25	
	Q501E4	500	25	
	Q601E4	600	25	
4.0 Amp	Q2004L3	200	10	L
	Q4004L3	400	10	
	Q5004L3	500	10	
	Q6004L3	600	10	
	Q2004L4	200	25	
	Q4004L4	400	25	
	Q5004L4	500	25	
	Q6004L4	600	25	
	Q7004L4	700	25	
	Q8004L4	800	25	
	Q2004F31	200	10	F
	Q4004F31	400	10	
	Q5004F31	500	10	
	Q6004F31	600	10	
	Q2004F41	200	25	
	Q4004F41	400	25	
	Q5004F41	500	25	
	Q6004F41	600	25	
6.0 Amp	Q2006L4	200	25	L
	Q4006L4	400	25	
	Q5006L4	500	25	
	Q6006L4	600	50	
	Q7006L4	700	50	
	Q8006L4	800	50	
	Q2006F41	200	25	F
	Q4006F41	400	25	
	Q5006F41	500	25	
	Q6006F51	600	50	
	Q2006R4	200	25	R
	Q4006R4	400	25	
	Q5006R4	500	25	
	Q6006R5	600	50	

** IGT in Quadrants I, II, & III

GATED TRIACS

IT(RMS)	PART NUMBER	VDRM	**IGT(mA)	PKG TYPE
6.0 Amp	Q7006R5	700	50	R
	Q8006R5	800	50	
	SC141B	200	50	
	SC141D	400	50	
	SC141E	500	50	
	SC141M	600	50	
	SC141N	800	50	
8.0 Amp	Q2008L4	200	25	L
	Q4008L4	400	25	
	Q5008L4	500	25	
	Q6008L5	600	50	
	Q7008L5	700	50	
	Q8008L5	800	50	
	Q2008F41	200	25	F
	Q4008F41	400	25	
	Q5008F41	500	25	
	Q6008F51	600	50	
	Q2008R4	200	25	R
	Q4008R4	400	25	
	Q5008R4	500	25	
	Q6008R5	600	50	
	Q7008R5	700	50	
	Q8008R5	800	50	
	SC143B	200	50	
	SC143D	400	50	
	SC143E	500	50	
	SC143M	600	50	
10.0 Amp	Q2010L5	200	50	L
	Q4010L5	400	50	
	Q5010L5	500	50	
	Q6010L5	600	50	
	Q7010L5	700	50	
	Q8010L5	800	50	
	Q2010F51	200	50	F
	Q4010F51	400	50	
	Q5010F51	500	50	
	Q6010F51	600	50	
	Q2010R5	200	50	R
	Q4010R5	400	50	
	Q5010R5	500	50	
	Q6010R5	600	50	
	Q7010R5	700	50	
	Q8010R5	800	50	
	SC146B	200	50	
	SC146D	400	50	
	SC146E	500	50	
	SC146M	600	50	
	SC146N	800	50	

** IGT in Quadrants I, II, & III

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GATED TRIACS

$I_{T(RMS)}$	PART NUMBER	V_{DRM}	**I_{GT}(mA)	PKG TYPE
15.0 Amp	Q2015L5	200	50	L
	Q4015L5	400	50	
	Q5015L5	500	50	
	Q6015L5	600	50	
	Q7015L5	700	50	
	Q8015L5	800	50	
	Q2015R5	200	50	R
	Q4015R5	400	50	
	Q5015R5	500	50	
	Q6015R5	600	50	
	Q7015R5	700	50	
	Q8015R5	800	50	
	SC151B	200	50	
	SC151D	400	50	
	SC151E	500	50	
	SC151M	600	50	
25.0 Amp	Q2025L6	200	80	L
	Q4025L6	400	80	
	Q5025L6	500	80	
	Q6025L6	600	80	
	Q7025L6	700	80	
	Q8025L6	800	80	
	Q2025P	200	80	P
	Q4025P	400	80	
	Q5025P	500	80	
	Q6025P	600	80	
	Q7025P	700	80	
	Q8025P	800	80	
	Q2025R6	200	80	R
	Q4025R6	400	80	
	Q5025R6	500	80	
	Q6025R6	600	80	
	Q7025R6	700	80	
	Q8025R6	800	80	
	SC129B	200	80	
	SC129D	400	80	
	SC129E	500	80	
	SC129M	600	80	
	Q2025J6	200	80	J
	Q4025J6	400	80	
	Q5025J6	500	80	
	Q6025J6	600	80	
	Q7025J6	700	80	
	Q8025J6	800	80	
	Q2025K6	200	80	K
	Q4025K6	400	80	
	Q5025K6	500	80	
	Q6025K6	600	80	
	Q7025K6	700	80	
	Q8025K6	800	80	
40.0 Amp	Q2040P	200	100	P
	Q4040P	400	100	
	Q5040P	500	100	
	Q6040P	600	100	
	Q7040P	700	100	
	Q2040J7	200	100	J
	Q4040J7	400	100	
	Q5040J7	500	100	
	Q6040J7	600	100	
	Q7040J7	700	100	
	Q8040J7	800	100	
	Q2040K7	200	100	K
	Q4040K7	400	100	

** I_{GT} in Quadrants I, II, & III

GATED TRIACS

$I_{T(RMS)}$	PART NUMBER	V_{DRM}	**I_{GT}(mA)	PKG TYPE
40.0 Amp	Q5040K7	500	100	K
	Q6040K7	600	100	
	Q7040K7	700	100	
	Q8040K7	800	100	
	Q2040W7	200	100	W
	Q4040W7	400	100	
	Q5040W7	500	100	
	Q6040W7	600	100	
	Q7040W7	700	100	
	Q8040W7	800	100	

** I_{GT} in Quadrants I, II, & III

QUADRACs

$I_{T(RMS)}$	PART NUMBER	V_{DRM}	VOLTS	PKG TYPE
4.0 AMP	Q2004LT	200	33-43	L
	Q4004LT	400	33-43	
	Q5004LT	500	33-43	
	Q6004LT	600	33-43	
6.0 Amp	Q2006LT	200	33-43	L
	Q4006LT	400	33-43	
	Q5006LT	500	33-43	
	Q6006LT	600	33-43	
8.0 Amp	Q2008LT	200	33-43	L
	Q4008LT	400	33-43	
	Q5008LT	500	33-43	
	Q6008LT	600	33-43	
10.0 Amp	Q2010LT	200	33-43	L
	Q4010LT	400	33-43	
	Q5010LT	500	33-43	
	Q6010LT	600	33-43	
15.0 Amp	Q2015LT	200	33-43	L
	Q4015LT	400	33-43	
	Q5015LT	500	33-43	
	Q6015LT	600	33-43	

ALTERNISTORS

$I_{T(RMS)}$	PART NUMBER	V_{DRM}	I_{GT}(µA)	PKG TYPE
15.0 Amp	Q2015L9	200	125	L
	Q4015L9	400	125	
	Q5015L9	500	125	
	Q6015L9	600	125	
	Q7015L9	700	125	
	Q8015L9	800	125	
	Q2015R9	200	125	R
	Q4015R9	400	125	
	Q5015R9	500	125	
	Q6015R9	600	125	
	Q7015R9	700	125	
	Q8015R9	800	125	
25.0 Amp	Q2025L9	200	125	L
	Q4025L9	400	125	
	Q5025L9	500	125	
	Q6025L9	600	125	
	Q7025L9	700	125	
	Q8025L9	800	125	
	Q2025R9	200	125	R
	Q4025R9	400	125	
	Q5025R9	500	125	
	Q6025R9	600	125	
	Q7025R9	700	125	
	Q8025R9	800	125	

ALTERNISTORS

$I_{T(RMS)}$	PART NUMBER	V_{DRM}	I_{GT}(µA)	PKG TYPE
40.0 Amp	Q2040K9	200	125	K
	Q4040K9	400	125	
	Q5040K9	500	125	
	Q6040K9	600	125	
	Q7040K9	700	125	
	Q8040K9	800	125	
	Q2040J9	200	125	J
	Q4040J9	400	125	
	Q5040J9	500	125	
	Q6040J9	600	125	
	Q7040J9	700	125	
	Q8040J9	800	125	
	Q2040W9	200	125	W
	Q4040W9	400	125	
	Q5040W9	500	125	
	Q6040W9	600	125	
	Q7040W9	700	125	
	Q8040W9	800	125	

SENSITIVE SCRs

$I_{T(RMS)}$	PART NUMBER	V_{DRM}	I_{GT}(µA)	PKG TYPE
0.8 Amp	EC103A	100	200	E
	EC103B	200	200	
	EC103C	300	200	
	EC103D	400	200	
	EC103E	500	200	
	EC103M	600	200	
	EC103A1	100	12	
	EC103B1	200	12	
	EC103C1	300	12	
	EC103D1	400	12	
	EC103E1	500	12	
	EC103M1	600	12	
	EC103A2	100	50	
	EC103B2	200	50	
	EC103C2	300	50	
	EC103D2	400	50	
	EC103E2	500	50	
	EC103M2	600	50	
	EC103A3	100	500	
	EC103B3	200	500	
	EC103C3	300	500	
	EC103D3	400	500	
	EC103E3	500	500	
	EC103M3	600	500	
	2N5060	30	200	E
	2N5061	60	200	
	2N5062	100	200	
	2N5063	150	200	
	2N5064	200	200	
	2N6564	300	200	
	2N6565	400	200	
1.5 Amp	TCR22-2	50	200	E
	TCR22-3	100	200	
	TCR22-4	200	200	
	TCR22-6	400	200	
	TCR22-8	600	200	
3.0 Amp	S0503LS1	50	50	L
	S0503LS2	50	200	
	S0503LS3	50	500	
	S1003LS1	100	50	
	S1003LS2	100	200	

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SENSITIVE SCRs

$I_{T(RMS)}$	PART NUMBER	V_{DRM}	I_{GT}(µA)	PKG TYPE
3.0 Amp	S1003LS3	100	500	L
	S2003LS1	200	50	
	S2003LS2	200	200	
	S2003LS3	200	500	
	S4003LS1	400	50	
	S4003LS2	400	200	
	S4003LS3	400	500	
	S6003LS1	600	50	
	S6003LS2	600	200	
	S6003LS3	600	500	
4.0 Amp	T106F1	50	200	F
	T106A1	100	200	
	T106B1	200	200	
	T106C1	300	200	
	T106D1	400	200	
	T106E1	500	200	
	T106M1	600	200	
	T107F1	50	500	
	T107A1	100	500	
	T107B1	200	500	
	T107C1	300	500	
	T107D1	400	500	
	T107E1	500	500	
	T107M1	600	500	
6.0 Amp	S0506LS2	50	200	L
	S0506LS3	50	500	
	S1006LS2	100	200	
	S1006LS3	100	500	
	S2006LS2	200	200	
	S2006LS3	200	500	
	S4006LS2	400	200	
	S4006LS3	400	500	
	S6006LS2	600	200	
	S6006LS3	600	500	
	S0506FS21	50	200	F
	S0506FS31	50	500	
	S1006FS21	100	200	
	S1006FS31	100	500	
	S2006FS21	200	200	
	S2006FS31	200	500	
	S4006FS21	400	200	
	S4006FS31	400	500	
	S6006FS21	600	200	
	S6006FS31	600	500	
8.0 Amp	S0508LS2	50	200	L
	S0508LS3	50	500	
	S1008LS2	100	200	
	S1008LS3	100	500	
	S2008LS2	200	200	
	S2008LS3	200	500	
	S4008LS2	400	200	
	S4008LS3	400	500	
	S6008LS2	600	200	
	S6008LS3	600	500	
	S0508FS21	50	200	F
	S0508FS31	50	500	
	S1008FS21	100	200	
	S1008FS31	100	500	
	S2008FS21	200	200	
	S2008FS31	200	500	
	S4008FS21	400	200	
	S4008FS31	400	500	
	S6008FS21	600	200	
	S6008FS31	600	500	

SENSITIVE SCRs

$I_{T(RMS)}$	PART NUMBER	V_{DRM}	I_{GT}(µA)	PKG TYPE
10.0 Amp	S0510LS2	50	200	L
	S0510LS3	50	500	
	S1010LS2	100	200	
	S1010LS3	100	500	
	S2010LS2	200	200	
	S2010LS3	200	500	
	S4010LS2	400	200	
	S4010LS3	400	500	
	S6010LS2	600	200	
	S6010LS3	600	500	
	S0510FS21	50	200	F
	S0510FS31	50	500	
	S1010FS21	100	200	
	S1010FS31	200	200	
	S2010FS31	200	500	
	S4010FS21	400	200	
	S4010FS31	400	500	
	S6010FS21	600	200	
	S6010FS31	600	500	

NON. SEN. SCRs

$I_{T(RMS)}$	PART NUMBER	V_{DRM}	I_{GT}(mA)	PKG TYPE
1.0 Amp	S031E	30	10	E
	S051E	50	10	
	S101E	100	10	
	S201E	200	10	
	S401E	400	10	
	S601E	600	10	
4.0 Amp	S0304F1	30	10	F
	S0504F1	50	10	
	S1004F1	100	10	
	S2004F1	200	10	
	S4004F1	400	10	
	S6004F1	600	10	
6.0 Amp	S0306L	30	15	L
	S0506L	50	15	
	S1006L	100	15	
	S2006L	200	15	
	S4006L	400	15	
	S6006L	600	15	
	S8006L	800	15	
	S0306F1	30	15	F
	S0506F1	50	15	
	S1006F1	100	15	
	S2006F1	200	15	
	S4006F1	400	15	
	S6006F1	600	15	
8.0 Amp	S0308L	30	15	L
	S0508L	50	15	
	S1008L	100	15	
	S2008L	200	15	
	S4008L	400	15	
	S6008L	600	15	
	S8008L	800	15	
	S0308F1	30	15	F
	S0508F1	50	15	
	S1008F1	100	15	
	S2008F1	200	15	
	S4008F1	400	15	
	S6008F1	600	15	
	S0308R	30	15	R
	S0508R	50	15	

NON. SEN. SCRs

$I_{T(RMS)}$	PART NUMBER	V_{DRM}	I_{GT}(mA)	PKG TYPE
8.0 Amp	S1008R	100	15	R
	S2008R	200	15	
	S4008R	400	15	
	S6008R	600	15	
	S8008R	800	15	
10.0 Amp	S0310L	30	15	L
	S0510L	50	15	
	S1010L	100	15	
	S2010L	200	15	
	S4010L	400	15	
	S6010L	600	15	
	S8010L	800	15	
	S0310F1	30	15	F
	S0510F1	50	15	
	S1010F1	100	15	
	S2010F1	200	15	
	S4010F1	400	15	
	S6010F1	600	15	
	S2800A	100	15	R
	S2800B	200	15	
	S2800C	300	15	
	S2800D	400	15	
	S2800E	500	15	
	S2800F	50	15	
	S2800M	600	15	
	S2800N	800	15	
12.0 Amp	S0312R	30	20	R
	S0512R	50	20	
	S1012R	100	20	
	S2012R	200	20	
	S4012R	400	20	
	S6012R	600	20	
	S8012R	800	20	
15.0 Amp	S0315L	30	30	L
	S0515L	50	30	
	S1015L	100	30	
	S2015L	200	30	
	S4015L	400	30	
	S6015L	600	30	
	S8015L	800	30	
16.0 Amp	S0316R	30	30	R
	S0516R	50	30	
	S1016R	100	30	
	S2016R	200	30	
	S4016R	400	30	
	S6016R	600	30	
	S8016R	800	30	
20.0 Amp	S0320L	30	30	L
	S0520L	50	30	
	S1020L	100	30	
	S2020L	200	30	
	S4020L	400	30	
	S6020L	600	30	
	S8020L	800	30	
25.0 Amp	S0325L	30	30	L
	S0525L	50	30	
	S1025L	100	30	
	S2025L	200	30	
	S4025L	400	30	
	S6025L	600	30	
	S8025L	800	30	
	S0325R	30	30	R
	S0525R	50	30	
	S1025R	100	30	

TECCOR ELECTRONICS, INC.
A SIEBE COMPANY
1801 Hurd Drive
Irving, TX 75038-4385 U.S.
(214)580-1515 Fax: (214)550-1309

THYRISTOR & TELECOM SPECIALIST

- TRIACS
- QUADRACS
- ALTERNISTORS
- SCRs
- RECTIFIERS
- DIACS / STS
- SIDACS
- SIDACTORS

NON. SEN. SCRs

$I_{T(RMS)}$	PART NUMBER	V_{DRM}	$I_{GT(mA)}$	PKG TYPE
25.0 Amp	S2025R	200	30	R
	S4025R	400	30	
	S6025R	600	30	
	S8025R	800	30	
35.0 Amp	S0335J	30	40	J
	S0535J	50	40	
	S1035J	100	40	
	S2035J	200	40	
	S4035J	400	40	
	S6035J	600	40	
	S8035J	800	40	
	S0335K	30	40	K
	S0535K	50	40	
	S1035K	100	40	
	S2035K	200	40	
	S4035K	400	40	
	S6035K	600	40	
	S8035K	800	40	
	S0335W	30	40	W
	S0535W	50	40	
	S1035W	100	40	
	S2035W	200	40	
	S4035W	400	40	
	S6035W	600	40	
	S8035W	800	40	
55.0 Amp	S0555M	50	40	M
	S1055M	100	40	
	S2055M	200	40	
	S4055M	400	40	
	S6055M	600	40	
	S8055M	800	40	
	S0555W	50	40	W
	S1055W	100	40	
	S2055W	200	40	
	S4055W	400	40	
	S6055W	600	40	
	S8055W	800	40	
65.0 Amp	S0565J	50	50	J
	S1065J	100	50	
	S2065J	200	50	
	S4065J	400	50	
	S6065J	600	50	
	S8065J	800	50	
	S0565K	50	50	K
	S1065K	100	50	
	S2065K	200	50	
	S4065K	400	50	
	S6065K	600	50	
	S8065K	800	50	
70.0 Amp	S0570W	50	50	W
	S1070W	100	50	
	S2070W	200	50	
	S4070W	400	50	
	S6070W	600	50	
	S8070W	800	50	

RECTIFIERS

$I_{T(RMS)}$	PART NUMBER	V_{DRM}	$I_{GT(mA)}$	PKG TYPE
15.0 Amp	D0515L	50	0.5	L
	D2015L	200	0.5	
	D4015L	400	0.5	
	D6015L	600	0.5	
	D8015L	800	0.5	
20.0 Amp	D0520L	50	0.5	L
	D2020L	200	0.5	
	D4020L	400	0.5	
	D6020L	600	0.5	
	D8020L	800	0.5	

DIACS

$I_{T(RMS)}$	PART NUMBER	V_{BO}	PKG TYPE
0.2 Amp	HT-32	27-37	DO-35
	HT-35	30-40	
	HT-40	35-45	
	HT-60	56-70	
	HT5761	28-36	
	HT5761A	30-34	
	HT5762	32-40	

STS

$I_{T(RMS)}$	PART NUMBER	V_{BO}	PKG TYPE
0.2 Amp	HS-10	10	DO-35
	HS-20	20	

SIDACS

$I_{T(RMS)}$	PART NUMBER	V_{BO}	PKG TYPE
1.0 Amp	K1050E	95-113	E
	K1100E	104-118	
	K1200E	110-125	
	K1300E	120-138	
	K1400E	130-146	
	K1500E	140-170	
	K2000F1	190-215	F
	K2200F1	205-230	
	K2400F1	220-250	
	K2500F1	240-280	
	K3000F1	270-330	

SIDACTORS
Transient Surge Protection

PART NUMBER	V_{BO}	I_{H} (µA)	I_{PP}	PKG TYPE
P0300EA70	27-36	150	75	E
P0640EA70	58-70	150	75	
P0720EA70	65-80	150	75	
P0800EA70	60-95	150	75	
P1100EA70	90-125	100	50	
P1300EA70	120-145	100	50	
P1500EA70	135-165	100	50	

SIDACTORS
Transient Surge Protection

PART NUMBER	V_{BO}	I_{H} (µA)	I_{PP}	PKG TYPE
P2300EA70	190-265	100	50	E
P2600EA70	220-300	100	50	
P3100EA70	275-350	100	50	
P3500EA70	300-400	100	50	
P2300BA70	190-265	150	100	B
P2600BA70	220-300	150	100	
P3100BA70	275-350	150	100	
P3500BA70	300-400	150	100	
P0300SA	27-36	150	75	S
P0640SA	58-70	150	75	
P0720SA	65-80	150	75	
P0800SA	60-95	150	75	
P1100SA	90-125	100	50	
P1300SA	120-145	100	50	
P1500SA	135-165	100	50	
P2300SA	190-265	100	50	
P2600SA	220-300	100	50	
P3100SA	275-350	100	50	
P3500SA	300-400	100	50	
P2300SB	190-265	150	100	S
P2600SB	220-300	150	100	
P3100SB	275-350	150	100	
P3500SB	300-400	150	100	
P2000AA61	190-215	100	50	A
P2200AA61	205-230	100	50	
P2400AA61	220-250	100	50	
P2500AA61	240-280	100	50	
P3000AA61	270-330	100	50	
P3300AA61	300-360	100	50	
P0602AA	54-72	300	150*	A
P1602AA	120-190	300	150*	
P2202AA	190-250	200	100*	
P2702AA	240-300	200	100*	
P3002AA	280-320	200	100*	
P1602AB	120-200	300	200*	A
P2202AB	190-250	300	200*	
P2702AB	240-300	300	200*	
P3002AB	280-320	300	200*	
P4802AB	440-580	300	200*	
P6002AB	540-720	300	200*	
P1553AA	140-170	200	100*	A
P2103AA	180-240	200	100*	
P2353AA	210-265	200	100*	
P2703AA	240-300	200	100*	
P3203AA	280-360	200	100*	
P3403AA	300-380	200	100*	
P1553AB	140-170	300	200*	A
P2103AB	180-240	300	200*	
P2353AB	210-265	300	200*	
P2703AB	240-300	300	200*	
P3203AB	280-360	300	200*	
P3403AB	300-380	300	200*	

* Surge rating based on two circuit operations. (Additional into available on request.),

W O R L D P R O D U C T S

TRANSIENT VOLTAGE SUPPRESSION DIODES

LOW CLAMPING VOLTAGE SERIES

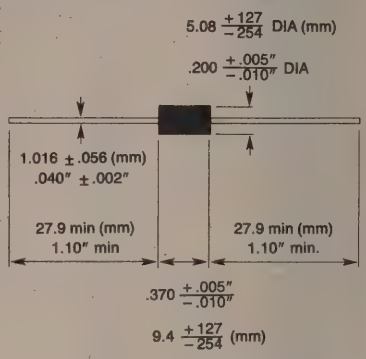
1N5908, 1N6373 –1N6389 ICTE-5 – ICTE-45C

ELECTRICAL CHARACTERISTICS @ 25°C

Part Number*	JEDEC Part Number	Rated Stand-off Voltage V_{WM} (Volts)	Minimum Breakdown Voltage @ 1mA V_{BR} (Volts)	Maximum Stand-By Current @ V_{WM} I_D (uA)	Maximum Clamping Voltage @ I_{PP1} V_C (Volts)	Peak Pulse Current I_{PP1} (Amps)	Maximum Clamping Voltage @ I_{PPM2} V_C (Volts)	Peak Pulse Current I_{PP2} (Amps)	Peak Pulse Current I_{PPM} (Amps)
	1N5908 (1)	5.0	6.0	300	7.6	30	8.0	60	160
ICTE-5	1N6373	5.0	6.0	300	7.1	1	7.5	10	160
ICTE-8	1N6374	8.0	9.4	25	11.3	1	11.5	10	100
ICTE-10	1N6375	10	11.7	2	13.7	1	14.1	10	90
ICTE-12	1N6376	20	14.1	2	16.1	1	16.5	10	70
ICTE-15	1N6377	15	17.6	2	20.1	1	20.6	10	60
ICTE-18	1N6378	18	21.2	2	24.2	1	25.2	10	50
ICTE-22	1N6379	22	25.9	2	29.8	1	32.0	10	40
ICTE-36	1N6380	36	42.4	2	50.6	1	54.3	10	23
ICTE-45	1N6381	45	52.9	2	63.3	1	70.0	10	19
ICTE-5C		5.0	6.0	600	7.2	1	7.6	10	160
ICTE-8C	1N6382	8.0	9.4	50	11.4	1	11.6	10	100
ICTE-10C	1N6383	10	11.7	2	14.1	1	14.5	10	90
ICTE-12C	1N6384	12	14.0	2	16.7	1	17.1	10	70
ICTE-15C	1N6385	15	17.6	2	20.8	1	21.4	10	60
ICTE-18C	1N6386	18	21.2	2	24.8	1	25.5	10	50
ICTE-22C	1N6387	22	25.9	2	30.8	1	32.0	10	40
ICTE-36C	1N6388	36	42.4	2	50.6	1	54.3	10	23
ICTE-45C	1N6389	45	52.9	2	63.3	1	70.0	10	19

* "C" suffix indicates bidirectional device. Notes: (1) V_C = 8.5 volts @ I_{PP} = 120 amps (Figure 1).

MECHANICAL DIMENSIONS



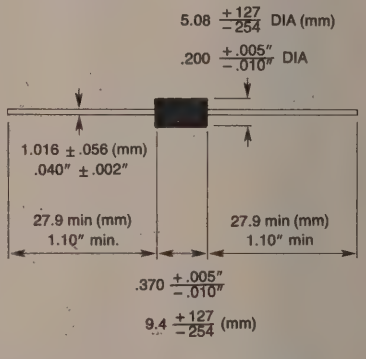
1.5KE 6.8 — 1.5KE 440A
1N6267 — 1N6303A

ELECTRICAL CHARACTERISTICS @ 25°C

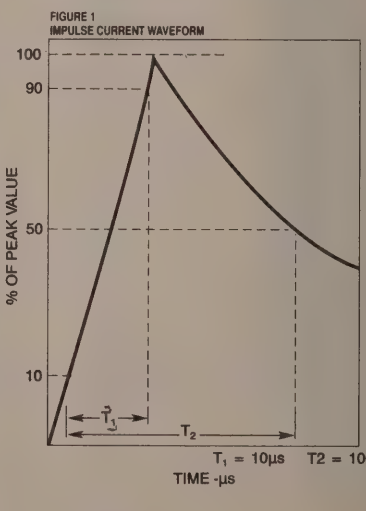
Part Number*	JEDEC Part Number	Rated Stand-off Voltage V_{WM} (Volts)	Breakdown Voltage V_{BR} (Volts) min	Breakdown Voltage V_{BR} (Volts) max	@ I_T (mA)	Maximum Stand-By Current @ V_{WM}** I_D (uA)	Maximum ClampingVoltage @ I_{PPM} (Fig.1) Vc max (Volts)	Rated Peak Impulse Current (Fig.1) I_{PPM} (Amperes)	Temperature Coefficient of V_{BR} ΦV_{BR} max (mV/Deg C)
1.5KE6.8	1N6267	5.5	6.12	7.48	10	1000	10.8	139	5
1.5KE6.8A	1N6267A	5.8	6.45	7.14	10	1000	10.5	143	5
1.5KE7.5	1N6268	6.05	6.15	8.25	10	500	11.7	128	5
1.5KE7.5A	1N6268A	6.4	7.13	7.88	10	500	11.3	132	5
1.5KE8.2	1N6269	6.63	7.38	9.02	10	200	12.5	120	6
1.5KE8.2A	1N6269A	7.02	7.79	8.61	10	200	12.1	124	6
1.5KE9.1	1N6270	7.27	8.19	10	1	50	13.8	109	7
1.5KE9.1A	1N6270A	7.78	8.65	9.55	1	50	13.4	112	7
1.5KE10	1N6271	8.1	9	11	1	10	15.0	100	8
1.5KE10A	1N6271A	8.55	9.5	10.5	1	10	14.5	103	8
1.5KE12	1N6273	9.72	10.8	13.2	1	5	17.3	87	10
1.5KE12A	1N6273A	10.2	11.4	12.6	1	5	16.7	90	10
1.5KE15	1N6275	12.1	13.5	16.5	1	5	22.0	68	13
1.5KE15A	1N6275A	12.8	14.3	15.8	1	5	21.2	71	12
1.5KE18	1N6277	14.5	16.2	19.8	1	5	26.5	56.5	17
1.5KE18A	1N6277A	15.8	17.1	18.9	1	5	25.2	59.5	19
1.5KE20	1N6278	16.2	18	22	1	5	29.1	51.3	19
1.5KE20A	1N6278A	17.1	19	21	1	5	27.7	54	19
1.5KE22	1N6279	17.8	19.8	24.2	1	5	31.9	47	21
1.5KE22A	1N6279A	18.8	20.9	23.1	1	5	30.6	49	20
1.5KE24	1N6280	19.4	21.6	26.4	1	5	34.7	43	25
1.5KE24A	1N6280A	20.5	22.8	25.2	1	5	33.2	45	22
1.5KE27	1N6281	21.8	24.3	29.7	1	5	39.1	38.5	28
1.5KE27A	1N6281A	23.1	25.7	28.4	1	5	37.5	40	25
1.5KE30	1N6282	24.7	27	31	1	5	43.5	34.5	24
1.5KE30A	1N6282A	25.6	28.5	31.5	1	5	41.4	36	28
1.5KE33	1N6283	26.8	29.7	36.3	1	5	47.7	31.5	31
1.5KE33A	1N6283A	28.2	31.4	34.7	1	5	45.7	33	30
1.5KE39	1N6285	31.6	35.1	42.9	1	5	56.4	26.5	39
1.5KE39A	1N6285A	33.3	37.1	41	1	5	53.9	28	36
1.5KE47	1N6287	38.1	42.3	51.7	1	5	67.8	22.2	50
1.5KE47A	1N6287A	40.2	44.7	49.4	1	5	64.8	23.2	48
1.5KE56	1N6289	45.5	50.4	61.6	1	5	80.5	18.6	58
1.5KE56A	1N6289A	47.8	53.2	58.8	1	5	77.0	19.5	56
1.5KE68	1N6291	55.1	61.2	74.8	1	5	98.0	15.3	71
1.5KE68A	1N6291A	58.1	64.6	71.4	1	5	92.0	16.3	69
1.5KE82	1N6293	66.4	73.8	90.2	1	5	118.0	12.7	90
1.5KE82A	1N6293A	70.1	77.9	86.1	1	5	113.0	13.3	86
1.5KE100	1N6295	81	90	110	1	5	144.0	10.4	109
1.5KE100A	1N6295A	85.5	95	105	1	5	137.0	11	104
1.5KE120	1N6297	97.2	108	132	1	5	173.0	8.7	131
1.5KE120A	1N6297A	102	114	126	1	5	165.0	9.1	125
1.5KE130	1N6298	105	117	143	1	5	187.0	8	250
1.5KE130A	1N6298A	111	124	127	1	5	179.0	8.4	136
1.5KE150	1N6300	121	135	165	1	5	215.0	7	164
1.5KE150A	1N6300A	128	143	158	1	5	207.0	7.2	157
1.5KE180	1N6302	146	162	198	1	5	258.0	5.8	197
1.5KE180A	1N6302A	154	171	189	1	5	246.0	6.1	188
1.5KE200	1N6303	162	180	220	1	5	287.0	5.2	219
1.5KE200A	1N6303A	171	190	210	1	5	274.0	5.5	209
1.5KE220		175	198	242	1	5	344.0	4.3	240
1.5KE220A		185	209	231	1	5	328.0	4.6	230
1.5KE250		202	225	275	1	5	360.0	5	270
1.5KE250A		214	237	263	1	5	344.0	5	260
1.5KE300		243	270	330	1	5	430.0	5	320
1.5KE300A		256	285	325	1	5	414.0	5	325
1.5KE350		284	315	385	1	5	504.0	4	385
1.5KE350A		300	332	368	1	5	504.0	4	385
1.5KE400		324	360	440	1	5	574.0	4	440
1.5KE400A		342	380	420	1	5	548.0	4	420
1.5KE440		356	396	484	1	5	631.0	4	420
1.5KE440A		376	418	462	1	5	600.0	4	420

* Add C or CA suffix for bidirectional device types. **For bidirectional types having V_{WM} of 10 volts and under, their I_D limit is doubled.

MECHANICAL DIMENSIONS



IMPULSE CURRENT WAVEFORM



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WORLD PRODUCTS INC.
19654 8TH ST. EAST, SONOMA, CA 95476 PHONE (707) 996-5201 FAX (707) 996-3380

W O R L D P R O D U C T S

500W TRANSIENT VOLTAGE SUPPRESSION DIODES

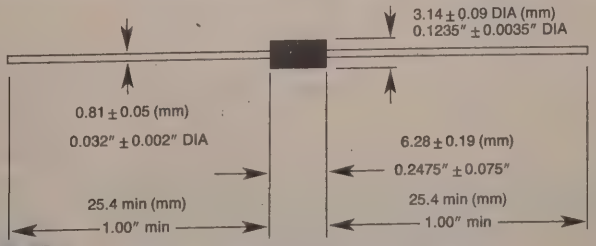
SA5.0-SA170A

ELECTRICAL CHARACTERISTICS @ 25°C

Part Number*		Rated Stand-off Voltage VWM (Volts)	Breakdown Voltage VBR (Volts) min	Breakdown Voltage VBR (Volts) max	@IT (mA)	Maximum Stand-By Current @ VWM** ID (uA)	Maximum Clamping Voltage @ IPPM (Fig.1) VC max (Volts)	Rated Peak Impulse Current (Fig.1) IPPM (Amperes)	Temperature Coefficient of VBR ∅v max (mV/Deg C)
SA5.0		5.0	6.40	7.30	10	600	9.6	52.0	5.0
SA5.0A		5.0	6.40	7.00	10	600	9.2	54.3	5.0
SA6.0		6.0	6.67	8.15	10	600	11.4	43.9	5.0
SA6.0A		6.0	6.67	7.37	10	600	10.3	48.5	5.0
SA6.5		6.5	7.22	8.82	10	400	12.3	40.7	5.0
SA6.5A		6.5	7.22	7.98	10	400	11.2	44.7	5.0
SA7.0		7.0	7.78	9.51	10	200	13.3	37.8	6.0
SA7.0A		7.0	7.78	8.60	10	200	12.0	41.7	6.0
SA7.5		7.5	8.33	10.2	1	50	14.3	35.0	7.0
SA7.5A		7.5	8.33	9.21	1	50	12.9	38.8	7.0
SA8.0		8.0	8.89	10.9	1	25	15.0	33.3	7.0
SA8.0A		8.0	8.89	9.83	1	25	13.6	36.7	7.0
SA8.5		8.5	9.44	11.5	1	10	15.9	31.4	8.0
SA8.5A		8.5	9.44	10.4	1	10	14.4	34.7	8.0
SA9.0		9.0	10.0	12.2	1	5	16.9	29.5	9.0
SA9.0A		9.0	10.0	11.1	1	5	15.4	32.5	9.0
SA10		10	11.1	13.6	1	3	18.8	26.6	10.0
SA10A		10	11.1	12.3	1	3	17.0	29.4	10.0
SA11		11	12.2	14.9	1	3	20.1	24.9	11.0
SA11A		11	12.2	13.5	1	3	18.2	27.4	11.0
SA12		12	13.3	16.3	1	3	22.0	22.7	12.0
SA12A		12	13.3	14.7	1	3	19.9	25.1	12.0
SA13		13	14.4	17.6	1	3	23.8	21.0	13.0
SA13A		13	14.4	15.9	1	3	21.5	23.2	13.0
SA14		14	15.6	19.1	1	3	25.8	19.4	14.0
SA14A		14	15.6	17.2	1	3	23.2	21.5	14.0
SA15		15	16.7	20.4	1	3	26.9	18.8	16.0
SA15A		15	16.7	18.5	1	3	24.4	20.6	16.0
SA16		16	17.8	21.8	1	3	28.8	17.6	19.0
SA16A		16	17.8	19.7	1	3	26.0	19.2	17.0
SA17		17	18.9	23.1	1	3	30.5	16.4	20.0
SA17A		17	18.9	20.9	1	3	27.6	18.1	19.0
SA18		18	20.0	24.4	1	3	32.2	15.5	21.0
SA18A		18	20.0	22.1	1	3	29.2	17.2	20.0
SA20		20	22.2	27.1	1	3	35.8	13.9	25.0
SA20A		20	22.2	24.5	1	3	32.4	15.4	23.0
SA22		22	24.4	29.8	1	3	39.4	12.7	28.0
SA22A		22	24.4	26.9	1	3	35.5	14.1	25.0
SA24		24	26.7	32.6	1	3	43.0	11.6	31.0
SA24A		24	26.7	29.5	1	3	38.9	12.8	28.0
SA26		26	28.9	35.3	1	3	46.6	10.7	31.0
SA26A		26	28.9	31.9	1	3	42.1	11.9	30.0
SA28		28	31.1	38.0	1	3	50.0	9.9	35.0
SA28A		28	31.1	34.4	1	3	45.4	11.0	31.0
SA30		30	33.3	40.7	1	3	53.5	9.3	39.0
SA30A		30	33.3	36.8	1	3	48.4	10.3	36.0
SA33		33	36.7	44.9	1	3	59.0	8.5	42.0
SA33A		33	36.7	40.6	1	3	53.3	9.4	39.0
SA36		36	40.0	48.9	1	3	64.3	7.8	46.0
SA36A		36	40.0	44.2	1	3	58.1	8.6	41.0
SA43		43	47.8	58.4	1	3	76.7	6.5	55.0
SA43A		43	47.8	52.8	1	3	69.4	7.2	50.0
SA48		48	53.3	65.1	1	3	85.5	5.8	63.0
SA48A		48	53.3	58.9	1	3	77.4	6.5	56.0
SA58		58	64.4	78.7	1	3	103.0	4.9	78.0
SA58A		58	64.4	71.2	1	3	93.6	5.3	70.0
SA60		60	66.7	81.5	1	3	107.0	4.7	80.0
SA60A		60	66.7	73.7	1	3	96.8	5.2	71.0
SA75		75	83.3	102.0	1	3	134.0	3.7	101.0
SA75A		75	83.3	92.1	1	3	121.0	4.1	91.0
SA90		90	100.0	122.0	1	3	160.0	3.1	121.0
SA90A		90	100.0	111.0	1	3	146.0	3.4	110.0
SA110		110	122.0	149.0	1	3	196.0	2.6	148.0
SA110A		110	122.0	135.0	1	3	177.0	2.8	133.0
SA160		160	178.0	218.0	1	3	287.0	1.7	217.0
SA160A		160	178.0	197.0	1	3	259.0	1.9	195.0
SA170		170	189.0	231.0	1	3	304.0	1.6	230.0
SA170A		170	189.0	209.0	1	3	275.0	1.8	208.0

*Add C or CA suffix for bidirectional device types. (Contact factory for other voltage types.) **For bidirectional types having VWM of 10 volts and under, their ID limit is doubled.

MECHANICAL DIMENSIONS



SEE OUR OTHER DATA PAGES IN SECTIONS 1500, 2450, 4300 AND 4700.

WORLD PRODUCTS INC.
19654 8TH ST. EAST, SONOMA, CA 95476 PHONE (707) 996-5201 FAX (707) 996-3380

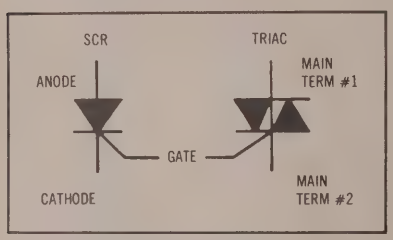
MINIGLOSSARY THYRISTORS/ HIGH POWER DIODES

THYRISTORS

A thyristor is a four-layer semiconductor (pnpn) that can be switched from an OFF to an ON state. This is usually done by a voltage or current pulse to the gate terminal. The device will then continue to conduct so long as the principal current of the device flows through the thyristor's two main terminals.

In many respects a thyristor is analogous to an electromechanical latching relay. In fact, thyristors have largely replaced these relays in newer equipment designs. But, misapplications and/or failure to fully understand the parameters of these and other solid state devices often leads to catastrophic field failures.

The terminology shown on this page has been condensed from common industry data books and is intended to be a guide for the engineer.



di/dt: *Critical rate of rise of ON state current* is the user's maximum design limit (Fig. 1).

di_R/dt: *Rate of decay of ON state current* (Fig. 1 & 2).

dv/dt (critical): *Rate of rise of OFF state voltage*. Lowest voltage rate of rise to cause a thyristor to turn ON.

dv/dt (reapplied) : *Rate of rise of reapplied OFF state voltage.*

I_{FSM}: *Nonrepetitive ON state surge current in diodes.* Maximum peak value of ½ cycles (60 Hz) a diode can withstand up to 100 times in its lifetime.

I_{TSM}: *Nonrepetitive ON state surge current in thyristors*. Maximum peak value of 60 Hz cycles a thyristor can withstand up to 100 times in its lifetime.

I_{DRM}/I_{RRM}: *Maximum peak forward/ reverse leakage current* at specified temperature and repetitive conditions.

I_{GDM}: *Continuous gate current not to trigger*. Highest dc gate current that will *not* cause thyristor to switch from OFF to ON at a specific temperature.

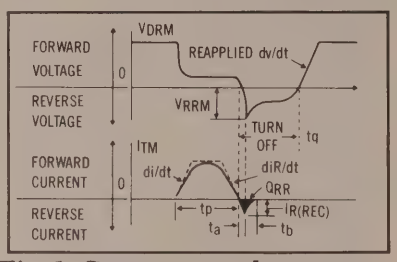


Fig. 1. Concurrent voltage and current waveforms

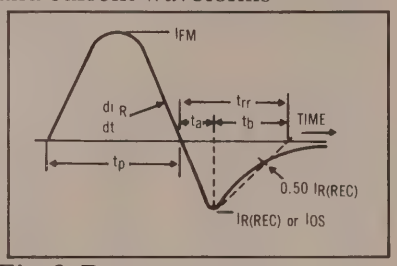


Fig. 2. Recovery current waveform

I_{GT}: *Continuous gate trigger current.* Absolute minimum gate current required to switch thyristor from OFF to ON.

I_H: *Holding Current*. Minimum current required to hold thyristor ON.

I_L: *Latching current*. Minimum current required to hold thyristor ON after removal of gate drive.

$I_{(REC)}$; *Recovery current*. Peak value of reverse current during recovery or turn OFF (Fig. 1 & 2).

I_{OS}: *Overshoot current*. See $I_{R(REC)}$.

I^2t: Maximum ON state, short time thermal capacity of the silicon element for operations less than ½ cycle of 180° conduction angle.

$I_{T(AV)}$: *Average ON state current* (max.)

Q_{RR}: *Reverse recovered charge* (Fig. 1).

$R_{\theta JC}$: *Junction-to-case thermal resistance* in degrees C per watt.

$T_{C(MAX)}$: *Max. allowable case temperature*.

$T_{J(MAX)}$: *Maximum allowable junction temp.*

t_d: *Delay time*. Interval between a specified point at beginning of gate pulse and the instant at which the principal voltage drops to a specified value. (OFF-ON) (Fig. 3)

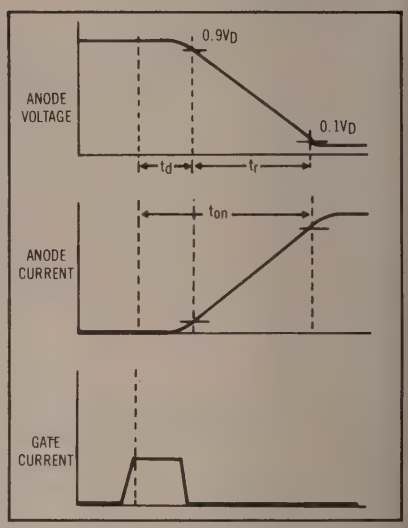


Fig. 3. Turn-on time waveforms

t_{on}: *Turn-on time*. The sum of delay time and rise time. (OFF-ON) (Fig. 3)

t_q: *Turn-off time.* Time between principal current reaching zero and the instant thyristor can block forward voltage without turning ON. (Fig. 1)

t_r: *Rise time*. Time between principal voltage dropping from one value to a second lower value when thyristor turns from OFF to ON. (Fig. 3)

t_{rr}: *Reverse recovery time*. (Fig. 2)

V_{DRM}/V_{RRM}: *Maximum repetitive peak OFF state/reverse voltage* excluding non-repetitive transients.

V_{DSM}/V_{RSM}: *Maximum nonrepetitive peak OFF state/reverse voltage*.

V_{FM}/V_{TM}: *Maximum forward voltage drop* at a specific forward current and case temp.

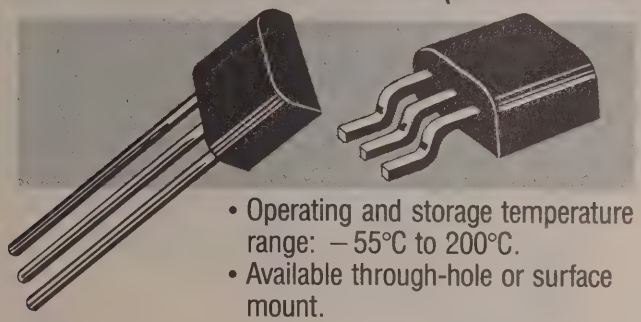
V_{GDM}: *Gate nontrigger voltage*. Highest dc voltage that will *not* cause thyristor to switch from OFF to ON.

V_{LATCH}: *Latching voltage*. Voltage required for thyristor to latch ON at a given gate current and junction temp.

$V_{TM(DYN)}$: *Dynamic ON state voltage*. Transient ON state voltage of thyristor when triggered into conduction for a given load and time.

ZETEX SEMICONDUCTOR PRODUCTS

HIGH PERFORMANCE TO-92 (SUPER E-LINE)



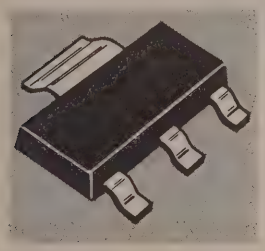
- Operating and storage temperature range: −55°C to 200°C.
- Available through-hole or surface mount.

HIGH PERFORMANCE TO92 (SUPER ELINE) TRANSISTORS * – 1.2WATTS

ZETEX P/N	VCBO V	VCEO V	IC A	IC MAX A	VCE(SAT) MAX V @ IC/IB(mA)	hFE MIN @ IC(mA)/VCE(V)
NPN						
ZTX857	350	300	3	10	0.14 1000/100	100 500/10
ZTX855	250	150	4	10	0.10 1000/100	100 1000/5
ZTX853	200	100	4	10	0.15 2000/100	100 2000/2
ZTX851	150	60	5	20	0.10 1000/50	100 2000/1
ZTX849	80	30	5	20	0.10 1000/20	100 1000/1
ZTX869	60	25	5	20	0.08 1000/10	300 1000/1
PNP						
ZTX958	−400	−400	−0.5	−1	−0.40 −500/−10	100 −500/−10
ZTX957	−350	−300	−1	−2	−0.20 −1000/−300	100 −500/−10
ZTX956	−250	−200	−2	−5	−0.15 −1000/−100	100 −1000/−5
ZTX955	−180	−140	−3	−10	−0.12 −1000/−100	100 −1000/−5
ZTX953	−140	−100	−3.5	−10	−0.16 −2000/−200	100 −1000/−1
ZTX951	−100	−60	−4	−15	−0.15 −2000/−200	100 −1000/−1
ZTX949	−50	−30	−4.5	−20	−0.10 −1000/−20	100 −1000/−1
ZTX948	−40	−20	−4.5	−20	−0.10 −500/−10	100 −1000/−1

* THIS SERIES OF TRANSISTORS IS ALSO AVAILABLE IN SOT223

SOT-223



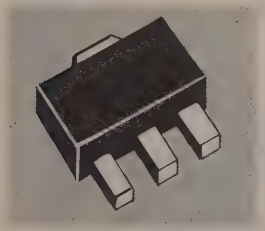
- Power dissipation to 2 Watts.
- Footprint compatible with DPAK.

SOT223 MEDIUM POWER TRANSISTORS – 2WATTS

ZETEX P/N	VCBO V	VCEO V	IC A	IC MAX A	VCE(SAT) MAX V @ IC/IB(mA)	hFE MIN @ IC(mA)/VCE(V)
NPN						
FZT657	300	300	0.5	1	0.5 100/10	50 100/5
FZT655	150	150	1	2	0.5 1000/20	20 1000/5
FZT605*	140	120	2	4	1.5 1000/1	2K 1000/1
FZT653	120	100	2	6	0.5 2000/200	25 2000/2
FZT651	80	60	3	8	0.6 3000/300	40 2000/2
FZT649	35	25	3	8	0.6 3000/300	15 6000/2
PNP						
FZT757	−300	−300	−0.5	−1	−0.5 −100/−10	50 −100/−5
FZT755	−150	−150	−1	−2	−0.5 −1000/−20	20 −1000/−5
FZT705*	−140	−120	−2	−4	−2.5 −2000/−2	2K −2000/−5
FZT753	−120	−100	−2	−8	−0.5 −2000/−200	25 −2000/−2
FZT751	−80	−60	−3	−8	−0.6 −3000/−300	40 −2000/−2
FZT749	−35	−25	−3	−8	−0.6 −3000/−300	15 −6000/−2

* DARLINGTONS

SOT-89

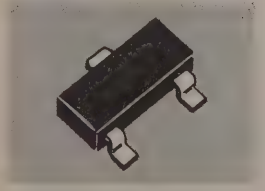


- Peak current of 2 Amps.
- Industry standard part numbers.

SOT223 HIGH GAIN TRANSISTORS – 2WATTS

ZETEX P/N	VCBO V	VCEO V	IC A	IC MAX A	VCE(SAT) MAX V @ IC/IB(mA)	hFE MIN @ IC(mA)/VCE(V)
NPN						
FZT696B	250	250	0.5	1	0.25 200/5	500 100/5.0
FZT694B	120	120	2	1	0.25 100/0.5	400 200/2.0
FZT692B	70	70	2	1	0.15 100/0.5	400 500/2.0
FZT690B	45	45	6	2	0.10 100/0.5	400 1000/2.0
FZT689B	20	20	8	3	0.35 3000/20	400 2000/2.0
FZT688B	20	15	10	4	0.45 3000/20	400 3000/2.0
PNP						
FZT796A	−200	−200	−0.5	−1	−0.30 −200/−20	250 −200/−2.0
FZT795A	−140	−140	−0.5	−1	−0.30 −200/−50	250 −200/−2.0
FZT792A	−75	−75	−2	−5	−0.50 −1000/−25	250 −500/−2.0
FZT790A	−50	−50	−2	−6	−0.45 −1000/−25	250 −500/−2.0
FZT789A	−25	−25	−2	−6	−0.45 −2000/−20	250 −1000/−2.0
FZT788A	−15	−15	−3	−10	−0.45 −3000/−20	250 −2000/−1.0

SOT-23



- Power dissipation to 500 mW.
- Peak currents of 2 Amps.

NEW INTRODUCTION

MICROPOWER VOLTAGE REFERENCES

ELECTRICAL CHARACTERISTICS	ZRA125	ZRA250	ZRA500
VREF VOLTAGE	1.25	2.50	5.00
TOLERANCE (%)	2 AND 3	1,2 AND 3	1,2 AND 3
MIN CURRENT (uA)	50.0	50.0	50.0
MAX CURRENT (mA)	25.0	25.0	25.0
OP. TEMP. (DEG C)	−40 TO 85	−40 TO 85	−40 TO 85
SLOPE IMP. (OHMS)	0.65	0.40	0.55
TEMP CO (PPM/DEG C)	90.0	90.0	150.0
NOISE (uV)	70.0	43.0	100
TURN ON (uS)	20.0	10.0	10.0
PACKAGE OPTIONS*	SOT23 TO92	SOT23 TO92	SOT23 TO92

* 2 AND 3 PIN TO92 (ELINE) PACKAGE AVAILABLE

In addition to the products showcased here, ZETEX Inc., formerly a division of Ferranti Semiconductors, offers a full range of industry standard MOSFETS and Bipolar transistors and diodes for through-hole and surface mount applications.

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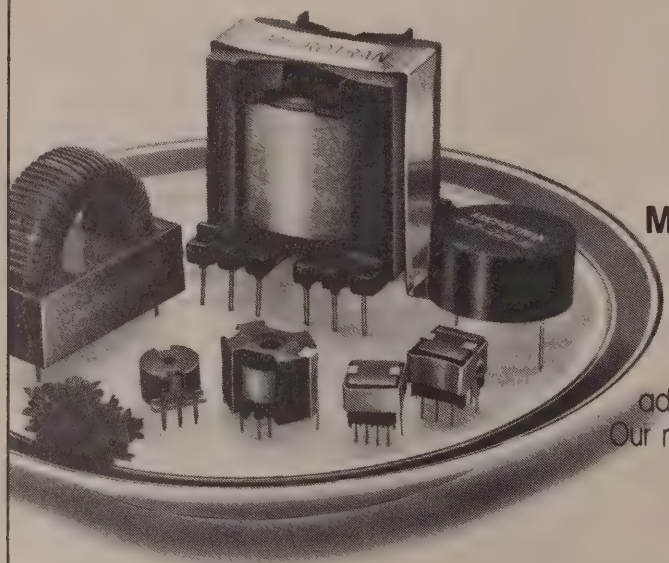

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See our data pages in EEM Transformer Section 5600 and Coil Section 1800.

AUDIO, SPECIAL, RF

Manufacturer	Starting EEM Page No.	Driver	Input	Inter-stage	Matching	Micro-phone	Output	Telephone Coupling	Isolation	RF-IF	Pulse Including Trigger	Local Area Networks	Balun
Abbott Technologies	A•2234	√							√		√		
Albar Inc.	A•2256	√									√		
Altran Corp.	A•2257		√			√	√	√					
Amecon	A•2260	√*	√*		√*	√*	√*	√*	√*		√*	√*	√*
APX Technologies, Inc.	A•2266	√	√	√	√		√	√	√	√	√		
AT&T Microelectronics	A•2268				√			√§	√§		√§		
Bey Electric	A•2295	√§*	√§*	√§*	√§*		√§*		√§*	√§*	√§*	√§*	
BH Electronics	A•2296	√									√		
C&C Jetronic Inc.	A•2302	√§	√§	√§	√§	√§	√§	√§	√§	√§	√§	√§	√§
Cletronics	A•2303		√*				√*						
Commmunication Coil	A•2305		√§*	√§*	√§*		√§*		√§*	√§*	√§*	√§*	√§*
Cramer Coil and Transformer Co. Inc.	A•2306							√§					
Custom Coils Inc.	A•2311	√§	√§		√§		√§		√§		√§		√§
Dale Electronics	A•2312	√	√	√	√	√	√	√	√	√			
Datatronics	A•2314	√§*	√§*	√§*	√§*	√§*	√§*	√§*	√§*	√§*	√§*	√§*	√§*
Dynage Power & Magnetics	A•2318	√*	√*	√*	√*		√*	√*	√*		√*		√*
Ensign Corp.	A•2326	√		√	√		√	√	√				
ESC Electronics Corp.	A•2329	√*											
EWC Inc.	A•2331	√	√	√	√	√	√	√	√		√		√
Fee-Fil-Mag	A•2349							√	√§				√§
Fernwood	A•2352	√*	√*	√*	√*		√*	√*	√*	√*			
Hi-Sonic Inc.	A•2360	√	√		√		√		√		√	√	
Hitran Corp.	A•2361						√		√				
ISL Products International Ltd.	A•2362	√	√	√	√	√	√	√	√	√	√		
JBM Electronics, Inc.	A•2363											√	
Kappa Technologies	A•2370								√		√		
Lenco Electronics Inc.	A•2374	√	√	√	√		√	√	√		√		
Magnelab Inc.	A•2378	√	√§	√§	√§		√§		√§		√§		√
Magnetek Triad	A•2383			√§	√§	√§	√§	√§			√§		

* MIL Spec. § Surface Mount.

AUDIO, SPECIAL, RF (cont'd)

Manufacturer	Starting EEM Page No.	Driver	Input	Inter-stage	Matching	Micro-phone	Output	Telephone Coupling	Isolation	RF-IF	Pulse Including Trigger	Local Area Networks	Balun
Magnetico Inc.	A•2389	√§*	√§*	√§*	√§*	√§*	√§*	√§*	√§*	√§*	√§*	√§*	√§*
Microtran Co. Inc.	A•2404	√§*	√§*	√§*	√§*	√*	√*	√§*	√§*		√§*		
Midcom Inc.	A•2425		√§	√§	√§		√§	√§	√§		√§		
Mitchell Electronics Corp.	A•2433				√				√		√		
Multi Products International	A•2436			√	√	√		√	√		√	√	
North Hills Signal Processing	A•2438				√*		√*		√*	√*	√*		√*
NWL Transformers	A•2437								√*				
PC Transformer Corp.	A•2445		√§*	√§*	√§*		√§*	√§*					
Pearson Electronics	A•2454										√		
Pico Electronics	A•2455	√§*	√§*	√§*	√§*	√§*	√§*	√§*	√§*	√§*	√§*	√§*	√§*
Plitron	A•2506				√		√						
Powertronix	A•2509								√*				
Precision Electronics, Inc.	A•2526	√§*	√§*	√§*	√§*	√§*	√§*	√§*	√§*	√§*	√§*	√§*	√§*
Premier Magnetics	A•2508		√§*		√§*		√§	√§	√§*			√	
Prem Magnetics	A•2512		√	√	√		√	√§	√				
Renco Electronics, Inc.	A•2527	√§	√§	√§	√§	√§	√§	√§	√§	√§	√§	√§	√§
Rhombus Industries	A•2533	√	√	√§	√§		√	√	√§	√§	√§	√§	√§
Shogyo International Corp.	A•2534		√		√	√	√	√	√				
Stancor/White Rodgers	A•2558	√	√	√	√	√	√	√	√				
Tamura	A•2571		√		√	√	√	√	√	√	√	√	√
TMP Inc.	A•2580	√	√			√	√	√	√	√			
Toroid Corp. of Maryland	A•2586								√§	√§			
Torotel Products Inc.	A•2594	√*	√*	√*	√*	√*	√*	√*	√*	√§*	√§*	√*	√§*
Transformer Technologies	A•2598	√	√						√§	√§	√		
Trans American Transformers	A•2597	√§*	√§*	√§*	√§*	√§*	√§*	√§*	√§*	√§*	√§*	√§*	√§*
Valor Electronics	A•2602								√§			√§	
Vernitron International	A•2599			√	√§			√§	√		√	√§	√
Wilco	A•2604		√						√	√			√
Z-Man Magnetics	A•2606									√	√		√§

* MIL Spec. § Surface Mount.

TRANSFORMERS, POWER

Manufacturer	Starting EEM Page No.	Power											Scott T	PCB Mount	Control		Current Instrument	Switch Mode	Planar Construction
		115-230V Input																	
		50-60 Hz	400 Hz	Filament	Rectifier	Split Bobbin	Isolation	Voltage Regulating	DC-to-DC Converter	Variable Incl. Auto Transformer	High Voltage	Toroidal			Synchro/ Resolver Synchro	Servo			
Abbott Technologies	A•2234	√*	√*	√*	√*	√	√*	√	√			√*	√	√*	√		√	√	
Advanced Components Industries	A•2254	√	√	√	√	√	√				√						√		
Albar Inc.	A•2256	√	√		√	√	√	√	√			√						√	
Amecon	A•2260	√*	√*	√*	√*	√*	√					√*		√*			√*	√*	
APX Technologies, Inc.	A•2266	√			√	√	√	√			√	√		√			√		
AT&T Microelectronics	A•2268	√			√	√	√		√					√			√	√	
Avel Transformers Inc.	A•2272	√	√			√	√					√		√					
Bel Fuse	A•2276						√		√			√							
Bey Electric	A•2295	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*			√*	√*	√*
BH Electronics	A•2296								√					√			√	√	
Bicron Electronics	A•2299	√	√	√	√		√			√		√		√					
C&C Jetronic Inc.	A•2302	√	√	√	√	√	√	√	√	√	√	√		√	√	√	√	√	
Cletronics	A•2303	√	√			√						√							
Communication Coil	A•2305		√*		√*	√*	√*		√*		√*	√*		√*	√*	√*	√*	√*	
Cramer Coil and Transformer Co. Inc.	A•2306	√	√	√	√	√	√	√	√		√	√		√				√	
CR Magnetics	A•2309																√		
Custom Coils Inc.	A•2311	√	√	√	√	√	√	√	√		√	√	√	√	√	√	√	√	√
Dale Electronics	A•2312													√				√	
Datatronics	A•2314	√§*	√§*	√§*	√§*	√§*	√§*	√§*	√§*	√§*	√§*	√§*	√§*	√§*	√§*	√§*	√§*	√§*	√§*
Del Electronics Corp.	A•2315	√*	√*	√*			√*				√*								
Dynage Power and Magnetics	A•2318	√*	√*	√*	√*	√*	√*	√*	√*		√*	√*		√*				√*	
Eichhoff Electronics	A•2323	√					√							√					
Electromech Inc.	A•2324	√	√	√	√	√					√	√		√			√	√	
Ensign Corp.	A•2326	√	√	√	√	√	√			√				√			√		
ESC Electronics Corp.	A•2329								√*			√*		√*			√	√	
EWC Inc.	A•2331	√	√	√	√	√	√					√		√					
FDK America	A•2348	√					√	√	√		√	√		√			√	√	
Fee-Fil-Mag	A•2349	√	√				√		√			√							
Fernwood	A•2355	√*	√*	√*	√*		√*	√*	√*			√*		√*				√*	
FETCO	A•2352	√	√								√			√					
Flex-Core	A•2357																√		
Hipotronics	A•2358	√		√			√	√		√	√		√						
Hi-Sonic Inc.	A•2360	√*	√*	√*	√*	√*	√*		√*		√*	√*	√*	√*	√*	√*	√*	√*	
Hitran Corp.	A•2361	√	√	√	√		√	√			√		√						
ISL Products International Ltd.	A•2362													√					
JBM Electronics, Inc.	A•2363								√										
JM Transformer Co., Inc.	A•2364	√	√	√	√	√	√			√	√	√		√					
Kappa Technologies	A•2370						√	√											
Lenco Electronics Inc.	A•2374	√	√	√	√	√	√	√			√		√	√	√	√	√	√	
Magnecomp	A•2377	√	√	√	√	√	√		√			√	√	√	√		√	√	
Magnelab	A•2378	√	√	√	√	√	√		√		√	√		√		√	√	√	√

* MIL Spec.

TRANSFORMERS, POWER (cont'd)

Manufacturer	Starting EEM Page No.	Power											Control					
		115-230V Input																
		50-60 Hz	400 Hz	Filament	Rectifier	Split Bobbin	Isolation	Voltage Regulating	DC-to-DC Converter	Variable Incl. Auto Transformer	High Voltage	Toroidal	Scott T	PCB Mount	Synchro/ Resolver Synchro	Servo	Current Instrument	Switch Mode	Planar Construction
Magnetico Inc.	A-2389	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*
MCI Transformer	A-2392	√*	√*	√*	√*	√*	√*							√*				√*	
Microtran Co. Inc.	A-2404	√*	√*	√*	√*	√*	√*		√*			√	√	√				√	
Mitchell Electronics Corp.	A-2433	√	√			√	√			√		√		√			√	√	
Mulit Comp, Inc.	A-2434	√	√	√	√	√	√	√	√		√	√		√				√	
Multi Products International	A-2436	√		√	√	√	√	√			√	√		√			√	√	
North Hills Signal Processing	A-2438													√*					
NWL Transformers	A-2437	√*	√*	√*	√*		√*	√*	√*	√*	√*	√*	√*						
Ohmite Manufacturing Co.	A-2442	√	√					√			√								
Panel Components	A-2443	√					√												
Paraline Transformer Corp.	A-2444	√*				√*	√*							√*					
PC Transformer Corp.	A-2445	√*	√*	√*	√*	√*	√*							√*					
Pearson Electronics	A-2454																√		
Pico Electronics	A-2455	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	
Plitron	A-2506	√	√		√		√			√		√							
Powertronix	A-2509	√*	√*		√*		√*			√*		√*							
Precision Electronics, Inc.	A-2393	√*	√*	√*	√*	√*	√*	√*	√*		√*	√*	√*	√*			√*	√*	
Premier Magnetics	A-2508					√	√	√	√			√		√			√	√	
Prem Magnetics	A-2512	√		√	√	√	√							√					
Renco Electronics Inc.	A-2527	√		√	√	√	√	√	√	√	√	√		√			√	√	
RFI (Del Electronics)	A-2532	√*	√*	√*	√*	√*	√*	√*	√*		√	√							
Shogyo International Corp.	A-2534	√				√			√			√		√					
Signal Transformer Corp.	A-2536	√	√	√	√	√	√	√	√			√		√			√	√	√
Staco Energy Products Co.	A-2535	√	√				√	√		√		√		√					
Stancor/White Rodgers	A-2558	√	√	√	√	√	√							√					
Superior Electric	A-2557	√								√									
Talema Electronic Inc.	A-2566	√	√		√		√					√		√			√		
Tamura	A-2571	√	√		√	√	√			√		√		√				√	
Technipower	A-2565	√	√					√		√	√								
TMP Inc.	A-2580	√	√		√	√	√		√	√	√								
Todd Systems, Inc.	A-2582	√*	√*	√*	√*		√*	√*		√*									
Torelco Inc.	A-2581	√*	√*	√*	√*	√*	√*		√*	√*	√*	√*		√*			√*	√*	
Toroid Corp. of Maryland	A-2586	√	√		√		√			√		√		√			√		
Torotel Products Inc.	A-2594	√*	√*		√*	√*	√*		√*			√*		√*			√*	√*	√*
Tortran Inc.	A-2593	√	√									√					√		
Trans American Transformers	A-2597	√*	√*			√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	
Ulveco, Inc.	A-2600	√	√		√		√	√		√		√					√		
Vernitron International	A-2599					√	√		√			√		√			√	√	
Wilco	A-2604					√		√		√	√	√		√				√	
Z-Man Magnetics	A-2606								√			√					√	√	

* MIL Spec.

WIRE GAUGES— DIAMETER, AREA AND COPPER WEIGHT

	Diameter at 20°C (68°F)		Area at 20°C (68°F)			Weight at 20°C (68°F), bare copper wire		
Size, AWG	mils	mm	mils	c mils	mm	lb/1,000 ft.	lb/mile	kg/km
4/0	460.0	11.68	166,200	211,600	107.2	640.5	3,382	953.2
3/0	409.6	10.40	131,800	167,800	85.01	507.8	2,681	755.7
2/0	364.8	9.266	104,500	133,100	67.43	402.8	2,127	599.5
1/0	324.9	8.252	82,891	105,600	53.49	319.5	1,687	477.6
1	289.3	7.348	85,730	83,690	42.41	253.3	1,338	337.0
2	257.6	6.543	52,120	66,360	33.62	200.9	1,061	298.9
3	229.4	5.827	41,330	52,620	26.67	159.3	841.1	237.1
4	204.3	5.189	32,780	41,740	21.15	126.3	667.1	188.0
5	181.9	4.620	25,990	33,090	16.77	100.2	528.8	149.0
6	162.0	4.115	20,610	26,240	13.30	79.44	419.4	118.2
7	144.3	3.665	16,350	20,820	10.55	63.03	332.8	93.80
8	128.5	3.264	12,970	16,510	8.367	49.98	263.9	74.38
9	114.4	2.906	10,280	13,090	6.631	39.61	209.2	58.95
10	101.9	2.588	8,155	10,380	5.261	31.43	166.0	46.77
11	90.7	2.304	6,460	8,230	4.17	24.90	131	37.1
12	80	2.05	5,130	6,530	3.310	19.8	104	29.4
13	72.0	1.83	4,070	5,180	2.63	15.7	82.9	23.4
14	64.1	1.63	3,230	4,110	2.08	12.4	65.7	18.5
15	57.1	1.45	2,560	3,260	1.650	9.87	52.1	14.7
16	50.8	1.29	2,030	2,580	1.31	7.81	41.2	11.6
17	45.3	1.150	1,610	2,050	1.040	6.21	32.8	9.24
18	40.3	1.02	1,280	1,620	0.823	4.92	26.0	7.32
19	35.9	0.912	1,010	1,290	0.653	3.90	20.6	5.81
20	32.0	0.813	804.0	1,020	0.519	3.10	16.4	4.61
21	28.5	0.724	638.0	812.0	0.412	2.46	13.0	3.66
22	25.3	0.643	503.0	640.0	0.324	1.94	10.2	2.88
23	22.6	0.574	401.0	511.0	0.259	1.55	8.16	2.30
24	20.1	0.511	317.0	404.0	0.205	1.22	6.46	1.82
25	17.9	0.455	252.0	320.0	0.162	0.970	5.12	1.44
26	15.9	0.404	199.0	253.0	0.128	0.765	4.04	1.14
27	14.2	0.361	158.0	202.0	0.102	0.610	3.22	0.908
28	12.6	0.320	125	159.0	0.0804	0.481	2.54	0.715
29	11.3	0.287	100.0	128.0	0.0647	0.387	2.04	0.575
30	10.0	0.254	78.50	100.0	0.0507	0.303	1.60	0.450
31	8.9	0.226	62.20	79.2	0.0401	0.240	1.27	0.357
32	8.0	0.203	50.30	64.0	0.0324	0.194	1.02	0.288
33	7.1	0.180	39.60	50.40	0.0255	0.153	0.806	0.227
34	6.3	0.160	31.20	39.7	0.0201	0.120	0.634	0.179
35	5.6	0.142	24.60	31.4	0.0159	0.0940	0.501	0.141
36	5.0	0.127	19.60	25.00	0.0127	0.0757	0.400	0.113
37	4.50	0.114	15.90	20.20	0.0103	0.0613	0.324	0.0912
38	4.0	0.102	12.60	16.0	0.00811	0.0484	0.256	0.0721
39	3.5	0.0889	9.62	12.2	0.00621	0.0371	0.196	0.0552
40	3.1	0.0787	7.55	9.61	0.00487	0.0291	0.154	0.0433
41	2.8	0.0711	6.16	7.84	0.00397	0.0237	0.125	0.0353
42	2.5	0.0635	4.91	6.25	0.00317	0.0189	0.0999	0.0282
43	2.2	0.0559	3.80	4.84	0.00245	0.0147	0.0774	0.0218
44	2.0	0.0508	3.14	4.00	0.00203	0.0121	0.0639	0.0180
45	1.8	0.0457	2.54	3.24	0.00164	0.00981	0.0519	0.0146
46	1.6	0.0406	2.01	2.56	0.00130	0.00775	0.0409	0.0115
47	1.4	0.0356	1.54	1.96	0.000993	0.00593	0.0313	0.00883
48	1.2	0.0305	1.13	1.44	0.000730	0.00436	0.0230	0.00649
49	1.1	0.0279	0.950	1.21	0.000613	0.00366	0.0193	0.00545
50	1.0	0.0254	0.785	1.00	0.000507	0.00303	0.0160	0.00450

Abbott TECHNOLOGIES, INC.

60 & 400 Hz Military & Industrial Transformers

Since 1961, Abbott Technologies, Inc. has been commited to providing high quality, reliable power transformers and inductors to the electronics industry.

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READY REFERENCE GUIDE

Model Family		Input		Construction		Power Levels (VA)	Output Voltages	EEM Page
Cat.	QPL*	Freq. (Hz)	Phase	Mil-Spec	Ind'l			
P	M27/312-322	50-60	1Ø	Grade 4		5-300	5-486	A•2236-37
6C	M27/326-331	50-60	1Ø	Grade 4		5-170	5-120	A•2238
6DM	—	50-60	3Ø	Grade 5		200-3000	5-200	A•2239
6DF	—	50-60	3Ø		Ind'l	200-3000	5-200	A•2239
6H	—	50-60	1Ø		Ind'l	250VA-10KVA	120-480	A•2240
6J	—	50-60	3Ø		Ind'l	250VA-15KVA	120-440	A•2240
6B	—	50-60	1Ø		Ind'l	10-1300	5-120	A•2241
TM	M27/350-354	380-420	1Ø	Grade 5		15-100	5-115	A•2242
TF	—	380-420	1Ø		Ind'l	15-100	5-115	A•2242
E	M27/338-343	380-420	1Ø	Grade 5		2-175	5-486	A•2243-44
4A	M27/332-337	380-420	1Ø	Grade 5		7-150	5-120	A•2245
4C	—	380-1000	1Ø	Grade 5		5-504	5-334	A•2246-47
4D	M27/344-349	380-420	3Ø	Grade 5		90-1000	5-200	A•2248
R	—	380-420	1Ø	Grade 5		1.5-9	5-300	A•2249-50
TL	—	10KHz		Grade 5		—	—	A•2251
Custom-Designed MIL-SPEC Magnetics								A•2252-53

*For specific QPL Model Numbers contact the sales office nearest you.

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Also see our listing for DC Power Supplies in Volume **D**, Pages **D**•1512-**D**•1515 and Inverters Pages **D**•2228, 2229.

Abbott TECHNOLOGIES, INC.

QPL Transformers

Over 750 Power Transformers Qualified to MIL-T-27

As a design engineer or purchasing agent for a military prime contractor or sub-contractor, you now can achieve rapid project approval and eliminate the time and expense of transformer qualification simply by specifying Abbott QPL transformers.

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- Thermal Shock 25 cycles (−55°C to +130°C)
- Humidity
- Shock
- Life Testing
- Vibration
- Immersion
- Flammability

Abbott's military transformers have proven themselves in the Space Shuttle, B-1 Bomber, Cruise Missile, Phalanx, Ram, Harpoon, AWACS and Apache Helicopter programs.

Only Abbott offers a selection this wide.

60 Hz	400 Hz (1ϕ and 3ϕ)
5-220 Volts	5-300 Volts
5-300 VA	2-375 VA
Grade 4, Class S	Grade 5, Class S

(See "Ready Reference Guide" on adjacent page for more model information.)

Only Abbott offers this commitment to quality

Our reputation for reliability has been earned by a conservative design philosophy in which special attention is given to thermal margins and the use of quality materials. Our Quality Assurance program is in accordance with MIL-I-45208A and MIL-STD-45662. Each transformer is 100% tested to the following requirements: visual and mechanical, turns ratio, excitation current, dielectric withstanding voltage and continuity.

We have our own fully equipped test laboratory which has been accepted by the Defense Logistics Agency to perform qualification testing and Group A and B Inspection to military specification MIL-T-27. This is a reflection of our commitment to serving the defense electronics and aerospace industries.

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Abbott TECHNOLOGIES, INC

60 Hz MIL-T-27 Transformers

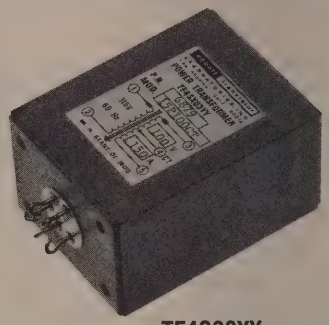
MODEL P

SPECIFICATIONS

INPUT PRIMARY: 115 VAC, 60 Hz ± 5 Hz, 1 phase.†
"A" Option: 230 V ac. Add suffix "A" to model number, e.g., 5P10CTA (Fig. 1).
"B" Option: 115/230 V ac. Add suffix "B" to model number, e.g., 5P10CTB (Fig. 2).
REGULATION: 10% no load to full load.
SECONDARY VOLTAGE TOLERANCE: Within 3% of listed output voltage when measured at full load and 115 VAC input.
CONSTRUCTION: To MIL-T-27, Grade 4, Class S, Case: steel.
ENVIRONMENT: To operate in 95°C maximum ambient temperature. Encapsulated to meet MIL-STD-810 for vibration, shock, acceleration, sand, dust, humidity, salt-spray, fungus, sunshine, rain, explosion, and altitude (to a vacuum). NOTE: For high altitude operation, encapsulate terminals.
INSULATION TEST: 1750 VAC.
SECONDARY: See output voltage and current of specific models listed.

†For 50 Hz operation, reduce secondary current by 10% of ratings listed. These units are capable of 400 Hz operation; however, see Abbott's distinct line of miniature 400 Hz transformers.

Now QPL!



TF4S03YY

Size	B	C	D	E	F	G
A1	1½	1¾	2⅜	1 1/16	1¼	6-32
A2	1¾	2 1/16	2¾	1¼	1½	6-32
A3	1⅞	2⅜	3⅛	1¼	1¾	8-32
A4	2	2⅜	3⅛	1½	1¾	8-32
A5	2⅛	2 11/16	3½	1½	2	8-32
A6	2¼	2 11/16	3½	1⅝	2	8-32
A7*	2⅝	3⅛	4⅛	2	2¼	8-32
A8*	2⅞	3 7/16	4½	2¼	2½	10-32
A9*	3⅛	3¾	4⅞	2 7/16	2¾	10-32
A10*	3⅜	4 1/16	5¼	2⅝	3	¼-20
A11*	3⅞	4 11/16	6	2¾	3½	¼-20

Model Type	Weight Lbs. (Max.)	Primary DCR (ohms typical)
5P	1.0	86
10P	1.5	36
15P	2.0	24
20P	2.5	15
30P	3.0	8.5
40P	3.3	6.7
80P	5.0	3.7
120P	6.5	1.9
160P	8.2	1.6
200P	10.5	1.1
300P	17.0	0.5

*See Fig. 3 for header configuration used on any unit with output current greater than 10 amps.

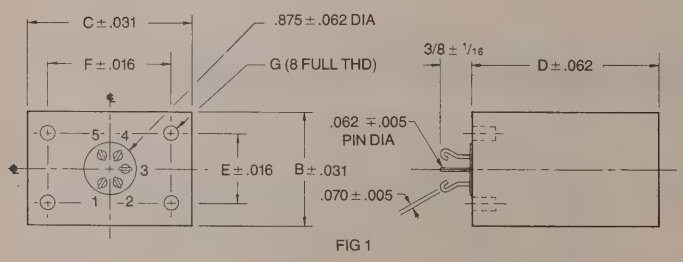


FIG 1

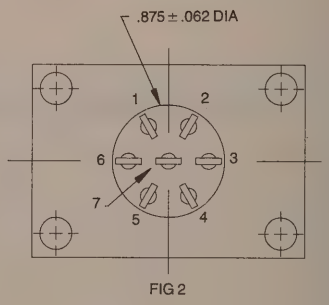


FIG 2

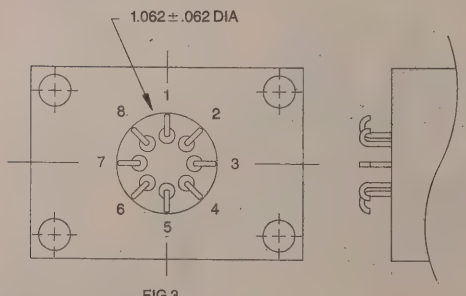
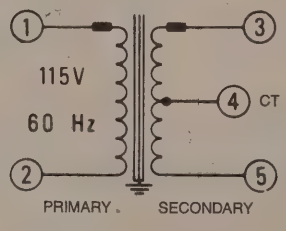
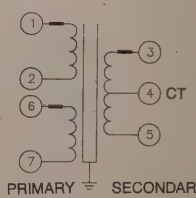


FIG 3

CIRCUIT DIAGRAM
Standard and "A" Option



"B" Option for 115 V. Connect 1 and 6, 2 and 7. for 230 V. Connect 2 and 6.



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Abbott TECHNOLOGIES, INC — 60 Hz MIL-T-27 Transformers

MODEL P

Output Volts (F.L.)	Output Current (Amp)	Size	Secondary DCR ohms (typical)	Model Number	QPL Model No.
5.0	1.00	A1	0.335	5P5CT	M27/312-01
	2.00	A2	0.12	10P5CT	M27/313-01
	3.00	A3	0.07	15P5CT	M27/314-01
	4.00	A4	0.066	20P5CT	M27/315-01
	6.00	A5	0.04	30P5CT	M27/316-01
	8.00	A6	0.03	40P5CT	M27/317-01
	16.00	A7	0.014	80P5CT	M27/318-01
6.3	0.79	A1	0.53	5P6.3CT	M27/312-02
	1.58	A2	0.18	10P6.3CT	M27/313-02
	2.38	A3	0.094	15P6.3CT	M27/314-02
	3.16	A4	0.1	20P6.3CT	M27/315-02
	4.76	A5	0.06	30P6.3CT	M27/316-02
	6.35	A6	0.059	40P6.3CT	M27/317-02
	12.70	A7	0.02	80P6.3CT	M27/318-02
	19.00	A8	0.0014	120P6.3CT	M27/319-01
8.0	0.67	A1	0.87	5P8CT	M27/312-03
	1.25	A2	0.27	10P8CT	M27/313-03
	1.88	A3	0.16	15P8CT	M27/314-03
	2.50	A4	0.15	20P8CT	M27/315-03
	3.76	A5	0.08	30P8CT	M27/316-03
	5.00	A6	0.079	40P8CT	M27/317-03
	10.00	A7	0.04	80P8CT	M27/318-03
	15.00	A8	0.022	120P8CT	M27/319-02
	20.00	A9	0.0072	160P8CT	M27/320-01
10	0.50	A1	1.34	5P10CT	M27/312-04
	1.00	A2	0.42	10P10CT	M27/313-04
	1.50	A3	0.23	15P10CT	M27/314-04
	2.00	A4	0.23	20P10CT	M27/315-04
	3.00	A5	0.14	30P10CT	M27/316-04
	4.00	A6	0.11	40P10CT	M27/317-04
	8.00	A7	0.05	80P10CT	M27/318-04
	12.00	A8	0.031	120P10CT	M27/319-03
	16.00	A9	0.008	160P10CT	M27/320-02
	20.00	A10	0.02	200P10CT	M27/321-01
12.6	0.39	A1	2.06	5P12.6CT	M27/312-05
	0.79	A2	0.65	10P12.6CT	M27/313-05
	1.19	A3	0.4	15P12.6CT	M27/314-05
	1.59	A4	0.34	20P12.6CT	M27/315-05
	2.38	A5	0.2	30P12.6CT	M27/316-05
	3.18	A6	0.18	40P12.6CT	M27/317-05
	6.35	A7	0.07	80P12.6CT	M27/318-05
	9.53	A8	0.041	120P12.6CT	M27/319-04
	12.70	A9	0.035	160P12.6CT	M27/320-03
	15.90	A10	0.027	200P12.6CT	M27/321-02
14	0.36	A1	2.95	5P14CT	M27/312-06
	0.72	A2	0.74	10P14CT	M27/313-06
	1.07	A3	0.6	15P14CT	M27/314-06
	1.43	A4	0.4	20P14CT	M27/315-06
	2.15	A5	0.23	30P14CT	M27/316-06
	2.86	A6	0.19	40P14CT	M27/317-06
	5.72	A7	0.1	80P14CT	M27/318-06
	8.59	A8	0.055	120P14CT	M27/319-05
	11.40	A9	0.042	160P14CT	M27/320-04
	14.30	A10	0.029	200P14CT	M27/321-03
16	0.34	A1	3.35	5P16CT	M27/312-07
	0.68	A2	1.08	10P16CT	M27/313-07
	0.94	A3	0.67	15P16CT	M27/314-07
	1.25	A4	0.52	20P16CT	M27/315-07
	1.87	A5	0.28	30P16CT	M27/316-07
	2.50	A6	0.28	40P16CT	M27/317-07
	5.00	A7	0.12	80P16CT	M27/318-07
	7.50	A8	0.072	120P16CT	M27/319-06
	10.00	A9	0.046	160P16CT	M27/320-05
	12.50	A10	0.034	200P16CT	M27/321-04
	18.70	A11	0.02	300P16CT	M27/322-01
18	0.28	A1	4.65	5P18CT	M27/312-08
	0.55	A2	1.42	10P18CT	M27/313-08
	0.83	A3	0.78	15P18CT	M27/314-08
	1.11	A4	0.62	20P18CT	M27/315-08
	1.67	A5	0.38	30P18CT	M27/316-08
	2.21	A6	0.36	40P18CT	M27/317-08
	4.44	A7	0.16	80P18CT	M27/318-08
	6.68	A8	0.08	120P18CT	M27/319-07
	8.89	A9	0.060	160P18CT	M27/320-06
	11.10	A10	0.04	200P18CT	M27/321-05
	16.70	A11	0.022	300P18CT	M27/322-02
20	0.25	A1	5.25	5P20CT	M27/312-09
	0.50	A2	1.54	10P20CT	M27/313-09
	0.75	A3	0.9	15P20CT	M27/314-09
	1.00	A4	0.85	20P20CT	M27/315-09
	1.50	A5	0.4	30P20CT	M27/316-09
	2.00	A6	0.43	40P20CT	M27/317-09
	4.00	A7	0.19	80P20CT	M27/318-09
	6.00	A8	0.120	120P20CT	M27/319-08
	8.00	A9	0.070	160P20CT	M27/320-07
	10.00	A10	0.066	200P20CT	M27/321-06
	15.00	A11	0.026	300P20CT	M27/322-03
22	0.22	A1	7.3	5P22CT	M27/312-10
	0.45	A2	1.9	10P22CT	M27/313-10
	0.68	A3	1.2	15P22CT	M27/314-10
	0.91	A4	0.95	20P22CT	M27/315-10
	1.36	A5	0.55	30P22CT	M27/316-10
	1.82	A6	0.57	40P22CT	M27/317-10
	3.64	A7	0.25	80P22CT	M27/318-10
	5.45	A8	0.125	120P22CT	M27/319-09
	7.27	A9	0.092	160P22CT	M27/320-08
	9.10	A10	0.073	200P22CT	M27/321-07
	13.60	A11	0.031	300P22CT	M27/322-04
25	0.20	A1	8.23	5P25CT	M27/312-11
	0.40	A2	2.55	10P25CT	M27/313-11
	0.60	A3	1.4	15P25CT	M27/314-11
	0.80	A4	1.37	20P25CT	M27/315-11
	1.20	A5	0.7	30P25CT	M27/316-11
	1.60	A6	0.67	40P25CT	M27/317-11
	3.20	A7	0.3	80P25CT	M27/318-11
	4.80	A8	0.182	120P25CT	M27/319-10
	6.40	A9	0.11	160P25CT	M27/320-09
	8.00	A10	0.079	200P25CT	M27/321-08
	12.00	A11	0.042	300P25CT	M27/322-05
28	0.18	A1	11.4	5P28CT	M27/312-12
	0.36	A2	3.0	10P28CT	M27/313-12
	0.54	A3	1.9	15P28CT	M27/314-12
	0.71	A4	1.6	20P28CT	M27/315-12
	1.07	A5	0.94	30P28CT	M27/316-12
	1.43	A6	0.90	40P28CT	M27/317-12
	2.86	A7	0.4	80P28CT	M27/318-12
	4.29	A8	0.205	120P28CT	M27/319-11
	5.72	A9	0.150	160P28CT	M27/320-10
	7.10	A10	0.11	200P28CT	M27/321-09
	10.70	A11	0.046	300P28CT	M27/322-06
31	0.16	A1	13.8	5P31CT	M27/312-13
	0.32	A2	3.8	10P31CT	M27/313-13
	0.48	A3	2.2	15P31CT	M27/314-13
	0.64	A4	2.2	20P31CT	M27/315-13
	0.97	A5	0.96	30P31CT	M27/316-13
	1.29	A6	0.95	40P31CT	M27/317-13
	2.58	A7	0.45	80P31CT	M27/318-13
	3.87	A8	0.31	120P31CT	M27/319-12
	5.17	A9	0.166	160P31CT	M27/320-11
	6.40	A10	0.12	200P31CT	M27/321-10
	9.67	A11	0.054	300P31CT	M27/322-07
35	0.14	A1	17.6	5P35CT	M27/312-14
	0.29	A2	4.5	10P35CT	M27/313-14
	0.43	A3	3.0	15P35CT	M27/314-14
	0.57	A4	2.4	20P35CT	M27/315-14
	0.86	A5	1.4	30P35CT	M27/316-14
	1.14	A6	1.32	40P35CT	M27/317-14
	2.28	A7	0.5	80P35CT	M27/318-14
	3.43	A8	0.35	120P35CT	M27/319-13
	4.57	A9	0.240	160P35CT	M27/320-12
	5.71	A10	0.17	200P35CT	M27/321-11
	8.59	A11	0.072	300P35CT	M27/322-08
39	0.13	A1	19.7	5P39CT	M27/312-15
	0.26	A2	6.3	10P39CT	M27/313-15
	0.38	A3	3.5	15P39CT	M27/314-15
	0.51	A4	3.6	20P39CT	M27/315-15
	0.77	A5	1.62	30P39CT	M27/316-15
	1.03	A6	1.5	40P39CT	M27/317-15
	2.05	A7	0.7	80P39CT	M27/318-15
	3.07	A8	0.342	120P39CT	M27/319-14
	4.10	A9	0.270	160P39CT	M27/320-13
	5.12	A10	0.18	200P39CT	M27/321-12
	7.69	A11	0.08	300P39CT	M27/322-09
43	0.12	A1	22.0	5P43CT	M27/312-16
	0.23	A2	7.0	10P43CT	M27/313-16
	0.35	A3	4.65	15P43CT	M27/314-16
	0.46	A4	4.0	20P43CT	M27/315-16
	0.70	A5	2.15	30P43CT	M27/316-16
	0.93	A6	1.62	40P43CT	M27/317-16
	1.85	A7	0.94	80P43CT	M27/318-16
	2.79	A8	0.48	120P43CT	M27/319-15
	3.70	A9	0.382	160P43CT	M27/320-14
	4.64	A10	0.26	200P43CT	M27/321-13
	6.95	A11	0.108	300P43CT	M27/322-10
48	0.10	A1	30.0	5P48CT	M27/312-17
	0.21	A2	9.3	10P48CT	M27/313-17
	0.31	A3	5.2	15P48CT	M27/314-17
	0.42	A4	4.4	20P48CT	M27/315-17
	0.63	A5	2.4	30P48CT	M27/316-17
	0.83	A6	2.35	40P48CT	M27/317-17
	1.63	A7	1.0	80P48CT	M27/318-17
	2.50	A8	0.66	120P48CT	M27/319-16
	3.33	A9	0.405	160P48CT	M27/320-15
	4.17	A10	0.29	200P48CT	M27/321-14
	6.26	A11	0.165	300P48CT	M27/322-11
55	0.09	A1	34.4	5P55CT	M27/312-18
	0.18	A2	11.0	10P55CT	M27/313-18
	0.27	A3	7.5	15P55CT	M27/314-18
	0.36	A4	6.0	20P55CT	M27/315-18
	0.55	A5	3.5	30P55CT	M27/316-18
	0.73	A6	3.2	40P55CT	M27/317-18
	1.46	A7	1.5	80P55CT	M27/318-18
	2.18	A8	0.82	120P55CT	M27/319-17
	2.91	A9	0.6	160P55CT	M27/320-16
	3.64	A10	0.41	200P55CT	M27/321-15
	5.46	A11	0.175	300P55CT	M27/322-12
63	0.08	A1	52.0	5P63CT	M27/312-19
	0.16	A2	16.4	10P63CT	M27/313-19
	0.24	A3	8.6	15P63CT	M27/314-19
	0.32	A4	8.6	20P63CT	M27/315-19
	0.48	A5	3.9	30P63CT	M27/316-19
	0.64	A6	3.7	40P63CT	M27/317-19
	1.27	A7	1.7	80P63CT	M27/318-19
	1.91	A8	1.11	120P63CT	M27/319-18
	2.25	A9	0.64	160P63CT	M27/320-17
	3.18	A10	0.47	200P63CT	M27/321-16
	4.76	A11	0.187	300P63CT	M27/322-13
70	0.071	A1	68.0	5P70CT	M27/312-20
	0.143	A2	19.0	10P70CT	M27/313-20
	0.212	A3	11.2	15P70CT	M27/314-20
	0.286	A4	9.8	20P70CT	M27/315-20
	0.429	A5	5.5	30P70CT	M27/316-20
	0.572	A6	5.2	40P70CT	M27/317-20
	1.140	A7	2.4	80P70CT	M27/318-20
	1.720	A8	1.20	120P70CT	M27/319-19
	2.280	A9	0.93	160P70CT	M27/320-18
	2.860	A10	0.67	200P70CT	M27/321-17
	4.290	A11	0.26	300P70CT	M27/322-14
80	0.067	A1	80.0	5P80CT	M27/312-21
	0.125	A2	25.0	10P80CT	M27/313-21
	0.187	A3	13.6	15P80CT	M27/314-21
	0.250	A4	13.4	20P80CT	M27/315-21
	0.375	A5	6.4	30P80CT	M27/316-21
	0.500	A6	6.4	40P80CT	M27/317-21
	1.000	A7	2.7	80P80CT	M27/318-21
	1.500	A8	1.43	120P80CT	M27/319-20
	2.000	A9	1.06	160P80CT	M27/320-19
	2.500	A10	0.74	200P80CT	M27/321-18
	3.750	A11	0.3	300P80CT	M27/322-15
90	0.055	A1	112.00	5P90CT	M27/312-22
	0.111	A2	30.4	10P90CT	M27/313-22
	0.167	A3	20.0	15P90CT	M27/314-22
	0.222	A4	14.8	20P90CT	M27/315-22
	0.332	A5	8.6	30P90CT	M27/316-22
	0.445	A6	8.4	40P90CT	M27/317-22
	0.890	A7	3.8	80P90CT	M27/318-22
	1.340	A8	1.96	120P90CT	M27/319-21
	1.780	A9	1.49	160P90CT	M27/320-20
	2.220	A10	1.05	200P90CT	M27/321-19
	3.320	A11	0.43	300P90CT	M27/322-16
100	0.050	A1	113.0	5P100CT	M27/312-23
	0.100	A2	40.5	10P100CT	M27/313-23
	0.150	A3	22.0	15P100CT	M27/314-23
	0.200	A4	15.5	20P100CT	M27/315-23
	0.300	A5	10.0	30P100CT	M27/316-23
	0.400	A6	9.4	40P100CT	M27/317-23
	0.800	A7	4.2	80P100CT	M27/318-23
	1.200	A8	2.75	120P100CT	M27/319-22
	1.600	A9	1.69	160P100CT	M27/320-21
	2.000	A10	1.17	200P100CT	M27/321-20
	3.000	A11	0.48	300P100CT	M27/322-17
110	0.045	A1	140.0	5P110CT	M27/312-24
	0.091	A2	44.5	10P110CT	M27/313-24
	0.136	A3	28.0	15P110CT	M27/314-24
	0.182	A4	23.0	20P110CT	M27/315-24
	0.272	A5	13.6	30P110CT	M27/316-24
	0.364	A6	12.5	40P110CT	M27/317-24
	0.726	A7	5.7	80P110CT	M27/318-24
	1.090	A8	3.05	120P110CT	M27/319-23
	1.450	A9	2.3	160P110CT	M27/320-22
	1.820	A10	1.6	200P110CT	M27/321-21
	2.720	A11	0.65	300P110CT	M27/322-18
123	0.040	A1	198.0	5P123CT	M27/312-25
	0.081	A2	70.0	10P123CT	M27/313-25
	0.122	A3	33.5	15P123CT	M27/314-25
	0.162	A4	35.0	20P123CT	M27/315-25
	0.244	A5	15.3	30P123CT	M27/316-25
	0.325	A6	14.6	40P123CT	M27/317-25
	0.650	A7	6.5	80P123CT	M27/318-25
	0.970	A8	4.35	120P123CT	M27/319-24
	1.300	A9	2.57	160P123CT	M27/320-23
	1.620	A10	1.8	200P123CT	M27/321-22
	2.440	A11	0.74	300P123CT	M27/322-19

Other standard models to 300V output and 1000 VA are available. Contact our nearest office for complete information.

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Abbott TECHNOLOGIES, INC

60 Hz MIL-T-27 Transformers

MODEL 6C

SPECIFICATIONS

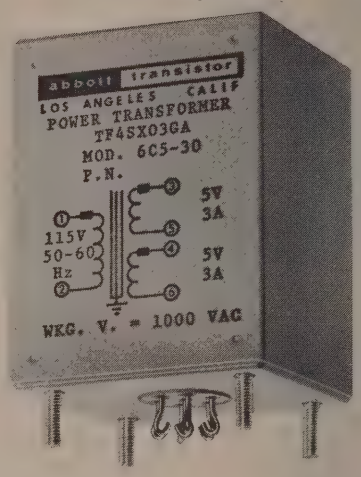
INPUT PRIMARY: 115 VAC, 50 to 65 Hz, 1 Phase. See "A" and "X" options below.
REGULATION: 10% no load to full load.
SECONDARY VOLTAGE TOLERANCE: Within 3% when measured at full load and 115 VAC input.
INSULATION TEST: 1500 VAC.
OPERATING TEMP.: 90°C maximum ambient temperature.
CONSTRUCTION: To MIL-T-27, Grade 4, Class S, life "X" (10,000 hrs.)

EFFICIENCY: From 80% to 90% typical.
ENVIRONMENT: Encapsulated to meet MIL-STD-810 for vibration, shock, sand, dust, humidity, salt spray, fungus, sunshine, rain, explosion, and altitude (to a vacuum). NOTE: for high altitude operation, encapsulate terminals.
OPTIONS AVAILABLE: Other output voltages and 230 VAC input are available. Please consult our nearest office for complete information.

Output Volts (F.L.)	Output Current (Amps) Parallel Connection	Output Current (Amps) Series Connection	Size	Weight Lbs. Typ.	Model Number	QPL Number
5V Parallel	1.00	0.50	EB	1.2	6C5-5	M27/326-01
10V C.T.	3.00	1.50	FA	2.2	6C5-15	M27/327-01
Series	6.00	3.00	GA	3.3	6C5-30	M27/328-01
	12.00	6.00	HA	4.7	6C5-60	M27/329-01
	20.00	10.00	JA	7.4	6C5-100	M27/330-01
6.3V Parallel	0.80	0.40	EB	1.2	6C6-5	M27/326-02
12.6V C.T.	2.38	1.19	FA	2.2	6C6-15	M27/327-02
Series	4.76	2.38	GA	3.3	6C6-30	M27/328-02
	9.52	4.76	HA	4.7	6C6-60	M27/329-02
	20.00	10.00	JA	7.4	6C6-126	M27/330-02
8V Parallel	0.62	0.31	EB	1.2	6C8-5	M27/326-03
16V C.T.	1.86	0.93	FA	2.2	6C8-15	M27/327-03
Series	3.72	1.86	GA	3.3	6C8-30	M27/328-03
	7.44	3.72	HA	4.7	6C8-60	M27/329-03
	17.50	8.75	JA	7.4	6C8-140	M27/330-03
	20.00	10.00	KA	9.8	6C8-160	M27/331-01
10V Parallel	0.50	0.25	EB	1.2	6C10-5	M27/326-04
20V C.T.	1.50	0.75	FA	2.2	6C10-15	M27/327-04
Series	3.00	1.50	GA	3.3	6C10-30	M27/328-04
	6.00	3.00	HA	4.7	6C10-60	M27/329-04
	14.00	7.00	JA	7.4	6C10-140	M27/330-04
	17.00	8.50	KA	9.8	6C10-170	M27/331-02
12V Parallel	0.40	0.20	EB	1.2	6C12-5	M27/326-05
24V C.T.	1.20	0.60	FA	2.2	6C12-15	M27/327-05
Series	2.40	1.20	GA	3.3	6C12-30	M27/328-05
	4.80	2.40	HA	4.7	6C12-60	M27/329-05
	11.60	5.80	JA	7.4	6C12-140	M27/330-05
	14.16	7.08	KA	9.8	6C12-170	M27/331-03
17V Parallel	0.30	0.15	EB	1.2	6C17-5	M27/326-06
34V C.T.	0.88	0.44	FA	2.2	6C17-15	M27/327-06
Series	1.76	0.88	GA	3.3	6C17-30	M27/328-06
	3.52	1.76	HA	4.7	6C17-60	M27/329-06
	8.20	4.10	JA	7.4	6C17-140	M27/330-06
	10.00	5.00	KA	9.8	6C17-170	M27/331-04
20V Parallel	0.24	0.12	EB	1.2	6C20-5	M27/326-07
40V C.T.	0.72	0.36	FA	2.2	6C20-15	M27/327-07
Series	1.44	0.72	GA	3.3	6C20-30	M27/328-07
	2.88	1.44	HA	4.7	6C20-60	M27/329-07
	7.00	3.50	JA	7.4	6C20-140	M27/330-07
	8.50	4.25	KA	9.8	6C20-170	M27/331-05
28V Parallel	0.18	0.09	EB	1.2	6C28-5	M27/326-08
56V C.T.	0.54	0.27	FA	2.2	6C28-15	M27/327-08
Series	1.08	0.54	GA	3.3	6C28-30	M27/328-08
	2.16	1.08	HA	4.7	6C28-60	M27/329-08
	5.00	2.50	JA	7.4	6C28-140	M27/330-08
	6.06	3.03	KA	9.8	6C28-170	M27/331-06
44V Parallel	0.10	0.05	EB	1.2	6C44-5	M27/326-09
88V C.T.	0.30	0.15	FA	2.2	6C44-15	M27/327-09
Series	0.60	0.30	GA	3.3	6C44-30	M27/328-09
	1.20	0.60	HA	4.7	6C44-60	M27/329-09
	3.16	1.58	JA	7.4	6C44-140	M27/330-09
	3.86	1.93	KA	9.8	6C44-170	M27/331-07
60V Parallel	0.08	0.04	EB	1.2	6C60-5	M27/326-10
120V C.T.	0.24	0.12	FA	2.2	6C60-15	M27/327-10
Series	0.48	0.24	GA	3.3	6C60-30	M27/328-10
	0.96	0.48	HA	4.7	6C60-60	M27/329-10
	2.32	1.16	JA	7.4	6C60-140	M27/330-10
	2.82	1.41	KA	9.8	6C60-170	M27/331-08

NOTE: These units are also capable of 400 Hz operation.

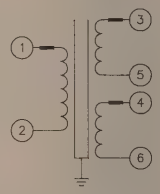
Now QPL!



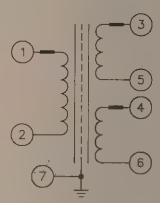
TF4S03 ___

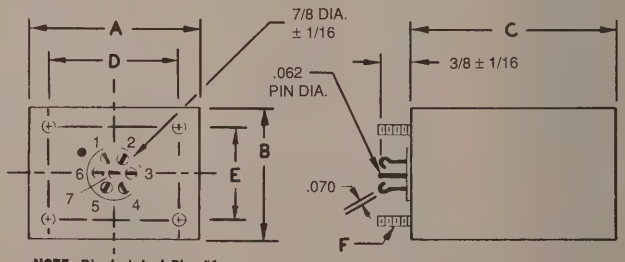
Circuit Diagram

Standard and "A" Option
Series Connected: Connect 4 and 5.
Parallel Connected: Connect 3 and 4, 5 and 6.
230 V ac. Add suffix "A" to model number, e.g., 6C5-5A.



"X" Option
Series Connected: Connect 4 and 5.
Parallel Connected: Connect 3 and 4, 5 and 6.
Electrostatic shield grounded to case and Pin 7.
Add suffix "X" to model number, e.g., 6C5-5X.





NOTE: Black dot at Pin #1.

Size	A	B	C	D	E	F
EB	1.938	1.812	2.438	1.375	1.250	6-32 x 3/8
FA	2.312	2.062	3.125	1.688	1.438	6-32 x 3/8
GA	2.750	2.375	3.812	2.125	1.750	6-32 x 3/8
HA	3.062	2.625	4.250	2.297	1.859	8-32 x 3/8
JA	3.562	3.062	4.875	2.625	2.125	8-32 x 3/8
KA	3.938	3.375	5.250	3.000	2.438	10-32 x 1/2

Dimension A, B = +0.000 −0.125
Dimension C = +0.000 −0.188
Dimension D, E = ±0.016 except size KA = 0.031
Dimension F = ±0.062

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Abbott TECHNOLOGIES, INC.

60 Hz, 3 Ø MIL-T-27 and Industrial Transformers

MODEL 6D

SPECIFICATIONS

INPUT PRIMARY:

WYE:	120V L-Com. or 208V L-L	Suffix A
DELTA:	120V L-L	Suffix C
DELTA:	230V L-L	Suffix E
DELTA:	440V L-L	Suffix F

NOTE: To order a specific input voltage add suffix to model number. (EXAMPLE: 6D ( ) 15-200E has input 230V L-L (3 wire DELTA)).

INPUT FREQUENCY: 50 Hz to 65 Hz.

OUTPUT: See specific models listed.

OUTPUT VOLTAGE TOLERANCE: Within 5% when measured at full load and nominal VAC input.

REGULATION: 10% max. no load to full load. (6% on size 3 thru 6).

INSULATION TEST: 1500 VRMS

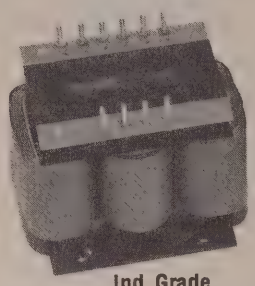
EFFICIENCY: Ranges from 90% to 95% typical.

OPERATING AMBIENT TEMP.: 80°C maximum on sizes 1-6; 60°C maximum on sizes 7-9.

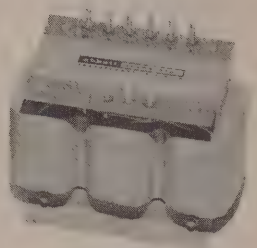
MIL-T-27 CONSTRUCTION: (Grade 5 Class S). Specify the letter "M" in the model number. (Example: 6DM15-200 ( )).

NOTE: MIL-T-27 add .20 to Dim. A, B, C. Other inputs and/or outputs available.

INDUSTRIAL CONSTRUCTION: Industrial Grade (open frame): Specify the letter "F" in the model number. (Example: 6DF 15-200 ( )).



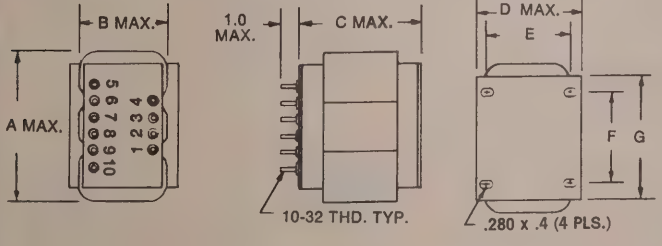
Ind. Grade



MIL-T-27
TF 5S03ZZ

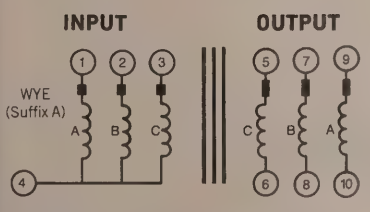
Model No.	Delta: L to L (3 wire) WYE: L to Com. (4 wire) Volts R.M.S.	Load Current (Amps)	WYE: L to L (3 wire) Volts R.M.S.	Load Current (Amps)	Size	Wt. Lbs. (Typ.)
6D( )5-200( )	5	13.30	8.66	7.70	1	14
6D( )5-450( )	5	30.00	8.66	17.30	2	20
6D( )5-650( )	5	43.30	8.66	25.00	3	28
6D( )12-200( )	12	5.56	20.8	3.21	1	14
6D( )12-450( )	12	12.50	20.8	7.21	2	20
6D( )12-650( )	12	18.10	20.8	10.40	3	28
6D( )12-850( )	12	23.60	20.8	13.60	4	39
6D( )12-1100( )	12	30.60	20.8	17.60	5	48
6D( )12-1500( )	12	41.70	20.8	24.00	6	58
6D( )12-2000( )	12	55.55	20.8	32.05	7	60
6D( )12-2500( )	12	69.44	20.8	40.09	8	68
6D( )12-3000( )	12	83.30	20.8	48.08	9	78
6D( )15-200( )	15	4.44	26.0	2.56	1	14
6D( )15-450( )	15	10.00	26.0	5.77	2	20
6D( )15-650( )	15	14.40	26.0	8.33	3	28
6D( )15-850( )	15	18.90	26.0	10.90	4	39
6D( )15-1100( )	15	24.40	26.0	14.10	5	48
6D( )15-1500( )	15	33.30	26.0	19.20	6	58
6D( )15-2000( )	15	44.44	26.0	25.65	7	60
6D( )15-2500( )	15	55.55	26.0	32.05	8	68
6D( )15-3000( )	15	66.66	26.0	38.46	9	78
6D( )20-200( )	20	3.33	34.6	1.93	1	14
6D( )20-450( )	20	7.50	34.6	4.33	2	20
6D( )20-650( )	20	10.80	34.6	6.26	3	28
6D( )20-850( )	20	14.20	34.6	8.19	4	39
6D( )20-1100( )	20	18.30	34.6	10.60	5	48
6D( )20-1500( )	20	25.00	34.6	14.40	6	58
6D( )20-2000( )	20	33.33	34.6	19.27	7	60
6D( )20-2500( )	20	41.66	34.6	24.08	8	68
6D( )20-3000( )	20	50.00	34.6	28.88	9	78

Model No.	Delta: L to L (3 wire) WYE: L to Com. (4 wire) Volts R.M.S.	Load Current (Amps)	WYE: L to L (3 wire) Volts R.M.S.	Load Current (Amps)	Size	Wt. Lbs. (Typ.)
6D( )28-200( )	28	2.38	48.5	1.37	1	14
6D( )28-450( )	28	5.36	48.5	3.09	2	20
6D( )28-650( )	28	7.74	48.5	4.47	3	28
6D( )28-850( )	28	10.10	48.5	5.83	4	39
6D( )28-1100( )	28	13.10	48.5	7.56	5	48
6D( )28-1500( )	28	17.90	48.5	10.30	6	58
6D( )28-2000( )	28	23.81	48.5	13.75	7	60
6D( )28-2500( )	28	29.76	48.5	17.18	8	68
6D( )28-3000( )	28	35.71	48.5	20.62	9	78
6D( )48-200( )	48	1.39	83.1	.80	1	14
6D( )48-450( )	48	3.13	83.1	1.81	2	20
6D( )48-650( )	48	4.51	83.1	2.61	3	28
6D( )48-850( )	48	5.90	83.1	3.41	4	39
6D( )48-1100( )	48	7.64	83.1	4.41	5	48
6D( )48-1500( )	48	10.40	83.1	6.02	6	58
6D( )48-2000( )	48	13.88	83.1	8.02	7	60
6D( )48-2500( )	48	17.36	83.1	10.02	8	68
6D( )48-3000( )	48	20.83	83.1	12.03	9	78
6D( )115-200( )	115	.58	200.0	.34	1	14
6D( )115-450( )	115	1.30	200.0	.75	2	20
6D( )115-650( )	115	1.88	200.0	1.09	3	28
6D( )115-850( )	115	2.46	200.0	1.42	4	39
6D( )115-1100( )	115	3.19	200.0	1.84	5	48
6D( )115-1500( )	115	4.35	200.0	2.51	6	58
6D( )115-2000( )	115	5.80	200.0	3.33	7	60
6D( )115-2500( )	115	7.25	200.0	4.18	8	68
6D( )115-3000( )	115	8.67	200.0	5.00	9	78



SIZE	A	B	C	D	E	F	G
1	6.10	4.10	4.62	4.10	3.10	3.75	4.81
2	7.70	4.10	5.43	4.10	3.10	4.00	6.00
3	7.70	5.10	5.43	5.10	4.10	4.00	6.00
4	9.20	4.60	6.78	5.10	3.86	5.24	7.50
5	9.20	5.10	6.78	5.60	4.36	5.24	7.50
6	9.20	5.85	6.78	6.35	5.11	5.24	7.50
7	11.00	4.85	8.13	5.10	3.86	6.40	9.00
8	11.00	5.35	8.13	5.60	4.36	6.40	9.00
9	11.00	5.85	8.13	6.10	5.11	6.40	9.00

DIM. TOL.: E, F, G, ±.06



INPUT CONNECTION
WYE: L-Com. 1, 2, 3 Line. 4 com.
WYE: L-L 1, 2, 3 (Pin 4 not used)
DELTA: L-L 1, 2, 3 (Pin 4 not used)

OUTPUT CONNECTION
WYE: L-Com. connect 6-8-10 Load 5-6, 7-6, 9-6
DELTA: L-L Connect 6-7, 8-9, 5-10 Load 5, 7, 9
WYE: L-L connect 6-10, 8-10 Load 5, 7, 9

OTHER STANDARD MODELS AVAILABLE TO 30KVA

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Abbott TECHNOLOGIES, INC — 50/60 Hz Universal Isolation Transformers

MODEL 6H/6J

- **3 phase and single phase models**
- **Multiple taps for a wide range of input/output combinations**
- **All units feature electrostatic shielding**
- **250VA-15KVA, 3 phase**
- **250VA-10KVA, single phase**

Input/Output Voltages: Reversible, allowing use of transformer in step-up or step-down application.

3 phase

WYE 120/208V: WYE 120/208V	**Suffix A**
WYE 120/208V: DELTA 220/240V	**Suffix B**
WYE 120/208V: DELTA 440V	**Suffix C**
DELTA 220/240V: DELTA 220/240V	**Suffix D**
DELTA 220/240V: DELTA 440V	**Suffix E**
DELTA 440V: DELTA 440V	**Suffix F**

Single phase (see schematic for various voltage combinations available through series/parallel connection.)

120/240V primary to 120/240 secondary	**Suffix H**
120/240V primary to 220/440V secondary	**Suffix K**

Input Frequency: 47-65 Hz

Dielectric Withstanding Voltage: 2000VRMS, 60HZ, for 1 minute.

Operating Ambient Temperature: 60 Degrees C Max.

Adjustable Voltage Taps: Allow adjustment of output voltage, (use of tap on primary side raises output approximately 5%.)

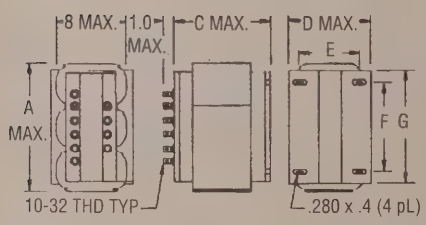
ORDER INSTRUCTIONS: FOLLOW EXAMPLE BELOW TO SPECIFY MODEL CONFIGURATION:

6H 5000 H

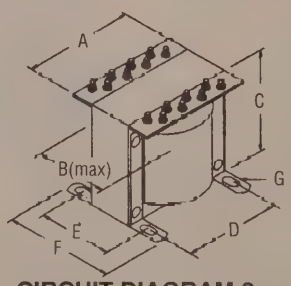
- 6H / 6J — Sgl. Phase 6H, 3 Phase 6J
- 5000 — Power (VA) (See Chart)
- H — Suffix (See Specification)

POWER (VA)	DIMENSIONS A	B	C	D	E	F	G	TYP. WT. (Lbs)
6H								
250	5.25	4.00	4.37	4.37	2.85	3.75	.26x.4	13
500	6.37	4.75	5.31	5.31	3.22	4.20	.26x.4	23
1000	7.50	5.50	6.25	6.75	3.60	4.85	.26x.4	36
2500	7.50	9.00	6.25	6.75	6.75	8.00	.26x.4	65
5000	9.00	9.75	8.00	8.00	4.88	6.00	.28x.56	90
10000	9.00	13.50	8.00	8.00	8.63	9.75	.28x.56	150
6J								
250	6.25	4.50	4.62	4.10	3.10	3.75	4.81	14
500	8.00	4.50	5.43	4.10	3.10	4.20	6.00	20
1000	9.50	5.50	6.78	5.60	4.36	5.24	7.50	48
2500	11.50	5.70	8.13	5.60	4.36	6.40	9.00	68
5000	11.50	7.70	8.13	7.60	6.36	6.40	9.00	105
10000	15.00	7.75	10.80	7.75	6.00	8.25	12.00	175
15000	15.00	9.00	10.80	9.00	7.25	8.25	12.00	205

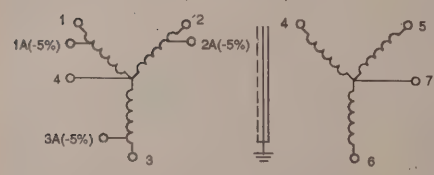
3 PHASE 6J



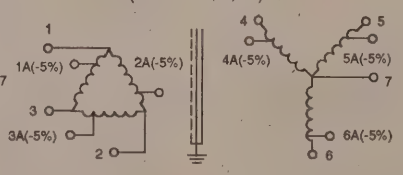
SINGLE PHASE 6H



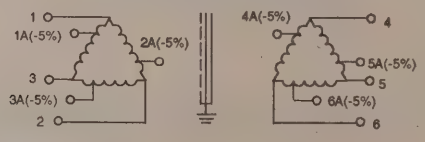
CIRCUIT DIAGRAM 1
(SUFFIX A)



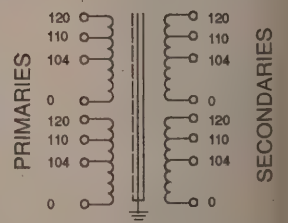
CIRCUIT DIAGRAM 2
(SUFFIX B, C)



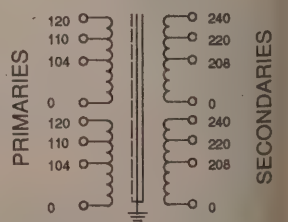
CIRCUIT DIAGRAM 3
(SUFFIX D, E, F)



CIRCUIT DIAGRAM 5
(SUFFIX K)



CIRCUIT DIAGRAM 4
(SUFFIX H)



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Abbott TECHNOLOGIES, INC.

60 Hz Industrial Transformers

OTHER STANDARD MODELS AVAILABLE TO 20KVA

MODEL 6B

SPECIFICATIONS

INPUT PRIMARY: 115 VAC standard. 230 VAC at 10% additional cost. Specify by suffixing "A" to model number. 115/230 VAC dual input at 10% additional cost. Specify by suffixing "B" to model number.

INPUT FREQUENCY: 50 to 400 Hz, 1 phase.

REGULATION: 15% Max. from no load to full load (6% on units size 8 and larger).

SECONDARY VOLTAGE TOLERANCE: Within 5% of listed output voltage when measured at full load and 115 VAC input.

INSULATION TEST: 1500 VAC.

OPERATING TEMPERATURE: 80°C maximum ambient (70°C on units size 8 and larger).

APPROXIMATE EFFICIENCY: Ranges from 80% to 90% typical.

CONSTRUCTION: Commercial grade using Silicon Iron for core and heavy insulated synthetic film magnet wire with class "B" rating impregnated with a high quality insulating varnish having a class "H" rating. Other outputs and/or inputs available on request.

Output Volts (F.L.)	Output Current (Amps) Parallel Connection	Output Current (Amps) Series Connection	Size	Weight Lbs. Typ.	Model Number
5V Parallel	2.0	1.0	1	1.2	6B5-10
10V C.T. Series	3.0	1.5	2	1.5	6B5-15
	6.0	3.0	3	2.2	6B5-30
	12.0	6.0	4	3.0	6B5-60
	18.0	9.0	5	4.3	6B5-90
	26.0	13.0	6	5.5	6B5-130
	32.0	16.0	7	7.0	6B5-160†
	60.0	30.0	8	13.0	6B5-300†
	100.0	50.0	9	23.0	6B5-500†
6.3V Parallel	1.60	0.80	1	1.2	6B6-10
12.6V C.T. Series	2.40	1.20	2	1.5	6B6-15
	4.80	2.40	3	2.2	6B6-30
	9.40	4.70	4	3.0	6B6-60
	14.4	7.20	5	4.3	6B6-90
	20.6	10.3	6	5.5	6B6-130
	25.4	12.7	7	7.0	6B6-160†
	48.0	24.0	8	13.0	6B6-300†
	95.0	47.5	9	23.0	6B6-600†
8V Parallel	1.20	0.60	1	1.2	6B8-10
16V C.T. Series	1.80	0.90	2	1.5	6B8-15
	3.60	1.80	3	2.2	6B8-30
	7.60	3.80	4	3.0	6B8-60
	11.2	5.60	5	4.3	6B8-90
	16.2	8.10	6	5.5	6B8-130
	20.0	10.0	7	7.0	6B8-160*
	37.5	18.75	8	13.0	6B8-300†
	75.0	37.50	9	23.0	6B8-600†
	100.0	50.0	10	26.0	6B8-800†
10V Parallel	1.0	0.5	1	1.2	6B10-10
20V C.T. Series	1.5	0.75	2	1.5	6B10-15
	3.0	1.5	3	2.2	6B10-30
	6.0	3.0	4	3.0	6B10-60
	9.0	4.5	5	4.3	6B10-90
	13.0	6.5	6	5.5	6B10-130
	16.0	8.0	7	7.0	6B10-160*
	30.0	15.0	8	13.0	6B10-300†
	60.0	30.0	9	23.0	6B10-600†
	85.0	42.5	10	26.0	6B10-850†
	100.0	50.0	11	36.0	6B10-1000†
12V Parallel	0.82	0.41	1	1.2	6B12-10
24V C.T. Series	1.24	0.62	2	1.5	6B12-15
	2.50	1.25	3	2.2	6B12-30
	5.0	2.50	4	3.0	6B12-60
	7.5	3.75	5	4.3	6B12-90
	10.82	5.41	6	5.5	6B12-130
	13.32	6.66	7	7.0	6B12-160*
	25.00	12.50	8	13.0	6B12-300†
	50.00	25.00	9	23.0	6B12-600†
	71.00	35.50	10	26.0	6B12-850†
	100.00	50.00	11	36.0	6B12-1200†

* Use Fig. 3 for layout †Use Fig. 4 for layout

SIZE	A	B	C	D	E	F	HOLE	FIG.
1	1.95	1.68	2.31	2.37	—	2.87	0.18	1
2	2.26	1.93	2.68	2.81	—	3.12	0.18	1
3	2.57	2.18	3.06	3.12	—	3.56	0.18	1
4	2.81	2.43	3.37	2.25	2.12	2.70	0.2 x 0.3	2
5	3.12	2.68	3.75	2.50	2.25	2.86	0.2 x 0.3	2
6	3.44	2.93	4.12	2.75	2.37	2.98	0.2 x 0.3	3
7	3.75	3.18	4.50	3.00	2.50	3.11	0.2 x 0.3	3
7A	4.50	3.18	3.75	3.75	2.50	3.11	0.26 x 0.4	4
8	5.25	3.87	4.37	4.37	2.85	3.75	0.26 x 0.4	3
8A	5.25	3.87	4.37	4.37	2.85	3.75	0.26 x 0.4	4
9	6.37	4.62	5.31	5.31	3.22	4.20	0.26 x 0.4	4 or 5
10	6.37	4.99	5.31	5.31	3.60	4.58	0.26 x 0.4	4 or 5
11	7.50	5.37	6.25	6.75	3.60	4.85	0.26 x 0.4	4

DIMENSIONAL TOLERANCE: ±0.06 except B is max.

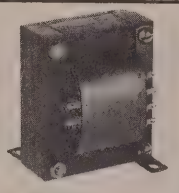


FIG. 1, 2, 3

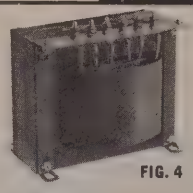
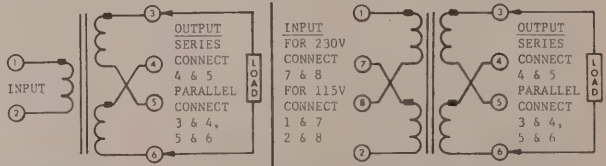


FIG. 4

Output Volts (F.L.)	Output Current (Amps) Parallel Connection	Output Current (Amps) Series Connection	Size	Weight Lbs. Typ.	Model Number
17V Parallel	0.58	0.29	1	1.2	6B17-10
34V C.T. Series	0.88	0.44	2	1.5	6B17-15
	1.76	0.88	3	2.2	6B17-30
	3.52	1.76	4	3.0	6B17-60
	5.28	2.64	5	4.3	6B17-90
	7.64	3.82	6	5.5	6B17-130
	9.40	4.70	7	7.0	6B17-160*
	17.65	8.8	8	13.0	6B17-300†
	35.00	17.5	9	23.0	6B17-600†
	50.00	25.00	10	26.0	6B17-850†
	76.5	38.25	11	36.0	6B17-1300†
20V Parallel	0.5	0.25	1	1.2	6B20-10
40V C.T. Series	0.74	0.37	2	1.5	6B20-15
	1.5	0.75	3	2.2	6B20-30
	3.0	1.5	4	3.0	6B20-60
	4.5	2.25	5	4.3	6B20-90
	6.5	3.25	6	5.5	6B20-130
	8.0	4.0	7	7.0	6B20-160*
	15.0	7.50	8	13.0	6B20-300*
	30.0	15.0	9	23.0	6B20-600†
	42.5	21.25	10	26.0	6B20-850†
	65.0	32.50	11	36.0	6B20-1300†
28V Parallel	0.36	0.18	1	1.2	6B28-10
56V C.T. Series	0.52	0.26	2	1.5	6B28-15
	1.06	0.53	3	2.2	6B28-30
	2.14	1.07	4	3.0	6B28-60
	3.20	1.60	5	4.3	6B28-90
	4.64	2.32	6	5.5	6B28-130
	5.70	2.85	7	7.0	6B28-160*
	10.70	5.35	8	13.0	6B28-300*
	21.43	10.71	9	23.0	6B28-600†
	30.36	15.18	10	26.0	6B28-850†
	46.42	23.21	11	36.0	6B28-1300†
44V Parallel	0.22	0.11	1	1.2	6B44-10
88V C.T. Series	0.34	0.17	2	1.5	6B44-15
	0.68	0.34	3	2.2	6B44-30
	1.36	0.68	4	3.0	6B44-60
	2.04	1.02	5	4.3	6B44-90
	2.94	1.47	6	5.5	6B44-130
	3.62	1.81	7	7.0	6B44-160*
	6.82	3.41	8	13.0	6B44-300*
	13.64	6.82	9	23.0	6B44-600*
	19.32	9.66	10	26.0	6B44-850*
	29.54	14.77	11	36.0	6B44-1300†
60V Parallel	0.16	0.08	1	1.2	6B60-10
120V C.T. Series	0.250	0.125	2	1.5	6B60-15
	0.50	0.25	3	2.2	6B60-30
	1.0	0.50	4	3.0	6B60-60
	1.5	0.75	5	4.3	6B60-90
	2.16	1.08	6	5.5	6B60-130
	2.66	1.33	7	7.0	6B60-160*
	5.00	2.50	8	13.0	6B60-300*
	10.00	5.00	9	23.0	6B60-600*
	14.16	7.08	10	26.0	6B60-850*
	21.67	10.83	11	36.0	6B60-1300†


INPUT
OUTPUT SERIES CONNECT 4 & 5 PARALLEL CONNECT 3 & 4, 5 & 6
LOAD
INPUT FOR 230V CONNECT 7 & 8 FOR 115V CONNECT 1 & 7 2 & 8
OUTPUT SERIES CONNECT 4 & 5 PARALLEL CONNECT 3 & 4, 5 & 6
LOAD

STANDARD & "A" OPTION "B" OPTION

"X" Option: Electrostatic shield grounded to mounting bracket. Add suffix "X" to model number, e.g., 6A5-10X.

MECHANICAL DRAWINGS

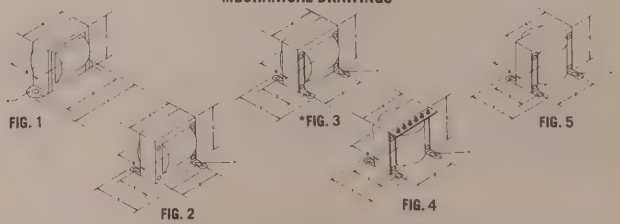


FIG. 1 FIG. 2 *FIG. 3 FIG. 4 FIG. 5

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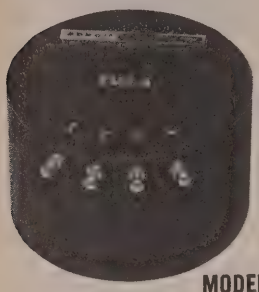
Abbott TECHNOLOGIES, INC

400 Hz MIL-T-27 and Industrial Toroid Transformers

MODELS TM TF

Now QPL!



MODEL TM
TF5S03ZZ

SPECIFICATIONS

INPUT PRIMARY: 115V, 400 Hz ±20 Hz, 1 phase; for 230V operation add the suffix "A"

REGULATION: 5% or less, no load to full load

SECONDARY VOLTAGE TOLERANCE: Within 5% when measured at full load and 115 VAC input

INSULATION TEST: 1000 VAC

OPERATING TEMPERATURE: MODEL TM 90°C maximum ambient/MODEL TF 80°C maximum ambient.

APPROXIMATE EFFICIENCY: 90% to 95% typical.

OUTPUT SECONDARY: See voltage and current of specific models listed

CONSTRUCTION: MODEL TF — Open frame, Industrial Grade with Teflon leads 6" long. MODEL TM — to meet MIL-T-27, Grade 5, Class S, MIL-type Designation TF5S03ZZ

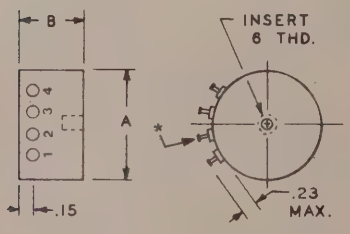
OPTIONS: "A" option is for 230V input primary. Add suffix "A" to model number (i.e. TF10-1A). "C" option is for center tapped output. Add suffix "C" to mode number (i.e. TF10-1C)

MODEL TF
Industrial Grade

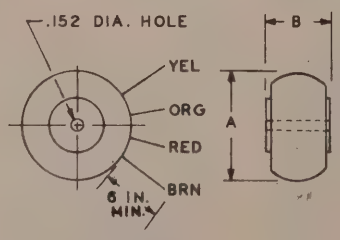
Output Volts (F.L.)	Model No. TM	Model No. TF	QPL No. (Style M only)	Output Current (Amps)	Size	VA
5V	TM1-1	TF1-1	M27/350-01	3.00	1	15
	TM1-2	TF1-2	M27/351-01	5.00	2	25
	TM1-3	TF1-3	M27/352-01	10.00	3	50
7V	TM2-1	TF2-1	M27/350-02	2.14	1	15
	TM2-2	TF2-2	M27/351-02	3.57	2	25
	TM2-3	TF2-3	M27/352-02	7.14	3	50
	TM2-4	TF2-4	M27/353-01	10.00	4	70
10V	TM3-1	TF3-1	M27/350-03	1.50	1	15
	TM3-2	TF3-2	M27/351-03	2.50	2	25
	TM3-3	TF3-3	M27/352-03	5.00	3	50
	TM3-4	TF3-4	M27/353-02	7.50	4	75
	TM3-5	TF3-5	M27/354-01	10.00	5	100
12V	TM4-1	TF4-1	M27/350-04	1.25	1	15
	TM4-2	TF4-2	M27/351-04	2.08	2	25
	TM4-3	TF4-3	M27/352-04	4.17	3	50
	TM4-4	TF4-4	M27/353-03	6.25	4	75
	TM4-5	TF4-5	M27/354-02	8.33	5	100
14V	TM5-1	TF5-1	M27/350-05	1.07	1	15
	TM5-2	TF5-2	M27/351-05	1.79	2	25
	TM5-3	TF5-3	M27/352-05	3.57	3	50
	TM5-4	TF5-4	M27/353-04	5.36	4	75
	TM5-5	TF5-5	M27/354-03	7.14	5	100
17V	TM6-1	TF6-1	M27/350-06	0.88	1	15
	TM6-2	TF6-2	M27/351-06	1.47	2	25
	TM6-3	TF6-3	M27/352-06	2.94	3	50
	TM6-4	TF6-4	M27/353-05	4.41	4	75
	TM6-5	TF6-5	M27/354-04	5.88	5	100

Output Volts (F.L.)	Model No. TM	Model No. TF	QPL No. (Style M only)	Output Current (Amps)	Size	VA
24V	TM7-1	TF7-1	M27/350-07	0.63	1	15
	TM7-2	TF7-2	M27/351-07	1.04	2	25
	TM7-3	TF7-3	M27/352-07	2.08	3	50
	TM7-4	TF7-4	M27/353-06	3.13	4	75
	TM7-5	TF7-5	M27/354-05	4.17	5	100
26V	TM7.5-1	TF7.5-1	M27/350-11	0.58	1	15
	TM7.5-2	TF7.5-2	M27/351-11	0.96	2	25
	TM7.5-3	TF7.5-3	M27/352-11	1.92	3	50
	TM7.5-4	TF7.5-4	M27/353-10	2.88	4	75
	TM7.5-5	TF7.5-5	M27/354-09	3.85	5	100
28V	TM8-1	TF8-1	M27/350-08	0.54	1	15
	TM8-2	TF8-2	M27/351-08	0.89	2	25
	TM8-3	TF8-3	M27/352-08	1.79	3	50
	TM8-4	TF8-4	M27/353-07	2.68	4	75
	TM8-5	TF8-5	M27/354-06	3.57	5	100
34V	TM9-1	TF9-1	M27/350-09	0.44	1	15
	TM9-2	TF9-2	M27/351-09	0.75	2	25
	TM9-3	TF9-3	M27/352-09	1.47	3	50
	TM9-4	TF9-4	M27/353-08	2.21	4	75
	TM9-5	TF9-5	M27/354-07	2.94	5	100
115V	TM10-1	TF10-1	M27/350-10	0.13	1	15
	TM10-2	TF10-2	M27/351-10	0.21	2	25
	TM10-3	TF10-3	M27/352-10	0.43	3	50
	TM10-4	TF10-4	M27/353-09	0.65	4	75
	TM10-5	TF10-5	M27/354-08	0.87	5	100

NEW 26V models available. Contact our nearest office for complete information.

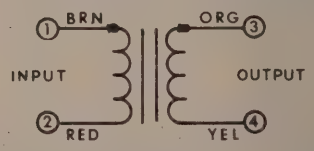


MODEL TM



MODEL TF

STANDARD & OPTION A



OPTION C

SIZE	1		2		3		4		5	
MODEL	TM	TF	TM	TF	TM	TF	TM	TF	TM	TF
DIM A	1.62	1.50	1.75	1.63	2.13	2.00	2.13	2.00	2.38	2.25
DIM B	0.95	0.95	1.00	1.00	1.10	1.10	1.30	1.30	1.60	1.60
WT. (LB. MAX.)	0.26	0.17	0.33	0.25	0.52	0.38	0.66	0.52	1.1	0.79
INSERT	6-32	—	8-32	—	8-32	—	10-32	—	10-32	—

DIMENSIONAL TOLERANCE: Model TM ±.03; Model TF Dim A, B Max.
*Terminal Spacing is 0.35.

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Abbott TECHNOLOGIES, INC.

400 Hz MIL-T-27 Transformers

MODEL E

SPECIFICATIONS

Input Primary:
115 VAC, 400 Hz ± 20 Hz, 1 phase.

Regulation:
10% no load to full load. (12% for 2E models)

Secondary Voltage Tolerance: Within 5% when measured at full load and 11 VAC input

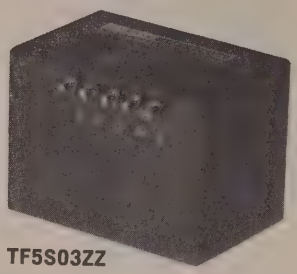
Construction:
To MIL-T-27, Grade 5, Class S Molded Daillyl Phthalate (Low Outgassing)

Environment:
Encapsulated to meet MIL-STD-810, including vibration, ambient temperature to 85°C, shock, sand, dust, humidity, saltspray, fungus, sunshine, rain, explosion, and altitude (to a vacuum).

Secondary:
See output voltage and current of specific models listed.

Other models are available. Contact our nearest office for complete information.

Now QPL!



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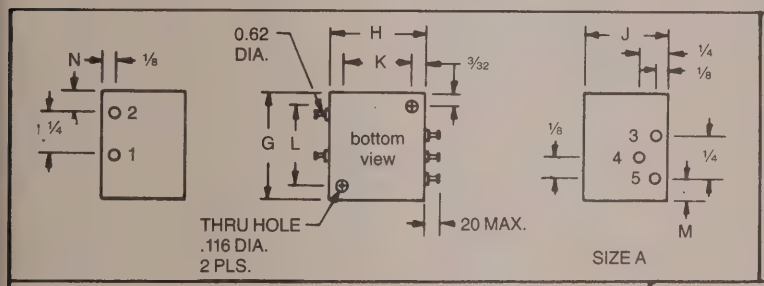

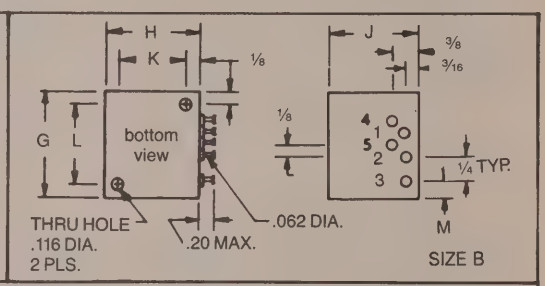

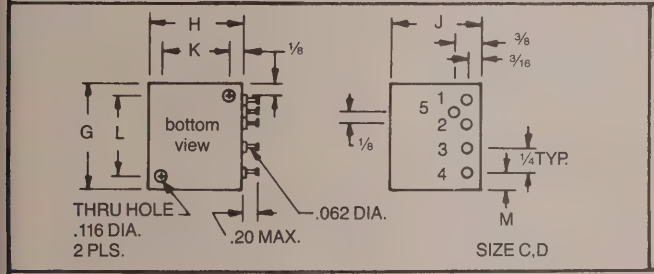

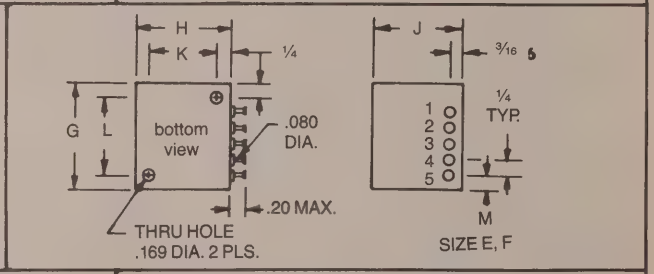

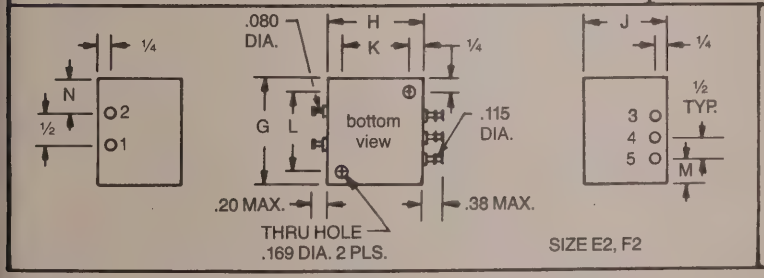

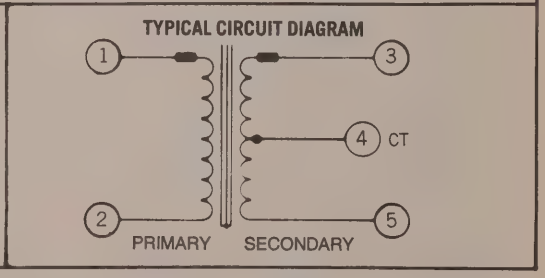

Size	G	H	J	K	L	M	N
A	.87	.74	.78	.55	.68	3/16	3/16
B	1.25	1.19	.88	.94	1.00	1/4	—
C	1.43	1.24	1.27	.99	1.18	1/4	—
D	1.47	1.28	1.40	1.03	1.22	1/4	—
E	2.31	1.52	1.75	1.02	1.81	1/2	—
E2	2.31	1.52	1.75	.102	1.81	1/2	3/4
F	2.75	2.71	2.31	2.21	2.25	3/4	—
F2	2.75	2.71	2.31	2.21	2.25	3/4	1

Dim. Tol. =
Fraction ± 1/32,
xx = ±0.015,
xxx = ±0.005

NOTE:
DIMENSIONS G & H MEASURED ATTOP OF TRANSFORMER

MODEL TYPE	WEIGHT lbs. (max)	PRIMARY DCR ohms (typical)
2E	0.06	201
6E	0.15	61
15E	0.28	14
24E	0.32	12
80E	0.80	2.0
175E	2.2	0.7

ABBOTT TECHNOLOGIES, INC.
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Abbott TECHNOLOGIES, INC

400 Hz MIL-T-27 Transformers

MODEL E

Output Volts	Output Current (Amps)	Size	Secondary DCR ohms	Model Number	QPL No.
5.0	0.400	A	0.60	2E5CT	M27/338-01
	1.200	B	0.173	6E5CT	M27/339-01
	3.000	C	0.046	15E5CT	M27/340-01
	4.800	D	0.040	24E5CT	M27/341-01
	16.000	E2	0.009	80E5CT	M27/342-01
	35.000	F2	0.012	175E5CT	M27/343-01
6.3	0.317	A	1.06	2E6.3CT	M27/338-02
	0.950	B	0.24	6E6.3CT	M27/339-02
	2.380	C	0.088	15E6.3CT	M27/340-02
	3.800	D	0.107	24E6.3CT	M27/341-02
	12.800	E2	0.016	80E6.3CT	M27/342-02
	27.800	F2	0.019	175E6.3CT	M27/343-02
8.0	0.250	A	1.63	2E8CT	M27/338-03
	0.750	B	0.396	6E8CT	M27/339-03
	1.880	C	0.135	15E8CT	M27/340-03
	3.000	D	0.140	24E8CT	M27/341-03
	10.000	E2	0.017	80E8CT	M27/342-03
	22.000	F2	0.010	175E8CT	M27/343-03
10.0	0.200	A	2.50	2E10CT	M27/338-04
	0.600	B	0.587	6E10CT	M27/339-04
	1.500	C	0.27	15E10CT	M27/340-04
	2.400	D	0.180	24E10CT	M27/341-04
	8.000	E	7.2	80E10CT	M27/342-04
	17.500	F2	0.020	175E10CT	M27/343-04
12.6	0.158	A	4.10	2E12.6CT	M27/338-05
	0.475	B	0.99	6E12.6CT	M27/339-05
	1.180	C	0.32	15E12.6CT	M27/340-05
	1.900	D	0.225	24E12.6CT	M27/341-05
	6.350	E	0.030	80E12.6CT	M27/342-05
	13.900	F2	0.021	175E12.6CT	M27/343-05
14.0	0.142	A	5.59	2E14CT	M27/338-06
	0.428	B	1.11	6E14CT	M27/339-06
	1.070	C	0.35	15E14CT	M27/340-06
	1.720	D	0.32	24E14CT	M27/341-06
	5.600	E	0.04	80E14CT	M27/342-06
	12.500	F2	0.022	175E14CT	M27/343-06
16	0.125	A	6.63	2E16CT	M27/338-07
	0.375	B	1.58	6E16CT	M27/339-07
	0.940	C	0.54	15E16CT	M27/340-07
	1.500	D	0.35	24E16CT	M27/341-07
	5.000	E	0.05	80E16CT	M27/342-07
	10.900	F2	0.025	175E16CT	M27/343-07
18	0.111	A	9.00	2E18CT	M27/338-08
	0.333	B	2.21	6E18CT	M27/339-08
	0.832	C	0.74	15E18CT	M27/340-08
	1.330	D	0.40	24E18CT	M27/341-08
	4.450	E	0.08	80E18CT	M27/342-08
	9.700	F	0.027	175E18CT	M27/343-08
20	0.100	A	10.9	2E20CT	M27/338-09
	0.300	B	2.78	6E20CT	M27/339-09
	0.750	C	1.4	15E20CT	M27/340-09
	1.200	D	0.48	24E20CT	M27/341-09
	4.000	E	0.09	80E20CT	M27/342-09
	8.750	F	0.020	175E20CT	M27/343-09
22	0.091	A	14.6	2E22CT	M27/338-10
	0.273	B	2.80	6E22CT	M27/339-10
	0.680	C	0.92	15E22CT	M27/340-10
	1.090	D	0.63	24E22CT	M27/341-10
	3.630	E	0.12	80E22CT	M27/342-10
	7.900	F	0.020	175E22CT	M27/343-10
25	0.080	A	20.40	2E25CT	M27/338-11
	0.240	B	3.60	6E25CT	M27/339-11
	0.600	C	1.30	15E25CT	M27/340-11
	0.960	D	0.68	24E25CT	M27/341-11
	3.200	E	0.13	80E25CT	M27/342-11
	7.000	F	0.042	175E25CT	M27/343-11
26	0.077	A	21.22	2E26CT	M27/338-27
	0.231	B	3.74	6E26CT	M27/339-31
	0.577	C	1.35	15E26CT	M27/340-31
	0.923	D	0.71	24E26CT	M27/341-31
	3.08	E	0.14	80E26CT	M27/342-31
	6.73	F	0.044	175E26CT	M27/343-31
28	0.071	A	30.0	2E28CT	M27/338-12
	0.214	B	4.20	6E28CT	M27/339-12
	0.535	C	1.83	15E28CT	M27/340-12
	0.855	D	0.98	24E28CT	M27/341-12
	2.850	E	0.14	80E28CT	M27/342-12
	6.250	F	0.043	175E28CT	M27/343-12
31	0.064	A	25.6	2E31CT	M27/338-13
	0.192	B	5.71	6E31CT	M27/339-13
	0.485	C	1.62	15E31CT	M27/340-13
	0.772	D	1.27	24E31CT	M27/341-13
	2.470	E	0.18	80E31CT	M27/342-13
	5.650	F	0.061	175E31CT	M27/343-13
35	0.057	A	29.5	2E35CT	M27/338-14
	0.171	B	6.89	6E35CT	M27/339-14
	0.428	C	2.28	15E35CT	M27/340-14
	0.685	D	1.70	24E35CT	M27/341-14
	2.280	E	0.28	80E35CT	M27/342-14
	5.000	F	0.098	175E35CT	M27/343-14
39	0.051	A	38.6	2E39CT	M27/338-15
	0.154	B	9.39	6E39CT	M27/339-15
	0.384	C	2.54	15E39CT	M27/340-15
	0.615	D	2.20	24E39CT	M27/341-15
	2.050	E	0.32	80E39CT	M27/342-15
	4.480	F	0.110	175E39CT	M27/343-15
43	0.046	A	44.3	2E43CT	M27/338-16
	0.139	B	10.25	6E43CT	M27/339-16
	0.348	C	2.85	15E43CT	M27/340-16
	0.556	D	2.42	24E43CT	M27/341-16
	1.860	E	0.35	80E43CT	M27/342-16
	4.060	F	0.114	175E43CT	M27/343-16
48	0.041	A	57.0	2E48CT	M27/338-17
	0.125	B	15.30	6E48CT	M27/339-17
	0.312	C	4.05	15E48CT	M27/340-17
	0.500	D	3.27	24E48CT	M27/341-17
	1.660	E	0.40	80E48CT	M27/342-17
	3.650	F	0.160	175E48CT	M27/343-17
55	0.036	A	89.0	2E55CT	M27/338-18
	0.109	B	17.30	6E55CT	M27/339-18
	0.262	C	7.2	15E55CT	M27/340-18
	0.435	D	3.83	24E55CT	M27/341-18
	1.450	E	0.67	80E55CT	M27/342-18
	3.170	F	0.196	175E55CT	M27/343-18
63	0.031	A	100.0	2E63CT	M27/338-19
	0.095	B	24.9	6E63CT	M27/339-19
	0.238	C	6.51	15E63CT	M27/340-19
	0.380	D	5.35	24E63CT	M27/341-19
	1.270	E	0.71	80E63CT	M27/342-19
	2.770	F	0.20	175E63CT	M27/343-19
70	0.028	A	139.0	2E70CT	M27/338-20
	0.085	B	27.1	6E70CT	M27/339-20
	0.214	C	9.4	15E70CT	M27/340-20
	0.342	D	8.10	24E70CT	M27/341-20
	1.140	E	0.80	80E70CT	M27/342-20
	2.500	F	0.25	175E70CT	M27/343-20
80	0.025	A	163.0	2E80CT	M27/338-21
	0.075	B	39.0	6E80CT	M27/339-21
	0.198	C	13.4	15E80CT	M27/340-21
	0.300	D	9.0	24E80CT	M27/341-21
	1.000	E	0.92	80E80CT	M27/342-21
	2.180	F	0.34	175E80CT	M27/343-21
90	0.022	A	218.0	2E90CT	M27/338-22
	0.067	B	41.0	6E90CT	M27/339-22
	0.166	C	15.9	15E90CT	M27/340-22
	0.267	D	12.5	24E90CT	M27/341-22
	0.890	E	1.08	80E90CT	M27/342-22
	1.940	F	0.38	175E90CT	M27/343-22
100	0.020	A	283.0	2E100CT	M27/338-23
	0.060	B	59.5	6E100CT	M27/339-23
	0.150	C	16.8	15E100CT	M27/340-23
	0.240	D	14.4	24E100CT	M27/341-23
	0.800	E	1.64	80E100CT	M27/342-23
	1.750	F	0.52	175E100CT	M27/343-23
110	0.018	A	392.0	2E110CT	M27/338-24
	0.054	B	62.3	6E110CT	M27/339-24
	0.136	C	22.1	15E110CT	M27/340-24
	0.218	D	19.5	24E110CT	M27/341-24
	0.728	E	2.03	80E110CT	M27/342-24
	1.590	F	0.72	175E110CT	M27/343-24
115	0.017	A	410.00	2E115CT	M27/338-28
	0.052	B	65.10	6E115CT	M27/339-32
	0.130	C	23.10	15E115CT	M27/340-32
	0.209	D	20.40	24E115CT	M27/341-32
	0.696	E	2.12	80E115CT	M27/342-32
	1.520	F	0.72	175E115CT	M27/343-32
123	0.016	A	495.00	2E123CT	M27/338-25
	0.048	B	96.00	6E123CT	M27/339-25
	0.122	C	30.70	15E123CT	M27/340-25
	0.195	D	21.90	24E123CT	M27/341-25
	0.650	E	2.35	80E123CT	M27/342-25
	1.420	F	0.81	175E123CT	M27/343-25
138	0.014	A	550.00	2E138CT	M27/338-26
	0.043	B	133.00	6E138CT	M27/339-26
	0.108	C	36.00	15E138CT	M27/340-26
	0.174	D	30.30	24E138CT	M27/341-26
	0.580	E	3.17	80E138CT	M27/342-26
	1.260	F	1.14	175E138CT	M27/343-26
157	0.038	B	153.00	6E157CT	M27/339-27
	0.095	C	53.00	15E157CT	M27/340-27
	0.152	D	36.10	24E157CT	M27/341-27
	0.508	E	3.60	80E157CT	M27/342-27
	1.100	F	1.31	175E157CT	M27/343-27
175	0.034	B	168.00	6E175CT	M27/339-28
	0.085	C	56.00	15E175CT	M27/340-28
	0.136	D	49.50	24E175CT	M27/341-28
	0.455	E	5.50	80E175CT	M27/342-28
	1.000	F	1.87	175E175CT	M27/343-28
200	0.030	B	248.00	6E200CT	M27/339-29
	0.071	C	65.00	15E200CT	M27/340-29
	0.120	D	57.00	24E200CT	M27/341-29
	0.400	E	5.60	80E200CT	M27/342-29
	1.875	F	2.65	175E200CT	M27/343-29
220	0.027	B	278.00	6E220CT	M27/339-30
	0.068	C	91.50	15E220CT	M27/340-30
	0.109	D	79.00	24E220CT	M27/341-30
	0.364	E	8.10	80E220CT	M27/342-30
	0.790	F	2.92	175E220CT	M27/343-30
250	0.024	B	407.00	6E250CT	N/A
	0.060	C	141.00	15E250CT	N/A
	0.096	D	114.00	24E250CT	N/A
	0.320	E	11.20	80E250CT	N/A
	0.700	F	3.95	175E250CT	N/A
275	0.021	B	417.00	6E275CT	N/A
	0.054	C	146.00	15E275CT	N/A
	0.087	D	120.00	24E275CT	N/A
	0.290	E	13.60	80E275CT	N/A
	0.635	F	4.65	175E275CT	N/A
310	0.019	B	592.00	6E310CT	N/A
	0.048	C	160.00	15E310CT	N/A
	0.077	D	180.00	24E310CT	N/A
	0.256	E	14.10	80E310CT	N/A
	0.565	F	6.80	175E310CT	N/A
350	0.017	B	680.00	6E350CT	N/A
	0.042	C	232.00	15E350CT	N/A
	0.068	D	200.00	24E350CT	N/A
	0.217	E	21.20	80E350CT	N/A
	0.500	F	8.00	175E350CT	N/A
387	0.038	C	310.00	15E387CT	N/A
	0.062	D	225.00	24E387CT	N/A
	0.206	E	22.70	80E387CT	N/A
	0.450	F	10.00	175E387CT	N/A
433	0.034	C	457.00	15E433CT	N/A
	0.055	D	300.00	24E433CT	N/A
	0.184	E	31.60	80E433CT	N/A
	0.404	F	11.20	175E433CT	N/A
486	0.049	D	340.00	24E486CT	N/A
	0.164	E	35.60	80E486CT	N/A
	0.360	F	16.00	175E486CT	N/A

Other standard models to 1000 Volts are available. Contact our nearest office for complete information.
*QPL Testing underway.

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Abbott TECHNOLOGIES, INC

400 Hz MIL-T-27 Transformers

MODEL 4A

SPECIFICATIONS

INPUT PRIMARY: 115 V, 400 Hz ±20 Hz, 1 Phase.

"A" Option: 230 V ac. Add suffix "A" to model number, e.g., 4A5-50A.

"X" Option: Electrostatic shield grounded to core. Add "X" to model number, e.g., 4A5-50X.

REGULATION: 10% no load to full load.

SECONDARY VOLTAGE TOLERANCE: Within 5% when measured at full load and 115 VAC input.

INSULATION TEST: 1500 VAC.

OPERATING TEMP.: 95°C maximum ambient temperature.

CONSTRUCTION: To MIL-T-27, Grade 5, Class S, life "X", (10,000 hrs.)

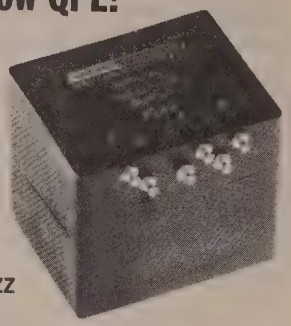
EFFICIENCY: From 90% to 93% typical.

ENVIRONMENT: Encapsulated to meet MIL-STD-810 for vibration, shock, sand, dust, humidity, salt spray, fungus, sunshine, rain, explosion, and altitude (to a vacuum). NOTE: for high altitude operation, encapsulate terminals.

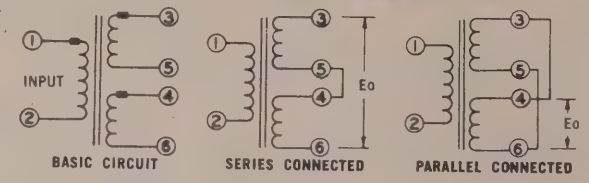
OPTIONS AVAILABLE: Other output voltages and 230 VAC input are available. Please consult our nearest office for complete information.

Output Volts (F.L.)	Output Current (Amps) Parallel Connection	Output Current (Amps) Series Connection	Size	Weight Lbs. Typ.	Model Number	QPL Number
5V Parallel	1.40	0.70	1	0.26	4A5-7	M27/332-01
10V C.T.	2.00	1.00	2	0.30	4A5-10	M27/333-01
Series	5.00	2.50	3	0.47	4A5-25	M27/334-01
	8.00	4.00	4	0.77	4A5-40	M27/335-01
	24.0	12.0	5	1.6	4A5-120	M27/336-01
	30.0	15.0	6	2.0	4A5-150	M27/337-01
6.3V Parallel	1.11	0.55	1	0.26	4A6-7	M27/332-02
12.6V C.T.	1.58	0.79	2	0.30	4A6-10	M27/333-02
Series	4.00	2.00	3	0.47	4A6-25	M27/334-02
	8.00	4.00	4	0.77	4A6-50	M27/335-02
	19.0	9.50	5	1.6	4A6-120	M27/336-02
	23.8	11.9	6	2.0	4A6-150	M27/337-02
	*31.70	15.85	7	2.2	4A6-200	
8V Parallel	0.87	0.43	1	0.26	4A8-7	M27/332-03
16V C.T.	1.25	0.62	2	0.30	4A8-10	M27/333-03
Series	3.12	1.56	3	0.47	4A8-25	M27/334-03
	6.24	3.12	4	0.77	4A8-50	M27/335-03
	15.0	7.50	5	1.6	4A8-120	M27/336-03
	18.7	9.35	6	2.0	4A8-150	M27/337-03
	*25.00	12.50	7	2.2	4A8-200	
10V Parallel	0.70	0.35	1	0.26	4A10-7	M27/332-04
20V C.T.	1.00	0.50	2	0.30	4A10-10	M27/333-04
Series	2.50	1.25	3	0.47	4A10-25	M27/334-04
	5.00	2.50	4	0.77	4A10-50	M27/335-04
	12.0	6.00	5	1.6	4A10-120	M27/336-04
	15.0	7.50	6	2.0	4A10-150	M27/337-04
	*20.00	10.00	7	2.2	4A10-200	
12V Parallel	0.58	0.29	1	0.26	4A12-7	M27/332-05
24V C.T.	0.84	0.42	2	0.30	4A12-10	M27/333-05
Series	2.08	1.04	3	0.47	4A12-25	M27/334-05
	4.16	2.08	4	0.77	4A12-50	M27/335-05
	10.0	5.00	5	1.6	4A12-120	M27/336-05
	12.5	6.25	6	2.0	4A12-150	M27/337-05
	*16.7	8.35	7	2.2	4A12-200	
17V Parallel	0.41	0.20	1	0.26	4A17-7	M27/332-06
34V C.T.	0.58	0.29	2	0.30	4A17-10	M27/333-06
Series	1.47	0.73	3	0.47	4A17-25	M27/334-06
	2.94	1.47	4	0.77	4A17-50	M27/335-06
	7.06	3.53	5	1.6	4A17-120	M27/336-06
	8.82	4.41	6	2.0	4A17-150	M27/337-06
	*11.80	5.90	7	2.2	4A17-200	
20V Parallel	0.35	0.17	1	0.26	4A20-7	M27/332-07
40V C.T.	0.50	0.25	2	0.30	4A20-10	M27/333-07
Series	1.25	0.62	3	0.47	4A20-25	M27/334-07
	2.50	1.25	4	0.77	4A20-50	M27/335-07
	6.00	3.00	5	1.6	4A20-120	M27/336-07
	7.50	3.75	6	2.0	4A20-150	M27/337-07
	*10.00	5.00	7	2.2	4A20-200	
28V Parallel	0.25	0.12	1	0.26	4A28-7	M27/332-08
56V C.T.	0.35	0.17	2	0.30	4A28-10	M27/333-08
Series	0.89	0.44	3	0.47	4A28-25	M27/334-08
	1.78	0.89	4	0.77	4A28-50	M27/335-08
	4.28	2.14	5	1.6	4A28-120	M27/336-08
	5.36	2.68	6	2.0	4A28-150	M27/337-08
	*7.14	3.57	7	2.2	4A28-200	
44V Parallel	0.15	0.07	1	0.26	4A44-7	M27/332-09
88V C.T.	0.22	0.11	2	0.36	4A44-10	M27/333-09
Series	0.56	0.28	3	0.47	4A44-25	M27/334-09
	1.12	0.56	4	0.77	4A44-50	M27/335-09
	2.72	1.36	5	1.6	4A44-120	M27/336-09
	3.40	1.70	6	2.0	4A44-150	M27/337-09
	*4.54	2.27	7	2.2	4A44-200	
60V Parallel	0.11	0.05	1	0.26	4A60-7	M27/332-10
120V C.T.	0.16	0.08	2	0.30	4A60-10	M27/333-10
Series	0.41	0.20	3	0.47	4A60-25	M27/334-10
	0.82	0.41	4	0.77	4A60-50	M27/335-10
	2.00	1.00	5	1.6	4A60-120	M27/336-10
	2.50	1.25	6	2.0	4A60-150	M27/337-10
	*3.53	1.66	7	2.2	4A60-200	

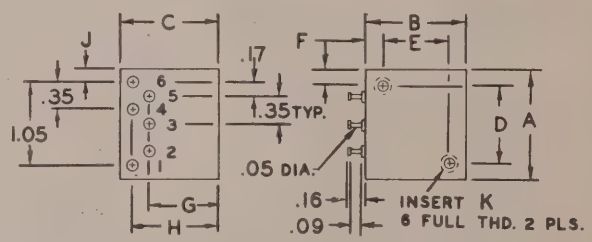
Now QPL!



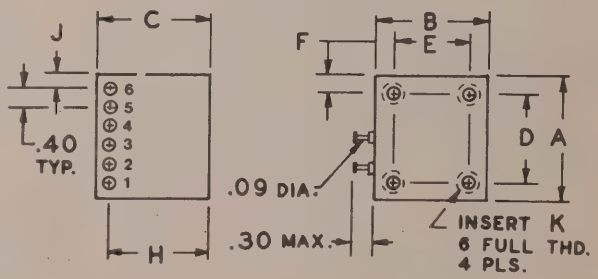
TF5S03ZZ



"X" Option: Electrostatic shield grounded to core. Add "X" to model number, e.g., 4A5-50X.



SIZES 1,2,3,4



SIZES 5,6,7

Size	A	B	C	D	E	F	G	H	J	K
1	1.37	1.25	1.31	1.00	.87	.19	1.00	1.19	.16	4-40
2	1.50	1.37	1.37	1.12	1.00	.19	1.06	1.25	.22	4-40
3	1.75	1.50	1.56	1.25	1.00	.25	1.25	1.44	.35	6-32
4	2.00	1.62	1.81	1.50	1.12	.25	1.50	1.69	.47	6-32
5	2.43	2.00	2.10	1.93	1.50	.25	—	1.90	.21	6-32
6	2.81	2.12	2.43	2.21	1.52	.30	—	2.23	.40	8-32
7	2.81	2.25	2.43	2.21	1.65	.30	—	2.23	.40	8-32

Tolerance: ±.02 except F, G, H, J: ±.04.

Note: NEW models available to 200 VA. Contact our nearest office for complete information.

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Abbott TECHNOLOGIES, INC

400 Hz MIL-T-27 Power Transformers

MODEL 4C

- **Military Designation No. TF5S03ZZ**
- **Rugged construction for high shock and extreme environments**
- **High-temperature operation**
- **Designed for airborne, missile use**

Specifications:

Input Primary: 115VAC, 380-1000 Hz, 1 phase

Regulation: 10% or less, (+/- 4% voltage adjust taps - select models, typical), no load to full load.

Secondary Voltage Tolerance: Within 5% when measured at full load and 115 VAC input.

Dielectric Withstanding Voltage: 1500 VRMS

Efficiency: Ranges from 68% to 96% typical

Operating Ambient Temperature: 85 deg. C maximum ambient temperature. 130 deg. C maximum operating temperature.

Construction: To MIL-T-27, Grade 5, Class S.

Environment: MIL-STD 810C, including vibration, shock, sand, dust, humidity, saltspray, fungus, sunshine, rain, explosion, and altitude (to a vacuum).

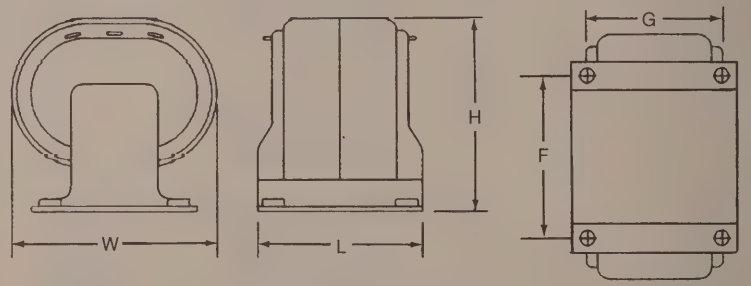
Output Secondary: See voltage and current of specific models listed.

Other outputs and/or inputs available upon request.

SIZE	OVERALL DIMENSIONS (NOTE 4)			MTG. DIMENSIONS		APP. WT.	MTG. METH.
	L	W	H	F	G	(LBS)	
SM 3	1.00	1.25	1.19	1.00	Note 1	.06	Note 1
SM 2	1.50	1.25	1.69	1.00	Note 1	.10	Note 1
SM 1	1.50	1.50	1.69	1.13	Note 1	.16	Note 1
1 A	1.69	1.53	1.81	1.16	1.13	.25	Note 2
2	2.00	1.94	2.13	1.28	1.25	.40	Note 2
3	2.31	1.81	2.13	1.28	1.44	.45	Note 2
35	2.06	2.38	2.19	1.53	1.69	.70	Note 2
4	2.31	2.38	2.56	1.53	1.69	.90	Note 2
5	2.75	2.38	2.88	1.53	2.19	1.20	Note 2
6	2.75	2.63	3.13	1.53	2.19	1.50	Note 2
7	3.00	2.88	3.38	1.78	2.5	2.00	Note 2
8	3.38	2.88	3.38	1.78	2.5	2.50	Note 2
9	4.06	3.38	3.88	2.19	3.50	5.00	Note 3
10	4.50	3.94	3.94	2.75	3.13	6.00	Note 3

Note 1 — SM series are two hole mounting with holes on center line. #4-40 Pem nuts are fastened to the bracket.
Note 2 — #6-32 Pem nuts on bracket are standard.
Note 3 — #8-32 Pem nuts on bracket are standard.
Note 4 — Overall dimensions approximate; given for reference only.
Note 5 — MTG dimensions tolerance ± .010

- All primaries 380-1000 cps
- Dielectric test voltages:
  PRIMARIES 1500 Volts RMS
  SECONDARIES 1500 Volts RMS
- Encapsulant: filled semi-rigid, cycloaliphatic epoxy resin.



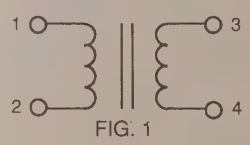


FIG. 1

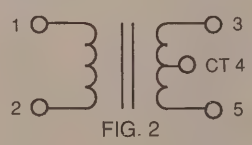


FIG. 2

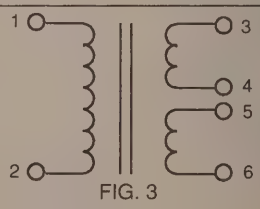


FIG. 3

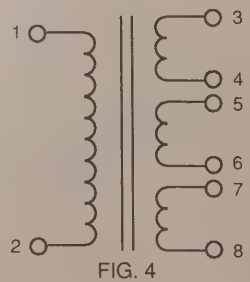
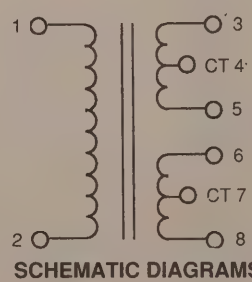


FIG. 4



SCHEMATIC DIAGRAMS

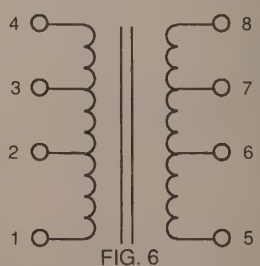


FIG. 6

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Abbott TECHNOLOGIES, INC.

400 Hz MIL-T-27 Power Transformers

MODEL 4C

VA	Schematic Diagram	Model No.	Secondary Volts	Secondary Amps	Insulation Volts (RMS)	Primary Volts	Size
5	2	4C1	6.3CT	0.8	1500	115	SM3
7.6	2	4C2	6.3CT	1.2	1500	115	SM2
43	2	4C3	6.3CT	6.8	1500	110/115/120	2
48	3	4C4	6.3	4.9	1500	115	3
			6.3	2.7			
45.4	2	4C5	6.3CT	7.2	1500	115	35
98	4	4C6	6.3	7	1500	120	35
			6.3	7	1500		
			6.3	1.5	1500		
88	5	4C7	6.3CT	7	1500	120	4
			6.3CT	7			
106	4	4C8	6.3	13.7	1500	115	4
			6.3	2.9	1500		
			6.3	0.3	1500		
77.5	2	4C9	6.3CT	12.3	1500	115	5
48	4	4C11	6.3	2.4	1500	115	3
			6.3	2.4	1500		
			6.3	2.4	1500		
12.6	2	4C26	6.3CT	2	1500	115	SM1
18.9	2	4C27	6.3CT	3	1500	115	1A
31.5	2	4C28	6.3CT	5	1500	115	2
15	2	4C29	5CT	3	2500	115	SM1
30	2	4C30	5CT	6	2500	115	2
102	2	4C31	8.5CT	12	1500	115	5
196	2	4C32	8.5CT	23	1500	115	7
298	2	4C33	8.5CT	35	1500	115	8
383	2	4C34	8.5CT	45	1500	115	9
42.3	1	4C12	14.1	3	1500	115	3
12	2	4C10	20CT	0.6	1500	115	SM1
95	2	4C35	21CT	4.5	1500	115	5
189	2	4C13	21CT	9	1500	115	7
378	2	4C36	21CT	18	1500	115	9
504	2	4C37	21 CT	24	1500	115	10
96	2	4C38	24 CT	4	1500	115	5
192	2	4C39	24 CT	8	1500	115	7
384	2	4C40	24 CT	16	1500	115	9
504	2	4C41	24 CT	21	1500	115	10
13	1	4C14	26	0.5	1500	115	SM1
39	2	4C15	26 CT	1.5	1500	115	3
78	2	4C23	26 CT	3	1500	115	4
130	2	4C24	26 CT	5	1500	115	6
66.5	5	4C16	28 CT	0.8	1500	115	3
			6.3CT	7			
94.3	2	4C42	41 CT	2.3	1500	115	5
185	2	4C43	41 CT	4.5	1500	115	7
369	2	4C44	41 CT	9	1500	115	9
492	2	4C45	41 CT	12	1500	115	10
96	2	4C46	48 CT	2	1500	115	5
192	2	4C47	48 CT	4	1500	115	7
384	2	4C48	48 CT	8	1500	115	9
480	2	4C49	48 CT	10	1500	115	10
104	2	4C25	52 CT	2	1500	115	5
10.4	2	4C17	52 CT	0.2	1500	115	SM1
405	2	4C18	90 CT	4.5	1500	115	9
5.8	1	4C19	115	.05	1500	115	SM2
322	1	4C21	115	2.8	1500	115	8
50	6	4C20	105/115/125	0.4	1500	105/115/125	2
125	6	4C50	105/115/125	1	1500	105/115/125	6
300	6	4C51	105/115/125	2.4	1500	105/115/125	8
400	6	4C52	105/115/125	3.2	1500	105/115/125	9
500	6	4C53	105/115/125	4	1500	105/115/125	10
8.4	1	4C22	334	.025	1500	115	SM1

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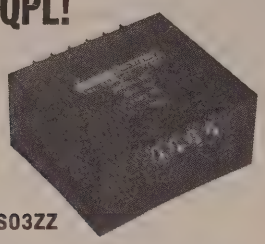
Abbott TECHNOLOGIES, INC

400 Hz, 3 Ø MIL-T-27 Transformers

MODEL 4D

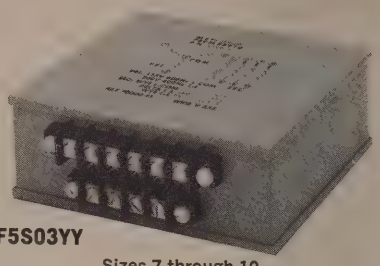
Now QPL!



TF5S03ZZ

Sizes 1 through 6

- Designed to meet the light weight and high temperature requirements of airborne, shipboard, and military electronics.
- Power levels range from 90 to 1,000 watts.



TF5S03YY

Sizes 7 through 10

MODEL NUMBER	STD. INPUT QPL NUMBER*	OUTPUT PER PHASE: DELTA: L to L (3 wire) WYE: L to COM. (4 wire) VOLTS R.M.S.	DELTA: L to L (3 wire) WYE: L to COM. (4 wire) LOAD CURRENT AMPS	WYE: L to L (3 wire) VOLTS R.M.S.	WYE: L to L (3 wire) LOAD CURRENT AMPS	SIZE	WEIGHT LBS. (TYP.)
4D5-90	M27/344-01	5	6.00	8.66	3.47	1	1.3
4D5-120	M27/345-01	5	8.00	8.66	4.62	2	1.6
4D5-150	M27/346-01	5	10.00	8.66	5.78	3	2.3
4D5-200	M27/347-01	5	13.34	8.66	7.70	4	2.4
4D5-500	**	5	20.00	8.66	19.24	7	6.1
4D5-650	**	5	30.00	8.66	25.02	8	6.8
4D12-90	M27/344-02	12	2.50	20.8	1.45	1	1.3
4D12-120	M27/345-02	12	3.34	20.8	1.93	2	1.6
4D12-150	M27/346-02	12	4.17	20.8	2.41	3	2.3
4D12-200	M27/347-02	12	5.56	20.8	3.21	4	2.4
4D12-270	M27/347-01	12	7.50	20.8	4.33	5	2.8
4D12-375	M27/349-01	12	10.42	20.8	6.02	6	3.8
4D12-500	**	12	13.88	20.8	8.01	7	6.1
4D12-650	**	12	18.05	20.8	10.42	8	6.8
4D12-800	**	12	22.22	20.8	12.82	9	7.6
4D12-1000	**	12	27.78	20.8	16.02	10	8.1
4D15-90	M27/344-03	15	2.00	26.0	1.16	1	1.3
4D15-120	M27/345-03	15	2.67	26.0	1.54	2	1.6
4D15-150	M27/346-03	15	3.34	26.0	1.93	3	2.3
4D15-200	M27/347-03	15	4.45	26.0	2.57	4	2.4
4D15-270	M27/348-02	15	6.00	26.0	3.47	5	2.8
4D15-375	M27/349-02	15	8.34	26.0	4.82	6	3.8
4D15-500	**	15	11.11	26.0	6.41	7	6.1
4D15-650	**	15	14.44	26.0	8.33	8	6.8
4D15-800	**	15	17.78	26.0	10.25	9	7.6
4D15-1000	**	15	22.23	26.0	12.82	10	8.1
4D20-90	M27/344-04	20	1.50	34.6	.87	1	1.3
4D20-120	M27/345-04	20	2.00	34.6	1.16	2	1.6
4D20-150	M27/346-04	20	2.50	34.6	1.45	3	2.3
4D20-200	M27/347-04	20	3.34	34.6	1.93	4	2.4
4D20-270	M27/348-03	20	4.50	34.6	2.60	5	2.8
4D20-375	M27/349-03	20	6.25	34.6	3.61	6	3.8
4D20-500	**	20	8.33	34.6	4.81	7	6.1
4D20-650	**	20	10.83	34.6	6.26	8	6.8
4D20-800	**	20	13.33	34.6	7.70	9	7.6
4D20-1000	**	20	16.67	34.6	9.63	10	8.1
4D28-90	M27/344-05	28	1.08	48.5	.62	1	1.3
4D28-120	M27/345-05	28	1.43	48.5	.83	2	1.6
4D28-150	M27/346-05	28	1.79	48.5	1.03	3	2.3
4D28-200	M27/347-05	28	2.38	48.5	1.38	4	2.4
4D28-270	M27/348-04	28	3.22	48.5	1.86	5	2.8
4D28-375	M27/349-04	28	4.47	48.5	2.58	6	3.8
4D28-500	**	28	5.95	48.5	3.43	7	6.1
4D28-650	**	28	7.74	48.5	4.46	8	6.8
4D28-800	**	28	9.52	48.5	5.50	9	7.6
4D28-1000	**	28	11.91	48.5	6.87	10	8.1
4D48-90	M27/344-06	48	.63	83.1	.36	1	1.3
4D48-120	M27/345-06	48	.84	83.1	.49	2	1.6
4D48-150	M27/346-06	48	1.05	83.1	.61	3	2.3
4D48-200	M27/347-06	48	1.39	83.1	.81	4	2.4
4D48-270	M27/348-05	48	1.88	83.1	1.09	5	2.8
4D48-375	M27/349-05	48	2.61	83.1	1.51	6	3.8
4D48-500	**	48	3.47	83.1	2.00	7	6.1
4D48-650	**	48	4.51	83.1	2.60	8	6.8
4D48-800	**	48	5.56	83.1	3.20	9	7.6
4D48-1000	**	48	6.95	83.1	4.01	10	8.1
4D115-90	M27/344-07	115	.26	200.0	.15	1	1.3
4D115-120	M27/345-07	115	.35	200.0	.20	2	1.6
4D115-150	M27/346-07	115	.44	200.0	.25	3	2.3
4D115-200	M27/347-07	115	.58	200.0	.34	4	2.4
4D115-270	M27/348-06	115	.79	200.0	.45	5	2.8
4D115-375	M27/349-06	115	1.09	200.0	.63	6	3.8
4D115-500	**	115	1.45	200.0	.83	7	6.1
4D115-650	**	115	1.88	200.0	1.08	8	6.8
4D115-800	**	115	2.32	200.0	1.33	9	7.6
4D115-1000	**	115	2.90	200.0	1.66	10	8.1

* For Suffix "A" and "B" DELTA numbers, call factory. **QPL Testing underway.

SPECIFICATIONS

INPUT PRIMARY: WYE: (4 wire) Line to Common 115 VAC
WYE: (3 wire) Line to Line 200 VAC
DELTA: (3 wire) Line to Line 115 VAC (see option "A")
DELTA: (3 wire) Line to Line 200 VAC (see option "B")

INPUT FREQUENCY: 400 Hz ±20 Hz.

OUTPUT: See specific models listed.

OUTPUT VOLTAGE TOLERANCE: Within 5% when measured at full load and nominal VAC input.

REGULATION: 10% no load to full load.

INSULATION TEST: 1500 VRMS

EFFICIENCY: Ranges from 90% to 95% typical.

OPERATING TEMPERATURE: 80°C maximum ambient temperature.

TEMPERATURE RISE: Less than 50°C.

Construction: To MIL-T-27 Grade 5, Class S.

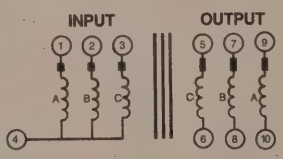
ENVIRONMENT: Encapsulated to meet MIL-STD-810, including vibration temperature to 80°C, shock, sand, dust, humidity, salt spray, fungus, sunshine, rain, explosion. Note: For high altitude operation, encapsulate terminals.

Option "A"—To order DELTA input 115 VAC L-L; Add suffix "A" to Model No., e.g., 4D5-90A.

Option "B"—To order DELTA input 200 VAC L-L; Add suffix "B" to Model No., e.g., 4D5-90B.

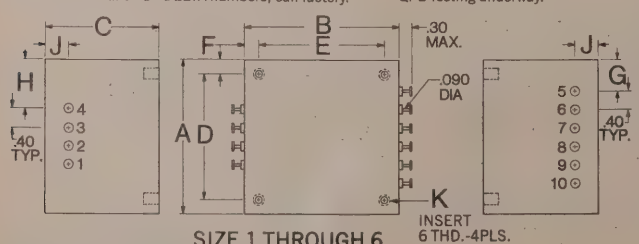
Size	A	B	C	D	E	F	G	H	J	K
1	2.90	2.40	1.45	2.50	2.00	.20	.45	.85	.20	6-32
2	2.90	2.70	1.55	2.50	2.30	.20	.45	.85	.20	6-32
3	3.65	2.80	1.70	3.15	2.30	.25	.82	1.22	.20	8-32
4	3.65	3.00	1.70	3.15	2.50	.25	.82	1.22	.20	8-32
5	3.65	3.00	1.95	3.15	2.50	.25	.82	1.22	.20	8-32
6	4.95	3.20	1.90	4.45	2.70	.25	1.47	1.87	.20	8-32
7	5.31	4.50	2.00	4.31	3.50	.50	.62	1.37	—	10-32
8	5.62	4.20	2.31	4.62	3.20	.50	.78	1.53	—	10-32
9	5.31	4.75	2.31	4.31	3.75	.50	.78	1.53	—	10-32
10	6.12	4.75	2.31	5.12	3.75	.50	.78	1.53	—	10-32

Load current more then 20 amps. Dim. H is 1.56
Dim. Tol.: D. E. ±.02 all others ±.04



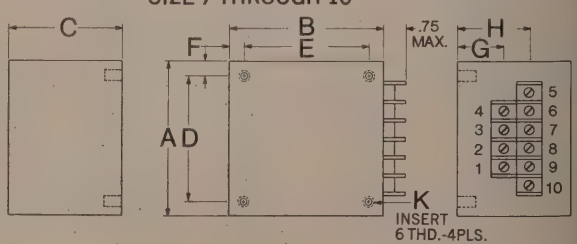
INPUT CONNECTION:
WYE, 115V to Com. 1, 2, 3, Line 4 Com
WYE, 200V L-L 1, 2, 3 (Pin 4 not used)
DELTA 115V or 200V L-L 1, 2, 3 (Pin 4 not used)

OUTPUT CONNECTION:
WYE, L-Com Connect 6-8 10 Load 5-6, 7-6, 9-6
DELTA L-L Connect 6-7, 8-9, 5-10 Load 5, 7, 9
WYE L-L Connect 6-10, 8-10 Load 5, 7, 9



SIZE 1 THROUGH 6

SIZE 7 THROUGH 10



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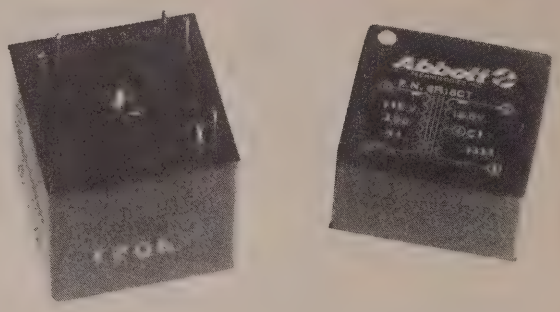
Abbott TECHNOLOGIES, INC — 400 Hz MIL-T-27 P.C. Toroid Transformers

MODEL R

- Military designation TF5S03ZZ
- Compact toroidal construction in a convenient printed-circuit mount package
- Power levels 1.5, 3, 6, and 9 VA
- Standard output voltages 5 to 300 volts
- Low outgassing molded construction for high-altitude operation



SPECIFICATIONS

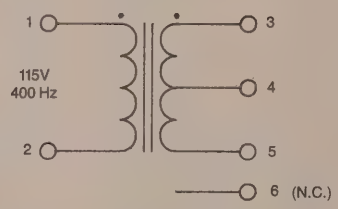
INPUT PRIMARY: 115 VAC, 400 Hz ± 20 Hz, 1 phase.
REGULATION: Ranges from 10% to 23% maximum
ELECTROSTATIC SHIELD OPTION: (1.5, 3, 6 VA only) add "X" suffix to part number (eg: 3R6CTBX)
SECONDARY VOLTAGE TOLERANCE: Within 3% of listed output voltage when measured at full load and 115 VRMS input
DIELECTRIC WITHSTANDING VOLTAGE: 910 VRMS (1624 VRMS −200 to 300 V outputs)
EFFICIENCY: Ranges from 70% to 83% minimum
OPERATING AMBIENT TEMPERATURE: 95°C maximum
CONSTRUCTION: To MIL-T-27 Grade 5, Class S
ENVIRONMENT: Encapsulated to meet MIL-STD-810, including vibration, shock, sand, dust, humidity, saltspray, fungus, sunshine, rain, explosion and altitude (to a vacuum).

DIMENSIONS

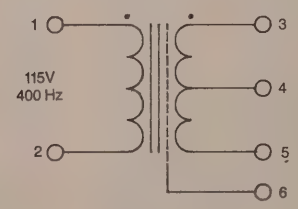
STANDARD (WITHOUT SHIELD)			"X" OPTION (WITH SHIELD)		
VA	CASE HEIGHT (MAX)	WEIGHT LBS (MAX)	VA	CASE HEIGHT (MAX)	WEIGHT LBS (MAX)
1.5	.47	.053	1.5	.59	.068
3.0	.59	.068	3.0	.78	.103
6.0	.78	.103	6.0	1.03	.137
9.0	1.03	.137	9.0	N/A	N/A

CIRCUIT DIAGRAM

Standard

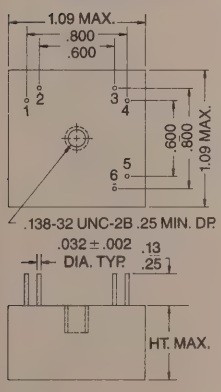


"X" Option
(With Electrostatic Shield)

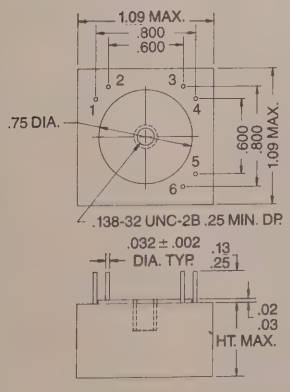


MECHANICAL DRAWINGS

CONFIGURATION A



CONFIGURATION B



*QPL Testing Underway

ORDER INSTRUCTIONS: R Line Toroid Transformers can be ordered in A or B configuration, and with electrostatic shielding ("X" Option). Add "A" or "B" suffix to model number to select configuration. Add "X" suffix after A or B to order electrostatic shielding. (Not available as standard on 9 VA models). Follow this example:

1.5R110CTBX

Model number — Configuration — Electrostatic shielding option

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Abbott TECHNOLOGIES INC

400 Hz MIL-T-27 P.C. Toroid Transformers

MODEL R

Output Volts (F.L.)	Output Current (Amp)	V.A.	Model Number	Output Volts (F.L.)	Output Current (Amp)	V.A.	Model Number	Output Volts (F.L.)	Output Current (Amp)	V.A.	Model Number
5.0	.300	1.5	1.5R5CT	20.0	.075	1.5	1.5R20CT	75.0	.020	1.5	1.5R75CT
	.600	3.0	3R5CT		.150	3.0	3R20CT		.040	3.0	3R75CT
	1.20	6.0	6R5CT		.300	6.0	6R20CT		.080	6.0	6R75CT
	1.80	9.0	9R5CT		.450	9.0	9R20CT		.120	9.0	9R75CT
6.0	.250	1.5	1.5R6CT	22.0	.068	1.5	1.5R22CT	82.0	.018	1.5	1.5R82CT
	.500	3.0	3R6CT		.136	3.0	3R22CT		.036	3.0	3R82CT
	1.00	6.0	6R6CT		.272	6.0	6R22CT		.073	6.0	6R82CT
	1.50	9.0	9R6CT		.409	9.0	9R22CT		.109	9.0	9R82CT
6.3	.238	1.5	1.5R6.3CT	24.0	.062	1.5	1.5R24CT	91.0	.016	1.5	1.5R91CT
	.476	3.0	3R6.3CT		.125	3.0	3R24CT		.033	3.0	3R91CT
	.952	6.0	6R6.3CT		.250	6.0	6R24CT		.066	6.0	6R91CT
	1.43	9.0	9R6.3CT		.375	9.0	9R24CT		.099	9.0	9R91CT
7.0	.214	1.5	1.5R7CT	26.0	.057	1.5	1.5R26CT	100	.015	1.5	1.5R100CT
	.428	3.0	3R7CT		.115	3.0	3R26CT		.030	3.0	3R100CT
	.857	6.0	6R7CT		.230	6.0	6R26CT		.060	6.0	6R100CT
	1.28	9.0	9R7CT		.346	9.0	9R26CT		.090	9.0	9R100CT
7.5	.200	1.5	1.5R7.5CT	28.0	.053	1.5	1.5R28CT	110	.014	1.5	1.5R110CT
	.400	3.0	3R7.5CT		.107	3.0	3R28CT		.027	3.0	3R110CT
	.800	6.0	6R7.5CT		.214	6.0	6R28CT		.054	6.0	6R110CT
	1.20	9.0	9R7.5CT		.321	9.0	9R28CT		.082	9.0	9R110CT
8.0	.187	1.5	1.5R8CT	30.0	.050	1.5	1.5R30CT	115	.013	1.5	1.5R115CT
	.375	3.0	3R8CT		.100	3.0	3R30CT		.026	3.0	3R115CT
	.750	6.0	6R8CT		.200	6.0	6R30CT		.052	6.0	6R115CT
	1.12	9.0	9R8CT		.300	9.0	9R30CT		.078	9.0	9R115CT
9.0	.166	1.5	1.5R9CT	33.0	.045	1.5	1.5R33CT	120	.012	1.5	1.5R120CT
	.333	3.0	3R9CT		.091	3.0	3R33CT		.025	3.0	3R120CT
	.666	6.0	6R9CT		.182	6.0	6R33CT		.050	6.0	6R120CT
	1.00	9.0	9R9CT		.272	9.0	9R33CT		.075	9.0	9R120CT
10.0	.150	1.5	1.5R10CT	36.0	.041	1.5	1.5R36CT	130	.011	1.5	1.5R130CT
	.300	3.0	3R10CT		.083	3.0	3R36CT		.023	3.0	3R130CT
	.600	6.0	6R10CT		.166	6.0	6R36CT		.046	6.0	6R130CT
	.900	9.0	9R10CT		.250	9.0	9R36CT		.069	9.0	9R130CT
11.0	.136	1.5	1.5R11CT	39.0	.038	1.5	1.5R39CT	150	.010	1.5	1.5R150CT
	.272	3.0	3R11CT		.077	3.0	3R39CT		.020	3.0	3R150CT
	.545	6.0	6R11CT		.166	6.0	6R39CT		.040	6.0	6R150CT
	.818	9.0	9R11CT		.230	9.0	9R39CT		.060	9.0	9R150CT
12.0	.125	1.5	1.5R12CT	43.0	.035	1.5	1.5R43CT	180	.008	1.5	1.5R180CT
	.250	3.0	3R12CT		.069	3.0	3R43CT		.017	3.0	3R180CT
	.500	6.0	6R12CT		.139	6.0	6R43CT		.033	6.0	6R180CT
	.750	9.0	9R12CT		.209	9.0	9R43CT		.050	9.0	9R180CT
12.6	.119	1.5	1.5R12.6CT	47.0	.032	1.5	1.5R47CT	200	.007	1.5	1.5R200CT
	.238	3.0	3R12.6CT		.064	3.0	3R47CT		.015	3.0	3R200CT
	.476	6.0	6R12.6CT		.127	6.0	6R47CT		.030	6.0	6R200CT
	.714	9.0	9R12.6CT		.191	9.0	9R47CT		.045	9.0	9R200CT
13.0	.115	1.5	1.5R13CT	51.0	.029	1.5	1.5R51CT	220	.007	1.5	1.5R220CT
	.230	3.0	3R13CT		.059	3.0	3R51CT		.013	3.0	3R220CT
	.461	6.0	6R13CT		.117	6.0	6R51CT		.027	6.0	6R220CT
	.692	9.0	9R13CT		.176	9.0	9R51CT		.041	9.0	9R220CT
15.0	.100	1.5	1.5R15CT	56.0	.027	1.5	1.5R56CT	240	.006	1.5	1.5R240CT
	.200	3.0	3R15CT		.053	3.0	3R56CT		.012	3.0	3R240CT
	.400	6.0	6R15CT		.107	6.0	6R56CT		.025	6.0	6R240CT
	.600	9.0	9R15CT		.160	9.0	9R56CT		.037	9.0	9R240CT
16.0	.093	1.5	1.5R16CT	62.0	.024	1.5	1.5R62CT	270	.005	1.5	1.5R270CT
	.187	3.0	3R16CT		.048	3.0	3R62CT		.011	3.0	3R270CT
	.375	6.0	6R16CT		.096	6.0	6R62CT		.022	6.0	6R270CT
	.562	9.0	9R16CT		.145	9.0	9R62CT		.033	9.0	9R270CT
18.0	.083	1.5	1.5R18CT	68.0	.022	1.5	1.5R68CT	300	.005	1.5	1.5R300CT
	.166	3.0	3R18CT		.044	3.0	3R68CT		.010	3.0	3R300CT
	.333	6.0	6R18CT		.088	6.0	6R68CT		.020	6.0	6R300CT
	.500	9.0	9R18CT		.132	9.0	9R68CT		.030	9.0	9R300CT

* ADD "A" OR "B" SUFFIX TO SELECT A OR B CONFIGURATION
ADD "X" SUFFIX AS DESIRED TO INDICATE ELECTROSTATIC SHIELDING OPTION
(E.S. SHIELDING NOT AVAILABLE AS STANDARD ON 9 VA MODELS) EG. 1.5R110CTBX

*QPL Testing Underway

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Abbott TECHNOLOGIES, INC

TL Power Inductors

MODEL TL

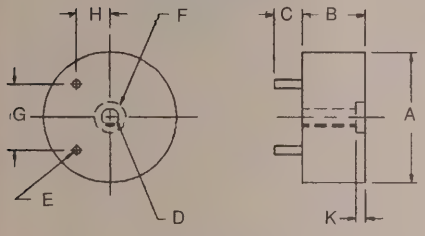
MILITARY CONSTRUCTION: Encapsulated to meet construction requirements of MIL-T-27E Type TF5S04ZZ.

APPLICATION: These inductors have low losses in the 3 to 100 kHz frequency range, making them ideal for switching regulator and AC filter choke applications.

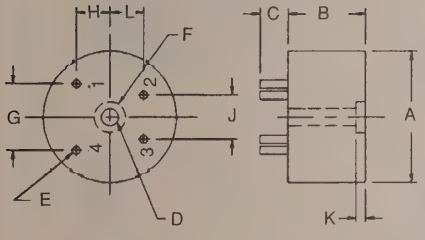
INDUCTANCE: Part numbers correspond to inductance values in microhenries, which are measured at 1 V, 10 kHz, 0 DC with an inductance tolerance of + 15%, -5%. Values of inductance other than listed in an existing size are available. Part Number would be: TL(A, B, or C) -- (inductance in Microhy at 0 DC).

CURRENT RATINGS: Listing I_1 is for approximately 10% drop in inductance with a typical 20 degree C temperature rise, and Listing I_2 is for approximately 20% drop in inductance with a typical 40 degree C temperature rise.

SINGLE WINDING



DUAL WINDING



Model	TLA		TLB		TLC	
	Single	Dual	Single	Dual	Single	Dual
A Dia. (±.030)	.875	.875	1.188	1.188	1.375	1.375
B (±.063)	.438	.563	.563	.688	.750	.813
C (±.030)	.250	.250	.250	.250	.250	.250
D Dia. (±.010)	.156	.156	.156	.156	.156	.156
E Dia. (±.005)	.073	.073	.073	.073	.073	.073
F Dia. (±.015)	.281	.281	.281	.281	.281	.281
G (±.010)	.400	.400	.600	.600	.800	.800
H Dia. (±.010)	.200	.200	.300	.300	.200	.200
J (±.010)	—	.200	—	.400	—	.400
K C-bore (±.015)	.082	.082	.082	.082	.082	.082
L (±.010)	—	.200	—	.300	—	.500
Wt. (Lbs.)	.04	.04	.09	.09	.19	.19

*QPL Testing Underway

DIMENSIONS IN INCHES

Part No.	Winding	A dia. ±.030	B ±.063	C ±.030	D dia. ±.010	E dia. ±.005	F dia. ±.015	G ±.010	H ±.010	J ±.010	K C"bore ±.015	L ±.010	Wt. Oz.
TLA	Single	.875	.438	.250	.156	.073	.281	.400	.200	—	.082	—	.6
	Double		.563							.200		.200	
TLB	Single	1.188	.563	.250	.156	.073	.281	.600	.300	—	.082	—	1.5
	Double		.688							.400		.300	
TLC	Single	1.375	.750	.250	.156	.073	.281	.800	.300	—	.082	—	3
	Double		.813							.400		.500	

TLA

Part No.	No. of Windings	Inductance at 0 DC (µH)	I_1 at 10% drop in L (amps)	I_2 at 20% drop in L (amps)	Max. DCR (ohms)
TLA-1250	1	1250	.8	1.2	.7
TLA-800	1	800	1	1.5	.45
TLA-500	1	500	1.2	1.8	.3
TLA-350	1	350	1.5	2.2	.2
TLA-200*		200	2	3	.12
	2	50	4	6	.03
TLA-88*		88	3	4.5	.052
	2	22	6	9	.013
TLA-32*		32	5	7.5	.02
	2	8	10	15	.005

TLB

Part No.	No. of Windings	Inductance at 0 DC (µH)	I_1 at 10% drop in L (amps)	I_2 at 20% drop in L (amps)	Max. DCR (ohms)
TLB-3000	1	3000	.8	1.2	1.2
TLB-2000	1	2000	1	1.5	.8
TLB-1200	1	1200	1.25	1.88	.5
TLB-780	1	780	1.6	2.4	.3
TLB-520	1	520	2	3	.2
TLB-320	1	320	2.5	3.75	.13
TLB-220*		220	3	4.5	.08
	2	55	6	9	.02
TLB-120*		120	4	6	.05
	2	30	8	12	.013
TLB-80*		80	5	7.5	.032
	2	20	10	15	.008

TLC

Part No.	No. of Windings	Inductance at 0 DC (µH)	I_1 at 10% drop in L (amps)	I_2 at 20% drop in L (amps)	Max. DCR (ohms)
TLC-10000	1	10000	.84	1.1	2.1
TLC-6400	1	6400	1	1.35	1.4
TLC-2500	1	2500	1.6	2.2	.55
TLC-1600	1	1600	2.1	2.8	.34
TLC-1000	1	1000	2.6	3.5	.21
TLC-640*	2	640	3.3	4.5	.13
		160	6.6	9	.033
TLC-400*	2	400	4	5.4	.088
		100	8	10.8	.022
TLC-240*	2	240	5	6.8	.056
		60	10	13.6	.014

*Two identical windings brought out to four terminals permit series, parallel, center tapped, or transformer connections.

ABBOTT TECHNOLOGIES, INC.
Head Office: 8203 Vineland Avenue, Sun Valley, CA 91352, (818) 504-0644, FAX (818) 768-0395 **1-800-367-8200**
Eastern Sales Office: 321 Commercial Avenue, Suite 304, Palisades Park, NJ 07650, (201) 461-4005, FAX (201) 461-6323

Abbott TECHNOLOGIES, INC

Custom-Designed MIL-SPEC Magnetics

Abbott is a leading source of custom-designed magnetics which comply with the rigorous requirements of today's military environment. Abbott custom magnetics have successfully performed in some of the most demanding applications known. A sample of these applications is shown on the opposite page.

A Broad Range of Capabilities

Abbott's design team is experienced with a broad range of magnetic technologies, and can develop solutions to your magnetic problems, in a very short amount of time. Our custom designs reflect the same high standards and conservative design margins of our standard products. The table below describes our normal capabilities.

Our standard quality system is in compliance with MIL-I-45208 and enhanced quality assurance is available to conform to MIL-Q-9858. Our designs normally comply with MIL-STD-454, and MIL-T-27. Special testing can be performed on these units to demonstrate compliance with MIL-STD-810, and MIL-STD-202. Other testing is available upon request.

Many custom requirements can be satisfied by modifying an existing product which can shorten the time needed for delivering the initial prototype. Often we can qualify a modified standard unit to various MIL specs by SIMILARITY, thereby reducing testing costs. We have the capability of providing customers QPL qualification on their custom or modified standard designs.

Device Types	Size	Frequency	Construction
Power Transformers (single and multiple phase) Signal Transformers Autotransformers Pulse Transformers Switching Transformers Multiple and Complex Windings Instrument Transformers Magnetic Amplifiers Current Transformers Inductors Ferroresonant Transformers Audio Transformers	Up to 400 lbs	Up to 1 Megahertz	Laminated Toroidal Ferrite Cut-Core Metal Cased Epoxy Cased Hermetically Sealed Open Frame Conformal Coated Diallyl Phthalate Cased Hermetically Sealed Headers Turrent Terminals Hooked Pins Lead Wires Quick Disconnects Connectors Special Terminations Standard Terminations Special/Custom Terminations

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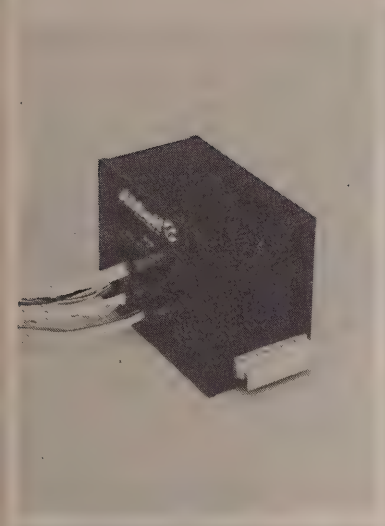
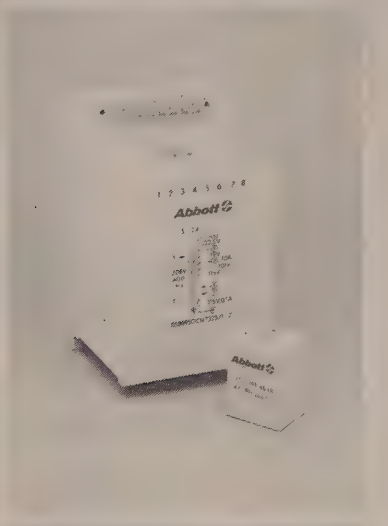
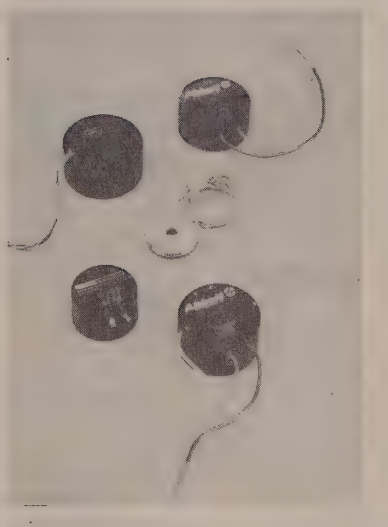
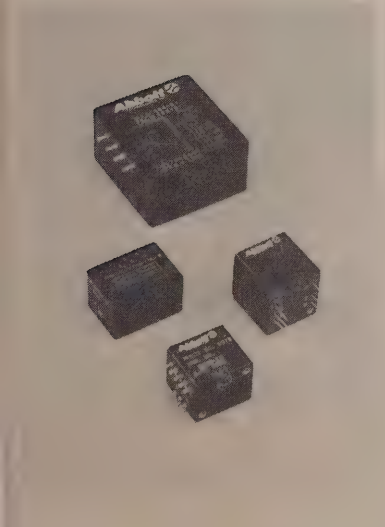
Abbott TECHNOLOGIES, INC.

Custom-Designed MIL-SPEC Magnetics









- Space Shuttle
- Cruise Missile
- Tactical Computer Terminal (TCT)
- F-14 Charging System
- AH-64 (Apache Helicopter)
- TADS
- B-1 Bomber
- MK-37 Torpedo
- Harpoon
- AN/SLQ-37
- Trident Submarine
- MK-118 Fire Control System
- Patriot Missile
- MS^3
- Lantirn
- LAMPS
- Maverick Missile
- LLADS
- Aquila-RPV
- A-6

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ENCAPSULATED POWER TRANSFORMERS

Step Down Size... Step Up Performance..!

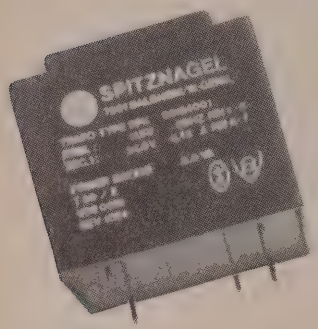
PC-Mountable Power Transformer

- are manufactured according to the International Safety Standards, such as UL, VDE, IEC.
- provide an insulation system which allows the 5,000 Vrms HiPot Test (up to 12,000 Vrms on request.)
- are encapsulated for a higher heat transfer, which results in a higher power/volume ratio.
- are encapsulated for mechanical strength, shock resistance, moisture resistance, better insulation system for the price of the open frame version.
- provide an interchangeable pin placement on the bobbin base, which increase the available options for custom-made transformers.

SPACE LIMITING SPK SERIES

Offers 9 sizes from 0.2 VA to 5.5 VA (power ratings up to 50 VA on request).

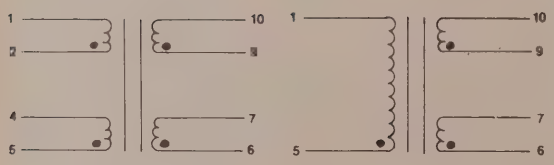
The SPK series is manufactured with a split bobbin, which allows the primary and secondary to be wound side by side, rather than one over the other.

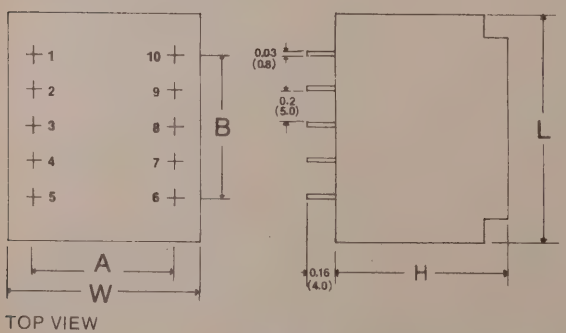


AVAILABLE VOLTAGES:

SINGLE PRIMARY DUAL PRIMARY	115V, 60 HZ or 2x115V, 50/60 HZ
DUAL OR SINGLE SECONDARY	6, 9, 12, 15, 18 and 24 V
LOAD REGULATION	30% SPK060 25%
TEMPERATURE RISE	<35° C Class B 130
Hi Pot TEST	5000V RMS

CUSTOM MADE TRANSFORMERS ON REQUEST





TOP VIEW

Cat. #	Rated Power VA	Dimension L	W	H	A	B
SPK002	**0.2**	0.87	1.0	0.67	0.8	0.6
SPK007	**0.7**	1.06	1.06	0.8	0.8	0.8
SPK005	**0.6**	1.26	1.06	0.6	0.8	0.8
SPK015	**1.5**	1.26	1.06	0.86	0.8	0.8
SPK020	**2.0**	1.26	1.06	0.94	0.8	0.8
SPK030	**2.2**	1.26	1.06	1.06	0.8	0.8
SPK031	**2.7**	1.26	1.06	1.2	0.8	0.8
SPK040	**4.3**	1.61	1.4	1.1	1.1	0.8
SPK060	**5.5**	1.75	1.46	1.3	1.1	1.0

SPK 002 x 4 Pins

SPK 060 x 6 Pins

ADVANCED COMPONENTS INDUSTRIES, INC.
1308 Sartori Avenue, #105 • Torrance, California 90501
(310) 328-0060 • Fax (310) 328-0062

ENCAPSULATED POWER TRANSFORMERS

Step Down Size... Step Up Performance..!

PC-Mountable Power Transformer

- are manufactured according to the International Safety Standards, such as UL, VDE, IEC.
- provide an insulation system which allows the 5,000 Vrms HiPot Test (up to 12,000 Vrms on request.)
- are encapsulated for a higher heat transfer, which results in a higher power/volume ratio.
- are encapsulated for mechanical strength, shock resistance, moisture resistance, better insulation system for the price of the open frame version.
- provide an interchangeable pin placement on the bobbin base, which increase the available options for custom-made transformers.

HEIGHT LIMITING SPF SERIES

Offers 10 sizes from 3.0 VA to 25.0 VA (power ratings up to 45 VA on request).

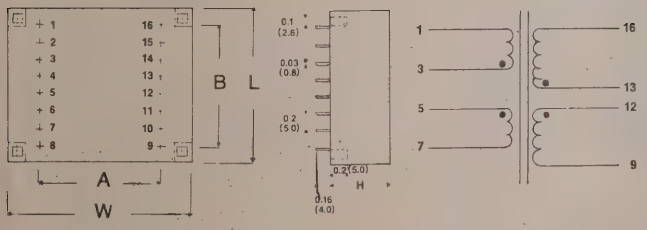
The Low-Profile design of the SPF Series allows a closer card spacing (3/4" card spacing for the 3.0 VA transformer). The SPF Series is wound non-concentrical on a dual split bobbin.

V D E

AVAILABLE VOLTAGES:

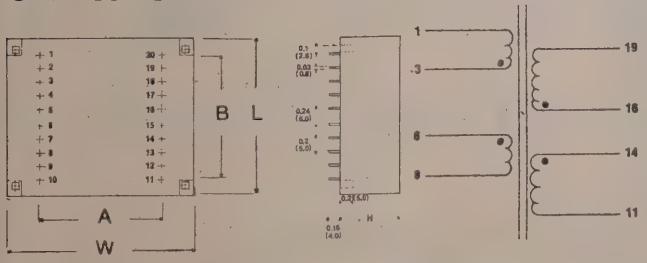
DUAL PRIMARY	2 X 115V, 50/60 HZ
DUAL SECONDARY	6, 9, 12, 15, 18 and 24 V
LOAD REGULATION	20%
TEMPERATURE RISE	< 40° C Class B 130
Hi Pot TEST	5000V RMS
CUSTOM MADE TRANSFORMERS ON REQUEST	

SPF 033 - SPF 043 - SPF 063 - SPF 093



TOP VIEW

SPF 103 - SPF 143 - SPF 183 - SPF 253



TOP VIEW

Cat.#	Rated Power VA	Dimensions L	W	H	A	B
SPF033	**3.0**	1.75	2.1	0.67	1.4	1.4
SPF043	**4.0**	1.75	2.1	0.73	1.4	1.4
SPF063	**6.0**	1.75	2.1	0.87	1.4	1.4
SPF093	**9.0**	1.75	2.1	1.0	1.4	1.4
SPF103	**10.0**	2.3	2.75	0.87	1.8	1.84
SPF143	**14.0**	2.3	2.75	0.94	1.8	1.84
SPF183	**18.0**	2.3	2.75	1.06	1.8	1.84
SPF253	**25.0**	2.3	2.75	1.38	1.8	1.84

ADVANCED COMPONENTS INDUSTRIES, INC.
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(310) 328-0060 • Fax (310) 328-0062

ALBAR's Magnetics

Custom fits.

PART OF THE SOLUTION

When you need a solution for your power problems, don't buy one designed for someone else. ALBAR, a leader in power conversion technology, can design and build superior custom magnetics that will fit into your application for optimal performance, and be cost-effective, too.

ALBAR has made it's name as a manufacturer of custom magnetics and power supplies (linear, ferroresonant and switch mode). Since 1979, our products have been specified in diverse fields like communications, health care and entertainment.

AN ENGINEERING STAFF THAT'S UP TO THE CHALLENGE

Our engineers have a wealth of experience, from microwatt to megawatt power ranges. They hold many patents in the field and have published widely in technical journals. You can be sure that they will be able to solve whatever problems your applications present.

ALBAR's customers know that we ship only top quality, 100% tested products from our plant in Lynnwood, Washington. With our advanced manufacturing capabilities, you'll get the best products and get them on time.

Get a solution that works just for you. Talk to ALBAR for the one that fits.

We're here to help.

When you are ready to discuss your application or just ask a question, call ALBAR toll-free at **1-800-822-5227**.

ALBAR

ALBAR, Inc. P.O. box 2368, 19013 36th Avenue West, Lynnwood, Washington 98036
(206) 771-4006 Toll free: 1-800-822-5227 Fax: (206) 771-2163

altran
ALTRAN CORP.

ALTRAN CORP. is located in Crystal Lake, Illinois, 50 miles northwest of Chicago. Our main offices and production facilities are conveniently accessible from both Chicago's O'Hare Airport, and Milwaukee's Mitchell Field. Driving time from either facility is about one hour. As designers and manufacturers of quality magnetic components, we provide many facets of the electronics industry with an array of bobbin, toroidal and printed circuit type transformers and inductors.

Quality Magnetic Components for . . .
Power Conversion • International Medical Electronics • Telephony

POWER CONVERSION

ALTRAN's skilled engineers and precision manufacturing facilities are capable of designing and producing the finest magnetics for power conversion requirements. By utilizing our U. L. recognized insulation systems, we can satisfy virtually any specifications a customer may require.

Linear power conversion can be accommodated for 50 Hz, 60 Hz, 400 Hz or any other frequency up to 1.5 KVA.

Power transformers and associated filtering magnetics can be readily produced to precise performance levels.

Switchmode inverters, converters, drive and filtering magnetics can be manufactured for switching frequencies from below 20 KHz to above 100 KHz.

The development and production of power conversion components has been a major part of **ALTRAN's** history as a reliable source for quality, high-performance magnetics–the cornerstone of our company

COMPONENTS SHOWN APPROXIMATELY 47% ACTUAL SIZE.

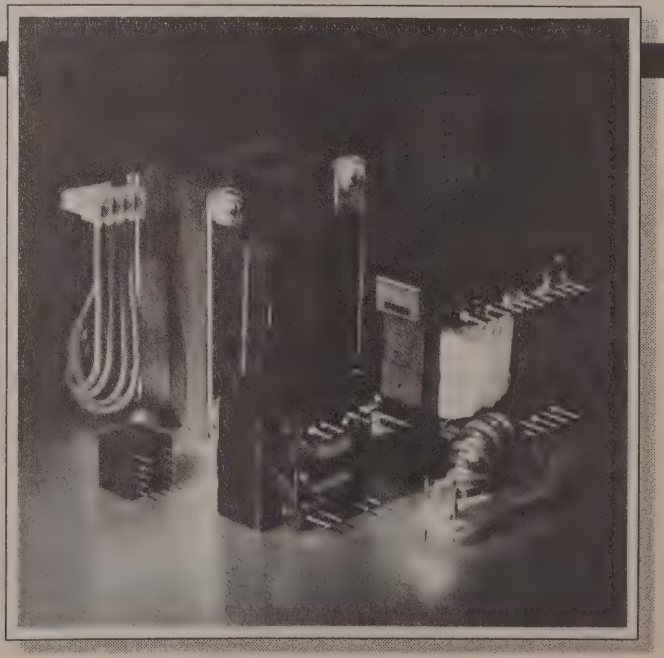
INTERNATIONAL MAGNETICS

In this era of expanding global markets, many manufacturers are finding needs to employ magnetic components which are compatible with foreign power specifications. **ALTRAN** has the engineering expertise to produce components to meet the electrical requirements and standards of Europe, Australia, Japan and most countries throughout the world.

To comply with foreign standards **ALTRAN** has received approvals directly, or through our customer's products from V. D. E., I. E. C., DENTORI, SEMKO and British regulatory agencies - to mention a few.

If your product is distributed internationally, or you plan to introduce them abroad, **ALTRAN** can assist in fulfilling your magnetics requirements.

COMPONENTS SHOWN APPROXIMATELY 43% ACTUAL SIZE.



Call or write today, and learn how ALTRAN can assist with your Magnetics needs
The benefits could be quite rewarding

6101 FACTORY ROAD
CRYSTAL LAKE • ILLINOIS 60014
TEL: (815) 455-5650 • FAX: (815) 455-3171

ALTRAN's engineers and technicians develop the optimum design to always meet your requirements of performance, size and cost. Our objective is to give our customers exactly what they need...when they need it...and do so within budgetary limitations.

We welcome your inquiries regarding transformers and coils for:
•Power Conversion •Audio to r.f. Frequency impedance Matching
•Telephone Voice Frequency & Data Coupling and •Filtering

altran
ALTRAN CORP.

The Combination of the Latest Technology & Highest Quality . . .

COMPONENTS SHOWN APPROXIMATELY 50% ACTUAL SIZE.

MEDICAL ELECTRONICS

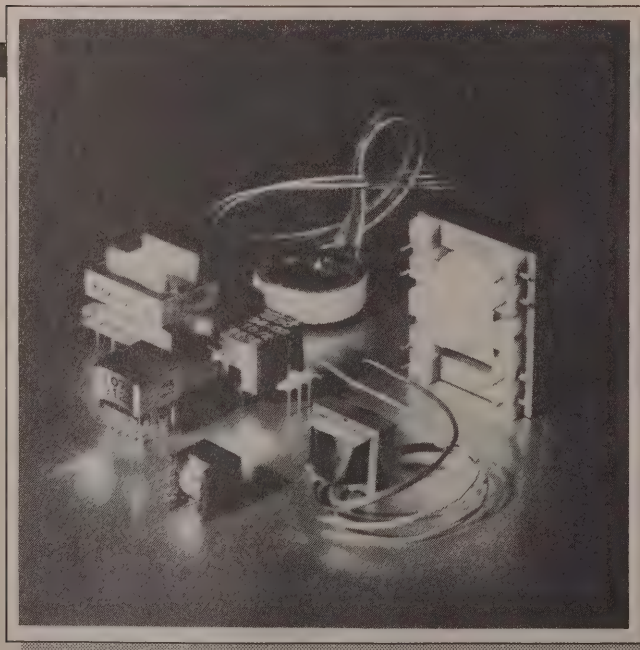
To accommodate the ever-increasing requirements and demands of the Medical Electronics industry, **ALTRAN** now designs and manufacturers inductors and transformers that meet and fully comply with UL 544, CSA C22.2, IEC 601-1 and other international agency standards.

ALTRAN builds linear and switching magnetics for medical power conversion, as well as isolation-to-patient coupling devices.

In addition, we are currently manufacturing specialized magnetic components for application to EKG, defibrillator and other cardiac equipment.

As applications and usage of magnetic components develop within the Medical Electronics industry. **ALTRAN** will be prepared to answer the questions and satisfy the requirements of this critical market. When there is virtually no margin for error, we know what that means–we do it daily.

COMPONENTS SHOWN APPROXIMATELY 54% ACTUAL SIZE.



MAGNETICS FOR TELEPHONY

As with many industries utilizing specialized and advanced technologies, **ALTRAN** encourages a close liaison with the customer's design engineers to develop magnetics which will help solve complex transmission problems–today...and in the future.

In the field of telephony where miniaturization is often a critical consideration, **ALTRAN's** engineers have made the development of miniaturized components a major goal. **ALTRAN** offers coupling, feedbridge and hybrid transformers measuring under one-half inch (13 mm) in height, which handle D. C. loop currents.

If high performance within space limitations are a necessary factor, consult with **ALTRAN** for your optimum solution.

Call or write today, and learn how ALTRAN can assist with your Magnetics needs
The benefits could be quite rewarding

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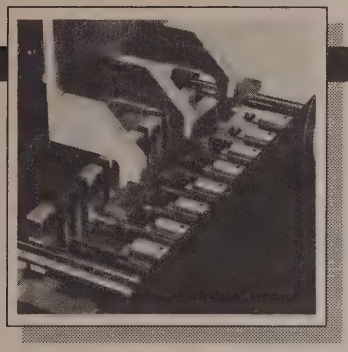
altran
ALTRAN CORP.

From design & development...to delivery you can always rely on ALTRAN to meet your Magnetics requirements.



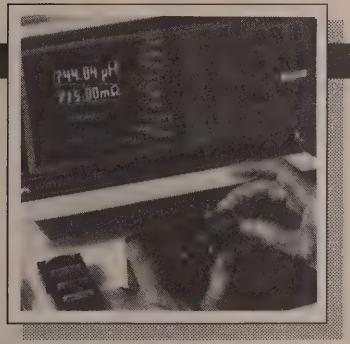
PRODUCTION CAPABILITIES

ALTRAN has the manufacturing capabilities to produce any size order. We are cost efficient in providing relatively small prototype quantities, and extremely competitive in producing high volume runs.

As design and technology in the magnetics industry has rapidly advanced, equally has the sophistication of **ALTRAN's** manufacturing facilities. Our production equipment includes monitored, computer controlled automatic winding and wire wrapping machines for high volume runs requiring precision accuracy and concise tolerances.

Supplementing our high volume multiple winding and wrapping equipment, **ALTRAN** utilizes shuttle-type winding machines for toroids, accurate heavy-duty machines for heavy gauge magnet wire, and specialized equipment for winding switch-mode components of the highest reliability.

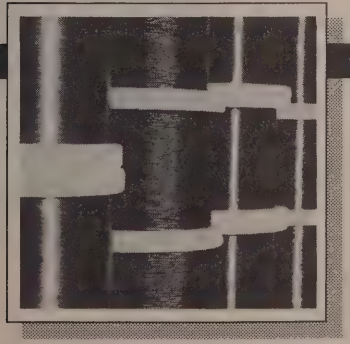
The management and staff of **ALTRAN** all recognize the crucial importance of meeting our customers production schedules. When placing an order with **ALTRAN**, you can rest assured that it will be completed and delivered as per your requirements.



QUALITY CONTROL

Our testing laboratory has the mechanical and electrical equipment to test and analyze any parameter. **ALTRAN's** calibration program assures us, and you of the most accurate and precise testing of components possible.

We work closely with every customer to meet the exact A. Q. L. level they require. In addition, we maintain our own standards–performing very close to a zero defect program.



SELECTED MATERIALS

To further assure the reliability and performance of our products, **ALTRAN** uses only the highest quality materials in the assembly of all magnetic components.

For products utilizing our U. L. recognized insulation system, we use only all U. L. recognized materials–without exception.

In addition, all magnetic wire, electrical steel laminations, ferrite core, coil forms and other constructive materials are specifically selected and inspected by **ALTRAN**.

Call or write today, and learn how ALTRAN can assist with your Magnetics needs
The benefits could be quite rewarding

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AMECON
THE ENERGY SAVER FOR 22 YEARS

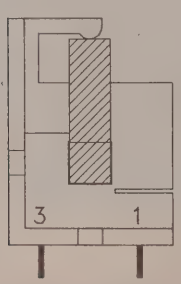
SNAP–ON LOAD DETECTOR "LD–50"

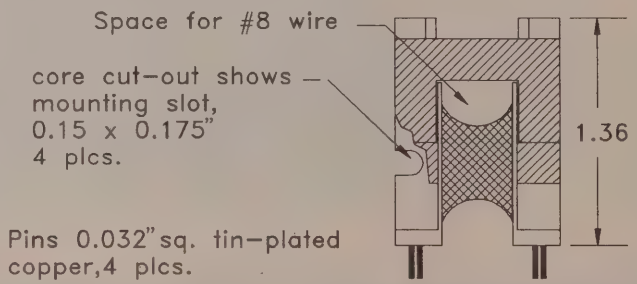
- This new revolutionary snap–on load detector mounts on pre–wired systems without disrupting existing connections. (Field assembleable.)
- Broad frequency response: 30Hz. to 15kHz. (See Curve.)
- Measure currents up to 50Amps continuous, 150Amps intermittent.
- High reliability long lasting magnetic device.
- Output linear to within 3% from 5 to 50Amps input. (See VL/Ip vs. Ip curves.)
- Less than $2.00 in production quantities.
- Excellent for low–budget energy management and automation control.
- Available pre–assembled or un–assembled, to snap over existing wiring.
- Note: These features have made this new device the answer to a myriad of new applications such as monitoring relays and lamps, Hi/Low current limits, instrumentation, solid–state switchgear, motor controls, and much more.

NEW HIGH SENSITIVITY CURRENT TRANSFORMERS.

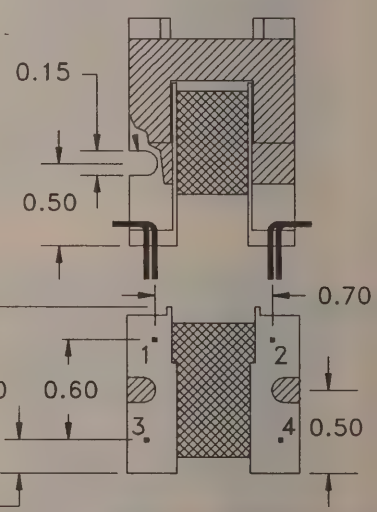
The high–sensitivity series of current transformers has been specifically designed for those applications where a low value of current is to be monitored. A primary winding is supplied (pins 1&2) which helps increase the sensitivity of the transformer.

LD–50





5360 SERIES.

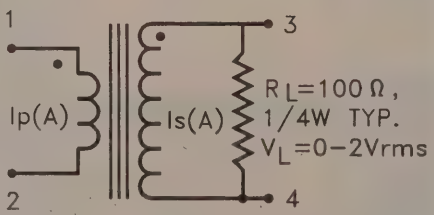


ELECTRICAL SPECS

VL Volts	RL Ohms	Is Amps	Sec. DCR Ohms	Sec. Ind. Hy	Accy at 100%	Accy at 10%
2.0*	100	0.02*	36	1.1	1.0	0.3

TEMPERATURE –55°TO120°C.

P/N	Load Current Ip(A)	Turns Ratio	Pri. Ind. mHy	Pri. DCR Ohms
5361	0.05	1000:400	176	15
5362	0.1	1000:200	44	3.7
5363	0.2	1000:100	11	0.93
5364	0.5	1000:40	1.76	0.15
5365	1	1000:20	0.44	0.038
5366	2	1000:10	0.11	0.010
5367	5	1000:4	0.018	0.0025
LD–50	20	1000:1		



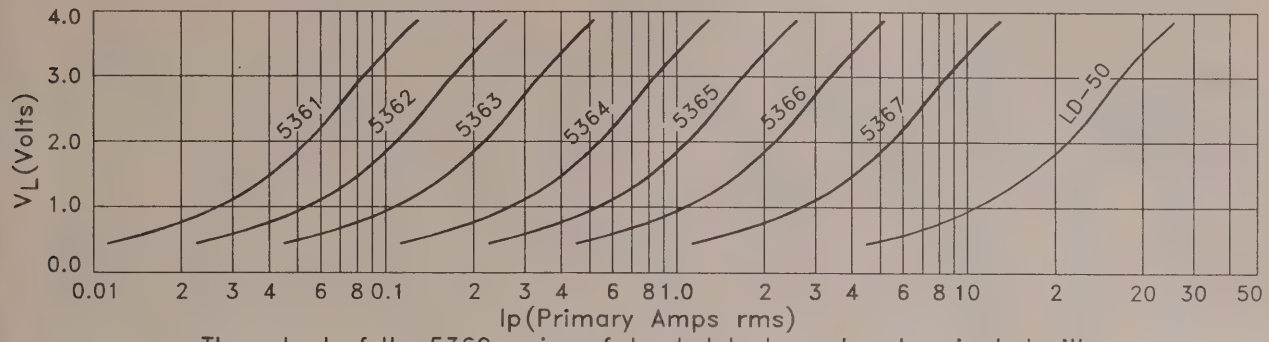
The terminating resistor is customer supplied. For LD–50, the one–turn primary is customer supplied.

* Many customized output voltages and currents are available on special request, at same low price.

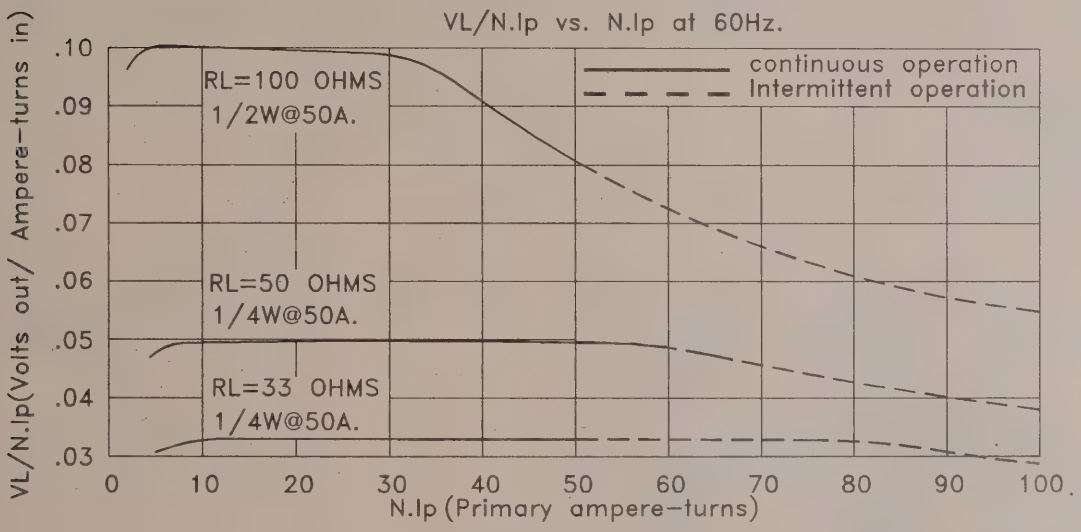
SERVING YOU SINCE 1972 WITH KNOWLEDGE & SENSIBLE PRODUCTS

1900 CHRIS LANE / ANAHEIM, CA 92805 / 714-634-2220 / FAX 714-634-0905

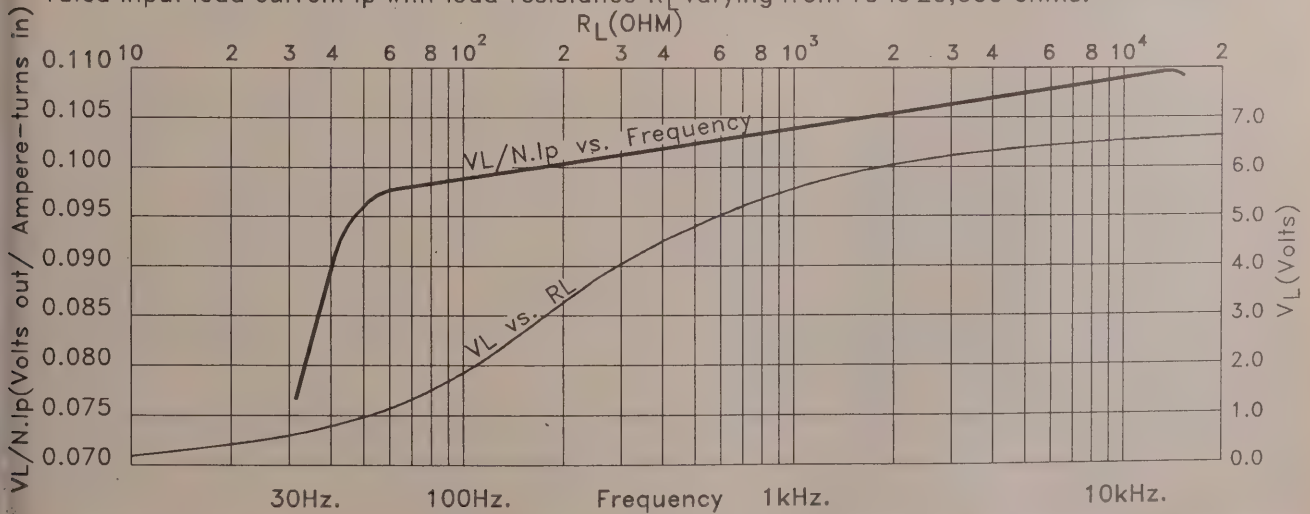
AMECON
THE ENERGY SAVER
FOR 22 YEARS



The output of the 5360 series of load detectors when terminated with a 100 ohm resistor. Ip ranging from 0.25 to 2.5 times the rated current.



VL vs RL curve shows the output of the 5360 series of load detectors (including the LD-50) at rated input load current Ip with load resistance R_L varying from 10 to 20,000 ohms.



VL/N.Ip vs. Frequency curve shows the output of the load sensor as a function of frequency across a 100 ohm terminating resistor at rated primary current. (20A for LD-50)

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AMECON
THE ENERGY SAVER FOR 22 YEARS

CURRENT TRANSFORMERS FOR DIGITAL CIRCUITS

	PART NO.	Ip	V/A	RL Ω	RL WATT	Rs	RCF @10%	Iex μA RMS	Vex V RMS	WT. LB.	POTTED DIMENSIONS L	ID(MIN)	HT	W	C	D	FIG.
STANDARD ACCURACY OPTIMUM SERIES	5300-0575	5	.4	270	.015	42	1.087	765	2.31	.024	.660	.177	.795	.563	.500	–	3
	5300-1015	10	.2	120	.033	38	1.047	996	2.63	.024	.660	.177	.795	.563	.500	–	3
	5300-2030	20	.1	68	.059	24	1.023	760	2.71	.028	.660	.177	.795	.563	.500	–	3
	5300-5060	50	.05	33	.189	14	1.014	1430	3.52	.066	0.931	.370	0.990	.470	.600	.300	2
	5300-1012	100	.025	15	.417	7	1.009	1550	3.62	.121	1.188	.500	1.188	.690	.800	.400	1
STANDARD ACCURACY NORMAL SERIES	5304	20	.1	100	.040	42	1.030	662	2.84	.040	0.931	.370	0.990	.470	.600	.300	2
	5306	30	.1	100	.090	46	1.018	644	4.38	.088	1.188	.500	1.188	.563	.800	.400	1
	5308	50	.1	100	.25	46	1.019	1090	7.28	.105	1.375	.625	1.375	.563	1.00	.400	1
	5310	75	.1	100	.57	24	1.016	1520	9.26	.129	1.500	.688	1.500	.563	1.20	.400	1
	5311	100	.1	100	1.0	21	1.014	1740	12.0	.191	1.750	.750	1.750	.563	1.40	.400	1
	5312	150	.1	100	2.25	11	1.011	1820	16.6	.442	2.188	.938	2.188	.813	1.80	.500	1
HIGH ACCURACY MINIATURE SERIES	5326	3.5	.2	200	.0025	76	1.030	88	0.97	.028	.660	.177	.795	.720	.500	.32	2
	5327	5	.1	100	.0025	49	1.015	183	0.74	.015	.660	.177	.795	.375	.500	–	3
	5328	5	.2	200	.005	61	1.013	158	1.31	.028	.660	.177	.795	.720	.500	.32	2
	5329	10	.05	100	.0025	213	1.006	74	1.57	.015	.660	.177	.795	.375	.500	–	3
	5330	10	.1	200	.005	252	1.009	58	2.26	.028	.660	.177	.795	.720	.500	.32	2

FIG. 1

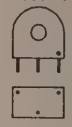


FIG. 2

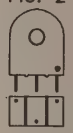
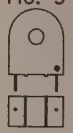
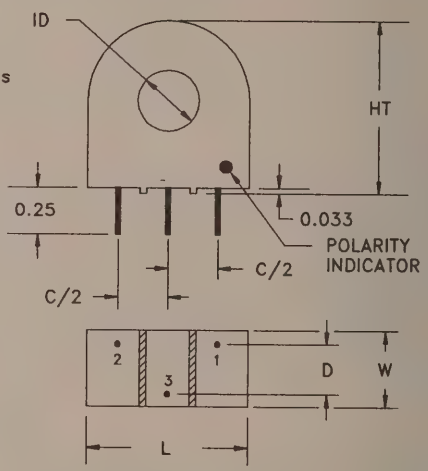


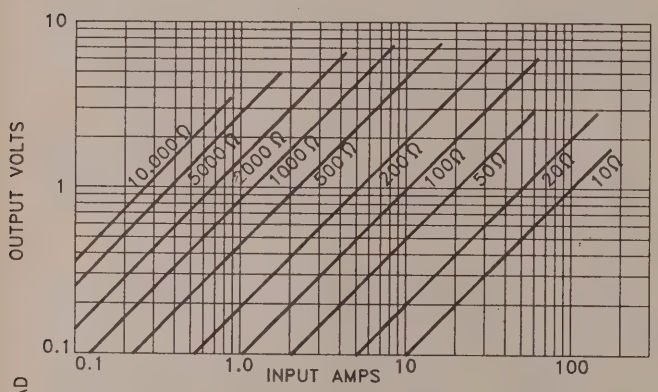
FIG. 3

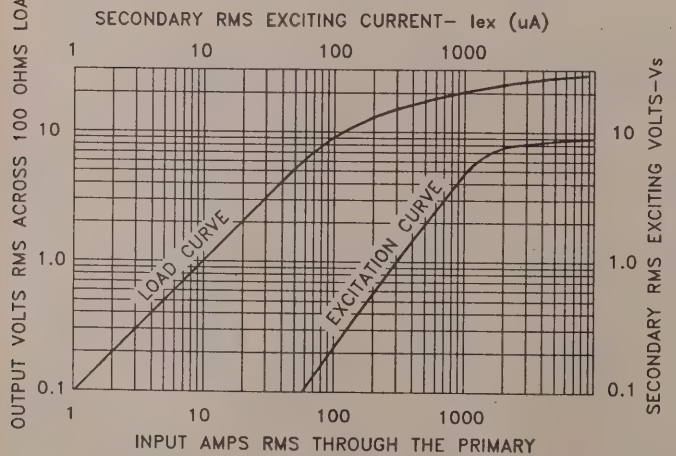


Ip: Primary current.
V/A: Output volts per input amps.
RL: Terminating resistor.
N: Nominal turns.
Rs: Winding resistance.
RCF: Ratio correction factor. The current reading should be multiplied by this value to obtain the true value of the primary current.
Iex and Vex: Excitation current and voltage at rated operating conditions.
WT: Net weight in pounds.



OUTPUT VOLTS VS. INPUT AMPS FOR DIFFERENT LOADS.

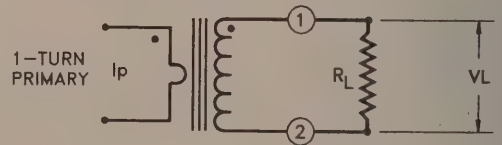




UNLESS REQUESTED, THE TERMINATING RESISTOR AND THE ONE–TURN PRIMARY ARE CUSTOMER SUPPLIED.

PIN 3: NORMALLY FOR MECHANICAL SUPPORT ONLY; WILL BE USED FOR CENTER–TAPPED DESIGNS.

EACH P/N ADJUSTED TO BE MOST ACCURATE AT SPECIFIED LOAD.



THE CURVES ON THE LEFT SHOW THE PERFORMANCE CHARACTERISTICS OF P/N 5304.
FOR CURVES ON OTHER DEVICES REQUEST THE FULL AMECON CATALOG.

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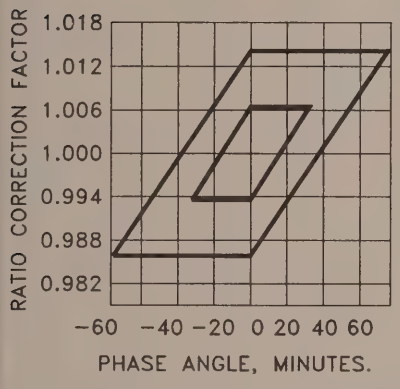
AMECON
THE ENERGY SAVER FOR 22 YEARS

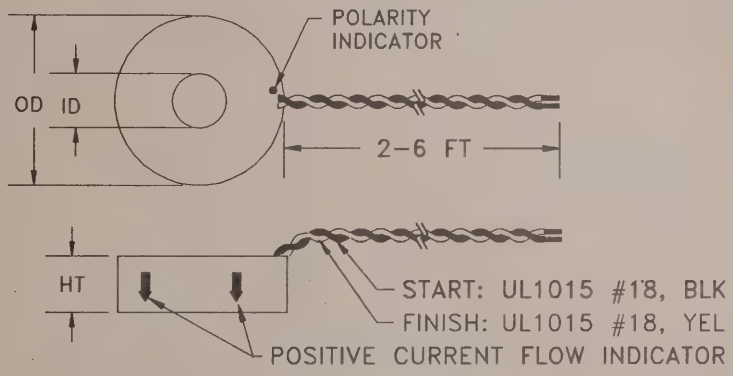
CURRENT TRANSFORMERS FOR ELECTRONIC METERING.

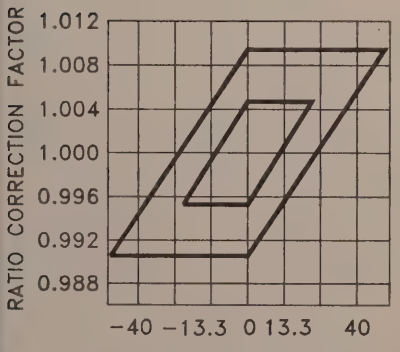
P/N	Ratio	Rated Pri Amps Ip	Rated Sec Amps Is	Rated Sec Burden R_L	Ratio Error (%)		Phase Angle Error (Minutes)		Dimensions		
					at 100%Ip	at 10%Ip	at 100%Ip	at 10%Ip	OD(MAX) (in)	ID (MIN) (in)	HT(MAX) (in)
5381	300:1	60	0.2	1	0.22	0.30	9	29	1.31	0.44	0.81
5382	600:1	120	0.2	1	0.15	0.19	7	19	1.55	0.65	0.55
5383	1000:1	100	0.1	5	0.13	0.20	6	25	2.34	0.75	0.78
5384	2000:1	200	0.1	5	0.06	0.07	3	13	2.34	0.75	0.78

* Accuracy figures are based on a resistive load. (0.9 to unity power factor)
* Meets UL 94–V1 flame retardant specifications.
* Dielectric insulation voltage: 4000 VAC.
* Over–voltage protection available on request.
* Operating Temperature Range: –40°C to +85°C. (–50°C to +125°C on request.)
* Many other ratios and custom–designed CT's available upon request.

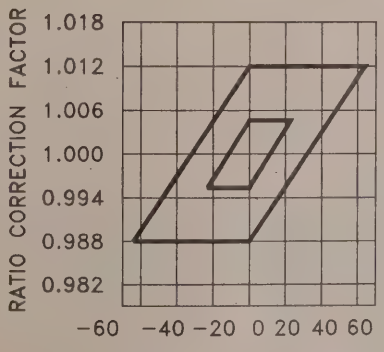


ACCURACY LIMITS FOR # 5381

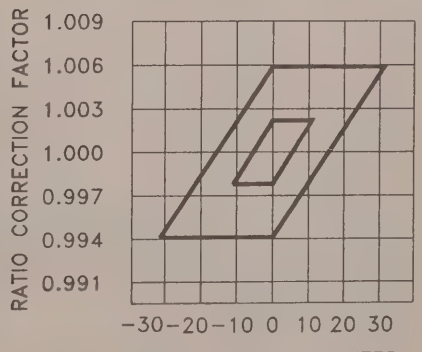




ACCURACY LIMITS FOR # 5382



ACCURACY LIMITS FOR # 5383



ACCURACY LIMITS FOR # 5384

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AMECON
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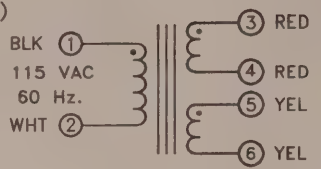
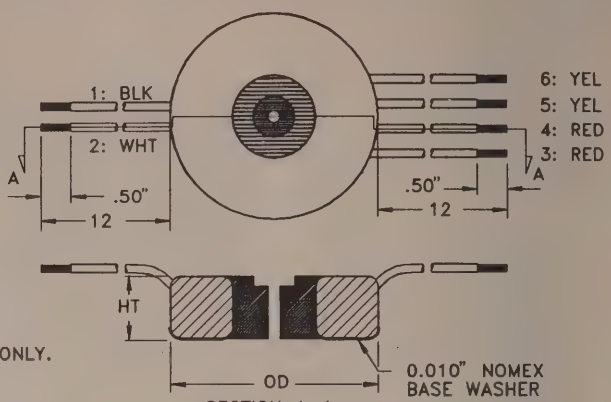
LARGEST SELECTION OF HEAVY DUTY 60Hz. TOROIDAL POWER TRANSFORMERS.

SOME ADVANTAGES OF TOROIDAL POWER TRANSFORMERS COMPARED TO LAMINATED TRANSFORMERS.

- Higher efficiency (Save Energy)
- Lower Mechanical hum.
- Lower electrical noise
- Lower Magnetic leakage
- Easier to electrostatically shield.
- Lower weight
- Smaller dimensions
- And most important price competitive compared to old fashioned laminated transformers.



208, 220 OR 230 VAC PRIMARY ON REQUEST
PIN NUMBERS ARE FOR REFERENCE ONLY.



Part Number	Load Voltage	Load Current
7.5VA Series, 2.2"x1.1" 0.41#, 21% regulation		
1001	9	0.83
1002	12	0.63
1003	15	0.50
1004	18	0.42
1005	24	0.31
1006	28	0.27
10VA Series, 2.4"x1.1" 0.53#, 20% regulation		
1021	9	1.11
1022	12	0.83
1023	15	0.67
1024	18	0.56
1025	24	0.42
1026	28	0.36
15VA Series, 2.5"x1.1" 0.64#, 1% regulation.		
1041	9	1.67
1042	12	1.25
1043	15	1.00
1044	18	0.83
1045	24	0.63
1046	28	0.54
1047	2x9	0.83
1048	2x12	0.63
1049	2x15	0.50
1050	2x18	0.42
1051	2x24	0.31
1052	2x28	0.27
25VA Series, 2.8"x1.2" 0.85#, 18% regulation.		
1061	9	2.78
1062	12	2.08
1063	15	1.67
1064	18	1.39
1065	24	1.04
1066	28	0.89
1067	2x9	1.39
1068	2x12	1.04
1069	2x15	0.83
1070	2x18	0.69
1071	2x24	0.52
1072	2x28	0.45
30VA Series, 2.8"x1.3" 0.98#, 16% regulation.		
1081	9	3.33
1082	12	2.50
1083	15	2.00
1084	18	1.67
1085	24	1.25
1086	28	1.07
1087	2x9	1.67
1088	2x12	1.25
1089	2x15	1.00
1090	2x18	0.83
1091	2x24	0.63
1092	2x28	0.54
50VA Series, 3.2"x1.3" 1.34#, 16% regulation.		
1101	9	5.56
1102	12	4.17
1103	15	3.33
1104	18	2.78
1105	24	2.08
1106	28	1.79
1107	115	0.43
1108	2x9	2.78
1109	2x12	2.08
1110	2x15	1.67
1111	2x18	1.39
1112	2x24	1.04
1113	2x28	0.89
1114	2X48	0.52
1115	2X57.5	0.43
1116	2X115	0.22
75VA Series, 3.3"x1.4" 1.74#, 14% regulation.		
1121	9	8.33
1122	12	6.25
1123	15	5.00
1124	18	4.17
1125	24	3.13
1126	28	2.68
1127	115	0.65
1128	2x9	4.17
1129	2x12	3.13
1130	2x15	2.50
1131	2x18	2.08
1132	2x24	1.56
1133	2x28	1.34
1134	2X48	0.78
1135	2X57.5	0.65
1136	2X115	0.33
100VA Series, 3.8"x1.4" 2.24#, 12% regulation.		
1141	9	11.11
1142	12	8.33
1143	15	6.67
1144	18	5.55
1145	24	4.17
1146	28	3.57
1147	115	0.87
1148	2x9	5.55
1149	2x12	4.17
1150	2x15	3.33
1151	2x18	2.78
1152	2x24	2.08
1153	2x28	1.79
1154	2X48	1.04
1155	2X57.5	0.87
1156	2X115	0.43
120VA Series, 3.8"x1.4" 2.24#, 14% regulation.		
1161	9	13.33
1162	12	10.00
1163	15	8.00
1164	18	6.67
1165	24	5.00
1166	28	4.29
1167	115	1.04
1168	2x9	6.67
1169	2X12	5.00
1170	2x15	4.00
1171	2x18	3.33
1172	2x24	2.50
1173	2x28	2.14
1174	2X48	1.25
1175	2X57.5	1.04
1176	2X115	0.52
150VA Series, 4.2"X1.5" 3.56#, 8% regulation.		
1181	9	16.67
1182	12	12.5
1183	15	10.0
1184	18	8.33
1185	24	6.25
1186	28	5.36
1187	115	1.30
1188	2x9	8.33
1189	2x12	6.25
1190	2x15	5.00
1191	2x18	4.17
1192	2x24	3.13
1193	2x28	2.68
1194	2X48	1.56
1195	2X57.5	1.30
1196	2X115	0.65
200VA Series, 4.5"X1.9" 4.30#, 7% regulation.		
1201	9	22.22
1202	12	16.67
1203	15	13.33
1204	18	11.11
1205	24	8.33
1206	28	7.14
1207	115	1.74
1208	2x9	11.11
1209	2X12	8.33
1210	2x15	6.67
1211	2x18	5.56
1212	2x24	4.17
1213	2x28	3.57
1214	2X48	2.08
1215	2X57.5	1.74
1216	2X115	0.89
300VA Series, 4.8"X2.0" 5.2 #, 6 % regulation.		
1222	12	25.00
1223	15	20.00
1224	18	16.67
1225	24	12.50
1226	28	10.71
1227	115	2.61
1228	2x9	16.67
1229	2X12	12.50
1230	2x15	10.00
1231	2x18	8.33
1232	2x24	6.25
1233	2x28	5.36
1234	2X48	3.13
1235	2X57.5	2.61
1236	2X115	1.30
400VA Series, 5.2"X2.2" 7.2 #, 6 % regulation.		
1243	15	26.67
1244	18	22.22
1245	24	16.67
1246	28	14.29
1247	115	3.48
1248	2x9	22.22
1249	2x12	16.67
1250	2x15	13.33
1251	2x18	11.11
1252	2x24	8.33
1253	2x28	7.14
1254	2X48	4.17
1255	2X57.5	3.48
1256	2X115	1.74
500VA Series, 5.5"X2.3" 8.2 #, 6% regulation.		
1263	15	33.33
1264	18	27.78
1265	24	20.83
1266	28	17.86
1267	115	4.35
1268	2x9	27.78
1269	2x12	20.83
1270	2x15	16.67
1271	2x18	13.89
1272	2x24	10.42
1273	2x28	8.93
1274	2X48	5.21
1275	2X57.5	4.35
1276	2X115	2.17
750VA Series, 6.0"X2.7" 11.6#, 5 % regulation.		
1285	24	31.25
1286	28	26.79
1287	115	6.52
1289	2X12	31.25
1280	2x15	25.00
1291	2x18	20.83
1292	2x24	15.63
1293	2x28	13.39
1294	2X48	7.81
1295	2X57.5	6.52
1296	2X115	3.26
1 kVA Series, 6.8"X2.7" 15.9#, 4% regulation.		
1307	115	8.70
1311	2x18	27.78
1312	2x24	20.83
1313	2x28	17.86
1314	2X48	10.42
1315	2X57.5	8.70
1316	2X115	4.35
1.5kVA Series, 7.1"x3.4" 22#, 4% regulation.		
1307	115	13.04
1312	2x24	31.25
1313	2x28	26.78
1314	2X48	15.63
1315	2X57.5	13.04
1316	2X115	6.52
2.5kVA Series, 7.8"X4.4" 33#, 3% regulation.		
1327	115	21.74
1334	2X48	26.04
1335	2X57.5	21.74
1336	2X115	10.87
6.0kVA Series, 10.5"X5.0" 77#, 2% regulation.		
1356	2X115	26.09
9.0kVA Series, 11.7"X6.0" 116#, 2% regulation.		
1376	2X115	39.13

NOTE: Mechanical dimensions and electrical data accurate to within ±3%.
Semi Epoxy Molded. Add 0.20" OD & 0.09" HT. Full Epoxy Molded: Add 0.20" OD & HT.

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AMECON
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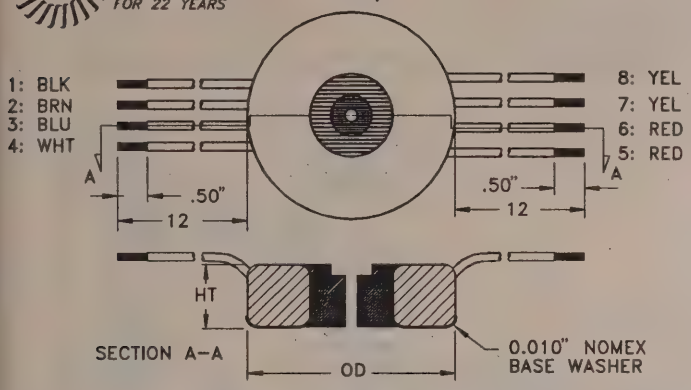
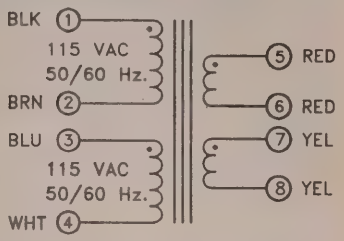
LARGEST SELECTION OF HEAVY DUTY 50/60Hz. TOROIDAL POWER TRANSFORMERS.



For Line Voltage	115V	230V
Apply Input To:	1 & 2	1 & 4
Connect	1 to 3 and 2 to 4	2 to 3

208, 220 OR 240VAC PRIMARY ON REQUEST

PIN NUMBERS ARE FOR REFERENCE ONLY.



Part Number	Load Voltage	Load Current
6VA Series, 2.2"x1.1" 0.44#, 19% regulation		
2001	9	0.67
2002	12	0.50
2003	15	0.40
2004	18	0.33
2005	24	0.25
2006	28	0.21
8VA Series, 2.4"x1.1" 0.53#, 18% regulation		
2021	9	0.88
2022	12	0.67
2023	15	0.53
2024	18	0.44
2025	24	0.33
2026	28	0.28
12VA Series, 2.5"x1.1" 0.72#, 15% regulation.		
2041	9	1.33
2042	12	1.00
2043	15	0.80
2044	18	0.67
2045	24	0.50
2046	28	0.43
2047	2x9	0.67
2048	2x12	0.50
2049	2x15	0.40
2050	2x18	0.33
2051	2x24	0.25
2052	2x28	0.21
20VA Series, 2.8"x1.2" 0.92#, 16% regulation.		
2061	9	2.22
2062	12	1.67
2063	15	1.33
2064	18	1.11
2065	24	0.83
2066	28	0.71
2067	2x9	1.11
2068	2x12	0.83
2069	2x15	0.67
2070	2x18	0.555
2071	2x24	0.42
2072	2x28	0.36
25VA Series, 2.8"x1.3" 1.1#, 15% regulation.		
2081	9	2.78
2082	12	2.08
2083	15	1.67
2084	18	1.39
2085	24	1.04
2086	28	0.89
2087	2x9	1.39
2088	2x12	1.04
2089	2x15	0.83
2090	2x18	0.69
2091	2x24	0.52
092	2x28	0.45
40VA Series, 3.2"x1.3" 1.5#, 15% regulation.		
2101	9	4.44
2102	12	3.33
2103	15	2.67
2104	18	2.22
2105	24	1.67
2106	28	1.43
2107	115	0.35
2108	2x9	2.22
2109	2x12	1.67
2110	2x15	1.33
2111	2x18	1.11
2112	2x24	0.83
2113	2x28	0.71
2114	2X48	0.42
2115	2X57.5	0.35
2116	2X115	0.17
60VA Series, 3.3"x1.4" 1.9#, 13% regulation.		
2121	9	6.66
2122	12	5.00
2123	15	4.00
2124	18	3.33
2125	24	2.50
2126	28	2.14
2127	115	0.52
2128	2x9	3.33
2129	2x12	2.50
2130	2x15	2.00
2131	2x18	1.66
2132	2x24	1.25
2133	2x28	1.07
2134	2X48	0.63
2135	2X57.5	0.52
2136	2X115	0.26
80 VA Series, 3.8"x1.4" 2.5 #, 13% regulation.		
2141	9	8.88
2142	12	6.66
2143	15	5.33
2144	18	4.44
2145	24	3.33
2146	28	2.86
2147	115	0.70
2148	2x9	4.44
2149	2x12	3.33
2150	2x15	2.67
2151	2x18	2.22
2152	2x24	1.67
2153	2x28	1.43
2154	2X48	0.83
2155	2X57.5	0.70
2156	2X115	0.35
100VA Series, 3.8"x1.4" 2.5#, 16% regulation.		
2161	9	11.11
2162	12	8.33
2163	15	6.66
2164	18	5.55
2165	24	4.17
2166	28	3.57
2167	115	0.87
2168	2x9	5.56
2169	2X12	4.17
2170	2x15	3.33
2171	2x18	2.78
2172	2x24	2.08
2173	2x28	1.79
2174	2X48	1.04
2175	2X57.5	0.87
2176	2X115	0.43
120VA Series, 4.2"X1.5" 3.3#, 13% regulation.		
2181	9	13.33
2182	12	10.00
2183	15	8.00
2184	18	6.66
2185	24	5.00
2186	28	4.29
2187	115	1.04
2188	2x9	6.66
2189	2x12	5.00
2190	2x15	4.00
2191	2x18	3.33
2192	2x24	2.50
2193	2x28	2.14
2194	2X48	1.25
2195	2X57.5	1.04
2196	2X115	0.52
160VA Series, 4.5"X1.9" 4.9#, 8% regulation.		
2201	9	17.77
2202	12	13.33
2203	15	10.66
2204	18	8.88
2205	24	6.66
2206	28	5.71
2207	115	1.39
2208	2x9	8.89
2209	2X12	6.67
2210	2x15	5.33
2211	2x18	4.44
2212	2x24	3.33
2213	2x28	2.86
2214	2X48	1.67
2215	2X57.5	1.39
2216	2X115	0.70
250VA Series, 4.8"X2.0" 6.2#, 8% regulation.		
2222	12	20.83
2223	15	16.67
2224	18	13.89
2225	24	10.41
2226	28	8.93
2227	115	2.17
2228	2x9	13.88
2229	2X12	10.41
2230	2x15	8.33
2231	2x18	6.94
2232	2x24	5.20
2233	2x28	4.46
2234	2X48	2.60
2235	2X57.5	2.17
2236	2X115	1.09
320VA Series, 5.2"X2.2" 8.1#, 6% regulation.		
2243	15	21.33
2244	18	17.78
2245	24	13.33
2246	28	11.42
2247	115	2.78
2248	2x9	17.77
2249	2x12	13.33
2250	2x15	10.67
2251	2x18	8.89
2252	2x24	6.67
2253	2x28	5.71
2254	2X48	3.33
2255	2X57.5	2.78
2256	2X115	1.39
400VA Series, 5.5"X2.3" 9.4 #, 6% regulation.		
2264	18	22.22
2265	24	16.67
2266	28	14.28
2267	115	3.48
2268	2x9	22.22
2269	2x12	16.67
2270	2x15	13.33
2271	2x18	11.11
2272	2x24	8.33
2273	2x28	7.14
2274	2X48	4.17
2275	2X57.5	3.48
2276	2X115	1.74
600VA Series, 6.0"X2.7" 13.2#, 5 % regulation.		
2285	24	25.00
2286	28	21.42
2287	115	5.22
2289	2X12	25.00
2280	2x15	20.00
2291	2x18	16.67
2292	2x24	12.50
2293	2x28	10.71
2294	2X48	6.25
2295	2X57.5	5.22
2296	2X115	2.61
800VA Series, 6.8"X2.7" 16.8#, 4% regulation.		
2307	115	6.96
2311	2x18	22.22
2312	2x24	16.67
2313	2x28	14.28
2314	2X48	8.33
2315	2X57.5	6.96
2316	2X115	3.48
1.2kVA Series, 7.1"x3.4" 22 #, 4% regulation.		
2327	115	10.43
2332	2x24	25.00
2333	2x28	21.42
2334	2X48	12.50
2335	2X57.5	10.43
2336	2X115	5.22
2.0kVA Series, 7.8"X4.4" 36 #, 3% regulation.		
2347	115	17.39
2354	2X48	20.83
2355	2X57.5	17.39
2356	2X115	8.70
5.0kVA Series, 10.5"X5.0" 77#, 2% regulation.		
2376	2X115	21.74
7.5kVA Series, 11.7"X6.0" 116#, 2% regulation.		
2396	2X115	32.51

IMPORTANT NOTES.

1: All transformers have been designed for 50/60 Hz.
2: 60 Hz TO 400 kHz. Designs available upon request.
3: Custom designs tailored to your specs are made & evaluated on a 2 wk. cycle.
4: 100% electrostatic shielding available on all transformers with a small power derating.
5: Magnetic shielding & lower magnetic leakage designs for sensitive areas such as encountered in computers & audio equipment are available on all transformers.
6: Low profile designs are available upon request.
7: Amecon has the world's most complete toroidal mfg. facilities. We can machine wind toroids in excess of 50"dia & 2000 LB.

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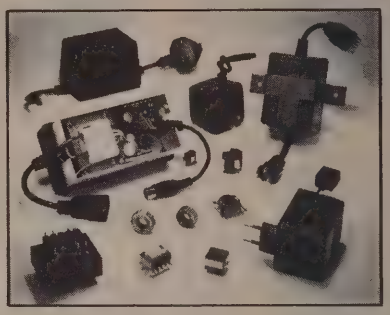
- AC and DC External Power Supplies
- Regulated Linear Power Supplies
- Custom Made Specialized Power Supplies
- Battery Chargers
- Power, Pulse and Telecommunication Transformers
- Inductors and Specialized Magnetic Products

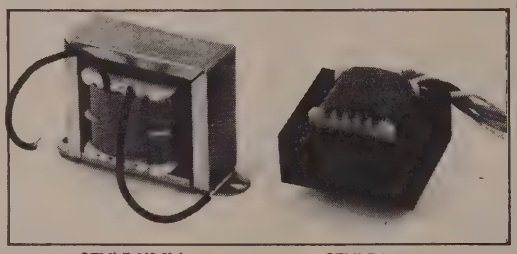


Power Transformers 0.1-250VA

AVAILABLE FEATURES

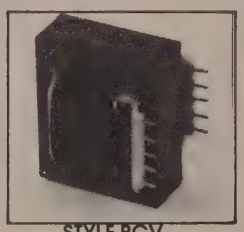
- Any combination of output voltages and load currents
- Single and dual primaries 120/240 volts
- 50/60 Hz operation
- Single or split secondaries
- Split bobbin or concentric winding
- Vertical or horizontal mounting
- Leads or terminals
- Specified breakdown voltage 500–4000 VAC
- High efficiency, specified power dissipation
- Designed to meet UL/CSA/VDE as required

HARDWARE MOUNTED

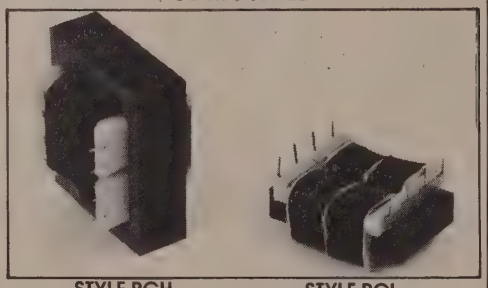


STYLE HMV STYLE HMH

PCB MOUNTED



STYLE PCV



STYLE PCH STYLE PCL

POWER AND SIZE

Power (VA)	Sizes EI
3	EI–35
6	EI–35, EI–41
15	EI–41, EI–48
40	EI–57, EI–60
60	EI–66
100	EI–76, EI–85
180	EI–85
250	EI–96

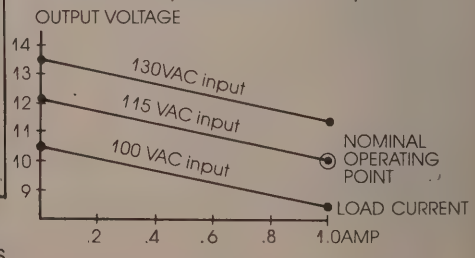
The sizes shown above are recommended sizes for consideration up to the indicated power level.

The optimum selection depends on your exact requirements. Please discuss it with our engineers.

International Transformers IEC BABT

We design and manufacture transformers to the international standards such as VDE, BSI and other agencies. These transformers have larger clearance distances, higher breakdown voltages and provide 220/240 VAC 50 Hz operation.

TYPICAL OUTPUT LOAD CURVES for transformer with nominal output 10VAC @ 1 Amp



See our Power Supply Pages in Volume D Section 4000

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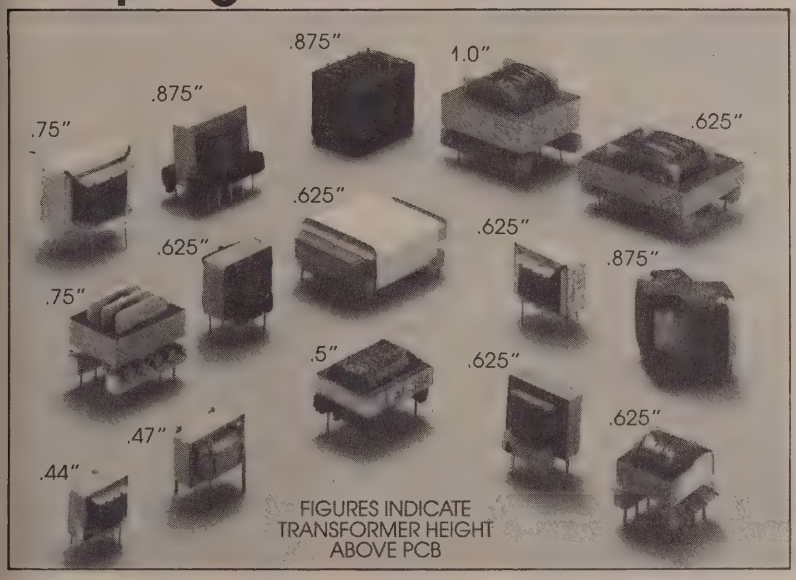
Coupling Transformers

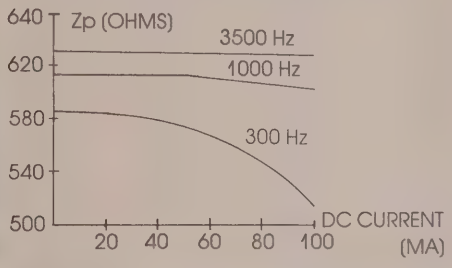


PARAMETERS SELECTION GUIDE

Impedance	Ohms
Return Loss	DB
DC Current	0-120 MA
DCR	Ohms
Frequency Response	DB
Insertion Loss	DB
Max. Power Level	DBM
Longitudinal Balance	40–90 DB
Cross Talk	60–90 DB
Breakdown Voltage	250–4000 VRMS

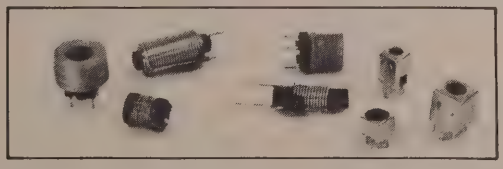
*We will help you select the optimum design in the smallest package based on your exact parameters.

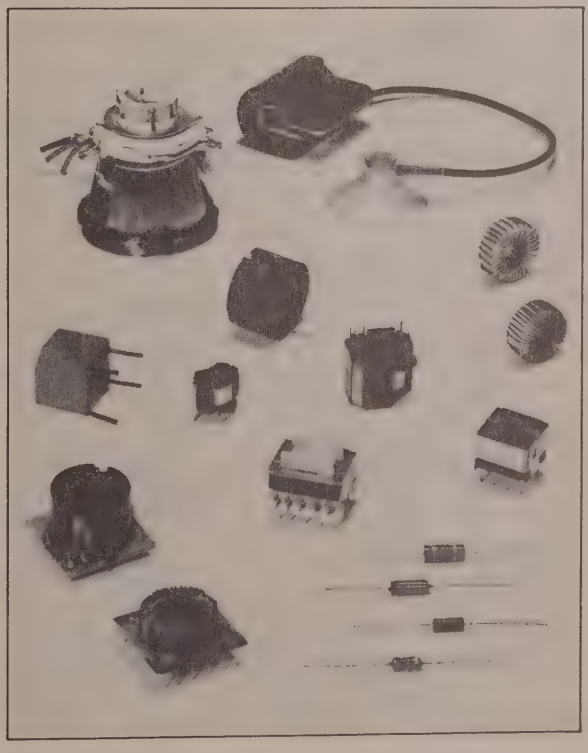
Typical reflected impedance Vs DC Current in coupling transformer primary



Inductors and Specialized Magnetic Products:

- Molded Inductors
- DC Carrying Axial Inductors
- Toroidal Inductors
- Fly Back Transformers and Yokes
- Specialized Magnetics Components





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AT&T Microelectronics

TRANSFORMERS

Miniature Pulse Transformers — 2745 & 2741 Series For Primary-Rate T-Carrier and CEPT

Description

The 2745 and 2741 Miniature Pulse Transformers are ferrite-core devices. They have a compact design for use on densely populated boards. They are compatible with water-soluble fluxes and can be cleaned with aqueous or solvent systems. The devices are packed in tubes for easy machine insertion and are available in through-hole or surface-mount technology. These devices are just two of the many quality transformers offered by AT&T.

Application

The 2745 and 2741 Transformers are designed for use as line interface transformers and are compatible with the AT&T Digital Signaling Interface (DSI) devices. These transformers contain well-balanced windings to help cancel common-mode noise on the line and improve longitudinal suppression. The 2758 series is a surface-mount version of the 2745 and 2741 units.

Electrical Characteristics

Component Code	Turns Ratio (PRI:SEC)	Minimum Primary Inductance (mH)	Maximum Primary Leakage Inductance (μH)	Maximum Interwinding Capacitance (pF)	Maximum dc Resistance Primary (Ω)	Maximum dc Resistance Secondary (Ω)	Minimum ac Breakdown (Vac)	Figure	Schematic
2741G*	1:2	3.15	6.5	5	1.85	4.40	850	1	1
2741H*	1:1.36	0.92	2.5	5	0.83	1.43	850	1	2
2741J*	1:1.37	0.92	2.0	8	0.80	1.25	850	1	6
2745B	1:2	3.5	7.0	110(TYP)	4.9	10.2	850	2	3
2745C	1:1.37	0.680	1.2	85(TYP)	1.0	1.4	850	2	4
2745G	1:1.14	1.75	1.4	80	0.95	1.10	850	2	4
2745AE	1:1.43	1.3	1.2	90	0.58	0.86	850	2	4
2745AF	1:2	3.15	3.0	23	1.55	3.15	850	2	3
2745AG	1:1	2.3	2.0	25	0.98	1.06	850	2	4
2745AH	1:3.76	0.43	0.64	45.0	0.35	1.45	850	2	7
2745CA	1:1.36	0.92	0.7	20	0.85	1.18	850	2	9
2745AJ	1:1.07	1.0	0.8	75(TYP)	0.50	1.0	850	2	4
2758A	1:1.41	12.0	10.0	30	3.0	5.0	500	3	5
2758B2	1:1.14	1.75	2.0	80	0.80	0.80	850	4	8
2758C2	1:2	3.15	3.0	30	1.10	2.25	850	4	11
2758D†	1:1.14	1.3	1.5	5	0.50	0.60	850	3	10
2758E	1:2	3.15	3.2	5	1.00	3.40	850	3	10
2758G2	1:1.37	0.7	1.2	50(TYP)	0.34	0.44	850	4	8

* A wire-wound electrostatic shield is included between the primary and secondary.
† 2758D2 also available with same electrical requirements except Figure 4 mechanical dimensions.

Outline Drawings

Dimensions are in inches and (millimeters).

Figure 1

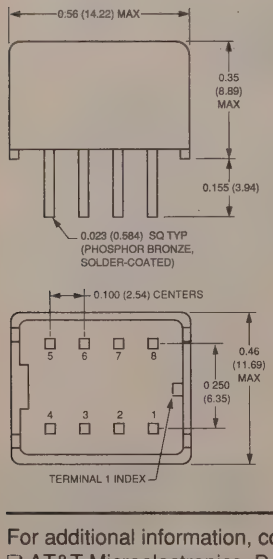


Figure 2

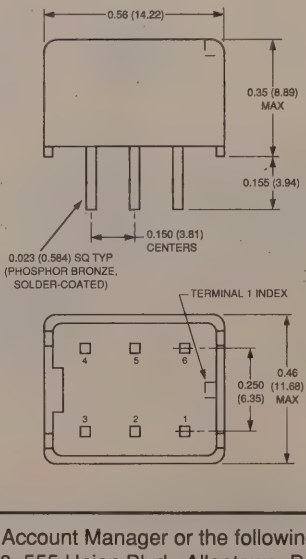
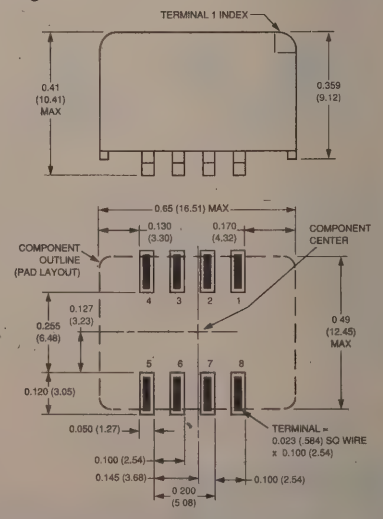


Figure 3



For additional information, contact your AT&T Account Manager or the following:
❑ AT&T Microelectronics, Dept. AL-500404200, 555 Union Blvd., Allentown, PA 18103 **1-800-372-2447** (In Canada, **1-800-553-2448**)

AT&T Microelectronics

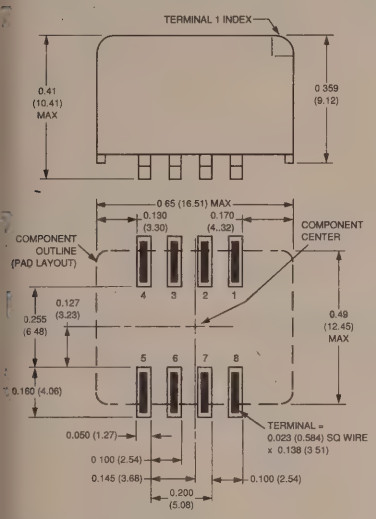
TRANSFORMERS

Miniature Pulse Transformers — 2745 & 2741 Series For Primary-Rate T-Carrier and CEPT

Outline Drawings (continued)

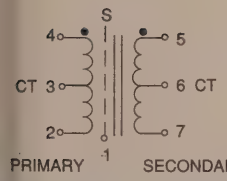
Dimensions are in inches and (millimeters).

Figure 4



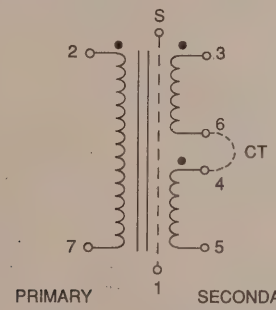
Schematic Drawings

Schematic 1



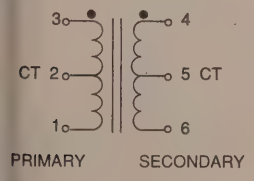
Notes: S denotes electrostatic shield. There is an internal connection to pin 8; do not use.

Schematic 2

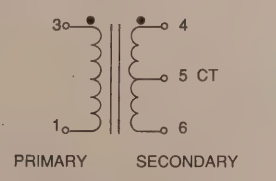


Notes: Center tap is formed by externally connecting terminal 6 to 4. There is an internal connection to terminal 8; do not use.

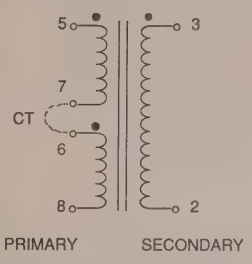
Schematic 3



Schematic 4

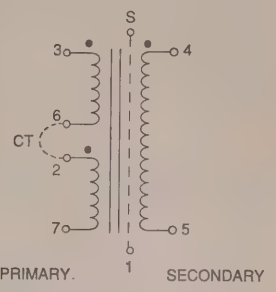


Schematic 5



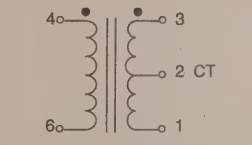
Note: Center tap is formed by externally connecting terminal 7 to 6.

Schematic 6

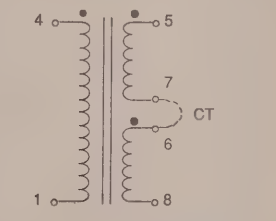


Notes: S denotes electrostatic shield. Center tap is formed by externally connecting terminal 6 to 2. There is an internal connection to terminal 8; do not use.

Schematic 7

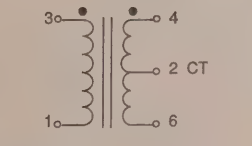


Schematic 8

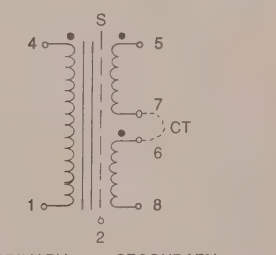


Note: Center tap is formed by externally connecting terminal 7 to 6.

Schematic 9

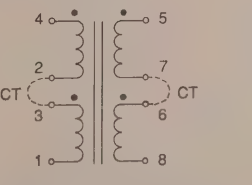


Schematic 10



Notes: S denotes electrostatic shield. Center tap is formed by externally connecting terminal 7 to 6.

Schematic 11



Note: Center tap is formed by externally connecting terminal 2 to 3 and 7 to 6.

AT&T Microelectronics

TRANSFORMERS

ISDN Basic-Rate Interface Transformers

Description

The 2718, 2754, and 2717 are ferrite-core pulse transformers. They are compatible with water-soluble fluxes and can be cleaned with aqueous or solvent systems. The 2718 and 2717 units are packaged in tubes for easy machine insertion. The 2754 type transformers are packaged in boxes, not tubes, due to the larger size.

AT&T also offers a line of ferrite-core surface-mount structures for high-frequency power transformer applications. For more information, contact AT&T Microelectronics.

Application

AT&T supplies isolation transformers for use at the two-wire U-Interface and for use at the S/T Interface. These transformers meet the ANSI T1.601-1988 (2B1Q line code) for the 2754 series transformers, and the 2718 series meets the CCITT basic-rate 2B+D applications. The 2717B was designed for the prestandard AMI line code.

Electrical Characteristics

Component Code	Turns Ratio (PRI:SEC)	Minimum Primary Inductance (mH)	Maximum Primary Leakage Inductance (μH)	Maximum Interwinding Capacitance (pF)	Maximum dc Resistance Primary (Ω)	Maximum dc Resistance Secondary (Ω)	Minimum ac Breakdown (Vac)	Figure	Schematic
2718AM	1:2.5	22	18	25	2.8	6.0	1000	1	1
2718AW	1:2	22	18	25	2.2	5.4	1500	1	2
2718AT	1:2.5	22	12	30	1.9	5.8	1500	1	2
2718AU	1:1.8	22	11	30	2.0	4.2	1500	1	2
2718AY	1:1.8	22	16.5	25	2.3	4.9	1500	1	2
2754B*	1:2.5	11.5	23	—	1.5	9.1	1000	2	3
2754G2	1:2.5	12	25.6	—	2.5	12.2	1000	2	5
2754H2	1:1.5	12.3	27.5	—	6.8	12.4	1000	2	5
2717BK	1:1.42	8.5	10	30	2.0	3.2	850	3	4

* Operating temperature range is 0 °C to 85 °C.

Outline Drawings

Dimensions are in inches and (millimeters).

Figure 1

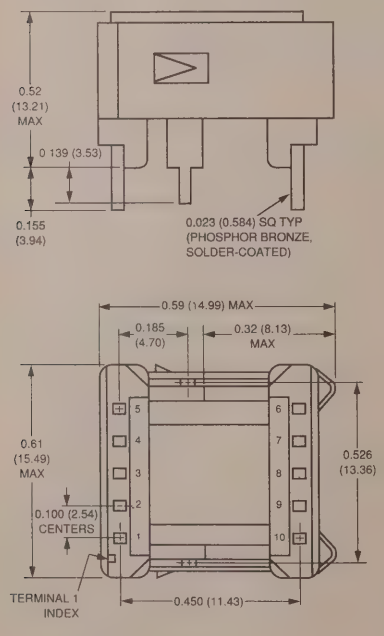


Figure 2

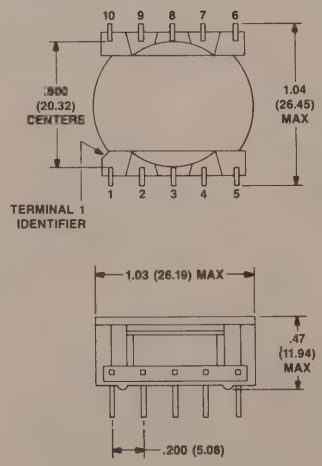
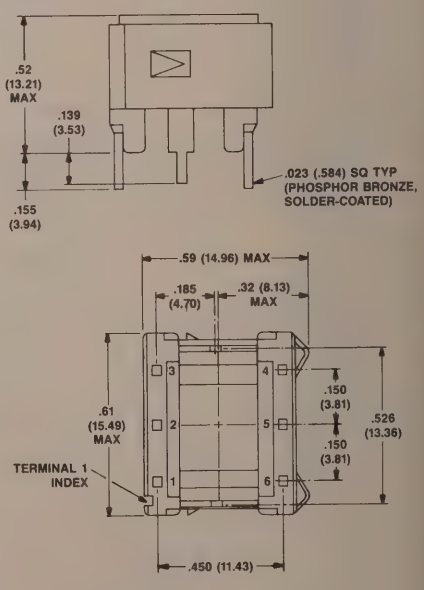


Figure 3



For additional information, contact your AT&T Account Manager or the following:
❑ AT&T Microelectronics, Dept. AL-500404200, 555 Union Blvd., Allentown, PA 18103 **1-800-372-2447** (In Canada, **1-800-553-2448**)

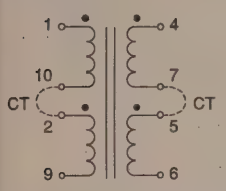
AT&T Microelectronics

TRANSFORMERS

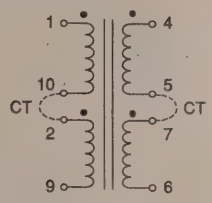
ISDN Basic-Rate Interface Transformers

Schematic Drawings

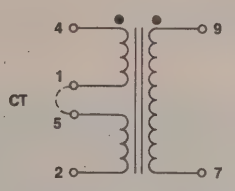
Schematic 1



Schematic 2

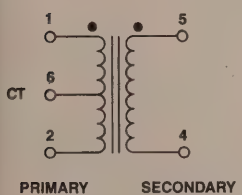


Schematic 3

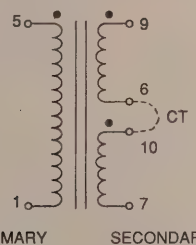


Notes: Center tap is formed by externally connecting terminal 1 to 5. There is an internal connection to terminals 8 and 3; do not use. Typical application: device connected to terminals 4 to 2 and line connected to terminals 9 to 7.

Schematic 4



Schematic 5



Notes: Center tap is formed by externally connecting terminal 6 to 10. There is an internal connection to terminals 8 and 3; do not use. Typical application: device connected to terminals 5 to 1 and line connected to terminals 9 to 7.

TOROIDAL POWER TRANSFORMERS...ASK AVEL

ENCAPSULATED RANGE OFF-THE-SHELF

Designed for both PCB and flying lead connection. The resin filled thermoplastic case protects the transformer from harsh environmental conditions and from accidental damage. The PCB style is a time saver in assembly.

▼ PRINTED CIRCUIT STYLE ▼

Type	Primary Volts V	Nom. Load VA	Secondary RMS Volts V	Secondary RMS Current A	Dimensions Dia. in	Dimensions Ht. in	Weight lbs Typical	Mounting
40/3030	115+115	15	6+6	1.250	2.60	1.30	0.77	8–32 Central
40/3031	115+115	15	9+9	0.830	2.60	1.30	0.77	
40/3032	115+115	15	12+12	0.625	2.60	1.30	0.77	
40/3033	115+115	15	15+15	0.500	2.60	1.30	0.77	
40/3034	115+115	15	20+20	0.375	2.60	1.30	0.77	
40/3035	115+115	30	6+6	2.500	3.25	1.40	1.30	8–32 Central
40/3036	115+115	30	9+9	1.666	3.25	1.40	1.30	
40/3037	115+115	30	12+12	1.250	3.25	1.40	1.30	
40/3038	115+115	30	15+15	1.000	3.25	1.40	1.30	
40/3039	115+115	30	20+20	0.750	3.25	1.40	1.30	
40/3040	115+115	50	9+9	2.800	3.75	1.55	2.00	2 × 8–32 spaced 0.40in
40/3041	115+115	50	12+12	2.100	3.75	1.55	2.00	
40/3042	115+115	50	15+15	1.670	3.75	1.55	2.00	
40/3043	115+115	50	20+20	1.250	3.75	1.55	2.00	
40/3044	115+115	50	25+25	1.000	3.75	1.55	2.00	

▼ FLEXIBLE LEAD STYLE ▼

Type	Primary Volts V	Nom. Load VA	Secondary RMS Volts V	Secondary RMS Current A	Dimensions Dia. in	Dimensions Ht. in	Weight lbs Typical	Mounting
40/3000	115+115	15	6+6	1.250	2.70	1.25	0.77	8–32 Central
40/3001	115+115	15	9+9	0.830	2.70	1.25	0.77	
40/3002	115+115	15	12+12	0.625	2.70	1.25	0.77	
40/3003	115+115	15	15+15	0.500	2.70	1.25	0.77	
40/3004	115+115	15	20+20	0.375	2.70	1.25	0.77	
40/3005	115+115	30	6+6	2.500	3.30	1.35	1.30	8–32 Central
40/3006	115+115	30	9+9	1.666	3.30	1.35	1.30	
40/3007	115+115	30	12+12	1.250	3.30	1.35	1.30	
40/3008	115+115	30	15+15	1.000	3.30	1.35	1.30	
40/3009	115+115	30	20+20	0.750	3.30	1.35	1.30	
40/3010	115+115	50	9+9	2.800	3.90	1.55	2.00	2×8–32 spaced 0.40in
40/3011	115+115	50	12+12	2.100	3.90	1.55	2.00	
40/3012	115+115	50	15+15	1.670	3.90	1.55	2.00	
40/3013	115+115	50	20+20	1.250	3.90	1.55	2.00	
40/3014	115+115	50	25+25	1.000	3.90	1.55	2.00	
40/3015	115+115	90	12+12	3.750	4.20	1.80	3.00	2×8–32 spaced 0.40in
40/3016	115+115	90	15+15	3.000	4.20	1.80	3.00	
40/3017	115+115	90	20+20	2.250	4.20	1.80	3.00	
40/3018	115+115	90	25+25	1.800	4.20	1.80	3.00	
40/3019	115+115	90	30+30	1.500	4.20	1.80	3.00	
40/3020	115+115	130	18+18	3.610	4.90	1.90	4.30	2×8–32 spaced 0.80in
40/3021	115+115	130	22+22	3.000	4.90	1.90	4.30	
40/3022	115+115	130	30+30	2.160	4.90	1.90	4.30	
40/3023	115+115	130	35+35	1.850	4.90	1.90	4.30	
40/3024	115+115	130	40+40	1.620	4.90	1.90	4.30	

GENERAL SPECIFICATION— PRINTED CIRCUIT, FLEXIBLE LEAD STYLE

Input line voltage: 115 or 230V
Frequency: 50/60Hz Operating range 47 to 400Hz
Secondary voltage tolerance: within 3% at nominal input and full load.
Primary to Secondary insulation: 2500V r.m.s.
Maximum operating temperature 55°C ambient.
Leads: 10 in. long, stranded.
Also available with UL recognition.

PERFORMANCE DETAILS

Nominal Load VA	Regulation %	Temp. Rise °C	Iron Loss W	Copper Loss W
15	15	14	0.26	2.25
30	13	30	0.40	4.00
50	10	35	0.60	5.00
90	7	40	1.00	6.50
130	6.5	40	2.00	10.00

Avel Transformers Inc.

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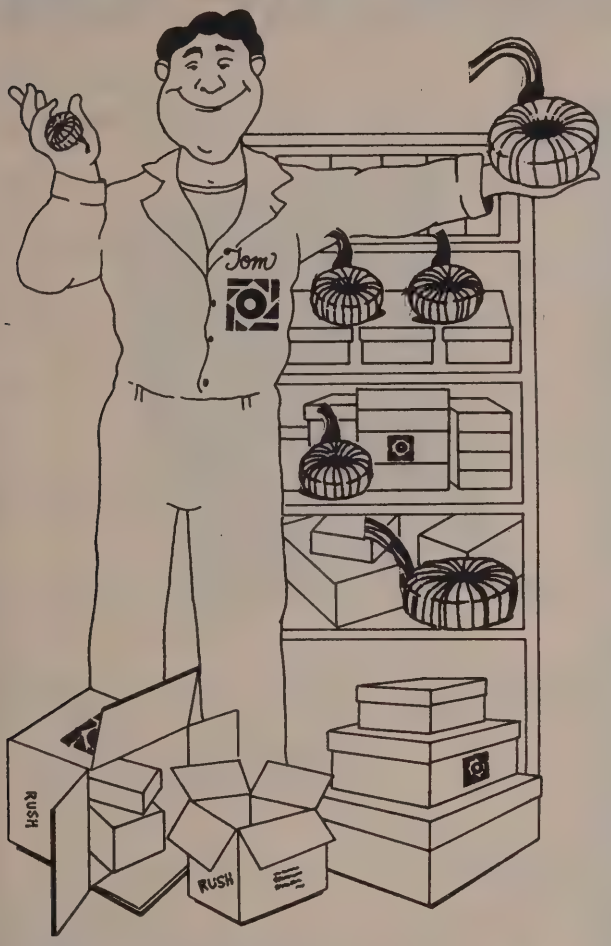
TOROIDAL POWER TRANSFORMERS...ASK AVEL



READY MADE RANGE

IN STOCK

The polyester tape finish has proved to be the most popular method of constructing toroidal transformers for modern day electronics.

Choosing from the wide range of toroids, shown in the table, is the most inexpensive way to match J. I. T. schedules. Transformers can be shipped the same day requested!

TYPE	LOAD VA	SECONDARY RMS VOLTS V	SECONDARY RMS CURRENT A	DIMENSIONS DIA. INS.	DIMENSIONS HT. INS.	WEIGHT LBS. TYPICAL	MOUNTING
D4000	30	6+6	2.50	2.8	1.2	0.93	2 in. Dished Fixing Plate 0.08 in. Clearance
D4001	30	9+9	1.67	2.8	1.2	0.93	
D4002	30	12+12	1.25	2.8	1.2	0.93	
D4003	30	15+15	1.00	2.8	1.2	0.93	
D4004	30	18+18	0.83	2.8	1.2	0.93	
D4005	30	22+22	0.68	2.8	1.2	0.93	
D4006	30	25+25	0.60	2.8	1.2	0.93	
D4007	30	30+30	0.50	2.8	1.2	0.93	
D4010	60	9+9	3.33	3.5	1.3	1.87	2.75 in. Dished Fixing Plate 0.16 in. Clearance
D4011	60	12+12	2.50	3.5	1.3	1.87	
D4012	60	15+15	2.00	3.5	1.3	1.87	
D4013	60	18+18	1.67	3.5	1.3	1.87	
D4014	60	22+22	1.36	3.5	1.3	1.87	
D4015	60	25+25	1.20	3.5	1.3	1.87	
D4016	60	30+30	1.00	3.5	1.3	1.87	
D4019A	60	120+120	0.25	3.5	1.3	1.87	
D4018	60	220	0.27	3.5	1.3	1.87	
D4020	100	12+12	4.17	3.6	1.7	2.65	2.75 in. Dished Fixing Plate 0.16 in. Clearance
D4021	100	15+15	3.33	3.6	1.7	2.65	
D4022	100	18+18	2.78	3.6	1.7	2.65	
D4023	100	22+22	2.27	3.6	1.7	2.65	
D4024	100	25+25	2.00	3.6	1.7	2.65	
D4025	100	30+30	1.67	3.6	1.7	2.65	
D4028A	100	120+120	0.42	3.6	1.7	2.65	
D4027	100	220	0.45	3.6	1.7	2.65	
D4030	160	18+18	4.44	4.5	1.7	4.19	3.5 in. Dished Fixing Plate 0.16 in. Clearance
D4031	160	22+22	3.64	4.5	1.7	4.19	
D4032	160	25+25	3.20	4.5	1.7	4.19	
D4033	160	30+30	2.67	4.5	1.7	4.19	
D4034	160	35+35	2.29	4.5	1.7	4.19	
D4037A	160	120+120	0.67	4.5	1.7	4.19	
D4036	160	220	0.73	4.5	1.7	4.19	
D4040	230	25+25	4.60	4.7	2.0	5.89	4.3 in. Dished Fixing Plate 0.16 in. Clearance
D4041	230	30+30	3.83	4.7	2.0	5.89	
D4042	230	35+35	3.29	4.7	2.0	5.89	
D4043	230	40+40	2.88	4.7	2.0	5.89	
D4046A	230	120+120	0.96	4.7	2.0	5.89	
D4045	230	220	1.05	4.7	2.0	5.89	
D4050	330	25+25	6.60	5.2	2.0	7.28	4.3 in. Dished Fixing Plate 0.16 in. Clearance
D4051	330	30+30	5.50	5.2	2.0	7.28	
D4052	330	35+35	4.71	5.2	2.0	7.28	
D4053	330	40+40	4.13	5.2	2.0	7.28	
D4054	330	45+45	3.67	5.2	2.0	7.28	
D4057A	330	120+120	1.38	5.2	2.0	7.28	
D4056	330	220	1.50	5.2	2.0	7.28	
D4060	530	30+30	8.83	5.9	2.4	11.03	4.3 in. Dished Fixing Plate 0.16 in. Clearance
D4061	530	35+35	7.57	5.9	2.4	11.03	
D4062	530	40+40	6.63	5.9	2.4	11.03	
D4063	530	45+45	5.89	5.9	2.4	11.03	
D4064	530	50+50	5.30	5.9	2.4	11.03	
D4067A	530	120+120	2.21	5.9	2.4	11.03	
D4066	530	220	2.41	5.9	2.4	11.03	

GENERAL SPECIFICATION

Primaries: 120V + 120V
Frequency: 50/60 Hz
Operating range: 47 to 400 Hz
Secondary voltage tolerance: within 3% at nominal input and full load.
Primary to secondary insulation: 4000V rms
Ambient plus temperature rise should not exceed 105°C
Leads: 6 inches long pvc insulated

Load VA	Regulation %	Temp. Rise °C	Iron Loss W	Copper Loss W
30	16	50	0.40	4.8
60	13	50	0.9	7.8
100	10	50	1.2	10
160	9	56	2.0	14.4
230	8	56	2.75	18.4
330	7	58	3.4	23
530	6	60	5.0	32

Recognized Component Underwriters Labs, Inc.

Or, for special needs, let us quote on a custom design with competitive pricing!

Avel Transformers Inc.

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CUSTOM MADE TOROIDAL POWER TRANSFORMERS...ASK AVEL

Toroids – the lighter – quieter – smaller – lower in stray field alternative to laminated transformers.

When your design indicates more than an off-the-shelf type, let Avel quote to your specifications.

Consider the options/parameters below when planning your design.

Finishes: Polyester tape • Encapsulated – metal/plastic • Vacuum varnish impregnated.

Terminations: Stranded leads • Solid leads • PCB style • Terminals • Tag band.

Method of mounting: • Epoxy center with threaded bush/clearance hole.

• Fixing kit (dished metal washer & bolt)

• Mounting frame

Shielding: Can be added to further reduce the inherent low radiated field-of the toroidal transformer in the form of exterior metal shielding or for interwinding shielding – copper foil.

Agency standards: UL 506 recognized • IEC 742 approved, covering VDE 0550/0551.

Construction to UL 544, 1411 etc. CSA, and most international specifications.

EXAMPLE OF COMMON SIZES 50/60 Hz

VA RATING	NOMINAL SIZES IN.	WEIGHTS POUNDS	REGULATION	SUGGESTED FIXING DISC/BOLT
15	2.8 x 1.1	0.77	16%	2 in./3/16 in.
30	2.8 x 1.2	0.93	16%	2 in./3/16 in.
60	3.5 x 1.3	1.87	13%	2.8 in./1/4 in.
100	3.6 x 1.7	2.65	10%	2.8 in./1/4 in.
160	4.5 x 1.7	4.19	9%	3.5 in./1/4 in.
230	4.7 x 2.0	5.89	8%	4.3 in./5/16 in.
330	5.2 x 2.0	7.28	7%	4.3 in./5/16 in.
530	5.9 x 2.4	11.03	6%	4.3 in./5/16 in.
600	6.5 x 3.0	13.23	5%	2 x 1/4-20 Spaced 1 in.
800	7.1 x 3.0	15.44	4%	2 x 1/4-20 Spaced 1 in.
1000	7.7 x 3.2	17.64	4%	2 x 1/4-20 Spaced 1 in.
1500	8.3 x 3.5	19.85	3%	Fixing Bracket
2000	8.5 x 3.9	20.95	3%	Fixing Bracket
2500	8.5 x 4.7	26.46	2.5%	Fixing Bracket
3000	9.6 x 4.7	33.08	2%	Fixing Bracket

Heat rise typically 40°C at 50 Hz.

A smaller transformer will result if design is for 60 Hz only, or if a higher temperature rise is specified.

Fixing Bracket will increase height by 0.4 inch.

Avel Transformers Inc.

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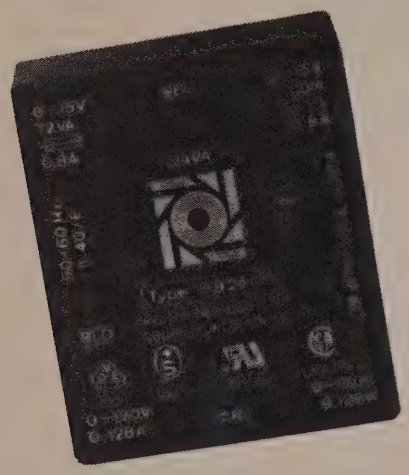
LOW PROFILE POWER TRANSFORMERS...ASK AVEL

THE INTERNATIONAL TRANSFORMER



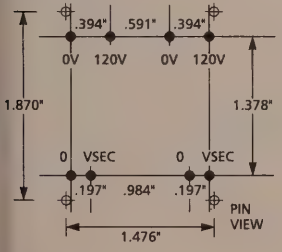
ENCAPSULATED – SLIM LINE – PCB MOUNTED,
LOW INTER-WINDING CAPACITANCE – 5000 V HIPOT TESTED

CERTIFIED TO:
IEC 742, DIN/EN60 742, UL 506, CSA 22.2, SEV TP 21/2A, VDE 0551-9.75

The OB range bobbin transformer was designed for use where a power supply is an integral part of a printed circuit board especially for close card spacing and/or where regulatory agency recognitions are needed.

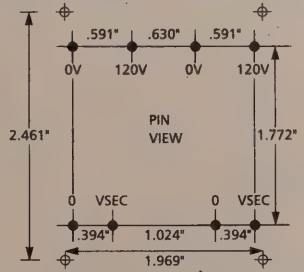
Resin filled under vacuum into a thermoplastic case, allowing for a 5000 V hipot in a low profile package.

BOARD DETAILS –
2, 4, 6 VA.
PIN SIZE 0.04" X 0.02"



TYPE	HEIGHT	WIDTH	DEPTH	FIXING
OB 2	0.692"	2.087"	1.732"	No 4 Self Tap
OB 4	0.772"			
OB 6	0.889"			

BOARD DETAILS –
0.8, 10, 14, 18, 24, 30 VA.
PIN SIZE 0.04" X 0.02"



TYPE	HEIGHT	WIDTH	DEPTH	FIXING
OB 0.8	0.425"	2.677"	2.244"	No Self Tap
OB 10	0.898"			
OB 14	0.961"			
OB 18	1.087"			
OB 24	1.236"			
OB 30	1.409"			

Primary 120 V + 120 V 50/60 Hz
Secondary voltage tolerance: within 5% at nominal input and input and full load.
Certification to: UL 506, CSA C22.2, VDE 0551, IEC 742, SEV 1003, DIN/EN60 742.

Type	Load VA	Secondary RMS Rating Series	Secondary RMS Rating Parallel	Regulation Typically	Weight Grams	Weight lbs.
OB.8-5	0.8	10V @ 80mA	5V @ 160mA	30%	107	0.23
OB.8-6	0.8	12V @ 67mA	6V @ 133mA	30%	107	0.23
OB.8-9	0.8	18V @ 44mA	9V @ 88mA	30%	107	0.23
OB.8-12	0.8	24V @ 33mA	12V @ 66mA	30%	107	0.23
OB.8-15	0.8	30V @ 27mA	15V @ 33mA	30%	107	0.23
OB.8-18	0.8	36V @ 22mA	18V @ 44mA	30%	107	0.23
OB.8-24*	0.8	48V @ 17mA	24V @ 33mA	30%	107	0.23
OB2-5	2	10V @ 200mA	5V @ 400mA	25%	115	0.254
OB2-6	2	12V @ 170mA	6V @ 330mA	25%	115	0.254
OB2-9	2	18V @ 110mA	9V @ 220mA	25%	115	0.254
OB2-12	2	24V @ 85mA	12V @ 170mA	25%	115	0.254
OB2-15	2	30V @ 70mA	15V @ 140mA	25%	115	0.254
OB2-18	2	36V @ 55mA	18V @ 110mA	25%	115	0.254
OB2-24*	2	48V @ 40mA	24V @ 80mA	25%	115	0.254
OB4-5	4	10V @ 400mA	5V @ 800mA	22%	145	0.320
OB4-6	4	12V @ 330mA	6V @ 660mA	22%	145	0.320
OB.4-9	4	18V @ 220mA	9V @ 440mA	22%	145	0.320
OB4-12	4	24V @ 165mA	12V @ 330mA	22%	145	0.320
OB4-15	4	30V @ 135mA	15V @ 270mA	22%	145	0.320
OB4-18	4	36V @ 110mA	18V @ 220mA	22%	145	0.320
OB4-24*	4	48V @ 85mA	24V @ 170mA	22%	145	0.320
OB6-5	6	10V @ 600mA	5V @ 1·2A	19%	175	0.386
OB6-6	6	12V @ 500mA	6V @ 1A	19%	175	0.386
OB6-9	6	18V @ 330mA	9V @ 660mA	19%	175	0.386
OB6-12	6	24V @ 250mA	12V @ 500mA	19%	175	0.386
OB6-15	6	30V @ 200mA	15V @ 400mA	19%	175	0.386
OB6-18	6	36V @ 165mA	18V @ 330mA	19%	175	0.386
OB6-24*	6	48V @ 125mA	24V @ 250mA	19%	175	0.386
OB10-5	10	10V @ 1A	5V @ 2A	26%	280	0.617
OB10-6	10	12V @ 830mA	6V @ 1·66A	26%	280	0.617
OB10-9	10	18V @ 550mA	9V @ 1·10A	26%	280	0.617
OB10-12	10	24V @ 420mA	12V @ 840mA	26%	280	0.617
OB10-15	10	30V @ 335mA	15V @ 670mA	26%	280	0.617
OB10-18	10	36V @ 280mA	18V @ 560mA	26%	280	0.617
OB10-24*	10	48V @ 210mA	24V @ 420mA	26%	280	0.617
OB14-5	14	10V @ 1·4A	5V @ 2·8A	18%	315	0.695
OB14-6	14	12V @ 1·15A	6V @ 2·3A	18%	315	0.695
OB14-9	14	18V @ 780mA	9V @ 1·56A	18%	315	0.695
OB14-12	14	24V @ 585mA	12V @ 1·17A	18%	315	0.695
OB14-15	14	30V @ 470mA	15V @ 940mA	18%	315	0.695
OB14-18	14	36V @ 390mA	18V @ 780mA	18%	315	0.695
OB14-24*	14	48V @ 290mA	24V @ 580mA	18%	315	0.695
OB18-5	18	10V @ 1·8A	5V @ 3·6A	17%	375	0.827
OB18-6	18	12V @ 1·5A	6V @ 3·0A	17%	375	0.827
OB18-9	18	18V @ 1·0A	9V @ 2·0A	17%	375	0.827
OB18-12	18	24V @ 750mA	12V @ 1·5A	17%	375	0.827
OB18-15	18	30V @ 600mA	15V @ 1·2A	17%	375	0.827
OB18-18	18	36V @ 500mA	18V @ 1·0A	17%	375	0.827
OB18-24	18	48V @ 375mA	24V @ 750mA	17%	375	0.827
OB24-5	24	10V @ 2·4A	5V @ 4·8A	16%	445	0.981
OB24-6	24	12V @ 2·0A	6V @ 4·0A	16%	445	0.981
OB24-9	24	18V @ 1·33A	9V @ 2·66A	16%	445	0.981
OB24-12	24	24V @ 1·0A	12V @ 2·0A	16%	445	0.981
OB24-15	24	30V @ 800mA	15V @ 1·6A	16%	445	0.981
OB24-18	24	36V @ 670mA	18V @ 1·34A	16%	445	0.981
OB24-24*	24	48V @ 500mA	24V @ 1·0A	16%	445	0.981
OB30-5	30	10V @ 3·0A	5V @ 6·0A	15%	530	1.169
OB30-6	30	12V @ 2·5A	6V @ 5·0A	15%	530	1.169
OB30-9	30	18V @ 1·67A	9V @ 3·33A	15%	530	1.169
OB30-12	30	24V @ 1·25A	12V @ 2·5A	15%	530	1.169
OB30-15	30	30V @ 1·0A	15V @ 2·0A	15%	530	1.169
OB30-18	30	36V @ 830mA	18V @ 1·67A	15%	530	1.169
OB30-24*	30	48V @ 625mA	24V @ 1·25A	15%	530	1.169

*These transformers meet VDE 0550 only.

Avel Transformers Inc.
47 South End Plaza, New Milford, CT 06776 • **203-355-4711-Fax: 203-354-8597**

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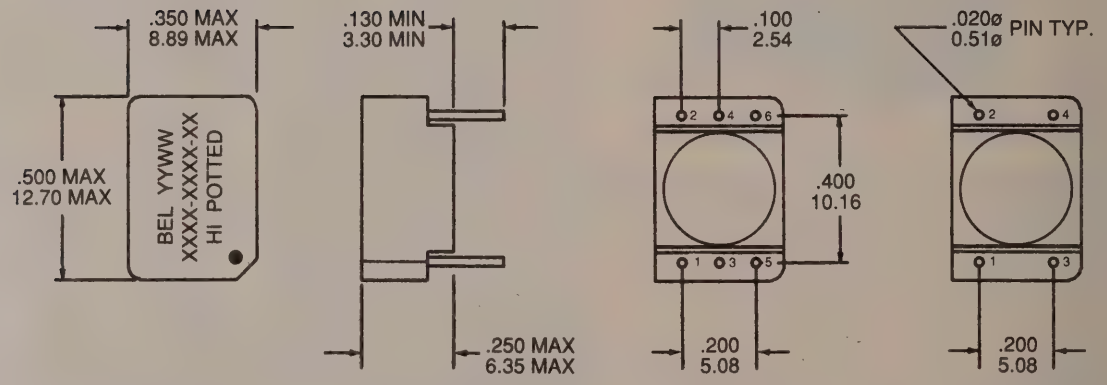
LAN NETWORKING TRANSFORMERS

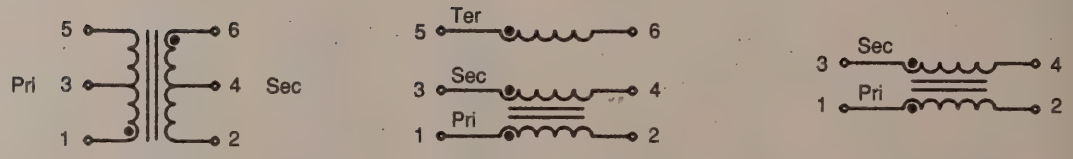
- Reliable, High Quality Construction
- Wide Selection of Standard Types
- Competitive Pricing on Small and High Volume Orders
- Shipment from Stock Available on Most Types
- 2,000 V RMS Isolation Standard on All Items
- Custom Designs Available
- Versatile "T" Case Outline



Top View | **Side View** | **Bottom View** 3 Winding OR 2 Winding W/ Cen. Tap | **Bottom View** 2 Winding

Inches
MM

PINOUTS



3 Winding | 2 Winding W/ Cen. Tap | 2 Winding

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LAN NETWORKING TRANSFORMERS

Part Number * 0553	Turns Ratio ±5%	Primary Sine Wave OLC (uh min)	Primary Winding ET-Const (V-us max)	Rise Time (ns max)	Pri/Sec Cw/w (pf max)	Pri/Sec Leakage Ind (uh max)	Pri DCR (Ohms max	Sec DCR (Ohms max	Tertiary DCR (Ohms max
0053-IC	1:1:1	5,000	25.0	10.5	60	1.3	3.9	3.9	3.9
0023-IC	1:1:1	2,000	16.0	8.2	37	0.8	2.5	2.5	2.5
0013-IC	1:1:1	1,000	11.0	8.0	30	0.7	2.0	2.0	2.0
5006-IC	1:1:1	500	8.5	5.3	32	0.4	1.3	1.3	1.3
2006-IC	1:1:1	200	5.0	4.2	18	0.3	0.9	0.9	0.9
1006-IC	1:1:1	100	5.0	5.6	15	0.5	1.0	1.0	0.1
0506-IC	1:1:1	50	5.2	5.6	18	0.5	1.3	1.3	1.3
0206-IC	1:1:1	20	3.2	4.1	21	0.4	0.9	0.9	0.9
0106-IC	1:1:1	10	3.7	5.1	22	0.5	0.9	0.9	0.9
0053-PC	2:1:1	5,000	25.0	16.0	33	3.6	3.9	2.0	2.0
0023-PC	2:1:1	2,000	16.0	11.0	19	1.8	2.5	1.4	1.4
5006-PC	2:1:1	500	8.5	5.6	11	1.1	1.3	0.7	0.7
2006-PC	2:1:1	200	5.0	3.2	8	0.8	0.9	0.5	0.5
0206-PC	2:1:1	20	5.8	7.5	12	1.5	1.3	0.8	0.8
2006-QC	3:1:1	200	5.0	3.6	7	1.1	0.9	0.4	0.4
0206-QC	3:1:1	20	3.2	2.7	6	1.3	0.9	0.4	0.4
0023-DC	1ct: 1ct	2,000	16.0	8.2	37	0.8	2.5	2.5	-
0013-DC	1ct: 1ct	1,000	11.0	8.0	30	0.7	2.0	2.0	-
5006-DC	1ct: 1ct	500	8.5	5.3	32	0.4	1.3	1.3	-
2006-DC	1ct: 1ct	200	5.0	4.2	18	0.3	0.9	0.9	-
0506-DC	1ct: 1ct	50	5.2	5.6	18	0.5	1.3	1.3	-
0206-DC	1ct: 1ct	20	3.2	4.1	21	0.4	0.9	0.9	-
0106-DC	1ct: 1ct	10	3.7	5.1	22	0.5	0.9	0.9	-
0023-OC	2 ct: 1 ct	2,000	16.0	11.0	19	1.8	2.5	1.4	-
5006-OC	2 ct: 1 ct	500	8.5	5.6	12	1.2	1.4	0.8	-
2006-OC	2 ct: 1 ct	200	5.0	3.2	8	0.8	0.9	0.5	-
0506-OC	2 ct: 1 ct	50	5.2	5.2	12	1.3	1.3	0.7	-
0206-OC	2 ct: 1 ct	20	5.8	7.5	12	1.5	1.3	0.8	-
0106-OC	2 ct: 1 ct	10	3.7	4.5	9	1.5	0.9	0.5	-

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10 BASE T MAGNETICS ISOLATION TRANSFORMERS

- IEEE 802.3 10mbit/sec Over Twisted Pair
- Industry Standard Packaging
- 2000 Vrms Isolation
- High Performance - High Quality
- Custom Designs Available
- Through Hole Or Surface Mount

Electrical Specifications:

Part Number * A553-	Turns Ratio (±5%)	Primary Sine Wave OCL (μh)	Primary Winding ET-Constant (V-μs min.)	Rise Time (ns max.)	Pri/Sec Cw/w (pf max.)	Pri/Sec Leakage Inductance (μh max.)	Primary DCR (ohms max.)	Secondary DCR (ohms max.)	Package Style
0756-AB	1:1	75	2.1	3.0	10	0.20	0.20	0.20	B
1006-AB	1:1	100	2.1	3.0	10	0.20	0.20	0.20	B
5006-DC	1ct:1ct	500	8.5	5.3	32	0.40	1.3	1.3	C
2006-DC	1ct:1ct	200	5.0	4.2	18	0.30	1.0	0.9	C
1006-DC	1ct:1ct	100	5.0	3.0	12	0.20	0.9	0.9	C
5006-DE	1ct:1ct	500	8.5	5.3	32	0.40	1.3	1.3	E
2006-DE	1ct:1ct	200	5.0	4.2	18	0.30	1.0	0.9	E
1006-DE	1ct:1ct	100	5.0	3.0	12	0.20	0.9	0.9	E
5006-OC	2ct:1ct	500	8.5	5.6	12	1.2	1.3	0.8	C
2006-OC	2ct:1ct	200	5.0	3.2	8	0.8	1.0	0.5	C
1006-OC	2ct:1ct	100	5.0	3.0	7	0.6	0.9	0.9	C
5006-OE	2ct:1ct	500	8.5	5.6	12	1.2	1.3	0.8	E
2006-OE	2ct:1ct	200	5.0	3.2	8	0.8	1.0	0.5	E
1006-OE	2ct:1ct	100	5.0	3.0	7	0.6	0.9	0.9	E
0716-00	1ct:1ct 1ct:$\sqrt{2}$ct	200	5.0	4.2	18	0.30	0.35	0.35	E

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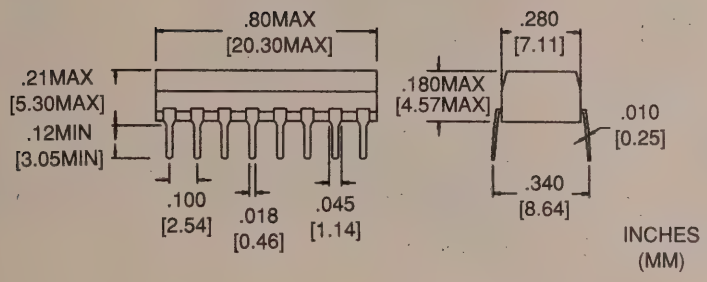
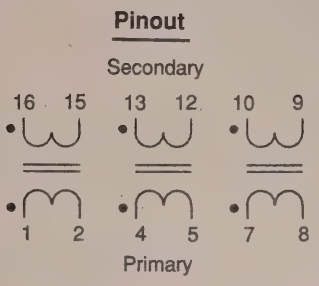
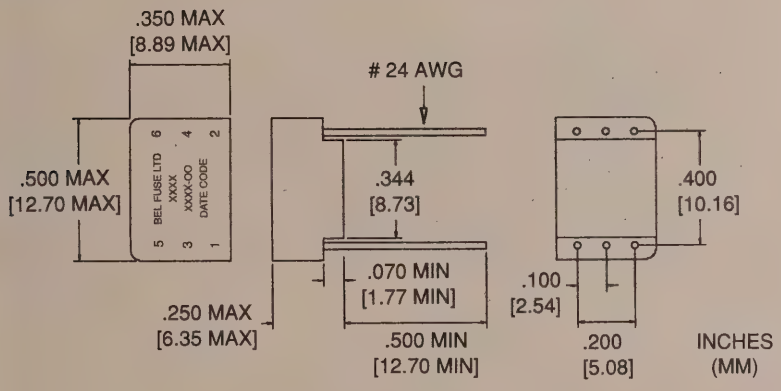
PACKAGE STYLES AVAILABLE

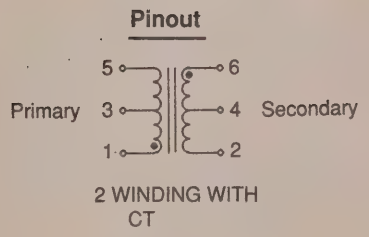
Package B



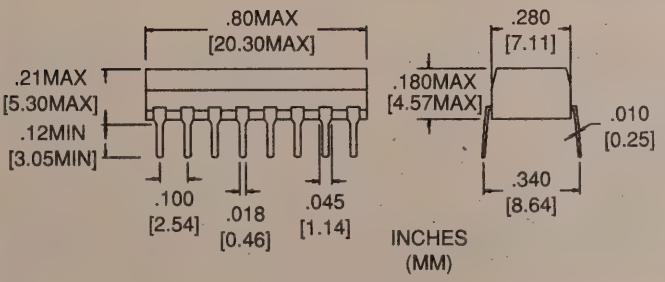


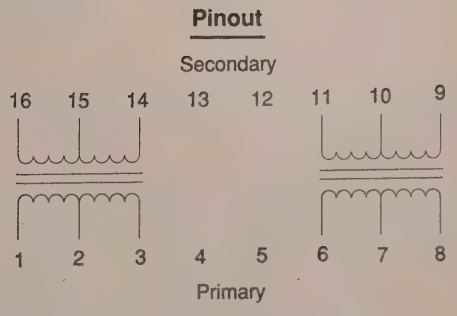
Package C





Package E





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10 BASE T INTEGRATED MODULES

- Autoinsertable Packages For High Speed Manufacturing
- Approved For Use By The Major Semiconductor Manufacturers
- Molded Unibody Construction For High Reliability
- Filter/Transformer Combinations
- Filter/Transformer/Common Mode Choke Combinations
- Surface Mount Packages Available
- Sip Packages Available For Hub Applications

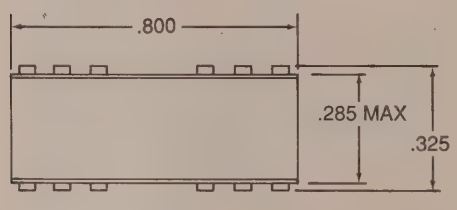
Electrical Ratings All Units

- Cut Off Frequency; 17 MHz
- Insertion Loss (1-10 MHz); 1 db Max
- Inband Variation (1-10 MHz); 0.30 db Max
- Isolation (Input To Output): 2000 Vrms

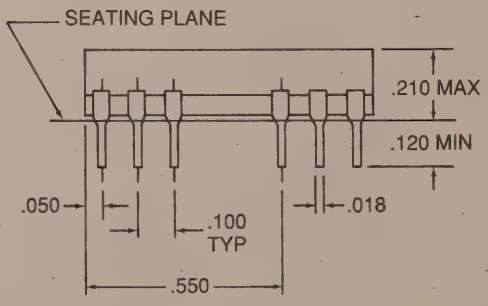
Bel Fuse manufactures a complete line of 10Base T "Single Chip Solutions." These products include all of the magnetics, semicoductors, and glue components to manufacture an entire 10Base T M.A.U. all in one (1) simple unit.

Part Number	I/O Z	Attenuation									
		20MHz		30MHz		40MHz		60MHz		80MHz	
		T	R	T	R	T	R	T	R	T	R
A556-2006-DE	100/100	10	10	27	17	27	25	27	25	27	25

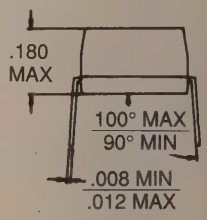
Bel A556-2006-DE



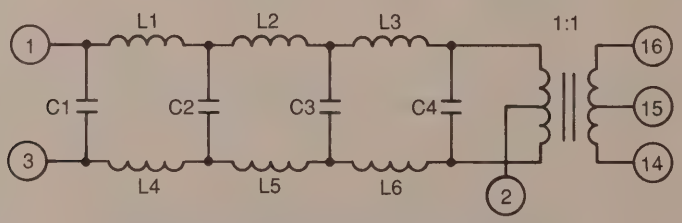
Top View



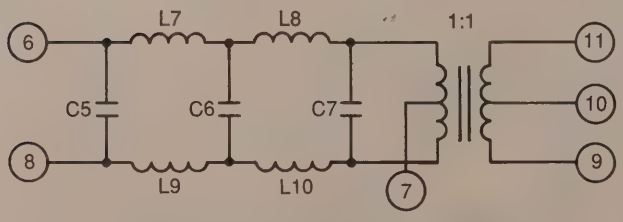
Front View



Side View



Seven Pole Transmit Butterworth Filter



Five Pole Receive Butterworth Filter

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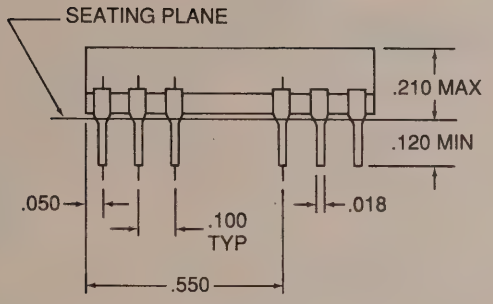
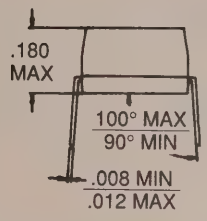
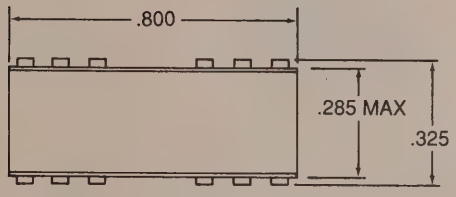
10 BASE T FILTER Bel A556-2006-00



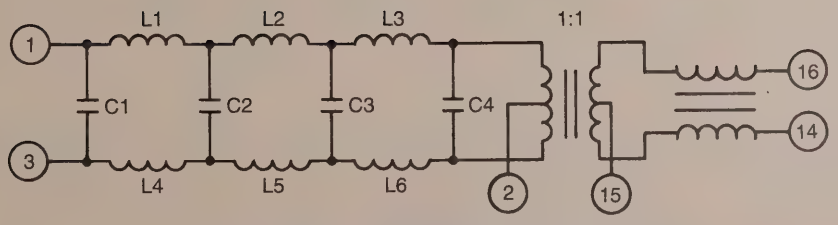
Front View



Side View



Top View

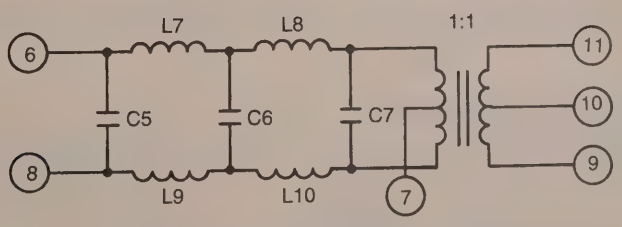


Seven Pole Transmit Butterworth Filter

Basic Filter Specifications

f_c (3dB Cutoff): 17MHz
Inband Variation (5-10MHz): <0.5dB
Attenuation at 30MHz
Transmit Filter: >27dB
Receive Filter: >17.5dB
I/O Impedance: 100Ω
Insertion Loss (5-10MHz): <1dB
Isolation Input to Output: 2000Vrms for 1 min.

Note: All dimensions are in inches ±.005 unless otherwise specified.



Five Pole Receive Butterworth Filter

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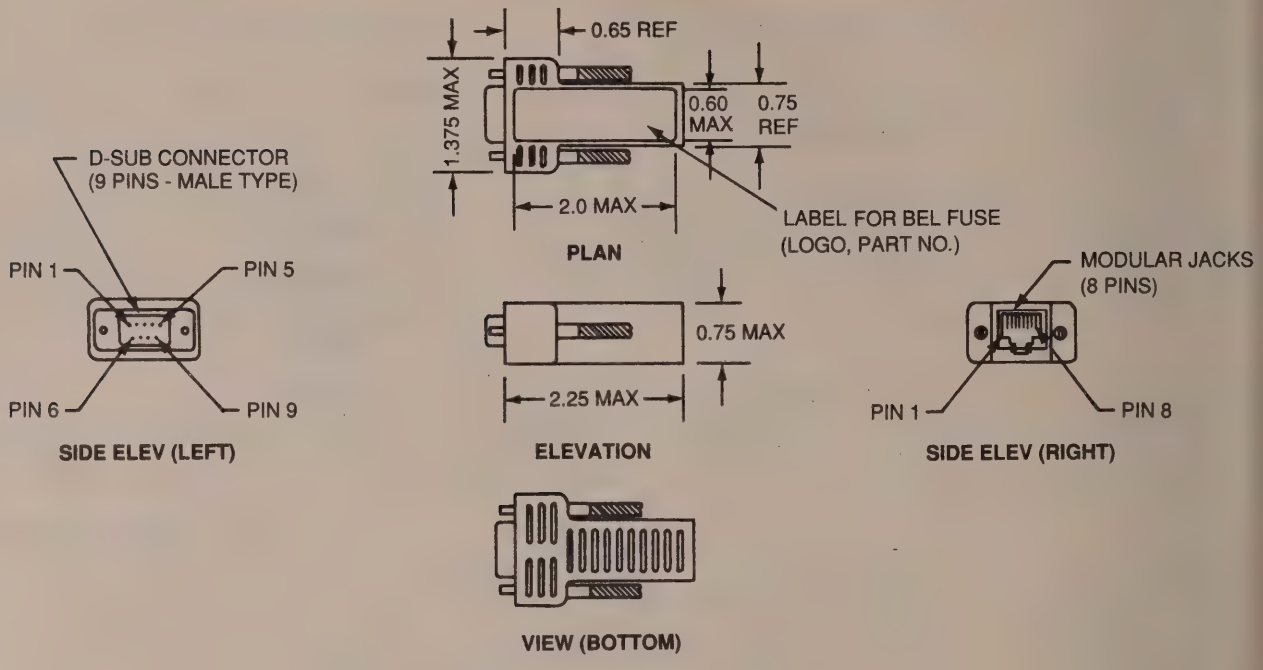
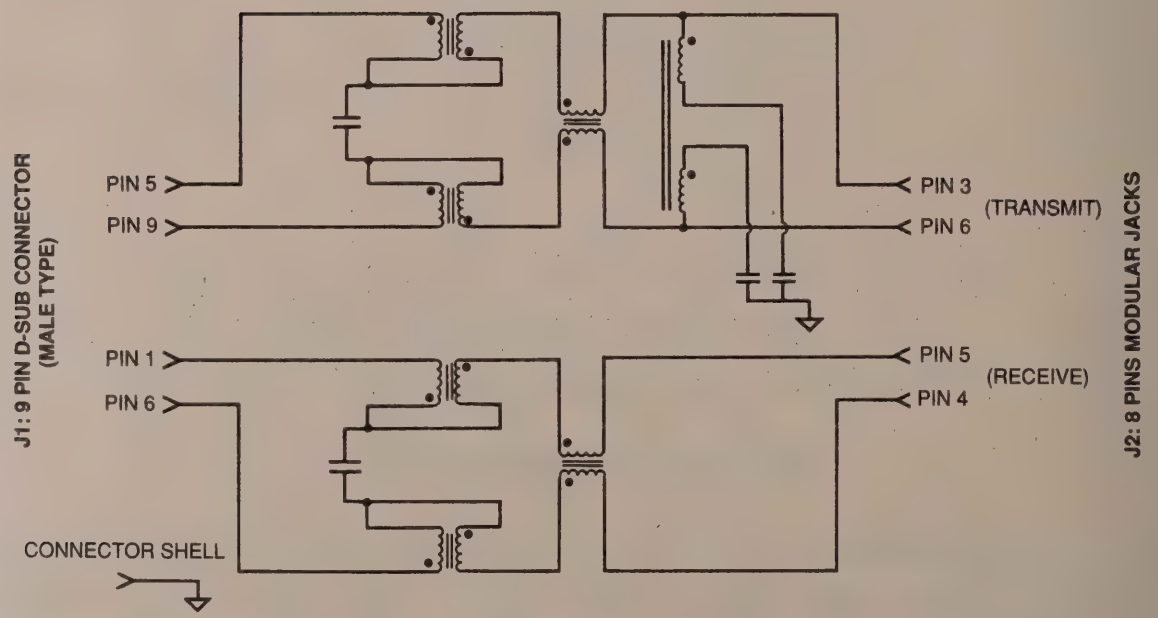
STANDARD MEDIA FILTER Bel 0802-5999-11





Electrical Specifications

1. ATTENUATION

0.5	TO	1.0 MHz	1.5 db MAX
1.0	TO	2.0 MHz	1.3 db MAX
2.0	TO	24.0 MHz	1.1 db MAX
24.0	TO	28.0 MHz	1.3 db MAX
28.0	TO	32.0 MHz	1.5 db MAX

2. INPUT RETURN LOSS (150 Ohm & 100 Ohm PORT)

1.0	TO	2.0 MHz	14 db MIN
2.0	TO	32.0 MHz	18 db MIN

3. COMMON MODE ATTENUATION

2.0	TO	32.0 MHz	40 db MIN
32.0	TO	80.0 MHz	30 db MIN
80.0	TO	100.0 MHz	20 db MIN

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HIGH FREQUENCY ISOLATION TRANSFORMERS AUTOINSERTABLE ETHERNET/LAN NETWORKING APPLICATIONS

- IEEE 802.3 Compatible (10Base2 & 10Base5)
- High Temperature Suitable (0° to 70°C. Operable)
- Custom Designs Available
- Low Profile 14 And 16 Pin Styles Available For Autoinsertion
- Cost Effective Triad Packaging
- Fast Rise Times—Efficient Operation
- All Packages Comply With International Safety Requirements For LANS; Including 2,000V RMS Isolation
- Suitable For High Frequency Applications

Table of Electrical Specifications @ 25°C.

Part Number A553-	Turns Ratio (±5%)	OCL. - (μ±20%)	ET Constant - (V-μs min.)	Rise Time (ns max.)	C_{ww} (pf max.)	L_L (μh max.)	DCR (ohms max.)
0306-A( )	1:1	30	1.8	3.0	8	0.20	0.20
0356-A( )	1:1	35	1.8	3.0	9	0.20	0.20
0506-A( )	1:1	50	2.1	3.0	10	0.20	0.20
0756-A( )	1:1	75	2.1	3.0	10	0.20	0.25
0806-A( )	1:1	80	2.1	3.0	10	0.20	0.25
1006-A( )	1:1	100	2.1	3.5	10	0.20	0.25
1506-A( )	1:1	150	3.0	3.5	12	0.25	0.30
2506-A( )	1:1	250	3.5	3.5	15	0.25	0.40

*** To Order:**

Select Part Number from table above and insert letter suffix from overleaf to indicate package style desired... [eg. A553-0506-A(B)].

—or—

Custom Designs involving other ratios, variations between the three individual transformers, or changes in electrical parameters are welcomed by our design staff. Consult the factory for a prompt quotation based upon your requirements.

Bel Fuse manufactures a comprehensive line of pulse transformers, coils, SMD & custom magnetics. In addition to our extensive line of magnetic components we offer a complete line of standard and custom delay lines and fuses.

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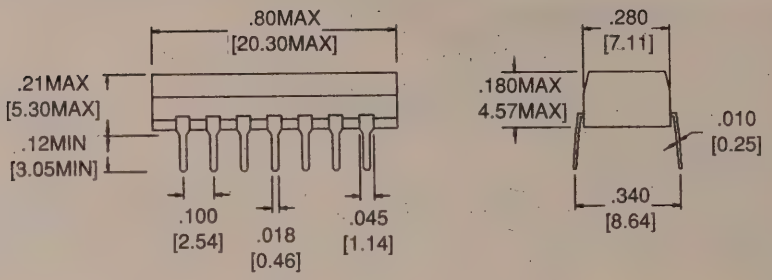
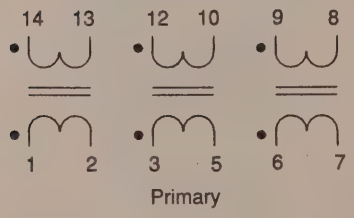
PACKAGE STYLES AVAILABLE

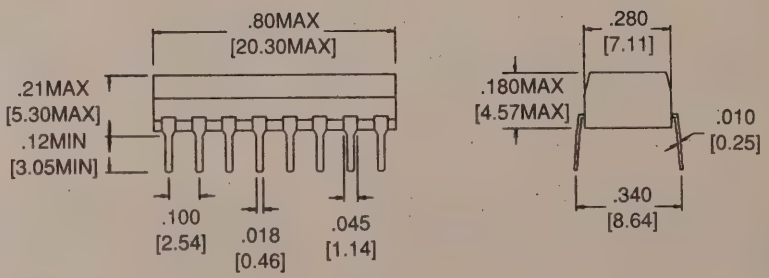
Package A



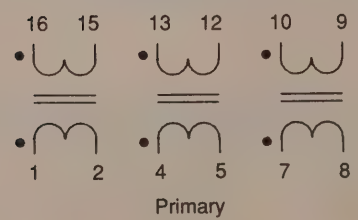
Pinouts For 14 Pin Pkg.



Package B



Pinouts For 16 Pin Pkg.



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TOKEN RING MAGNETICS
4 mbt / 16 mbt MAGNETICS

High Reliability Autoinsertable Packaging

- Low Insertion Loss Over Wide Frequency Ranges (1 MHz - 32 MHz)
- Autoinsertable Packaging Available
- High Isolation To Meet International Requirements
- UTP / STP Applications
- Common Mode Chokes Available
- Single Packages Including Impedance Matching Transformers, Filtering And Common Mode Chokes
- Cost Savings Over Hand Insertion / Epoxy Filled Parts

Electrical Data At 25°C

Part Number A553-	Turns Ratio (±5%)	PRI OCL (Typ) (UH)	Leakage IND (Max) UH	$C_{W/W}$ (PRI/SEC) (Max) (PFd)	DCR (PRI/SEC) (Max) (Ohms)	Package Style
1506-6E	1:1: .816: .816	125	0.10	10	.4/.4	E
1506-6K	1:1: .816: .816	125	0.10	10	.4/.4	AUTO K
5006-KE	1:1:2:2	125	0.10	10	.4/.8	E
5006-KK	1:1:2:2	125	0.10	10	.4/.8	AUTO K
5006-JE	1:1:1:1	125	0.10	10	.4/.4	E
5006-JK	1:1:1:1	125	0.10	10	.4/.4	AUTO K
0013-JE	1:1:1:1	1000	0.25	15	1.0/1.0	E
0013-JK	1:1:1:1	1000	0.25	15	1.0/1.0	AUTO K

Insertion Loss

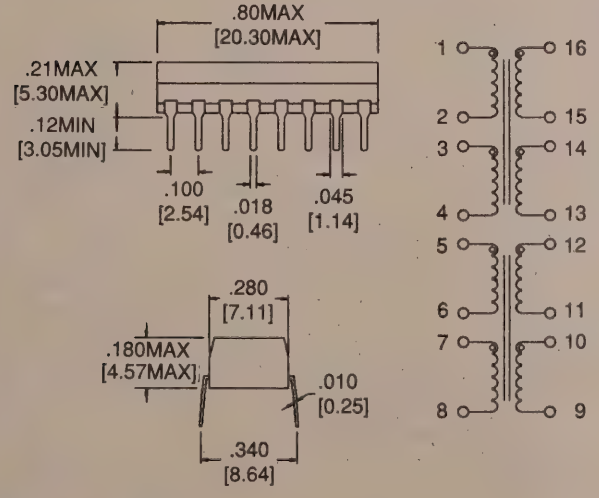
0.20 dB Max 2.2 MHz - 20 MHz
0.40 dB Max 1.4 MHz - 31 MHz
1.0 dB Max 900 KHz - 40 MHz

Return Loss

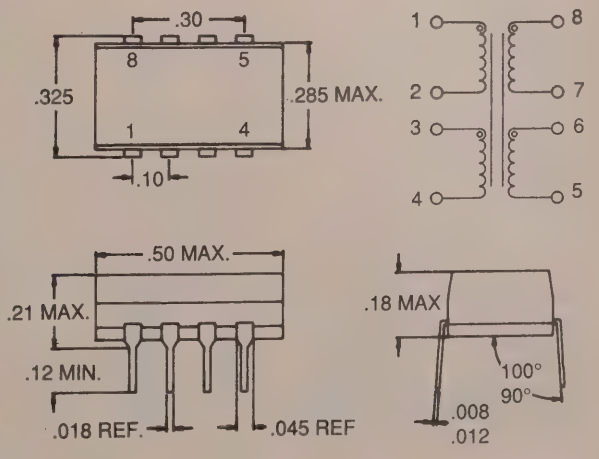
22 dB Min 1 MHz - 8 MHz
20 dB Min 8 MHz - 16 MHz
18 dB Min 16 MHz - 24 MHz

Notes: 1. OCL Measured At 100 KHz and 20 mV.
2. Isolation Voltage 2000 Vrms 1 Minute - All Parts
3. Rise Time 10 nSEC Max - All Parts

"E" Package - Autoinsertable 16 Pin



Auto "K" Package - Autoinsertable 8 Pin



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TOKEN RING MAGNETICS
4 mbt / 16 mbt MAGNETICS

High Reliability Autoinsertable Packaging

- Low Insertion Loss Over Wide Frequency Ranges (1 MHz - 32 MHz)
- Autoinsertable Packaging Available
- High Isolation To Meet International Requirements
- UTP / STP Applications
- Common Mode Chokes Available
- Single Packages Including Impedance Matching Transformers, Filtering And Common Mode Chokes

Electrical Data At 25°C

Part Number 0553-	Turns Ratio (±5%)	PRI OCL (Typ) (UH)	Leakage IND (Max) (UH)	$C_{W/W}$ (PRI/SEC) (Max) (PFd)	DCR (PRI/SEC) (Max) (Ohms)	Package Style
1506-6K	1:1: .816: .816	125	0.10	10	.4/.4	K
1506-6L	1:1: .816: .816	125	0.10	10	.4/.4	L
5006-KK	1:1:2:2	125	0.10	10	.4/.8	K
5006-KL	1:1:2:2	125	0.10	10	.4/.8	L
5006-JK	1:1:1:1	125	0.10	10	.4/.4	K
5006-JL	1:1:1:1	125	0.10	10	.4/.4	L
0013-JK	1:1:1:1	1000	0.25	15	1.0/1.0	K
0013-JL	1:1:1:1	1000	0.25	15	1.0/1.0	L

Insertion Loss

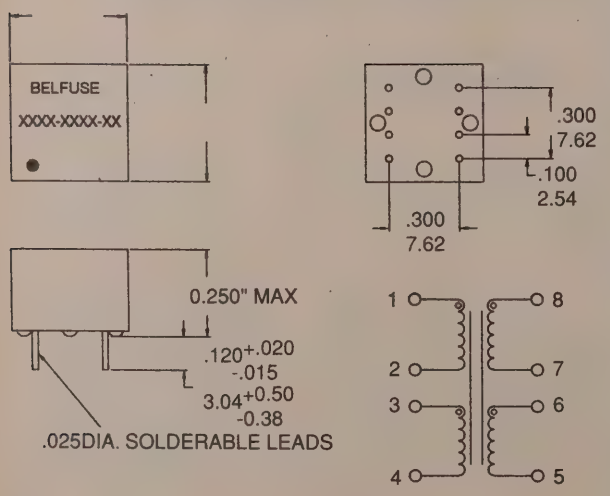
0.20 dB Max 2.2 MHz - 20 MHz
0.40 dB Max 1.4 MHz - 31 MHz
1.0 dB Max 900 KHz - 40 MHz

Return Loss

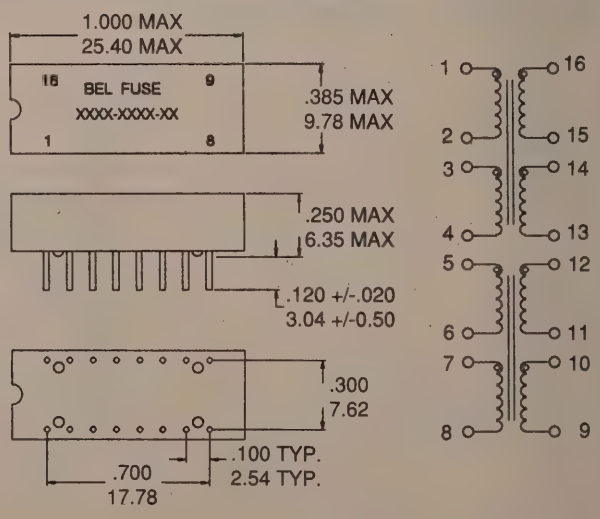
22 dB Min 1 MHz - 8 MHz
20 dB Min 8 MHz - 16 MHz
18 dB Min 16 KHz - 24 MHz

Notes: 1. OCL Measured At 100 KHz and 20 mV.
2. Isolation Voltage 2000 Vrms 1 Minute - All Parts
3. Rise Time 10 nSEC Max - All Parts

Package K



Package L



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AUTOINSERTABLE T1 CARRIER INTERFACE TRANSFORMERS

- For T 1/CEPT Telecom Line Interface
- 2000 Volt Isolation Standard
- Custom Designs Available

Part Number
A553-0013-(XX)
Primary OCL 1.20 mH (MIN)
Primary DCR 0.80 Ohms (MAX)
$C_{w/w}$ 35 PFd (MAX)

Electrical Specifications At 25°C

	Turns T1/T2	L_L µH MAX	SEC DCR (Ohms) MAX	Package / Schematic # Pins
–00	1: 1.385ct/1:1:1	.80/.50	.80	16 / I
–01	1ct:2ct/1:1	.80/.50	1.8/.80	14 / II
–02	1:2ct/1: 1.36	.80/.50	1.8/.80	14 / IV
–03	1:1.385ct/1:1ct	.80/.50	.80/.80	14 / III
–04	1.17:1/1:2ct	.50/.80	.80/1.8	14 / V
–05	PIN (1-2):(14-12) 1:1 (1-3):(14-12) 1.25:1 (5-7):(14-12) 1:2ct	.50/.50/.80	.80/.80/1.8 NOTE $C_{w/w}$ = 50 PFd On –05	14 / III
–06	1:2ct/1:2ct	.80/.80	1.8/1.8	14 / III
–07	1:1.15ct/1:2ct	.50/.80	.80/1.8	14 / III
–08	1:1:1.266/1:2ct	.80/.80	.80/1.8	14 / III

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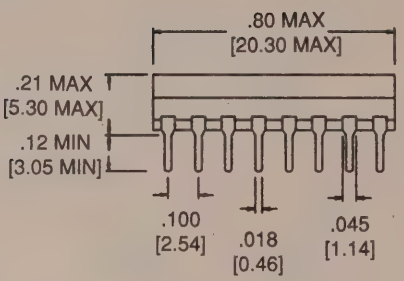
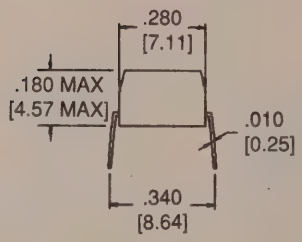
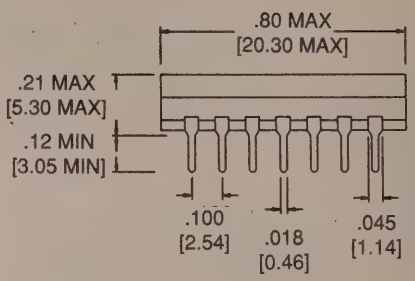
AUTOINSERTABLE T1 CARRIER INTERFACE TRANSFORMERS

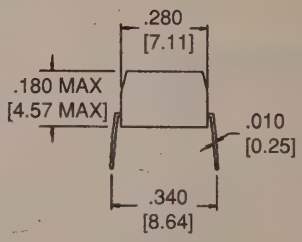
16 Pin DIP

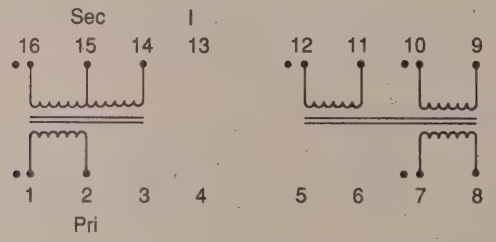


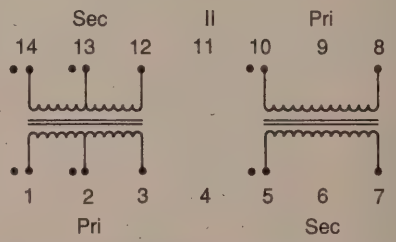


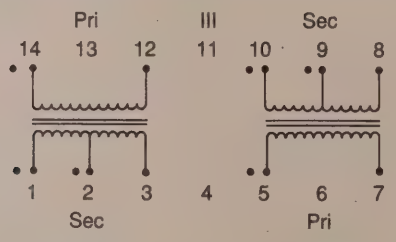
14 Pin DIP

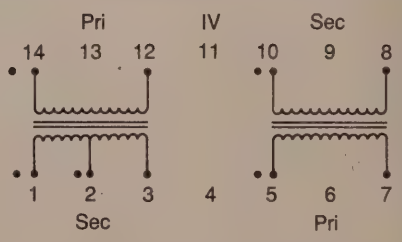


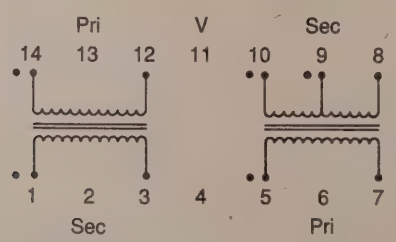


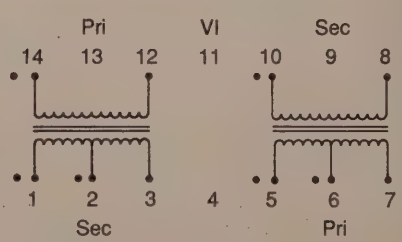












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T1 CARRIER INTERFACE TRANSFORMERS

- For T 1/CEPT Telecom Line Interface
- 2000 Volt Isolation Standard
- Low Profile
- Single And Dual Packages Available
- Surface Mount Available

Part Number
0553-0013-(XX)
Primary OCL 1.20 mH (MIN)
Primary DCR 0.80 Ohms (MAX)
$C_{w/w}$ 35 PFd (MAX) Except Where Noted

Electrical Specifications At 25°C

0553-0013	Turns Ratio (±5%)	L_L µH MAX	DCR SEC (Ohms) MAX	Package Style
–IC	1:1:1	.50	.80	C
–AC	1:1	.50	.80	C
–BC	1ct:1	.50	.80	C
–YC	1: 1.36	.80	.80	C
–HC	1ct: 2ct	.80	1.8	C
–1J	1:2ct/1: 2ct	.80/.80	1.8/1.8	J
–2J	1:2ct/1: 1.36	.80/.80	1.8/.80	J
–4J	1ct:2ct/1:1	.80/.50	1.8/.8	J
–5J	1.17:1/1:2ct	.50/.80	.80/1.8	J
–6J	1-2:14-12 1:1 1-3:14-12 1.25:1 5-7:10-8 1:2ct	.50/.50/.80 NOTE $C_{w/w}$ = 50 PFd On –6J	.80/.80/1.8	J
–RC	1:1.15ct	.50	.80	C
–SC	1:1:1.266	.80	.80	C
–7J	1:1.15ct/1:2ct	.50/.80	.80/1.8	J
–8J	1:1:1.266/1:2ct	.80/.80	.80/1.8	J

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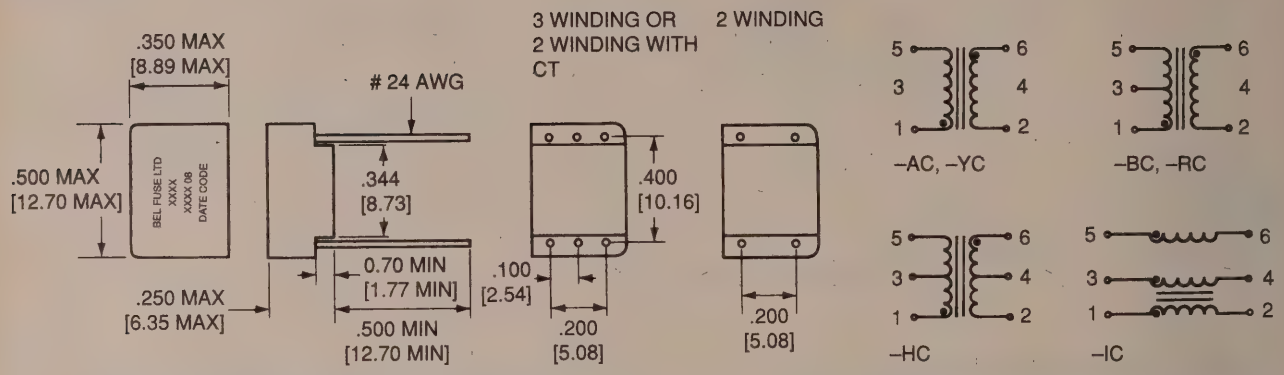
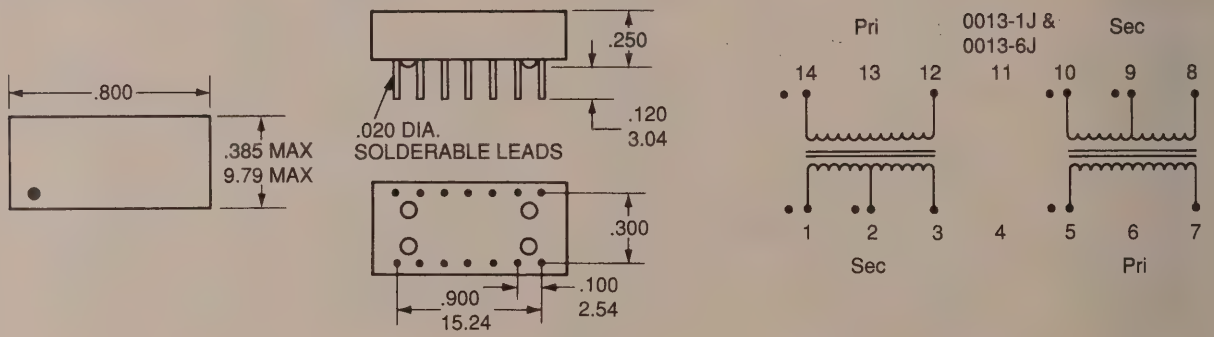
ELECTRICAL/MECHANICAL PACKAGES FOR T1 MAGNETICS

Package C



Package J (Dual)



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SURFACE MOUNT T1 CARRIER INTERFACE TRANSFORMERS

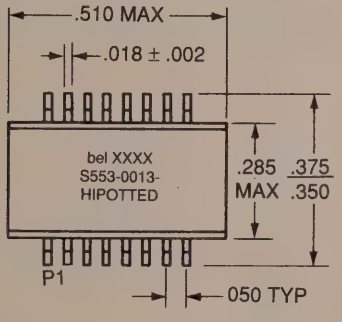
- For T 1/CEPT Telecom Line Interface
- 2000 Volt Isolation Standard
- Low Cost - Readily Available
- Custom Designs Available

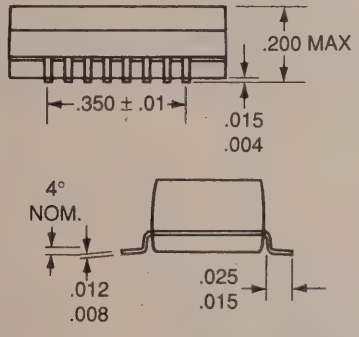
Part Number S553-0013-(XX)

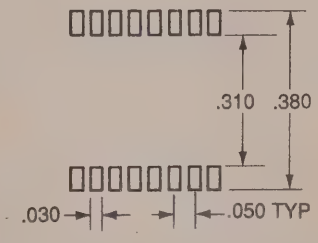
Primary OCL	1.20 MH (MIN)
Primary DCR	0.80 Ohms (MAX)
$C_{w/w}$	35 PFd (MAX)

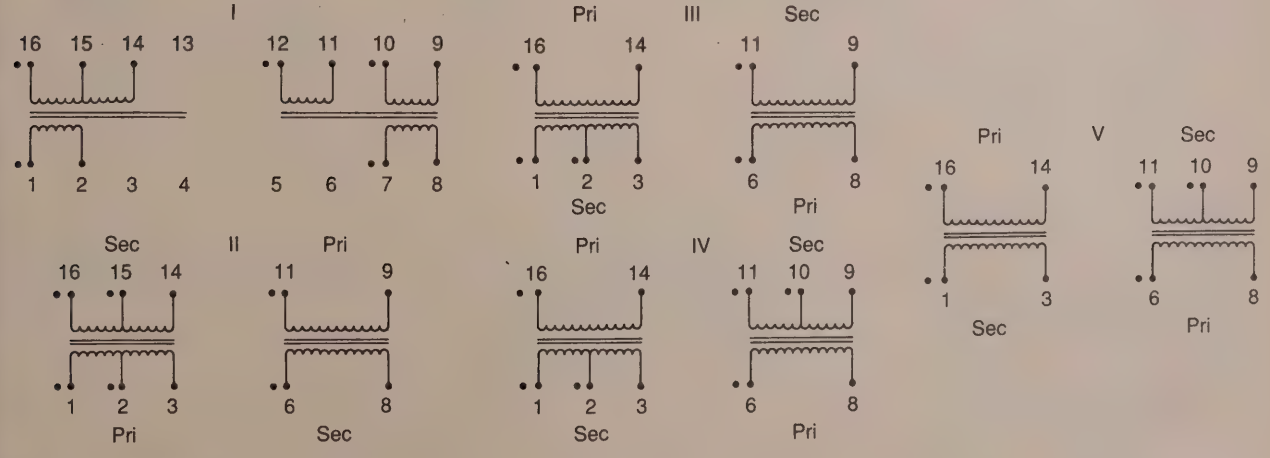
Electrical Specifications At 25°C

5553-0013	Turns Ratio T1/T2	L_L µH MAX	DCR (Ohms) MAX	Schematic
–00	1:1.385ct/1:1:1	.80/.50	.80	I
–01	1ct:2ct/1:1	.80/.50	1.8/.8	II
–02	1:2ct/1: 1.36	.80/.80	1.8/.80	III
–03	1:2ct/1:2ct	.80/.80	1.8/1.8	IV
–04	1.17:1/1:2ct	.50/.80	.80/1.8	V
–05	(1-2):(16-14) 1:1 (1-3):(16-14) 1.25:1 (5-8):(9-11) 1:2ct	.50/.50/.80 NOTE $C_{w/w}$ = 50 PFd On –05	.80/.80/1.8	VI
–06	1:1.15ct/1:2ct	.50/.80	.80/1.8	IV
–07	1:1:1.266/1:2ct	.80/.80	.80/1.8	IV









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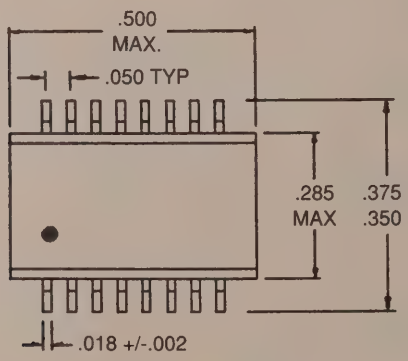
SURFACE MOUNT TRANSFORMERS

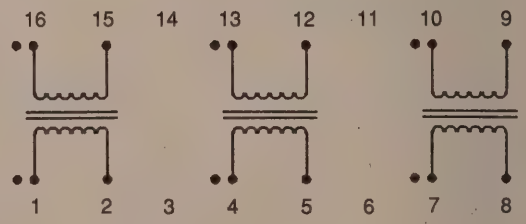
Electrical Specifications @ 25°C "E" Package

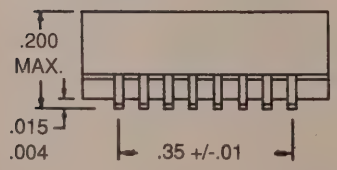
Part Number S553-	Turns Ratio (+/-5%)	Primary OCL (μH±20%)	ET Constant (V-μs min.)	Rise Time (ns max.)	PRI/SEC $C_{W/W}$ (pf max.)	L_L (μH max.)	PRI DCR (ohm max.)	SEC DCR (ohm max.)
0206-AE	1:1	20	0.8	1.8	5	0.10	0.10	0.10
0306-AE	1:1	30	0.9	1.8	5	0.10	0.10	0.10
0356-AE	1:1	35	0.9	1.8	5	0.10	0.15	0.15
0506-AE	1:1	50	1.0	1.8	5	0.10	0.15	0.15
0756-AE	1:1	75	1.4	1.8	7	0.10	0.17	0.17
1006-AE	1:1	100	1.5	1.8	8	0.10	0.20	0.20
1506-AE	1:1	150	1.8	1.8	9	0.10	0.20	0.20
2506-AE	1:1	250	2.0	2.0	10	0.15	0.25	0.25
0206-IE	2:1	20	0.8	1.8	5	0.20	0.10	0.10
0306-IE	2:1	30	0.9	1.8	5	0.20	0.10	0.10
0506-IE	2:1	50	1.0	1.8	5	0.25	0.15	0.10
1006-IE	2:1	100	1.5	1.8	7	0.30	0.20	0.10
2506-IE	2:1	250	2.0	2.0	9	0.35	0.25	0.15

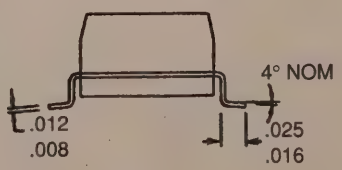
Custom Designs

Custom Designs involving other ratios, variations between the three (3) individual transformers, or changes in electrical parameters are welcome by our design staff. Consult the factory for a prompt quotation based upon your requirements.









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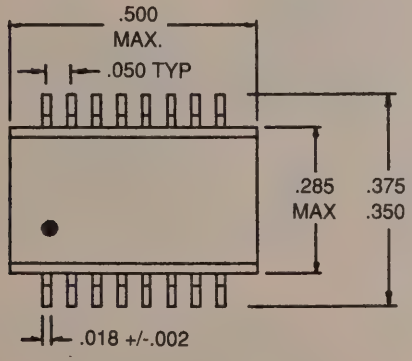
SURFACE MOUNT TRANSFORMERS

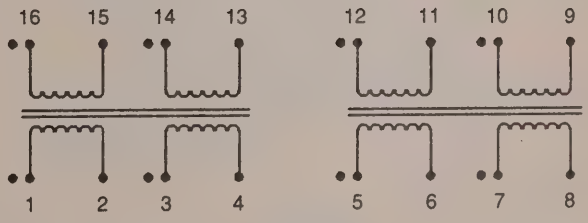
Electrical Specifications @ 25°C "F" Package

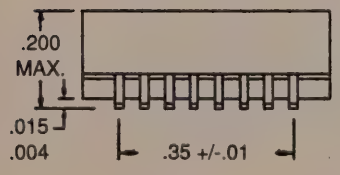
Part Number S553-	Turns Ratio (+/-5%)	Primary OCL (µH±20%)	ET Constant (V-µs min.)	Rise Time (ns max.)	PRI/SEC $C_{W/W}$ (pf max.)	L_L (µH max.)	PRI DCR (ohm max.)	SEC DCR (ohm max.)
0206-JF	1:1:1:1	20	1.5	2.5	6	0.20	0.30	0.30
0306-JF	1:1:1:1	30	1.8	2.5	7	0.20	0.30	0.30
0356-JF	1:1:1:1	35	1.8	2.5	7	0.20	0.30	0.30
0506-JF	1:1:1:1	50	2.1	3.0	10	0.20	0.30	0.30
0756-JF	1:1:1:1	75	2.1	3.0	10	0.20	0.30	0.30
0806-JF	1:1:1:1	80	2.1	3.0	10	0.20	0.30	0.30
1006-JF	1:1:1:1	100	2.1	3.5	10	0.20	0.30	0.30
0206-KF	1:1:2:2	20	1.5	2.5	6	0.20	0.30	0.60
0306-KF	1:1:2:2	30	1.8	2.5	7	0.20	0.30	0.60
0356-KF	1:1:2:2	35	1.8	2.5	8	0.25	0.30	0.60
0506-KF	1:1:2:2	50	2.1	3.0	10	0.25	0.30	0.60
5006-KF	1:1:2:2	125	2.1	3.0	10	0.10	0.40	0.80
1506-GF	1:1: .816: .816	125	2.1	3.0	10	0.10	0.40	0.80

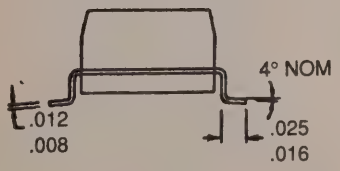
Custom Designs

Custom Designs involving other ratios, variations between the two (2) individual transformers, or changes in electrical parameters are welcome by our design staff. Consult the factory for a prompt quotation based upon your requirements.









eem

MINIGLOSSARY ENCAPSULATION

MATERIALS/HANDLING

Catalyst: A substance which changes the *rate* of chemical reaction. Very small quantities can cause fast change.

Conformal coating Sprayed or dipped. A thin conformal jacket which protects an assembly from moisture or other degrading environments.

Curing agent: See catalyst.

Hardener: See catalyst.

Hermetic: A permanent gas-tight seal.

RTV: Room Temperature Vulcanizing. Associated with silicone rubber sealants which vulcanize at room temperature.

Thermoplastic: Plastic materials which can be made to flow *repeatedly* with the application of heat.

Thermosetting: Plastics which once cured cannot be made to flow again.

Thixotropy: The property of a coating compound which has low viscosity when agitated, but which thickens when the agitation ceases.

Viscosity: Measured in units of *poise* or *centipoise*. The property of a liquid which resists internal flow. Low viscosity equates with thin and vice-versa.

PROCESSING

Casting: Parts or assemblies are placed in a mold. Encapsulating material is added and cured. Part is then removed from the mold.

Dip coating: Part or assembly is dipped into the encapsulating material. Final thickness is determined by number of dips, viscosity, rate of withdrawal, and temperature.

Embedding: Wherein an encapsulant substantially fills all voids in and about an assembly.

Impregnation: A process of encapsulation involving evacuating all air and then allowing the encapsulating material to flow in and fill all voids.

Molding: Similar to casting except this process usually implies multicavity molds and costly machines.

Potting: Wherein the part or assembly is immersed in an encapsulating material contained in a shell which becomes a permanent outer surface after curing.

DIELECTRIC

Arc resistance: An encapsulant's resistance to the formation of a conductive path or track. Measured in time.

Breakdown voltage: The voltage at which an encapsulant fails electrically.

Capacitance: The property of conductors and dielectrics which allows the storage of an electrical charge when the voltage is applied.

Corona: A luminous discharge of electricity due to air ionization when a certain voltage is reached. Can be internal or external. The formation of ozone can cause rapid deterioration of certain materials.

Dielectric: Insulator (Nonconductor.)

Dielectric constant: The property of a material that determines its ability to store electrostatic energy.

Dielectric strength: The ratio of dielectric breakdown to the thickness of insulating material.

Dissipation factor: The ratio of a dielectric material's energy losses.

Flashover: Point at which an electric discharge occurs around an edge or across a surface. Can result in a carbon track and permanent degradation.

Insulation resistance: (IR) An insulating material's total DC leakage.

Surface resistivity: The resistance of the surface of an insulating material to the flow of direct current.

Voltage endurance: Sometimes called corona resistance. The ability of a material to withstand the application of sustained high voltage.

Volume resistivity: The resistance of a material to direct current flow as a measure of volume. Expressed as ohm-centimeters.

Why 201-694-5000 is the number to call for custom transformers.

Our 30 years' experience brings you fast, accurate solutions to tough transformer application problems. Power range from 10 VA to 300 kVA.

If you need a single special transformer with unusual requirements, we'll build it, and deliver it to you as promised. And if you need moderate to OEM quantities, call us too—we'll fit our schedule to your schedule.

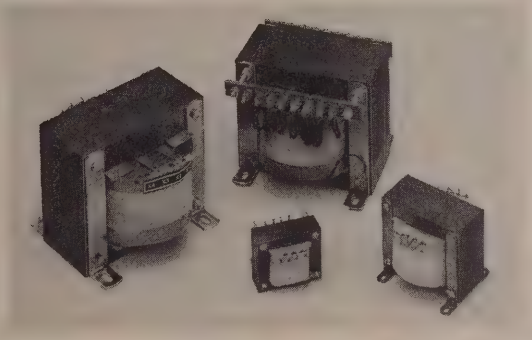
As you can see from the photos, our typical models cover a wide range. Call us. Our design and engineering expertise is ready to help you.

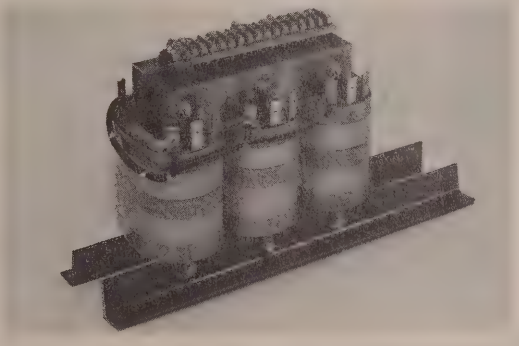
Meeting military specs (T-27D, T-16315, E-917C, and others) is as routine for us as building to UL, VDE, CSA, and other international standards.

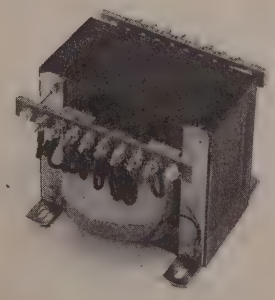
- 50/60/400 Hz and higher
- 48-hour turnaround on prototypes
- Fast rebuild of large transformers
- No order too small, or too large
- Design services available

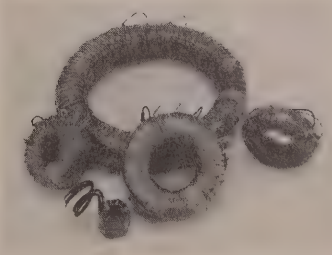
- Open-type
- Enclosed
- Encapsulated
- Hermetic

- Power transformers
- Current transformers
- Toroids
- High frequency
- Constant voltage









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8441

BH Electronics

Series 505 SCR Trigger Transformers

- Four Case Styles
- 1600 or 2500 VRMS Isolation
- Tinned Copper Leads
- Low Ciw To Prevent False Triggering

- Order by Part Number

505 - XX YY

STANDARD CASE STYLES

CASE NO.	PCB MOUNTING	ISOLATION VOLTAGE	TEMPERATURE RANGE	ENCAPSULATED	LEAD SIZE
35	YES	1600 VRMS 60HZ	-10°C TO +70°C	YES	20 AWG
36	YES	1600 VRMS 60 HZ	0°C TO 60°C	YES	20 AWG
37	YES	1600 VRMS 60 HZ	0°C TO 60°C	NO	20 AWG
55	YES	2500 VRMS 60 HZ	0°C TO 60°C	YES	20 AWG

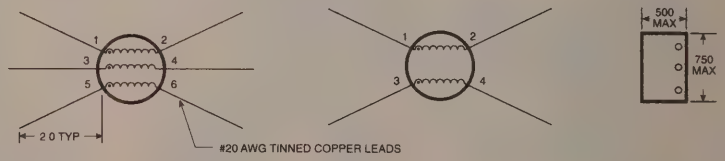
STANDARD ELECTRICAL SPECIFICATIONS

ELECTRICAL PARAMETER NUMBER	TURNS RATIO	PRIMARY INDUNTANCE (mh - MIN.)	PRIMARY ET CONSTANT (V - μ sec MIN.)	INTERWINDING CAPACITANCE (PF - MAX.)	LEAKAGE INDUNTANCE (μ h - MAX.)
00	1:1	.25	45	20	5
01	1:1	1.0	90	30	20
02	1:1	5.0	180	30	45
03	1:1	20.0	360	50	200
04	1:1:1	.25	45	20	5
05	1:1:1	1.0	90	30	20
06	1:1:1	5.0	180	30	45
07*	1:1:1	20.0	360	50	200
08	2:1	1.0	90	30	40
09	2:1	5.0	180	30	60
10	2:1:1	1.0	90	30	40
11	2:1:1	5.0	180	30	60
12	5:1	20.0	360	50	200
13	5:1:1	20.0	360	50	200

*AVAILABLE IN "55"STYLE CASE ONLY

STANDARD CASE STYLES

35



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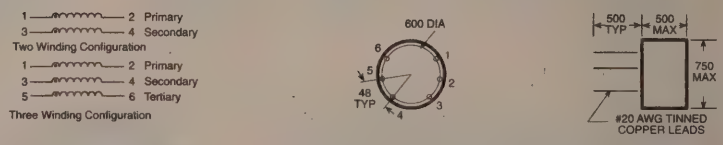

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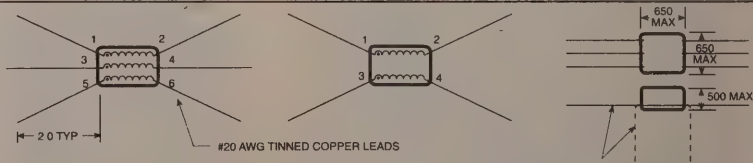

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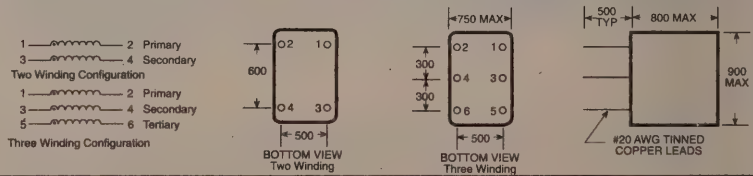

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BH Electronics

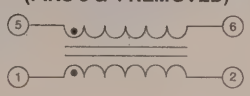
Power Control Transformers

- Ideal for SCR Trigger Applications
- High Isolation Voltages
- ET Products to 1500 v μ sec
- Fully Encapsulated
- Low Interwinding Capacitance
- Hi-Pot Tested to 2500 VAC

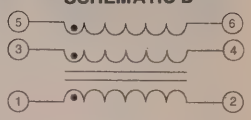
SCHEMATIC A (PINS 3 & 4 REMOVED)

SCHEMATIC B

SCHEMATIC C (PINS 3 & 4 REMOVED)

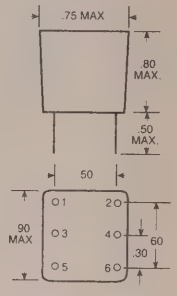


SCHEMATIC D



BH PART NUMBER	TURNS RATIO	PRIMARY INDUCTANCE (mH - MIN.)	PRIMARY ET CONSTANT (Vμ SEC MIN.)	LEAKAGE INDUCTANCE (μH MAX.)	Ciw (pf MAX.)	DCR PRI. Ω MAX	DCR SEC. Ω MAX	DCR TER. Ω MAX	SCHEMATIC STYLE	PKG. STYLE
505-5570	1:1	.25	45	5	20	1.0	1.0	N/A	A	1
505-5571	1:1:1	.25	45	5	20	1.0	1.0	1.0	B	1
505-5572	1:1	1.0	90	20	30	2.0	2.0	N/A	A	1
505-5573	1:1:1	1.0	90	20	30	2.0	2.0	2.0	B	1
505-5574	1:1	5.0	180	45	30	3.0	3.0	N/A	A	1
505-5575	1:1:1	5.0	180	45	30	3.0	3.0	3.0	B	1
505-5576	1:1	20.0	360	45	50	5.0	5.0	N/A	A	1
505-5577	1:1:1	20.0	360	75	50	3.0	3.0	3.0	B	1
505-5578	2:1	1.0	90	40	30	2.0	1.0	N/A	A	1
505-5579	2:1:1	1.0	90	60	30	2.0	1.0	1.0	B	1
505-5580	2:1	5.0	180	40	30	3.0	2.0	N/A	A	1
505-5581	2:1:1	5.0	180	45	30	3.0	2.0	2.0	B	1
505-5582	2:1	20.0	360	200	75	5.0	3.0	N/A	A	1
505-5583	2:1:1	20.0	360	200	75	3.0	2.0	2.0	B	1
505-5584	5:1	20.0	360	200	50	5.0	2.0	N/A	A	1
505-5585	5:1:1	20.0	360	200	50	5.0	2.0	2.0	B	1
505-3852	1:1	1.0	700	26	36	3.0	3.2	N/A	C	2
505-3853	1:1	5.0	1500	130	42	6.3	7.0	N/A	C	2
505-3854	1:1:1	1.0	700	25	40	3.0	3.3	3.3	D	2
505-3855	1:1:1	5.0	1500	147	46	6.3	7.5	7.5	D	2
505-3856	2:1	1.0	700	24	36	3.0	2.0	N/A	C	2
505-3857	2:1	5.0	1500	125	42	6.3	4.0	N/A	C	2
505-3858	2:1:1	1.0	700	27	40	3.0	2.0	2.0	D	2
505-3859	2:1:1	5.0	1500	160	46	6.3	4.0	4.0	D	2

PKG. STYLE 1



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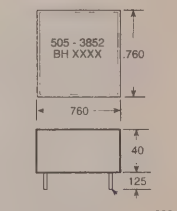
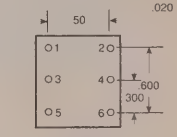


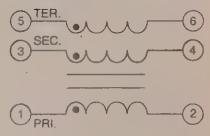


General Purpose Pulse Transformers

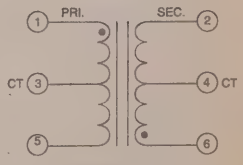
- Designed for a Wide Variety of Low Power Applications
- PC Board Mounting • Surface Mount Available • 500 VDC Hi-Pot

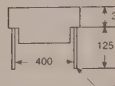
BH PART NUMBER	TURNS RATIO (±5%)	PRIMARY SINE WAVE L_{OC} (μH MIN.)	PRIMARY ET-CONSTANT (Vμ SEC MIN.)	PRI./SEC. Cw/w (pf MAX.)	PRI./SEC. LEAKAGE INDUCTANCE (μH MAX.)	PRIMARY DCR (OHMS MAX.)	SECONDARY DCR (OHMS MAX.)	TERTIARY DCR (OHMS MAX.)	SCHEMATIC STYLE
500-1300-1	1:1:1	5000	25.0	60	1.3	1.5	1.5	1.5	A
500-1301-1	1:1:1	2000	16.0	37	0.8	1.0	1.0	1.0	A
500-1302-1	1:1:1	500	8.5	30	0.4	1.0	1.0	1.0	A
500-1303-1	1:1:1	200	5.0	18	0.3	0.9	0.9	0.9	A
500-1304-1	1:1:1	50	5.2	18	0.5	0.5	0.5	0.5	A
500-1305-1	1:1:1	20	3.2	21	0.4	0.2	0.2	0.2	A
500-1306-1	1:1:1	10	3.7	22	0.5	0.1	0.1	0.1	A
500-1307-1	2:1:1	5000	25.0	33	3.6	1.0	1.0	1.0	A
500-1308-1	2:1:1	2000	16.0	19	1.8	1.0	0.5	0.5	A
500-1309-1	2:1:1	500	8.5	11	1.1	1.0	0.7	0.7	A
500-1310-1	2:1:1	200	5.0	8	0.8	0.9	0.5	0.5	A
500-1311-1	2:1:1	20	5.8	12	1.5	1.0	0.5	0.5	A
500-1312-1	3:1:1	200	5.0	7	1.1	0.9	0.4	0.4	A
500-1313-1	3:1:1	20	3.2	6	1.3	0.9	0.4	0.4	A
500-1314-1	4:2:1	2000	16.0	20	2.5	2.5	1.4	0.8	A
500-1315-1	4:2:1	500	8.5	13	0.9	1.0	0.8	0.5	A
500-1316-1	4:2:1	200	5.0	8	0.8	0.9	0.5	0.4	A
500-1317-1	1CT:1CT	2000	16.0	37	0.8	2.0	2.0	-	B
500-1318-1	1CT:1CT	500	8.5	32	0.4	1.0	1.0	-	B
500-1319-1	1CT:1CT	200	5.0	18	0.3	0.5	0.5	-	B
500-1320-1	1CT:1CT	50	5.2	18	0.5	1.0	1.0	-	B
500-1321-1	1CT:1CT	20	3.2	21	0.4	0.9	0.9	-	B
500-1322-1	1CT:1CT	10	3.7	22	0.5	0.9	0.9	-	B
500-1323-1	2CT:1CT	2000	16.0	19	1.8	1.0	0.5	-	B
500-1324-1	2CT:1CT	500	8.5	12	1.2	1.0	0.5	-	B
500-1325-1	2CT:1CT	200	5.0	8	0.8	0.9	0.5	-	B
500-1326-1	2CT:1CT	50	5.2	12	1.3	1.3	0.7	-	B
500-1327-1	2CT:1CT	20	5.8	12	1.5	1.0	0.5	-	B
500-1328-1	2CT:1CT	10	3.7	9	1.5	0.9	0.5	-	B

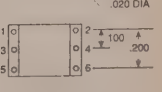
SCHEMATIC A



SCHEMATIC B







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MAXIMUM CURRENT CAPACITY—CONDUCTORS

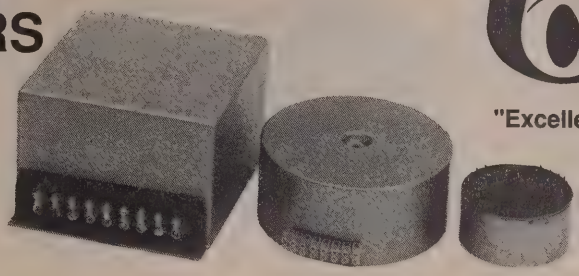
Size, AWG	MIL-W-5088				National Electrical Code	Underwriters Laboratory		American Insurance Association	500 c mils/A
	Copper		Aluminum			60°C	80°C		
	Single-wire	Wire-bundled	Single-wire	Wire-bundled					
30	...	...	...	...	...	0.2	0.4	...	0.20
28	...	...	...	...	...	0.4	0.6	...	0.32
26	...	...	...	...	...	0.6	1.0	...	0.51
24	...	...	...	...	...	1.0	1.6	...	0.81
22	9	5	...	...	...	1.6	2.5	...	1.28
20	11	7.5	...	...	...	2.5	4.0	3	2.04
18	16	10	...	...	6	4.0	6.0	5	3.24
16	22	13	...	...	10	6.0	10.0	7	5.16
14	32	17	...	...	20	10.0	16.0	15	8.22
12	41	23	...	...	30	16.0	26.0	20	13.05
10	55	33	...	...	35	...	...	25	20.8
8	73	46	58	36	50	...	...	35	33.0
6	101	60	86	51	70	...	...	50	52.6
4	135	80	108	64	90	...	...	70	83.4
2	181	100	149	82	125	...	...	90	132.8
1	211	125	177	105	150	...	...	100	167.5
0	245	150	204	125	200	...	...	125	212.0
00	283	175	237	146	225	...	...	150	266.0
000	328	200	...	...	275	...	...	175	336.0
0000	380	225	...	...	325	...	...	225	424.0

TOROIDAL POWER TRANSFORMERS

INFORMATION

BICRON™

"Excellence Through Teamwork"



Type 4 Mounting
Available in a Variety
of Sizes, Mountings
and Terminations.

IMPORTANT ADVANTAGES FOR YOUR PRODUCT

VERY HIGH EFFICIENCY
(between 85-97%)

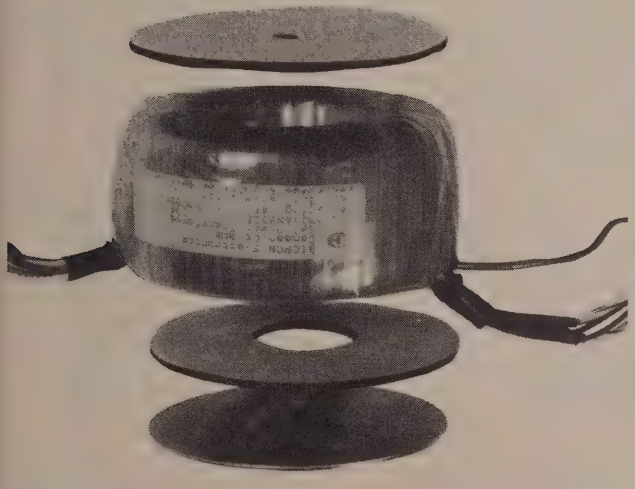
LIGHTWEIGHT
(1 KVA weighs 16 lbs.)

SMALL SIZE
(.6 KVA is 5.7 X 3.2)

LOW STRAY FIELDS
(.5 Gauss @ 1 inch attainable)

SILENT OPERATION
(<10db)

AGENCY APPROVALS
(UL478, UL544, UL1411, IEC601)



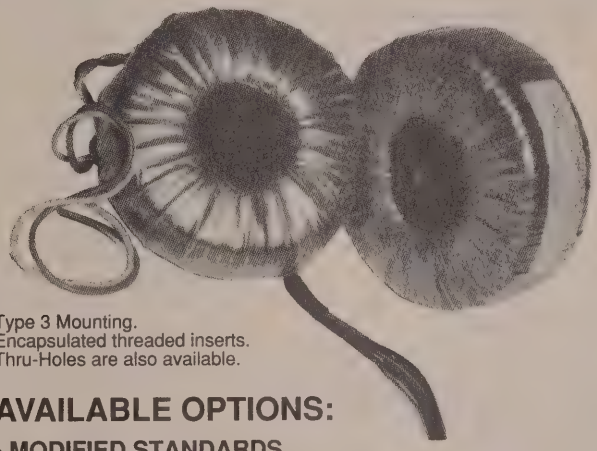
Standard Configuration Type 2.
Shown above is the Standard Method of Mounting.
Transformers can be supplied without steel washer
and insulating pads (specify Type 1.)

The Company

BICRON ELECTRONICS, employing over 150 people, was founded in 1964 as a manufacturer of custom magnetics components for military and industrial markets. The product mix expanded to encompass TOROIDAL POWER TRANSFORMERS, CURRENT TRANSFORMERS, SPECIALTY MAGNETICS and SOLENOIDS. Our customer base includes Fortune 500 companies such as GE, Westinghouse, Motorola, Lucas, with whom we have long standing relationships. Our 150 9001 Quality System and Total Quality Management has enabled us to certified by numerous customer's.

OVERVIEW

Toroidal transformers are the next best answer to the ideal conception of a power transformer. The compactness of the rolled core utilizing high quality silicon iron, grain oriented steel provide maximized magnetic efficiency. The large surface areas allow excellent heat transfer for the windings while minimizing the length of wire per turn. The magnetic flux flows along the magnetically oriented grains of the toroid core, without stray force lines, due to the closed field and lack of air gaps. The tightly wound core surrounded by wire and insulation confine the audible hum created by magnostriction.



Type 3 Mounting.
Encapsulated threaded inserts.
Thru-Holes are also available.

AVAILABLE OPTIONS:

• **MODIFIED STANDARDS**
A program allowing our customers to optimize their systems requirements and overall costs. (See next page.)

• **MOUNTING**
Tie-Wrap • Washer/Insulators • Bolt-Mount • Moulded-In-Threaded-Insert • Encapsulated with Leads, PC pins, or Terminal Blocks.

• **SHIELDING**
Faraday shielding between primary and secondary and/or secondary and secondary
Magnetic shielding around the circumference or totally encompassing the transformer.

FREE LITERATURE AVAILABLE

Toroidal Transformers
Application and Design Notes
Specification Guidelines

FOR TECHNICAL ASSISTANCE

CALL 203/824-5125 FAX 203/824-1137

Data subject to change without notice.

Bicron Electronics Co., 50 Barlow Street, Canaan, CT 06018 • Tel: 203-824-5125 • Fax: 203-824-1137

GENERAL PURPOSE TOROIDAL POWER TRANSFORMERS

BICRON™

"Excellence Through Teamwork"

Standard Bicron Power Transformers for Industry

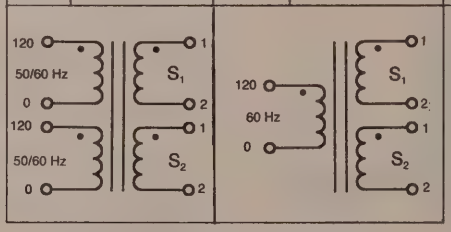
Specifications

UL 478 Recognized
Standard leads are PVC, Class A, 10" long
Dielectric strength 2500Vrms, primary to secondary
Maximum transformer operating temperature 265°F
Maximum temperature rise 150°F at rated power
Supplied with either metal mounting disk and two insulating pads (series AU2/BU2) or moulded-in threaded insert (series AU3/BU3) as specified
50/60 Hz power rating designed for 120/240 volt operation
60 Hz only power rating designed for 120 volt operation

Options

Full encapsulation
PC mounting
Terminal strips
Additional magnetic shielding
Special marking and mounting arrangement
Consult Bicron for other sizes and voltages

Power VA	Part Number see note (50/60 Hz)	Power VA	Part Number see note (60 Hz only)	Reg %	Size see note O.D. x Ht (inches)	Wgt. (lbs)	Secondary Full Load Voltage per Winding	
RECOGNIZED				UL478		SERIES	AU/BU	
20	AU202AD...D	24	BU202AS...D	17	2.7 x 1.5	.8	Vrms	code
30	AU203AD...D	36	BU202AS...D	17	2.7 x 1.9	1.2	6V	006
40	AU204AD...D	48	BU204AS...D	16	3.5 x 1.5	1.5	9V	009
60	AU206AD...D	72	BU204AS...D	13	3.5 x 1.8	1.9	12V	012
80	AU208AD...D	96	BU208AS...D	12	4.2 x 1.7	2.1	15V	015
100	AU210AD...D	120	BU210AS...D	11	4.2 x 1.9	2.3	18V	018
160	AU216AD...D	200	BU216AS...D	10	4.7 x 2.0	3.1	24V	024
230	AU223AD...D	275	BU223AS...D	8	4.7 x 2.5	5.5	28V	028
330	AU233AD...D	400	BU233AS...D	7	4.8 x 3.1	6.8	30V	030
400	AU240AD...D	480	BU240AD...D	7	5.7 x 2.6	7.5	36V	036
530	AU253AD...D	640	BU253AS...D	6	5.7 x 3.3	9.8	40V	040
600	AU260AD...D	720	BU260AS...D	5	5.7 x 3.5	11.0	48V	048
750	AU275AD...D	900	BU275AS...D	5	6.3 x 3.5	13.0	60V	064
1000	AU31A0D...D	1200	BU31A0S...D	5	6.3 x 3.8	16.0	72V	072
1200	AU31A2D...D	1440	BU31A2S...D	5	6.3 x 4.5	18.0	90V	090
1500	AU31A5D...D	1800	BU31A5S...D	5	7.9 x 3.5	21.0	100V	100
2000	AU32A0D...D	2400	BU32A0S...D	5	7.9 x 4.1	28.0	120V	120



Transformer Connections

NOTES:
SIZE: dimensions include mounting hardware.
SPECIFY: part number by inserting code eg: AU223AD...D + CODE = AU223AD100D defines transformer operation at 50/60 hz; rated at 230VA; dual pri. and sec. windings; each sec. winding rated 100V @ 1.15 Amps. BU32A0S...D + CODE = BU32A0S060D defines transformer operation 60 hz only; rated 2400VA; 120V pri. and dual sec. windings; each sec. winding rated 60V @ 20 Amps.

Bicron's "Modified Standard" Option

INFINITE ELECTRICAL CONFIGURATIONS

This program permits our customers to optimize their system requirements and overall costs by incorporating electrical and mechanical modifications to standard product without voiding BICRON's product recognition. These safety agency recognitions include IEC-601, UL544, UL1411, UL478.

VERSATILE MECHANICAL CONFIGURATIONS

Our customers are provided this service without significant engineering or manufacturing charges. When you need fast, reliable technical service, responsive delivery of prototype and production products at standard prices, CALL BICRON.

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MEDICAL TOROIDAL POWER TRANSFORMERS

BICRON™

"Excellence Through Teamwork"

BAUART GEPRÜFT

We supply WORLD-CLASS RECOGNIZED transformers to manufacturers of:

- Video Printers
- O^2/CO^2 Monitors
- Image Processing
- MRI
- Ultrasound Diagnostics
- Power Conditioners
- ECG Analyzers
- APEA Monitors

Standard Bicron Power Transformers for Medical Equipment

Specifications

100, 120, 200, 220, 240 Volt, 50/60 Hz operation
Standard leads are PVC, Class A, 10" long
Dielectric strength 4000 VRMS, primary to secondary
Max. transformer operating temperature 265°F
Max. temperature rise 150°F at rated power
Supplied with either metal mounting disk and two insulating pads (TYPE 2) or molded-in threaded insert (TYPE 3) as specified
UL 544 • IEC601
Special manufacturing methods to minimize mechanical noise (hum)
Safety shield
Thermal protected
Leakage current less than 50 µA

Options

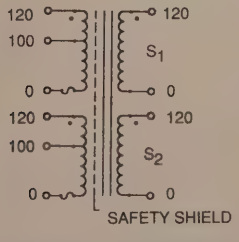
Full encapsulation
PC mounting
Terminal strips
Additional magnetic shielding
Special marking and mounting arrangement
Consult Bicron for other sizes and voltages

50/60 Hz Power Rating (VA)	Secondary Full Load Voltage per Winding	Reg. Full Load (%)	Size O.D. x Ht. (inches)	Wgt. (lbs)	Type 2 Mounting Part Number	Type 3 Mounting Part Number
	RECOGNIZED	UL544				SERIES AM
100	120V @ 0.8A	11	4.3 x 2.0	3	AM210AD120S	
230	120V @ 1.9A	8	4.8 x 2.6	6	AM223AD120S	
400	120V @ 3.3A	7	5.8 x 2.5	7	AM240AD120S	
600	120V @ 5.0A	5	5.8 x 3.6	11	AM260AD120S	
750	120V @ 6.3A	5	6.4 x 3.4	13		AM375AD120S
1000	120V @ 4.7A	5	6.4 x 3.9	16		AM31A0D120D
1500	120V @ 6.2A	5	8.0 x 3.7	21		AM31A5D120D
2000	120V @ 8.3A	4	8.0 x 4.3	28		AM32A0D120D
2500	120V @ 10.4A	4	8.8 x 4.9	33		AM32A5D120D
3000	120V @ 11.6A	3	8.8 x 5.0	36		AM373A0120D
	RECOGNIZED	UL544 / IEC-601 CLASS 1				SERIES AW
100	120V @ 0.8A	11	4.3 x 2.0	3	AW210AD120S	
230	120V @ 1.9A	8	4.8 x 2.6	6	AW223AD120S	
400	120V @ 3.3A	7	5.8 x 2.5	7	AW240AD120S	
600	120V @ 5.0A	5	5.8 x 3.6	11	AW260AD120S	
750	120V @ 6.3A	5	6.5 x 3.6	13		AW375AD120S
1000	120V @ 4.7A	5	6.5 x 4.2	18		AW31A0D120D
1500	120V @ 6.2A	5	8.1 x 4.5	30		AW31A5D120D
2000	120V @ 8.3A	4	8.6 x 5.1	41		AW32A0D120D
2500	120V @ 10.4A	4	9.2 x 5.2	46		AW32A5D120D
3000	120V @ 11.6A	3	9.3 x 5.3	48		AW33A0D120D

For custom applications use our "Modified Standard" program

NOTE: BICRON through it's family recognition program with National and European safety agencies and authorities has been empowered to modify our standard product and apply the recognition logos of these agencies.

Transformer Connections



Notes: 1. Winding S2 not supplied with power rating less than 1 KVA.

2. Primary windings must be connected in series or parallel.

FOR TECHNICAL ASSISTANCE
AND ADDITIONAL LITERATURE
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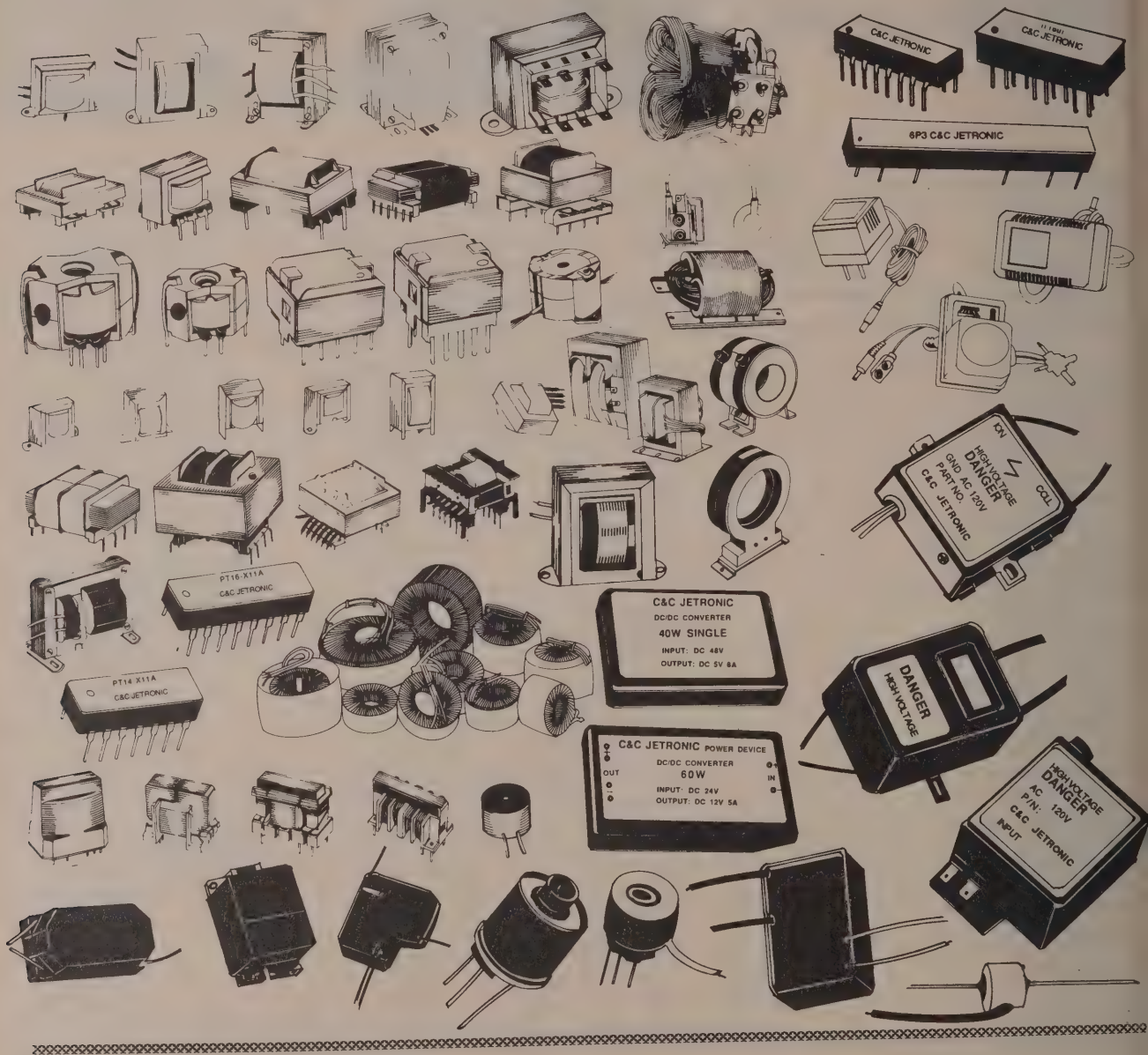
C&C JETRONIC TRANSFORMERS



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eem MINIGLOSSARY ELECTROMECHANICAL RELAYS

RELAYS

Hybrid: Isolated input and output either with a solid-state input and an electromechanical output or vice versa. Typically a reed switch is used to trigger a solid-state output or a solid-state amplifier is used to trigger an electromechanical relay.

Differential: Have multiple windings to function when voltage, current and/or power difference reaches a specific level or value.

Close-differential: The dropout value is specified close to the pickup value.

Frequency sensitive: Operates at a set frequency or within specific frequency bands. A resonant reed, for example.

Hermetically sealed: Totally sealed by glass-to-metal or metal-to-metal seals to ensure very low rates of gas leakage over long time periods.

Encapsulated: Imbedded in a suitable potting compound.

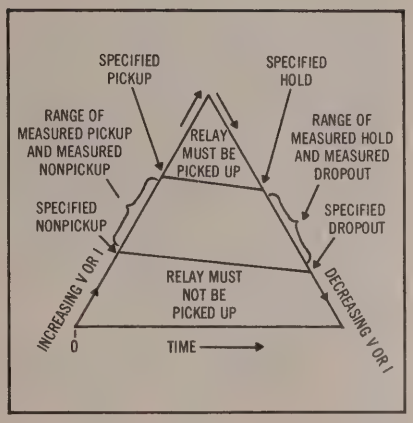
Sealed: Enclosed in a relatively airtight cover. (Not the same as hermetically sealed.)

Covered: Unsealed metal or plastic enclosure or housing.

CONTACTS

Dry circuit: contacts that carry current but do not open or close during energizing of the load circuit. Often wrongly used in reference to low level contacts.

Low Level: Contacts controlling relatively low voltages and low currents. Generally below 5 Vdc and 10mA.



OPERATING CHARACTERISTICS

Measured dropout: The value at which all contacts restore to their unoperated position as current or voltage decreases.

Specified dropout: The value at or *above* which all contacts *must* restore to their unoperated position as voltage or current is decreased.

Specified hold: The value that *must* be reached before any contact change occurs as voltage or current is decreased on an operated relay.

Specified nonpickup: The value that *must* be reached before any contact change occurs as voltage or current decreases on an unoperated relay.

Measured pickup: The value at which all contacts function as voltage or current increases on an unoperated relay.

Specified pickup. The value at or *below* which all contacts *must* function as voltage or current increases on an unoperated relay.

Sensitivity: Specified pickup expressed in watts.

Normal bridging: The make-before-break action between adjacent contacts on relays designed for this purpose.

Abnormal bridging: The undesired closing of contacts caused by a metal bridge or protrusion developed by arcing.

Magnetic freezing: Sticking of the armature to the core as a result of residual magnetism.

TIME

Actuation: The interval from coil energization or de-energization to the functioning of a specified contact.

Initial actuation: The interval from coil energization or de-energization to the *first* closing or opening of a previously open or closed contact.

Final actuation: Sum of initial actuation *and* bounce intervals following an actuation.

Contact bounce: The interval from close or opening of a contact to the end of the bounce of "chatter."

Chatter: See bounce.

Operate: Normally taken as the interval between energization and the opening or closing of the last contact to function not including bounce.

Release: Normally taken as the interval between de-energization and the opening or closing of the last contact to function excluding bounce.

Transfer: The interval between opening a closed contact and closing an open contact of a break-before-make relay.

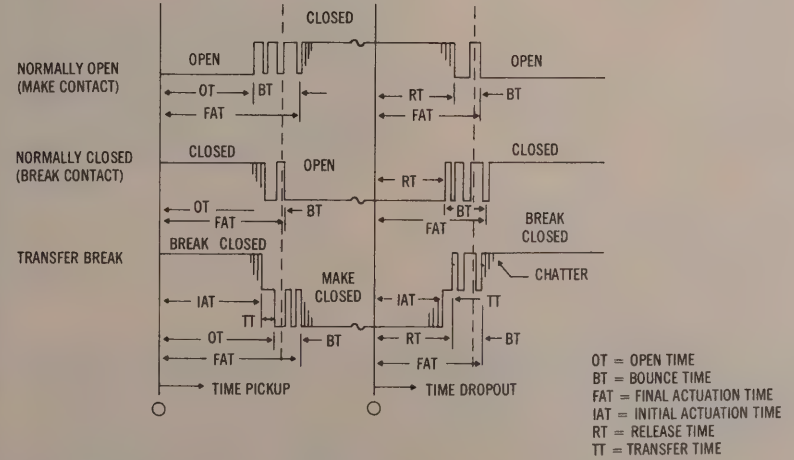


Fig. 2. Typical time vs. current (non-inductive load)

eem MINIGLOSSARY CONNECTORS

Connector terminology is often quite confusing. This confusion starts with the very names of connectors. The name of a connector may derive from its shape, application, type of conductor or even method of termination.

Shape—Circular, cylindrical, and rectangular.

Electrical application—High voltage, RF, microwave, input/output, etc.

Mechanical application—Printed circuit, rack & panel, cable, etc.

Conductor type—Coaxial, flat cable, ribbon cable, flex circuit, etc.

Termination method—Wirewrap, soldercup, solderless, etc.

Hardware such as clamps, hoods, and adapters are frequently used to convert cable connectors to rack and panel types. This adds to the name confusion. A very common telephone connector, for example (the "C" type) got its name from the model number of the original maker.

Contact: The part(s) of the connector that actually provides circuit continuity between its two sections—the parts which are normally mated. The back end of the connector should properly be called the *termination.* This is the point where the wires or PC board is attached to the connector.

Contact alignments: Often called *contact float.* Describes the amount of allowable contact movement within the connector body. Permits self-alignment.

Male vs. female: In the U.S. this describes the contact construction. In Europe this term is more often used to describe the outer shell mating action which may be the reverse of the contacts.

Closed entry: A female contact which prevents entry of a male contact larger than a specific size.

Open entry: A female contact designed for a specific size of male contact but which will allow entry of larger male contacts by spring action.

Hermaphrodite: Contacts or connector bodies which are the same configuration. Male/female designations do not apply. Bodies usually have some mechanical means for maintaining polarity.

Hermetic seal: Glass-to-metal seals at terminations. Often used improperly to describe vacuum-tight seals.

Waterproof seal: May or may not be truly *waterproof.* May prevent easy entrance of casual water by means of a rubber or other boot.

Printed circuit connector: Connectors which are used in conjunction with printed circuit boards. There are two distinctly different styles.

Edgeboard. May be called *edge* or *card.* The printed circuit (PC) board edge enters the connector.

Two-piece: One part of the connecting pair is physically attached to the PC board itself. The other part is attached to something else such as a cable or a motherboard.

Readout: Describes the arrangement at the terminating edge of a PC board. May be single or double. A double readout PC board has termination strips on each side not usually interconnected.

Ribbon connectors: A type of connector which allows flat "ribbon" cable to be attached to a round or rectangular connector but also used interchangeably for flat connectors to flat cable.

Ribbon contact connector: Describes the contacts in a rectangular connector which have a self-wiping mating action. Not the same as ribbon connector.

Solderless terminal: Any style of termination which does not require solder for a permanent connection. See *crimp* and *insulation displacement.*

Crimp termination: A stripped wire is inserted into a barrel or trough which is then crimped to the conductor with a suitable tool.

Insulation displacement: Unstripped insulated wire is fitted into a channel containing metal teeth which are forced through the insulation to make contact with the conductor.

Service rating: The maximum rated voltage and/or current which may be applied continuously. May be called *working voltage.* Can be confused with the term used to describe how many times a connector may be mated and separated.

Withstanding voltage: Also called *test voltage.* The voltage a connector must withstand for one minute without breakdown. Applied between connectors and between connectors and shell and any grounding devices of the connector.

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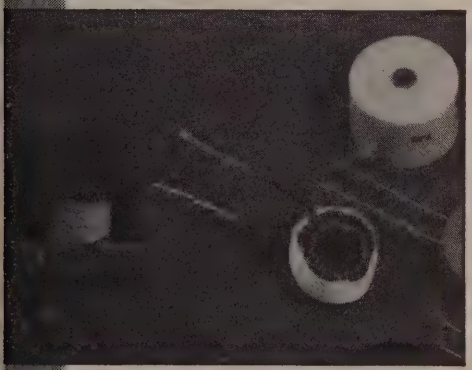

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- MIL-T-27
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■ Standardization.
We attempt to meet your requirements with industry standard materials.

■ Experience.
Cramer has thirty years in the custom magnetics business.

Switching Magnetics

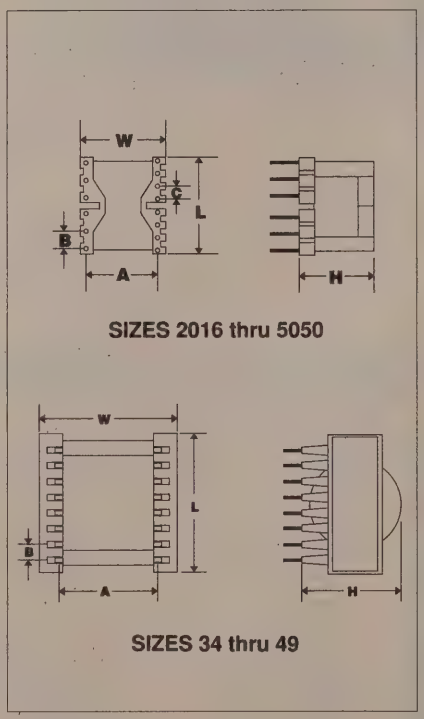
CSM Series Switchmode Power Transformers

The CSM series offers common building blocks for the use as switchmode power transformers.

The materials utilized by this series offer high inductance and negative core loss versus temperature (to 80° C). This means reduced transformer size for modern switchmode supplies. CSM Series transformers are designed for use in all switching topologies (Forward, Flyback, Push-Pull, Bridge and Half-Bridge).

The power output ratings listed on this page are based on a forward converter operating at 50 KHz, 48% duty cycle, 50 ° C ambient temperature, and 1500 volt hipot. Within these conditions the flyback topology reduces power output by 20% or more.

Safety agencies include V.D.E., I.E.C., C.S.A. and U.L. Most designs are constructed to Underwriters Laboratories, Inc. recognized Class 130(B) electrical insulation system (OBJY2), file #110339.



SIZES 2016 thru 5050

SIZES 34 thru 49

Table: *Power Output

SIZE	P Out*	L	W	H	A	B	C	#P
2016	30	0.92	0.92	0.85	0.80	.15	.10	14
2020	40	0.92	0.92	1.00	0.80	.15	.10	14
2620	70	1.10	1.20	1.10	1.00	.15	-	12
2625	80	1.10	1.20	1.20	1.00	.15	-	12
3220	100	1.30	1.40	1.10	1.20	.20	-	12
3230	150	1.30	1.40	1.50	1.20	.20	-	12
3535	200	1.40	1.60	1.60	1.40	.20	-	12
4040	300	1.60	1.70	1.80	1.50	.20	-	12
5050	400	2.10	2.10	2.10	1.80	.20	-	12
34	100	1.80	1.60	1.40	1.00	.20	-	14
39	200	1.90	1.80	1.50	1.20	.20	-	16
44	400	2.10	2.00	1.70	1.40	.20	-	18
49	600	2.30	2.20	1.60	1.80	.20	-	20

CVTI Inductors can be manufactured to any inductance, limited only by energy storage rating. They can be supplied selfleading PC mountable or on standard toroid mounts. We use proprietary software to quickly determine turns, wire size, and temperature rise.

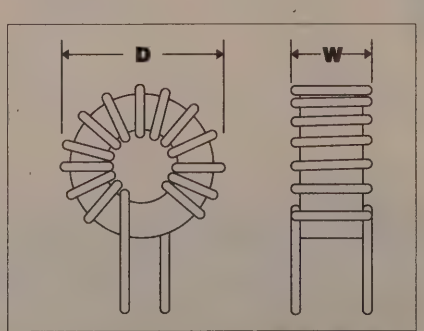


Table: *Maximum Energy Storage

SIZE	D	W	M.E.S.*
1	0.9	.4	475
2	1.2	.6	1500
3	1.4	.6	2200
4	1.7	.7	3800
5	2.0	.9	8000

Quality Custom Magnetics - Made in the U.S.A.

Cramer
Coil & Transformer Co., Inc.

401 Progress Drive - Saukville, Wisconsin 53080 - (414) 268-2150 - FAX (414) 375-5710

Linear Magnetics

CHPT Series Power Transformers

Our most economical and versatile linear power tranformers feature low capacitive coupling and 2500 VAC dielectric. Six pins per side allow for multiple primaries either series/parallel or multiple tapped, limited to 480 volts. The secondaries are supplied series/parallel, 3 isolated or 2 isolated centertapped. **Constructed to Underwriters Laboratories Inc., recognized Class 130(B) electrical insulation system (OBJY2). System designation C5; File # E110339.**

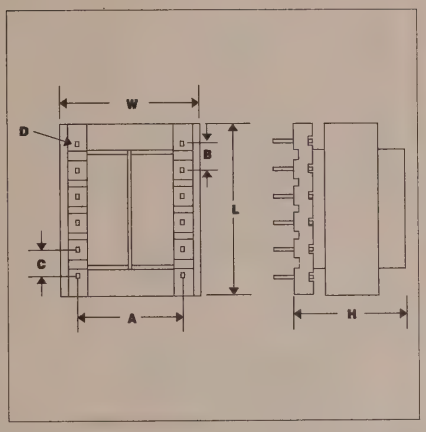


Table:

SIZE	VA	L	W	H	A	B	C	D*
1	2.0	1.4	1.25	1.15	.87	.15	.20	.036
2	4.4	1.65	1.38	1.18	.95	.20	.25	.025
3	10	1.9	1.58	1.38	1.1	.20	.30	.025
4	20	2.3	1.80	1.58	1.3	.20	.30	.025
5	25	2.3	1.80	1.82	1.3	.20	.30	.025

* Square

CIPT Series International Power Transformers

Constructed to meet International safety specifications, the CIPT series offers low capacitive coupling and a standard 4000 volt hipot. PC and chassis mount styles are available. Multiple primaries are supplied in series/parallel or series tapped configurations, limited to 480 volts, and the number of available terminals or pins per side. The secondaries are supplied with series/parallel, multiple tapped or isolated configurations. **Constructed to Underwriters Laboratories Inc., recognized Class 130(B) electrical insulation system (OBJY2). System designation C5; File # E110339.**

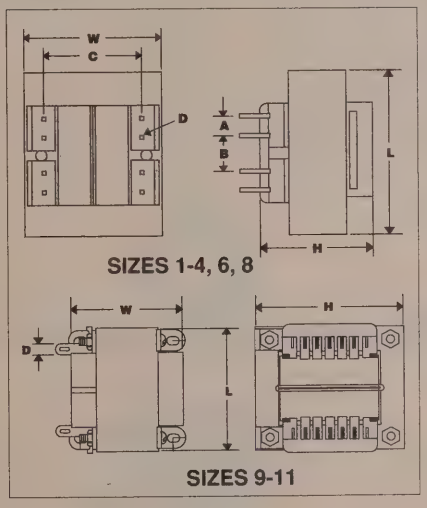


Table:

SIZE	VA	L	W	H	A	B	C	D*	PINS/ SIDE
1	2.5	1.63	1.31	1.13	.20	.25	1.00	.025	4
2	5.0	1.63	1.31	1.19	.20	.40	1.00	.025	4
3	10	1.87	1.56	1.19	.20	.40	1.14	.038	4
4	20	2.25	1.88	1.60	.40	.40	1.46	.038	6
5	25	2.81	1.88	1.31	-	-	-	.187	5
6	30	2.63	2.19	1.82	.55	.28	1.68	.045	6
7	43	3.13	2.19	2.69	-	-	-	.187	5
8	56	3.00	2.50	1.81	.60	.30	1.90	.045	6
9	80	2.50	2.38	3.00	-	-	-	.187	6
10	130	2.81	2.88	3.38	-	-	-	.250	6
11	175	3.13	2.88	3.75	-	-	-	.250	6

* Square

CLF Series Power Transformers

CLF chassis mount power transformers offer small size, low capacitive coupling, a standard 2500 volt hipot and .187 faston tabs for quick installation. They are supplied with single or multiple primaries. Multiple primaries are supplied in series/parallel or series tapped configurations limited to 480 volts and the 4 available lugs. Secondaries are supplied series/parallel or multiple tapped. **Constructed to Underwriters Laboratories Inc., recognized Class 130(B) electrical insulation system (OBJY2). System designation C5; File # E110339.**

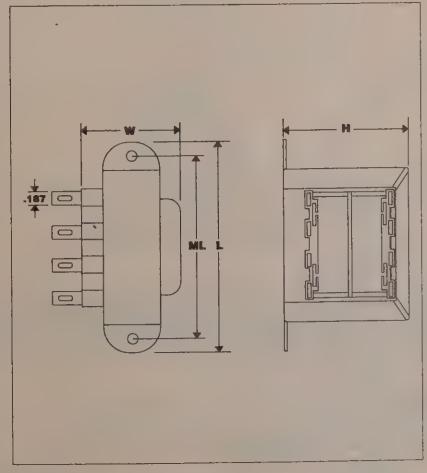


Table:

SIZE	VA	L	W	H	ML
3	2.4	2.06	1.06	1.19	1.75
4	6.0	2.38	1.25	1.38	2.00
5	12	2.81	1.38	1.63	2.38
6	30	3.25	1.69	1.94	2.81
7	56	3.69	1.81	2.25	3.13
8	100	4.03	2.25	2.56	3.56

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CSPE Series Slim Pack Power Transformers

The CSPE features low profile, semi-toroidal hum bucking construction, low capacitive coupling and 2500 VAC dielectric. They are supplied with series/parallel primaries and secondaries limited to VA rating. Two isolated secondaries can be supplied when they have approximately equal VA ratings. **Constructed to Underwriters Laboratories Inc., recognized Class 130(B) electrical insulation system (OBJY2). System designation C5; File # E110339.**

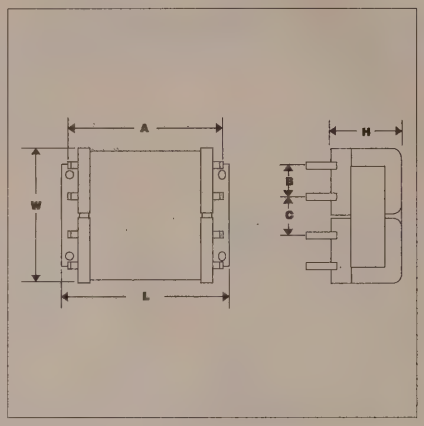


Table:

SIZE	VA	L	W	H	A	B	C	WT
1	2.5	1.87	1.56	0.65	1.60	.38	.38	.42lb
2	6.0	1.87	1.56	0.85	1.60	.38	.38	.58lb
3	12	2.50	2.00	1.07	2.00	.50	.50	.92lb
4	24	2.87	2.25	1.25	1.90	.60	.53	.94lb

CTFE Series Power Transformers

The CTFE series is built around cost-effective industry standard packaging. It features PC board mountability, 2500 VAC dielectric and low capacitive inductance. It can be supplied with single or multiple primaries. **Constructed to Underwriters Laboratories Inc., recognized Class 130(B) electrical insulation system (OBJY2). System designation C5; File # E110339.**

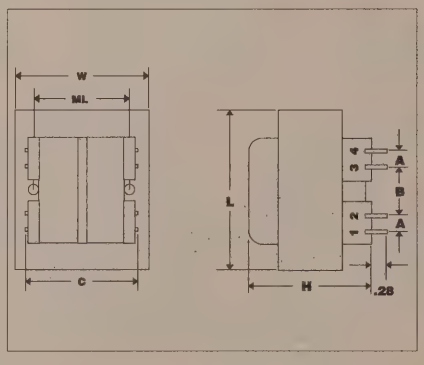
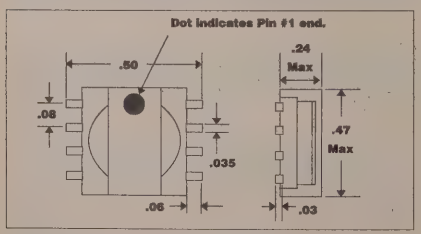


Table:

SIZE	VA	L	W	H	ML	A	B	C
2	1.1	1.38	1.12	0.94	-	.25	.25	1.20
3	2.4	1.38	1.12	1.19	-	.25	.25	1.20
4	6.0	1.63	1.31	1.31	1.06	.25	.35	1.28
5	12	1.87	1.56	1.44	1.25	.30	.40	1.41
6	20	2.25	1.87	1.44	1.50	.30	.40	1.60
7	36	2.63	2.19	1.56	-	.40	.40	1.85

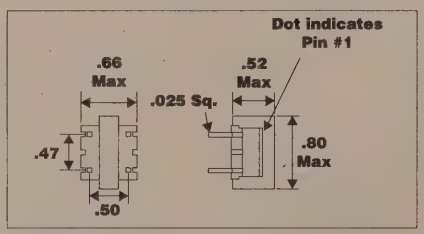
Custom and Telecommunications Magnetics

CTCT 500 Surface Mountable Modem Transformer



Impedance: Primary & Secondary - 600 Ohms each.Designed to reflect 600 Ohms on primary, with 500 ohm load on secondary.
DC Resistance: Primary: 58 ohms +/- 10%, Secondary: 72 ohms +/- 10%.
Insertion loss: 1.0 dB Max @1000 Hz.
Frequency response: 600 - 4000 Hz, +/- .5 dB, Ref. 1000 Hz.
Return Loss: 1 KHz - 20 dB Min., 600 Hz - 16 dB Min., 4 KHz - 26 dB Min.
Dielectric Strength: Primary - Secondary: 1500 Vrms.

CTCT 1104 Coupling Transformer



Impedance: Primary & Secondary - 600 Ohms each.Designed to reflect 600 Ohms on primary, with 600 ohm load on secondary.
DC Resistance: Primary: 30 ohms +/- 15%, Secondary: 40 ohms +/- 15%.
Insertion loss: 1.5 dB Max @1000 Hz.
Frequency response: 300 - 3000 Hz, +/- .5 dB, Ref. 1000 Hz.
Return Loss: 300 Hz - 20 dB Min., 1000 Hz - 26 dB Min., 3000 Hz - 20 dB Min.
Dielectric Strength: Primary - Secondary: 1500 Vrms.

Custom Coils

WE DO MORE!

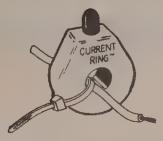
Solenoids, air-core inductors, magnetic pick-ups and lvdts are examples of coils not listed on these pages. Cramer can manufacture these types within machine capabilities. If you have a specific requirement, or simply need help developing a new idea, PLEASE CALL. **Expert engineering support is offered for most custom requirements.**

Quality Custom Magnetics - Made in the U.S.A.

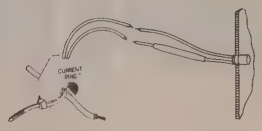
CURRENT INDICATORS AND TRANSFORMERS

ON-OFF CURRENT INDICATORS

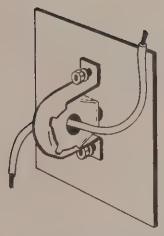
Wire Mounted Current Indicator, CR-45



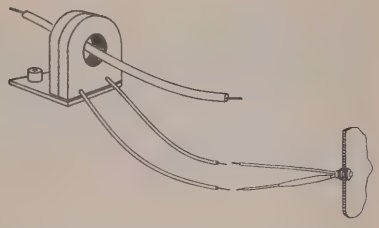
CR-45



Remote Current Indicator, Model 19 with PH-25



Panel Mounting Bracket, MB-45



Remote Current Indicator, Model 18 with PH-31

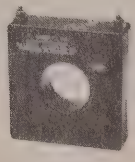
CURRENT TRANSFORMERS

UL RECOGNIZED

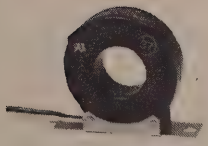
- *Window Diameters From .5 to 8.25"*
- *Ratios From 50:5 to 4,000:5*
- *5 Amp and Other Secondary Currents Available.*

Model 17
.5" Window Dia.
2000 Turns

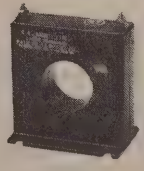
RL Series



SHT Series

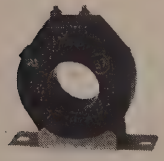


RBL Series



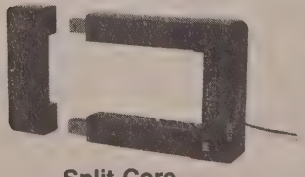
SFT Series

Rectangular



RBT Series

RT Series



Split-Core

CALL OR FAX FOR COMPLETE TECHNICAL INFORMATION

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308 AXMINISTER DR.
FENTON, MO 63026
314-343-8518
(FAX) 314-343-5119

SEE SECTION 4500
FOR INFORMATION ON OUR CURRENT RELAYS.

SEE SECTION 5500
FOR INFORMATION ON OUR CURRENT TRANSDUCERS.

MINIGLOSSARY CAPACITORS

Anode: One of two plates or conductors. In polarized capacitors, the anode should be connected to the positive conductor in the circuit.

Capacitive Reactance: The opposition (in ohms) of capacitance to the flow of alternating current, equal to the reciprocal of the product of the angular frequency (2π times frequency in Hertz) of the current times the capacitance in farads.

Cathode: One of two plates or conductors. In electrostatic capacitors the cathode is metallic. In electrolytic capacitors the cathode is a liquid, gel or other conductive material which is in intimate contact with a metallic cathodic connection.

Dielectric Constant: The ratio of the capacitance of a capacitor with some material other than air between the capacitor plates to the capacitance of the same capacitor with air between the plates. For example, the dielectric constants of air, Teflon®, polystyrene and ruby mica are 1, 2.1, 2.6 and 5.4, respectively.

Electrolytic: A capacitor with one metallic conductor (generally the anode) and with a liquid or semiconductor cathode. Nonpolarized electrolytic capacitors generally have two equal anodes as well as the liquid cathode. These anodes operate alternately as anode and cathodic connection as alternating current is applied.

Electrostatic: One of two general classes of capacitors in which two or more discrete metallic conductors are present and separated by an insulating dielectric material. Examples include: mica, ceramic, film, and paper types.

Farad: The basic unit of measure in capacitors. A capacitor charged to one volt with a charge of one coulomb (one ampere flowing for one second) has a capacitance of one farad. Capacitors are generally rated at portions of a farad (microfarads or picofarads).

1 farad (F) = 1,000,000 microfarads (μF) 1 microfarad (μF) = 1,000,000 picofarads (pF)

Impedance: All capacitors exhibit impedance. It is a function of capacitor type and internal construction. This can be particularly important in certain applications such as filters for switching power supplies. Capacitors used in these applications often have special multiple tab construction to shorten current paths and to reduce internal resistance.

Leakage Current: Expressed as dcl for electrolytic capacitors, a measure of the intrinsic losses in a charged capacitor. Generally speaking, the lower the dcl, the higher quality the capacitor.

Power Factor: A measure of the overall efficiency of a capacitor. Power factor ratings take all internal losses into consideration in a complex formula. This parameter of certain capacitors is often very important in AC applications such as motor-start and/or motor-run capacitors

Rated Voltage: The rated working voltage of a capacitor. Generally expressed in DC Volts (Vdcw). This is the voltage at which a capacitor may be safely operated at 25°C continuously within its overall parameters.

Ripple Current: The total amount of alternating and direct current that may be applied to an electrolytic capacitor under stated conditions. In general, the higher the ripple current applied, the shorter the operating life of the capacitor will be. Application of significantly higher than rated ripple currents can shorten the capacitor life dramatically and may even cause catastrophic failure (explosion).

Surge Voltage: The momentary surge voltage which may be applied for a stated length of time without doing permanent damage to the unit.

Temperature: Capacitors are generally rated at 25°C at sea level under specific humidity conditions. Operating temperature ranges are also given, along with derating (reliability) curves for operation at temperatures other than 25°C.

Temperature Coefficient: Expressed as TC in ppm (parts per million) or in percent (%) from the norm of 25°C. This is seldom a straight line and may vary widely for certain types. Most capacitors have positive TC in that the capacitance increases as temperature increases. Some types, however, have negative TC in that the capacitance decreases as temperature increases.

Ceramic Capacitor Codes
(Capacitance Given In pF)

Color	Digit	Multiplier	Tolerance			Temperature Coefficient ppm°C	Significant Figure	Multiplier
			Class 1		Class 2			
			10pF or less	Over 10pF				
Black	0	1	±2.0pF	±20%	±20%	0	0.0	–1
Brown	1	10	±0.1pF	±1%		–33		–10
Red	2	100		±2%		–75	1.0	–100
Orange	3	1000		±3%		–150	1.5	–1000
Yellow	4	10000			+100% –0%	–220	2.0	–10000
Green	5		±0.5pF	±5%	±5%	–330	3.3	+1
Blue	6					–470	4.7	+10
Violet	7					–750	7.5	+100
Gray	8	0.01	±0.25pF		+80% –20%	+150 to –1500		+1000
White	9	0.1	±1.0pF	±10%	±10%	+100 to –750		+10000
Silver								
Gold								

HIGH VOLTAGE TRANSFORMERS

Designed To Your Needs

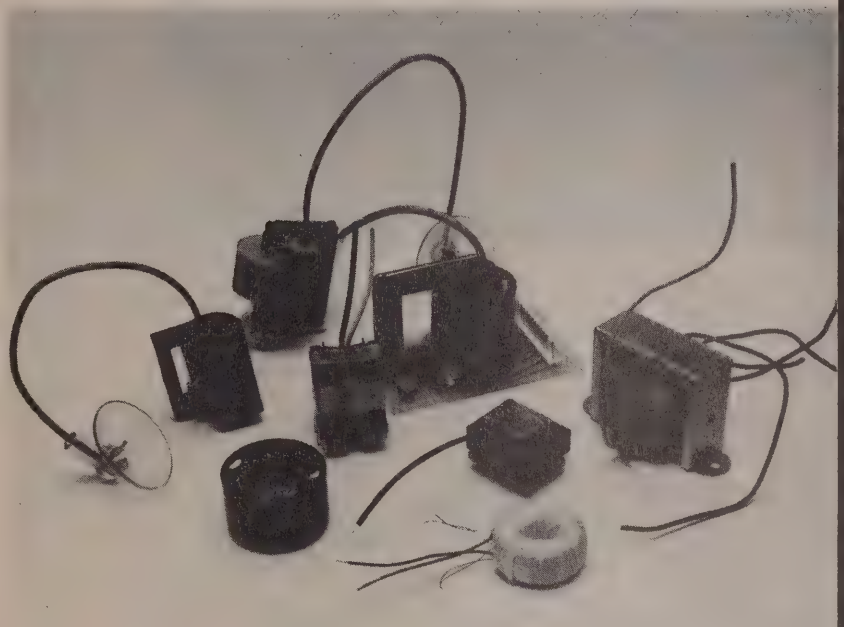
CUSTOM COILS INC.
605-934-2460

FEATURES

OUTPUT VOLTAGE
UP TO 60KV

OUTPUT POWER
UP TO 500VA

INPUT
115, 57 to 63 Hz
115/230V, 47 to 63 Hz
Switching - up to 100 KHz



FORMATS

PC MOUNT
Low profile • Split section
Horizontal • Vertical
High voltage exit - lead wire or bobbin terminal
Toroids on headers

CHASSIS MOUNT
Low profile • Split section
Lead wire or any type of termination

WINDING TECHNIQUES
Layer winding • Bobbin winding • Pi winding
Concentric winding
Non concentric winding
Toroidal winding

Dependable Personal Service & Consistent Quality

- Design Engineering Assistance
- Fast Sample / Prototype Turnaround
- Materials & Construction Applicable to CSA, TUV, VDE & UL Approvals
- Highest Quality Standards
- Specialists in Design & Manufacture of all types of Custom Transformers & Inductors
- 15,000 sq. ft. of Manufacturing Space
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MODEL TA
Transformers
Audio, Telephone Coupling

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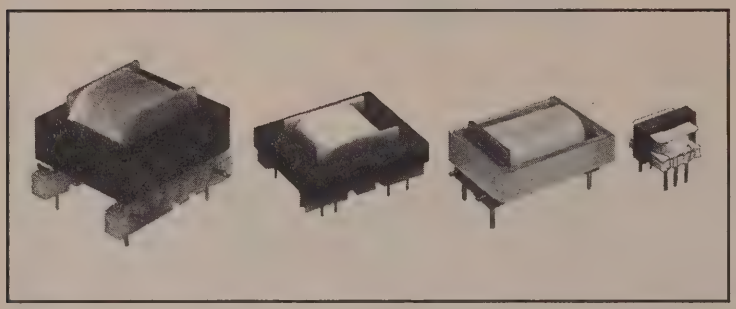


FEATURES

- Designed to meet FCC Part 68
- Provide line isolation, impedance matching and line balance
- Designed and built to meet telephone company requirements for data and voice access on leased private telephone lines or through dial-up switched telephone networks

STANDARD ELECTRICAL SPECIFICATIONS

MODEL	IMPEDANCE (Ohms) PRI	IMPEDANCE (Ohms) SEC	COUPLING APPLICATION	UNBALANCED DC CURRENT (mA)	RETURN LOSS MIN. (dB)	INSERTION LOSSES @ 1 kHz (dB)	FREQUENCY RESPONSE REF. @ 1 kHz (dB)	IMPEDANCE MATCHING	DISTORTION	STYLE	SCHEMATIC NUMBER
TA-10-08	600	600	DATA/VOICE	0	26	1.0	± .5	± 10%	.5%	C	5
TA-10-07	600	600	DATA/VOICE	0	26	1.0	± .5	± 10%	.5%	J	5
TA-30-06	600	600	DATA/VOICE	0-5	14	1.5	± 1.5	± 25%	5.0%	J	5
TA-10-05	600	600	DATA/VOICE	0	26	.6	± .5	± 10%	.5%	B	5
TA-30-02	600	600	DATA/VOICE	0-5	15	1.4	± 1.5	± 25%	5.0%	B	5
TA-30-03	600	600	DATA	0-90	8	2.4	± 1.0	± 25%	5.0%	G	5
TA-32-02	600	600	DATA/VOICE	0-80	11	1.2	± 1.5	± 25%	5.0%	M	13
TA-40-01*	600	600	DATA/VOICE	0-90	14	1.7	± 2.0	± 20%	.5%	N	13
TA-33-02	600	600	DATA/VOICE	0-100	8	1.6	± 1.5	± 25%	5.0%	E	15
TA-30-04	600	600 CT	DATA	0-90	8	2.4	± 1.0	± 25%	5.0%	H	9
TA-10-04	600 CT	600 CT	DATA/VOICE	0	26	.6	± .5	± 10%	.5%	A	4
TA-30-01	600 CT	600 CT	DATA/VOICE	0-5	15	1.4	± 1.5	± 25%	5.0%	A	4
TA-31-01	600 SPLIT	600	DATA/VOICE	0-50	8	1.4	± 1.5	± 25%	5.0%	K	11
TA-32-03	600 SPLIT	600	DATA/VOICE	0-80	11	1.2	± 1.5	± 25%	5.0%	L	14
TA-13-01	600	600 SPLIT	DATA/VOICE	0-75	13	1.2	± .5	± 10%	.5%	E	7
TA-33-01	600	600 SPLIT	DATA/VOICE	0-100	8	1.6	± 1.5	± 25%	5.0%	E	7
TA-10-01	600	600/600	DATA/VOICE HYBRID	0	26	.8	± .5	± 10%	.5%	A	1
TA-30-05	600	600/600	DATA/VOICE HYBRID	0-5	14	1.4	± 1.5	± 25%	5.0%	A	10
TA-11-01	600	600/600	DATA/VOICE HYBRID	0	26	.8	± .5	± 10%	.5%	D	1
TA-30-07	600	900	DATA/VOICE	0-5	14	1.5	± 1.5	± 25%	5.0%	J	2
TA-10-02	600	900	DATA/VOICE	0	26	.7	± .5	± 10%	.5%	B	2
TA-32-01	600/900	600	DATA/VOICE	0-100/0-120	8	1.4	± 1.5	± 25%	5.0%	L	12
TA-14-01	600	600/900	DATA/VOICE	0-100/0-120	14	.5	± .5	± 10%	.5%	F	8
TA-10-06	900	900	DATA/VOICE	0	26	.7	± .5	± 10%	.5%	A	6
TA-10-03	4k	600	DATA/VOICE	0	22	.7	± .5	± 10%	.5%	B	3
TA-23-01	600	600 SPLIT	DATA/VOICE	0-75	13	1.2	± .5	± 10%	.5%	E	16

* Reference for TA-40-01 is 1.8 kHz. Model **TA-3** is the **low-cost** alternative to Model TA-1. For HOLDING COIL information, refer to MODEL TE/TD.

ELECTRICAL SPECFICATIONS

Power Level: - 45 dBm to + 7 dBm except TA-40-01 (- 45 dBm to + 10 dBm).

Longitudinal Balance: Per FCC 68.310. 60 dB minimum = 200 - 1000 Hz. 45 dB minimum = 1000 - 4000 Hz.

Dielectric Strength: Per FCC 68.304, 1500 V peak.

Frequency Range: Data/Voice = 300 to 3500 Hz. Data = 800 to 3500 Hz.

MECHANICAL SPECIFICATIONS

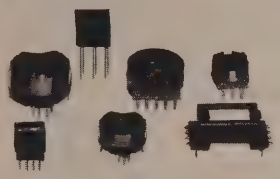
Coating: Impregnated with polyester varnish.

Terminals: Precision spaced P. C. type plug-in terminals.

MODELS PL-xx, PT, PT-xx, TC Transformers

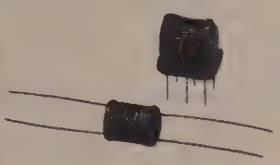
ISDN, Pulse, Trigger Type, SCR Isolation, Converter, Low Power

A COMPANY OF VISHAY DALE®



MODEL PT
ISDN
Transformers

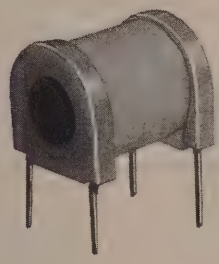
FEATURES
- Integrated Services Digital Network transformers that provide isolation for the line card and terminal in conjunction with both "S/T"and "U" interfaces
- Designed to meet CCITT I.430 pulse wave form template requirements
- Isolation voltage levels available for U.S. and International uses
- P. C. board mountable in through-hole and surface mount packages
- Standard and custom configurations available



MODELS
PT-10 and PT-20
Transformers
Pulse,
Trigger Type

FEATURES
- Choice of printed circuit or bobbin-type configurations
- Designed to transfer high amplitude or long duration pulses without saturation and for low-cost trigger source isolation in half and full wave SCR power control circuits, including motor speed controls, heater controls and incandescent lighting controls

ELECTRICAL SPECIFICATIONS
Primary Inductance Values: From 200µH to 5000µH.
Turns Ratio: 1:1, 1:1:1, 2:1, 2:1:1 and 5:1.
Temperature Range: - 10°C to + 70°C.



MODEL PT-50
Transformers
Trigger,
SCR Isolation

FEATURES
- Designed for low-cost trigger source isolation in SCR power control circuits and to transfer high amplitude or long duration pulses without saturation
- Small physical size and low profile provide packaging advantages
- Industrial and commercial applications include motor speed controls, lighting controls and heater controls
- Interchangeable. Designed for circuit board mounting using the same mounting dimensions as 11Z and PT-20 models.

ELECTRICAL SPECIFICATIONS
Primary Inductance Values: From 200µH to 5000µH.
Turns Ratio: 1:1, 2:1 and 5:1.
Temperature Range: - 55°C to + 105°C.

MODEL TC
Transformers
Converter

FEATURES
- Designed especially for low-power solid state circuits and for mounting on P. C. boards
- Miniature size for minimum space and choice of encapsulated or open (impregnated) styles
- High conversion efficiency from DC input to filtered DC output

ELECTRICAL SPECIFICATIONS
Transformer Power Rating: 3 watt.
Isolation, Primary-Secondary: 500 V 60 Hz. Operating characteristics may be varied to suit specific applications by appropriate selection of circuit components.
Operating Temperature Range: - 20°C to + 80°C. Intended for use in enclosed commercial and industrial applications.

Low Power
Transformers

MODELS PL-11, -12, -13, -14, -32, -33, -34
Single Primary, Input 115 V 60 Hz, Dual Secondary: PL-11 thru -14. Single Secondary: PL-32 thru -34.

MODELS PL-22, -23, -24, -42, -43, -44
Dual Primary - Dual Secondary
115 V 60Hz or
230 V 50 - 60 Hz

FEATURES
- P. C. pin mounting. Provides isolation from power line. Mounting frames and bobbin standoff available. Laminated construction for low-cost industrial applications.
- Recognized under the Component Program of Underwriters Laboratories, Inc. (UL File E71961). For general purpose transformers (UL Standard 506).
- **PL-11, PL-12, PL-13, PL-14:** Dual secondaries for **series connection** to obtain twice voltage with center tap or **parallel connection** for twice current rating
- **PL-32, PL-33, PL-34:** Single secondary and lower cost construction
- **PL-22, PL-23, PL-24, PL-42, PL-43, PL-44:** Dual Secondary for **series connection** obtains twice winding voltage with center tap or for **parallel connection** obtains twice winding current rating
- **PL-22, PL-23, PL-24:** Concentric windings for increased coupling, decreased leakage reactance and improved regulation.
- **PL-42, PL-43, PL-44:** Split-section winding for increased dielectric strength between primary and secondary windings plus reduced interwinding capacitance

DALE ELECTRONICS, INC., E. Hwy 50, P.O. Box 180, Yankton, SD 57078-0180 • Phone (605) 665-9301 • Fax 605-665-1627

DATATRONICS

Tel: 909-928-7700 • Fax: 909-928-7701

TRANSFORMERS

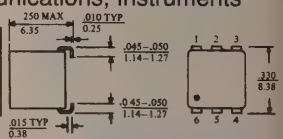
✔High Performance ✔SPC Quality ✔Fast Delivery ✔Low Cost ✔Tech Support

Broad Selection With Economical Custom Designs

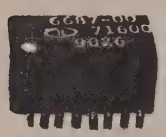
• ISDN	• Networking	• Switching	• Mil-Spec	• Sealed
• LAN	• Isolation	• Pulse	• SMDs	• Open

LM-501 SERIES SMD LINE MATCHING - Ideal for Modems, Laptops, Telecommunications, Instruments

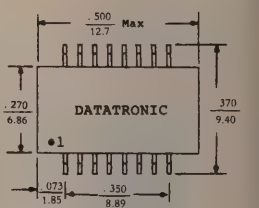
Nominal Impedance	Turns Ratio	Insertion Loss	Frequency Response	Return Loss	Longitudinal Balance	Distortion	Dielectric Strength
600 Ohm	1.00:1.00	2.0dB max at 2KHz	+/- 0.25dB max 200-4KHz	24 dB min 200-4KHz*	80 dB min	-76dB max	4600 Vrms for 1 min



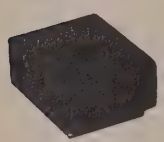
216 SERIES SMD ISOLATION FOR LAN ETHERNET



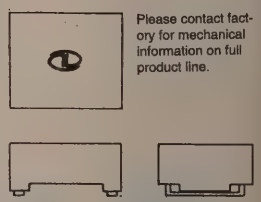
Part Number	Turns Ratio (±5%)	Sine Wave Inductance (µhy±20%)	Pulse Inductance (µhy Min)	Primary ET (V-µs Min)	Rise Time (NS Max)	Cw/w Pri/Sec (PF Max)	Leakage Pri/Sec (µhy Max)	DCR (Ohm Max)	Hipot (VRMS)
PT21602	1:1	100	80	2.5	3.0	9.0	0.20	0.30	2000
PT21604	1:1	150	120	3.0	3.0	11.0	0.26	0.40	2000
PT21605	1:1	175	140	3.3	3.8	12.0	0.28	0.50	2000
PT21607	1:1	30	24	2.0	3.0	5.0	0.15	0.15	2000
PT21609	1:1	50	40	2.0	3.0	7.0	0.20	0.20	2000
PT21611	1CT:1CT	200	160	3.0	3.0	10.0	0.20	0.30	2000



225 SERIES SMD INDUCTOR

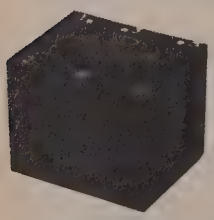


Part Number	Rated Current (AMPS DC)	Inductance with DC Current (µhy) Typ.	Inductance without DC Current (µhy ±15%)	DCR Max (Ohms)
PT22503	1.6	16.80	22.00	.093
PT22505	1.6	46.00	62.00	.180
PT22507	2.5	8.70	12.20	.047
PT22509	2.5	24.00	36.00	.090
PT22513	4.0	13.00	22.00	.046
PT22516	6.4	6.90	12.70	.024

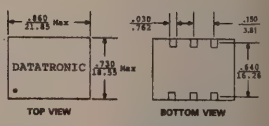


Please contact factory for mechanical information on full product line.

306 SERIES SMD TELEPHONE LINE

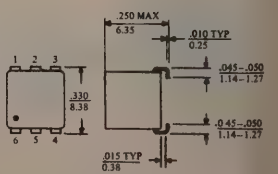


Part Number	Impedance (Ohms)		Insertion Loss (dB)	DCR (Ohms Max)	
	Primary	Secondary		PRI	SEC
PT30601	600	600	1.0	46	63
PT30602	600	600	1.0	46	63
PT30603	600CT	600CT	1.5	46	63
PT30604	600CT	600CT	1.5	46	63
PT30605	600 (4W)	600/600	3.7	38	30/30
PT30606	600 (4W)	600/600	3.7	38	30/30



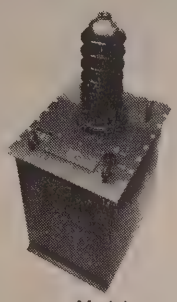
WIDE BAND RF

Part Number Type D	Type W	Type J	Ratio Impedance	Frequency MHz	Insertion Loss 3dB MHz	2dB MHz	1dB MHz
2-2-1D	2-2-1W	2-2-1J	2	.070-200	.070-200	.100-100	.50-50
2-16-6D	2-16-6W	2-16-6J	16	.030-75	.030-75	.060-30	10-20
3-2.5-6D	3-2.5-6W	3-2.5-6J	2.5	.010-100	.010-100	.020-50	.05-20
3-36-1D	3-36-1W	3-36-1J	36	.030-20	.030-20	.050-10	.10-5
4-2.5-6D	4-2.5-6W	4-2.5-6J	2.5	.010-50	.010-50	.025-25	.05-10
4-25-1D	4-25-1W	4-25-1J	25	.020-30	.020-30	.050-20	.10-10



DEL ELECTRONICS CORPORATION

High Voltage Line Isolation Transformers In Oil Insulating Tanks



Model
3–TR–150–11

FEATURES:

- ▼ Complete varnish impregnation under vacuum
- ▼ Epoxy anchoring
- ▼ Immersed in high grade insulating oil*
- ▼ Electrostatic shield between primary and secondary windings
- ▼ "AN" type connector provided for input connections
- ▼ Good regulation

*Note: Shipped without oil to minimize transportation charges, except when otherwise specified in order.

SPECIFICATIONS:

- ▼ Each model available with porcelain output insulator
- ▼ Models also available with two shielded polyethylene output cables in place of porcelain insulator
- ▼ Standard types available for 120V and 240V input lines in 1:1, 1:2, and 2:1 voltage ratios with other input and output voltages available upon request
- ▼ Recommended for industrial, research, and developmental applications

Custom Designs for 3-phase power available upon request.

Standard 60Hz Types				
Model No.*	Max. kVA	kV dc Insulation	Tank Size (in.) (W X D X H)**	Insulator Height (in.)***
1-TR-30-XX	1	30	10 X 12 X 11	6
1.5-TR-30-XX	1.5	30	13 X 13⅞ X 16½	6
1-TR-50-XX	1	50	13 X 13⅞ X 16⅜	8½
3-TR-50-XX	3	50	13 X 13⅞ X 16⅜	8½
1-TR-60-XX	1	60	9¾ X 12⅜ X 13⅜	11
2-TR-60-XX	2	60	16½ X 16½ X 21⅜	11
3-TR-60-XX	3	60	16½ x 16½ X 21⅜	11
5-TR-60-XX	5	60	16½ X 16½ X 21⅜	11
3-TR-75-XX	3	75	16½ X 16½ X 22	11
1-TR-100-XX	1	100	20¾ X 17½ X 17 13/16	14
3-TR-100-XX	3	100	20¾ X 17½ X 17 13/16	14
3-TR-150-XX	3	150	15½ X 18¾ X 24	19½
5-TR-150-XX	5	150	15½ X 18¾ X 24	19½
0.5-TR-250-XX	0.5	250	25 X 33 X 37 5/16	28¾
2-TR-250-XX	2	250	25 X 33 X 37 5/16	28¾
3-TR-250-XX	3	250	29¾ X 29¾ X 36⅜	28¾
5-TR-250-XX	5	250	25 X 33 X 37¼	28¾
4-TR-300-XX	4	300	39½ X 47½ X 50½	35
Models With Shielded Cables Instead Of Porcelain Insulator:				
0.5-CTR-250-XX	0.5	250	25 X 33 X 37 5/16	
2-CTR-250-XX	2	250	25 X 33 X 37 5/16	
3-CTR-250-XX	3	250	29¾ X 29¾ X 36⅜	
4-CTR-300-XX	4	300	25 X 33 X 37¼	
5-CTR-250-XX	5	250	39½ X 47½ X 50½	

*Note: Add the following suffix in place of XX:

For	Suffix	For	Suffix
120/120	11	240/120	21
120/240	12	240/240	22

**Note: Dimensions are nominal and outline drawings are available upon request.
***Note: If shielded polyethylene output cables are desired in place of porcelain insulator, designate part number with a "C" prefix, e.g., 1-CTR-30-XX.

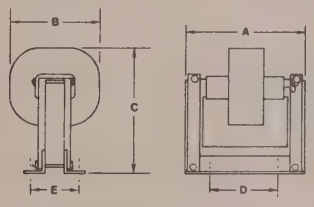
Transformer, High Voltage—Line Isolation Open Type Construction—Epoxy Coated

FEATURES:

- ▼ Designed for continuous operation at rated voltage and power
- ▼ Epoxy coated, air insulated up to 30kV dc, oil insulated over 30kV dc
- ▼ Well suited to applications requiring reliable isolated line voltage at power ratings up to 1kVA
- ▼ Other higher voltage and power units available upon request

SPECIFICATIONS:
Primaries: 115V or 230V, 60Hz
Secondaries: 115V

Type	Rating kVA	Size (A X B X C)	Mounting Dimensions (D X E)	Insulation kV dc Working
AD 1640	0.200	6⅛ X 4 X 5⅛	4½ X 3	10
AD 1641	0.500	7⅝ X 5⅞ X 7¾	5⅜ X 4¼	10
AD 1642	0.750	9½ X 6 5/16 X 8¼	7¼ X 4 13/16	10
AD 1643	1.000	8½ X 8 X 9¾	6 X 5	10
AD 1644	0.200	8½ X 4 X 5⅝	6⅞ X 3⅛	20
AD 1645	0.500	10¼ X 5⅝ X 7½	8 X 4¼	20
AD 1646	0.750	9¾ X 6¾ X 8	7½ X 4 13/16	20
AD 1647	1.000	11¼ X 6⅝ X 8¾	8¾ X 4⅝	20
AD 3060	0.250	8½ X 7¼ X 6½	7 5/16 X 3⅜	30
AD 3061	0.500	9¾ X 7 X 8¾	7 13/16 X 3½	30
AD 3062	0 750	10½ X 7½ X 9½	8½ X 3⅝	30
AD 3063	1.000	11 X 9 X 9½	8⅞ X 3¾	30
AD 3064	0.250	10 X 7 X 6½	8 13/16 X 3⅜	40
AD 3065	0.500	11¼ X 7¼ X 8¾	9⅛ X 3½	40
AD 3066	0.750	12½ X 7½ X 9½	10¼ X 3⅝	40
AD 3067	1.000	12¾ X 9 X 9½	10 7/16 X 3¾	40
AD 3068	0.250	13¼ X 7¼ X 6½	12 X 3⅜	50
AD 3069	0.500	13¼ X 7¼ X 8¾	11⅛ X 3½	50
AD 3070	0.750	14½ X 7½ X 9½	12¼ X 3⅝	50
AD 3071	1.000	14¾ X 9 X 9½	12 7/16 X 3¾	50



Transformer, High Voltage-Custom

- ▼ High Frequency Inverter Transformer 100W-30kW
- ▼ Pulse Modulator Magnetics
  - • Pulse Transformers
  - • Charging Chokes
  - • Low Capacitance Filament
- ▼ Power-60Hz and 400Hz - 1 phase and 3-phase

DEL ELECTRONICS CORPORATION
One Commerce Park, Valhalla, New York 10595
PHONE: 914/686-3600 FAX: 914/686-5424

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TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 93/94 EDITION OF EEM

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Capacitors, Product Selection Guide **A•1003**

Coils, Chokes, Inductors, Product Selection Guide **A•1179**

Connectors, Terminals & Sockets, Product Selection Guide **C•1139**

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eem

MINIGLOSSARY
BASIC CAPACITOR FORMULAS

I. Capacitance (farads)

English: $C = \frac{.224\,K\,A}{t_D}$

Metric: $C = \frac{.0884\,K\,A}{t_D}$

II. Energy stored in capacitors (Joules, watt-sec)

$E = \frac{1}{2}\,CV^2$

III. Linear charge of a capacitor (Amperes)

$I = C\frac{dV}{dt}$

IV. Total Impedance of a capacitor (ohms)

$Z = \sqrt{R_s^2 + (X_C - X_L)^2}$

Where Rs = ESR

V. Capacitive Reactance (ohms)

$X_C = \frac{1}{2\pi fC}$

VI. Inductive Reactance (ohms)

$X_L = 2\pi fL$

VII. Phase Angles:

Ideal Capacitors: Current leads voltage 90°
Ideal Inductors: Current lags voltage 90°
Ideal Resistors: Current in phase with voltage

VIII. Dissipation Factor

$DF = \tan\delta \text{ (loss angle)} = \frac{ESR}{X_c} = (2\pi fC)\,(ESR)$

IX. Power Factor

PF = Sine δ (loss angle) = Cos ϕ (phase angle)
PF = DF (when less than 10%)

X. Quality Factor (dimensionless)

$Q = \text{Cotan } \delta \text{ (loss angle)} = \frac{1}{DF}$

XI. Equivalent Series Resistance (ohms)

$ESR = (DF)\,(Xc) = (DF)\,(\frac{1}{2}\pi fC)$

XII. Power Loss (watts)

Power loss $= (2\pi fCV^2)\,(DF)$

XIII. KVA (Kilowatts)

$KVA = 2\pi fCV^2 \times 10^{-3}$

XIV. Temperature Characteristic (ppm/°C)

$TC = \frac{Ct - C_{25}}{C_{25}\,(T_t - 25)} \times 10^6$

XV. Cap Drift (%)

$C.D. = \frac{C_1 - C_2}{C_1} \times 100$

XVI. Reliability of Ceramic Capacitors

$\frac{L_O}{L_t} = \left(\frac{V_t}{V_O}\right)^x \left(\frac{T_t}{T_O}\right)^\tau$

XVII. Capacitors in Series (current the same)

Any number: $\frac{1}{C_T} = \frac{1}{C_1} + \frac{1}{C_2} \cdots + \frac{1}{C_N}$

Two: $C_T = \frac{C_1\,C_2}{C_1 + C_2}$

XVIII. Capacitors in Parallel (voltage the same)

$C_T = C_1 + C_2 \cdots + C_N$

XIX. Aging Rate

A.R. = % Δ C/decade of time

XX. Decibels

$db = 20 \log \frac{V_1}{V_2}$

Metric prefixes:

Pico	X 10^{-12}
Nano	X 10^{-9}
Micro	X 10^{-6}
Milli	X 10^{-3}
Deci	X 10^{-1}
Deca	X 10
Kilo	X 10^3
Mega	X 10^6
Giga	X 10^9
Tera	X 10^{12}

Symbols:

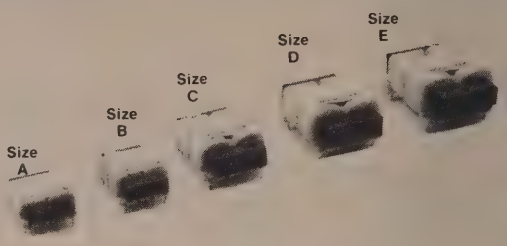
K	=	Dielectric Constant
A	=	Area of electrode overlap
t_D	=	Dielectric thickness
V	=	Voltage (volts)
t	=	time (hours)
R_S	=	Series Resistance (ohms)
f	=	frequency (Hertz)
L	=	Inductance (henries)
δ	=	Loss angle
ø	=	Phase angle
x+y	=	Exponent effect of voltage and temperature
L_O	=	Operating life (hours)
L_t	=	Test life (hours)
V_t	=	Test voltage (volts)
V_o	=	Operating voltage (volts)
T_t	=	Test temperature (°C)
T_o	=	Operating temperature (°C)

DYNAGE Magnetics

PANCAKE™ PC POWER TRANSFORMERS
53 models, 5 sizes, 24 voltages, dual primaries

CROSS REFERENCE CHART (OTHER MANUFACTURERS MODELS)

SIZE	DYNAGE	SIGNAL	PREM	EWC
A	PCA10-0.250	LP10-250	SPW-050	LP 10-250B23
B	PCB10-0.600	LP10-600	SPW-100	LP 10-600B1
C	PCC10-1.200	LP10-1200	SPW-300	LP 10-1200B2
D	PCD10-2.400	LP10-2400	----	----
E	PCE10-4.800	LP10-4800	----	----
A	PCA12-0.200	LP12-200	SPW-051	LP 12-200B24
B	PCB12-0.450	LP12-450	SPW-101	LP 12-450B3
C	PCC12-0.900	LP12-900	SPW-301	LP 12-900B4
D	PCD12-1.900	LP12-1900	----	----
E	PCE12-3.800	LP12-3800	----	----
A	PCA16-0.150	LP16-150	SPW-052	LP 16-150B25
B	PCB16-0.350	LP16-350	SPW-102	LP 16-350B5
C	PCC16-0.700	LP16-700	SPW-302	LP 16-700B6
D	PCD16-1.500	LP16-1500	----	----
E	PCE16-3.000	LP16-3000	----	----
A	PCA20-0.125	LP20-125	SPW-053	LP 20-125B26
B	PCB20-0.300	LP20-300	SPW-103	LP 20-300B7
C	PCC20-0.600	LP20-600	SPW-303	LP 20-600B8
D	PCD20-1.200	LP20-1200	----	----
E	PCE20-2.400	LP20-2400	----	----
A	PCA24-0.100	LP24-100	SPW-054	LP 24-100B27
B	PCB24-0.250	LP24-250	SPW-104	LP 24-250B9
C	PCC24-0.500	LP24-500	SPW-304	LP 24-500B10
D	PCD24-1.000	LP24-1000	----	----
E	PCE24-2.000	LP24-2000	----	----
A	PCA30-0.85	LP30-85	SPW-061	----
B	PCB30-0.200	LP30-200	SPW-111	----
C	PCC30-0.400	LP30-400	SPW-311	----
D	PCD30-0.800	LP30-800	----	----
E	PCE30-1.600	LP30-1600	----	----
A	PCA34-0.075	LP34-75	SPW-055	LP 34-75B28
B	PCB34-0.170	LP34-170	SPW-105	LP 34-170B11
C	PCC34-0.340	LP34-340	SPW-305	LP 34-340B12
D	PCD34-0.700	LP34-700	----	----
E	PCE34-1.400	LP34-1400	----	----



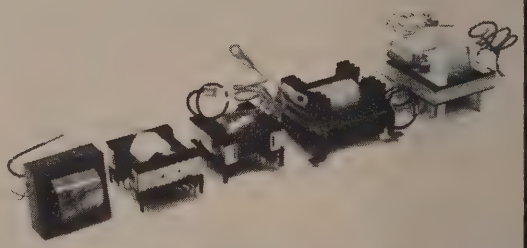
- Low prices
- High quality

Need a special? We have capability to design and produce to your requirements.

CROSS REFERENCE CHARTS (Cont'd)

SIZE	DYNAGE	SIGNAL	PREM	EWC
A	PCA40-0.060	LP40-60	SPW-056	LP 40-60B29
B	PCB40-0.150	LP40-150	SPW-106	LP 40-150B13
C	PCC40-0.300	LP40-300	SPW-306	LP 40-300B14
D	PCD40-0.600	LP40-600	----	----
E	PCE40-1.200	LP40-1200	----	----
A	PCA56-0.045	LP56-45	SPW-057	LP 56-45B30
B	PCB56-0.100	LP56-100	SPW-107	LP 56-100B15
C	PCC56-0.200	LP56-200	SPW-307	LP 56-200B16
D	PCD56-0.425	LP56-425	----	----
E	PCE56-0.850	LP56-850	---	----
A	PCA88-0.028	LP88-28	SPW-058	LP 88-28B31
B	PCB88-0.065	LP88-65	LPW-108	LP 88-65B17
C	PCC88-0.130	LP88-130	SPW-308	LP 88-130B18
A	PCA120-0.020	LP120-20	SPW-059	LP 120-20B32
B	PCB120-0.050	LP120-50	SPW-109	LP 120-50B19
C	PCC120-0.100	LP120-100	SPW-309	LP 120-100B20
A	PCA230-0.010	LP230-10	SPW-060	LP 230-10B33
B	PCB230-0.025	LP230-15	SPW-110	LP 230-25B21
C	PCC230-0.050	LP230-50	SPW-310	LP 230-50B22

SWITCHMODE POWER SUPPLY MAGNETICS



Transformers — driver, interstage, and output

We have standard designs for your custom requirements. Selected ferrite "E" cores with associated nylon bobbins are predesigned to minimize the custom design effort to meet your needs.

- Low prices
- High quality
- Custom designs

Inductors — toroidal and lamination types

- Designs available up to 300 amps
- Minimum possible size
- Selection of sizes
- Available with open winding or encapsulated or partial encapsulated

- Low prices
- High quality
- Custom designs

Transformers — current sense (toroidal)

- Fourteen (14) standard designs
- Low prices (cost effective designs)
- Open, sealed, or totally encapsulated

- High quality
- Custom designs

- UL, CSA, VDE and IEC Capabilities
- Designs to Military Specifications

DYNAGE Magnetics
DIVISION OF OAKLEAF, INC.

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DYNAGE Magnetics

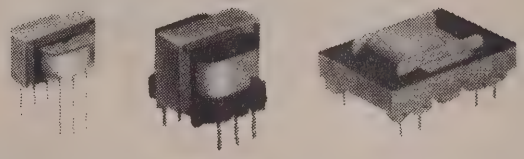
TELEPHONE INTERCONNECT TRANSFORMERS

Line coupling transformers — Hybrid transformers — Holding coils

- Designed to meet FCC Part 68
- 1500 volt dielectric strength
- For interconnecting data/voice devices to telephone lines

REFERENCE CHART (with cross reference to other mfrs.)

Size	Impedance, Pri:Sec	DYNAGE Model	STANCOR Model	MICRO-TRAN Model	DALE Model	Height, inches	Pc Bd Area, in2	Wt., oz.
Voice/Data Coupling								
26	600:600	TC26-A102	TTPC-2	T-1104	TA10-07	0.49	0.52	0.5
26	600:900	TC26-A104	TTPC-4	-----	-----	0.49	0.52	0.5
26	4000:600	TC26-A105	TTPC-5	-----	-----	0.49	0.52	0.5
26	600CT:600CT	TC26-D103	TTPC-3	-----	-----	0.49	0.52	0.5
39	600:600	TC39-A107	TTPC-7	-----	TA10-05	0.74	0.53	0.6
39	600:900	TC39-A110	TTPC-10	-----	TA10-02	0.74	0.53	0.6
39	900:900	TC39-A120	-----	-----	TA10-06	0.74	0.53	.06
39	4000:600	TC39-A111	TTPC-11	-----	TA10-03	0.74	0.53	0.6
39	600:600CT	TC39-B134	-----	-----	-----	0.74	0.53	0.6
39	600CT:600CT	TC39-D101	TTPC-1	-----	TA10-04	0.74	0.53	0.6
39	600CT:600CT	TC39-D108	TTPC-8	-----	-----	0.74	0.53	0.6
40	600:600	TC40-A121	-----	T2104	-----	0.75	0.53	0.6
40	600:900	TC40-A122	-----	T2108	-----	0.75	0.53	0.6
40	900:900	TC40-A123	-----	T2110	-----	0.75	0.53	0.6
40	4000:600	TC40-A124	-----	T2316	-----	0.75	0.53	0.6
40	600:600CT	TC40U-B106	TTPC-6	-----	-----	0.75	0.53	1.0
40	600CT:600CT	TC40-D125	-----	T2106	-----	0.75	0.53	0.6
45	600:600SP	TC45U-E113	TTPC-13	-----	-----	0.59	0.76	0.5
126	600CT:600CT	TC126U-J119	TTPC-19	-----	-----	0.60	2.10	2.5
132	600SP:600SP	TC132U-L118	TTPC-18	T9117	-----	0.63	2.10	2.5
132	600SP:600SP	TC132U-J126	-----	T9116	-----	0.63	2.10	2.5
154	600:600	TC154U-A115	TTPC-15	-----	-----	0.69	2.23	2.5
154	900:600	TC154U-A116	TTPC-16	-----	-----	0.69	2.23	2.5
154	600:600SP	TC154U-E127	-----	T5114	TA13-01	0.69	2.23	2.5
154	600:600SP	TC154U-E114	TTPC-14	-----	-----	0.69	2.23	2.5
Data Modem Coupling — For 300/1200/2400 BPS Modems for Microcomputers								
40	600:600CT	TD40U-B128	-----	T2114	-----	0.75	0.53	0.6
45	600:600	TD45U-A129	-----	T2111	-----	0.59	0.76	0.5
45	600:600CT	TD45U-B130	-----	T2112	-----	0.59	0.76	0.5
50	600:600	TD50U-A131	-----	T9311	-----	0.50	1.00	0.7
50	600:600SP	TD50U-E132	-----	T9312	-----	0.50	1.00	0.7
50	600:600SP	TD50U-E133	-----	T9317	-----	0.50	1.00	0.7



These products will meet telephone interconnect coupling, matching, and bridging requirements for use in voice, instrument, and modem applications.

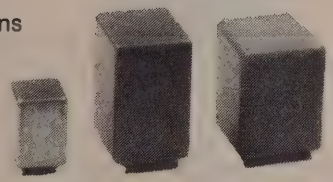
- Contact us for your special requirements.

REFERENCE CHART (with cross reference to other mfrs.)

Size	Impedance, Pri:Sec	DYNAGE Model	STANCOR Model	MICRO-TRAN Model	DALE Model	Height, inches	Pc Bd Area, in2	Wt., oz.
Hybrid — Two required for conventional hybrid operation								
39	600:600/600	THY39-E148	-----	-----	TA10-01	0.74	0.53	0.6
40	600:600/600	THY40-E136	-----	T2220	-----	0.75	0.53	0.6
50	600:60C/600	THY50U-E135	-----	T9320	-----	0.50	1.00	0.7
83	600:600/600	THY83-E142	-----	-----	TA11-01	0.85	0.97	1.2
86	600:600/600	THY86-E109	TTPC-9	-----	-----	0.86	1.00	1.0
86	600:600/600	THY86-E137	-----	T3220	-----	0.86	1.00	1.0
133	600:600/600	THY133U-L138	-----	T9220	-----	0.63	2.11	2.2
206	600:600/600	THY206U-P139	-----	T4220	-----	1.21	1.70	3.5
275	600:600/600	THY275U-L140	-----	T5220	-----	1.19	2.31	5.5
Holding Coils								
32		THC32-G141	-----	T7410	-----	0.41	0.79	0.8
39		THC39-G146	-----	-----	1A40-01	0.44	0.89	0.8
78		THC78-G143	-----	T8410	-----	0.63	1.23	2.0
95		THC95-G145	-----	-----	1A50-01	0.69	1.37	2.0
154		THC154-H117	TTPC-17	T5415	-----	0.69	2.23	2.5
185		THC185-G144	-----	-----	TA12-01	1.19	1.55	3.5
213		THC213-G147	-----	T4415	-----	1.25	1.70	3.5
236		THC236-G112	TTPC-12	-----	-----	1.32	1.79	1.5

CUSTOM MIL-T-27 TRANSFORMERS

- For military applications
- For hi-rel industrial applications
- Competitive prices

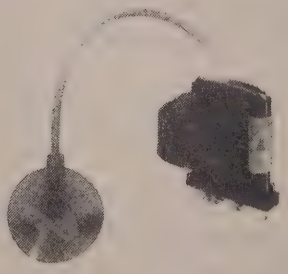


- Construction to MIL-T- 27D, grade 4 or 5, Class "S", life "X", (10,000 hrs.)
- Encapsulated to meet MIL-STD-810C for vibration, shock, sand, dust, humidity, salt spray, fungus, sunshine, rain, explosion, and high altitude.

Call us for your special requirements!

FLYBACK TRANSFORMERS (HIGH VOLTAGE)

- Up to 30KV output
- Epoxy (or silicon) encapsulated
- Up to 32 KHz, typical
- Varicus footprint styles available



- Made to customer specifications

Please send us your specifications for high voltage transformers (flyback). Our engineers will work with you to design transformers for your special needs.

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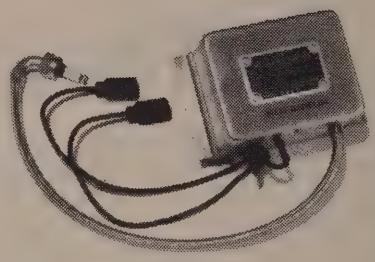
HIGH VOLTAGE TRANSFORMERS

IGNITION TRANSFORMERS

Various types of custom ignition transformers are offered ranging from the continuous sparking type to the high energy arc exciters that deliver up to a 12 joule arc at a rate of 4 times per second.

Custom ignition transformers/modulators for military applications, such as large tent heaters, are also offered.

Contact us to design custom type ignition transformers to meet your requirements.

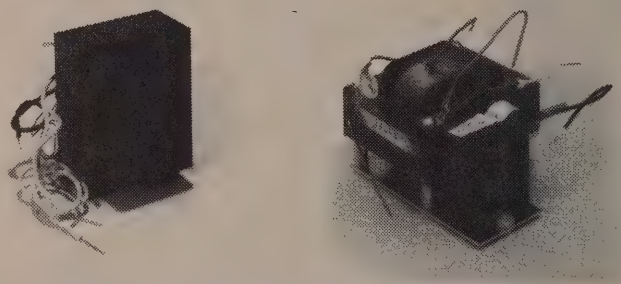


Ignition modulator for military tent heater.

OZONE GENERATOR TRANSFORMERS

Custom ozone generator transformers can be designed to meet your specific ozone generator application. Units of different frequency and voltage combinations are offered as required by the plate designs.

For your specific requirement, please contact us for engineering discussions and price quotations.

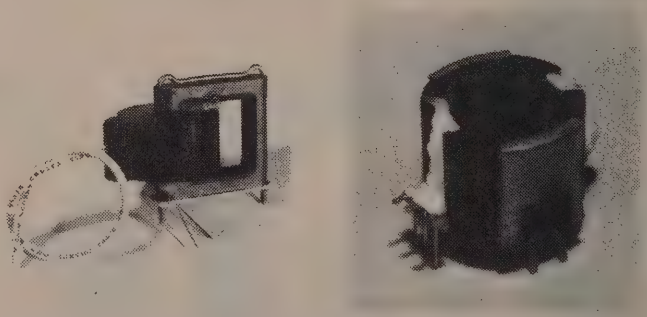


Custom ozone generator transformers

AIR CLEANER & ION GENERATOR TRANSFORMERS

Various types of air cleaner transformers for electrostatic cleaning and transformers for ion generation are offered.

Contact us to design custom units to meet your specific requirements.



Custom air cleaner and ion generator transformers

OTHER HV TRANSFORMERS

Contact us for any high voltage transformer application.

• Low Prices • High Quality • Custom Designs
Call or FAX us for your special requirements!

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DYNAGE Power

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WALL PLUG-IN, DESK TOP, AND WALL MOUNT UNITS

AC/AC, AC/DC, and AC/DC Regulated

AC/DC ADAPTERS

Up to 14 case sizes are offered with a variety of output cord and connector configurations to meet your specific requirement. Units can be custom designed to meet your input and output ratings. Plug types for many different countries are available. Several standard models with UL, CSA and other approvals are offered.

Centertapped or multi-secondary versions with three or four conductor output cords are availalbe. Screw terminal outputs are also offered on some case sizes.

Wall plug-in units for North American receptacles.

AC/DC ADAPTERS

These adapters are unregulated, filtered, DC output units offered in up to 14 case sizes with a wide variety of output cord and connector configuation. Dual or triple DC outputs with three or four conductor output cords are available. Input plug types of many different countries are offered.

UL and CSA approved standard models are available. Units designed to meet VDE, TUV, and others are also offered.

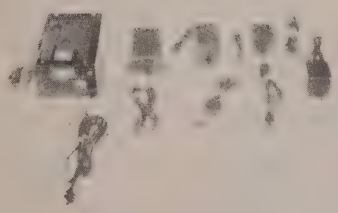
Wall plug-in units for various International receptacles.

LINEAR REGULATED POWER SUPPLIES

The larger case sizes are used for the linear regulated DC power supply units. Some of the larger cases are of the wall plug-in type mainly for North American receptacles. Most of the larger cases are of the desktop (or wall mount) style.

Single or multiple regulated outputs are offered with 2, 3, 4, or 5 conductor output cords available. Input cords for most countries are available in the desk top or wall mount units.

Custom designs can be made to meet your specific requirements.



Desktop and wall mount units with input cords for North American receptacles or various International receptacles.

SWITCHING POWER SUPPLIES

the switching regulated power supplies are offered primarily in the larger case sizes. Some versions are available in wall plug-in type cases but most offerings are in desk top units. Units are designed to meet EMI requirements per FCC Docket 20780 Class B. Wide input voltage ranges of 90–130 and 180-260 VAC are standard.

Custom designs can be made to meet your specific requirements.

- Low prices
- High quality.
- Custom designs to meet your exact requirements.
- Standard designs available with UL and CSA approvals.
- UL, CSA, and VDE submittals upon request.
- Quick delivery on preproduction units (made in USA)
- Plugs for Continental Europe, UK, Australia, North America, and others.

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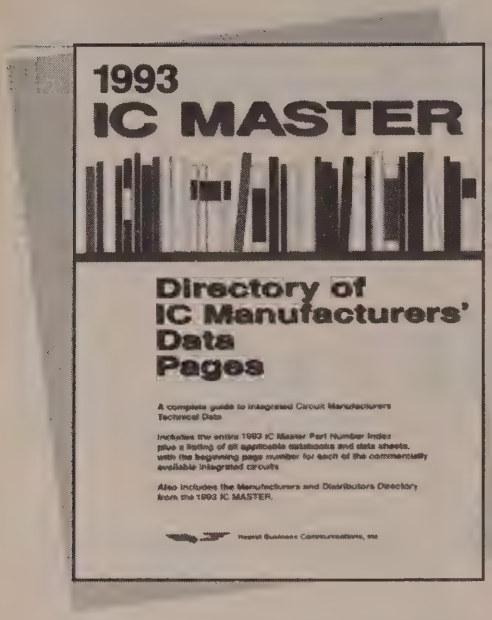

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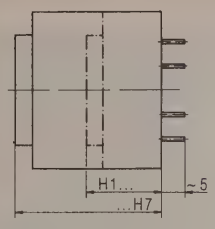
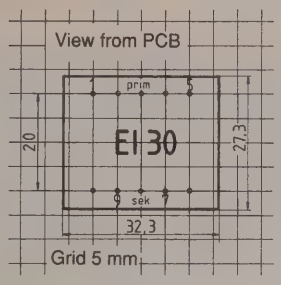


with solder wire 0.8 mm ø

Pin configuration,
e.g. 1, 5, 7 and 9



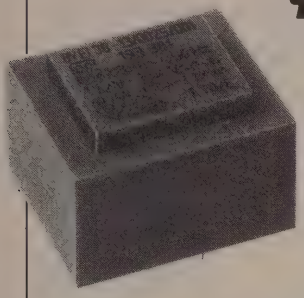
EI30

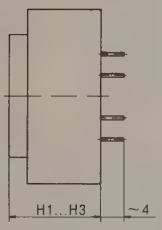
Safety Transformers

110-380 VAC input range
0.5-2.8 VA output range

Epoxy encapsulated transformers offer:

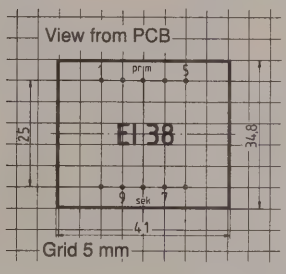
- Higher VA Rating in a small package
- UL & VDE Safety Approvals
- Custom Designs Available Upon Request





with solder wire 0.8 mm ø

Pin configuration,
e.g. 1, 5, 7 and 9



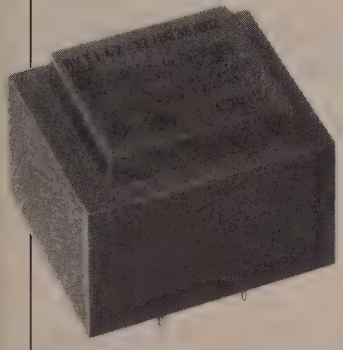
EI38

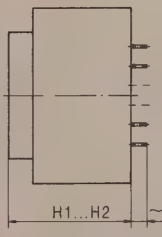
Safety Transformers

110-380 VAC input range
2.0-4.0 VA output range

Contact us for a complete catalog of:

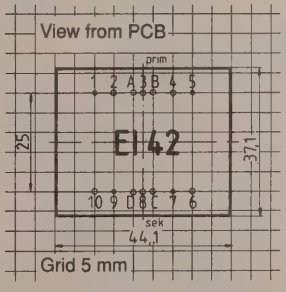
- All types up to 100 VA output
- Transformers with or without internal fusing
- Pricing & Delivery





with solder wire 0.8 mm ø

Pin configuration,
e.g. 1, 5, 7 and 9



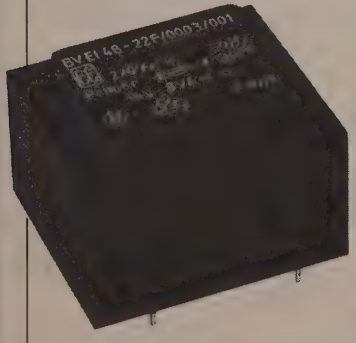
EI42

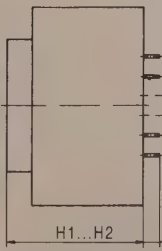
Safety Transformers

110-380 VAC input range
4.0-7.5 VA output range

Epoxy encapsulated transformers offer:

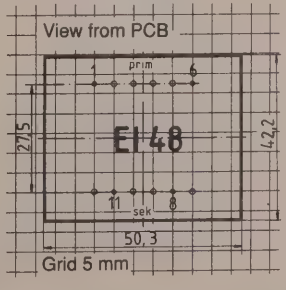
- Higher VA Rating in a small package
- UL & VDE Safety Approvals
- Custom Designs Available Upon Request





with solder wire 0.8 mm ø

Pin configuration,
e.g. 1, 6, 8 and 11



EI48

Safety Transformers

110-380 VAC input range
9.0-12.0 VA output range

Epoxy encapsulated transformers offer:

- Higher VA Rating in a small package
- UL & VDE Safety Approvals
- Custom Designs Available Upon Request

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- POWER
- ISOLATION
- CONTROL
- AUTO
- STEPUP
- STEPDOWN
- CURRENT
- C.V.T.
- CHOKES
- HI FREQ
- INDUCTORS

FEATURES

TRANSFORMERS

Power—.5VA to 50KVA

115V, 57 to 63 Hz
115/230V, 47 to 63 Hz
International power input, 47 to 63 Hz
400 Hz
Single or multi outputs
For power supply, control, filament & rectifier circuits (+5, ±12, ±15 or any combination)
• Non concentric winding technique • Minimum inter-winding capacitance • Excellent isolation • Very low leakage • Minimum electrical noise • High efficiency • UL recognized components for Class B (130°C)

Hi Freq—Up to 40 KHz

Ferrite cores
Switching power supply
AC-DC converter
DC-DC converter
Inverter

Current—Up to 500 Amp

Sense
Instrumentation
Measuring devices
AC and DC

INDUCTORS

Power—50, 60, 400 Hz

1 μH to 50H of inductance
1μ Amp to 60 Amp of current

Hi Freq—Up to 100 KHz

1 μH to 50H of inductance
Switching power supply
Ferrite cores
Converter
Inverter

FORMATS

PC MOUNT

(Hi Pot 4K VRMS)

• Low profile • Split pack
• Horizontal • Vertical

CHASSIS MOUNT

(Hi Pot 4K VRMS)

• Low profile • Split pack
• Quick connect, solder tab, lead wire, or any type of termination
Open frame/Closed frame

SERVICES

• Design to your specifications • Design to UL standards • First article engineering sample within one week • No engineering set up charge • O.E.M. services • 100% Q.C.—guaranteed reliability • Our CAD system eliminates the need for a catalog

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WALL PLUG-IN/DESK TOP POWER SOURCES • TAILORED TO YOUR EXACT NEEDS

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- **AC/AC**
- **AC/DC (unreg)**
- **AC/DC (reg)**
- **BATTERY CHARGERS**
- **LINEAR SUPPLIES**

FEATURES

Power—.1VA to 40VA (WALL PLUG-IN)
.1VA to 1KVA (DESK TOP)

Input—100VAC to 240VAC

Freq.—47Hz to 400Hz

Output—.1V to 200V (WALL PLUG-IN)
.1V to 1KV (DESK TOP)

Current—.01A to 5A (WALL PLUG-IN)
.01A to 400A (DESK TOP)

Termination—CONNECTORS, SCREW TERM.
ETC.

SERVICES

- DESIGNED TO YOUR SPECIFICATIONS
- DESIGNED TO UL/CSA/VDE/IEC
- FIRST ARTICLE ENGINEERING SAMPLE WITHIN ONE (1) WEEK
- NO MINIMUM ORDER QUANTITY
- NO ENGINEERING CHARGE
- 100% Q.A.

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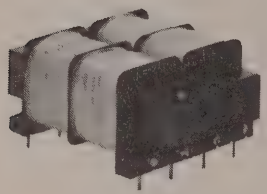
Ensign Corporation

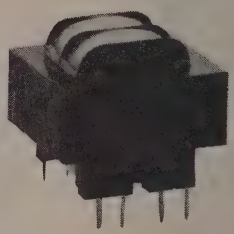
CUSTOM TRANSFORMERS

PRINTED CIRCUIT (LOW PROFILE)



TRANSFORM YOUR NEEDS ... INTO QUALITY PRODUCTS YOU CAN TRUST

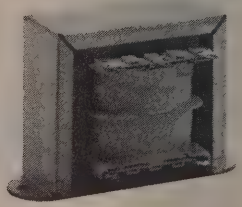
PRINTED CIRCUIT



WALL PLUG-INS

- LAMINATIONS, FERRITES, AIR-CORE
- POWER, IMPEDANCE MATCHING, AUDIO, AUTO-TRANSFORMERS, & MORE

QUICK-CONNECT/ SOLDER TERMINAL



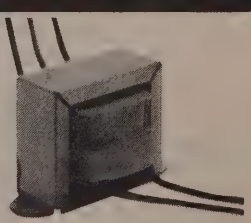
MALCOLM BALDRIGE AWARD WINNER PREFERRED SUPPLIER

TOROIDS

- WE DESIGN TO A VARIETY OF UL, CSA, & INTERNATIONAL STANDARDS

ALL SIZES UP TO 1 KVA

COLOR-CODED LEAD WIRES



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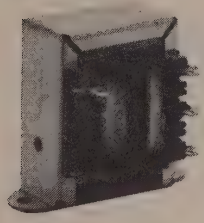
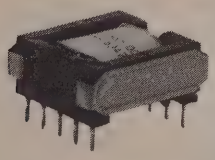
CUSTOM TRANSFORMERS

QUICK-CONNECT/SOLDER TERMINALS (INTERNATIONAL)

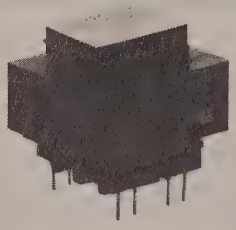
- OPTIONAL FLAME RETARDANT MATERIALS
- OPTIONAL INTERNAL FUSING

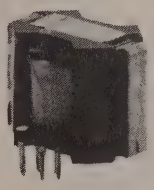
PRINTED CIRCUIT (INTERNATIONAL)

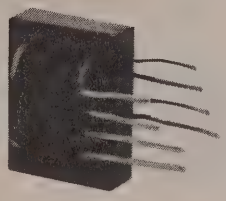


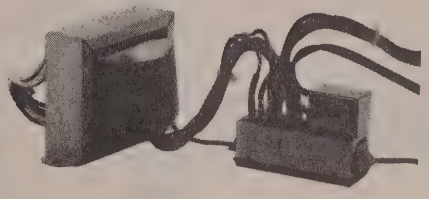


DIMENSIONS YOU NEED

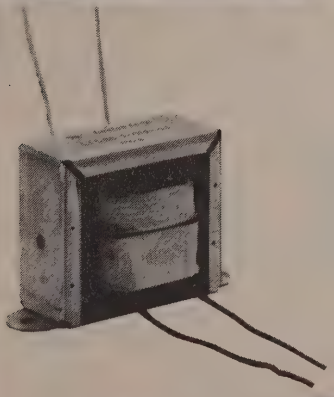








LOW VOLTAGE (12V) LIGHTING

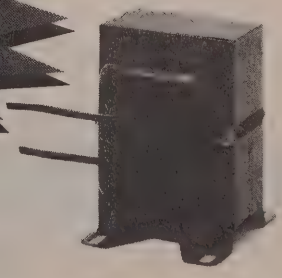


- UL INSULATION SYSTEMS FROM 130°C TO 200°C
- 100% HI-POT TESTING UP TO 4000V

MANUFACTURERS OF CUSTOM & PRE-DESIGNED TRANSFORMERS

Tailoring Our Business To Fit Your Needs

Quality Products You Can TRUST



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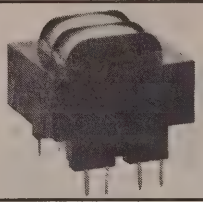
Ensign Corporation

PRE-DESIGNED TRANSFORMERS

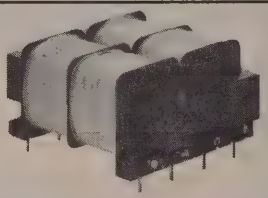
Reduce the time and cost to go from concept to market by using pre-engineered UL recognized power transformers. Use as is or make custom modifications. UL insulation systems from 130°C to 200°C. Except where noted, all operate in both 50 Hz and 60 Hz applications.

PRINTED CIRCUIT



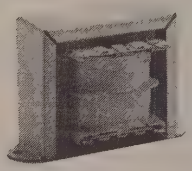
The industry standard for printed circuit applications. Sizes to 36 VA. Output ranges from 5 VAC to 120 VAC.

PRINTED CIRCUIT (LOW PROFILE)



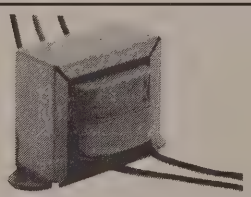
Ideal for multi-layer PCB's, or in tight quarters. Complete winding isolation. Sizes to 48 VA. Output ranges from 5 VAC to 240 VAC.

QUICK-CONNECT/ SOLDER TERMINALS



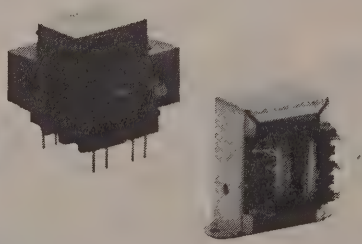
Securely anchored integral terminals function either as convenient solder lugs or 3/16" male quick-connects. Sizes to 100 VA. Output ranges from 10 VAC to 120 VAC. Chassis mount.

COLOR-CODED LEAD WIRES



Inputs and outputs easily identified by 600V rated lead wires. Ready for harnessing or direct soldering. 6" standard, other lengths upon request. Sizes to 100 VA. Output ranges from 10 VAC to 120 VAC. Chassis mount.

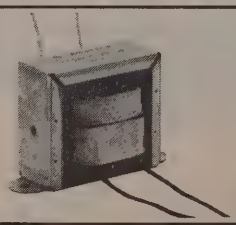
INTERNATIONAL



Meet construction & performance required by IEC, VDE, TUV, etc. 4000V dielectric strength. Provide creepage & clearance distances. Windings enclosed in protective shroud. Single, dual, or multi-tap inputs.

Printed circuit versions in sizes to 80 VA. Chassis mount versions with solder lugs, quick-connect terminals, or color-coded lead wire in sizes to 200 VA. Output ranges from 10 VAC to 240 VAC.

LOW VOLTAGE (12V) LIGHTING



60 Hz applications only. Available in 120V, 120/240, 208, 240, 277, & 120/277V input versions. Output voltage regulation specifically designed for 12V halogen & incandescent lamps.

50 watt & 75 watt sizes standard. UL 200°C insulation systems standard. Available in several chassis mount styles.

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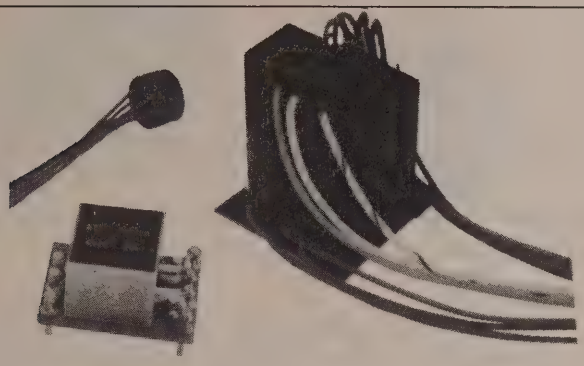
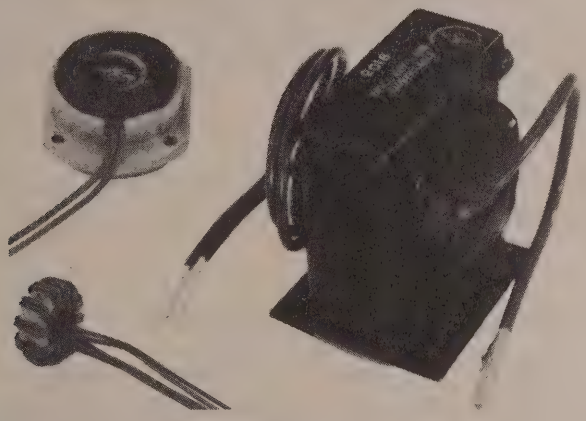
ESC

TRANSFORMERS

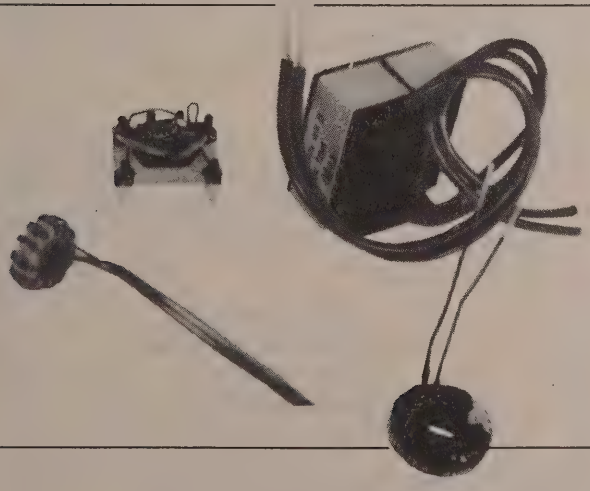
MILITARY AEROSPACE INDUSTRIAL



ESC will manufacture your transformer/coils in strict accordance with your engineering design documents. Our 35 years of manufacturing experience will be incorporated into each product which will be an exact reflection of your design. Timely and economical advantages as well as customer visibility is offered by our service to you.



ESC maintains a Quality Control System that conforms to MIL-I-45208 and MIL-Q-9858, as applicable. Equipment calibration is per MIL-STD-45662 and in-line testing is performed as well as 100% final testing of your products. All applicable testing is in accordance with MIL-T-27E. Soldering workmanship is certified to per MIL-STD-2000.



ESC is fully versed and experienced with the military and aerospace requirements as well as high volume commercial and industrial products. Our high volume capacity is achieved through manufacture in any one of our five offshore plants. Contact us for further information regarding our ability to meet your requirements.

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SEE OUR DELAY LINE ADS IN SECTION 2350

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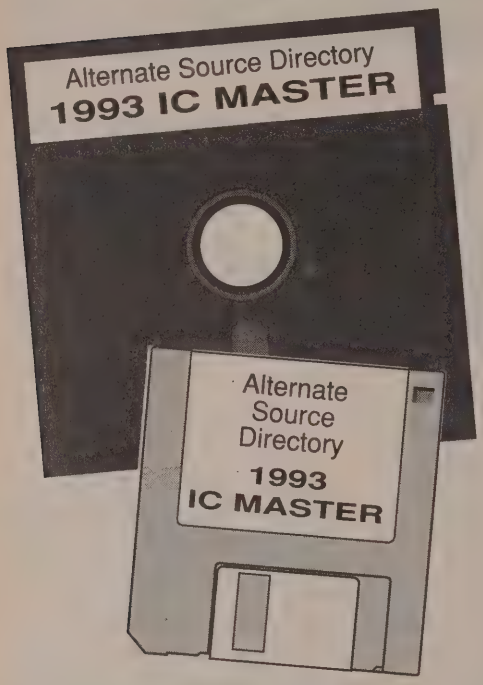
Hearst Engineering Software

ICMASD

Alternate Source Directory



The all new 1993 ICMASD-IC Alternate Source Directory on Disk is identical to the Alternate Source Directory Section contained in Volume Two of the printed version of the 1993 IC Master. All you need is an IBM XT/AT or 100% compatible personal computer with hard drive.

ICMASD is the most comprehensive and reliable guide available to all ICs known to have a realistic replacement or alternative. The 1993 version contains over 106,000 listings to help you find the functional equivalents for both current and discontinued parts.

The electronic ICMASD is fast, convenient...and can be customized for your specific needs!

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ICMASD is organized in a similar fashion to the printed version in the IC MASTER. The database is arranged by manufacturer, showing the manufacturer's original basic part number. All known replacements for that part are listed in alphanumeric order.

The enhanced flexibility of the electronic ICMASD allows you to add comments, up to 19 digits long, to any device listing in the system. These comments can be part numbers, project notes, prices, or any information unique to your application.

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Published annually in March

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Hearst Business Publishing
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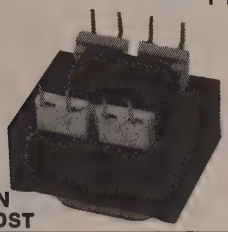
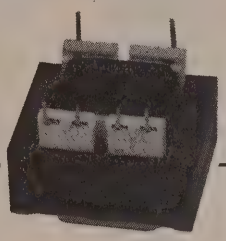
Recognized Component
Underwriters Labs, Inc.

Miniature Split-Bobbin Plug-In Power Transformers

For printed circuit applications

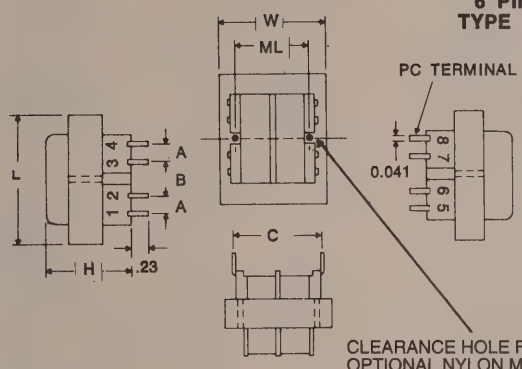


SPLIT BOBBIN — HIGHLY ISOLATED

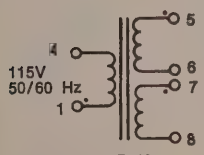


8 PIN TYPE DST

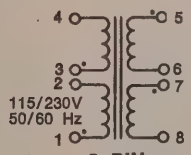
6 PIN TYPE ST



NOTE: PINS 2 & 3 OMITTED ON SINGLE PRIMARY VERSIONS



6 PIN TYPE ST



8 PIN TYPE DST

TRANSFORMERS WOUND ON A SPLIT BOBBIN PERMIT THE PRIMARIES AND SECONDARIES TO BE WOUND SIDE BY SIDE RATHER THAN ONE OVER THE OTHER.

FEATURES ARE:

2500V RMS Hipot
Elimination of electro-static shield
No cross-overs of primary and secondary leads
Class B insulation — 130°C

Transformers can be supplied with single 115V or 115/230V, 50/60 Hz dual primaries. Secondaries can be series or parallel connected.

Size	VA	L	W	H	ML	A	B	C	Lbs.
2	1.1	1 3/8	1 1/8	15/16	—	.250	.250	1.200	0.17
3	2.4	1 3/8	1 1/8	1 3/16	—	.250	.250	1.200	0.25
4	6	1 5/8	1 5/16	1 5/16	1 1/16	.250	.350	1.280	0.44
5	12	1 7/8	1 5/16	1 7/16	1 1/4	.300	.400	1.410	0.70
6	20	2 1/4	1 7/8	1 7/16	1 1/2	.300	.400	1.600	0.80
7	36	2 5/8	2 3/16	1 7/16	†	.400	.400	1.850	1.10

†Size 7 has 4 mtg. holes on 2 9/16 x 1 3/4 centers.

EWC, Inc. reserves the right to make changes without notice in design and specifications in order to effect product improvement.

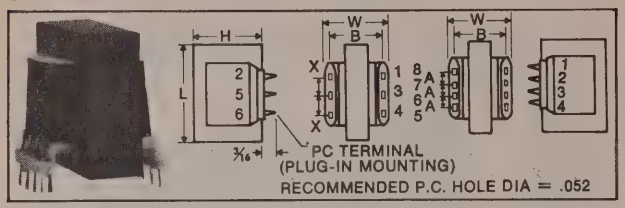
Part Number		Secondary RMS Rating	
Single 115V 6 Pin	Dual 115/230V 8 Pin	Series	Parallel
ST 2-10B41	DST 2-10B41	10V C.T. @ 0.11A	5V @ 0.22A
ST 3-10B1	DST 3-10B1	10V C.T. @ 0.25A	5V @ 0.5A
ST 4-10B2	DST 4-10B2	10V C.T. @ 0.6A	5V @ 1.2A
ST 5-10B3	DST 5-10B3	10V C.T. @ 1.2A	5V @ 2.4A
ST 6-10B4	DST 6-10B4	10V C.T. @ 2A	5V @ 4A
ST 7-10B51	DST 7-10B51	10V C.T. @ 3.6A	5V @ 7.2A
ST 2-12B42	DST 2-12B42	12.6V C.T. @ 0.09A	6.3V @ 0.18A
ST 3-12B5	DST 3-12B5	12.6V C.T. @ 0.2A	6.3V @ 0.4A
ST 4-12B6	DST 4-12B6	12.6V C.T. @ 0.5A	6.3V @ 1.0A
ST 5-12B7	DST 5-12B7	12.6V C.T. @ 1.0A	6.3V @ 2.0A
ST 6-12B8	DST 6-12B8	12.6V C.T. @ 1.6A	6.3V @ 3.2A
ST 7-12B52	DST 7-12B52	12.6V C.T. @ 2.85A	6.3V @ 5.7A
ST 2-16B43	DST 2-16B43	16V C.T. @ 0.07A	8V @ 0.14A
ST 3-16B9	DST 3-16B9	16V C.T. @ 0.15A	8V @ 0.3A
ST 4-16B10	DST 4-16B10	16V C.T. @ 0.4A	8V @ 0.8A
ST 5-16B11	DST 5-16B11	16V C.T. @ 0.8A	8V @ 1.6A
ST 6-16B12	DST 6-16B12	16V C.T. @ 1.25A	8V @ 2.5A
ST 7-16B53	DST 7-16B53	16V C.T. @ 2.25A	8V @ 4.5A
ST 2-20B44	DST 2-20B44	20V C.T. @ 0.055A	10V @ 0.11A
ST 3-20B13	DST 3-20B13	20V C.T. @ 0.12A	10V @ 0.24A
ST 4-20B14	DST 4-20B14	20V C.T. @ 0.3A	10V @ 0.6A
ST 5-20B15	DST 5-20B15	20V C.T. @ 0.6A	10V @ 1.2A
ST 6-20B16	DST 6-20B16	20V C.T. @ 1A	10V @ 2A
ST 7-20B54	DST 7-20B54	20V C.T. @ 1.8A	10V @ 3.6A
ST 2-24B45	DST 2-24B45	24V C.T. @ 0.045A	12V @ 0.09A
ST 3-24B17	DST 3-24B17	24V C.T. @ 0.1A	12V @ 0.2A
ST 4-24B18	DST 4-24B18	24VC.T. @ 0.25A	12V @ 0.5A
ST 5-24B19	DST 5-24B19	24V C.T. @ 0.5A	12V @ 1.0A
ST 6-24B20	DST 6-24B20	24V C.T. @ 0.8A	12V @ 1.6A
ST 7-24B55	DST 7-24B55	24V C.T. @ 1.5A	12V @ 3.0A
ST 2-28B46	DST 2-28B46	28V C.T. @ 0.04A	14V @ 0.08A
ST 3-28B21	DST 3-28B21	28V C.T. @ 0.085A	14V @ 0.17A
ST 4-28B22	DST 4-28B22	28V C.T. @ 0.2A	14V @ 0.4A
ST 5-28B23	DST 5-28B23	28V C.T. @ 0.42A	14V @ 0.84A
ST 6-28B24	DST 6-28B24	28V C.T. @0.7A	14V @ 1.4A
ST 7-28B56	DST 7-28B56	28V C.T. @ 1.3A	14V @ 2.6A
ST 2-36B47	DST 2-36B47	36V C.T. @ 0.03A	18V @ 0.06A
ST 3-36B25	DST 3-36B25	36V C.T. @ 0.065A	18V @ 0.13A
ST 4-36B26	DST 4-36B26	36V C.T. @ 0.17A	18V @ 0.34A
ST 5-36B27	DST 5-36B27	36V C.T. @ 0.35A	18V @ 0.7A
ST 6-36B28	DST 6-36B28	36V C.T. @ 0.55A	18V @ 1.1A
ST 7-36B57	DST 7-36B57	36V C.T. @ 1A	18V @ 2A
ST 2-48B48	DST 2-48B48	48V C.T. @ 0.023A	24V @ 0.046A
ST 3-48B29	DST 3-48B29	48V C.T. @ 0.05A	24V @ 0.1A
ST 4-48B30	DST 4-48B30	48V C.T. @ 0.125A	24V @ 0.25A
ST 5-48B31	DST 5-48B31	48V C.T. @ 0.25A	24V @ 0.5A
ST 6-48B32	DST 6-48B32	48V C.T. @ 0.4A	24V @ 0.8A
ST 7-48B58	DST 7-48B58	48V C.T. @ 0.75A	24V @ 1.5A
ST 2-56B49	DST 2-56B49	56V C.T. @ 0.02A	28V @ 0.04A
ST 3-56B33	DST 3-56B33	56V C.T. @ 0.045A	28V @ 0.09A
ST 4-56B34	DST 4-56B34	56V C.T. @ 0.11A	28V @ 0.22A
ST 5-56B35	DST 5-56B35	56V C.T. @ 0.22A	28V @ 0.44A
ST 6-56B36	DST 6-56B36	56V C.T. @ 0.35A	28V @ 0.7A
ST 7-56B59	DST 7-56B59	56V C.T. @ 0.65A	28V @ 1.3A
ST 2-120B50	DST 2-120B50	120V C.T. @ 0.01A	60V @ 0.02A
ST 3-120B37	DST 3-120B37	120V C.T. @ 0.02A	60V @ 0.04A
ST 4-120B38	DST 4-120B38	120V C.T. @ 0.05A	60V @ 0.1A
ST 5-120B39	DST 5-120B39	120V C.T. @ 0.1A	60V @ 0.2A
ST 6-120B40	DST 6-120B40	120V C.T. @ 0.16A	60V @ 0.32A
ST 7-120B60	DST 7-120B60	120V C.T. @ 0.3A	60V @ 0.6A

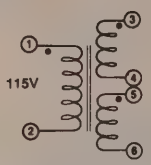
385 HIGHWAY 33, ENGLISHTOWN, NJ 07726
908/446-3110 FAX 908/446-5362

EWC® INC

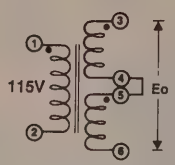
P.C. Power Transformers—Concentric or Split Bobbin & FORM-TRAN® Construction

STYLE B NO CHANNEL FRAME

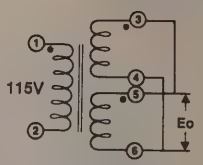




PC-6 PINS

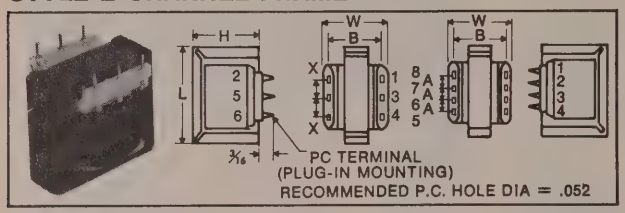


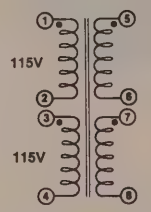
SERIES CONNECTED



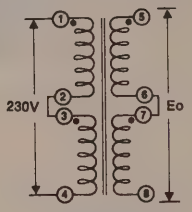
PARALLEL CONNECTED

STYLE E CHANNEL FRAME

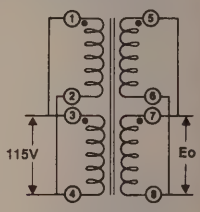




DPC-8 PINS

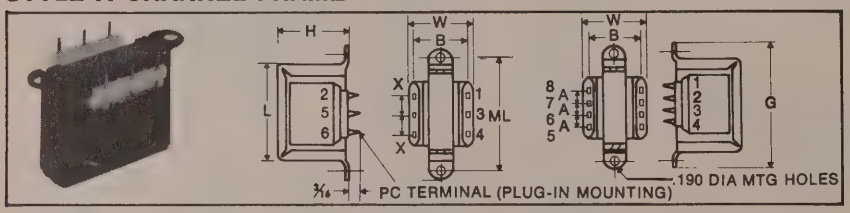


SERIES CONNECTED

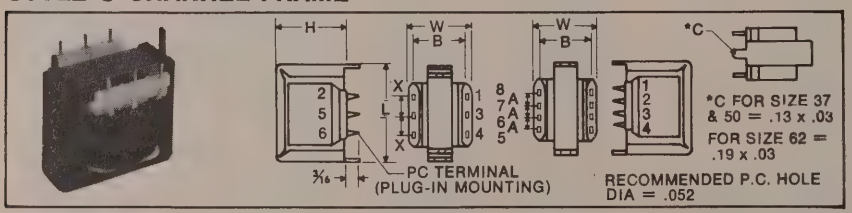


PARALLEL CONNECTED

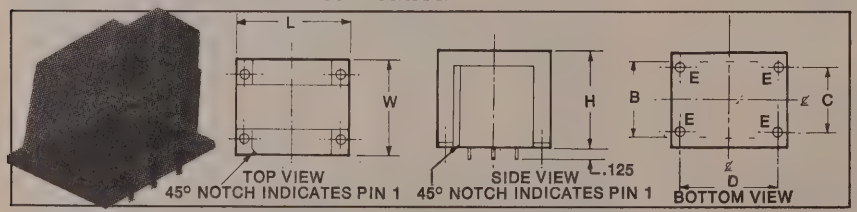
STYLE A CHANNEL FRAME



STYLE C CHANNEL FRAME



STYLE P FORM-TRAN PACKAGING



HOW TO ORDER

D PC - 10 - 2400 B 4

Primary Rating

No Letter	115V	50/500 Hz	6 pin
C	230V	50/500 Hz	6 pin
D	115/230V	50/500 Hz	8 pin
E	277V	50/500 Hz	6 pin
F	332V	50/500 Hz	6 pin

Transformer Series
PC—Single Section Bobbin PC Transformers
EL—"2" Section" Split Bobbin PC Transformer (50/60 Hz only)

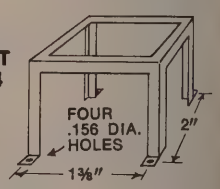
Secondary Voltage Rating
in volts RMS

Secondary Current Rating
in mA RMS

Individual Spec

Mechanical-Configuration
A=Channel Frame Mounting—Style A —Screw Mount
B=No Frame
C=Channel Frame Mounting—Style C —PC Mount
E=Channel Frame—No Mounting
P=Potted—FORM-TRAN™ Construction

"SLIDE ON" BRACKET FOR SIZE 24 P/N B24



SIZE	VA	STYLE A, B, C, E, P 6 PIN X	8 PIN A	B	STYLE B L	W	H	STYLE A, C, E L	W	H	STYLE A G	ML	STYLE P L	W	H	B	C	D	E
25	1.0	0.250	0.200	1.200	1	1.375	0.83	—	—	—	—	—	1.11	1.45	0.92	1.200	N/A	N/A	N/A
37	1.2	0.312	0.200	1.000	1.375	1.125	1.188	1.500	1.125	1.220	2.062	1.75	1.52	1.22	1.26	1.000	.840	1.270	.125
50	4.4	0.400	0.250	1.100	1.625	1.250	1.375	1.720	1.250	1.400	2.375	2.00	1.77	1.30	1.44	1.100	1.000	1.463	.159
62	10	0.400	0.250	1.300	1.875	1.438	1.625	1.970	1.438	1.660	2.813	2.38	2.02	1.50	1.70	1.300	1.125	1.625	.159
24	24	0.400	0.250	2.100	1.625	2.250	1.375	**	**	**	**	**	1.70	2.32	1.42	2.100	2.000	1.463	.159

** USE B24 BRACKET

EWC® INC.
385 HIGHWAY 33, ENGLISHTOWN, NJ 07726
908/446-3110 FAX 908/446-5362

Recognized Component Underwriters Labs, Inc.

P.C. Power Transformers
Concentric and Split Bobbin Construction

SECONDARY RMS RATING

Series V.C.T.	MA	Parallel @ 2x Current V	MA	Size
10 @	90	5 @	180	25
10 @	120	5 @	240	37
10 @	440	5 @	880	50
10 @	1000	5 @	2000	62
10 @	2400	5 @	4800	24
12.6 @	70	6.3 @	140	25
12.6 @	100	6.3 @	200	37
12.6 @	350	6.3 @	700	50
12.6 @	800	6.3 @	1600	62
12.6 @	2000	6.3 @	4000	24
16 @	55	8 @	110	25
16 @	75	8 @	150	37
16 @	260	8 @	520	50
16 @	640	8 @	1280	62
16 @	1500	8 @	3000	24
20 @	45	10 @	90	25
20 @	60	10 @	120	37
20 @	220	10 @	440	50
20 @	500	10 @	1000	62
20 @	1200	10 @	2400	24
24 @	35	12 @	70	25
24 @	50	12 @	100	37
24 @	180	12 @	360	50
24 @	450	12 @	900	62
24 @	1000	12 @	2000	24
28 @	30	14 @	60	25
28 @	40	14 @	80	37
28 @	160	14 @	320	50
28 @	360	14 @	720	62
28 @	800	14 @	1.6A	24
34 @	25	17 @	50	25
34 @	35	17 @	70	37
34 @	125	17 @	250	50
34 @	300	17 @	600	62
34 @	700	17 @	1400	24
40 @	20	20 @	40	25
40 @	30	20 @	60	37
40 @	110	20 @	220	50
40 @	250	20 @	500	62
40 @	600	20 @	1200	24
56 @	15	28 @	30	25
56 @	20	28 @	40	37
56 @	80	28 @	160	50
56 @	180	28 @	360	62
56 @	420	28 @	840	24
88 @	10	44 @	20	25
88 @	15	44 @	30	37
88 @	50	44 @	100	50
88 @	120	44 @	240	62
88 @	270	44 @	540	24
120 @	8	60 @	16	25
120 @	10	60 @	20	37
120 @	35	60 @	70	50
120 @	85	60 @	170	62
120 @	200	60 @	400	24
180 @	5	90 @	10	25
180 @	6	90 @	12	37
180 @	24	90 @	48	50
180 @	55	90 @	110	62
180 @	130	90 @	260	24
230 @	4	115 @	8	25
230 @	5	115 @	10	37
230 @	20	115 @	40	50
230 @	40	115 @	80	62
230 @	100	115 @	200	24

RATINGS BASED ON 20% REGULATION.

EL SERIES - PRIMARY 50/60H$_z$ ALL OTHERS - PRIMARY 50/500H$_z$

Single 115V 6 Pin	Single 230V 6 Pin	Dual 115/230V 8 Pin	* Single 277V 6 Pin	* Single 332V 6 Pin
PC-10-90B53	CPC-10-90B53	DPC-10-90B53	Not Available	Not Available
PC-10-120B1	CPC-10-120B1	DPC-10-120B1	EPC-10-120B1	FPC-10-120B1
PC-10-440B2	CPC-10-440B2	DPC-10-440B2	EPC-10-440B2	FPC-10-440B2
PC-10-1000B3	CPC-10-1000B3	DPC-10-1000B3	EPC-10-1000B3	FPC-10-1000B3
PC-10-2400B4	CPC-10-2400B4	DPC-10-2400B4	EPC-10-2400B4	FPC-10-2400B4
PC-12-70B54	CPC-12-70B54	DPC-12-70B54	Not Available	Not Available
PC-12-100B5	CPC-12-100B5	DPC-12-100B5	EPC-12-100B5	FPC-12-100B5
PC-12-350B6	CPC-12-350B6	DPC-12-350B6	EPC-12-350B6	FPC-12-350B6
PC-12-800B7	CPC-12-800B7	DPC-12-800B7	EPC-12-800B7	FPC-12-800B7
PC-12-2000B8	CPC-12-2000B8	DPC-12-2000B8	EPC-12-2000B8	FPC-12-2000B8
PC-16-55B55	CPC-16-55B55	DPC-16-55B55	Not Available	Not Available
PC-16-75B9	CPC-16-75B9	DPC-16-75B9	EPC-16-75B9	FPC-16-75B9
PC-16-260B10	CPC-16-260B10	DPC-16-260B10	EPC-16-260B10	FPC-16-260B10
PC-16-640B11	CPC-16-640B11	DPC-16-640B11	EPC-16-640B11	FPC-16-640B11
PC-16-1500B12	CPC-16-1500B12	DPC-16-1500B12	EPC-16-1500B12	FPC-16-1500B12
PC-20-45B56	CPC-20-45B56	DPC-20-45B56	Not Available	Not Available
PC-20-60B13	CPC-20-60B13	DPC-20-60B13	EPC-20-60B13	FPC-20-60B13
PC-20-220B14	CPC-20-220B14	DPC-20-220B14	EPC-20-220B14	FPC-20-220B14
PC-20-500B15	CPC-20-500B15	DPC-20-500B15	EPC-20-500B15	FPC-20-500B15
PC-20-1200B16	CPC-20-1200B16	DPC-20-1200B16	EPC-20-1200B16	FPC-20-1200B16
PC-24-35B57	CPC-24-35B57	DPC-24-35B57	Not Available	Not Available
PC-24-50B17	CPC-24-50B17	DPC-24-50B17	EPC-24-50B17	FPC-24-50B17
PC-24-180B18	CPC-24-180B18	DPC-24-180B18	EPC-24-180B18	FPC-24-180B18
PC-24-450B19	CPC-24-450B19	DPC-24-450B19	EPC-24-450B19	FPC-24-450B19
PC-24-1000B20	CPC-24-1000B20	DPC-24-1000B20	EPC-24-1000B20	FPC-24-1000B20
PC-28-30B58	CPC-28-30B58	DPC-28-30B58	Not Available	Not Available
PC-28-40B49	CPC-28-40B49	DPC-28-40B49	EPC-28-40B49	FPC-28-40B49
PC-28-160B50	CPC-28-160B50	DPC-28-160B50	EPC-28-160B50	FPC-28-160B50
PC-28-360B51	CPC-28-360B51	DPC-28-360B51	EPC-28-360B51	FPC-28-360B51
PC-28-800B52	CPC-28-800B52	DPC-28-800B52	EPC-28-800B52	FPC-28-800B52
PC-34-25B59	CPC-34-25B59	DPC-34-25B59	Not Available	Not Available
PC-34-35B21	CPC-34-35B21	DPC-34-35B21	EPC-34-35B21	FPC-34-35B21
PC-34-125B22	CPC-34-125B22	DPC-34-125B22	EPC-34-125B22	FPC-34-125B22
PC-34-300B23	CPC-34-300B23	DPC-34-300B23	EPC-34-300B23	FPC-34-300B23
PC-34-700B24	CPC-34-700B24	DPC-34-700B24	EPC-34-700B24	FPC-34-700B24
PC-40-20B60	CPC-40-20B60	DPC-40-20B60	Not Available	Not Available
PC-40-30B25	CPC-40-30B25	DPC-40-30B25	EPC-40-30B25	FPC-40-30B25
PC-40-110B26	CPC-40-110B26	DPC-40-110B26	EPC-40-110B26	FPC-40-110B26
PC-40-250B27	CPC-40-250B27	DPC-40-250B27	EPC-40-250B27	FPC-40-250B27
PC-40-600B28	CPC-40-600B28	DPC-40-600B28	EPC-40-600B28	FPC-40-600B28
PC-56-15B61	CPC-56-15B61	DPC-56-15B61	Not Available	Not Available
PC-56-20B29	CPC-56-20B29	DPC-56-20B29	EPC-56-20B29	FPC-56-20B29
PC-56-80B30	CPC-56-80B30	DPC-56-80B30	EPC-56-80B30	FPC-56-80B30
PC-56-180B31	CPC-56-180B31	DPC-56-180B31	EPC-56-180B31	FPC-56-180B31
PC-56-420B32	CPC-56-420B32	DPC-56-420B32	EPC-56-420B32	FPC-56-420B32
PC-88-10B62	CPC-88-10B62	DPC-88-10B62	Not Available	Not Available
PC-88-15B33	CPC-88-15B33	DPC-88-15B33	EPC-88-15B33	FPC-88-15B33
PC-88-50B34	CPC-88-50B34	DPC-88-50B34	EPC-88-50B34	FPC-88-50B34
PC-88-120B35	CPC-88-120B35	DPC-88-120B35	EPC-88-120B35	FPC-88-120B35
PC-88-270B36	CPC-88-270B36	DPC-88-270B36	EPC-88-270B36	FPC-88-270B36
PC-120-8B63	CPC-120-8B63	DPC-120-8B63	Not Available	Not Available
PC-120-10B37	CPC-120-10B37	DPC-120-10B37	EPC-120-10B37	FPC-120-10B37
PC-120-35B38	CPC-120-35B38	DPC-120-35B38	EPC-120-35B38	FPC-120-35B38
PC-120-85B39	CPC-120-85B39	DPC-120-85B39	EPC-120-85B39	FPC-120-85B39
PC-120-200B40	CPC-120-200B40	DPC-120-200B40	EPC-120-200B40	FPC-120-200B40
PC-180-5B64	CPC-180-5B64	DPC-180-5B64	Not Available	Not Available
PC-180-6B41	CPC-180-6B41	DPC-180-6B41	EPC-180-6B41	FPC-180-6B41
PC-180-24B42	CPC-180-24B42	DPC-180-24B42	EPC-180-24B42	FPC-180-24B42
PC-180-55B43	CPC-180-55B43	DPC-180-55B43	EPC-180-55B43	FPC-180-55B43
PC-180-130B44	CPC-180-130B44	DPC-180-130B44	EPC-180-130B44	FPC-180-130B44
PC-230-4B65	CPC-230-4B65	DPC-230-4B65	Not Available	Not Available
PC-230-5B45	CPC-230-5B45	DPC-230-5B45	EPC-230-5B45	FPC-230-5B45
PC-230-20B46	CPC-230-20B46	DPC-230-20B46	EPC-230-20B46	FPC-230-20B46
PC-230-40B47	CPC-230-40B47	DPC-230-40B47	EPC-230-40B47	FPC-230-40B47
PC-230-100B48	CPC-230-100B48	DPC-230-100B48	EPC-230-100B48	FPC-230-100B48

*** SIZE 24 AND FORMTRAN - UL APPROVED ONLY. EPC AND FPC BUILT TO MEET - NOT SUBMITTED.**

METHOD OF DETERMINING SECONDARY RMS CURRENT:

Rectifier Type	Filter Type	RMS Secondary Current
Full Wave Center Tap	Choke Input	.7 x DC Amps
Full Wave Center Tap	Capacitor Input	1.2 x DC Amps
Full Wave Bridge	Choke Input	1.0 x DC Amps
Full Wave Bridge	Capacitor Input	1.8 x DC Amps

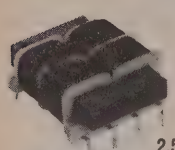
EWC, Inc. reserves the right to make changes without notice in design and specifications in order to effect product improvement.

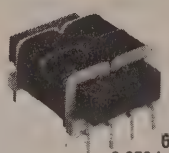
385 HIGHWAY 33, ENGLISHTOWN, NJ 07726
908/446-3110 FAX 908/446-5362

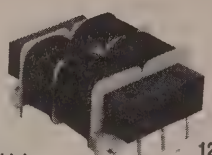
EWC® INC.

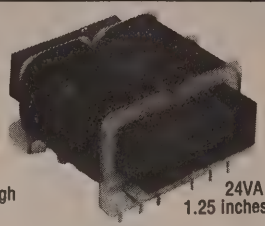
Miniature LO-PROFILE Plug-In Power Transformers

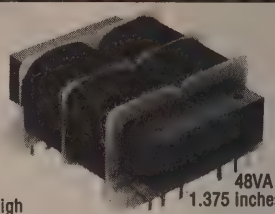
Recognized Component Underwriters Labs, Inc.


2.5VA
0.650 inches high


6VA
0.850 inches high

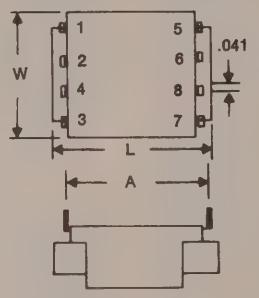

12VA
1.065 inches high


24VA
1.25 inches high


48VA
1.375 inches high

FIVE SIZES:

EWC's Lo-Profile, plug-in power transformers are designed for low height, critical pc board applications in semiconductor control and instrumentation. Interchangeable with those of other manufacturers, the units are for use in single, dual or reference dc supplies or isolated control circuits. Sizes 2, 6 and 12 are available encapsulated in form-fitting shells to protect against possible damage due to water-soluble or other fluxes as well as electrolytic corrosion experienced on open-type constructions.



Size 24 C = .530
Size 48 C = .660
Others C = B

Figure 1

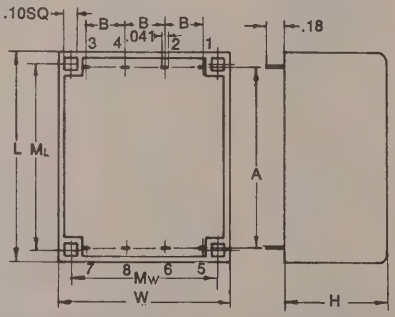
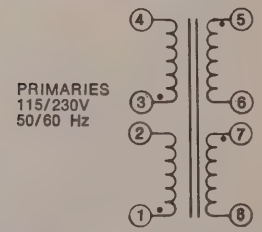


Figure 2–Replace "B" in part no. with "P"–UL Approved Only.



• INDICATES LIKE POLARITY

SIZE	FIG.	L	W	H	A	B	ML	MW	Oz.
2	1	1.875	1.562	0.650	1.600	0.375	—	—	5
6	1	1.875	1.562	0.850	1.600	0.375	—	—	7
12	1	2.500	2.000	1.065	2.000	0.500	—	—	11
24	1	2.875	2.250	1.250	1.900	0.600	—	—	15
48	1	3.125	2.500	1.375	2.180	0.600	—	—	21
2	2	2.030	1.635	0.785	1.600	0.375	1.795	1.340	
6	2	2.030	1.635	0.950	1.600	0.375	1.795	1.340	
12	2	2.675	2.126	1.185	2.000	0.500	2.440	1.850	

EWC, Inc. reserves the right to make changes without notice in design and specifications in order to effect product improvement.

PART NO.	SIZE	SECONDARY RMS RATINGS SERIES	SECONDARY RMS RATINGS PARALLEL
LP 10-250B23	2	10V C.T. @ 250mA	5V @ 500mA
LP 10-600B1	6	10V C.T. @ 600mA	5V @ 1.20A
LP 10-1200B2	12	10V C.T. @ 1.20A	5V @ 2.40A
LP 10-2400B89	24	10V C.T. @ 2.40A	5V @ 4.80A
LP 10-4800B90	48	10V C.T. @ 4.80A	5V @ 9.60A
LP 12-200B24	2	12.6V C.T. @ 200mA	6.3V @ 400mA
LP 12-450B3	6	12.6V C.T. @ 450mA	6.3V @ 900mA
LP 12-900B4	12	12.6V C.T. @ 900mA	6.3V @ 1.80A
LP 12-1900B91	24	12.6V C.T. @ 1.90A	6.3V @ 3.80A
LP 12-3800B92	48	12.6V C.T. @ 3.80A	6.3V @ 7.60A
LP 16-150B25	2	16V C.T. @ 150mA	8V @ 300mA
LP 16-350B5	6	16V C.T. @ 350mA	8V @ 700mA
LP 16-700B6	12	16V C.T. @ 700mA	8V @ 1.40A
LP 16-1500B93	24	16V C.T. @ 1.50A	8V @ 3.00A
LP 16-3000B94	48	16V C.T. @ 3.00A	8V @ 6.00A
LP 18-135B105	2	18V C.T. @ 135mA	9V @ 270mA
LP 18-325B106	6	18V C.T. @ 325mA	9V @ 650mA
LP 18-650B107	12	18V C.T. @ 650 mA	9V @ 1.30A
LP 18-1300B108	24	18V C.T. @ 1.30A	9V @ 2.60A
LP 18-2600B109	48	18V C.T. @ 2.60A	9V @ 5.20A
LP 20-125B26	2	20V C.T. @ 125mA	10V @ 250mA
LP 20-300B7	6	20V C.T. @ 300mA	10V @ 600mA
LP 20-600B8	12	20V C.T. @ 600mA	10V @ 1.20A
LP 20-1200B95	24	20V C.T. @ 1.20A	10V @ 2.40A
LP 20-2400B96	48	20V C.T. @ 2.40A	10V @ 4.80A
LP 24-100B27	2	24V C.T. @ 100mA	12V @ 200mA
LP 24-250B9	6	24V C.T. @ 250mA	12V @ 500mA
LP 24-500B10	12	24V C.T. @ 500mA	12V @ 1.00A
LP 24-1000B97	24	24V C.T. @ 1.00A	12V @ 2.00A
LP 24-2000B98	48	24V C.T. @ 2.00A	12V @ 4.00A
LP 28-90B115	2	28V C.T. @ 90 mA	14V @ 180mA
LP 28-215B116	6	28V C.T. @ 215mA	14V @ 430mA
LP 28-430B117	12	28V C.T. @ 430mA	14V @ 860mA
LP 28-850B118	24	28V C.T. @ 850mA	14V @ 1.70A
LP 28-1700B119	48	28V C.T. @ 1.70A	14V @ 3.40A
LP 30-85B125	2	30V C.T. @ 85mA	15V @ 170mA
LP 30-200B126	6	30V C.T. @ 200mA	15V @ 400mA
LP 30-400B127	12	30V C.T. @ 400mA	15V @ 800mA
LP 30-800B128	24	30V C.T. @ 800mA	15V @ 1.60A
LP 30-1600B129	48	30V C.T. @ 1.60A	15V @ 3.20A
LP 34-75B28	2	34V C.T. @ 75mA	17V @ 150mA
LP 34-170B11	6	34V C.T. @ 170mA	17V @ 340mA
LP 34-340B12	12	34V C.T. @ 340mA	17V @ 680mA
LP 34-700B99	24	34V C.T. @ 700mA	17V @ 1.40A
LP 34-1400B100	48	34V C.T. @ 1.40A	17V @ 2.80A
LP 40-60B29	2	40V C.T. @ 60mA	20V @ 120mA
LP 40-150B13	6	40V C.T. @ 150mA	20V @ 300mA
LP 40-300B14	12	40V C.T. @ 300mA	20V @ 600mA
LP 40-600B101	24	40V C.T. @ 600mA	20V @ 1.20A
LP 40-1200B102	48	40V C.T. @ 1.20A	20V @ 2.40A
LP 56-45B30	2	56V C.T. @ 45mA	28V @ 90mA
LP 56-100B15	6	56V C.T. @ 100mA	28V @ 200mA
LP 56-200B16	12	56V C.T. @ 200mA	28V @ 400mA
LP 56-425B103	24	56V C.T. @ 425mA	28V @ 850mA
LP 56-850B104	48	56V C.T. @ 850mA	28V @ 1.70A
LP 88-28B31	2	88V C.T. @ 28mA	44V @ 56mA
LP 88-65B17	6	88V C.T. @ 65mA	44V @ 130mA
LP 88-130B18	12	88V C.T. @ 130mA	44V @ 260mA
LP 120-20B32	2	120V C.T. @ 20mA	60V @ 40mA
LP 120-50B19	6	120V C.T. @ 50mA	60V @ 100mA
LP 120-100B20	12	120V C.T. @ 100mA	60V @ 200mA
LP 230-10B33	2	230V C.T. @ 10 mA	115V @ 20mA
LP 230-25B21	6	230V C.T. @ 25mA	115V @ 50mA
LP 230-50B22	12	230V C.T. @ 50mA	115V @ 100mA

EWC® INC. 385 HIGHWAY 33, ENGLISHTOWN, NJ 07726
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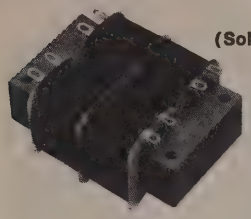
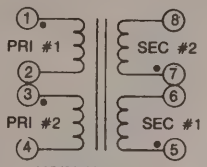
LO-PROFILE Hi-Power Humbucking Transformers



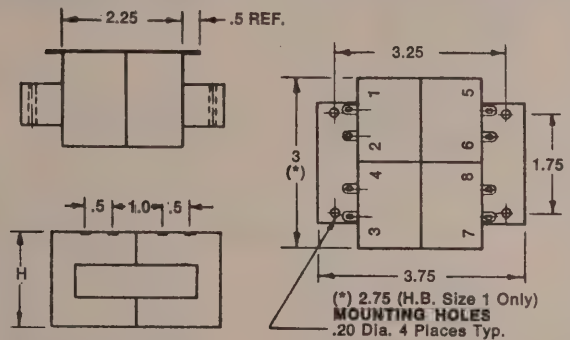
(Solder Terminals)

Varnish Finish (Standard)



115/230V 50/60 Hz
DUAL PRI.

SOLDER TERMINALS (.5-1-.5) Approx. Spacing



H.B. Size	H (Max.)	Wt. (lbs.) (Approx.)	VA (Nom.)	Reg. (%) (Typ.)	T. Rise (°C) (Typ.)
I	.850	1.00	20	30	25
II	1.25	1.75	50	30	45
III	1.50	2.25	75	25	55
IV	1.85	3.00	135	20	65
V	2.35	4.25	200	15	75

- **SOLDER TERMINALS**
- **SIDE-BY-SIDE BOBBINS**
- **20VA TO 200VA • 115/230V @ 50/60Hz**
- **1.5KV RMS HIPOT • CLASS B (130°C)**

ADVANTAGES:

- Side-By-Side Bobbins (Secondary Wound alongside of Primary) Lower Interwinding Capacitance — eliminates the need for electro-static shield
- Hum-bucking (Semi-Toroidal) Construction [Lower Radiated Magnetic Fields, Balanced Wdgs., Larger Heat Radiating Surface and Lower Center of Gravity]
- High Power for Low Panel Heights and Narrow Card Spacing

MOUNTING: (4) Lamination Holes .20 Dia. Insulated hardware required.

RATINGS PER SECONDARY OUTPUT: VA-SEC = 0.5 x VA (Output) • V-SEC = V-SEC (Parallel) • I-SEC = I-SEC (Series)

NON-STANDARD RATINGS: Tapped primaries, secondaries different voltages, currents or frequencies can be furnished.

Units with higher VA ratings up to 1.25 KVA can also be supplied.

EWC, Inc. reserves the right to make changes without notice in design and specifications in order to effect product improvement.

PART NO.	Size	SECONDARY RMS RATINGS SERIES	SECONDARY RMS RATINGS PARALLEL
LP 10-2B34	I	10V C.T. @ 2.00A	5V @ 4.00A
LP 10-5B35	II	10V C.T. @ 5.00A	5V @ 10.0A
LP 10-7.5B36	III	10V C.T. @ 7.50A	5V @ 15.0A
LP 10-13.5B37	IV	10V C.T. @ 13.5A	5V @ 27.0A
LP 10-20B38	V	10V C.T. @ 20.0A	5V @ 40.0A
LP 12-1.6B39	I	12.6V C.T. @ 1.60A	6.3V @ 3.20A
LP 12-4B40	II	12.6V C.T. @ 4.00A	6.3V @ 8.00A
LP 12-6B41	III	12.6V C.T. @ 6.00A	6.3V @ 12.0A
LP 12-11B42	IV	12.6V C.T. @ 11.0A	6.3V @ 22.0A
LP 12-16B43	V	12.6V C.T. @ 16.0A	6.3V @ 32.0A
LP 16-1.25B44	I	16V C.T. @ 1.25A	8V @ 2.50A
LP 16-3.15B45	II	16V C.T. @ 3.15A	8V @ 6.30A
LP 16-4.75B46	III	16V C.T. @ 4.75A	8V @ 9.50A
LP 16-8.5B47	IV	16V C.T. @ 8.50A	8V @ 17.0A
LP 16-12.5B48	V	16V C.T. @ 12.5A	8V @ 25.0A
LP 18-1.1B110	I	18V C.T. @ 1.10A	9V @ 2.20A
LP 18-2.75B111	II	18V C.T. @ 2.75A	9V @ 5.50A
LP 18-4.2B112	III	18V C.T. @ 4.20A	9V @ 8.40A
LP 18-7.5B113	IV	18V C.T. @ 7.50A	9V @ 15.0A
LP 18-11B114	V	18V C.T. @ 11.0A	9V @ 22.0A
LP 20-1B49	I	20V C.T. @ 1.00A	10V @ 2.00A
LP 20-2.5B50	II	20V C.T. @ 2.50A	10V @ 5.00A
LP 20-3.75B51	III	20V C.T. @ 3.75A	10V @ 7.50A
LP 20.6.75B52	IV	20V C.T. @ 6.75A	10V @ 13.5A
LP 20-10B53	V	20V C.T. @ 10.0A	10V @ 20.0A
LP 24-0.85B54	I	24V C.T. @ 0.85A	12V @ 1.70A
LP 24-2.1B55	II	24V C.T. @ 2.10A	12V @ 4.20A
LP 24-3.15B56	III	24V C.T. @ 3.15A	12V @ 6.30A
LP 24-5.75B57	IV	24V C.T. @ 5.75A	12V @ 11.5A
LP 24-8.5B58	V	24V C.T. @ 8.50A	12V @ 17.0A
LP 28-0.7B120	I	28V C.T. @ 0.70A	14V @ 1.40A
LP 28-1.75B121	II	28V C.T. @ 1.75A	14V @ 3.50A
LP 28-2.7B122	III	28V C.T. @ 2.70A	14V @ 5.40A
LP 28-4.8B123	IV	28V C.T. @ 4.80A	14V @ 9.60A
LP 28-7B124	V	28V C.T. @ 7.00A	14V @ 14.0A
LP 30-0.65B130	I	30V C.T. @ 0.65A	15V @ 1.30A
LP 30-1.65B131	II	30V C.T. @ 1.65A	15V @ 3.30A
LP 30-2.5B132	III	30V C.T. @ 2.50A	15V @ 5.00A
LP 30-4.5B133	IV	30V C.T. @ 4.50A	15V @ 9.00A
LP 30-6.65B134	V	30V C.T. @ 6.65A	15V @ 13.3A
LP 34-0.6B59	I	34V C.T. @ 0.60A	17V @ 1.20A
LP 34-1.5B60	II	34V C.T. @ 1.50A	17V @ 3.00A
LP 34-2.25B61	III	34V C.T. @ 2.25A	17V @ 4.50A
LP 34-4B62	IV	34V C.T. @ 4.00A	17V @ 8.00A
LP 34-6B63	V	34V C.T. @ 6.00A	17V @ 12.0A
LP 40-0.5B64	I	40V C.T. @ 0.50A	20V @ 1.00A
LP 40-1.25B65	II	40V C.T. @ 1.25A	20V @ 2.50A
LP 40-1.9B66	III	40V C.T. @ 1.90A	20V @ 3.80A
LP 40-3.4B67	IV	40V C.T. @ 3.40A	20V @ 6.80A
LP 40-5B68	V	40V C.T. @ 5.00A	20V @ 10.0A
LP 56-0.35B69	I	56V C.T. @ 0.35A	28V @ 0.70A
LP 56-0.9B70	II	56V C.T. @ 0.90A	28V @ 1.80A
LP 56-1.35B71	III	56V C.T. @ 1.35A	28V @ 2.70A
LP 56-2.4B72	IV	56V C.T. @ 2.40A	28V @ 4.80A
LP 56-3.5B73	V	56V C.T. @ 3.50A	28V @ 7.00A
LP 88-0.23B74	I	88V C.T. @ 0.23A	44V @ 0.46A
LP 88-0.575B75	II	88V C.T. @ 0.575A	44V @ 1.15A
LP 88-0.85B76	III	88V C.T. @ 0.85A	44V @ 1.70A
LP 88-1.5B77	IV	88V C.T. @ 1.50A	44V @ 3.00A
LP 88-2.3B78	V	88V C.T. @ 2.30A	44V @ 4.60A
LP 120-0.17B79	I	120V C.T. @ 170mA	60V @ 340mA
LP 120-0.425B80	II	120V C.T. @ 425mA	60V @ 850mA
LP 120-0.625B81	III	120V C.T. @ 625mA	60V @ 1.25A
LP 120-1.1B82	IV	120V C.T. @ 1.10A	60V @ 2.20A
LP 120-1.7B83	V	120V C.T. @ 1.70A	60V @ 3.40A
LP 230-0.09B84	I	230V C.T. @ 90mA	115V @ 180mA
LP 230-0.22B95	II	230V C.T. @ 220mA	115V @ 440mA
LP 230-0.325B86	III	230V C.T. @ 325mA	115V @ 650mA
LP 230-0.6B87	IV	230V C.T. @ 600mA	115V @ 1.20A
LP 230-0.9B88	V	230V C.T. @ 900mA	115V @ 1.80A

385 HIGHWAY 33, ENGLISHTOWN, NJ 07726
908/446-3110 FAX 908/446-5362

EWC® INC.

Power Transformers

Recognized Component
Underwriters Labs, Inc.

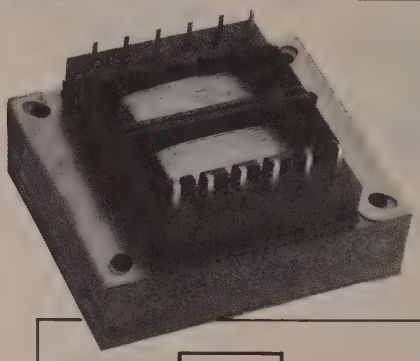
INTERNATIONAL SERIES POWER TRANSFORMERS

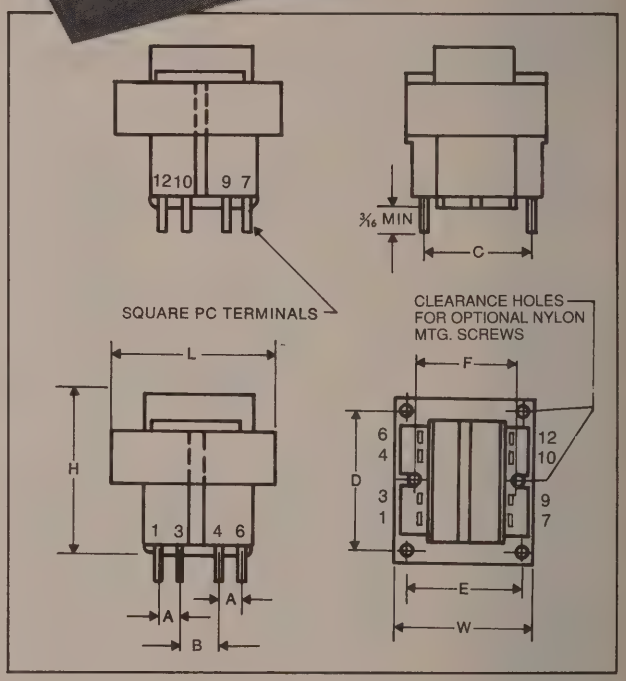
UL, VDE, IEC and CSA certified.

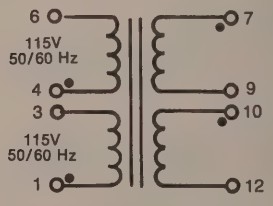
In addition to being certified to VDE 0806, IEC 380, CSA 22.2 No. 66 and UL506, the EWC series of International Transformers is designed and built to meet most other international safety standards.

These transformers are available in both PC and chassis-mount construction. With power ratings of 2.5VA to 175VA, these transformers are built on dual-bobbins with insulating shrouds to provide 4000V RMS isolation between primary and secondary. The non-concentric construction reduces primary to secondary capacitance and eliminates the need for an electrostatic shield.

PART NO. PC MOUNT	VA (SIZE)	SECONDARY RMS RATING	
		SERIES	PARALLEL
14A-2.5-10B1	2.5	10V C.T. @0.25A	5V @0.5A
14A-5.0-10B2	5.0	10V C.T. @0.5A	5V @1.0A
14A-10-10B3	10.0	10V C.T. @1.0A	5V @2.0A
14A-20-10B4	20.0	10V C.T. @2.0A	5V @4.0A
14A-30-10B5	30.0	10V C.T. @3.0A	5V @6.0A
14A-56-10B6	56.0	10V C.T. @5.6A	5V @11.2A
14A-2.5-12B7	2.5	12.6V C.T. @0.2A	6.3V @0.4A
14A-5.0-12B8	5.0	12.6V C.T. @0.4A	6.3V @0.8A
14A-10-12B9	10.0	12.6V C.T. @0.8A	6.3V @1.6A
14A-20-12B10	20.0	12.6V C.T. @1.6A	6.3V @3.2A
14A-30-12B11	30.0	12.6V C.T. @2.4A	6.3V @4.8A
14A-56-12B12	56.0	12.6V C.T. @4.4A	6.3V @8.8A
14A-2.5-16B13	2.5	16V C.T. @0.15A	8V @0.3A
14A-5.0-16B14	5.0	16V C.T. @0.31A	8V @0.62A
14A-10-16B15	10.0	16V C.T. @0.62A	8V @1.25A
14A-20-16B16	20.0	16V C.T. @1.25A	8V @2.5A
14A-30-16B17	30.0	16V C.T. @1.9A	8V @3.8A
14A-56-16B18	56.0	16V C.T. @3.5A	8V @7.0A
14A-2.5-20B19	2.5	20V C.T. @0.12A	10V @0.24A
14A-5.0-20B20	5.0	20V C.T. @0.25A	10V @0.5A
14A-10-20B21	10.0	20V C.T. @0.5A	10V @1.0A
14A-20-20B22	20.0	20V C.T. @1.0A	10V @2.0A
14A-30-20B23	30.0	20V C.T. @1.5A	10V @3.0A
14A-56-20B24	56.0	20V C.T. @2.8A	10V @5.6A
14A-2.5-24B25	2.5	24V C.T. @0.1A	12V @0.2A
14A-5.0-24B26	5.0	24V C.T. @0.21A	12V @0.42A
14A-10-24B27	10.0	24V C.T. @0.42A	12V @0.84A
14A-20-24B28	20.0	24V C.T. @0.83A	12V @1.66A
14A-30-24B29	30.0	24V C.T. @1.25A	12V @2.5A
14A-56-24B30	56.0	24V C.T. @2.33A	12V @4.66A
14A-2.5-28B31	2.5	28V C.T. @0.09A	14V @0.18A
14A-5.0-28B32	5.0	28V C.T. @0.18A	14V @0.36A
14A-10-28B33	10.0	28V C.T. @0.36A	14V @0.72A
14A-20-28B34	20.0	28V C.T. @0.72A	14V @1.44A
14A-30-28B35	30.0	28V C.T. @1.06A	14V @2.12A
14A-56-28B36	56.0	28V C.T. @2.0A	14V @4.0A
14A-2.5-36B37	2.5	36V C.T. @0.07A	18V @0.14A
14A-5.0-36B38	5.0	36V C.T. @0.14A	18V @0.28A
14A-10-36B39	10.0	36V C.T. @0.28A	18V @0.56A
14A-20-36B40	20.0	36V C.T. @0.56A	18V @1.12A
14A-30-36B41	30.0	36V C.T. @0.82A	18V @1.64A
14A-56-36B42	56.0	36V C.T. @1.56A	18V @3.12A







MECHANICAL DIMENSIONS

VA	WT.	L	W	H	A	B
2.5	0.25	1.625	1.312	1.125	.200	.250
5.0	0.37	1.625	1.312	1.375	.200	.400
10.0	0.53	1.875	1.562	1.375	.200	.400
20.0	0.90	2.250	1.875	1.625	.400	.400
30.0	1.15	2.625	2.187	1.562	.550	.275
56.0	1.70	3.000	2.500	1.812	.600	.300

VA	C	D	E	F	PIN DIM	MTG
2.5	1.000	—	—	1.062	.025 SQ	#4
5.0	1.000	—	—	1.062	.025 SQ	#4
10.0	1.140	—	—	1.250	.038 SQ	#4
20.0	1.460	—	—	1.500	.038 SQ	#4
30.0	1.680	2.18	1.75	—	.045 SQ	#6
56.0	1.900	2.50	2	—	.045 SQ	#6

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Recognized Component
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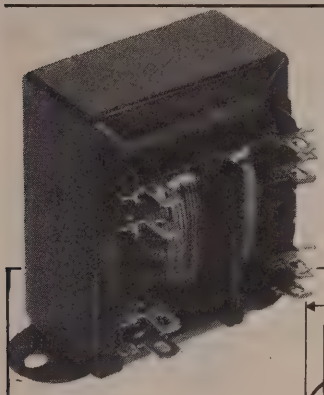
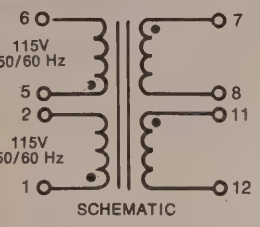
Power Transformers





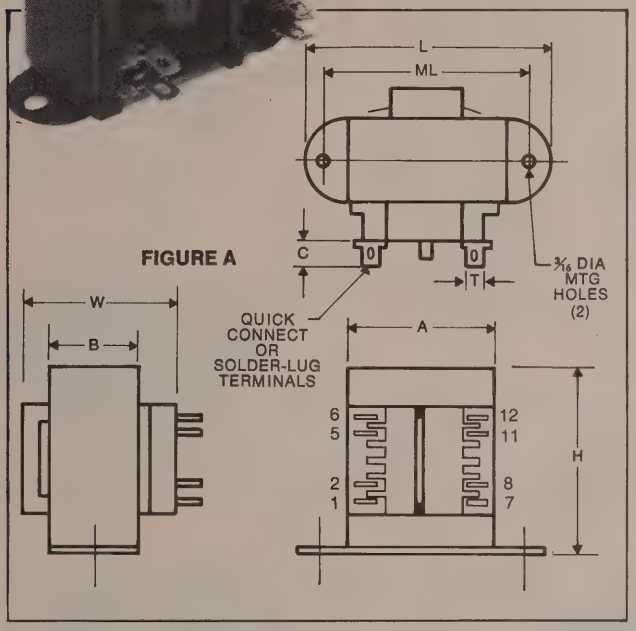
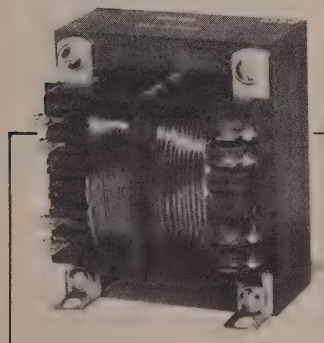


FIGURE A



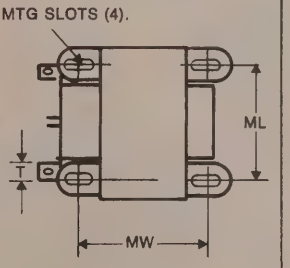
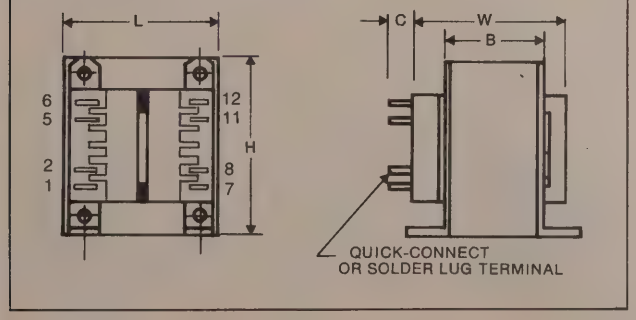


FIGURE B



INTERNATIONAL SERIES POWER TRANSFORMERS

UL, VDE, IEC and CSA certified.

PART NO. CHASIS MOUNT	(SIZE) VA	SECONDARY RMS RATING	
		SERIES	PARALLEL
A41-25-10A1	25	10V C.T. @2.5A	5V @5.0A
A41-43-10A2	43	10V C.T. @4.3A	5V @8.6A
A41-80-10A3	80	10V C.T. @8.0A	5V @16.0A
A41-130-10A4	130	10V C.T. @13.0A	5V @26.0A
A41-175-10A5	175	10V C.T. @17.5A	5V @35.0A
A41-25-12A7	25	12.6V C.T. @2.0A	6.3V @4.0A
A41-43-12A8	43	12.6V C.T. @3.4A	6.3V @6.8A
A41-80-12A9	80	12.6V C.T. @6.3A	6.3V @12.6A
A41-130-12A10	130	12.6V C.T. @10.3A	6.3V @20.6A
A41-175-12A11	175	12.6V C.T. @14.0A	6.3V @28.0A
A41-25-16A13	25	16V C.T. @1.6A	8V @3.2A
A41-43-16A14	43	16V C.T. @2.7A	8V @5.4A
A41-80-16A15	80	16V C.T. @5.0A	8V @10.0A
A41-130-16A16	130	16V C.T. @8.1A	8V @16.2A
A41-175-16A17	175	16V C.T. @11.0A	8V @22.0A
A41-25-20A19	25	20V C.T. @1.25A	10V @2.5A
A41-43-20A20	43	20V C.T. @2.2A	10V @4.4A
A41-80-20A21	80	20V C.T. @4.0A	10V @8.0A
A41-130-20A22	130	20V C.T. @6.5A	10V @13.0A
A41-175-20A23	175	20V C.T. @8.8A	10V @17.6A
A41-25-24A25	25	24V C.T. @1A	12V @2A
A41-43-24A26	43	24V C.T. @1.8A	12V @3.6A
A41-80-24A27	80	24V C.T. @3.3A	12V @6.6A
A41-130-24A28	130	24V C.T. @5.4A	12V @10.8A
A41-175-24A29	175	24V C.T. @7.3A	12V @14.6A
A41-25-28A31	25	28V C.T. @0.9A	14V @1.86A
A41-43-28A32	43	28V C.T. @1.5A	14V @3.0A
A41-80-28A33	80	28V C.T. @2.8A	14V @5.6A
A41-130-28A34	130	28V C.T. @4.6A	14V @9.2A
A41-175-28A35	175	28V C.T. @6.25A	14V @12.5A
A41-25-36A37	25	36V C.T. @0.7A	18V @1.4A
A41-43-36A38	43	36V C.T. @1.2A	18V @2.4A
A41-80-36A39	80	36V C.T. @2.2A	18V @4.4A
A41-130-36A40	130	36V C.T. @3.6A	18V @7.2A
A41-175-36A41	175	36V C.T. @4.8A	18V @9.6A
A41-25-230A42	25	230V C.T. @0.11A	115V @0.22A
A41-43-230A43	43	230V C.T. @0.19A	115V @0.38A
A41-80-230A44	80	230V C.T. @0.35A	115V @0.7A
A41-130-230A45	130	230V C.T. @0.57A	115V @1.14A
A41-175-230A46	175	230V C.T. @0.76A	115V @1.52A

MECHANICAL DIMENSIONS

VA	WT.	L	W	H	A	B
25	1.25	2.812	1.875	2.312	2.000	1.125
43	1.6	3.125	2.062	2.687	2.250	1.125
80	2.8	2.500	2.375	3.000	—	1.375
130	4.1	2.812	2.875	3.375	—	1.625
175	5.2	3.125	2.875	3.750	—	1.625

VA	C	T	ML	MW	MTG	FIG.
25	.312	.187	2.375	—	#6	A
43	.312	.187	2.812	—	#6	A
80	.312	.187	2.000	2.18	#6	B
130	.375	0.25	2.250	2.50	#8	B
175	.375	0.25	2.500	2.50	#8	B

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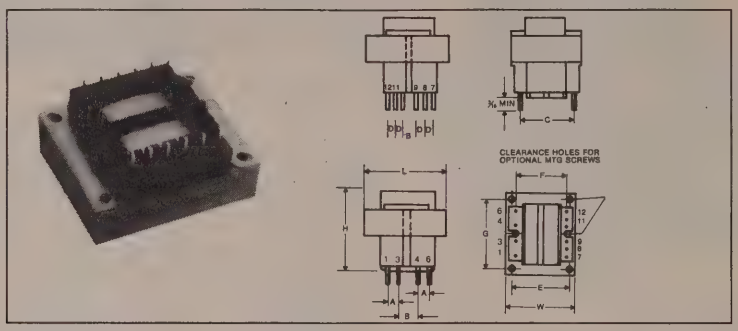
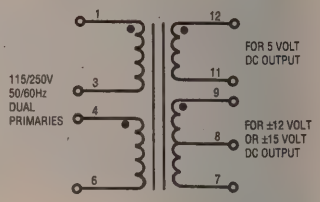
EWC® INC.

International Triple Output Power Transformers

These transformers were designed around our standard international series and are rated in terms of the final DC ouput after regulation by a 3-terminal IC regulator. Isolation is 4000V.

PC BOARD MOUNT

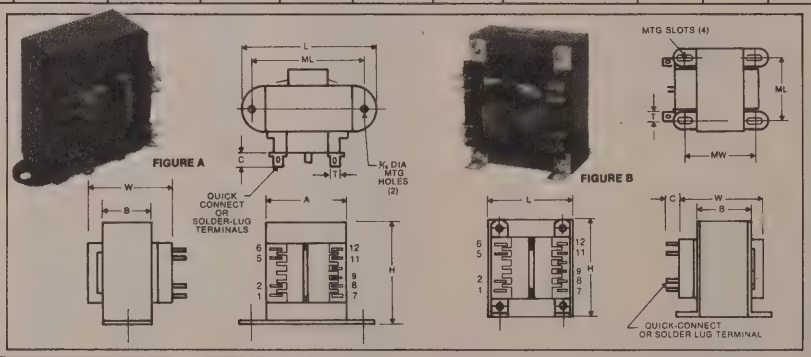


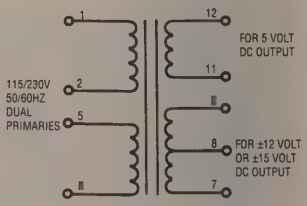


Part Number	DC Output		VA
14A-20-512-B1	5V@750MA	±12V@200MA	20
14A-20-515-B2	5V@750MA	±15V@175MA	20
14A-30-512B3	5V@1.25A	±12V@250MA	30
14A-30-515B4	5V@1.25A	±15V@200MA	30
14A-56-512-B5	5V@3A	±12V@300MA	56
14A-56-515-B6	5V@3A	±15V@250MA	56

	Dimensions							Pin	Mtg.			Mtg. Screw		
VA	L	W	H	A	B	C	D	Dimensions	E	F	G	Size	Quantity	Lbs.
20.0	2 1/4	1 7/8	1 5/8	.400	.400	1.460	.200	0.038SQ	-	1 1/2	-	#4	2	0.90
30.0	2 5/8	2 3/16	1 9/16	.550	.275	1.680	.275	0.045SQ	1 3/4	-	2 3/16	#6	4	1.15
56.0	3	2 1/2	1 13/16	.600	.300	1.900	.300	0.045SQ	2	-	2 1/2	#6	4	1.70

CHASSIS MOUNT





Part Number	DC Output		VA
A41-25-512A1	5v@1.25A	±12V@150MA	25
A41-25-515A2	5V@1.25A	±15V@130MA	25
A41-43-512A3	5V@2A	±12V@300MA	43
A41-43-515A4	5V@2A	±15V@250MA	43
A41-80-512A5	5V@3.5A	±12V@600MA	80
A41-80-515A6	5V@3.5A	±15V@500MA	80

	Dimensions								Mtg.				
VA	L	W	H	A	B	C	Terminals	Fig.	ML	MW	Mtg. Screw	Lbs.
25	2 13/16	1 7/8	2 5/16	2	1 1/8	5/16	3/16 (.187)	A	2 3/8	-	#6	1.25
43	3 1/8	2 1/16	2 11/16	2 1/4	1 1/8	5/16	3/16 (.187)	A	2 13/16	-	#6	1.6
80	2 1/2	2 3/8	3	-	1 3/8	5/16	3/16 (.187)	B	2	2 3/16	#6	2.8

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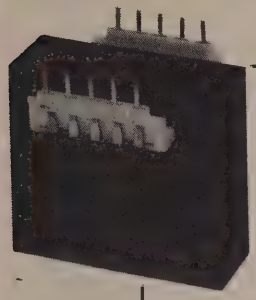
Recognized Component
Underwriters Labs, Inc.

Triple Output Power Transformers

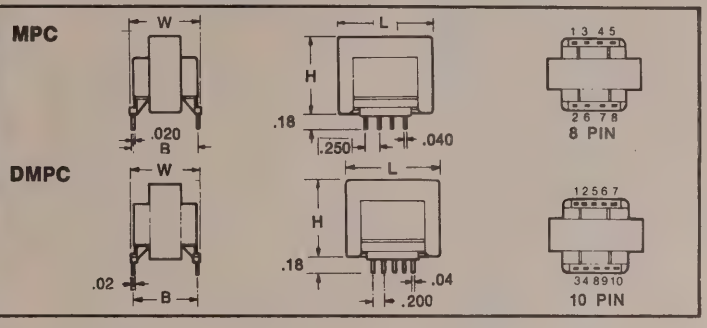
For triple-output regulated supplies

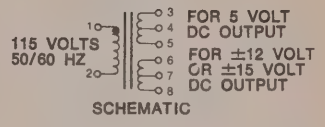
IDEAL FOR MICROPROCESSOR APPLICATIONS

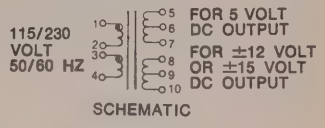
These lines were designed around our standard PC, LP and CHASSIS-TRAN series transformers and are rated in terms of the final DC output after regulation by a 3-terminal IC regulator. 1500V Hipot is standard.

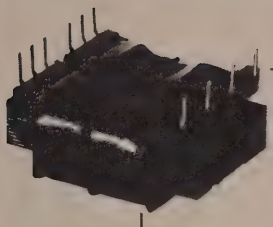


TYPE MPC AND DMPC









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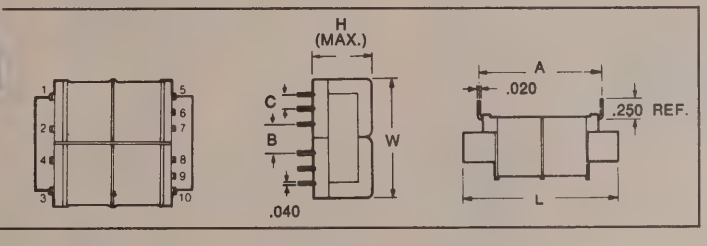
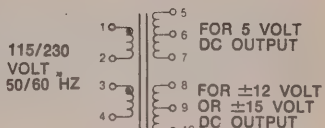
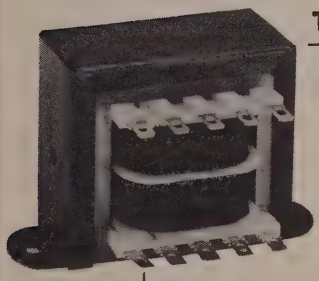
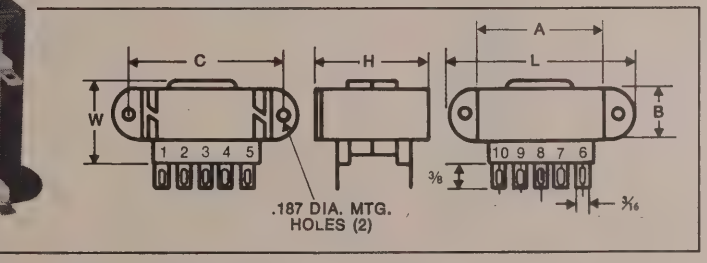
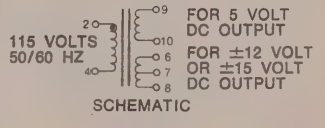


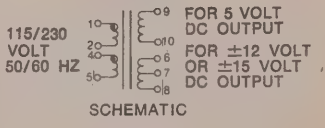




TYPE MT AND DMT







Part Number Primary 50/60 Hz		DC Output		
115V	115/230V	Output 1	Output 2	Size
MPC-V-12B1	N/A	5V @ 180mA	12V @ 35mA	V
MPC-V-15B2	N/A	5V @ 180mA	15V @ 30mA	V
MPC-X-12B11	DMPC-X-12B31	5V @ 360mA	12V @ 60mA	X
MPC-X-15B12	DMPC-X-15B32	5V @ 360mA	15V @ 50mA	X
MPC-Y-12B21	DMPC-Y-12B41	5V @ 835mA	12V @ 150mA	Y
MPC-Y-15B22	DMPC-Y-15B42	5V @ 835mA	15V @ 130mA	Y
N/A	MPL-6-12B51	5V @ 135mA	12V @ 40mA	6
N/A	MPL-6-15B52	5V @ 135mA	15V @ 35mA	6
N/A	MPL-12-12B61	5V @ 270mA	12V @ 85mA	12
N/A	MPL-12-15B62	5V @ 270mA	15V @ 70mA	12
MT-6-12A01	DMT-6-12A01	5V @ 1.75A	12V @ 210mA	6
MT-6-15A02	DMT-6-15A02	5V @ 1.75A	15V @ 175mA	6
MT-7-12A03	DMT-7-12A03	5V @ 2.8A	12V @ 350mA	7
MT-7-15A04	DMT-7-15A04	5V @ 2.8A	15V @ 280mA	7
MT-8-12A05	DMT-8-12A05	5V @ 4A	12V @ 600mA	8
MT-8-15A06	DMT-8-15A06	5V @ 4A	15V @ 500mA	8

Size	Type	Lbs.	L	W	H	A	B	C
6	MT	1.1	3¼	1 11/16	1 15/16	2 5/16	1 1/16	2 13/16
7	MT	1.7	3 11/16	1 13/16	2¼	2 11/16	1 1/16	3⅛
8	MT	2.75	4 1/32	2¼	2 5/16	3 1/16	1 5/16	3 5/16
V	MPC	0.31	1⅝	1¼	1⅜	—	1.100	—
X	MPC	0.56	1⅞	1 7/16	1⅝	—	1.300	—
Y	MPC	0.75	1⅝	2¼	1⅜	—	2.100	—
6	MPL	0.43	1⅞	1 9/16	0.850	1.600	0.375	0.187
12	MPL	0.68	2½	2.000	1.065	2.000	0.500	0.250

EWC, Inc. reserves the right to make changes without notice in design and specifications in order to effect product improvement.

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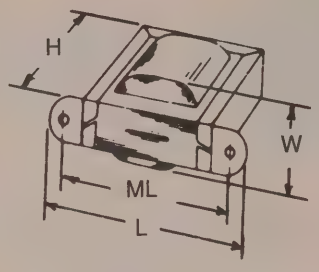
Isolation & Auto Transformers

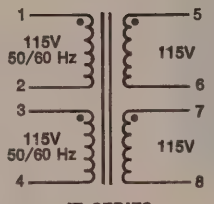
SPLIT BOBBIN ISOLATION TRANSFORMERS

3 VA to 1.25 KVA (50/60 Hz) 230V/230V or 115V/115V or 230V/115V or 115V/230V 1.5 KV RMS Hipot — UL Class B (130°C)

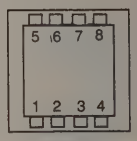


(Mtg. Style: C)
(STD. SIZE I-VIII)

ISOLATION TRANSFORMER	VA MAX.	SIZE
IT 200.3-OF	3	I
IT 200.7-OF	7	II
IT 201.5-OF	15	III
IT 202.5-OF	25	IV
IT 204-OF	40	V
IT 206-OF	60	VI
IT 208-OF	80	VII
IT 212-OF	120	VIII
IT 218-OF	180	IX
IT 225-OF	250	X
IT 235-OF	350	XI
IT 255-OF	550	XII
IT 280-OF	800	XIV
IT 2125-OF	1250	XV



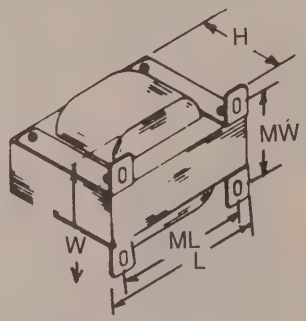
IT SERIES



IT-SOLDER TERMINAL LOCATION

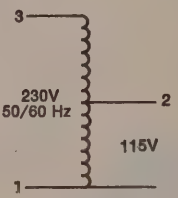
BOBBIN AUTO TRANSFORMERS

10 VA to 2.5 KVA (50-500 Hz) Step Down: 230V/115V or Step Up: 115V/230V 1.5 KV RMS Hipot — UL Class B (130°C)

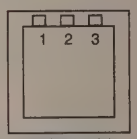


(Mtg. Style B)
(STD: SIZE IX-XVI)

AUTO TRANSFORMER	VA MAX.	SIZE
AT 101-OF	10	I
AT 102-OF	20	II(a)
AT 104-OF	40	III
AT 107-OF	70	IV
AT 110-OF	100	V
AT 112-OF	120	V(a)
AT 115-OF	150	VI
AT 120-OF	200	VII
AT 125-OF	250	VIII
AT 135-OF	350	IX
AT 150-OF	500	IX(a)
AT 175-OF	750	IX(b)
AT 1100-OF	1000	XII
AT 1150-OF	1500	XIV
AT 1150-OF	2500	XV

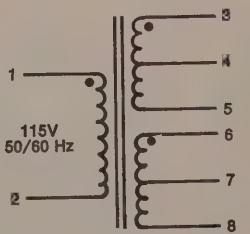


AT SERIES

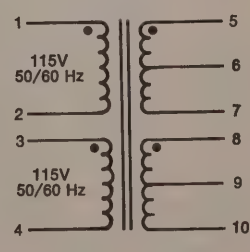


AT-SOLDER TERMINAL LOCATION

SIZE	WT. (LB.) APPROX.	W	L	H	ML	MW
I	.25	1¼	2¼6	1¾6	1¾	—
II	.375	1⅜	2⅜	1⅜	2	—
II(a)	.5	1½	2⅜	1⅜	2	—
III	.625	1½	2¹³⁄₁₆	1⅝	2⅜	—
IV	1.0	1⅝	3¼	1¹⁵⁄₁₆	2¹³⁄₁₆	—
V	1.25	1⅞	3¼	1¹⁵⁄₁₆	2¹³⁄₁₆	—
V(a)	1.5	2⅛	3¼	1¹⁵⁄₁₆	2¹³⁄₁₆	—
VI	1.75	2	3¹¹⁄₁₆	2¼	3⅛	—
VII	2.5	2¼	4	2⅜6	3⅜6	—
VIII	3.5	2½	4½	2⅞	4	—
IX	4.75	2¾	3¾	3⅛	3⅛	2¼
IX(a)	6	3¼	3¾	3⅛	3⅛	2¾
IX(b)	8	4	3¾	3⅛	3⅛	3⅞6
X	6.25	3	4⅛	3⅞6	3⅞6	2⅜
XI	8	3¼	4½	3¾	3¾	2½
XII	12	4⅜	4½	3¾	3¾	3½
XIV	17	4½	5¼	4⅜	4⅜	3⅝
XV	25	6	5¼	4⅜	4⅜	5⅛
XVI	22.5	4½	6⅜	5⅝6	5⅝6	3¼

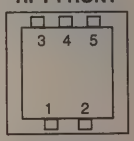


RPT SERIES



DRPT SERIES

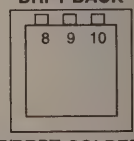
RPT FRONT



RPT BACK

DRPT FRONT

DRPT BACK



RPT/DRPT-SOLDER TERMINAL LOCATION

EWC® INC.
385 HIGHWAY 33, ENGLISHTOWN, NJ 07726
908/446-3110 FAX 908/446-5362

Split-Bobbin Rectifier Power Transformers

1 VA to 1.5 KVA — 115V @ 50/60 Hz Primary **1500V RMS Hipot — UL Class B (130°C) — Open Frame (STD)**

Primary 115V 50/60 Hz	Secondary Ratings (RMS)		Mtg. Style	Size
	Series	Parallel		
RPT 10-0.1	10V C.T. @ 0.1A	5V C.T. @ 0.2A	C	I
RPT 10-0.25	10V C.T. @ 0.25A	5V C.T. @ 0.5A	C	I
RPT 10-0.5	10V C.T. @ 0.5A	5V C.T. @ 1A	C	II
RPT 10-1	10V C.T. @ 1A	5V C.T. @ 2A	C	III
RPT 10-2	10V C.T. @ 2A	5V C.T. @ 4A	C	IV
RPT 10-4	10V C.T. @ 4A	5V C.T. @ 8A	C	V
RPT 10-6	10V C.T. @ 6A	5V C.T. @ 12A	C	VI
RPT 10-8	10V C.T. @ 8A	5V C.T. @ 16A	C	VII
RPT 10-12	10V C.T. @ 12A	5V C.T. @ 24A	C	VIII
RPT 10-15	10V C.T. @ 15A	5V C.T. @ 30A	B	IX
RPT 10-25	10V C.T. @ 25A	5V C.T. @ 50A	B	X
RPT 10-30	10V C.T. @ 30A	5V C.T. @ 60A	B	XI
RPT 10-50	10V C.T. @ 50A	5V C.T. @ 100A	B	XII
RPT 10-75	10V C.T. @ 75A	5V C.T. @ 150A	B	XIV
RPT 10-100	10V C.T. @ 100A	5V C.T. @ 200A	B	XVI
RPT 12.8-0.1	12.8V C.T. @ 0.1A	6.4V C.T. @ 0.2A	C	I
RPT 12.8-0.25	12.8V C.T. @ 0.25A	6.4V C.T. @ 0.5A	C	II
RPT 12.8-0.5	12.8V C.T. @ 0.5A	6.4V C.T. @ 1A	C	II
RPT 12.8-1	12.8V C.T. @ 1A	6.4V C.T. @ 2A	C	III
RPT 12.8-2	12.8V C.T. @ 2A	6.4V C.T. @ 4A	C	V
RPT 12.8-4	12.8V C.T. @ 4A	6.4V C.T. @ 8A	C	VI
RPT 12.8-6	12.8V C.T. @ 6A	6.4V C.T. @ 12A	C	VII
RPT 12.8-8	12.8V C.T. @ 8A	6.4V C.T. @ 16A	C	VIII
RPT 12.8-12	12.8V C.T. @ 12A	6.4V C.T. @ 24A	B	IX
RPT 12.8-20	12.8V C.T. @ 20A	6.4V C.T. @ 40A	B	X
RPT 12.8-25	12.8V C.T. @ 25A	6.4V C.T. @ 50A	B	XI
RPT 12.8-50	12.8V C.T. @ 50A	6.4V C.T. @ 100A	B	XIV
RPT 12.8-100	12.8V C.T. @ 100A	6.4V C.T. @ 200A	B	XVI
RPT 16-0.1	16V C.T. @ 0.1A	8V C.T. @ 0.2A	C	I
RPT 16-0.25	16V C.T. @ 0.25A	8V C.T. @ 0.5A	C	II
RPT 16-0.5	16V C.T. @ 0.5A	8V C.T. @ 1A	C	III
RPT 16-1	16V C.T. @ 1A	8V C.T. @ 2A	C	IV
RPT 16-2	16V C.T. @ 2A	8V C.T. @ 4A	C	V
RPT-16-4	16V C.T. @ 4A	8V C.T. @ 8A	C	VI
RPT 16-6	16V C.T. @ 6A	8V C.T. @ 12A	C	VIII
RPT 16-8	16V C.T. @ 8A	8V C.T. @ 16A	C	VIII
RPT 16-10	16V C.T. @ 10A	8V C.T. @ 20A	B	IX
RPT 16-12	16V C.T. @ 12A	8V C.T. @ 24A	B	X
RPT 16-20	16V C.T. @ 20A	8V C.T. @ 40A	B	XI
RPT 16-25	16V C.T. @ 25A	8V C.T. @ 50A	B	XII
RPT 16-50	16V C.T. @ 50A	8V C.T. @ 100A	B	XIV
RPT 16-75	16V C.T. @ 75A	8V C.T. @ 150A	B	XVI
RPT 24-0.1	24V C.T. @ 0.1A	12V C.T. @ 0.2A	C	I
RPT 24-0.25	24V C.T. @ 0.25A	12V C.T. @ 0.5A	C	II
RPT 24-0.5	24V C.T. @ 0.5A	12V C.T. @ 1A	C	III
RPT 24-1	24V C.T. @ 1A	12V C.T. @ 2A	C	IV
RPT 24-2	24V C.T. @ 2A	12V C.T. @ 4A	C	VI
RPT 24-3	24V C.T. @ 3A	12V C.T. @ 6A	C	VII
RPT 24-4	24V C.T. @ 4A	12V C.T. @ 8A	C	VIII
RPT 24-6	24V C.T. @ 6A	12V C.T. @ 12A	B	IX
RPT 24-8	24V C.T. @ 8A	12V C.T. @ 16A	B	X
RPT 24-12	24V C.T. @ 12A	12V C.T. @ 24A	B	XI
RPT 24-20	24V C.T. @ 20A	12V C.T. @ 40A	B	XII
RPT 24-25	24V C.T. @ 25A	12V C.T. @ 50A	B	XIV
RPT 24-50	24V C.T. @ 50A	12V C.T. @ 100A	B	XVI
RPT 36-0.1	36V C.T. @ 0.1A	18V C.T. @ 0.2A	C	II
RPT 36-0.25	36V C.T. @ 0.25A	18V C.T. @ 0.5A	C	III
RPT 36-0.5	36V C.T. @ 0.5A	18V C.T. @ 1A	C	IV
RPT 36-1	36V C.T. @ 1A	18V C.T. @ 2A	C	VI
RPT 36-2	36V C.T. @ 2A	18V C.T. @ 4A	C	VII
RPT 36-3	36V C.T. @ 3A	18V C.T. @ 6A	C	VIII
RPT 36-4	36V C.T. @ 4A	18V C.T. @ 8A	B	IX
RPT 36-6	36V C.T. @ 6A	18V C.T. @ 12A	B	X
RPT 36-8	36V C.T. @ 8A	18V C.T. @ 16A	B	XI
RPT 36-12	36V C.T. @ 12A	18V C.T. @ 24A	B	XII
RPT 36-20	36V C.T. @ 20A	18V C.T. @ 40A	B	XIV
RPT 36-25	36V C.T. @ 25A	18V C.T. @ 50A	B	XVI
RPT 36-30	36V C.T. @ 30A	18V C.T. @ 60A	B	XVI
RPT 56-01	56V C.T. @ 0.1A	28V C.T. @ 0.2A	C	II
RPT 56-0.25	56V C.T. @ 0.25A	28V C.T. @ 0.5A	C	IV
RPT 56-0.5	56V C.T. @ 0.5A	28V C.T. @ 1A	C	V
RPT 56-1	56V C.T. @ 1A	28V C.T. @ 2A	C	VI
RPT 56-2	56V C.T. @ 2A	28V C.T. @ 4A	C	VIII
RPT 56-3	56V C.T. @ 3A	28V C.T. @ 6A	B	IX
RPT 56-4	56V C.T. @ 4A	28V C.T. @ 8A	B	X
RPT 56-6	56V C.T. @ 6A	28V C.T. @ 12A	B	XI
RPT 56-8	56V C.T. @ 8A	28V C.T. @ 16A	B	XII
RPT 56-12	56V C.T. @ 12A	28V C.T. @ 24A	B	XIV
RPT 56-20	56V C.T. @ 20A	28V C.T. @ 40A	B	XVI
RPT 56-25	56V C.T. @ 25A	28V C.T. @ 50A	B	XVI

Primary 115V 50/60 Hz	Secondary Ratings (RMS)		Mtg. Style	Size
	Series	Parallel		
RPT 68-0.1	68V C.T. @ 0.1A	34V C.T. @ 0.2A	C	III
RPT 68-0.25	68V C.T. @ 0.25A	34V C.T. @ 0.5A	C	IV
RPT 68-0.5	68V C.T. @ 0.5A	34V C.T. @ 1A	C	V
RPT 68-1	68V C.T. @ 1A	34V C.T. @ 2A	C	VII
RPT 68-1.5	68V C.T. @ 1.5A	34V C.T. @ 3A	C	VIII
RPT 68-2	68V C.T. @ 2A	34V C.T. @ 4A	B	IX
RPT 68-3	68V C.T. @ 3A	34V C.T. @ 6A	B	X
RPT 68-4	68V C.T. @ 4A	34V C.T. @ 8A	B	XI
RPT 68-6	68V C.T. @ 6A	34V C.T. @ 12A	B	XII
RPT 68-8	68V C.T. @ 8A	34V C.T. @ 16A	B	XII
RPT 68-12	68V C.T. @ 12A	34V C.T. @ 24A	B	XIV
RPT 68-15	68V C.T. @ 15A	34V C.T. @ 30A	B	XVI
RPT 68-20	68V C.T. @ 20A	34V C.T. @ 40A	B	XVI
RPT 80-0.1	80V C.T. @ 0.1A	40V C.T. @ 0.2A	C	III
RPT 80-0.25	80V C.T. @ 0.25A	40V C.T. @ 0.5A	C	IV
RPT 80-0.5	80V C.T. @ 0.5A	40V C.T. @ 1A	C	VI
RPT 80-1	80V C.T. @ 1A	40V C.T. @ 2A	C	VII
RPT 80-1.5	80V C.T. @ 1.5A	40V C.T. @ 3A	C	VIII
RPT 80-2	80V C.T. @ 2A	40V C.T. @ 4A	B	IX
RPT 80-3	80V C.T. @ 3A	40V C.T. @ 6A	B	X
RPT 80-4	80V C.T. @ 4A	40V C.T. @ 8A	B	XI
RPT 80-6	80V C.T. @ 6A	40V C.T. @ 12A	B	XII
RPT 80-8	80V C.T. @ 8A	40V C.T. @ 16A	B	XIV
RPT 80-12	80V C.T. @ 12A	40V C.T. @ 24A	B	XVI
RPT 88-0.1	88V C.T. @ 0.1A	44V C.T. @ 0.2A	C	III
RPT 88-0.25	88V C.T. @ 0.25A	44V C.T. @ 0.5A	C	IV
RPT 88-0.5	88V C.T. @ 0.5A	44V C.T. @ 1A	C	VI
RPT 88-1	88V C.T. @ 1A	44V C.T. @ 2A	C	VII
RPT 88-2	88V C.T. @ 2A	44V C.T. @ 4A	B	IX
RPT 88-3	88V C.T. @ 3A	44V C.T. @ 6A	B	X
RPT 88-4	88V C.T. @ 4A	44V C.T. @ 8A	B	XI
RPT 88-6	88V C.T. @ 6A	44V C.T. @ 12A	B	XII
RPT 88-8	88V C.T. @ 8A	44V C.T. @ 16A	B	XIV
RPT 88-12	88V C.T. @ 12A	44V C.T. @ 24A	B	XVI
RPT 120-0.1	120V C.T. @ 0.1A	60V C.T. @ 0.2A	C	III
RPT 120-0.25	120V C.T. @ 0.25A	60V C.T. @ 0.5A	C	V
RPT 120-0.5	120V C.T. @ 0.5A	60V C.T. @ 1A	C	VI
RPT 120-1	120V C.T. @ 1A	60V C.T. @ 2A	C	VIII
RPT 120-1.5	120V C.T. @ 1.5A	60V C.T. @ 3A	B	IX
RPT 120-2	120V C.T. @ 2A	60V C.T. @ 4A	B	X
RPT 120-3	120V C.T. @ 3A	60V C.T. @ 6A	B	XI
RPT 120-4	120V C.T. @ 4A	60V C.T. @ 8A	B	XII
RPT 120-6	120V C.T. @ 6A	60V C.T. @ 12A	B	XIV
RPT 120-8	120V C.T. @ 8A	60V C.T. @ 16A	B	XVI
RPT 120-12	120V C.T. @ 12A	60V C.T. @ 24A	B	XVI
RPT 160-0.1	160V C.T. @ 0.1A	80V C.T. @ 0.2A	C	IV
RPT 160-0.25	160V C.T. @ 0.25A	80V C.T. @ 0.5A	C	VI
RPT 160-0.5	160V C.T. @ 0.5A	80V C.T. @ 1A	C	VII
RPT 160-0.75	160V C.T. @ 0.75A	80V C.T. @ 1.5A	C	VIII
RPT 160-1	160V C.T. @ 1A	80V C.T. @ 2A	B	IX
RPT 160-1.5	160V C.T. @ 1.5A	80V C.T. @ 3A	B	X
RPT 160-2	160V C.T. @ 2A	80V C.T. @ 4A	B	XI
RPT 160-4	160V C.T. @ 4A	80V C.T. @ 8A	B	XIV
RPT 160-6	160V C.T. @ 6A	80V C.T. @ 12A	B	XVI
RPT 160-8	160V C.T. @ 8A	80V C.T. @ 16A	B	XVI
RPT 180-0.1	180V C.T. @ 0.1A	90V C.T. @ 0.2A	C	IV
RPT 180-0.25	180V C.T. @ 0.25A	90V C.T. @ 0.5A	C	VI
RPT 180-0.5	180V C.T. @ 0.5A	90V C.T. @ 1A	C	VII
RPT 180-1	180V C.T. @ 1A	90V C.T. @ 2A	B	IX
RPT 180-1.5	180V C.T. @ 1.5A	90V C.T. @ 3A	B	X
RPT 180-2	180V C.T. @ 2A	90V C.T. @ 4A	B	XI
RPT 180-4	180V C.T. @ 4A	90V C.T. @ 8A	B	XIV
RPT 180-6	180V C.T. @ 6A	90V C.T. @ 12A	B	XVI
RPT 180-8	180V C.T. @ 8A	90V C.T. @ 16A	B	XVI
RPT 230-0.1	230V C.T. @ 0.1A	115V C.T. @ 0.2A	C	IV
RPT 230-0.25	230V C.T. @ 0.25A	115V C.T. @ 0.5A	C	VI
RPT 230-0.5	230V C.T. @ 0.5A	115V C.T. @ 1A	C	VIII
RPT 230-0.75	230V C.T. @ 0.75A	115V C.T. @ 1.5A	B	IX
RPT 230-1	230V C.T. @ 1A	115V C.T. @ 2A	B	X
RPT 230-1.5	230V C.T. @ 1.5A	115V C.T. @ 3A	B	XI
RPT 230-2	230V C.T. @ 2A	115V C.T. @ 4A	B	XII
RPT 230-4	230V C.T. @ 4A	115V C.T. @ 8A	B	XVI
RPT 230-6	230V C.T. @ 6A	115V C.T. @ 12A	B	XVI
RPT 300-0.1	300V C.T. @ 0.1A	150V C.T. @ 0.2A	C	V
RPT 300-0.25	300V C.T. @ 0.25A	150V C.T. @ 0.5A	C	VII
RPT 300-0.5	300V C.T. @ 0.5A	150V C.T. @ 1A	B	IX
RPT 300-1	300V C.T. @ 1A	150V C.T. @ 2A	B	XI
RPT 300-2	300V C.T. @ 2A	150V C.T. @ 4A	B	XIV
RPT 300-4	300V C.T. @ 4A	150V C.T. @ 8A	B	XVI

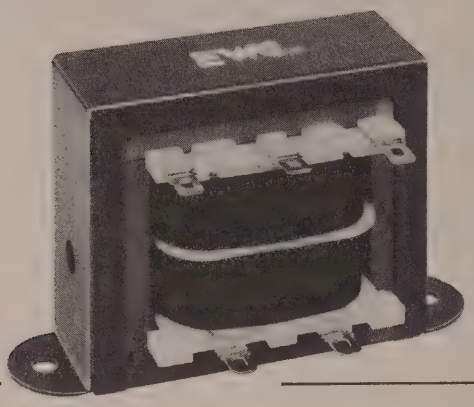
EWC, Inc. reserves the right to make changes without notice in design and specifications in order to effect product improvement.

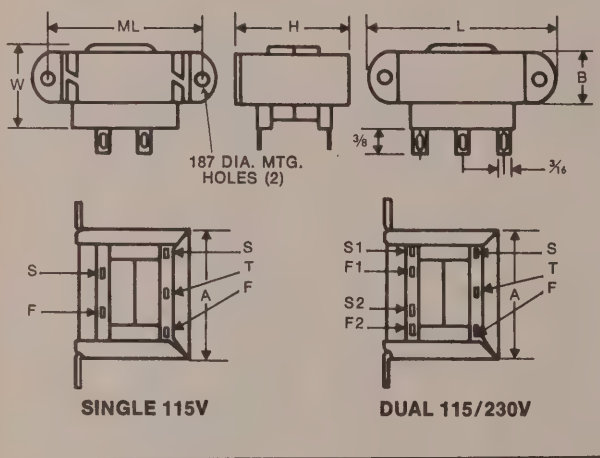
See preceding page for Mechanical Dimensions. **NOTE: DRPT also available with 115/230V, 50/60 Hz primary.**

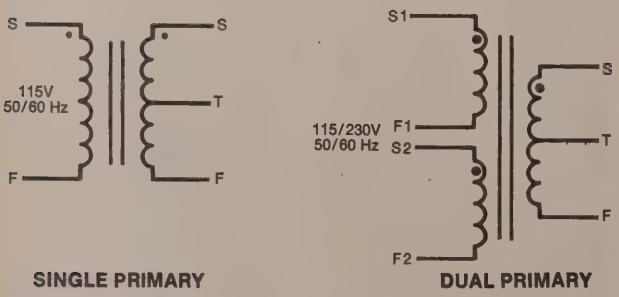
385 HIGHWAY 33, ENGLISHTOWN, NJ 07726
908/446-3110 FAX 908/446-5362

CHASSIS-TRAN®

Recognized Component
Underwriters Labs, Inc.







SIZE	VA	L	W	H	A	B	ML	LBS.
3	2.4	2 1/16	1 1/16	1 3/16	1 5/8	9/16	1 3/4	0.25
4	6	2 3/8	1 1/4	1 3/8	1 11/16	11/16	2	0.44
5	12	2 13/16	1 3/8	1 5/8	1 15/16	13/16	2 3/8	0.7
6	30	3 1/4	1 11/16	1 15/16	2 5/16	1 1/16	2 13/16	1.1
7	56	3 11/16	1 13/16	2 1/4	2 11/16	1 1/16	3 1/8	1.7
8	100	4 1/32	2 1/4	2 7/16	3 1/16	1 5/16	3 5/16	2.75

QUICK CONNECT POWER TRANSFORMERS

2500 Volt RMS Hipot in a variety of practical sizes. Maximum operating temperature 130°C available with either single 115 or dual 115/230V primary.

EWC's split bobbin and non-concentric winding provide better insulation and high signal isolation, thus eliminating the need for electrostatic shielding.

Adaptations of standard transformers are also available. Dots on schematics shown below indicate like polarity.

PART NUMBER		SECONDARY RMS RATING
SINGLE 115V	DUAL 115/230V	
241-3-10A1	NOT AVAILABLE	10V C.T. @ 0.25A
241-4-10A11	DP 241-4-10A11	10V C.T. @ 0.6A
241-5-10A21	DP 241-5-10A21	10V C.T. @ 1.2A
241-6-10A31	DP 241-6-10A31	10V C.T. @ 3.0A
241-7-10A41	DP 241-7-10A41	10V C.T. @ 5.0A
241-8-10A51	DP 241-8-10A51	10V C.T. @ 10A
241-3-12A2	NOT AVAILABLE	12.6V C.T. @ 0.2A
241-4-12A12	DP 241-4-12A12	12.6V C.T. @ 0.5A
241-5-12A22	DP 241-5-12A22	12.6V C.T. @ 1.0A
241-6-12A32	DP 241-6-12A32	12.6V C.T. @ 2.5A
241-7-12A42	DP 241-7-12A42	12.6V C.T. @ 4.0A
241-8-12A52	DP 241-8-12A52	12.6V C.T. @ 8.0A
241-3-16A3	NOT AVAILABLE	16V C.T. @ 0.15A
241-4-16A13	DP 241-4-16A13	16V C.T. @ 0.4A
241-5-16A23	DP 241-5-16A23	16V C.T. @ 0.8A
241-6-16A33	DP 241-6-16A33	16V C.T. @ 2.0A
241-7-16A43	DP 241-7-16A43	16V C.T. @ 3.5A
241-8-16A53	DP 241-8-16A53	16V C.T. @ 6.25A
241-3-20A4	NOT AVAILABLE	20V C.T. @ 0.12A
241-4-20A14	DP 241-4-20A14	20V C.T. @ 0.3A
241-5-20A24	DP 241-5-20A24	20V C.T. @ 0.6A
241-6-20A34	DP 241-6-20A34	20V C.T. @ 1.5A
241-7-20A44	DP 241-7-20A44	20V C.T. @ 2.8A
241-8-20A54	DP 241-8-20A54	20V C.T. @ 5.0A
241-3-24A5	NOT AVAILABLE	24V C.T. @ 0.1A
241-4-24A15	DP 241-4-24A15	24V C.T. @ 0.25A
241-5-24A25	DP 241-5-24A25	24V C.T. @ 0.5A
241-6-24A35	DP 241-6-24A35	24V C.T. @ 1.25A
241-7-24A45	DP 241-7-24A45	24V C.T. @ 2.4A
241-8-24A55	DP 241-8-24A55	24V C.T. @ 4.0A
241-3-28A6	NOT AVAILABLE	28V C.T. @ 0.085A
241-4-28A16	DP 241-4-28A16	28V C.T. @ 0.2A
241-5-28A26	DP 241-5-28A26	28V C.T. @ 0.42A
241-6-28A36	DP 241-6-28A36	28V C.T. @ 1.1A
241-7-28A46	DP 241-7-28A46	28V C.T. @ 2.0A
241-8-28A56	DP 241-8-28A56	28V C.T. @ 3.6A
241-3-36A7	NOT AVAILABLE	36V C.T. @ 0.065A
241-4-36A17	DP 241-4-36A17	36V C.T. @ 0.17A
241-5-36A27	DP 241-5-36A27	36V C.T. @ 0.35A
241-6-36A37	DP 241-6-36A37	36V C.T. @ 0.85A
241-7-36A47	DP 241-7-36A47	36V C.T. @ 1.5A
241-8-36A57	DP 241-8-36A57	36V C.T. @ 2.8A
241-3-48A8	NOT AVAILABLE	48V C.T. @ 0.05A
241-4-48A18	DP 241-4-48A18	48V C.T. @ 0.125A
241-5-48A28	DP 241-5-48A28	48V C.T. @ 0.25A
241-6-48A38	DP 241-6-48A38	48V C.T. @ 0.63A
241-7-48A48	DP 241-7-48A48	48V C.T. @ 1.2A
241-8-48A58	DP 241-8-48A58	48V C.T. @ 2.0A
241-3-56A9	NOT AVAILABLE	56V C.T. @ 0.045A
241-4-56A19	DP 241-4-56A19	56V C.T. @ 0.11A
241-5-56A29	DP 241-5-56A29	56V C.T. @ 0.22A
241-6-56A39	DP 241-6-56A39	56V C.T. @ 0.54A
241-7-56A49	DP 241-7-56A49	56V C.T. @ 1.0A
241-8-56A59	DP 241-8-56A59	56V C.T. @ 1.8A
241-3-120A10	NOT AVAILABLE	120V C.T. @ 0.02A
241-4-120A20	DP 241-4-120A20	120V C.T. @ 0.05A
241-5-120A30	DP 241-5-120A30	120V C.T. @ 0.1A
241-6-120A40	DP 241-6-120A40	120V C.T. @ 0.25A
241-7-120A50	DP 241-7-120A50	120V C.T. @ 0.5A
241-8-120A60	DP 241-8-120A60	120V C.T. @ 0.85A

Explanation of part number series 241 Size-4 Sec. Volts — 36 Prefix "DP" used in dual primary versions.

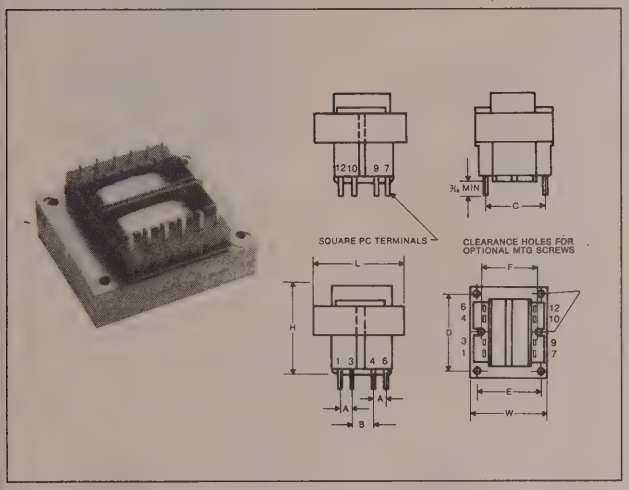
EWC, Inc. reserves the right to make changes without notice in design and specifications in order to effect product improvement.

EWC® INC.
385 HIGHWAY 33, ENGLISHTOWN, NJ 07726
908/446-3110 FAX 908/446-5362

Class 2 Transformers

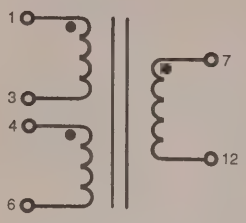
PC BOARD MOUNT

Designed With The Same Construction As Our 14A Series International Transformers. Isolation is 4000V.



Dimensions							Pin Dimensions	Mtg.			Mtg Size	Screw Quant	Lbs.
VA	L	W	H	A	B	C		D	E	F			
2.5	1 5/8	1 5/16	1 1/8	.200	.250	1.000	0.025SQ	-	-	1 1/16	#4	2	0.25
5.0	1 5/8	1 5/16	1 3/8	.200	.400	1.000	0.025SQ	-	-	1 1/16	#4	2	0.37
10.0	1 7/8	1 9/16	1 3/8	.200	.400	1.140	0.038SQ	-	-	1 1/4	#4	2	0.53
20.0	2 1/4	1 7/8	1 5/8	.400	.400	1.460	0.038SQ	-	-	1 1/2	#4	2	0.90
30.0	2 5/8	2 3/16	1 9/16	.550	.275	1.680	0.045SQ	2 3/16	1 3/4	-	#6	4	1.15
50.0	3	2 1/2	1 13/16	.600	.300	1.900	0.045SQ	2 1/2	2	-	#6	4	1.70

115/230V
50/60Hz
DUAL
PRIMARIES

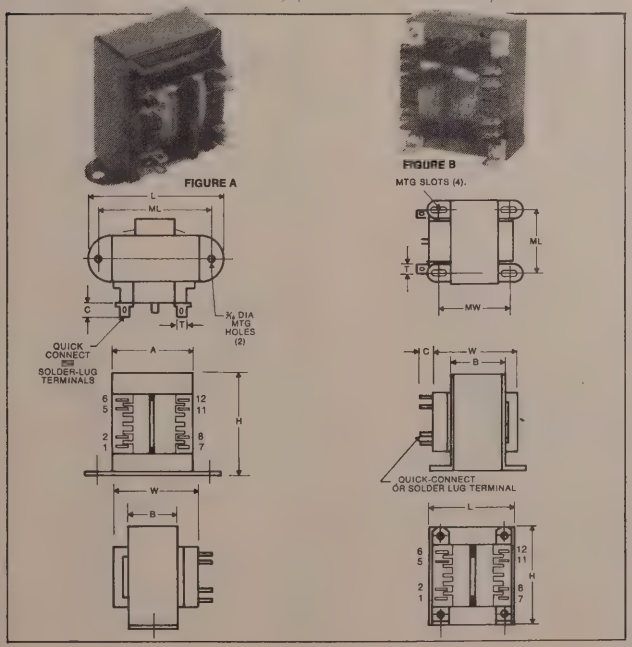


Part Number	Secondary RMS Rating	Secondary Fuse Required
CL2-2.5-12B1	12V@.20A	N/A*
CL2-2.5-24B2	24V@.10A	N/A*
CL2-5.0-12B3	12V@.42A	N/A*
CL2-5.0-24B4	24V@.20A	N/A*
CL2-10-12B5	12V@.83A	N/A*
CL2-10-24B6	24V@.42A	N/A*
CL2-20-12B7	12V@1.66A	N/A*
CL2-20-24B8	24V@.833A	N/A*
CL2-30-12B9	12V@2.50A	3.0A
CL2-30-24B10	24V@1.25A	N/A*
CL2-50-12B11	12V@4.20A	5.0A
CL2-50-24B12	24V@2.10A	2.5A

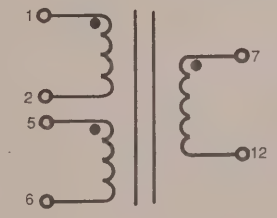
*Inherently Limited - No Fuse Required.

CHASSIS MOUNT

Designed With The Same Construction As Our A41 Series International Transformers. Isolation is 4000V.



115/230V
50/60HZ
DUAL
PRIMARIES



Dimensions				A	B	C	Terminals	Fig.	Mtg.		Mtg. Screw	Lbs.
VA	L	W	H						ML	MW		
25	2 13/16	1 7/8	2 5/16	2	1 1/8	3/16	3/16 (.187)	A	2 3/4	-	#6	1.25
40	3 1/8	2 1/16	2 11/16	2 1/4	1 1/8	3/16	3/16 (.187)	A	2 13/16	-	#6	1.6
80	2 1/2	2 3/8	3	-	1 3/8	3/16	3/16 (.187)	B	2	2 3/16	#6	2.8

Part Number	Secondary RMS Rating	Secondary Fuse Required
CL2-25-12A1	12V@ 2.10A	2.5A
CL2-25-24A2	24V@ 1.05A	N/A*
CL2-40-12A3	12V@ 3.33A	4.0A
CL2-40-24A4	24V@ 1.66A	2.0A
CL2-80-24A5	12V@ 3.33A	4.0A

*Inherently Limited - No Fuse Required.

385 HIGHWAY 33, ENGLISHTOWN, NJ 07726
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Power Transformers/MIL-T-27

400 Hz Miniature

ELECTRICAL SPECIFICATIONS

Primary voltage [1-2] = 115V ±10%
400 Hz ±5%

Secondary Voltage ±3% with [1-2] = 115V 400 Hz and delivering rated load. [Range 5 to 300V]

Dielectric strength 2.8 x max working voltage

See table for balance of specifications.

PHYSICAL SPECIFICATIONS

Size—sizes for standard VA ratings are given in Table.
Construction: Grade 5, Class S per MIL-T-27.

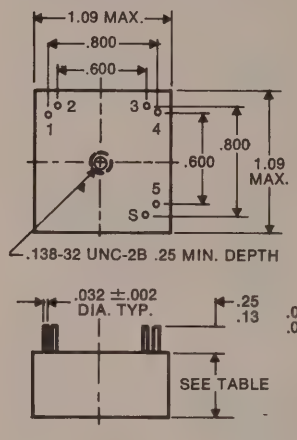
VA Rating	Package Size	Height Max	Reg. Max %	△t Max °C	Weight Max oz
1.5	1.09 sq.	0.47	23	17	.85
1.5S	1.09 sq.	0.59	18	17	1.10
3.0	1.09 sq.	0.59	18	20	1.10
3.0S	1.09 sq.	0.78	12	20	1.65
6.0	1.09 sq.	0.78	12	25	1.65
6.0S	1.09 sq.	1.03	10	25	2.20
9.0	1.09 sq.	1.03	10	30	2.20
9.0S	1.40 sq.	0.97	8	32	3.40
16	1.40 sq.	0.97	8	32	3.40
25	1.40 sq.	1.20	7	45	4.40

HOW TO ORDER

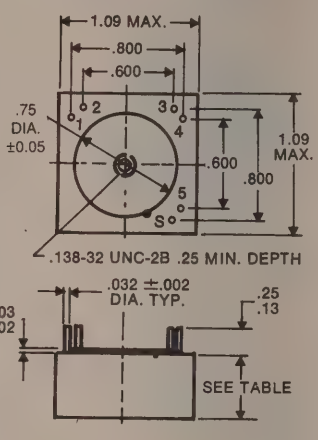
M 1.5 A 26 TS

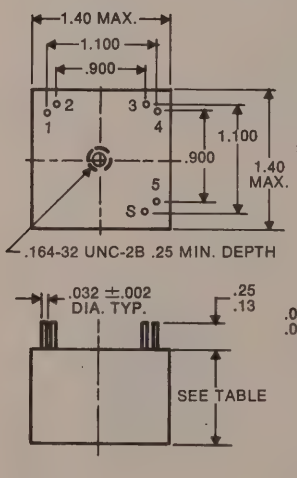
- Series Designation
- VA rating [1.5 to 25VA]
- Package style [A or B]
- Secondary voltage [5 to 300V]
- Schematic [X, T, XS or TS]

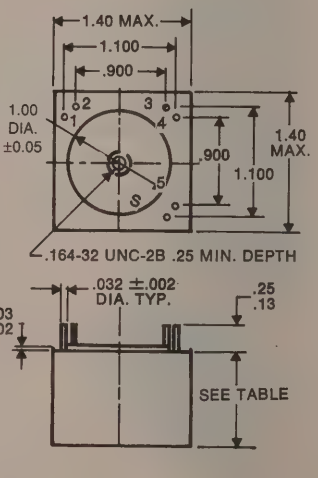
PACKAGE STYLE A



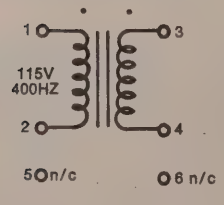
PACKAGE STYLE B



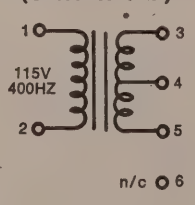




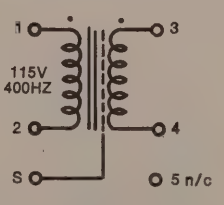
SCHEMATIC "X"



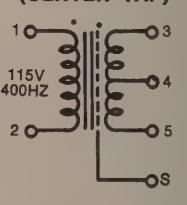
SCHEMATIC "T" (CENTER TAP)



SCHEMATIC "XS"



SCHEMATIC "TS" (CENTER TAP)



EWC® INC.
385 HIGHWAY 33, ENGLISHTOWN, NJ 07726
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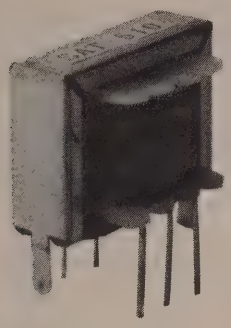
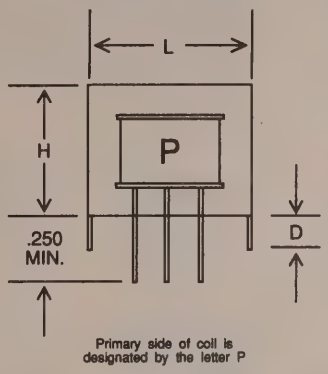
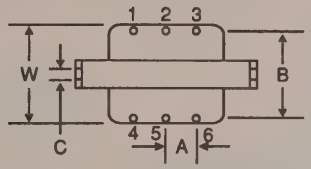
Audio Transformers

Economical off-shore construction, miniature, dry-type (no D.C.), printed circuit mounting, 1000 VAC isolation.

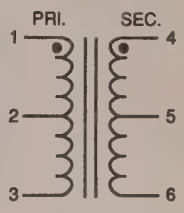




Primary side of coil is designated by the letter P



SCHEMATIC



Size	L	W	H	A	B	C	D	Pins
.075W	.599	.473	.433	.098	.457	.079	.150	26 AWG
.100W	.697	.630	.551	.110	.612	.086	.157	25 AWG
.200W	.800	.571	.640	.118	.553	.086	.165	25 AWG
.460W	1.000	.866	.750	.177	.846	.102	.189	24 AWG

			Impedance ±10% (@1KHz)		Resistance ± 20%	
Part Number	Size	Type	Pri.	Sec.	Pri.	Sec.
43012	.075W	OUTPUT	500 C.T.	8 C.T.	35	.8
43013	.075W	COUPLING	600 C.T.	600 C.T.	45	40
43014	.075W	OUTPUT	1K C.T.	8 C.T.	60	.8
43015	.075W	COUPLING	10K C.T.	600 C.T.	450	100
43016	.075W	DRIVER	10K C.T.	2K C.T.	500	200
43017	.100W	OUTPUT	500 C.T.	8 C.T.	22	.8
43018	.100W	INTERSTAGE	500 C.T.	500 C.T.	30	28
43019	.100W	OUTPUT	1.2K C.T.	8 C.T.	80	.8
43020	.100W	OUTPUT	48 C.T.	8 C.T.	2.5	.5
43021	.100W	OUTPUT	200 C.T.	8 C.T.	12	.8
43022	.200W	OUTPUT	200 C.T.	8 C.T.	12	.8
43023	.200W	OUTPUT	500 C.T.	8 C.T.	26	.8
43024	.200W	COUPLING	600 C.T.	600 C.T.	65	55
43025	.200W	OUTPUT	800 C.T.	8 C.T.	40	.8
43026	.200W	OUTPUT	1.2K C.T.	8 C.T.	80	.8
43027	.200W	INTERSTAGE	1.5K C.T.	500 C.T.	120	50
43028	.200W	COUPLING	10K C.T.	600 C.T.	600	100
43029	.200W	DRIVER	10K C.T.	2K C.T.	600	155
43030	.460W	OUTPUT	48 C.T.	8 C.T.	2.5	.5
43031	.460W	OUTPUT	120 C.T.	8 C.T.	7	.7
43032	.460W	OUTPUT	200 C.T.	8 C.T.	12	.5
43033	.460W	OUTPUT	500 C.T.	8 C.T.	18	.7
43034	.460W	INTERSTAGE	500 C.T.	500 C.T.	35	28
43035	.460W	DRIVER	10K C.T.	2K C.T.	600	155
43036	.460W	OUTPUT	1.2K C.T.	8 C.T.	75	.8
43037	.460W	COUPLING	600 C.T.	600 C.T.	65	55

385 HIGHWAY 33, ENGLISHTOWN, NJ 07726
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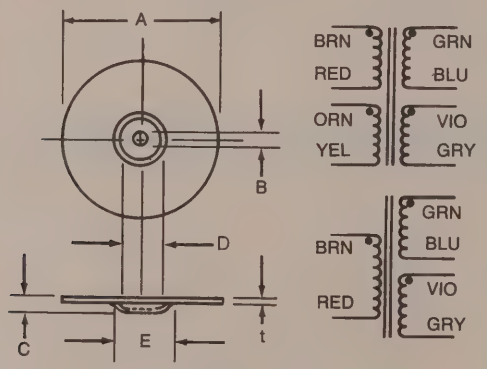
Toroidal Power Transformers

Toroidal Power Transformers Up to 1.0 KVA

Standard transformers suitable for use in applications where low magnetic noise and superior electrical performance in a small package is required. Designed and built to meet the basic requirements of UL, CSA, VDE and IEC, these transformers are 100% dielectric tested at 4000V rms and utilize a Class B, 130C recognized insulation system. Available with either 115V, 50-500Hz or 115/230, 50-500Hz primaries and up to 1KVA output, these transformers may be specified for use in many applications.

Optional mounting hardware includes two Neoprene pads and a metal washer. Standard leads are 8″ long self-leads. Other ratings available upon request.

VA	O.D.	HT.	LBS
20	2.88	1.25	1.10
40	3.25	1.38	1.54
70	3.75	1.44	2.20
100	3.75	1.57	2.86
150	4.50	1.57	3.30
340	4.50	2.32	5.28
600	5.50	2.75	9.68
1000	6.38	2.88	14.5

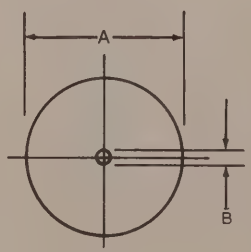


ZINC PLATED STEEL CENTERING WASHER

PART NO.	A	B	C	D	E	t	WT/OZ
200109A0001	2.0	0.17	0.18	0.30	0.44	.04	0.5
200109A0002	2.4	0.20	0.22	0.40	0.75	.05	1.0
200109A0003	2.8	0.25	0.26	0.62	1.08	.05	1.3
200109A0004	3.5	0.25	0.28	0.85	1.29	.06	2.6
200109A0005	4.4	0.32	0.33	1.08	1.64	.08	5.5
200109A0006	5.7	0.32	0.37	1.08	1.64	.08	9.1

NEOPRENE WASHER

PART NO.	A	B
200110A0001	2.0	0.17
200110A0002	2.4	0.20
200110A0003	2.8	0.25
200110A0004	3.5	0.25
200110A0005	4.4	0.32
200110A0006	5.7	0.32



PART NO.		SECONDARY RMS RATING	
SINGLE 115V PRIMARY	DUAL 115/230V PRIMARY	VOLTGE Vrms	CURRENT Arms
T20-10B1	DT20-10B1	2×5	2.00
T40-10B2	DT40-10B2	2×5	4.00
T70-10B3	DT70-10B3	2×5	7.00
T100-10B4	DT100-10B4	2×5	10.0
T150-10B5	DT150-10B5	2×5	15.0
T340-10B6	DT340-10B6	2×5	34.0
T20-12B7	DT20-12B7	2×6.3	1.58
T40-12B8	DT40-12B8	2×6.3	3.17
T70-12B9	DT70-12B9	2×6.3	5.55
T100-12B10	DT100-12B10	2×6.3	7.93
T150-12B11	DT150-12B11	2×6.3	11.9
T340-12B12	DT340-12B12	2×6.3	27.0
T20-16B13	DT20-16B13	2×8	1.25
T40-16B14	DT40-16B14	2×8	2.50
T70-16B15	DT70-16B15	2×8	4.37
T100-16B16	DT100-16B16	2×8	6.25
T150-16B17	DT150-16B17	2×8	9.37
T340-16B18	DT340-16B18	2×8	21.2
T600-16B19	DT600-16B19	2×8	37.5
T20-18B20	DT20-18B20	2×9	1.11
T40-18B21	DT40-18B21	2×9	2.22
T70-18B22	DT70-18B22	2×9	3.88
T100-18B23	DT100-18B23	2×9	5.55
T150-18B24	DT150-18B24	2×9	8.33
T340-18B25	DT340-18B25	2×9	18.8
T600-18B26	DT600-18B26	2×9	33.3
T20-20B27	DT20-20B27	2×10	1.00
T40-20B28	DT40-20B28	2×10	2.00
T70-20B29	DT70-20B29	2×10	3.50
T100-20B30	DT100-20B30	2×10	5.00
T150-20B31	DT150-20B31	2×10	7.50
T340-20B32	DT340-20B32	2×10	17.0
T600-20B33	DT600-20B33	2×10	30.0
T20-24B34	DT20-20B34	2×12	0.83
T40-24B35	DT40-24B35	2×12	1.66
T70-24B36	DT70-24B36	2×12	2.91
T100-24B37	DT100-24B37	2×12	4.16
T150-24B38	DT150-24B38	2×12	6.25
T340-24B39	DT340-24B39	2×12	14.1
T600-24B40	DT600-24B40	2×12	25.0
T20-28B41	DT20-28B41	2×14	0.71
T40-28B42	DT40-28B42	2×14	1.42
T70-28B43	DT70-28B43	2×14	2.50
T100-28B44	DT100-28B44	2×14	3.57
T150-28B45	DT150-28B45	2×14	5.35
T340-28B46	DT340-28B46	2×14	12.1
T600-28B47	DT600-28B47	2×14	21.4
T1000-28B48	DT1000-28B48	2×14	35.7
T20-36B49	DT20-36B49	2×18	0.55
T40-36B50	DT40-36B50	2×18	1.11
T70-36B51	DT70-36B51	2×18	1.94
T100-36B52	DT100-36B52	2×18	2.77
T150-36B53	DT150-36B53	2×18	4.16
T340-36B54	DT340-36B54	2×18	9.44
T600-36B55	DT600-36B55	2×18	16.6
T1000-36B56	DT1000-36B56	2×18	27.7

EWC, Inc. reserves the right to make changes without notice in design and specifications in order to effect product improvement.

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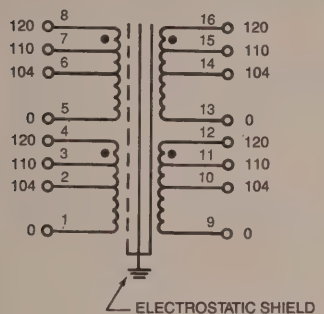
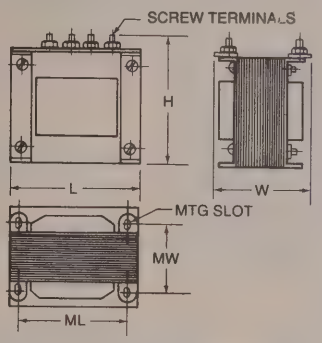
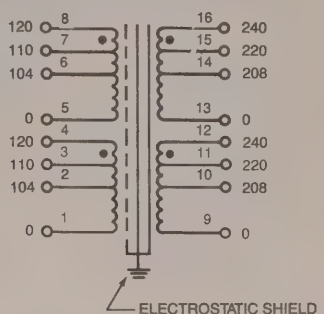
Power Isolation Transformers

These transformers are designed to eliminate the necessity of specifying many different power transformers due to variations in input line-voltage conditions. Two 120V primary windings with taps at 104V and 110V permit operation from 104V, 110V, 120V, 208V, 220V, 230V or 240V power lines. Multi-tapped secondary windings provide additional flexibility permitting a large number of possible input/output combinations including autotransformer connections which effectively double output VA ratings.

A grounded electrostatic shield, 1/4" thick terminal boards with plated hardware, varnish impregnation and 2500Vrms hipot are standard.







DU SERIES
110/220V 50/500Hz DUAL PRIMARIES TO 110/220 DUAL SECONDARIES

		RATING (EACH SEC)		MECHANICAL DIMENSIONS					
PART NO.	KVA	VOLTS (RMS)	AMPS	L	W	H	ML	MW	LBS
DU-1/4-B1	0.25	0/104/110/120	1.1	5.31	4.25	5.25	4.37	2.50	12
DU-1/2-B2	0.50	0/104/110/120	2.3	5.31	5.31	5.25	4.37	3.62	18
DU-1-B3	1	0/104/110/120	4.5	7.56	6.25	7.37	6.75	4.12	33
DU-2-B4	2	0/104/110/120	9	7.56	8.25	7.37	6.75	6.00	56
DU-3-B5	3	0/104/110/120	14	7.56	9.25	7.37	6.75	7.00	70
DU-5-B6	5	0/104/110/120	23	7.56	10.8	7.37	6.75	8.50	89
DU-7.5-B7	7.5	0/104/110/120	31	9.00	10.8	8.00	7.50	6.50	105
DU-10-B8	10	0/104/110/120	41	9.00	13.0	8.00	7.50	9.00	150

SU SERIES
110/220 50/500Hz DUAL PRIMARIES TO 220/440 DUAL SECONDARIES

		RATING (EACH SEC)		MECHANICAL DIMENSIONS					
PART NO.	KVA	VOLTS (RMS)	AMPS	L	W	H	ML	MW	LBS
SU-1/4-B1	0.25	0/208/220/240	0.55	5.31	4.25	5.25	4.37	2.50	12
SU-1/2-B2	0.50	0/208/220/240	1.15	5.31	5.31	5.25	4.37	3.62	18
SU-1-B3	1	0/208/220/240	2.25	7.56	6.25	7.37	6.75	4.12	33
SU-2-B4	2	0/208/220/240	4.5	7.56	8.25	7.37	6.75	6.00	56
SU-3-B5	3	0/208/220/240	7	7.56	9.25	7.37	6.75	7.00	70
SU-5-B6	5	0/208/220/240	11.5	7.56	10.8	7.37	6.75	8.50	89
SU-7.5-B7	7.5	0/208/220/240	15.5	9.00	10.8	8.00	7.50	6.50	105
SU-10-B8	10	0/208/220/240	20.5	9.00	13.0	8.00	7.50	9.00	150

Audio Transformers 5W

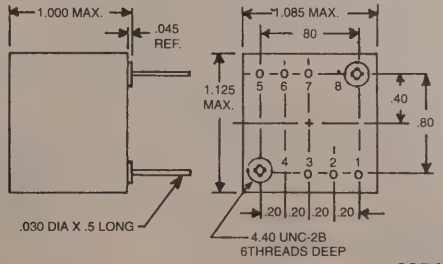
MILITARY AND COMMERCIAL APPLICATIONS (MEETS THE REQUIREMENTS OF MIL-T-27 GRADE 5, CLASS - S)

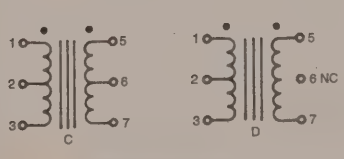
SPECIFICATIONS

- **Power:** 5 W Max at 200 Hz; 500 MW Max at 60 Hz
- **Response:** ±1 db 60 to 10,000 Hz
- **Terminals:** Pin, Dumet, tin plated
- **Mounting:** Two 4-40 inserts, 0.80" x 0.80"
- **Weight:** 2.5 oz.

Standard Types Available

Catalog No.	Primary (1-3) Impedance	Secondary (5-7) Impedance	DC Resistance - Ohms ±25% at 25°C		Maximum Unbalanced DC in Primary ma	Reference Schematic
			Primary	Secondary		
32004G01	10K CT	10K CT	700	900	1	C
32004G02	10K CT	600 CT	700	50	1	C
32004G03	10K CT	4	700	0.4	1	D
32004G04	1500 CT	15	93	1.5	2.5	D
32004G05	1000 CT	600 CT	65	50	3	C
32004G06	1000 CT	4	65	0.4	3	D
32004G07	600 CT	600 CT	40	50	4	C
32004G08	600 CT	60	40	5	4	D
32004G09	600 CT	15	40	1.5	4	D
32004G10	600 CT	4	40	0.4	4	D
32004G11	250 CT	600 CT	15	50	7	C





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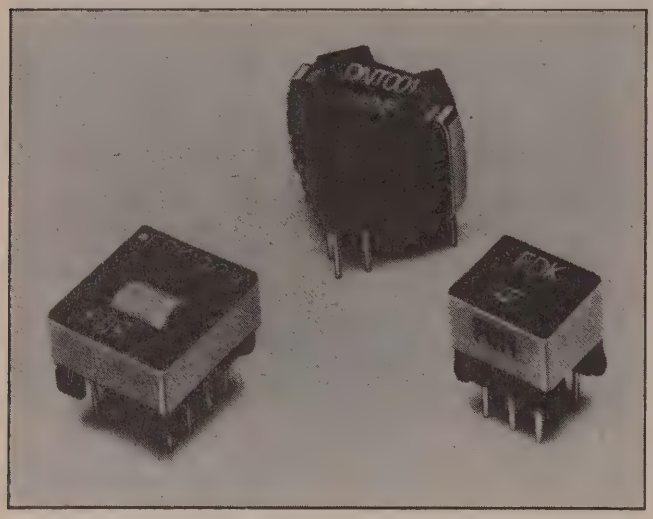
EWC® INC.

ISDN INTERFACE TRANSFORMERS



Features

- Compliance with the CCITT I. 430 in relation to:
  - Pulse shape
  - Impedance characteristics
  - Longitudinal conversion loss
- Compact size
- High inductance, low capacitance
- Low leakage inductance
- Phantom feeding capability

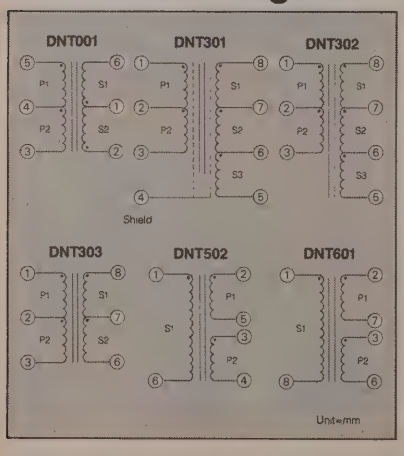
Applications

- Private branch exchange (PBX) equipment
- Digital service unit (DSU)
- Terminal adapters
- Terminal units
  - G4-mode facsimiles
  - ISDN telephones and the like

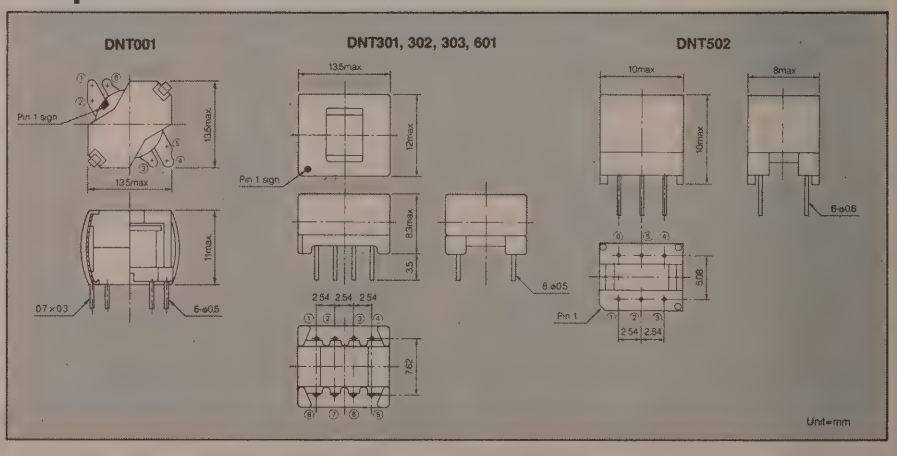
Electrical Characteristics

Models	DNT001	DNT301	DNT302	DNT303	DNT502	DNT601
Complying interfaces	Basic-rate (192kbps)				Primary-rate (1.544Mbps)	
Winding ratio	2:1 (P1+P2: S1+S2)	1:2 (P1+P2:S1+S2+S3) 1:1.5 (P1+P2:S1+S2)		1:2 (P1+P2+:S1+S2)	2.65:1:1 (S1: P1: P2)	
Inductance (line side)	22mH min. (S1+S2) at 1kHz 0.1mA	22mH min. (P1+P2) at 10kHz 0.1V			300μH min. (S1) at 1MHz 0.1V	200μH min. (S1) at 1MHz 0.1V
Leakage inductance (line side)	—	10μH max. at 10kHz 7mV			1.5μH max. at 1MHz 0.1V	
Stray capacity (line side)	—	120pF max. at 1MHz 0.1V		150pF max. at 1MHz 0.1V	—	—
DC resistance	3.0Ω max. (S1+S2)	P1+P2:5Ω max. S1+S2+S3:10Ω max.		P1+P2+:5Ω max. S1+S2:10Ω max.	S1: 0.55Ω max. P1, P2:0.25Ω max.	
Insulation withstanding voltage	DC 100V for 1 min.	AC 500V for 1 min.			DC 100V for 1 min.	
Complying LSIs	Siemens PEB2080, 2085 AMD Am79C30, 79C31 National semiconductor TP3420	Fujitsu MB86402		Siemens PEB2080, 2085 AMD Am79C30, 79C31 National semiconductor TP3420	Siemens PEB2235	

Connection Diagram



Shapes and Dimensions



FDK
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802.3: 10Base2 and 10Base5

Key Features

- Universal AUI Transformer may be used for typical applications requiring 75, 100 or 150 µH.
- All FEE Fil-Mag components are manufactured in ISO 9001 certified facilities to meet the highest international standards
- IEEE 802.3 (10Base2, 10Base5) compatible
- 2000 Vrms isolation meets IEEE 802.3 safety requirements for LANS
- Low leakage inductance and coupling capacitances mean fast rise times
- Ideal for thick and thin coaxial Ethernet

Surface Mount

- Proven in all surface mount soldering processes
- Small form factor, 50-mil lead spacing
- Available in tubes; tape and reel optional

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In the construction of the components described, the full intent of the specification will be met. FEE Fil-Mag, however, reserves the right to make, from time to time, such departures from the detail specifications as may be required to permit improvements in the design of its products.

The information included herein is believed to be accurate and reliable. However, FEE Fil-Mag assumes no responsibility for its use; nor for any infringements of patents or other rights of third parties which may result from its use.

FEE Fil-Mag®

FEE Fil-Mag

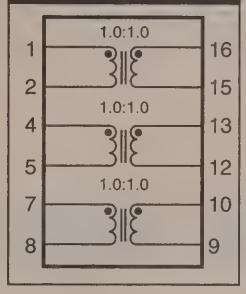
Universal Ethernet AUI Transformer

Electrical Specifications at 25°C

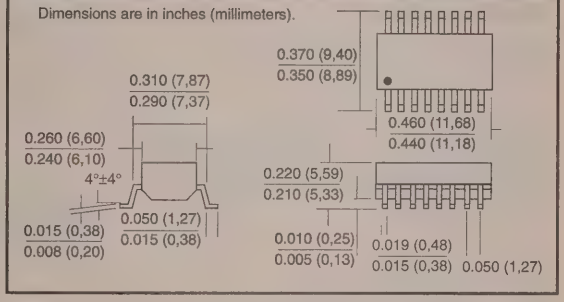
Part No	Turns Ratio ±5%	L_p µH	L_L µH max	C_C pF max	Rise Time nSec max	ET VuSec max	DCR Ohms max	Pri-Sec Isolation Voltage Vrms min
23Z391	1:1	75-150	0.20	10	3.0	2.4	0.30	2000
23Z391SM	1:1	75-150	0.20	10	3.0	2.4	0.30	2000

Ratings:
Power Rating: 250 mW
Operating Temperature: 0 to 70°C
Insulation Resistance: 10,000 MOhm min

Schematic

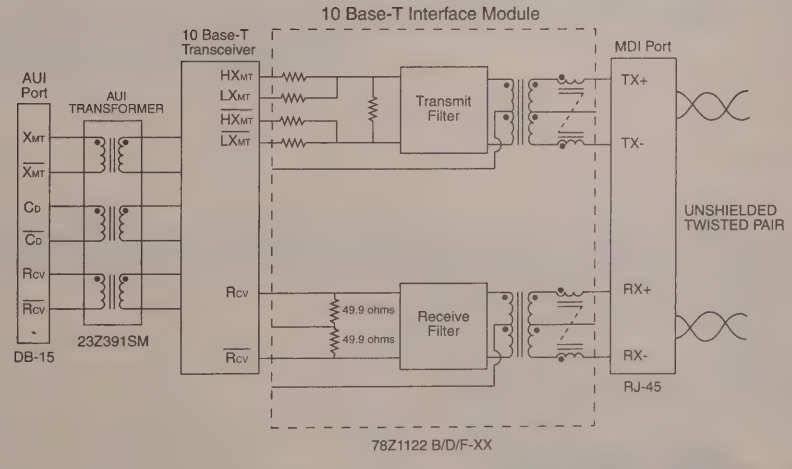


Surface Mount Package



Notes:
A. Each lead is within 0.010" (0,25) radius of its true position at maximum material dimension
B. Coplanarity within 0.002" (0,05)
C. Mold flash or protrusion are included in body dimensions but shall not exceed 0.006" (0,15)

Typical Application Circuit



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Fax (619) 569-6073

802.3:10Base-T, 10Base2, 10Base5

Key Features

- All FEE Fil-Mag components are manufactured in ISO 9001 certified facilities to meet the highest international standards
- IEEE 802.3 (10Base-T,10Base2, 10Base5) compatible
- 2000 Vrms isolation meets IEEE 802.3 safety requirements for LANS
- Low leakage inductance and coupling capacitances mean fast rise times
- Ideal for twisted-pair applications, including 10Base-T

Surface Mount

- Proven in all surface mount soldering processes
- Small form factor, 50-mil lead spacing
- Available in tubes; tape and reel optional

Through-Hole

- Low-profile, 16-pin DIP package
- Auto insertable

FEE Fil-Mag

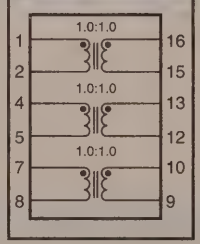
10Base-T and Ethernet Transformers

Electrical Specifications at 25°C

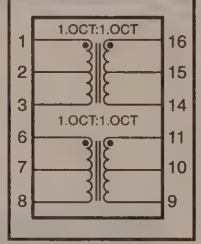
Part No	Turns Ratio ±5%	L_p µH ±20%	L_L µH max	C_C pF max	Rise Time nSec max	ET Vu Sec max	DCR Ohms max	DWV Vrms	Schem
23Z90	1:1	75	0.20	10	3.0	2.4	0.20	2000	A
23Z90SM	1:1	75	0.20	10	3.0	2.4	0.20	2000	A
23Z91	1:1	100	0.20	10	3.0	2.4	0.30	2000	A
23Z91SM	1:1	100	0.20	10	3.0	2.4	0.30	2000	A
23Z92	1:1	150	0.20	12	3.0	3.0	0.30	2000	A
23Z92SM	1:1	150	0.20	12	3.0	3.0	0.30	2000	A
23Z108	1:1	350	0.30	16	3.5	3.5	0.35	2000	A
23Z108SM	1:1	350	0.30	16	3.5	3.5	0.35	2000	A
23Z114	1ct:1ct	200	0.30	12	3.0	3.0	0.30	2000	B
23Z114SM	1ct:1ct	200	0.30	12	3.0	3.0	0.30	2000	B
23Z118	2ct:1ct:1ct:1ct	200	0.30	12	3.0	3.0	0.40	2000	C
23Z118SM	2ct:1ct:1ct:1ct	200	0.30	12	3.0	3.0	0.40	2000	C

Ratings:
Power Rating: 250mW
Operating Temperature: 0° to 70°C
Insulation Resistance: 10,000 MOhm/min.

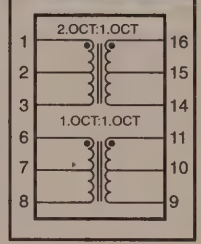
Schematic A



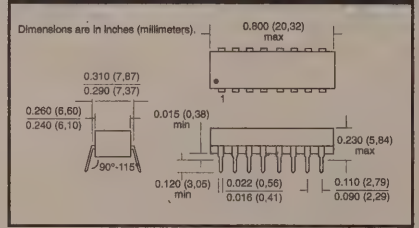
Schematic B



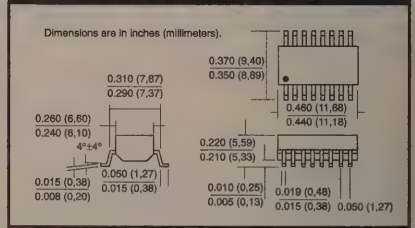
Schematic C



Standard DIP Package



Surface Mount Package



Notes:
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B. Coplanarity within 0.002" (0,05)
C. Mold flash or protrusion are included in body dimensions but shall not exceed 0.006" (0,15)

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Fax (65) 7413013

FEE Fil-Mag USA
9445 Farnham
San Diego, CA 92123
Tel (619) 569-6577
Fax (619) 569-6073

High Performance and Quality--Low Cost

Key Features

- All FEE Fil-Mag components are manufactured in ISO 9001 certified facilities to meet the highest international standards
- IEEE 802.5 compatible for 4 MHz and 16 MHz applications
- Single and dual configurations

Surface Mount

- Proven in all surface mount soldering processes
- Available in tubes

Through-Hole

- Low-profile, 16-pin DIP package
- Auto insertable

FEE Fil-Mag

Token Ring Transformers for Concentrator and Adapter Card Applications

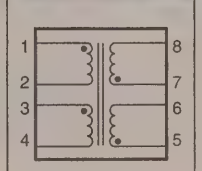
Electrical Specifications at 25°C

Part No	Turns Ratio ±3%	L_p µH min	L_L µH max	C_C pF max	Rise Time nSec max	DCR Ohms max Pri	DCR Ohms max Sec	Package	Schem	Recommended Application
42Z4030	1:1:2:2	1000	0.40	15	15	0.40	0.80	DIL	A	4MHz
42Z4031	1:1:2:2	1000	0.40	15	15	0.40	0.80	DIL	B	4MHz
42Z4033	1:1:2:2	250	0.15	15	15	0.50	0.80	DIL	A	16MHz
23Z803	1:1:2:2	250	0.15	15	15	0.50	0.80	DIP	A	16MHz
23Z803SM	1:1:2:2	250	0.15	15	15	0.50	0.80	DIP-SMD	A	16MHz
42Z4034	1:1:2:2	250	0.15	15	15	0.50	0.80	DIL	B	16MHz
23Z804	1:1:2:2	250	0.15	15	15	0.50	0.80	DIP	B	16MHz
23Z804SM	1:1:2:2	250	0.15	15	15	0.50	0.80	DIP-SMD	B	16MHz
42Z4035	1:1:1:1	750	0.20	25	5	1.00	1.00	DIL	A	16MHz
23Z805	1:1:1:1	750	0.20	25	5	1.00	1.00	DIP	A	16MHz
23Z805SM	1:1:1:1	750	0.20	25	5	1.00	1.00	DIP-SMD	A	16MHz
42Z4036	1:1:1:1	750	0.20	25	5	1.00	1.00	DIL	B	16MHz
23Z806	1:1:1:1	750	0.20	25	5	1.00	1.00	DIP	B	16MHz
23Z806SM	1:1:1:1	750	0.20	25	5	1.00	1.00	DIP-SMD	B	16MHz

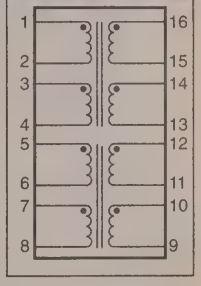
Ratings:
Insertion Loss: 0.5 dB max at 10 MHz
Return Loss: 20 dB min at 5 MHz
Isolation Primary to Secondary: DWV 500 Vrms
CMRR: -60 dB min at 1 MHz

Notes:
A. Each lead is within 0.010" (0,25) radius of its true position at maximum material dimension
B. Coplanarity within 0.002" (0,05)
C. Mold flash or protrusion are not included in body dimensions but shall not exceed 0.006" (0.15)

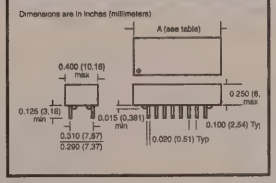
Schematic A



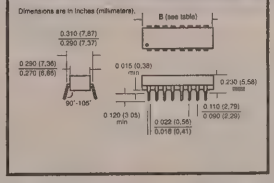
Schematic B



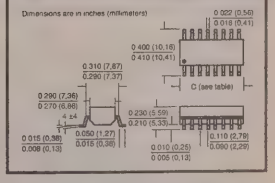
DIL Package



DIP Package



DIP/SMD Package



Dimensions

Part Number	Pins	Dimension "A" inch (mm) max
42Z4030	8	0.500 (12,70)
42Z4033	8	0.500 (12,70)
42Z4035	8	0.500 (12,70)
42Z4031	16	1.000 (25,4)
42Z4034	16	1.000 (25,4)
42Z4036	16	1.000 (25,4)

Dimensions

Part Number	Pins	Dimension "B" inch (mm) max
23Z803	8	0.500 (12,70)
23Z805	8	0.500 (12,70)
23Z804	16	0.810 (20,57)
23Z806	16	0.810 (20,57)

Dimensions

Part Number	Pins	Dimension "C" inch (mm) ±0.010 (0,25)
23Z803SM	8	0.500 (12,70)
23Z805SM	8	0.500 (12,70)
23Z804SM	16	0.810 (20.57)
23Z806SM	16	0.810 (20,57)

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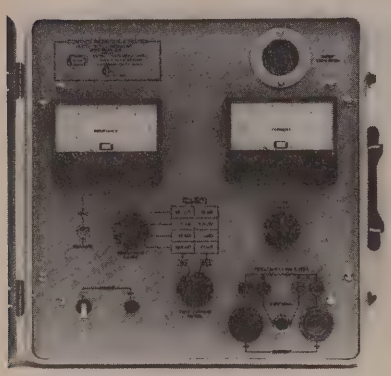
SHALLTRONIX
ELECTRO TECHNIK

TEST EQUIPMENT

CONTACT-RESISTANCE TESTER



The AOT-10 is designed to test the contact resistance of circuit breakers, connectors, bus bar connections, etc. A four-terminal ohmmeter, it will measure resistance over five ranges from 0-10 microohms to 0.1 ohm. Two test current ranges are standard on the unit, 0-10 A and 0-100 A. The ohmmeter reads accurate resistance for any indicated test current within its range.

INSULATION RESISTANCE TESTERS

IRT-5000 – A rugged line operated unit with a continuously adjustable D.C. test potential from 0 to 5000 volts. There are four resistance ranges covering values from 1 - 1,000,000 megohms. Deadman safety switch removes high voltage and discharges load build-up capacitance. Ideal for long cables.

BIRT-5000 – Electrically similar to above unit but with built in rechargeable battery.
Hand crank models to 5000 volts are also available.
Custom designs can be manufactured to suit your individual requirements.

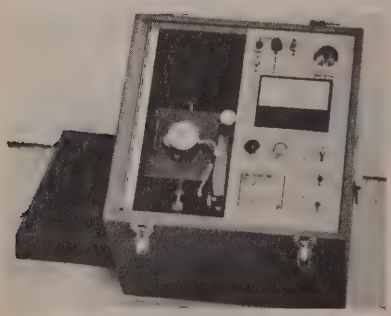
PORTABLE BREAKDOWN TESTERS

Two standard models, the AVC-25V (2500 V ac) and the AVC-50 V (5000 V ac) cover more than 95% of these requirements. Both units offer a continuously adjustable output voltage to their maximum rated values.
All units are equipped with a high-voltage pilot lamp, power and fault lamps, automatic cut-out and a heavy duty retractable high-voltage probe.
These units also automatically verify the grounding and polarity of the supply receptacle.
Other units, for special applications, are available on request.

EARTH TESTERS

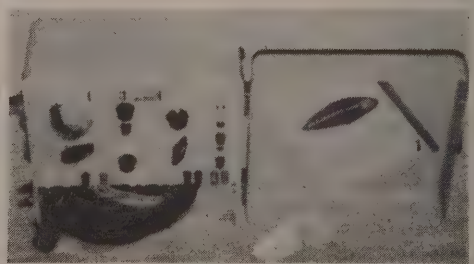
For the measurement of earth resistance of service ground rods and station ground grids. Useful as well for earth resistivity measurements for transformer station site selection.
Geohm II – a galvanometer type instrument with 4 ranges: 0-5/50/500/5000 ohms. Unit utilizes a convenient potentiometer adjustment for balance.
Geohm III – an electronic, direct reading, digital instrument. High and low range selection with automatic range switching within ranges, permit accurate resistance measurements from 0-199.99 kΩ. Range selected, low battery, high spike resistance and overflow are indicated on edges of display.The high 0.01-ohm resolution, and filtering to reject the influence of stray voltages in the earth, produce an instrument very suitable for station ground grid measurements and loop testing on neutralizing transformer installations. Uses four 'C' cells.

PORTABLE OIL TEST SET



AVO-600 – A high voltage test set to establish dielectric breakdown of transformer and other insulating oils. This unit features 3 selectable motorized rates of voltage rise to a maximum of 60 kV. The voltmeter freezes at the breakdown voltage. The unit meets ASTM specifications.

POWER TRANSFORMER RATIOMETER



TR-1A – A precision instrument for testing single phase, or three phase transformers without lead changing. Test potential is 120 V for power transformers, 2.5 volt for current transformers. The ratio readout is from 0.00000 to 0.99999, accuracy is ±0.005% at 120 V. Leads included.

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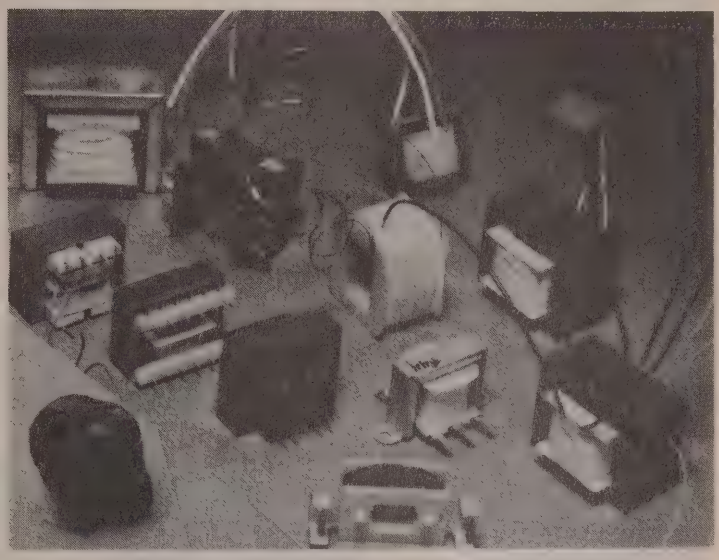
• FAX (407) 321-9410 • Phone (407) 321-3800

FETCO
ELECTRO TECHNIK

TRANSFORMER & COIL PRODUCTS

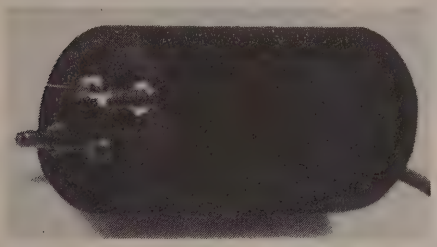
STANDARD PRODUCTS

- Audio Transformers
- Power Transformers
- Electric Wave Filters
- Pulse Transformers
- Switch Power Magnetics
- High Q Coils



PULSE TRANSFORMERS

The ability to design and manufacture a diverse line of pulse transformers allows FETCO to meet the most demanding size, weight and performance specifications to service the laser industry.

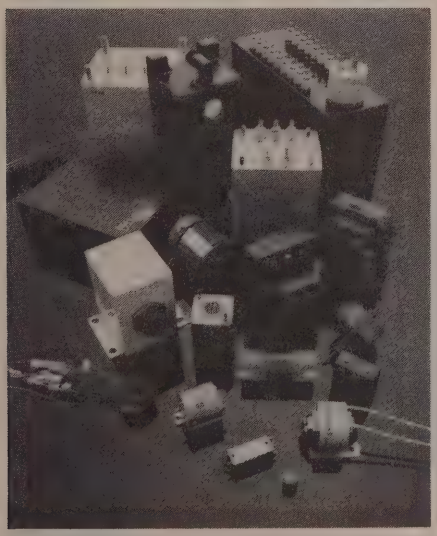


SERIES INJECTION TRIGGER TRANSFORMERS

Type	Peak Output Voltage Maximum (kV)	Rise Time 10-90% (uS)	Pulse Width 50% Amplitude (uS)	Maximum Input DC Source (Volts)	Primary Pulse Current (A)	Turns Ratio Secondary To Primary	Hold-off Primary To Secondary (kVdc)
455-1368-000	30	.3	.5	1500	5000	30:1	30
455-1369-000	3	1.0	3.5	1500	180	3:1	30
455-1370-000	30	1.0	3.5	800	1400	50:1	30
455-1371-000	25	.5	.8	1500	3000	25:1	30
455-1372-000	30	1.0	1.0	1000	4000	30:1	30
455-1373-000	30	1.0	1.0	1000	4000	30:1	30
455-1374-000	40	.4	.75	1500	3500	30:1	30

SECONDARY WINDING

Inductance Resistance			Maximum Current	Nominal Dimensions				Mounting Holes		
				(note 2)				Inches Center to Center		
mH unsat	uH sat	ohms	DC (A)	Length (inches)	Width (inches)	Height (inches)	Weight (lb.)	A	B	Diameter (inches)
2.3	80	.025	25	3.7	3.2	5.4	3.5	3.100	1.500	0.187
2.6	80	.012	25	3.7	3.2	5.4	3.5	3.100	1.500	0.187
15	300	.06	15	3.02	3.66	4.08	3.5	2.300	2.000	0.187
1.4	60	.012	40	3.7	3.2	5.4	4.	3.100	1.500	0.187
22	500	.06	15	6.0	4.6	5.6	10.	3.375	2.500	0.187
22	500	.06	15	4.25	4.6	7.10	10.	3.375	2.500	0.187
3.6	125	.012	80	6.0	4.6	5.6	10.	3.375	2.500	0.187



PRODUCT CAPABILITY

FETCO has total capability for the design, development and manufacture of the following components and sub-systems for the defense industry. Our engineering staff is always available for consultation to ensure the optimum solution for any application.

- Power supplies up to 25 kV and 1 kW DC to DC, AC to DC and DC to AC
- Transformers from miniature signal type up to 35kVA
- Inductors DC, AC and RF
- Magnetic amplifiers and saturable reactors
- Various signal processing and conditioning sub-systems
- Build-to-print production of all the above categories

If your requirement falls into any of these areas, we would welcome the opportunity to provide a proposal or quotation as appropriate.

Florida Electronics & Transformer Co.
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ELECTRO TECHNIK

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FETCO

POWER SUPPLIES

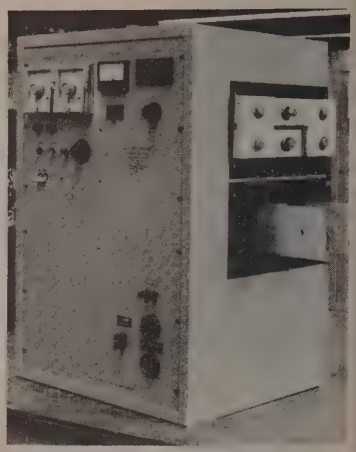
POWER SUPPLIES

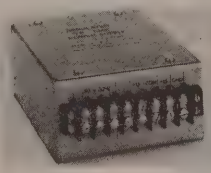
A broad variety of low and high voltage and current power supplies are manufactured to standard designs and for special applications.

AC Our ac designs are rugged, and include ammeter and voltmeter as required. Regulated high current designs are available for special applications, up to **2000 A.**

DC Manufactured in bench-top or rack-mount models, standard and custom designs are available with both fixed and adjustable outputs.

Typical Specifications: Line Regulation – ±0 03% of output voltage for line variation of ±10%. Load Regulation – 0.03% from zero to full load. Ripple – 2 mV rms. Short-circuit protection.
Voltmeter and ammeter as required.





REGULATED VARIABLE VOLTAGE

MODEL NUMBER	MAXIMUM VOLTAGE	MAXIMUM CURRENT
VR-5-2	5 V	2 A
VR-5-5	5 V	5 A
VR-5-10	5 V	10 A
VR-5-20	5 V	20 A
VR-10-1	10 V	1 A
VR-10-2	10 V	2 A
VR-10-5	10 V	5 A
VR-10-10	10 V	10 A
VR-10-20	10 V	20 A
VR-20-0.5	20 V	0.5 A
VR-20-1	20 V	1 A
VR-20-2	20 V	2 A
VR-20-5	20 V	5 A
VR-20-10	20 V	10 A
VR-20-20	20 V	20 A
VR-40.0.5	40 V	0.5 A
VR-40-1	40 V	1 A
VR-40-2	40 V	2 A
VR-40-5	40 V	5 A
VR-40-10	40 V	10 A
VR-40-20	40 V	20 A
VR-60-0.2	60 V	0.2 A
VR-60-0.5	60 V	0.5 A
VR-60-1	60 V	1 A
VR-60-2	60 V	2 A
VR-60-5	60 V	5 A
VR-60-10	60 V	10 A
VR-80-0.2	80 V	0.2 A
VR-80-0.5	80 V	0.5 A
VR-80-1	80 V	1 A
VR-80-2	80 V	2 A
VR-80-5	80 V	5 A
VR-100-0.2	100 V	0.2 A
VR-100-0.5	100 V	0.5 A
VR-100-1	100 V	1 A
VR-100-2	100 V	2 A
VR-100-5	100 V	5 A

POWER SUPPLIES AND P.C. BOARDS

FETCO is equipped for the production of power supplies and P.C. boards, all of which can be produced precisely to the customer's print.

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QUALITY MAGNETICS

Fernwood Transformer

MILITARY • AEROSPACE • INDUSTRIAL

Fernwood Transformer will manufacture products from your drawings or from your written requirements through our computer-aided design department. This program will produce optimum design and size for your high frequency requirements. Power range up to 50 KVA and frequencies up to 1 GHZ.

Fernwood Transformer is on the QPL list for grade 4 and grade 5, MIL-T-27E. Military demands high quality and reliability. Our assembly lines have in-process inspection and all products are tested 100%. Our facility is approved to MIL-I-45208 and instrument calibration is per MIL-STD-45662. Our soldering is certified to MIL-STD-2000.

We design to meet UL, CSA, and VDE when required. Our production is computer-controlled so each customer can have a timely flow chart of materials, processes, and delivery dates.

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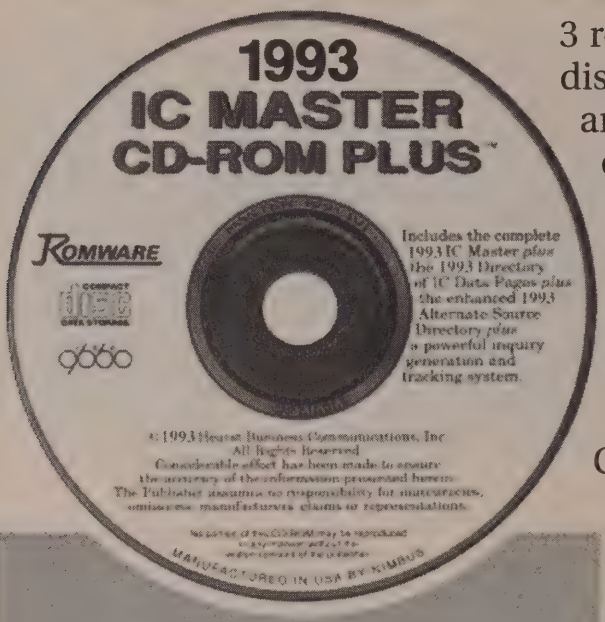
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SPLIT CORE CURRENT (INSTRUMENT) TRANSFORMERS

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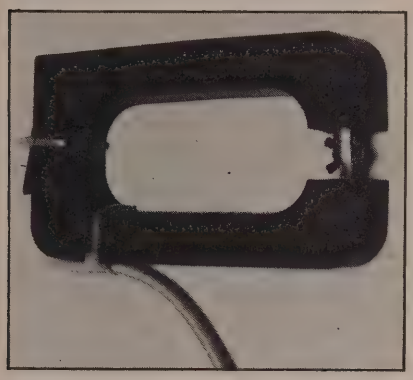
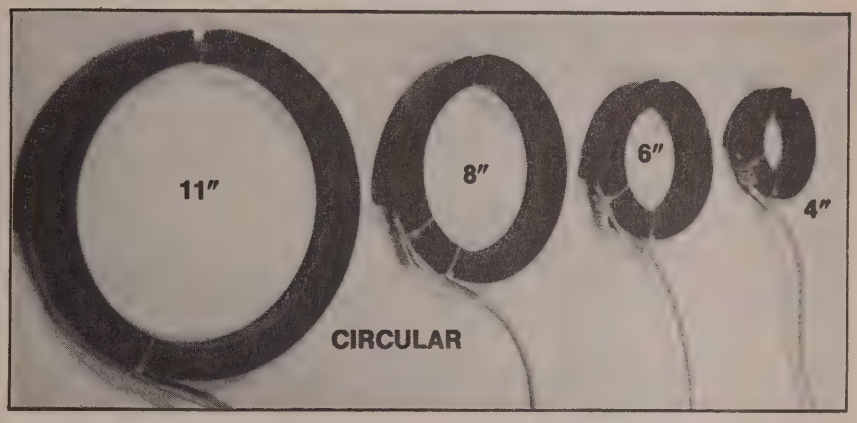
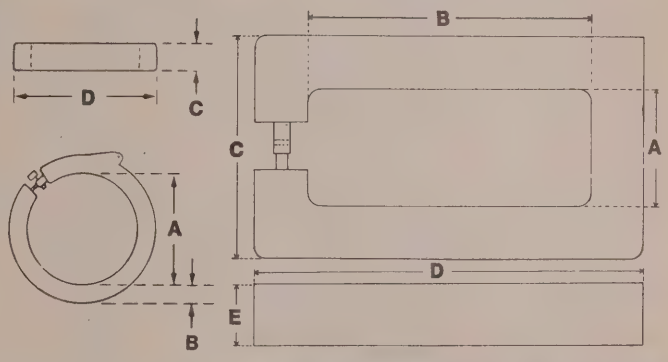
RECTANGULAR 2.75" X 6.63"





Four models are available for round conductors plus one for buss bars. Use with any 5 amp indicating or recording ammeter or with an Amp or Watt transducer. The flexible core is made of directional silicon steel. The secondary windings are copper wire. Encapsulation is silicon rubber to protect against moisture, dirt, oil and corona. Remains flexible from -45°C to +200°C. Insulation level 600 Vac and can be used over insulated conductors at higher voltages. Frequency: 50-60 Hz. Safety Factor: An electronic voltage clamp holds secondary voltage to less than 1 Volt when open circuit voltage exceeds 40 Vac. Transformer is red and secondary leads are yellow with spade connectors.

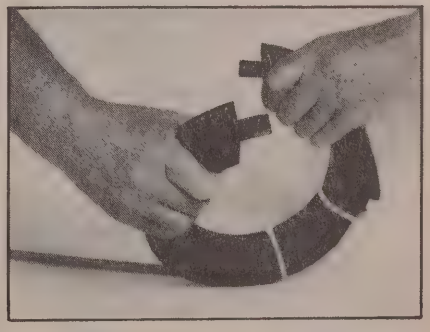
CIRCULAR **RECTANGULAR**

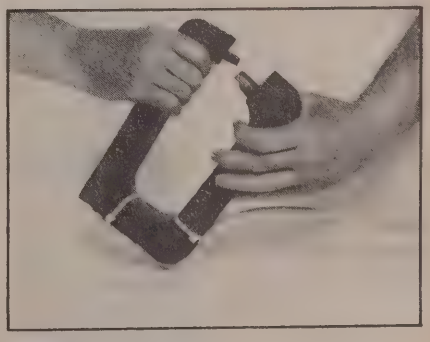


SPECIFICATIONS

Dimensions-Inches					
	4"I.D.	6"I.D.	8"I.D.	11"I.D.	Rectangular
"A"	4.00	6.00	8.00	11.00	2.75
"B"	1.25	1.25	1.25	1.25	6.63
"C"	1.50	1.50	1.50	1.50	5.50
"D"	6.50	8.50	10.50	13.50	1.50
"E"					
Average Weight-Lbs					
	3.50	4.25	5.50	7.50	4.25

Current Ratio	Circular 4"	6"	8"	11"	Rect 2.75x6.63	Burden VA	Accuracy	Thrml Factor
200/5	X					2	4%	1.25
250/5	X					2	4%	1.25
300/5	X	X				2	4%	1.25
400/5	X	X				2	3%	1.25
500/5	X	X			X	3	3%	1.25
600/5	X	X			X	3	2%	1.25
800/5	X	X			X	5	2%	1.50
1000/5	X	X	X		X	10	2%	2.00
1200/5	X	X	X		X	10	2%	2.00
1500/5	X	X	X		X	10	2%	2.00
2000/5	X	X	X	X	X	10	2%	2.00
2500/5		X	X	X	X	10	2%	2.00
3000/5		X	X	X	X	10	2%	1.50
3500/5		X	X	X	X	10	2%	1.50
4000/5		X	X	X	X	10	2%	1.25
5000/5		X	X	X	X	10	2%	1.25
6000/5		X	X	X	X	10	2%	1.25





Note:
Opens with a *twisting motion* only.

SI UNITS

RELATIVE QUANTITY SYMBOLS

$\neq$	not equal to
$\approx$	approximately equal to
$\propto$	proportional to
$<$	smaller than
$\leq$	smaller than or equal to
$\ll$	much smaller than
$>$	larger than
$\geq$	larger than or equal to
$\gg$	much larger than
$\equiv$	identical to or equivalent
$\uparrow$	increases
$\downarrow$	decreases

PREFIXES FOR SI UNITS

Multiple	Prefix	Symbol
10^{12}	tera	T
10^{9}	giga	G
10^{6}	mega	M
10^{3}	kilo	k
10^{-3}	milli	m
10^{-6}	micro	μ
10^{-9}	nano	n
10^{-12}	pico	p

Quantity	Symbol	SI Unit	Symbol	Derivation
acceleration	a	m s^{-2}	—	velocity/time
acceleration due to gravity	g	m s^{-2}	—	velocity/time
amount of substance	n	mole	mol	mole fraction (n) used
amplification factor	μ	*a ratio*	—	—
angle	$\theta_1, \varphi_1, \alpha_1$	—	—	—
angle of incidence	i	degree or radian	°	—
angle of refraction	r	degree or radian	°	—
angle, Bragg	θ	number	—	—
angle, critical	c	degree or radian	°	—
anode slope resistance	R_A	ohm	Ω	$\Delta V_a / \Delta I_a$
area	A	metres squared	m^2	$l \times b$
atomic number	Z	a number	—	number of protons
Avogadro constant	L, N_A	number	—	—
breadth	b	metre	m	fundamental unit
capacitance	C	farad	F	charge/p.d.
charge, electric	Q	coulomb	C	current × time
charge on electron	e	coulomb	C	$1{\cdot}6 \times 10^{-19}$ C
conductance	G	ohm^{-1}	Ω^{-1}	reciprocal of resistance
current, electric	I	ampere	A	fundamental unit
decay constant	λ	*a ratio*	—	—
density	ρ	kg m^{-3}	—	m/V
distance along path	s	metre	m	fundamental unit
efficiency	η	*a ratio*	—	work output/work input
electrochemical equiv.	z	g C^{-1}	—	mass/charge
electromotive force	E	volt	V	energy/charge
electron	e	—	—	—
energy	E	joule	J	N m
energy, kinetic	E_k	joule	J	N m. $E_k = 1/2mv^2$
energy, potential	E_p	joule	J	N m. $E_p = mgh$
Faraday constant	F	coulomb mol^{-1}	C mol^{-1}	96,500 C mol^{-1}
field strength, electric	E	V m^{-1}	—	potential gradient: p.d./dist.
field-strength magnetic	H	ampere-turns	—	current × no. of turns
flux, magnetic	Φ	weber	Wb	e.m.f/rate of change of flux
flux density	B	tesla	T	flux/area
focal length	f	metre	m	—
force	F	newton	N	kg m s^{-2}
free energy	ΔG	joule	J	—
frequency	f	hertz	Hz	oscillations/time
gas constant	r	joule	J	energy
half-life,radioactivity	$t_{1/2}$	second	s	fundamental unit
heat capacity	C	J K^{-1}	—	quantity of heat/temp. rise
heat of reaction	ΔH	joule	J	heat energy
heat capacity, specific	c	J K^{-1} kg^{-1}	—	heat capacity/mass
heat, quantity of	q	joule	J	energy

SI UNITS

Quantity	Symbol	SI Unit	Symbol	Derivation
height	h	metre	m	fundamental unit
image distance	υ	metre	m	fundamental unit
inductance, mutual	M	henry	H	induced e.m.f./rate of change of current
inductance, self	L	henry	H	—
intensity of radiation	I	*a number*	—	—
latent heat	L	joule	J	quantity of heat
latent heat, specific	l	J kg^{-1}	—	quantity of heat
latent heat, molar	L_m	joule mol^{-1}	J	quantity of heat
length	l	metre	m	fundamental unit
magnetizing force	H	ampere-turns	—	—
magnetic moment	m	Wb m	—	torque in unit magnetic field
magnification, linear	m	*a ratio*	—	—
mass	m	kilogramme	kg	fundamental unit
mass number	A	*a number*	—	number of neutrons + protons
molar volume	V_m	(dm^3)	—	volume of 1 mole
molar solution	M	*a ratio*	—	moles/dm^3
moment of force	—	N m	—	force × perp. distance
neutron number	N	*a number*	—	number of neutrons
number	n	—	—	—
number of molecules	N	—	—	—
number turns on coil	n	*a number*	—	—
number order spectrum	p	*a number*	—	—
object distance	u	metre	m	fundamental unit
peak current	I_o	ampere	A	see current
peak e.m.f.	E_o	volt	V	see e.m.f.
period	T	second	s	fundamental unit
permeability	μ	H m^{-1}	—	henry/metre
permeability, vacuum	μ_o	H m^{-1}	—	—
permeability, relative	μ_r	*a ratio*	—	$\mu = \frac{\mu}{\mu_o}$
permittivity	ε	F m^{-1}	—	farad/metre
permittivity, vacuum	ε_o	F m^{-1}	—	farad/metre
permittivity, relative	ε_r	*a ratio*	—	$\varepsilon_r = \frac{\varepsilon}{\varepsilon_o}$
potential, electric	V	volt	V	energy/charge
potential difference	V	volt	V	energy/charge
power	P	watt	W	J s^{-1}
pressure	p	pascal	Pa	N m^{-2}: force/area
radius	r	metre	m	fundamental unit
reactance	X	ohm	Ω	E_o/I_o
refractive index	n	*a ratio*	—	—
resistance	R	ohm	Ω	p.d./current
resistivity, electrical	ρ	ohm-metre	—	resistance × length
relative density	d	*a ratio*	—	ρ_{sub}/ρ_{water}
r.m.s. current	$I_{r.m.s}$	ampere	A	see current
r.m.s. voltage	$V_{r.m.s}$	volt	V	see e.m.f.
slit separation	s	metre	m	fundamental unit
tension	T	newton	N	see force
temperature, Celsius	θ	degree C	°C	from kelvin
temp. interval	θ	degree	° or K	—
temp. absolute	T	kelvin	K	fundamental unit
thickness	d	metre	m	fundamental unit
time	t	second	s	fundamental unit
torque	T	Nm	—	see moment
turns ratio	T	*a ratio*	—	n_{sec}/n_{prim}
(unit of electricity)	—	kW h	—	kilowatt × hour
velocity	u,υ	ms^{-1}	—	distance/time
velocity, angular	ω	$second^{-1}$	s^{-1}	angle/time
velocity, e.m.waves	c	m s^{-1}	—	—
velocity of sound	υ	m s^{-1}	—	—
volume	V	metre cubed	m^3	l × b × h
wavelength	λ	metre	m	fundamental unit
work	w	joule	J	force x distance (Nm)
weight	W	newton	N	kg m s^{-2}or mg

The control of electric current is only as good as the components that carry it.

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Specialist In Creating and Manufacturing Of Custom And Standard Inductor And Transformer Components...

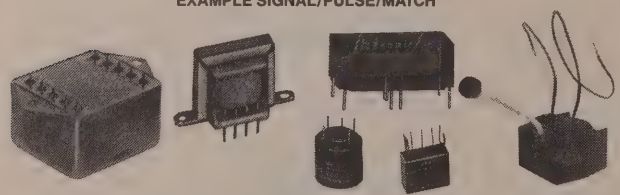
TRANSFORMERS

TRANSFORMERS: Hisonic's special power/converter and signal/matching transformers for both audio and wide video ranges are used in airborne comm/nav and ground communications systems. Included are toroidal, pot core, and laminated core types manufactured to commercial and MIL specifications. Our 30 year experience is at your disposal to help solve your transformer and inductor problems.

EXAMPLE DC CONV/AC POWER

P/N	Input	OP Freq.	VA Rating	Output Volts Peak (or RMS)	Size
24-0170-10	10V DC	24KHZ	0.8	20CT	.28x.6x48H
24-0193-10	14/28V DC	6KHZ	18	4.7.11.5CT.22.5CT.550	1.8 ODx.94H
06-2124-10	200V L-L	400HZ-3ϕ	840	200L-L	4.3x3.9x2.1H
24-0107-10	14/28V DC	2KHZ	27	90/45CT.180/25.180/25	2.1 ODx.88H
24-0512-10	260V PK	100PPS	20KVA PK	4.6 KV PK PULSE	2.5x2.3x1.1H
24-0114-10	14/28V DC	400HZ	75	26.60	2.9 ODx1.5H
24-0271-10	14/28V DC	5KHZ	80	6.5CT.22.5CT.100.100	2.0x2.0x1.0H
24-0277-10	42V DC	10KHZ	200	100	2.0x2.5x1.2H
24-0177-10	10V AC	400HZ	2	1.4.1.4.10(RMS)	1.9 ODx.86H
24-0169-10	26V AC	400HZ	17	21/13CT(RMS)	1.0x1.4x1.3H
24-0215-10	115V AC	400HZ	180	20.27.27.42(RMS)	3.2x3.8x4.1H

EXAMPLE SIGNAL/PULSE/MATCH



P/N	Description	Impedance	Response	Level	Size
24-0239-11	Video Range Match	150:150.25	100KHZ-2.5MHZ	60mw	.63x.63x.44H
24-0275-10	Wide Band Match	135CT:1000	1KHZ-2MHZ	4mw	1.1 ODx.75H
24-0659-10	Syncro/Resolver	800 OHMS	400HZ	270mw	1.5x.75x.56H
24-0240-10	Wide Bank Hybrid	600.600+600	50HZ-50KHZ	1mw	1.8x2.0x1.0H
24-0171-10	Radio Freq. Hybrid	50.100+100	700KHZ-4MHZ	10mw	75 ODx85H
24-0153-10	Pulse Match	10K.40K	tp 1.2ms.tr60us	25mw	.53x.53x.7H
24-0180-10	Pulse Output	5.600w/tap	tp.4us.tr.2us	6KW	1.5 ODx.8H
24-1108-03	Epoxy encapsulated	10,000 V pulse transformer			3.2 in³

INDUCTORS

INDUCTORS: Our manufacturing capabilities are the result of experience dating back to 1950 and now include virtually every known construction your special applications may require . . . and at reasonable prices.

EXAMPLE *CUSTOM INDUCTORS

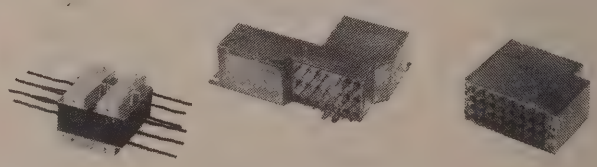
P/N	Fig.	Description	Characteristics	Type	Size
26-5103 Series	2	Encaps. PC Mtg.	See R Series Std.	Tor.	1.06x.5H
06-4000-27	1	DC Filter Choke	250uH@1.5ACD	Tor.	970Dx.4H
06-4000-39	3	Var. Ind. PC Mtg.	90-110 MH Q250	Pot	.80Dx.5H
26-5034 Series	4	Xtal Case Mtg.	See J Series Std.	Tor.	.34x.75x.8H
26-5135-00	5	Shielded Choke	50uH@100ADC	Lam.	2.65x5x3H

*Advise requirements for recommended solution and quotation

SPECIAL ASSEMBLIES

SPECIAL ASSEMBLIES: Today's equipment designs place extreme demands on component configurations. No challenge is too great for our engineers to tackle. If it can be built, Hisonic can build it.

EXAMPLE CUSTOM ASSEMBLIES



P/N	Description	Size
27-0049-00	Metal cased multiple transformer/inductor/capacitor network	7.8 lb³
24-1100-00	Encapsulated dual multi-winding inductor w/heat sink	18.9 m³
27-0053-00	Metal cased/4 inductor and 2 transformer assemblies	4.5 in³

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STANDARD TRANSFORMERS

DIT SERIES — Drive Isolation Transformers. (12-550KVA, U.L. Listed)

Designed to provide electrical isolation and voltage transformation for SCR adjustable-speed motor drives. Dry type. 600V class. Single phase and three phase. 50HZ and 60Hz. 5% FCAN and FCBN primary taps. Open frame or NEMA 1 enclosed, 150°C rise/220°C insulation class standard, 115°C or 80°C or 55°C rise/220°C insulation class optional.

Size Range (KVA)

Single Phase

• 1, 1½, 3, 5, 8, 12, 15, 20, 27, 30, 34

Three Phase

• 8, 12, 15, 20, 27, 34, 40, 51, 63, 75, 93, 120, 150, 180, 220, 280, 330, 440, 550, 660, 760, 870, 980, 1100.

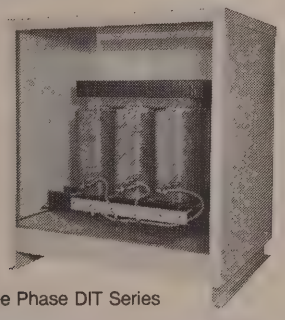
Standard Voltages Available

Single Phase

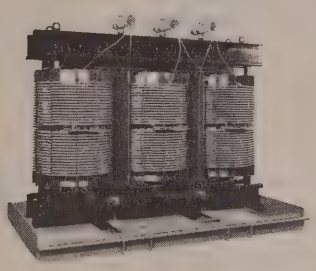
• Primary or Secondary 208, 230, 380, 460, 575, 230/460, 415

Three Phase

• Primary (△) 208, 230, 380, 460, 575, 230/460, 415
• Secondary 208Y/120, 230Y/133, 380Y/220, 460Y/266, 575Y/332, 230x460Y/133x266, 415Y/240



Three Phase DIT Series



HVDT 15KV Class Transformer

GPT SERIES—General Purpose Transformers (3-500KVA, UL Listed)

Designed to provide electrical isolation and voltage transformation for lighting, electric heating and industrial motor loads. Dry type, 600V class, single phase and three phase, 50Hz and 60Hz. FCAN and FCBN primary tap arrangements are standard. 150°C rise/220°C insulation class standard, 110°C or 85°C rise/220°C insulation class optional.

Size Range (KVA)

Single Phase

• 3, 5, 7½, 10, 15, 25, 37½, 50, 75, 100, 167

Three Phase

• 3, 6, 9, 15, 25, 30, 45, 50, 60, 75, 112½, 150, 225, 300, 400, 500, 750, 1000

Standard Voltages Available

Single Phase

• Primary (3KVA-15KVA) 240/480, 208, 277, 480, 600
(25KVA-167KVA) 240x480, 600
• Secondary (All KVA sizes) 120/240

Three Phase

• Primary (Δ) 240, 480, 600
• Secondary 208Y/120, 240Δ, 480Y/277

HVDT SERIES—High Voltage Distribution Transformers

Designed for in-plant distribution and voltage step-down. Conventional dry type or resin cast coil. 5KV through 15KV class. Single phase and three phase. 50Hz and 60Hz. FCAN and FCBN primary tap arrangements are standard. 150°C rise/220°C insulation class standard, 110°C or 85°C or 55°C rise/220°C insulation class optional.

Size Range (KVA)

Single Phase

• 3, 5, 10, 15, 25, 37½, 50, 75, 100, 167, 200, 250, 333, 500

Three Phase

• 15, 30, 45, 75, 112½, 150, 225, 300, 400, 500, 750, 1000

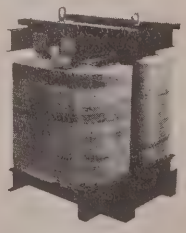
Standard Voltages Available

Single Phase

• Primary
5KV Class: 2400/4160Y
8.66KV Class: 4160/7200Y
15KV Class: 7200/12470Y
7620/13200Y, 7960/13800Y
• Secondary (All KVA Sizes)
120/240

Three Phase

• Primary (△)
5KV Class: 2400, 4160, 4800
8.66KV Class: 7200
15 KV Class: 12000, 12470, 13200, 13800
• Secondary
208Y/120, 240△, 480Y/277



DC Link Choke
4 mH at 1000 Adc
5 KV Class

SPECIALTY MAGNETIC COMPONENTS

Transformers

• Convection, forced air or water cooled.
• Dry type, liquid filled, cast-resin.
• Low voltage, high voltage to 300KV.
• High current to 20,000 Amperes.
• High frequency to 10KHz.
• Low temperature rise, high efficiency.
• Ferroresonant transformers - conventional constant voltage and harmonic-neutralized.
• Computer grade isolation transformers to 0.001 picofarads.
• Low capacitance transformers, electrostatic shielded.
• High reactance transformers - short circuit current limited.
• Modulation (Output) transformers to 50KW.
• Rectifier and filament transformers.

Inductors

LC Series - Link Chokes (DC)

Designed for use as a smoothing inductor in the DC link between rectifier and inverter in variable-speed AC motor drives from 15 to 1000 HP. Dry type, 600V class.

LR Series - Line Reactors (AC)

Designed for use as a line reactor in the three phase input lines supplying variable-speed AC motor drives from 15 to 1000 HP. Dry type, 600V class; three phase; 50Hz and 60Hz.
Other specialty inductors include:
• AC, DC.
• Iron-core, air-core.
• Linear, swinging.
• AC current limiting reactors.
• AC power factor correction reactors.
• DC filter chokes.
• AM modulation reactors.

Saturable Reactors:

Low voltage, High voltage to 15 KV. Sizes to 1000 KVA.

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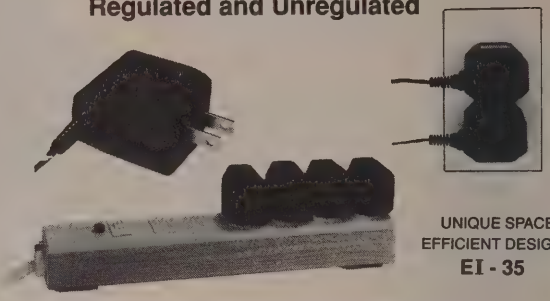
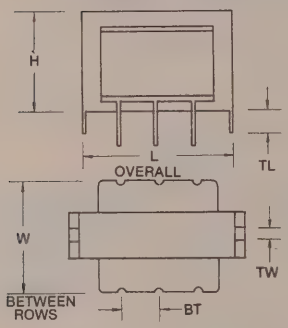
Case Sizes EI - 28 to EI - 76

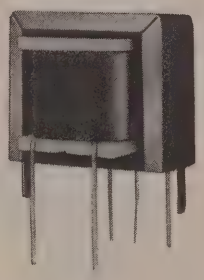
Regulated and Unregulated



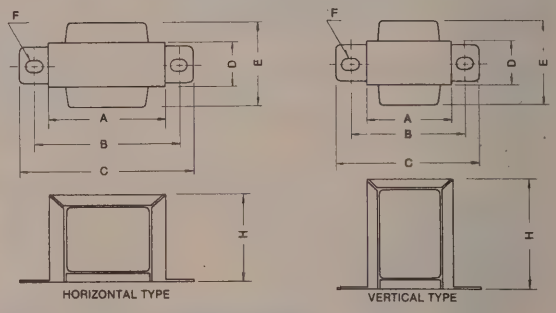
UNIQUE SPACE EFFICIENT DESIGN
EI - 35

AUDIO/COMMUNICATIONS TELEPHONE TRANSFORMERS





POWER TRANSFORMERS



DIMENSIONS: M/M HORIZONTAL TYPE / VERTICAL TYPE

Type	Part No.	Description	Impedance Pri	Impedance Sec	Resistance Pri	Resistance Sec	Dimension
EI-14 Series .075 Watts Max.	AT-141	Output	500C.T.	8	35	.8	L =15.2mm(.599) H =11.0mm(.433) W =12.0mm(.473) TW= 2.0mm(.079) TL = 3.8mm(.150) BT = 2.5mm(.098) All Dimensions Nom
	AT-142	Coupling	600C.T.	600C.T.	45	40	
	AT-143	Output	1KC.T.	8	60	.8	
	AT-144	Coupling	10KC.T.	600C.T.	450	100	
	AT-145	Driver	10KC.T.	2KC.T.	500	200	
EI-16 Series .100 Watts Max.	AT-161	Output	500C.T.	8	22	.8	L =17.7mm(.697) H =14.0mm(.551) W =16.0mm(.630) TW= 2.2mm(.086) TL = 4.0mm(.157) BT = 2.8mm(.110) All Dimensions Nom
	AT-162	Interstage	500C.T.	500C.T.	30	28	
	AT-163	Output	1.2KC.T.	8	80	.8	
	AT-164	Output	48C.T.	8	2.5	.5	
	AT-165	Output	200C.T.	8	12	.8	
EI-19 Series .200 Watts Max.	AT-191	Output	200C.T.	8	12	.8	L =20.3mm(.800) H =16.2mm(.640) W =14.5mm(.571) TW= 2.2mm(.086) TL = 4.2mm(.165) BT =3.0mm(.118) All Dimensions Nom
	AT-192	Output	500C.T.	8	26	.8	
	AT-193	Coupling	600C.T.	600C.T.	65	55	
	AT-194	Output	800C.T.	8	40	.8	
	AT-195	Output	1.2KC.T.	8	80	.8	
	AT-196	Interstage	1.5KC.T.	500C.T.	120	50	
	AT-197	Coupling	10KC.T.	600C.T.	600	100	
	AT-198	Driver	10KC.T.	2KC.T.	600	155	
EI-24 Series .460 Watts Max.	AT-241	Output	48C.T.	8	2.5	.5	L =25.3mm(.100) H =18.4mm(.725) W =16.0mm(.630) TW= 2.6mm(.102) TL = 4.8mm(.189) BT = 4.5mm(.177) All Dimensions Nom
	AT-242	Output	120C.T.	8	7.0	.7	
	AT-243	Output	200C.T.	8	12.0	.5	
	AT-244	Output	500C.T.	8	180	.7	
	AT-245	Interstage	500C.T.	500C.T.	35	28	
	AT-246	Driver	10KC.T.	2KC.T.	600	155	
	AT-247	Output	1.2KC.T.	8	75	.8	
	AT-248	Coupling	600C.T.	600C.T.	65	55	

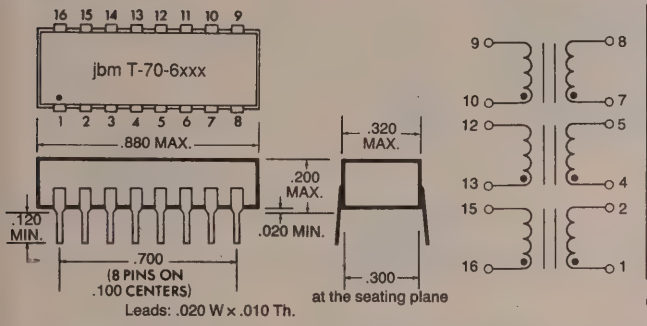
• Welcome Offer Original Sample and Diagram

SEE OUR PAGES IN SECTIONS 2100, 1300, 4750 & 6000

Metric Size Output (VA)	Input	A	B	C	D	E	F	H
EI-28 (1)	120	29.5	37.5	49.5	9-15	25-34	3.5 x 5.8	28
		27	35	47				31
EI-35 (2)	120	36.5	45	56.5	10-17	31-40	3.5 x 5.8	32.5
		31.5	41	53				38
EI-41 (4.5)	120	42.5	52	61	14-24	32-43	3.5 x 5.8	37
		35	45	57				44
EI-48 (7)	120	50.5	60	69.5	17-25	37-46	3.5 x 5.8	43.5
		42	52	64				51
EI-54 (13)	120	56	67	78	20-26	44-56	4.2 x 6.5	49
		48	59	70				56
EI-57 (18)	120	59	70	80	20-26	44-56	4.2 x 6.5	51
		49.5	61	75				60
EI-60 (25)	120	62	75	89	21-33	45-2	4.2 x 6.5	54
		52	66	78				63
EI-66 (40)	120	68.5	81	92	23-41	53-70	4.2 x 6.5	59
		57.5	74	84				69
EI-76 (75)	120	79	90	100	31-41	60	5 x 7	65
		67	78	89				78
EI-86 (110)	120	87.5	105	107	31-41	67	5 x 7	74
		75	86	97				89
EI-96 (300)	120	98	109	120	40-60	77	5 x 7	84
		85	96	107				98

Pulse Transformers

Type T-70 ETHERNET LAN APPLICATIONS



ELECTRICAL SPECIFICATIONS (measured @ 25 C)

JBM Part Number 16 PIN	OCL µH ±20%	ET-Constant V-µS Min	Rise Time nS Max	CW pF Max	LE µH Max	DCR Ω Max
T-70-601	25	2.0	3.0	5	0.15	0.15
T-70-602	30	2.0	3.0	5	0.15	0.15
T-70-603	35	2.2	3.0	6	0.15	0.20
T-70-604	50	2.2	3.0	7	0.20	0.20
T-70-605	75	2.5	3.0	8	0.20	0.25
T-70-606	100	2.5	3.0	9	0.25	0.30
T-70-607	125	3.0	3.0	10	0.25	0.30
T-70-608	150	3.0	3.0	11	0.25	0.40
T-70-609	175	3.5	3.5	12	0.25	0.50
T-70-610	200	3.5	3.5	13	0.30	0.50
T-70-611	250	3.5	3.5	14	0.30	0.50

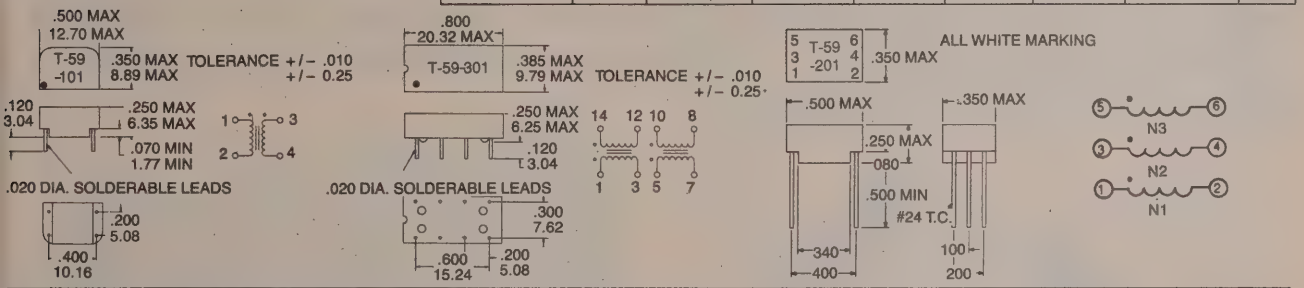
OCL is the pulse inductance measured with a pulse voltage of 1.0V, pulse width .4µSEC and PRR of 1 MHZ.

TYPE T-59 STARLAN APPLICATIONS

- IEEE 802.3 compatible
- All parts comply with safety requirements for LAN
- Custom design available

TABLE OF ELECTRICAL SPECIFICATIONS @ 25°C

JBM Model #	Turns Ratio (±5%)	Pulse Inductance (±20%)	ET Constant (V-µs min.)	Rise Time (ns max.)	Pri/Sec CW/W (pf max.)	Pri-Sec LL (µh max.)	Primary DCR (ohms max.)	HYPOT (Vrms)
SING T-59-101	1:1	2.5 mh	25	50	35	6.0	1.0	1000
DOUB T-59-301	1:1	2.5 mh	25	50	40	6.0	1.0	2000
T-59-201	1:1:1	500 µh	8.5	5.3	32	0.4	1.3	2000



TYPE T-90 TOKEN RING APPLICATIONS

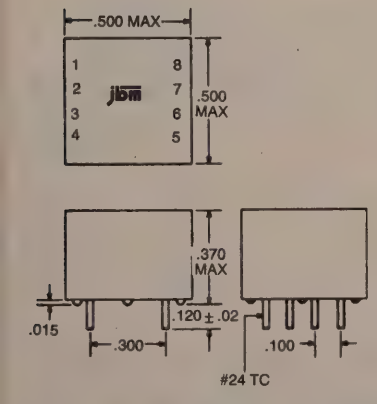
- 802.5 Token ring compatible
- Single and dual package
- Meets all international safety standards
- Designed for T1 token ring applications

RATINGS: ALL TRANSFORMERS

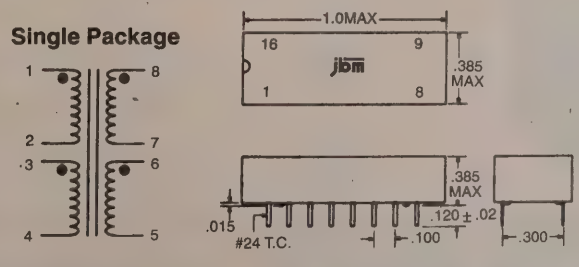
Turns Ratio	Insertion Loss	CMRR	Return Loss	Rise Time	HYPOT
1:1:2:2	0.50 dB Max.	– 60 dB Min.	20 dB Min.	15 ns Max.	1000V-RMS

TABLE OF ELECTRICAL SPECIFICATIONS @ 25°C

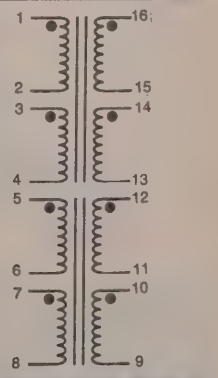
JBM Model	Primary OCL (µh typ)	Primary LL (µh max.)	Pri-Sec CW/W (pf max.)	DCR Pri (ohms max.)	DCR Sec (ohms max.)
SINGLE T-90-301	500	0.25	10	0.40	0.80
DUAL T-90-601	500	0.25	10	0.40	0.80



Single Package



Dual Package



JBM Electronics, Inc. • 1 Commerce Drive • Bedford, NH 03110
603-623-0222 • Fax: 603-623-0446

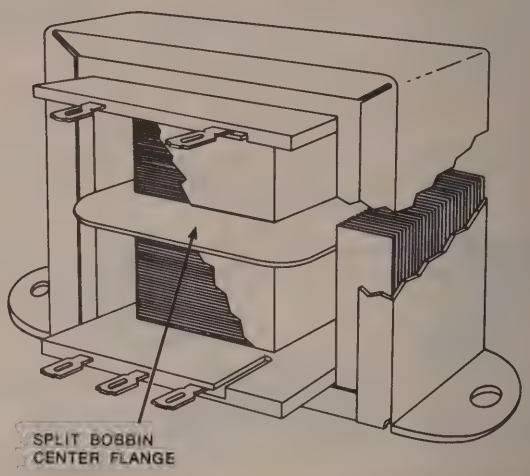
Split Bobbin Power Transformers & Split Bobbin Isolation Transformers

JM transformer
YOUR PRIMARY SOURCE

- 50/60 Hz
- Power Ratings to 1800 VA
- Single, Dual, and Tapped Primaries
- Single and Multiple Outputs
- Terminals for Quick-Connect or Soldering
- Flexible Leads also Available
- Available enclosed with Steel Covers

- Non-Concentric Winding — Lower Capacitance — Better Insulation — **2500-4000** VRMS Hipot — No Need for Electro-static Shield
- **LOW LEAKAGE**
- We design to meet UL, CSA, VDE, IEC, and TUV Standards.

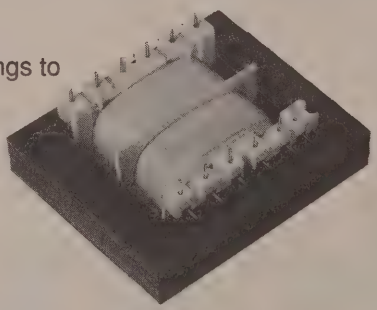
WE SPECIALIZE IN POWER TRANSFORMERS AND ISOLATION TRANSFORMERS FOR MEDICAL ELECTRONICS (PATIENT ATTACHED EQUIPMENT) FOR DOMESTIC AND FOREIGN APPLICATIONS.



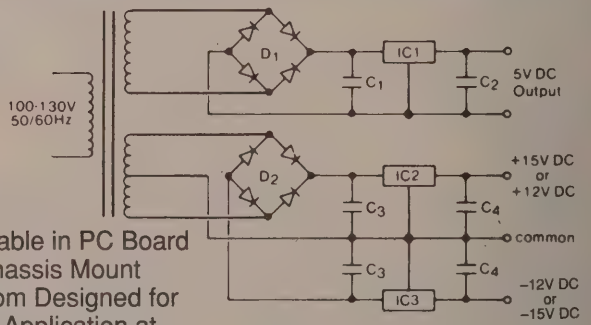
CUSTOM PROTOTYPES AVAILABLE WITHIN ONE WEEK

Split Bobbin and Low Profile Split Bobbin PC Board Transformers

- 50/60 Hz
- Power Ratings to 48 VA



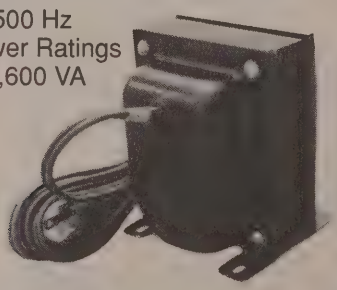
Transformers for Triple Output (Microprocessor) Applications



- Available in PC Board or Chassis Mount
- Custom Designed for Your Application at NO Extra Cost

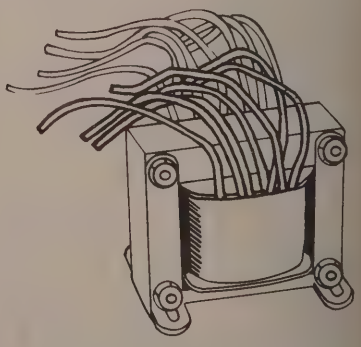
Auto-transformers

- 50/500 Hz
- Power Ratings to 3,600 VA



Rectifier Power Transformers with Flexible Leads

- 50/500 Hz
- Power Ratings up to 1800 VA
- Wide Range of Voltages
- Single, Dual, and Tapped Primaries
- Single and Multiple Outputs
- Available Enclosed in Steel Covers



WE DESIGN TO MEET UL, CSA, VDE, IEC, & TUV STANDARDS

See the Following Pages for Our Standard Split Bobbin Power, Isolation and PC Board Transformers and Toroidal Transformers

J M Transformer Co., Inc.

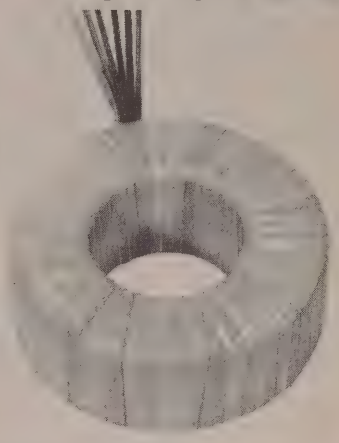
112 FLORIDA STREET, FARMINGDALE, NY 11735 • (516) 293-0475 • FAX: (516) 293-3923

JM transformer
YOUR PRIMARY SOURCE

Toroids

- Low Magnetic Strayfield
- High Efficiency
- Light Weight and Small
- Quiet
- Easy Mounting
  (Optional mtg. washer with
  2 neoprene pads available)
- Low Profile Designs Are Readily Available

CUSTOM PROTOTYPES AVAILABLE WITHIN ONE WEEK

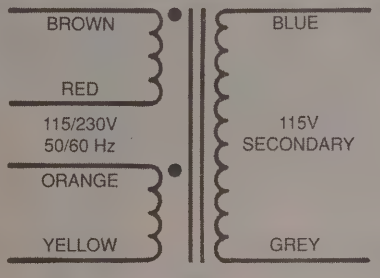


TOROIDAL ISOLATION TRANSFORMERS

- Low Leakage
- 4,000 VRMS Hipot
- Insulated With Extra Care
  And Extra Insulating Material

WE SPECIALIZE IN POWER TRANSFORMERS AND ISOLATION TRANSFORMERS FOR MEDICAL ELECTRONICS (PATIENT ATTACHED EQUIPMENT) FOR DOMESTIC AND FOREIGN APPLICATIONS

STANDARD TRANSFORMERS



Part Number	OD	HT	Approx. Lbs.	Secondary RMS Rating
Ti-1.9	5.4"	1.9"	4.9	115V @ 1.9A
Ti-2.5	5.4"	2.2"	5.8	115V @ 2.5A
Ti-3.6	5.4"	2.9"	8.3	115V @ 3.6A
Ti-4.7	5.9"	2.9"	10.5	115V @ 4.7A
Ti-8.7	7.8"	2.7"	16.0	115V @ 8.7A

TOROIDAL POWER TRANSFORMERS

ideal for use in rectifier circuits

Toroids are ideally suited for Custom Designs at **NO EXTRA COST**; your requirements for power transformers are likely to vary mechanically and or electrically. Consequently we do not feature standard toroidal power transformers.

Size	OD	HT	Approx. Lbs.	Typical power 60 Hz	Typical Power 50/60Hz
250	5.4"	1.9"	4.9	300 VA	250 VA
325	5.4"	2.2"	5.8	390 VA	325 VA
475	5.4"	2.9"	8.3	570 VA	475 VA
600	5.9"	2.9"	10.5	720 VA	600 VA
1,000	7.8"	2.7"	16.0	1,200 VA	1,000 VA

MANY OTHER SIZES ARE AVAILABLE.

Phone or send your requirements for immediate response.

J M Transformer Co., Inc. 112 FLORIDA STREET, FARMINGDALE, NY 11735 • (516) 293-0475 • FAX: (516) 293-3923

Split Bobbin Transformers

JM transformer
YOUR PRIMARY SOURCE

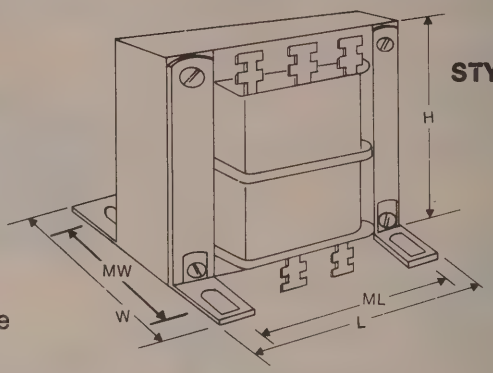
The use of a Split Bobbin allows winding to be nonconcentric (side-by-side), consequently high isolation is achieved at low cost.

- Better insulation — 2500 VRMS hipot is standard.
- Lower capacitance — no need for electro-static shield.
- Low Leakage

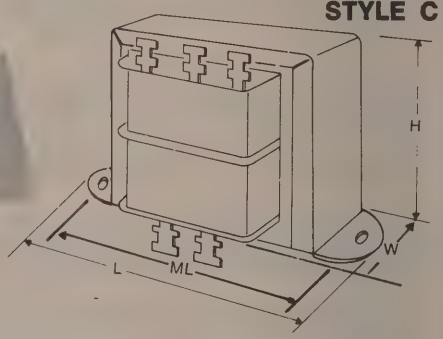
Also available:

- **Units with 4000 VRMS hipot**
- Steel covers
- **Flexible leads**
- Multiple outputs
- Tapped primaries
- Quick disconnect terminals
- Consult factory for any other configurations you may require
- **High voltage transformers**
- **We Design to Meet UL, CSA, VDE, IEC, & TUV Standards.**

STYLE B



STYLE C



WE SPECIALIZE IN POWER TRANSFORMERS AND ISOLATION TRANSFORMERS FOR MEDICAL ELECTRONICS (PATIENT ATTACHED EQUIPMENT) FOR DOMESTIC AND FOREIGN APPLICATIONS

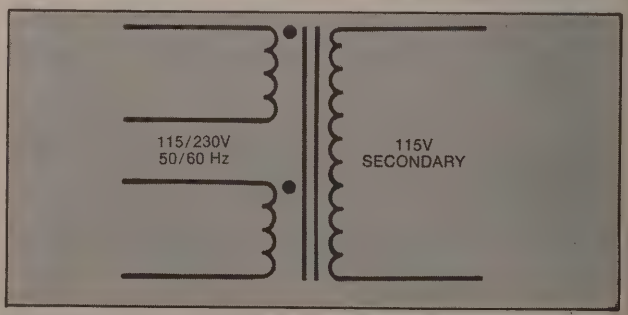
CUSTOM PROTOTYPES AVAILABLE WITHIN ONE WEEK. CHECK OUR LOW PRICES.

Size	Mounting Style	L	W	H	ML	MW	Approx. Lbs.	Typical Power
40	C	3 11/16	1 31/32	2 1/4	3 1/8	—	1 1/2	40VA
50	C	3 11/16	2 1/16	2 1/4	3 1/8	—	1 3/4	50VA
75	C	4 1/32	2 7/32	2 9/16	3 9/16	—	2	75VA
100	C	4 1/32	2 15/32	2 9/16	3 9/16	—	2 3/4	100VA
120	C	4 1/2	2 15/32	2 7/8	4	—	3	120VA
150	B	3 3/4	2 13/16	3 1/8	3 1/8	2 1/4	4	150VA
200	B	4 1/8	3	3 7/16	3 7/16	2 3/8	5 1/2	200VA
300	B	4 1/2	3 1/4	3 3/4	3 3/4	2 1/2	7	300VA
500	B	4 1/2	4 1/4	3 3/4	3 3/4	3 1/2	11	500VA
750	B	5 1/4	4 1/2	4 3/8	4 3/8	3 5/8	16	750VA
1000	B	6 3/8	4 5/8	5 5/16	5 5/16	3 1/4	20	1000VA
1800	B	7 1/2	5 3/8	6 1/4	6 3/4	3 5/8	32	1800VA

Split Bobbin Power Isolation Transformers

Recognized Component
UL 544

Part Number	Size	Secondary RMS Rating
I-.8	100	115V @ .8A
I-1	120	115V @ 1A
I-1.3	150	115V @ 1.3A
I-1.7	200	115V @ 1.7A
I-2.6	300	115V @ 2.6A
I-4.3	500	115V @ 4.3A
I-6.5	750	115V @ 6.5A
I-9	1000	115V @ 9A
I-15	1800	115V @ 15A



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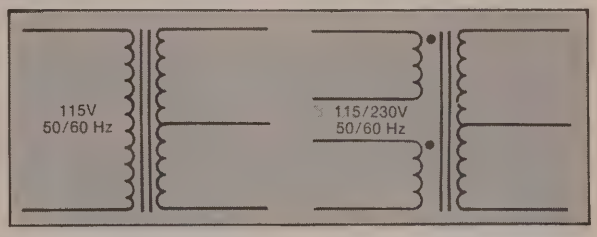
JM transformer
YOUR PRIMARY SOURCE

Split Bobbin Power Transformers



Ideal for use in rectifier circuits

Add Prefix D to Part Numbers below if Dual Primary is Required

Please note that the sizes shown on this page refer to the chart on the facing page

Part Number	Secondary RMS Rating	Size
10T-4	10VCT @ 4A	40
10T-5	10VCT @ 5A	50
10T-7.5	10VCT @ 7.5A	75
10-10*	10V @ 10A	100
10-12*	10V @ 12A	120
10-15*	10V @ 15A	150
12T-3.2	12.6VCT @ 3.2A	40
12T-4	12.6VCT @ 4A	50
12T-6	12.6VCT @ 6A	75
12T-8	12.6VCT @ 8A	100
12-10*	12.6V @ 10A	120
12-12*	12.6V @ 12A	150
16T-2.5	16VCT @ 2.5A	40
16T-3.2	16VCT @ 3.2A	50
16T-4.5	16VCT @ 4.5A	75
16T-6	16VCT @ 6A	100
16T-8	16VCT @ 8A	120
16-10*	16V @ 10A	150
16-12*	16V @ 12A	200
20T-2	20VCT @ 2A	40
20T-2.5	20VCT @ 2.5A	50
20T-3.8	20VCT @ 3.8A	75
20T-5	20VCT @ 5A	100
20T-6	20VCT @ 6A	120
24T-1.7	24VCT @ 1.7A	40
24T-2	24VCT @ 2A	50
24T-3.2	24VCT @ 3.2A	75
24T-4	24VCT @ 4A	100
24T-5	24VCT @ 5A	120
24T-6	24VCT @ 6A	150
24T-8	24VCT @ 8A	200
24-12*	24V @ 12A	300
28T-1.4	28VCT @ 1.4A	40
28T-1.8	28VCT @ 1.8A	50
28T-2.6	28VCT @ 2.6A	75
28T-3.5	28VCT @ 3.5A	100

Part Number	Secondary RMS Rating	Size
28T-4.2	28VCT @ 4.2A	120
28T-5.4	28VCT @ 5.4A	150
28T-7	28VCT @ 7A	200
28-10*	28V @ 10A	300
32T-1.2	32VCT @ 1.2A	40
32T-1.5	32VCT @ 1.5A	50
32T-2.4	32VCT @ 2.4A	75
32T-3	32VCT @ 3A	100
32T-3.8	32VCT @ 3.8A	120
32T-4.5	32VCT @ 4.5A	150
32T-6	32VCT @ 6A	200
36T-1	36VCT @ 1A	40
36T-1.4	36VCT @ 1.4A	50
36T-2	36VCT @ 2A	75
36T-2.8	36VCT @ 2.8A	100
36T-3.3	36VCT @ 3.3A	120
36T-4	36VCT @ 4A	150
36T-5.5	36VCT @ 5.5A	200
36T-8	36VCT @ 8A	300
36-12*	36V @ 12A	500
40T-1	40VCT @ 1A	40
40T-1.2	40VCT @ 1.2A	50
40T-1.8	40VCT @ 1.8A	75
40T-2.5	40VCT @ 2.5A	100
40T-3	40VCT @ 3A	120
40T-3.8	40VCT @ 3.8A	150
40T-5	40VCT @ 5A	200
40T-7.5	40VCT @ 7.5A	300
48T-.8	48VCT @ .8A	40
48T-1	48VCT @ 1A	50
48T-1.5	48VCT @ 1.5A	75
48T-2	48VCT @ 2A	100
48T-2.5	48VCT @ 2.5A	120
48T-3	48VCT @ 3A	150
48T-4	48VCT @ 4A	200
48T-6	48VCT @ 6A	300

Part Number	Secondary RMS Rating	Size
56T-.7	56VCT @ .7A	40
56T-.9	56VCT @ .9A	50
56T-1.3	56VCT @ 1.3A	75
56T-1.7	56VCT @ 1.7A	100
56T-2.1	56VCT @ 2.1A	120
56T-2.7	56VCT @ 2.7A	150
56T-3.6	56VCT @ 3.6A	200
56T-5.4	56VCT @ 5.4A	300
56-8*	56V @ 8A	500
56-13*	56V @ 13A	750
68T-.6	68VCT @ .6A	40
68T-.7	68VCT @ .7A	50
68T-1.1	68VCT @ 1.1A	75
68T-1.4	68VCT @ 1.4A	100
68T-1.8	68VCT @ 1.8A	120
68T-2.2	68VCT @ 2.2A	150
68T-2.9	68VCT @ 2.9A	200
68T-4.4	68VCT @ 4.4A	300
68-7*	68V @ 7A	500
68-11*	68V @ 11A	750
80T-.5	80VCT @ .5A	40
80T-.6	80VCT @ .6A	50
80T-.9	80VCT @ .9A	75
80T-1.2	80VCT @ 1.2A	100
80T-1.5	80VCT @ 1.5A	120
80T-1.9	80VCT @ 1.9A	150
80T-2.5	80VCT @ 2.5A	200
80T-3.8	80VCT @ 3.8A	300
80T-6	80VCT @ 6A	500
80-9*	80V @ 9A	750
120T-.3	120VCT @ .3A	40
120T-.4	120VCT @ .4A	50
120T-.6	120VCT @ .6A	75
120T-.8	120VCT @ .8A	100

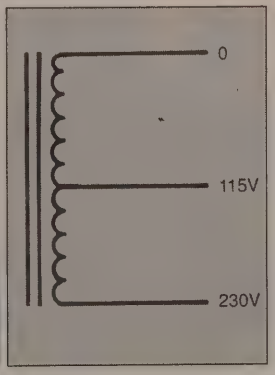
* These items do not have center-tapped secondaries

Autotransformers

230V/115V or 115V/230V 50/60Hz

Autotransformers with a 2:1 or 1:2 ratio are twice as powerful as isolation transformers of the same size.

Custom Prototypes Available Within 1 Week



Part Number	Power Rating	Size
A-80	80VA	40
A-100	100VA	50
A-150	150VA	75
A-200	200VA	100
A-240	240VA	120
A-300	300VA	150

Part Number	Power Rating	Size
A-400	400VA	200
A-600	600VA	300
A-1000	1000VA	500
A-1500	1500VA	750
A-2000	2000VA	1000
A-3600	3600VA	1800

112 FLORIDA STREET, FARMINGDALE, NY 11735 • (516) 293-0475 • FAX: (516) 293-3923 J M Transformer Co., Inc.

Split Bobbin PC Board Transformers

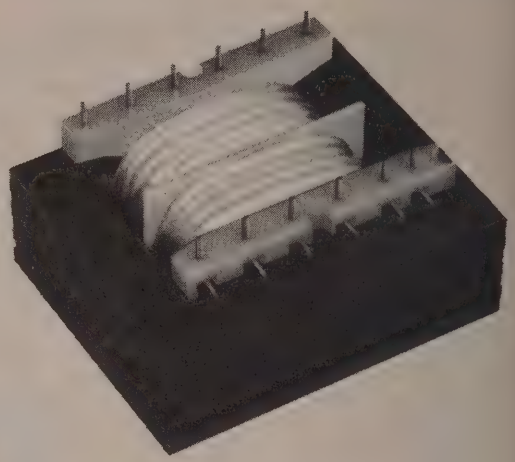
JM transformer
YOUR PRIMARY SOURCE

The use of a Split Bobbin allows winding to be nonconcentric (side-by-side), consequently high isolation is achieved at low cost.

- Better insulation — 2500 VRMS hipot is standard.
- Lower capacitance — no need for electro-static shield.

Please note that the standard items listed below utilize 6 or 8 pins, while 12 pins are available. We would like to quote your more complex requirements . . . you may save cost and space by combining two less complex Transformers into one.

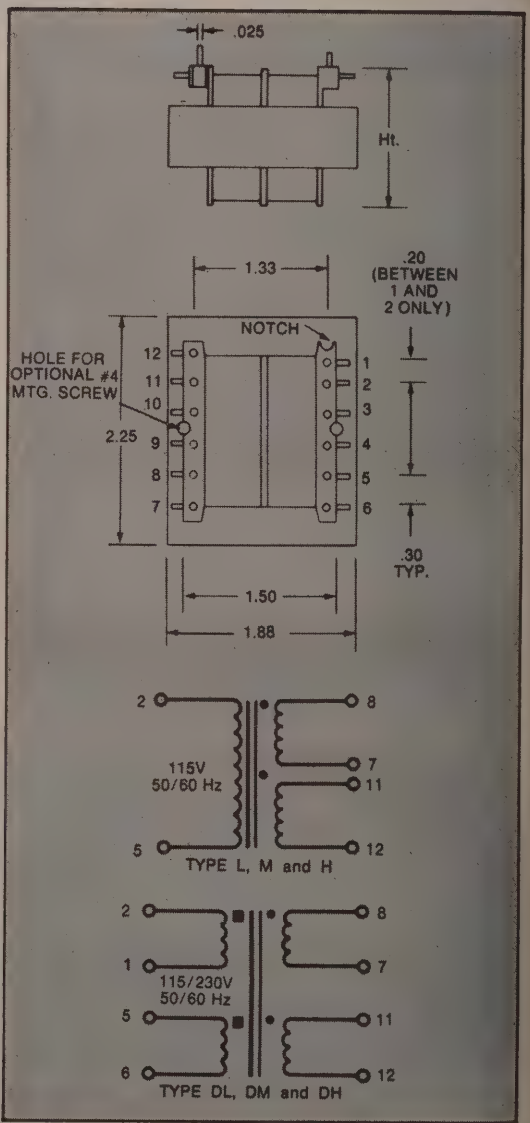
We would also be glad to quote your less complex requirements. For example, if only a Single Primary and Single Secondary are needed, you can save considerable cost by utilizing only 4 Pins.



CUSTOM PROTOTYPES AVAILABLE WITHIN ONE WEEK

STANDARD TRANSFORMERS

	Part Number		Secondary RMS Ratings			
	Single 115V Pri.	Dual 115/230V Pri.	Series	Parallel	Ht.	Approx. Lbs.
LOW PROFILE	L-10	DL-10	10VCT @ 2A	5V @ 4A	1.34	.75
	L-12	DL-12	12.6VCT @ 1.6A	6.3V @ 3.2A	1.34	.75
	L-16	DL-16	16VCT @ 1.25A	8V @ 2.5A	1.34	.75
	L-20	DL-20	20VCT @ 1A	10V @ 2A	1.34	.75
	L-24	DL-24	24VCT @ .8A	12V @ 1.6A	1.34	.75
	L-32	DL-32	32VCT @ .625A	16V @ 1.25A	1.34	.75
	L-40	DL-40	40VCT @ .5A	20V @ 1A	1.34	.75
	L-48	DL-48	48VCT @ .4A	24V @ .8A	1.34	.75
	L-80	DL-80	80VCT @ .25A	40V @ .5A	1.34	.75
	L-120	DL-120	120VCT @ .16A	60V @ .32A	1.34	.75
	M-10	DM-10	10VCT @ 2.4A	5V @ 4.8A	1.55	.9
	M-12	DM-12	12.6VCT @ 1.9A	6.3V @ 3.8A	1.55	.9
	M-16	DM-16	16VCT @ 1.5A	8V @ 3A	1.55	.9
	M-20	DM-20	20VCT @ 1.2A	10V @ 2.4A	1.55	.9
	M-24	DM-24	24VCT @ 1A	12V @ 2A	1.55	.9
	M-32	DM-32	32VCT @ .75A	16V @ 1.5A	1.55	.9
	M-40	DM-40	40VCT @ .6A	20V @ 1.2A	1.55	.9
	M-48	DM-48	48VCT @ .5A	24V @ 1A	1.55	.9
	M-80	DM-80	80VCT @ .3A	40V @ .6A	1.55	.9
	M-120	DM-120	120VCT @ .2A	60V @ .4A	1.55	.9
	H-10	DH-10	10VCT @ 3A	5V @ 6A	1.79	1.1
	H-12	DH-12	12.6VCT @ 2.4A	6.3V @ 4.8A	1.79	1.1
	H-16	DH-16	16VCT @ 1.8A	8V @ 3.6A	1.79	1.1
	H-20	DH-20	20VCT @ 1.5A	10V @ 3A	1.79	1.1
	H-24	DH-24	24VCT @ 1.25A	12V @ 2.5A	1.79	1.1
	H-32	DH-32	32VCT @ .95A	16V @ 1.9A	1.79	1.1
	H-40	DH-40	40VCT @ .75A	20V @ 1.5A	1.79	1.1
	H-48	DH-48	48VCT @ .625A	24V @ 1.25A	1.79	1.1
	H-80	DH-80	80VCT @ .375A	40V @ .75A	1.79	1.1
	H-120	DH-120	120VCT @ .25A	60V @ .5A	1.79	1.1



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JM transformer
YOUR PRIMARY SOURCE

Low Profile Split Bobbin PC Board Transformers

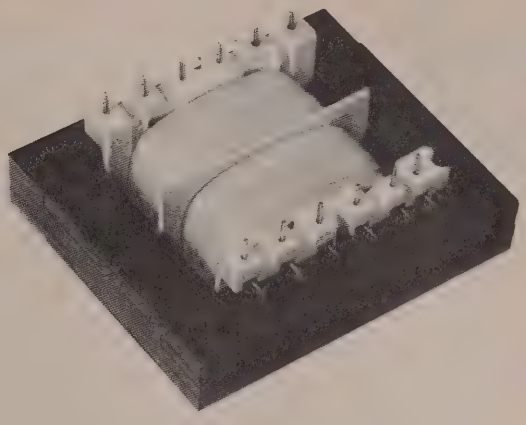
- **Only 1.13″ high**

XL Series transformers offer a particularly low profile for 18VA, allowing for 1.25″ card spacing.

The use of a split bobbin allows winding to be non-concentric (side-by-side), consequently high isolation is achieved at low cost.

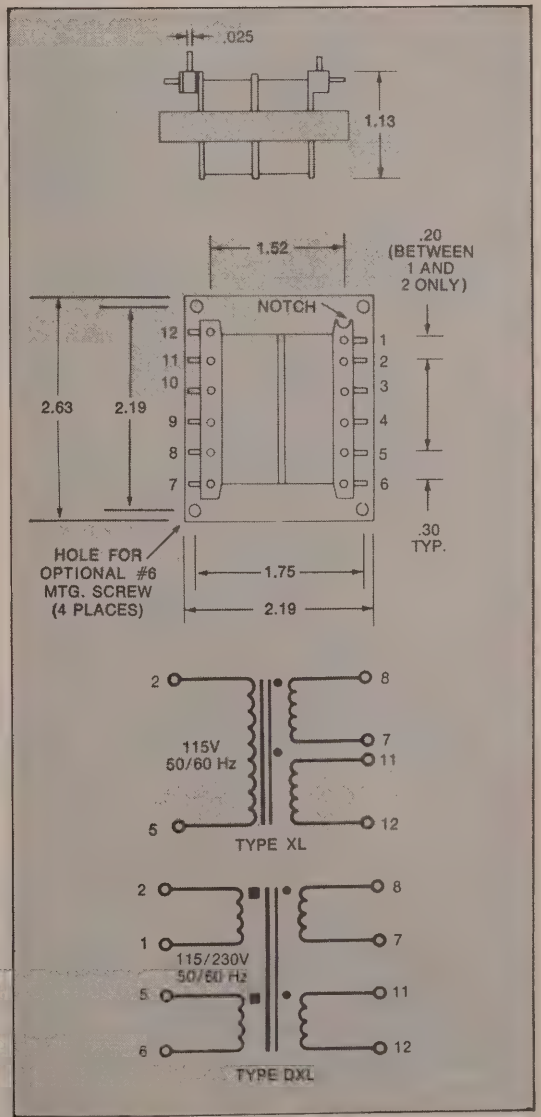
- Better Insulation — 2500 VRMS hipot is standard.
- Lower Capacitance — no need for electro-static shield.

If the standard items shown here do not fit your requirements, we would be glad to quote on your custom needs. Often this can save space and considerable cost.



STANDARD TRANSFORMERS

Part Number		Secondary RMS Ratings		Approx. Lbs.
Single 115V Pri.	Dual 115/230V Pri.	Series	Parallel	
XL-10	DXL-10	10VCT @ 1.6A	5V @ 3.2A	.7
XL-12	DXL-12	12.6VCT @ 1.25A	6.3V @ 2.5A	.7
XL-14	DXL-14	14VCT @ 1.28A	7V @ 2.56A	.7
XL-16	DXL-16	16VCT @ 1A	8V @ 2A	.7
XL-18	DXL-18	18VCT @ 1A	9V @ 2A	.7
XL-20	DXL-20	20VCT @ .8A	10V @ 1.6A	.7
XL-22	DXL-22	22VCT @ .8A	11V @ 1.6A	.7
XL-24	DXL-24	24VCT @ .68A	12V @ 1.36A	.7
XL-28	DXL-28	28VCT @ .64A	14V @ 1.28A	.7
XL-32	DXL-32	32VCT @ .5A	16V @ 1A	.7
XL-36	DXL-36	36VCT @ .5A	18V @ 1A	.7
XL-40	DXL-40	40VCT @ .4A	20V @ .8A	.7
XL-44	DXL-44	44VCT @ .4A	22V @ .8A	.7
XL-48	DXL-48	48VCT @ .34A	24V @ .68A	.7
XL-56	DXL-56	56VCT @ .32A	28V @ .64A	.7
XL-72	DXL-72	72VCT @ .25A	36V @ .5A	.7
XL-88	DXL-88	88VCT @ .2A	44V @ .4A	.7
XL-120	DXL-120	120VCT @ .134A	60V @ .268A	.7



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PRIME RAW MATERIALS

CUSTOM PROTOTYPES
AVAILABLE WITHIN ONE WEEK

SERVICE IS AN IMPORTANT
PART OF OUR PRODUCTS

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J M Transformer Co., Inc.

KAPPA® TECHNOLOGIES INC.

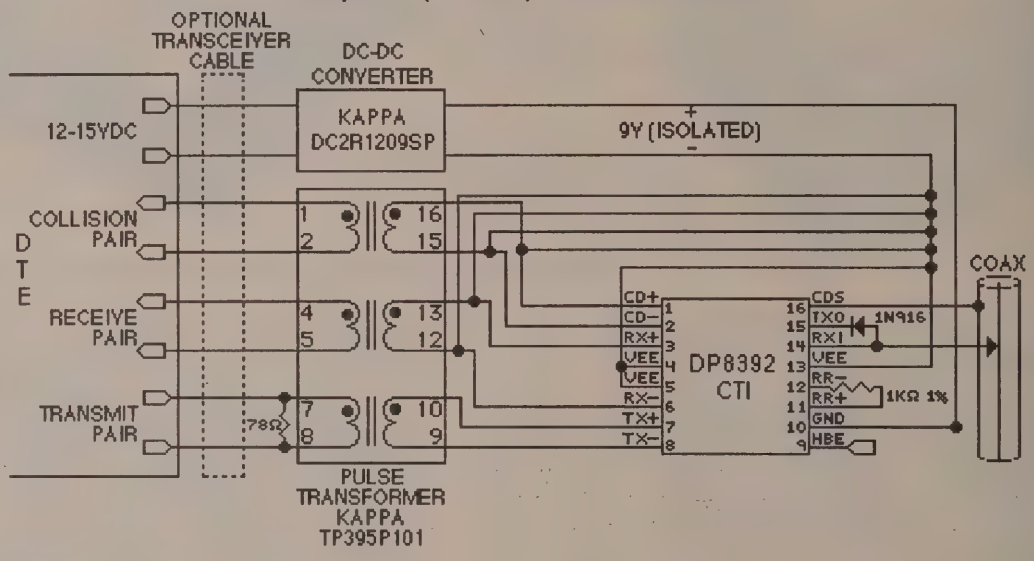
ETHERNET
Isolation Transformers

Features

- IEEE 802.3 compliant
- 16-pin DIP and SMD package options
- 2000Vrms isolation (500Vrms optional)
- SMD withstands all standard attachment processes

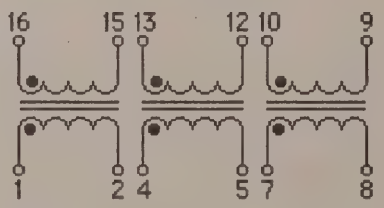
Typical Application

Cheapernet (10Base2) Transceiver or MAU

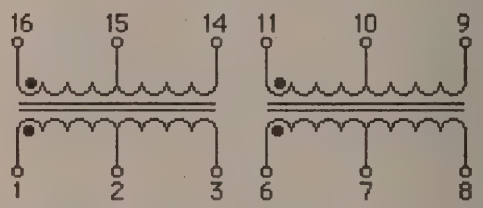


Schematic Diagrams

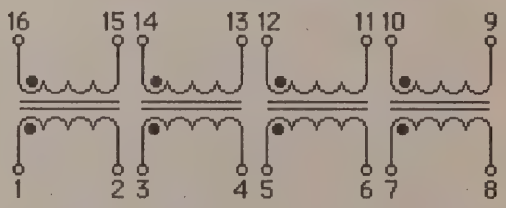
TP395 Series



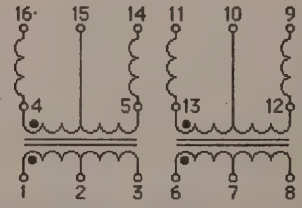
TP2031 and TP396 Series



TP497 Series



TP2032



Ratings

- Peak pulse voltage .....50V peak-to-peak
- Dissipation Rating.....75mW typical
- Avg Power Rating (40°C rise).....250mW typical
- Insertion loss[1], 1-10MHz .....0.5db maximum
- Return loss[1,2], 1-10MHz.....-20db typical
- Crosstalk[1], 1-10MHz .....-45db minimum
- Common mode Atten, 1-10MHz[1,3]...-50db minimum

Environmental Specifications

- Operating temperature range .....-0°C to +70°C
- Storage temperature range .....-40°C to +100°C
- Isolation[4], Pri-to-Sec.....>10GΩ @ 2KVrms
- Marking permanency[5] .....per Method 215
- Lead solderability[5] .....per Method 208

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KAPPA® TECHNOLOGIES INC.

ETHERNET
Isolation Transformers

Environmental Specifications

KAPPA[4,6] PART NUMBER	TURNS RATIO (±5%) XMT		RCV		OCL (µH) ±20%	ET CONSTANT (V-µS min)	T_R (ns max)	$C_{W/W}$ (pf max)	L_L (µH max)	DC RESISTANCE (Ω max)
	XMT	RCV	XMT	RCV						
TP2031(*)	1CT:√2CT		1CT:1CT		140 min	3.0	3.6	20.0	0.30	0.90
TP2032(*)	1CT:√2CT		1CT:1CT		140 min	3.0	3.6	20.0	0.30	0.90
TP395(*)350	1:1	1:1	1:1	- -	35	2.2	3.0	8.0	0.20	0.25
TP395(*)500	1:1	1:1	1:1	- -	50	2.2	3.0	9.0	0.20	0.25
TP395(*)750	1:1	1:1	1:1	- -	75	2.4	3.0	10.0	0.25	0.30
TP395(*)101	1:1	1:1	1:1	- -	100	2.5	3.5	10.0	0.35	0.30
TP395(*)125	1:1	1:1	1:1	- -	125	3.0	3.5	11.0	0.35	0.30
TP395(*)151	1:1	1:1	1:1	- -	150	3.0	3.5	12.0	0.35	0.30
TP395(*)201	1:1	1:1	1:1	- -	200	3.5	3.6	13.0	0.35	0.35
TP395(*)251	1:1	1:1	1:1	- -	250	3.5	3.7	15.0	0.35	0.40
TP395(*)301	1:1	1:1	1:1	- -	300	3.6	3.9	18.0	0.35	0.50
TP396(*)151	1CT:1CT		1CT:1CT		150	3.0	3.5	12.0	0.35	0.30
TP396(*)201	1CT:1CT		1CT:1CT		200	3.5	3.6	13.0	0.35	0.30
TP396(*)251	1CT:1CT		1CT:1CT		250	3.5	3.7	15.0	0.35	0.30
TP497(*)750	1:1	1:1	1:1	1:1	75	2.4	3.0	10.0	0.25	0.30
TP497(*)101	1:1	1:1	1:1	1:1	100	2.5	3.5	10.0	0.35	0.30
TP497(*)125	1:1	1:1	1:1	1:1	125	3.0	3.5	11.0	0.35	0.30
TP497(*)151	1:1	1:1	1:1	1:1	150	3.0	3.5	12.0	0.35	0.30

(*) Insert package code: "**D**" = SOIC Gull-wing SMD (0.050" pitch); "**G**" = Standard Gull-wing SMD (0.100" pitch); "**P**" = DIP

Notes to **Ratings** and **Electrical Specifications**:

[1] Insertion loss, Return loss and Crosstalk apply to TP2031 and TP2032 only, and Common mode attenuation to TP2032 only.

[2] Return loss is measured with R_G=100Ω and R_L=200Ω on "XMT" leg, and R_G=R_L=100Ω on "RCV" leg.

[3] Figures are for common-to-common mode attenuation. Common-to-differential mode attenuation will be -60db min.

[4] For 500V_{RMS} version, add suffix "A" to the part number.

[5] "Method" numbers refer to MIL-STD-202 test methods.

[6] **TP497** series is available only in "**G**" or "**P**" packages.

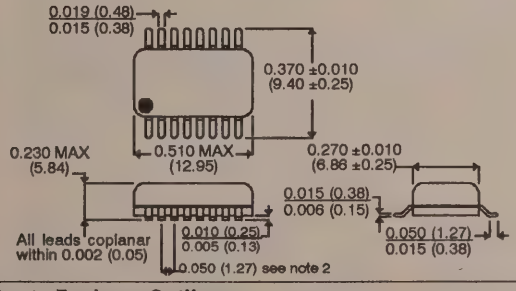
[7] Inductance is measured using the "open-circuit" method. OCL is measured @ 100KHz & 20mV_{rms}. $C_{W/W}$ and L_L is measured @ 1MHz & 20mV_{RMS}.

[8] High voltage isolation requirements per IEC 380.

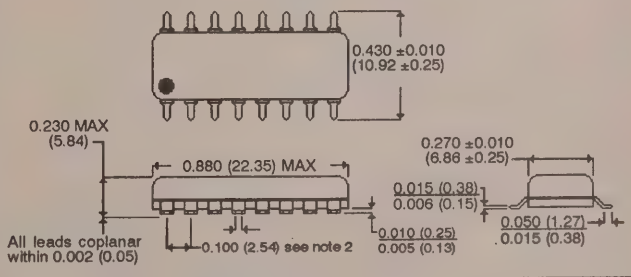
[9] Other package styles available upon special request.

Package Outlines

16-pin SOIC Gull-wing SMD (0.050" pitch)



16-pin Standard Gull-wing SMD (0.100" pitch)



Notes to **Package Outlines**:

[1] Dimensions shown are expressed in inches (mm).

[2] Lead spacing shall be measured within this zone.
a. Shoulder & lead tip dimensions are to centerline of leads.

[3] Tolerance non-cumulative.

[4] Lead material: Alloy 42, electrotin-plated per MIL-T-10727.

[5] Body material: Plastic (epoxy or Diallyl Phthalate).

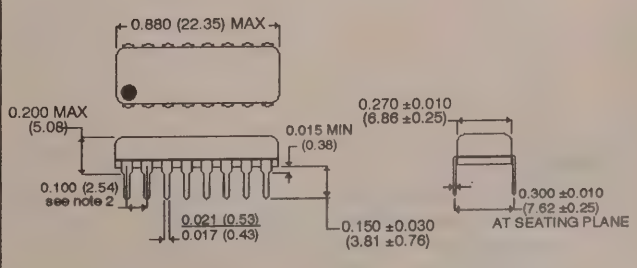
[6] Round recessed hole in bottom-left corner, or notch on left end, denote lead no. 1.

[7] Body dimensions do not include molding flash which shall not exceed 0.006 (0.15).

[8] Each lead is within ±0.010 (±0.25) radius of its true position at maximum material dimension.

[9] Unit marking shall include manufacturer's name, part number, date code and index mark.

16-pin Dual-In-Line



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KAPPA® TECHNOLOGIES INC.

Token Ring
Isolation Transformers

General Description

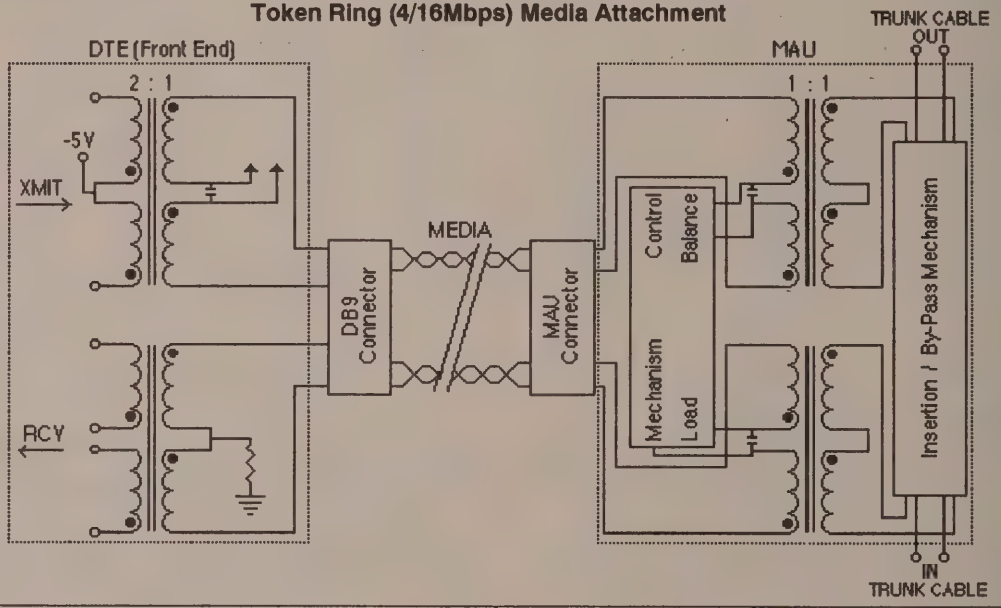
This Series of transformers is designed to meet the requirements of IEEE 802.5 standard for 4Mbps and 16Mbps Token Ring applications. The units provide both DC isolation as well as impedance-matching for DTE (2:1), MAU (1:1) or STP-to-UTP step-down applications, and are available in single (8-pin), dual (16- and 20-pin) DIL through-hole and SOIC surface mount packages.

Features

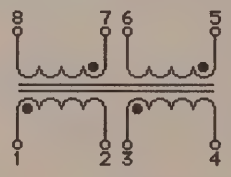
- IEEE 802.5 Compliant
- Low insertion loss (<-0.5db @ 10MHz)
- 4Mbps and 16Mbps data rates
- Both through-hole & surface mount package options

Typical Application

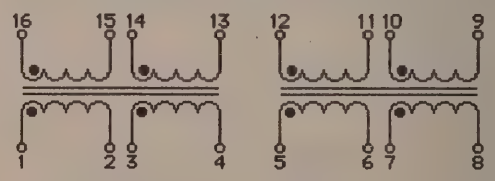
Token Ring (4/16Mbps) Media Attachment



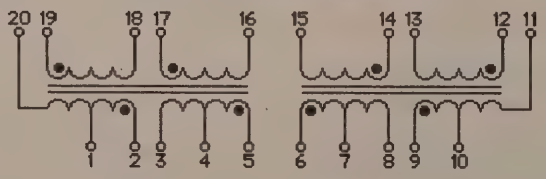
Single Transformer Units



Dual Transformer Units



TP293W225 Transformer



Ratings

- Insertion Loss @ 10MHz (@ 20MHz for TP293W225) .....-0.50db maximum
- Common-mode Attenuation @ 1MHz .....-60.0db minimum
- Return Loss @ 1MHz.....-20.0db minimum (see note 2)
- Crosstalk from 1-10MHz (dual units only) .....-43.0db minimum from section-to-section

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KAPPA® TECHNOLOGIES INC.

Token Ring
Isolation Transformers

Environmental Specifications

- Operating Temperature .....-0°C to +70°C
- Non-operating Temperature .....-40°C to +100°C
- Isolation (primary-to-secondary) ....500Vrms - 1 min.
- Insulation Resistance .....>10GΩ @ 500Vrms
- Marking Permanency.....per Method 215, MIL-STD-202
- Lead Solderability.....per Method 208, MIL-STD-202

Electrical Specifications @ +25°C

KAPPA PART NUMBER		OCL	TURNS RATIO	$C_{W/W}$	RISE TIME	L_L	DC RESISTANCE (Ω max)		APPLICATION
SINGLE	DUAL	(μH MIN)	(±5%)	(pf max)	(ns max)	(μH max)	PRI	SEC	
TP183(*)102	TP284(*)102	1000	1:1:2:2	15.0	15.0	0.40	0.40	0.80	4Mbps
TP186(*)251	TP287(*)251	250	1:1:2:2	15.0	15.0	0.15	0.50	0.80	16Mbps
TP187(*)751	TP288(*)751	750	1:1:1:1	25.0	5.0	0.20	1.00	1.00	16Mbps
TP191(*)750	TP291(*)750	75	1:1:2:2	14.0	3.0	0.30	0.50	0.80	16Mbps
TP192(*)101	TP292(*)101	100	1.22:1.22:1:1	10.0	3.0	0.20	0.30	0.30	16Mbps
N/A	TP293W225	225	1:4:10	15.0	5.0	0.30	0.40	0.80	16Mbps

(*) Insert package code: "**D**" = SOIC Gull-wing SMD (0.050" pitch); "**W**" = Wide-body Dual-In-Line

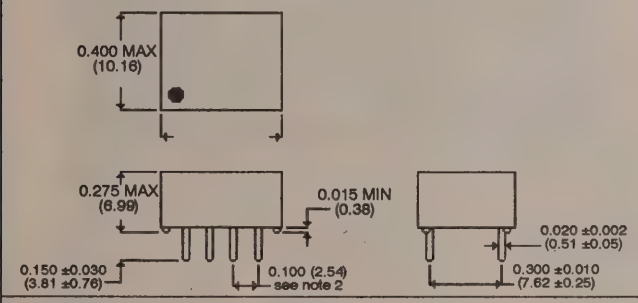
Notes to **Ratings** and **Electrical Specifications**:

[1] Inductance is measured using the "open-circuit" method. Primary inductance is measured @ 100KHz @ 20mVrms. Leakage inductance and Interwinding capacitance is measured @ 1MHz @ 20mVrms.

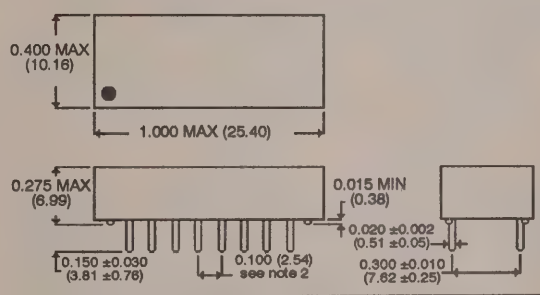
[2] Return loss on TP293W225 is as follows: -22db min (1-8MHz), -20db min (8-16MHz) and -18db min (16-24MHz).

Package Outlines

8-pin Dual-In-Line



16-pin Dual-In-Line



Notes to **Package Outlines**:

1. Dimensions are expressed in inches (mm).
2. Lead spacing shall be measured within this zone.
   a. Shoulder and lead tip dimensions are to centerline of leads.
3. Tolerance non-cumulative.
4. Lead Mtl: Alloy 42 per ASTM F-30 or equiv., electrotin-plated per MIL-T-10727.
5. Body Material: Plastic (epoxy or Diallyl Phthalate).
6. Round emboss in bottom-left corner, or notch on left end, denote lead no. 1
7. Body dimensions do not include molding flash which shall be ≤0.006 (0.15).
8. Each lead is within ±0.010 (±0.25) radius of its true position at max. mtl dimension.
9. Unit marking includes mfr's name, part number, date code and index mark.

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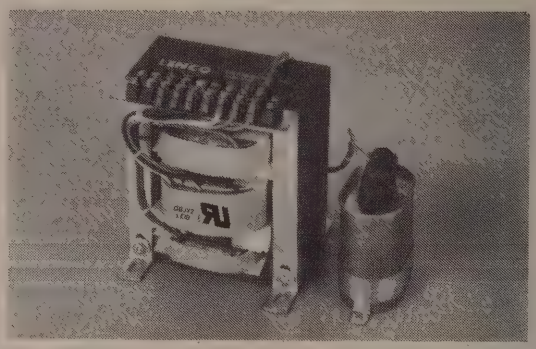
Regulating Transformers

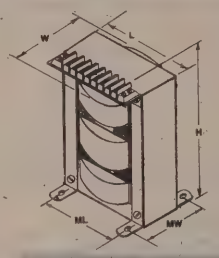
Output regulated to ±3% for input variations of +15% -25% • Removes most voltage sags, surges, brownouts, noise and distortion • Less than 3% distortion • Minimum load efficiency of 85% • Temperature –20°C to +70°C • Low cost, quiet operation



FREQUENCY 60Hz/OUTPUT 120V

MODEL	POWER	INPUT	MOUNTING
CVS-50-120-60*	50VA	120V	H
CVS-50-240-60*	50VA	240V	H
CVS-50-480-60*	50VA	480V	H
CVS-100-120-60	100VA	120V	A
CVS-100-240-60	100VA	240V	A
CVS-100-480-60	100VA	480V	A
CVS-150-120-60	150VA	120V	B
CVS-150-240-60	150VA	240V	B
CVS-150-480-60	150VA	480V	B
CVS-250-120-60	250VA	120V	C
CVS-250-240-60	250VA	240V	C
CVS-250-480-60	250VA	480V	C
CVS-500-120-60	500VA	120V	D
CVS-500-240-60	500VA	240V	D
CVS-500-480-60	500VA	480V	D
CVS-750-120-60	750VA	120V	E
CVS-750-240-60	750VA	240V	E
CVS-750-480-60	750VA	480V	E
CVS-1000-120-60	1000VA	120V	F
CVS-1000-240-60	1000VA	240V	F
CVS-1000-480-60	1000VA	480V	F
CVS-1500-120/240-60	1500VA	120/240V	G
CVS-1500-240/480-60	1500VA	240/480V	G

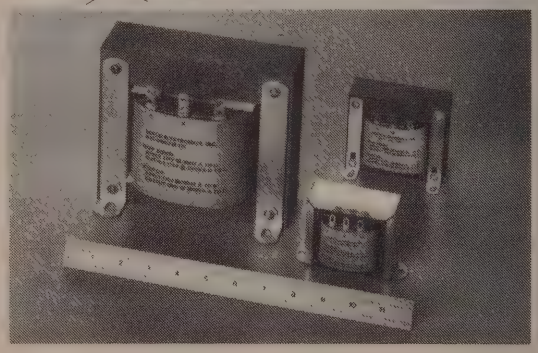
*** Minimum load efficiency of 70%**



MOUNTING	L	W	H	ML	MW
A	4.5	3.8	6	3.75	2.35
B	5.35	4.35	6.51	4.38	2.62
C	5.35	5.15	6.51	4.38	3.62
D	5.85	6.42	7.01	4.81	4.75
E	7.20	6.10	8.70	5.94	3.60
F	7.20	7.0	8.70	5.94	4.68
G	8.69	7.0	10.50	7.22	3.92
H	3.70	3.70	5.00	3.06	2.25

Autotransformer

Designed and manufactured to Lenco's high standards. Stocked in 100 VA through 5000 VA for immediate delivery. Approximately 50% reduction in size, cost, high efficiency and bi-directional. Note: Does not provide isolation.



FREQUENCY 50/60Hz

LUG STYLE	MODEL NO.	POWER	INPUT/OUTPUT BI-DIRECTIONAL	FIGURE NO.	MOUNTING
Solder	ATF-100-230-115	100VA	115/230V	1	A
Solder	ATF-100-480-240	100VA	240/480V	1	A
Solder	ATF-150-230-115	150VA	115/230V	1	B
Solder	ATF-150-480-240	150VA	240/480V	1	B
Solder	ATF-250-230-115	250VA	115/230V	2	C
Solder	ATF-250-480-240	250VA	240/480V	2	C
Solder	ATF-500-230-115	500VA	115/230V	2	D
Solder	ATF-500-480-240	500VA	240/480V	2	D
10-32 Tapped	ATF-1000-230-115	1000VA	115/230V	2	E
10-32 Tapped	ATF-1000-480-240	1000VA	240/480V	2	E
10-32 Tapped	ATF-1500-230-115	1500VA	115/230V	2	F
10-32 Tapped	ATF-1500-480-240	1500VA	240/480V	2	F
10-32 Tapped	ATF-2000-230-115	2000VA	115/230V	2	G
10-32 Tapped	ATF-2000-480-240	2000VA	240/480V	2	G
10-32 Tapped	ATF-2500-230-115	2500VA	115/230V	2	H
10-32 Tapped	ATF-2500-480-240	2500VA	240/480V	2	H
10-32 Tapped	ATF-3000-230-115	3000VA	115/230V	2	I
10-32 Tapped	ATF-3000-480-240	3000VA	240/480V	2	J
10-32 Tapped	ATF-5000-230-115	5000VA	115/230V	2	K
10-32 Tapped	ATF-5000-480-240	5000VA	240/480V	2	L

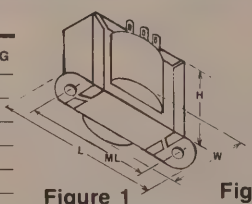


Figure 1

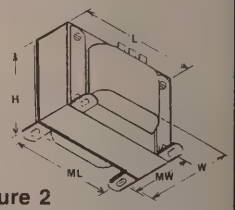


Figure 2

MOUNTING	L	W	H	ML	MW
A	4.06	2.4	2.64	3.56	—
B	4.06	2.7	2.64	3.56	—
C	3.81	2.9	3.19	3.13	2.38
D	4.56	3.5	3.81	3.75	2.75
E	5.31	4.3	4.44	4.38	3.13
F	6.44	4.3	5.38	5.31	2.88
G	6.44	5.6	5.38	5.31	3.75
H	7.13	5.0	6.10	5.81	3
I	7.13	5.3	6.10	5.81	3.25
J	7.13	5.6	6.10	5.81	3.25
K	7.13	7.1	6.10	5.81	4.75
L	7.13	7.0	6.10	5.81	4.75

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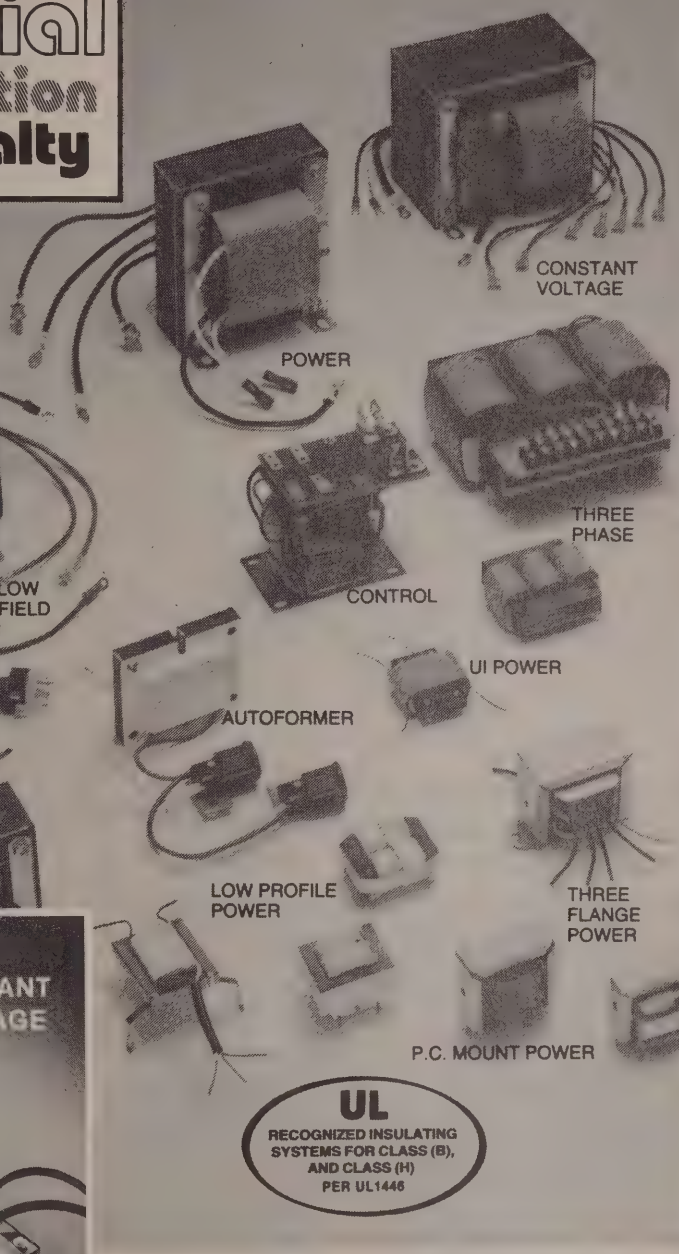

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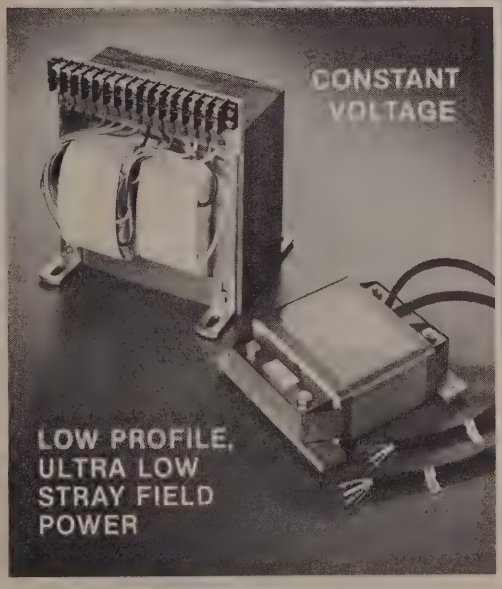

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We can produce transformers to your specifications:

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- Secondary voltages up to 1000V

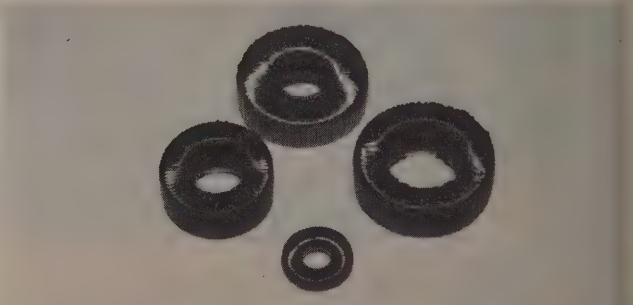
Transformer meeting other special requirements are made according to customer's request. When ordering please give the following information:

- Max. dimensions (Ht. and Dia.)
- Output
- Frequency
- Primary Voltage(s)
- With or without static screen
- Secondary voltage(s) at full load
- Max. no load voltage(s)
- Continuous or intermittent service
- Ambient temperature
- Mounting hardware

Lumintech is Dedicated to Quality, Price and Customer Service.

General Data Off The Shelf Series

Output VA	Copper Losses at 100 CW	No Load Losses W	Outer Dia. In.	Ht. In.	Weight Lbs.
15	3	.2	2.4	1.2	.66
30	6	.3	2.8	1.3	1.00
40	7	.4	3.0	1.3	1.32
50	8	.5	3.2	1.4	1.54
80	13	.5	3.8	1.4	2.20
100	14	.7	3.8	1.6	2.42
120	15	.8	3.8	1.8	2.86
160	22	1.0	4.5	1.7	3.30
225	24	1.4	4.5	1.9	4.40
300	25	2.0	4.5	2.3	5.28
500	33	2.5	5.5	2.4	8.14
625	41	3.0	5.5	2.8	9.68
750	43	4.1	6.3	2.5	11.66
1000	45	4.7	6.3	2.9	14.52
1300	61	5.1	7.9	2.6	19.3
1600	63	7.1	7.9	3.0	23.1
1900	66	8.2	7.9	3.4	26.4
2200	78	11.3	7.9	3.4	33.2
2500	85	9.9	7.9	3.6	33.9
2800	93	11.0	9.6	3.2	35.2
3200	94	12.8	9.6	3.6	40.7
3700	100	15.0	9.6	4.0	46.2
4400	115	16.2	10.8	3.8	53.9
5000	115	19.0	10.8	4.2	61.6



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• POWER TRANSFORMERS •
50 Hz to 5 KHz up to 1 KVA • Laminated
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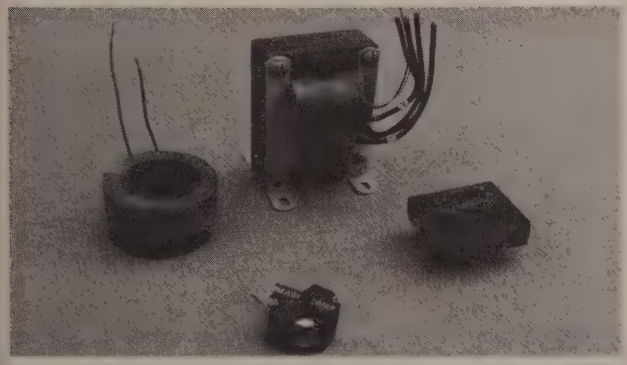

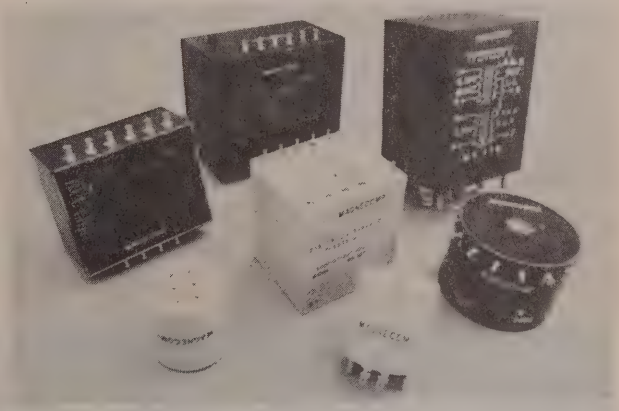

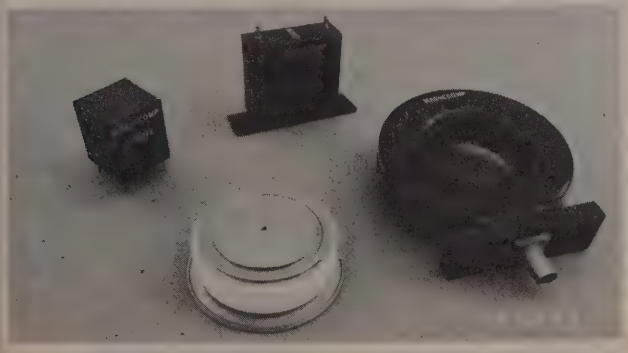

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- Power Transformers
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- Power Inductors
- Filter Inductors
- Miniature coils
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At MAGNELAB you will find an extensive tooling facility along with the skills to develop the intricate fixtures required for precision manufacturing. We are particularly proud of this capability in providing you with just the right part.

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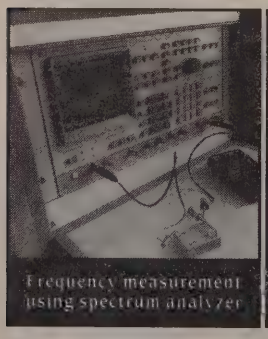
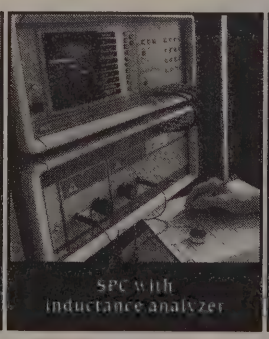

Frequency measurement using spectrum analyzer

Computerized milling operation

Custom fixturing


SPC with inductance analyzer

Production run of precision inductors

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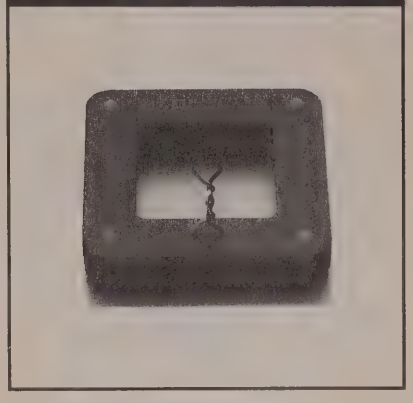
LCT



LOW PHASE-ANGLE OPENING CURRENT TRANSFORMERS

The ECT series is designed to monitor service entrance currents with high accuracy and very low phase angle.

Opening current transformers are ideal for applications where the service is not easily interrupted during installation.

Model No.	Rating
ECT-1250-100	100 Amp
ECT-1250-200	200 Amp
ECT-1250-400	400 Amp
ECT-1250-600	600 Amp
ECT-1250-800	800 Amp

- Accuracy ±1%
- Phase angle <20 minutes
- Size (see drawing below)

A-3.375"
B-3.375"
C-1.313"
D-1.250"
E-1.313"

SMALL OPENING CURRENT TRANSFORMERS

The SCT family is designed for tight spaces.

Model No.	Rating
SCT-0750-005	5 Amp
SCT-0750-015	15 Amp
SCT-0750-030	30 Amp
SCT-0750-050	50 Amp
SCT-0750-070	70 Amp
SCT-0750-100	100 Amp
SCT-0750-150	150 Amp
SCT-1250-070	70 Amp
SCT-1250-100	100 Amp
SCT-1250-150	150 Amp
SCT-1250-200	200 Amp
SCT-1250-250	250 Amp
SCT-1250-300	300 Amp
SCT-1250-400	400 Amp

- Accuracy ±1%
- Phase angle<2 degrees
- Size

Size	SCT-0750	SCT-1250
A	2.000"	3.250"
B	2.100"	3.350"
C	0.610"	1.000"
D	0.750"	1.250"
E	0.750"	1.250"

LARGE-FRAME OPENING CURRENT TRANSFORMERS

The LCT series is designed to measure currents in large conductors or where multiple conductors must be simultaneously measured.

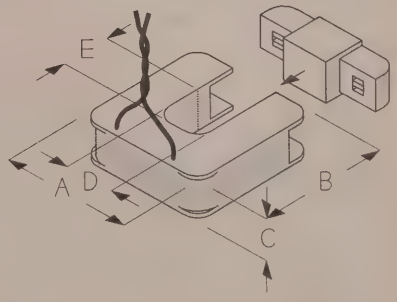
Model No.	Rating
LCT-3000-400	400 Amp
LCT-3000-600	600 Amp
LCT-3000-800	800 Amp
LCT-3000-1000	1000 Amp

- Accuracy ±2%
- Phase angle <3 degrees
- Size (see drawing below)

A-5.250"
B-5.250"
C-0.750"
D-3.000"
E-3.000"

Features common to all opening current transformers:

- Output is 0.333 V at rated current.
- Internal precision burden resistor across secondary.
- Leads-8 ft. twisted pair.
- Epoxy encapsulated housing.
- Accuracy is measured from 10% to 130% of rated current.
- No exposed metal parts on assembled transformer.
- Shrouded core blades for protection during installation.
- Core interleaved at joints for accuracy.
- Phase angle is measured at 50% of rated current.



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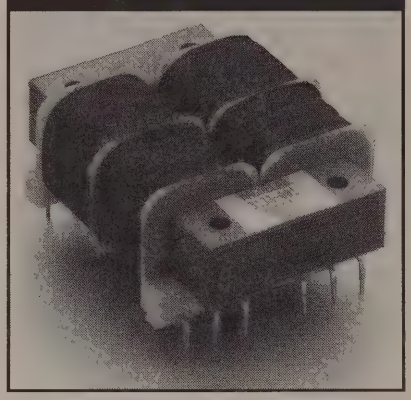


POT

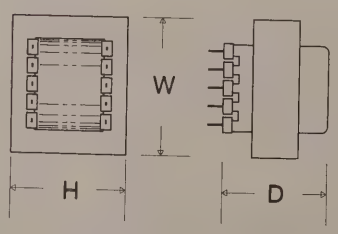
POWER TRANSFORMERS EUROPEAN CONSTRUCTION

Size Code No.	Power (watts) (a)	Dimensions D	W (inches)	H
0560	05	1.3	1.7	1.4
0620	09	1.4	1.9	1.6
0680	13	1.6	2.1	1.7
0750	20	1.7	2.3	1.9
0751	27	2.0	2.3	1.9
0870	35	2.0	2.6	2.2
0871	42	2.1	2.6	2.2
0872	54	2.3	2.6	2.2
1000	62	2.2	3.0	2.5
1001	79	2.5	3.0	2.5
1002	99	2.7	3.0	2.5
1101	98	2.5	3.4	2.8
1200	143	2.7	3.8	3.1

(a) Thruput power for 40C temperature rise. ±10% input voltage range and 50/60 hz frequency range.

To order, specify:

1. Input voltage and range.
2. Frequency and range.
3. Output voltages & currents
4. Size code
5. Isolation requirements
6. Terminals-lugs or pins



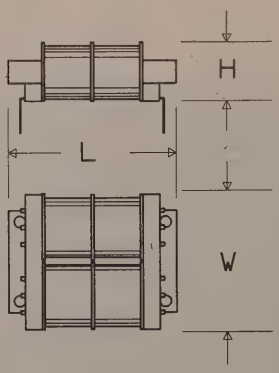
POWER TRANSFORMER LOW PROFILE HIGH ISOLATION

Size Code No.	Power (watts) (a)	Dimensions L	W (inches)	H
0370	2.5	1.9	1.6	0.7
0371	6	1.9	1.6	0.9
0500	12	2.5	2.0	1.1
0560	24	2.9	2.3	1.3
0620	48	3.2	2.5	1.4

(a) Thruput power for 40C temperature rise. ±10% input voltage range and 50/60 hz frequency range.

To order, specify:

1. Input voltage and range.
2. Frequency and range.
3. Output voltages & currents
4. Size code
5. Isolation requirements



FERRITE TRANSFORMERS HIGH SHIELDING

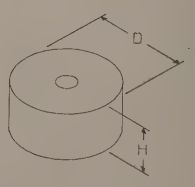
Size Code No.	Power (watts) (a)	Dimensions D	H (inches)
0704	2.5	0.30	0.25
0905	4	0.40	0.30
1107	9	0.49	0.32
1408	13	0.55	1.38
1811	30	0.71	0.46
2213	60	0.87	0.59
2616	110	1.04	0.66
3019	200	1.21	0.77
3622	300	1.43	0.92
4229	500	1.70	1.23

(a) Thruput power with square wave drive at 100 khz for 1408 and larger, 250 khz for 1107 and smaller.

(b) Surface mount available for 1107 and smaller.

To order, specify:

1. Input voltage and range.
2. Waveform and frequency.
3. Output voltages.
4. Output currents.
5. Circuit topology.
6. Isolation requirements.
7. Desired family & size code.



MAGNELAB CORPORATION
DESIGN & MANUFACTURE OF TRANSFORMER PRODUCTS

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Boulder, Colorado 80301
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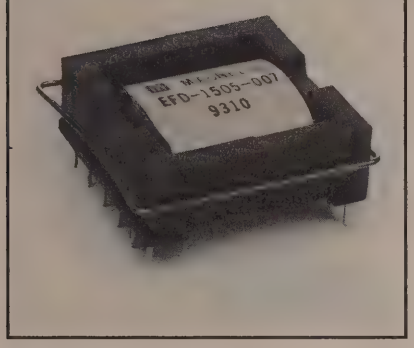
SEMI-CUSTOM FERRITE-CORE TRANSFORMERS

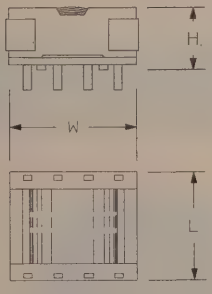
EFD



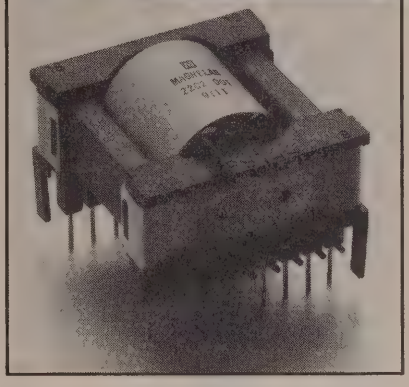
LOW PROFILE SWITCHING POWER TRANSFORMERS

Size Code No.	Power (watts) (a)	Dimensions W	L (inches)	H
1105	56	0.64	0.64	0.32
2007	103	0.79	0.84	0.40
2509	233	0.99	1.00	0.50
3009	291	1.15	1.12	0.50

(a) Thruput power at 500 khz for square wave drive.



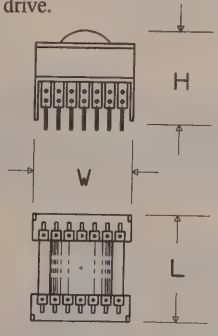
ETD



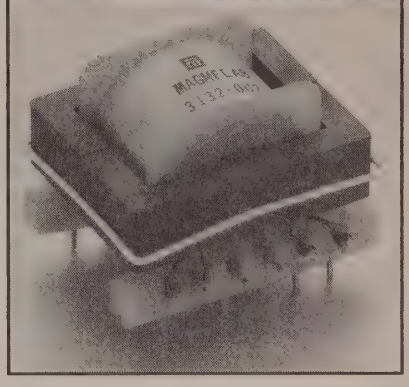
HIGH PERFORMANCE SWITCHING POWER TRANSFORMERS

Size Code No.	Power (watts) (a)	Dimensions W	L (inches)	H
0290	200	1.00	1.00	0.80
0340	375	1.66	1.56	1.35
0390	600	1.87	1.76	1.46
0440	900	2.07	1.96	1.57
0490	1100	2.26	2.15	1.67

(a) Thruput power at 100 khz for square wave drive.



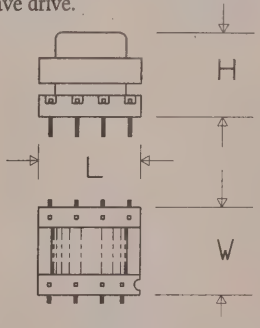
FEP



LOW COST SWITCHING POWER TRANSFORMERS

Size Code No.	Power (watts) (a)	Dimensions W	L (inches)	H
0187	45	0.73	0.66	0.63
0250	75	1.01	0.77	0.81
0375	250	1.38	1.13	1.01
0500	480	1.63	1.32	1.14
0625	600	1.88	1.50	1.27
0750	1000	2.25	1.88	1.49

(a) Thruput power at 100 khz for square wave drive.



Information common to all ferrite switching power transformers

To order power transformer, specify:
1. Input voltage & range
2. Waveform and frequency
3. Output voltages
4. Output currents
5. Circuit topology
6. Family and size code (i.e.: ETD-0390)
7. Isolation requirements

To order switching power inductors, specify:
1. Inductance
2. Peak current
3. Frequency
4. Peak voltage expected across inductor
5. Circuit topology
6. Family and size code (i.e.: FEP-0250)

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MAGNELAB

TOROID CT'S OTHER PRODUCTS

UCT

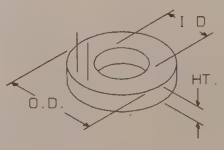
UL RECOGNIZED TOROIDAL CURRENT TRANSFORMERS

The UCT family is designed for measuring service entrance and circuit currents where interruption during installation is permitted.

- Precision burden resistor.
- Leads-8 ft. twisted pair.
- Epoxy encapsulated housing.
- Output 0.333 V at rated current
- Accuracy ±1% from 10% to 130% of rated current.
- Phase angle <1 degree at 50% of rated current.

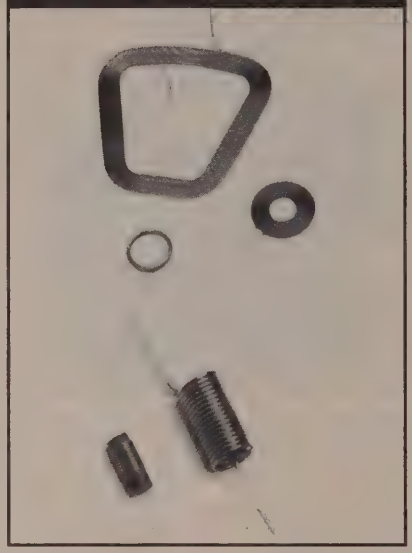
Model No.	Rated Amps	Size Code
UCT-0300-005	5	A
UCT-0300-030	30	A
UCT-0500-060	60	B
UCT-0750-100	100	C
UCT-1000-200	200	D
UCT-1250-400	400	E

Size Code	I.D.	O.D. (inches)	HT.
A	0.30	1.70	0.75
B	0.50	1.90	0.75
C	0.75	2.10	0.75
D	1.00	2.40	0.80
E	1.25	2.70	0.80



Other UL Recognized models available. Contact factory for further information.

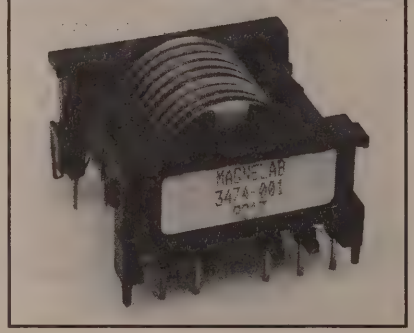
CUSTOM COILS



Magnelab specializes in the tooling and manufacture of custom coil products for many applications such as:

- Loop antennas
- Planar inductors
- Flat motor field coils
- Stick antennas

HIGH VOLTAGE HIGH ISOLATION TRANSFORMERS



Custom high voltage and high isolation transformers are a Magnelab specialty. Applications include medical on-patient care products and aerospace instrumentation.

AC MAGNETIC FLUX PROBE

MODEL 1846-001

Magnelab's AC flux probe is a highly sensitive, calibrated coil assembly which measures AC magnetic flux. Unwanted stray fields from transformers, motors, generators, relays, conductors, etc. are easily detected and mapped.

- Sensitivity-100 mV per gauss at 60 hz.
- Accuracy 5%
- Senses amplitude and direction.
- Electrostatically shielded.

CUSTOM DESIGNED TRANSFORMERS

Magnelab provides custom design and manufacturing to meet your needs.

MAGNELAB CORPORATION
DESIGN & MANUFACTURE OF TRANSFORMER PRODUCTS

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Boulder, Colorado 80301
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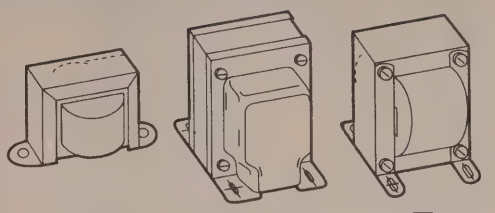
MagneTek Triad

Power Transformers

Triad No.	Fig.	Secondary Volts	Secondary Amps	Test Volts	Case Size (in.) H × W × D	Wt. Lbs.	Price Each
SINGLE SECONDARY PRIMARY 115 VOLTS — 50-60 Hz.							
F-6X#	A	2.5 CT	6	2500	1 15/16 × 3 5/16 × 1 3/4	1	$11.24
F-3X#	A	2.5 CT	10	3000	2 9/32 × 3 1/4 × 2 1/4	1.7	14.63
F-7X	A	5 CT	3	1500	1 15/16 × 3 5/16 × 2	1.3	12.57
F-8X	A	5 CT	6	1500	2 9/32 × 3 1/4 × 2 1/4	1.7	14.83
F-12X	A	5 CT	8	2500	2 19/32 × 4 × 2 1/4	2.5	18.03
F-43X#	A	6.3	4	1500	1 15/16 × 3 5/16 × 2	1.25	11.52
F-69X	A	6.3 CT	8	1500	2 9/16 × 4 × 2 1/4	2.3	19.15
F-21A	B	6.3 CT	10	1500	3 19/32 × 2 31/32 × 3 1/8	3.8	33.57
F-22A	B	6.3 CT	20	2000	3 7/8 × 3 9/32 × 4 1/8	7	38.75
F-28U*	C	7.5 6.3 CT	25	3000	4 5/8 × 3 13/16 × 3 5/8	7.5	53.17
F-180X	A	10 CT	1	1500	1 15/16 × 3 5/16 × 1 3/4	.9	13.43
F-31X	A	10 CT	3	2000	2 9/32 × 3 1/4 × 2 1/8	1.7	13.69
F-96U	C	10 CT	6	1500	3 × 2 1/2 × 2 3/4	2.1	20.77
F-97U	C	10 CT	8	1500	3 7/16 × 2 13/16 × 3	4.0	29.41
F-113X	A	12	.15	1500	1 3/8 × 2 3/8 × 1 3/8	.4	7.93
F-216X#	A	12	.35	1500	1 3/8 × 2 3/8 × 1 3/8	.37	8.52
F-114X	A	12	.7	1500	1 5/8 × 2 13/16 × 1 5/8	.8	8.80
F-217X#	A	12	1.2	1500	2 × 3 1/4 × 1 3/4	1.0	11.26
F-218X#	A	12	2	1500	2 × 3 1/4 × 1 7/8	1.13	12.15
F-219X#	A	12	4	1500	2 9/16 × 4 × 2 1/4	2.3	16.80
F-220U#	C	12	6	1500	3 7/16 × 3 5/16 × 2 1/2	3.5	23.40
F-221U#	C	12	8	1500	3 13/16 × 3 1/4 × 2 3/4	4.0	22.21
F-29U	C	12 CT 11 CT 10 CT	11	3000	4 3/8 × 3 1/2 × 3 3/8	6.5	39.97
F-70X	A	12.6 CT	1	1500	1 15/16 × 3 5/16 × 1 3/4	1.3	10.54
F-224X#	A	12.6	3	1500	2 1/4 × 3 3/4 × 2 1/4	1.6	15.26
F-182U	C	12.6 CT	6	1500	3 3/4 × 2 13/16 × 2 7/16	3.8	24.18
F-183U	C	12.6 CT	8	1500	3 13/16 × 3 5/16 × 2 15/16	5	30.78
F-250X	A	14 CT	1	1500	1 15/16 × 3 1/4 × 1 3/4	1.2	12.23
F-251X	A	14 CT	2	1500	2 1/4 × 3 11/16 × 1 15/16	1.5	13.41
F-252U	C	14 CT	4	1500	3 × 2 1/2 × 2 7/16	3	20.65
F-253U	C	14 CT	6	1500	3 3/8 × 2 13/16 × 2 7/8	4	24.31
F-254X	A	20 CT	1	1500	2 1/4 × 3 11/16 × 1 15/16	1.5	13.57
F-255X	A	20 CT	2	1500	2 9/16 × 4 × 2 1/4	2.5	16.82
F-256U	C	20 CT	4	1500	2 3/8 × 2 13/16 × 2 7/8	4	22.73
F-257U	C	20 CT	6	1500	3 3/4 × 3 3/4 × 3 3/4	5.7	30.98
F-258U	C	20 CT	8	1500	3 3/4 × 3 3/4 × 3 1/2	6.4	36.56
F-259U	C	20 CT	10	1500	4 3/4 × 3 7/16 × 3 1/2	7.4	41.66
F-192X	A	24 CT	2	1500	2 9/16 × 4 × 2 1/4	2.3	16.32
F-193U	C	24 CT	4	1500	3 13/16 × 3 1/4 × 2 13/16	4	27.51
F-260U	C	24 CT	6	1500	3 3/4 × 3 1/4 × 3 1/2	6.4	36.47
F-261U	C	24 CT	8	1500	4 1/4 × 3 7/16 × 3 1/2	7.4	41.91
F-401U	C	24 CT	10	1500	4 1/4 × 3 7/16 × 3 3/4	8.0	38.80
F-226U	C	24 CT	12	1500	4 5/16 × 3 3/4 × 4 1/4	10.4	51.34
F-56X	A	25.2 CT	2.8	1500	2 21/32 × 2 × 2 1/2	2.5	17.85
F-119X	A	26.8 CT	.15	1500	1 3/4 × 2 3/8 × 1 1/2	.45	12.02
F-122X	A	28 CT	0.175	1500	1 3/4 × 2 3/8 × 1 1/2	.35	11.36

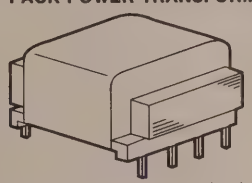


A B C

Triad No.	Fig.	Secondary Volts	Secondary Amps	Test Volts	Case Size (in.) H × W × D	Wt. Lbs.	Price Each
PRIMARY 115 VOLTS — 50-60 Hz (CONT'D)							
F-124X	A	28 CT	0.800	1500	1 15/16 × 3 1/4 × 2	1.0	$12.18
F-184X	A	28 CT	1	1500	2 5/16 × 3 11/16 × 2 1/4	1.4	13.80
F-187U	C	28 CT	4	1500	3 1/2 × 2 7/8 × 3 1/16	5.3	26.99
F-188X	A	35 CT	.1	1500	1 5/8 × 2 13/16 × 1 7/16	.35	12.10
F-228X#	A	35 CT	.3	1500	1 5/8 × 2 13/16 × 1 5/8	.6	10.51
F-189X	A	35 CT	.5	1500	2 5/16 × 3 11/16 × 1 15/16	1	12.61
F-191U	C	35 CT	4	1500	3 13/16 × 3 5/16 × 3 5/16	6	29.68
F-268U	C	35 CT	8	1500	4 1/2 × 3 3/4 × 4 1/4	11	49.97
F-270X	A	40 CT	1	1500	2 9/16 × 4 × 2 1/4	2.6	14.69
F-271U	C	40 CT	2	1500	3 3/4 × 2 13/16 × 2 7/8	4	21.46
F-272U	C	40 CT	4	1500	3 3/4 × 3 1/4 × 3 1/2	6.4	31.33
F-273U	C	40 CT	6	1500	4 1/2 × 3 3/4 × 4	10	50.71
F-275U	C	40 CT	10	1500	5 1/4 × 4 3/4 × 4 1/2	14.5	66.27
F-59X	A	60 CT	.4	1500	1 15/16 × 3 5/16 × 2	1.3	11.91
F-279U	C	60 CT	1	1500	3 × 2 1/2 × 2 3/4	3.4	22.23
F-280U	C	60 CT	2	1500	3 3/4 × 3 1/4 × 3 1/4	5.6	31.33
F-282U	C	60 CT	6	1500	5 1/4 × 4 3/4 × 4 1/4	12.5	53.92
PRIMARY 115 230 VOLTS — 50-60 Hz							
F-301X	A	2.5 CT	3	1500	1 5/8 × 2 13/16 × 1 5/8	.68	$12.84
F-313X	A	6.3	.6	1500	1 3/8 × 2 3/8 × 1 3/8	.37	12.54
F-314X	A	6.3 CT	1.2	2500	1 5/8 × 2 13/16 × 1 5/8	.7	12.95
F-316X	A	6.3 CT	3	2500	1 15/16 × 3 5/16 × 2	1.3	16.66
F-318X	A	6.3 CT	6	1500	2 19/32 × 4 × 2 1/4	2.3	24.50
F-325X	A	12.6 CT	1.5	1500	1 15/16 × 3 5/16 × 2	1.3	13.21
F-344X	A	12.6 CT	2	1500	1 15/16 × 3 5/16 × 2	1.25	13.92
F-326X	A	12.6 CT	2.5	1500	2 9/32 × 3 11/16 × 2	1.55	16.13
F-3181U	C	12.6 CT	4	1500	3 1/16 × 2 9/16 × 2 5/16	2.3	22.23
F-3112X	A	14 CT	.25	1500	1 3/8 × 2 3/8 × 1 1/2	.3	12.84
F-3116X	A	24 CT	.2	1500	1 3/8 × 2 3/8 × 1 1/2	.45	11.52
F-3117X	A	24 CT	.4	1500	1 5/8 × 2 13/16 × 1 1/2	.75	13.53
F-3118X	A	24 CT	.7	1500	1 15/16 × 3 1/4 × 2	1.3	14.07
F-345X	A	24 CT	1	1500	1 15/16 × 3 5/16 × 2	1.3	12.71
F-341X	A	25.2 CT	2	1500	2 19/32 × 4 × 2 1/4	2.2	17.96
F-340X	A	26.8 CT	1	1500	1 15/16 × 3 5/16 × 2	1.3	16.66
F-355X	A	26.8 CT	1.7	1500	2 19/32 × 4 × 2 1/4	2.3	18.39
F-3185U	C	28 CT	2	1500	3 1/16 × 2 1/2 × 2 7/16	2.9	23.20
F-354X	A	35 CT	1.5	1500	2 19/32 × 4 × 2 1/4	2.2	17.96

#60 Hz operation. *Tapped primary to produce lower voltages.

FLAT-PACK POWER TRANSFORMERS

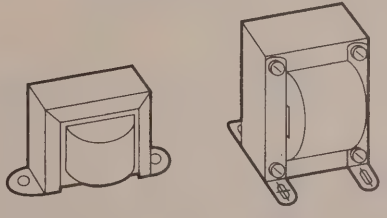


Designed to meet the needs of low-clearance printed circuit boards and solid state designs. Allows 1″ board spacing for 6 VA units or 1¼″ spacing for 12 VA units.

115/230 VAC, 50-60 HZ

Triad No.	VA	Secondary Ratings, rms: Individual	Series	Parallel	Price Each
FP10-250	2.5	5V@.25A	10V CT@.25A	5V@.5A	$10.75
FP10-600	6.0	5V@.6A	10V CT@.6A	5V@1.2A	12.00
FP10-1200	12.0	5V@1.2A	10V CT@1.2A	5V@2.4A	14.00
FP12-200	2.5	6.3V@.2A	12.6V CT@.2A	6.3V@.4A	10.75
FP12-475	6.0	6.3V@.475A	12.6V CT@.475A	6.3V@.95A	12.00
FP12-950	12.0	6.3V@.95A	12.6V CT@.95A	6.3V@1.9A	14.00
FP16-150	2.5	8V@.15A	16V CT@.15A	8V@.3A	10.75
FP16-375	6.0	8V@.375A	16V CT@.375A	8V@.75A	12.00
FP16-750	12.0	8V@.75A	16V CT@.75A	8V@1.5A	14.00
FP20-125	2.5	10V@.125A	20V CT@.125A	10V@.25A	10.75
FP20-300	6.0	10V@.3A	20V CT@.3A	10V@.6A	12.00
FP20-600	12.0	10V@.6A	20V CT@.6A	10V@1.2A	14.00
FP24-100	2.5	12V@.1A	24V CT@.1A	12V@.2A	10.75
FP24-250	6.0	12V@.25A	24V CT@.25A	12V@.5A	12.00
FP24-500	12.0	12V@.5A	24V CT@.5A	12V@1.0A	14.00
FP30-85	2.5	15V@.08A	30V CT@.08A	15V@.16A	10.75
FP30-200	6.0	15V@.2A	30V CT@.2A	15A@.4A	12.00
FP30-400	12.0	15V@.4A	30V CT@.4A	15A@.8A	14.00
FP34-75	2.5	17V@.075A	34V CT@.075A	17V@.15A	10.75
FP34-170	6.0	17V@.17A	34V CT@.17A	17V@.34A	12.00
FP34-340	12.0	17V@.34A	34V CT@.34A	17V@.68A	14.00
FP40-60	2.5	20V@.06A	40V CT@.06A	20V@.12A	10.75
FP40-150	6.0	20V@.15A	40V CT@.15A	20V@.3A	12.00
FP40-300	12.0	20V@.3A	40V CT@.3A	20V@.6A	14.00
FP56-45	2.5	28V@.045A	56V CT@.045A	28V@.09A	10.75
FP56-100	6.0	28V@.1A	56V CT@.1A	28V@.2A	12.00
FP56-200	12.0	28V@.2A	56V CT@.2A	28V@.4A	14.00
FP88-28	2.5	44V@.028A	88V CT@.028A	44V@.056A	10.75
FP88-65	6.0	44V@.065A	88V CT@.065A	44V@.13A	12.00
FP88-130	12.0	44V@.13A	88V CT@.13A	44V@.26A	14.00
FP120-20	2.5	60V@.02A	120V CT@.02A	60V@.04A	10.75
FP120-50	6.0	60V@.05A	120V CT@.05A	60V@.1A	12.00
FP120-100	12.0	60V@.1A	120V CT@.1A	60V@.2A	14.00
FP230-10	2.5	115V@.01A	230V CT@.01A	115V@.02A	10.75
FP230-25	6.0	115V@.025A	230V CT@.025A	115V@.05A	12.00
FP230-50	12.0	115V@.05A	230V CT@.05A	115V@.1A	14.00

SMOOTHING FILTER REACTORS



A B

Triad No.		Induct., Henries	Current mADC	Resist., Ohms	Size, Inches H × W × D	Price Each
C-1X	A	15	20	1000	1 3/16 × 2 1/16 × 1 1/4	$ 8.91
C-3X	A	10	50	500	1 5/8 × 2 13/16 × 1 1/2	8.55
C-8X	A	7	75	240	1 15/16 × 3 5/16 × 1 3/4	10.74
C-7X	A	10	90	270	1 15/16 × 3 5/16 × 2	11.17
C-14X	A	6	200	150	2 19/32 × 4 × 2 1/4	16.52
C-24X	A	1	240	50	1 5/8 × 2 13/16 × 1 1/2	8.34
C-36X	A	.5	300	30	1 3/8 × 2 3/8 × 1 1/2	8.80
C-17X	A	1.5	300	40	2 9/32 × 3 11/16 × 2	14.31
C-40X	A	.32	600	10	1 15/16 × 3 5/16 × 2	10.21
C-47U	B	.3 .075†	1A/2A	3/0.75	3 1/2 × 2 7/8 × 3 5/16	26.42
C-56U	B	.035	2A	.75	2 1/4 × 2 5/8 × 2	17.14
C-49U	B	.032 .008†	5A/10A	19/.05	4 1/4 × 3 1/2 × 3 5/8	56.96
C-59U	B	.01	12.5A	.10	3 1/2 × 4 1/2 × 3	37.34
C-80U	B	.024 .006†	20A/40A	.1/.025	5 5/16 × 4 5/16 × 5 1/2	134.65
C-60U	B	.005	22.5A	.06	3 3/4 × 4 1/2 × 4 3/16	55.66

*Inductive tolerance, −20% +50%. †Split winding.

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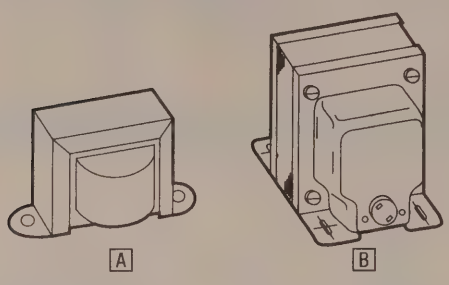
MagneTek Triad

Power Transformers

ISOLATION TRANSFORMERS—50-60 HZ

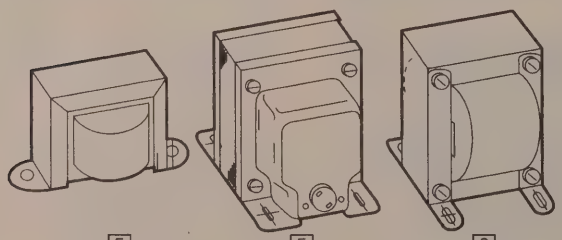


All units have static shield, 115V output.

Triad No.	Fig.	VA Output	Input Volts	Case Size, In. H × W × D	Price Each
N-48X	A	15	115	1 15/16 × 3 15/16 × 2	$ 13.76
N-51X	A	35	115	2 9/32 × 3 11/16 × 2 1/8	14.21
N-68X	A	50	115/230‡	2 9/32 × 3 11/16 × 2 1/8	18.42
N-53MG#	B	85	115	3 19/32 × 2 21/32 × 4 1/8	56.28
N-77U	C	100	115/230	3 7/16 × 2 13/16 × 3	29.15
N-54MG#	B	150	115	3 7/8 × 3 9/32 × 5 13/16	60.56
N-67A	D	150	115/230‡	3 7/8 × 3 9/32 × 3 7/8	40.13
N-55MG#	B	250	115	4 5/8 × 3 15/16 × 5	71.67
N-255MG#	B	250	230	4 5/8 × 3 15/16 × 5	71.67
N-66A	D	250	115/230‡	4 5/8 × 3 15/16 × 4 5/8	59.04
N-57MG#	B	500	115	5 5/16 × 4 1/2 × 6 1/4	108.67
N-257MG#	B	500	230	5 5/16 × 4 1/2 × 6 1/4	108.67
N-59MG#	B	1000	115	5 5/16 × 4 1/2 × 8	207.22
N-259MG#	B	1000	230	5 5/16 × 4 1/2 × 8	207.22

#3-wire cord, plug and socket. ‡Split winding.

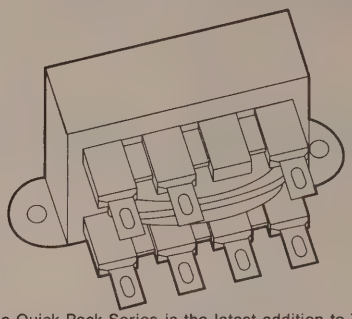
STEP-UP/STEP-DOWN AUTOFORMERS—50-60 HZ



Triad No.	Fig.	VA Output	Input Volts	Output Volts	Size, Inches H × W × D	Price Each
N-1X	E	50	230	115	2 9/32 × 3 11/16 × 2	$ 11.01
N-3MG#	F	85	230	115	3 19/32 × 2 31/32 × 3 1/2	38.75
N-2X	E	100	230	115	2 5/8 × 4 × 2 1/16	16.18
N-150MG	F	150	115	230	3 19/32 × 2 31/32 × 3 5/16	52.22
F-302U#	G	150	277	115	2 13/16 × 3 3/8 × 2 1/4	22.78
N-4MG#	F	150	230	115	3 19/32 × 2 31/32 × 4 1/4	52.22
N-6U	G	200	230	115	3 3/8 × 2 13/16 × 2 13/16	29.78
N-250MG#	F	250	115	230	3 7/8 × 3 1/4 × 3 11/16	64.22
N-5MG#	F	250	230	115	3 7/8 × 3 9/32 × 4 13/16	64.22
N-500MG#	F	500	115	230	4 5/8 × 3 7/8 × 4 3/4	72.22
N-7MG#	F	600	230	115	4 5/8 × 3 15/16 × 5	72.22
N-1000MG#	F	1000	115	230	5 3/8 × 4 1/2 × 5 1/2	119.67
N-9MG#	F	1250	230	115	5 5/16 × 4 1/2 × 6 1/4	142.78
N-11MG#	F	2000	230	115	5 3/4 × 4 1/2 × 8 1/4	201.78

#3-wire cord, plug and socket.

QUICK PACK POWER TRANSFORMERS



UL RECOGNIZED
Class B

The Quick Pack Series is the latest addition to Triad's extensive line of small power transformers. Quick Pack transformers can offer a significant reduction in size and weight for a given VA rating. Plus, these transformers come with special quick-connect or solder terminals. Quick Pack transformers are available in six sizes for a wide variety of applications.

Split Bobbin Non-Concentric Winding—Eliminates costly electrostatic shielding, reduces transformer size and space. The Quick Pack transformer's unique construction makes possible higher HiPot testing, 2500 V rather than 1500 V. This series is available with a single 115 VAC or dual 115/230 VAC primary, rated 50/60 Hz. Class B insulation insures maximum total temperature of 130°C continuous.

Triad No.	VA Rating	Output Rating	Size, Inches H × W × D	Price Each
		115V 50/60 Hz PRIMARY		
F3-10	2.4	10 VCT @ 0.25A	1 3/16 × 1 5/16 × 1 1/16	$ 7.68
F3-12	2.4	12.6 VCT @ 0.2A	1 3/16 × 1 5/16 × 1 1/16	7.68
F3-16	2.4	16 VCT @ 0.15A	1 3/16 × 1 5/16 × 1 1/16	7.68
F3-20	2.4	20 VCT @ 0.12A	1 3/16 × 1 5/16 × 1 1/16	7.68
F3-24	2.4	24 VCT @ 0.1A	1 3/16 × 1 5/16 × 1 1/16	7.68
F3-28	2.4	28 VCT @ 0.085 A	1 3/16 × 1 5/16 × 1 1/16	7.68
F3-36	2.4	36 VCT @ 0.065 A	1 3/16 × 1 5/16 × 1 1/16	7.68
F3-48	2.4	48 VCT @ 0.05 A	1 3/16 × 1 5/16 × 1 1/16	7.68
F3-56	2.4	56 VCT @ 0.045 A	1 3/16 × 1 5/16 × 1 1/16	7.68
F3-120	2.4	120 VCT @ 0.02 A	1 3/16 × 1 5/16 × 1 1/16	7.68
		115/230V 50/60 Hz PRIMARY		
FD4-10	6	10 VCT @ 0.6A	1 3/8 × 1 5/8 × 1 1/4	$10.25
FD4-12	6	12.6 VCT @ 0.5A	1 3/8 × 1 5/8 × 1 1/4	10.25
FD4-16	6	16 VCT @ 0.4A	1 3/8 × 1 5/8 × 1 1/4	10.25
FD4-20	6	20 VCT @ 0.3A	1 3/8 × 1 5/8 × 1 1/4	10.25
FD4-24	6	24 VCT @ 0.25A	1 3/8 × 1 5/8 × 1 1/4	10.25
FD4-28	6	28 VCT @ 0.2A	1 3/8 × 1 5/8 × 1 1/4	10.25
FD4-36	6	36 VCT @ 0.17A	1 3/8 × 1 5/8 × 1 1/4	10.25
FD4-48	6	48 VCT @ 0.125A	1 3/8 × 1 5/8 × 1 1/4	10.25
FD4-56	6	56 VCT @ 0.11A	1 3/8 × 1 5/8 × 1 1/4	10.25
FD4-120	6	120 VCT @ 0.05A	1 3/8 × 1 5/8 × 1 1/4	10.25
FD5-10	12	10 VCT @ 1.2A	1 5/8 × 1 15/16 × 1 3/8	11.35
FD5-12	12	12.6 VCT @ 1.0A	1 5/8 × 1 15/16 × 1 3/8	11.35
FD5-16	12	16 VCT @ 0.8A	1 5/8 × 1 15/16 × 1 3/8	11.35
FD5-20	12	20 VCT @ 0.6A	1 5/8 × 1 15/16 × 1 3/8	11.35
FD5-24	12	24 VCT @ 0.5A	1 5/8 × 1 15/16 × 1 3/8	11.35
FD5-28	12	28 VCT @ 0.42A	1 5/8 × 1 15/16 × 1 3/8	11.35
FD5-36	12	36 VCT @ 0.35A	1 5/8 × 1 15/16 × 1 3/8	11.35
FD5-48	12	48 VCT @ 0.25A	1 5/8 × 1 15/16 × 1 3/8	11.35
FD5-56	12	56 VCT @ 0.22A	1 5/8 × 1 15/16 × 1 3/8	11.35
FD5-120	12	120 VCT @ 0.1A	1 5/8 × 1 15/16 × 1 3/8	11.35
FD6-10	30	10 VCT @ 3.0A	1 15/16 × 2 15/16 × 1 11/16	14.70
FD6-12	30	12.6 VCT @ 2.5A	1 15/16 × 2 15/16 × 1 11/16	14.70
FD6-16	30	16 VCT @ 2.0A	1 15/16 × 2 15/16 × 1 11/16	14.70
FD6-20	30	20 VCT @ 1.5A	1 15/16 × 2 15/16 × 1 11/16	14.70
FD6-24	30	24 VCT @ 1.25A	1 15/16 × 2 15/16 × 1 11/16	14.70
FD6-28	30	28 VCT @ 1.1A	1 15/16 × 2 15/16 × 1 11/16	14.70
FD6-36	30	36 VCT @ 0.85A	1 15/16 × 2 15/16 × 1 11/16	14.70
FD6-48	30	48 VCT @ 0.63A	1 15/16 × 2 15/16 × 1 11/16	14.70
FD6-56	30	56 VCT @ 0.54A	1 15/16 × 2 15/16 × 1 11/16	14.70
FD6-120	30	120 VCT @ 0.25A	1 15/16 × 2 15/16 × 1 11/16	14.70
FD7-10	56	10 VCT @ 5.0A	2 1/4 × 2 11/16 × 1 13/16	18.00
FD7-12	56	12.6 VCT @ 4.0A	2 1/4 × 2 11/16 × 1 13/16	18.00
FD7-16	56	16 VCT @ 3.5A	2 1/4 × 2 11/16 × 1 13/16	18.00
FD7-20	56	20 VCT @ 2.8A	2 1/4 × 2 11/16 × 1 13/16	18.00
FD7-24	56	24 VCT @ 2.4A	2 1/4 × 2 11/16 × 1 13/16	18.00
FD7-28	56	28 VCT @ 2.0A	2 1/4 × 2 11/16 × 1 13/16	18.00
FD7-36	56	36 VCT @ 1.5A	2 1/4 × 2 11/16 × 1 13/16	18.00
FD7-48	56	48 VCT @ 1.2A	2 1/4 × 2 11/16 × 1 13/16	18.00
FD7-56	56	56 VDT @ 1.0A	2 1/4 × 2 11/16 × 1 13/16	18.00
FD7-120	56	120 VCT @ 0.5A	2 1/4 × 2 11/16 × 1 13/16	18.00
FD8-10	100	56 VCT @ 10.0A	2 9/16 × 3 1/16 × 2 1/4	25.00
FD8-12	100	12.6 VCT @ 8.0A	2 9/16 × 3 1/16 × 2 1/4	25.00
FD8-16	100	16 VCT @ 6.25A	2 9/16 × 3 1/16 × 2 1/4	25.00
FD8-20	100	20 VCT @ 5.0A	2 9/16 × 3 1/16 × 2 1/4	25.00
FD8-24	100	24 VCT @ 4.0A	2 9/16 × 3 1/16 × 2 1/4	25.00
FD8-28	100	28 VCT @ 3.6A	2 9/16 × 3 1/16 × 2 1/4	25.00
FD8-36	100	36 VCT @ 2.8A	2 9/16 × 3 1/16 × 2 1/4	25.00
FD8-48	100	48 VCT @ 2.0A	2 9/16 × 3 1/16 × 2 1/4	25.00
FD8-56	100	56 VCT @ 1.8A	2 9/16 × 3 1/16 × 2 1/4	25.00
FD8-120	100	120 VCT @ 0.85A	2 9/16 × 3 1/16 × 2 1/4	25.00

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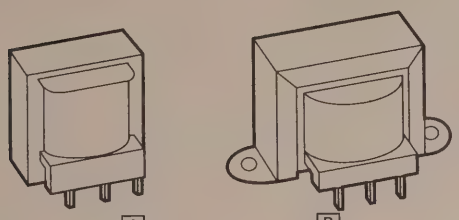
MagneTek Triad

Power Transformers

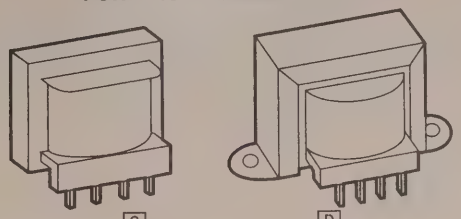
LOW-VOLTAGE, LOW CURRENT, PLUG-IN PRINTED CIRCUIT POWER TRANSFORMERS



A B

Triad No.	Fig.	Output Watts	Secondary		Price Each
			Series	Parallel Conn.	
PRIMARY 115 VOLTS—50-60 Hz.					
F-131P	A	1 1/2	8 V CT @ 188 A	4 V @ 376 A	$12.20
F-139P	A	1 1/2	12.6 V CT @ .12 A	6.3 V @ .24 A	12.68
F-132P	A	1 1/2	15 V CT @ .10 A	7.5 V @ .20 A	12.27
F-150P	A	1 1/2	17 V CT @ .085 A	8.5 V @ .17 A	12.98
F-138P	A	1 1/2	25.2 V CT @ .06 A	12.6 V @ .12 A	12.68
F-133P	A	1 1/2	30 V CT @ .05 A	15 V @ .10 A	12.69
F-160P	A	1 1/2	34 V CT @ .045 A	17 V @ .09 A	14.33
F-137P	A	1 1/2	40 V CT @ .038 A	20 V @ .076 A	12.18
F-134P	A	1 1/2	54 V CT @ .028 A	27 V @ .056 A	13.57
F-135P	A	1 1/2	76 V CT @ .02 A	38 V @ .04 A	13.62
F-136P	A	1 1/2	116 V CT @ .013 A	58 V @ .026 A	15.13
F-141XP	B	4 1/2	8 V CT @ .562 A	4 V @ 1.124 A	10.78
F-149XP	B	4 1/2	12.6 V CT @ .35 A	6.3 V @ .70 A	10.78
F-142XP	B	4 1/2	15 V CT @ .30 A	7.5 V @ .60 A	10.06
F-161XP	B	4 1/2	17 V CT @ .264 A	8.5 V @ .528 A	10.78
F-148XP	B	4 1/2	25.2 V CT @ .178 A	12.6 V @ .356 A	10.78
F-143XP	B	4 1/2	30 V CT @ .15 A	15 V @ .30 A	10.02
F-162XP	B	4 1/2	34 V CT @ .132 A	1 V @ .264 A	10.78
F-147XP	B	4 1/2	40 V CT @ .112 A	20 V @ .224 A	10.78
F-144XP	B	4 1/2	54 V CT @ .084 A	27 V @ .168 A	10.78
F-145XP	B	4 1/2	76 V CT @ .060 A	38 V @ .120 A	10.62
F-146XP	B	4 1/2	116 V CT @ .033 A	58 V @ .066 A	10.78
F-151XP	B	7 1/2	8 V CT @ .940 A	4 V @ 1.880 A	13.37
F-159XP	B	7 1/2	12.6 V CT @ .60 A	6.3 V @ 1.2 A	13.37
F-152XP	B	7 1/2	15 V CT @ .50 A	7.5 V @ 1.00 A	13.37
F-163XP	B	7 1/2	17 V CT @ .441 A	8.5 V @ .882 A	13.48
F-158XP	B	7 1/2	25.2 V CT @ .30 A	12.6 V @ .60 A	13.37
F-153XP	B	7 1/2	30 V CT @ .25 A	15 V @ .50 A	13.37
F-164XP	B	7 1/2	34 V CT @ .22 A	17 V @ .44 A	13.48
F-157XP	B	7 1/2	40 V CT @ .188 A	20 V @ .376 A	13.37
F-154XP	B	7 1/2	54 V CT @ .14 A	27 V @ .28 A	13.37
F-155XP	B	7 1/2	76 V CT @ .100 A	38 V @ .200 A	13.37
F-156XP	B	7 1/2	116 V CT @ .065 A	58 V @ .130 A	13.37
PRIMARY 115/230 VOLTS—50-60 Hz.					
F-3132P	B	1 1/2	5 V CT @ .1 A	7.5 V @ .2 A	$ 9.13
F-333P	B	1 1/2	30 V CT @ .05 A	15 V @ .10 A	10.15
F-348XP	A	4 1/2	12.6 V CT @ .350 A	6.3 V @ .700 A	10.28
F-3142XP	A	4 1/2	15 V CT @ .3 A	7.5 V @ .6 A	9.35
F-349XP	A	4 1/2	16 V CT @ .28 A	8 V @ .56 A	10.35
F-350XP	A	4 1/2	24 V CT @ .180 A	12 V @ .360 A	11.88
F-358XP	A	4 1/2	20 V CT @ .225 A	10 V @ .450 A	12.34
F-3143XP	A	4 1/2	30 V CT @ .15 A	15 V @ .3 A	10.99
F-363XP	A	7 1/2	230 V CT @ .020 A	115 V @ .040 A	11.68
F-3152XP	A	7 1/2	15 V CT @ .5 A	7.5 V @ 1.0 A	11.75
F-3153XP	A	7 1/2	30 V CT @ .25 A	15 V @ .5 A	11.75
F-359XP	A	10	24 V CT @ .45 A	12 V @ .90 A	14.56
F-362XP	A	10	20 V CT @ .500 A	10 V @ 1.0 A	15.04
F-365XP	A	10	12.6 V CT @ .800 A	6.3 V @ 1.6 A	15.04
F-366XP	A	10	16 V CT @ .640 A	8 V @ 1.28 A	14.71
F-371P	B	24	12.6 V CT @ 2 A	6.3 V @ 4 A	16.11
F-372P	B	24	16 V CT @ 1.5 A	8 V @ 3 A	16.27
F-373P	B	24	20 V CT @ 1.2 A	10 V @ 2.4 A	16.20
F-374P	B	24	24 V CT @ 1 A	12 V @ 2 A	16.02
F-375P	B	24	28 V CT @ .8 A	14 V @ 1.6 A	16.04
F-376P	B	24	34 V CT @ .7 A	17 V @ 1.4 A	16.27
F-377P	B	24	40 V CT @ .6 A	20 V @ 1.2 A	16.27
F-378P	B	24	56 V CT @ .42 A	28 V @ .84 A	16.22
F-379P	B	24	120 V CT @ .2 A	60 V @ .4 A	16.38

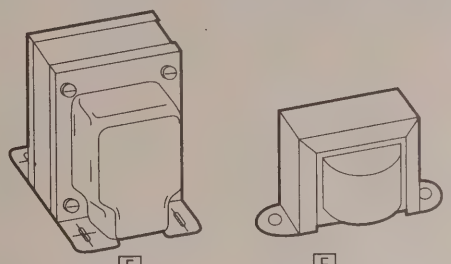
TRIPLE OUTPUT SECONDARIES FOR ±15 VDC AND ±5 VDC



C D

Triad No.	Fig.	Net Watts	Sec. No. 1	Sec. No. 2	Price Each
F-165P	C	1 1/2	24 V CT @ .025 A	9 V @ .100 A	$15.56
F-167P	C	1 1/2	32 V CT @ .020 A	15 V @ .060 A	16.34
F-168XP	D	4 1/2	32 V CT @ .050 A	15 V @ .195 A	11.24
F-166XP	D	7 1/2	24 V CT @ .125 A	9 V @ .500 A	13.87
F-169XP	D	7 1/2	32 V CT @ .100 A	15 V @ .287 A	13.44

LOW VOLTAGE RECTIFIER TRANSFORMERS

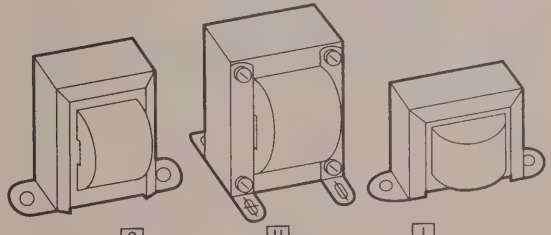


E F

All use 115 volt tapped primary. Used to supply transistor DC voltage. 15 halfwave or 30 in bridge circuit.

Triad No	Fig.	Secondary		Test Volts	Price Each
		Volts	Amps		
F-94X	F	10-20 CT-40 CT	.035	1500	$10.99
F-90X	F	10-20 CT-40 CT	.1	1500	11.84
F-91X	F	10-20 CT-40 CT	.3	1500	15.52
F-93X	F	10-20 CT-40 CT	.75	1500	17.21
F-92A	E	10-20 CT-40 CT	1.0	1500	24.40

POWER SUPPLY, CONTROL AND FILAMENT TRANSFORMERS



G H I

Triad No.	Fig.	Secondary		Test Volts	Price Each
		Volts	Amps		
MULTIPLE SECONDARY PRIMARY 115 VOLTS—50-60 Hz.					
F-237Z#	G	12 CT 12 CT	1 1	1500	$22.58
F-241U#	H	18 CT 18 CT	1 1	1500	22.64
F-243U#	H	18 CT 18 CT	1 4	1500	44.42
F-244U#	H	18 CT 18 CT	4 8	1500	53.90
F-195X	I	18 CT 32 CT 15.5CT	8 .25 .75	1500	17.55
F-196U	H	32 CT	1	1500	25.38
F-197U	H	15 CT 32 CT	2 1	1500	25.29
F-198U	H	15 CT 32 CT 15 CT	4 1 6	1500	40.28

#60 Hz operation.

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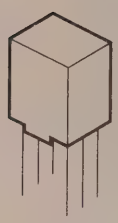
MagneTek Triad

Audio Transformers

RED SPEC TRANSISTOR TRANSFORMERS



Transformers designed and constructed to conform to the rigid requirements of MIL-T-27D. Solid epoxy molded case, permanent and legible circuit data on every unit, base mounting pad for easy inspection of all soldering joints, high strength gold-plated nickel alloy leads, base dimensions of only 0.31″ × 0.41″. Total height of only 0.465″, weight of 1.10 ounce.

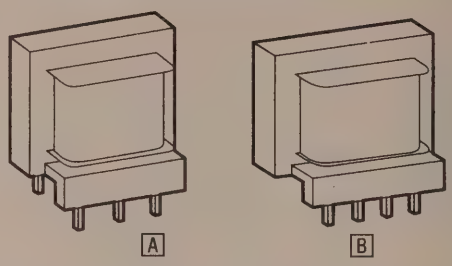
Triad No.	Impedance, Ohms Primary	Impedance, Ohms Secondary	Power Level mW	Price Each
LOW LEVEL INPUT TRANSFORMERS				
SP-4	200,000 CT	1000 CT	10	$21.29
SP-5	50,000 CT	1000 CT	25	21.14
LOW LEVEL INTERSTAGE TRANSFORMERS				
SP-13	25,000 CT 20,000 CT	1000 CT 800 CT	40	$20.11
LOW LEVEL DRIVER TRANSFORMERS				
SP-20	10,000 CT	1200 CT	50	$20.84
SP-21	10,000 CT	2000 CT	50	21.21
SP-22	10,000	2000 CT 500	50	21.69
SP-29	10,000 CT	500 CT	50	20.01
OUTPUT TRANSFORMERS				
SP-33	1000	50	50	$17.25
SP-42	150 CT	12	50	15.51
SP-49	300	600	50	21.98
SP-50	500 CT	600	50	16.31
SP-51	900 CT	600	50	19.12
SP-52	1500 CT	600	50	21.29
OUTPUT-ISOLATION TRANSFORMERS				
SP-66	10,000 CT	10,000 CT	50	$16.93
SP-67	600 CT	600 CT	50	18.64
SP-68	10,000	10,000 CT 2500*	50	22.33
SP-69	600	600 CT 150	50	18.56
SP-70	600	600	50	17.48

*Split winding

AUDIO CHOKES

Triad No.	Inductive, Hys.	Current mA	Resistance Ohms	Price Each
SP-128	0.1	5	15	$11.81

PLUG-IN PC AUDIO TRANSFORMERS

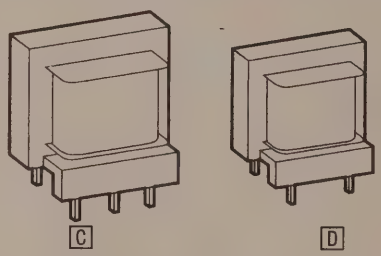


Output 100 mW. Size 5/8″ × 15/32″ except TY-146P, 1 watt output, size 1½″ × 1⅜″ × 1⅛″.

Triad No.	Fig.	Impedance, Ohms Primary	Impedance, Ohms Secondary	Pri. DC Unbal., mA	Price Each
TY-141P	A	10000 CT	10000 CT	4	$12.98
TY-142P	A	10000 CT	2000 CT	4	8.73
TY-144P	A	15000 CT	15000 CT	4	9.58
TY-145P	A	600 CT	600 CT	15	9.67
TY-146P	B	600 CT/150†	600 CT/150†	. . . . .	14.12

†Split wiring

TELEPHONE COUPLING TRANSFORMERS



Transformers specifically designed and manufactured to telephone company requirements for voice/data use over leased private line or through the dial-up switched telephone network. Used for impedance matching, isolation, line balance, bridging, hybrid and holding-coil applications. All units in plug-in printed circuit construction. **Frequency Response:** 300-3500 Hz. ±0.5 dB. **Longitudinal Balance:** 45 dB min. **Return Loss:** 26 dB min. **Distortion:** 0.5% max. **Impedance Matching:** ±10%. **Power Level:** −45 dBm to +7 dBm.

Triad No.	Fig.	Application	Impedance, Ohms Primary	Impedance, Ohms Secondary	Price Each
TY-300P	C	Hybrid†	600	600/800‡	$11.27
TY-301P	D	Coupling	600	900	10.71
TY-302P	C	Hybrid†	600	600/800	10.08
TY-303P	D	Bridging	4000	600	8.93
TY-304P	C	Coupling	600CT	600CT	8.45

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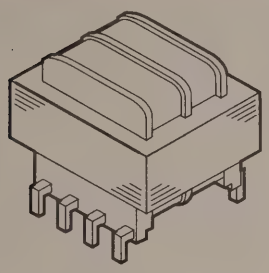
90 E. Union Street
Goodland, IN 47948
Phone: 800-624-6384
FAX: (219) 297-3111

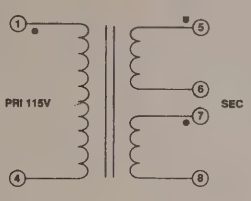
MagneTek Triad

Power Transformers

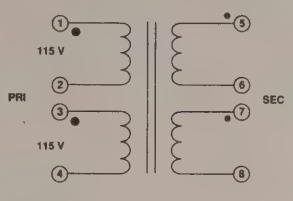
SPLIT-BOBBIN TRANSFORMERS

Split-bobbin transformers are nonconcentrically wound with primary and secondaries wound side by side, unlike the secondary-on-top-of primary windings of standard PC board transformers. Split-bobbin winding and the resultant low capacitive coupling eliminate costly electrostatic shielding. The unique construction also makes possible higher voltage ratings—2500 V rather than 1500 V.





6 PIN



8 PIN

Triad No.	VA	Secondary Ratings, rms: Individual	Series	Parallel	Price Each
115 VAC, 6-PIN					
F10-110	1.1	5V @ .11A	10V CT @ .11A	5V @ .22A	**$ 7.50**
F10-250	2.5	5V @ .25A	10V CT @ .25A	5V @ .5A	**7.65**
F10-600	6.0	5V @ .6A	10V CT @ .6A	5V @ 1.2A	**8.65**
F10-1200	12.0	5V @ 1.2A	10V CT @ 1.2A	5V @ 2.4A	**9.90**
F10-2000	20.0	5V @ 2A	10V CT @ 2A	5V @ 4A	**11.85**
F10-3600	36.0	5V @ 3.6A	10V CT @ 3.6A	5V @ 7.2A	**14.50**
F12-090	1.1	6.3V @ .09A	12.6V CT @ .09A	6.3V @ .18A	**7.50**
F12-200	2.5	6.3V @ .2A	12.6V CT @ .2A	6.3V @ .4A	**7.65**
F12-500	6.0	6.3V @ .5A	12.6V CT @ .5A	6.3V @ 1.0A	**8.65**
F12-1000	12.0	6.3V @ 1.0A	12.6V CT @ 1.0A	6.3B @ 2.0A	**9.90**
F12-1600	20.0	6.3V @ 1.6A	12.6V CT @ 1.6A	6.3V @ 3.2A	**11.85**
F12-2850	36.0	6.3V @ 2.85A	12.6V CT @ 2.85A	6.3V @ 5.7A	**14.50**
F16-070	1.1	8V @ .07A	16V CT @ .07A	8V @ .14A	**7.50**
F16-150	2.5	8V @ .15A	16V CT @ .15A	8V @ .3A	**7.65**
F16-400	6.0	8V @ .4A	16V CT @ .4A	8V @ .8A	**8.65**
F16-800	12.0	8V @ .8A	16V CT @ .8A	8V @ 1.6A	**9.90**
F16-1250	20.0	8V @ 1.25A	16V CT @ 1.25A	8V @ 2.5A	**11.85**
F16-2250	36.0	8V @ 2.25A	16V CT @ 2.25A	8V @ 4.5A	**14.50**
F20-055	1.1	10V @ .055A	20V CT @ .055A	10V @ .11A	**7.50**
F20-120	2.5	10V @ .12A	20V CT @ .12A	10V @ .24A	**7.65**
F20-300	6.0	10V @ .3A	20V CT @ .3A	10V @ .6A	**8.65**
F20-600	12.0	10V @ .6A	20V CT @ .6A	10V @ 1.2A	**9.90**
F20-1000	20.0	10V @ 1.0A	20V CT @ 1.0A	10V @ 2.0A	**11.85**
F20-1800	36.0	10V @ 1.8A	20V CT@ 1.8A	10V @ 3.6A	**14.50**
F24-045	1.1	12V @ .045A	24V CT @ .045A	12V @ .09A	**7.50**
F24-100	2.5	12V @ .1A	24V CT @ .1A	12V @ .2A	**7.65**
F24-250	6.0	12V @ .25A	24V CT @ .25A	12V @ .5A	**8.65**
F24-500	12.0	12V @ .5A	24V CT @ .5A	12V @ 1.0A	**9.90**
F24-800	20.0	12V @ .8A	24V CT @ .8A	12V @ 1.6A	**11.85**
F24-1500	36.0	12V @ 1.5A	24V CT @ 1.5A	12V @ 3.0A	**14.50**
F28-040	1.1	14V @ .04A	28V CT @ .04A	14V @ .08A	**7.50**
F28-85	2.5	14V @ .085A	28V CT @ .085A	14V @ .17A	**7.65**
F28-200	6.0	14V @ .2A	28V CT @ .2A	14V @ .4A	**8.65**
F28-420	12.0	14V @ .42A	28V CT @ .42A	14V @ .84A	**6.44**
F28-700	20.0	14V @ .7A	28V CT @ .7A	14V @ 1.4A	**11.85**
F28-1300	36.0	14V @ 1.3A	28V CT @ 1.3A	14V @ 2.6A	**14.50**
F36-030	1.1	18V @ .03A	36V CT @ .03A	18V @ .06A	**7.50**
F36-65	2.5	18V @ .065A	36V CT @ .065A	18V @ .13A	**7.65**
F36-170	6.0	18V @ .17A	36V CT @ .17A	18V @ .34A	**8.65**
F36-350	12.0	18V @ .35A	36V CT @ .35A	18V @ .7A	**9.90**
F36-550	20.0	18V @ .55A	36V CT @ .55A	18V @ 1.1A	**11.85**
F36-1000	36.0	18V @ 1.0A	36V CT @ 1.0A	18V @ 2.0A	**14.50**
F48-023	1.1	24V @ .023A	48V CT @ .023A	24V @ .046A	**7.50**
F48-050	2.5	24V @ .05A	48V CT @ .05A	24V @ .1A	**7.65**
F48-125	6.0	24V @ .125A	48V CT @ .125A	24V @ .25A	**8.65**
F48-250	12.0	24V @ .25A	48V CT @ .25A	24V @ .5A	**9.90**
F48-400	20.0	24V @ .4A	48V CT @ .4A	24V @ .8A	**11.85**
F48-750	36.0	24V @ .75A	48V CT @ .75A	24V @ 1.5A	**14.50**
F56-020	1.1	28V @ .02A	56V CT @ .02A	28V @ .04A	**7.50**
F56-045	2.5	28V @ .045A	56V CT @ .045A	28V @ .09A	**7.65**
F56-110	6.0	28V @ .11A	56V CT @ .11A	28V @ .22A	**8.65**
F56-220	12.0	28V @ .22A	56V CT @ .22A	28V @ .44A	**9.90**
F56-350	20.0	28V @ .35A	56V CT @ .35A	28V @ .7A	**11.85**
F56-650	36.0	28V @ .65A	56V CT @ .65A	28V @ 1.3A	**14.50**
F120-010	1.1	60V @ .01A	120V CT @ .01A	60V @ .02A	**7.50**
F120-020	2.5	60V @ .02A	120V CT @ .02A	60V @ .04A	**7.65**
F120-050	6.0	60V @ .05A	120V CT @ .05A	60V @ .1A	**8.65**
F120-100	12.0	60V @ .1A	120V CT @ .1A	60V @ .2A	**9.90**
F120-160	20.0	60V @ .16A	120V CT @ .16A	60V @ .32A	**11.85**
F120-300	36.0	60V @ .3A	120V CT @ .3A	60V @ .6A	**14.50**

Triad No.	VA	Secondary Ratings, rms: Individual	Series	Parallel	Price Each
115/230 VAC, 8-PIN					
FS10-110	1.1	5V @ .11A	10V CT @ .11A	5V @ .22A	**$ 8.70**
FS10-250	2.5	5 V @ .25A	10V CT @ .25A	5V @ .5A	**9.00**
FS10-600	6.0	5V @ .6A	10V CT @ .6A	5V @ 1.2A	**9.60**
FS101200	12.0	5V @ 1.2A	10V CT @ 1.2A	5V @ 2.4A	**11.00**
FS102000	20.0	5V @ 2A	10V CT @ 2A	5V @ 4A	**13.50**
FS103600	36.0	5V @ 3.6A	10V CT @ 3.6A	5V @ 7.2A	**16.00**
FS12-090	1.1	6.3V @ .09A	12.6V CT @ .09A	6.3V @ .18A	**8.70**
FS12-200	2.5	6.3V @ .2A	12.6V CT @ .2A	6.3V @ .4A	**9.00**
FS12-500	6.0	6.3V @ .5A	12.6V CT @ .5A	6.3V @ 1.0A	**9.60**
FS121000	12.0	6.3V @ 1.0A	12.6V CT @ 1.0A	6.3V @ 2.0A	**11.00**
FS121600	20.0	6.3V @ 1.6A	12.6V CT @ 1.6A	6.3V @ 3.2A	**13.50**
FS122850	36.0	6.3V @ 2.85A	12.6V CT @ 2.85A	6.3V @ 5.7A	**16.00**
FS16-070	1.1	8V @ .07A	16V CT @ .07A	8V @ .14A	**8.70**
FS16-150	2.5	8V @ .15A	16V CT @ .15A	8V @ .3A	**9.00**
FS16-400	6.0	8V @ .4A	16V CT @ .4A	8V @ .8A	**9.60**
FS16-800	12.0	8V @ .8A	16V CT @ .8A	8V @ 1.6A	**11.00**
FS161250	20.0	8V @ 1.25A	16V CT @ 1.25	8V @ 2.5A	**13.50**
FS162250	36.0	8V @ 2.25A	16V CT @ 2.25	8V @ 4.5A	**16.00**
FS20-055	1.1	10V @ .055A	20V CT @ .055A	10V @ .11A	**8.70**
FS20-120	2.5	10V @ .12A	20V CT @ .12A	10V @ .24A	**9.00**
FS20-300	6.0	10V @ .3A	20V CT @ .3A	10V @ .6A	**9.60**
FS20-600	12.0	10V @ .6A	20V CT @ .6A	10V @ 1.2A	**11.00**
FS201000	20.0	10V @ 1.0A	20V CT @ 1.0A	10V @ 2A	**13.50**
FS201800	36.0	10V @ 1.8A	20V CT @ 1.8A	10V @ 3.6A	**16.00**
FS24-045	1.1	12V @ .045A	24V CT @ .045A	12V @ .09A	**8.70**
FS24-100	2.5	12V @ .1A	24V CT @ .1A	12V @ .2A	**9.00**
FS24-250	6.0	12V @ .25A	24V CT @ .25A	12V @ .5A	**9.60**
FS24-500	12.0	12V @ .5A	24V CT @ .5A	12V @ 1A	**11.00**
FS24-800	20.0	12V @ .8A	24V CT @ .8A	12V @ 1.6A	**13.50**
FS241500	36.0	12V @ 1.5A	24V CT @ 1.5A	12V @ 3A	**16.00**
FS28-040	1.1	14V @ .04A	28V CT @ .04A	14V @ .08A	**8.70**
FS28-85	2.5	14V @ .085A	28V CT @ .085A	14V @ .17A	**9.00**
FS28-200	6.0	14V @ .2A	28V CT @ .2A	14V @ .4A	**9.60**
FS28-420	12.0	14V @ .42A	28V CT @ .42A	14V @ .84A	**11.00**
FS28-700	20.0	14V @ .7A	28V CT @ .7A	14V @ 1.4A	**13.50**
FS281300	36.0	14V @ 1.3A	28V CT @ 1.3A	14V @ 2.6A	**16.00**
FS36-030	1.1	18V @ .03A	36V CT @ .03A	18V @ .06A	**8.70**
FS36-65	2.5	18V @ .065A	36V CT @ .065A	18V @ .13A	**9.00**
FS36-170	6.0	18V @ .17A	36V CT @ .17A	18V @ .34A	**9.60**
FS36-350	12.0	18V @ .35A	36V CT @ .35A	18V @ .7A	**11.00**
FS36-550	20.0	18V @ .55A	36V CT @ .55A	18V @ 1.1A	**13.50**
FS361000	36.0	18V @ 1A	36V CT @ 1A	18V @ 2A	**16.00**
FS48-023	1.1	24V @ .023A	36V CT @ .023A	24V @ .046A	**8.70**
FS48-050	2.5	24V @ .05A	48V CT @ .05A	24V @ .1A	**9.00**
FS48-125	6.0	24V @ .125A	48V CT @ .125A	24V @ .25A	**9.60**
FS48-250	12.0	24V @ .25A	48V CT @ .25A	24V @ .5A	**11.00**
FS48-400	20.0	24V @ .4A	48V CT @ .4A	24V @ .8A	**13.50**
FS48-750	36.0	24V @ .75A	48V CT @ .75A	24V @ 1.5A	**16.00**
FS56-020	1.1	28V @ .02A	56V CT @ .02A	28V @ .04A	**8.70**
FS56-045	2.5	28V @ .045A	56V CT @ .045A	28V @ .09A	**9.00**
FS56-110	6.0	28V @ .11A	56V CT @ .11A	28V @ .22A	**9.60**
FS56-220	12.0	28V @ .22A	56V CT @ .22A	28V @ .44A	**11.00**
FS56-350	20.0	28V @ .35A	56V CT @ .35A	28V @ .7A	**13.50**
FS56-650	36.0	28V @ .65A	56V CT @ .65A	2V @ 1.3A	**16.00**
FS120-01	1.1	60V @ .01A	120V CT @ .01A	60V @ .02A	**8.70**
FS120-02	2.5	60V @ .02A	120V CT @ .02A	60V @ .04A	**9.00**
FS120-05	6.0	60V @ .05A	120V CT @ .05A	60V @ .1A	**9.60**

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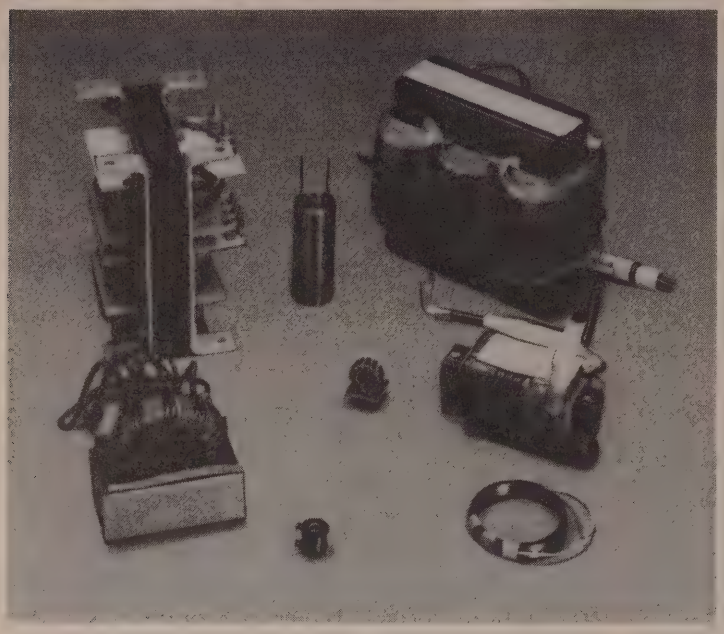

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TRANSFORMERS

TRANSFORMERS

- Power — 0 to 35 KVA
- Voltage — 0-3000 Volts Peak 1 to 3 Phase
- Frequency — Audio (3 Hz) through Radio (500 KHz)
- Packaging — Air Cooled, Potted, Encapsulated, Enclosed
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MAGNETICO QUALIFICATIONS

Mil - Std - 981	**Mil - Std - 981:** Design, Manufacturing and Quality Standards for Custom Electromagnetic Devices for Space Application.
Mil - T - 21038	**Mil - T - 21038:** Transformers, pulse, low power.
Mil - T - 27	**Mil - T - 27:** Military Specification for Transformers and Inductors, audio power and high-power pulse.
QPL Approved	**QPL:** Qualified Products List, Mil - T - 27.
Mil - Std - 2000	**Mil - Std - 2000:** Standard Requirements for Soldered Electrical and Electronic Assemblies.
NHB 5300.4(3A-1)	**NHB 5300.4(3A-1):** NASA Requirements for Soldering Electrical Connections.
Environmental Test Lab	**DESC APPROVED ENVIRONMENTAL LAB** MIL - T - 27 QUALIFICATION TESTING, TABLE VI ■ MIL - T - 21038 QUALIFICATION TESTING, TABLE VII ■ MIL - STD - 981 GROUP A & GROUP B TESTING

WHEN QUALITY COUNTS . . .

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THE BEST IN CUSTOM HIGH QUALITY MAGNETICS

MIL-STD-981 - Electromagnetic Devices For Space Applications
WS6536/MIL-STD-2000 - Approved Certified Program for High Reliability Soldering
QUALIFICATION INSPECTION MIL-T-27 - Complete Environmental Testing

STANDARD MINIATURE 400 Hz POWER TRANSFORMERS

CONDENSED PERFORMANCE DATA-PRIMARY VOLTAGE 115 VRMS.
All Units Designed to meet MIL-T-27E.
IMMEDIATE DELIVERY FOR PROTOTYPE QUANTITIES.

Catalog Number	VA Rating	Secondary Voltage (RMS)	O.D. ± 1/32	Height ± 1/32	Nominal Weight	Nom. Reg.	Nom.* Temp. Rise
9600	2	6-300 V	1″	1 19/32″	1 oz/ 30 gm	18%	10°C
9601	4	6-300 V	1″	11/16″	1.2 oz/ 35 gm	15%	12°C
9602	6	6-300 V	1″	7/8″	1.6 oz/ 45 gm	10%	18°C
9603	9	6-300 V	1″	1 1/16″	2.1 oz/ 60 gm	8%	20°C
9604	30	6-300 V	1 3/8″	1 1/2″	5.3 oz/150 gm	7%	23°C
10648	75	10-300 V	2″	1 5/16″	10 oz	± 3%	30°C
10649	150	10-300 V	2 1/4″	1 9/16″	18 oz	± 3%	40°C

CALL FOR STANDARD LITERATURE

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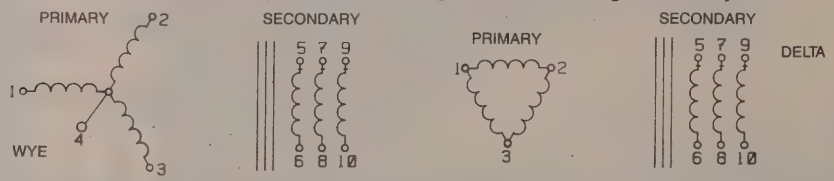
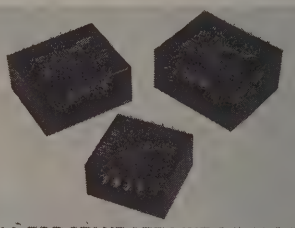
CUSTOM DESIGNS AVAILABLE UPON REQUEST

400 HZ 3φ POWER TRANSFORMERS...*Off The Shelf*

* Designed to meet the requirements of: **MIL-T-27/344/345/346/347/348/349** ①
* 120 standard designs from 90 VA thru 375 VA, including a wide variety of input and output voltage configurations offering maximum design flexibility.





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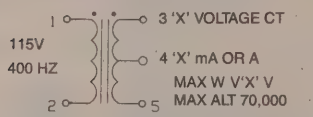
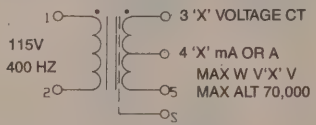
MINIATURE 400HZ POWER TRANSFORMERS...*Off The Shelf*

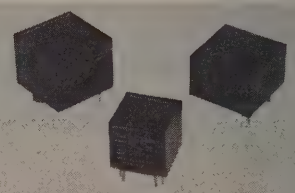
* Designed to meet the requirements of: **MIL-T-27/37** thru **MIL-T-27/47** ①
* 308 standard designs from 1.5 VA thru 25 VA**, including a wide variety of output voltages offering maximum design flexibility.

CIRCUIT DIAGRAM AND MARKING



CIRCUIT DIAGRAM AND MARKING

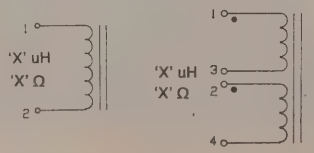


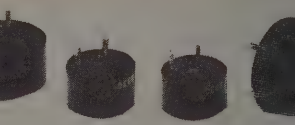


CALL FOR STANDARD LINE CATALOG

SWITCHING REGULATOR INDUCTORS...*Off The Shelf*

* Designed to meet the requirements of: **MIL-T-27/287/288/289** ①
* 24 standard designs. Type TF5S04ZZ

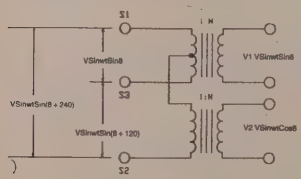




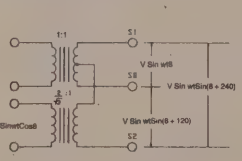
INDUCTANCE: 8uhy to 10MH, up to 13ADC
CALL FOR STANDARD LITERATURE

STANDARD SCOTT "T" TRANSFORMERS

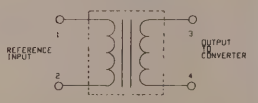
SYNCHRO TO RESOLVER CONVERTER

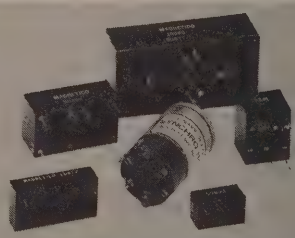


RESOLVER TO SYNCHRO CONVERTER



STANDARD REFERENCE TRANSFORMER





CALL FOR STANDARD LINE CATALOG OR TO ORDER CUSTOM DESIGN

① "All units designed to meet the dimensional and performance requirements of MIL-T-XXX, however not all part numbers are listed on the Qualified Products List (QPL). The current status should be verified with the factory."

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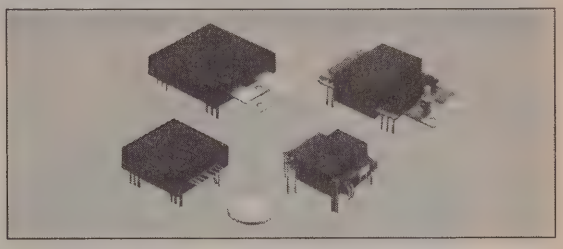
WS6536/ MIL-STD-2000 - Approved Certified Program for High Reliability Soldering
QUALIFICATION INSPECTION MIL-T-27 - Complete Environmental Testing

LOW PROFILE PLANAR CONSTRUCTION MAGNETICS

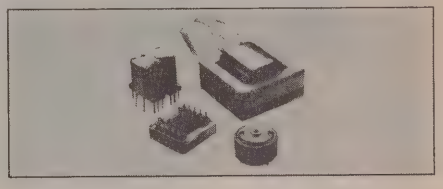
Contact engineering directly for technical assistance.



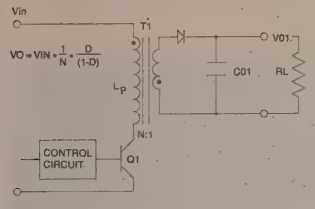
PWM AND RESONANT POWER CONVERSION TRANSFORMERS

TYPICAL TOPOLOGIES

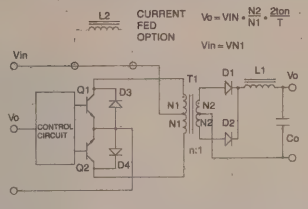
Actual circuit operation verified in switching topology. Leakage inductance, efficiency, temperature rise, and SRF characterized. Single-ended 20 Khz-500 Khz to 250 watts. Bridge and push-pull 20 Khz-250 Khz to 1 Kw. Low profile designs are available for sem modules. Proximity effect and skin depth accounted for. Our wide variety of cores in stock allows quick custom modification. Call, write, or fax for specific device bulletin.



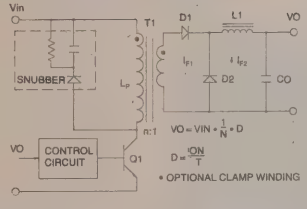
DISCONTINUOUS/CONTINUOUS MODE FLYBACK REGULATOR



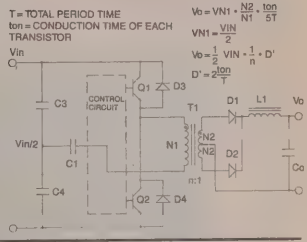
CENTER TAPPED PUSH-PULL SWITCHING REGULATOR



DOUBLE/SINGLE ENDED FORWARD CONVERTER



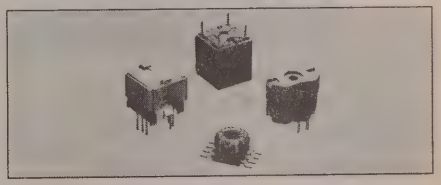
HALF-BRIDGE CIRCUIT



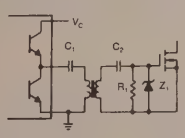
GATE DRIVE TRANSFORMERS

TYPICAL APPLICATION

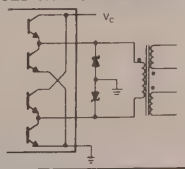
Meant to interface with PWM IC output or standard driver IC_S to supply Hi peak currents with low rise times to power fets. Low stray capacity - Hi SRF. Standard ratios 2:1, 1.5:1, 1:1. Models to 3750 DWV. Lowest leakage inductance on toroids. 20 Khz to 1 Mhz. Wide variety to choose from. Call, write or fax for catalog.



SINGLE ENDED TRANSFORMER DRIVE

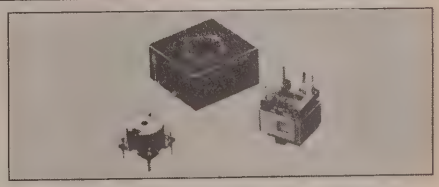


BALANCED TRANSFORMER DRIVE

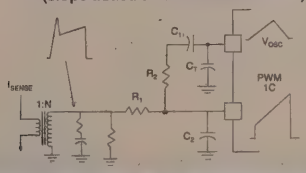


CURRENT SENSE TRANSFORMERS

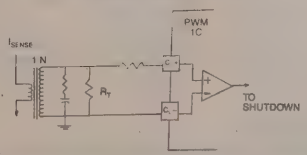
Typical applications shown. A wide variety of devices are offered in a variety of geometric shapes including toroids where the user can thread his current sense lead thru the center post. I_{IN} pk to 20 A in range from 10 Khz to 1 Mhz., Uni-polar or Bi-polar. High stock mounting available. Ratios from 1:20 to 1:200. Call, write, or fax for individual brochure.



CURRENT MODE CONTROL (slope added to inductor Waveform)



CURRENT TIME



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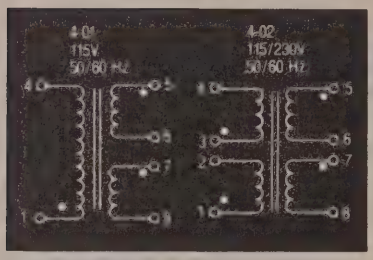
HORIZONTAL PC TRANSFORMERS

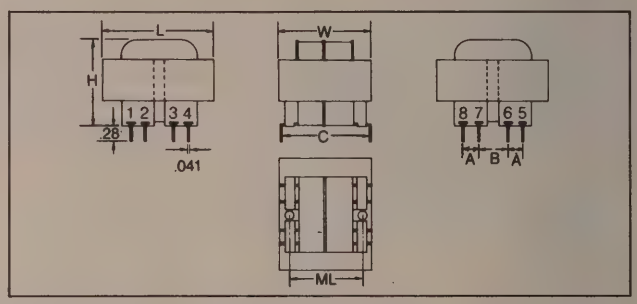
SERIES 4-01 & 4-02

Recognized Component Underwriters Labs Inc.

Available

2,500-volt RMS Hipot, available in a variety of sizes. Maximum operating temperature 130°C. Available with either single 115V, or dual 115/230V primary. MCI's pin configuration is designed for ease of connection in printed circuit boards. Heavier transformers are provided with mounting holes for additional mounting security. Adaptations of standard transformers are also available. Dots on schematics shown below indicate like polarity.





To determine part number for specific transformer to be ordered:

1. Locate the column, in the table, for the required voltage.
2. In the voltage column, locate the required current rating.
3. Moving left from the current rating, find the number indicating required primary—single 115V primary or dual 115/230V.
4. Derive part number by combining digits identifying required primary and digits at top of column giving required voltage.

DIMENSIONS

Size	VA	L	W	H	ML	A	B	C	Optional Mtg. Screw & Nut	Lbs.
2	1.1	1-3/8	1-1/8	15/16	—	.250	.250	1.200	None	0.17
3	2.4	1-3/8	1-1/8	1-3/16	—	.250	.250	1.200	None	0.25
4	6.0	1-5/8	1-5/16	1-5/16	1-1/16	.250	.350	1.280	4-40x1-3/8 Nylon	0.44
5	12.0	1-7/8	1-9/16	1-7/16	1-1/4	.300	.400	1.410	4-40x1-3/8 Nylon	0.70
6	20.0	2-1/4	1-7/8	1-7/16	1-1/2	.300	.400	1.600	4-40x1-3/8 Nylon	0.80
7	36.0	2-5/8	2-3/16	1-9/16	†	.400	.400	1.850	†	1.1

† 4 mounting holes $2\frac{3}{16}$ x $1\frac{3}{4}$ for #6 screw

CURRENT RATINGS (AMPS RMS)

Last 3 Digits of Part Number:			-010	-012	-016	-020	-024	-028	-036	-048	-056	-120
First 4 Digits: Single 115V Primary	Dual 115/230V Primary		SERIES CONNECTION SECONDARY VOLTAGE 10V C.T.	12.6V C.T.	16V C.T.	20V. C.T.	24V C.T.	28V C.T.	36V C.T.	48V C.T.	56V C.T.	120V C.T.
4-01-2___	4-02-2___		.110	.090	.070	.055	.045	.040	.030	.023	.020	.010
4-01-3___	4-02-3___		.250	.200	.150	.120	.100	.085	.065	.050	.045	.020
4-01-4___	4-02-4___		.600	.500	.400	.300	.250	.200	.170	.125	.110	.050
4-01-5___	4-02-5___		1.200	1.000	.800	.600	.500	.420	.350	.250	.220	.100
4-01-6___	4-02-6___		2.000	1.600	1.250	1.000	.800	.700	.550	.400	.350	.160
4-01-7___	4-02-7___		3.600	2.850	2.250	1.800	1.500	1.300	1.000	.750	.650	.300
			PARALLEL CONNECTION SECONDARY VOLTAGE 5V	6.3V	8V	10V	12V	14V	18V	24V	28V	60V
4-01-2___	4-02-2___		.220	.180	.140	.110	.090	.080	.060	.046	.040	.020
4-01-3___	4-02-3___		.500	.400	.300	.240	.200	.170	.130	.100	.090	.040
4-01-4___	4-02-4___		1.200	1.000	.800	.600	.500	.400	.340	.250	.220	.100
4-01-5___	4-02-5___		2.400	2.000	1.600	1.200	1.000	.840	.700	.500	.440	.200
4-01-6___	4-02-6___		4.000	3.200	2.500	2.000	1.600	1.400	1.100	.800	.700	.320
4-01-7___	4-02-7___		7.200	5.700	4.500	3.600	3.000	2.600	2.000	1.500	1.300	.600

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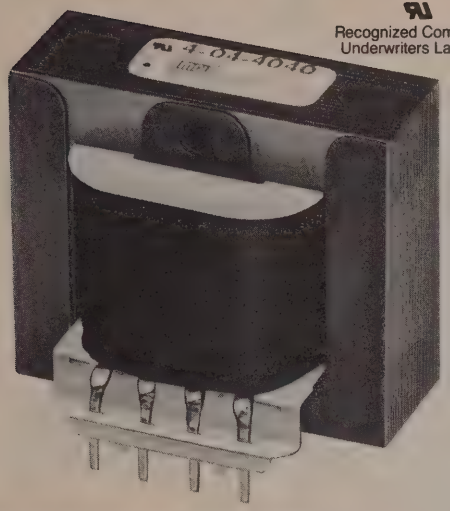
SERIES 4-03 & 4-04

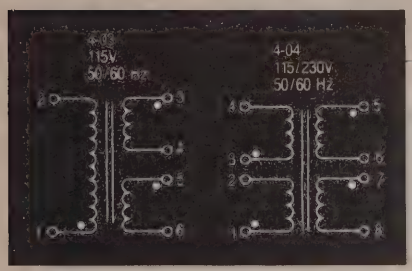
VERTICAL PC TRANSFORMERS

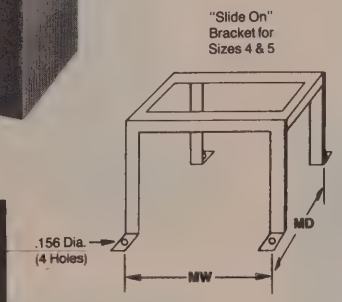


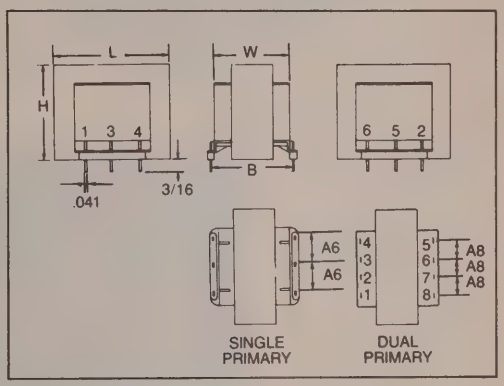
Recognized Component Underwriters Labs Inc.

Available

1,500-volt RMS Hipot, available in a variety of sizes. Maximum operating temperature 130°C. Available with dual 115/230V primary. MCI's pin configuration is designed for ease of connection in printed circuit boards. Adaptations of standard transformers are also available. Dots on schematics shown below indicate like polarity.







DIMENSIONS									OPTIONAL BRACKET*		
Size	VA	L	W	H	A-6 (C Pin)	A-8 (8 Pin)	B	WT. (oz.)	No.	MW	MD
1	1.0	1	1-3/8	0.83	0.250	0.200	1.200	2.5	—	—	—
2	1.2	1-3/8	1-1/8	1-3/16	0.312	0.200	1.000	3.0	—	—	—
3	4.4	1-5/8	1-1/4	1-3/8	0.400	0.250	1.100	5.0	—	—	—
4	10.0	1-7/8	1-7/16	1-5/8	0.400	0.250	1.300	9.0	9-14 9901	1-41/64	1-1/8
5	24.0	1-5/8	2-1/4	1-3/8	0.400	0.250	2.100	12.0	9-14 9902	1-3/8	2

To determine part number for specific transformer to be ordered:

1. **Locate the column, in the table, for the required voltage.**
2. **In the voltage column, locate the required current rating.**
3. **Moving left from the current rating, find the number indicating required primary—single 115V primary or dual 115/230V.**
4. **Derive part number by combining digits identifying required primary and digits at top of column giving required voltage.**

CURRENT RATINGS (AMPS RMS)

Last 3 Digits of Part Number:			-010	-012	-016	-020	-024	-028	-034	-040	-056	-088	-120	-180	-230
First 4 Digits: Single 115V Primary	Dual 115/230V Primary		SERIES CONNECTION SECONDARY VOLTAGE 10V C.T.	12.6V C.T.	16V C.T.	20V C.T.	24V C.T.	28V C.T.	34V C.T.	40V C.T.	56V C.T.	88V C.T.	120V CT.	180V C.T.	230V C.T.
4-03-1___	4-04-1___		.090	.070	.055	.045	.035	.030	.025	.020	.015	.010	.008		
4-03-2___	4-04-2___		.120	.100	.075	.060	.050	.040	.035	.030	.020	.015	.010	.006	.005
4-03-3___	4-04-3___		.440	.350	.260	.220	.180	.160	.125	.110	.080	.050	.035	.024	.020
4-03-4___	4-04-4___		1.000	.800	.640	.500	.450	.360	.300	.250	.180	.120	.085	.055	.040
4-03-5___	4-04-5___		2.400	2.000	1.500	1.200	1.000	.800	.700	.600	.420	.270	.200	.130	.100
			PARALLEL CONNECTION SECONDARY VOLTAGE 5V	6.3V	8V	10V	12V	14V	17V	20V	28V	44V	60V	90V	115V
4-03-1___	4-04-1___		.180	.140	.110	.090	.070	.060	.050	.040	.030	.020	.016		
4-03-2___	4-04-2___		.240	.200	.150	.120	.100	.080	.070	.060	.040	.030	.020	.012	.010
4-03-3___	4-04-3___		.880	.700	.520	.440	.360	.320	.250	.220	.160	.100	.070	.048	.040
4-03-4___	4-04-4___		2.000	1.600	1.280	1.000	.900	.720	.600	.500	.360	.240	.170	.110	.080
4-03-5___	4-04-5___		4.800	4.000	3.000	2.400	2.000	1.600	1.400	1.200	.840	.540	.400	.260	.200

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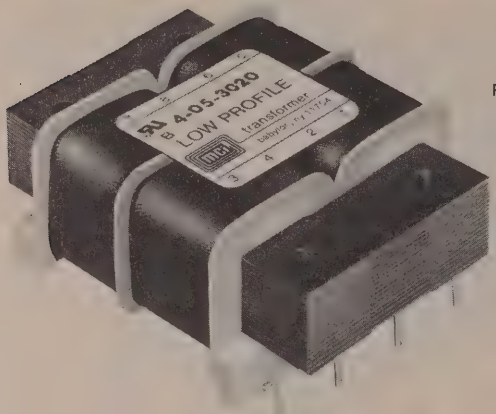
LOW PROFILE PC TRANSFORMERS

SERIES 4-05



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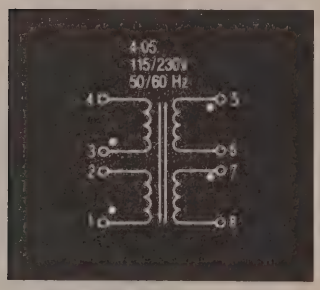
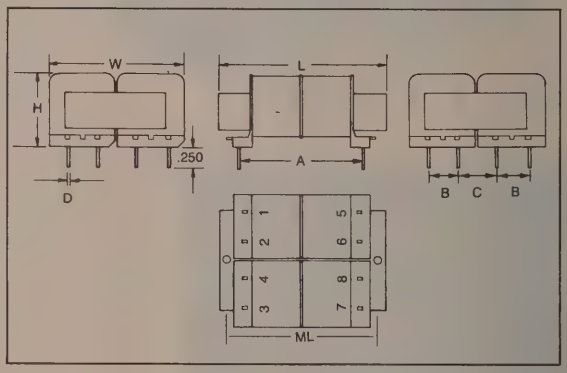
1,500-volt RMS Hipot, available in a variety of sizes. Maximum operating temperature 130°C. Available with dual 115/230V primary. MCI's pin configuration is designed for ease of connection in printed circuit boards. Adaptations of standard transformers are also available. Dots on schematics shown below indicate like polarity.





DIMENSIONS										
Part No.:	VA	L	W	H	A	B	C	D	ML	OZ
4-05-1___	2.5	1-7/8	1-9/16	.650	1.600	.375	.375	.041 × .020		5
4-05-2___	6	1-7/8	1-9/16	.850	1.600	.375	.375	.041 × .020		7
4-05-3___	12	2-1/2	2	1.065	2.000	.500	.500	.041 × .020		11
4-05-4___	24	2-7/8	2-1/4	1-1/4	1.900	.600	.530	.040 SQ	2-13/32 (with 2 holes for #4 screws)	15
4-05-5___	48	3-1/8	2-1/2	1-3/8	2.180	.600	.660	.040 SQ	2-5/8 (with 2 holes for #6 screws)	21

CURRENT RATINGS (AMPS RMS)												
Last 3 Digits of Part Number:	-010	-012	-016	-020	-024	-030	-034	-040	-056	-088	-120	-230
First 4 Digits: Dual 115/230V Primary				SERIES CONNECTION				SECONDARY VOLTAGE				
	10VCT	12.6VCT	16VCT	20VCT	24VCT	30VCT	34VCT	40VCT	56VCT	88VCT	120VCT	230VCT
4-05-1___	.250	.200	.156	.125	.104	.085	.073	.062	.044	.028	.020	.010
4-05-2___	.600	.450	.350	.300	.250	.200	.170	.150	.100	.065	.050	.025
4-05-3___	1.200	.900	.700	.600	.500	.400	.340	.300	.200	.130	.100	.050
4-05-4___	2.400	1.900	1.500	1.200	1.000	.800	.700	.600	.425	.275	.200	.100
4-05-5___	4.800	3.800	3.000	2.400	2.000	1.600	1.400	1.200	.850	.550	.400	.200
				PARALLEL CONNECTION				SECONDARY VOLTAGE				
	5V	6.3V	8V	10V	12V	15V	17V	20V	28V	44V	60V	115V
4-05-1___	.500	.400	.312	.250	.208	.170	.146	.124	.088	.056	.040	.020
4-05-2___	1.200	.900	.700	.600	.500	.400	.340	.300	.200	.130	.100	.050
4-05-3___	2.400	1.800	1.400	1.200	1.000	.800	.680	.600	.400	.260	.200	.100
4-05-4___	4.800	3.800	3.000	2.400	2.000	1.600	1.400	1.200	.850	.550	.400	.200
4-05-5___	9.600	7.600	6.000	4.800	4.000	3.200	2.800	2.400	1.700	1.100	.800	.400

MCI TRANSFORMER CORPORATION

TOLL FREE: 1-800-MCI-TRAN

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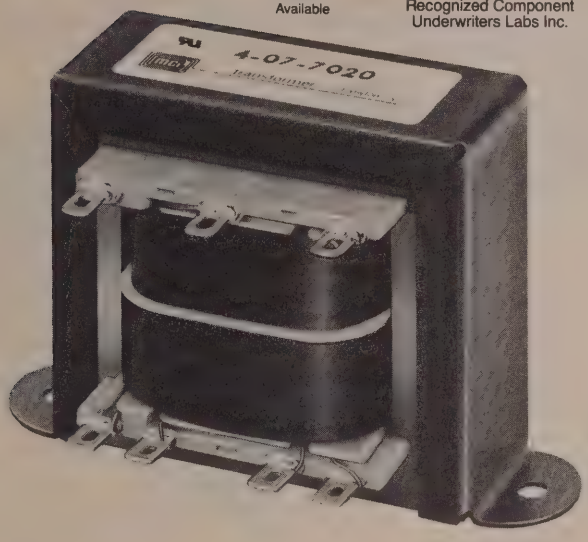
WEST COAST: 1230 BLOSSER LANE, WILLITS, CA 95490 • 707-459-5994 • FAX: 707-459-5998

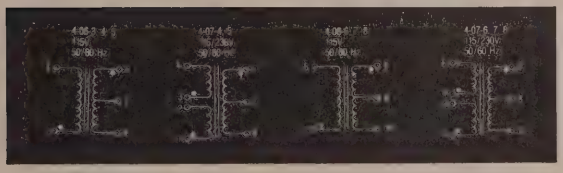
SERIES 4-06 & 4-07

QUICK CONNECT POWER TRANSFORMERS

Available

Recognized Component Underwriters Labs Inc.

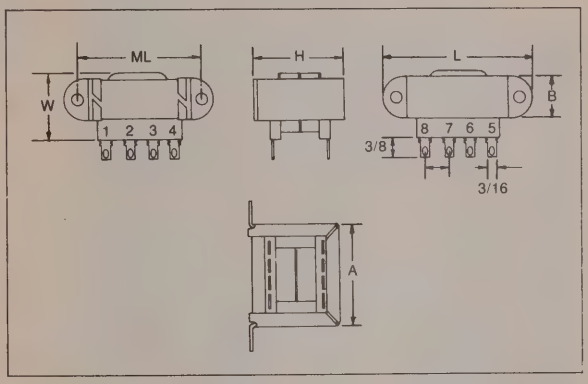




2,500 Volt RMS Hipot in a variety of practical sizes. Maximum operating temperature 130°C available with either single 115 or dual 115/230V primary (for all but 2.4 VA size).

MCI's split bobbin and non-concentric winding provide better insulation and high signal isolation, thus eliminating the need for electrostatic shielding.

Adaptations of standard transformers are also available. Dots on schematics shown below indicate like polarity.



To determine part number for specific transformer to be ordered:

1. **Locate the column, in the table, for the required voltage.**
2. **In the voltage column, locate the required current rating.**
3. **Moving left from the current rating, find the number indicating required primary—single 115V primary or dual 115/230V.**
4. **Derive part number by combining digits identifying required primary and digits at top of column giving required voltage.**

DIMENSIONS								
Size	VA	L	W	H	A	B	ML	Lbs.
3	2.4	2-1/16	1-1/16	1-3/16	1-7/16	9/16	1-3/4	0.25
4	6	2-3/8	1-1/4	1-3/8	1-11/16	11/16	2	0.44
5	12	2-13/16	1-3/8	1-5/8	1-15/16	13/16	2-3/8	0.7
6	30	3-1/4	1-11/16	1-15/16	2-5/16	1-1/16	2-13/16	1.1
7	56	3-11/16	1-13/16	2-1/4	2-11/16	1-1/16	3-1/8	1.7
8	100	4-1/32	2-1/4	2-9/16	3-1/16	1-5/16	3-9/16	2.75

CURRENT RATINGS (AMPS RMS)										
Last 3 Digits of Part Number:		-010	-012	-016	-020	-024	-028	-036	-048	-056	-120
First 4 Digits: Single 115V Primary	Dual 115/230V Primary	SECONDARY VOLTAGE 10V C.T.	12.6V C.T.	16V C.T.	20V C.T.	24V C.T.	28V C.T.	36V C.T.	48V C.T.	56V C.T.	120V C.T.
4-06-3___		.250	.200	.150	.120	.100	.085	.065	.050	.045	.020
4-06-4___	4-07-4___	.600	.500	.400	.300	.250	.200	.170	.125	.110	.050
4-06-5___	4-07-5___	1.200	1.000	.800	.600	.500	.420	.350	.250	.220	.100
4-06-6___	4-07-6___	3.000	2.500	2.000	1.500	1.250	1.100	.850	.630	.540	.250
4-06-7___	4-07-7___	5.000	4.000	3.500	2.800	2.400	2.000	1.500	1.200	1.000	.500
4-06-8___	4-07-8___	10.000	8.000	6.250	5.000	4.000	3.600	2.800	2.000	1.800	.850

MCI TRANSFORMER CORPORATION

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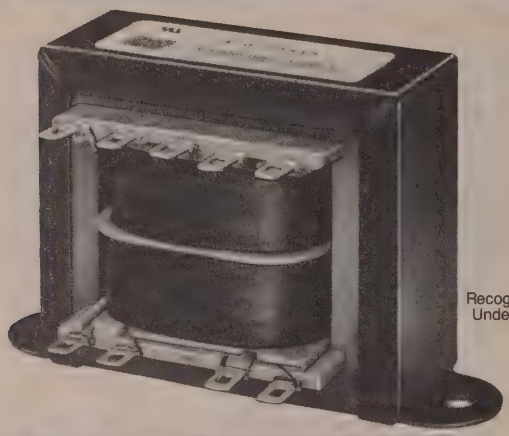
WEST COAST: 1230 BLOSSER LANE, WILLITS, CA 95490 • 707-459-5994 • FAX: 707-459-5998

QUICK CONNECT TRIPLE OUTPUT TRANSFORMERS

SERIES 4-06-X5 4-07-X5

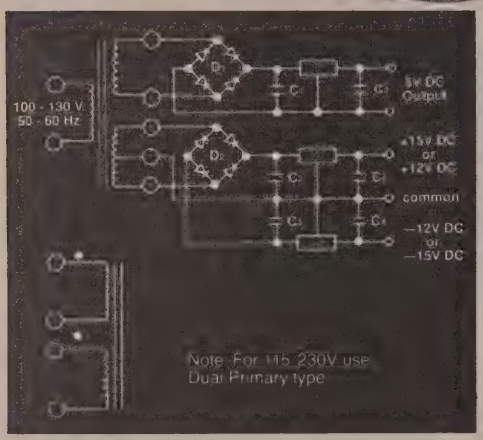


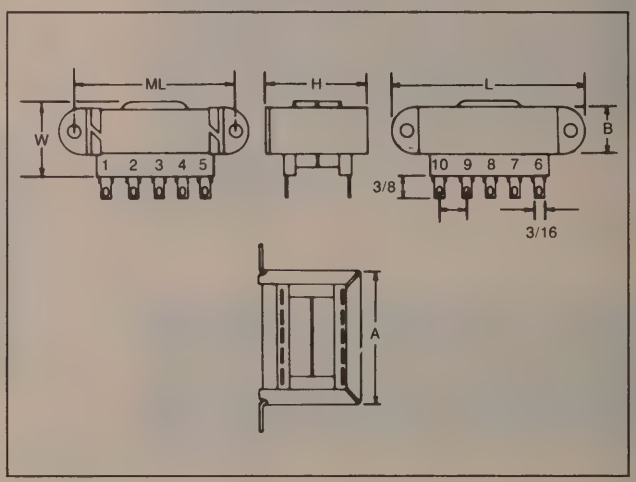
MCI has added these transformers to our product line for our customers with a need for one transformer to supply either 5VDC and ±12VDC or 5VDC and ±15VDC, in 3 power ratings of 35, 22.4, and 13.8 watts DC regulated.

There are 2 primary voltages available. Our 4-06 series which is for 100-130 volts, and our 4-07 series which is for either 100-130 volts or 200-260 volts.

The additional components necessary are supplied in the chart below.

Recognized Component
Underwriters Labs Inc.





To determine part number for specific transformer to be ordered:

1. **Locate the column, in the table, for the required voltage.**
2. **In the voltage column, locate the required current rating.**
3. **Moving left from the current rating, find the number indicating required primary—single 115V primary or dual 115/230V.**
4. **Derive part number by combining digits identifying required primary and digits at top of column giving required voltage.**

DIMENSIONS

SIZE	REGULATED POWER WATTS	L	W	H	A	B	ML	lbs.
6	13.8	3-1/4	1-3/4	1-15/16	2-5/16	1-1/16	2-13/16	1.1
7	22.4	3-11/16	1-13/16	2-1/4	2-11/16	1-1/16	3-1/8	1.7
8	35.0	4-1/32	2-1/4	2-9/16	3-1/16	1-5/16	3-9/16	2.75

SPECIFICATION

MCI PART NO. PRIMARY 50/60 Hz		DC OUTPUT		SIZE	REGULATED POWER	SUGGESTED COMPONENTS C_2, C_4, See Note ①						
115V	115/230V	OUTPUT 1	OUTPUT 2		WATTS	D1 ④	C1	IC1 ③	D2 ④	C3	IC2 ③	IC3 ③
4-06-6512	4-07-6512	5V @ 1.75A	±12V @ 210MA	6	13.8	3N253	10 KMFD @ 20VDC	LM 323K-5	3N247	1.5 KMFD @ 50 VDC	LM 340K-12	LM 320K-12
4-06-6515	4-07-6515		±15V @ 175MA								LM 340K-15	LM 320K-15
4-06-7512	4-07-7512	5V @ 2.8A	±12V @ 350MA	7	22.4	MDA-400	15 KMFD @ 20VDC	LM 323K-5	3N247	2 KMFD @ 50 VDC	LM 340K-12	LM 320K-12
4-06-7515	4-07-7515		± 15V @ 280MA								LM 340K-15	LM 320K-15
4-06-8512	4-07-8512	5V @ 4A	± 12V @ 600MA	8	35.0	MDA-800	26 KMFD @ 20VDC	LM-338 ②	3N247	3.1 KMFD @ 50 VDC	LM 340K-12	LM 320K-12
4-06-8515	4-07-8515		± 15V @ 500MA								LM 340K-15	LM 320K-15

Note ①: Output capacitors C_2 and C_4 are required to stabilize regulators. Values can be 1 MFD min. tantalum or 10 MFD min. electrolytic, 20V min.
Note ②: LM-338 is an adjustable regulator and MFR's specifications (National Semiconductor) should be consulted for values of external components.
Note ③: All IC's are National Semiconductor types.
Note ④: All diodes are Motorola types.

MCI TRANSFORMER CORPORATION
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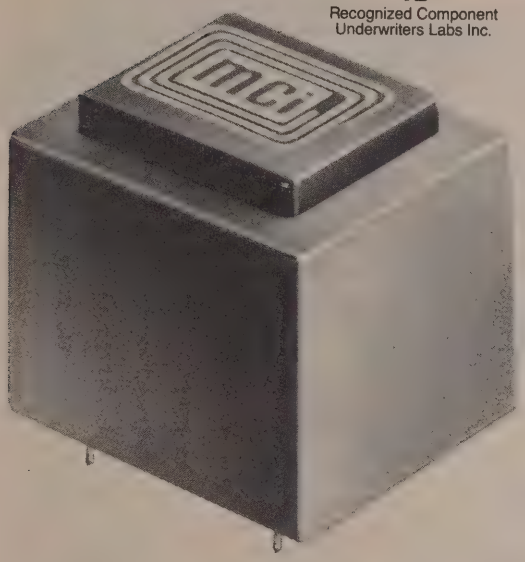
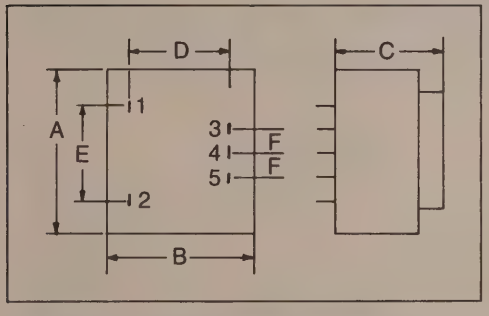
SERIES 4-11 & 4-12

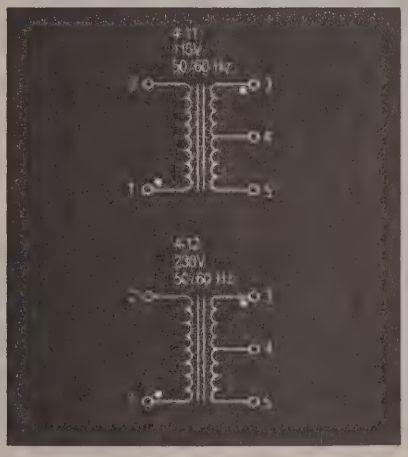
HORIZONTAL PC ENCAPSULATED TRANSFORMERS

Recognized Component
Underwriters Labs Inc.



Our encapsulated design offers high reliability because of its mechanical strength, electrical insulation and moisture resistance. The internal construction consists of a split bobbin which isolates the primary and secondary thereby eliminating any need for an electrostatic shield. The construction will pass requirements of U.L., C.S.A. and V.D.E.





To determine part number for specific transformer to be ordered:

1. Locate the column, in the table, for the required voltage.
2. In the voltage column, locate the required current rating.
3. Moving left from the current rating, find the number indicating required primary—single 115V primary or 230V.
4. Derive part number by combining digits identifying required primary and digits at top of column giving required voltage.

DIMENSIONS

Size	VA	A	B	C	D	Primary E	Secondary F	Wt. (Lb.)
2	1.0	1.280	1.080	.890	.800	.800	.200	.16
3	1.2	1.280	1.080	.970	.800	.800	.200	.19
4	1.8	1.280	1.080	1.085	.800	.800	.200	.21
5	2.2	1.280	1.080	1.185	.800	.800	.200	.25
6	3.2	1.660	1.415	1.125	1.000	.800	.200	.33
7	4.5	1.780	1.500	1.300	1.000	1.000	.300	.44

CURRENT RATING (AMPS RMS)

Last 3 Digits of Part Number:		-010	-012	-016	-020	-024	-028	-036	-048	-056	-120
First 4 Digits: Single 115V Primary	Single 230V Primary	SECONDARY VOLTAGE 10V C.T.	12.6V C.T.	16V C.T.	20V C.T.	24V C.T.	28V C.T.	36V C.T.	48V C.T.	56V C.T.	120V C.T.
4-11-2___	4-12-2___	.100	.080	.065	.050	.045	.035	.030	.020	.018	.008
4-11-3___	4-12-3___	.120	.095	.075	.060	.050	.045	.035	.025	.021	.010
4-11-4___	4-12-4___	.180	.145	.115	.090	.075	.065	.050	.038	.032	.015
4-11-5___	4-12-5___	.220	.175	.140	.110	.095	.080	.060	.045	.040	.018
4-11-6___	4-12-6___	.320	.255	.200	.160	.135	.115	.090	.067	.057	.027
4-11-7___	4-12-7___	.450	.360	.280	.225	.190	.160	.125	.095	.080	.038

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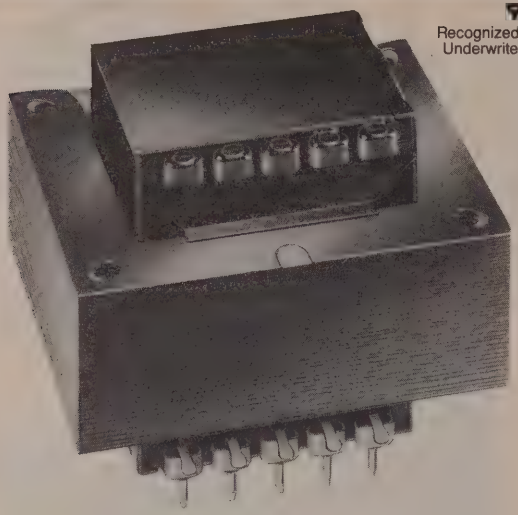
VDE HORIZONTAL P.C. TRANSFORMERS

SERIES 4-41& 4-42



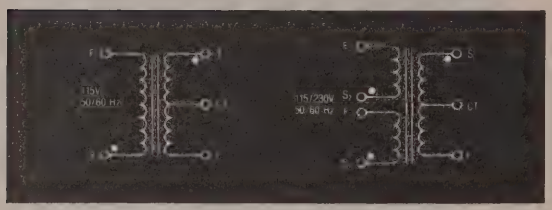
Recognized Component
Underwriters Labs Inc.

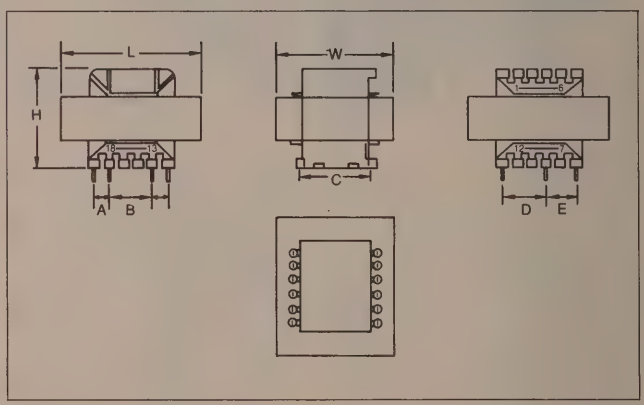
4,000 Volt RMS Hipot. In a variety of sizes. Maximum operating temperature 130°C. Available with either 115V or dual 115/230V primary.

MCI's split bobbin and non-concentric winding provide better insulation and high signal isolation, thus eliminating the need for electrostatic shielding.

These transformers are designed to pass VDE's strict creepage distance requirements.

Adaptations of standard transformers are also available. Dots on schematics shown below indicate like polarity.





TERMINAL POSITIONS

	4-41 115V Primary		4-42 115/230V Primary				Secondary		
	S	F	S1	F1	S2	F2	S	C.T.	F
2	13	18	13	14	17	18	7	9	12
3	11	15	11	12	14	15	6	8	10
4	11	15	11	12	14	15	6	8	10
5	11	15	11	12	14	15	6	8	10

DIMENSIONS

SIZE	VA	L	W	H	A	B	C	D	E	Lbs.
2	10	1⅞	1⁹⁄₁₆	2½	.200	.600	1.000	.600	.400	.57
3	20	2¼	1⅞	1¹³⁄₁₆	.300	.600	1.200	.600	.600	.97
4	30	2¼	1⅞	2¹⁄₁₆	.300	.600	1.200	.600	.600	1.20
5	45	2⅝	2³⁄₁₆	2¹⁄₃₂	.300	.600	1.400	.600	.600	1.40

CURRENT RATING (AMPS RMS)

Last 3 Digits of Part Number:		-010	-012	-016	-020	-024	-028	-036	-048	-056	-120
First 4 Digits: of Part Number:		SECONDARY VOLTAGE 10V C.T.	12.6V C.T.	16V C.T.	20V C.T.	24V C.T.	28V C.T.	36V C.T.	48V C.T.	56V C.T.	120V C.T.
Single 115V Primary	Dual 115/230V Primary										
4-41-2___	4-42-2___	1.000	.800	.625	.500	.420	.360	.280	.210	.180	.085
4-41-3___	4-42-3___	2.000	1.600	1.250	1.000	.840	.720	.560	.420	.360	.170
4-41-4___	4-42-4___	3.000	2.400	1.875	1.500	1.250	1.075	.835	.625	.540	.250
4-41-5___	4-42-5___	4.500	3.600	2.815	2.250	1.875	1.610	1.250	.940	.805	.375

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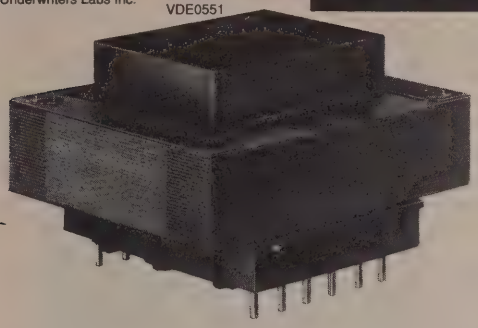
SERIES 4-44

VDE P.C. MOUNT TRANSFORMERS

Recognized Component Underwriters Labs Inc.

Has passed strict requirements of EN 6950 and EN 6742. VDE0551

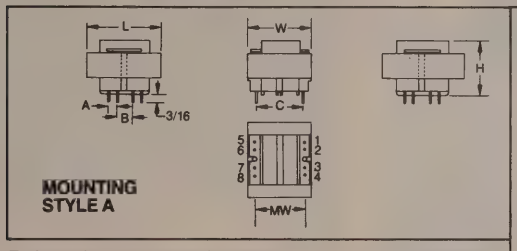


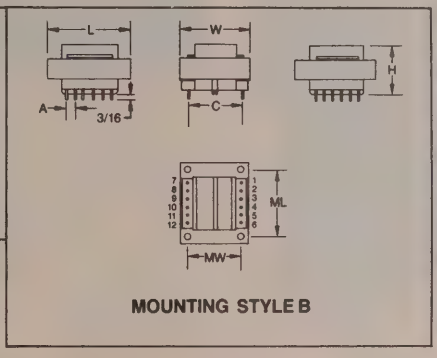
4,000 Volt RMS Hipot. In a variety of sizes. Maximum operating temperature 130°C. Available with either 115V or dual 115/230V primary.

MCI's split bobbin and non-concentric winding provide better insulation and high signal isolation, thus eliminating the need for electrostatic shielding.

These transformers are designed to pass VDE's strict creepage distance requirements.

Adaptations of standard transformers are also available. Dots on schematics shown below indicate like polarity.





To determine part number for specific transformer to be ordered:

1. **Locate the column, in the table, for the required voltage.**
2. **In the voltage column, locate the required current rating.**
3. **Moving left from the current rating, find the number indicating required primary— dual 115/230V.**
4. **Derive part number by combining digits identifying required primary and digits at top of column giving required voltage.**

DIMENSIONS

Transformer	VA	Schematic	Mounting Style	L	W	H	A	B	C	Pin Dimensions	MW	ML	Screw Size	Maximum Number Terminals	Lbs.
4-44-3___	2.5	1	A	1-5/8	1-5/16	1-1/8	.200	.250	1.000	.025 sq.	1-1/16		4	8	.25
4-44-4___	5.0	1	A	1-5/8	1-5/16	1-3/8	.200	.400	1.000	.025 sq.	1-1/16		4	8	.37
4-44-5___	10.0	1	A	1-7/8	1-9/16	1-3/8	.200	.400	1.128	.036 sq.	1-1/4		4	8	.53
4-44-6___	20.0	2	A	2-1/4	1-7/8	1-5/8	.400	.400	1.436	.036 sq.	1-1/2		4	12	.90
4-44-7___	30.0	2	B	2-5/8	2-3/16	1-9/16	.275		1.650	.045 sq.	1-3/4	2-3/16	6	12	1.15
4-44-8___	56.0	2	B	3	2-1/2	1-13/16	.300		1.866	.045 sq.	2	2-1/2	6	12	1.70

CURRENT RATING (AMPS RMS)

Last 3 Digits of Part No.	-010	-012	-016	-20	-024	-028	-036
	SERIES CONNECTION			SECONDARY VOLTAGE			
First 4 Digits:	10V CT	12.6V CT	16V CT	20V CT	24V CT	28V CT	36V CT
4-44-3___	.25	.20	.15	.12	.10	.09	.07
4-44-4___	.50	.40	.31	.25	.21	.18	.14
4-44-5___	1.00	.80	.62	.50	.42	.36	.28
4-44-6___	2.00	1.60	1.25	1.00	.83	.72	.56
4-44-7___	3.00	2.40	1.90	1.50	1.25	1.06	.82
4-44-8___	5.60	4.40	3.50	2.80	2.33	2.00	1.56
	PARALLEL CONNECTION			SECONDARY VOLTAGE			
	5V	6.3V	8V	10V	12V	14V	18V
4-44-3___	.50	.40	.30	.24	.20	.18	.14
4-44-4___	1.00	.80	.62	.50	.42	.36	.28
4-44-5___	2.00	1.60	1.25	1.00	.84	.73	.56
4-44-6___	4.00	3.20	2.50	2.00	1.66	1.44	1.12
4-44-7___	6.00	4.80	3.80	3.00	2.50	2.12	1.64
4-44-8___	11.20	8.80	7.00	5.60	4.66	4.00	3.12

MCI TRANSFORMER CORPORATION

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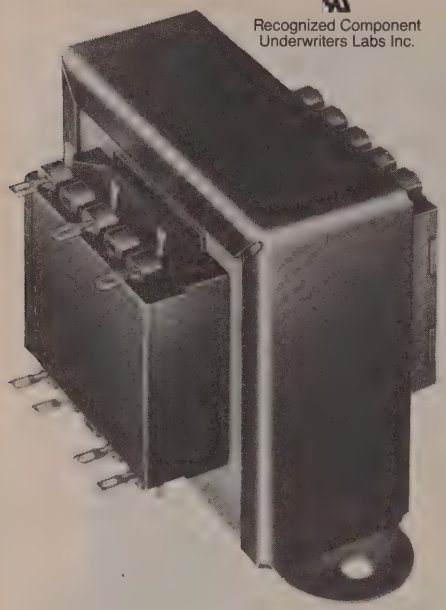
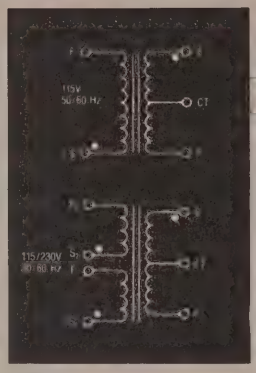
WEST COAST: 1230 BLOSSER LANE, WILLITS, CA 95490 • 707-459-5994 • FAX: 707-459-5998

VDE QUICK CONNECT POWER TRANSFORMERS

SERIES 4-46 & 4-47

Recognized Component
Underwriters Labs Inc.



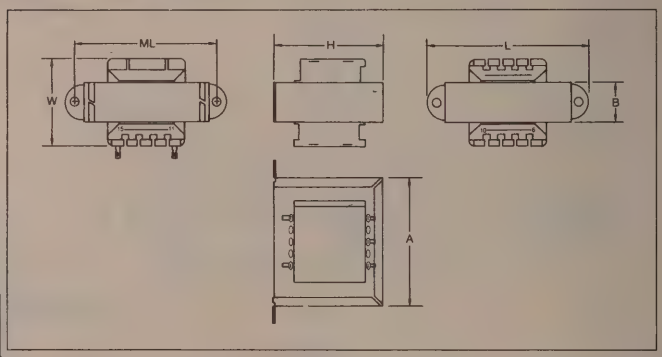


4,000 Volt RMS Hipot. In a variety of sizes. Maximum operating temperature 130°C. Available with either 115V or dual 115/230V primary.

MCI's split bobbin and non-concentric winding provide better insulation and high signal isolation, thus eliminating the need for electrostatic shielding.

These transformers are designed to pass VDE's strict creepage distance requirements.

Adaptations of standard transformers are also available. Dots on schematics shown below indicate like polarity.



TERMINAL POSITIONS

	4-46 115V Primary		4-47 115/230V Primary				Secondary		
	S	F	S1	F1	S2	F2	S	C.T.	F
2	13	18	13	14	17	18	7	9	12
3	11	15	11	12	14	15	6	8	10
4	11	15	11	12	14	15	6	8	10
5	11	15	11	12	14	15	6	8	10
6	11	15	11	12	14	15	6	8	10
7	13	18	13	14	17	18	7	9	12
8	13	18	13	14	17	18	7	9	12
9	13	18	13	14	17	18	7	9	12

DIMENSIONS

SIZE	VA	L	W	H	A	B	ML	Lbs.
2	10	$2\frac{13}{16}$	$1\frac{1}{2}$	$1\frac{5}{8}$	$1\frac{15}{16}$	$\frac{11}{16}$	$2\frac{3}{8}$	.57
3	20	$3\frac{1}{4}$	$1\frac{13}{16}$	$1\frac{15}{16}$	$2\frac{5}{16}$	$\frac{7}{8}$	$2\frac{13}{16}$	.97
4	30	$3\frac{1}{4}$	$2\frac{1}{32}$	$1\frac{15}{16}$	$2\frac{5}{16}$	$1\frac{1}{8}$	$2\frac{13}{16}$	1.20
5	45	$3\frac{11}{16}$	$2\frac{1}{32}$	$2\frac{1}{4}$	$2\frac{11}{16}$	1	$3\frac{1}{8}$	1.40
6	56	$3\frac{11}{16}$	$2\frac{5}{32}$	$2\frac{1}{4}$	$2\frac{11}{16}$	$1\frac{1}{8}$	$3\frac{1}{8}$	1.70
7	70	$4\frac{1}{32}$	$2\frac{9}{32}$	$2\frac{9}{16}$	$3\frac{1}{16}$	$1\frac{1}{16}$	$3\frac{9}{16}$	2.40
8	80	$4\frac{1}{32}$	$2\frac{1}{2}$	$2\frac{9}{16}$	$3\frac{1}{16}$	$1\frac{5}{16}$	$3\frac{9}{16}$	2.80
9	100	$4\frac{1}{2}$	$2\frac{17}{32}$	$2\frac{13}{16}$	$3\frac{13}{32}$	$1\frac{7}{32}$	4	3.20

CURRENT RATING (AMPS RMS)

Last 3 Digits of Part Number:		-010	-012	-016	-020	-024	-028	-036	-048	-056	-120
First 4 Digits: of Part Number:		SECONDARY VOLTAGE 10V C.T.	12.6V C.T.	16V C.T.	20V C.T.	24V C.T.	28V C.T.	36V C.T.	48V C.T.	56V C.T.	120V C.T.
Single 115V Primary	Dual 115/230V Primary										
4-46-2___	4-47-2___	1.000	.800	.625	.500	.420	.360	.280	.210	.180	.085
4-46-3___	4-47-3___	2.000	1.600	1.250	1.000	.840	.720	.560	.420	.360	.170
4-46-4___	4-47-4___	3.000	2.400	1.875	1.500	1.250	1.075	.835	.625	.540	.250
4-46-5___	4-47-5___	4.500	3.600	2.815	2.250	1.875	1.610	1.250	.940	.805	.375
4-46-6___	4-47-6___	5.600	4.500	3.500	2.800	2.335	2.000	1.560	1.170	1.000	.470
4-46-7___	4-47-7___		5.560	4.375	3.500	2.290	2.500	1.950	1.460	1.250	.585
4-46-8___	4-47-8___			5.000	4.000	3.335	2.860	2.225	1.670	1.430	.670
4-46-9___	4-47-9___				5.000	4.170	3.575	2.780	2.090	1.790	.835

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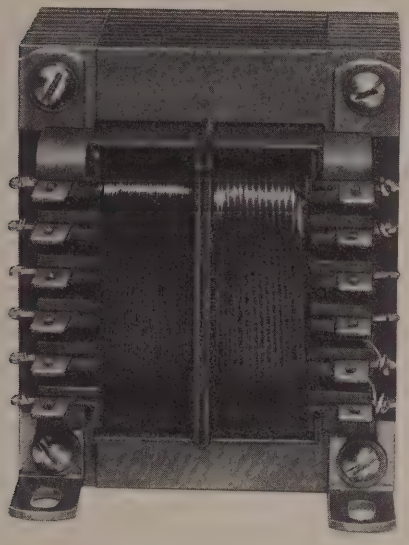
SERIES 4-49

VDE QUICK CONNECT TRANSFORMERS

Recognized Component Underwriters Labs Inc.

Has passed strict requirements of EN 6950 and EN 6742. VDE0551



4,000 Volt RMS Hipot. In a variety of sizes. Maximum operating temperature 130°C. Available with either 115V or dual 115/230V primary.

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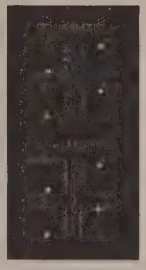
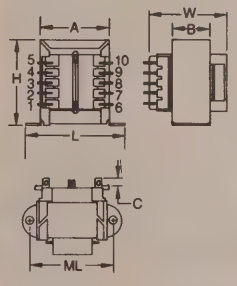
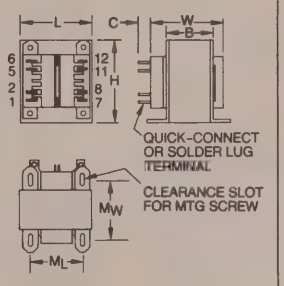
Adaptations of standard transformers are also available. Dots on schematics shown below indicate like polarity.



MOUNTING STYLE C



MOUNTING STYLE D



To determine part number for specific transformer to be ordered:

1. **Locate the column, in the table, for the required voltage.**
2. **In the voltage column, locate the required current rating.**
3. **Moving left from the current rating, find the number indicating required primary— dual 115/230V.**
4. **Derive part number by combining digits identifying required primary and digits at top of column giving required voltage.**

CURRENT RATINGS (AMPS RMS)

Last 3 Digits of Part No.:	-010	-012	-016	-020	-024	-028	-036	-230
	SERIES CONNECTION		SECONDARY VOLTAGE					
First 4 Digits:	10V CT	12.6V CT	16V CT	20V CT	24V CT	28V CT	36V CT	230V CT
4-49-4___	2.50	2.00	1.60	1.25	1.00	.90	.70	.11
4-49-5___	4.30	3.40	2.70	2.20	1.80	1.50	1.20	.19
4-49-6___	8.00	6.30	5.00	4.00	3.30	2.80	2.20	.35
4-49-7___	13.00	10.30	8.10	6.50	5.40	4.60	3.60	.57
4-49-8___	17.50	14.00	11.00	8.80	7.30	6.25	4.80	.76
	PARALLEL CONNECTION		SECONDARY VOLTAGE					
	5V	6.3V	8V	10V	12V	14V	18V	115V
4-49-4___	5.00	4.00	3.20	2.50	2.00	1.86	1.40	.22
4-49-5___	8.60	6.80	5.40	4.40	3.60	3.00	2.40	.38
4-49-6___	16.00	12.60	10.00	8.00	6.60	5.60	4.40	.70
4-49-7___	26.00	20.60	16.20	13.00	10.80	9.20	7.20	1.14
4-49-8___	35.00	28.00	22.00	17.60	14.60	12.50	9.60	1.52

DIMENSIONS

Transformer	VA	Schematic	Mounting Style	L	W	H	A	B	C	Terminals	ML	MW	Screw Size	Maximum Number Terminals	Lbs.
4-49-4___	25	1	C	2-13/16	1-7/8	1-5/16	2	1-1/8	5/16	3/16	2-3/8		6	10	1.25
4-49-5___	43	1	C	3-1/8	2-1/16	2-11/16	2-1/4	1-1/8	5/16	3/16	2-13/16		6	10	1.60
4-49-6___	80	2	D	2-1/2	2-3/8	3		1-3/8	5/16	3/16	2	2-3/16	6	12	2.80
4-49-7___	130	2	D	2-13/16	2-7/8	3-3/8		1-5/8	3/8	1/4	2-1/4	2-1/2	8	12	4.10
4-49-8___	175	2	D	3-1/8	2-7/8	3-3/4		1-5/8	3/8	1/4	2-1/2	2-1/2	8	12	5.5

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PRICE LIST

HORIZONTAL P C

PART NO.	PRICE	PAGE
4-01-2___	6.45	A•2392
4-01-3___	6.60	A•2392
4-01-4___	7.50	A•2392
4-01-5___	8.30	A•2392
4-01-6___	10.00	A•2392
4-01-7___	11.15	A•2392
4-02-2___	7.50	A•2392
4-02-3___	7.70	A•2392
4-02-4___	8.30	A•2392
4-02-5___	9.25	A•2392
4-02-6___	11.30	A•2392
4-02-7___	12.45	A•2392

QUICK CONNECT POWER

PART NO.	PRICE	PAGE
4-06-3___	6.55	A•2395
4-06-4___	7.20	A•2395
4-06-5___	8.25	A•2395
4-06-6___	11.00	A•2395
4-06-7___	14.50	A•2395
4-06-8___	19.15	A•2395
4-07-4___	8.74	A•2395
4-07-5___	9.50	A•2395
4-07-6___	12.16	A•2395
4-07-7___	14.92	A•2395
4-07-8___	20.14	A•2395

VDE P C

PART NO.	PRICE	PAGE
4-41-2___	8.05	A•2398
4-41-3___	10.39	A•2398
4-41-4___	11.40	A•2398
4-41-5___	13.52	A•2398
4-42-2___	9.36	A•2398
4-42-3___	11.83	A•2398
4-42-4___	13.03	A•2398
4-42-5___	15.33	A•2398
4-44-3___	7.82	A•2399
4-44-4___	8.40	A•2399
4-44-5___	9.43	A•2399
4-44-6___	11.51	A•2399
4-44-7___	13.24	A•2399
4-44-8___	16.13	A•2399

VERTICAL P C

PART NO.	PRICE	PAGE
4-03-1___	9.10	A•2393
4-03-2___	6.90	A•2393
4-03-3___	8.20	A•2393
4-03-4___	9.30	A•2393
4-03-5___	12.90	A•2393
4-04-1___	10.40	A•2393
4-04-2___	8.00	A•2393
4-04-3___	9.40	A•2393
4-04-4___	10.75	A•2393
4-04-5___	14.00	A•2393

TRIPLE OUTPUT

PART NO.	PRICE	PAGE
4-06-65___	14.50	A•2396
4-06-75___	19.00	A•2396
4-06-85___	25.00	A•2396
4-07-65___	16.00	A•2396
4-07-75___	20.00	A•2396
4-07-85___	26.00	A•2396

VDE QUICK CONNECT

PART NO.	PRICE	PAGE
4-46-2___	8.23	A•2400
4-46-3___	10.62	A•2400
4-46-4___	11.69	A•2400
4-46-5___	13.85	A•2400
4-46-6___	15.15	A•2400
4-46-7___	20.31	A•2400
4-46-8___	22.65	A•2400
4-46-9___	26.50	A•2400
4-47-2___	9.54	A•2400
4-47-3___	12.06	A•2400
4-47-4___	13.32	A•2400
4-47-5___	15.66	A•2400
4-47-6___	17.09	A•2400
4-47-7___	22.44	A•2400
4-47-8___	24.90	A•2400
4-47-9___	28.94	A•2400
4-49-4___	12.46	A•2401
4-49-5___	15.92	A•2401
4-49-6___	21.74	A•2401
4-49-7___	28.79	A•2401
4-49-8___	33.05	A•2401

LOW PROFILE P C

PART NO.	PRICE	PAGE
4-05-1___	9.80	A•2394
4-05-2___	10.85	A•2394
4-05-3___	13.75	A•2394
4-05-4___	14.80	A•2394
4-05-5___	17.90	A•2394

*ENCAPSULATED P C

PART NO.	PRICE	PAGE
4-11/12-2___	7.68	A•2397
4-11/12-3___	7.74	A•2397
4-11/12-4___	7.80	A•2397
4-11/12-5___	7.86	A•2397
4-11/12-6___	8.40	A•2397
4-11/12-7___	8.99	A•2397

*These parts are not a stock item.
Terms: Net 30 for customers with approved credit.
F.O.B.: Babylon, N.Y.
Prices subject to change without notice.

DISCOUNT SCHEDULE

QUANTITY	PRICE	QUANTITY	PRICE
1-9	Net	50-99	43%
10-24	25%	100-249	50%
25-49	35%	250 UP	POR

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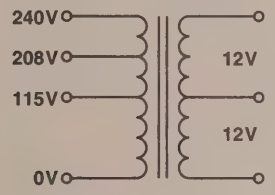
OTHER MCI TRANSFORMER PRODUCTS

HIGH VOLTAGE IGNITION/POTENTIAL TRANSFORMERS

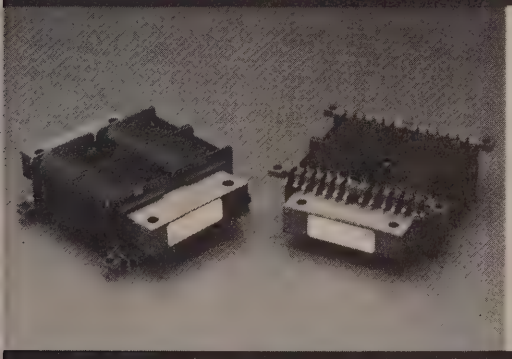
The MCI Multi Section HV coil is encapsulated in epoxy to provide the maximum reliability at minimum cost. Many variations of standard designs can be produced with up to 10,000V output.

Designs presently CSA certified are 120 V in with 5,000 or 6,000 Volts out, current limited to 19 ma.

CLASS 2 UNIVERSAL INPUT VOLTAGE UL & CSA



P/N 2-51-4024 IS 24V C/T AT 40VA
2-51-7024 IS 24V AT 80VA



VERY LOW PROFILE 55 VA 1.21" Height

This unique MCI design satisfies goals to streamline products and maintain cost objectives while meeting UL/CSA/VDE requirements. 14 output pins provide secure mounting along with availability of many isolated output windings.

INDUSTRY STANDARD LOW PROFILE FOR VDE/IEC APPLICATIONS

Industry standard 2.5 VA & 6 VA designs encapsulated to meet VDE and IEC rqmts. See page 6 for current and voltage ratings. Add E to part number for encapsulated version.

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MICROTRAN company, inc.

SMPS MAGNETICS

toroidal power inductors

OUTLINE DRAWINGS FOR SL SERIES

New Swinging Chokes for Switch Mode Power Supplies, Regulators, and EMI/RFI Filter Applications

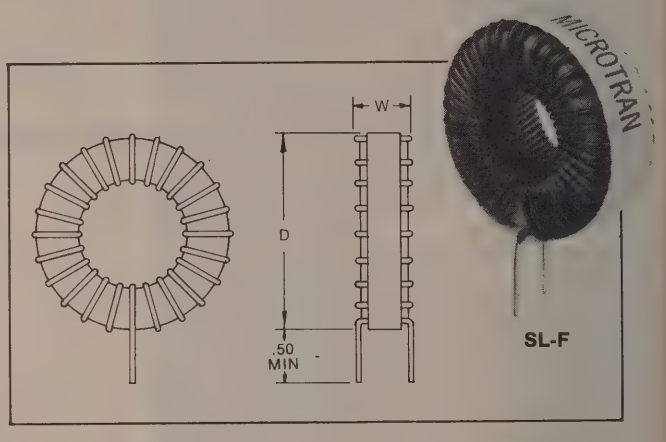
- Specially designed for controlled saturation — repeatable specific inductance at a specific current.
- Designed to handle high current spikes typically encountered in high current SMPS applications.
- Application frequencies up to 1 MHz.
- Toroidal construction — closed magnetic field — low EMI.

OPEN FRAME -F

Tinned leads to 1/16" of body for PCB mounting. Additional mechanical mounting recommended for larger units with finer wire. To order add -F to Part No., i.e. SL2-50-F.

DIMENSIONS (Inches)

Series	D Max.	W Max.	Wt. Oz.
SL05-F	.56	.30	.13
SL06-F	.87	.40	.45
SL1-F	1.00	.50	.64
SL2-F	1.30	.65	1.59
SL3-F	1.90	.90	4.10
SL4-F	2.20	1.10	8.00



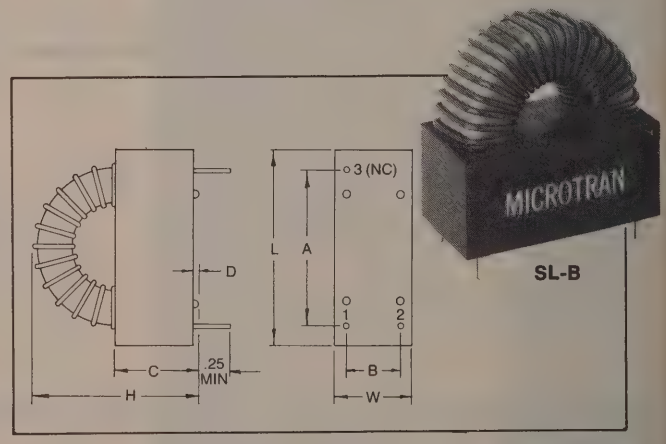
BASE MOUNTED -B

Rugged, epoxy base mounted for PCB applications. To order add -B to Part No., i.e. SL2-50-B.

DIMENSIONS (Inches)

Series	L Max.	W Max.	H Max.	A	B	C Max.	D	Wt. Oz.
SL05-B	.66	.34	.62	.50	.20	.22	.025	.15
SL06-B	.87	.43	.94	.60	.20	.22	.025	.49
SL1-B	1.01	.52	1.08	.90	.40	.26	.025	.70
SL2-B	1.31	.66	1.33	1.10	.50	.36	.030	1.7
SL3-B	1.90	.90	1.98	1.60	.60	.41	.030	4.4
SL4-B	2.12	1.08	2.30	1.75	.90	1.00	——	8.8

Tolerances dimensions A and B ± .015.



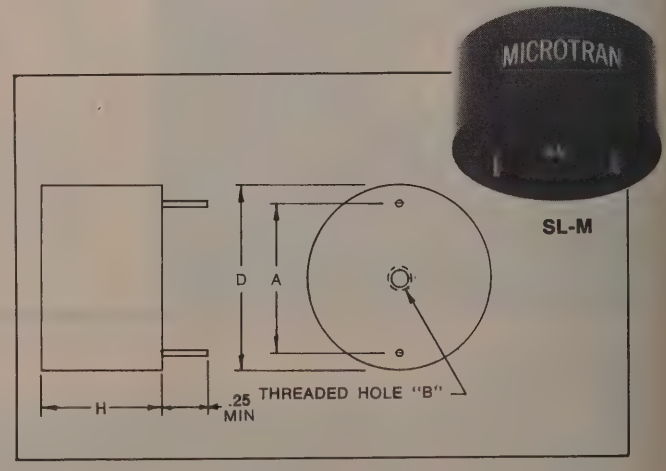
MOLDED -M

Epoxy molded with threaded insert for MIL and industrial PCB applications. MIL designation TF5S04ZZ. To order add -M to Part No., i.e. SL2-50-M.

DIMENSIONS (Inches)

Series	D	H	A	B	Wt. Oz.
SL05-M	.625	.34	.52	——	.18
SL06-M	.937	.46	.75	——	.60
SL1-M	1.08	.52	.90	4-40×8	.86
SL2-M	1.375	.70	1.20	6-32×8	2.3
SL3-M	2.00	1.00	1.70	8-32×10	6.0
SL4-M	2.50	1.25	1.25	10-32×12	10.8

Tolerance ±.015.



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SMPS MAGNETICS

MICROTRAN company, inc.

toroidal power inductors

PART NO.	INDUCTANCE @ 0 DC μH	MAX. DCR (OHMS)	RATED CURRENT (AMPS)	5% L DROP (DC AMPS)	10% L DROP (DC AMPS)	20% L DROP (DC AMPS)	30% L DROP (DC AMPS)	40% L DROP (DC AMPS)	50% L DROP (DC AMPS)
(NEW!) SL05 SIZE SERIES									
SL05-15 (*)	15	.010	4.0	2.5	3.6	5.2	6.6	8.2	9.8
SL05-24 (*)	24	.018	2.5	2.2	3.0	4.2	5.5	6.7	7.9
SL05-35 (*)	35	.037	1.6	1.4	2.0	3.3	4.5	5.5	6.6
SL05-55 (*)	55	.072	1.0	1.4	1.9	2.7	3.5	4.2	5.0
SL05-85 (*)	85	.142	.65	.80	1.2	2.0	2.7	3.3	3.9
SL05-158 (*)	158	.271	.40	.60	.90	1.4	1.9	2.3	2.8
SL05-192 (*)	192	.530	.25	.53	.80	1.3	1.7	2.1	2.5
SL05-305 (*)	305	1.050	.16	.50	.74	1.1	1.4	1.7	2.0
(NEW!) SL06 SIZE SERIES									
SL06-26 (*)	26	.011	6.5	5.2	6.8	9.2	11.2	13.4	15.9
SL06-36 (*)	36	.013	6.5	4.5	5.8	7.8	9.6	11.5	13.5
SL06-51 (*)	51	.015	6.5	3.5	4.6	6.2	7.9	9.5	11.2
SL06-80 (*)	80	.027	4.5	2.6	3.5	4.7	6.0	7.3	8.7
SL06-122 (*)	122	.056	3.0	2.3	3.0	4.0	5.0	6.0	7.0
SL06-188 (*)	188	.104	2.0	1.9	2.5	3.4	4.1	4.9	5.7
SL06-300 (*)	300	.215	1.0	1.5	1.9	2.6	3.1	3.8	4.5
SL06-460 (*)	460	.430	.65	1.1	1.5	2.1	2.6	3.2	3.7
SL1 SIZE SERIES									
SL1-1.1 (*)	1.1	.002	5.0	26.3	34.1	50.0	59.8	71.8	83.3
SL1-2.5 (*)	2.5	.003	5.0	17.0	22.1	32.4	38.8	46.6	54.1
SL1-4.5 (*)	4.5	.004	5.0	10.7	14.3	21.0	25.2	30.2	35.1
SL1-8.0 (*)	8.0	.005	5.0	8.8	11.6	16.0	20.0	24.0	27.8
SL1-15 (*)	15	.007	5.0	5.1	7.5	11.0	14.0	16.9	20.0
SL1-30 (*)	30	.009	5.0	4.2	5.5	8.0	10.2	12.4	14.9
SL1-60 (*)	60	.017	5.0	2.1	3.6	5.4	6.9	8.5	10.2
SL1-120 (*)	120	.027	5.0	1.7	2.6	3.9	5.0	6.1	7.4
SL1-220 (*)	220	.037	5.0	1.5	2.0	3.0	3.8	4.6	5.5
SL1-450 (*)	450	.090	3.2	1.3	1.6	2.2	2.8	3.4	4.0
SL1-900 (*)	900	.230	1.5	.9	1.2	1.6	1.9	2.4	2.8
SL1-1500(*)	1500	.470	1.1	.6	.8	1.2	1.5	1.8	2.1
SL2 SIZE SERIES									
SL2-1.4 (*)	1.4	.003	5.0	28.3	43.8	62.2	82.1	102.5	123.0
SL2-2.5 (*)	2.5	.003	5.0	23.8	36.8	52.5	69.7	87.0	104.3
SL2-5.5 (*)	5.5	.005	5.0	16.0	24.8	35.4	47.0	58.7	70.4
SL2-13 (*)	13	.007	5.0	9.5	14.7	21.0	31.5	39.3	47.1
SL2-26 (*)	26	.010	5.0	6.3	10.0	15.0	20.0	25.0	30.0
SL2-50 (*)	50	.013	5.0	4.2	6.9	10.3	13.9	17.4	21.0
SL2-100 (*)	100	.018	5.0	3.3	4.9	7.5	9.8	12.2	14.9
SL2-225 (*)	225	.034	5.0	2.9	3.7	5.1	6.9	8.3	9.9
SL2-475 (*)	475	.055	4.5	1.5	2.0	3.4	4.4	5.5	6.8
SL2-1000(*)	1000	.130	4.5	1.2	1.6	2.3	3.1	3.9	4.7
SL2-1800(*)	1800	.340	2.0	1.0	1.3	1.9	2.4	2.9	3.5
SL2-2700(*)	2700	.520	2.0	.6	.9	1.4	1.8	2.3	2.8
SL3 SIZE SERIES									
SL3-1.3 (*)	1.3	.003	9.0	51.6	72.2	101.0	128.3	160.3	192.3
SL3-3.0 (*)	3.0	.004	9.0	40.0	56.0	78.4	99.5	124.3	149.0
SL3-6.5 (*)	6.5	.005	9.0	31.2	43.6	61.0	77.5	96.8	116.1
SL3-14 (*)	14	.008	9.0	24.4	34.3	48.6	62.1	77.5	92.9
SL3-30 (*)	30	.011	9.0	17.6	24.8	35.2	45.0	56.2	67.4
SL3-55 (*)	55	.015	9.0	12.2	18.5	26.3	33.6	42.0	50.4
SL3-100 (*)	100	.020	9.0	9.4	13.3	19.7	25.2	31.6	37.9
SL3-220 (*)	220	.020	9.0	4.9	6.6	9.4	11.9	14.4	17.1
SL3-470 (*)	470	.034	7.0	2.7	4.1	6.3	8.1	10.0	12.0
SL3-1000(*)	1000	.120	3.5	2.0	2.7	4.2	5.4	6.8	8.2
SL3-2200(*)	2200	.220	2.8	1.6	2.1	3.0	3.8	4.6	5.5
SL3-4000(*)	4000	.300	2.0	1.1	1.5	2.1	2.8	3.3	4.0
SL4 SIZE SERIES									
SL4-2.2 (*)	2.2	.003	14.0	49.8	67.2	100.2	130.2	158.8	190.6
SL4-5 (*)	5.0	.004	14.0	40.0	54.0	80.5	104.6	127.6	153.1
SL4-11 (*)	11	.005	14.0	32.1	43.3	64.5	83.8	102.2	122.6
SL4-23 (*)	23	.007	14.0	24.6	33.2	49.5	64.3	78.4	94.1
SL4-50 (*)	50	.011	14.0	18.3	24.7	36.9	47.8	58.3	70.0
SL4-100 (*)	100	.016	14.0	12.8	17.3	25.9	33.6	41.0	49.2
SL4-230 (*)	230	.023	14.0	7.1	10.4	15.8	20.5	25.0	30.0
SL4-470 (*)	470	.023	14.0	3.5	5.4	8.0	10.4	12.7	15.4
SL4-1000(*)	1000	.065	9.0	2.4	3.5	5.5	7.2	8.8	10.7
SL4-2200(*)	2200	.120	7.0	2.0	3.0	4.0	5.0	6.1	7.3
SL4-4000(*)	4000	.260	4.5	1.1	1.8	2.8	3.5	4.5	5.4
SL4-5600(*)	5600	.310	4.5	.9	1.4	2.2	3.0	3.8	4.5

*** Add either -F, -B, or -M to Part No. to designate construction.**
See photos and outline drawings on adjacent page.

NOTES:

1. Non-standard inductance values available on special order, i.e., specify P/N SL2-75-F for 75 μH.
2. Inductance ±15% measured at 1 kHz. See drive level test condition chart.
3. DCR measured at 20°C. 130°C insulation system.
4. Current values for percentage inductance drop are typical.
5. Recommended PC board clearance hole .065 dia. min.

DRIVE LEVEL TEST CONDITIONS

Inductance	Drive Level @ 1 kHz
0-200 μH	100 mA AC
200 μH — 2 mH	10 mA AC
2 mH — 20 mH	1 mA AC

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MICROTRAN company, Inc.

SMPS MAGNETICS

common mode suppression inductors

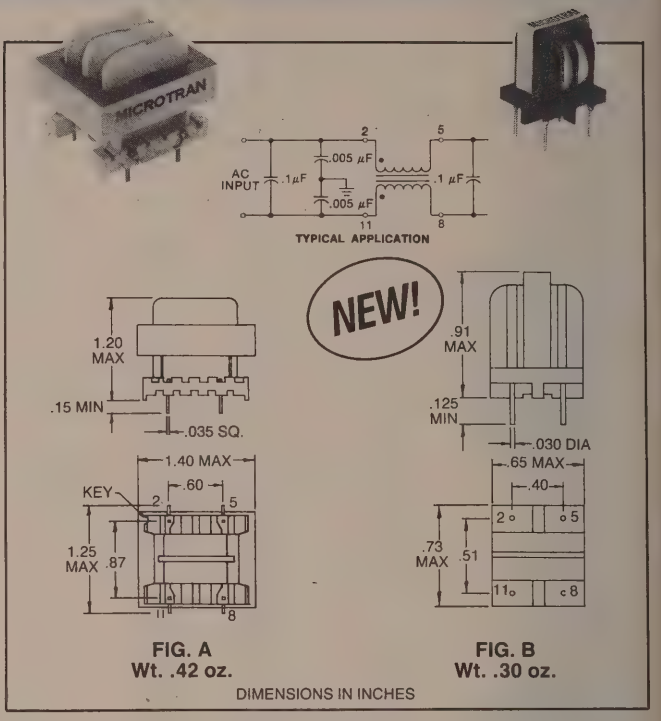
For Elimination of Line Transmitted EMI/RFI Interference from SMPS Equipment

- 3750V RMS hipot.
- 130°C insulation system.
- VDE, IEC, UL, CSA compatible.
- Cost effective design.

Minimizes AC line-conducted interference from switching power supplies and regulators. Balun winding to within 1% produces opposing magnetic fluxes in the core to effectively cancel differential-mode noise signals. Substantially reduces component count as well as inductor size, as compared to differential filtering. Constructed with spacing between windings to meet international safety requirements.

Part No.	Inductance mH Min.	RMS Max. Amps	DCR Max. Ohms	Fig.
SC1-16800	12.6	.50	1.0	A
SC1-07900	5.93	.75	.43	A
SC1-04900	3.67	1.00	.22	A
SC1-03770	2.77	1.25	.156	A
SC1-01960	1.47	1.5	.11	A
SC1-01280	.96	2.0	.071	A
SC1-00840	.63	2.5	.046	A
SC1-00490	.37	3.0	.027	A
SC1-00290	.21	4.0	.0175	A
SC2-14000	14.0	.25	2.1	B
SC2-05250	5.25	.37	.83	B
SC2-03250	3.25	.50	.52	B
SC2-01450	1.45	.75	.22	B
SC2-00750	.75	1.00	.12	B
SC2-00330	.33	1.50	.052	B
SC2-00120	.12	2.0	.024	B

NOTES: Inductance shown is for each winding measured @ 10 kHz, 1V RMS. Inductance with each winding connected series opposing under 100 µH typical @ 10 kHz, 1V RMS. Inter-winding capacitance: 5 pF typical @ 10 kHz, 1V RMS.

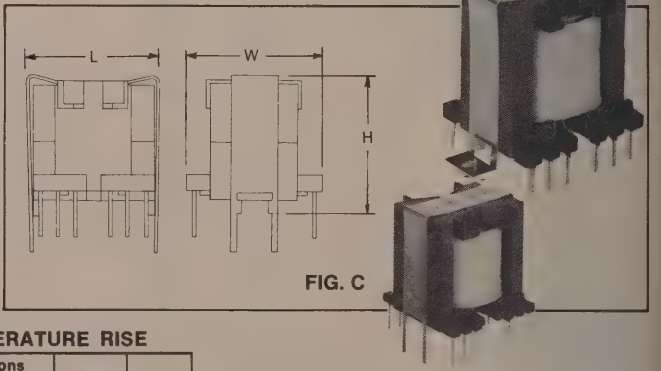


custom switch mode power transformers

For Switching Power Supplies

Utilizes latest core materials and shape factor to provide smallest possible volume and minimum PC board footprint for effective manufacturing cost reduction. These transformers are available in standard size/power ratings from 25 to 880 watts output for use over a wide frequency range. Standard configurations allow short turn-around time on custom-design samples. Other packaging and styles are available, such as horizontally mounted units. For application assistance, contact our Engineering Department.

- Standardized components speeds delivery.
- VDE, IEC, UL, CSA compatible.
- Frequency range 20 kHz — 300 kHz and higher.
- Core material for newest generation of higher frequency SMPS.

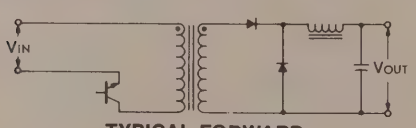


TRANSFORMER OUTPUT POWER VS. FREQUENCY AND TEMPERATURE RISE

Size Series	Power (W) 50 kHz			Power (W) 100 kHz			Max. Dimensions (Inches)			Wt. Oz.	Fig.
	20°C	30°C	40°C	20°C	30°C	40°C	L	W	H		
SP2016-(*)	25	35	40	40	55	63	.92	.92	.83	.8	C
SP2020-(*)	35	45	55	55	70	80	.92	.92	1.0	.9	C
SP2620-(*)	60	80	95	90	115	135	1.15	1.17	1.0	1.5	C
SP2625-(*)	70	90	110	105	130	160	1.15	1.17	1.17	1.8	C
SP3220-(*)	80	110	130	120	155	190	1.36	1.34	1.0	2.2	C
SP3230-(*)	115	150	185	155	210	260	1.36	1.34	1.4	3.2	C
SP3535-(*)	170	220	265	230	315	355	1.48	1.55	1.6	4.4	C
SP4040-(*)	225	325	385	350	460	525	1.67	1.67	1.76	6.9	C
SP5050-(*)	310	445	525	580	740	880	2.10	2.10	2.10	12.9	C

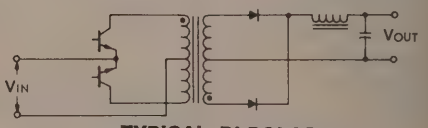
* Custom P/N assigned by factory.

NOTES: The power ratings are based on forward converter circuitry with 40% duty cycle. Flyback circuits provide less power; bi-polar circuits will provide more. If the design is to meet VDE or IEC requirements, derate output power by 20%.



TYPICAL FORWARD CONVERTER

TYPICAL FLYBACK CONVERTER



TYPICAL BI-POLAR PUSH-PULL CONVERTER

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POWER TRANSFORMERS

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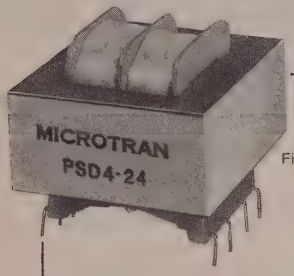
SPLITFORM® split bobbin power transformers

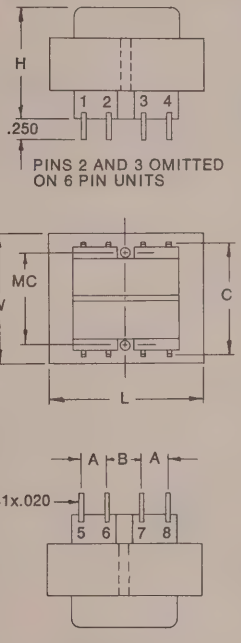
For PC Board Solid-State Power, Control, and Instrumentation Applications

- Split Bobbin Construction
  - Center Flange Insulation Barrier
  - High Isolation for Low Leakage Applications
  - Low Capacitive Coupling Minimizes Line Noise and False Triggering
- 2,500V RMS Hipot
- 115V Single or 115/230V 50/60 Hz Dual Primary
- Dual Secondaries may be either Parallel or Series Connected
- Precision Spaced Terminals
  - Terminal Numbers are Molded on Bobbin
- 130°C Insulation System
- Attractive Pricing — Superior Quality

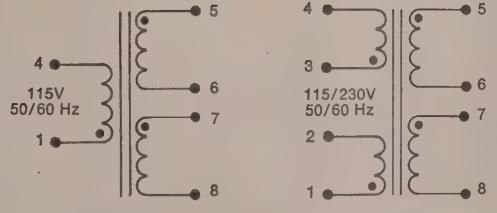


File #LR73078 UL 1585 Class 2 & 3 - File #E96720
UL 506 - File #E79781

PART NO.		SECONDARY RMS RATING			
		Parallel Connected		Series Connected	
Single 115V PSS Series	Dual 115/230V PSD Series	AC Volts	RMS Amps	AC Volts	RMS Amps
PSS2-10	PSD2-10	5.0	0.22	10.0 CT	0.11
PSS3-10	PSD3-10	5.0	0.5	10.0 CT	0.25
PSS4-10	PSD4-10	5.0	1.2	10.0 CT	0.60
PSS5-10	PSD5-10	5.0	2.4	10.0 CT	1.2
PSS2-12	PSD2-12	6.3	0.18	12.6 CT	0.09
PSS3-12	PSD3-12	6.3	0.4	12.6 CT	0.2
PSS4-12	PSD4-12	6.3	1.0	12.6 CT	0.5
PSS5-12	PSD5-12	6.3	2.0	12.6 CT	1.0
PSS2-16	PSD2-16	8.0	0.14	16.0 CT	0.07
PSS3-16	PSD3-16	8.0	0.3	16.0 CT	0.15
PSS4-16	PSD4-16	8.0	0.8	16.0 CT	0.4
PSS5-16	PSD5-16	8.0	1.6	16.0 CT	0.8
PSS2-20	PSD2-20	10.0	0.11	20.0 CT	0.055
PSS3-20	PSD3-20	10.0	0.24	20.0 CT	0.12
PSS4-20	PSD4-20	10.0	0.6	20.0 CT	0.3
PSS5-20	PSD5-20	10.0	1.2	20.0 CT	0.6
PSS2-24	PSD2-24	12.0	0.09	24.0 CT	0.045
PSS3-24	PSD3-24	12.0	0.2	24.0 CT	0.1
PSS4-24	PSD4-24	12.0	0.5	24.0 CT	0.25
PSS5-24	PSD5-24	12.0	1.0	24.0 CT	0.5
PSS2-28	PSD2-28	14.0	0.08	28.0 CT	0.04
PSS3-28	PSD3-28	14.0	0.17	28.0 CT	0.085
PSS4-28	PSD4-28	14.0	0.4	28.0 CT	0.2
PSS5-28	PSD5-28	14.0	0.84	28.0 CT	0.42
PSS2-36	PSD2-36	18.0	0.06	36.0 CT	0.03
PSS3-36	PSD3-36	18.0	0.13	36.0 CT	0.065
PSS4-36	PSD4-36	18.0	0.34	36.0 CT	0.17
PSS5-36	PSD5-36	18.0	0.7	36.0 CT	0.35
PSS2-48	PSD2-48	24.0	0.046	48.0 CT	0.023
PSS3-48	PSD3-48	24.0	0.1	48.0 CT	0.05
PSS4-48	PSD4-48	24.0	0.25	48.0 CT	0.125
PSS5-48	PSD5-48	24.0	0.5	48.0 CT	0.25
PSS2-56	PSD2-56	28.0	0.04	56.0 CT	0.02
PSS3-56	PSD3-56	28.0	0.09	56.0 CT	0.045
PSS4-56	PSD4-56	28.0	0.22	56.0 CT	0.11
PSS5-56	PSD5-56	28.0	0.44	56.0 CT	0.22
PSS2-120	PSD2-120	60.0	0.02	120.0 CT	0.01
PSS3-120	PSD3-120	60.0	0.04	120.0 CT	0.02
PSS4-120	PSD4-120	60.0	0.1	120.0 CT	0.05
PSS5-120	PSD5-120	60.0	0.2	120.0 CT	0.1



SCHEMATICS



6 PIN PSS SERIES

8 PIN PSD SERIES

DIMENSIONS Inches (mm)

PSS, PSD Series	VA	L	W	H	MC	A	B	C	Lb. (Gm.)
2	1.1	1.44 (36.6)	1.23 (31.2)	1.00 (25.4)	— —	.250 (6.35)	.250 (6.35)	1.200 (30.5)	0.17 (77.4)
3	2.4	1.44 (36.6)	1.23 (31.2)	1.26 (32)	— —	.250 (6.35)	.250 (6.35)	1.200 (30.5)	0.25 (114)
4	6	1.69 (43)	1.39 (35.3)	1.36 (34.5)	1.0625* (27.0)*	.250 (6.35)	.350 (8.9)	1.280 (32.5)	0.44 (200)
5	12	1.97 (50)	1.63 (41.4)	1.5 (38.1)	1.250* (31.8)*	.300 (7.62)	.400 (10.16)	1.410 (35.8)	0.70 (319)

* Clearance hole for 4-40 x 1⅜" nylon mtg. screws. Order screw as P/N PS-S and nut as P/N PS-N; Sold only in pkgs. of 100 each.

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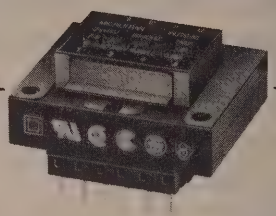
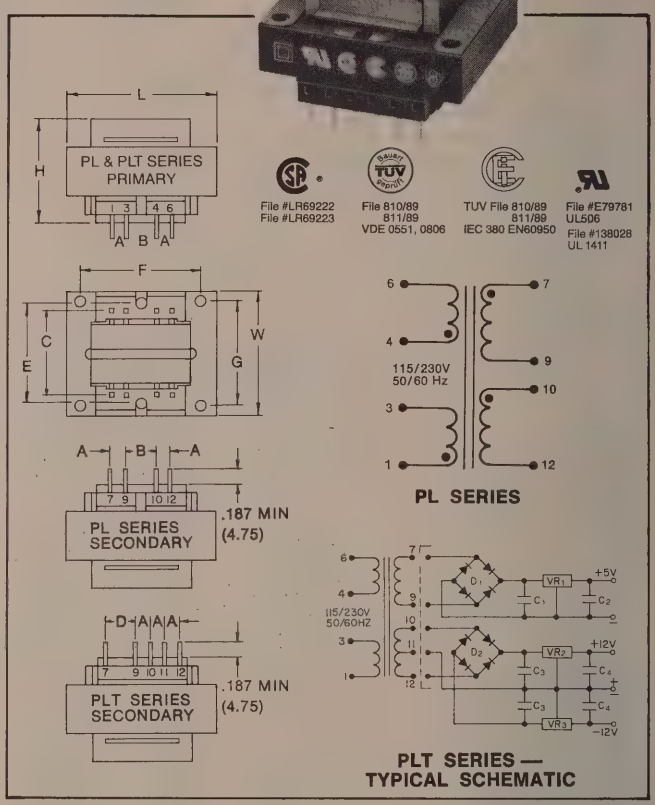
POWER TRANSFORMERS

low profile international series power transformers

For PC Board Solid-State Power, Control, and Instrumentation Applications
115/230V 50/60 Hz Primary

- Meets US and International Safety Standards—UL, VDE, IEC, CSA
- 4,000 Volt RMS Hipot Test — Dual Non-concentric Bobbins and Insulating Shroud Provide High Isolation and Reduced Capacitance
- 130°C Insulation System — Insulating Materials Meet UL 94V-0 Flammability Requirements
- Cost Effective Design





File #LR69222
File #LR69223

File 810/89
811/89
VDE 0551, 0806

TUV File 810/89
811/89
IEC 380 EN60950

File #E79781
UL506
File #138028
UL 1411

PL SERIES — FOR CONTROL AND POWER SUPPLY APPLICATIONS

Part No.	VA (Size)	Secondary: Parallel Connected AC Volts	Parallel Connected RMS Amps	Series Connected AC Volts	Series Connected RMS Amps
PL2.5-10	2.5	5.0	0.5	10.0 CT	0.25
PL5.0-10	5.0	5.0	1.0	10.0 CT	0.5
PL10-10	10.0	5.0	2.0	10.0 CT	1.0
PL20-10	20.0	5.0	4.0	10.0 CT	2.0
PL30-10	30.0	5.0	6.0	10.0 CT	3.0
PL56-10	56.0	5.0	11.2	10.0 CT	5.6
PL2.5-12	2.5	6.3	0.4	12.6 CT	0.2
PL5.0-12	5.0	6.3	0.8	12.6 CT	0.4
PL10-12	10.0	6.3	1.6	12.6 CT	0.8
PL20-12	20.0	6.3	3.2	12.6 CT	1.6
PL30-12	30.0	6.3	4.8	12.6 CT	2.4
PL56-12	56.0	6.3	8.8	12.6 CT	4.4
PL2.5-16	2.5	8.0	0.3	16.0 CT	0.15
PL5.0-16	5.0	8.0	0.62	16.0 CT	0.31
PL10-16	10.0	8.0	1.25	16.0 CT	0.62
PL20-16	20.0	8.0	2.5	16.0 CT	1.25
PL30-16	30.0	8.0	3.8	16.0 CT	1.9
PL56-16	56.0	8.0	7.0	16.0 CT	3.5
PL2.5-20	2.5	10.0	0.24	20.0 CT	0.12
PL5.0-20	5.0	10.0	0.5	20.0 CT	0.25
PL10-20	10.0	10.0	1.0	20.0 CT	0.5
PL20-20	20.0	10.0	2.0	20.0 CT	1.0
PL30-20	30.0	10.0	3.0	20.0 CT	1.5
PL56-20	56.0	10.0	5.6	20.0 CT	2.8
PL2.5-24	2.5	12.0	0.2	24.0 CT	0.1
PL5.0-24	5.0	12.0	0.42	24.0 CT	0.21
PL10-24	10.0	12.0	0.84	24.0 CT	0.42
PL20-24	20.0	12.0	1.66	24.0 CT	0.83
PL30-24	30.0	12.0	2.5	24.0 CT	1.25
PL56-24	56.0	12.0	4.66	24.0 CT	2.33
PL2.5-28	2.5	14.0	0.18	28.0 CT	0.09
PL5.0-28	5.0	14.0	0.36	28.0 CT	0.18
PL10-28	10.0	14.0	0.72	28.0 CT	0.36
PL20-28	20.0	14.0	1.44	28.0 CT	0.72
PL30-28	30.0	14.0	2.12	28.0 CT	1.06
PL56-28	56.0	14.0	4.0	28.0 CT	2.0
PL2.5-36	2.5	18.0	0.14	36.0 CT	0.07
PL5.0-36	5.0	18.0	0.28	36.0 CT	0.14
PL10-36	10.0	18.0	0.56	36.0 CT	0.28
PL20-36	20.0	18.0	1.12	36.0 CT	0.56
PL30-36	30.0	18.0	1.64	36.0 CT	0.82
PL56-36	56.0	18.0	3.12	36.0 CT	1.56

DIMENSIONS Inches (mm)

VA (Size)	L	W	H	A†	B	C	D	Mounting E	Mounting F	Mounting G	Mtg. Screws	Pin Square	Lbs. (Kg.)
2.5	1.625 (41.3)	1.313 (33.3)	1.125 (28.6)	.200 (5.1)	.250 (6.4)	1.000 (25.4)	—	1.063 (27.0)	—	—	2X #4 (2X M3)	.025 (.635)	.25 (.11)
5.0	1.625 (41.3)	1.313 (33.3)	1.375 (34.9)	.200 (5.1)	.400 (10.2)	1.000 (25.4)	—	1.063 (27.0)	—	—	2X #4 (2X M3)	.025 (.635)	.37 (.17)
10.0	1.875 (47.6)	1.563 (39.7)	1.375 (34.9)	.200 (5.1)	.400 (10.2)	1.140 (29.0)	—	1.250 (31.8)	—	—	2X #4 (2X M3)	.036 (.914)	.53 (.24)
20.0	2.250 (57.1)	1.875 (47.6)	1.625 (41.3)	.400 (10.2)	.400 (10.2)	1.460 (37.1)	.40 (10.2)	1.500 (38.1)	—	—	2X #4 (2X M3)	.036 (.914)	.90 (.41)
30.0	2.625 (66.7)	2.188 (55.6)	1.563 (39.7)	.550 (14.0)	.275 (7.0)	1.680 (42.7)	.55 (14.0)	—	2.19 (55.6)	1.75 (44.5)	4X #6 (4X M3)	.045 (1.14)	1.15 (.52)
56.0	3.000 (76.2)	2.500 (63.5)	1.813 (46.0)	.600 (15.2)	.300 (7.6)	1.900 (48.3)	.60 (15.2)	—	2.50 (63.5)	2.00 (50.8)	4X #6 (4X M5)	.045 (1.14)	1.70 (.77)

† For PLT series secondary only, dimension A is ½ of value shown.

PLT SERIES — FOR TRIPLE OUTPUT REGULATED POWER SUPPLIES

For Microprocessor, Logic, and Op Amp Applications

Part No.	VA AC (Size)	DC Output #1 DC Volts	DC Output #1 Amps DC	DC Output #2 DC Volts	DC Output #2 mA DC	C_1	C_3	VR_1	VR_2	VR_3	D_1	D_2
PLT20-32	20.0	5.0	1.25	±12	150	7,500 μF 20V DC	1,500 μF 50V DC	LM-323K-5	LM-340K-12	LM-320K-12	3N253	3N247
PLT30-32	30.0	5.0	1.75	±12	210	10,000 μF 20V DC	1,500 μF 50V DC	LM-323K-5	LM-340K-12	LM-320K-12	3N253	3N247
PLT56-32	56.0	5.0	2.8	±12	350	15,000 μF 20V DC	2,000 μF 50V DC	LM-323K-5	LM-340K-12	LM-320K-12	MDA-400	3N247

C_2 and C_4 10,000 μF @ 20V. All VR's are National Semiconductor P/N's. All diodes are Motorola P/N's.

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- Physical Barriers Between Primary and Secondary — Double Protection System — 4,000 Volt Hipot

PW SERIES — FOR CONTROL AND POWER SUPPLY APPLICATIONS

115/230V 50/60 Hz Primary

Part No.	Secondary: Parallel Connected AC Volts	Secondary: Parallel Connected RMS Amps	Secondary: Series Connected AC Volts	Secondary: Series Connected RMS Amps	Schematic	Fig.
PW28 SERIES • 0.5 VA						
PW28-10	10.0 CT	.050	(Single Secondary)		1†	A
PW28-16	16.0 CT	.031	(Single Secondary)		1†	A
PW28-24	24.0 CT	.021	(Single Secondary)		1†	A
PW35 SERIES • 1.1 VA						
PW35-10	10.0 CT	.110	(Single Secondary)		1	A
PW35-12	12.6 CT	.090	(Single Secondary)		1	A
PW35-16	16.0 CT	.070	(Single Secondary)		1	A
PW35-24	24.0 CT	.046	(Single Secondary)		1	A
PW35-36	36.0 CT	.031	(Single Secondary)		1	A
PW41 SERIES • 3.5 VA						
PW41-10	10.0 CT	.350	(Single Secondary)		1	B
PW41-12	12.6 CT	.280	(Single Secondary)		1	B
PW41-16	16.0 CT	.220	(Single Secondary)		1	B
PW41-24	24.0 CT	.150	(Single Secondary)		1	B
PW41-36	36.0 CT	.100	(Single Secondary)		1	B
PW48 SERIES • 9.5 VA						
PW48-10	5.0	1.900	10.0 CT	.950	2	B
PW48-12	6.3	1.500	12.6 CT	.750	2	B
PW48-16	8.0	1.200	16.0 CT	.600	2	B
PW48-24	12.0	.800	24.0 CT	.400	2	B
PW48-36	18.0	.520	36.0 CT	.260	2	B
PW48-56	28.0	.340	56.0 CT	.170	2	B
PW54 SERIES • 12.5 VA						
PW54-10	5.0	2.500	10.0 CT	1.250	2	C
PW54-12	6.3	2.000	12.6 CT	1.000	2	C
PW54-16	8.0	1.560	16.0 CT	.780	2	C
PW54-24	12.0	1.040	24.0 CT	.520	2	C
PW54-36	18.0	.700	36.0 CT	.350	2	C
PW54-56	28.0	.446	56.0 CT	.223	2	C

† PW28 Series has 115V only primary. For 230V only primary, order as PW28-10-230, etc.

PWT SERIES — FOR TRIPLE OUTPUT REGULATED AND UNREGULATED POWER SUPPLIES

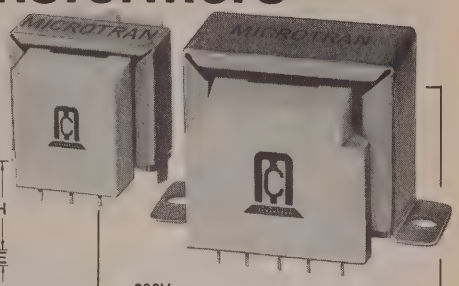
115/230V 50/60 Hz Primary

Part No.	Secondary #1 AC Volts	Secondary #1 RMS Amps	Secondary #2 AC Volts	Secondary #2 RMS Amps	DC Output #1 CT FW DC Volts	DC Output #1 mA DC	DC Output #2 CT FW DC Volts	DC Output #2 mA DC	Schematic	Fig.
PWT54-1024	9.0 CT	.800	24.0 CT	.300	+5	670	±15	170	3	C
PWT54-1633	16.0 CT	.550	33.0 CT	.180	+9.0*	470	±21*	120	4	C

* +9.0 and ±21 DC output volts are for inputs to +5V and ±15V IC Voltage Regulator; see Schematic #4.

Recognized Component Underwriters Labs Inc.

UL 1411
File #E82992



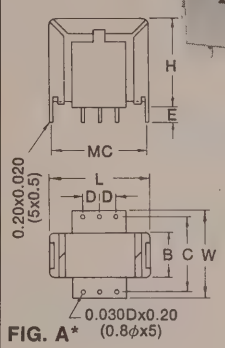


FIG. A*

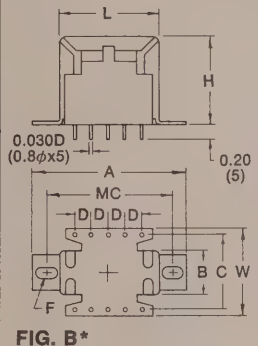


FIG. B*

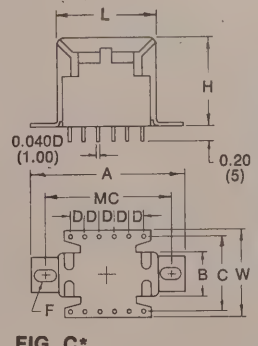
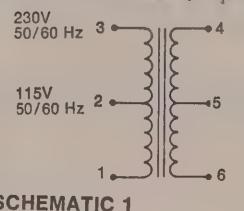
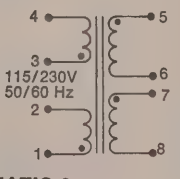


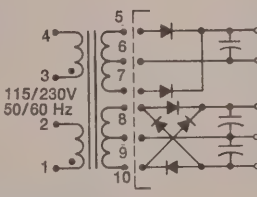
FIG. C*



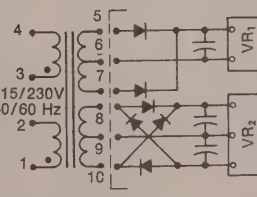
SCHEMATIC 1



SCHEMATIC 2



SCHEMATIC 3



SCHEMATIC 4

DIMENSIONS Inches (mm)

Series	Max VA	L	W	H	MC	A	B	C	D	E	F	Oz. (Gm)
PW28	0.7	1.16 (29.5)	1.32 (33.5)	1.10 (28)	1.12 (28.5)	— —	0.50 (12.5)	0.984 (25)	0.197 (5)	0.20 (5)	— —	2.5 (70)
PW35	2	1.44 (36.5)	1.69 (43)	1.26 (32)	1.40 (35.5)	— —	0.61 (15.5)	1.380 (35)	0.295 (7.5)	0.24 (6)	— —	4.5 (130)
PW41	5	1.67 (42.5)	1.91 (48.5)	1.42 (36)	2.05 (52)	2.36 (60)	0.85 (21.5)	1.575 (40)	0.394 (10)	— —	0.138x0.177 (3.5x4.5)	8.0 (230)
PW48	9.5	1.99 (50.5)	2.05 (52)	1.69 (43)	2.32 (59)	2.72 (69)	1.08 (27.5)	1.772 (45)	0.295 (7.5)	— —	0.177x0.256 (4.5x6.5)	14.0 (400)
PW54	15	2.22 (56.5)	2.09 (53)	1.93 (49)	2.72 (69)	3.15 (80)	1.08 (27.5)	1.772 (45)	0.295 (7.5)	— —	0.177x0.256 (4.5x6.5)	18.0 (510)

PWT54 and PW54 have same dimensions
* Request terminal layout sheet for pin locations.

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NEW! 2.5 VA Size 0.650 inches high for 13/16″ Card Spacing
6 VA Size 0.85″ high for 1″ Card Spacing
12 VA Size 1.065″ high for 1 1/4″ Card Spacing
24 VA Size 1.250″ high for 19/16″ Card Spacing

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  Low Capacity Coupling Minimizes Line Noise and False Triggering
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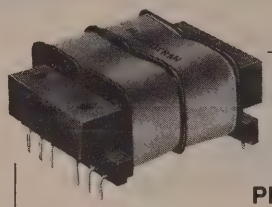
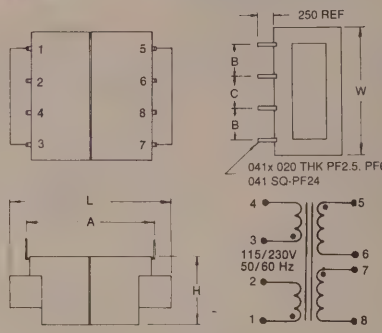


UL 506 File #E79781

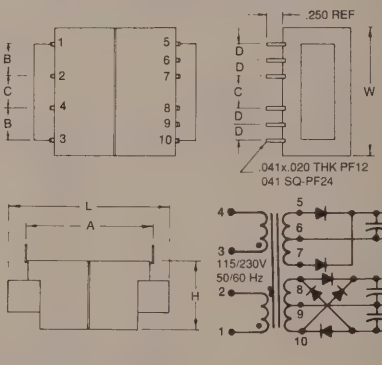
PF SERIES—FOR POWER SUPPLIES, INSTRUMENTS, CONTROL EQUIPMENT

		Secondary			
	VA	Parallel Connected		Series Connected	
Part No.	(Size)	AC Volts	RMS Amps	AC Volts	RMS Amps
PF2.5-10	2.5	5.0	.50	10.0 CT	.250
PF6-10	6	5.0	1.20	10.0 CT	.60
PF12-10	12	5.0	2.40	10.0 CT	1.20
PF24-10	24	5.0	4.80	10.0 CT	2.40
PF2.5-12	2.5	6.3	.40	12.6 CT	.20
PF6-12	6	6.3	.90	12.6 CT	.45
PF12-12	12	6.3	1.90	12.6 CT	.95
PF24-12	24	6.3	3.80	12.6 CT	1.90
PF2.5-16	2.5	8.0	.30	16.0 CT	.15
PF6-16	6	8.0	.70	16.0 CT	.35
PF12-16	12	8.0	1.50	16.0 CT	.75
PF24-16	24	8.0	3.00	16.0 CT	1.50
PF2.5-20	2.5	10.0	.25	20.0 CT	.125
PF6-20	6	10.0	.60	20.0 CT	.30
PF12-20	12	10.0	1.20	20.0 CT	.60
PF24-20	24	10.0	2.40	20.0 CT	1.20
PF2.5-24	2.5	12.0	.20	24.0 CT	.10
PF6-24	6	12.0	.50	24.0 CT	.25
PF12-24	12	12.0	1.00	24.0 CT	.50
PF24-24	24	12.0	2.00	24.0 CT	1.00
PF2.5-30	2.5	15.0	.17	30.0 CT	.085
PF6-30	6	15.0	.40	30.0 CT	.20
PF12-30	12	15.0	.80	30.0 CT	.40
PF24-30	24	15.0	1.60	30.0 CT	.80
PF2.5-34	2.5	17.0	.15	34.0 CT	.075
PF6-34	6	17.0	.34	34.0 CT	.17
PF12-34	12	17.0	.70	34.0 CT	.35
PF24-34	24	17.0	1.40	34.0 CT	.70
PF2.5-56	2.5	28.0	.09	56.0 CT	.045
PF6-56	6	28.0	.20	56.0 CT	.10
PF12-56	12	28.0	.42	56.0 CT	.21
PF24-56	24	28.0	.85	56.0 CT	.43

PF SERIES



PFT SERIES



DIMENSIONS (Inches)

VA (Size)	L	W	H	A	B	C	D†	Wt. Oz.
2.5	1.870	1.560	0.650	1.600	0.375	0.375	—	5
6	1.875	1.563	0.850	1.600	0.375	0.375	—	7
12	2.500	2.000	1.065	2.000	0.500	0.500	0.250	11
24	2.870	2.250	1.250	1.900	0.600	0.530	0.300	15

PFT SERIES—FOR TRIPLE OUTPUT REGULATED POWER SUPPLIES

		Secondary #1		Secondary #2		DC Output #1		DC Output #2	
Part No.	VA (Size)	AC Volts	RMS Amps	AC Volts	RMS Amps	CT FW DC Volts	mA DC	CT FW DC Volts	mA DC
PFT12-35	12	16.0 CT	0.36	35.0 CT	.15	+8.75*	300	±22*	85
PFT12-28	12	16.0 CT	0.36	28.0 CT	.187	+8.75*	300	±17.6	106
PFT24-35	24	16.0 CT	0.72	35.0 CT	.30	+8.75*	600	±22*	170
PFT24-28	24	16.0 CT	0.72	28.0 CT	.375	+8.75*	600	±17.6	212

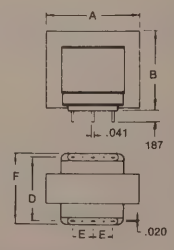
+8.75, ±17.6 or ±22 DC output volts are for inputs to +5V and ±12 or ±15V IC Voltage Regulators. See PFT schematic. Line input 115/230V ±10%.

400 Hz PRINTED CIRCUIT POWER

Compact design for miniature solid state circuitry. Precision spaced molded-in terminals for power supplies, control equipment, instrument and similar applications. – Dual secondaries may be connected in series or parallel for varied voltage and current requirements. 115V Primary. See chart to right.

Part No.	Secondary Parallel	Secondary Series
PC4304	3.15V @ .1A	6.3V CT @ .05A
PC4312	12.6V @ .026A	25.2V CT @ .013A
PC4316	28V @ .012A	56V CT @ .006A
PC4320	35V @ .01A	70V CT @ .005A
PC4408	6.3V @ .60A	12.6V CT @ .30A
PC4412	12.6V @ .30A	25.2V CT @ .15A
PC4416	28V @ .14A	55V CT @ .07A
PC4424	40V @ .10A	80V CT @ .05A
PC4428	58V @ .066A	116V CT @ .033A
PC4432	115V @ .010A, 12.6V @ .150A	

PC4300
PC4400
SERIES



DIMENSIONS (Inches)

Series	A	B	D	E	F	Wt. Oz.
PC4300	.766	.719	0.420	0.187	.688	0.5
PC4400	1.016	.844	0.781	0.200	.953	1.2

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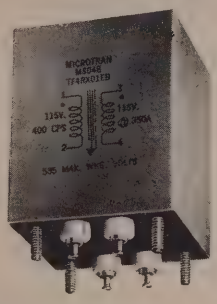
POWER TRANSFORMERS AND INDUCTORS

MICROTRAN company, inc.

FIG. A:



HERMETICALLY SEALED PER MIL-T-27.
MIL Designation: TF4S03XX
See MIL Case Dimension Chart

FIG. B

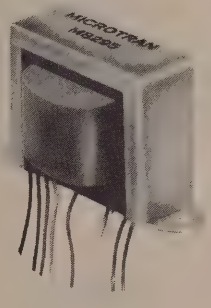
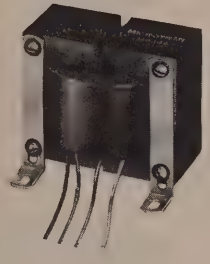


FIG. C



50/60 Hz CONTROL & POWER SUPPLY–MIL/COMMERCIAL

Designed for solid state and low voltage power supply applications. Primary 105/115/125 Volts. Part numbers listed on left are hermetically sealed per MIL Designation: TF4S03XX. Part numbers listed on right are open frame construction.

MIL		COMMON ELECTRICAL RATINGS				COMMERCIAL					
		Secondary		Rectifier Circuit				Open Frame Dimensions			
MIL Part No.	Fig. A MIL Case XX	AC Volts	RMS Amps	CT FW DC Volts**	FW Bridge DC Volts**	Open Frame Part No.	Fig.	L	W	H	Mounting Centers
M8042	AJ	6.3 CT	.6	1.9	3.8	M8242	B	2.375	1.375	1.500	2.000
M8043	FB	6.3 CT	2.0	1.9	3.8	M8243	B	3.250	1.625	1.940	2.812
M8086	GA	6.3 CT	6.0	1.9	3.8	M8286*	B	3.688	2.125	2.250	3.125
M8087	GA	12.6 CT	3.0	4.7	9.4	M8287	B	3.688	2.125	2.250	3.125
—	—	12 CT	4.0	9.9 (series)	19.8 (series)	M8247†	C	4.125	3.125	3.750	3.437×2.500
		12	4.0	9.9 (series)	19.8 (series)						
M8044	JB	12.6 CT	2.0	10.5 (series)	21 (series)	M8244	C	3.375	2.875	3.094	2.812×2.500
		12.6	2.0	10.5 (series)	21 (series)						
M8022	JB	18.5 CT	3.0	7.4	14.8	M8222	C	3.375	2.500	3.094	2.812×2.125
M8088	HA	26 CT	2.5	10.8	21.6	M8288	C	3.000	2.750	2.750	2.500×3.375
M8152	AJ	28 CT	0.15	11.7	23.4	—	—	—	—	—	—
M8045	FA	28 CT	.6	11.7	23.4	M8245	B	3.250	2.125	1.940	2.812
M8055	JA	30 CT	2.5	12.5	25	M8255	C	3.750	2.750	3.469	3.125×2.250
M8089	AJ	40 CT	.1	17	34	M8289	B	2.375	1.375	1.500	2.000
M8090	EA	40 CT	.3	17	34	M8290	B	2.812	1.625	1.625	2.375
M8091	GB	40 CT	.75	17	34	M8291	B	3.688	2.125	2.250	3.125
M8046	LA	49 CT	2.5	21	42	M8246	C	4.500	3.250	4.031	3.750×2.500
M8056	HA	80 CT	.6	35	70	M8256	C	3.000	2.625	2.750	2.500×2.375

†Secondary may be connected in series to provide 24V@4A or parallel for 12V@8A. *60 Hz only.
**DC Output for resistive or inductive loads. Output volts based on approx. 1V drop per rectifier.

50/60 Hz ISOLATION/POWER–MIL/COMMERCIAL

Center tap permits use in either F.W. Bridge or F.W. CT circuitry. Electrostatic shielding. Part numbers listed on left are hermetically sealed per MIL Designation: TF4S03XX. Part numbers listed on right are open frame construction.

MIL		COMMON ELECTRICAL RATINGS				COMMERCIAL					
								Open Frame Dimensions			
MIL Part No.	Fig. A MIL Case XX	Input Voltage	Output Voltage	Current RMS Amps	VA Rating	Open Frame Part No.	Fig.	L	W	H	Mounting Centers
M8094	AH	115	115 CT	0.0085	1	M8294	B	2.125	1.125	1.187	1.750
M8151	FA	115	115 CT	0.13	15	M8251	B	3.250	1.625	1.940	2.812
M8096*	GA	115	115 CT	0.35	40	M8296*	B	4.000	2.250	2.562	3.562
M8078*	KA	115	115 CT	0.9	100	M8278*	C	3.750	3.125	3.469	3.125×2.750

*Primary 105/115/125V.

FILTER INDUCTORS–MIL/COMMERCIAL

For 50/60 and 400 Hz Power Supplies. 1500 Test Volt. May be connected in series or parallel for inductive requirements. Part numbers listed on left are hermetically sealed per MIL Designation: TF4S03XX. Part numbers listed on right are open frame construction. Inductance values shown are for 60 Hz, except M8102 120 Hz.

MIL		COMMON ELECTRICAL RATINGS						COMMERCIAL						
		Series Connected			Parallel Connected					Open Frame Dimensions			
MIL Part No.	Fig. A MIL Case XX	Inductance Henrys	DC Amps	DCR Ohms	Inductance Henrys	DC Amps	DCR Ohms	Open Frame Part No.	Fig.	L	W	H	Mounting Centers
M8098	AH	3.5	0.050	200	0.875	0.10	50	M8198	B	2.125	1.125	1.189	1.750
M8099	AJ	1.0	0.15	65	0.25	0.30	16	M8199	B	2.375	1.250	1.500	2.000
M8100	EB	0.5	0.3	30	0.125	0.6	7.5	M8200	B	2.812	1.375	1.625	2.375
M8101	FB	0.32	0.6	16	0.08	1.2	4	M8201	B	3.250	1.625	1.940	2.812
M8102	JA	0.2	1.0	4	0.05	2.0	1	M8202	C	3.375	2.375	3.094	2.812×2.125

400 Hz ISOLATION/POWER

Center Tap Permits Use in Either FW Bridge or FW CT Circuitry. Electrostatic Shielding. Primary 115 Volts.

	Secondary			Fig A. MIL Case XX
Part No.	AC Volts	RMS Amps	VA	
M8059	115 CT	0.35	40	EB
M8060	115 CT	1.3	150	GA
M8061*	115 CT	2.6	300	JA
M8062*	115 CT	4.4	500	KA

*Primary 105/115/125V.

Epoxy molded with .50" pins for printed circuit applications. MIL Designation: TF5S03XX

400 Hz POWER SUPPLY

For Silicon Rectifier Circuitry, and Filament Applications. Primary 105/115/125 Volts.

	Secondary		Rectifier Circuit		Fig. A MIL Case XX
Part No.	AC Volts	RMS Amps	CT FW DC Volts**	FW Bridge DC Volts**	
M8064†	6.3 CT	0.6	1.9	3.8	AH
M8039	12.6	0.8	10.5 (series)	21 (series)	AJ
	12.6 CT	0.8	10.5 (series)	21 (series)	AJ
M8065	26 CT	1.5	10.8	21.6	EA
M8066	26 CT	3	10.7	21.5	FA
M8067	30 CT	1.5	12.5	25	FB
M8070†	65 CT	0.170	28.4	56.8	AH

**DC Output for resistive or inductive loads. Output volts based on approx. 1V drop per rectifier.
†Primary 115V only.

400 Hz TORODIAL POWER

Toroidal cores permit smaller height and package and greater efficiency. Size savings up to 30%. Printed circuit pins can be bent for chassis mounting. Low phase shift. Primary 115 Volts.

	Secondary			Dimensions		Nominal Wt. Oz.	Fig.
Part No.	AC Volts	RMS mA	VA	OD	Height		
M8106	28 CT	320	9	1.156	1.125	2	D
M8107	28 CT	710	20	1.500	1.250	4	D
M8108	56 CT	160	9	1.156	1.125	2	D
M8109	56 CT	356	20	1.500	1.250	4	D
M8111	115 CT	170	20	1.500	1.250	4	D

.170 Clearance Hole for #8 Screw.

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MICROTRAN company, inc.

CONVERTER TRANSFORMERS

d.c. to d.c. converter transformers

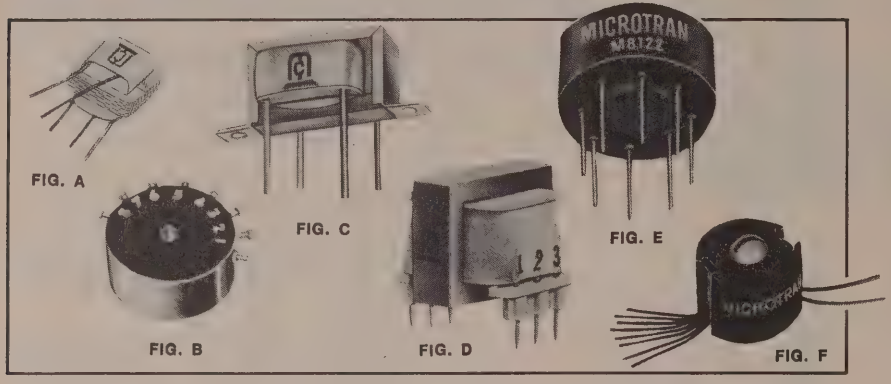


FIG. A FIG. B FIG. C FIG. D FIG. E FIG. F

APPLICATIONS:

- Portable Radiation Monitors
- Infra-Red Detectors
- Op-Amp Power Supplies
- DC Isolation
- Geodetic-Oceanographic-Medical Equipment
- Mobile Equipment
- High Intensity Flashers
- DC Supply for Modular Equipment

Select Unit to meet your Power and Size Requirements	Part No.	Total VA Output	DC Input Volts	DC Output Bridge Volts	DC Output Bridge mA	DC Output CT Full Wave Volts	DC Output CT Full Wave mA	Switch Freq. Hz Approx.	Typical Transistor	Dimensions (Inches) L	W	H	Mounting Centers MD	Mounting Centers MW	Type of Construction	Fig.	Schematic	Approx. Wt. Oz.
25 mW to 190 mW HIGH VOLTAGE LOW POWER MINIATURE DESIGN	M8149	25 mW	3	1000*	25 μA	—	—	400	2N670	1.016	.953	.844	—	—	Printed Circuit	D	2	1.25
	M8050	25 mW	3	1000*	25 μA	—	—	400	2N670	1.69	.812	.844	1.375	—	Open Frame	C	2	1.25
	M8073	25 mW	4	425-500*	50 μA	—	—	50-3k†	2N1305	.375	.375	.375	—	—	Open Frame	A	3	0.1
	M8074	50 mW	3	535*	90 μA	—	—	400	2N414	1.69	.812	.844	1.375	—	Open Frame	C	4	1.25
	M8072	190 mW	2.7	480*	400 μA	—	—	800	2N1307	1.69	.812	.844	1.375	—	Open Frame	C	1	1.25
	M8092	190 mW	2.7	480*	400 μA	—	—	800	2N1307	1.03	.875	.80	—	—	Open Frame	D	1	1.25
	M8120	190 mW	28	480*	400 μA	—	—	3.5k	2N4355	1.69	.812	.844	1.375	—	Open Frame	C	7	1.25
3 VA	M8121	3	5	190*	15	—	—	20k	2N6121	.563 D x .344H—‡					Pot Core	F	8	0.3
5 VA LOW PROFILE ENCAPSULATED	M8115	5	13.8	±250 or 500	10	250	20	6k	2N3054	1.25D x .75H—0.140 Cl. Hole					Molded Toroid	B	6	1.1
	M8117	5	28	±250 or 500	10	250	20	6k	2N3054	1.25D x .75H—0.140 Cl. Hole					Molded Toroid	B	5	1.1
	M8122	5	5	±15 or 30	175	15	350	20k	2N3055	.875D x .531H					P.C. Molded Toroid	E	5	1.1
30 VA LOW PROFILE ENCAPSULATED	M8132	30	13.8	±15 or 30	1000	15	2000	20k	2N3055	1.25D x .75H—0.140 Cl. Hole					Molded Toroid	B	5	1.1
	M8133	30	28	±15 or 30	1000	15	2000	20k	2N3055	1.25D x .75H—0.140 Cl. Hole					Molded Toroid	B	5	1.1

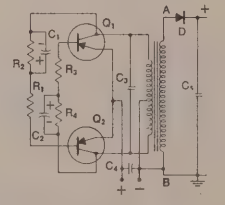
‡ Supplied with 4-40 nylon mtg. screw and nut in center hole.

* Output when used with schematic indicated.

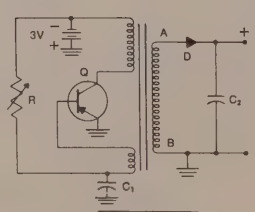
† Frequency depends on load and bias conditions.

ALL CONVERTER TRANSFORMERS ARE SUPPLIED WITH ENGINEERING BULLETIN LISTING COMPONENT VALUES

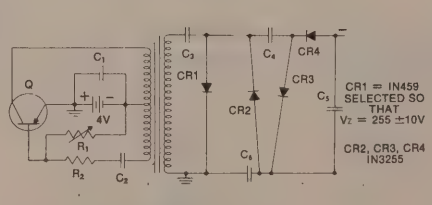
TYPICAL DC-DC CONVERTER TRANSFORMER CIRCUITS



SCHEMATIC 1



SCHEMATIC 2



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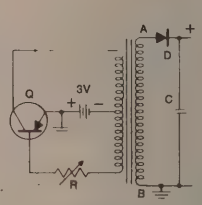
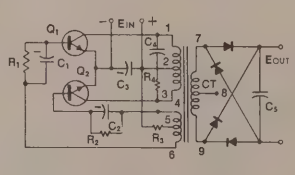
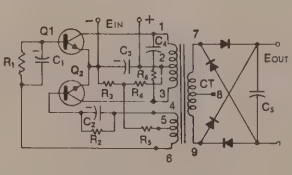


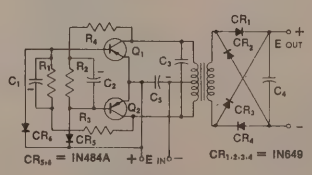
SCHEMATIC 4



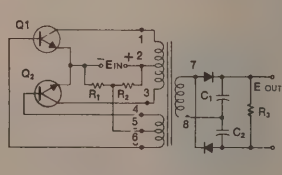
SCHEMATIC 5



SCHEMATIC 6



SCHEMATIC 7



SCHEMATIC 8

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TOROIDAL INDUCTORS

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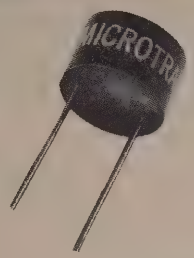
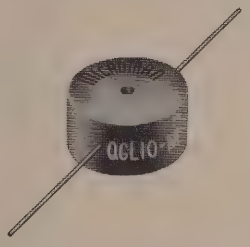
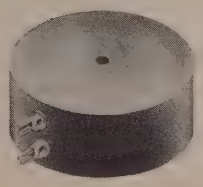


QE-M Molded

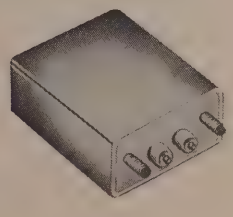
QG-F, QI-F, QK-F, QPL-F, QTL-F Open Frame



QG-M Molded



QI-M, QK-M, QPL-M, QTL-M Molded



QI-H, QK-H 2 studs, QPL-H, QTL-H 4 studs Hermetic

QE SERIES

Ultra miniaturized with low height design. Exceptionally high "Q" and wide frequency range. Frequency range of QEL Series 1 to 300 kHz; QEM, 3 to 500 kHz. Accuracy, ±2%. Molded in epoxy resin with .020" × 2" tinned copperweld leads. Size, .450" dia. × .285".

QEL-M SERIES				QEM-M SERIES			
Part No.	Inductance	Typ. DCR	Typ. Dist. Cap., pF	Part No.	Inductance	Typ. DCR	Typ. Dist. Cap., pF
QEL1-M	1 mH	2.1	25	QEM05-M	0.5 mH	2.1	20
QEL2-M	2	3.6	30	QEM1-M	1	3.8	30
QEL5-M	5	7.3	35	QEM2-M	2	6.2	35
QEL10-M	10	15.8	45	QEM5-M	5	15.9	45
QEL15-M	15	20	45	QEM10-M	10	19	50
QEL25-M	25	32	50	QEM15-M	15	42	55
QEL50-M	50	69	50	QEM25-M	25	88	60
QEL100-M	100	185	70	QEM50-M	50	193	70

QG SERIES

Frequency range of QGL Series, to 20kHz; QGM Series, 2 to 100 kHz. Accuracy, ±2%. **QG-F:** Open frame, microcrystalline wax dipped with 4" #28 AWG leads. Size .625" dia. × .281". **QG-M:** Molded in high temperature epoxy resin with .020" × 2" tinned copperweld leads. Leads may be bent downward for plug-in printed circuit use. Size, .875" dia. × .375".

QGL SERIES				QGM SERIES			
QGL5-	5 mH	2.5	30	QGM1-	1 mH	1.4	22
QGL10-	10	5	33	QGM2-	2	2.5	25
QGL15-	15	8	34	QGM5-	5	6	28
QGL30-	30	17	37	QGM10-	10	12	31
QGL50-	50	28	40	QGM15-	15	18	32
QGL100-	100	50	42	QGM25-	25	30	35
QGL250-	250	130	46	QGM50-	50	52	37
QGL500-	500	290	48	QGM100-	100	115	39
QGL1000-	1.0 H	530	51				
QGL1500-	1.5	825	53				

QI SERIES

Frequency range to 20 kHz; accuracy, ±2%. **QIL-M:** Molded in high temperature epoxy with silver plated turret lugs. Size, 1.187" dia. × .50". **QIL-H:** Hermetically sealed in metal case with Teflon terminals. Size, 1.062" × .50" × 1.219". **QIL-F:** Open frame. Microcrystalline wax dipped with 4" #28 plastic leads. Size, 1" dia. × .406".

QIL SERIES							
QIL3-	3 mH	.73	36	QIL150-	150 mH	34	50
QIL5-	5	1.1	38	QIL250-	250	55	53
QIL10-	10	2.1	40	QIL500-	500	95	55
QIL15-	15	3.3	42	QIL1000-	1.0 H	210	57
QIL25-	25	5.3	45	QIL1500-	1.5	335	59
QIL50-	50	11	47	QIL2500-	2.5	550	61
QIL100-	100	22	49				

QK SERIES

Frequency range of QKL Series to 10 kHz; QKM Series, 5 to 50 kHz. Accuracy, ±2%. **QK-F:** Open frame, microcrystalline wax dipped; 4" #28 AWG leads. Size, 1.25" dia × .625". **QK-H:** Hermetically sealed with Teflon terminals. Size, 1.469" × .781" × 1.734". **QK-M:** Molded in high temperature epoxy resin, silver plated turret lugs. Size, 1.375" dia. × .75"; #8 clearance hole.

QKL SERIES							
QKL5-	5 mH	.62	60	QKL250-	250 mH	28	87
QKL10-	10	1.1	66	QKL500-	500	63	91
QKL15-	15	1.7	68	QKL1000-	1.0 H	110	96
QKL25-	25	2.8	72	QKL1500-	1.5	175	98
QKL50-	50	6	76	QKL2500-	2.5	275	103
QKL100-	100	11	81	QKL5000-	5	645	106
QKL150-	150	17	83	QKL10,000-	10	1175	112
QKM SERIES							
QKM2-	2 mH	.45	52	QKM100-	100 mH	25	79
QKM5-	5	1.1	58	QKM250-	250	65	87
QKM10-	10	2.5	62	QKM500-	500	115	92
QKM25-	25	6.5	70	QKM1000-	1.0 H	250	97
QKM50-	50	11	74				

QP SERIES

Frequency range to 10 kHz; accuracy ±2%. **QPL-F:** Open frame, microcrystalline wax dipped; 4" #24 leads. Size, 1.938" × .875". **QPL-H:** Hermetically sealed with Teflon terminals. Size, 1.938" × 1.063" × 2.281". **QPL-M:** Molded in high temperature epoxy resin; silver plated turret lugs. Size, 2" dia. × 1".

QPL SERIES							
QPL25-	25 mH	1.5	100	QPL2500-	2.5 H	150	133
QPL50-	50	2.5	105	QPL5000-	5.0	350	138
QPL100-	100	6	110	QPL7500-	7.5	525	140
QPL250-	250	15	115	QPL10,000-	10	600	142
QPL500-	500	25	120	QPL15,000-	15	900	146
QPL1000-	1.0 H	60	125	QPL25,000-	25	1500	150
QPL1500-	1.5	90	130				

QT SERIES

Frequency range to 15 kHz; accuracy, ±2%. **QTL-F:** Open frame, microcrystalline wax dipped; 4" #24 leads. Size, 2.438" dia. × 1". **QTL-H:** Hermetically sealed with Teflon terminals. Size, 2.563" × 1.313" × 2.813". **QTL-M:** Molded in epoxy resin. Size, 2.875" × 1.375".

QTL SERIES							
QTL25-	25 mH	0.85	127	QTL1500-	1.5 H	40	177
QTL50-	50	1.5	136	QTL2500-	2.5	70	184
QTL100-	100	2.8	144	QTL5000-	5	140	192
QTL150-	150	3.9	149	QTL10,000-	10	270	200
QTL250-	250	7	156	QTL15,000-	15	430	205
QTL500-	500	15	164	QTL25,000-	25	850	212
QTL1000-	1.0 H	27	173	QTL50,000-	50	1500	221

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MICROTRAN company, inc.

TELEPHONE INTERCONNECT TRANSFORMERS

line coupling

UL 1459 File# E138028
See Application Notes

FOR INTERCONNECT OF VOICE/DATA MODEM TERMINALS TO TELEPHONE LINES

Provides line isolation and matching—Prevents line imbalance—Wide dynamic signal capability—Low distortion
Permits optimum use of Voice-Grade Telephone Lines for broadband data signals—Designed to meet FCC Part 68

- Frequency Response: 300-3500 Hz ±0.5 dB
- Longitudinal Balance: Per FCC 68.310
- Impedance Matching ±10% over entire frequency range
- Level: −45 dBm to +7 dBm
- Distortion: 0.5% Max.
- Dielectric Strength 1500V RMS

Part No.	Primary Impedance	Secondary Impedance	Pri. Unbal. mA DC	Ins. Loss dB	Pri. DCR	Sec. DCR	Schematic	Fig.	Application Notes
VOICE/DATA COUPLING									
SURFACE MOUNT									
TSL103	600	346	0	2.75	127	150	2	A	Ultra low profile. .164" high. For PCMCIA type II PC Card. Uses only .32" x .40" real estate. 1,000V hipot.
TS3104	600	600	0	1.4	76	135	2	B	Very low profile. 0.315" high.
TS3106	600CT	600CT	0	1.4	76	135	7	B	Very low profile. 0.315" high.
TS1104	600	600	0	1.0	46	63	2	C	Very low profile.
TS1104-M	600	600	0	1.0	46	63	1	D	Very low profile. Molded to meet MIL-T-27 Grade 5.
TS1106	600CT	600CT	0	1.5	46	63	7	C	Very low profile.
TS1106-M	600CT	600CT	0	1.5	46	63	7	D	Very low profile. Molded to meet MIL-T-27 Grade.
THROUGH HOLE MOUNT									
PM32-F	600	600	1.5	1.6	75	105	1	PM-F	Frequency response 300 Hz-100kHz±2dB. 0.27" H.1000V hipot.
PM34-F	600CT	600CT	3	1.6	75	105	15	PM-F	Frequency response 300 Hz-100kHz±2dB. 0.27" H.1000V hipot.
PM32-M	600	600	1.5	1.6	75	105	1	E	Frequency response 300 Hz-100kHz±2dB. 0.27" H.1000V hipot.
PM34-M	600CT	600CT	3	1.6	75	105	15	F	Frequency response 300 Hz-100kHz±2dB. 0.27" H.1000V hipot.
TP3104	600	600	0	1.4	76	135	7	G	Very low profile. 0.315" high.
TP3106	600CT	600CT	0	1.4	76	135	7	G	Very low profile. 0.315" high.
TV104	600	600	2.5	2.2	50	65	2	I	Small footprint.
T1104	600	600	0	1.0	46	63	1	J	Very low profile.
T1104-M	600	600	0	1.0	46	63	1	K	Hipot 3750V.
TL1104	600	600	0	1.5	66	102	2	L	For dry circuits.
TL1106	600CT	600CT	0	1.5	66	102	7	L	For dry circuits.
TM104	600	374	0	2.0	108	120	1	M	1,000V hipot.
T2104	600	600	0	1.0	36	50	1	N	
T2106	600CT	600CT	0	1.0	36	50	7	P	
T2108	600	900	0	1.0	36	77	1	N	
T2110	900	900	0	1.0	55	78	8	O	Electrostatic shield.
T2316	4000	600	0	1.0	340	51	1	N	For bridging applications.
T9116	600 Split	600 Split	80	2.0	95	180	17	T	Low crosstalk, 1500V Pri. to Sec. and core.
T9117	600 Split	600 Split	80	1.3	78	92	18	T	Low crosstalk. Return loss 23 dB @ 440Ω+0.035μF. Parallel load. 1500V Pri. to Sec. and core. 1000V Sec. to core.
TL1114	600CT	600 Split	90	1.8	73	134	20	U	Handles loop currents.
T4113	900/600	600 Split	60/75Pri.	1.2	62	36/36	3	S	Level -15 to +7 dBm.
T5114	600	600 Split	75	1.7	100	49/49	9	V	
T5119	600	600	100	1.5	62	108	1	V	
T5117	600	600	125	1.1	45	58	1	V	
T5115	600	600 Split	120	0.8	40	25/25	10	W	
T6112	600	900/600	100/120Sec.	0.5	25	26	6	Y	Electrostatic Shield.
LOW PROFILE - 8MM SERIES									
TP3106	600CT	600CT	0	1.4	76	135	7	G	Very low profile. 0.315" high.
TS3106	600CT	600CT	0	1.4	76	135	7	B	Very low profile. 0.315" high.
ULTRA LOW PROFILE - 4MM SERIES									
TSL103	600	346	0	2.75	127	150	2	A	Ultra low profile. .164" high. For PCMCIA type II PC Card. Uses only .32" x .40" real estate. 1,000V hipot.
INTERNATIONAL SERIES 3,750V HIPOT									
THP104-M	600	600	0	1.1	65	73	2	Z	
TH2104	600	600	0	1.0	38	52	1	N	
TH2106	600CT	600CT	0	1.0	38	52	7	P	
TH9306	600CT	600CT	0	1.5	44	56	7	BB	3750V RMS hipot between windings, 1250V between winding and core
TH5114	600	600 Split	75	2.0	127	76/76	9	V	
TH5117	600	600	125	1.1	56	74	1	V	
TH5116	600	600 Split	125	1.0	56	37/37	9	V	Longitudinal balance 40dB min.
TH5118	600 Split	600	125	1.0	28/28	74	9	V	

Available on special order with other ratings and constructions. **See outline dwgs. and schematic diagrams on following pages.**

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TELEPHONE INTERCONNECT TRANSFORMERS

MICROTRAN company, inc.

line coupling—hybrid—holding coils

UL 1459 FILE# E138028
See Application Notes

FOR INTERCONNECT OF VOICE/DATA MODEM TERMINALS TO TELEPHONE LINES

Provides line isolation and matching—Prevents line imbalance—Wide dynamic signal capability—Low distortion
Permits optimum use of Voice-Grade Telephone Lines for broadband data signals—Designed to meet FCC Part 68

- Frequency Response: 300-3500 Hz ±0.5 dB
- Level: −45 dBm to +7 dBm
- Longitudinal Balance: Per FCC 68.310
- Distortion: 0.5% Max.
- Impedance Matching ±10% over entire frequency range
- Dielectric Strength 1500V RMS

Part No.	Primary Impedance	Secondary Impedance	Pri. Unbal. mA DC	Ins. Loss dB	Pri. DCR	Sec. DCR	Schematic	Fig.	Application Notes
DATA MODEM COUPLING — NON-VOICE APPLICATION FOR 300/1200/2400 BPS MODEM BOARD FOR MICROCOMPUTERS FOR FREQUENCY RESPONSE, IMPEDANCE MATCHING, RETURN LOSS, REQUEST OUTLINE DRAWING.									
SURFACE MOUNT									
TSL103	600	346	0	2.75	127	150	2	A	Ultra low profile. .164" high. For PCMCIA type II PC Card. Uses only .32" x .40" real estate. 1000V hipot.
TS1115	600	600	65	1.5	42	59	2	C	Insertion loss measured at rated DC.
THROUGH HOLE MOUNT									
TP3111	600	600	50	1.8	49	76	2	H	Insertion loss measured at rated DC. Very low profile 0.35" high.
TL1115	600	600	65	1.5	42	59	2	L	Insertion loss measured at rated DC.
TM105	600	470	100	2.5	108	120	1	M	100Ma rating, low profile.
TM106	600	470	100	2.0	108	120	1	M	100Ma rating, low profile.
T9311	600	600	90	1.8	75	100	1	AA	0.50" max ht.
T9312	600	600 Split	90	1.8	75	100	9	BB	0.50" max ht.
T9317	600	600 Split	50	1.6	75	95	9	BB	0.50" max ht.
TL1111	600CT	600 Split	90	1.6	63	103	20	U	
T2111*	600	600	90	2.0	71	117	13	CC	Low profile.
T2112*	600	600CT	90	2.0	71	117	14	CC	Low profile.
T2113*	600	600	90	2.0	71	117	13	N	
T2114*	600	600CT	90	2.1	71	117	14	P	
Except sec. to core, highpot 1000V RMS.									
LOW PROFILE - 8MM SERIES									
TP3111	600	600	50	1.8	49	76	2	H	Insertion loss measured at rated DC. Very low profile 0.35" high.
HOLDING COILS									
T4415	2.0 H/1.3 H		60/100	N/A	180	N/A	4	R	
T5415	1.4 H ±20%		120	N/A	90/90	N/A	5	V	Split winding, 1500V windings to core, 500V between windings.
T7410	1.0 H/0.8 H		0/25	N/A	225	N/A	4	DD	Toroidal construction, Low crosstalk, 1000V hipot.
T8410	1.0 H/0.8 H		0/40	N/A	113	N/A	4	DD	Toroidal construction, Low crosstalk, 1000V hipot.
HYBRID - TWO REQUIRED FOR CONVENTIONAL HYBRID OPERATION									
SURFACE MOUNT									
TS3220	600 (4W)	600/600	0	1.0	49	70/70	11	B	Very low profile. 0.35" high.
TS1220	600 (4W)	600/600	0	.7	39	37/37	11	C	Surface mount. Very low profile.
TS1220-M	600 (4W)	600/600	0	.7	39	37/37	11	D	Surface mount. Very low profile. Molded to meet MIL-T-27 grade 5.
THROUGH HOLE MOUNT									
TP3220	600 (4W)	600/600	0	1.0	49	70/70	11	G	Very low profile. 0.35" high.
TL1220	600 (4W)	600/600	0	.7	39	37/37	11	L	For dry circuits.
T2220	600 (4W)	600/600	0	1.0	57	42/42	11	P	Trans-hybrid loss 45dB typical.
T3220	600 (4W)	600/600	0	.7	34	25/25	11	Q	Trans-hybrid loss 45dB typical.
TL1320	600 (4W)	600/600	80 (2W)	1.8	98	78/78	21	U	Handles loop currents. Frequency response ±0.7 dB 300-3500 Hz.
T4220	600 (1W)	600/600	60 (2W)	1.0	61	62/62	12	S	Electrostatic shield. @ 0 dBm. Impedance matching ±15%.
T9320	600 (4W)	600/600	50 (2W)	1.4	75	85/85	11	BB	.50" max. ht. Frequency response ±0.7 dB 500-3500 Hz, ±1.6 dB. 300-3500 Hz @ 0 dBm.
T9220	600 (4W)	600/600	80 (2W)	1.6	100	190	19	T	Low profile. Low crosstalk. DCR values are max.
LOW PROFILE - 8MM SERIES									
TP3220	600 (4W)	600/600	0	1.0	49	70/70	11	G	Very low profile. 0.315" high.
TS3220	600 (4W)	600/600	0	1.0	49	70/70	11	G	Very low profile. 0.35" high.
INTERNATIONAL SERIES 3,750V HIPOT									
THP220-M	600 (4W)	600/600	0	1.0	60	62.5/62.5	11	Z	3750V hipot.
TH2220	600 (4W)	600/600	0	1.2	60	25/25	11	EE	3750V RMS hipot except 200V between 2 wire and balance windings. Trans-hybrid loss 45 dB typical.
TH5220	600 (4W)	600/600	100 (2W)	3.7*	50	30/30	16	X	3750V RMS hipot except 1500V between 2 wire and balance windings. Max level +20 dBm. E.S.S.

Insertion loss does not include dB in hybrid balance network.

MICROTRAN company, inc.

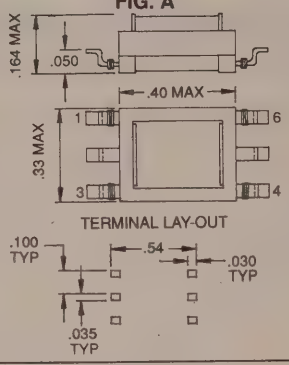
TELEPHONE INTERCONNECT TRANSFORMERS

OUTLINE DRAWINGS – TELEPHONE INTERCONNECT

NEW!

SURFACE MOUNT
Ultra Low Profile
Ultra Small Footprint
Vacuum Varnish
Impregnated.
Wt. 0.04 oz.
Flammability
per UL 94VO

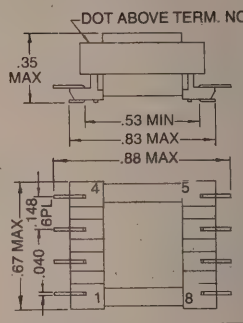
FIG. A



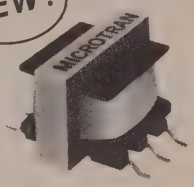
NEW!

SURFACE MOUNT
Very low profile
open PCB construction.
Vacuum varnish
impregnated
Wt. 0.2 oz.
Flammability
per UL 94VO

FIG. B

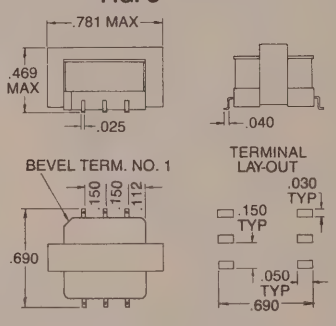


NEW!

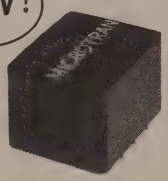


SURFACE MOUNT
Very low profile.
Open construction.
Vacuum varnish impregnated.
Wt. 0.4 oz.
Flammability
per UL 94VO

FIG. C

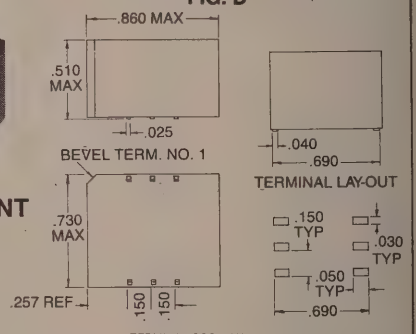


NEW!



SURFACE MOUNT
Very low profile.
Molded construction.
MIL-T-27 TF5S21ZZ.
Wt. 0.5 oz.
Flammability
per UL 94VO

FIG. D



Pico miniature size.
Plug-in printed circuit
construction. Epoxy
molded to MIL-T-27
TF5S21ZZ. Tinned
copperweld leads.
0.020×.75". Wt. 0.1 Oz.
Flammability
per UL 94VO

FIG. E

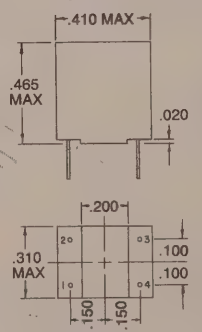
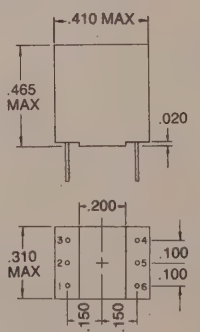
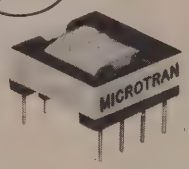


FIG. F

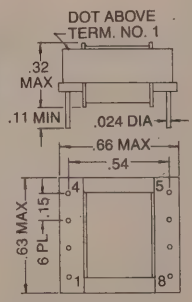


NEW!



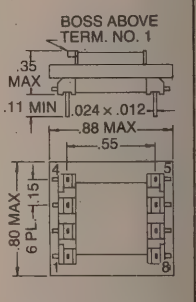
Very low profile
PC construction.
Vacuum varnish
impregnated
Flammability
per UL 94VO

FIG. G



Wt. 0.2 oz.

FIG. H

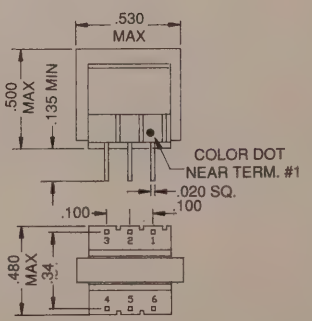


Wt. 0.4 oz.

NEW!

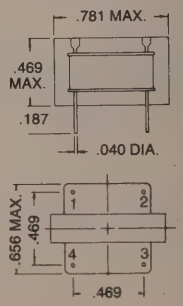
SMALL FOOTPRINT
Low Profile
Plug-in Printed
Circuit Construction
Vacuum Varnish
Impregnated.
Wt. 0.05 oz.

FIG. I



Plug-in printed circuit
construction.
Vacuum finish
impregnated.
Wt. 0.4 Oz.

FIG. J



DIMENSIONS IN INCHES.

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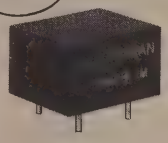
TELEPHONE INTERCONNECT TRANSFORMERS

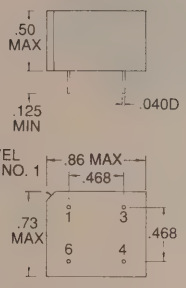
MICROTRAN company, inc.

OUTLINE DRAWINGS –TELEPHONE INTERCONNECT

NEW!

FIG. K

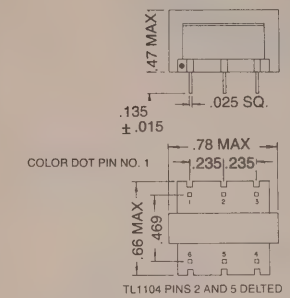




Very low profile.
PC epoxy molded construction.
MIL-T-27 TF5S21ZZ.
Wt. 0.5 Oz.
Flammability per UL 94V0

NEW!

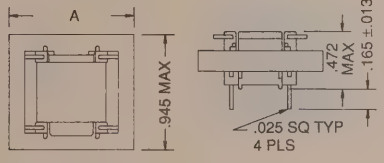
FIG. L



Very low profile.
PC construction.
Vacuum varnish impregnated.
Wt. 0.4 Oz.
Available with .040" standoffs.
On Special Order.

NEW!

FIG. M

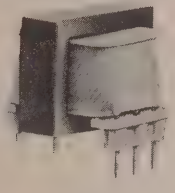


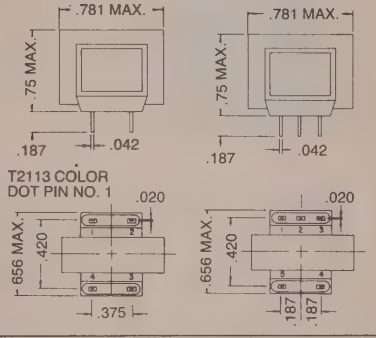
Low Profile
Plug-in Printed Circuit Construction
Vacuum Varnish Impregnated.
Wt. 0.55 oz.

Part No.	A
TM104	1,024 Max.
TM105, 106	.906 Max.

FIG. N

FIG. O





Plug-in printed circuit construction.
Vacuum varnish impregnated.
Wt. 0.5 Oz.

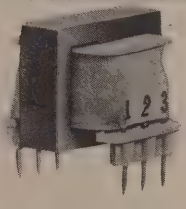
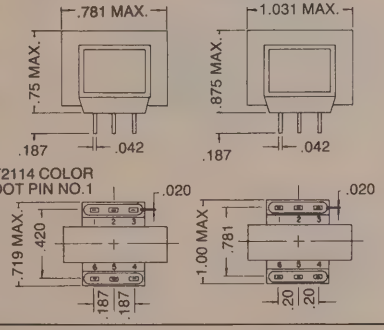


FIG. P
Wt. 0.5 Oz.

FIG. Q
Wt. 1.2 Oz.



Plug-in printed circuit construction.
Vacuum varnish impregnated.

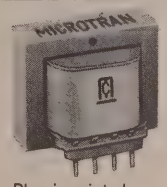
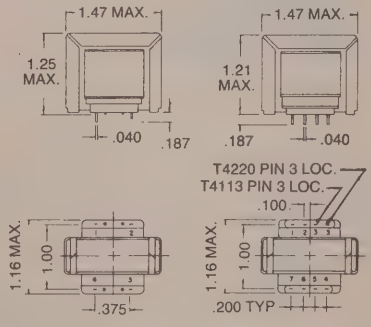


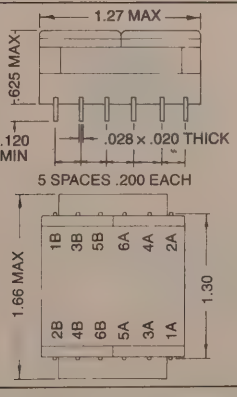
FIG. R

FIG. S



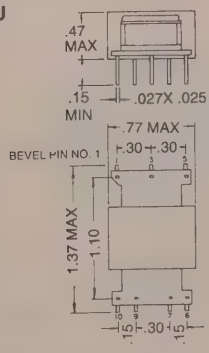
Plug-in printed circuit construction.
Vacuum varnish impregnated. Wt. 3.5 Oz.
Available with mounting flanges **on Special Order.**
.187 Dia. holes, 1.75 mounting centers.
Add -FB to Part No.

FIG. T



Low profile hum-bucking semi-toroidal construction.
High crosstalk attenuation.
Plug-in printed circuit construction. Vacuum varnish impregnated.
Wt. 2.2 Oz.

FIG. U



Plug-in printed circuit construction.
Vacuum varnish impregnated.
Wt. 0.76 oz.

DIMENSIONS IN INCHES

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MICROTRAN company, inc

TELEPHONE INTERCONNECT TRANSFORMERS

OUTLINE DRAWINGS –TELEPHONE INTERCONNECT

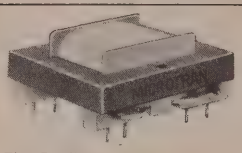
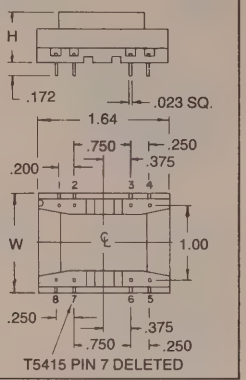


FIG. V



Flat Profile.
Plug-in printed circuit construction.
Vacuum varnish impregnated.
Wt. 2.5 Oz.

Part No.	H	W
T5114, T5415, T5119	.69	1.344
TH5114	.69	1.453
T5117, TH5116-18	.83	1.453

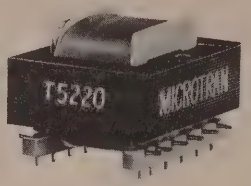


FIG. W

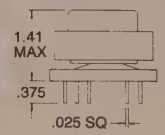
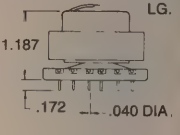
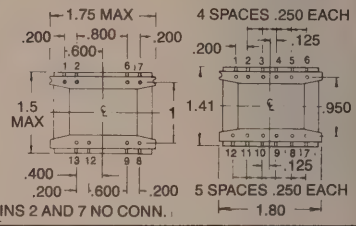


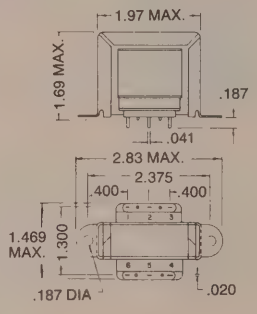
FIG. X SHIELD 3" LG.





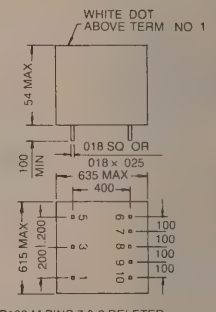
Plug-in printed circuit construction.
Vacuum varnish impregnated.
Wt. 5.5 Oz.

FIG. Y



Plug-in printed circuit construction with mounting channel.
Vacuum varnish impregnated. Wt. 9.5 Oz.

FIG. Z



Very low profile.
PC epoxy molded construction.
MIL-T-27 TF5S21ZZ.
Wt. 0.5 Oz.
Flammability per UL 94V0

FIG. AA

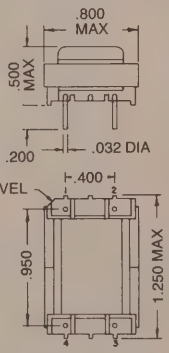
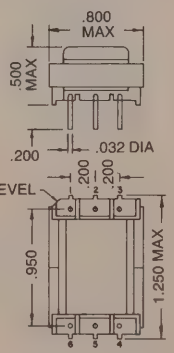


FIG. BB



Very low profile plug-in printed circuit construction.
Vacuum varnish impregnated.
Wt. 0.66 oz.

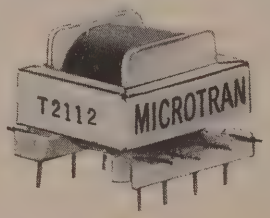
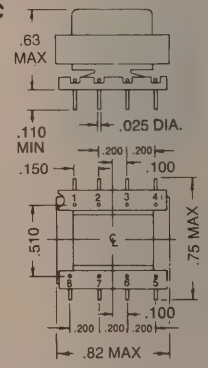


FIG. CC



Low-profile plug-in printed circuit construction.
Vacuum varnish impregnated.
Wt. 0.5 Oz.

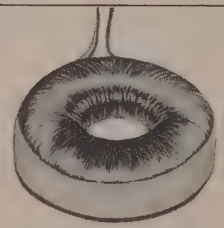
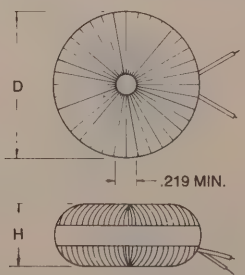


FIG. DD



High-Q Toroid.
Microcrystalline wax impregnated.
Supplied with 4" #28 leads.

Size Series	D	H	Wt. Oz.
T7400	1	.406	.75
T8400	1.25	.625	2

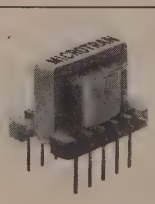
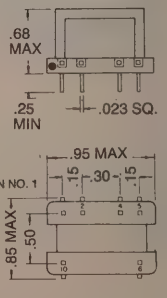


FIG. EE



PC construction.
Vacuum varnish impregnated.
Wt. 0.5 Oz.

DIMENSIONS IN INCHES

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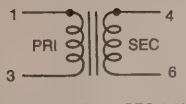
TELEPHONE INTERCONNECT TRANSFORMERS

MICROTRAN company, Inc.

SCHEMATIC DIAGRAMS FOR TELEPHONE INTERCONNECT

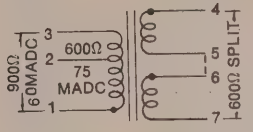
T5117, TH5117 PRI. 1-4 SEC. 6-7
TM103-6, T9311 PRI. 1-2 SEC. 4-3
T5119 PRI. 6-9 SEC. 3-2

#1



THP104-M PRI 1-5 SEC 6-10
TP/TS3104 PRI. 1-4, SEC. 8-5

#2



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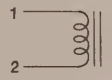
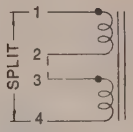


#4



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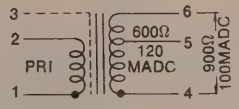

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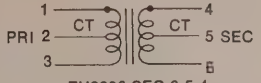
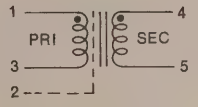


TH9306 SEC 6-5-4
TP/TS3106 PRI. 1-2-4, SEC. 5-6-7

#7



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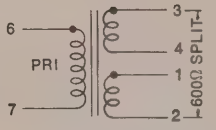
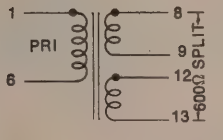


T9312 & T9317 PRI. 1-6,
SEC. 2-5, 3-4
TH5118 PRI. 1-2, 3-4 SEC. 6-7

#9



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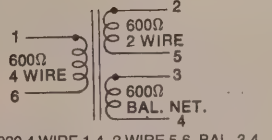
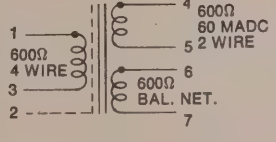


TP/TS3220 4 WIRE 1-4, 2 WIRE 5-6, BAL. 3-4
THP220-M 4 WIRE 1-5, 2 WIRE 6-7, BAL. 9-10
TH2220 4 WIRE 6-10, 2 WIRE 1-2, BAL. 4-5

#11



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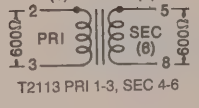
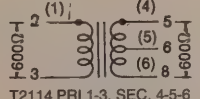


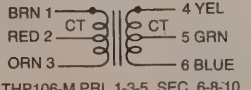
T2113 PRI 1-3, SEC 4-6

#13



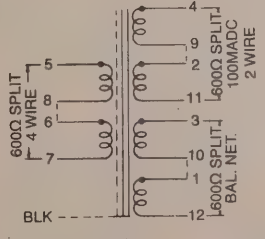
T2114 PRI 1-3, SEC. 4-5-6

#14

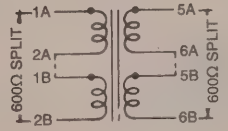


THP106-M PRI. 1-3-5, SEC. 6-8-10

#15



#16



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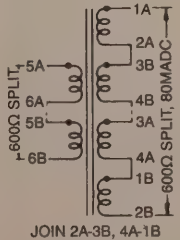
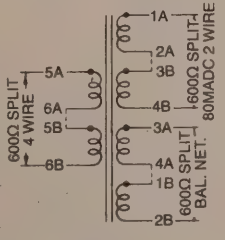


JOIN 2A-3B, 4A-1B

#18



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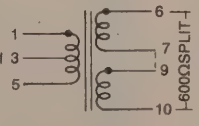
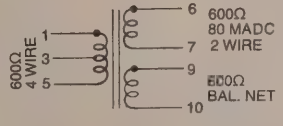


#20



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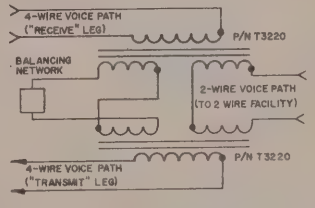


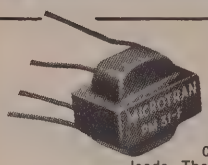
TYPICAL HYBRID APPLICATION

145 EAST MINEOLA AVENUE, P.O. BOX 236, VALLEY STREAM, NEW YORK 11582-0236 • TEL.: 516-561-6050 • FAX: 516-561-1117

MINIATURIZED AUDIO TRANSFORMERS

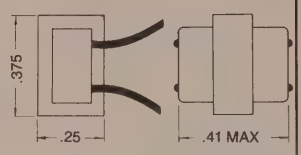
MICROTRAN company, inc.

OPEN FRAME PM-F

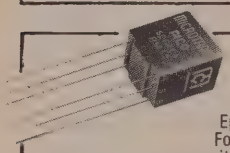


4 inch #30 color coded leads. Thorough resin impregnation and baking assures reliability. To order add -F to Part No., i.e. PM33-F. Wt. .05 oz.

MIL Designation: TF6S21ZZ

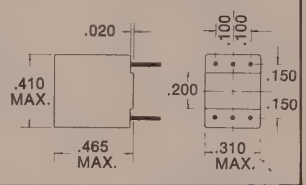


MOLDED PM-M

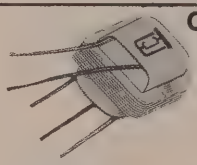


Epoxy molded. For printed circuit application. Tinned copperweld leads .020×.75″ for reliable soldered joints and high-density welded lead packaging. Wt. .1 oz. To order add -M to Part No., i.e. PM12-M.

MIL Designation: TF5S21ZZ

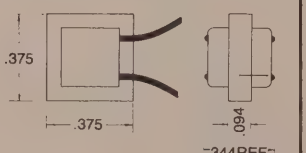


OPEN FRAME UM-F

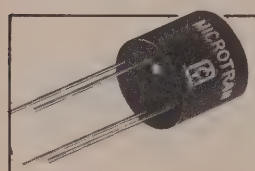


To order add -F to Part No., i.e. UM22-F. Wt. 0.08 oz. 4″ #30 color coded leads.

MIL Designation: TF6S21ZZ

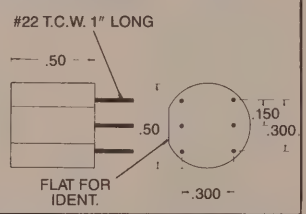


MOLDED UM-M



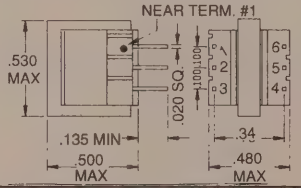
To order add -M to Part No., i.e. UM22-M. Wt. 0.14 oz.

MIL Designation: TF5S21ZZ

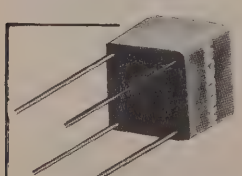


NEW! OPEN FRAME PRINTED CIRCUIT VM-PC

Small Footprint Plug-in Printed Circuit Construction Vacuum Varnish Impregnated. Wt. 0.16 oz.

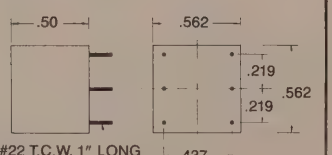


MOLDED VM-M



Epoxy molded. Wt. 0.25 oz. To order add -M to Part No., i.e. VM2-M.

MIL Designation: TF5S21ZZ



DIMENSIONS IN INCHES.

PICO-MINIATURE — PM SERIES

Frequency Response ±2 dB 300 Hz to 100 kHz†

For maximum utilization of space in miniaturized printed circuit board applications. Manufactured per MIL-T-27.

Part No.	Primary Impedance	Secondary Impedance	Pri. Unbal. mA DC	Pri. DCR	Sec. DCR	Power Level mW
PM37-(*)	120 CT	3.2	10	16	0.75	50
PM38-(*)	300 CT	600	7	41	98	50
PM35-(*)	500	50	3	60	8	50
PM36-(*)	500	500/125 split	3	72	85	50
PM32-(*)	600	600	1.5	75	105	50
PM34-(*)	600 CT	600 CT	3	75	105	50
PM33-(*)	1500 CT	600	3	170	95	50
PM31-(*)	2500	2500 CT	1	250	325	50
• PM29(*)	10,000 CT	500 CT	1	1050	80	50
PM27(*)	10,000	1200	0.5	1050	280	50
• PM23(*)	10,000 CT	1200 CT	1	1050	280	50
• PM25(*)	10,000	1200/300 split	0.5	1050	280	50
• PM19(*)	10,000 CT	2000 CT	1	1000	300	50
• PM21(*)	10,000	2000/500 split	0.5	1000	300	50
• PM17(*)	10,000 CT	10,000 CT	1	1000	1300	50
PM15(*)	25,000	1000	0.25	1700	110	40
• PM11(*)	25,000 CT	1000 CT	0.5	1700	110	40
• PM13(*)	25,000	1000/250 split	0.25	1700	110	40
• PM7(*)	50,000 CT	1000 CT	0	3300	75	10
• PM9(*)	50,000	1000/250 split	0	3300	75	10
• PM5(*)	200,000	1000	0	5300	110	10
• PM3(*)	200,000 CT	1000 CT	0	5300	110	10
PM41-(*)	Audio Choke	.3 H	4	43		
PM40-(*)	Audio Choke	3.5 H	2	700		
PM39-(*)	Audio Choke	6 H	2	1800		
PM90	Magnetic Shield Mu-metal slip-on can for PM-M series. 20dB shielding. 0.365″ × 0.465″ × 0.500″ high.					

• These items not available in open frame construction.
* Add either -F, -M to Part No. See photos figures PM-M & PM-F. Frequency response measured as stated power level above.
† PM3 and PM5 — 45 kHz.

ULTRA-MINIATURE — UM SERIES

Frequency Response ±2 dB 300 to 10,000 Hz

Measured at level stated for 300 Hz. Miniaturized design offers a relatively high power level and printed circuit packaging. Response measured at level stated for 300 Hz. Mfd. per MIL-T-27.

Part No.	Primary Impedance	Secondary Impedance	Pri. Unbal. mA DC	Pri. DCR	Sec. DCR	Level mW @ 300 Hz	Level mW @ 1 kHz
UM26-(*)	400	11	3	35	1.5	15	500
UM27-(*)	400 CT	11	6	35	1.5	15	500
UM25-(*)	400	50	3	35	5	15	500
UM29-(*)	600 CT	600 CT	7	45	60	5	400
UM24-(*)	1000	50	3	65	10	5	500
UM33-(*)	1000 CT	600	6	80	65	5	500
UM32-(*)	1500 CT	600	5	135	65	5	500
UM39-(*)	2500 CT	600 CT	2	250	50	5	500
UM34-(*)	10,000 CT	600 CT	2	850	40	5	500
UM31-(*)	10,000 CT	1200 CT	2	850	120	5	500
UM37-(*)	10,000	2000 CT	1	850	200	5	500
UM35-(*)	15,000 CT	15,000 CT	1	930	1210	5	300
UM36-(*)	20,000 CT	800 CT	0.5	1100	80	5	500
UM22-(*)	20,000	1000	0.5	1100	100	5	300
UM23-(*)	20,000	1200 CT	0.5	1100	110	5	300
UM21-(*)	100,000	1000	0	1900	135	5	70
UM30-(*)	Choke	1.5 H (0 mA) 0.7 H (2 mA) 100 DCR					
UM28-(*)	Choke	10 H (0 mA) 8 H (0.5 mA) 650 DCR					
UM90	Magnetic Shield Mu-metal slip-on can for UM-M series. 20 dB shielding. 0.594″D × 0.562″ high.						

* Add either -F, or -M to Part No. to designate construction. See Photos. Power levels shown are for 7.5% maximum distortion.

VERI-MINIATURE — VM SERIES

Frequency Response ±2 dB 200 to 10,000 Hz

Part No.	Primary Impedance	Secondary Impedance	Pri. Unbal. mA DC	Pri. DCR	Sec. DCR	Level mW
VM1-(*)	50	600	5.5	7	90	15
VM7-(*)	500	3.4	3.5	50	0.5	15
VM16-(*)	500 CT	250 CT	7.5	50	25	15
VM14-(*)	600 CT	600 CT	7.0	50	65	15
VM8-(*)	1250	3.4	2.0	135	0.5	15
VM9-(*)	1250	50	2.0	135	6.5	15
VM10-(*)	2500	2500 CT	1.5	225	215	3
VM17-(*)	10,000 CT	5000 CT	0	400	300	5
VM12-(*)	20,000	1000	0.16	625	85	5
VM13-(*)	20,000	1000 CT	0.16	625	85	5
VM3-(*)	25,000	600	0.15	720	45	5
VM5-(*)	50,000	600	0.1	830	55	5
VM15-(*)	50,000 CT	50,000 CT	0	2000	2600	5
VM6-(*)	100,000	1200 CT	0.07	2000	150	5
VM2-(*)	200,000	600	0.05	3000	110	2.5
VM4-(*)	200,000	1200	0.035	3100	165	5
VM11-(*)	Choke	20 H (0 mA) 12 H (0.5 mA)			1000	
VM90	Magnetic Shield Mu-metal slip-on can for VM-M series. 20 dB shielding. 0.625″ × 0.625″ × 0.531″ high.					

* Add either -FPB, -M, or -PC to Part No. to designate construction. See Photos.

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MINIATURIZED AUDIO TRANSFORMERS

MICROTRAN company, inc.

PRINTED CIRCUIT — DCM SERIES

Industrial/Commercial grade miniature printed circuit transformers. Rigid terminals provide fixed mounting centers usually found in expensive molded transformers. Wt. .5 oz.

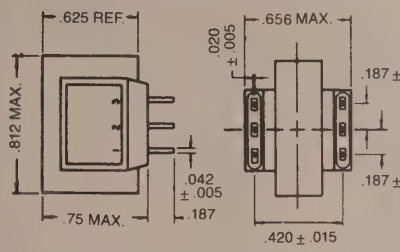


FIG. -S SINGLE THREADED STUD MOUNTING

Double Mu-metal shielding. 3 inch #30 color coded leads. .312"D. Stud provided with nut. .625"D×.812"H. Wt. 0.55 oz.

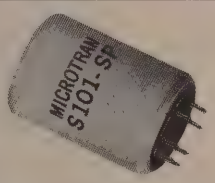


FIG. -SP PRINTED CIRCUIT MOUNTED

Double Mu-metal shielded. .75"D×1.063"H. 7-.040 pins .125"H. Wt. 0.62 oz.

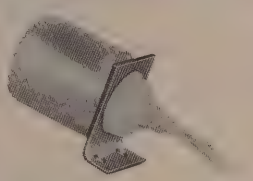


FIG. -FB RIGHT ANGLE MOUNTING BRACKET

For mounting of -S series transformers. M.C. 0.375".

DECI-MINIATURE—DCM SERIES

FREQUENCY RESPONSE 200-15,000 Hz ±2 dB

Part No.	Primary Impedance	Secondary Impedance	Pri. Unbal. mA DC	Operating Level dBm
DCM1-PC	25,000 CT	1200 CT	2	18
DCM2-PC	15,000 CT	15,000 CT	3	19
DCM3-PC	15,000 CT	600 CT	3	19
DCM4-PC	10,000 CT	5000 CT	4	20
DCM5-PC	10,000	2500/625 Split	2	20
DCM6-PC	10,000 CT	1500 CT	4	20
DCM7-PC	5000 CT	80,000 CT	6	15
DCM8-PC	4000 CT	1200 CT	6	20
DCM9-PC	4000 CT	600 CT	6	20
DCM10-PC	4000	600/150 Split	3	20
DCM11-PC	2500 CT	2500 CT	8	20
DCM12-PC	2500	2500/625 Split	4	20
DCM13-PC	2500 CT	625 CT	8	20
DCM14-PC	2500 CT	200 CT	8	20
DCM18-PC	600 CT	50,000 CT	16	20
DCM19-PC	600	8000/2000 Split	8	20
DCM20-PC	600 CT	200 CT	16	20
DCM21-PC	600 CT	600 CT	16	20
DCM22-PC	250 CT	600 CT	25	20
DCM51-PC	Choke	10H @ 0 mA DC	5H @ 3 mA DC	300 DCR
DCM52-PC	Choke	5H @ 0 mA DC	2H @ 5 mA DC	155 DCR
DCM53-PC	Choke	2.5H @ 0 mA DC	1H @ 7 mA DC	75 DCR

LOW LEVEL MICROPHONE/TRANSDUCER INPUT

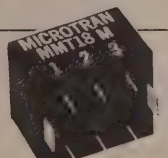
FOR: PROFESSIONAL SOUND STUDIOS — BROADCAST MIXING CONSOLES — CONTROL AND INSTRUMENT AMPLIFIERS

EQUIVALENT TO IMPORTED EUROPEAN STUDIO GRADE TRANSFORMERS

- WIDE BANDWIDTH — BROAD FREQUENCY RESPONSE
- EXTREMELY LOW DISTORTION
- NEGLIGIBLE HUM PICK UP
- SUBMINIATURE SIZE
- EASE OF MOUNTING AND ORIENTATION
- POLARIZING VOLTAGE CONNECTION FOR CONDENSER MICROPHONES
- LOW MICROPHONICS
- ELECTROSTATIC SHIELDING

Part No.	Nom. Turns Ratio Pri:Sec	Nominal Impedance Ratio Primary	Nominal Impedance Ratio Secondary	Typ. Open Circuit Primary Impedance @ 50 Hz†	Frequency Response ‡	Fig.	Replaces Beyer Part No.
S101-S	1:20	12.5	5000	100	30-15,000 Hz ± 1 dB	-S	351.020.704
S101-SP	1:20	12.5	5000	100	30-15,000 Hz ± 1 dB	-SP	370.020.704
S105-S	1:15	200	45,000	2000	30-15,000 Hz ± 1 dB	-S	351.015.006
S105-SP	1:15	200	45,000	2000	30-15,000 Hz ± 1 dB	-SP	370.015.006
S107-S	1:15	200/50 split	45,000	2000	30-15,000 Hz ± 1 dB	-S	351.215.006
S107-SP	1:15	200/50 split	45,000	2000	30-15,000 Hz ± 1 dB	-SP	370.215.006
S108-S	1:10	200	20,000	2000	30-15,000 Hz ± 1 dB	-S	351.010.005
S108-SP	1:10	200	20,000	2000	30-15,000 Hz ± 1 dB	-SP	370.010.005
S111-S	1:7.1	200	10,000	2000	30-15,000 Hz ± 1 dB	-S	351.007.004
S111-SP	1:7.1	200	10,000	2000	30-15,000 Hz ± 1 dB	-SP	370.007.004
S116-S	1:5	200	5000	2000	30-15,000 Hz ± 1 dB	-S	351.005.003
S116-SP	1:5	200	5000	2000	30-15,000 Hz ± 1 dB	-SP	370.005.003
S126-S	1:1	600 CT	600	3750	30-20,000 Hz ± .5 dB	-S	351.101-031
S126-SP	1:1	600 CT	600	3750	30-20,000 Hz ± .5 dB	-SP	371.101-031
S130-S	1:1	10,000	10,000	100,000	30-15,000 Hz ± 1 dB	-S	351.001.022
S130-SP	1:1	10,000	10,000	100,000	30-15 000 Hz ± 1 dB	-SP	372.001.081
S100-FB	Right angle mounting bracket for S100-S series.					-FB	

† Designed for optional bridging termination use to provide additional 6 dB output voltage gain.
‡ Frequency response measured with source equal to nominal primary impedance and with unloaded secondary except 100k load on S105 and S107 series.

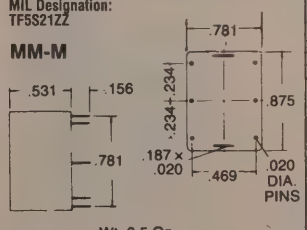


MOLDED

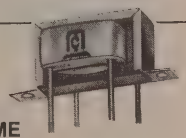
Designed for plug-in printed circuit applications. Cast Epoxy resin provides highest resistance to extremes of ambient.
To order add -M to Part No., i.e. MM2-M.

MIL Designation:
TF5S21ZZ

MM-M



Wt. 0.5 Oz.

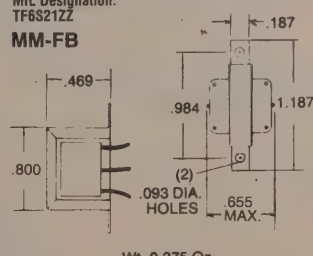


OPEN FRAME WITH CHANNEL

To order add -FB to Part No., i.e. MMT3-FB.
4 inch #28 color coded leads.

MIL Designation:
TF6S21ZZ

MM-FB



Wt. 0.375 Oz.

DIMENSIONS IN INCHES.

MICRO-MINIATURE—MM AND MMT SERIES

The low profile design of this series makes them ideal for use in plug-in printed circuit boards.

Available in open frame, hermetic, and molded constructions, all units are manufactured to MIL-T-27.

These units can be used as input, interstage, output, isolation and other impedance matching requirements.

Part No.	Primary Impedance	Secondary Impedance	Pri. Unbal. mA DC	Oper. Level dBm	Freq. Response ±2 dB
MM1-(*)	200/50	250,000/62,500	0	4	200-10,000
MMT1-(*)	600	600	8	22	200-15,000
MMT26-(*)	600 CT	600 CT	16	22	200-15,000
MMT33-(*)	600 CT	600/150 split	16	22	200-15,000
MMT9-(*)	600 CT	1200 CT	16	22	200-15,000
MMT32-(*)	600 CT	1200/300 split	16	22	200-15,000
MMT31-(*)	2000 CT	500 CT	10	28	200-15,000
MMT11-(*)	4000 CT	600 CT	5	28	200-15,000
MMT21-(*)	4000 CT	600/150 split	5	28	200-15,000
MMT17-(*)	10,000 CT	200 CT	6	20	200-15,000
MMT28-(*)	10,000 CT	1500 CT	2	20	200-15,000
MMT29-(*)	10,000 CT	10,000 CT	2	20	200-15,000
MMT7-(*)	25,000	1200 CT	1	20	200-15,000
MMT18-(*)	25,000 CT	1200 CT	2	20	200-15,000
MMT3-(*)	50,000	600	0.7	20	200-15,000
MMT4-(*)	50,000 CT	600 CT	1.4	20	200-15,000

*Add either -M or -FB to P/N to designate construction. See photos.

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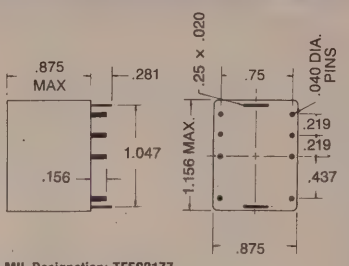
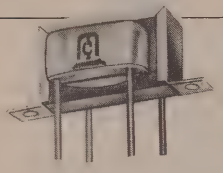
MICROTRAN company, inc.

MINIATURIZED AUDIO TRANSFORMERS

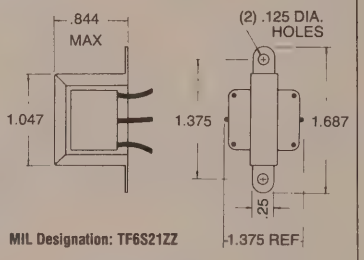
MOLDED M-M
To order add -M to Part No. For plug-in printed circuit applications. Epoxy resin provides resistance to extremes of ambient. Wt. 1.75 oz.



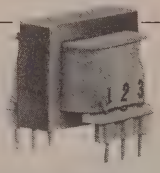
MIL Designation: TF5S21ZZ



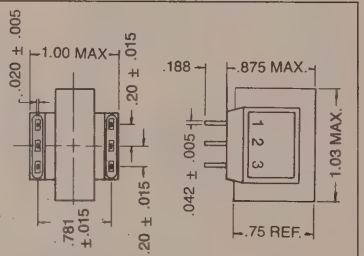
OPEN FRAME WITH CHANNEL M-FB
To order add -FB to Part No. Leads 4" long. #28 PVC Wt. 1.13 oz.



MIL Designation: TF6S21ZZ

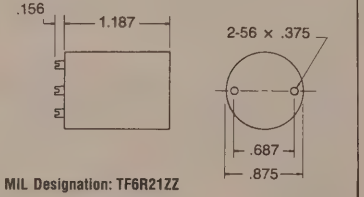


OPEN FRAME PRINTED CIRCUIT M-PC
To order add -PC to Part No. Units with more than 6 pins have 7 or 8 — .025 x .015 pins or .150 centers. Wt. 1.2 oz.



MIL Designation: TF6S21ZZ

ALUMINUM CASED M-A
To order add -A to Part No. Supplied with 2-56 screws. Wt. 1.25 oz.



MIL Designation: TF6R21ZZ

MINIATURE AUDIO M & MT SERIES

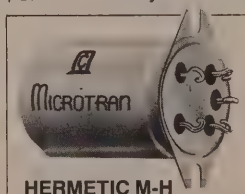
This group of transformers is often referred to as "the designers' series."

In this series, Microtran offers the widest spectrum of electrical and mechanical specifications. All units are manufactured in accordance with the requirements of MIL-T-27. All dimensions shown in inches.

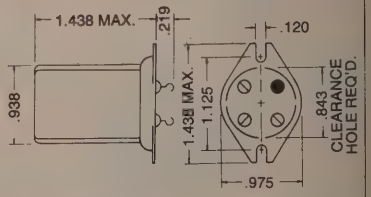
All items shown in charts below are available in any of the mechanical packages shown. Primary and secondary windings may be interchanged to obtain required impedance matching.

Part No.*	Primary Impedance	Secondary Impedance	Primary Unbalance mA DC	Operating Level dBm	Frequency Response ±2 dB
M3-(*)•	7.5/30	50,000	0	5	20-20,000
M12-(*)	50/250 CT	50/250/600 CT	0	8	20-20,000
M1-(*)•	50/250/600 CT	50,000	0	5	20-20,000
M1-S	Same as M1 above — with dual nickel alloy shield				
M2-(*)•	50/250/600 CT	50,000 CT	0	5	20-20,000
M14-(*)	200	½ Megohm	0	9	80-3,000
M15-(*)	10,000	1 Megohm	0	11	100-2,500
M8-(*)	15,000	50/250/600 CT	0	8	20-20,000
M9-(*)	15,000	50/250/600 CT	4	21	150-20,000
M4-(*)	15,000	60,000	0	6	20-15,000
M5-(*)	15,000	60,000	4	14	200-20,000
M6-(*)	15,000	95,000 CT	0	5	20-15,000
M7-(*)	15,000	95,000 CT	4	11	200-20,000
M10-(*)•	30,000 CT	50/250/600 CT	0	8	30-50,000
M11-(*)•	50,000	50/250/600 CT	0	5	20-20,000
M13-(*)	Reactor	300 hy. 0 DC	50 hy. @ 3 mA		6000Ω D.C.R.
M90	Magnetic Shield Mu-Metal slip on can for M-A Series 25 dB shielding				
MT2-(*)	100	10 CT/40 CT	100	27	200-20,000
MT30-(*)	250 CT	500	10	30	200-15,000
MT23-(*)	250 CT	1000	10	30	200-15,000
MT14-(*)	400	10	50	25	200-20,000
MT15-(*)	500 CT	210	30	27	300-20,000
MT1-(*)	600	600	10	23	200-15,000
MT35-(*)‡	600	600 CT & 600 CT	0	5	40-20,000
MT36-(*)†	600 CT	600 CT	0	15	50-15,000
MT26-(*)	600 CT	600 CT	20	23	200-15,000
MT9-(*)	600 CT	1,200 CT	4	23	200-15,000
MT33-(*)	600/150 Split	600/150 Split	20	23	200-20,000
MT22-(*)	600/150 Split	1,200 CT	4	23	200-15,000
MT29-(*)	1600 CT	450	15	30	200-15,000
MT12-(*)	2,000	3.4	10	32	200-15,000
MT24-(*)	2,500	600 CT	10	32	200-15,000
MT13-(*)	4,000 CT	3.4	3	32	200-15,000
MT11-(*)	4,000 CT	600 CT	3	32	200-15,000
MT21-(*)	4,000 CT	600/150 Split	3	32	200-15,000
MT25-(*)	7,500 CT	600 CT	8	32	200-15,000
MT34-(*)	10,000/2500 Split	2000/500 Split	4	20	200-20,000
MT10-(*)•	25,000	600	3	22	200-15,000
MT7-(*)•	25,000	1,200 CT	3	22	200-15,000
MT18-(*)•	25,000 CT	1,200 CT	6	22	200-15,000
MT5-(*)•	50,000	6	3	20	300-15,000
MT3-(*)	50,000	600	3	20	300-15,000
MT8-(*)•	50,000 CT	1,200 CT	3	20	300-15,000
MT20-(*)•	50,000 CT	1200/300 Split	3	20	300-15,000
MT6-(*)•	100,000	1,200 CT	1.4	17	200-15,000

* Add -M, -PC, -A, or -FB to Part No. to designate construction.
• These items not available in -PC construction.
‡ For telephone line coupling or hybrid telephone line.
† Broadcast fidelity line matching transformer. Frequency response ±0.5 dB.



HERMETIC M-H
To order add -H to Part No. Grey Enamel Finish. High Compression Glass Terminals. Wt. 1.25 oz.



MIL Designation: TF4R21YY

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action request form

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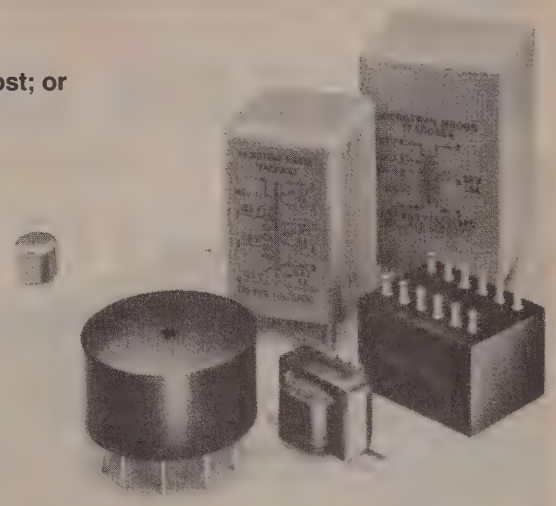

Date .....

Name/Title .....

Company .....

Address .....

.....

Phone ..... Fax .....

POWER

TYPES: ☐ 50/60 / 400 Hz.
☐ SMPS/Converter
☐ Inductor

TRANSFORMERS

Windings	Volts	RMS Amps	RMS Test V.
Pri.			
Sec. #1			
Sec. #2			
Sec. #3			

Frequency ..... Hz

Maximum Temperature Rise ..... °C

INDUCTORS

Inductance	Current RMS/DC	DCR

Ambient Temperature ..... °C

Regulation ..... %

AUDIO

TYPES: ☐ Input
☐ Inductors
☐ Output
☐ Telecommunication
☐ Matching

TRANSFORMERS

Windings	Winding Impedance	Unbal DC	Source/Load Impedance	RMS Test V.
Pri.				
Sec. #1				
Sec. #2				

Frequency Response .....

Power Level ..... Distortion ..... %

INDUCTORS

Inductance	mA DC	DCR	Freq.

Insertion Loss ..... dB

Return Loss ..... dB

GENERAL REQUIREMENTS

Size restrictions? .....

Construction: ☐ Open
☐ Cased

Mounting:
☐ Surface Mount
☐ Through Hole
☐ Chassis..... Connection Type:
☐ Solderable
☐ Quick Connect
☐ Lead Wire

SCHEMATIC DIAGRAM/APPLICATION CIRCUIT

Agency approvals required: ☐ U.L. ☐ CSA ☐ IEC ☐ VDE ☐ Other .....

Mil Specs: ☐ MIL-T-27 ☐ Grade ..... ☐ Other .....

Other requirements .....

Product application .....

Anticipated annual volume ..... Initial production date .....

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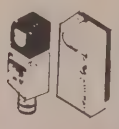
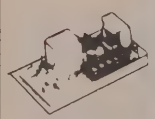
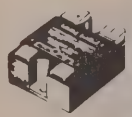

PHOTOELECTRICS

RELAYS


LIQUID LEVEL CONTROLS


SOLID STATE RELAYS

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BUD

CIRCUIT BREAKERS
Airpax
Aromat
Heinemann
Potter & Brumfield

CONNECTORS & SOCKETS
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Amphenol
Aromat
Curtis
Custom Connector
Idec
Lumberg
Master Electronics
Panduit
Potter & Brumfield
Souriau
Vernitron-Beau
Welcon/Wells

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Engler
Hecon
IVO
Kessler-Ellis
Master Electronics
Omron
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Aromat
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FILTERS
Curtis

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Aromat
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Coto
Crydom Controls
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National Controls
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SSAC
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Syracuse Electronics

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Curtis
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Kulka
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Havey Hubbell
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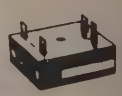
H.H. Smith
Modor
Panduit
Pomona

TEMPERATURE CONTROLS

TIMERS

PADDLE SWITCHES

TRANSFORMERS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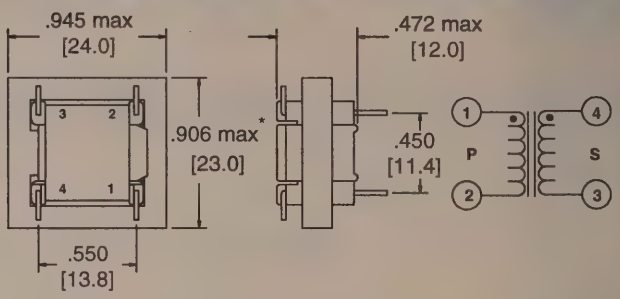
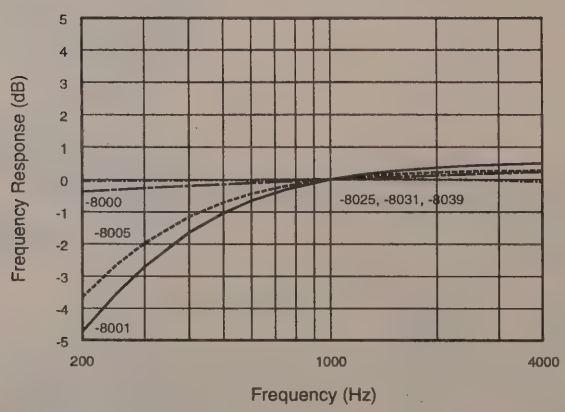
- CSA file number LR61218
- 671-8025 and 671-8031 are suitable for use in V.32 and V.32 bis applications
- 671-8039 is suitable for use in V.fast applications



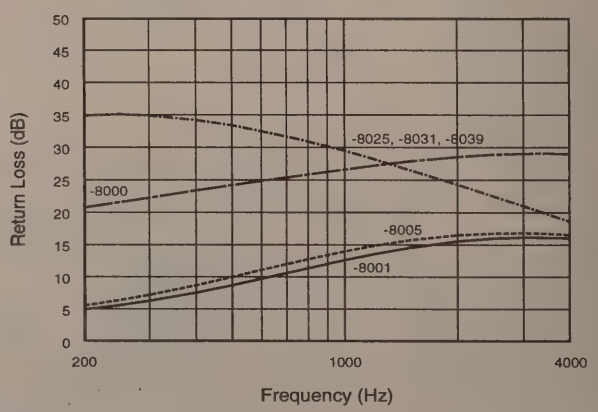
*1.024 [26.0] for 671-8000, 671-8025, 671-8031 and 671-8039

SPECIFICATIONS	671-8000	671-8001	671-8005	671-8025	671-8031	671-8039	units
Suitable for modem speeds up to:	V.29	V.29	V.29	V.32 bis	V.32 bis	V.fast	---
Reflects 600 ohms at PRI with Rload =	600	470	470	374	374	301	ohms
D.C. Resistance, 20°C, ±10%, PRI	25.1	108	108	108	108	150	ohms
D.C. Resistance, 20°C, ±10%, SEC	20.3	120	120	120	120	150	ohms
Frequency Response, 600 to 3500 Hz	---	± 1.0	± 0.65	---	---	---	dB
Frequency Response, 300 to 600 Hz	---	± 4.0	± 2.5	---	---	---	dB
Frequency Response, 200 to 4000 Hz	± 0.5	---	---	± 0.25	± 0.25	± 0.25	dB
Insertion Loss at 1 kHz, 20°C	0.75 ±0.25	2.5 max	2.0 ± 0.5	2.0 ± 0.25	2.0 ± 0.25	3.0 ± 0.50	dB
Return Loss vs. 600 ohms at 1 kHz	27 typ.	12 typ.	13 typ.	30 typ.	30 typ.	30 typ.	dB
Dielectric Test PRI - SEC, PRI - core	1250	1250	1250	1250	1250	1250	VAC
Direct Current in PRI, maximum	none	100	100	none	none	none	mADC
Turns Ratio (PRI:SEC), 1 kHz, ± 2%	1:1	1:1	1:1	1:1	1:1	1:1	---
Longitudinal Balance, 60 to 1000 Hz	60 min	60 min	60 min	60 min	60 min	60 min	dB
Longitudinal Balance, 1000 to 4000 Hz	40 min	40 min	40 min	40 min	40 min	40 min	dB
Total Harmonic Dist., 600 Hz, -10 dBm	-69 typ.	-58 typ.	-64 typ.	-76 max	-82 max	-91 typ.	dB

Typical Frequency Response, ref. 1kHz



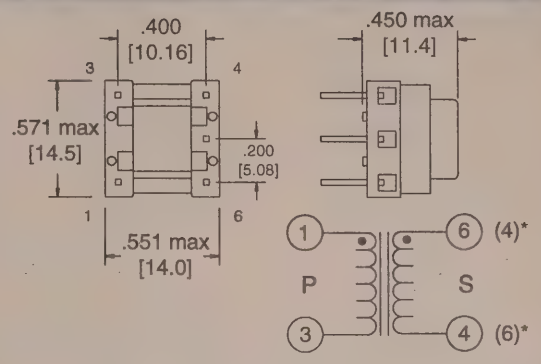
Typical Return Loss versus 600Ω



Midcom

Pocket/Laptop Modem Transformers

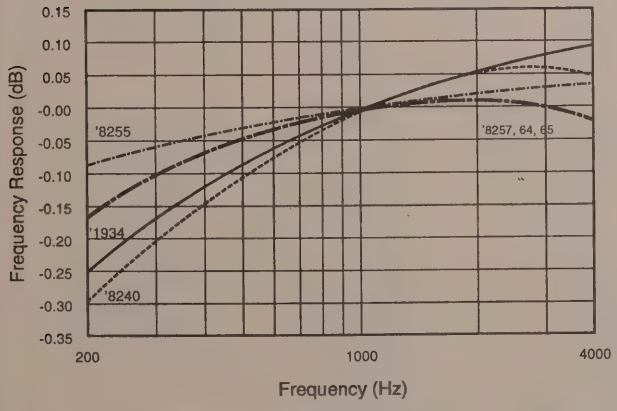
- Small size, suitable for laptop and pocket modem applications
- Pin-compatible series allows upgrade path for faster modem speeds



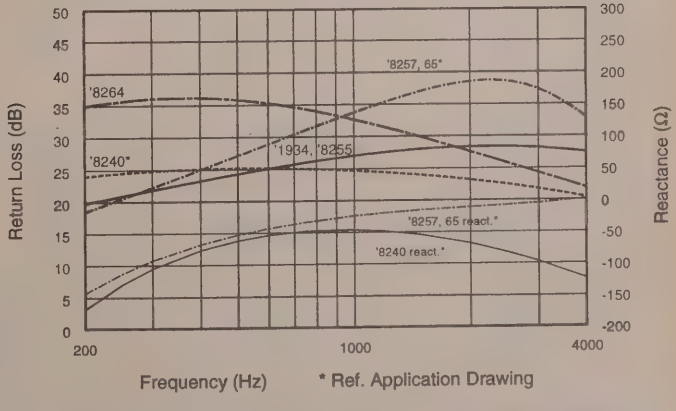
* 671-8240, 671-8257, 671-8265

SPECIFICATIONS	671-1934	671-8240	671-8255	671-8257	671-8264	671-8265	units
Suitable for Modem speeds up to:	V.29	V.29	V.32	V.32	V.32 bis	V.32 bis	---
Reflects 600 ohms at PRI with Rload =	600	600	600	475	442	442	ohms
D.C. Resistance, 20°C, ±10%, PRI	46.5	52	46.5	59	80	86	ohms
D.C. Resistance, 20°C, ±10%, SEC	67.6	59	67.6	80	87	91	ohms
Frequency Response, 300 to 3500 Hz	± 0.25	± 0.5	± 0.25	± 0.5	± 0.25	± 0.5	dB
Insertion Loss at 1 kHz, 20°C	1.25 max	1.5 max	1.25 max	1.5 max	2.0 max	2.0 max	dB
Return Loss versus 600 ohms at 300 Hz	21 min	23 typ.	21 min	22 typ.	21 min	22 typ.	dB
Return Loss versus BS6305 (a) network	---	14 min*	---	14 min*	---	14 min*	dB
Dielectric Test, PRI - SEC, PRI - core	1250	3750	1250	3750	1250	3750	VAC
Direct Current in PRI, maximum	none	none	none	none	none	none	mADC
Turns Ratio (PRI:SEC), 1 kHz, ± 2%	0.920 : 1	1 : 1	0.920 : 1	1 : 1	1 : 1	1 : 1	---
Longitudinal Balance, 60 to 1000 Hz	60 min	60 min	60 min	60 min	60 min	60 min	dB
Longitudinal Balance, 1000 to 4000 Hz	40 min	60 min	40 min	60 min	40 min	60 min	dB
Total Harmonic Dist., 600 Hz, -10 dBm	-68 typ.	-68 typ.	-71 max	-71 max	-76 max	-76 max	dB
Agency Approvals: A=AUSTEL, B=BABT, C=CSA, U=UL	C,U	A,B,C,U	C,U	A,B,C,U	C,U	A,B,C,U	---

Typical Frequency Response, ref. 1kHz



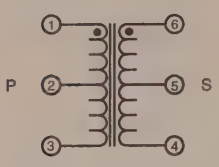
Typical Return Loss versus 600Ω



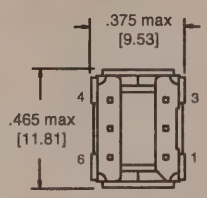
* Ref. Application Drawing

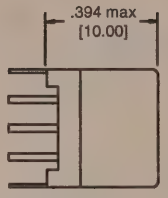
Telecom Pulse Transformers

Midcom™

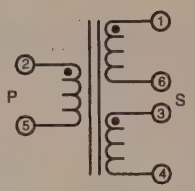


671-5792

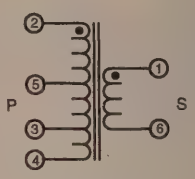




671-5792, -5832, -6599



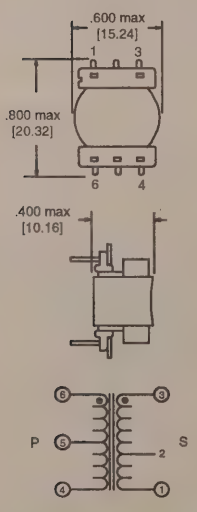
671-5832



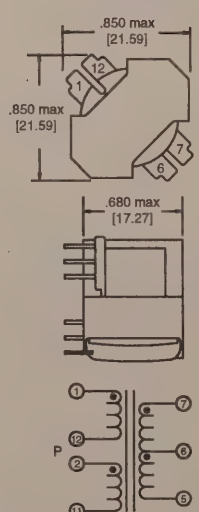
671-6599

SPECIFICATIONS	671-5792	671-5832	671-6599	671-6390	671-6629	671-6630	671-6687	671-6911	units
Application	**T1**	**T1**	**T1/E1**	**DDS**	**ISDN**	**ISDN**	**ISDN**	**HDSL**	---
Line impedance	100	100	75/100/120	135	135	135	135	135	ohms
D.C. Resistance, 20°C, ±10%, PRI	1.0 max	0.6 max	0.96 - 1.55	17.8	9.7	16	10.0 max	2.18 max	ohms
D.C. Resistance, 20°C, ±10%, SEC	1.0 max	1.2 max	0.75 - 1.15	17.8	1.7	4	3.0 max	1.15 max	ohms
Frequency Response	±0.1	±0.25	±0.15	±1.0	±0.75	±0.75	±0.25	±1.0	dB
from	100k	100k	50k	100	1k	1k	2k	100	Hz
to	1.544M	4.0M	3.0M	112k	100k	100k	200k	112k	Hz
Insertion Loss @ frequency (f) kHz	0.2 @772	0.1 @772	0.25 @772	1.5 @10	0.7 @10	1.5 @10	1.5 @10	1.0 @200	dB
Return Loss vs. Line Z at (f) kHz	25 @772	20 @772	20 @772	32 @1.0	25 @10	25 @10	20 @25	10 @200	dB
Dielectric Test, PRI - SEC, PRI - core	1250	1500 VDC	1650 VDC	1250	1100	1100	1500 VDC	1500	VAC
Direct Current in PRI, maximum	CT only	none	none	CT only	60	60	20	100	mADC
Turns Ratio (PRI:SEC), 1 kHz, ± 2%	1CT:1CT	1:1:1	1/1.16/1.26	1:1	2:1	2:1	1.5:1	1.8:1	---
Longitudinal Balance, 1 kHz to 15 kHz	---	---	---	40	---	---	55	---	dB
Longitudinal Balance, 15 kHz to (f) MHz	35 (2)	35 (2)	40 (2)	40 (0.1)	40 (0.1)	40 (0.1)	55 @40k	40 (0.2)	dB

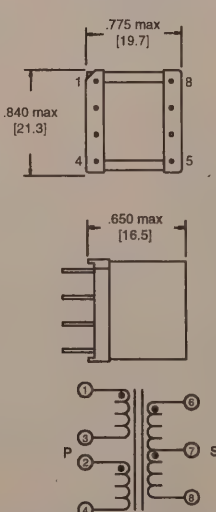
671-6390



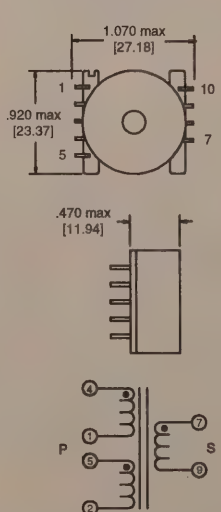
671-6629



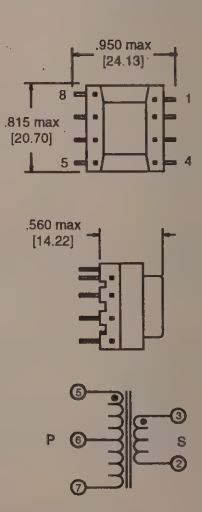
671-6630



671-6687



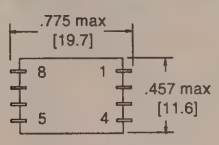
671-6911

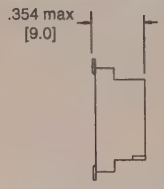


Midcom

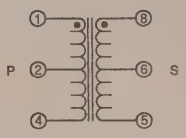
Internationally Approved Couplers

- BABT approved with reinforced insulation barrier
- Suitable for facsimile, V.32 bis and V.fast
- Hybrid (2W to 4W) versions: 671-1859, 671-9099





671-8275
671-8279



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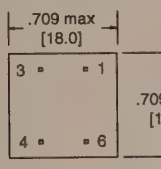
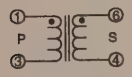
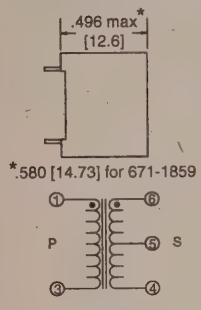
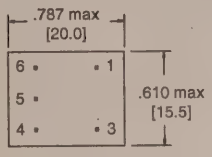




671-8236
671-8238
671-8285



671-1859



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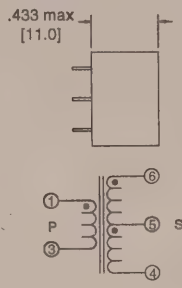
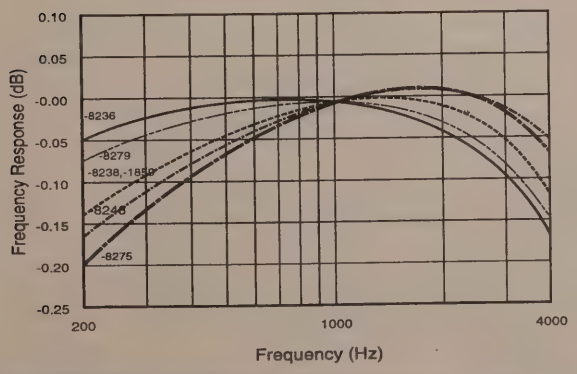


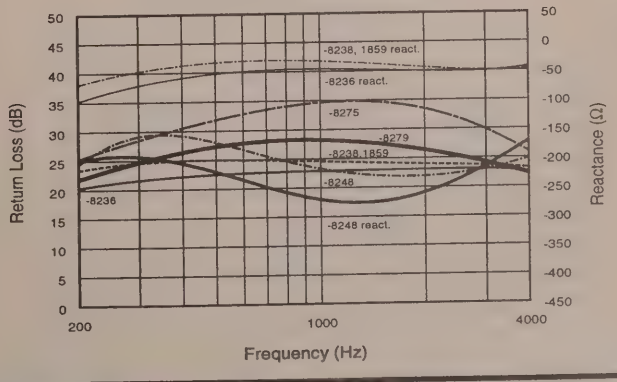
671-9099

SPECIFICATIONS	671-1859	671-8236	671-8238	671-8285	671-8248	671-9099	671-8275	671-8279	671-8299	units
Suitable for Modem speeds up to:	V.29	V.32 bis	V.29	V.fast	V.32bis	V.32bis	V.29	V.32bis	V.32bis	---
D.C. Resistance, 20°C, ±10%, PRI	70	67	67	108	67.5	67.5	128	128	128	ohms
D.C. Resistance, 20°C, ±10%, SEC	85.5	67	67	108	67.5	101.3	128	128	128	ohms
Frequency Response, 200 to 4000 Hz	±1.0	±1.0	±1.0	±4.0	±1.2	±0.5	±1.0	±1.0	±1.0	dB
Insertion Loss at 1 kHz, 20°C	1.1 max	1.2 typ.	1.2 typ.	2.5 max	1.2 typ.	1.6 max	2.7 typ.	2.6 typ.	2.6 typ.	dB
Return Loss versus BS6305 (b)	14 min	14 min	14 min	14 min	14 min	14 min	14 min	14 min	14 min	dB
Dielectric Test, PRI - SEC, PRI - core	3750	3750	3750	3750	3750	3750	3750	3750	3750	VAC
Direct Current in PRI, maximum	none	none	none	none	none	none	none	none	none	mADC
Turns Ratio (PRI:SEC), 1 kHz, ± 1%	0.7071:1	1:1	1:1	1:1	1:1	0.7071:1	1:1	1:1	1:1	---
Longitudinal Balance, 60 to 1000 Hz	60	60	60	60	60	60	60	60	60	dB
Longitudinal Balance, 1000 to 4000 Hz	40	40	40	40	40	40	40	40	40	dB
Total Harmonic Dist., 600 Hz, -10 dBm	-68 typ.	-76 max	-68 typ.	-89 typ.	-71 max	-71 max	-73 typ.	-76 max	-76 max	dB
Agency Approvals: * = Pending A=AUSTEL, B=BABT, C=CSA, U=UL	A,B,C,U	A,B,C,U	A,B,C,U	A,B,C,U	A,B,C,U	A,B,C,U	A*,B*,C,U	A*,B*,C,U	A*,B*,C,U	---

Typical Frequency Response, ref. 1kHz



Typical Return Loss versus 600Ω



Surface Mount Telecom Transformers

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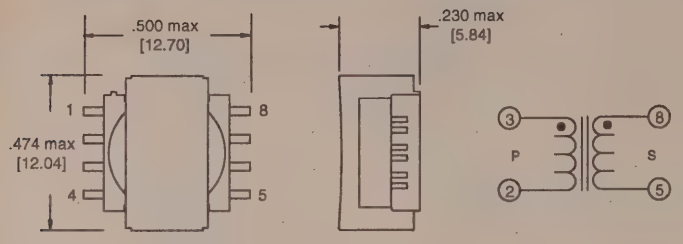
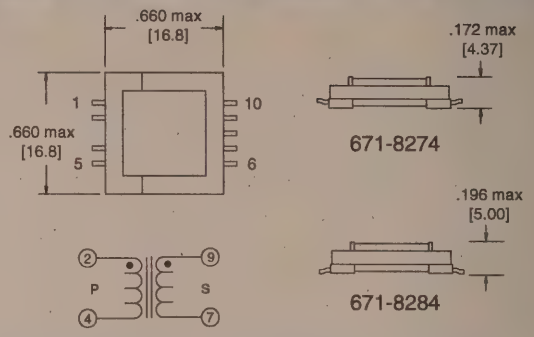
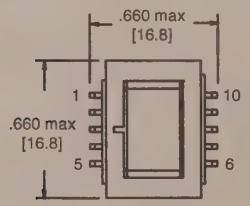
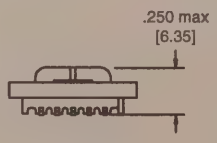


671-8234 (Available in Tape & Reel)

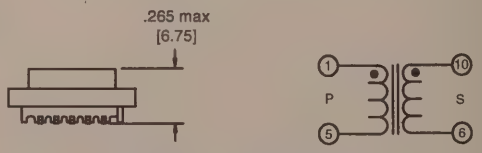


SPECIFICATIONS	671-8234	671-8274	671-8284	671-8269	671-8270	units
Suitable for Modem speeds up to:	V.29	V.32bis	V.32bis	V.32bis	V.32bis	---
Reflects 600 ohms at PRI with Rload =	487	294	294	332	332	ohms
D.C. Resistance, 20°C, ±10%, PRI	67	156	156	132	132	ohms
D.C. Resistance, 20°C, ±10%, SEC	85	145	145	132	132	ohms
Frequency Response, 300 to 3500 Hz	±0.5	±0.25	±0.25	±0.25	±0.25	dB
Insertion Loss at 1 kHz, 20°C	1.5 max	3.15 ±0.25	3.15 ±0.25	2.6 ±0.35	2.6 ±0.35	dB
Return Loss vs. 600 ohms at 1 kHz	22 typ.	25 min	25 min	25 min	25 min	dB
Dielectric Test, PRI - SEC, PRI - core	1250	1250	1250	1250	1250	VAC
Direct Current in PRI, maximum	none	none	none	none	none	mADC
Turns Ratio (PRI:SEC), 1 kHz, ± 2%	1:1	1:1	1:1	1:1	1:1	---
Longitudinal Balance, 60 to 1000 Hz	60	60	60	60	60	dB
Longitudinal Balance, 1000 to 4000 Hz	60	40	40	40	40	dB
Total Harmonic Dist., 600 Hz, -10 dBm	-60 typ.	-76 max	-76 max	-76 max	-76 max	dB



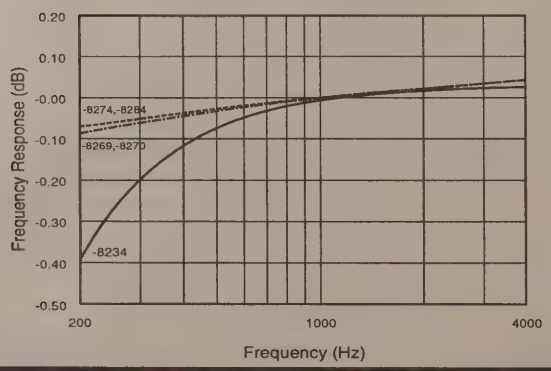


671-8269

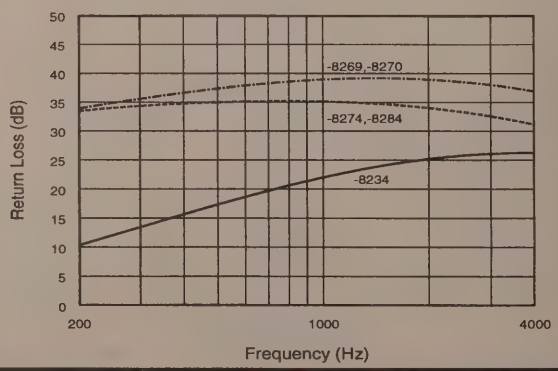


671-8270 (Available in Tape & Reel)

Typical Frequency Response, ref. 1kHz



Typical Return Loss versus 600Ω



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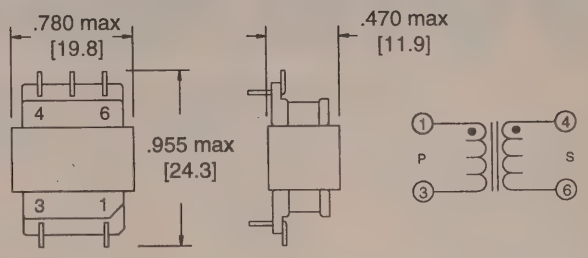
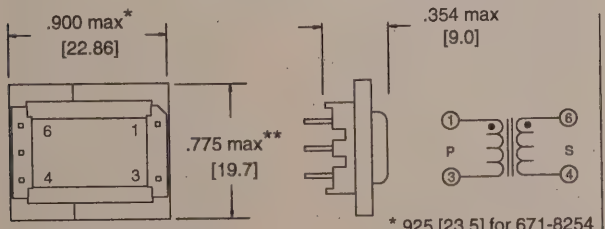


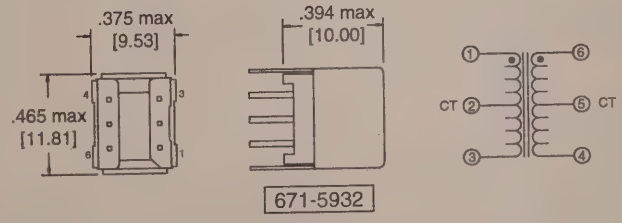
671-1538 and 671-8262

SPECIFICATIONS	671-1538	671-8262	671-8253	671-8254	671-8271	671-8273	671-5932	units
Suitable for Modem speeds up to:	V.32	V.32bis	V.32bis	V.29	V.32	V.32bis	V.29	---
Reflects 600 ohms at PRI with Rload =	530	374	392	600	464	464	470	ohms
D.C. Resistance, 20°C, ±10%, PRI	43	108	107.5	112	80 ±15%	80 ±15%	68 max	ohms
D.C. Resistance, 20°C, ±10%, SEC	43	120	107.5	141	100 ±15%	100 ±15%	102 max	ohms
Frequency Response, 300 to 3500 Hz	±0.2	±0.25	±0.25	±4.5	±1.5	±2.0	±0.25	dB
Insertion Loss at 1 kHz, 20°C	0.85	2.0 ±0.25	1.87 ±0.25	3.5	2.0	2.0	1.2	dB
Return Loss versus 600 ohms at 300 Hz	25 min	15 min	23 min	5.3	8.0 typ.	7.7 typ.	26 min	dB
Dielectric Test, PRI - SEC, PRI - core	1250	1250	1250	1250	1250	1250	1100	VAC
Direct Current in PRI, maximum	none	none	none	100	100	80	none	mADC
Turns Ratio (PRI:SEC), 1 kHz, ± 2%	1:1	1:1	1:1	1:1	.958:1	.958:1	1:1	---
Longitudinal Balance, 60 to 1000 Hz	60	60	60	60	60	60	60	dB
Longitudinal Balance, 1000 to 4000 Hz	40	40	40	40	40	40	60	dB
Total Harmonic Dist., 600 Hz, -10 dBm	-71 max	-76 max	-76 max	-70 typ.	-70 max	-76 max	-45 typ.	dB
Agency Approvals: C=CSA, U=UL	C,U	C,U	C,U	C,U	C,U	C,U	C,U	---

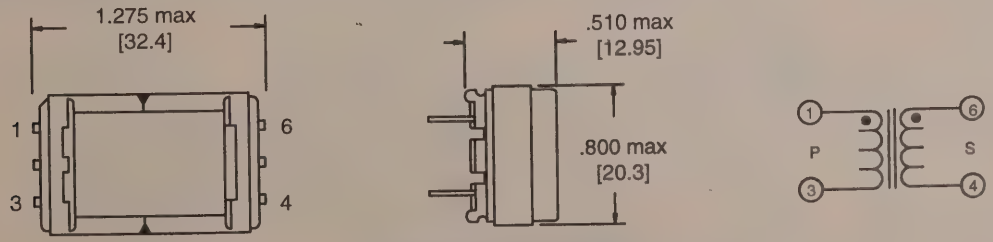


671-8253 and 671-8254

*.925 [23.5] for 671-8254
**.800 [20.32] for 671-8254



671-5932



671-8271 and 671-8273

COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A
A/D acrylonitrile butadiene-styrene
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AFC audio frequency control
AFT automatic filter test
ALGOL algorithmic language
AM a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
ASIC application specific IC
ATE automatic test equipment
ATG automatic test generation
AWG American wire gauge

B
BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility syste

C
CAD computer-aided design
CAE computer-aided engineering
CAM computer-aided manufacture
CAMAC computer-automated measurement and control
CAPP computer-aided process planning
CAT computer-aided test
CATV cable television or community antenna television
CCC (leaded) ceramic chip carriers
CCD computer-controlled display
CERMET ceramic metal element
CIE computer-integrated engineering
CIM computer-integrated manufacturing
CLCC ceramic leadless chip carriers
CMOS complementary metal-oxide semiconductor
Comm. communications
CPS characters per second
CPU central processing unit

D
D/A digital to analog
DAC digital to analog converter
DBMS data base management system
DC direct current
DFT design for testability
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DRAM dynamic RAM
DTL diode transistor logic

E
EDA electronic design automation
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EIA Electronic Industries Association
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM erasable programmable ROM
ESR equivalent series resistance

F
FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G
GaAsFET gallium arsenide FET
CMIP commn management information protocol
GPIB general purpose interface bus
GPS global positioning system

H
HF high frequency (3 to 30 MHz)
HIPOT test, measurement, and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I
IAB Internet Activities Board
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared
ISDN integrated services digital network
ISO International Standards Organization

J
JEDEC Joint Electronic Device Engineering Council
JFET junction FET
JMOS junction MOS

K
kHz kilohertz (10^3 hertz)
KSR keyboard send /receive

L
LAN local area network
LC (filters) inductance/capacitance
LCC leaded chip carrier
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M
MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
µF microfarad
MHz megahertz
MIC microwave IC
MIPS million instructions per second
MIB microcomputer interface board
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor FET
MOSIGT metal oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N
NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM national instrumentation module
NOR not OR
NTC negative temperature coefficient

O
OCR optical character reader
OEM original equipment manufacturer
OR a logical operator
OSI open systems interconnection

P
PAL programmable array logic
PC printed circuit
PCB printed circuit board
PCM pulse code modulation
PCS plastic clad silica
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLCC plastic leaded chip carrier
PLL phased lock loop
PPI plan position indicator
PROM programmable ROM
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q
QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R
RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S
SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon-controlled switch
SDA source & detector assemblies
SGMP simple gateway monitoring protocol
SIDAC bidirectional voltage-triggered switch
SIMM single in-line memory module
SIP single in-line package
SMD surface mount device
SMT surface mount technology
SNMP simpole network management protocol
SO small outline
SOIC small outline IC
SOT small outline transistor
SSI small scale integration
SSR solid-state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T
TC temperature coefficient
TCE thermal coefficient of expansion
TXCO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U
UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

V
VAC volts (of) alternating current
VAN value-added network
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency (30 kHz to 300 MHz)
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W
WPS word processing software

Y
YIG yttrium iron garnet

Z
ZIF zero insertion force

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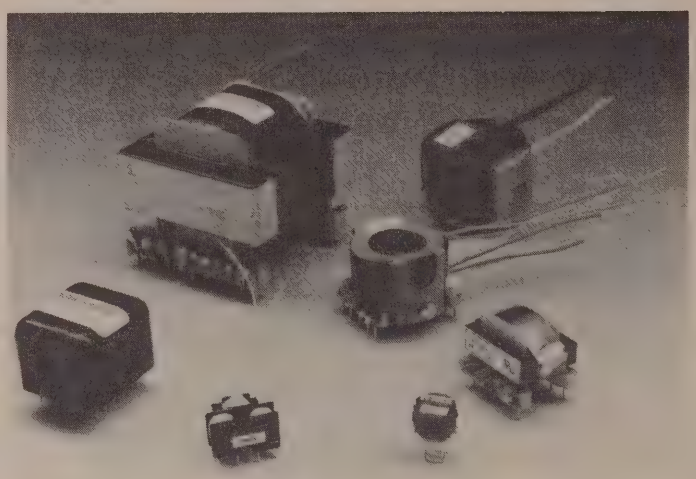
CUSTOM MAGNETICS



MAGNETICS
- SWITCH MODE MAGNETICS
  - POWER TRANSFORMERS
  - PULSE TRANSFORMERS
  - INDUCTORS
  - BASE DRIVE TRANSFORMERS
  - CURRENT TRANSFORMERS
- 50-60 Hz MAGNETICS
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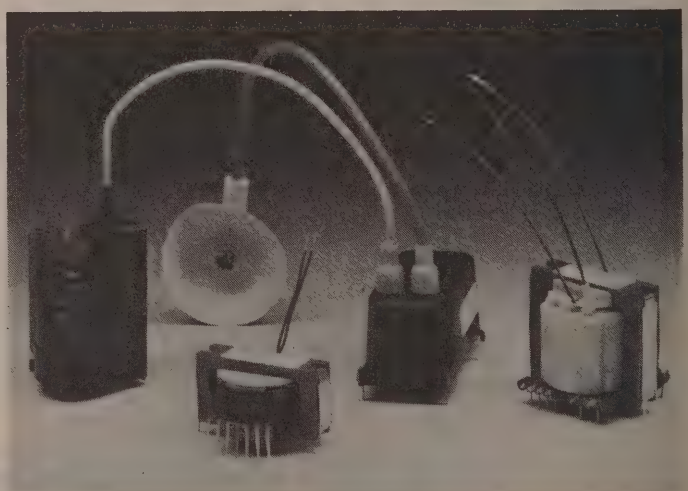

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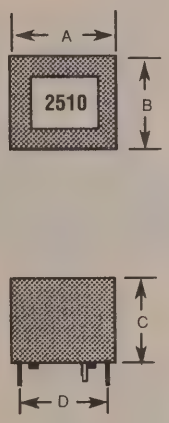
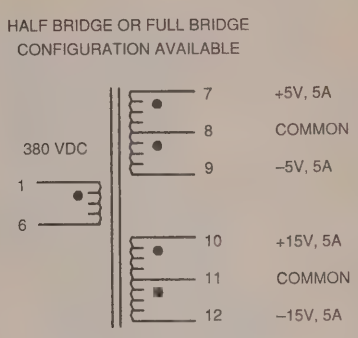
100	1.00	1.00	.98	.80	14
100	1.30	1.00	.98	.80/.20	21
200	1.26	1.26	1.26	1.00	12
200	1.56	1.26	1.26	1.0/.20	18
400	1.47	1.47	1.47	1.20	12
400	1.77	1.47	1.47	1.2/.20	18





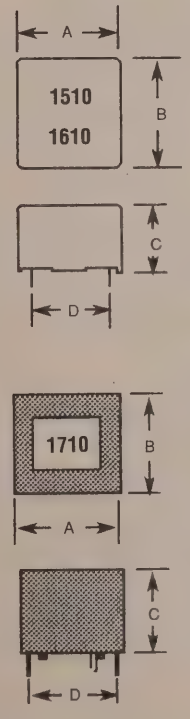
TYPICAL SCHEMATIC

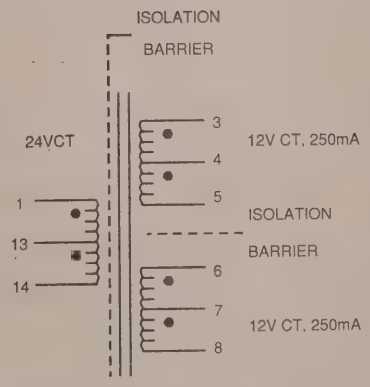
(EXTRA WINDINGS OPTIONAL)

MINIATURE ISOLATION TRANSFORMERS

ISOLATION (RMS)	A	B	C	D	MAX # PINS
1510 SERIES					
3200	1.07	1.03	.58	.800	8
1610 SERIES					
3750	.63	.76	.54	.500	4
1710 SERIES					
4500	1.00	1.00	.98	.800	9

NOTE: ALL DIMENSIONS ARE IN INCHES AND ARE REFERENCE UNLESS SPECIFIED





TYPICAL SCHEMATIC

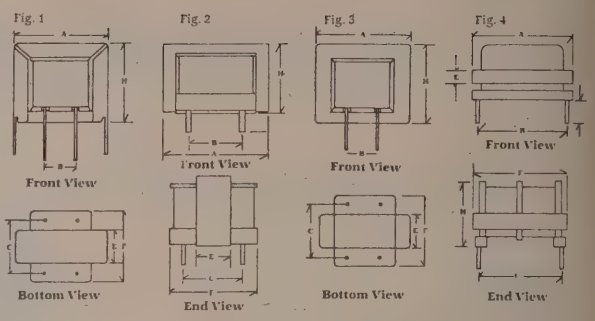
3005 S.W. 154th TERRACE #3, BEAVERTON, OREGON 97006 (503) 626-4200 FAX (503) 643-4889

Multi Products International
250 Lackawanna Ave., West Paterson, New Jersey 07424
(201) 890-1344 • Telex: 219289 • FAX: 201-890-1677

Audio Matching Transformers

MPI's miniature audio transformers are highly reliable and extremely economical. All can be supplied vacuum epoxy impregnated with standard leads or plug-in printed circuit construction. Several standard bobbins with various pin spacings permit optimum use of voice-grade telephone lines for broadband data signals.

Several standard cores can be used in the construction of specific high quality designs. MPI can also provide other custom designs with other ratings and constructions.



FEATURES

- Meet FCC part 68 specifications
- Frequency response ±.5dB from 300-3500 Hz
- Wide dynamic signal level
- Low distortion (0.5% maximum)
- Impedance matching of ± 10% over entire range.
- FAX or call for complete mounting details and further dimensional data.

SPECIFICATIONS

PART NO.	IMPEDANCE Pri	IMPEDANCE Sec	DC RESIS. Pri	DC RESIS. Sec	MAX. POWER	INSERT. LOSS	DC CUR.
*A10N-HH-1A/1	600	600	55	69	+7dBm	1.7dB	0mA
*A14N-HH-1A/1	600	600	60	46	+6dBm	1.4dB	0mA
A16N-HH-1A/1	600	600	52	48	+7dBm	1.2dB	0mA
*A19S-HH-1A/1	600	600	35	25	+7dBm	1.1dB	0mA
*A19S-MH-1A/2	1500	600	78	67	+5dBm	1.2dB	0mA
A19F-HH-1A/1	600	600	45	45	+7dBm	1.0dB	2mA
A19F-HH-1A/3	600	600	64	86	+7dBm	1.8dB	90mA
A19H-CC-1A/1	150	150	25	35	+7dBm	1.0dB	2mA
A19H-HC-1A/1	600	150	45	35	+7dBm	1.0dB	2mA
A19H-MH-1A/1	1500	600	78	67	0dBm	1.7dB	0mA
A19H-HK-1A/1	600	900	45	55	+7dBm	1.0dB	2mA
A19H-HH-1A/2	600	600	180	80	+1dBm	2.5dB	80mA
*A19N-HH-1A/1	600	600	69	95	0dBm	1.9dB	120mA
A19H-HH-1C/1	600	600	25	40	+7dBm	1.0dB	2mA
*A19H-HH-4C/1	600	600	65	86	+9dBm	2.4dB	100mA
*A19N-HH-1A/1	600	600	65	85	+7dBm	2.5dB	100mA
*A19N-HH-1A/2	600	600	180	75	+5dBm	3.5dB	80mA
*A19M-HH-1A/3	600	600	65	86	+9dBm	2.4dB	100mA
*A19M-HH-1A/6	600	600	35	45	+7dBm	2.0dB	0mA
*A19N-HH-5C/1	600	600	19	26	+6dBm	1.0dB	10mA
*A26F-HH-1A/1	600	600	77	99	+7dBm	2.0dB	80mA
*A28H-HH-1A/1	600	600	36	28	+27dBm	1.0dB	120mA
*A35F-HH-1A/1	600	600	71	83	+7dBm	1.3dB	70mA
*A41F-HH-1A/2	600	600	94	49	+7dBm	1.0dB	120mA

*Indicates stocked items (others available as special order)

DIMENSIONS

CASE	FIG	A	B	C	E	F	H
10N	3	10.5 (0.41)	4.0 (0.16)	8.4 (0.33)	4.2 (0.17)	11.0 (0.43)	8.5 (0.33)
14N	3	14.5 (0.57)	5.8 (0.23)	12.0 (0.47)	5.5 (0.22)	13.4 (0.53)	11.0 (0.43)
16N	3	17.0 (0.67)	6.0 (0.24)	13.0 (0.51)	5.5 (0.22)	17.0 (0.67)	14.7 (0.58)
19S	3	19.5 (0.77)	7.4 (0.29)	15.0 (0.59)	5.4 (0.21)	14.5 (0.57)	11.5 (0.45)
19F	4	20.0 (0.79)	15.2 (0.60)	13.0 (0.51)	6.5 (0.26)	16.5 (0.65)	17.5 (0.69)
*19F	4	20.7 (0.81)	15.2 (0.60)	12.96 (0.51)	6.73 (0.27)	16.5 (0.65)	14.7 (0.58)
19N	3	19.5 (0.77)	9.4 (0.37)	10.7 (0.42)	6.5 (0.26)	17.5 (0.69)	17.5 (0.69)
19M	2	19.5 (0.77)	9.4 (0.37)	10.3 (0.41)	6.5 (0.26)	17.5 (0.69)	17.5 (0.69)
19H	1	20.3 (0.80)	8.0 (0.32)	14.5 (0.57)	6.8 (0.27)	15.8 (0.62)	16.0 (0.63)
26F	4	27.9 (1.10)	30.4 (1.20)	10.2 (0.40)	5.1 (0.20)	19.1 (0.75)	12.7 (0.50)
28H	1	29.5 (1.16)	12.0 (0.47)	23.5 (0.93)	12.5 (0.49)	28.8 (1.10)	26.5 (1.04)
35F	4	35.1 (1.38)	27.9 (1.10)	25.4 (1.00)	7.4 (0.29)	31.8 (1.25)	12.5 (0.49)
41F	4	41.6 (1.63)	31.7 (1.25)	25.4 (1.00)	6.3 (0.25)	34.0 (1.34)	17.5 (0.69)

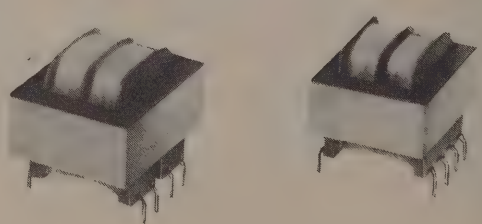
*For A19F-HH-1A/3 only

Dimensions in mm (in.)

Power Transformers

Multiproducts International offers an extensive group of standard and custom, single and multiple input (120/240VAC) power transformers that are engineered and manufactured to the highest standards with stringent quality assurance. All MPI power transformers meet or exceed UL 1411 and other applicable agency standards.

The MPI family of PC board mount, split bobbin, high isolation power transformers is an example of our capabilities. Available in 4 sizes and supplied with 115 VAC or 115/230V primary inputs, these low profile units include a 130°C insulation system, and have an isolation rating of 2500 VAC, 60Hz, hi-pot. Special variations and non-standard products are also available.



FAX or Call for complete details and dimensional data on all multi MPI power transformer products.

SPECIFICATIONS

Input: 115V/230V and 115 VAC.

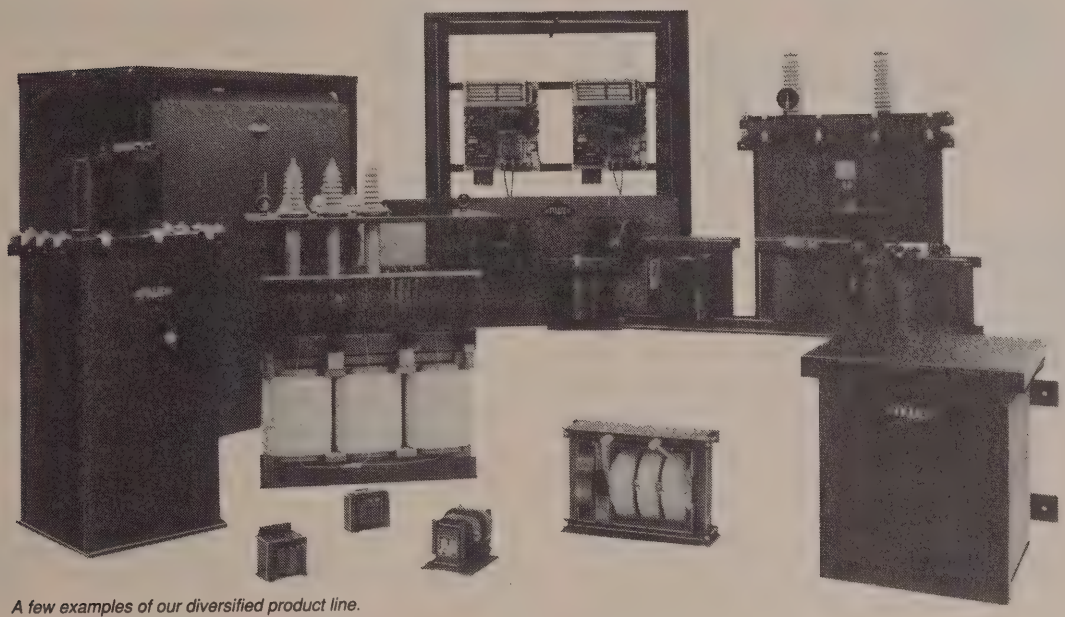
Input (V): 9 steps ranging from 10-120VAC.

Current (A): 9 steps ranging from 110mA-1.2A.

Model sizes: EI-35 to EI-48

Multi Products International
P.O. Box 737 • 250 Lackawanna Avenue
West Paterson, NJ 07424
(201) 890-1344
FAX (201) 890-1677

NWL... the Source for Custom Transformers Electronic & Industrial from Watts to Megawatts



A few examples of our diversified product line.

Designed and Manufactured to Your Specific Requirements

- **Transformers:** Plate, Water Cooled, Step Down, High Current, High Frequency, Instrument, Phase Changing, High Voltage Isolation, Welding, High Voltage, Testing, High Reactance, Output, Modulation, Epoxy Cast
- **Power Supplies:** AC/AC & AC/DC Power Supplies and Controllers, High Current & High Voltage Power Supplies, Electrostatic Precipitator, Transformer Rectifier Sets
- **Controls:** SCR Controls, Packaged Controls, Energy Management Software, Digital Voltage Controllers, Microprocessors
- **Reactors:** Saturable Core, Current Limiting, Chokes, Swinging Chokes, Air Core, AC, Line, Harmonic Filter

Capability Range

- **Voltage:** Up to 20 KV input, Up to 300 KV output • **Frequency:** 4 Hz to 50 KHz
- **Current:** Up to 40,000 amps DC or 50,000 amps AC output • **KVA:** Up to 6,000

NWL TRANSFORMERS

312 Rising Sun Square Road, P.O. Box 358 Bordentown, NJ 08505
Contact: Barbara Teem (609) 298-7300, FAX: (609) 298-1982, Toll Free: (800) 448-1269

North Hills™ Signal Processing

A Porta Systems Company

DC Isolated Signal Transformers • Baluns • Data Bus Couplers
RF Power Dividers • Sum & Difference Hybrids • LAN Coupling Baluns
RF Signal Combiners • Impedance Matching Adapters • Wideband Transformers

WIDEBAND TRANSFORMERS

UNBALANCED TO BALANCED TRANSFORMERS

Balanced secondaries center-tapped and dc-isolated from primaries. Mid-band insertion loss approx. 0.5 dB.

LOW POWER SERIES (1W)

Series		Extended Video		Video Frequency		Medium Frequency		Radio Frequency	
Cases		PB		LA,LB		BA,BB		BA,BB,HB	
LCO		20 Hz		1 kHz		10 kHz		100 kHz	
Impedance Unb.	Bal.	Type No.	HCO MHz	Type No.	HCO MHz	Type No.	HCO MHz	Type No.	HCO MHz
50	50	0014	6	0009	25	0010	80	0001	125
	75	0113	6	0104	25	0111	80	0101	125
	90			0203	20	0202	60	0200	125
	100	0315	6	0311	20	0301	60	0300	100
	124	0316		0306	20	0302	60	0307	100
	135			0303	18	0312	60	0310	100
	150			0415	15	0401	60	0400	100
	200	0522	4	0511	15	0520	60	0500	100
	300			0517	12	0521	50	0501	100
	450			0603	10	0602	40	0600	65
	600			0706	8	0703	32	0700	65
	800			0802	7	0801	25	0800	60
	1200			0904	6	0902	15	0900	30
75	50	1003	6	1002	25	1001	60	1000	100
	75	1111	6	1102	25	1112	60	1100	100
	90			1202	20	1201	60	1200	100
	100			1314	20	1310	60	1300	100
	110	1307	6	1318	20	1319	60	1320	100
	124	1309	10	1301	20	1311	60	1302	100
	135			1312	20	1315	60	1317	100
	150	1408	6	1404	16	1405	60	1400	100
	200			1516	15	1513	60	1500	100
	300	1520	4	1502	15	1514	60	1501	100
	450			1602	12	1601	40	1600	60
	600			1704	10	1707	32	1700	60
	800			1802	10	1801	20	1800	30
	1200			1902	9	1905	15	1900	30
	1850			1903	6	1901	8	1906	15

WIDEBAND POWER DIVIDERS/COMBINERS

Series 01 and 10 Power Dividers are designed for applications in the 0.2 to 110 and 3.0 to 225 MHz frequency ranges.Hybrid Junction Techniques are employed to assure superior isolation and minimal insertion loss. VSWR is optimized at all ports. 50 and 75 ohm impedances are standard. Other impedances available on special order. Connectors are BNC.

HIGH POWER SERIES

Power Level	10 W	25 W	100 W	1 kW
Cases	HB	BA,BB	BA,BB	KA
MHz Range	.1-30	.1-30	.5-30	2-32
Unb/Bal	Type No.	Type No.	Type No.	Type No.
50:50	0008	0011	0012	0013
50:75	0108	0109	0105	0107
50:100	0309	0308	0304	0314
50:150	0406	0402	0404	0407
50:200	0519	0512	0516	0515
50:300	0514	0518	0506	0513
50:450	0604	0605	0606	0601
50:600	0705	0701	0704	0702
75:75	1105	1110	1118	1108
75:100	1306	1304	1305	1316
75:150	1406	1401	1403	1407
75:200	1517	1519	1512	1518
75:300	1515	1510	1505	1511
75:450	1603	1604	1605	1606
75:600	1709	1703	1708	1705

ISOLATION TRANFORMERS UNBALANCED TO UNBALANCED

Ground Isolation in 50 and 75 Ohm Coaxial Systems

- Flat frequency, linear phase response
- Insulated BNC Connectors
- 120 dB isolation at power frequencies

Type No.	Impedance Unb/Unb (Ω)	Bandwidth	Case Styles
0005	50:50	1kHz - 25MHz	CC,MA
1103	75:75	1kHz - 25MHz	CC,MA
0112	50:75	1kHz - 25MHz	CC,MA
0017	50:50	10Hz - 5MHz	CC,MA
1117	75:75	10Hz - 5MHz	CC,MA,UA
0016	50:50	20Hz - 20MHz	PA
1116	75:75	20Hz - 20MHz	PA,UA
1121	75:75	3.5Hz - 8MHz	TC
0018	50:50	20kHz - 300MHz	VA
1122	75:75	20kHz - 300MHz	VA
1204	75:93	15Hz - 4MHz	PA
0115	50:75	15Hz-5MHz	PA

HUMBUCKING TRANSFORMERS

Insulated BNC Connectors

Type	Impedance	Bandwidth	Isolation at 60Hz
0019PA	50:50	DC - 20MHz	50dB min
0020CC	50:50	DC - 25MHz	40dB min
1119PA	75:75	DC - 20MHz	50dB min
1120CC	75:75	DC - 25MHz	40dB min

	2-WAY				4-WAY				8-WAY			
Model	50-201RA	75-201RA	50-210RA	75-210RA	50-401RB	75-401RB	50-410RB	75-410RB	50-801SA	75-801SA	50-810SA	75-810SA
Impedance (Ω)	50	75	50	75	50	75	50	75	50	75	50	75
Frequency Range (MHz)	0.2 - 110		3.0 - 225		0.2 - 110		3.0 - 225		0.2 - 110		3.0 - 225	
Insertion Loss (dB)	0.5		1.0		0.5		1.0		1.0		1.5	
Isolation (dB min)	30		25		25		25		25		20	
Amplitude Balance (± dB)	0.5		1.0		0.5		1.0		1.5		1.5	
Phase Balance (± °)	1.0		2.0		1.0		2.0		1.0		3.0	
VSWR	1.2		1.25		1.2		1.2		1.25		1.25	
Input Power (watts)	5		3		5		3		5		3	
Case Style	RA		RA		RB		RB		SA		SA	
Weight (gm)	50		50		65		65		160		160	

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North Hills™ Signal Processing

A Porta Systems Company

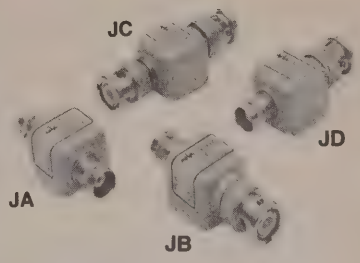
WIDEBAND COAXIAL IMPEDANCE ADAPTERS

For interconnection of unbalanced circuits of different characteristic impedances with low insertion loss.

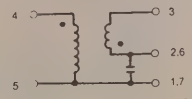
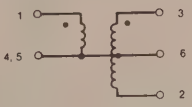
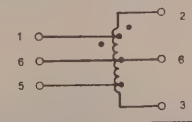
Line of standard models with combinations of type BNC male and female connectors match 50:75, 50:90, and 75:90 ohm circuits. Adapters transfer power bidirectionally and are matched in both directions.

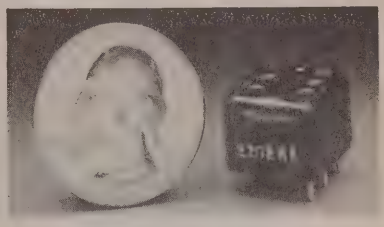
Bandwidths shown correspond to low-end — 3 dB maximum cut-off frequency, and high end frequency at which VSWR does not exceed 1.25.

Model No.	50 Ohms M	50 Ohms F	75 Ohms M	75 Ohms F	90 Ohms M	90 Ohms F	Bandwidth (MHz)
0120-JA		•		•			.05-300
0102-JB	•			•			.05-300
0102-JC	•		•				.05-300
0102-JD		•	•				.05-300
0114-JA		•		•			5-1000
0114-JB	•			•			5-1000
0114-JC	•		•				5-1000
0114-JD		•	•				5-1000
0201-JA		•				•	.05-300
0201-JB	•					•	.05-300
0201-JC	•				•		.05-300
0201-JD		•			•		.05-300
1203-JA				•		•	.2-300
1203-JB			•			•	.2-300
1203-JC			•		•		.2-300
1203-JD				•	•		.2-300



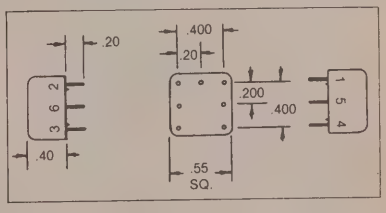
MINIATURE WIDEBAND TRANSFORMERS: NA Series — .10 to 300 MHz

Configuration	Part No.	Impedance Ration • Ohms	Simplified Schematic Diagram
Unbal. to Unbal. Phase Reversing	0003 NA 1106 NA 2200 NA	50:50 75:75 90:90	
Unbal. to Unbal. Phase Reversing DC isolated	0007 NA 1107 NA 2201 NA	50:50 75:75 90:90	
Unbal. to Unbal. Non-inverting	0002 NA 0508 NA 1506 NA	50:12.5 50:200 75:300	
Unbal. to Bal.	0004 NA 0117 NA 0319 NA 0325 NA 0408 NA 0509 NA 1004 NA 1101 NA 1710 NA 1409 NA 1507 NA	50:50 50:75 50:100 50:120 50:150 50:200 75:50 75:75 75:100 75:150 75:300	
Bal. to Bal.	0510 NA 1508 NA	50:200 75:300	



The Model 2202 NA Wideband Transformer shown with a coin to illustrate size.

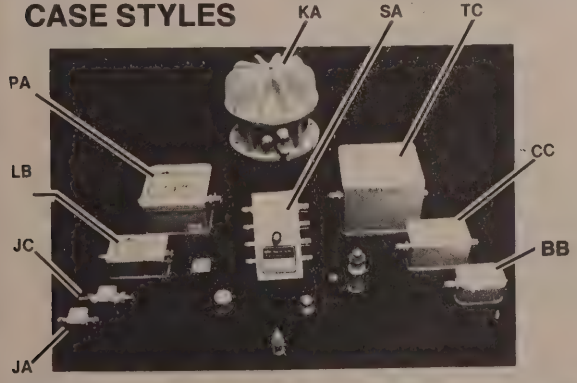
DIMENSIONS (in inches)



Wt — 4 gms (.14 oz.)

Temp. — 20°C to +80°C

CASE STYLES



APPROXIMATE DIMENSIONS

Type	W	L	H	Mtg Ctrs A	Mtg Ctrs B	Stud Size	Recm. Mtg Hole
BA	1.3	2.3	1.15	.81	1.37	4-40 × .37	.147
BB	1.3	2.6	1.15	.81	1.37	4-40 × .37	.147
HB	.9	.9	.7	—	—	—	.052
LA	1.7	2.8	1.25	1.00	1.50	6-32 × .37	.173
LB	1.7	3.2	1.25	1.00	1.50	6-32 × .37	.173
CC	1.7	3.5	1.55	1.00	1.50	6-32 × .37	.173
PA	3.0	3.9	2.0	1.90	2.30	6-32 × .37	.173
PB	3.0	3.6	2.0	1.90	2.30	6-32 × .37	.173
TC	3.3	4.6	2.9	2.50	2.50	6-32 × .37	.173
MA	2.1	2.1	1.2	0.50	1.65	—	—
UA	3.5	5.0	2.7	2.50	4.00	6-32 × .37	.173
VA	0.8	1.2	0.9	—	—	—	—

Specifications Subject to Change Without Notice.

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North Hills™ Signal Processing

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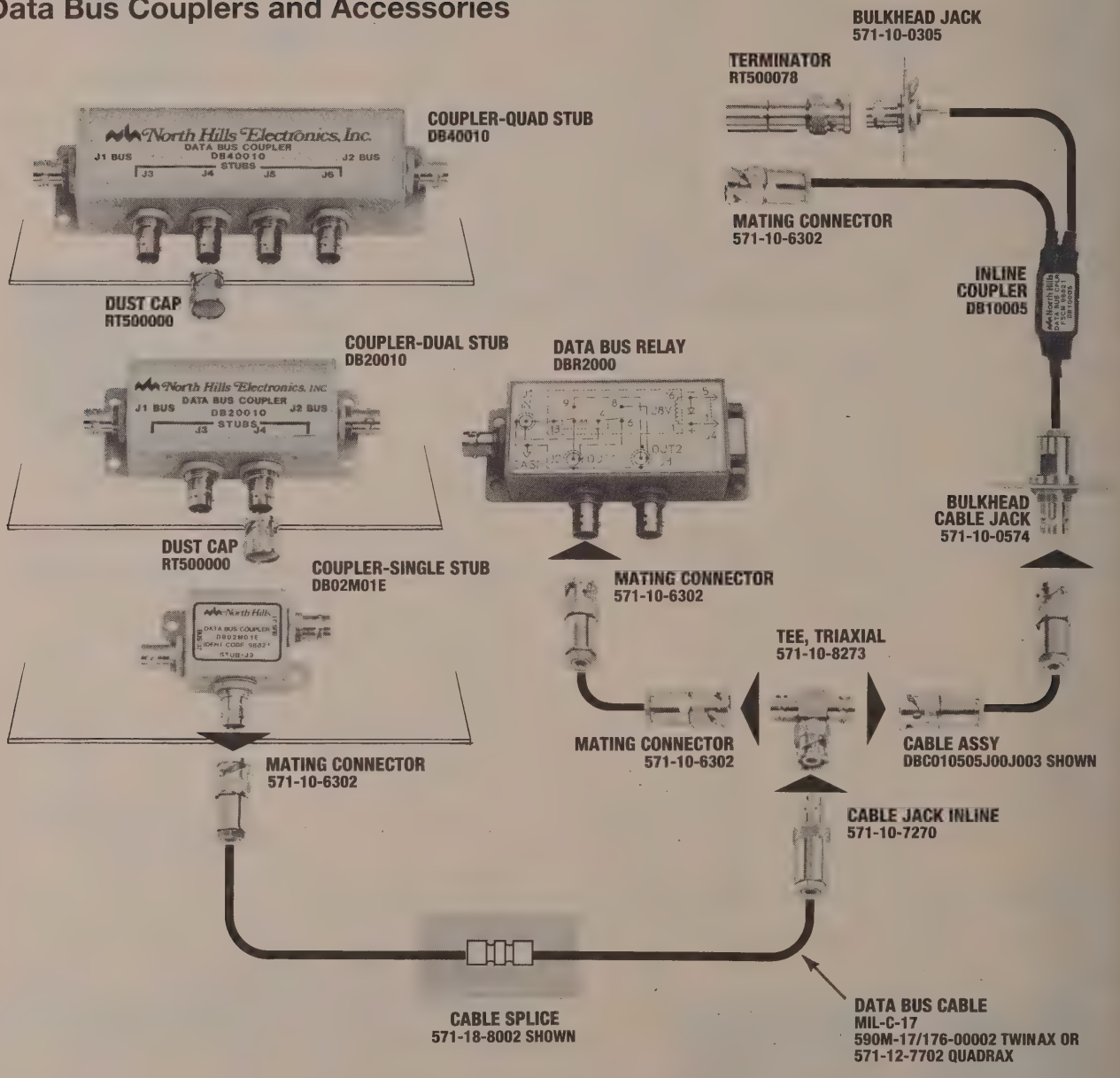
MIL-STD-1553
Data Bus Couplers and Accessories



FEATURES:

- *Complete assortment of Data Bus interconnect accessories, cable assemblies and Data Bus Couplers (Box or In-Line)*
- *Readily Available from Stock*
- *Reduced Cost*
- *Harness Testers*

™ Trademark of North Hills Electronics, Inc.

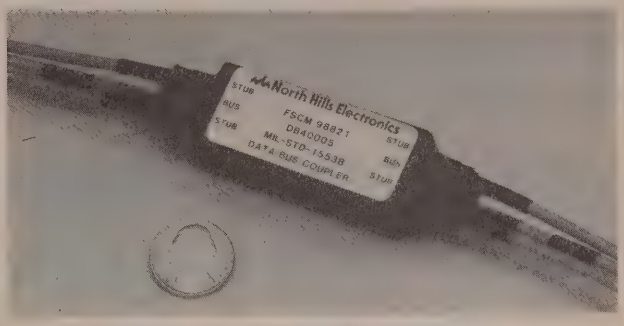
North Hills™ Signal Processing

A Porta Systems Company

North Hills Electronics manufactures a full line of MIL-STD-1553 data bus couplers suitable for severe airborne and ground-based applications, as well as test and development systems. They are available in both box and in-line configurations and with a wide variety of connectors. All North Hill Electronics' couplers are manufactured with our own transformers built to MIL-T-21038 and have been qualified on many military programs. Consult us for details and qualification test data.

Couplers are available from stock in configurations ranging from 1 stub to 8 stubs and we would be pleased to provide you with devices to your own specific requirements. Consult us for details.

The tabulation below describes our standard product line of couplers and accessories



DB40005 4 STUB IN-LINE COUPLER

P/N	DESCRIPTION	CASE SIZE (L × W × H)
SINGLE STUB COUPLERS:		
DB01M01E	1553B, FLANGED, D-621/602	1.5 × 1.4 × .9
DB02M01E	1553B, FLANGED, BJ71 (MINIATURE)	1.5 × 1.4 × .9
DB03M01E	1553B, FLANGED, BJ371 (MINIATURE THREADED)	1.5 × 1.4 × .9
DB04M01E	1553B, FLANGED, BJ3150 (SUB-MINIATURE THREADED)	1.5 × 1.4 × .9
DB05M01E	1553B, FLANGED, BJ150 (SUB-MINIATURE)	1.5 × 1.4 × .9
DB06M01E	1553B, IN LINE	1.6 × .81 × .52
DB07M01E	1553B, WITH STUDS, BJ77	2.5 × 1.7 × 1.2
DB10005	1553B, MINIATURE IN-LINE	.88 × .39 × .58
NH12824	1553A, FLANGED, USAF #7822056-001	1.5 × 1.15 × 1.0
NH12825	1553A, FLANGED, USAF #7822056-002, WITH TERMINATION	1.5 × 1.15 × 1.0
NH12826	1553B, FLANGED, USAF #7822056-003	1.5 × 1.15 × 1.0
NH12827	1553B, FLANGED, USAF #7822056-004, WITH TERMINATION	1.5 × 1.15 × 1.0
TWO STUB COUPLERS:		
DB20005	1553B, MINIATURE IN-LINE	2.17 × .42 × .77
DB20010	1553B, FLANGED, BJ71 (MINIATURE)	3.125 × 1.5 × 1.0
DB20020	1553B, FLANGED, BJ371 (MINIATURE THREADED)	3.125 × 1.5 × 1.0
DB20030	1553B, FLANGED, BJ150 (SUB-MINIATURE)	3.125 × 1.5 × 1.0
DB20040	1553B, FLANGED, BJ3150 (SUB-MINIATURE THREADED)	3.125 × 1.5 × 1.0
THREE STUB COUPLERS:		
DB30005	1553B, MINIATURE IN-LINE	
DB30010	1553B, FLANGED, BJ71 (MINIATURE)	
DB30020	1553B, FLANGED, BJ371 (MINIATURE THREADED)	4.0 × 1.5 × 1.0
DB30030	1553B, FLANGED, BJ150 (SUB-MINIATURE)	4.0 × 1.5 × 1.0
DB30040	1553B, FLANGED, BJ3150 (SUB-MINIATURE THREADED)	4.0 × 1.5 × 1.0
FOUR STUB COUPLERS:		
DB40005	1553B, MINIATURE IN-LINE	2.31 × .95 × .84
DB40010	1553B, FLANGED, BJ71 (MINIATURE)	4.87 × 1.5 × 1.0
DB40020	1553B, FLANGED, BJ371 (MINIATURE THREADED)	4.87 × 1.5 × 1.0
DB40030	1553B, FLANGED, BJ150 (SUB-MINIATURE)	4.87 × 1.5 × 1.0
DB40040	1553B, FLANGED, BJ3150 (SUB-MINIATURE THREADED)	4.87 × 1.5 × 1.0
FIVE STUB COUPLERS:		
DB50010	1553B, FLANGED, BJ71 (MINIATURE)	5.75 × 1.5 × 1.0
DB50020	1553B, FLANGED, BJ371 (MINIATURE THREADED)	5.75 × 1.5 × 1.0
DB50030	1553B, FLANGED, BJ150 (SUB-MINIATURE)	5.75 × 1.5 × 1.0
DB50040	1553B, FLANGED, BJ3150 (SUB-MINIATURE THREADED)	5.75 × 1.5 × 1.0
EIGHT STUB COUPLERS:		
DB80031	1553B, FLANGED, BJ150 (SUB-MINIATURE)	8.25 × 2.0 × 1.0
DB80091	1553B, FLANGED, BJ77 (MINIATURE)	4.88 × 1.5 × 1.9
BUS SWITCHERS:		
DBR1000	1553B, ON-OFF BUS SWITCH, BJ71, DE9 MALE, 28V	1.5 × 1.4 × .9
DBR1001	1553B, ON-OFF BUS SWITCH, BJ71, DE9 MALE, 5V	1.5 × 1.4 × .9
DBR2000	1553B, DPDT BUS SWITCH, BJ71, DE9, 28V	3.125 × 1.5 × 1.0
DBR2001	1553B, DPDT BUS SWITCH, BJ71, DE9, 5V	3.125 × 1.5 × 1.0
MISCELLANEOUS HARDWARE AND ACCESSORIES:		
DB03005	75 OHM TERMINATOR, IN-LINE	1.35 × .44D
RT500000	RFI/DUST CAP, PL75 TYPE	
RT500078	78 OHM TERMINATOR, PL75 TYPE	
RT600000	RFI/DUST CAP, PL375 TYPE	
RT600078	78 OHM TERMINATOR, PL375 TYPE	
RT700000	RFI/DUST CAP, PL155 TYPE	
RT700078	78 OHM TERMINATOR, PL155 TYPE	
RT800000	RFI/DUST CAP, PL3155 TYPE	
RT800078	78 OHM TERMINATOR, PL3155 TYPE	
571-10-6302	CONNECTOR, MATING, PL75-47 TYPE	
571-10-0574	BULKHEAD CABLE JACKS, BJ74-47 TYPE	
571-10-8373	TEE, 2 FEMALE PORTS AND ONE MALE PORT	
571-10-0302	SOLDER WELL BULKHEAD JACK, BJ77 TYPE	
571-10-7270	IN-LINE CABLE JACK, CJ70-47 TYPE	
599-07-2403	HEAT SHRINKABLE MARKING SLEEVE	
590M-17/176-00002	MIL-STD 1553 CABLE	
CABLE ASSEMBLIES-CONSULT FACTORY		

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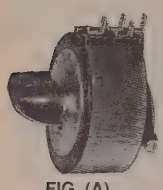
FIG. (A)

FIG. (B)

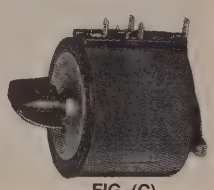
FIG. (C)

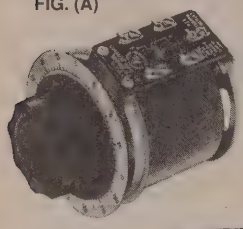
FIG. (D)

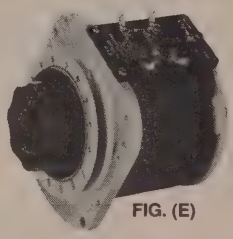
FIG. (E)

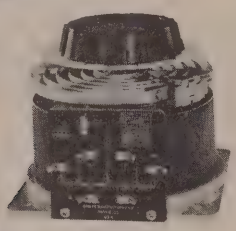
FIG. (F)

FIG. (G)

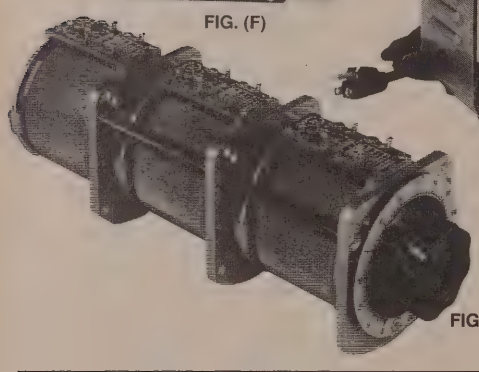
FIG. (H)

APPLICATIONS

Power Supplies
Plating Rectifiers
Welders
Automation Equipment
X-Ray Equipment
Test Equipment
Communications Equipment
Engineering Labs
Quality Control Test Stations

FEATURES

- 99% Efficient
- Excellent Regulation and Resolution
- Low Impendance
- No Phase Shift or Distortion
- Rugged and Reliable
- UL and CSA Listed Models
- Broad Product Line Includes Single Phase and Three Phase Manual and Motor Driven Units
- Standard or Special Designs

120 Volt Input Single-Phase Models

Type	Fig.	Output Volts	Output Amps	Size H × W × D	Wt. Lbs
VT1	A	0-120/132	1.3	3 3/16 × 2 7/8 × 1 13/16	1.5
VT1N	A	0-120	1.5	3 3/16 × 2 7/8 × 1 13/16	1.5
VT1F	G	0-132	1.0	4 1/4 × 3 3/8 × 3 11/16	2.3
VT02	B	0-120/132	2.0	3 3/16 × 2 7/7 × 2 5/16	2.25
VT02N	B	0-120	2.5	3 3/16 × 2 7/8 × 2 5/16	2.25
VT02F	G	0-132	1.75	4 1/4 × 3 3/8 × 3 11/16	3.2
VT3	C	0-120/132	3.0	3 3/16 × 2 7/8 × 2 13/16	3.0
VT3N	C	0-120	3.3	3 3/16 × 2 7/8 × 2 13/16	3.0
VT5	D	0-120/140	5.0	4 1/4 × 3 9/16 × 3 5/8	5.25
VT5F	G	0-140	5.0	6 1/4 × 4 7/8 × 4 1/2	7.8
VT10	E	0-120/140	10.0	5 11/16 × 4 7/8 × 4 1/2	10.25
VT10F	G	0-140	10.0	7 3/8 × 5 7/32 × 5 1/4	13.8
VT25	F	0-120/140	25.0	8 1/16 × 7 1/2 × 4 1/2	22.0
VT25F	G	0-140	25.0	11 1/4 × 8 1/4 × 5 1/2	31.0

240 Volt Input Single-Phase Models

Type	Fig.	Output Volts	Output Amps	Size H × W × D	Wt. Lbs
VT10H	E	0-240/280	4.0	5 11/16 × 4 7/8 × 4 1/2	10.25
VT10HF	G	0-280	4.0	7 3/8 × 5 7/32 × 5 1/4	13.8
VT25H	F	0-240/280	11.0	8 1/16 × 7 1/2 × 4 1/2	22.0
VT25HF	G	0-280	11.0	11 1/4 × 8 1/4 × 5 1/2	31.0

240 Volt Input Three-Phase Models

Type	Fig.	Output Volts	Output Amps	Size H × W × D	Wt. Lbs
VT1-3	H	0-240	1.3	4 1/4 × 2 7/8 × 6 17/32	5.3
VT02-3	H	0-240	2.0	4 1/4 × 2 7/8 × 8 1/32	8.0
VT3-3	H	0-240	3.0	4 1/4 × 2 7/8 × 9 27/32	9.8
VT5-3	H	0-240	5.0	4 13/16 × 4 5/32 × 11 7/8	17.0
VT10-3	H	0-240	10.0	5 11/16 × 4 7/8 × 14 1/8	31.0
VT25-3	H	0-240	25.0	8 1/16 × 7 1/2 × 15 1/16	68.0

480 Volt Input Three-Phase Models

Type	Fig.	Output Volts	Output Amps	Size H × W × D	Wt. Lbs
VT10H-3	H	0-480	4.0	5 11/16 × 4 7/8 × 14 1/8	31.0
VT25H-3	H	0-480	11.0	8 1/16 × 7 1/2 × 15 1/16	65.0

Solid State Power and Motor Speed Controls

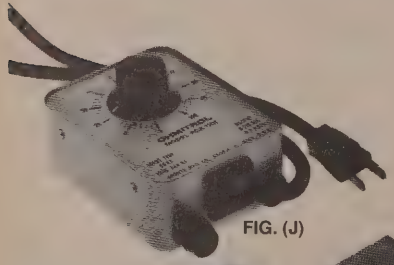
FIG. (J)

FIG. (K)

FIG. (I)

APPLICATIONS

Vibratory Parts Feeders
Heating Elements
Electric Motor Speed Control
Plastic Molding Machinery
Laboratory Ovens

FEATURES

- Very Compact Design
- AC and DC Output Models
- Built in On-Off Switch
- Hardwired and Portable Models with Cord and Plug
- Long Life
- Special Designs Available

CATALOG NO.		INPUT VOLTS	FREQ.	OUTPUT RANGE (nominal)	LOAD CAPACITY RATING (maximum)	TRIMMER RANGE (minimum)
COMPONENT STYLE	PORTABLE STYLE					
PCA-1000 (I)	PCA-1001 (J)	120 VAC	60 Hz	0-120 VAC	1 KW, 8.3 Amps AC	0-50 Volts
PCA-1050 (I)					15 Amps AC	
PCA-1100 (I)	PCA-1101(J)		50 Hz		1 KW, 8.3 Amps AC	
PCA-1020 (I)	PCA-1021 (J)	240 VAC	60 Hz	0-240 VAC	2 KW, 8.3 Amps AC	0-100 Volts
PCA-1120 (I)	PCA-1121 (J)		50 Hz			
PCD-1100 (K)		120 VAC	60 Hz	0-120 VDC and Full 120 VDC	6.0 Amp DC–Resistive 3.5 Amp DC–Motor Load	10-50 Volts
PCD-1100 (K)			50 Hz			
PCD-1020 (K)		240 VAC	60 Hz	0-240 VDC and Full 240 VDC		20-100 Volts
PCD-1120 (K)			50 Hz			

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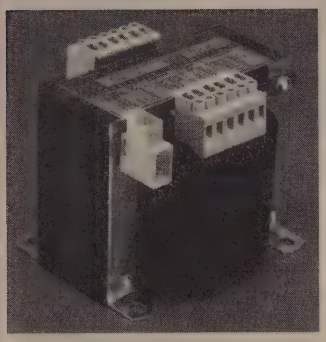
Isolation Step-Down Transformers (Low Leakage)



Isolation Step-down Transformers for use at 48-66Hz. Designed to meet requirements UL and CSA medical standards. Low-leakage: special safety design provides extra insulation between the primary and secondary windings. Check with us on availability of international models approved by VDE.
Input voltages: 100, 120, 200, 220, 240
Output voltages: 100, 120, 200, 220, 240 (±10%), jumper selectable.
Connections: Line connections are made via screw terminals on the terminal blocks which are completely insulated and touch-proof for safety. Jumpering connections are made with QDs (no QDs are used on model 82510050; use 14AWG hookup wire); Jumper wire assemblies (Part #82110060—16AWG, 1/4" QDs, 4-6") available separately.

Part Number	Rating	DIMENSIONS Max. Height	Width 1	Width 2	Mounting 1	Mounting 2	Weight
82510010	100VA	103.2mm 4.06"	95.3mm 3.75"	93.2mm 3.67"	79.5mm 3.13"	63.5mm 2.50"	5.3#
82510030	500VA	134.9mm 5.31"	133.4mm 5.25"	149.4mm 5.88"	111.3mm 4.38"	111.3mm 4.38"	18.5#
82510040	1000VA	159.5mm 6.28"	162.1mm 6.38"	148.3mm 5.84"	134.9mm 5.31"	98.6mm 3.88"	33#
82510050	2000VA	212.9mm 8.38"	190.5mm 7.50"	190.5mm 7.50"	171.5mm 6.75"	117.6mm 4.63"	53#

SPECIFICATIONS

Safety: Built to UL 506, CSA 22.2/No. 66 (transformers); and UL 544, CSA C22.2/ No. 125 (medical products)

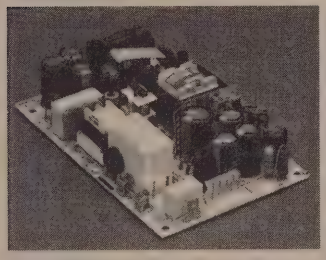
Approvals:
UL (File #E132834
CSA (File #LR 86160-1)

Connection Information:

Connect	Input To	In/Out Voltage	Output To	Connect
1 to 4, 2 to 5	1 – 2	100	7 – 8	7 to 10, 8 to 11
1 to 4, 3 to 6	1 – 3	120	7 – 9	7 to 10, 9 to 12
2 to 4	1 – 5	200	7 – 11	8 to 10
2 to 4	1 – 6	220	7 – 12	8 to 10
3 to 4	1 – 6	240	7 – 12	9 to 10

SCHEMATIC

International Switching Power Supply



#82310010: Switching power supply; specifications at right

Surface-mounted switching power supply can be adjusted for 115VAC/60Hz or international 230VAC/50Hz power and carries UL, CSA and TUV approvals. Miniature size (5.4" x 3.5"), low profile (1.1" high), high reliability (MTBF 80,000 hours min.). Internally filtered to meet FCC (FCC Docket 20780, part 15, class B) and VDE regulations (VDE 0871, level B) for conducted EMI. Short circuit protection for all outputs; overvoltage protection for ±5 output. Wiring harnesses available separately.

SPECIFICATIONS

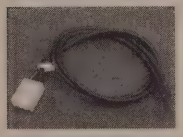
Input Characteristics:
Input voltage: 90-132VAC or 180-265VAC (jumper selectable)
Input frequency range: 47-63Hz, single phase
Inrush current (cold start): 25A 5ms max. at nom. line input, full load & 25°C ambient
Efficiency: 70% typical
Holdup time: 1 cycle min. at nominal line, full load condition.
Load transient response: 5% max. for 50% to 100% load change

Output Characteristics:

Max. power output (Watts)	Output Voltage (Volts)	Min. Load (Amps)	Max. Current (Amps)	Tolerance (%)	Noise Ripple (mv peak to peak)
40	+5	0.5	2.5	±3	50
	+12	0.4	2.0	±5	120
	-12	0.04	0.3	±10	120

Protection: Overvoltage protection: Standard on +5V output set at 6.25V ± 0.5V
Isolation: Input to output terminals: 1500VAC for 1 minute
Input to safety ground: 1500VAC for 1 minute
Output to safety ground: 500 VAC for 1 minute
Insulation Resistance: Output to safety ground: 50Ω min. at 500 VDC
Safety: Designed to meet UL 478, UL 1012, CSA 22.2 No. 154, VDE 804, VDE 806, IEC 380 and IEC 435
Approvals: UL (File #E87379), CSA (File #LR57908X), TUV (File #R74029)

Wiring harnesses (sold separately)



#82110011: Harness for AC Power Input

#82110020: Harness for DC Power Output

#82110030: Harness for Ground Connection

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SSC SERIES		Printed Circuit Types with Single Primary. Available 115 or 230 VAC, 50/60 HZ, with Single Center Tapped Secondaries. Secondary Voltages from 4 to 230 VAC. Power Available from 0.5 to 20 VA.
CSC SERIES		Printed Circuit Types with Single Primary. Available 115 or 230 VAC, 50/60 HZ with Two Equal Secondaries. Secondary Voltages from 4 to 230 Total Series Volts. Power Available from 2 VA to 20 VA.
DSF SERIES		Lead Wires or Lugs with Dual 115 or 230 VAC Primaries, 50/60 HZ. Two Separate and Equal Secondaries. Total Secondary Volts in Series from 6.3 to 480 VAC. Power Available from 50 VA to 450 VA.
TTC SERIES		Telephone Couplers, Hybrids, and Holding Coils. Printed Circuit Types.
MSH SERIES		Dual Primaries for 115/230 VAC, 50/60 HZ Operation. Voltages from 6.3 to 480 VAC. Power from 50-450 VA. Multiple Secondary Types Including Designs for Microprocessor Supplies and Multiple-Tapped Control Types.
DLP SERIES		Low Profile Printed Circuit Types Dual Primaries for 115/230 VAC, 50/60 HZ Operation. Voltages from 6.3 to 230 VAC. Power from 5-50 VA.
MLP SERIES		Low Profile Printed Circuit Types with Multiple Dual 115 VAC Primaries and Secondary Outputs for Logic and OP AMP Supplies.
DHP SERIES		Printed Circuit Types-Compact Design. Single or Dual 115 VAC Primaries 50/60 HZ. Dual Identical Secondaries 5 to 230 VAC. Power from 5-80 VA.

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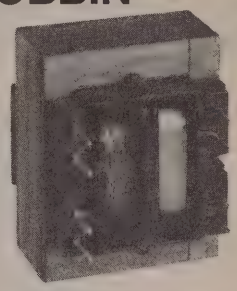
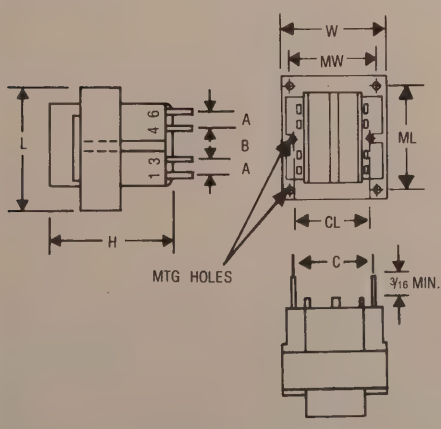
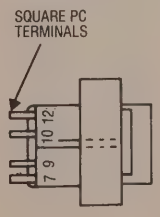
INTERNATIONAL SERIES LOW PROFILE DUAL BOBBIN PRINTED CIRCUIT POWER TRANSFORMERS

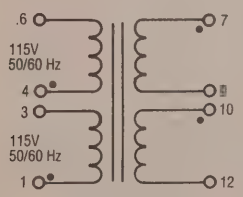


- **Designed to meet UL, VDE, IEC-65, CSA.**
- Dual bobbin construction with insulating shrouds—provides 4000V hipot and results in low interwinding capacitance, eliminating the need for electro-static shielding.
- 130°C insulating system—materials meet UL flammability requirements.
- Dual 115V/230V 50/60 HZ primaries.
- Dual secondaries for variety of utilization.
- Low cost.

Part No.	R.M.S. SECONDARY RATINGS			
	Series	Parallel	Size	VA
VPC3-10	10 VCT @ 0.25A	5 V @ 0.5 A	3	2.5
VPC3-12	12.6VCT @ 0.2 A	6.3V @ 0.4 A	3	2.5
VPC3-16	16 VCT @ 0.15A	8 V @ 0.3 A	3	2.5
VPC3-20	20 VCT @ 0.12A	10 V @ 0.24A	3	2.5
VPC3-24	24 VCT @ 0.1 A	12 V @ 0.2 A	3	2.5
VPC3-28	28 VCT @ 0.09A	14 V @ 0.18A	3	2.5
VPC3-36	36 VCT @ 0.07A	18 V @ 0.14A	3	2.5
VPC4-10	10 VCT @ 0.5 A	5 V @ 1.0 A	4	5.0
VPC4-12	12.6VCT @ 0.4 A	6.3V @ 0.8 A	4	5.0
VPC4-16	16 VCT @ 0.31A	8 V @ 0.62A	4	5.0
VPC4-20	20 VCT @ 0.25A	10 V @ 0.5 A	4	5.0
VPC4-24	24 VCT @ 0.21A	12 V @ 0.42A	4	5.0
VPC4-28	28 VCT @ 0.18A	14 V @ 0.36A	4	5.0
VPC4-36	36 VCT @ 0.14A	18 V @ 0.28A	4	5.0
VPC5-10	10 VCT @ 1.0 A	5 V @ 2.0 A	5	10.0
VPC5-12	12.6VCT @ 0.8 A	6.3V @ 1.6 A	5	10.0
VPC5-16	16 VCT @ 0.62A	8 V @ 1.25A	5	10.0
VPC5-20	20 VCT @ 0.5 A	10 V @ 1.0 A	5	10.0
VPC5-24	24 VCT @ 0.42A	12 V @ 0.84A	5	10.0
VPC5-28	28 VCT @ 0.36A	14 V @ 0.72A	5	10.0
VPC5-36	36 VCT @ 0.28A	18 V @ 0.56A	5	10.0
VPC6-10	10 VCT @ 2.0 A	5 V @ 4.0 A	6	20.0
VPC6-12	12.6VCT @ 1.6 A	6.3V @ 3.2 A	6	20.0
VPC6-16	16 VCT @ 1.25A	8 V @ 2.5 A	6	20.0
VPC6-20	20 VCT @ 1.0 A	10 V @ 2.0 A	6	20.0
VPC6-24	24 VCT @ .83A	12 V @ 1.66A	6	20.0
VPC6-28	28 VCT @ .72A	14 V @ 1.44A	6	20.0
VPC6-36	36 VCT @ .56A	18 V @ 1.12A	6	20.0
VPC7-10	10 VCT @ 3.0 A	5 V @ 6.0 A	7	30.0
VPC7-12	12.6VCT @ 2.4 A	6.3V @ 4.8 A	7	30.0
VPC7-16	16 VCT @ 1.9 A	8 V @ 3.8 A	7	30.0
VPC7-20	20 VCT @ 1.5 A	10 V @ 3.0 A	7	30.0
VPC7-24	24 VCT @ 1.25A	12 V @ 2.5 A	7	30.0
VPC7-28	28 VCT @ 1.06A	14 V @ 2.12A	7	30.0
VPC7-36	36 VCT @ .82A	18 V @ 1.64A	7	30.0
VPC8-10	10 VCT @ 5.6 A	5 V @ 11.2 A	8	56.0
VPC8-12	12.6VCT @ 4.4 A	6.3V @ 8.8 A	8	56.0
VPC8-16	16 VCT @ 3.5 A	8 V @ 7.0 A	8	56.0
VPC8-20	20 VCT @ 2.8 A	10 V @ 5.6 A	8	56.0
VPC8-24	24 VCT @ 2.33A	12 V @ 4.66A	8	56.0
VPC8-28	28 VCT @ 2.0 A	14 V @ 4.0 A	8	56.0
VPC8-36	36 VCT @ 1.56A	18 V @ 3.12A	8	56.0







SIZE	VA	L	W	H	A	B	C	PIN	MTG CL	MTG MW	MTG ML	MTG Screw	WT. lbs.
3	2.5	1 5/8	1 5/16	1 1/8	.200	.250	1.000	.025SQ	1 1/16	—	—	#4	0.25
4	5.0	1 5/8	1 5/16	1 3/8	.200	.400	1.000	.025SQ	1 1/16	—	—	#4	0.37
5	10.0	1 7/8	1 9/16	1 3/8	.200	.400	1.140	.038SQ	1 1/4	—	—	#4	0.53
6	20.0	2 1/4	1 7/8	1 5/8	.400	.400	1.460	.038SQ	1 1/2	—	—	#4	0.90
7	30.0	2 5/8	2 3/16	1 9/16	.550	.275	1.680	.045SQ	—	1 3/4	2 3/16	#6	1.15
8	56.0	3	2 1/2	1 13/16	.600	.300	1.900	.045SQ	—	2	2 1/2	#6	1.70

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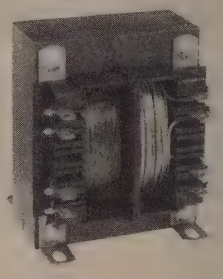
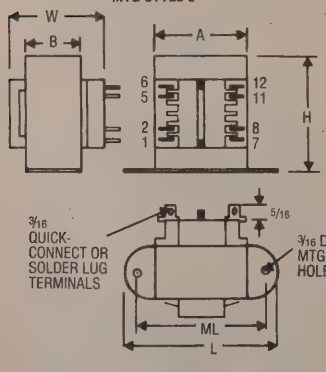
INTERNATIONAL SERIES CHASSIS MOUNT TYPE DUAL BOBBIN POWER TRANSFORMERS



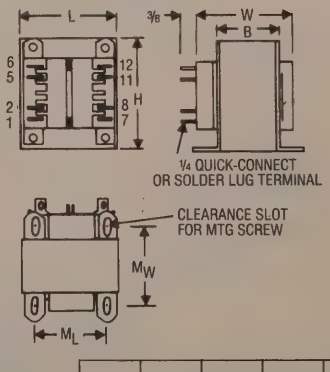
- **Designed to meet UL, VDE, IEC-65, CSA.**
- Dual bobbin construction with insulating shrouds — provides 4000V hipot and results in low interwinding capacitance eliminating the need for electro-static shielding.
- 130°C insulating system — materials meet UL flammability requirements.
- Dual 115V/230V 50/60 HZ primaries.
- Dual secondaries for variety of utilization.
- Low cost.

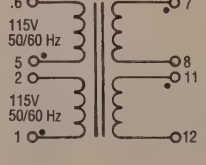
Part No.	R.M.S. SECONDARY RATINGS			
	Series	Parallel	Size	VA
VRP6-10	10 VCT @ 2.5 A	5 V @ 5.0 A	6	25
VRP6-12	12.6VCT @ 2.0 A	6.3V @ 4.0 A	6	25
VRP6-16	16 VCT @ 1.6 A	8 V @ 3.2 A	6	25
VRP6-20	20 VCT @ 1.25A	10 V @ 2.5 A	6	25
VRP6-24	24 VCT @ 1.0 A	12 V @ 2.0 A	6	25
VRP6-28	28 VCT @ 0.9 A	14 V @ 1.8 A	6	25
VRP6-36	36 VCT @ 0.7 A	18 V @ 1.4 A	6	25
VRP6-230	230 VCT @ 0.11A	115 V @ 0.22A	6	25
VRP7-10	10 VCT @ 4.3 A	5 V @ 8.6 A	7	43
VRP7-12	12.6VCT @ 3.4 A	6.3V @ 6.8 A	7	43
VRP7-16	16 VCT @ 2.7 A	8 V @ 5.4 A	7	43
VRP7-20	20 VCT @ 2.2 A	10 V @ 4.4 A	7	43
VRP7-24	24 VCT @ 1.8 A	12 V @ 3.6 A	7	43
VRP7-28	28 VCT @ 1.5 A	14 V @ 3.0 A	7	43
VRP7-36	36 VCT @ 1.2 A	18 V @ 2.4 A	7	43
VRP7-230	230 VCT @ 0.19A	115 V @ 0.38A	7	43
VRP8-10	10 VCT @ 8.0 A	5 V @ 16.0 A	8	80
VRP8-12	12.6VCT @ 6.3 A	6.3V @ 12.6 A	8	80
VRP8-16	16 VCT @ 5.0 A	8 V @ 10.0 A	8	80
VRP8-20	20 VCT @ 4.0 A	10 V @ 8.0 A	8	80
VRP8-24	24 VCT @ 3.3 A	12 V @ 6.6 A	8	80
VRP8-28	28 VCT @ 2.8 A	14 V @ 5.6 A	8	80
VRP8-36	36 VCT @ 2.2 A	18 V @ 4.4 A	8	80
VRP8-230	230 VCT @ 0.35A	115 V @ 0.7 A	8	80
VRP9-10	10 VCT @ 13.0 A	5 V @ 26.0 A	9	130
VRP9-12	12.6VCT @ 10.3 A	6.3V @ 20.6 A	9	130
VRP9-16	16 VCT @ 8.1 A	8 V @ 16.2 A	9	130
VRP9-20	20 VCT @ 6.5 A	10 V @ 13.0 A	9	130
VRP9-24	24 VCT @ 5.4 A	12 V @ 10.8 A	9	130
VRP9-28	28 VCT @ 4.6 A	14 V @ 9.2 A	9	130
VRP9-36	36 VCT @ 3.6 A	18 V @ 7.2 A	9	130
VRP9-230	230 VCT @ 0.57A	115 V @ 1.14A	9	130
VRP10-16	16 VCT @ 11.0 A	8 V @ 22.0 A	10	175
VRP10-20	20 VCT @ 8.8 A	10 V @ 17.6 A	10	175
VRP10-24	24 VCT @ 7.3 A	12 V @ 14.6 A	10	175
VRP10-28	28 VCT @ 6.25A	14 V @ 12.5 A	10	175
VRP10-36	36 VCT @ 4.8 A	18 V @ 9.6 A	10	175
VRP10-230	230 VCT @ 0.76A	115 V @ 1.52A	10	175

MTG STYLE C



MTG STYLE B





SIZE	VA	L	W	H	A	B	MTG Style	MTG ML	MTG MW	MTG Screw	WT. lbs.
6	25	2 13/16	1 7/8	2 5/16	2	1 1/8	C	2 3/8	—	#6	1.25
7	43	3 1/8	2 1/16	2 11/16	2 1/4	1 1/8	C	2 13/16	—	#6	1.60
8	80	3 9/16	2 3/8	3 1/16	2 5/8	1 5/16	B	2	2 1/4	#6	2.60
9	130	2 13/16	2 7/8	3 3/8	—	1 5/8	B	2 1/4	2 1/2	#8	4.10
10	175	3 1/8	2 7/8	3 3/4	—	1 5/8	B	2 1/2	2 1/2	#8	6.50

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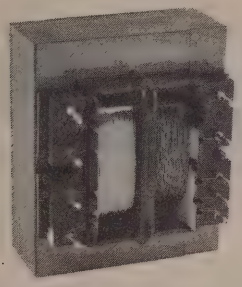
INTERNATIONAL SERIES DUAL BOBBIN MICROPROCESSOR TRANSFORMERS

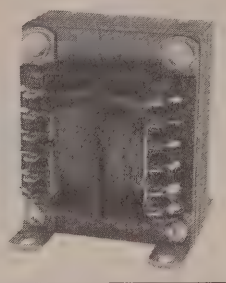
VPCM - Printed Circuit



• Designed to meet UL, VDE, IEC and CSA

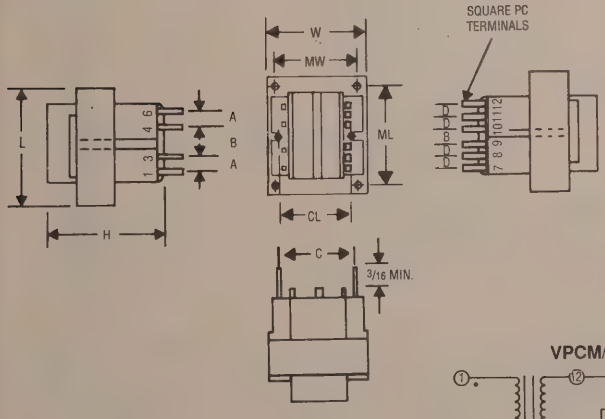
- Dual bobbin construction for low interwinding capacitance. Eliminates need for electro-static shielding and provides 4000V Hipot.
- 130°C insulation system. Exceeds UL flammability requirement.
- Dual 115V/230V primaries are standard.
- DC output combinations ±12V and 5V and ±15V and 5V. Rated at regulator output.

VRPM - Chassis Mount

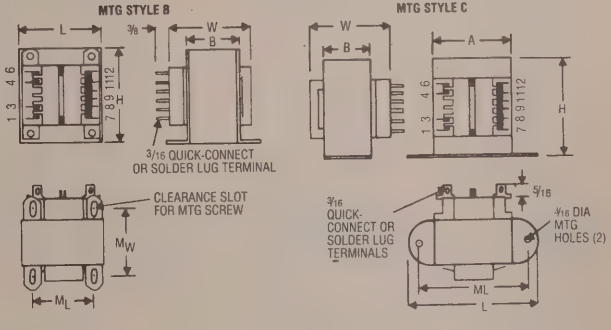


P/N 115/230V 50/60Hz	Regulated DC Ratings		Recommended Components (C2 & C4 = 10 MFD @ 20V for all parts)								
	IC_1	IC_2	C_1 MFD	C_1 V	C_3 MFD	C_3 V	D_1	D_2	IC_1	IC_2	IC_3
VPCM6-12	5V @ 750mA	±12V @ 200mA	2.3K	50	600	50	PE20	PF20	LM-323K-5	LM-340K-12	LM-320K-12
VPCM7-12	5V @ 1.25A	±12V @ 250mA	4.1K	15	600	50	PE20	PF20	LM-323K-5	LM-340K-12	LM-320K-12
VPCM8-12	5V @ 3A	±12V @ 300mA	10.0K	15	1.1K	50	PE20	PF20	LM-338	LM-340K-12	LM-320K-12
VPCM6-15	5V @ 750mA	±15V @ 175mA	2.3K	50	600	50	PE20	PF20	LM-323K-5	LM-340K-15	LM-320K-15
VPCM7-15	5V @ 1.25A	±15V @ 200mA	4.1K	15	1.1K	50	PP20	PF20	LM-323K-5	LM-340K-15	LM-320K-15
VPCM8-15	5V @ 3A	±15V @ 250mA	10.0K	15	1.1K	50	PP20	PF20	LM-338	LM-304K-15	LM-320K-15
VRPM6-12	5V @ 1.25A	±12V @ 150mA	4.1K	15	600	50	PE20	PF20	LM-323K-5	LM-340K-12	LM-320K-12
VRPM7-12	5V @ 2A	±12V @ 300mA	8.0K	15	1.1K	50	PE20	PF20	LM-323K-5	LM-340K-12	LM-320K-12
VRPM8-12	5V @ 3.5A	±12V @ 600mA	10.0K	15	2.1K	50	PE20	PF20	LM-338	LM-340K-12	LM-320K-12
VRPM6-15	5V @ 1.25A	±15V @ 130mA	4.1K	15	600	50	PE20	PF20	LM-323K-5	LM-340K-15	LM-320K-15
VRPM7-15	5V @ 2A	±15V @ 250mA	8.0K	15	1.1K	50	PP20	PF20	LM-323K-5	LM-340K-15	LM-320K-15
VRPM8-15	5V @ 3.5A	±15V @ 500mA	10.0K	15	2.1K	50	PP20	PF20	LM-338	LM-340K-15	LM-320K-15

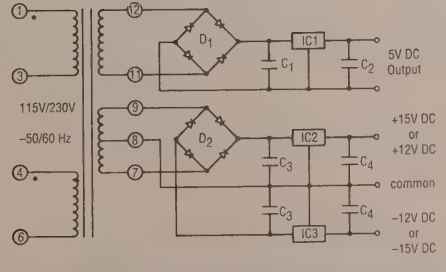
VPCM MECHANICAL



VRPM MECHANICAL



VPCM/VRPM SCHEMATIC



Dimensions														
Size	L	W	H	A	B	C	D	CL	Terminal Dims.	MTG Style	Mtg. MW	Mtg. ML	Mtg. Screw	Lbs.
VPCM6	2 1/4	1 7/8	1 5/8	.400	.400	1.460	.200	1 1/2	.038 SQ.	—	—	—	# 4	0.90
VPCM7	2 5/8	2 3/16	1 9/16	.550	.275	1.680	.275	—	.045 SQ.	—	1 3/4	2 3/16	# 6	1.15
VPCM8	3	2 1/2	1 13/16	.600	.300	1.900	.300	—	.045 SQ.	—	2	2 1/2	# 6	1.70
VRPM6	2 13/16	1 7/8	2 5/16	2	1 1/8	—	—	—	3/16	C	—	2 3/8	# 6	1.25
VRPM7	3 1/8	2 1/16	2 11/16	2 1/4	1 1/8	—	—	—	3/16	C	—	2 13/16	# 6	1 60
VRPM8	3 9/16	2 3/8	3 1/16	2 5/8	1 5/16	—	—	—	3/16	B	2	2 1/4	# 6	2.60

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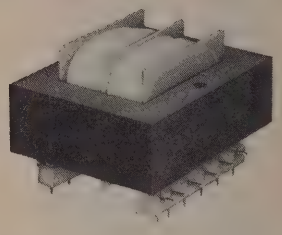
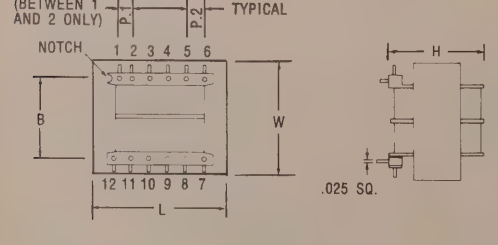
LOW PROFILE SPLIT BOBBIN PRINTED CIRCUIT POWER TRANSFORMERS

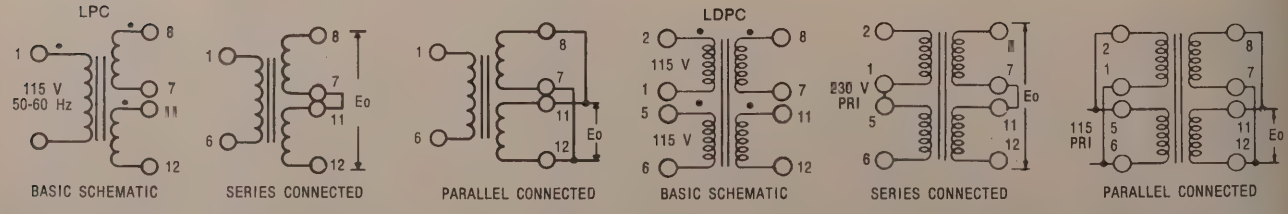
- Low profile — allows closer printed circuit board stacking
- Split bobbin construction — center flange insulation barrier provides 2500 VRMs Hipot — non concentric coil winding results in low interwinding capacitance, eliminates need for electro-static shielding.
- Class S (130°C) insulation system
- Single 115V and dual 115V/230V primaries are standard.
- Dual secondaries for variety of utilization
- 12 pin bobbin design increases available options for multi-winding special orders
- Low regulation



PRIMARY 50/60HZ		R.M.S. SECONDARY RATINGS			
Single 115V	Dual 115V/230V	Series	Parallel	SIZE	VA
LPC3- 12	LDPC3- 12	12.6VCT @ 105MA	6.3V @ 210MA	3	1.25
LPC3- 16	LDPC3- 16	16 VCT @ 80MA	8 V @ 160MA	3	1.25
LPC3- 20	LDPC3- 20	20 VCT @ 65MA	10 V @ 130MA	3	1.25
LPC3- 24	LDPC3- 24	24 VCT @ 55MA	12 V @ 110MA	3	1.25
LPC3- 34	LDPC3- 34	34 VCT @ 35MA	17 V @ 70MA	3	1.25
LPC3- 40	LDPC3- 40	40 VCT @ 30MA	20 V @ 60MA	3	1.25
LPC3- 56	LDPC3- 56	56 VCT @ 20MA	28 V @ 40MA	3	1.25
LPC3-120	LDPC3-120	120 VCT @ 10MA	60 V @ 20MA	3	1.25
LPC4- 12	LDPC4- 12	12.6VCT @ 360MA	6.3V @ 720MA	4	4.50
LPC4- 16	LDPC4- 16	16 VCT @ 280MA	8 V @ 560MA	4	4.50
LPC4- 20	LDPC4- 20	20 VCT @ 225MA	10 V @ 450MA	4	4.50
LPC4- 24	LDPC4- 24	24 VCT @ 185MA	12 V @ 370MA	4	4.50
LPC4- 34	LDPC4- 34	34 VCT @ 130MA	17 V @ 260MA	4	4.50
LPC4- 40	LDPC4- 40	40 VCT @ 110MA	20 V @ 220MA	4	4.50
LPC4- 56	LDPC4- 56	56 VCT @ 80MA	28 V @ 160MA	4	4.50
LPC4-120	LDPC4-120	120 VCT @ 40MA	60 V @ 80MA	4	4.50
LPC5- 12	LDPC5- 12	12.6VCT @ 795MA	6.3V @ 1.59A	5	10.0
LPC5- 16	LDPC5- 16	16 VCT @ 625MA	8 V @ 1.25A	5	10.0
LPC5- 20	LDPC5- 20	20 VCT @ 500MA	10 V @ 1.00A	5	10.0
LPC5- 24	LDPC5- 24	24 VCT @ 415MA	12 V @ 930MA	5	10.0
LPC5- 34	LDPC5- 34	34 VCT @ 295MA	17 V @ 590MA	5	10.0
LPC5- 40	LDPC5- 40	40 VCT @ 250MA	20 V @ 500MA	5	10.0
LPC5- 56	LDPC5- 56	56 VCT @ 180MA	28 V @ 360MA	5	10.0
LPC5-120	LDPC5-120	120 VCT @ 85MA	60 V @ 170MA	5	10.0
LPC6- 12	LDPC6- 12	12.6VCT @ 1.9A	6.3V @ 3.8A	6	24.0
LPC6- 16	LDPC6- 16	16 VCT @ 1.5A	8 V @ 3.0A	6	24.0
LPC6- 20	LDPC6- 20	20 VCT @ 1.2A	10 V @ 2.4A	6	24.0
LPC6- 24	LDPC6- 24	24 VCT @ 1.0A	12 V @ 2.0A	6	24.0
LPC6- 34	LDPC6- 34	34 VCT @ 705MA	17 V @ 1.4A	6	24.0
LPC6- 40	LDPC6- 40	40 VCT @ 600MA	20 V @ 1.2A	6	24.0
LPC6- 56	LDPC6- 56	56 VCT @ 430MA	28 V @ 860MA	6	24.0
LPC6-120	LDPC6-120	120 VCT @ 200MA	60 V @ 400MA	6	24.0



LPC, LDPC SIZE	VA	L″	W″	H″	P-1	P-2	B	WT. (oz.)
3	1.25	1 3/8	1 5/16	1 1/16	.150	.200	.862	3
4	4.50	1 5/8	1 3/8	1 3/16	.200	.250	.950	5
5	10.0	1 7/8	1 5/8	1 5/16	.200	.300	1.100	9
6	24.0	2 1/4	1 7/8	1 5/16	.200	.300	1.300	14



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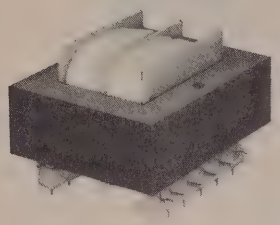
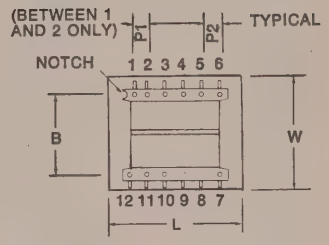
LOW PROFILE SPLIT BOBBIN MICROPROCESSOR PRINTED CIRCUIT POWER TRANSFORMERS

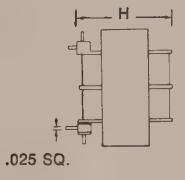
- Low profile — allows closer printed circuit board stacking
- Split bobbin construction—center flange insulation barrier provides 2500 VRMs Hipot—non concentric coil winding results in low inter-winding capacitance, eliminates need for electro-static shielding
- Class S (130°C) insulation system
- Single 115V and dual 115V/230V primaries are standard
- DC output combinations — ±12 and 5V or ±15 and 5V rated at the regulator output with allowance for line variations up to ±13%
- Packaging Flexibility



Primary 50/60 Hz		Regulated DC Ratings		
Single 115V	Dual 115V/230V	IC1	IC2	Size
LM4-12	LDM4-12	5VDC@185mA	±12VDC@35mA	4
LM5-12	LDM5-12	5VDC@365mA	±12VDC@60mA	5
LM6-12	LDM6-12	5VDC@850mA	±12VDC@150mA	6
LM4-15	LDM4-15	5VDC@185mA	±15VDC@30mA	4
LM5-15	LDM5-15	5VDC@365mA	±15VDC@50mA	5
LM6-15	LDM6-15	5VDC@850mA	±15VDC@130mA	6



LM, LDM Size	L″	W″	H″	P-1	P-2	B	WT. (oz.)
4	1 5/8	1 3/8	1 3/16	.200	.250	.950	5
5	1 7/8	1 5/8	1 3/16	.200	.300	1.100	9
6	2 1/4	1 7/8	1 3/16	.200	.300	1.300	14

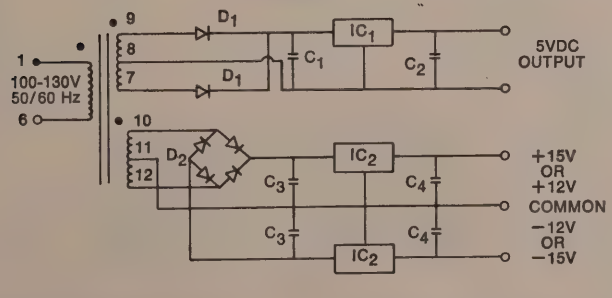


RECOMMENDED COMPONENTS

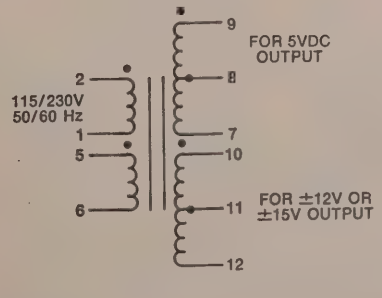
Part Number	C_1		C_2		C_3		C_4		D_1(2)	D_2(4)	IC_1	IC_2
	MFD	V	MFD	V	MFD	V	MFD	V				
LM4-12/LDM4-12	1000	20	2.7	20	150	50	10	20	1N4001	1N4002	LM342P-5.0	LM326N
LM4-15/LDM4-15	1000	20	2.7	20	150	50	10	20	1N4001	1N4002	LM342P-5.0	LM325N
LM5-12/LDM5-12	2100	30	2.7	20	250	50	10	20	1N4001	1N4002	LM341P-5.0	LM326N
LM5-15/LDM5-15	2100	30	2.7	20	250	50	10	20	1N4001	1N4002	LM341P-5.0	LM325N
LM6-12/LDM6-12	4000	20	2.7	20	1000	50	2.7	20	1N4001	1N4002	LM340K-5.0	LM326N
LM6-15/LDM6-15	4000	20	2.7	20	1000	50	2.7	20	1N4001	1N4002	LM340K-5.0	LM325N

SCHEMATIC DIAGRAMS

LM SERIES



LDM SERIES



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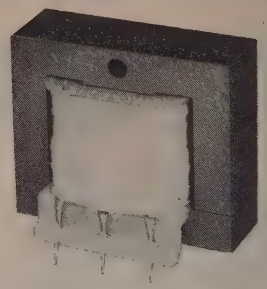
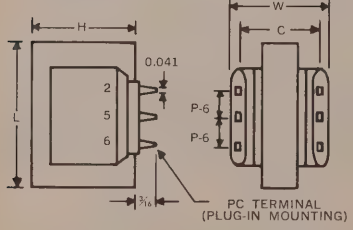
PLUG-IN PRINTED CIRCUIT POWER TRANSFORMERS

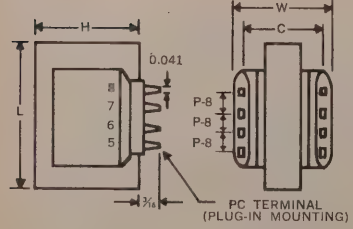


- Packaging flexibility
- Miniaturized construction
- Precision spaced molded-in terminals
- 105°C insulation system
- 1500V Hipot
- Low regulation
- Single 115V and dual 115V/230V primaries are standard
- Dual secondaries for variety of utilization

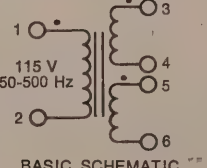
PRIMARY 50/400HZ		R.M.S. SECONDARY RATINGS			
Single 115V	Dual 115V/230V	Series	Parallel	SIZE	VA
PC2- 12	DPC2- 12	12.6VCT @ 70MA	6.3V @ 140MA	2	1.0
PC2- 16	DPC2- 16	16 VCT @ 55MA	8 V @ 110MA	2	1.0
PC2- 20	DPC2- 20	20 VCT @ 45MA	10 V @ 90MA	2	1.0
PC2- 24	DPC2- 24	24 VCT @ 35MA	12 V @ 70MA	2	1.0
PC2- 34	DPC2- 34	34 VCT @ 25MA	17 V @ 50MA	2	1.0
PC2- 40	DPC2- 40	40 VCT @ 20MA	20 V @ 40 MA	2	1.0
PC2- 56	DPC2- 56	56 VCT @ 15MA	28 V @ 30MA	2	1.0
PC3- 12	DPC3- 12	12.6VCT @ 105MA	6.3V @ 210MA	3	1.25
PC3- 16	DPC3- 16	16 VCT @ 80MA	8 V @ 160MA	3	1.25
PC3- 20	DPC3- 20	20 VCT @ 65MA	10 V @ 130MA	3	1.25
PC3- 24	DPC3- 24	24 VCT @ 55MA	12 V @ 110MA	3	1.25
PC3- 34	DPC3- 34	34 VCT @ 35MA	17 V @ 70MA	3	1.25
PC3- 40	DPC3- 40	40 VCT @ 30MA	20 V @ 60MA	3	1.25
PC3- 56	DPC3- 56	56 VCT @ 20MA	28 V @ 40MA	3	1.25
PC3-120	DPC3-120	120 VCT @ 10MA	60 V @ 20MA	3	1.25
PC4- 12	DPC4- 12	12.6VCT @ 360MA	6.3V @ 720MA	4	4.50
PC4- 16	DPC4- 16	16 VCT @ 280MA	8 V @ 560MA	4	4.50
PC4- 20	DPC4- 20	20 VCT @ 225MA	10 V @ 450MA	4	4.50
PC4- 24	DPC4- 24	24 VCT @ 185MA	12 V @ 370MA	4	4.50
PC4- 34	DPC4- 34	34 VCT @ 130MA	17 V @ 260MA	4	4.50
PC4- 40	DPC4- 40	40 VCT @ 110MA	20 V @ 220MA	4	4.50
PC4- 56	DPC4- 56	56 VCT @ 80MA	28 V @ 160MA	4	4.50
PC4-120	DPC4-120	120 VCT @ 40MA	60 V @ 80MA	4	4.50
PC5- 12	DPC5- 12	12.6VCT @ 795MA	6.3V @ 1.59A	5	10.0
PC5- 16	DPC5- 16	16 VCT @ 625MA	8 V @ 1.25A	5	10.0
PC5- 20	DPC5- 20	20 VCT @ 500MA	10 V @ 1.00A	5	10.0
PC5- 24	DPC5- 24	24 VCT @ 415MA	12 V @ 930MA	5	10.0
PC5- 34	DPC5- 34	34 VCT @ 295MA	17 V @ 590MA	5	10.0
PC5- 40	DPC5- 40	40 VCT @ 250MA	20 V @ 500MA	5	10.0
PC5- 56	DPC5- 56	56 VCT @ 180MA	28 V @ 360MA	5	10.0
PC5-120	DPC5-120	120 VCT @ 85MA	60 V @ 170MA	5	10.0
PC6- 12	DPC6- 12	12.6VCT @ 1.9A	6.3V @ 3.8A	6	24.0
PC6- 16	DPC6- 16	16 VCT @ 1.5A	8 V @ 3.0A	6	24.0
PC6- 20	DPC6- 20	20 VCT @ 1.2A	10 V @ 2.4A	6	24.0
PC6- 24	DPC6- 24	24 VCT @ 1.0A	12 V @ 2.0A	6	24.0
PC6- 34	DPC6- 34	34 VCT @ 705MA	17 V @ 1.4A	6	24.0
PC6- 40	DPC6- 40	40 VCT @ 600MA	20 V @ 1.2A	6	24.0
PC6- 56	DPC6- 56	56 VCT @ 430MA	28 V @ 860MA	6	24.0
PC6-120	DPC6-120	120 VCT @ 200MA	60 V @ 400MA	6	24.0



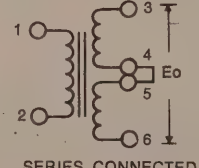
PC-6 PINS



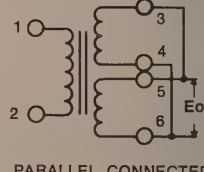
DPC-8 PINS



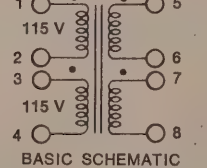
BASIC SCHEMATIC



SERIES CONNECTED



PARALLEL CONNECTED



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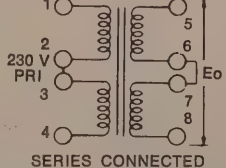
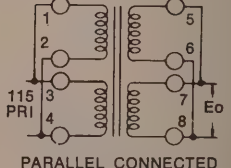


SERIES CONNECTED



PARALLEL CONNECTED

SIZE	VA	L	W	H	P-6 PIN	P-8 PIN	C	WT. (oz.)
2	1.0	1	1⅜	0.83	.250	.200	1.200	2.5
3	1.25	1⅜	1⅛	1⅞₁₆	.312	.200	1.000	3
4	4.50	1⅝	1¼	1⅜	.400	.250	1.100	5
5	10.0	1⅞	1⅞₁₆	1⅝	.400	.250	1.300	9
6	24.0	1⅝	2¼	1⅜	.400	.250	2.100	12

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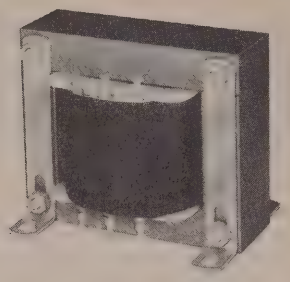
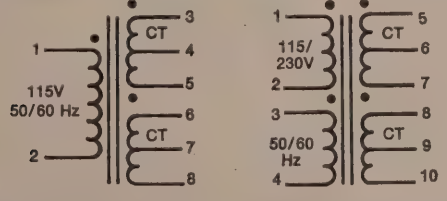
RECTIFIER POWER TRANSFORMERS



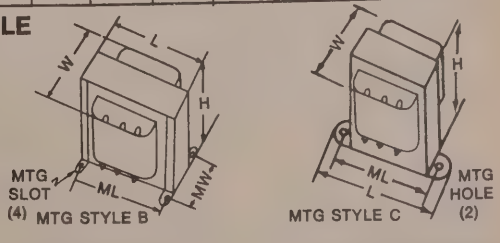
- Single 115V or dual 115V/230V — 50/60 Hz primaries.
- (2) center tapped secondaries provide variety of utilization.
- 1500 VRMS hipot.
- Class 130°C insulation system.
- Rugged construction — only prime raw materials are used.
- Secondary voltage and currents are R.M.S. and are designed for a wide range of rectifier power circuit applications. Our Engineering/Applications staff can assist you with selecting the unit that best suits your rectifier circuit requirements. Custom design and construction is available for your special requirements.

PRIMARY 50/60 Hz		R.M.S. SECONDARY RATINGS		Mtg.						Mtg.	Approx.
Single 115V	Dual 115V/230V	Series	Parallel	Style	L	W	H	ML	MW	Screw	Wt.
RP10- 1	DRP10- 1	10 VCT @ 1A	5 VCT @ 2A	C	2 13/16	1 1/2	1 5/8	2 3/8	—	# 8	.6
RP10- 2	DRP10- 2	10 VCT @ 2A	5 VCT @ 4A	C	3 1/4	1 3/4	1 13/16	2 13/16	—	# 8	1.0
RP10- 4	DRP10- 4	10 VCT @ 4A	5 VCT @ 8A	C	3 11/16	2	2 1/4	3 1/8	—	# 8	1.5
RP10- 6	DRP10- 6	10 VCT @ 6A	5 VCT @ 12A	C	3 11/16	2 1/8	2 1/4	3 1/8	—	# 8	1.7
RP10- 8	DRP10- 8	10 VCT @ 8A	5 VCT @ 16A	C	4 1/32	2 1/4	2 5/16	3 5/16	—	# 8	2.3
RP10-10	DRP10-10	10 VCT @ 10A	5 VCT @ 20A	C	4 1/32	2 1/2	2 5/16	3 5/16	—	# 8	2.8
RP10-12	DRP10-12	10 VCT @ 12A	5 VCT @ 24A	C	4 1/2	2 1/2	2 7/8	4	—	# 8	3.0
RP12.8- 1	DRP12.8- 1	12.8 VCT @ 1A	6.4 VCT @ 2A	C	2 13/16	1 5/8	1 5/8	2 3/8	—	# 8	.7
RP12.8- 2	DRP12.8- 2	12.8 VCT @ 2A	6.4 VCT @ 4A	C	3 1/4	2	1 13/16	2 13/16	—	# 8	1.1
RP12.8- 4	DRP12.8- 4	12.8 VCT @ 4A	6.4 VCT @ 8A	C	3 11/16	2 1/8	2 1/4	3 1/8	—	# 8	1.7
RP12.8- 6	DRP12.8- 6	12.8 VCT @ 6A	6.4 VCT @ 12A	C	4 1/32	2 1/4	2 5/16	3 5/16	—	# 8	2.3
RP12.8- 8	DRP12.8- 8	12.8 VCT @ 8A	6.4 VCT @ 16A	C	4 1/32	2 1/2	2 5/16	3 5/16	—	# 8	2.8
RP12.8-10	DRP12.8-10	12.8 VCT @ 10A	6.4 VCT @ 20A	C	4 1/2	2 1/2	2 7/8	4	—	# 8	3.0
RP12.8-12	DRP12.8-12	12.8 VCT @ 12A	6.4 VCT @ 24A	B	3 3/4	2 3/4	3 1/8	3 1/8	2 1/4	# 8	4.5
RP16- 1	DRP16- 1	16 VCT @ 1A	8 VCT @ 2A	C	3 1/4	1 3/4	1 13/16	2 13/16	—	# 8	1.0
RP16- 2	DRP16- 2	16 VCT @ 2A	8 VCT @ 4A	C	3 11/16	2	2 1/4	3 1/8	—	# 8	1.5
RP16- 4	DRP16- 4	16 VCT @ 4A	8 VCT @ 8A	C	4 1/32	2 1/4	2 5/16	3 5/16	—	# 8	2.3
RP16- 6	DRP16- 6	16 VCT @ 6A	8 VCT @ 12A	C	4 1/32	2 1/2	2 5/16	3 5/16	—	# 8	2.8
RP16- 8	DRP16- 8	16 VCT @ 8A	8 VCT @ 16A	C	4 1/2	2 1/2	2 7/8	4	—	# 8	3.0
RP16-10	DRP16-10	16 VCT @ 10A	8 VCT @ 20A	B	3 3/4	2 3/4	3 1/8	3 1/8	2 1/4	# 8	4.5
RP16-12	DRP16-12	16 VCT @ 12A	8 VCT @ 24A	B	4 1/8	3	3 1/16	3 1/16	2 3/8	#10	5.5
RP24- 1	DRP24- 1	24 VCT @ 1A	12 VCT @ 2A	C	3 1/4	1 3/4	1 13/16	2 13/16	—	# 8	1.0
RP24- 2	DRP24- 2	24 VCT @ 2A	12 VCT @ 4A	C	3 11/16	2 1/8	2 1/4	3 1/8	—	# 8	1.7
RP24- 4	DRP24- 4	24 VCT @ 4A	12 VCT @ 8A	C	4 1/32	2 1/2	2 5/16	3 5/16	—	# 8	2.8
RP24- 6	DRP24- 6	24 VCT @ 6A	12 VCT @ 12A	B	3 3/4	2 3/4	3 1/8	3 1/8	2 1/4	# 8	4.5
RP24- 8	DRP24- 8	24 VCT @ 8A	12 VCT @ 16A	B	4 1/8	3	3 1/16	3 1/16	2 3/8	#10	5.5
RP24-10	DRP24-10	24 VCT @ 10A	12 VCT @ 20A	B	4 1/2	3 1/4	3 3/4	3 3/4	2 1/2	#10	7.0
RP24-12	DRP24-12	24 VCT @ 12A	12 VCT @ 24A	B	4 1/2	3 1/2	3 3/4	3 3/4	2 3/4	#10	8.7
RP36- 1	DRP36- 1	36 VCT @ 1A	18 VCT @ 2A	C	3 11/16	2	2 1/4	3 1/8	—	# 8	1.5
RP36- 2	DRP36- 2	36 VCT @ 2A	18 VCT @ 4A	C	4 1/32	2 1/4	2 5/16	3 5/16	—	# 8	2.3
RP36- 4	DRP36- 4	36 VCT @ 4A	18 VCT @ 8A	B	3 3/4	2 3/4	3 1/8	3 1/8	2 1/4	# 8	4.5
RP36- 6	DRP36- 6	36 VCT @ 6A	18 VCT @ 12A	B	4 1/8	3	3 1/16	3 1/16	2 3/8	#10	5.5
RP36- 8	DRP36- 8	36 VCT @ 8A	18 VCT @ 16A	B	4 1/2	3 1/2	3 3/4	3 3/4	2 3/4	#10	8.7
RP36-10	DRP36-10	36 VCT @ 10A	18 VCT @ 20A	B	4 1/2	3 3/4	3 3/4	3 3/4	3	#10	9.4
RP36-12	DRP36-12	36 VCT @ 12A	18 VCT @ 24A	B	5 1/4	4	4 3/8	4 3/8	2 7/8	1/4	12.3
RP56- 1	DRP56- 1	56 VCT @ 1A	28 VCT @ 2A	C	3 11/16	2 1/8	2 1/4	3 1/8	—	# 8	1.7
RP56- 2	DRP56- 2	56 VCT @ 2A	28 VCT @ 4A	C	4 1/2	2 1/2	2 7/8	4	—	# 8	3.0
RP56- 4	DRP56- 4	56 VCT @ 4A	28 VCT @ 8A	B	4 1/8	3	3 1/16	3 1/16	2 3/8	#10	5.5
RP56- 6	DRP56- 6	56 VCT @ 6A	28 VCT @ 12A	B	4 1/2	3 3/4	3 3/4	3 3/4	3	#10	9.4
RP56- 8	DRP56- 8	56 VCT @ 8A	28 VCT @ 16A	B	5 1/4	4	4 3/8	4 3/8	2 7/8	1/4	12.3
RP56-10	DRP56-10	56 VCT @ 10A	28 VCT @ 20A	B	5 1/4	4 1/4	4 3/8	4 3/8	3 1/8	1/4	13.4
RP56-12	DRP56-12	56 VCT @ 12A	28 VCT @ 24A	B	5 1/4	4 3/4	4 3/8	4 3/8	3 5/8	1/4	15.8
RP68- 1	DRP68- 1	68 VCT @ 1A	34 VCT @ 2A	C	4 1/32	2 1/4	2 5/16	3 5/16	—	# 8	2.3
RP68- 2	DRP68- 2	68 VCT @ 2A	34 VCT @ 4A	B	3 3/4	2 3/4	3 1/8	3 1/8	2 1/4	# 8	4.5
RP68- 4	DRP68- 4	68 VCT @ 4A	34 VCT @ 8A	B	4 1/2	3 1/2	3 3/4	3 3/4	2 3/4	#10	8.7
RP68- 6	DRP68- 6	68 VCT @ 6A	34 VCT @ 12A	B	5 1/4	4	4 3/8	4 3/8	2 7/8	1/4	12.3
RP68- 8	DRP68- 8	68 VCT @ 8A	34 VCT @ 16A	B	5 1/4	4 1/4	4 3/8	4 3/8	3 1/8	1/4	13.4
RP68-10	DRP68-10	68 VCT @ 10A	34 VCT @ 20A	B	5 1/4	4 3/4	4 3/8	4 3/8	3 5/8	1/4	15.8
RP68-12	DRP68-12	68 VCT @ 12A	34 VCT @ 24A	B	6 3/8	5 1/4	5 5/16	5 5/16	3 1/4	1/4	21.0
RP80- 1	DRP80- 1	80 VCT @ 1A	40 VCT @ 2A	C	4 1/32	2 1/4	2 5/16	3 5/16	—	# 8	2.3
RP80- 2	DRP80- 2	80 VCT @ 2A	40 VCT @ 4A	B	3 3/4	2 3/4	3 1/8	3 1/8	2 1/4	# 8	4.5
RP80- 4	DRP80- 4	80 VCT @ 4A	40 VCT @ 8A	B	4 1/2	3 1/2	3 3/4	3 3/4	3	#10	9.4
RP80- 6	DRP80- 6	80 VCT @ 6A	40 VCT @ 12A	B	5 1/4	4	4 3/8	4 3/8	2 7/8	1/4	12.3
RP80- 8	DRP80- 8	80 VCT @ 8A	40 VCT @ 16A	B	5 1/4	4 3/4	4 3/8	4 3/8	3 5/8	1/4	15.8
RP80-10	DRP80-10	80 VCT @ 10A	40 VCT @ 20A	B	6 3/8	5 1/4	5 5/16	5 5/16	3 1/4	1/4	21.0
RP80-12	DRP80-12	80 VCT @ 12A	40 VCT @ 24A	B	6 3/8	5 1/4	5 5/16	5 5/16	3 1/4	1/4	21.0

SCHEMATIC



MTG. STYLE



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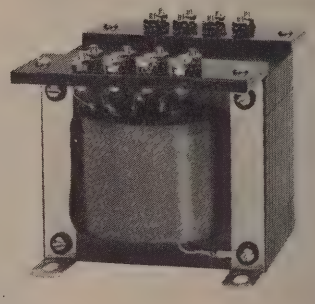
64D NANCY ST. / WEST BABYLON, NY 11704 / (516) 491-3300 / FAX 516-491-3689

ISOLATION POWER TRANSFORMERS STEP-UP/STEP-DOWN VARIABLE VOLTAGE RATINGS

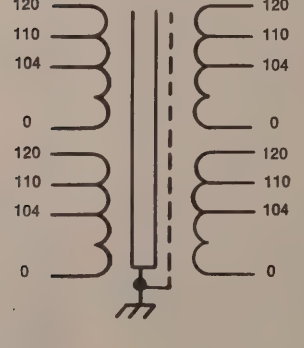
- The IPS Series features (4) identical windings; (2) primaries and (2) secondaries; each rated at 0/104/110/120 volts allowing for rating combinations of 104V, 110V, 120V, 208V, 214V, 220V, and 240V with primary and secondary isolated from each other. Step-down of 440V to 220V or step-up of 220V to 440V can be achieved by inter-connecting primaries and secondaries in an Auto-Transformer configuration. This eliminates isolation but a doubling of the power rating can be realized.
- The DIPS series is similar to the IPS series except the dual secondaries are each rated 0/208/220/240 volts.
- 50 Hz to 500 Hz operating frequency range.
- Electrostatically shielded with shield grounded to the core. This connection can be opened for floating shield.
- ¼ inch thick phenolic terminal boards with nickel plated brass hardware (#10-32 on 250 VA and 500 VA; ¼-20 on 1000 VA and 2000 VA). Voltage rating can be varied with easy to make interconnections.
- Completely varnish impregnated and ruggedly constructed with prime raw materials.
- Well insulated and designed to withstand 2500 VRMS hipot.
- 55°C temperature rise above ambient



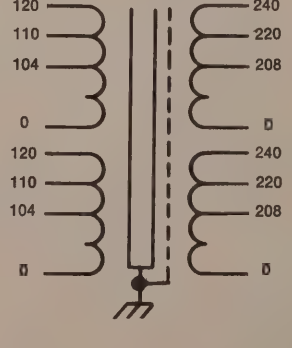
Part No.	Power Volt-Amps	Secondary Ratings				Mechanical Dimensions					Mtg. & Term. Screw	Approx. Wt. (lbs.)
		Series Volts	Max. Amps	Parallel Volts	Max. Amps	L	W	H	ML	MW		
IPS-250	250	0/208/220/240	1.1	0/104/110/120	2.2	5 5/16	4 1/4	5 1/4	4 3/8	2 1/2	#10	12
IPS-500	500	0/208/220/240	2.3	0/104/110/120	4.6	5 5/16	5 5/16	5 1/4	4 3/8	3 5/8	#10	18
IPS-1000	1000	0/208/220/240	4.5	0/104/110/120	9.0	7 7/16	7	7 3/8	6 3/4	3 1/8	¼	33
IPS-2000	2000	0/208/220/240	9.0	0/104/110/120	18.0	7 7/16	9	7 3/8	6 3/4	5 1/8	¼	56
DIPS-250	250	0/416/440/480	0.55	0/208/220/240	1.1	5 5/16	4 1/4	5 1/4	4 3/8	2 1/2	#10	12
DIPS-500	500	0/416/440/480	1.15	0/208/220/240	2.3	5 5/16	5 5/16	5 1/4	4 3/8	3 5/8	#10	18
DIPS-1000	1000	0/416/440/480	2.25	0/208/220/240	4.5	7 7/16	7	7 3/8	6 3/4	3 1/8	¼	33
DIPS-2000	2000	0/416/440/480	4.50	0/208/220/240	9.0	7 7/16	9	7 3/8	6 3/4	5 1/8	¼	56

SCHEMATIC DIAGRAMS

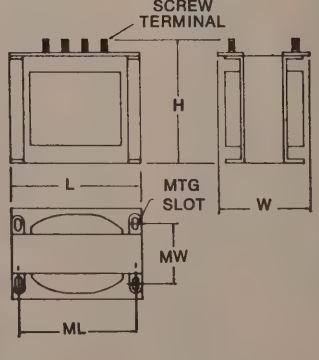
IPS SCHEMATIC



DIPS SCHEMATIC

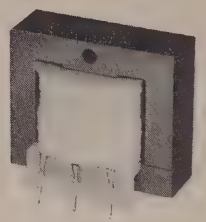


MECHANICAL OUTLINE



PCT TRANSFORMER CORP.
64D NANCY ST. / WEST BABYLON, NY 11704 / (516) 491-3300 / FAX 516-491-3689

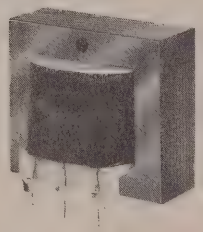
PLUG-IN PRINTED CIRCUIT AUDIO TRANSFORMERS



Designed for Input, Interstage, Output and Isolation Circuits. ±2db 200 Hz-15,000 Hz Frequency Response and 20dbm Power Rating for Entire Series.

P/N	PRI Z	Sec Z	Idc	Schematic
APC1-1	600Ω	600Ω	8mA	1
APC1-2	600Ω C.T.	600Ω C.T.	16mA	2
APC1-3	600Ω	8000/2000Ω Split	8mA	4
APC1-4	2500Ω	600Ω	4mA	1
APC1-5	2500Ω C.T.	600Ω C.T.	8mA	2
APC1-6	2500Ω C.T.	2500Ω C.T.	8mA	2
APC1-7	4000Ω	600Ω/150Ω Split	3mA	4
APC1-8	4000Ω C.T.	600Ω C.T.	6mA	2
APC1-9	4000Ω C.T.	1200Ω C.T.	6mA	2

PLUG-IN PRINTED CIRCUIT TELEPHONE COUPLING TRANSFORMERS

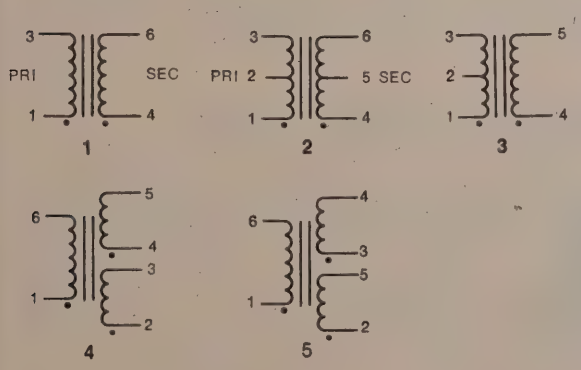


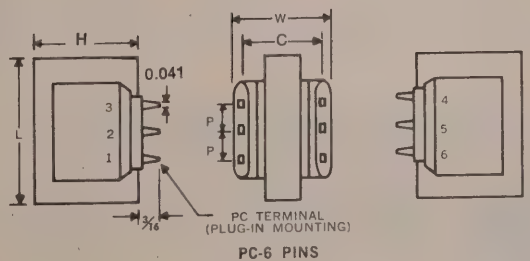
Designed for Interconnection of Voice/Data Modem Terminals to Telephone Lines.

- Frequency response ±0.5dB 300Hz-3500Hz
- Power level −45dbm to +7dbm
- Longitudinal balance — per FCC Part 68
- Distortion — 0.5% max.
- Impedance matching ±10% over frequency range
- Return loss — 26dB min.

P/N	PRI Z	Sec Z	Application	Schematic
TPC1-1	600Ω	600Ω	Coupling	1
TPC1-2	600Ω C.T.	600Ω C.T.	Coupling	2
TPC1-3	600Ω	900Ω	Coupling	1
TPC1-4	900Ω	900Ω	Coupling	1
TPC1-5	900Ω/600Ω	600Ω	Coupling	3
TPC1-6	4000Ω	600Ω	Bridging	1
TPC1-7	600Ω (4W)	600Ω/600Ω	Hybrid (2) Req'd	5

APC & TPC SCHEMATICS AND MECHANICAL LAYOUT





L	W	H	P	C	Wt. (oz.)
13/16	1 9/32	3/4	.187	.420	.5

Other ratings and configurations are available on special order for your custom requirements.

PEARSON ELECTRONICS, INC.

Wide Band, Precision Current Monitors

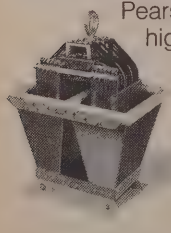
With a Pearson™ Current Monitor and an oscilloscope, you can measure pulse or ac currents from milliamperes to kiloamperes, in any conductor or beam of charged particles, at frequencies up to 200 MHz or down to below 1 Hz. The monitor is physically isolated from the circuit. It is a current transformer capable of highly precise measurement of pulse amplitude and waveshape. The Model 110, for example, offers pulse-amplitude accuracy of + 1%, -0% (typical of all Pearson current monitors), 20 nanosecond rise time, and droop of only 0.8% per millisecond. Three dB bandwidth is 1 Hz to 20 MHz. Whether you wish to measure current in a conductor, an electron device or a particle accelerator, it is likely that one of our off-the-shelf models (ranging from ¼" to 10¾" ID) will do the job. In addition to our standard models, we build many custom designed current transformers to meet special needs and applications.

Pearson Current Monitor Transformers

Model Number	Output† (volts/amp.)	Hole Dia. (inches)	Maximum Peak Curr. (amps)	Droop (%/microsec.)	Useable Rise Time (nanosec.)	IT Max. (amp-sec.)	Maximum RMS Curr. (amps)	Approx. 3 dB pt. Low (Hz)	Approx. 3 dB pt. High (MHz)	I/f (peak amps/Hz)
2877	1.0	0.25	100	0.2	2	0.0004**	2.5	300	200	0.0025
4100	1.0	0.5	500	0.09	10	0.002**	5	140	35	0.006
2100	1.0	2	500	0.08	20	0.005**	7.5	125	20	0.017
3100*	1.0	3.5	500	0.04	50	0.03**	12	60	7	0.1
150	0.5	2	1,000	0.02	20	0.02**	15	30	20	0.07
325*	0.25	3.5	2,000	0.1	30	0.09	60	160	10	0.6
2878	0.1	0.25	400	0.02	5	0.004**	10	30	70	0.025
410	0.1	0.5	5,000	0.06	20	0.25	50	120	20	1.7
411	0.1	0.5	5,000	0.0009	20	0.2**	50	1	20	0.6
110	0.1	2	5,000	0.0008	20	0.5**	65	1	20	1.5
110A	0.1	2	10,000	0.0008	20	0.5**	65	1	20	1.5
310*	0.1	3.5	5,000	0.02	40	0.6	140	30	10	3.6
1010*	0.1	10.75	5,000	0.25	50	0.7**	120	400	7	4.4
1025	0.025	2	20,000	0.1	100	0.5	100	160	4	3
3025*	0.025	3.5	20,000	0.004	100	3.0	325	7	4	20
2879	0.01	0.25	2,000	0.002	20	0.04**	25	3	20	0.25
101	0.01	2	50,000	0.0001	100	2.5**	200	0.25	4	12
301X*	0.01	3.5	50,000	0.003	200	22	400	5	2	140
1080*	0.005	3.5	200,000	0.002	250	25	750	3.0	1.5	150
1330*	0.005	3.5	100,000	0.0006	250	65	1400	0.9	1.5	400
1423*	0.001	3.5	500,000	0.0007	300	75	2500	1.0	1.2	450
2093*	0.001	4.75	500,000	0.0001	2000	1200	2500	0.15	0.2	7500

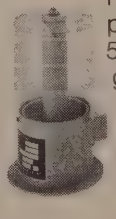
† Initial pulse response with one megohm in parallel with 20 pF load impedance. With the exception of the 2093, a 50 ohm termination will cut the output in half.
*Double Shielded **May need small bias current through secondary for maximum rating.

High Voltage Pulse Transformers



Pearson Electronics specializes in the design of high voltage pulse transformers, covering the range of 100kV to 500kV. Typical systems incorporating our pulse transformers include pulse modulators for klystron and traveling wave microwave tubes and voltage pulsers for particle accelerator injectors, x-ray tubes, and high power lasers.

Capacitive Voltage Dividers



Pearson high voltage coaxial capacitive dividers permit measurement of pulse voltages up to 500 kV. The incorporation of a simple yet elegant geometry assures precision, stability, and reliability. The units are designed for immersion in high voltage insulating oil and are frequently used in observing the output wave shape of our high voltage pulse transformers.

Contact us and we will send you engineering data.

PEARSON ELECTRONICS, INC.
1860 Embarcadero Road, Palo Alto, California 94303 U.S.A. • Phone (415) 494-6444 • Telex 171-412 • FAX (415) 494-6716

PICO Catalog Contents

SURFACE MOUNT TRANSFORMERS

A•2455

LOW PROFILE (.2" Height × .55 × .55)	A•2456-57
2 OHM TO 30K OHM; 400 Hz to 250 KHz; 100 MILLIWATT AT 1 KHz	A•2458-59
2 OHM TO 40K OHM; 400 Hz TO 100 KHz; 400 MILLIWATT AT 1 KHz	A•2460-61
20 OHM TO 100K OHM; 300 Hz TO 75KHz; 600 MILLIWATT AT 1 KHz	A•2462-63
20 OHM TO 250K OHM; 150 Hz TO 75 KHz; 1 WATT AT 1 KHz	A•2464-65
.75" × .375" TRANSFORMERS; 2 OHM TO 135K OHM; 75 Hz TO 30 KHz; 1.5 WATT AT 1 KHz	A•2466-67
.75" × .52" TRANSFORMERS; 2 OHM TO 135K OHM; 50 Hz TO 30 KHz; 2 WATT AT 1 KHz	A•2468-69
.75" × .82" TRANSFORMERS; 2 OHM TO 80K OHM; 20Hz TO 25 KHz; 3 WATT AT 1 KHz	A•2470-71
400 Hz POWER TRANSFORMERS. PRIMARY VOLTAGES OF 115V OR 26V. ULTRA-MINIATURE SIZE.	A•2472
PULSE TRANSFORMERS	A•2473
DC-DC CONVERTER TRANSFORMERS	A•2474-75
MIL-STD-1553 INTERFACE TRANSFORMERS/MULTIPLEX DATA BUS PULSE TRANSFORMERS	A•2476

PLUG-IN TRANSFORMERS

A•2477

1/4" × 1/4" TRANSFORMERS; 2 OHM TO 30K OHM; 400 Hz TO 250 KHz; 100 MILLIWATT AT 1 KHz	A•2478-79
.35" × .32" TRANSFORMERS; 2 OHM TO 40K OHM; 400 Hz TO 100 KHz; 400 MILLIWATT AT 1 KHz	A•2480-81
.35" × .46" TRANSFORMERS; 2 OHM TO 100K OHM; 300 Hz TO 100 KHz; 600 MILLIWATT AT 1 KHz	A•2482-83
.5" × .35" TRANSFORMERS; 2 OHM TO 100K OHM; 300 Hz TO 75 KHz; 600 MILLIWATT AT 1 KHz	A•2484-85
.5" × .5" TRANSFORMERS; 2 OHM TO 250K OHM; 150 Hz TO 75 KHz; 1 WATT AT 1 KHz	A•2486-87
.75" × .375" TRANSFORMERS; 2 OHM TO 135K OHM; 75 Hz TO 30 KHz; 1.5 WATT AT 1 KHz	A•2488-89
.75" × .52" TRANSFORMERS; 2 OHM TO 135K OHM; 50 Hz TO 30 KHz; 2 WATT AT 1 KHz	A•2490-91
.75" × .82" TRANSFORMERS; 2 OHM TO 80K OHM; 20Hz TO 25 KHz; 3 WATT AT 1 KHz	A•2492-93
MICROPHONE/TRANSDUCER AUDIO INPUT TRANSFORMERS ***Interchangeable with transformers made by Beyer Dynamic of Germany.***	A•2494
400 Hz POWER TRANSFORMERS. PRIMARY VOLTAGES OF 115V OR 26V. PLUG-IN CONSTRUCTION. ULTRA-MINIATURE SIZE.	A•2495
PULSE TRANSFORMERS .05μSEC TO 100μSEC WITH MINIATURIZED PLUG-IN CONSTRUCTION	A•2496
PLUG-IN PULSE TRANSFORMERS	A•2497
MIL-STD-1553 INTERFACE TRANSFORMERS/MULTIPLEX DATA BUS PULSE TRANSFORMERS	A•2498
QPL STANDARDS (MIL-T-21038/27C)	A•2499
ULTRA MINIATURE DC-DC CONVERTER TRANSFORMERS	A•2500-01
MINIATURIZED SWITCHMODE INVERTER TRANSFORMERS; ***50KHz—150KHz/10 Watts—60 Watts***	A•2502-03
MINIATURE FLYBACK CONVERTER TRANSFORMERS; ***50 KHz-100 KHz/10 Watts-50 Watts***	A•2504-05

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• EMI Common Mode Suppression Inductors
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• New AC-DC Power Supplies 0.5" ht., up to 200 Watts
Pages **D**•1859 through 1873

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Pages **D**•2137 through 2184

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Delivery: Stock to one week

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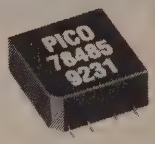
FAX: 914-699-5565

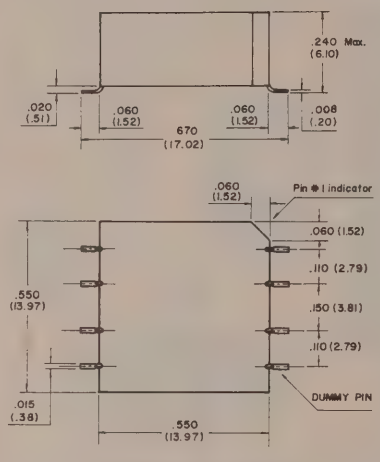
PICO Electronics, Inc.

453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552

New Surface Mount (.2″Ht.×.55″×.55″)

LOW PROFILE AUDIO TRANSFORMERS





TERMINALS ARE CLOCKWISE FROM PIN #1

All dimensions are in inches, ( ) = MM

PICO PART NUMBER	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	PAR	POWER WATTS 1 KHz and higher	300 Hz and higher	PRIMARY UNBAL DC CURRENT ma	PRIMARY DC RESISTANCE OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	PAR CONN	TURNS/RATIO PRIM/SEC SEC SER CONN	SEC PAR CONN	PICO PRICES 1-9 ***
78003	10 ct	10 ct	2 5	4	.050	31 6	83	1 16	.29	1:1	2 1	26.76
78005	20 ct	8 ct	2	4	050	22.3	1 66	93	23	1.58 1	3 16 1	26.76
78010	20 ct	20 ct	5	4	050	22 3	1 66	2 33	58	1.1	2 1	26.76
78015	32 ct	32 ct	8	4	.050	17.6	2 66	3.73	93	1:1	2 1	26.76
78020	40 ct	40 ct	10	4	050	15.8	3 33	4.66	1 16	1 1	2 1	26.76
78025	48 ct	16 ct	4	4	050	14 4	4	1 86	46	1 73:1	3 46 1	28.40
78030	50 ct	50 ct	12 5	4	050	14 1	4 16	5 8	1 45	1.1	2 1	28.40
78035	80 ct	32 ct	8	4	050	11 1	6 66	3 73	93	1.58.1	3 16.1	33 71
78040	100 ct	40 ct	10	4	050	10	8 33	4 66	1 16	1 58 1	3.16 1	28.40
78045	100 ct	100 ct	25	.4	050	10	8.33	11.6	2.91	1:1	2:1	25.54
78050	120 ct	12 8 ct	3 2	4	050	9 1	10	1 49	37	3 06 1	6 12 1	25.54
78055	120 ct	60 ct	15	.4	050	9.1	10	7	1 75	1 41:1	2 83:1	33.71
78060	120 ct	120 ct	30	4	050	9 1	10	14	3 5	1 1	2 1	33.71
78065	150 ct	12 ct	3	4	050	8.2	12 5	1 4	35	3 54 1	7 08.1	25.54
78070	150 ct	50 ct	12 5	4	050	8 2	12 5	5 8	1 45	1 73:1	3 46 1	28.40
78075	150 ct	100 ct	25	4	050	8 2	12 5	11 6	2 91	1 22:1	2 45 1	28.40
78080	150 ct	150 ct	37 5	4	050	8 2	12 5	17 5	4 37	1 1	2 1	33.71
78085	150 ct	600 ct	150	4	050	8 2	12 5	70	17 5	1 2	1 1	28.40
78090	200 ct	200 ct	50	4	050	7	16 6	23.3	5 83	1:1	2 1	28.40
78095	300 ct	12 ct	3	4	050	5 8	25	1 4	35	5 1	10 1	25.54
78100	300 ct	50 ct	12 5	.4	050	5 8	25	5 8	1 45	2 45 1	4 9 1	28.40
78105	300 ct	150 ct	37 5	.4	050	5 8	25	17 5	4 37	1 41 1	2 83 1	28.40
78110	300 ct	300 ct	75	.4	050	5 8	25	35	8 75	1 1	2 1	33.71
78115	300 ct	600 ct	150	.4	050	5 8	25	70	17 5	1 1 41	1 41 1	25.54
78120	320 ct	12 8 ct	3 2	4	050	5 6	26 6	1 49	37	5 1	10 1	25.54
78125	400 ct	40 ct	10	.4	050	5	33 3	4 66	1 16	3 16 1	6 32 1	33.71
78130	400 ct	120 ct	30	.4	050	5	33.3	14	3 5	1 83 1	3 65 1	33.71
78135	400 ct	200 ct	50	.4	050	5	33 3	23 3	5 83	1 41:1	2 83 1	28.40
78140	400 ct	400 ct	100	.4	050	5	33 3	46 6	11 66	1:1	2 1	33.71
78145	400 ct	1000 ct	250	.4	050	5	33 3	116 6	29 16	1 1 58	1 26 1	38.68
78150	400 ct	2000 ct	500	.4	050	5	33 3	233 3	58 3	1 2 24	1 1 12	38.68
78155	400 ct	4000 ct	1000	.4	050	5	33 3	466 6	116 6	1 3.16	1 1 58	34.93
78160	500 ct	12.8 ct	3 2	.4	050	4 5	41 6	1 49	37	6 25 1	12 5 1	29.60
78165	500 ct	16 ct	4	.4	050	4 5	41 6	1 86	46	5 6 1	11 2 1	29.60
78170	500 ct	50 ct	12 5	.4	050	4 5	41 6	5 83	1 45	3 16:1	6 32 1	29.60
78175	500 ct	150 ct	37 5	.4	050	4 5	41 6	17 5	4 37	1 83 1	3 65 1	29.60
78180	500 ct	500 ct	125	.4	050	4 5	41 6	58 3	14 58	1 1	2 1	29.60
78185	*500 ct	500 ct	–	.4	050	4 5	41 6	58 3	14 58–	1.1	–	29.60
78190	500 ct	600 ct	150	.4	050	4 5	41 6	70	17 5	1 1.1	1 83 1	29.60
78195	600 ct	12 8 ct	3 2	.4	050	4 1	50	1 49	37	6 85 1	13 7 1	25.54
78200	600 ct	30 ct	7 5	.4	050	4 1	50	3 5	875	4 47 1	8 94 1	26.76
78205	600 ct	48 ct	12	.4	050	4 1	50	5 6	1 4	3 54 1	7 07 1	26.76
78210	600 ct	200 ct	50	.4	050	4 1	50	23 3	5.83	1 73 1	3 46 1	26.76
78215	600 ct	600 ct	150	.4	050	4 1	50	70	17 5	1:1	2 1	26.76
78220	*600 ct	600 ct	–	.4	050	4 1	50	70	17 5–	1 1	–	29.60
78225	600 ct	1200 ct	300	.4	050	4 1	50	140	35	1 1.41	1 41 1	26.76
78230	640 ct	12.8 ct	3.2	.4	050	3 9	53 3	1 49	37	7 07 1	14 4 1	26.76
78235	700 ct	100 ct	25	.4	050	3 8	58 3	11 6	2 91	2 65:1	5 29 1	26.76
78240	800 ct	12.8 ct	3 2	.4	050	3 5	66 6	1 49	.37	7.9:1	15.8 1	26.76
78245	800 ct	48 ct	12	.4	050	3 5	66 6	5 6	1 4	4 08.1	8 16 1	39.94
78250	800 ct	800 ct	200	.4	050	3 5	66 6	93 3	23.3	1 1	2 1	26.76
78255	900 ct	600 ct	150	.4	050	3 3	75	70	17 5	1 22:1	2 45.1	26.76
78260	1000 ct	12 ct	3	.4	050	3 2	83 3	1.4	35	9 13 1	18 3 1	26.76
78265	1000 ct	50 ct	12.5	.4	050	3 2	83 3	5 83	1 45	4 47.1	8 94 1	29.60
78270	1000 ct	1000 ct	250	.4	050	3 2	83.3	116 6	29 15	1 1	2 1	29.60

SPECIFICATIONS:

- **MIL-T-27:** All units manufactured to MIL-T-27. Military Designation is TF5S21ZZ for Transformers.
- **FREQUENCY RESPONSE:** ±2dB, 300 Hz-50 KHz at 1.0 Milliwatt.

MAXIMUM DISTORTION: 5% With Rated Power Level at 1 KHz and 300 Hz.

DIELECTRIC STRENGTH: All Units Tested at 200 V RMS.

- **INSULATION RESISTANCE:** Greater Than 10,000 Megohms at 300 V DC.
- **WEIGHT:** 3 Grams

OPERATING TEMPERATURE: −55°C to +130°C

- **TERMINALS:** Solderability per MIL-STD-202 Method 208.
- **THERMAL SHOCK:** 25 Cycles, Method 107D, MIL-STD-202E, Test Condition A-1.

***Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

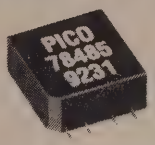
Delivery— stock to one week

For immediate engineering assistance or to place an order— ***Call Toll Free 800-228-9747***

PICO Electronics, Inc.

453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552 • • FAX 914-699-5565

LOW PROFILE AUDIO TRANSFORMERS

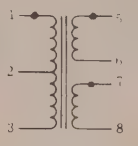


SURFACE MOUNT
PICO surface mount units utilize materials and methods to withstand extreme temperature (220°C) of vapor phase, I.R., and other reflow procedures without degradation of electrical or mechanical characteristics.

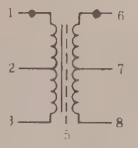
PICO PART NUMBER	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS PAR	POWER WATTS 1 KHz and higher	POWER WATTS 300 Hz and higher	PRIMARY UNBAL DC CURRENT ma	PRIMARY DC RESISTANCE OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	SECONDARY DC RESISTANCE OHMS PAR CONN	TURNS/RATIO PRIM/SEC SEC SER CONN	TURNS/RATIO PRIM/SEC SEC PAR CONN	PICO PRICES 1-9 ***
78275	1060 ct	12 8 ct	3 2	4	.050	3 1	88.3	1 49	37	9 1·1	18 2 1	26.76
78280	1200 ct	12.8 ct	3.2	4	.050	2.9	100	1 49	.37	9 68.1	19.4.1	25.54
78285	1200 ct	500 ct	125	4	050	2 9	100	58.3	14 58	1 55 1	3.1 1	25.54
78290	1200 ct	*1200 ct	300	4	050	2 9	100	140	35	1.1	2·1	25.54
78295	*1200 ct	1200 ct	–	4	.050	2.9	100	140	35	1 1	–	33.71
78300	1500 ct	12 ct	3	4	050	2 6	125	1.4	35	11 2.1	22.4 1	26.76
78305	1500 ct	500 ct	125	4	050	2 6	125	58 3	14.58	1 73 1	3 46 1	29.60
78310	*1500 ct	600 ct	–	4	050	2 6	125	70	17.5	1 58.1	–	29.60
78315	*1500 ct	1500 ct	–	4	050	2 6	125	175	43 75	1 1	–	29.60
78320	1600 ct	12.8 ct	3 2	4	050	2 5	133 3	1 49	37	11 2 1	22 4 1	26.76
78325	2000 ct	8 ct	2	4	050	2 2	166 6	93	23	15 8·1	31 6 1	34.93
78330	2000 ct	2000 ct	500	4	050	2.2	166 6	233 3	58 33	1 1	2 1	34.93
78335	*2000 ct	2000 ct	–	4	.050	2 2	166.6	233 3	58 33	1 1	–	38.68
78340	2000 ct	8000 ct	2000	4	050	2	166 6	933 3	233 3	1·2	1 1	34.93
78345	2000 ct	2500 ct	625	4	050	1 8	166 6	291 6	72 9	1 1	2:1	34.93
78350	3000 ct	3000 ct	725	4	050	1.8	250	350	87 5	1 1	2 1	28.40
78355	*3000 ct	3000 ct	–	4	050	1 7	250	350	87 5	1·1		38.68
78360	3600 ct	3600 ct	900	4	050	1 6	300	420	105	1 1	2 1	28.40
78365	4000 ct	16 ct	4	4	050	1 6	333 3	1 86	46	15 8 1	31 6 1	34.93
78370	4000 ct	600 ct	150	4	050	1 6	333 3	70	17 5	2 58 1	5.16 1	34.93
78375	4000 ct	1000 ct	250	4	050	1 6	333.3	116 6	29 16	2 1	4:1	38.68
78380	*4000 ct	8000 ct	–	4	050	1 4	333 3	933 3	233 3	1 1 41	-	38.68
78385	5000 ct	500 ct	125	4	050	1 4	416 6	58 3	14 58	3 16 1	6 32 1	29.60
78390	5000 ct	5000 ct	1250	4	050	1.2	416 6	583 3	145 8	1 1	2 1	29.60
78395	7500 ct	50 ct	12 5	4	050	1 2	625	5 83	1 45	12 2 1	24 5 1	29.60
78400	7500 ct	100 ct	25	4	050	1 2	625	11 66	2 91	8 66 1	17 3 1	29.60
78405	7500 ct	600 ct	150	.4	.050	1.2	625	70	17 5	3.54.1	7.07.1	33.71
78410	7500 ct	2500 ct	625	.4	.050	1.2	625	291.6	72.9	1.73:1	3.46·1	33.71
78415	*7500 ct	7500 ct	–	.4	050	1.1	625	875	218.75	1:1	–	38.68
78420	8000 ct	12.8 ct	3.2	.4	.050	1.1	666.6	1.49	.37	25:1	50:1	29.60
78425	8000 ct	1000 ct	250	.4	.050	1.1	666 6	116.6	29.16	2.83:1	5.66·1	33.71
78430	*8000 ct	1200 ct	–	.4	.050	1.1	666.6	140	35	2.58:1	–	38.68
78435	*9000 ct	9000 ct	–	.4	.050	1.0	750	1050	262.5	1:1	–	38.68
78440	10000 ct	12.8 ct	3 2	4	050	1 0	833	1.49	37	28 1	56 1	26.76
78445	10000 ct	16 ct	4	4	050	1.0	833	1 86	46	25:1	50 1	26.76
78450	10000 ct	100 ct	25	4	050	1 0	833	11 66	2 91	10 1	20 1	29.60
78455	10000 ct	200 ct	50	4	050	1 0	833	23 3	5 83	7 07 1	14 14·1	29.60
78460	10000 ct	500 ct	125	4	050	1 0	833	58 3	14 58	4 47.1	8 94 1	29.60
78465	10000 ct	600 ct	150	4	050	1 0	833	70	17 5	4 08.1	8 16 1	29.60
78470	10000 ct	1000 ct	250	4	050	1 0	833	116.6	29 16	3 16 1	6 32 1	29.60
78475	10000 ct	1200 ct	300	4	050	1.0	833	140	35	2 89 1	5 77 1	34.93
78480	10000 ct	1500 ct	375	.4	050	1.0	833	175	43 75	2 58·1	5 16.1	34.93
78485	10000 ct	2000 ct	500	4	050	1.0	833	233 33	58 33	2 24:1	4 47 1	34.93
78490	10000 ct	5000 ct	1250	4	050	1 0	833	583 3	145 83	1 41 1	2 83 1	34.93
78495	10000 ct	7500 ct	1875	4	050	1 0	833	875	218 75	1 15·1	2 3.1	34.93
78500	10000 ct	10000 ct	2500	4	050	1 0	833	1166 6	291 6	1 1	2 1	33 71
78505	10000 ct	10000 ct	–	4	.050	1 0	833	1166 6	291 6	1 1	–	38.68

***Discount Prices: 1–9 Net: 10–24 less 10%; 25–49 less 16%; 50–99 less 23%; 100–499 less 30%
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York

SCHEMATICS FOR TRANSFORMERS WITH SPLIT SECONDARIES



SCHEMATICS FOR TRANSFORMERS WITH ELECTROSTATIC SHIELD



FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- PICO IS APPROVED QPL SOURCE (MIL-T-27)
- MAGNETIC SHIELD DESIGN AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED
- VARIATION OF STANDARD DESIGNS AVAILABLE
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION CONTACT FACTORY FOR DETAILS

THIS PRODUCT IS PATENTED

New Surface Mount (.2"Ht.×.55"×.55")

For immediate engineering assistance or to place an order— ***Call Toll Free 800-228-9747***

Delivery— stock to one week

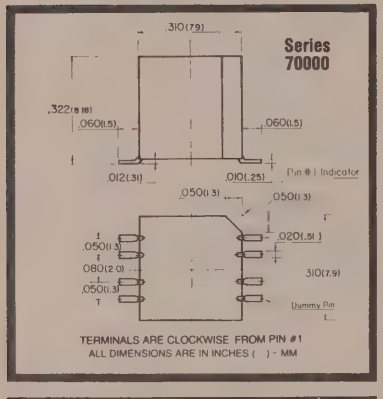
PICO Electronics, Inc.

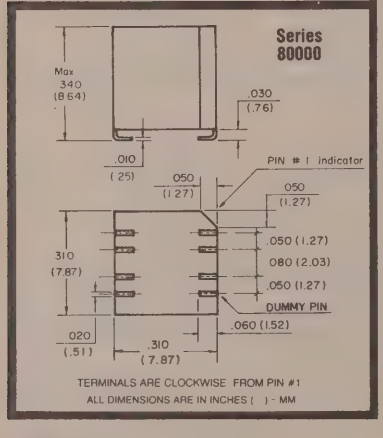
453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552 • • FAX 914-699-5565

SURFACE MOUNT

PICO surface mount units utilize materials and methods to withstand extreme temperature (220°C) of vapor phase, I.R., and other reflow procedures without degradation of electrical or mechanical characteristics.

PICO's ultra-miniature transformers





Gull Wing PICO PART NUMBER	J Lead PICO PART NUMBER	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	SER	POWER MILLIWATTS 1 KHz and higher	400 Hz and higher	PRIMARY UNBAL DC CURRENT ma	PRIMARY DC RESISTANCE OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	PAR CONN	TURNS/RATIO PRIM/SEC SEC SER CONN	SEC PAR CONN	PICO PRICES 1-9 ***
70003	80003	10 ct	10 ct	2.5	125	20	11.5	1.1	1.35	.34	1:1	2:1	29.01
70005	80005	20 ct	8 ct	2	125	20	8	2.1	1.28	.32	1.58:1	3.16:1	29.01
70010	80010	20 ct	20 ct	5	125	20	8	2.1	2.56	.64	1:1	2:1	29.01
70015	80015	32 ct	32 ct	8	125	20	6.5	3.52	4.32	1.08	1:1	2:1	29.01
70020	80020	40 ct	40 ct	10	125	20	5.6	4	4.77	1.19	1:1	2:1	28.78
70025	80025	48 ct	16 ct	4	125	20	5.2	4.3	2.3	.58	1.73:1	3.46:1	26.37
70030	80030	50 ct	50 ct	12.5	125	20	5	5.5	6.6	1.65	1:1	2:1	26.37
70035	80035	80 ct	32 ct	8	125	20	4	8.5	4.25	1.06	1.58:1	3.16:1	28.78
70040	80040	100 ct	40 ct	10	125	20	3.6	12.1	4.85	1.21	1.58:1	3.16:1	28.78
70045	80045	100 ct	100 ct	25	125	20	3.6	12.1	12	3	1:1	2:1	26.37
70050	80050	120 ct	12.8 ct	3.2	125	20	3.3	13.2	1.6	.4	3.06:1	6.12:1	26.37
70055	80055	120 ct	60 ct	15	125	20	3.3	13.2	7.3	1.83	1.41:1	2.83:1	31.54
70060	80060	120 ct	120 ct	30	125	20	3.3	13.2	16	4	1:1	2:1	31.54
70065	80065	150 ct	12 ct	3	125	20	3	15	1.56	.39	3.54:1	7.07:1	30.53
70070	80070	150 ct	50 ct	12.5	125	20	3	15	6.6	1.65	1.73:1	3.46:1	31.54
70075	80075	150 ct	100 ct	25	125	20	3	15	14.5	3.63	1.22:1	2.45:1	31.54
70080	80080	150 ct	150 ct	37.5	125	20	3	15	18.3	4.58	1:1	2:1	31.54
70085	80085	150 ct	600 ct	150	125	20	3	15	72	18	1:2	1:1	31.54
70090	80090	200 ct	200 ct	50	125	20	2.5	22	25.8	6.7	1.1	2:1	31.54
70095	80095	300 ct	12 ct	3	125	20	2	33	1.56	.39	5:1	10:1	31.54
70100	80100	300 ct	50 ct	12.5	125	20	2	33	6.6	1.65	2.45:1	4.9:1	31.54
70105	80105	300 ct	150 ct	37.5	125	20	2	33	18.3	4.58	1.1.41	2.83:1	31.54
77110	80110	300 ct	300 ct	75	125	20	2	33	40.3	10.08	1:1	2:1	31.54
70115	80115	300 ct	600 ct	150	125	20	2	33	72	18	1:1.41	1.41:1	28.67
70120	80120	320 ct	12.8 ct	3.2	125	20	2	34	1.6	0.4	5:1	10:1	33.82
70125	80125	400 ct	40 ct	10	125	20	1.8	49	4.7	1.18	3.16:1	6.32:1	33.82
70130	80130	400 ct	120 ct	30	125	20	1.8	49	16.3	4.08	1.83:1	3.65:1	33.82
70135	80135	400 ct	200 ct	50	125	20	1.8	49	27.3	6.83	1.41.1	2.83:1	33.82
70140	80140	400 ct	400 ct	100	125	20	1.8	49	49	12.25	1:1	2:1	30.75
70145	80145	400 ct	1000 ct	250	125	20	1.8	48	120	30	1.1.58	1.26.1	33.82
70150	80150	400 ct	2000 ct	500	125	20	1.8	49	270	67.5	1.2.24	1:1.12	33.82
70155	80155	400 ct	4000 ct	1000	125	20	1.8	49	476	119	1:3.16	1.1.58	33.82
70160	80160	500 ct	12.8 ct	3.2	125	20	1.6	54	1.6	0.4	6.25:1	12.5:1	30.75
70165	80165	500 ct	16 ct	4	125	20	1.6	54	2.3	0.58	5.6.1	11.2:1	30.75
70170	80170	500 ct	50 ct	12.5	125	20	1.6	54	6.6	1.65	3.16:1	6.32:1	30.75
70175	80175	500 ct	150 ct	37.5	125	20	1.6	54	18.3	4.58	1.83.1	3.65:1	30.75
70180	80180	500 ct	500 ct	125	125	20	1.6	54	65	16.3	1:1	2:1	33.82
70185	80185	*500 ct	500 ct	–	125	20	1.6	54	65	–	1:1	–	33.82
70190	80190	500 ct	600 ct	150	125	20	1.6	54	72	18	1.1.1	1.83:1	33.82
70195	80195	600 ct	12.8 ct	3.2	125	20	1.5	59	1.6	0.4	6.85:1	13.7:1	33.82
70200	80200	600 ct	30 ct	7.5	125	20	1.5	59	4.1	1.03	4.47.1	8.94:1	30.75
70205	80205	600 ct	48 ct	12	125	20	1.5	59	5.2	1.3	3.54.1	7.07:1	30.75
70210	80210	600 ct	200 ct	50	125	20	1.5	59	26.5	6.63	1.73:1	3.46:1	30.75
70215	80215	600 ct	600 ct	150	125	20	1.5	59	72	18	1:1	2:1	30.75
70220	80220	*600 ct	600 ct	–	125	20	1.5	59	72	–	1:1	–	33.82
70225	80225	600 ct	1200 ct	300	125	20	1.5	59	160	40	1.1.41	1.41.1	31.54
70230	80230	640 ct	12.8 ct	3.2	125	20	1.5	62	1.6	0.4	7.07.1	14.14.1	31.54
70235	80235	700 ct	100 ct	25	125	20	1.35	65	12	3	2.65.1	5.29:1	31.54
70240	80240	800 ct	12.8 ct	3.2	125	20	1.3	88	15	4	7.9:1	15.8:1	33.82
70245	80245	800 ct	48 ct	12	125	20	1.3	88	6.7	1.68	4.08.1	8.16:1	30.75
70250	80250	800 ct	800 ct	200	125	20	1.3	88	106	26.5	1.1	2:1	30.75
70255	80255	900 ct	600 ct	150	125	20	1.2	93	74	18.5	1.22.1	2.45.1	30.75
70260	80260	1000 ct	12 ct	3	125	20	1.2	120	1.55	0.39	9.13:1	18.3:1	34.71
70265	80265	1000 ct	50 ct	12.5	125	20	1.2	120	6.6	1.65	4.47.1	8.94:1	34.71
70270	80270	*1000 ct	1000 ct	250	125	20	1.2	120	120	30	1.1	2:1	31.54
70275	80275	1060 ct	12.8 ct	3.2	125	20	1.2	125	1.6	0.4	9.1:1	18.2:1	34.71
70280	80280	1200 ct	12.8 ct	3.2	125	20	1	133	1.6	0.4	9.68.1	19.4:1	34.71
70285	80285	1200 ct	500 ct	125	125	20	1	133	65	16.25	1.55.1	3.1:1	34.71
70290	80290	1200 ct	1200 ct	300	125	20	1	133	160	40	1.1	2:1	34.71
70295	80295	*1200 ct	1200 ct	–	125	20	1	133	160	–	1:1	–	34.71
70300	80300	1500 ct	12 ct	3	125	20	1	180	1.55	0.39	11.2:1	22.4:1	34.71
70305	80305	1500 ct	500 ct	125	125	20	1	180	65	16.3	1.73.1	3.46:1	31.54
70310	80310	*1500 ct	600 ct	–	125	20	1	180	73	–	1.58.1	--	31.54
70315	80315	*1500 ct	1500 ct	–	125	20	1	180	215	–	1:1	–	34.71
70320	80320	1600 ct	12.8 ct	3.2	125	20	1	190	1.6	0.4	11.2:1	22.4:1	34.71
70325	80325	2000 ct	8 ct	2	125	20	0.8	218	1	.25	15.8:1	31.6:1	34.71
70330	80330	2000 ct	2000 ct	500	125	20	0.8	218	260	65	1.1	2:1	34.71
70335	80335	*2000 ct	2000 ct	–	125	20	0.8	218	260	–	1:1	–	34.71
70340	80340	2000 ct	8000 ct	2000	125	20	0.8	218	830	207.5	1.2	1:1	33.82

*INCLUDES ELECTROSTATIC SHIELD

***Discount Prices: 1–9 Net: 10–24 less 10%; 25–49 less 16%; 50–99 less 23%; 100–499 less 30%
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

SPECIFICATIONS

- **MIL-T-27:** . . . . . All units manufactured to MIL-T-27, Military Designation is TF5S21ZZ for Transformers, TF5S20ZZ for inductors.
- **FREQUENCY RESPONSE:** ±3db, 400 Hz-250 KHz at 1.0 Milliwatt.
- **MAXIMUM DISTORTION:** . . . 5% With Rated Power Level at 1 KHz and 400 Hz.
- **DIELECTRIC STRENGTH:** All Units Tested at 200 V RMS.
- **INSULATION RESISTANCE:** Greater Than 10,000 Megohms at 300 V DC.
- **WEIGHT:** . . . . . 1.5 GRAMS
- **TERMINALS:** . . . . . Solderability per MIL-STD-202 Method 208.
- **THERMAL SHOCK:** . . . . . 25 Cycles, Method 107D, MIL-STD-202E, Test Condition A-1.

For immediate engineering assistance or to place an order— ***Call Toll Free 800-228-9747***

Delivery—stock to one week

PICO Electronics, Inc.

453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552 • • FAX 914-699-5565

Gull Wing PICO PART NUMBER	J Lead PICO PART NUMBER	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	PAR	POWER MILLIWATTS 1 KHz and higher	400 Hz and higher	PRIMARY UNBAL DC CURRENT ma	PRIMARY DC RESISTANCE OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	PAR CONN	TURNS/RATIO PRIM/SEC SEC SER CONN	SEC PAR CONN	PICO PRICES 1-9 ***
70345	80345	2500 ct	2500 ct	625	125	20	0.75	280	280	70	1:1	2:1	33 82
70350	80350	3000 ct	3000 ct	725	125	20	0.65	330	330	82.5	1:1	2:1	33.82
70355	80355	*3000 ct	3000 ct	–	125	20	0.65	330	330	–	1:1	–	33.82
70360	80360	3600 ct	3600 ct	900	125	20	0.6	370	450	112.5	1:1	2:1	33.82
70365	80365	4000 ct	16 ct	4	125	20	0.57	400	2.3	0.58	15.8:1	31.6:1	33.82
70370	80370	4000 ct	600 ct	150	125	20	0.57	400	73	18.25	2.58:1	5.16:1	33.82
70375	80375	4000 ct	1000 ct	250	125	20	0.57	400	120	30	2:1	4:1	33.82
70380	80380	*4000 ct	8000 ct	–	125	20	0.57	400	1070	–	1:1 41	–	37 18
70385	80385	5000 ct	500 ct	125	125	20	0.5	540	65	16.25	3.16:1	6.32:1	33.82
70390	80390	5000 ct	5000 ct	1250	125	20	0.5	540	650	162.5	1:1	2:1	33.82
70395	80395	7500 ct	50 ct	12.5	125	20	0.5	835	6.6	1.65	12.2 1	24.5:1	37.18
70400	80400	7500 ct	100 ct	25	125	20	0.4	835	12	3	8.66:1	17.3:1	34.16
70405	80405	7500 ct	600 ct	150	125	20	0.4	835	72	18	3 54.1	7.07:1	34.16
70410	80410	7500 ct	2500 ct	625	125	20	0.4	835	280	70	1.73:1	3.46:1	34.16
70415	80415	*7500 ct	7500 ct	–	125	20	0.4	835	1020	–	1:1	–	34.16
70420	80420	8000 ct	12.8 ct	3.2	125	20	0.4	865	1.6	0.4	25:1	50:1	37 18
70425	80425	8000 ct	1000 ct	250	125	20	0.4	865	120	30	2.83:1	5.66:1	37.18
70430	80430	*8000 ct	1200 ct	–	125	20	0.4	865	160	–	2.58:1	–	37.18
70435	80435	*9000 ct	9000 ct	–	125	20	0.4	1160	1160	–	1:1	–	37.18
70440	80440	10,000 ct	12.8 ct	3.2	125	20	0.36	1200	1.6	0.4	28:1	56:1	37.18
70445	80445	10,000 ct	16 ct	4	125	20	0.36	1200	1.77	0.44	25:1	50:1	34.16
70450	80450	10,000 ct	100 ct	25	125	20	0.36	1200	12	3	10:1	20:1	34.16
70455	80455	10,000 ct	200 ct	50	125	20	0.36	1200	27	6.75	7.07:1	14.14:1	34 16
70460	80460	10,000 ct	500 ct	125	125	20	0.36	1200	65	16.25	4.47:1	8.94:1	34.16
70465	80465	10,000 ct	600 ct	150	125	20	0.36	1200	72	18	4.08:1	8.16:1	34.16
70470	80470	10,000 ct	1000 ct	250	125	20	0.36	1200	120	30	3.16:1	6.32:1	34 16
70475	80475	10,000 ct	1200 ct	300	125	20	0.36	1200	160	40	2.88:1	5.77:1	34.16
70480	80480	10,000 ct	1500 ct	375	125	20	0.36	1200	215	53.8	2.58:1	5.16:1	34.71
70485	80485	10,000 ct	2000 ct	500	125	20	0.36	1200	260	65	2.24:1	4.47:1	34.71
70490	80490	10,000 ct	5000 ct	1250	125	20	0.36	1200	650	162.5	1.41:1	2.83:1	34.71
70495	80495	10,000 ct	7500 ct	1875	125	20	0.36	1200	1020	255	1.15:1	2.3:1	34.71
70500	80500	10,000 ct	10,000 ct	2500	125	20	0.36	1200	1200	300	1:1	2:1	31.54
70505	80505	*10,000 ct	10,000 ct	–	125	20	0.36	1200	1440	–	1:1	–	37.18
70510	80510	15,000 ct	400 ct	100	100	15	0.35	1420	43	10.75	6.12:1	12.24:1	34.16
70515	80515	15,000 ct	500 ct	125	100	15	0.35	1420	49	12.25	5.48:1	10.95:1	34.16
70520	80520	15,000 ct	600 ct	150	100	15	0.35	1420	68	17	5:1	10:1	34.16
70525	80525	15,000 ct	10,000 ct	2500	100	15	0.35	1420	1100	275	1.22:1	2.45:1	34.16
70530	80530	*15,000 ct	15,000 ct	–	100	15	0.35	1420	1730	–	1:1	–	37.18
70535	80535	15,000 ct	15,000 ct	3750	100	15	0.35	1420	1730	433	1:1	2:1	34.71
70540	80540	16,000 ct	1000 ct	250	100	15	0.35	1500	115	28.75	4:1	8:1	34.71
70545	80545	20,000 ct	500 ct	125	100	15	0.3	1600	60	15	6.33.1	12.65:1	37.18
70550	80550	20,000 ct	600 ct	150	100	15	0.3	1600	66	16.5	5.77:1	11.55:1	37.18
70555	80555	20,000 ct	800 ct	200	100	15	0.3	1600	94	23.5	5:1	10:1	37 18
70560	80560	20,000 ct	1000 ct	250	100	15	0.3	1600	106	26.5	4 47:1	8.94:1	37.18
70565	80565	20,000 ct	5000 ct	1250	100	15	0.3	1600	600	150	2:1	4:1	37.18
70570	80570	20,000 ct	10,000 ct	2500	100	15	0.3	1600	1100	275	1.41:1	2.83:1	37.18

*INCLUDES ELECTROSTATIC SHIELD

***Discount Prices: 1–9 Net: 10–24 less 10%; 25–49 less 16%; 50–99 less 23%; 100–499 less 30%
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

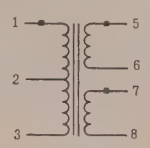
INDUCTORS

PART NUMBER	PART NUMBER	INDUCTANCE	DC CURRENT ma	DC RESISTANCE OHMS	PRICES 1–9***
70825	80825	SERIES { 10 0 / 2 75 } PARALLEL { 2 5 / .65 }	0 / 2 / 0 / 4	2250 / 560	30 02
70830	80830	SERIES { 5.5 / 1.5 } PARALLEL { 1.3 / .40 }	0 / 2 / 0 / 4	1000 / 250	30.02
70835	80835	SERIES { .85 / .25 } PARALLEL { 21 / 06 }	1 / 6 / 2 / 12	240 / 60	30.02
70840	80840	SERIES { 6 / .15 } PARALLEL { 15 / 04 }	0 / 5 / 0 / 10	144 / 36	30.02

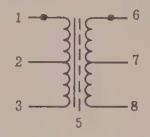
SURFACE MOUNT

SERIES 70000 SERIES 80000

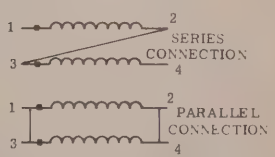
SCHEMATIC FOR TRANSFORMERS WITH SPLIT SECONDARIES



SCHEMATIC FOR TRANSFORMERS WITH ELECTROSTATIC SHIELD



SCHEMATIC FOR INDUCTORS



FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- PICO IS APPROVED QPL SOURCE (MIL-T-27)
- MAGNETIC SHIELD DESIGN AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED
- VARIATION OF STANDARD DESIGNS AVAILABLE
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS.

THIS PRODUCT IS PATENTED

INDUCTORS

ALL INDUCTORS HAVE SPLIT WINDINGS AND MEASUREMENTS ARE LISTED FOR BOTH SERIES AND PARALLEL CONNECTIONS. TWO VALUES OF INDUCTANCE, EACH AT A PARTICULAR VALUE OF D.C. CURRENT, ARE LISTED FOR EACH INDUCTOR.

For immediate engineering assistance or to place an order— ***Call Toll Free 800-228-9747***

Delivery— stock to one week

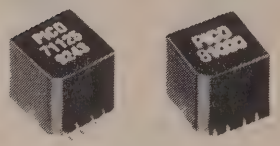
PICO Electronics, Inc.

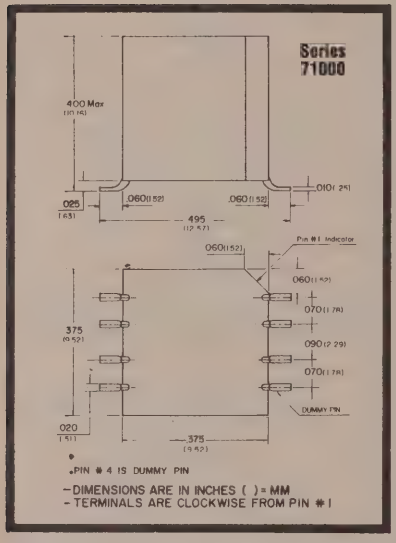
453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552 • • FAX 914-699-5565

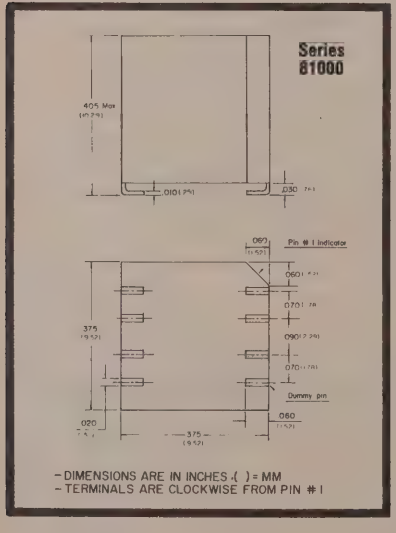
SURFACE MOUNT

PICO surface mount units utilize materials and methods to withstand extreme temperature (220°C) of vapor phase, I.R., and other reflow procedures without degradation of electrical or mechanical characteristics.

PICO's ultra-miniature transformers







Gull Wing PICO PART NUMBER	J Lead PICO PART NUMBER	PRIMARY IMPED OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	PAR	POWER WATTS 1 KHz and higher	400 Hz and higher	PRIMARY UNBAL DC CURRENT ma	PRIM DC RESIST OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	PAR CONN	TURNS/RATIO PRIM/SEC SEC SER CONN	SEC PAR CONN	PICO PRICES 1-9 ***
71003	81003	10 ct	10 ct	2.5	.4	.075	31.6	1.1	1.3	.33	1:1	2:1	21.41
71005	81005	20 ct	8 ct	2	.4	.075	22.3	2.2	1	.25	1.58:1	3.16:1	21.41
71010	81010	20 ct	20 ct	5	.4	.075	22.3	2.2	2.6	.65	1:1	2:1	21.41
71015	81015	32 ct	32 ct	8	.4	.075	17.6	3.5	4.2	1.05	1:1	2:1	21.41
71020	81020	40 ct	40 ct	10	.4	.075	15.8	4	4.5	1.2	1:1	2:1	21.41
71025	81025	48 ct	16 ct	4	.4	.075	14.4	5.3	1.9	.48	1.73:1	3.46:1	22.72
71030	81030	50 ct	50 ct	12.5	.4	.075	14.1	5.6	6.5	1.6	1:1	2:1	22.72
71035	81035	80 ct	32 ct	8	.4	.075	11.1	8	4	1	1.58:1	3.16:1	26.97
71040	81040	100 ct	40 ct	10	.4	.075	10	10	4.5	1.2	1.58:1	3.16:1	22.72
71045	81045	100 ct	100 ct	25	.4	.075	10	10	12	3	1:1	2:1	20.43
71050	81050	120 ct	12.8 ct	3.2	.4	.075	9.1	12	1.5	.38	3.06:1	6.12:1	20.43
71055	81055	120 ct	60 ct	15	.4	.075	9.1	12	7.2	1.8	1.41:1	2.83:1	26.97
71060	81060	120 ct	120 ct	30	.4	.075	9.1	12	14.5	3.6	1:1	2:1	26.97
71065	81065	150 ct	12 ct	3	.4	.075	8.2	15	1.5	.38	3.54:1	7.08:1	20.43
71070	81070	150 ct	50 ct	12.5	.4	.075	8.2	15	6	1.5	1.73:1	3.46:1	22.72
71075	81075	150 ct	100 ct	25	.4	.075	8.2	15	12	3	1.22:1	2.45:1	22.72
71080	81080	150 ct	150 ct	37.5	.4	.075	8.2	15	16.8	4.2	1:1	2:1	26.97
71085	81085	150 ct	600 ct	150	.4	.075	8.2	15	70	17.5	1:2	1:1	22.72
71090	81090	200 ct	200 ct	50	.4	075	7	20	24	6	1:1	2:1	22.72
71095	81095	300 ct	12 ct	3	.4	.075	5.8	30	1.5	.38	5:1	10:1	20.43
71100	81100	300 ct	50 ct	12.5	.4	.075	5.8	30	6	1.5	2.45:1	4.9:1	22.72
71105	81105	300 ct	150 ct	37.5	.4	.075	5.8	30	18	4.5	1.41:1	2.83:1	22.72
71110	81110	300 ct	300 ct	75	.4	.075	5.8	30	36	9	1:1	2:1	26.97
71115	81115	300 ct	600 ct	150	.4	.075	5.8	30	72	18	1:1.41	1.41:1	20.43
71120	81120	320 ct	12.8 ct	3.2	.4	.075	5.6	32	1.5	.38	5:1	10:1	20.43
71125	81125	400 ct	40 ct	10	.4	.075	5	40	4.5	1.1	3.16:1	6.32:1	26.97
71130	81130	400 ct	120 ct	30	.4	.075	5	40	14	3.5	1.83:1	3.65:1	26.97
71135	81135	400 ct	200 ct	50	.4	.075	5	40	24	6	1.41:1	2.83:1	22.72
71140	81140	400 ct	400 ct	100	.4	.075	5	40	48	12	1:1	2:1	26.97
71145	81145	400 ct	1000 ct	250	.4	.075	5	40	120	30	1:1.58	1.26:1	30.94
71150	81150	400 ct	2000 ct	500	.4	.075	5	40	240	60	1:2.24	1:1.12	30.94
71155	81155	400 ct	4000 ct	1000	.4	.075	5	40	480	120	1:3.16	1:1.58	27.94
71160	81160	500 ct	12.8 ct	3.2	.4	.075	4.5	50	1.5	.38	6.25:1	12.5:1	23.68
71165	81165	500 ct	16 ct	4	.4	.075	4.5	50	2	.5	5.6:1	11.2:1	23.68
71170	81170	500 ct	50 ct	12.5	.4	.075	4.5	50	6	1.5	3.16:1	6.32:1	23.68
71175	81175	500 ct	150 ct	37.5	.4	.075	4.5	50	16	4.5	1.83:1	3.65:1	23.68
71180	81180	500 ct	500 ct	125	.4	.075	4.5	50	60	15	1:1	2:1	23.68
71185	81185	*500 ct	500 ct	–	.4	.075	4.5	50	60	–	1:1	–	23.68
71190	81190	500 ct	600 ct	150	.4	.075	4.5	50	72	18	1:1.1	1.83:1	23.68
71195	81195	600 ct	12.8 ct	3.2	.4	.075	4.1	60	1.5	.38	6.85:1	13.7:1	20.43
71200	81200	600 ct	30 ct	7.5	.4	.075	4.1	60	3.6	.9	4.47:1	8.94:1	21.41
71205	81205	600 ct	48 ct	12	.4	.075	4.1	60	5.8	1.45	3.54:1	7.07:1	21.41
71210	81210	600 ct	200 ct	50	.4	.075	4.1	60	24	6	1.73:1	3.46:1	21.41
71215	81215	600 ct	600ct	150	.4	.075	4.1	60	72	18	1:1	2:1	21.41
71220	81220	*600 ct	600 ct	–	.4	.075	4.1	60	72	–	1:1	–	23.68
71225	81225	600 ct	1200 ct	300	.4	.075	4.1	60	144	36	1:1.41	1.41:1	21.41
71230	81230	640 ct	12 8 ct	3.2	.4	.075	3.9	64	1.5	.38	7.07:1	14.4:1	21.41
71235	81235	700 ct	100 ct	25	.4	.075	3.8	70	12	3	2.65:1	5.29:1	21.41
71240	81240	800 ct	12.8 ct	3.2	.4	.075	3.5	80	1.5	.38	7.9:1	15.8:1	21.41
71245	81245	800 ct	48 ct	12	.4	.075	3.5	80	5.8	1.45	4.08:1	8.16:1	31.95
71250	81250	800 ct	800 ct	200	.4	.075	3.5	80	96	24	1:1	2:1	21.41
71255	81255	900 ct	600 ct	150	.4	.075	3.3	90	72	18	1.22:1	2.45:1	21.41
71260	81260	1000 ct	12 ct	3	.4	.075	3.2	100	1.5	.38	9.13:1	18.3:1	21.41
71265	81265	1000 ct	50 ct	12.5	.4	.075	3.2	100	6	1.5	4.47:1	8.94:1	23.68
71270	81270	1000 ct	1000 ct	250	.4	.075	3.2	100	120	30	1:1	2:1	23.68
71275	81275	1060 ct	12.8 ct	3.2	.4	.075	3.1	106	1.5	.38	9.1:1	18.2:1	21.41
71280	81280	1200 ct	12.8 ct	3.2	.4	.075	2.9	120	1.5	.38	9.68:1	19.4:1	19.28
71285	81285	1200 ct	500 ct	125	.4	.075	2.9	120	60	15	1.55:1	3.1:1	19.28
71290	81290	1200 ct	1200 ct	300	.4	.075	2.9	120	140	35	1:1	2:1	19.28
71295	81295	*1200 ct	1200 ct	–	.4	.075	2.9	120	140	–	1:1	–	26.36
71300	81300	1500 ct	12 ct	3	.4	.075	2.6	150	1.5	.38	11.2:1	22.4:1	21.41
71305	81305	1500 ct	500 ct	125	.4	.075	2.6	150	60	15	1.73:1	3.46:1	23.68
71310	81310	*1500 ct	600 ct	–	.4	.075	2.6	150	72	–	1.58:1	–	23.68
71315	81315	*1500 ct	1500 ct	–	.4	.075	2.6	150	180	–	1:1	–	23.68
71320	81320	1600 ct	12.8 ct	3.2	.4	.075	2.5	160	1.5	.38	11.2:1	22.4:1	21.41
71325	81325	2000 ct	8 ct	2	.4	.075	2.2	200	1	.25	15.8:1	31.6:1	27.94
71330	81330	2000 ct	2000 ct	500	.4	.075	2.2	200	240	60	1:1	2:1	27.94
71335	81335	*2000 ct	2000 ct	–	.4	.075	2.2	200	240	–	1:1	–	30.94
71340	81340	2000 ct	8000 ct	2000	.4	.075	2.2	200	960	240	1:2	1:1	27.94
71345	81345	2500 ct	2500 ct	625	.4	.075	2	250	300	75	1:1	2:1	27.94

SPECIFICATIONS

- **MIL-T-27:** . . . . . All units manufactured to MIL-T-27, Military Designation is TF5S21ZZ for Transformers, TF5S20ZZ for Inductors.
- **FREQUENCY RESPONSE:** ±3db, 400 Hz-100 KHz at 1.0 Milliwatt.
- **MAXIMUM DISTORTION:** . . . 5% With Rated Power Level at 1 KHz and 400 Hz.
- **DIELECTRIC STRENGTH:** All Units Tested at 200 V RMS.
- **INSULATION RESISTANCE:** Greater Than 10,000 Megohms at 300 V DC.
- **WEIGHT:** . . . . . 3 Grams
- **TERMINALS:** . . . . . Solderability per MIL-STD-202 Method 208.
- **THERMAL SHOCK:** . . . . . 25 Cycles, Method 107D, MIL-STD-202E, Test Condition A-1.

*INCLUDES ELECTROSTATIC SHIELD

***Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%
Ordering Instruction: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

For immediate engineering assistance or to place an order–

Call Toll Free 800-228-9747

PICO Electronics, Inc.

453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552 • • FAX 914-699-5565

Gull Wing PICO PART NUMBER	J Lead PICO PART NUMBER	PRIMARY IMPED OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	PAR	POWER WATTS 1 KHz and higher	400 Hz and higher	PRIMARY UNBAL DC CURRENT ma	PRIM DC RESIST OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	PAR CONN	TURNS/RATIO PRIM/SEC SEC SER CONN	SEC PAR CONN	PICO PRICES 1-9 ***
71350	81350	3000 ct	3000 ct	725	.4	.075	1.8	300	360	90	1:1	2:1	22.73
71355	81355	*3000 ct	3000 ct	–	.4	.075	1.8	300	360	–	1:1	–	30.94
71360	81360	3600 ct	3600 ct	900	.4	.075	1.7	360	432	108	1:1	2:1	22.73
71365	81365	4000 ct	16 ct	4	.4	.075	1.6	400	1.9	.47	15.8:1	31.6:1	27.94
71370	81370	4000 ct	600 ct	150	.4	.075	1.6	400	72	18	2.58:1	5.16:1	27.94
71375	81375	4000 ct	1000 ct	250	.4	.075	1.6	400	120	30	2:1	4.1	30.94
71380	81380	*4000 ct	8000 ct	–	.4	.075	1.6	400	960	–	1:1 41	–	30.94
71385	81385	5000 ct	500 ct	125	.4	.075	1.4	500	60	15	3.16:1	6.32:1	23.68
71390	81390	5000 ct	5000 ct	1250	.4	.075	1.4	500	600	150	1:1	2:1	23.68
71395	81395	7500 ct	50 ct	12.5	.33	.075	1.2	750	6	1.5	12.2.1	24.5:1	23.68
71400	81400	7500 ct	100 ct	25	.33	075	1.2	750	12	3	8.66.1	17.3:1	23 68
71405	81405	7500 ct	600 ct	150	.33	.075	1.2	750	72	18	3.54:1	7.07:1	26.36
71410	81410	7500 ct	2500 ct	625	.33	.075	1.2	750	300	75	1.73:1	3.46:1	26.36
71415	81415	*7500 ct	7500 ct	–	.33	075	1.2	750	900	–	1:1	–	30.94
71420	81420	8000 ct	12.8 ct	3.2	.3	.075	1.1	800	1.5	.38	25:1	50 1	23 68
71425	81425	8000 ct	1000 ct	250	.3	075	1.1	800	120	30	2.83:1	5.66:1	26 36
71430	81430	*8000 ct	1200 ct	–	.3	075	1 1	800	144	–	2.58:1	–	30.94
71435	81435	*9000 ct	9000 ct	–	.27	.075	1.1	900	1080	–	1:1	–	30.94
71440	81440	10,000 ct	12.8 ct	3.2	.25	.075	1.0	1000	1.5	.38	28:1	56:1	21.41
71445	81445	10,000 ct	16 ct	4	.25	.075	1.0	1000	1.92	.48	25:1	50:1	21.41
71450	81450	10,000 ct	100 ct	25	.25	.075	1.0	1000	12	3	10:1	20:1	23.68
71455	81455	10,000 ct	200 ct	50	.25	.075	1.0	1000	24	6	7.07:1	14.14:1	23.68
71460	81460	10,000 ct	500 ct	125	.25	.075	1.0	1000	60	15	4.47:1	8.94:1	23.68
71465	81465	10,000 ct	600 ct	150	.25	.075	1.0	1000	72	18	4.08:1	8.16:1	23.68
71470	81470	10,000 ct	1000 ct	250	.25	.075	1.0	1000	120	30	3 16:1	6.32:1	23.68
71475	81475	10,000 ct	1200 ct	300	.25	.075	1.0	1000	144	36	2.89:1	5.77:1	27.94
71480	81480	10,000 ct	1500 ct	375	.25	.075	1.0	1000	180	45	2.58:1	5.16:1	27.94
71485	81485	10,000 ct	2000 ct	500	.25	.075	1.0	1000	240	60	2.24:1	4.47:1	27.38
71490	81490	10,000 ct	5000 ct	1250	.25	:075	1.0	1000	600	150	1.41:1	2.83:1	27.85
71495	81495	10,000 ct	7500 ct	1875	.25	.075	1.0	1000	900	225	1.15:1	2.3:1	27.94
71500	81500	10,000 ct	10,000 ct	2500	.25	.075	1.0	1000	1200	300	1:1	2:1	26.93
71505	81505	*10,000 ct	10,000 ct	–	.25	.075	1.0	1000	1200	–	1:1	–	30.94
71510	81510	15,000 ct	400 ct	100	.16	.075	.82	1500	48	12	6.12:1	12.24:1	26.93
71515	81515	15,000 ct	500 ct	125	.16	.075	.82	1500	60	15	5.48.1	10 95 1	26 93
71520	81520	15,000 ct	600 ct	150	.16	.075	.82	1500	72	18	5:1	10 1	26.93
71525	81525	15,000 ct	10,000 ct	2500	.16	.075	.82	1500	1200	300	1.22:1	2.45:1	26.93
71530	81530	*15,000 ct	15,000 ct	–	.16	.075	.82	1500	1800	–	1:1	–	30.94
71535	81535	15,000 ct	15,000 ct	3750	.16	075	.82	1500	1800	450	1:1	2:1	27.94
71540	81540	16,000 ct	1,000 ct	250	.15	.075	.8	1600	120	30	4:1	8:1	27.94
71545	81545	20,000 ct	500 ct	125	.125	.075	.7	2000	60	15	6.33:1	12.65:1	25.79
71550	81550	20,000 ct	600 ct	150	.125	075	.7	2000	72	18	5.77:1	11.55:1	25 79
71555	81555	20,000 ct	800 ct	200	.125	.075	.7	2000	96	24	5:1	10:1	24.65
71560	81560	20,000 ct	1000 ct	250	.125	.075	.7	2000	120	30	4.47:1	8.94:1	30.94
71565	81565	20,000 ct	5000 ct	1250	.125	.075	.7	2000	600	150	2:1	4:1	26 93
71570	81570	20,000 ct	10,000 ct	2500	.125	.075	.7	2000	1200	300	1.41:1	2.83:1	26.93
71575	81575	*20,000 ct	20,000 ct	–	.125	.075	.7	2000	2400	–	1:1	–	30 94
71580	81580	25,000 ct	500 ct	125	.1	.075	.63	2500	60	15	7.07:1	14.14:1	27.94
71585	81585	25,000 ct	1000 ct	250	.1	.075	.63	2500	120	30	5:1	10:1	27.94
71590	81590	30,000 ct	50 ct	12 5	.083	.075	.58	3000	6	1.5	24.5:1	49:1	27.94
71595	81595	30,000 ct	1200 ct	300	.083	.075	.58	3000	144	36	5:1	10:1	27 94
71600	81600	30,000 ct	500 ct	125	.083	.075	.58	3000	60	15	7.75:1	15.5:1	27.95
71605	81605	30,000 ct	200 ct	50	.083	.075	.58	3000	24	6	12.25:1	24.5:1	27.95
71610	81610	30,000 ct	5,000 ct	1250	.083	.075	.58	3000	600	150	2.45:1	4.9:1	27.95
71615	81615	30,000 ct	10,000 ct	2500	.083	.075	.58	3000	1200	300	1.73:1	3 46:1	27.95
71620	81620	*30,000 ct	30,000 ct	–	.083	.075	.58	3000	3600	–	1:1	–	30.41
71625	81625	40,000 ct	400 ct	100	.062	.062	.5	4000	48	12	10:1	20:1	30 41

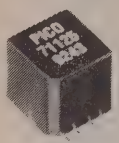
*INCLUDES ELECTROSTATIC SHIELD

***Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%;50-99 less 23%; 100-499 less 30%

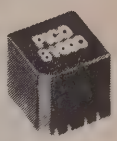
Ordering Instructions:
No minimum. Net 30 days
F.O.B. Mt. Vernon, New York.

SURFACE MOUNT

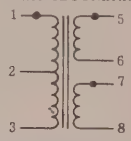
SERIES 71000



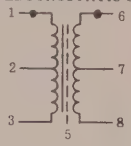
SERIES 81000



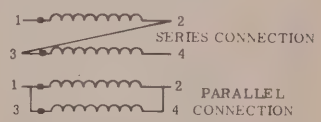
SCHEMATICS FOR TRANSFORMERS WITH SPLIT SECONDARIES



SCHEMATIC FOR TRANSFORMERS WITH ELECTROSTATIC SHIELD



SCHEMATIC FOR INDUCTORS



FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- PICO IS APPROVED QPL SOURCE (MIL-T-27)
- MAGNETIC SHIELD DESIGN AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED.
- VARIATION OF STANDARD DESIGNS AVAILABLE
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS.

THIS PRODUCT IS PATENTED

INDUCTORS

ALL INDUCTORS HAVE SPLIT WINDINGS AND MEASUREMENTS ARE LISTED FOR BOTH SERIES AND PARALLEL CONNECTIONS. TWO VALUES OF INDUCTANCE, EACH AT A PARTICULAR VALUE OF D.C. CURRENT, ARE LISTED FOR EACH INDUCTOR.

PICO PART NUMBER	PICO PART NUMBER	INDUCTANCE SERIES		DC CURRENT	DC RESISTANCE	PRICES 1–9***
71705	81705	SERIES	0.1 .08	4 10	25	21.41
		PARALLEL	.025 .02	8 20	6.5	
71710	81710	SERIES	0.9 0.5	2 6	105	21 41
		PARALLEL	.23 13	4 12	26	
71715	81715	SERIES	2.5 0.9	2 4	630	21 41
		PARALLEL	0.6 0.23	4 8	160	
71720	81720	SERIES	4.5 1.2	2 4	2300	22.73
		PARALLEL	1.1 0.3	4 8	575	

For immediate engineering assistance or to place an order—

Call Toll Free 800-228-9747

Delivery—stock to one week

PICO Electronics, Inc.

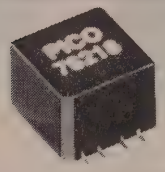
453 N. MacQuesten Pkwy.
Mt. Vernon, N.Y. 10552

FAX 914-699-5565

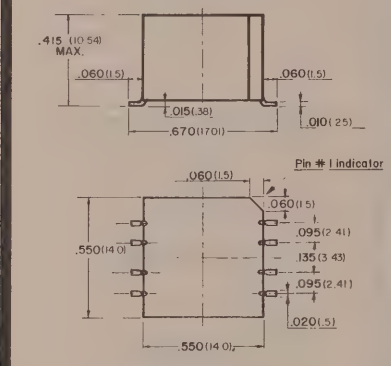
SURFACE MOUNT

PICO surface mount units utilize materials and methods to withstand extreme temperature (220°C) of vapor phase, I.R., and other reflow procedures without degradation of electrical or mechanical characteristics.

PICO's ultra-miniature transformers



76000 SERIES



TERMINALS ARE CLOCKWISE FROM PIN #1.

All dimensions are in inches, ( ) = MM

*PIN #4 IS DUMMY PIN

PICO PART NUMBER	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	SPLIT WINDINGS PAR	POWER WATTS 1KHz and higher	400 Hz and higher	300 Hz and higher	PRIMARY UNBALANCED DC CURRENT ma	PRIMARY DC RESISTANCE OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	SECONDARY DC RESISTANCE OHMS PAR CONN	TURNS RATIO PRIM/SEC SEC SER CONN	TURNS RATIO PRIM/SEC SEC PAR CONN	*** PRICE 1-9
76203	20 ct	8 ct	2	.6	.4	.3	30.0	2	1.2	3	1.58:1	3.16:1	26.69
76205	20 ct	20 ct	5	.6	.4	.3	30.0	2	2.8	7	1:1	2:1	26.69
76210	32 ct	32 ct	8	.6	.4	.3	23.0	3.3	4.5	1.13	1:1	2:1	26.69
76215	40 ct	40ct	10	.6	.4	.3	21.0	3.7	5	1.25	1:1	2:1	26.69
76218	48 ct	16 ct	4	.6	.4	.3	19.0	3.75	3	.75	1.73:1	3.46:1	26.69
76220	50 ct	50 ct	12.5	.6	.4	.3	19.0	5	7	1.75	1:1	2:1	26.69
76225	80 ct	32 ct	8	.6	.4	.3	15.0	7.5	4.3	1.13	1.58:1	3.16:1	26.69
76228	100 ct	40 ct	10	.6	.4	.3	13.0	10.8	5	1.25	1.58:1	3.16:1	26.69
76230	100 ct	100 ct	25	.6	.4	.3	13.0	10.8	12	3	1:1	2:1	26.69
76235	120 ct	12.8 ct	3.2	.6	.4	.3	12.0	9.3	2.2	.55	3.06:1	6.12:1	26.69
76240	120 ct	60 ct	15	.6	.4	.3	12.0	9	7.2	1.8	1.41:1	2.83:1	26.69
76245	120 ct	120 ct	30	.6	.4	.3	12.0	11.6	13	3.3	1:1	2:1	26.69
76250	150 ct	12 ct	3	.6	.4	.3	11.0	11.2	2.2	55	3.54:1	7.08:1	26.69
76255	150 ct	50 ct	12.5	.6	.4	.3	11.0	13	6.8	1.7	1.73:1	3.46:1	26.69
76260	150 ct	100 ct	25	.6	.4	.3	11.0	13	11.8	3	1.22:1	2.45:1	26.69
76265	150 ct	150 ct	37.5	.6	.4	.3	11.0	12	18.3	4.6	1:1	2:1	26.69
76270	150 ct	600 ct	150	.6	.4	.3	11.0	13	75	19	1.2	1.1	26.69
76275	200 ct	200 ct	50	.6	.4	.3	10.0	19	21.3	5.4	1:1	2:1	26.69
76280	300 ct	12 ct	3	.6	.4	.3	8.0	24	1.7	.43	5:1	10:1	26.69
76285	300 ct	50 ct	12.5	.6	.4	.3	8.0	30	6.8	1.7	2.45:1	4.9:1	26.69
76290	300 ct	150 ct	37.5	.6	.4	.3	8.0	30	18	4.6	1.41:1	2.83:1	26.69
76295	300 ct	300 ct	75	.6	.4	.3	8.0	30	34	8.5	1:1	2:1	26.69
76300	300 ct	600 ct	150	.6	.4	.3	8.0	30	60	15	1.1.41	1.41:1	26.69
76305	320 ct	12.8 ct	3.2	.6	.4	.3	7.5	31	1.7	.43	5:1	10:1	26.69
76310	400 ct	40 ct	10	.6	.4	.3	7.0	41	4.5	1.13	3.16:1	6.32:1	26.69
76315	400 ct	120 ct	30	.6	.4	.3	7.0	41	12	3	1.83:1	3.65:1	26.69
76320	400 ct	200 ct	50	.6	.4	.3	7.0	41	21.3	5.4	1.41:1	2.83:1	26.69
76325	400 ct	400 ct	100	.6	.4	.3	7.0	41	37.5	9.4	1:1	2:1	26.69
76330	400 ct	1000 ct	250	.6	.4	.3	7.0	41	96	24	1.1.58	1.26:1	26.69
76335	400 ct	2000 ct	500	.6	.4	.3	7.0	41	212	53	1.2.24	1.1.12	26.69
76340	400 ct	4000 ct	1000	.6	.4	.3	7.0	41	375	94	1.3.16	1.1.58	26.69
76342	500 ct	12.8 ct	3.2	.6	.4	.3	6.0	48	1.7	43	6.25:1	12.5:1	26.69
76344	500 ct	16 ct	4	.6	.4	.3	6.0	48	1.9	5	5.6:1	11.2:1	26.69
76345	500 ct	50 ct	12.5	.6	.4	.3	6.0	39	6.8	1.7	3.16:1	6.32:1	26.69
76347	500 ct	150 ct	37.5	.6	.4	.3	6.0	48	18	4.6	1.83:1	3.65:1	26.69
76350	500 ct	500 ct	125	.6	.4	.3	6.0	48	54	13.5	1:1	2:1	26.69
76355	*500 ct	500 ct	–	.6	.4	.3	6.0	48	68	–	1:1	–	26.69
76360	500 ct	600 ct	150	.6	.4	.3	6.0	48	59	15	1.1:1	1.83:1	26.69
76365	600 ct	12.8 ct	3.2	.6	.4	.3	5.5	53	1.7	43	6.85:1	13.7:1	26.69
76367	600 ct	30 ct	7.5	.6	.4	.3	5.5	53	4.2	1.1	4.47:1	8.94:1	26.69
76370	600 ct	48 ct	12	.6	.4	.3	5.5	53	6.8	1.7	3.54:1	7.07:1	26.69
76375	600 ct	200 ct	50	.6	.4	.3	5.5	53	21.3	5.3	1.73:1	3.46:1	26.69
76380	600 ct	600 ct	150	.6	.4	.3	5.5	57	79	20	1:1	2:1	26.69
76385	*600 ct	600 ct	–	.6	.4	.3	5.5	53	75	–	1:1	–	26.69
76387	600 ct	1200 ct	300	.6	.4	.3	5.5	53	105	26	1.1.41	1.41:1	26.69
76390	640 ct	12.8 ct	3.2	.6	.4	.3	5.5	66	1.7	43	7.07:1	14.14:1	26.69
76395	700 ct	100 ct	25	.6	.4	.3	5.0	69	12	3	2.65:1	5.29:1	26.69
76400	800 ct	12.8 ct	3.2	.6	.4	.3	5.0	75	1.7	43	7.9:1	15.8:1	26.69
76405	800 ct	48 ct	12	.6	.4	.3	5.0	75	6.8	1.7	4.08:1	8.16:1	26.69
76410	800 ct	800 ct	200	.6	.4	.3	5.0	75	105	26	1:1	2:1	26.69
76415	900 ct	600 ct	150	.6	.4	.3	4.5	79	75	19	1.22:1	2.45:1	26.69
76420	1000 ct	12 ct	3	.6	.4	.3	4.5	103	1.6	4	9.13:1	18.3:1	26.69
76425	1000 ct	50 ct	12.5	.6	.4	.3	4.5	103	6.4	1.6	4.47:1	8.94:1	26.69
76430	1000 ct	1000 ct	250	.6	.4	.3	4.5	103	115	28	1:1	2:1	26.69
76435	1060 ct	12.8 ct	3.2	.6	.4	.3	4.0	108	1.7	43	9.1:1	18.2:1	26.69
76440	1200 ct	12.8 ct	3.2	.6	.4	.3	4.0	113	1.7	43	9.68:1	19.4:1	26.69
76445	1200 ct	500 ct	125	.6	.4	.3	4.0	113	54	13.5	1.55:1	3.1:1	26.69
76450	1200 ct	1200 ct	300	.6	.4	.3	4.0	113	126	31.6	1:1	2:1	26.69
76455	*1200 ct	1200 ct	–	.6	.4	.3	4.0	111	125	–	1:1	–	26.69
76460	1500 ct	12 ct	3	.6	.4	.3	3.5	126	1.6	4	11.2:1	22.4:1	26.69
76465	1500 ct	500 ct	125	.6	.4	.3	3.5	126	68	17	1.73:1	3.46:1	26.69
76470	*1500 ct	600 ct	–	.6	.4	.3	3.5	126	94	–	1.58:1	–	26.69
76475	*1500 ct	1500 ct	–	.6	.4	.3	3.5	126	176	–	1:1	–	26.69
76480	1600 ct	12.8 ct	3.2	.6	.4	.3	3.5	130	1.7	43	11.2:1	22.4:1	26.69
76483	2000 ct	8 ct	2	.6	.4	.3	3.0	210	1.2	3	15.8:1	31.6:1	26.69
76485	2000 ct	2000 ct	500	.6	.4	.3	3.0	198	218	55	1.1	2:1	26.69
76490	*2000 ct	2000 ct	–	.6	.4	.3	3.0	198	218	–	1:1	–	26.69
76495	2000 ct	8000 ct	2000	.6	.4	.3	3.0	198	850	213	1:2	1:1	26.69
76497	2500 ct	2500 ct	625	.6	.4	.3	2.5	220	305	76	1.1	2:1	26.69
76500	3000 ct	3000 ct	750	.6	.4	.3	2.5	243	335	84	1:1	2:1	26.69

***Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

*INCLUDES ELECTROSTATIC SHIELD
**MINIATURIZED TELEPHONE COUPLING APPLICATION

SPECIFICATIONS

- **MIL-T-27:** . . . . . All units manufactured to MIL-T-27, Military Designation is TF5S21ZZ for Transformers.
- **FREQUENCY RESPONSE:** ±3db, 300 Hz-75 KHz at 1.0 Milliwatt.
- **MAXIMUM DISTORTION:** . . . 5% With Rated Power Level at 1 KHz and 400 Hz.
- **DIELECTRIC STRENGTH:** All Units Tested at 200 V RMS.
- **INSULATION RESISTANCE:** Greater Than 10,000 Megohms at 300 V DC.
- **WEIGHT:** . . . . . 5 Grams
- **TERMINALS:** . . . . . Solderability per MIL-STD-202 Method 208.
- **THERMAL SHOCK:** . . . . . 25 Cycles, Method 107D, MIL-STD-202E, Test Condition A-1.

Delivery— stock to one week

PICO Electronics, Inc.

453 N. MacQuesten Pkwy.
Mt. Vernon, N.Y. 10552

FAX 914-699-5565

For immediate engineering assistance or to place an order– ***Call Toll Free 800-228-9747***

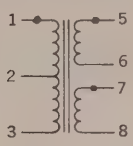
SURFACE MOUNT
PICO surface mount units utilize materials and methods to withstand extreme temperature (220°C) of vapor phase, I.R., and other reflow procedures without degradation of electrical or mechanical characteristics.

PICO PART NUMBER	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	PAR	POWER WATTS 1KHz and higher	400 Hz and higher	300 Hz and higher	PRIMARY UNBALANCED DC CURRENT ma	PRIMARY DC RESISTANCE OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	PAR CONN	TURNS RATIO PRIM/SEC SEC SER CONN	SEC PAR CONN	*** PRICE 1–9
76505	*3000 ct	3000 ct	–	.6	.4	.3	2.5	304	335	–	1·1	–	27 79
76510	3600 ct	3600 ct	900	.6	.4	.3	2.5	330	366	92	1·1	2·1	26.69
76512	4000 ct	16 ct	4	.6	.4	.3	2.0	350	3	75	15 8·1	31.6.1	26 69
76514	4000 ct	600 ct	150	.6	.4	.3	2 0	350	76	19	2 58·1	5 16·1	26.69
76515	4000 ct	1000 ct	250	.6	.4	.3	2.0	350	115	29	2·1	4 1	26 69
76520	*4000 ct	8000 ct	–	.6	.4	.3	2.0	350	1062	–	1·1 41	–	27.79
76525	5000 ct	500 ct	125	6	.4	.3	2.0	350	67	17	3 16·1	6.32·1	26.69
76530	5000 ct	5000 ct	1250	.6	.4	.3	2.0	390	538	135	1 1	2 1	26 69
76535	7500 ct	50 ct	12.5	6	.4	.3	1.5	600	7	1.75	12 2·1	24.5 1	29 61
76540	7500 ct	100 ct	25	.6	.4	.3	1.5	600	12	3	8.66·1	17 3·1	29 61
76545	7500 ct	600 ct	150	.6	.4	.3	1.5	600	78	19.5	3 54·1	7 07·1	29 61
76550	7500 ct	2500 ct	625	.6	.4	.3	1 5	600	305	77	1 73·1	3 46 1	29.61
76555	*7500 ct	7500 ct	–	6	.4	.3	1.5	750	828	–	1·1	–	31 70
76560	8000 ct	12.8 ct	3 2	6	.4	.3	1.5	750	1 7	43	25 1	50.1	29.61
76565	8000 ct	1000 ct	250	.6	.4	.3	1.5	750	115	29	2 83.1	5 66·1	29 61
76570	*8000 ct	1200 ct	–	6	.4	.3	1 5	750	158	–	2.58.1	–	31 70
76575	*9000 ct	9000 ct	–	6	.4	.3	1 4	796	1100	–	1 1	–	31.70
76580	10,000 ct	12.8 ct	3.2	6	.4	.3	1.4	1048	1.7	43	28 1·	56 1	29 61
76585	10,000 ct	16 ct	4	6	.4	.3	1.4	1048	3	75	25 1	50 1	29 61
76590	10,000 ct	100 ct	25	6	.4	.3	1 4	839	12	3	10·1	20.1	29 61
76595	10,000 ct	200 ct	50	.6	.4	.3	1 4	839	27	6 7	7 07·1	14 14·1	29.61
76600	10,000 ct	500 ct	125	6	.4	.3	1.4	850	67	17	4 47·1	8 94.1	29.61
76605	10,000 ct	600 ct	150	6	.4	.3	1 4	850	74	18.5	4 08.1	8.16 1	29.61
76610	10,000 ct	1000 ct	250	6	.4	.3	1.4	850	115	29	3 16·1	6 32·1	29 61
76615	10,000 ct	1200 ct	300	6	.4	.3	1.4	850	158	39.5	2 89·1	5 77·1	29.61
76620	10,000 ct	1500 ct	375	.6	.4	.3	1 4	850	177	44	2 58·1	5 16 1	29 61
76625	10,000 ct	2000 ct	500	6	.4	.3	1 4	850	255	64	2.24.1	4 47 1	29 61
76630	10,000 ct	5000 ct	1250	6	.4	.3	1.4	850	630	158	1 41 1	2 83 1	29 61
76635	10,000 ct	7500 ct	1875	.6	.4	.3	1.4	850	772	193	1 15·1	2 3·1	29 61
76640	10,000 ct	10,000 ct	2500	6	.4	.3	1.4	866	1215	304	1 1	2·1	29 61
76645	*10,000 ct	10,000 ct	–	6	.4	.3	1 4	1060	1215	–	1 1	–	31 70
76650	15,000 ct	400 ct	100	6	.4	.3	1 0	1305	47	12	6 12 1	12 24 1	29 61
76652	15,000 ct	500 ct	125	6	.4	.3	1.0	1305	53	13	5.48.1	10.95·1	29.61
76655	15,000 ct	600 ct	150	6	.4	.3	1 0	1305	72.5	18	5.1	10 1	29 61
76660	15,000 ct	10,000 ct	2500	.6	.4	.3	1.0	1305	1215	304	1 22·1	2 45 1	29.61
76665	*15,000 ct	15,000 ct	–	6	.4	.3	1 0	1305	1800	-	1 1	–	31 70
76670	15,000 ct	15,000 ct	3750	6	.4	.3	1.0	1305	1800	450	1.1	2 1	29.61
76675	16,000 ct	1000 ct	250	6	.4	.3	1.0	1343	115	29	4 1	8 1	29 61
76680	20,000 ct	500 ct	125	.5	.4	.3	1 0	1560	68	17	6 33.1	12 65 1	31 70
76685	20,000 ct	600 ct	150	.5	.4	.3	1.0	1560	75	19	5 77·1	11.55.1	31.70
76690	20,000 ct	800 ct	200	5	.4	.3	1 0	1560	108	27	5.1	10 1	31 70
76695	20,000 ct	1000 ct	250	.5	.4	.3	1.0	1560	121	30.5	4 47·1	8 94 1	31 70
76700	20,000 ct	5000 ct	1250	.5	.4	.3	1 0	1560	672	168	2·1	4 1	31 70
76705	20,000 ct	10,000 ct	2500	.5	.4	.3	1 0	1560	1520	380	1.41·1	2 83.1	31.70
76710	*20,000 ct	20,000 ct	–	5	.4	.3	1.0	1560	2727	682	1 1	–	32 98
76715	25,000 ct	500 ct	125	.4	.4	.3	0.8	2170	68	17	7.07 1	14 14 1	31.70
76720	25,000 ct	1000 ct	250	4	.4	.3	0.8	2170	120	30	5·1	10 1	31 70
76725	30,000 ct	50 ct	12 5	33	33	.3	0 8	2400	7	1 75	24 5 1	49 1	32.98
76730	30,000 ct	1200 ct	300	.33	33	.3	0.8	2400	156	39	5·1	10 1	32.98
76732	30,000 ct	500 ct	125	33	33	.3	0 8	2400	68	17	7.75 1	15 5 1	32.98
76734	30,000 ct	200 ct	50	33	.33	.3	0.8	2400	29	7 2	12.25.1	24.5 1	32.98
76735	30,000 ct	5000 ct	1250	.33	33	.3	0.8	2400	673	169	2 45.1	4 9.1	32.98
76740	30,000 ct	10,000 ct	2500	33	.33	.3	0.8	2400	1520	380	1.73·1	3 46.1	32.98
76745	*30,000 ct	30,000 ct	–	33	.33	.3	0.8	3000	3310	–	1 1	–	35.41
76750	40,000 ct	400 ct	100	25	.25	.25	0.7	3400	57	14.3	10.1	20.1	35 41
76755	40,000 ct	2000 ct	500	25	25	25	0.7	3400	268	67	4.47·1	8 94 1	35.41
76760	40,000 ct	4000 ct	1000	25	.25	25	0.7	3400	476	119	3.16·1	6.32·1	35 41
76765	40,000 ct	20,000 ct	5000	.25	25	25	0.7	3400	2700	675	1 41 1	2 83·1	35.41
76770	*40,000 ct	40,000 ct	–	25	25	25	0.7	3400	4750	–	1 1	–	39 49
76775	50,000 ct	200 ct	50	.2	.2	2	0 6	4850	27	6.7	15.8·1	31.6 1	39 49
76777	50,000 ct	500 ct	125	.2	2	.2	0.6	4850	68	17	10 1	20 1	39 49
76779	50,000 ct	600 ct	150	.2	2	.2	0.6	4850	75	18 5	9 13 1	18 26 1	39 49
76780	60,000 ct	15,000 ct	3750	.16	.16	.16	0.5	5275	2250	563	2.1	4 1	42 58
76785	62,500 ct	50 ct	12.5	16	16	.16	0.5	*5445	8 7	2 2	35 4 1	70 7 1	42 58
76787	80,000 ct	15,000 ct	3750	12	12	.12	0.4	6130	2250	563	2 3 1	4 6 1	42 58
76790	90,000 ct	10,000 ct	2500	.1	.1	1	0.4	8140	1520	380	3.1	6 1	44 74
76795	95,000 ct	15,000 ct	3750	.1	.1	1	0.4	8400	2250	563	2.52.1	5 03 1	44 74
76800	100,000 ct	60 ct	15	1	1	1	0.4	8750	9 2	2 3	40.8 1	81 6.1	44 74
76805	100,000 ct	100 ct	25	1	1	1	0 4	8750	15	3 8	31 6 1	63 2 1	44 74
76810	100,000 ct	500 ct	125	.1	.1	1	0 4	8750	68	17	14 1.1	28 3 1	44.74
76815	100,000 ct	10,000 ct	2500	1	1	1	0.4	8750	1535	385	3 16·1	6 32 1	44 74

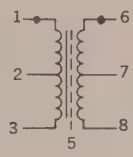
***Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

*INCLUDES ELECTROSTATIC SHIELD

SURFACE MOUNT SCHEMATIC FOR TRANSFORMERS WITH SPLIT WINDING



SCHEMATIC FOR TRANSFORMERS WITH ELECTROSTATIC SHIELD



FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- PICO IS APPROVED QPL SOURCE (MIL-T-27)
- MAGNETIC SHIELDS AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED.
- VARIATION OF STANDARD DESIGNS AVAILABLE
- PRIMARY AND SECONDARY WINDINGS CAN BE USED EITHER AS INPUT OR OUTPUT.
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS.

Delivery— stock to one week

PICO Electronics, Inc.
453 N. MacQuesten Pkwy.
Mt. Vernon, N.Y. 10552

For immediate engineering assistance or to place an order– ***Call Toll Free 800-228-9747***

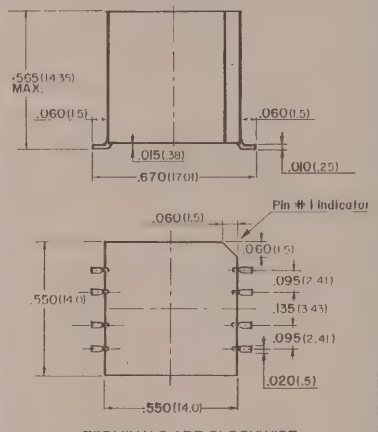
FAX 914-699-5565

SURFACE MOUNT

PICO surface mount units utilize materials and methods to withstand extreme temperature (220°C) of vapor phase, I.R., and other reflow procedures without degradation of electrical or mechanical characteristics.

PICO's ultra-miniature transformers

77000 SERIES



TERMINALS ARE CLOCKWISE FROM PIN #1.

- PIN #4 IS DUMMY PIN

DIMENSIONS ARE IN INCHES (MM)

SPECIFICATIONS

- **MIL-T-27:** . . . . . All units manufactured to MIL-T- 27, Audio Transformers are Type TF5S21ZZ
- **FREQUENCY RESPONSE:** ±3db, 150 Hz-75 KHz at 1.0 Milliwatt. (When Primary Impedance ≥ 50K Ohms, ±3 db 150 Hz to 20 KHz)
- **MAXIMUM DISTORTION:** . . . 5% With Rated Power Level at 1 KHz, 400 Hz and 150 Hz.
- **DIELECTRIC STRENGTH:** All Units Tested at 200 V RMS.
- **INSULATION RESISTANCE:** Greater Than 10,000 Megohms at 300 V DC.
- **WEIGHT:** . . . . . 7.5 Grams
- **TERMINALS:** . . . . . Solderability per MIL-STD-202 Method 208.
- **THERMAL SHOCK:** . . . . . 25 Cycles, Method 107C, MIL-STD-202D, Test Condition A-1.

Delivery— stock to one week

PICO Electronics, Inc.

453 N. MacQuesten Pkwy.
Mt. Vernon, N.Y. 10552

FAX 914-699-5565

PICO PART NUMBER	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS PAR	POWER WATTS 1KHz and higher	POWER WATTS 400 Hz and higher	POWER WATTS 150 Hz and higher	PRIMARY UNBALANCED DC CURRENT ma	PRIMARY DC RESISTANCE OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	SECONDARY DC RESISTANCE OHMS PAR CONN	TURNS RATIO PRIM/SEC SEC SER CONN	TURNS RATIO PRIM/SEC SEC PAR CONN	*** PRICE 1–9
77203	20 ct	8 ct	2	1.0	75	11	22.0	1.75	1.0	25	1.58:1	3.16:1	26.69
77205	20 ct	20 ct	5	1.0	75	.11	22.0	1.75	2.5	.63	1:1	2:1	26.69
77210	32 ct	32 ct	8	1.0	75	11	18.0	2.7	3.7	.93	1.1	2:1	26.69
77215	40 ct	40 ct	10	1.0	75	11	16.0	3	5.2	1.3	1.1	2.1	26.69
77218	48 ct	16ct	4	1.0	75	11	13.0	4.5	2.4	6	1.73:1	3.46:1	26.69
77220	50 ct	50 ct	12.5	1.0	75	11	13.0	4.5	6.2	1.6	1.1	2.1	26.69
77225	80 ct	32 ct	8	1.0	75	11	11.0	6.6	3.7	.93	1.58:1	3.16:1	26.69
77228	100 ct	40 ct	10	1.0	75	.11	10.0	9.7	5.6	1.4	1.58:1	3.16:1	26.69
77230	100 ct	100 ct	25	1.0	75	11	10.0	9.7	11	2.8	1.1	2:1	26.69
77235	120 ct	12.8 ct	3.2	1.0	75	11	9.0	10.8	1.6	4	3.06:1	6.12:1	26.69
77240	120 ct	60 ct	15	1.0	75	11	9.0	10.8	8.5	2.2	1.41:1	2.83:1	26.69
77245	120 ct	120 ct	30	1.0	75	11	9.0	10.8	15	3.8	1.1	2.1	26.69
77250	150 ct	12 ct	3	1.0	75	11	8.0	13.5	1.75	44	3.54:1	7.08:1	26.69
77255	150 ct	50 ct	12.5	1.0	75	11	8.0	12	5.8	1.5	1.73:1	3.46:1	26.69
77260	150 ct	100 ct	25	1.0	75	11	8.0	12	13	3.3	1.22:1	2.44:1	26.69
77265	150 ct	150 ct	37.5	1.0	75	11	8.0	12	20	5	1.1	2.1	26.69
77270	150 ct	600 ct	150	1.0	75	11	8.0	12	82	20.5	1.2	1.1	26.69
77275	200 ct	200 ct	50	1.0	75	11	7.0	17	24	6.0	1.1	2.1	26.69
77280	300 ct	12 ct	3	1.0	75	11	5.0	30	1.75	44	5.1	10.1	26.69
77285	300 ct	50 ct	12.5	1.0	75	11	5.0	27	6.2	1.6	2.45:1	4.9:1	26.69
77290	300 ct	150 ct	37.5	1.0	75	11	5.0	26	21	5.3	1.41:1	2.83:1	26.69
77295	300 ct	300 ct	75	1.0	75	11	5.0	27	38	9.5	1.1	2.1	26.69
77300	300 ct	600 ct	150	1.0	75	11	5.0	27	66	17	1.41:1	1.41:1	26.69
77305	320 ct	12.8 ct	3.2	1.0	75	11	5.0	30	1.75	44	5.1	10.1	26.69
77310	400 ct	40 ct	10	1.0	75	11	5.0	39	4.3	1.1	3.16:1	6.32:1	26.69
77315	400 ct	120 ct	30	1.0	75	11	5.0	30	14	3.5	1.83:1	3.65:1	26.69
77320	400 ct	200 ct	50	1.0	75	11	5.0	39	24	6	1.41:1	2.83:1	26.69
77325	400 ct	400 ct	100	1.0	75	11	5.0	39	42	10.5	1.1	2.1	26.69
77330	400 ct	1000 ct	250	1.0	75	11	5.0	39	109	28	1.1.58	1.26.1	26.69
77335	400 ct	2000 ct	500	1.0	75	11	5.0	39	198	49	1.2.24	1.1.12	26.69
77340	400 ct	4000 ct	1000	1.0	75	11	5.0	39	436	109	1.3.16	1.1.58	26.69
77342	500 ct	12.8 ct	3.2	1.0	75	11	4.5	43	1.6	4	6.25:1	12.5:1	26.69
77344	500 ct	16 ct	4	1.0	75	11	4.5	43	2.3	56	5.6":1	11.2:1	26.69
77345	500 ct	50 ct	12.5	1.0	75	11	4.5	43	5.8	1.5	3.16:1	6.32:1	26.69
77347	500 ct	150 ct	37.5	1.0	75	11	4.5	43	19.8	5	1.83:1	3.65:1	26.69
77350	500 ct	500 ct	125	1.0	75	11	4.5	43	60	15	1.1	2.1	26.69
77355	*500 ct	500 ct	-	1.0	75	11	4.5	43	60	-	1.1	-	27.79
77360	500 ct	600 ct	150	1.0	75	11	4.5	43	66	17	1.1.1	1.83:1	26.69
77365	600 ct	12.8 ct	3.2	1.0	75	11	4.0	68	1.75	44	6.85:1	13.7:1	26.69
77367	600 ct	30 ct	7.5	1.0	75	11	4.0	60	3.7	.93	4.47:1	8.94:1	26.69
77370	600 ct	48 ct	12	1.0	75	11	4.0	60	5.9	1.5	3.54:1	7.07:1	26.69
77375	600 ct	200 ct	50	1.0	75	11	4.0	60	25	6.3	1.73:1	3.46:1	26.69
77380	600 ct	600 ct	150	1.0	75	11	4.0	60	66	17	1.1	2.1	26.69
77385	*600 ct	600 ct	-	1.0	75	11	4.0	60	68	-	1.1	-	27.79
77386	*600 ct	900 ct	-	1.0	75	11	4.0	60	104	-	1.1.22	-	27.79
77387	600 ct	1200 ct	300	1.0	75	11	4.0	60	116	29	1.1.41	1.41:1	26.69
77390	640 ct	12.8 ct	3.2	1.0	75	11	4.0	69	1.75	44	7.07:1	14.14:1	26.69
77395	700 ct	100 ct	25	1.0	.75	11	4.0	62	10.6	2.7	2.65:1	5.29:1	26.69
77400	800 ct	12.8 ct	3.2	1.0	75	11	3.5	78	1.75	44	7.91:1	15.8:1	26.69
77405	800 ct	48 ct	12	1.0	75	11	3.5	74	6	1.5	4.08:1	8.16:1	26.69
77410	800 ct	800 ct	200	1.0	75	11	3.5	74	102	26	1.1	2.1	26.69
77415	900 ct	600 ct	150	1.0	75	11	3.0	90	66	17	1.23:1	2.45:1	26.69
77417	*900 ct	900 ct	-	1.0	75	11	3.0	90	102	-	1.1	-	27.79
77420	1000 ct	12 ct	3	1.0	75	11	3.0	115	1.75	44	9.13:1	18.26:1	26.69
77425	1000 ct	50 ct	12.5	1.0	75	11	3.0	100	5.8	1.5	4.47:1	8.94:1	26.69
77430	1000 ct	1000 ct	250	1.0	75	11	3.0	75	103	26	1.1	2.1	26.69
77435	1060 ct	12.8 ct	3.2	1.0	75	11	3.0	115	1.75	44	9.1:1	18.2:1	26.69
77440	1200 ct	12.8 ct	3.2	1.0	75	11	3.0	122	1.75	44	9.68:1	19.4:1	26.69
77445	1200 ct	500 ct	125	1.0	75	11	3.0	113	63	16	1.55:1	3.1:1	26.69
77450	1200 ct	1200 ct	300	1.0	75	11	3.0	113	155	39	1.1	2.1	26.69
77455	*1200 ct	1200 ct	-	1.0	75	11	3.0	109	150	-	1.1	-	27.79
77460	1500 ct	12 ct	3	1.0	75	11	2.5	140	1.75	44	11.18:1	22.36:1	26.69
77465	1500 ct	500 ct	125	1.0	75	11	2.5	150	60	15	1.73:1	3.46:1	26.69
77470	*1500 ct	600 ct	-	1.0	75	11	2.5	150	66	-	1.58:1	-	27.79
77475	*1500 ct	1500 ct	-	1.0	75	11	2.5	150	168	-	1.1	-	27.79
77480	1600 ct	12.8 ct	3.2	1.0	75	11	2.5	140	1.75	44	11.18:1	22.36:1	26.69
77483	2000 ct	8 ct	2	1.0	75	11	2.0	250	1.0	.25	15.8:1	31.6:1	26.69
77485	2000 ct	2000 ct	500	1.0	75	11	2.0	185	255	64	1.1	2.1	26.69
77490	*2000 ct	2000 ct	-	1.0	75	11	2.0	175	240	-	1.1	-	27.79
77495	2000 ct	8000 ct	2000	1.0	75	11	2.0	185	1015	254	1.2	1.1	26.69
77497	2500 ct	2500 ct	625	1.0	75	11	2.0	245	268	68	1.1	2.1	26.69
77500	3000 ct	3000 ct	750	1.0	75	11	1.8	267	295	74	1.1	2.1	26.69
77505	*3000ct	3000 ct	-	1.0	.75	11	1.8	267	368	-	1.1	-	27.79
77510	3600 ct	3600 ct	900	1.0	.75	11	1.5	300	413	103	1.1	2.1	26.69
77512	4000 ct	16 ct	4	1.0	.75	.11	1.5	395	2.5	.65	15.8:1	31.6:1	26.69
77514	4000 ct	600 ct	150	1.0	.75	.11	1.5	395	66	17	2.58:1	5.16:1	26.69

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*INCLUDES ELECTROSTATIC SHIELD

*For immediate engineering assistance or to place an order–**Call Toll Free 800-228-9747***

PICO PART NUMBER	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	PAR	POWER WATTS 1KHz and higher	400 Hz and higher	150 Hz and higher	PRIMARY UNBALANCED DC CURRENT ma	PRIMARY DC RESISTANCE OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	PAR CONN	TURNS RATIO PRIM/SEC SEC SER CONN	SEC PAR CONN	*** PRICE 1–9
77515	4000 ct	1000 ct	250	1.0	.75	.11	1.5	395	108	27	2:1	4:1	26.69
77520	*4000 ct	8000 ct	–	1.0	.75	.11	1.5	390	955	–	1:1.41	–	27.79
77525	5000 ct	500 ct	125	1.0	.75	.11	1.3	450	62	16	3.16:1	6.32:1	26.69
77530	5000 ct	5000 ct	1250	1.0	.75	.11	1.3	450	620	155	1:1	2:1	26.69
77535	7500 ct	50 ct	12.5	1.0	.75	.11	1.0	670	6	1.5	12.25:1	24.5:1	29.62
77540	7500 ct	100 ct	25	1.0	.75	.11	1.0	670	11	2.8	8.66:1	17.32:1	29.62
77545	7500 ct	600 ct	150	1.0	.75	.11	1.0	670	66	16.5	3.54:1	7.07:1	29.62
77550	7500 ct	2500 ct	625	1.0	.75	.11	1.0	670	268	67	1.73:1	3.46:1	29.62
77555	*7500 ct	7500 ct	–	1.0	.75	.11	1.0	670	925	–	1:1	–	32.66
77560	8000 ct	12.8 ct	3.2	1.0	.75	.11	1.0	765	1.75	.44	25:1	50:1	29.62
77565	8000 ct	1000 ct	250	1.0	.75	.11	1.0	695	106	26.5	2.83:1	5.66:1	29.62
77570	*8000 ct	1200 ct	–	1.0	.75	.11	1.0	715	153	–	2.58:1	–	32.66
77575	*9000 ct	9000 ct	–	1.0	.75	.11	1.0	925	1020	–	1:1	–	32.66
77580	10,000 ct	12.8 ct	3.2	1.0	.75	.11	1.0	768	1.6	4	28:1	56:1	29.62
77585	10,000 ct	16 ct	4	1.0	.75	.11	1.0	756	1.7	43	25:1	50:1	29.62
77590	10,000 ct	100 ct	25	1.0	.75	.11	1.0	780	10	2.5	10:1	20:1	29.62
77595	10,000 ct	200 ct	50	1.0	.75	.11	1.0	780	24	6	7.07:1	14.14:1	29.62
77600	10,000 ct	500 ct	125	1.0	.75	.11	1.0	780	60	15	4.47:1	8.94:1	29.62
77605	10,000 ct	600 ct	150	1.0	.75	.11	1.0	780	83	21	4.08:1	8.16:1	29.62
77610	10,000 ct	1000 ct	250	1.0	.75	.11	1.0	780	106	27	3.16:1	6.32:1	29.62
77615	10,000 ct	1200 ct	300	1.0	.75	.11	1.0	780	145	36	2.89:1	5.77:1	29.62
77620	10,000 ct	1500 ct	375	1.0	.75	.11	1.0	780	160	40	2.58:1	5.16:1	29.62
77625	10,000 ct	2000 ct	500	1.0	.75	.11	1.0	780	300	75	2.24:1	4.47:1	29.62
77630	10,000 ct	5000 ct	1250	1.0	.75	.11	1.0	780	610	153	1.41:1	2.83:1	29.62
77635	10,000 ct	7500 ct	1875	1.0	.75	.11	1.0	780	932	233	1.16:1	2.31:1	29.62
77640	10,000 ct	10,000 ct	2500	1.0	.75	.11	1.0	780	1075	269	1:1	2:1	29.62
77645	*10,000 ct	10,000 ct	–	1.0	.75	.11	1.0	715	985	–	1:1	–	32.66
77650	15,000 ct	400 ct	100	.66	.66	.11	0.8	1165	52	13	6.12:1	12.25:1	29.62
77652	15,000 ct	500 ct	125	.66	.66	.11	0.8	1165	60	15	5.48:1	10.95:1	29.62
77655	15,000 ct	600 ct	150	.66	.66	.11	0.8	1165	80	20	5:1	10:1	29.62
77660	15,000 ct	10,000 ct	2500	.66	.66	.11	0.8	1165	1050	263	1.22:1	2.45:1	29.62
77665	*15,000 ct	15,000 ct	–	.66	.66	.11	0.8	1165	1600	–	1:1	–	32.66
77670	15,000 ct	15,000 ct	3750	.66	.66	.11	0.8	1165	1600	400	1:1	2:1	29.62
77675	16,000 ct	1000 ct	250	62	.62	.11	0.8	1560	108	27	4:1	8:1	29.62
77680	20,000 ct	500 ct	125	5	5	.11	0.7	1750	60	15	6.32:1	12.65:1	29.62
77685	20,000 ct	600 ct	150	.5	.5	.11	0.7	1750	82	20.5	5.77:1	11.55:1	32.66
77690	20,000 ct	800 ct	200	5	.5	.11	0.7	1750	98	24.5	5:1	10:1	32.66
77695	20,000 ct	1000 ct	250	.5	5	.11	0.7	1750	135	34	4.47:1	8.94:1	32.66
77700	20,000 ct	5000 ct	1250	.5	.5	.11	0.7	1750	610	153	2:1	4:1	32.66
77705	20,000 ct	10,000 ct	2500	.5	.5	.11	0.7	1750	1075	269	1.41:1	2.83:1	32.66
77710	*20,000 ct	20,000 ct	–	.5	.5	.11	0.7	1715	2370	–	1:1	–	32.66
77715	25,000 ct	500 ct	125	4	4	.11	0.6	2470	60	15	7.07:1	14.14:1	32.98
77720	25,000 ct	1000 ct	250	4	4	.11	0.6	2470	106	27	5:1	10:1	32.66
77725	30,000 ct	50 ct	12.5	.33	.33	.11	0.5	2730	6.2	1.6	24.5:1	49:1	32.66
77730	30,000 ct	1200 ct	300	33	.33	.11	0.5	2815	156	39	5:1	10:1	32.98
77732	30,000 ct	500 ct	125	.33	.33	.11	0.5	2730	61	15.3	7.7:1	15.5:1	32.98
77734	30,000 ct	200 ct	50	.33	.33	.11	0.5	2730	24	6	12.2:1	24.5:1	32.98
77735	30,000 ct	5000 ct	1250	.33	.33	.11	0.5	2730	620	155	2.45:1	4.9:1	32.98
77740	30,000 ct	10,000 ct	2500	33	.33	.11	0.5	2730	1090	272	1.73:1	3.46:1	32.98
77745	*30,000 ct	30,000 ct	–	.33	.33	.11	0.5	2730	3740	–	1:1	–	35.41
77750	40,000 ct	400 ct	100	.25	.25	.11	0.5	3150	53	13	10:1	20:1	35.41
77755	40,000 ct	2000 ct	500	.25	.25	.11	0.5	3150	300	75	4.47:1	8.94:1	35.41
77760	40,000 ct	4000 ct	1000	25	25	.11	0.5	3150	548	137	3.16:1	6.32:1	35.41
77765	40,000 ct	20,000 ct	5000	25	25	.11	0.5	3150	3075	769	1.41:1	2.83:1	35.41
77770	*40,000 ct	40,000 ct	–	25	25	.11	0.5	3940	4350	–	1:1	–	39.49
77775	50,000 ct	200 ct	50	2	2	.11	0.4	4275	24	6	15.8:1	31.6:1	39.49
77777	50,000 ct	500 ct	125	2	2	.11	0.4	4275	60	15	0:1	20:1	39.49
77778	50,000 ct	600 ct	150	2	2	.11	0.4	4275	82	21	9.13:1	18.26:1	39.49
77779	50,000 ct	50,000 ct	12,500	2	2	.11	0.4	4500	6270	1568	1:1	2:1	39.49
77780	60,000 ct	15,000 ct	3750	16	16	.11	0.4	5960	1650	412	2:1	4:1	42.76
77785	62,500 ct	50 ct	12.5	16	16	.11	0.4	5960	6	1.5	35.4:1	70.7:1	42.76
77787	80,000 ct	15,000 ct	3750	.12	.12	11	0.3	7200	1690	423	2.3:1	4.6:1	42.76
77789	80,000 ct	80,000 ct	20,000	.12	.12	.11	0.3	7200	9920	2480	1:1	2:1	42.76
77790	90,000 ct	10,000 ct	2500	.11	.11	11	0.3	7500	1350	338	3:1	6:1	44.70
77795	95,000 ct	15,000 ct	3750	1	1	10	0.3	9550	1635	410	2.5:1	5:1	44.70
77800	100,000 ct	60 ct	15	.1	.1	10	0.3	10,000	8.5	2.2	40.8:1	81.6:1	44.70
77805	100,000 ct	100 ct	25	.1	1	.10	0.3	10,000	14	3.5	31.6:1	63.2:1	44.70
77810	100,000 ct	500 ct	125	1	.1	10	0.3	10,000	62	15.5	14.1:1	28.3:1	44.70
77813	100,000ct	1000 ct	250	1	1	10	0.3	10,000	140	35	10:1	20:1	44.70
77814	100,000 ct	2000 ct	500	1	.1	10	0.3	10,000	248	62	7.07:1	14.14:1	44.70
77815	100,000 ct	10,000 ct	2500	.1	1	.10	0.3	40,000	1075	270	3.16:1	6.32:1	44.70
77820	135,000 ct	82 ct	20.5	.074	.074	.074	0.25	13,700	9.5	2.4	40.6:1	81.2:1	46.76
77823	200,000 ct	500 ct	125	.05	.05	.05	0.2	17,340	75	19	20:1	40:1	46.76
77825	200,000 ct	1000 ct	250	.05	.05	.05	0.2	17,340	133	33	14.1:1	28.3:1	46.76
77830	200,000 ct	10,000 ct	2500	.05	.05	.05	0.2	17,340	1350	336	4.47:1	8.94:1	46.76
77835	200,000 ct	20,000 ct	5000	.05	.05	.05	0.2	17,340	3000	750	3.16:1	6.32:1	47.94
77837	250,000 ct	200 ct	50	.04	.04	.04	0.2	17,340	28	7	35.4:1	70.7:1	47.94
77840	250,000 ct	1000 ct	250	.04	.04	.04	0.2	17,340	118	30	15.8:1	31.6:1	47.94

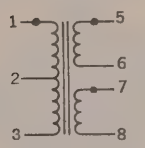
***Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30% *INCLUDES ELECTROSTATIC SHIELD

Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

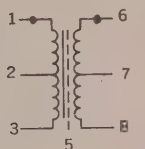
SURFACE MOUNT

PICO surface mount units utilize materials and methods to withstand extreme temperature (220°C) of vapor phase, I.R., and other reflow procedures without degradation of electrical or mechanical characteristics.

SURFACE MOUNT SCHEMATIC FOR TRANSFORMERS WITH SPLIT WINDING



SCHEMATIC FOR TRANSFORMERS WITH ELECTROSTATIC SHIELD



FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- PICO IS APPROVED QPL SOURCE (MIL-T-27)
- MAGNETIC SHIELDS AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED
- VARIATION OF STANDARD DESIGNS AVAILABLE
- PRIMARY AND SECONDARY WINDINGS CAN BE USED EITHER AS INPUT OR OUTPUT
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS

Delivery— stock to one week

PICO Electronics, Inc.

453 N. MacQuesten Pkwy.
Mt. Vernon, N.Y. 10552

For immediate engineering assistance or to place an order– ***Call Toll Free 800-228-9747***

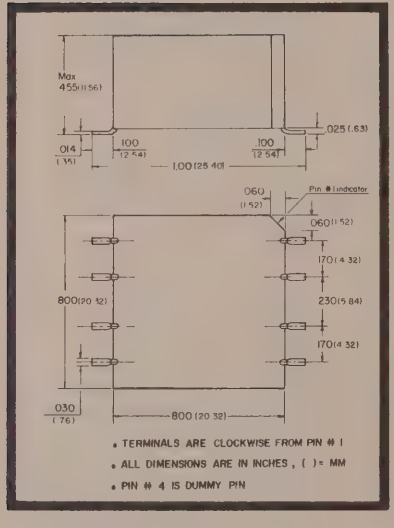
FAX 914-699-5565

SURFACE MOUNT

PICO surface mount units utilize materials and methods to withstand extreme temperature (220°C) of vapor phase, I.R., and other reflow procedures without degradation of electrical or mechanical characteristics.

PICO's ultra-miniature surface mount transformers

SERIES 82000



SPECIFICATIONS

- **MIL-T-27:** .....
All units manufactured to MIL-T-27, and are Hermetically Sealed Audio Transformers are Type TF5R21ZZ.
- **FREQUENCY RESPONSE:** .....
±3db, 75 Hz-30 KHz at 1.0 Milliwatt.
- **MAXIMUM DISTORTION:** .....
5% With Rated Power Level at 1 KHz, 300 kHz and 75 Hz.
- **DIELECTRIC STRENGTH:** .....
All Units Tested at 200 V RMS.
- **INSULATION RESISTANCE:** ...
Greater Than 10,000 Megohms at 300 V DC.
- **WEIGHT:** .....
12 Grams
- **OPERATING TEMPERATURE:**
-55°c to +105°c (All Units Can be Supplied to Class S Requirements, +130°c maximum).
- **TERMINALS:** .....
Solderability per MIL-STD-202 Method 208.
- **THERMAL SHOCK:** .....
25 Cycles, Method 107C, MIL-STD-202D, Test Condition A-1.

THIS PRODUCT IS PATENTED

Delivery— stock to one week

PICO PART NUMBER	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS PAR	POWER WATTS 1KHz and higher	POWER WATTS 300 Hz and higher	POWER WATTS 75 Hz and higher	PRIMARY UNBAL DC CURRENT ma	PRIMARY DC RESIST OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	SECONDARY DC RESISTANCE OHMS PAR CONN	TURNS RATIO PRIME/SEC SEC SER CONN	TURNS RATIO PRIME/SEC SEC PAR CONN	PICO PRICES 1–9 ***
82003	20 ct	8 ct	2	1 5	.9	03	22	1 6	76	19	1 58 1	3 16 1	32 63
82005	20 ct	20 ct	5	1 5	.9	.03	22	1 6	1 9	48	1:1	2 1	32 63
82010	32 ct	32 ct	8	1.5	.9	.03	17 5	2 56	3	.75	1 1	2:1	32 63
82015	40 ct	40 ct	10	1 5	.9	03	16	3 2	3 8	95	1 1	2 1	32 63
82018	48 ct	16 ct	4	1 5	.9	03	14 5	3 84	1 52	38	1 73 1	3 46 1	32 63
82020	50 ct	50 ct	12 5	1 5	.9	03	14	4	4 75	1 19	1 1	2 1	32 63
82025	80 ct	32 ct	8	1 5	.9	03	11	6 4	3	75	1 58 1	3 16 1	32 63
82028	100 ct	40 ct	10	1 5	.9	03	10	8	3 8	95	1 58 1	3 16 1	32 63
82030	100 ct	100 ct	25	1 5	.9	03	10	8	9 5	2 38	1 1	2 1	32 63
82035	120 ct	12 8 ct	3 2	1 5	.9	03	9	9 6	1 22	3	3 06 1	6 12 1	32 63
82040	120 ct	60 ct	15	1 5	.9	03	9	9 6	5 7	1 4	1 41 1	2 83 1	32 63
82045	120 ct	120 ct	30	1 5	.9	03	9	9 6	11 4	2 85	1 1	2 1	32 63
82050	150 ct	12 ct	3	1 5	.9	03	8	12	1 14	29	3 54 1	7 08 1	32 63
82055	150 ct	50 ct	12.5	1 5	.9	.03	8	12	4 75	1 19	1 73 1	3 46 1	32 63
82060	150 ct	100 ct	25	1 5	.9	03	8	12	9 5	2 38	1 22 1	2 44 1	32 63
82065	150 ct	150 ct	37 5	1 5	.9	03	8	12	14 3	3 56	1.1	2 1	32 63
82070	150 ct	600 ct	150	1 5	.9	03	8	12	57	14 3	1 2	1 1	32 63
82075	200 ct	200 ct	50	1 5	.9	.03	7	16	19	4 75	1 1	2 1	32 63
82080	300 ct	12 ct	3	1 5	.9	03	5 5	24	1 14	29	5 1	10 1	32 63
82085	300 ct	50 ct	12 5	1 5	.9	03	5.5	24	4 75	1 19	2 45 1	4 9 1	32 63
82090	300 ct	150 ct	37 5	1 5	.9	03	5 5	24	14 25	3 56	1 41 1	2 83 1	32 63
82095	300 ct	300 ct	75	1 5	.9	03	5 5	24	28 5	7 13	1:1	2 1	32 63
82100	300 ct	600 ct	150	1 5	.9	03	5.5	24	57	14 25	1 1 41	1 41 1	32 63
82105	320 ct	12 8 ct	3 2	1 5	.9	03	5 5	25 6	1 22	3	5 1	10 1	32 63
82110	400 ct	40 ct	10	1 5	.9	03	5	32	3 8	95	3 16 1	6 32 1	32 63
82115	400 ct	120 ct	30	1 5	.9	.03	5	32	11 4	2 85	1 83 1	3 65 1	32 63
82120	400 ct	200 ct	50	1 5	.9	03	5	32	19	4 75	1 41 1	2 83 1	32 63
82125	400 ct	400 ct	100	1 5	.9	03	5	32	38	9 5	1 1	2 1	32 63
82130	400 ct	1000 ct	250	1 5	.9	03	5	32	95	23 8	1 1 58	1 26 1	32 63
82135	400 ct	2000 ct	500	1 5	.9	03	5	32	190	47 5	1 2 24	1 1 12	32 63
82140	400 ct	4000 ct	1000	1 5	.9	03	5	32	380	95	1 3 16	1 1 58	32 63
82142	500 ct	12.8 ct	3 2	1 5	.9	03	4 5	40	1 22	3	6 25 1	12 5 1	32 63
82144	500 ct	16 ct	4	1 5	.9	03	4 5	40	1 52	38	5 6 1	11 2 1	32 63
82145	500 ct	50 ct	12 5	1 5	.9	03	4 5	40	4 75	1 19	3 16 1	6 32 1	32 63
82147	500 ct	150 ct	37 5	1 5	.9	03	4 5	40	14 25	3 56	1 83 1	3 65 1	32 63
82150	500 ct	500 ct	125	1 5	.9	03	4 5	40	47 5	11 88	1 1	2 1	32 63
82155	*500 ct	500 ct	–	1 5	.9	03	4 5	40	47 5	–	1 1	–	33 98
82160	500 ct	600 ct	150	1 5	.9	03	4 5	40	57	14.25	1 1 1	1 83 1	32 63
82165	600 ct	12 8 ct	3 2	1 5	.9	03	4	48	1 22	3	6 85 1	13 7	28 50
82167	600 ct	30 ct	7 5	1 5	.9	03	4	48	2 85	71	4 47 1	8 94 1	28 50
82170	600 ct	48 ct	12	1 5	.9	03	4	48	4 56	1 14	3 54 1	7 07 1	28 50
82175	600 ct	200 ct	50	1 5	.9	.03	4	48	19	4 75	1 73 1	3 46 1	28 50
82180	600 ct	600 ct	150	1 5	.9	03	4	48	57	14 25	1 1	2 1	32 63
82185	*600 ct	600 ct	–	1 5	.9	03	4	48	57	–	1 1	–	29 68
82186	*600 ct	900 ct	–	1 5	.9	03	4	48	85 5	–	1 1 22	–	29 68
82187	600 ct	1200 ct	300	1 5	.9	03	4	48	114	28 5	1 1 41	1 41 1	28 50
82190	640 ct	12.8 ct	3 2	1 5	.9	03	4	51 2	1 22	3	7 07 1	14 14 1	28 50
82195	700 ct	100 ct	25	1 5	.9	03	3 5	56	9 5	2 38	2 65 1	5 29 1	28 50
82200	800 ct	12.8 ct	3 2	1 5	.9	03	3.5	64	1 22	3	7 91 1	15 8 1	28 50
82205	800 ct	48 ct	12	1 5	.9	03	3.5	64	4 56	1 14	4 08 1	8 16 1	28 50
82210	800 ct	800 ct	200	1 5	.9	03	3 5	64	76	19	1 1	2 1	28 50
82215	900 ct	600 ct	150	1 5	.9	.03	3	72	57	14 3	1 23 1	2 45 1	28 50
82217	*900 ct	900 ct	–	1 5	.9	.03	3	72	85 5	–	1 1	–	29 68
82220	1000 ct	12 ct	3	1 5	.9	03	3	80	1 14	29	9 13 1	18 26 1	28 50
82225	1000 ct	50 ct	12 5	1.5	.9	03	3	80	4 75	1 19	4 47 1	8 94 1	28 50
82230	1000 ct	1000 ct	250	1 5	.9	03	3	80	95	23 8	1 1	2 1	28 50
82235	1060 ct	12.8 ct	3 2	1 5	.9	03	3	85	1 22	3	9 1 1	18 2 1	28 50
82240	1200 ct	12.8 ct	3 2	1 5	.9	03	3	96	1 22	3	9 68 1	19 4 1	28 50
82245	1200 ct	500 ct	125	1 5	.9	03	3	96	47 5	11.88	1 55 1	3 1 1	28 50
82250	1200 ct	1200 ct	300	1 5	.9	03	3	96	114	28 5	1 1	2 1	28 50
82255	*1200 ct	1200 ct	–	1 5	.9	03	3	96	114	–	1 1	–	29 68
82260	1500 ct	12 ct	3	1 5	.9	03	2 5	120	1 14	.29	11 18 1	22 36 1	28 50
82265	1500 ct	500 ct	125	1 5	.9	03	2 5	120	47 5	11 88	1 73 1	3 46 1	28 50
82270	*1500 ct	600 ct	–	1 5	.9	03	2 5	120	57	–	1 58 1	–	29 68
82275	*1500 ct	1500 ct	–	1.5	.9	.03	2 5	120	142	–	1 1	–	29 68
82280	1600 ct	12.8 ct	3.2	1 5	.9	03	2 5	128	1 22	3	11 18 1	22 36 1	28 50
82283	2000 ct	8 ct	2	1 5	.9	03	2 2	160	76	19	15 8 1	31 6 1	28 50
82285	2000 ct	2000 ct	500	1 5	.9	.03	2.2	160	190	47.5	1 1	2 1	28 50
82290	*2000 ct	2000 ct	–	1 5	.9	03	2.2	160	190	–	1 1	–	29 68
82295	2000 ct	8000 ct	2000	1 5	.9	03	2 2	160	760	190	1 2	1 1	28 50
82297	2500 ct	2500 ct	625	1 5	.9	03	2	200	238	59 5	1 1	2 1	28 50
82300	3000 ct	3000 ct	750	1 5	9	.03	1 8	240	285	71 3	1.1	2 1	28 50
82305	*3000 ct	3000 ct	–	1 5	9	03	1 8	240	285	–	1 1	–	29 68

*INCLUDES ELECTROSTATIC SHIELD
**MINIATURIZED TELEPHONE COUPLING APPLICATION
***Discount Prices: 1–9 Net; 10–24 less 10%; 25–49 less 16%; 50–99 less 23%; 100–499 less 30%
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

For immediate engineering assistance or to place an order— ***Call Toll Free 800-228-9747***

PICO PART NUMBER	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS PAR	POWER WATTS 1KHz and higher	POWER WATTS 300 Hz and higher	POWER WATTS 75 Hz and higher	PRIMARY UNBAL DC CURRENT ma	PRIMARY DC RESIST OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	SECONDARY DC RESISTANCE OHMS PAR CONN	TURNS RATIO PRIME/SEC SEC SER CONN	TURNS RATIO PRIME/SEC SEC PAR CONN	PICO PRICES 1–9 ***
82310	3600 ct	3600 ct	900	1.5	9	03	1 7	288	342	86	1 1	2 1	32 63
82312	4000 ct	16 ct	4	1 5	9	03	1 6	320	1 52	38	15 8 1	31.6 1	32.63
82314	4000 ct	600 ct	150	1 5	9	03	1 6	320	57	14 3	2 58 1	5.16 1	32 63
82315	4000 ct	1000 ct	250	1 5	9	03	1 6	320	95	23 8	2 1	4 1	32 63
82320	*4000 ct	8000 ct	–	1 5	9	03	1 6	320	760	–	1 1 41	–	33.98
82325	5000 ct	500 ct	125	1 5	9	03	1.4	400	47.5	11.88	3.16 1	6.32 1	32.63
82330	5000 ct	5000 ct	1250	1 5	9	03	1 4	400	475	119	1 1	2 1	32.63
82335	7500 ct	50 ct	12 5	1 3	9	03	1 2	600	4 75	1 19	12 25 1	24 5 1	36 34
82340	7500 ct	100 ct	25	1 3	9	03	1 2	600	9 5	2.38	8 66 1	17 32 1	36 34
82345	7500 ct	600 ct	150	1.3	9	03	1.2	600	57	14.3	3.54 1	7 07 1	36.34
82350	7500 ct	2500 ct	625	1 3	9	03	1.2	600	238	59 5	1 73 1	3.46 1	36 34
82355	*7500 ct	7500 ct	–	1 3	9	03	1 2	600	713	–	1 1	–	38 75
82360	8000 ct	12.8 ct	3 2	1 2	9	03	1 1	640	1 22	3	25 1	50 1	36 34
82365	8000 ct	1000 ct	250	1 2	9	03	1 1	640	95	23.8	2.83 1	5 66 1	36 34
82370	*8000 ct	1200 ct	–	1.2	9	03	1 1	640	114	–	2.58 1	–	38.75
82375	*9000 ct	9000 ct	–	1 1	9	03	1.1	720	855	–	1 1	–	38 75
82380	10,000 ct	12.8 ct	3.2	1 0	9	03	1	800	1 22	3	28 1	56 1	36 34
82385	10,000 ct	16 ct	4	1 0	9	03	1	800	1 52	38	25 1	50.1	36 34
82390	10,000 ct	100 ct	25	1 0	9	03	1	800	9 5	2 38	10.1	20 1	36.34
82395	10,000 ct	200 ct	50	1 0	9	03	1	800	19	4 75	7 07 1	14 14 1	36 34
82400	10,000 ct	500 ct	125	1 0	9	03	1	800	47.5	11 88	4 47 1	8 94 1	36 34
82405	10,000 ct	600 ct	150	1 0	9	03	1	800	57	14.25	4 08 1	8 16 1	36 34
82410	10,000 ct	1000 ct	250	1 0	9	03	1	800	95	23.8	3 16 1	6 32 1	36 34
82415	10,000 ct	1200 ct	300	1 0	9	03	1	800	114	28.5	2 89 1	5.77 1	36 34
82420	10,000 ct	1500 ct	375	1 0	9	03	1	800	143	35 8	2 58 1	5 16 1	36 34
82425	10,000 ct	2000 ct	500	1 0	9	03	1	800	190	47 5	2 24 1	4 47 1	36 34
82430	10,000 ct	5000 ct	1250	1.0	9	03	1	800	475	119	1 41 1	2 83 1	36 34
82435	10,000 ct	7500 ct	1875	1 0	9	03	1	800	713	178	1 16 1	2.31 1	36.34
82440	10,000 ct	10,000 ct	2500	1 0	9	03	1	800	950	238	1 1	2.1	36 34
82445	*10,000 ct	10,000 ct	–	1 0	9	03	1	800	950	–	1 1	–	38 75
82450	15,000 ct	400 ct	100	66	.66	03	8	1200	38	9 5	6 12 1	12 25 1	36 34
82452	15,000 ct	500 ct	125	.66	66	03	8	1200	48	12	5.48 1	10.95 1	36.34
82455	15,000 ct	600 ct	150	66	66	03	8	1200	57	14 3	5 1	10 1	36.34
82460	15,000 ct	10,000 ct	2500	66	66	03	8	1200	950	238	1 22 1	2 45 1	36 34
82465	*15,000 ct	15,000 ct	–	66	66	03	8	1200	1430	–	1:1	–	38.75
82470	15,000 ct	15,000 ct	3750	66	66	03	8	1200	1430	357	1:1	2:1	36 34
82475	16,000 ct	1000 ct	250	62	62	03	8	1280	95	23.8	4:1	8:1	36 34
82480	20,000 ct	500 ct	125	.5	5	03	7	1600	47 5	11 88	6 32:1	12 65 1	38.75
82485	20,000 ct	600 ct	150	5	5	03	7	1600	57	14.25	5 77 1	11 55 1	38 75
82490	20,000 ct	800 ct	200	.5	5	03	7	1600	76	19	5.1	10 1	38.75
82495	20,000 ct	1000 ct	250	5	.5	03	7	1600	95	23 8	4.47.1	8 94 1	38.75
82500	20,000 ct	5000 ct	1250	5	5	03	7	1600	475	119	2 1	4.1	38 75
82505	20,000 ct	10,000 ct	2500	.5	5	03	7	1600	950	238	1.41 1	2 83 1	38 75
82510	*20,000 ct	20,000 ct	–	5	.5	03	7	1600	1900	–	1 1	–	40 29
82515	25,000 ct	500 ct	125	4	.4	03	6	2000	47 5	11.88	7 07 1	14.14 1	38 75
82520	25,000 ct	1000 ct	250	4	.4	03	6	2000	95	23 8	5.1	10 1	38 75
82525	30,000 ct	50 ct	12 5	.33	33	03	6	2400	4 75	1 19	24.5 1	49 1	40 29
82530	30,000 ct	1200 ct	300	.33	33	03	6	2400	114	28.5	5 1	10 1	40 28
82532	30,000 ct	500 ct	125	.33	33	03	6	2400	47.5	11.88	7 7 1	15.5 1	40.28
82534	30,000 ct	200 ct	50	.33	33	03	6	2400	19	4 75	12 2:1	24.5 1	40.28
82535	30,000 ct	5000 ct	1250	33	33	03	6	2400	475	119	2 45:1	4 9.1	40 28
82540	30,000 ct	10,000 ct	2500	33	33	03	6	2400	950	238	1 73 1	3 46.1	40.28
82545	*30,000 ct	30,000 ct	–	33	33	03	6	2400	2850	–	1 1	–	43 40
82550	40,000 ct	400 ct	100	25	25	03	5	3200	38	9.5	10.1	20.1	43 40
82555	40,000 ct	2000 ct	500	25	25	03	5	3200	190	47 5	4 47 1	8.94.1	43 40
82560	40,000 ct	4000 ct	1000	25	25	03	5	3200	380	95	3 16.1	6 32.1	43 40
82565	40,000 ct	20,000 ct	5000	25	25	03	5	3200	1900	475	1 41.1	2.83 1	43.40
82570	*40,000 ct	40,000 ct	–	25	.25	03	5	3200	3800	–	1 1	–	48.18
82575	50,000 ct	200 ct	50	2	2	03	4	4000	19	4 75	15 8 1	31 6 1	48.18
82577	50,000 ct	500 ct	125	2	2	03	4	4000	47 5	11 88	10 1	20 1	48.18
82578	50,000 ct	600 ct	150	2	2	03	4	4000	57	14 3	9 13.1	18 26 1	48.18
82579	50,000 ct	50,000 ct	12,500	2	2	03	4	4000	4750	1190	1 1	2.1	48 18
82580	60,000 ct	15,000 ct	3750	16	16	03	4	4800	1430	358	2 1	4:1	52 05
82585	62,500 ct	50 ct	12 5	16	16	03	4	5000	4 75	1 19	35 4 1	70.7 1	52 05
82587	80,000 ct	15,000 ct	3750	12	12	03	3	6400	1430	358	2 3.1	4 6 1	52.05
82590	90,000 ct	10,000 ct	2500	11	11	03	3	7200	950	238	3 1	6 1	52 05
82595	95,000 ct	15,000 ct	3750	1	1	03	3	7600	1430	358	2.5 1	5 1	54.63
82600	100,000 ct	60 ct	15	1	1	03	3	8000	5 7	1 43	40 8 1	81 6 1	54 63
82605	100,000 ct	100 ct	25	1	1	03	3	8000	9 5	2 38	31 6 1	63 2 1	54 63
82610	100,000 ct	500 ct	125	1	1	03	3	8000	47 5	11 88	14 1.1	28.3 1	54 63
82613	100,000 ct	1000 ct	250	1	1	03	3	8000	95	23 8	10.1	20 1	54 63
82614	100,000 ct	2000 ct	500	1	1	03	3	8000	190	47.5	7 07.1	14 14.1	54.63
82615	100,000 ct	10,000 ct	2500	1	1	03	3	8000	950	238	3 16 1	6.32.1	54 63
82620	135,000 ct	82 ct	20 5	07	07	03	2	10,800	7 8	1 9	40 6 1	81.2 1	57 07

*INCLUDES ELECTROSTATIC SHIELD
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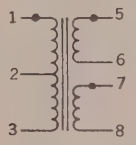
PICO's ultra-miniature surface mount transformers

SERIES 82000

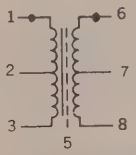
FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- PICO IS APPROVED QPL SOURCE (MIL-T-27)
- MAGNETIC SHIELDS AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED.
- VARIATION OF STANDARD DESIGNS AVAILABLE
- PRIMARY AND SECONDARY WINDINGS CAN BE USED EITHER AS INPUT OR OUTPUT.
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS.

SURFACE MOUNT SCHEMATIC FOR TRANSFORMERS WITH SPLIT WINDING



SCHEMATIC FOR TRANSFORMERS WITH ELECTROSTATIC SHIELD



PICO Electronics, Inc.
453 N. MacQuesten Pkwy.
Mt. Vernon, N.Y. 10552

FAX 914-699-5565

For immediate engineering assistance or to place an order—

Call Toll Free 800-228-9747

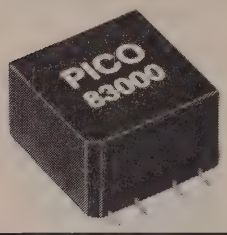
Delivery— stock to one week

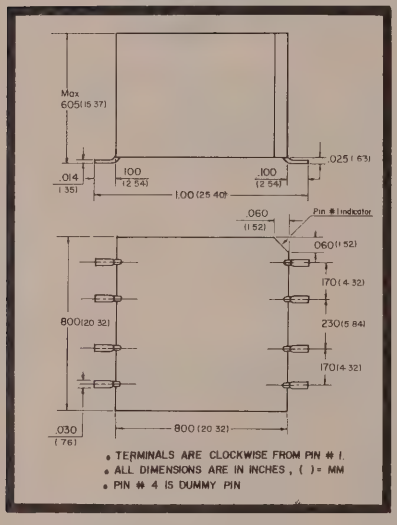
PICO's

SURFACE MOUNT

PICO surface mount units utilize materials and methods to withstand extreme temperature (220°C) of vapor phase, I.R., and other reflow procedures without degradation of electrical or mechanical characteristics.

ultra-miniature transformers SERIES 83000





SPECIFICATIONS

- **MIL-T-27:** ..... All units manufactured to MIL-T-27, and are Hermetically Sealed Audio Transformers are Type TF5R21ZZ
- **FREQUENCY RESPONSE:** ..... ±3db, 50 Hz-30 KHz at 1.0 Milliwatt. (±0.5 db, 300 Hz-5 KHz)
- **MAXIMUM DISTORTION:** ..... 5% With Rated Power Level at 1 KHz, 300 Hz and 50 Hz.
- **DIELECTRIC STRENGTH:** ..... All Units Tested at 200 V RMS.
- **INSULATION RESISTANCE:** ... Greater Than 10,000 Megohms at 300 V DC.
- **WEIGHT:** ..... 17 Grams
- **OPERATING TEMPERATURE:** -55°c to +105°c (All Units Can be Supplied to Class S Requirements, +130°c).
- **TERMINALS:** ..... Solderability per MIL-STD-202 Method 208.
- **THERMAL SHOCK:** ..... 25 Cycles, Method 107C, MIL-STD-202D, Test Condition A-1.

THIS PRODUCT IS PATENTED

PICO PART NUMBER	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS PAR	POWER WATTS 1KHz and higher	POWER WATTS 300 Hz and higher	POWER WATTS 50 Hz and higher	PRIMARY UNBAL DC CURRENT ma	PRIMARY DC RESIST OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	SECONDARY DC RESISTANCE OHMS PAR CONN	TURNS RATIO PRIM/SEC SEC SER CONN	TURNS RATIO PRIM/SEC SEC PAR CONN	PICO PRICES 1-9 ***
83003	20 ct	8 ct	2	2.0	1.5	.05	22	1.6	.88	.22	1.58:1	3.16:1	26 62
83005	20 ct	20 ct	5	2.0	1.5	.05	22	1.6	2.2	.55	1:1	2:1	26 62
83010	32 ct	32 ct	8	2.0	1.5	.05	17.5	2.56	3.52	.88	1:1	2:1	26 62
83015	40 ct	40 ct	10	2.0	1.5	.05	16	3.2	4.4	1.1	1:1	2:1	26 62
83018	48 ct	16ct	4	2.0	1.5	.05	14.5	3.84	1.76	.44	1.73:1	3.46:1	26 62
83020	50 ct	50 ct	12.5	2.0	1.5	.05	14	4	5.5	1.38	1:1	2:1	26 62
83025	80 ct	32 ct	8	2.0	1.5	.05	11	6.4	3.52	.88	1.58:1	3.16:1	26.62
83028	100 ct	40 ct	10	2.0	1.5	.05	10	8	4.4	1.1	1.58:1	3.16:1	26 62
83030	100 ct	100 ct	25	2.0	1.5	.05	10	8	11	2.75	1:1	2:1	26 62
83035	120 ct	12.8 ct	3.2	2.0	1.5	.05	9	9.6	1.41	.35	3.06.2	6.12:1	26 62
83040	120 ct	60 ct	15	2.0	1.5	.05	9	9.6	6.6	1.65	1.41:1	2.83:1	26 62
83045	120 ct	120 ct	30	2.0	1.5	.05	9	9.6	13.2	3.3	1:1	2:1	26 62
83050	150 ct	12 ct	3	2.0	1.5	.05	8	12	1.32	.33	3.54:1	7.08:1	26.62
83055	150 ct	50 ct	12.5	2.0	1.5	.05	8	12	5.5	1.38	1.73:1	3.46:1	26 62
83060	150 ct	100 ct	25	2.0	1.5	.05	8	12	11	2.75	1.22:1	2.44:1	26 62
83065	150 ct	150 ct	37.5	2.0	1.5	05	8	12	16.5	4.13	1:1	2:1	26 62
83070	150 ct	600 ct	150	2.0	1.5	.05	8	12	66	16.5	1:2	1:1	26 62
83075	200 ct	200 ct	50	2.0	1.5	.05	7	16	22	5.5	1:1	2:1	26 62
83080	300 ct	12 ct	3	2.0	1.5	.05	5.5	24	1.32	.33	5:1	10:1	26 62
83085	300 ct	50 ct	12.5	2.0	1.5	.05	5.5	24	5.5	1.38	2.45:1	4.9:1	26 62
83090	300 ct	150 ct	37.5	2.0	1.5	.05	5.5	24	16.5	4.13	1.41:1	2.83:1	26 62
83095	300 ct	300 ct	75	2.0	1.5	.05	5.5	24	33	8.25	1:1	2:1	26.62
83100	300 ct	600 ct	150	2.0	1.5	.05	5.5	24	66	16.5	1.1 41	1.41:1	26.62
83105	320 ct	12.8 ct	3.2	2.0	1.5	05	5.5	25.6	1.41	.35	5:1	10:1	26 62
83110	400 ct	40 ct	10	2.0	1.5	.05	5	32	4.4	1.1	3.16:1	6.32:1	26 62
83115	400 ct	120 ct	30	2.0	1.5	05	5	32	13.2	3.3	1.83:1	3.65:1	26 62
83120	400 ct	200 ct	50	2.0	1.5	.05	5	32	22	5.5	1.41:1	2.83:1	26 62
83125	400 ct	400 ct	100	2.0	1.5	.05	5	32	44	11	1:1	2:1	26.62
83130	400 ct	1000 ct	250	2.0	1.5	.05	5	32	110	27.5	1.1 58	1.26:1	26.62
83135	400 ct	2000 ct	500	2.0	1.5	.05	5	32	220	55	1.2 24	1.1 12	26 62
83140	400 ct	4000 ct	1000	2.0	1.5	05	5	32	440	110	1.3 16	1.1 58	26 62
83142	500 ct	12.8 ct	3.2	2.0	1.5	05	4.5	40	1.41	.35	6.25:1	12.5:1	26 62
83144	500 ct	16 ct	4	2.0	1.5	05	4.5	40	1.76	44	5.6:1	11.2:1	26 62
83145	500 ct	50 ct	12.5	2.0	1.5	.05	4.5	40	5.5	1.38	3.16:1	6.32:1	26 62
83147	500 ct	150 ct	37.5	2.0	1.5	05	4.5	40	16.5	4.13	1.83:1	3.65:1	26 62
83150	500 ct	500 ct	125	2.0	1.5	05	4.5	40	55	13.75	1.1	2:1	26 62
83155	*500 ct	500 ct	–	2.0	1.5	.05	4.5	40	55	–	1.1	–	27.68
83160	500 ct	600 ct	150	2.0	1.5	05	4.5	40	66	16.5	1:1.1	1.83:1	26 62
83165	600 ct	12.8 ct	3.2	2.0	1.5	.05	4	48	1.41	35	6.85:1	13.7	26.62
83167	600 ct	30 ct	7.5	2.0	1.5	.05	4	48	3.3	83	4.47:1	8.94:1	26 62
83170	600 ct	48 ct	12	2.0	1.5	.05	4	48	5.28	1.37	3.54:1	7.07:1	26.62
83175	600 ct	200 ct	50	2.0	1.5	.05	4	48	22	5.5	1.73.1	3.46:1	26.62
83180**	600 ct	600 ct	150	2.0	1.5	05	4	48	66	16.5	1.1	2.1	26 62
83185**	*600 ct	600 ct	–	2.0	1.5	.05	4	48	66	–	1.1	–	27.68
83186**	*600 ct	900 ct	–	2.0	1.5	.05	4	48	99	–	1:1.22	–	27.68
83187**	600 ct	1200 ct	300	2.0	1.5	05	4	48	132	33	1.1 41	1.41:1	26 62
83190	640 ct	12.8 ct	3.2	2.0	1.5	.05	4	51	1.41	35	7.07:1	14.14:1	26 62
83195	700 ct	100 ct	25	2.0	1.5	.05	3.5	56	11	2.75	2.65:1	5.29:1	26 62
83200	800 ct	12.8 ct	3.2	2.0	1.5	.05	3.5	64	1.41	.35	7.91.1	15.8:1	26 62
83205	800 ct	48 ct	12	2.0	1.5	.05	3.5	64	5.28	1.32	4.08:1	8.16:1	26 62
83210	800 ct	800 ct	200	2.0	1.5	.05	3.5	64	88	22	1.1	2:1	26 62
83215	900 ct	600 ct	150	2.0	1.5	.05	3	72	66	16.5	1.23:1	2.45:1	26 62
83217**	*900 ct	900 ct	–	2.0	1.5	.05	3	72	99	–	1:1	–	27.68
83220	1000 ct	12 ct	3	2.0	1.5	.05	3	80	1.32	.33	9.13:1	18.26:1	26 62
83225	1000 ct	50 ct	12.5	2.0	1.5	.05	3	80	5.5	1.38	4.47:1	8.94:1	26 62
83230	1000 ct	1000 ct	250	2.0	1.5	.05	3	80	110	27.5	1:1	2:1	26.62
83235	1060 ct	12.8 ct	3.2	2.0	1.5	.05	3	85	1.41	.35	9.1:1	18.2:1	26.62
83240	1200 ct	12.8 ct	3.2	2.0	1.5	05	3	96	1.41	.35	9.68:1	19.4:1	26 62
83245	1200 ct	500 ct	125	2.0	1.5	.05	3	96	55	13.75	1.55:1	3.1:1	26 62
83250	1200 ct	1200 ct	300	2.0	1.5	.05	3	96	132	33	1.1	2:1	26.62
83255	*1200 ct	1200 ct	–	2.0	1.5	.05	3	96	132	–	1:1	–	27.68
83260	1500 ct	12 ct	3	2.0	1.5	.05	2.5	120	1.32	.33	11.18:1	22.36:1	26 62
83265	1500 ct	500 ct	125	2.0	1.5	.05	2.5	120	55	13.75	1.73:1	3.46:1	26 62
83270	*1500 ct	600 ct	–	2.0	1.5	.05	2.5	120	66	–	1.58:1	–	27.68
83275	*1500 ct	1500 ct	–	2.0	1.5	.05	2.5	120	165	–	1:1	–	27.68
83280	1600 ct	12.8 ct	3.2	2.0	1.5	.05	2.5	128	1.41	.35	11.18:1	22.36:1	26 62
38283	2000 ct	8 ct	2	2.0	1.5	.05	2.2	160	.88	22	15.8:1	31.6:1	26 62
83285	2000 ct	2000 ct	500	2.0	1.5	.05	2.2	160	220	55	1.1	2:1	26.62
83290	*2000 ct	2000 ct	–	2.0	1.5	.05	2.2	160	220	–	1.1	–	27.68
83295	2000 ct	8000 ct	2000	2.0	1.5	.05	2.2	160	880	220	1:2	1:1	27.68
83297	2500 ct	2500 ct	625	2.0	1.5	.05	2	200	275	69	1:1	2:1	27.68
83300	3000 ct	3000 ct	750	2.0	1.5	05	1.8	240	330	83	1:1	2:1	27.68
83305	*3000 ct	3000 ct	–	2.0	1.5	.05	1.8	240	330	–	1:1	–	27.68

*INCLUDES ELECTROSTATIC SHIELD
**MINIATURIZED TELEPHONE COUPLING APPLICATION
***Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%

Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

PICO Electronics, Inc.
453 N. MacQuesten Pkwy.
Mt. Vernon, N.Y. 10552
• FAX 914-699-5565

PICO PART NUMBER	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS PAR	POWER WATTS 1KHz and higher	POWER WATTS 300 Hz and higher	POWER WATTS 50 Hz and higher	PRIMARY UNBAL DC CURRENT ma	PRIMARY DC RESIST OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	SECONDARY DC RESISTANCE OHMS PAR CONN	TURNS RATIO PRIM/SEC SEC SER CONN	TURNS RATIO PRIM/SEC SEC PAR CONN	PICO PRICES 1–9***
83310	3600 ct	3600 ct	900	2.0	1.5	05	1.7	288	396	99	1 1	2:1	27.68
83312	4000 ct	16 ct	4	2.0	1.5	05	1.6	320	1.76	44	15.8:1	31.6:1	27.68
83314**	4000 ct	600 ct	150	2 0	1.5	.05	1.6	320	66	16.5	2.58:1	5.16.1	27 68
83315	4000 ct	1000 ct	250	2.0	1.5	05	1.6	320	110	27.5	2.1	4:1	27.68
83320	*4000 ct	8000 ct	–	2 0	1.5	.05	1.6	320	880	–	1.1 41	–	27 68
83325	5000 ct	500 ct	125	2 0	1 5	.05	1.4	400	55	13.8	3 16.1	6.32 1	26.62
83330	5000 ct	5000 ct	1250	2 0	1.5	05	1.4	400	550	138	1 1	2.1	26.62
83335	7500 ct	50 ct	12 5	1.3	1.3	05	1.2	600	5 5	1 38	12.25.1	24.5:1	29.48
83340	7500 ct	100 ct	25	1 3	1.3	05	1.2	600	11	2.75	8 66:1	17.32:1	29.48
83345	7500 ct	600 ct	150	1.3	1.3	.05	1.2	600	66	16.5	3.54:1	7.07:1	29.48
83350	7500 ct	2500 ct	625	1.3	1.3	.05	1.2	600	275	69	1.73:1	3.46:1	29.48
83355	*7500 ct	7500 ct	–	1.3	1.3	.05	1.2	600	825	–	1:1	–	31.87
83360	8000 ct	12.8 ct	3.2	1.2	1.2	.05	1.1	640	1.4	.35	25:1	50:1	29.48
83365	8000 ct	1000 ct	250	1.2	1.2	.05	1.1	640	110	27.5	2.83:1	5.66:1	29.48
83370	*8000 ct	1200 ct	–	1.2	1.2	.05	1.1	640	132	–	2.58:1	–	31.87
83375	9000 ct	9000 ct	–	1.1	1.1	.05	1.1	720	990	–	1:1	–	31.87
83380	10,000 ct	12.8 ct	3.2	1.0	1.0	.05	1	800	1.4	.35	28:1	56:1	29.48
83385	10,000 ct	16 ct	4	1.0	1.0	.05	1	800	1.76	.44	25:1	50:1	29 48
83390	10,000 ct	100 ct	25	1.0	1.0	.05	1	800	11	2.75	10:1	20:1	29.48
83395	10,000 ct	200 ct	50	1.0	1.0	.05	1	800	22	5.5	7.07:1	14.14:1	29.48
83400	10,000 ct	500 ct	125	1.0	1.0	.05	1	800	55	13.75	4.47:1	8.94:1	29.48
83405	10,000 ct	600 ct	150	1.0	1.0	.05	1	800	66	16.5	4.08:1	8.16:1	29.48
83410	10,000 ct	1000 ct	250	1 0	1.0	05	1	800	110	27 5	3 16 1	6 32:1	29.48
83415	10,000 ct	1200 ct	300	1.0	1 0	05	1	800	132	33	2 89:1	5.77:1	29.48
83420	10,000 ct	1500 ct	375	1.0	1 0	.05	1	800	165	41 3	2.58 1	5 16.1	29.48
83425	10,000 ct	2000 ct	500	1 0	1 0	.05	1	800	220	55	2.24:1	4 47:1	29 48
83430	10,000 ct	5000 ct	1250	1.0	1.0	.05	1	800	550	138	1.41:1	1.83:1	29.48
83435	10,000 ct	7500 ct	1875	1.0	1.0	.05	1	800	825	206	1.16:1	2.31:1	29.48
83440	10,000 ct	10,000 ct	2500	1 0	1.0	05	1	800	1100	275	1:1	2 1	29 48
83445	*10,000 ct	10,000 ct	–	1.0	1.0	.05	1	800	1100	–	1:1	–	31.87
83450	15,000 ct	400 ct	100	.65	.65	.05	.8	1200	44	11	6.12.1	12.25 1	29 48
83452	15,000 ct	500 ct	125	65	65	05	.8	1200	55	13 8	5 48 1	10.95.1	29 48
83455	15,000 ct	600 ct	150	.65	.65	05	.8	1200	66	16.5	5:1	10.:1	29.48
83460	15,000 ct	10,000 ct	2500	.65	.65	.05	.8	1200	1100	275	1 22:1	2 45:1	29.48
83465	*15,000 ct	15,000 ct	–	65	65	05	.8	1200	1650	–	1:1	–	31.87
83470	15,000 ct	15,000 ct	3750	.65	.65	.05	.8	1200	1650	413	1:1	2:1	29 48
83475	16,000 ct	1000 ct	250	.62	.62	.05	.8	1280	110	27 5	4.1	8:1	29 48
83480	20,000 ct	500 ct	125	.5	.5	.05	.7	1600	55	13.8	6.32:1	12.65:1	31.87
83485	20,000 ct	600 ct	150	.5	.5	.05	.7	1600	66	16.5	5.77:1	11.55:1	31.87
83490	20,000 ct	800 ct	200	.5	.5	.05	.7	1600	88	22	5:1	10:1	31.87
83495	20,000 ct	1000 ct	250	.5	.5	.05	.7	1600	110	27.5	4 47:1	8.94.1	31.87
83500	20,000 ct	5000 ct	1250	.5	.5	.05	.7	1600	550	138	2:1	4:1	31.87
83505	20,000 ct	10,000 ct	2500	.5	.5	.05	.7	1600	1100	275	1:41:1	2.83:1	31.87
83510	*20,000 ct	20,000 ct	–	.5	.5	.05	.7	1600	2200	–	1:1	–	32 82
83515	25,000 ct	500 ct	125	.4	.4	.05	.6	2000	55	13.8	7.07:1	14.14:1	31.87
83520	25,000 ct	1000 ct	250	.4	.4	.05	.6	2000	110	27.5	5:1	10:1	31.87
83525	30,000 ct	50 ct	12.5	.33	.33	.05	.6	2400	5.5	1.38	24.5:1	49:1	32.83
83530	30,000 ct	1200 ct	300	.33	.33	.05	.6	2400	132	33	5:1	10:1	32.83
83532	30,000 ct	500 ct	125	.33	.33	.05	.6	2400	55	13.8	7 7:1	15.5:1	32.83
83534	30,000 ct	200 ct	50	.33	.33	.05	.6	2400	22	5.5	12.2.1	24.5.1	32 83
83535	30,000 ct	5000 ct	1250	33	33	05	.6	2400	550	137 5	2 45:1	4 9.1	32 83
83540	30,000 ct	10,000 ct	2500	33	33	05	.6	2400	1100	275	1.73.1	3.46.1	32.83
83545	*30,000 ct	30,000 ct	–	33	33	05	.6	2400	3300	–	1:1	–	35.29
83550	40,000 ct	400 ct	100	.25	.25	05	.5	3200	44	11	10:1	20:1	35.29
83555	40,000 ct	2000 ct	500	25	25	05	.5	3200	220	55	4 47:1	8.94:1	35.29
83560	40,000 ct	4000 ct	1000	.25	.25	.05	.5	3200	440	110	3.16:1	6.32:1	35.29
83565	40,000 ct	20,000 ct	5000	.25	.25	.05	.5	3200	2200	550	1.41:1	2.83:1	35.29
83570	*40,000 ct	40,000 ct	–	.25	.25	.05	.5	3200	4400	–	1:1	–	39.29
83575	50,000 ct	200 ct	50	.2	.2	.05	.4	4000	22	5.5	15.8:1	31.6:1	39.29
83577	50,000 ct	500 ct	125	2	2	05	.4	4000	55	13 8	10.1	20:1	39.29
83578	50,000 ct	600 ct	150	2	2	.05	.4	4000	66	16.5	9 13:1	18.26:1	39.29
83579	50,000 ct	50,000 ct	12,500	2	2	05	.4	4000	5500	1380	1 1	2:1	39 29
83580	60,000 ct	15,000 ct	3750	16	16	05	.4	4800	1650	413	2:1	4.1	39.65
83585	62,500 ct	50 ct	12 5	16	16	05	.4	5000	5 5	1.38	35.4:1	70.7:1	39.65
83587	80,000 ct	15,000 ct	3750	12	12	05	.3	6400	1650	413	2.3.1	4 6:1	39.65
83590	90,000 ct	10,000 ct	2500	11	11	05	.3	7200	1100	275	3.1	6:1	44.54
83595	95,000 ct	15,000 ct	3750	1	1	05	.3	7600	1650	413	2.5:1	5:1	44 54
83600	100,000 ct	60 ct	15	1	1	05	.3	8000	6.6	1.65	40 8:1	81 6:1	44 54
83605	100,000 ct	100 ct	25	1	1	05	.3	8000	11	2.75	31.6:1	63.2:1	44 54
83610	100,000 ct	500 ct	125	1	1	05	.3	8000	55	13.8	14.1:1	28.3.1	44.54
83613	100,000 ct	1000 ct	250	1	1	05	.3	8000	110	27.5	10 1	20:1	44.54
83614	100,000 ct	2000 ct	500	1	1	05	.3	8000	220	55	7.07:1	14 14.1	44.54
83615	100,000 ct	10,000 ct	2500	1	1	05	.3	8000	1100	275	3.16:1	6.32.1	44.54
83620	135,000 ct	82 ct	20 5	07	07	.05	.2	10,800	9	2.25	40.6:1	81.2:1	46 54

*INCLUDES ELECTROSTATIC SHIELD
**MINIATURIZED TELEPHONE COUPLING APPLICATION

***Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30 %
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York

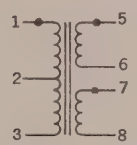
PICO's ultra-miniature surface mount transformers

SERIES 83000

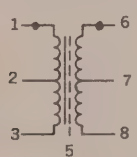
FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- PICO IS APPROVED QPL SOURCE (MIL-T-27)
- MAGNETIC SHIELDS AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED.
- VARIATION OF STANDARD DESIGNS AVAILABLE
- PRIMARY AND SECONDARY WINDINGS CAN BE USED EITHER AS INPUT OR OUTPUT
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS.

SURFACE MOUNT SCHEMATIC FOR TRANSFORMERS WITH SPLIT WINDING



SCHEMATIC FOR TRANSFORMERS WITH ELECTROSTATIC SHIELD



PICO Electronics, Inc.
453 N. MacQuesten Pkwy.
Mt. Vernon, N.Y. 10552

FAX 914-699-5565

For immediate engineering assistance or to place an order—

Call Toll Free 800-228-9747

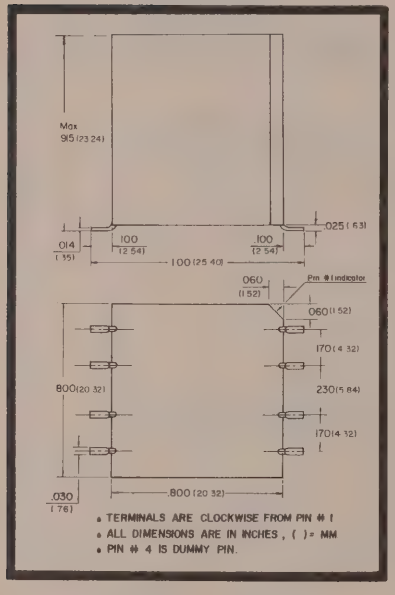
Delivery— stock to one week

SURFACE MOUNT

PICO surface mount units utilize materials and methods to withstand extreme temperature (220°C) of vapor phase, I.R., and other reflow procedures without degradation of electrical or mechanical characteristics.

PICO's ultra-miniature surface mount transformers

SERIES 84000



- TERMINALS ARE CLOCKWISE FROM PIN # 1
- ALL DIMENSIONS ARE IN INCHES, ( ) = MM
- PIN # 4 IS DUMMY PIN.

PICO PART NUMBER	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	SPLIT WINDINGS PAR	POWER WATTS 1KHz and higher	300 Hz and higher	20 Hz and higher	PRIMARY UNBAL DC CURRENT ma	PRIMARY DC RESIST OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	SECONDARY DC RESISTANCE OHMS PAR * CONN	TURNS RATIO PRIME/SEC SEC SER CONN	TURNS RATIO PRIME/SEC SEC PAR CONN	PICO PRICES 1–9 ***
84003	20 ct	8 ct	2	3.0	2.0	.006	22	1.6	.8	.2	1.58:1	3.16:1	29.23
84005	20 ct	20 ct	5	3.0	2.0	.006	22	1 6	2	.5	1.1	2:1	29 23
84010	32 ct	32 ct	8	3 0	2.0	.006	17.5	2.56	3 2	.8	1.1	2 1	29 23
84015	40 ct	40 ct	10	3 0	2.0	006	16	3.2	4	1	1:1	2 1	29 23
84018	48 ct	16 ct	4	3 0	2.0	006	14 5	3 84	1 6	.4	1.73.1	3.46.1	29.23
84020	50 ct	50 ct	12.5	3 0	2.0	.006	14	4	5	1 25	1.1	2.1	29.23
84025	80 ct	32 ct	8	3 0	2 0	006	11	6 4	3.2	8	1.58 1	3 16 1	29.23
84028	100 ct	40 ct	10	3 0	2.0	.006	10	8	4	1	1,58 1	3 16 1	29 23
84030	100 ct	100 ct	25	3 0	2.0	.006	10	8	10	2 5	1 1	2 1	29 23
84035	120 ct	12.8 ct	3.2	3.0	2 0	.006	9	9.6	1 3	32	3.06 1	26 12 1	29.23
84040	120 ct	60 ct	15	3 0	2 0	.006	9	9 6	6	1 5	1 41.1	2.83 1	29 23
84045	120 ct	120 ct	30	3 0	2.0	.006	9	9.6	12	3	1 1	2 1	29 23
84050	150 ct	12 ct	3	3.0	2 0	.006	8	12	1 2	3	3 54 1	7 08:1	29.23
84055	150 ct	50 ct	12.5	3.0	2.0	.006	8	12	5	1 25	1 73:1	3.46:1	29.23
84060	150 ct	100 ct	25	3 0	2.0	006	8	12	10	2 5	1 22 1	2 44 1	29 23
84065	150 ct	150 ct	37.5	3 0	2 0	.006	8	12	15	3 75	1 1	2 1	29 23
84070	150 ct	600 ct	150	3 0	2 0	006	8	12	60	15	1 2	1 1	29 23
84075	200 ct	200 ct	50	3 0	2 0	006	7	16	20	5	1 1	2 1	29 23
84080	300 ct	12 ct	3	3 0	2.0	006	5 5	24	1 2	3	5 1	10 1	29 23
84085	300 ct	50 ct	12 5	3 0	2 0	006	5 5	24	5	1 25	2 45 1	4 9 1	29 23
84090	300 ct	150 ct	37 5	3 0	2 0	.006	5 5	24	15	3 75	1 41 1	2 83 1	29 23
84095	300 ct	300 ct	75	3 0	2 0	006	5 5	24	30	7 5	1 1	2 1	29 23
84100	300 ct	600 ct	150	3 0	2 0	006	5 5	24	60	15	1.1 41	1 41 1	29 23
84105	320 ct	12 8 ct	3 2	3 0	2 0	006	5 5	25 6	1 3	32	5 1	10 1	29 23
84110	400 ct	40 ct	10	3 0	2.0	006	5	32	4	1	3 16 1	16 32 1	29 23
84115	400 ct	120 ct	30	3 0	2.0	006	5	32	12	3	1 83 1	3 65 1	29 23
84120	400 ct	200 ct	50	3 0	2 0	006	5	32	20	5	1 41 1	2 83 1	29 23
84125	400 ct	400 ct	100	3.0	2 0	006	5	32	40	10	1 1	2 1	29 23
84130	400 ct	1000 ct	250	3 0	2 0	006	5	32	100	25	1 1 58	1 26 1	29 23
84135	400 ct	2000 ct	500	3 0	2 0	006	5	32	200	50	1 2 24	1 1 12	29 23
84140	400 ct	4000 ct	1000	3 0	2 0	006	5	32	400	100	1 3 16	1 1 58	29 23
84142	500 ct	12.8 ct	3 2	3 0	2 0	006	4 5	40	1 3	32	6 25 1	12 5 1	29 23
84144	500 ct	16 ct	4	3 0	2 0	006	4 5	40	1 6	4	5 6 1	11 2 1	29 23
84145	500 ct	50 ct	12 5	3 0	2 0	006	4 5	40	5	1 25	3 16 1	6 32 1	29 23
84147	500 ct	150 ct	37 5	3 0	2 0	006	4 5	40	15	3 75	1 83 1	3 65 1	29 23
84150	500 ct	500 ct	125	3 0	2 0	006	4 5	40	50	12 5	1 1	2 1	29 23
84155	*500 ct	500 ct	–	3 0	2 0	006	4 5	40	50	–	1 1	–	30 46
84160	500 ct	600 ct	150	3 0	2 0	006	4.5	40	60	15	1 1 1	1 83 1	29 23
84165	600 ct	12.8 ct	3 2	3.0	2.0	.006	4	48	1 3	32	6 85 1	13.7 1	29 23
84167	600 ct	30 ct	7 5	3.0	2.0	006	4	48	3	75	4 47:1	8 94 1	29 23
84170	600 ct	48 ct	12	3.0	2 0	006	4	48	4 8	1 2	3 54 1	7 07 1	29 23
84175	600 ct	200 ct	50	3 0	2.0	.006	4	48	20	5	1 73 1	3 46 1	29 23
84180**	600 ct	600 ct	150	3 0	2.0	006	4	48	60	15	1 1	2 1	29 23
84185**	*600 ct	600 ct	–	3 0	2.0	006	4	48	60	–	1 1	–	30 46
84186**	*600 ct	900 ct	–	3 0	2 0	006	4	48	90	–	1 1 22	–	30 46
84187**	600 ct	1200 ct	300	3 0	2 0	006	4	48	120	30	1 1 41	1 41 1	29 23
84190	640 ct	12.8 ct	3 2	3 0	2 0	006	4	51	1 3	.32	7 07 1	14 14 1	29 23
84195	700 ct	100 ct	25	3.0	2 0	006	3 5	56	10	2 5	2 65 1	5 29 1	29 23
84200	800 ct	12.8 ct	3.2	3.0	2 0	006	3 5	64	1 3	32	7 91 1	15 8 1	29 23
84205	800 ct	48 ct	12	3 0	2 0	006	3.5	64	4 8	1.2	4 08 1	8 16 1	29 23
84210	800 ct	800 ct	200	3 0	2 0	006	3.5	64	80	20	1.1	2 1	29 23
84215	900 ct	600 ct	150	3.0	2.0	006	3	72	60	15	1 22.1	2 45 1	29 23
84217**	*900 ct	900 ct	–	3.0	2 0	006	3	72	90	–	1 1	–	30 46
84220	1000 ct	12 ct	3	3 0	2.0	.006	3	80	1 2	3	9.13 1	18 26 1	29 23
84225	1000 ct	50 ct	12 5	3 0	2 0	.006	3	80	5	1 25	4 47:1	8 94 1	29 23
84230	1000 ct	1000 ct	250	3 0	2 0	006	3	80	100	25	1 1	2 1	29 23
84235	1060 ct	12.8 ct	3 2	3 0	2 0	006	3	85	1 3	32	9 1 1	18 2 1	29 23
84240	1200 ct	12 8 ct	3 2	3 0	2 0	006	3	96	1 3	32	9 68 1	19 4 1	29 23
84245	1200 ct	500 ct	125	3 0	2 0	006	3	96	50	12 5	1 55 1	3 1 1	29 23
84250	1200 ct	1200 ct	300	3 0	2 0	006	3	96	120	30	1 1	2 1	29 23
84255	*1200 ct	1200 ct	–	3 0	2 0	006	3	96	120	–	1 1	–	30 46
84260	1500 ct	12 ct	3	3.0	2 0	006	2 5	120	1 2	3	11 18 1	22 36 1	29 23
84265	1500 ct	500 ct	125	3 0	2 0	006	2 5	120	50	12 5	1 73 1	3 46 1	29 23
84270	*1500 ct	600 ct	–	3.0	2 0	006	2 5	120	60	–	1 58:1	–	30 46
84275	*1500 ct	1500 ct	–	3.0	2 0	006	2.5	120	150	–	1 1	–	30 46
84280	1600 ct	12.8 ct	3.2	3.0	2.0	006	2.5	128	1 3	32	11 18 1	22 36 1	29.23
84283	2000 ct	8 ct	2	3 0	2 0	006	2.2	160	8	2	15 8:1	31 6 1	29.23
84285	2000 ct	2000 ct	500	3 0	2 0	006	2 2	160	200	50	1 1	2 1	29 23
84290	*2000 ct	2000 ct	–	3.0	2 0	006	2.2	160	200	–	1 1	–	30 46
84295	2000 ct	8000 ct	2000	3 0	2 0	006	2.2	160	800	200	1:2	1 1	29 23
84297	2500 ct	2500 ct	625	3 0	2 0	006	2	200	250	63	1 1	2 1	29 23
84300	3000 ct	3000 ct	750	3 0	2 0	006	1.8	240	300	75	1 1	2 1	29 23
84305	*3000 ct	3000 ct	–	3 0	2 0	.006	1 8	240	300	–	1 1	–	29 23

*INCLUDES ELECTROSTATIC SHIELD
**MINIATURIZED TELEPHONE COUPLING APPLICATION
***Discount Prices: 1–9 Net; 10–24 less 10%; 25–49 less 16%; 50–99 less 23%; 100–499 less 30%
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

SPECIFICATIONS

- **MIL-T-27:** ..... All units manufactured to MIL-T-27, and are Hermetically Sealed Audio Transformers are Type TF5R21ZZ
- **FREQUENCY RESPONSE:** ..... ±3db, 20 Hz-25 KHz at 1.0 Milliwatt.
- **MAXIMUM DISTORTION:** ..... 5% With Rated Power Level at 1 KHz and 300 Hz. 10% Distortion at 20 Hz.
- **DIELECTRIC STRENGTH:** ..... All Units Tested at 200 V RMS.
- **INSULATION RESISTANCE:** ... Greater Than 10,000 Megohms at 300 V DC.
- **WEIGHT:** ..... 28 Grams
- **OPERATING TEMPERATURE:** -55°c to +105°c (All Units Can be Supplied to Class S Requirements, +130°c).
- **TERMINALS:** ..... Solderability per MIL-STD-202 Method 208.
- **THERMAL SHOCK:** ..... 25 Cycles, Method 107C, MIL-STD-202D, Test Condition A-1.

THIS PRODUCT IS PATENTED

Delivery— stock to one week

For immediate engineering assistance or to place an order— ***Call Toll Free 800-228-9747***

PICO PART NUMBER	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	SPLIT WINDINGS PAR	POWER WATTS 1KHz and higher	300 Hz and higher	20 Hz and higher	PRIMARY UNBAL DC CURRENT ma	PRIMARY DC RESIST OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	SECONDARY DC RESISTANCE OHMS PAR CONN	TURNS RATIO PRIM/SEC SEC SER CONN	TURNS RATIO PRIM/SEC SEC PAR CONN	PICO PRICES 1–9 ***
84310	3600 ct	3600 ct	900	2.7	2.0	.006	1.7	288	360	90	1:1	2:1	29.23
84312	4000 ct	16 ct	4	2.5	2.0	006	1.6	320	1.6	4	15.8:1	31.6:1	29.23
84314**	4000 ct	600 ct	150	2.5	2.0	.006	1.6	320	60	15	2.58:1	5.16:1	29.23
84315	4000 ct	1000 ct	250	2.5	2.0	.006	1.6	320	100	25	2:1	4:1	29.23
84320	*4000 ct	8000 ct	–	2.5	2.0	.006	1.6	320	800	–	1:1 41	–	30.46
84325	5000 ct	500 ct	125	2.0	2.0	.006	1.4	400	50	12.5	3.16:1	6.32:1	29.32
84330	5000 ct	5000 ct	1250	2.0	2.0	.006	1.4	400	500	125	1:1	2:1	29.32
84335	7500 ct	50 ct	12.5	1.3	1.3	.006	1.2	600	5	1.25	12.25:1	24.5:1	32.42
84340	7500 ct	100 ct	25	1.3	1.3	.006	1.2	600	10	2.5	8.66:1	17.32:1	32.42
84345	7500 ct	600 ct	150	1.3	1.3	006	1.2	600	60	15	3.54:1	7.07:1	32.42
84350	7500 ct	2500 ct	625	1.3	1.3	006	1.2	600	250	63	1.73:1	3.46:1	32.42
84355	*7500 ct	7500 ct	–	1.3	1.3	006	1.2	600	750	–	1:1	–	34.76
84360	8000 ct	12.8 ct	3.2	1.2	1.2	006	1.1	640	1.3	32	25:1	50:1	32.42
84365	8000 ct	1000 ct	250	1.2	1.2	.006	1.1	640	100	25	2.83:1	5.66:1	32.42
84370	*8000 ct	1200 ct	–	1.2	1.2	006	1.1	640	120	–	2.58:1	–	34.76
84375	*9000 ct	9000 ct	–	1.1	1.1	006	1.1	720	900	–	1:1	–	34.76
84380	10,000 ct	12.8 ct	3.2	1.0	1.0	006	1	800	1.3	32	28:1	56:1	32.42
84385	10,000 ct	16 ct	4	1.0	1.0	006	1	800	1.6	4	25:1	50:1	32.42
84390	10,000 ct	100 ct	25	1.0	1.0	006	1	800	10	2.5	10:1	20:1	32.42
84395	10,000 ct	200 ct	50	1.0	1.0	006	1	800	20	5	7.07:1	14.14:1	32.42
84400	10,000 ct	500 ct	125	1.0	1.0	006	1	800	50	12.5	4.47:1	8.94:1	32.42
84405	10,000 ct	600 ct	150	1.0	1.0	.006	1	800	60	15	4.08:1	8.16:1	32.42
84410	10,000 ct	1000 ct	250	1.0	1.0	.006	1	800	100	25	3.16:1	6.32:1	32.42
84415	10,000 ct	1200 ct	300	1.0	1.0	.006	1	800	120	30	2.89:1	5.77:1	32.42
84420	10,000 ct	1500 ct	375	1.0	1.0	.006	1	800	150	38	2.58:1	5.16:1	32.42
84425	10,000 ct	2000 ct	500	1.0	1.0	.006	1	800	200	50	2.24:1	4.47:1	32.42
84430	10,000 ct	5000 ct	1250	1.0	1.0	.006	1	800	500	125	1.41:1	2.83:1	32.42
84435	10,000 ct	7500 ct	1875	1.0	1.0	.006	1	800	750	188	1.16:1	2.31:1	32.42
84440	10,000 ct	10,000 ct	2500	1.0	1.0	.006	1	800	1000	250	1:1	2:1	32.42
84445	*10,000 ct	10,000 ct	–	1.0	1.0	006	1	800	1000	–	1:1	–	34.76
84450	15,000 ct	400 ct	100	.66	.66	006	.8	1200	40	10	6.12:1	12.25:1	32.42
84452	15,000 ct	500 ct	125	.66	.66	.006	.8	1200	50	12.5	5.48:1	10.95:1	32.42
84455	15,000 ct	600 ct	150	.66	.66	.006	.8	1200	60	15	5:1	10:1	32.42
84460	15,000 ct	10,000 ct	2500	.66	.66	.006	.8	1200	1000	250	1.22:1	2.45:1	32.42
84465	*15,000 ct	15,000 ct	–	.66	.66	.006	.8	1200	1500	–	1:1	–	34.76
84470	15,000 ct	15,000 ct	3750	.66	.66	.006	.8	1200	1500	375	1:1	2:1	32.42
84475	16,000 ct	1000 ct	250	.62	.62	.006	.8	1280	100	25	4:1	8:1	32.42
84480	20,000 ct	500 ct	125	5	5	006	7	1600	50	12.5	6.32:1	12.6:1	34.76
84485	20,000 ct	600 ct	150	.5	5	006	7	1600	60	15	5.77:1	11.55:1	34.76
84490	20,000 ct	800 ct	200	5	.5	006	7	1600	80	20	5:1	10:1	34.76
84495	20,000 ct	1000 ct	250	5	5	006	.7	1600	100	25	4.47:1	8.94:1	34.76
84500	20,000 ct	5000 ct	1250	5	5	006	7	1600	500	125	2:1	4:1	34.76
84505	20,000 ct	10,000 ct	2500	.5	.5	.006	.7	1600	1000	250	1.41:1	2.83:1	34.76
84510	*20,000 ct	20,000 ct	–	5	.5	006	7	1600	2000	–	1:1	–	36.12
84515	25,000 ct	500 ct	125	.4	.4	006	6	2000	50	12.5	7.07:1	14.14:1	34.76
84520	25,000 ct	1000 ct	250	4	4	006	.6	2000	100	25	5:1	10:1	34.76
84525	30,000 ct	50 ct	12.5	33	33	006	6	2400	5	1.25	24.5:1	49:1	36.12
84530	30,000 ct	1200 ct	300	33	33	006	.6	2400	120	30	5:1	10:1	36.12
84532	30,000 ct	500 ct	125	33	.33	006	6	2400	50	12.5	7.7:1	15.5:1	36.12
84534	30,000 ct	200 ct	50	.33	.33	006	.6	2400	20	5	12.2:1	24.5:1	36.12
84535	30,000 ct	5000 ct	1250	33	.33	.006	.6	2400	500	125	2.45:1	4.9:1	36.12
84540	30,000 ct	10,000 ct	2500	33	.33	006	.6	2400	1000	250	1.73:1	3.46:1	36.12
84545	*30,000 ct	30,000 ct	–	33	33	006	6	2400	3000	–	1:1	–	38.73
84550	40,000 ct	400 ct	100	.25	25	006	5	3200	40	10	10:1	20:1	38.73
84555	40,000 ct	2000 ct	500	25	25	006	5	3200	200	50	4.47:1	8.94:1	38.73
84560	40,000 ct	4000 ct	1000	.25	25	006	5	3200	400	100	3.16:1	6.32:1	38.73
84565	40,000 ct	20,000 ct	5000	25	.25	006	5	3200	2000	500	1.41:1	2.83:1	38.73
84570	*40,000 ct	40,000 ct	–	.25	.25	006	5	3200	4000	–	1:1	–	43.19
84575	50,000 ct	200 ct	50	.2	2	.006	4	4000	20	5	15.8:1	31.6:1	43.19
84577	50,000 ct	500 ct	125	2	2	006	4	4000	50	12.5	10:1	20:1	43.19
84578	50,000 ct	600 ct	150	2	2	006	4	4000	60	15	9.13:1	18.26:1	43.19
84579	50,000 ct	50,000 ct	12,500	2	.2	.006	4	4000	5000	1250	1:1	2:1	43.19
84580	60,000 ct	15,000 ct	3750	16	.16	006	4	4800	1500	375	2:1	4:1	46.64
84585	62,500 ct	50 ct	12.5	16	.16	006	4	5000	5	1.25	35.4:1	70.7:1	46.64
84587	80,000 ct	15,000 ct	3750	12	.12	006	3	6400	1500	375	2.3:1	4.6:1	46.64

*INCLUDES ELECTROSTATIC SHIELD
**MINIATURIZED TELEPHONE COUPLING APPLICATION

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Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York

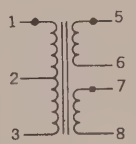
PICO's ultra-miniature surface mount transformers

SERIES 84000

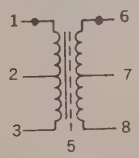
FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- PICO IS APPROVED QPL SOURCE (MIL-T-27)
- MAGNETIC SHIELDS AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED.
- VARIATION OF STANDARD DESIGNS AVAILABLE
- PRIMARY AND SECONDARY WINDINGS CAN BE USED EITHER AS INPUT OR OUTPUT.
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS.

SURFACE MOUNT SCHEMATIC FOR TRANSFORMERS WITH SPLIT WINDING



SCHEMATIC FOR TRANSFORMERS WITH ELECTROSTATIC SHIELD



For immediate engineering assistance or to place an order—

Call Toll Free 800-228-9747

Delivery— stock to one week

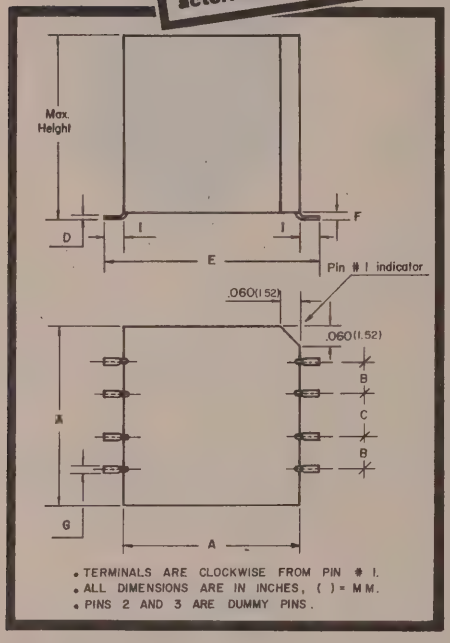
PICO Electronics, Inc.

453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552 • • FAX 914-699-5565

PICO's miniature 400 Hz transformers

SURFACE MOUNT
PICO surface mount units utilize materials and methods to withstand extreme temperature (220°C) of vapor phase, I.R., and other reflow procedures without degradation of electrical or mechanical characteristics.

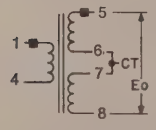
115V/26V Primary



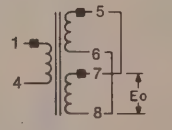
Serial Number	Max Height	A	B	C	D	E	F	G	I
76000	415 (10.54)	.550 (13.97)	.095 (2.41)	.135 (3.43)	.010 (.25)	.670 (17.02)	.015 (.38)	.020 (.51)	.060 (1.52)
77000	.565 (14.35)	550 (13.97)	095 (2.41)	135 (3.43)	010 (.25)	670 (17.02)	015 (.38)	020 (.51)	060 (1.52)
82000	455 (11.56)	.800 (20.32)	.170 (4.32)	.230 (5.84)	.014 (.35)	1.000 (25.40)	025 (.63)	030 (.76)	100 (2.54)
83000	605 (15.37)	800 (20.32)	170 (4.32)	230 (5.84)	014 (.35)	1.000 (25.40)	025 (.63)	030 (.76)	100 (2.54)
84000	915 (23.24)	800 (20.32)	.170 (4.32)	230 (5.84)	014 (.35)	1.000 (25.40)	025 (.63)	030 (.76)	100 (2.54)

FEATURES
- 400 Hz Aerospace Application
- Smallest Possible Size
- Secondary Has Split Winding (Secondary can Be Used at Half Voltage Twice the Current.)

SPECIFICATIONS
- Manufactured to MIL-T-27 (TF5S03ZZ)
- 90°c Ambient
- Input Primary 115v-400 Hz ±20 Hz or 26V-400HZ-±20 Hz (Your Choice-Just Choose The Proper Part No.)
- Regulation is 24% (T Units Have Regulation of 17%)
- Secondary Voltage Adjusted to Nominal Value at Half Load.



SERIES CONNECTED SECONDARY



PARALLEL CONNECTED SECONDARY

THIS PRODUCT IS PATENTED

SEC/ VOLT	SEC/ CURRENT ma	MODEL NUMBER 115V PRIMARY	MODEL NUMBER 26V PRIMARY	PICO PRICES 1-9*
5.0 CT	75	76900	76902	32 19
	150	77900	77902	32.19
	204	82650	82815	47.54
	338	83650	83815	42.28
	480	84650	84815	44 09
6.3 CT	59 5	76899	76903	32 19
	119	77899	77903	32 19
	162	82655	82820	47.54
	268	83655	83820	42.28
	381	84655	84820	44 09
8.0 CT	47	76898	76904	32 19
	94	77898	77904	32 19
	128	82660	82825	47 54
	211	83660	83825	42 28
	300	84660	84825	44 09
10 CT	37 5	76897	76905	32 19
	75	77897	77905	32 19
	102	82665	82830	47 54
	169	83665	83830	42 28
	240	84665	84830	44.09
12 8 CT	29	76892	76906	32 19
	58 6	77892	77906	32 19
	79 7	82670	82835	47 54
	132	83670	83835	42 28
	188	84670	84835	44 09
14 CT	26 8	76889	76907	32 19
	53 6	77889	77907	32 19
	72 9	82675	82840	47 54
	121	83675	83840	42.28
	171	84675	84840	44 09
16 CT	23	76887	76908	32.19
	47	77887	77908	32 19
	63 8	82680	82845	47 54
	106	83680	83845	42 28
	150	84680	84845	44 091
18 CT	20 8	76886	76909	32 19
	41 7	77886	77909	32 19
	56 7	82685	82850	47 54
	93 9	83685	83850	42 28
	133	84685	84850	44 09
20 CT	18 8	76885	76911	32 19
	37 5	77885	77911	32 19
	51	82690	82855	47 54
	84.5	83690	83855	42 28
	120	84690	84855	44 09
22 CT	17	76884	76912	32 19
	34	77884	77912	32 19
	46 4	82695	82860	47 54
	76 8	83695	83860	42 28
	109	84695	84860	44 09
24 CT	15 5	76882	76913	32 19
	31	77882	77913	32 19
	42 5	82700	82865	47 54
	70 4	83700	83865	42 28
	100	84700	84865	44 09
28 CT	13 4	76881	76914	32 19
	26 8	77881	77914	32 19
	36 4	82705	82870	47 54
	60 4	83705	83870	42 28
	85.7	84705	84870	44.09
31 CT	12	76879	76916	32 19
	24	77879	77916	32 19
	32 9	82710	82875	47 54
	54 5	83710	83875	42.28
	77 4	84710	84875	44 09
36 CT	10 4	76877	76917	32.19
	20.8	77877	77917	32 19
	28.3	82715	82880	47 54
	46 9	83715	83880	42 28
	66 7	84715	84880	44 09
39 CT	9 6	76876	76918	32.19
	19 2	77876	77918	32 19
	26.2	82720	82885	47 54
	43 3	83720	83885	42 28
	61 5	84720	84885	44 09

SEC/ VOLT	SEC/ CURRENT ma	MODEL NUMBER 115V PRIMARY	MODEL NUMBER 26V PRIMARY	PICO PRICES 1-9*
43 CT	8 7	76875	76919	32 19
	17 4	77875	77919	32 19
	23 7	82725	82890	47.54
	39 3	83725	83890	42 28
	55 8	84725	84890	44 09
48 CT	7 8	76874	76920	32 19
	15 6	77874	77920	32.19
	21 1	82730	82895	47 54
	35 2	83730	83895	42.28
	50	84730	84895	44 09
56 CT	6.6	76872	76921	32.19
	13 2	77872	77921	32.19
	18 2	82735	82900	47.54
	30 2	83735	83900	42 28
	42.9	84735	84900	44 09
63 CT	6	76869	76922	32 19
	11 9	77869	77922	32 19
	16.2	82740	82905	47.54
	26.9	83740	83905	42 28
	38 2	84740	84905	44 09
68 CT	5 5	76867	76923	32 19
	11	77867	77923	32 19
	15	82745	82910	47.54
	24.9	83745	83910	42 28
	35.3	84745	84910	44 09
80 CT	4.6	76862	76925	32 19
	9 4	77862	77925	32 19
	12 1	82750	82915	47.54
	21.1	83750	83915	42 28
	30	84750	84915	44 09
88 CT	4.2	76857	76926	32 19
	8 5	77857	77926	32 19
	11 6	82755	82920	47 54
	19 2	83755	83920	42 28
	27 3	84755	84920	44 09
100 CT	3 7	76854	76927	32 19
	8 5	77854	77927	32 19
	10 2	82760	82925	47 54
	16 9	83760	83925	42 28
	24	84760	84925	44 09
115 CT	3 2	76852	76928	32.19
	6.5	77852	77928	32.19
	8 9	82765	82930	47 54
	14 7	83765	83930	42 28
	20 9	84765	84930	44 09
123 CT	8.3	82770	82935	47 54
	13 7	83770	83935	42 28
	19 5	84770	84935	44 09
138 CT	7 4	82775	82940	47.54
	12 2	83775	83940	42.28
	17 4	84775	84940	44 09
157 CT	6 5	82780	82945	47 54
	10 8	83780	83945	42 28
	15 3	84780	84945	44 09
175 CT	5 8	82785	82950	47.54
	9 6	83785	83950	42.28
	13 7	84785	84950	44 09
200 CT	5 1	82790	82955	47 54
	8 4	83790	83955	42 28
	12	84790	84955	44 09
220 CT	7.7	83795	83960	44 43
	10.9	84795	84960	46 32
250 CT	6.8	83800	83965	46.54
	9.6	84800	84965	48.53
275 CT	6.1	83805	83970	48.85
	8.7	84805	84970	52.95
310 CT	5.4	83810	83975	50.79
	7.7	84810	84795	57.00

Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York

*Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%

For immediate engineering assistance or to place an order— ***Call Toll Free 800-228-9747***

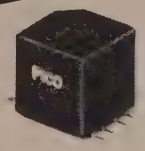
Delivery— stock to one week

PICO Electronics, Inc.
453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552 • • FAX 914-699-5565

PICO's Pulse Transformers

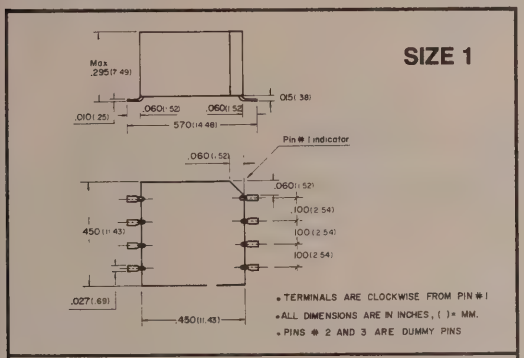
SURFACE MOUNT

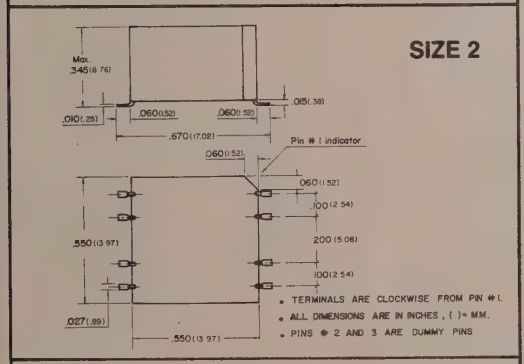
PICO surface mount units utilize materials and methods to withstand extreme temperature (220°C) of vapor phase, I.R., and other reflow procedures without degradation of electrical or mechanical characteristics.

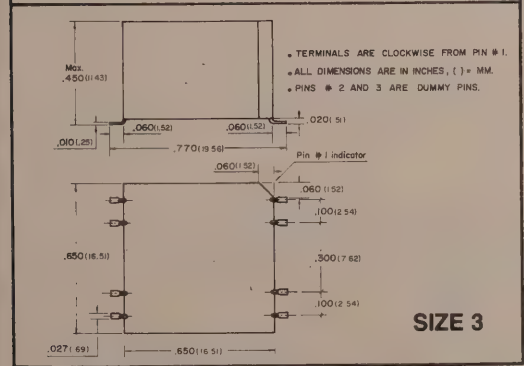


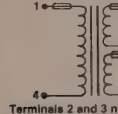
SPECIFICATIONS

- Units manufactured to MIL-T-21038 TP75SXNNNNK2
- **DIELECTRIC STRENGTH:** ..... All Units Tested at 500 V RMS.
- **INSULATION RESISTANCE:** ... Greater Than 10,000 Megohms at 700 V DC.
- **THERMAL SHOCK:** ..... 25 Cycles, Method 107C, MIL-STD-202E, Test Condition A-1.
- **OPERATING TEMPERATURE:** –55°c to +130°c).
- **TERMINALS:** Meet solderability per MIL-STD-202 Method 208
- **WEIGHT SIZE:** 1-2.5 Grams, 2-4.5 Grams, 3-8.0 Grams









Terminals 2 and 3 no connection mechanical stability only

THIS PRODUCT IS PATENTED

Delivery— stock to one week

SIZE 1

PICO PART #	TURNS RATIO TOLER. ±5%	Lm TYPICAL µH	LEAKAGE IND. VALUE IN µH TYPICAL LL (N1-N2)	LL (N1-N3)	WINDING RESISTANCE MAX VALUE IN OHMS R(N1)	R(N2)	R(N3)	TYPICAL INTER-WINDING CAP VALUE IN pF C1 (N1-N2)	C2 (N1-N3)	E.T. RATING VOLT-µsec MIN. PRIMARY	PRICE 1-9
75005	1:1:1	150	.100	.250	.070	.080	.085	25	12	10	17.95
75010	1:1:1	600	.400	1.1	15	18	21	25	12	20	17.95
75015	1:1:1	1300	.900	2.5	45	.51	.58	25	12	30	17.95
75020	1:1:1	2400	1.6	4.2	1.14	1.27	1.39	25	12	40	17.95
75025	1:1:1	3700	3.0	6.5	2.0	2.3	2.5	25	12	50	17.95
75030	2:1:1	150	.250	.450	.062	.014	.014	25	12	10	17.95
75035	2:1:1	600	1.0	1.5	15	.074	.087	25	12	20	17.95
75040	2:1:1	1300	1.5	3.5	45	.10	13	25	12	30	17.95
75045	2:1:1	2400	2.2	6.0	1.14	17	.20	25	12	40	17.95
75050	2:1:1	3700	3.4	9.0	2.07	.29	.32	25	12	50	17.95
75055	3:1:1	200	.617	1.0	.081	.018	.018	25	12	12	17.95
75060	3:1:1	800	1.2	1.5	18	.035	.040	25	12	24	17.95
75065	3:1:1	1800	2.5	5.0	.37	15	16	25	12	36	17.95
75070	3:1:1	3200	4.5	10.0	62	25	28	25	12	48	17.95
75075	3:1:1	5300	7.0	15.0	1.28	.25	.28	25	12	60	17.95
75080	3.3:1	200	200	1.0	.082	.096	.025	25	12	12	17.95
75085	3.3:1	800	1.0	1.5	18	.22	.042	25	12	24	17.95
75090	3.3:1	1800	2.5	5.0	.58	.73	.28	25	12	36	17.95
75095	3.3:1	3200	4.5	10.0	95	1.18	.55	25	12	48	17.95
75100	3.3:1	5300	7.0	15.0	1.56	1.78	69	25	12	60	17.95
75105	4:2:1	200	506	2.0	.047	.024	019	25	12	12	17.95
75110	4:2:1	800	1.5	3.0	.18	071	041	25	12	24	17.95
75115	4:2:1	1800	3.0	5.5	.46	28	16	25	12	36	17.95
75120	4:2:1	3200	5.5	10.0	.77	46	.25	25	12	48	17.95
75125	4:2:1	5300	8.0	15.0	1.25	72	40	25	12	60	17.95

SIZE 2

PICO PART #	TURNS RATIO TOLER. ±5%	Lm TYPICAL µH	LEAKAGE IND. VALUE IN µH TYPICAL LL (N1-N2)	LL (N1-N3)	WINDING RESISTANCE MAX VALUE IN OHMS R(N1)	R(N2)	R(N3)	TYPICAL INTER-WINDING CAP VALUE IN pF C1 (N1-N2)	C2 (N1-N3)	E.T. RATING VOLT-µsec MIN. PRIMARY	PRICE 1-9
75210	1:1:1	250	350	712	.038	.046	048	35	18	16	17.95
75215	1:1:1	1000	650	1.2	12	15	17	35	18	32	17.95
75220	1:1:1	2250	1.5	3.0	28	32	.37	35	18	48	17.95
75225	1:1:1	4000	2.5	5.0	59	66	74	35	18	65	17.95
75230	1:1:1	6200	4.0	8.0	1.27	1.48	1.56	35	18	80	17.95
75235	2:1:1	250	400	.815	.038	.014	015	35	18	16	17.95
75240	2:1:1	1000	800	1.6	12	044	049	35	18	32	17.95
75245	2:1:1	2250	1.8	3.6	28	.11	13	35	18	48	17.95
75250	2:1:1	4000	3.2	6.4	59	17	20	35	18	65	17.95
75255	2:1:1	6200	5.0	10.0	1.26	29	.31	35	18	80	17.95
75260	3:1:1	350	.400	.900	.036	017	.023	35	18	19	17.95
75265	3.1.1	1400	1.1	2.2	.15	035	039	35	18	38	17.95
75270	3:1:1	3000	2.4	5.0	.42	062	068	35	18	57	17.95
75275	3:1:1	5500	4.2	8.0	75	.23	24	35	18	76	17.95
75280	3:1:1	9000	6.5	10.0	1.02	39	41	35	18	95	17.95
75285	3:3:1	350	.450	1.0	063	068	049	35	18	19	17.95
75290	3:3:1	1400	1.2	2.6	15	17	065	35	18	38	17.95
75295	3:3:1	3000	2.5	5.0	.42	48	089	35	18	57	17.95
75300	3.3:1	5500	4.5	9.0	.94	1.14	43	35	18	76	17.95
75305	3:3:1	9000	7.0	14.0	1.54	1.74	64	35	18	95	17.95
75310	4:2:1	350	.700	1.64	040	023	014	35	18	19	17.95
75315	4.2.1	1400	1.3	2.7	.12	067	035	35	18	38	17.95
75320	4:2:1	3000	2.7	5.5	42	12	070	35	18	57	17.95
75325	4:2:1	5500	4.8	9.0	94	27	15	35	18	76	17.95
75330	4.2:1	9000	7.5	15.0	1.53	35	19	35	18	95	17.95

SIZE 3

PICO PART #	TURNS RATIO TOLER. ±5%	Lm TYPICAL µH	LEAKAGE IND. VALUE IN µH TYPICAL LL (N1-N2)	LL (N1-N3)	WINDING RESISTANCE MAX VALUE IN OHMS R(N1)	R(N2)	R(N3)	TYPICAL INTER-WINDING CAP VALUE IN pF C1 (N1-N2)	C2 (N1-N3)	E.T. RATING VOLT-µsec MIN PRIMARY	PRICE 1-9
75515	1:1:1	300	.300	.400	044	048	054	45	25	25	17.95
75520	1:1.1	1200	1.25	1.9	095	11	13	45	25	50	17.95
75525	1:1:1	2700	1.75	4.2	22	26	.29	45	25	75	17.95
75530	1:1:1	4800	3.0	7.3	.46	52	59	45	25	100	17.95
75535	1:1.1	7500	4.6	11.4	81	90	99	45	25	125	17.95
75540	2:1:1	300	.514	630	044	013	017	45	25	25	17.95
75545	2:1:1	1200	900	1.7	095	043	047	45	25	50	17.95
75550	2:1:1	2700	2.0	3.7	.22	10	12	45	25	75	17.95
75555	2:1:1	4800	3.0	6.5	46	17	19	45	25	100	17.95
75560	2:1.1	7500	4.88	10.0	.80	.28	34	45	25	125	17.95
75565	3:1.1	400	686	800	049	011	011	45	25	30	17.95
75570	3:1:1	1600	1.25	3.0	.12	035	038	45	25	60	17.95
75575	3:1:1	3600	2.75	6.5	.33	062	068	45	25	90	17.95
75580	3.1:1	6400	4.6	1.20	58	14	15	45	25	120	17.95
75585	3.1:1	10000	7.2	18.0	1.25	13	15	45	25	150	17.95
75590	3:3:1	400	.400	1.02	062	072	.012	45	25	30	17.95
75595	3:3:1	1600	1.25	1.5	12	14	040	45	25	60	17.95
75600	3:3:1	3600	3.0	2.9	.33	38	070	45	25	90	17.95
75605	3:3:1	6400	5.3	5.0	58	73	18	45	25	120	17.95
75610	3:3:1	10000	8.2	7.8	1.35	1.40	20	45	25	150	17.95
75615	4:2:1	400	.580	1.12	.054	016	009	45	25	30	17.95
75620	4:2:1	1600	1.2	3.0	12	052	028	45	25	60	17.95
75625	4:2:1	3600	2.75	7.0	33	15	084	45	25	90	17.95
75630	4:2.1	6400	4.6	12.0	.58	14	080	45	25	120	17.95
75635	4:2:1	10000	7.1	19.6	1.22	.27	15	45	25	150	17.95

*For immediate engineering assistance or to place an order— **Call Toll Free 800-228-9747***

PICO Electronics, Inc.
453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552 • • FAX 914-699-5565

SURFACE MOUNT

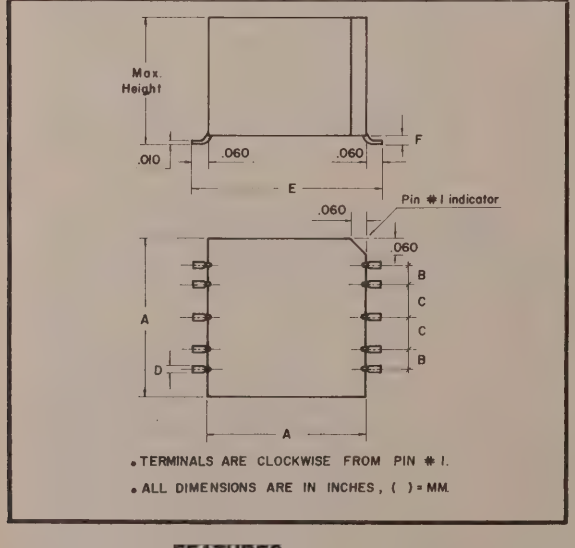
PICO surface mount units utilize materials and methods to withstand extreme temperature (220°C) of vapor phase, I.R., and other reflow procedures without degradation of electrical or mechanical characteristics.

Ultra-Miniature DC-DC Converter Transformers

- These units can be used as self saturated or square wave driven
- Input voltages of: 5V, 12V, 24V and 48V
- Output voltages up to 300 Volts
- Power levels up to 40 Watts

All units can be supplied with higher or lower output voltages. Delivery- stock to one week, special voltages 9 days.

Size	Max. Height	A	B	C	D	E	F
1	.310 (7.87)	.400 (10.16)	.050 (1.27)	.075 (1.91)	.020 (.51)	.520 (13.21)	.012 (.30)
2	.365 (9.27)	.495 (12.57)	.055 (1.40)	.095 (2.41)	.020 (.51)	.615 (15.62)	.012 (.30)
3	.460 (11.68)	.615 (15.62)	.075 (1.90)	.125 (3.18)	.027 (.69)	.735 (18.67)	.020 (.51)



INPUT 5 VOLTS

Part Number	D.C. OUT VOLTS Bridge	Full Wave	Dual Bridge	MAX. POWER OUT −55°c-+105°c	−55°c-+70°c	APPROX. SWITCH FREQ. Self-Saturated	Square-Wave Driven**	SIZE	*** PRICE 1-9
31420	10	5	±5	1.5W	3W	15K	30K TO 60K	1	41.54
31440	12	6	±6	1.5W	3W	15K	30K TO 60K	1	41.54
31460	28	14	±14	1.5W	3W	15K	30K TO 60K	1	41.54
31480	48	24	±24	1.5W	3W	20K	40K TO 60K	1	41.54
31500	100	50	±50	1.5W	3W	20K	40K TO 60K	1	41.54
32505	10	5	±5	3W	4.5W	15K	30K TO 60K	2	41.54
32525	12	6	±6	3W	4.5W	15K	30K TO 60K	2	41.54
32545	28	14	±14	3W	4.5W	15K	30K TO 60K	2	41.54
32565	48	24	±24	3W	4.5W	20K	40K TO 60K	2	41.54
32585	100	50	±50	3W	4.5W	20K	40K TO 60K	2	41.54
32588	150	75	±75	3W	-	10K	30K TO 60K	2	47.86
32591	200	100	±100	3W	-	10K	30K TO 60K	2	47.86
32594	300	150	±150	3W	-	10K	30K TO 60K	2	47.86
33503	10	5	±5	5W	7.5W	10K	20K TO 50K	3	41.54
33523	12	6	±6	5W	7.5W	10K	20K TO 50K	3	41.54
33543	28	14	±14	5W	7.5W	10K	20K TO 50K	3	41.54
33563	48	24	±24	5W	7.5W	10K	20K TO 50K	3	41.54
33583	100	50	±50	5W	7.5W	10K	20K TO 50K	3	41.54
33586	150	75	±75	5W	-	10K	30K TO 60K	3	47.86
33589	200	100	±100	5W	-	10K	30K TO 60K	3	47.86
33592	300	150	±150	5W	-	10K	30K TO 60K	3	47.86

** Lower switching frequency may be used at lower output power.

INPUT 12 VOLTS

Part Number	D.C. OUT VOLTS Bridge	Full Wave	Dual Bridge	MAX. POWER OUT −55°c-+105°c	−55°c-+70°c	APPROX. SWITCH FREQ. Self Saturated	Square-Wave Driven**	Size	*** Price 1-9
31520	12	6	±6	1.5W	3W	15K	30K TO 60K	1	41.54
31540	24	12	±12	1.5W	3W	15K	30K TO 60K	1	41.54
31560	28	14	±14	1.5W	3W	15K	30K TO 60K	1	41.54
31580	48	24	±24	1.5W	3W	20K	40K TO 60K	1	41.54
31600	100	50	±50	1.5W	3W	20K	40K TO 60K	1	41.54
32605	12	6	±6	3W	4.5W	15K	30K TO 60K	2	41.54
32625	24	12	±12	3W	4.5W	15K	30K TO 60K	2	41.54
32645	28	14	±14	3W	4.5W	15K	30K TO 60K	2	41.54
32665	48	24	±24	3W	4.5W	20K	40K TO 60K	2	41.54
32685	100	50	±50	3W	4.5W	20K	40K TO 60K	2	41.54
32688	150	75	±75	3W	-	10K	30K TO 60K	2	47.86
32691	200	100	±100	3W	-	10K	30K TO 60K	2	47.86
32694	300	150	±150	3W	-	10K	30K TO 60K	2	47.86
33603	12	6	±6	5W	7.5W	15K	30K TO 60K	3	41.25
33623	28	14	±14	5W	7.5W	15K	30K TO 60K	3	41.25
33643	48	24	±24	5W	7.5W	20K	40K TO 60K	3	41.25
33663	100	50	±50	5W	7.5W	20K	40K TO 60K	3	41.25
33666	150	75	±75	5W	-	10K	30K TO 60K	3	47.86
33669	200	100	±100	5W	-	10K	30K TO 60K	3	47.86
33672	300	150	±150	5W	-	10K	30K TO 60K	3	47.86

**Lower switching frequency may be used at lower output power.

*** Discount prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%

Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York

FEATURES

1) Units can be used as self-saturating or for linear switching applications. Operation over ambient temperature range from −55° to +105°c. All units manufactured to the requirements of MIL-T-27 (TF5S40ZZ)
2) All units can be supplied with higher or lower secondary voltages at the same power levels.
3) Secondary can be connected for full-wave bridge or dual bridge.

Delivery— stock to one week

For immediate engineering assistance or to place an order— ***Call Toll Free 800-228-9747***

PICO Electronics, Inc.

453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552 • • FAX 914-699-5565

INPUT 24 VOLTS

Part Number	D.C. OUT VOLTS Bridge	Full Wave	Dual Bridge	MAX. POWER OUT −55°c-+105°c	−55°c-−70°c	APPROX. SWITCH FREQ. Self Saturated	Square-Wave Driven**	Size	*** Price 1-9
31620	10	5	±5	1.5W	3W	15K	30K TO 60K	1	41.54
31640	28	14	±14	1.5W	3W	15K	30K TO 60K	1	41.54
31660	48	24	±24	1.5W	3W	20K	40K TO 60K	1	41.54
31680	100	50	±50	1.5W	3W	20K	40K TO 60K	1	41.54
32705	10	5	±5	3W	4.5W	15K	30K TO 60K	2	41.54
32725	28	14	±14	3W	4.5W	15K	30K TO 60K	2	41.54
32745	48	24	±24	3W	4.5W	20K	40K TO 60K	2	41.54
32765	100	50	±50	3W	4.5W	20K	40K TO 60K	2	41.54
32768	150	75	±75	3W	-	10K	30K TO 60K	2	47.86
32771	200	100	±100	3W	-	10K	30K TO 60K	2	47.86
32774	300	150	±150	3W	-	10K	30K TO 60K	2	47.86
33683	10	5	±5	5W	7.5W	15K	30K TO 60K	3	41.54
33703	28	14	±14	5W	7.5W	15K	30K TO 60K	3	41.54
33723	48	24	±24	5W	7.5W	20K	40K TO 60K	3	41.54
33743	100	50	±50	5W	7.5W	20K	40K TO 60K	3	41.54
33746	150	75	±75	5W	-	10K	30K TO 60K	3	47.86
33749	200	100	±100	5W	-	10K	30K TO 60K	3	47.86
33752	300	150	±150	5W	-	10K	30K to 60K	3	47.86

**Lower switching frequency may be used at lower output power.

INPUT 48 VOLTS

Part Number	D.C. OUT VOLTS Bridge	Full Wave	Dual Bridge	MAX. POWER OUT −55°c-+105°c	−55°c-−70°c	APPROX. SWITCH FREQ. Self Saturated	Square-Wave Driven**	Size	*** Price 1-9
31700	24	12	±12	1.5W	3W	15K	30K TO 60K	1	41.54
31720	48	24	±24	1.5W	3W	20K	40K TO 60K	1	41.54
31740	100	50	±50	1.5W	3W	20K	40K TO 60K	1	41.54
31760	150	75	±75	1.5W	3W	20K	40K TO 60K	1	41.54
32785	24	12	±12	3W	4.5W	15K	30K TO 60K	2	41.54
32805	48	24	±24	3W	4.5W	20K	40K TO 60K	2	41.54
32825	100	50	±50	3W	4.5W	20K	40K TO 60K	2	41.54
32845	150	75	±75	3W	4.5W	20K	40K TO 60K	2	41.54
32848	200	100	±100	3W	4.5W	10K	30K TO 60K	2	47.86
32851	300	150	±150	3W	4.5W	10K	30K TO 60K	2	47.86
33763	24	12	±12	5W	7.5W	15K	30K TO 60K	3	47.86
33783	48	24	±24	5W	7.5W	20K	40K TO 60K	3	47.86
33803	100	50	±50	5W	7.5W	20K	40K TO 60K	3	47.86
33823	150	75	±75	5W	7.5W	20K	40K TO 60K	3	47.86
33826	200	100	±100	5W	-	10K	30K TO 60K	3	47.86
33829	300	150	±150	5W	-	10K	30K TO 60K	3	47.86

**Lower switching frequency may be used at lower output power.

*** Discount prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%

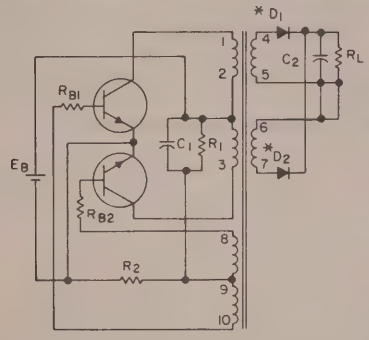
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York

PICO

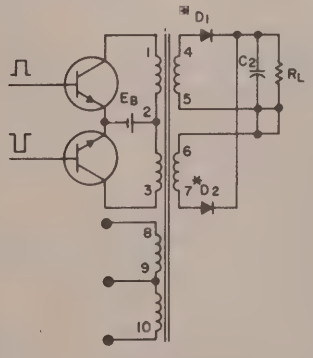
SURFACE MOUNT

Ultra-Miniature DC-DC Converter Transformers

SCHEMATIC USING
TRANSFORMERS AS SELF-SATURATING



SCHEMATIC USING
TRANSFORMERS AS LINEAR SWITCHING



* D1 AND D2 USE SCHOTTKY OR FAST SWITCHING DIODES

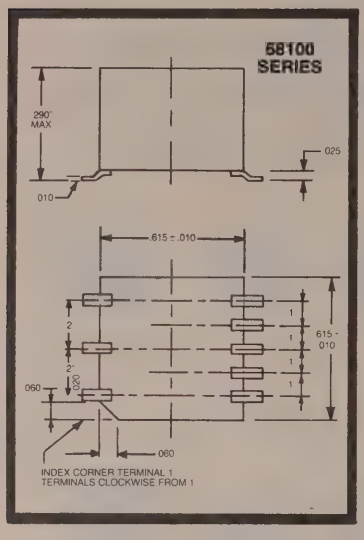
Delivery— stock to one week

*For immediate engineering assistance or to place an order— **Call Toll Free 800-228-9747***

PICO Electronics, Inc.

453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552 • • FAX 914-699-5565

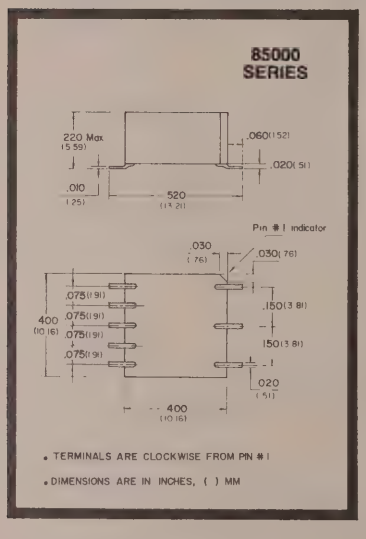
MIL-STD-1553 Interface Transformers
Multiplex Data BUS Pulse Transformers

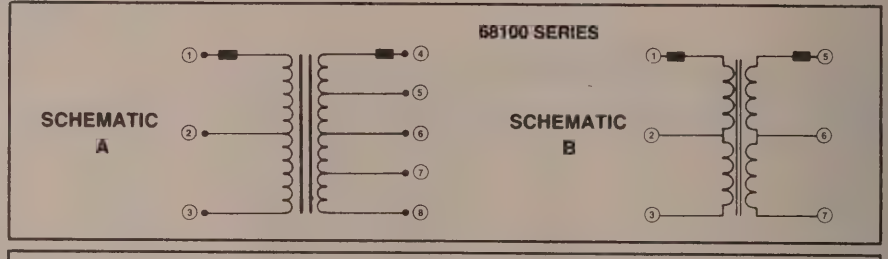


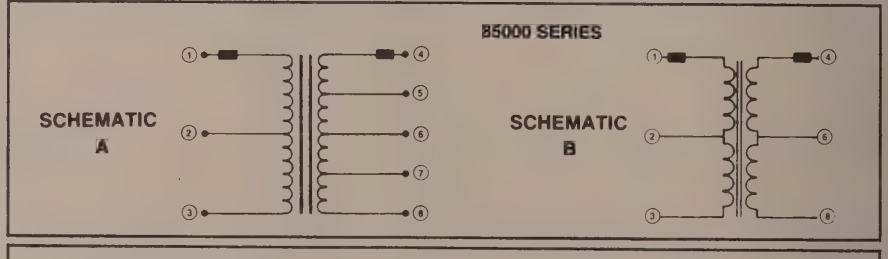
These pulse transformers manufactured to MIL-STD-1553 COMMAND/RESPONSE MULTIPLEX DATA BUS requirements. They also are manufactured to MIL-T-21038 specifications and are designed to meet MAC AIR SPECIFICATIONS A3818, A5690, A5232 and A4905.

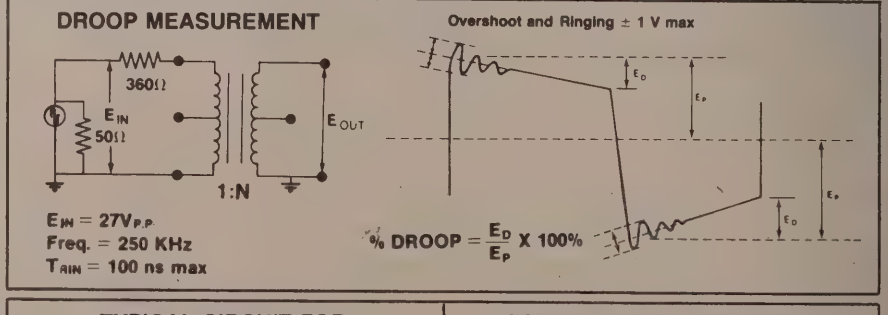
All of these transformers exhibit superior electrical performance. Common mode rejection ratio is greater than 45dB at 1 MHz. Input impedance is greater than 3000 ohms over the band from 75 kHz to 1mHz at 1V rms. This series possesses exceptional waveform integrity: Rise time and fall time is less than 100 nanoseconds. Overshoot and ringing is less than ± 1V peak. Droop is less than 20%.

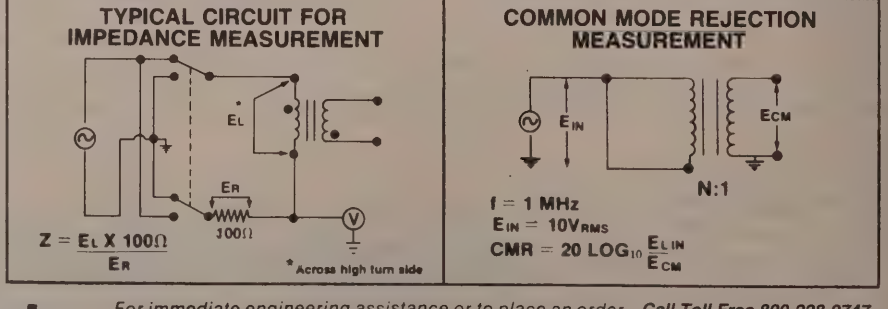
PICO PART NUMBER		TURNS RATIO	PRIMARY	SECOND-ARY	% DROOP (Typical)	CMR dB (Typical)	SCHEMATIC	PRICE (1–9)
68100 Series	85000 Series							
68110	85010	1CT : 1CT 1CT : .707CT	1–3 1–3	4–8 5–7	10	50	A	33.67
68120	85020	1.4CT : 1CT 2CT : 1CT	1–3 1–3	4–8 5–7	10	50	A	33.67
68130	85030	1.25CT : 1CT 1.66CT : 1CT	1–3 1–3	4–8 5–7	10	50	A	33.67
68140	85040	2.3CT : 1CT 3.2CT : 1 CT	1–3 1–3	4–8 5–7	10	50	A	33.67
68150	85050	1CT : 1CT	1–3	5–7	10	50	B	27.76
68160	85060	1CT : 1.41CT	1–3	5–7	10	50	B	27.76
68170	85070	1CT : 1.66CT	1–3	5–7	10	50	B	27.76
68180	85080	1CT : 2CT	1–3	5–7	10	50	B	27.76











SPECIFICATIONS:

- Units manufactured to MIL-T-21038 and MIL STD 1553
- IMPEDANCE ..... greater than 3KΩ over the band from 75kHz to 1MHz
- DROOP ..... 20% max.
- OVERSHOOT ..... 1V peak
- COMMON MODE REJECTION (CMR) greater than 45dB.
- DIELECTRIC STRENGTH: ..... All Units Tested at 200 V RMS.
- INSULATION RESISTANCE ..... Greater Than 10,000 Megohms at 300 V DC.
- WEIGHT: ... PLUG-IN 4 Grams. SURFACE MOUNT 5 Grams.
- OPERATING TEMPERATURE: ..... −55°c to +130°c).
- TERMINALS: Meet solderability per MIL- STD-202 Method 208

Delivery— stock to one week

PICO Electronics, Inc. *For immediate engineering assistance or to place an order— **Call Toll Free 800-228-9747***
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PICO Catalog Contents

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.35″ × .32″ TRANSFORMERS; 2 OHM TO 40K OHM; 400 Hz TO 100 KHz; 400 MILLIWATT AT 1 KHz	A•2480-81
.35″ × .46″ TRANSFORMERS; 2 OHM TO 100K OHM; 300 Hz TO 100 KHz; 600 MILLIWATT AT 1 KHz	A•2482-83
.5″ × .35″ TRANSFORMERS; 2 OHM TO 100K OHM; 300 Hz TO 75 KHz; 600 MILLIWATT AT 1 KHz	A•2484-85
.5″ × .5″ TRANSFORMERS; 2 OHM TO 250K OHM; 150 Hz TO 75 KHz; 1 WATT AT 1 KHz	A•2486-87
.75″ × .375″ TRANSFORMERS; 2 OHM TO 135K OHM; 75 Hz TO 30 KHz; 1.5 WATT AT 1 KHz	A•2488-89
.75″ × .52″ TRANSFORMERS; 2 OHM TO 135K OHM; 50 Hz TO 30 KHz; 2 WATT AT 1 KHz	A•2490-91
.75″ × .82″ TRANSFORMERS; 2 OHM TO 80K OHM; 20Hz TO 25 KHz; 3 WATT AT 1 KHz	A•2492-93
MICROPHONE/TRANSDUCER AUDIO INPUT TRANSFORMERS ***Interchangeable with transformers made by Beyer Dynamic of Germany.***	A•2494
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2 OHM TO 30K OHM; 400 Hz to 250 KHz; 100 MILLIWATT AT 1 KHz	A•2458-59
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.75″ × .375″ TRANSFORMERS; 2 OHM TO 135K OHM; 75 Hz TO 30 KHz; 1.5 WATT AT 1 KHz	A•2466-67
.75″ × .52″ TRANSFORMERS; 2 OHM TO 135K OHM; 50 Hz TO 30 KHz; 2 WATT AT 1 KHz	A•2468-69
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MIL-STD-1553 INTERFACE TRANSFORMERS/MULTIPLEX DATA BUS PULSE TRANSFORMERS	A•2476

See EEM Section 1800: Coils Chokes & Inductors for PICO's latest line of:
• Mini High "Q" Inductors • Mini Power Inductors (Surface Mount, Plug-In & Axial Leads)
• EMI Common Mode Suppression Inductors
Pages **A•**1263 through 1273

See EEM Section 4000: AC-DC Power Supplies
• New AC-DC Power Supplies 0.5" ht., up to 55 Watts
Pages **D•**1859 through 1873

See EEM Section 4025: Over 850 High Reliability Ultra-Miniature DC-DC Converters
• 0.2" ht., up to 30 Watts • New Fixed Frequency, DC-DC, 200 Watts–
68 Standard Dual and Single Models
Pages **D•**2137 through 2184

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PICO Electronics, Inc.

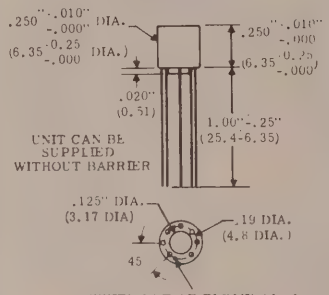
453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552

1/4"x1/4"

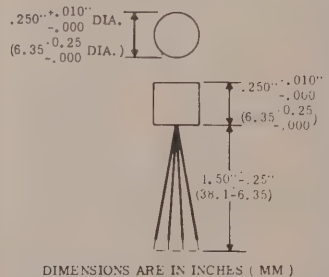
PICO's ultra-miniature transformers

For Surface Mount Versions of this series, see pages A•2458 & A•2459.

F SERIES Plug-In


.250" +.010" -.000 DIA. (6.35 +0.25 -.000 DIA.)
.250" +.010" -.000 (6.35 +0.25 -.000)
.020" (0.51)
1.00" ±.25" (25.4±6.35)
UNIT CAN BE SUPPLIED WITHOUT BARRIER
.125" DIA. (3.17 DIA)
.19 DIA. (4.8 DIA.)
45
WHITE DOT AT TERMINAL #1
TERMINALS CLOCKWISE FROM PIN #1

G SERIES Insulated Leads



PART NUMBER F Series Plug-In	PART NUMBER G Series Insulated Leads	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS PAR	POWER MILLIWATTS 1 KHz and higher	POWER MILLIWATTS 400 Hz and higher	PRIMARY UNBAL DC CURRENT ma	PRIMARY DC RESISTANCE OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	SECONDARY DC RESISTANCE OHMS PAR CONN	TURNS RATIO PRIM/SEC SEC SER CONN	TURNS RATIO PRIM/SEC SEC PAR CONN	PRICES 1-9*** F-Series	PRICES 1-9*** G-Series
F-28003	G-29003	10 ct	10 ct	2.5	125	20	11.5	1.1	1.35	34	1:1	2:1	27.67	26.32
F-28005	G-29005	20 ct	8 ct	2	125	20	8	2.1	1.28	32	1.58:1	3.16:1	27.67	26.32
F-28010	G-29010	20 ct	20 ct	5	125	20	8	2.1	2.56	64	1:1	2:1	27.67	26.32
F-28015	G-29015	32 ct	32 ct	8	125	20	6.5	3.52	4.32	1.08	1:1	2:1	27.67	26.32
F-28020	G-29020	40 ct	40 ct	10	125	20	5.6	4	4.77	1.19	1:1	2:1	27.46	26.32
F-28025	G-29025	48 ct	16 ct	4	125	20	5.2	4.3	2.3	58	1.73:1	3.46:1	25.16	23.94
F-28030	G-29030	50 ct	50 ct	12.5	125	20	5	5.5	6.6	1.65	1:1	2:1	25.16	23.94
F-28035	G-29035	80 ct	32 ct	8	125	20	4	8.5	4.25	1.06	1.58:1	3.16:1	27.46	23.94
F-28040	G-29040	100 ct	40 ct	10	125	20	3.6	12.1	4.85	1.21	1.58:1	3.16:1	27.46	23.94
F-28045	G-29045	100 ct	100 ct	25	125	20	3.6	12.1	12	3	1:1	2:1	25.16	23.94
F-28050	G-29050	120 ct	12.8 ct	3.2	125	20	3.3	13.2	1.6	4	3.06:1	6.12:1	25.16	23.94
F-28055	G-29055	120 ct	60 ct	15	125	20	3.3	13.2	7.3	1.83	1.41:1	2.83:1	30.07	23.94
F-28060	G-29060	120 ct	120 ct	30	125	20	3.3	13.2	16	4	1:1	2:1	30.07	28.54
F-28065	G-29065	150 ct	12 ct	3	125	20	3	15	1.56	39	3.54:1	7.07:1	27.32	26.01
F-28070	G-29070	150 ct	50 ct	12.5	125	20	3	15	6.6	1.65	1.73:1	3.46:1	30.07	31.73
F-28075	G-29075	150 ct	100 ct	25	125	20	3	15	14.5	3.63	1.22:1	2.45:1	30.07	28.54
F-28080	G-29080	150 ct	150 ct	37.5	125	20	3	15	18.3	4.58	1:1	2:1	30.07	28.54
F-28085	G-29085	150 ct	600 ct	150	125	20	3	15	72	18	1:2	1:1	30.07	28.54
F-28090	G-29090	200 ct	200 ct	50	125	20	2.5	22	26.8	6.7	1:1	2:1	30.07	28.54
F-28095	G-29095	300 ct	12 ct	3	125	20	2	33	1.56	39	5:1	10:1	30.07	28.54
F-28100	G-29100	300 ct	50 ct	12.5	125	20	2	33	6.6	1.65	2.45:1	4.9:1	30.07	28.54
F-28105	G-29105	300 ct	150 ct	37.5	125	20	2	33	18.3	4.58	1.41:1	2.83:1	30.07	28.54
F-28110	G-29110	300 ct	300 ct	75	125	20	2	33	40.3	10.08	1:1	2:1	27.32	28.54
F-28115	G-29115	300 ct	600 ct	150	125	20	2	33	72	18	1:1.41	1.41:1	32.24	26.01
F-28120	G-29120	320 ct	12.8 ct	3.2	125	20	2	34	1.6	0.4	5:1	10:1	32.24	30.62
F-28125	G-29125	400 ct	40 ct	10	125	20	1.8	49	4.7	1.18	3.16:1	6.32:1	32.24	30.62
F-28130	G-29130	400 ct	120 ct	30	125	20	1.8	49	16.3	4.08	1.83:1	3.65:1	32.24	30.62
F-28135	G-29135	400 ct	200 ct	50	125	20	1.8	49	27.3	6.83	1.41:1	2.83:1	32.24	30.62
F-28140	G-29140	400 ct	400 ct	100	125	20	1.8	49	49	12.25	1:1	2:1	29.31	27.90
F-28145	G-29145	400 ct	1000 ct	250	125	20	1.8	49	120	30	1:1.58	1.26:1	32.24	30.62
F-28150	G-29150	400 ct	2000 ct	500	125	20	1.8	49	270	67.5	1:2.24	1:1.12	32.24	30.62
F-28155	G-29155	400 ct	4000 ct	1000	125	20	1.8	49	476	119	1:3.16	1:1.58	32.24	30.62
F-28160	G-29160	500 ct	12.8 ct	3.2	125	20	1.6	54	1.6	0.4	6.25:1	12.5:1	29.31	27.90
F-28165	G-29165	500 ct	16 ct	4	125	20	1.6	54	2.3	0.58	5.6:1	11.2:1	29.31	27.90
F-28170	G-29170	500 ct	50 ct	12.5	125	20	1.6	54	6.6	1.65	3.16:1	6.32:1	29.31	27.90
F-28175	G-29175	500 ct	150 ct	37.5	125	20	1.6	54	18.3	4.58	1.83:1	3.65:1	29.31	27.90
F-28180	G-29180	500 ct	500 ct	125	125	20	1.6	54	65	16.3	1:1	2:1	32.24	30.62
F-28185	G-29185	*500 ct	500 ct	-	125	20	1.6	54	65		1:1	-	32.24	30.62
F-28190	G-29190	500 ct	600 ct	150	125	20	1.6	54	72	18	1:1.1	1.83:1	32.24	30.62
F-28195	G-29195	600 ct	12.8 ct	3.2	125	20	1.5	59	1.6	0.4	6.85:1	13.7:1	32.24	30.59
F-28200	G-29200	600 ct	30 ct	7.5	125	20	1.5	59	4.1	1.03	4.47:1	8.94:1	29.31	27.90
F-28205	G-29205	600 ct	48 ct	12	125	20	1.5	59	5.2	1.3	3.54:1	7.07:1	29.31	27.90
F-28210	G-29210	600 ct	200 ct	50	125	20	1.5	59	26.5	6.63	1.73:1	3.46:1	29.31	27.90
F-28215	G-29215	600 ct	600 ct	150	125	20	1.5	59	72	18	1:1	2:1	29.31	27.90
F-28220	G-29220	*600 ct	600 ct	-	125	20	1.5	59	72	-	1:1	-	32.24	30.59
F-28225	G-29225	600 ct	1200 ct	300	125	20	1.5	59	160	40	1:1.41	1.41:1	29.31	27.90
F-28230	G-29230	640 ct	12.8 ct	3.2	125	20	1.5	62	1.6	0.4	7.07:1	14.14:1	29.31	27.90
F-28235	G-29235	700 ct	100 ct	25	125	20	1.35	65	12	3	2.65:1	5.29:1	29.31	27.90
F-28240	G-29240	800 ct	12.8 ct	3.2	125	20	1.3	88	16	4	7.9:1	15.8:1	32.24	30.59
F-28245	G-29245	800 ct	48 ct	12	125	20	1.3	88	6.7	1.68	4.08:1	8.16:1	30.07	27.90
F-28250	G-29250	800 ct	800 ct	200	125	20	1.3	88	106	26.5	1:1	2:1	30.07	27.90
F-28255	G-29255	900 ct	600 ct	150	125	20	1.2	93	74	18.5	1.22:1	2.45:1	30.07	27.90
F-28260	G-29260	1000 ct	12 ct	3	125	20	1.2	120	1.55	0.39	9.13:1	18.3:1	33.10	31.42
F-28265	G-29265	1000 ct	50 ct	12.5	125	20	1.2	120	6.6	1.65	4.47:1	8.94:1	33.10	31.42
F-28270	G-29270	1000 ct	1000 ct	250	125	20	1.2	120	120	30	1:1	2:1	30.07	27.90
F-28275	G-29275	1060 ct	12.8 ct	3.2	125	20	1.2	125	1.6	0.4	9.11:1	18.2:1	33.10	31.42
F-28280	G-29280	1200 ct	12.8 ct	3.2	125	20	1	133	1.6	0.4	9.68:1	19.4:1	33.10	31.42
F-28285	G-29285	1200 ct	500 ct	125	125	20	1	133	65	16.25	1.55:1	3.11	33.10	31.42
F-28290	G-29290	1200 ct	1200 ct	300	125	20	1	133	160	40	1:1	2:1	33.10	31.42
F-28295	G-29295	*1200 ct	1200 ct	-	125	20	1	133	160	-	1:1	-	33.10	31.42
F-28300	G-29300	1500 ct	12 ct	3	125	20	1	180	1.55	0.39	11.2:1	22.4:1	33.10	31.42
F-28305	G-29305	1500 ct	500 ct	125	125	20	1	180	65	16.3	1.73:1	3.46:1	30.07	27.90
F-28310	G-29310	*1500 ct	600 ct	-	125	20	1	180	73	-	1.58:1	-	30.07	27.90
F-28315	G-29315	*1500 ct	1500 ct	-	125	20	1	180	215	-	1:1	-	33.10	31.42
F-28320	G-29320	1600 ct	12.8 ct	3.2	125	20	1	190	1.6	0.4	11.2:1	22.4:1	33.10	31.42
F-28325	G-29325	2000 ct	8 ct	2	125	20	0.8	218	1	.25	15.8:1	31.6:1	33.10	31.42
F-28330	G-29330	2000 ct	2000 ct	500	125	20	0.8	218	260	65	1:1	2:1	33.10	31.42
F-28335	G-29335	*2000 ct	2000 ct	-	125	20	0.8	218	260	-	1:1	-	33.10	31.42
F-28340	G-29340	2000 ct	8000 ct	2000	125	20	0.8	218	830	207.5	1:2	1:1	32.24	30.70

*INCLUDES ELETROSTATIC SHIELD

***Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

SPECIFICATIONS

- MIL-T-27: ..... All units manufactured to MIL-T-27, Military Designation is TF5R21ZZ for Transformers, TF5R20ZZ for Inductors.
- FREQUENCY RESPONSE: ..... ±3dB, 400 Hz-250 KHz at 1.0 Milliwatt.
- MAXIMUM DISTORTION: ..... 5% With Rated Power Level at 1 KHz and 400 Hz.
- DIELECTRIC STRENGTH: ..... All Units Tested at 200 V RMS.
- INSULATION RESISTANCE: ..... Greater Than 10,000 Megohms at 500 V DC.
- WEIGHT: ..... 1.1 Grams.
- OPERATING TEMPERATURE: ..... -55°c to +105°c (All Units Can Be Supplied to Class S Requirements, +130°c).
- TERMINALS ..... Solid .012 Diameter Conductor. Solderability per MIL-STD-202 Method 208.
- THERMAL SHOCK: ..... 25 Cycles, Method 107D, MIL-STD-202E, Test Condition A-1.

For immediate engineering assistance or to place an order— ***Call Toll Free 800-228-9747***

Delivery— stock to one week

PICO Electronics, Inc.
453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552 • • FAX 914-699-5565

PART NUMBER F Series Plug-In	PART NUMBER G Series Insulated Leads	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS PAR	POWER MILLIWATTS 1 KHz and higher	POWER MILLIWATTS 400 Hz and higher	PRIMARY UNBAL DC CURRENT ma	PRIMARY DC RESISTANCE OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	SECONDARY DC RESISTANCE OHMS PAR CONN	TURNS RATIO PRIM/SEC SER CONN	TURNS RATIO PRIM/SEC PAR CONN	PRICES 1-9*** F-Series	PRICES 1-9*** G-Series
F-28345	G-29345	2500 ct	2500 ct	625	125	20	0.75	280	280	70	1 1	2 1	32.24	30.70
F-28350	G-29350	3000 ct	3000 ct	725	125	20	0.65	330	330	82.5	1 1	2 1	32.24	30.70
F-28355	G-29355	*3000 ct	3000 ct	-	125	20	0 65	330	330	-	1 1	-	33.10	31.42
F-28360	G-29360	3600 ct	3600 ct	900	125	20	0 6	370	450	112.5	1 1	2 1	32.24	30.70
F-28365	G-29365	4000 ct	16 ct	4	125	20	0 57	400	2 3	0 58	15 8 1	31 6 1	32.24	30.70
F-28370	G-29370	4000 ct	600 ct	150	125	20	0 57	400	73	18.25	2 58 1	5.16 1	32.24	30.70
F-28375	G-29375	4000 ct	1000 ct	250	125	20	0.57	400	120	30	2 1	4 1	32.24	30.70
F-28380	G-29380	*4000 ct	8000 ct	-	125	20	0 57	400	1070	-	1 1 41	-	35.48	33.69
F-28385	G-29385	5000 ct	500 ct	125	125	20	0 5	540	65	16.25	3 16 1	6.32 1	32.24	30.70
F-28390	G-29390	5000 ct	5000 ct	1250	125	20	0.5	540	650	162 5	1 1	2 1	35.48	33.69
F-28395	G-29395	7500 ct	50 ct	12 5	125	20	0.5	835	6 6	1.65	12 2 1	24 5 1	35.48	33.69
F-28400	G-29400	7500 ct	100 ct	25	125	20	0.4	835	12	3	8 66 1	17 3 1	33.00	31.44
F-28405	G-29405	7500 ct	600 ct	150	125	20	0 4	835	72	18	3 54 1	7 07 1	33.00	31.44
F-28410	G-29410	7500 ct	2500 ct	625	125	20	0 4	835	280	70	1 73 1	3 46 1	33.00	31.44
F-28415	G-29415	*7500 ct	7500 ct	-	125	20	0 4	835	1020	-	1 1	-	33.00	31.44
F-28420	G-29420	8000 ct	12 8 ct	3 2	125	20	0 4	865	1 6	0 4	25 1	50 1	35.48	33.69
F-28425	G-29425	8000 ct	1000 ct	250	125	20	0.4	865	120	30	2 83 1	5 66 1	35.48	33.69
F-28430	G-29430	*8000 ct	1200 ct	-	125	20	0 4	865	160	-	2 58 1	-	35.48	33.69
F-28435	G-29435	*9000 ct	9000 ct	-	125	20	0 4	1160	1160	-	1 1	-	35.48	33.69
F-28440	G-29440	10,000 ct	12 8 ct	3 2	125	20	0 36	1200	1 6	0 4	28 1	56 1	35.48	33.69
F-28445	G-29445	10,000 ct	16 ct	4	125	20	0 36	1200	1 77	0 44	25 1	50 1	33.00	31.44
F-28450	G-29450	10,000 ct	100 ct	25	125	20	0 36	1200	12	3	10 1	20 1	33.00	31.44
F-28455	G-29455	10,000 ct	200 ct	50	125	20	0 36	1200	27	6 75	7 07 1	14 14 1	33.00	31.44
F-28460	G-29460	10,000 ct	500 ct	125	125	20	0 36	1200	65	16 25	4 47 1	8 94 1	33.00	31.44
F-28465	G-29465	10,000 ct	600 ct	150	125	20	0 36	1200	72	18	4 08 1	8 16 1	33.00	31.44
F-28470	G-29470	10,000 ct	1000 ct	250	125	20	0 36	1200	120	30	3 16 1	6 32 1	33.00	31.44
F-28475	G-29475	10,000 ct	1200 ct	300	125	20	0 36	1200	160	40	2 88 1	5 77 1	33.00	31.44
F-28480	G-29480	10,000 ct	1500 ct	375	125	20	0 36	1200	215	53 8	2 58 1	5.16 1	33.10	33.69
F-28485	G-29485	10,000 ct	2000 ct	500	125	20	0 36	1200	260	65	2 24 1	4 47 1	33.10	31.44
F-28490	G-29490	10,000 ct	5000 ct	1250	125	20	0 36	1200	650	162 5	1 41 1	2 83 1	33.10	31.44
F-28495	G-29495	10,000 ct	7500 ct	1875	125	20	0 36	1200	1020	255	1 15 1	2 3 1	33.10	31.44
F-28500	G-29500	10,000 ct	10,000 ct	2500	125	20	0 36	1200	1200	300	1 1	2 1	30.07	28.64
F-28505	G-29505	*10,000 ct	10,000 ct	-	125	20	0.36	1200	1440	-	1:1	-	35.48	33.69
F-28510	G-29510	15,000 ct	400 ct	100	100	15	0.35	1420	43.	10.75	6.12.1	12.24.1	33.10	31.44
F-28515	G-29515	15,000 ct	500 ct	125	100	15	0 35	1420	49	12 25	5 48 1	10 95 1	33.10	31.44
F-28520	G-29520	15,000 ct	600 ct	150	100	15	0.35	1420	68	17	5 1	10.1	33.10	31.44
F-28525	G-29525	15,000 ct	10,000 ct	2500	100	15	0.35	1420	1100	275	1.22:1	2.45 1	33.10	31.44
F-28530	G-29530	*15,000 ct	15,000 ct	-	100	15	0.35	1420	1730	-	1:1	-	35.48	33.69
F-28535	G-29535	15,000 ct	15,000 ct	3750	100	15	0.35	1420	1730	433	1:1	2 1	33.10	31.44
F-28540	G-29540	16,000 ct	1000 ct	250	100	15	0.35	1500	115	28.75	4:1	8:1	33.10	31.44
F-28545	G-29545	20,000 ct	500 ct	125	100	15	0 3	1600	60	15	6.33 1	12 65 1	35.48	33.69
F-28550	G-25550	20,000 ct	600 ct	150	100	15	0 3	1600	66	16 5	5 77 1	11 55 1	35.48	33.69
F-28555	G-29555	20,000 ct	800 ct	200	100	15	0.3	1600	94	23.5	5:1	10.1	35.48	33.69
F-28560	G-29560	20,000 ct	1000 ct	250	100	15	0.3	1600	106	26.5	4.47 1	8 94 1	35.48	33.69
F-28565	G-29565	20,000 ct	5000 ct	1250	100	15	0 3	1600	600	150	2 1	4 1	35.48	33.69
F-28570	G-29570	20,000 ct	10,000 ct	2500	100	15	0.3	1600	1100	275	1 41 1	2 83 1	35.48	33.69
F-SHIELD	MU-METAL SHIELD .285" d × .268" h (7.24 mm d × 6.73 mm h) SINGLE SHIELD												3.50	
FYY-SHIELD	MU-METAL SHIELD .315" d × .275" h (8.0 mm d × 6.99 mm h) USE WITH F-SHIELD FOR DOUBLE SHIELDING												3.50	
G-SHIELD	MU-METAL SHIELD .285" d × .335" h (7.24 mm d × 8.51 mm h) SINGLE SHIELD													3.50
GYY-SHIELD	MU-METAL SHIELD .315" d × .40" h (8.00 mm d × 10.16 mm h) USE WITH G-SHIELD FOR DOUBLE SHIELDING													3.50
GXX-SHIELD	MU-METAL SHIELD .35" d × .465" h (8.89 mm d × 11.81 mm h) USE WITH G-SHIELD AND GYY SHIELD FOR TRIPLE SHIELDING													3.50

*INCLUDES ELECTROSTATIC SHIELD

***Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York

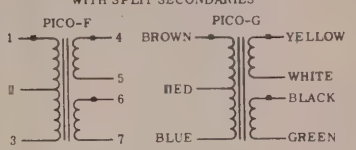
INDUCTORS

PART NUMBER F-SERIES	PART NUMBER G-SERIES	INDUCTANCE HENRIES	DC CURRENT ma	DC RESISTANCE OHMS	PRICES 1-9*** F SERIES	PRICES 1-9*** G SERIES
F-5825	G-6125	SERIES 10.0	0	2250	27.32	26.01
		SERIES 2.75	2			
		PARALLEL 2.5	0	560		
		PARALLEL .65	4			
F-5830	G-6130	SERIES 5.5	0	1000	27.32	26.01
		SERIES 1 5	2			
		PARALLEL 1.3	0	250		
		PARALLEL 40	4			
F-5835	G-6135	SERIES .85	1	240	27.32	26.01
		SERIES .25	6			
		PARALLEL .21	2	60		
		PARALLEL 06	12			
F-5840	G-6140	SERIES .6	0	144	27.32	26.01
		SERIES .15	5			
		PARALLEL .15	0	36		
		PARALLEL 04	10			

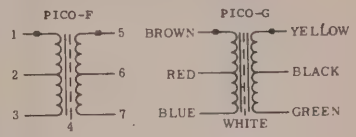
F SERIES Plug-In

G SERIES Insulated Leads

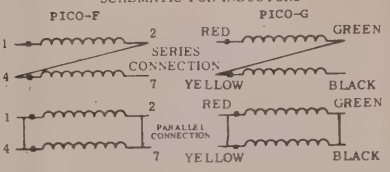
SCHEMATIC FOR TRANSFORMERS WITH SPLIT SECONDARIES



SCHEMATIC FOR TRANSFORMERS WITH ELECTROSTATIC SHIELD



SCHEMATIC FOR INDUCTORS



FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- PICO IS APPROVED QPL SOURCE (MIL-T-27)
- 5 MAGNETIC SHIELDS AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED
- VARIATION OF STANDARD DESIGNS AVAILABLE
- SPECIAL PRODUCTION TECHNIQUES ENSURE UNIFORM SIZE AND LEADS WHICH ARE FREE OF ENCAPSULANT. NO MENISCUS IN LEAD AREA.
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS.

This Product is Patented

INDUCTORS

ALL INDUCTORS HAVE SPLIT WINDINGS AND MEASUREMENTS ARE LISTED FOR BOTH SERIES AND PARALLEL CONNECTIONS. TWO VALUES OF INDUCTANCE. EACH AT A PARTICULAR VALUE OF D.C. CURRENT, ARE LISTED FOR EACH INDUCTOR.

For immediate engineering assistance or to place an order— ***Call Toll Free 800-228-9747***

Delivery— stock to one week

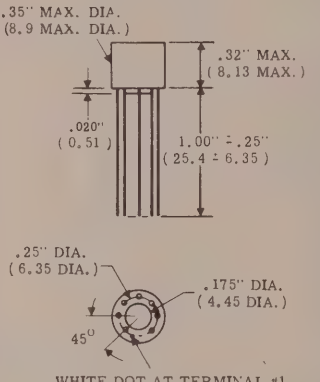
PICO Electronics, Inc.

453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552 • • FAX 914-699-5565

PICO's ultra-miniature transformers

For Surface Mount Versions of this series, see pages A•2460 & A•2461.

W SERIES Plug-In



PICO PART NUMBER W Series Plug-In	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	PAR	POWER WATTS 1 KHz and higher	400 Hz and higher	PRIMARY UNBAL DC CURRENT ma	PRIM DC RESIST OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	PAR CONN	TURNS/RATIO PRIM/SEC SEC SER CONN	SEC PAR CONN	PICO PRICES 1-9 *** W-Series
W-26003	10 ct	10 ct	2.5	.4	.075	31.6	1.1	1.3	.33	1:1	2:1	20.41
W-26005	20 ct	8 ct	2	.4	.075	22.3	2.2	1	.25	1.58:1	3.16:1	20.41
W-26010	20 ct	20 ct	5	.4	.075	22.3	2.2	2.6	.65	1:1	2:1	20.41
W-26015	32 ct	32 ct	8	.4	.075	17.6	3.5	4.2	1.05	1:1	2:1	20.41
W-26020	40 ct	40 ct	10	.4	.075	15.8	4	4.5	1.2	1:1	2:1	20 41
W-26025	48 ct	16 ct	4	.4	.075	14.4	5.3	1.9	.48	1.73:1	3.46:1	21.64
W-26030	50 ct	50 ct	12.5	.4	.075	14.1	5.6	6.5	1.6	1:1	2:1	21.64
W-26035	80 ct	32 ct	8	.4	.075	11.1	8	4	1	1.58:1	3.16:1	25.72
W-26040	100 ct	40 ct	10	.4	.075	10	10	4.5	1.2	1.58:1	3.16:1	21.64
W-26045	100 ct	100 ct	25	.4	.075	10	10	12	3	1:1	2:1	21.64
W-26050	120 ct	12.8 ct	3.2	.4	.075	9.1	12	1.5	.38	3.06:1	6.12:1	19.47
W-26055	120 ct	60 ct	15	.4	.075	9.1	12	7.2	1.8	1.41:1	2.83:1	25.72
W-26060	120 ct	120 ct	30	.4	.075	9.1	12	14.5	3.6	1:1	2:1	25.72
W-26065	150 ct	12 ct	3	.4	.075	8.2	15	1.5	.38	3.54:1	7.08:1	19.47
W-26070	150 ct	50 ct	12.5	.4	.075	8.2	15	6	1.5	1.73:1	3.46:1	21.64
W-26075	150 ct	100 ct	25	.4	.075	8.2	15	12	3	1.22:1	2.45:1	21.64
W-26080	150 ct	150 ct	37.5	.4	.075	8.2	15	16.8	4.2	1:1	2:1	25.72
W-26085	150 ct	600 ct	150	.4	.075	8.2	15	70	17.5	1:2	1:1	21.64
W-26090	200 ct	200 ct	50	.4	.075	7	20	24	6	1:1	2:1	21.64
W-26095	300 ct	12ct	3	.4	.075	5.8	30	1.5	.38	5:1	10:1	19.47
W-26100	300 ct	50 ct	12.5	.4	.075	5.8	30	6	1.5	2.45:1	4.9:1	21.64
W-26105	300 ct	150 ct	37.5	.4	.075	5.8	30	18	4.5	1.41:1	2.83:1	21.64
W-26110	300 ct	300 ct	75	.4	.075	5.8	30	36	9	1:1	2:1	25.72
W-26115	300 ct	600 ct	150	.4	.075	5.8	30	72	18	1:1.41	1.41:1	19.47
W-26120	320 ct	12.8 ct	3.2	.4	.075	5.6	32	1.5	.38	5:1	10.1	19.47
W-26125	400 ct	40 ct	10	.4	.075	5	40	4.5	1.1	3.16:1	6.32:1	25 72
W-26130	400 ct	120 ct	30	.4	.075	5	40	14	3.5	1.83:1	3.65:1	25.72
W-26135	400 ct	200 ct	50	.4	.075	5	40	24	6	1.41:1	2.83:1	21.64
W-26140	400 ct	400 ct	100	.4	.075	5	40	48	12	1:1	2:1	25.72
W-26145	400 ct	1000 ct	250	.4	.075	5	40	120	30	1:1.58	1.26:1	29.49
W-26150	400 ct	2000 ct	500	.4	.075	5	40	240	60	1:2.24	1:1.12	29.49
W-26155	400 ct	4000 ct	1000	.4	.075	5	40	480	120	1:3.16	1:1.58	26.65
W-26160	500 ct	12.8 ct	3.2	.4	.075	4.5	50	1.5	.38	6.25:1	12.5:1	22.57
W-26165	500 ct	16 ct	4	.4	.075	4.5	50	2	.5	5.6:1	11.2:1	22.57
W-26170	500 ct	50 ct	12.5	.4	.075	4.5	50	6	1.5	3.16:1	6.32:1	22.57
W-26175	500 ct	150 ct	37.5	.4	.075	4.5	50	18	4.5	1.83:1	3.65.1	22.57
W-26180	500 ct	500 ct	125	.4	.075	4.5	50	60	15	1:1	2:1	22.57
W-26185	*500 ct	500 ct	–	.4	.075	4.5	50	60	–	1:1	–	22.57
W-26190	500 ct	600 ct	150	.4	.075	4.5	50	72	18	1:1.1	1.83:1	22.57
W-26195	600 ct	12.8 ct	3.2	.4	.075	4.1	60	1.5	.38	6.85:1	13.7:1	19.47
W-26200	600 ct	30 ct	7.5	.4	.075	4.1	60	3.6	.9	4.47:1	8.94:1	20.41
W-26205	600 ct	48 ct	12	.4	.075	4.1	60	5.8	1.45	3.54:1	7.07:1	20.41
W-26210	600 ct	200 ct	50	.4	.075	4.1	60	24	6	1.73:1	3.46:1	20.41
W-26215	600 ct	600 ct	150	.4	.075	4.1	60	72	18	1:1	2:1	20.41
W-26220	*600 ct	600 ct	–	.4	.075	4.1	60	72	–	1:1	–	22.58
W-26225	600 ct	1200 ct	300	.4	.075	4.1	60	144	36	1:1.41	1.41:1	20.41
W-26230	640 ct	12.8 ct	3.2	.4	.075	3.9	64	1.5	.38	7.07:1	14.14:1	20.41
W-26235	700 ct	100 ct	25	.4	.075	3.8	70	12	3	2.65:1	5.29:1	20.41
W-26240	800 ct	12.8 ct	3.2	.4	.075	3.5	80	1.5	.38	7.9:1	15.8:1	20.41
W-26245	800 ct	48 ct	12	.4	.075	3.5	80	5.8	1.45	4 08:1	8.16:1	22.58
W-26250	800 ct	800 ct	200	.4	.075	3.5	80	96	24	1:1	2:1	20.41
W-26255	900 ct	600 ct	150	.4	.075	3.3	90	72	18	1.22:1	2.45:1	20.41
W-26260	1000 ct	12 ct	3	.4	.075	3.2	100	1.5	.38	9 13:1	18.3:1	20.41
W-26265	1000 ct	50 ct	12.5	.4	.075	3.2	100	6	1.5	4.47:1	8.94:1	22.58
W-26270	1000 ct	1000 ct	250	.4	.075	3.2	100	120	30	1:1	2:1	22.58
W-26275	1060 ct	12 8 ct	3.2	.4	.075	3.1	106	1.5	38	9.1:1	18.2:1	20.41
W-26280	1200 ct	12.8 ct	3.2	.4	.075	2.9	120	1.5	.38	9.68:1	19.4:1	18.38
W-26285	1200 ct	500 ct	125	.4	.075	2.9	120	60	15	1.55:1	3.1:1	18.38
W-26290	1200 ct	1200 ct	300	.4	.075	2.9	120	140	35	1:1	2:1	18.38
W-26295	*1200 ct	1200 ct	–	.4	.075	2.9	120	140	–	1.1	–	25 15
W-26300	1500 ct	12 ct	3	.4	.075	2.6	150	1.5	.38	11.2:1	22.4:1	20.41
W-26305	1500 ct	500 ct	125	.4	.075	2.6	150	60	15	1.73:1	3.46:1	22.58
W-26310	*1500 ct	600 ct	–	.4	.075	2.6	150	72	–	1.58:1	–	22.58
W-26315	*1500 ct	1500 ct	–	.4	.075	2.6	150	180	–	1:1	–	22.58
W-26320	1600 ct	12.8 ct	3.2	.4	.075	2.5	160	1.5	.38	11.2:1	22.4:1	20.41
W-26325	2000 ct	8 ct	2	.4	.075	2.2	200	1	.25	15.8:1	31.6:1	26.65
W-26330	2000 ct	2000 ct	500	.4	.075	2.2	200	240	60	1:1	2:1	26.65
W-26335	*2000 ct	2000 ct	–	.4	.075	2.2	200	240	–	1:1	–	29.49
W-26340	2000 ct	8000 ct	2000	.4	.075	2.2	200	960	240	1:2	1:1	26 65
W-26345	2500 ct	2500 ct	625	.4	.075	2	250	300	75	1:1	2:1	26.65

***Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%
50-99 less 23%; 100-499 less 30%

*INCLUDES ELECTROSTATIC SHIELD

Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

SPECIFICATIONS

- **MIL-T-27:** ..... All units manufactured to MIL-T-27, Military Designation is TF5R21ZZ for Transformers, TF5R20ZZ for Inductors.
- **FREQUENCY RESPONSE:** ..... ±3db, 400 Hz-100 KHz at 1.0 Milliwatt.
- **MAXIMUM DISTORTION:** ..... 5% With Rated Power Level at 1 KHz and 400 Hz.
- **DIELECTRIC STRENGTH:** ..... All Units Tested at 200 V RMS.
- **INSULATION RESISTANCE:** ... Greater Than 10,000 Megohms at 300 V DC.
- **WEIGHT:** ..... 2.5 Grams
- **OPERATING TEMPERATURE:** -55°c to +105°c (All Units Can be Supplied to Class S Requirements, +130°c).
- **TERMINALS:** ..... Solid .016 Diameter Conductor. Meet solderability per MIL-STD-202 Method 208
- **THERMAL SHOCK:** ..... 25 Cycles, Method 107D, MIL-STD-202E, Test Condition A-1.

Delivery— stock to one week

For immediate engineering assistance or to place an order— ***Call Toll Free 800-228-9747***

PICO Electronics, Inc.

453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552 • • FAX 914-699-5565

PICO PART NUMBER W Series Plug-In	PRIMARY IMPED OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	PAR	POWER WATTS 1 KHz and higher	400 Hz and higher	PRIMARY UNBAL DC CURRENT ma	PRIM DC RESIST OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	PAR CONN	TURNS/RATIO PRIM/SEC SEC SER CONN	SEC PAR CONN	PICO PRICES 1-9 *** W-Series
W-26350	3000 ct	3000 ct	725	.4	.075	1.8	300	360	90	1:1	2:1	21.64
W-26355	*3000 ct	3000 ct	–	.4	.075	1.8	300	360	–	1:1	–	29.49
W-26360	3600 ct	3600 ct	900	.4	.075	1.7	360	432	108	1:1	2:1	21.64
W-26365	4000 ct	16 ct	4	.4	.075	1.6	400	1.9	.47	15.8:1	31.6:1	26.65
W-26370	4000 ct	600 ct	150	.4	.075	1.6	400	72	18	2.58:1	5.16:1	26.65
W-26375	4000 ct	1000 ct	250	.4	.075	1.6	400	120	30	2:1	4:1	29.49
W-26380	*4000 ct	8000 ct	–	.4	.075	1.6	400	960	–	1:1.41	–	29.49
W-26385	5000 ct	500 ct	125	.4	.075	1.4	500	60	15	3.16:1	6.32:1	22.58
W-26390	5000 ct	5000 ct	1250	.4	.075	1.4	500	600	150	1:1	2:1	22.58
W-26395	7500 ct	50 ct	12.5	.33	.075	1.2	750	6	1.5	12.2:1	24.5:1	22.58
W-26400	7500 ct	100 ct	25	.33	.075	1.2	750	12	3	8.66:1	17.3:1	22.58
W-26405	7500 ct	600 ct	150	.33	.075	1.2	750	72	18	3.54:1	7.07:1	25.14
W-26410	7500 ct	2500 ct	625	.33	.075	1.2	750	300	75	1.73:1	3.46:1	25.14
W-26415	*7500 ct	7500 ct	–	.33	.075	1.2	750	900	–	1:1	–	29.49
W-26420	8000 ct	12.8 ct	3.2	.3	.075	1.1	800	1.5	.38	25:1	50:1	22.58
W-26425	8000 ct	1000 ct	250	.3	.075	1.1	800	120	30	2.83:1	5.66:1	25.14
W-26430	*8000 ct	1200 ct	–	.3	.075	1.1	800	144	–	2.58:1	–	29.49
W-26435	*9000 ct	9000 ct	–	.27	.075	1.1	900	1080	–	1:1	–	29.49
W-26440	10,000 ct	12.8 ct	3.2	.25	.075	1.0	1000	1.5	.38	28:1	56:1	20.41
W-26445	10,000 ct	16 ct	4	.25	.075	1.0	1000	1.92	.48	25:1	50:1	20.41
W-26450	10,000 ct	100 ct	25	.25	.075	1.0	1000	12	3	10:1	20:1	22.58
W-26455	10,000 ct	200 ct	50	.25	.075	1.0	1000	24	6	7.07:1	14.14:1	22.58
W-26460	10,000 ct	500 ct	125	.25	.075	1.0	1000	60	15	4.47:1	8.94:1	22.58
W-26465	10,000 ct	600 ct	150	.25	.075	1.0	1000	72	18	4.08:1	8.16:1	22.58
W-26470	10,000 ct	1000 ct	250	.25	.075	1.0	1000	120	30	3.16:1	6.32:1	22.58
W-26475	10,000 ct	1200 ct	300	.25	.075	1.0	1000	144	36	2.89:1	5.77:1	26.65
W-26480	10,000 ct	1500 ct	375	.25	.075	1.0	1000	180	45	2.58:1	5.16:1	26.65
W-26485	10,000 ct	2000 ct	500	.25	.075	1.0	1000	240	60	2.24:1	4.47:1	26.09
W-26490	10,000 ct	5000 ct	1250	.25	.075	1.0	1000	600	150	1.41:1	2.83:1	26.091
W-26495	10,000 ct	7500 ct	1875	.25	.075	1.0	1000	900	225	1.15:1	2.3:1	26.65
W-26500	10,000 ct	10,000 ct	2500	.25	.075	1.0	1000	1200	300	1:1	2:1	25.72
W-26505	*10,000 ct	10,000 ct	–	.25	.075	1.0	1000	1200	–	1:1	–	29.49
W-26510	15,000 ct	400 ct	100	.16	.075	.82	1500	48	12	6.12:1	12.24:1	25.72
W-26515	15,000 ct	500 ct	125	.16	.075	.82	1500	60	15	5.48:1	10.95:1	25.72
W-26520	15,000 ct	600 ct	150	.16	.075	.82	1500	72	18	5:1	10:1	25.72
W-26525	15,000 ct	10,000 ct	2500	.16	.075	.82	1500	1200	300	1.22:1	2.45:1	25.72
W-26530	*15,000 ct	15,000 ct	–	.16	.075	.82	1500	1800	–	1:1	–	29.49
W-26535	15,000 ct	15,000 ct	3750	16	.075	.82	1500	1800	450	1:1	2:1	26.55
W-26540	16,000 ct	1,000 ct	250	.15	.075	.8	1600	120	30	4.1	8:1	26.55
W-26545	20,000 ct	500 ct	125	.125	.075	.7	2000	60	15	6.33:1	12.65:1	25.72
W-26550	20,000 ct	600 ct	150	.125	.075	.7	2000	72	18	5.77:1	11.55:1	25.72
W-26555	20,000 ct	800 ct	200	.125	.075	.7	2000	96	24	5:1	10:1	23.51
W-26560	20,000 ct	1000 ct	250	.125	.075	.7	2000	120	30	4.47:1	8.94:1	29.49
W-26565	20,000 ct	5000 ct	1250	125	.075	.7	2000	600	150	2:1	4:1	25.72
W-26570	20,000 ct	10,000 ct	2500	.125	.075	.7	2000	1200	300	1.41:1	2.83:1	25.72
W-26575	*20,000 ct	20,000 ct	–	.125	.075	.7	2000	2400	–	1:1	–	29.49
W-26580	25,000 ct	500 ct	125	.1	.075	63	2500	60	15	7.07:1	14.14:1	26.65
W-26585	25,000 ct	1000 ct	250	.1	.075	.63	2500	120	30	5:1	10:1	26.65
W-26590	30,000 ct	50 ct	12.5	.083	.075	.58	3000	6	1.5	24.5:1	49:1	26.65
W-26595	30,000 ct	1200 ct	300	.083	.075	.58	3000	144	36	5:1	10:1	26.65
W-26600	30,000 ct	500 ct	125	.083	.075	.58	3000	60	15	7.75:1	15.5:1	26.65
W-26605	30,000 ct	200 ct	50	.083	.075	58	3000	24	6	12.25:1	24.5:1	26.65
W-26610	30,000 ct	5,000 ct	1250	.083	.075	.58	3000	600	150	2.45:1	4.9:1	26.65
W-26615	30,000 ct	10,000 ct	2500	.083	.075	.58	3000	1200	300	1.73:1	3.46:1	26.65
W-26620	*30,000 ct	30,000 ct	–	083	.075	.58	3000	3600	–	1:1	–	29.49
W-26625	40,000 ct	400 ct	100	.062	.062	.5	4000	48	12	10:1	20:1	29.49
W–SHIELD MU–METAL SHIELD .37"D x .32"H (9.4mmD x 8.1mmH) SINGLE SHIELD												3.52
WXX–SHIELD MU–METAL SHIELD .395"D x .33"H (10mmD x 8.4mmH) USE WITH W SHIELD FOR DOUBLE SHIELDING												3.52

*INCLUDES ELECTROSTATIC SHIELD

***Discount Prices: 1–9 Net; 10–24 less 10%; 25–49 less 16%; 50–99 less 23%; 100-499 less 30%

Ordering Instructions:
No minimum. Net 30 days
F.O.B. Mt. Vernon, New York.

INDUCTORS

ALL INDUCTORS HAVE SPLIT WINDINGS AND MEASUREMENTS ARE LISTED FOR BOTH SERIES AND PARALLEL CONNECTIONS. TWO VALUES OF INDUCTANCE, EACH AT A PARTICULAR VALUE OF D.C. CURRENT, ARE LISTED FOR EACH INDUCTOR.

PICO PART NUMBER	INDUCTANCE SERIES		DC CURRENT ma	DC RESISTANCE OHMS	PRICES 1–9***
W-26705	SERIES	0.1	4	25	20.41
		.08	10		
	PARALLEL	.025	8	6.5	
		.02	20		
W-26710	SERIES	0.9	2	105	20.41
		0.5	6		
	PARALLEL	.23	4	26	
		.13	12		
W-26715	SERIES	2.5	2	630	20.41
		0.9	4		
	PARALLEL	0.6	4	160	
		0.23	8		
W-26720	SERIES	4.5	2	2300	21.67
		1.2	4		
	PARALLEL	1.1	4	575	
		0.3	8		

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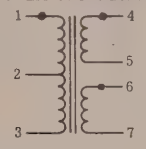
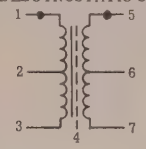
PICO's ultra-miniature transformers

W SERIES Plug-In

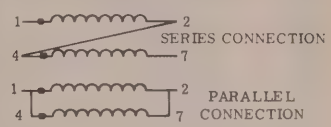
SCHEMATICS FOR TRANSFORMERS WITH SPLIT SECONDARIES



SCHEMATIC FOR TRANSFORMERS WITH ELECTROSTATIC SHIELD



SCHEMATIC FOR INDUCTORS



FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- PICO IS APPROVED QPL SOURCE (MIL-T-27)
- MAGNETIC SHIELDS AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED
- VARIATION OF STANDARD DESIGNS AVAILABLE
- SPECIAL PRODUCTION TECHNIQUES ENSURE UNIFORM SIZE AND LEADS WHICH ARE FREE OF ENCAPSULANT. NO MENISCUS IN LEAD AREA.
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS.

THIS PRODUCT IS PATENTED

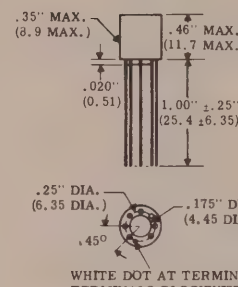
Delivery— stock to one week

PICO Electronics, Inc.

453 N. MacQuesten Pkwy.
Mt. Vernon, N.Y. 10552

PICO's ultra-miniature transformers

Y SERIES Plug-In



SPECIFICATIONS

- **MIL-T-27:** All units manufactured to MIL-T-27, Military Designation is TF5R21ZZ for Transformers, TF5R20ZZ for Inductors.
- **FREQUENCY RESPONSE:** ±3db, 300 Hz-100 KHz at 1.0 Milliwatt.
- **MAXIMUM DISTORTION:** 5% With Rated Power Level at 1 KHz and 400 Hz and 300 Hz.
- **DIELECTRIC STRENGTH:** All Units Tested at 200 V RMS.
- **INSULATION RESISTANCE:** Greater Than 10,000 Megohms at 300 V DC.
- **WEIGHT:** 3 Grams
- **OPERATING TEMPERATURE:** -55°c to +105°c (All Units Can be Supplied to Class S Requirements, +130°c).
- **TERMINALS:** Solid .016 Diameter Conductor. Meet solderability per MIL-STD-202 Method 208
- **THERMAL SHOCK:** 25 Cycles, Method 107D, MIL-STD-202E, Test Condition A-1.

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• FAX 914-699-5565

Delivery— stock to one week

PICO PART NUMBER Y-Series Plug-In	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS PAR	POWER WATTS 1KHz and higher	POWER WATTS 400 Hz and higher	POWER WATTS 300 Hz and higher	PRIMARY UNBAL DC CURRENT ma	PRIMARY DC RESIST OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	SECONDARY DC RESISTANCE OHMS PAR CONN	TURNS RATIO PRIME/SEC SEC SER CONN	TURNS RATIO PRIME/SEC SEC PAR CONN	PICO PRICES 1–9 *** Y-Series
Y-27003	10 ct	10 ct	2.5	.6	.2	.1	31.6	1	1.25	.32	1:1	2:1	20.42
Y-27005	20 ct	8 ct	2	.6	.2	.1	22.3	2	.9	.23	1.58:1	3.16:1	20.42
Y-27010	20 ct	20 ct	5	.6	.2	.1	22.3	2.1	2.25	.56	1:1	2:1	20.42
Y-27015	32 ct	32 ct	8	.6	.2	.1	17.6	3.4	4	1	1:1	2:1	20.42
Y-27020	40 ct	40 ct	10	.6	.2	.1	15.8	4.2	4.5	1.13	1:1	2:1	20.42
Y-27025	48 ct	16 ct	4	.6	.2	.1	14.4	5	1.8	.45	1.73:1	3.46:1	20.42
Y-27030	50 ct	50 ct	12.5	.6	.2	.1	14.1	5.25	5.6	1.4	1:1	2:1	20.42
Y-27035	80 ct	32 ct	8	.6	.2	.1	11.1	8.4	4	1	1.58:1	3.16:1	26.86
Y-27040	100 ct	40 ct	10	.6	.2	.1	10	10	4.5	1.13	1.58:1	3.16:1	26.86
Y-27045	100 ct	100 ct	25	.6	.2	.1	10	11	11.25	2.8	1:1	2:1	26.86
Y-27050	120 ct	12.8 ct	3.2	.6	.2	.1	9.1	14.4	1.8	.45	3.06:1	6.12:1	19.46
Y-27055	120 ct	60 ct	15	.6	.2	.1	9.1	14.4	8.4	2.1	1.41:1	2.83:1	25.71
Y-27060	120 ct	120 ct	30	.6	.2	.1	9.1	14.4	16.8	4.2	1:1	2:1	25.71
Y-27065	150 ct	12 ct	3	.6	.2	.1	8.2	15	1.5	.38	3.54:1	7.08:1	19.46
Y-27070	150 ct	50 ct	12.5	.6	.2	.1	8.2	15	6	1.5	1.73:1	3.46:1	21.64
Y-27075	150 ct	100 ct	25	.6	.2	.1	8.2	15	12	3	1.22:1	2.45:1	21.64
Y-27080	150 ct	150 ct	37.5	.6	.2	.1	8.2	15	18	4.5	1:1	2:1	25.33
Y-27085	150 ct	600 ct	150	.6	.2	.1	8.2	15	72	18	1:2	1:1	21.64
Y-27090	200 ct	200 ct	50	.6	.2	.1	7	22	24	6	1:1	2:1	21.64
Y-27095	300 ct	12 ct	3	.6	.2	.1	5.8	30	1.4	.35	5:1	10:1	19.46
Y-27100	300 ct	50 ct	12.5	.6	.2	.1	5.8	30	6	1.5	2.45:1	4.9:1	21.64
Y-27105	300 ct	150 ct	37.5	.6	.2	.1	5.8	30	18	4.5	1.41:1	2.83:1	21.64
Y-27110	300 ct	300 ct	75	.6	.2	.1	5.8	30	36	9	1:1	2:1	25.71
Y-27115	300 ct	600 ct	150	.6	.2	.1	5.8	30	72	18	1:1.41	1.41:1	20.42
Y-27120	320 ct	12.8 ct	3.2	.6	.2	.1	5.6	36	1.8	.45	5:1	10:1	19.46
Y-27125	400 ct	40 ct	10	.6	.2	.1	5	40	4.8	1.2	3.16:1	6.32:1	25.71
Y-27130	400 ct	120 ct	30	.6	.2	.1	5	40	14.5	3.6	1.83:1	3.65:1	25.71
Y-27135	400 ct	200 ct	50	.6	.2	.1	5	40	24	6	1.4:1	2.83:1	21.46
Y-27140	400 ct	400 ct	100	.6	.2	.1	5	40	48	12	1:1	2:1	25.71
Y-27145	400 ct	1000 ct	250	.6	.2	.1	5	40	125	31	1:1.58	1.26:1	29.49
Y-27150	400 ct	2000 ct	500	.6	.2	.1	5	40	240	60	1:2.24	1:1.12	29.49
Y-27155	400 ct	4000 ct	1000	.6	.2	.1	5	40	480	120	1:3.16	1:1.58	26.64
Y-27160	500 ct	12.8 ct	3.2	.6	.2	.1	4.5	50	1.5	.38	6.25:1	12.5:1	22.88
Y-27165	500 ct	16 ct	4	.6	.2	.1	4.5	50	1.9	.48	5.6:1	11.2:1	22.88
Y-27170	500 ct	50 ct	12.5	.6	.2	.1	4.5	50	6	1.5	3.16:1	6.32:1	22.88
Y-27175	500 ct	150 ct	37.5	.6	.2	.1	4.5	50	18	4.5	1.83:1	3.65:1	22.88
Y-27180	500 ct	500 ct	125	.6	.2	.1	4.5	50	60	15	1:1	2:1	22.88
Y-27185	*500 ct	500 ct	–	.6	.2	.1	4.5	50	60	–	1:1	–	22.88
Y-27190	500 ct	600 ct	150	.6	.2	.1	4.5	50	72	18	1:1.1	1.83:1	20.42
Y-27195	600 ct	12.8 ct	3.2	.6	.2	.1	4.1	60	1.5	.38	6.85:1	13.7:1	18.38
Y-27200	600 ct	30 ct	7.5	.6	.2	.1	4.1	60	3.6	.9	4.47:1	8.94:1	20.42
Y-27205	600 ct	48 ct	12	.6	.2	.1	4.1	60	5.8	1.45	3.54:1	7.07:1	20.42
Y-27210	600 ct	200 ct	50	.6	.2	.1	4.1	60	24	6	1.73:1	3.46:1	20.42
Y-27215**	600 ct	600 ct	150	.6	.2	.1	4.1	60	72	18	1:1	2:1	20.42
Y-27220**	*600 ct	600 ct	–	.6	.2	.1	4.1	60	72	–	1:1	–	20.42
Y-27225**	600 ct	1200 ct	300	.6	.2	.1	4.1	60	144	36	1:1.41	1.41:1	20.42
Y-27230	640 ct	12.8 ct	3.2	.6	.2	.1	3.9	64	1.5	.38	7.07:1	14.14:1	20.42
Y-27235	700 ct	100 ct	25	.6	.2	.1	3.8	70	12	3	2.65:1	5.29:1	20.42
Y-27240	800 ct	12.8 ct	3.2	.6	.2	.1	3.5	80	1.5	.38	7.9:1	15.8:1	20.42
Y-27245	800 ct	48 ct	12	.6	.2	.1	3.5	80	5.8	1.45	4.08:1	8.16:1	22.88
Y-27250	800 ct	800 ct	200	.6	.2	.1	3.5	80	96	24	1:1	2:1	22.88
Y-27255	900 ct	600 ct	150	.6	.2	.1	3.3	90	72	18	1.22:1	2.45:1	20.42
Y-27260	1000 ct	12 ct	3	.6	.2	.1	3.2	100	1.4	.35	9.13:1	18.3:1	20.42
Y-27265	1000 ct	50 ct	12.5	.6	.2	.1	3.2	100	6	1.5	4.47:1	8.94:1	22.88
Y-27270	1000 ct	1000 ct	250	.6	.2	.1	3.2	100	120	30	1:1	2:1	22.88
Y-27275	1060 ct	12.8 ct	3.2	.6	.2	.1	3.1	106	1.5	.38	9.1:1	18.2:1	20.42
Y-27280	1200 ct	12.8 ct	3.2	.6	.2	.1	2.9	120	1.5	.38	9.68:1	19.4:1	18.38
Y-27285	1200 ct	500 ct	125	.6	.2	.1	2.9	120	60	15	1.55:1	3.1:1	18.38
Y-27290	1200 ct	1200 ct	300	.6	.2	.1	2.9	120	144	36	1:1	2:1	18.38
Y-27295	*1200 ct	1200 ct	–	.6	.2	.1	2.9	120	144	–	1:1	–	20.42
Y-27300	1500 ct	12 ct	3	.6	.2	.1	2.6	150	1.44	.36	11.2:1	22.4:1	20.42
Y-27305	1500 ct	500 ct	125	.6	.2	.1	2.6	150	60	15	1.73:1	3.46:1	22.88
Y-27310	*1500 ct	600 ct	–	.6	.2	.1	2.6	150	72	–	1.58:1	–	29.49
Y-27315	*1500 ct	1500 ct	–	.6	.2	.1	2.6	150	180	–	1:1	–	22.88
Y-27320	1600 ct	12.8 ct	3.2	.6	.2	.1	2.5	160	1.5	.38	11.2:1	22.4:1	20.42
Y-27325	2000 ct	8 ct	2	.6	.2	.1	2.2	200	.96	.24	15.8:1	31.6:1	22.88
Y-27330	2000 ct	2000 ct	500	.6	.2	.1	2.2	200	240	60	1:1	2:1	26.64
Y-27335	*2000 ct	2000 ct	–	.6	.2	.1	2.2	200	240	–	1:1	–	29.49
Y-27340	2000 ct	8000 ct	2000	.6	.2	.1	2.2	200	960	240	1:2	1:1	26.64
Y-27345	2500 ct	2500 ct	625	.6	.2	.1	2	250	300	75	1:1	2:1	26.64
Y-27350	3000 ct	3000 ct	725	.6	.2	.1	1.8	300	360	90	1:1	2:1	21.41
Y-27355	*3000 ct	3000 ct	–	.6	.2	.1	1.8	300	360	–	1:1	–	29.49
Y-27360	3600 ct	3600 ct	900	.6	.2	.1	1.7	360	432	108	1:1	2:1	26.64
Y-27365	4000 ct	16 ct	4	.6	.2	.1	1.6	400	1.92	.48	15.8:1	31.6:1	26.64
Y-27370**	4000 ct	600 ct	150	.6	.2	.1	1.6	400	72	18	2.58:1	5.16:1	26.64
Y-27375	4000 ct	1000 ct	250	.6	.2	.1	1.6	400	120	30	2:1	4:1	26.64
Y-27380	*4000 ct	8000 ct	–	.6	.2	.1	1.6	400	960	–	1:1.41	–	26.64
Y-27385	5000 ct	500 ct	125	.5	.2	.1	1.4	500	60	15	3.16:1	6.32:1	21.41
Y-27390	5000 ct	5000 ct	1250	.5	.2	.1	1.4	500	600	150	1:1	2:1	21.41
Y-27395	7500 ct	50 ct	12.5	.33	.2	.1	1.2	750	6	1.5	12.2:1	24.5:1	21.41
Y-27400	7500 ct	100 ct	25	.33	.2	.1	1.2	750	12	3	8.66:1	17.3:1	22.66
Y-27405	7500 ct	600 ct	150	.33	.2	.1	1.2	750	72	18	3.54:1	7.07:1	25.15

***Discount Prices: 1-9 Net;
10-24 less 10%; 25-49 less 16%;
50-99 less 23%; 100-499 less 30%

Ordering Instructions
No minimum. Net 30 days
F.O.B. Mt. Vernon, New York

*INCLUDES ELECTROSTATIC SHIELD
**MINIATURIZED TELEPHONE COUPLING APPLICATION

PICO PART NUMBER Y-Series Plug-In	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	PAR	POWER WATTS 1KHz and higher	400 Hz and higher	300 Hz and higher	PRIMARY UNBAL DC CURRENT ma	PRIMARY DC RESIST OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	PAR CONN	TURNS RATIO PRIME/SEC SEC SER CONN	SEC OAR CONN	PICO PRICES 1–9 *** Y-Series
Y-27410	7500 ct	2500 ct	625	.33	.2	.1	1.2	750	300	75	1.73:1	3.46:1	25.15
Y-27415	*7500 ct	7500 ct	-	.33	.2	.1	1.2	750	900	-	1:1	-	29.49
Y-27420	8000 ct	12.8 ct	3.2	.3	.2	.1	1.1	800	1.5	.38	25:1	50:1	21.41
Y-27425	8000 ct	1000 ct	250	.3	.2	.1	1.1	800	120	30	2.83:1	5.66:1	21.41
Y-27430	*8000 ct	1200 ct	-	.3	.2	.1	1.1	800	144	-	2.58:1	-	26.64
Y-27435	*9000 ct	9000 ct	-	.27	.2	.1	1.1	900	1080	-	1:1	-	27.69
Y-27440	10,000 ct	12.8 ct	3.2	.25	.2	.1	1.0	1000	1.5	.38	28:1	56:1	20.42
Y-27445	10,000 ct	16 ct	4	.25	.2	.1	1.0	1000	1.92	.48	25:1	50:1	22.57
Y-27450	10,000 ct	100 ct	25	.25	.2	.1	1.0	1000	12	3	10:1	20:1	22.57
Y-27455	10,000 ct	200 ct	50	.25	.2	.1	1.0	1000	24	6	7.07:1	14.14:1	22.57
Y-27460	10,000 ct	500 ct	125	.25	.2	.1	1.0	1000	60	15	4.47:1	8.94:1	22.57
Y-27465	10,000 ct	600 ct	150	.25	.2	.1	1.0	1000	72	18	4.08:1	8.16:1	22.57
Y-27470	10,000 ct	1000 ct	250	.25	.2	.1	1.0	1000	120	30	3.16:1	6.32:1	22.57
Y-27475	10,000 ct	1200 ct	300	.25	.2	.1	1.0	1000	144	36	2.89:1	5.77:1	22.57
Y-27480	10,000 ct	1500 ct	375	.25	.2	.1	1.0	1000	180	45	2.58:1	5.16:1	24.60
Y-27485	10,000 ct	2000 ct	500	.25	.2	.1	1.0	1000	240	60	2.24:1	4.47:1	24.60
Y-27490	10,000 ct	5000 ct	1250	.25	.2	.1	1.0	1000	600	150	1.41:1	2.83:1	26.33
Y-27495	10,000 ct	7500 ct	1875	.25	.2	.1	1.0	1000	900	225	1.15:1	2.3:1	26.33
Y-27500	10,000 ct	10,000 ct	2500	.25	.2	.1	1.0	1000	1200	300	1:1	2:1	25.71
Y-27505	*10,000 ct	10,000 ct	-	.25	.2	.1	1.0	1000	1200	-	1:1	-	28.67
Y-27510	15,000 ct	400 ct	100	.16	.16	.1	.82	1500	48	12	6.12:1	12.24:1	25.71
Y-27515	15,000 ct	500 ct	125	.16	.16	.1	.82	1500	60	15	5.48:1	10.95:1	25.71
Y-27520	15,000 ct	600 ct	150	.16	.16	.1	.82	1500	72	18	5:1	10:1	25.71
Y-27525	15,000 ct	10,000 ct	2500	.16	.16	.1	.82	1500	1200	300	1.22:1	2.45:1	28.67
Y-27530	*15,000 ct	15,000 ct	-	.16	.16	.1	.82	1500	1800	-	1:1	-	28.67
Y-27535	15,000 ct	15,000 ct	3750	.16	.16	.1	.82	1500	1800	450	1:1	2.1	28.67
Y-27540	16,000 ct	1000 ct	250	.15	.15	.1	.8	1600	120	30	4:1	8.1	26.64
Y-27545	20,000 ct	500 ct	125	.125	.125	.1	.7	2000	60	15	6.33:1	12.65:1	25.71
Y-27550	20,000 ct	600 ct	150	.125	.125	.1	.7	2000	72	18	5.77:1	11.55:1	25.71
Y-27555	20,000 ct	800 ct	200	.125	.125	.1	.7	2000	96	24	5:1	10:1	20.42
Y-27560	20,000 ct	1000 ct	250	.125	.125	.1	.7	2000	120	30	4.47:1	8.94:1	25.71
Y-27565	20,000 ct	5000 ct	1250	.125	.125	.1	.7	2000	600	150	2:1	4:1	25.71
Y-27570	20,000 ct	10,000 ct	2500	.125	.125	.1	.7	2000	1200	300	1.41:1	2.83:1	25.71
Y-27575	*20,000 ct	20,000 ct	-	.125	.125	.1	.7	2000	2400	-	1:1	-	25.71
Y-27580	25,000 ct	500 ct	125	.1	.1	.1	.63	2500	60	15	7.07:1	14.14:1	25.71
Y-27585	25,000 ct	1000 ct	250	.1	.1	.1	.63	2500	120	30	5:1	10:1	25.71
Y-27590	30,000 ct	50 ct	12.5	.08	.08	.08	.58	3000	6	1.5	24.5:1	49:1	25.71
Y-27595	30,000 ct	1200 ct	300	.08	.08	.08	.58	3000	144	36	5:1	10:1	25.71
Y-27600	30,000 ct	500 ct	125	.08	.08	.08	.58	3000	60	15	7.75:1	15.5:1	25.71
Y-27605	30,000 ct	200 ct	50	.08	.08	.08	.58	3000	24	6	12.25:1	24.5:1	25.71
Y-27610	30,000 ct	5000 ct	1250	.08	.08	.08	.58	3000	600	150	2.45:1	4.9:1	28.65
Y-27615	30,000 ct	10,000 ct	2500	.08	.08	.08	.58	3000	1200	300	1.73:1	3.46:1	28.65
Y-27620	*30,000 ct	30,000 ct	-	.08	.08	.08	.58	3000	3600	-	1:1	-	28.65
Y-27625	40,000 ct	400 ct	100	.06	.06	.06	.5	4000	48	12	10:1	20:1	28.65
Y-27630	40,000 ct	2,000 ct	500	.06	.06	.06	.5	4000	240	60	4.47:1	8.94:1	28.65
Y-27635	40,000 ct	4,000 ct	1000	.06	.06	.06	.5	4000	480	120	3.16:1	6.32:1	29.72
Y-27640	40,000 ct	20,000 ct	5000	.06	.06	.06	.5	4000	2400	600	1.41:1	2.83:1	28.65
Y-27645	*40,000 ct	40,000 ct	-	.06	.06	.06	.5	4000	4800	-	1:1	-	28.65
Y-27650	50,000 ct	200 ct	50	.05	.05	.05	45	5000	24	6	15.8:1	31.6:1	29.72
Y-27655	50,000 ct	500 ct	125	.05	.05	.05	45	5000	60	15	10:1	20:1	29.72
Y-27660	50,000 ct	600 ct	150	.05	.05	.05	45	5000	72	18	9.13:1	18.26:1	29.72
Y-27665	60,000 ct	15,000 ct	3750	.04	.04	.04	.41	6000	1800	450	2.1	4:1	29.72
Y-27670	62,500 ct	50 ct	12.5	.04	.04	.04	.4	6250	6	1.5	35.4:1	70.7:1	29.72
Y-27675	80,000 ct	15,000 ct	3750	.03	.03	.03	.35	8000	1800	450	2.3:1	4.6:1	29.72
Y-27680	90,000 ct	10,000 ct	2500	.028	.028	.028	.33	9000	1200	300	3:1	6:1	29.72
Y-27685	95,000 ct	15,000 ct	3750	.026	.026	.026	.32	9500	1800	450	2.52:1	5.03:1	29.72
Y-27690	100,000 ct	60 ct	15	.025	.025	.025	.31	10,000	7.2	1.8	40.8:1	81.6:1	32.90
Y-27695	100,000 ct	100 ct	25	.025	.025	.025	.31	10,000	12	3	31.6:1	63.2:1	32.90
Y-27700	100,000 ct	500 ct	125	.025	.025	.025	.31	10,000	60	15	14.1:1	28.3:1	32.90
Y-27705	100,000 ct	10,000 ct	2500	.025	.025	.025	.31	10,000	1200	300	3.16:1	6.32:1	32.90
Y-SHIELD MU-METAL SHIELD .37" DIA. X .46" HT. (9.4MM DIA. X 11.7MM HT.) SINGLE SHIELD													3.51
YXX-SHIELD MU-METAL SHIELD .395" DIA. X .47" HT. (10.1MM DIA. X 11.9"MM HT.) USE WITH Y-SHIELD FOR DOUBLE SHIELDING													3.51

***Discount Prices: 1–9 Net: 10–24 less 10%; 25–49 less 16%; 50–99 less 23%; 100–499 less 30%
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York

*INCLUDES ELECTROSTATIC SHIELD

INDUCTORS

ALL INDUCTORS HAVE SPLIT WINDINGS AND MEASUREMENTS ARE LISTED FOR BOTH SERIES AND PARALLEL CONNECTIONS.

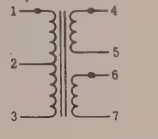
TWO VALUES OF INDUCTANCE, EACH AT A PARTICULAR VALUE OF DC CURRENT, ARE LISTED FOR EACH INDUCTOR.

Y-Series Plug-In	INDUCTANCE SERIES		DC CURRENT ma	DC RESISTANCE OHMS	PRICES 1–9***
Y-27750	SERIES	.075	10	10.5	19.48
		.06	30		
	PARALLEL	.018	20	2.6	
		.015	60		
Y-27760	SERIES	.3	4	25	21.65
		.15	20		
	PARALLEL	.075	8	6.2	
		.04	40		
Y-27770	SERIES	3.5	2	560	21.65
		1.0	5		
	PARALLEL	0.9	4	140	
		0.25	10		
Y-27780	SERIES	6.0	2	2100	21.65
		1.5	5		
	PARALLEL	1.5	4	525	
		0.38	10		
Y-27790	SERIES	20	1	5100	26.64
		8	3		
	PARALLEL	5	2	1275	
		2	6		

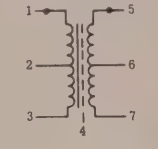
PICO's ultra-miniature transformers

Y SERIES Plug-In

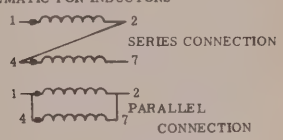
SCHEMATIC FOR TRANSFORMERS WITH SPLIT SECONDARIES



SCHEMATIC FOR TRANSFORMERS WITH ELECTROSTATIC SHIELD



SCHEMATIC FOR INDUCTORS



FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- PICO IS APPROVED QPL SOURCE (MIL-T-27)
- MAGNETIC SHIELDS AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED
- VARIATION OF STANDARD DESIGNS AVAILABLE
- PRIMARY AND SECONDARY WINDINGS CAN BE USED EITHER AS INPUT OR OUTPUT.
- SPECIAL PRODUCTION TECHNIQUES ENSURE UNIFORM SIZE AND LEADS WHICH ARE FREE OF ENCAPSULANT. NO MENISCUS IN LEAD AREA.
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS.

THIS PRODUCT IS PATENTED

Delivery— stock to one week

PICO Electronics, Inc.

453 N. MacQuesten Pkwy.
Mt. Vernon, N.Y. 10552

• FAX 914-699-5565

For immediate engineering assistance or to place an order—

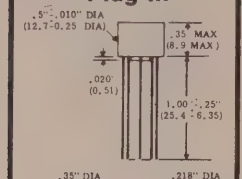
Call Toll Free 800-228-9747

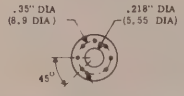
PICO's ultra-miniature transformers

These units can be manufactured and tested to MIL-T-27/357. Contact factory for price and delivery information and appropriate part numbers (MIL-T-27/357-01 thru MIL-T-27/357-114).

For Surface Mount Versions of this series, see pages A•2462 & A•2463.

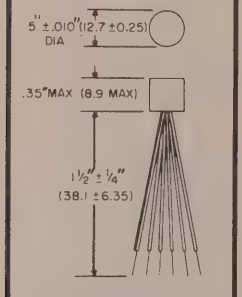
L SERIES Plug-In





WHITE DOT AT TERMINAL #1
TERMINALS CLOCKWISE FROM PIN #1

P SERIES Insulated Leads



Dimensions are in inches (MM)

PICO PART NUMBER			SECONDARY IMPEDANCE OHMS SPLIT WINDINGS		POWER WATTS					SECONDARY DC RESISTANCE OHMS		TURNS RATIO PRIM/SEC		PICO PRICES 1-9***	
L-Series Plug-in	P-Series Insulated Leads	PRIMARY IMPEDANCE OHMS	SER	PAR	1KHz and higher	400 Hz and higher	300 Hz and higher	PRIMARY UNBALANCED DC CURRENT ma	PRIMARY DC RESISTANCE OHMS	SER CONN	PAR CONN	SEC SER CONN	SEC PAR CONN	L-Series	P-Series
L-8203	P-9203	20 ct	8 ct	2	.6	.4	.3	30.0	2	1.2	.3	1.58:1	3.16:1	24.26	23.21
L-8205	P-9205	20 ct	20 ct	5	.6	.4	.3	30.0	2	2.8	.7	1:1	2:1	24.26	23.21
L-8210	P-9210	32 ct	32 ct	8	.6	.4	.3	23.0	3.3	4.5	1.13	1:1	2:1	24.26	23.21
L-8215	P-9215	40 ct	40ct	10	.6	.4	.3	21.0	3.7	5	1.25	1:1	2:1	24.26	23.21
L-8218	P-9218	48 ct	16 ct	4	.6	.4	.3	19.0	3.75	3	.75	1.73:1	3.46:1	24.26	23.21
L-8220	P-9220	50 ct	50 ct	12.5	.6	.4	.3	19.0	5	7	1.75	1:1	2:1	24.26	23.21
L-8225	P-9225	80 ct	32 ct	8	.6	.4	.3	15.0	7.5	4.3	1.13	1.58:1	3.16:1	24.26	23.21
L-8228	P-9228	100 ct	40 ct	10	.6	.4	.3	13.0	10.8	5	1.25	1.58:1	3.16:1	24.26	23.21
L-8230	P-9230	100 ct	100 ct	25	.6	.4	.3	13.0	10.8	12	3	1:1	2:1	24.26	23.21
L-8235	P-9235	120 ct	12.8 ct	3.2	.6	.4	.3	12.0	9.3	2.2	.55	3.06:1	6.12:1	24.26	23.21
L-8240	P-9240	120 ct	60 ct	15	.6	.4	.3	12.0	9	7.2	1.8	1.41:1	2.83:1	24.26	23.21
L-8245	P-9245	120 ct	120 ct	30	.6	.4	.3	12.0	11.6	13	3.3	1:1	2:1	24.26	23.21
L-8250	P-9250	150 ct	12 ct	3	.6	.4	.3	11.0	11.2	2.2	.55	3.54:1	7.08:1	24.26	23.21
L-8255	P-9255	150 ct	50 ct	12.5	.6	.4	.3	11.0	13	6.8	1.7	1.73:1	3.46:1	24.26	23.21
L-8260	P-9260	150 ct	100 ct	25	.6	.4	.3	11.0	13	11.8	3	1.22:1	2.45:1	24.26	23.21
L-8265	P-9265	150 ct	150 ct	37.5	.6	.4	.3	11.0	12	18.3	4.6	1:1	2:1	24.26	23.21
L-8270	P-9270	150 ct	600 ct	150	.6	.4	.3	11.0	13	75	19	1:2	1:1	24.26	23.21
L-8275	P-9275	200 ct	200 ct	50	.6	.4	.3	10.0	19	21.3	5.4	1.1	2:1	24.26	23.21
L-8280	P-9280	300 ct	12 ct	3	.6	.4	.3	8.0	24	1.7	.43	5:1	10:1	24.26	23.21
L-8285	P-9285	300 ct	50 ct	12.5	.6	.4	.3	8.0	30	6.8	1.7	2.45:1	4.9:1	24.26	23.21
L-8290	P-9290	300 ct	150 ct	37.5	.6	.4	.3	8.0	30	18	4.6	1.41:1	2.83:1	24.26	23.21
L-8295	P-9295	300 ct	300 ct	75	.6	.4	.3	8.0	30	34	8.5	1:1	2:1	24.26	23.21
L-8300	P-9300	300 ct	600 ct	150	.6	.4	.3	8.0	30	60	15	1:1.41	1.41:1	24.26	23.21
L-8305	P-9305	320 ct	12.8 ct	3.2	.6	.4	.3	7.5	31	1.7	.43	5:1	10:1	24.26	23.21
L-8310	P-9310	400 ct	40 ct	10	.6	.4	.3	7.0	41	4.5	1.13	3.16:1	6.32:1	24.26	23.21
L-8315	P-9315	400 ct	120 ct	30	.6	.4	.3	7.0	41	12	3	1.83:1	3.65:1	24.26	23.21
L-8320	P-9320	400 ct	200 ct	50	.6	.4	.3	7.0	41	21.3	5.4	1.41:1	2.83:1	24.26	23.21
L-8325	P-9325	400 ct	400 ct	100	.6	.4	.3	7.0	41	37.5	9.4	1:1	2:1	24.26	23.21
L-8330	P-9330	400 ct	1000 ct	250	.6	.4	.3	7.0	41	96	24	1:1.58	1.26:1	24.26	23.21
L-8335	P-9335	400 ct	2000 ct	500	.6	.4	.3	7.0	41	212	53	1:2.24	1.1.12	24.26	23.21
L-8340	P-9340	400 ct	4000 ct	1000	.6	.4	.3	7.0	41	375	94	1:3.16	1:1.58	24.26	23.21
L-8342	P-9342	500 ct	12.8 ct	3.2	.6	.4	.3	6.0	48	1.7	.43	6.25:1	12.5:1	24.26	23.21
L-8344	P-9344	500 ct	16 ct	4	.6	.4	.3	6.0	48	1.9	.5	5.6:1	11.2:1	24.26	23.21
L-8345	P-9345	500 ct	50 ct	12.5	.6	.4	.3	6.0	39	6.8	1.7	3.16:1	6.32:1	24.26	23.21
L-8347	P-9347	500 ct	150 ct	37.5	.6	.4	.3	6.0	48	18	4.6	1.83:1	3.65:1	24.26	23.21
L-8350	P-9350	500 ct	500 ct	125	.6	.4	.3	6.0	48	54	13.5	1:1	2:1	24.26	23.21
L-8355	P-9355	*500 ct	500 ct	–	.6	.4	.3	6.0	48	68	–	1:1	–	25.26	24.26
L-8360	P-9360	500 ct	600 ct	150	.6	.4	.3	6.0	48	59	15	1:1.1	1.83:1	24.26	24.26
L-8365	P-9365	600 ct	12.8 ct	3.2	.6	.4	.3	5.5	53	1.7	.43	6.85:1	13.7:1	24.26	24.26
L-8367	P-9367	600 ct	30 ct	7.5	.6	.4	.3	5.5	53	4.2	1.1	4.47:1	8.94:1	24.26	24.26
L-8370	P-9370	600 ct	48 ct	12	.6	.4	.3	5.5	53	6.8	1.7	3.54:1	7.07:1	24.26	24.26
L-8375	P-9375	600 ct	200 ct	50	.6	.4	.3	5.5	53	21.3	5.3	1.73.1	3.46:1	24.26	23.44
L-8380**	P-9380	600 ct	600 ct	150	.6	.4	.3	5.5	57	79	20	1:1	2:1	24.26	23.44
L-8385**	P-9385	*600 ct	600 ct	–	.6	.4	.3	5.5	53	75	–	1:1	–	25.26	24.26
L-8387**	P-9387	600 ct	1200 ct	300	.6	.4	.3	5.5	53	105	26	1:1.41	1.41:1	24.26	23.44
L-8390	P-9390	640 ct	12.8 ct	3.2	.6	.4	.3	5.5	66	1.7	.43	7.07:1	14.14:1	24.26	23.44
L-8395	P-9395	700 ct	100 ct	25	.6	.4	.3	5.0	69	12	3	2.65:1	5.29:1	24.26	23.44
L-8400	P-9400	800 ct	12.8 ct	3.2	.6	.4	.3	5.0	75	1.7	.43	7.9:1	15.8:1	24.26	23.44
L-8405	P-9405	800 ct	48 ct	12	.6	.4	.3	5.0	75	6.8	1.7	4.08:1	8.16:1	24.26	23.44
L-8410	P-9410	800 ct	800 ct	200	.6	.4	.3	5.0	75	105	26	1:1	2:1	24.26	23.44
L-8415	P-9415	900 ct	600 ct	150	.6	.4	.3	4.5	79	75	19	1.22:1	2.45:1	24.26	23.44
L-8420	P-9420	1000 ct	12 ct	3	.6	.4	.3	4.5	103	1.6	.4	9.13:1	18.3:1	24.26	23.44
L-8425	P-9425	1000 ct	50 ct	12.5	.6	.4	.3	4.5	103	6.4	1.6	4.47:1	8.94:1	24.26	23.44
L-8430	P-9430	1000 ct	1000 ct	250	.6	.4	.3	4.5	103	115	28	1:1	2:1	24.26	23.44
L-8435	P-9435	1060 ct	12.8 ct	3.2	.6	.4	.3	4.0	108	1.7	.43	9.1.1	18.2:1	24.26	23.44
L-8440	P-9440	1200 ct	12.8 ct	3.2	.6	.4	.3	4.0	113	1.7	.43	9.68:1	19.4:1	24.26	23.44
L-8445	P-9445	1200 ct	500 ct	125	.6	.4	.3	4.0	113	54	13.5	1.55:1	3.1:1	24.26	23.44
L-8450	P-9450	1200 ct	1200 ct	300	.6	.4	.3	4.0	113	126	31.6	1:1	2:1	24.26	23.44
L-8455	P-9455	*1200 ct	1200 ct	–	.6	.4	.3	4.0	111	125	–	1:1	–	25.26	24.26
L-8460	P-9460	1500 ct	12 ct	3	.6	.4	.3	3.5	126	1.6	.4	11.2:1	22.4:1	24.26	23.44
L-8465	P-9465	1500 ct	500 ct	125	.6	.4	.3	3.5	126	68	17	1.73:1	3.46:1	24.26	23.44
L-8470	P-9470	*1500 ct	600 ct	–	.6	.4	.3	3.5	126	94	–	1.58:1	–	25.26	24.26
L-8475	P-9475	*1500 ct	1500 ct	–	.6	.4	.3	3.5	126	176	–	1:1	–	25.26	24.26
L-8480	P-9480	1600 ct	12.8 ct	3.2	.6	.4	.3	3.5	130	1.7	.43	11.2:1	22.4:1	24.26	23.44
L-8483	P-9483	2000 ct	8 ct	2	.6	.4	.3	3.0	210	1.2	.3	15.8:1	31.6:1	24.26	23.44
L-8485	P-9485	2000 ct	2000 ct	500	.6	.4	.3	3.0	198	218	55	1:1	2:1	24.26	23.44
L-8490	P-9490	*2000 ct	2000 ct	–	.6	.4	.3	3.0	198	218	–	1:1	–	24.26	23.44
L-8495	P-9495	2000 ct	8000 ct	2000	.6	.4	.3	3.0	198	850	213	1:2	1:1	24.26	23.44
L-8497	P-9497	2500 ct	2500 ct	625	.6	.4	.3	2.5	220	305	76	1.1	2:1	24.26	23.44
L-8500	P-9500	3000 ct	3000 ct	750	.6	.4	.3	2.5	243	335	84	1:1	2:1	24.26	23.44

***Discount Prices: 1-9 Net; 10-24 less 10%; 25-29 less 16%; 50-99 less 23%; 100-499 less 30%
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

*INCLUDES ELECTROSTATIC SHIELD
**MINIATURIZED TELEPHONE COUPLING APPLICATION

SPECIFICATIONS

- **MIL-T-27:** All units manufactured to MIL-T-27, Military Designation is TF5R21ZZ for Transformers.
- **FREQUENCY RESPONSE:** +3db, 300 Hz-75 KHz at 1.0 Milliwatt.
- **MAXIMUM DISTORTION:** 5% With Rated Power Level at 1 KHz and 400 Hz.
- **DIELECTRIC STRENGTH:** All Units Tested at 200 V RMS.
- **INSULATION RESISTANCE:** Greater Than 10,000 Megohms at 300 V DC.
- **WEIGHT:** 5 Grams
- **OPERATING TEMPERATURE:** -55°c to +105°c (All Units Can be Supplied to Class S Requirements, +130°c).
- **TERMINALS:** Solid .016 Diameter Conductor. Solderability per MIL-STD-202 Method 208.
- **THERMAL SHOCK:** 25 Cycles, Method 107D, MIL-STD-202E, Test Condition A-1.

PICO Electronics, Inc.

453 N. MacQuesten Pkwy.,
Mt. Vernon, N.Y. 10552

FAX 914-699-5565

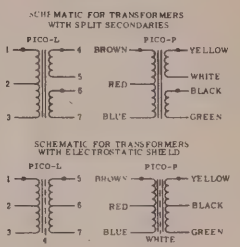
PICO PART NUMBER L-Series Plug-In	PICO PART NUMBER P-Series Insulated Leads	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS PAR	POWER WATTS 1KHz and higher	POWER WATTS 400 Hz and higher	POWER WATTS 300 Hz and higher	PRIMARY UNBALANCED DC CURRENT ma	PRIMARY DC RESISTANCE OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	SECONDARY DC RESISTANCE OHMS PAR CONN	TURNS RATIO PRIM/SEC SEC SER CONN	TURNS RATIO PRIM/SEC SEC PAR CONN	PICO PRICES 1-9*** L-Series	PICO PRICES 1-9*** P-Series
L-8505	P-9505	*3000 ct	3000 ct	–	.6	.4	.3	2.5	304	335	–	1:1	–	25.26	24.26
L-8510	P-9510	3600 ct	3600 ct	900	.6	.4	.3	2.5	330	366	92	1:1	2:1	24.26	23.44
L-8512	P-9512	4000 ct	16 ct	4	.6	.4	.3	2.0	350	3	.75	15.8:1	31.6:1	24.26	23.44
L-8514	P-9514	4000 ct	600 ct	150	.6	.4	.3	2.0	350	76	19	2.58:1	5.16:1	24.26	23.44
L-8515	P-9515	4000 ct	1000 ct	250	.6	.4	.3	2.0	350	115	29	2:1	4:1	24.26	23.44
L-8520	P-9520	*4000 ct	8000 ct	–	.6	.4	.3	2.0	350	1062	–	1:1.41	–	25.26	24.26
L-8525	P-9525	5000 ct	500 ct	125	.6	.4	.3	2.0	350	67	17	3.16:1	6.32:1	24.26	23.44
L-8530	P-9530	5000 ct	5000 ct	1250	.6	.4	.3	2.0	390	538	135	1:1	2:1	24.26	23.44
L-8535	P-9535	7500 ct	50 ct	12.5	.6	.4	.3	1.5	600	7	1.75	12.2:1	24.5:1	26.92	26.12
L-8540	P-9540	7500 ct	100 ct	25	.6	.4	.3	1.5	600	12	3	8.66:1	17.3:1	26.92	26.12
L-8545	P-9545	7500 ct	600 ct	150	.6	.4	.3	1.5	600	78	19.5	3.54:1	7.07:1	26.92	26.12
L-8550	P-9550	7500 ct	2500 ct	625	.6	.4	.3	1.5	600	305	77	1.73:1	3.46:1	26.92	26.4
L-8555	P-9555	*7500 ct	7500 ct	–	.6	.4	.3	1.5	750	828	–	1:1	–	28.82	26.91
L-8560	P-9560	8000 ct	12.8 ct	3.2	.6*	.4	.3	1.5	750	1.7	.43	25:1	50:1	26.92	26.14
L-8565	P-9565	8000 ct	1000 ct	250	.6	.4	.3	1.5	750	115	29	2.83:1	5.66:1	26.92	26.14
L-8570	P-9570	*8000 ct	1200 ct	–	.6	.4	.3	1.5	750	158	–	2.58:1	–	28.82	26.91
L-8575	P-9575	*9000 ct	9000 ct	–	.6	.4	.3	1.4	796	1100	–	1:1	–	28.82	26.91
L-8580	P-9580	10,000 ct	12.8 ct	3.2	.6	.4	3	1.4	1048	1.7	.43	28:1	56:1	26.92	26.14
L-8585	P-9585	10,000 ct	16 ct	4	.6	.4	.3	1.4	1048	3	.75	25:1	50:1	26.92	26.14
L-8590	P-9590	10,000 ct	100 ct	25	.6	.4	.3	1.4	839	12	3	10:1	20.1	26.92	26.14
L-8595	P-9595	10,000 ct	200 ct	50	.6	.4	.3	1.4	839	27	6.7	7.07:1	14.14:1	26.92	26.14
L-8600	P-9600	10,000 ct	500 ct	125	.6	.4	.3	1.4	850	67	17	4.47:1	8.94:1	26.92	26.14
L-8605	P-9605	10,000 ct	600 ct	150	.6	.4	.3	1.4	850	74	18.5	4.08:1	8.16:1	26.92	26.14
L-8610	P-9610	10,000 ct	1000 ct	250	.6	.4	.3	1.4	850	115	29	3.16:1	6.32:1	26.92	26.14
L-8615	P-9615	10,000 ct	1200 ct	300	.6	.4	.3	1.4	850	158	39.5	2.89:1	5.77:1	26.92	26.14
L-8620	P-9620	10,000 ct	1500 ct	375	.6	.4	.3	1.4	850	177	44	2.58:1	5.16:1	26.92	26.14
L-8625	P-9625	10,000 ct	2000 ct	500	.6	.4	.3	1.4	850	255	64	2.24:1	4.47:1	26.92	26.14
L-8630	P-9630	10,000 ct	5000 ct	1250	.6	.4	.3	1.4	850	630	158	1.41:1	2.83:1	26.92	26.14
L-8635	P-9635	10,000 ct	7500 ct	1875	.6	.4	.3	1.4	850	772	193	1.15:1	2.3:1	26.92	26.14
L-8640	P-9640	10,000 ct	10,000 ct	2500	.6	.4	.3	1.4	866	1215	304	1:1	2:1	26.92	26.14
L-8645	P-9645	*10,000 ct	10,000 ct	–	.6	.4	.3	1.4	1060	1215	–	1:1	–	28.82	26.91
L-8650	P-9650	15,000 ct	400 ct	100	.6	.4	.3	1.0	1305	47	12	6.12:1	12.24:1	26.92	26.14
L-8652	P-9652	15,000 ct	500 ct	125	.6	.4	.3	1.0	1305	53	13	5.48:1	10.95:1	26.92	26.14
L-8655	P-9655	15,000 ct	600 ct	150	.6	.4	.3	1.0	1305	72.5	18	5:1	10:1	26.92	26.14
L-8660	P-9660	15,000 ct	10,000 ct	2500	.6	.4	.3	1.0	1305	1215	304	1.22:1	2.45:1	26.92	26.14
L-8665	P-9665	*15,000 ct	15,000 ct	–	.6	.4	.3	1.0	1305	1800	–	1:1	–	28.82	26.91
L-8670	P-9670	15,000 ct	15,000 ct	3750	.6	.4	.3	1.0	1305	1800	450	1:1	2:1	26.92	26.14
L-8675	P-9675	16,000 ct	1000 ct	250	.6	.4	.3	1.0	1343	115	29	4:1	8:1	26.92	26.14
L-8680	P-9680	20,000 ct	500 ct	125	.5	.4	.3	1.0	1560	68	17	6.33:1	12.65:1	28.82	26.91
L-8685	P-9685	20,000 ct	600 ct	150	.5	.4	.3	1.0	1560	75	19	5.77:1	11.55:1	28.82	26.91
L-8690	P-9690	20,000 ct	800 ct	200	.5	.4	.3	1.0	1560	108	27	5:1	10:1	28.82	26.91
L-8695	P-9695	20,000 ct	1000 ct	250	.5	.4	.3	1.0	1560	121	30.5	4.47:1	8.94:1	28.82	26.91
L-8700	P-9700	20,000 ct	5000 ct	1250	.5	.4	.3	1.0	1560	672	168	2:1	4:1	28.82	26.91
L-8705	P-9705	20,000 ct	10,000 ct	2500	.5	.4	.3	1.0	1560	1520	380	1.41:1	2.83:1	28.82	26.91
L-8710	P-9710	*20,000 ct	20,000 ct	–	.5	.4	.3	1.0	1560	2727	682	1:1	–	29.98	28.82
L-8715	P-9715	25,000 ct	500 ct	125	.4	.4	.3	0.8	2170	68	17	7.07:1	14.14:1	28.82	26.91
L-8720	P-9720	25,000 ct	1000 ct	250	.4	.4	.3	0.8	2170	120	30	5:1	10:1	28.82	26.91
L-8725	P-9725	30,000 ct	50 ct	12.5	.33	.33	.3	0.8	2400	7	1.75	24.5:1	49:1	29.98	28.82
L-8730	P-9730	30,000 ct	1200 ct	300	.33	.33	.3	0.8	2400	156	39	5:1	10:1	29.98	28.82
L-8732	P-9732	30,000 ct	500 ct	125	.33	.33	.3	0.8	2400	68	17	7.75:1	15.5:1	29.98	28.82
L-8734	P-9734	30,000 ct	200 ct	50	.33	.33	.3	0.8	2400	29	7.2	12.25:1	24.5:1	29.98	28.82
L-8735	P-9735	30,000 ct	5000 ct	1250	.33	.33	.3	0.8	2400	673	169	2.45:1	4.9:1	29.98	28.82
L-8740	P-9740	30,000 ct	10,000 ct	2500	.33	.33	.3	0.8	2400	1520	380	1.73:1	3.46:1	29.98	28.82
L-8745	P-9745	*30,000 ct	30,000 ct	–	.33	.33	.3	0.8	3000	3310	–	1:1	–	32.19	30.27
L-8750	P-9750	40,000 ct	400 ct	100	.25	.25	.25	0.7	3400	57	14.3	10:1	20:1	32.19	30.27
L-8755	P-9755	40,000 ct	2000 ct	500	.25	.25	.25	0.7	3400	268	67	4.47:1	8.94:1	32.19	30.27
L-8760	P-9760	40,000 ct	4000 ct	1000	.25	.25	.25	0.7	3400	476	119	3.16:1	6.32:1	32.19	30.27
L-8765	P-9765	40,000 ct	20,000 ct	5000	.25	.25	.25	0.7	3400	2700	675	1.41:1	2.83:1	32.19	30.27
L-8770	P-9770	*40,000 ct	40,000 ct	–	.25	.25	.25	0.7	3400	4750	–	1:1	–	35.90	34.32
L-8775	P-9775	50,000 ct	200 ct	50	.2	.2	.2	0.6	4850	27	6.7	15.8:1	31.6:1	35.90	34.32
L-8777	P-9777	50,000 ct	500 ct	125	.2	.2	.2	0.6	4850	68	17	10:1	20:1	35.90	34.32
L-8779	P-9779	50,000 ct	600 ct	150	.2	.2	.2	0.6	4850	75	18.5	9.13:1	18.26:1	35.90	34.32
L-8780	P-9780	60,000 ct	15,000 ct	3750	.16	16	.16	0.5	5275	2250	563	2:1	4:1	38.71	37.76
L-8785	P-9785	62,500 ct	50 ct	12.5	16	.16	.16	0.5	5445	8.7	2.2	35.4:1	70.7:1	38.71	37.76
L-8787	P-9787	80,000 ct	15,000 ct	3750	.12	.12	.12	0.4	6130	2250	563	2.3:1	4.6:1	38.71	37.76
L-8790	P-9790	90,000 ct	10,000 ct	2500	.1	.1	.1	0.4	8140	1520	380	3:1	6:1	40.67	39.18
L-8795	P-9795	95,000 ct	15,000 ct	3750	.1	.1	.1	0.4	8400	2250	563	2.52:1	5.03:1	40.67	39.18
L-8800	P-9800	100,000 ct	60 ct	15	.1	.1	.1	0.4	8750	9.2	2.3	40.8:1	81.6:1	40.67	39.18
L-8805	P-9805	100,000 ct	100 ct	25	.1	.1	.1	0.4	8750	15	3.8	31.6:1	63.2:1	40.67	39.18
L-8810	P-9810	100,000 ct	500 ct	125	.1	.1	.1	0.4	8750	68	17	14.1:1	28.3:1	40.67	39.18
L-8815	P-9815	100,000 ct	10,000 ct	2500	.1	.1	.1	0.4	8750	1535	385	3.16:1	6.32:1	40.67	39.18
L-SHIELD		MU-METAL SHIELD .53" d X .41" h (13.46 mm d X 10.41 mm h)												3.50	
P-SHIELD		MU-METAL SHIELD .53' d X .41" h (13.46 mm d X 10.41 mm h)													3.50

*INCLUDES ELECTROSTATIC SHIELD

***Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York

L SERIES Plug-In

P SERIES Insulated Leads



FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- PICO IS APPROVED QPL SOURCE (MIL-T-27)
- MAGNETIC SHIELDS AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED.
- VARIATION OF STANDARD DESIGNS AVAILABLE
- PRIMARY AND SECONDARY WINDINGS CAN BE USED EITHER AS INPUT OR OUTPUT.
- SPECIAL PRODUCTION TECHNIQUES ENSURE UNIFORM SIZE AND LEADS WHICH ARE FREE OF ENCAPSULANT. NO MENISCUS IN LEAD AREA.
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS.

PICO Electronics, Inc.

453 N. MacQuesten Pkwy.
Mt. Vernon, N.Y. 10552

FAX 914-699-5565

Delivery— stock to one week

For immediate engineering assistance or to place an order—

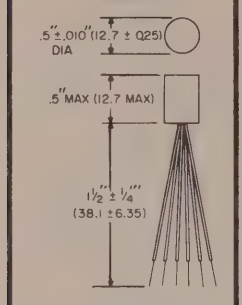
Call Toll Free 800-228-9747

PICO's ultra-miniature transformers

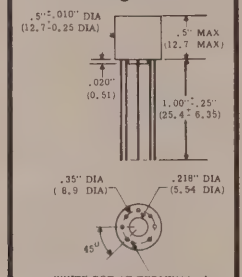
These units can be manufactured and tested to MIL-T-27/358. Contact factory for price and delivery information and appropriate parts numbers (MIL-T-27/358-01 thru MIL-T-27/358-123).

For Surface Mount Versions of this series, see pages A•2464 & A•2465.

K SERIES Insulated Leads



N SERIES Plug-In


.5" ± .010" DIA (12.7 ± 0.25 DIA)
.5" MAX (12.7 MAX)
.020" (0.51)
1.00" ± .25" (25.4 ± 6.35)
.35" DIA (8.9 DIA)
.218" DIA (5.54 DIA)
45°
WHITE DOT AT TERMINAL #1 TERMINALS CLOCKWISE FROM PIN #1

Dimensions are in inches (MM)

PICO PART NUMBER			SECONDARY IMPEDANCE OHMS SPLIT WINDINGS		POWER WATTS					SECONDARY DC RESISTANCE OHMS		TURNS RATIO PRIM/SEC		PICO PRICES 1-9***	
K-Series Insulated Leads	N-Series Plug-In	PRIMARY IMPEDANCE OHMS	SER	PAR	1KHz and higher	400 Hz and higher	150 Hz and higher	PRIMARY UNBALANCED DC CURRENT ma	PRIMARY DC RESISTANCE OHMS	SER CONN	PAR CONN	SEC SER CONN	SEC PAR CONN	K-Series	N-Series
K-7203	N-6203	20 ct	8 ct	2	1.0	.75	.11	22.0	1.75	1.0	.25	1.58:1	3.16:1	23.44	24.26
K-7205	N-6205	20 ct	20 ct	5	1.0	.75	.11	22.0	1.75	2.5	.63	1:1	2:1	23.44	24.26
K-7210	N-6210	32 ct	32 ct	8	1.0	.75	.11	18.0	2.7	3.7	.93	1:1	2:1	23.44	24.26
K-7215	N-6215	40 ct	40 ct	10	1.0	.75	.11	16.0	3	5.2	1.3	1:1	2:1	23.44	24.26
K-7218	N-6218	48 ct	16ct	4	1.0	.75	.11	13.0	4.5	2.4	.6	1.73:1	3.46:1	23.44	24.26
K-7220	N-6220	50 ct	50 ct	12.5	1.0	.75	.11	13.0	4.5	6.2	1.6	1:1	2:1	23.44	24.26
K-7225	N-6225	80 ct	32 ct	8	1.0	.75	.11	11.0	6.6	3.7	.93	1.58:1	3.16:1	23.44	24.26
K-7228	N-6228	100 ct	40 ct	10	1.0	.75	.11	10.0	9.7	5.6	1.4	1.58:1	3.16:1	23.44	24.26
K-7230	N-6230	100 ct	100 ct	25	1.0	.75	.11	10.0	9.7	11	2.8	1:1	2:1	23.44	24.26
K-7235	N-6235	120 ct	12.8 ct	3.2	1.0	.75	.11	9.0	10.8	1.6	.4	3.06:1	6.12:1	23.44	24.26
K-7240	N-6240	120 ct	60 ct	15	1.0	.75	.11	9.0	10.8	8.5	2.2	1.41:1	2.83:1	23.44	24.26
K-7245	N-6245	120 ct	120 ct	30	1.0	.75	.11	9.0	10.8	15	3.8	1:1	2:1	23.44	24.26
K-7250	N-6250	150 ct	12 ct	3	1.0	.75	.11	8.0	13.5	1.75	.44	3.54:1	7.08:1	23.44	24.26
K-7255	N-6255	150 ct	50 ct	12.5	1.0	.75	.11	8.0	12	5.8	1.5	1.73:1	3.46:1	23.44	24.26
K-7260	N-6260	150 ct	100 ct	25	1.0	.75	.11	8.0	12	13	3.3	1.22:1	2.44:1	23.44	24.26
K-7265	N-6265	150 ct	150 ct	37.5	1.0	.75	.11	8.0	12	20	5	1:1	2:1	23.44	24.26
K-7270	N-6270	150 ct	600 ct	150	1.0	.75	.11	8.0	12	82	20.5	1:2	1:1	23.44	24.26
K-7275	N-6275	200 ct	200 ct	50	1.0	.75	.11	7.0	17	24	6.0	1:1	2:1	23.44	24.26
K-7280	N-6280	300 ct	12 ct	3	1.0	.75	.11	5.0	30	1.75	.44	5:1	10:1	23.44	24.26
K-7285	N-6285	300 ct	50 ct	12.5	1.0	.75	.11	5.0	27	6.2	1.6	2.45:1	4.9:1	23.44	24.26
K-7290	N-6290	300 ct	150 ct	37.5	1.0	.75	.11	5.0	26	21	5.3	1.41:1	2.83:1	23.44	24.26
K-7295	N-6295	300 ct	300 ct	75	1.0	.75	.11	5.0	27	38	9.5	1:1	2:1	23.44	24.26
K-7300	N-6300	300 ct	600 ct	150	1.0	.75	.11	5.0	27	66	17	1.41:1	1.41:1	23.44	24.26
K-7305	N-6305	320 ct	12.8 ct	3.2	1.0	.75	.11	5.0	30	1.75	.44	5:1	10:1	23.44	24.26
K-7310	N-6310	400 ct	40 ct	10	1.0	.75	.11	5.0	39	4.3	1.1	3.16:1	6.32:1	23.44	24.26
K-7315	N-6315	400 ct	120 ct	30	1.0	.75	.11	5.0	30	14	3.5	1.83:1	3.65:1	23.44	24.26
K-7320	N-6320	400 ct	200 ct	50	1.0	.75	.11	5.0	39	24	6	1.41:1	2.83:1	23.44	24.26
K-7325	N-6325	400 ct	400 ct	100	1.0	.75	.11	5.0	39	42	10.5	1:1	2:1	23.44	24.26
K-7330	N-6330	400 ct	1000 ct	250	1.0	.75	.11	5.0	39	109	28	1:1.58	1.26:1	23.44	24.26
K-7335	N-6335	400 ct	2000 ct	500	1.0	.75	.11	5.0	39	198	49	1:2.24	1.1.12	23.44	24.26
K-7340	N-6340	400 ct	4000 ct	1000	1.0	.75	.11	5.0	39	436	109	1:3.16	1:1.58	23.44	24.26
K-7342	N-6342	500 ct	12.8 ct	3.2	1.0	.75	.11	4.5	43	1.6	.4	6.25:1	12.5:1	23.44	24.26
K-7344	N-6344	500 ct	16 ct	4	1.0	.75	.11	4.5	43	2.3	.56	5.6:1	11.2:1	23.44	24.26
K-7345	N-6345	500 ct	50 ct	12.5	1.0	.75	.11	4.5	43	5.8	1.5	3.16:1	6.32:1	23.44	24.26
K-7347	N-6347	500 ct	150 ct	37.5	1.0	.75	.11	4.5	43	19.8	5	1.83:1	3.65:1	23.44	24.26
K-7350	N-6350	500 ct	500 ct	125	1.0	.75	.11	4.5	43	60	15	1:1	2:1	23.44	24.26
K-7355	N-6355	*500 ct	500 ct	–	1.0	.75	.11	4.5	43	60	–	1:1	–	24.26	25.26
K-7360	N-6360	500 ct	600 ct	150	1.0	.75	.11	4.5	43	66	17	1:1.1	1.83:1	23.44	24.26
K-7365	N-6365	600 ct	12.8 ct	3.2	1.0	.75	.11	4.0	68	1.75	.44	6.85:1	13.7:1	23.44	24.26
K-7367	N-6367	600 ct	30 ct	7.5	1.0	.75	.11	4.0	60	3.7	.93	4.47:1	8.94:1	23.44	24.26
K-7370	N-6370	600 ct	48 ct	12	1.0	.75	.11	4.0	60	5.9	1.5	3.54:1	7.07:1	23.44	24.26
K-7375	N-6375	600 ct	200 ct	50	1.0	.75	.11	4.0	60	25	6.3	1.73:1	3.46:1	23.44	24.26
K-7380**	N-6380**	600 ct	600 ct	150	1.0	.75	.11	4.0	60	66	17	1:1	2:1	23.44	24.26
K-7385**	N-6385**	*600 ct	600 ct	–	1.0	.75	.11	4.0	60	68	–	1:1	–	24.26	25.26
K-7386**	N-6386**	*600 ct	900 ct	–	1.0	.75	.11	4.0	60	104	–	1.1.22	–	24.26	25.26
K-7387**	N-6387**	600 ct	1200 ct	300	1.0	.75	.11	4.0	60	116	29	1:1.41	1.41:1	23.44	24.26
K-7390	N-6390	640 ct	12.8 ct	3.2	1.0	.75	.11	4.0	69	1.75	.44	7.07:1	14.14:1	23.44	24.26
K-7395	N-6395	700 ct	100 ct	25	1.0	.75	.11	4.0	62	10.6	2.7	2.65:1	5.29:1	23.44	24.26
K-7400	N-6400	800 ct	12.8 ct	3.2	1.0	.75	.11	3.5	78	1.75	.44	7.91:1	15.8:1	23.44	24.26
K-7405	N-6405	800 ct	48 ct	12	1.0	.75	.11	3.5	74	6	1.5	4.08:1	8.16:1	23.44	24.26
K-7410	N-6410	800 ct	800 ct	200	1.0	.75	.11	3.5	74	102	26	1:1	2:1	23.44	24.26
K-7415	N-6415	900 ct	600 ct	150	1.0	.75	.11	3.0	90	66	17	1.23:1	2.45:1	23.44	24.26
K-7417**	N-6417**	*900 ct	900 ct	–	1.0	.75	.11	3.0	90	102	–	1.1	–	24.26	25.26
K-7420	N-6420	1000 ct	12 ct	3	1.0	.75	.11	3.0	115	1.75	.44	9.13:1	18.26:1	23.44	24.26
K-7425	N-6425	1000 ct	50 ct	12.5	1.0	.75	.11	3.0	100	5.8	1.5	4.47:1	8.94:1	23.44	24.26
K-7430	N-6430	1000 ct	1000 ct	250	1.0	.75	.11	3.0	75	103	26	1:1	2:1	23.44	24.26
K-7435	N-6435	1060 ct	12.8 ct	3.2	1.0	.75	.11	3.0	115	1.75	.44	9.1:1	18.2:1	23.44	24.26
K-7440	N-6440	1200 ct	12.8 ct	3.2	1.0	.75	.11	3.0	122	1.75	.44	9.68:1	19.4:1	23.44	24.26
K-7445	N-6445	1200 ct	500 ct	125	1.0	.75	.11	3.0	113	63	16	1.55:1	3.1:1	23.44	24.26
K-7450	N-6450	1200 ct	1200 ct	300	1.0	.75	.11	3.0	113	155	39	1:1	2:1	23.44	24.26
K-7455	N-6455	*1200 ct	1200 ct	–	1.0	.75	.11	3.0	109	150	–	1:1	–	24.26	25.26
K-7460	N-6460	1500 ct	12 ct	3	1.0	.75	.11	2.5	140	1.75	.44	11.18:1	22.36:1	23.44	24.26
K-7465	N-6465	1500 ct	500 ct	125	1.0	.75	.11	2.5	150	60	15	1.73:1	3.46:1	23.44	24.26
K-7470	N-6470	*1500 ct	600 ct	–	1.0	.75	.11	2.5	150	66	–	1.58:1	–	24.26	25.26
K-7475	N-6475	*1500 ct	1500 ct	–	1.0	.75	.11	2.5	150	168	–	1:1	–	24.26	25.26
K-7480	N-6480	1600 ct	12.8 ct	3.2	1.0	.75	.11	2.5	140	1.75	.44	11.18:1	22.36:1	23.44	24.26
K-7483	N-6483	2000 ct	8 ct	2	1.0	.75	.11	2.0	250	1.0	.25	15.8:1	31.6:1	23.44	24.26
K-7485	N-6485	2000 ct	2000 ct	500	1.0	.75	.11	2.0	185	255	64	1:1	2:1	23.44	24.26
K-7490	N-6490	*2000 ct	2000 ct	–	1.0	.75	.11	2.0	175	240	–	1:1	–	24.26	25.26
K-7495	N-6495	2000 ct	8000 ct	2000	1.0	.75	.11	2.0	185	1015	254	1:2	1:1	23.44	24.26
K-7497	N-6497	2500 ct	2500 ct	625	1.0	.75	.11	2.0	245	268	68	1.1	2:1	23.44	24.26
K-7500	N-6500	3000 ct	3000 ct	750	1.0	.75	.11	1.8	267	295	74	1:1	2:1	23.44	24.26
K-7505	N-6505	*3000ct	3000 ct	–	1.0	.75	.11	1.8	267	368	–	1:1	–	24.26	25.26
K-7510	N-6510	3600 ct	3600 ct	900	1.0	.75	.11	1.5	300	413	103	1:1	2:1	23.44	24.26
K-7512	N-6512	4000 ct	16 ct	4	1.0	.75	.11	1.5	395	2.5	.65	15.8:1	31.6:1	23.44	24.26
K-7514**	N-6514**	4000 ct	600 ct	150	1.0	.75	.11	1.5	395	66	17	2.58:1	5.16:1	23.44	24.26

SPECIFICATIONS

- **MIL-T-27:** ..... All units manufactured to MIL-T-27. Audio Transformers are Type TF5R21ZZ
- **FREQUENCY RESPONSE:** ..... ±3db, 150 Hz-75 KHz at 1.0 Milliwatt. (When Primary Impedance ≥ 50K Ohms, ±3 db 150 Hz to 20 KHz)
- **MAXIMUM DISTORTION:** ..... 5% With Rated Power Level at 1 KHz, 400 Hz and 150 Hz.
- **DIELECTRIC STRENGTH:** ..... All Units Tested at 200 V RMS.
- **INSULATION RESISTANCE:** ..... Greater Than 10,000 Megohms at 300 V DC.
- **WEIGHT:** ..... 7.5 Grams
- **OPERATING TEMPERATURE:** ... -55°c to +105°c (All Units Can be Supplied to Class S Requirements, +130°c).
- **TERMINALS:** ..... Solid .016 Diameter Conductor. Solderability per MIL-STD-202 Method 208.
- **THERMAL SHOCK:** ..... 25 Cycles, Method 107C, MIL-STD-202D, Test Condition A-1.

Delivery: Stock to one week

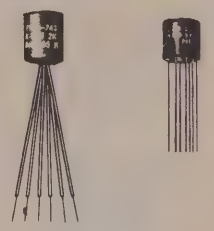
THIS PRODUCT IS PATENTED

*INCLUDES ELECTROSTATIC SHIELD
**MINIATURIZED TELEPHONE COUPLING APPLICATION

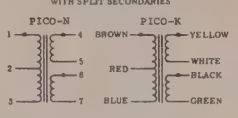
***Discount Prices: 1-9 Net; 10-24 Less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

PICO PART NUMBER			SECONDARY IMPEDANCE OHMS SPLIT WINDINGS		POWER WATTS					SECONDARY DC RESISTANCE OHMS		TURNS RATIO PRIM/SEC		PICO PRICES 1-9***	
K-Series Insulated Leads	N-Series Plug-In	PRIMARY IMPEDANCE OHMS	SER	PAR	1KHz and higher	400 Hz and higher	150 Hz and higher	PRIMARY UNBALANCED DC CURRENT ma	PRIMARY DC RESISTANCE OHMS	SER CONN	PAR CONN	SEC SER CONN	SEC PAR CONN	K-Series	N-Series
K-7515	N-6515	4000 ct	1000 ct	250	1.0	.75	.11	1.5	395	108	27	2:1	4.1	23.49	24.26
K-7520	N-6520	*4000 ct	8000 ct	–	1.0	.75	.11	1.5	390	955	–	1.1.41	–	24.26	25.26
K-7525	N-6525	5000 ct	500 ct	125	1.0	.75	.11	1.3	450	62	16	3.16:1	6.32:1	23.44	24.26
K-7530	N-6530	5000 ct	5000 ct	1250	1.0	.75	.11	1.3	450	620	155	1:1	2:1	23.44	24.27
K-7535	N-6535	7500 ct	50 ct	12.5	1.0	.75	.11	1.0	670	6	1.5	12.25:1	24.5:1	26.14	26.93
K-7540	N-6540	7500 ct	100 ct	25	1.0	.75	.11	1.0	670	11	2.8	8.66:1	17.32:1	26.14	26.93
K-7545	N-6545	7500 ct	600 ct	150	1.0	.75	.11	1.0	670	66	16.5	3.54:1	7.07:1	26.14	26.93
K-7550	N-6550	7500 ct	2500 ct	625	1.0	.75	.11	1.0	670	268	67	1.73:1	3.46:1	26.14	26.93
K-7555	N-6555	*7500 ct	7500 ct	–	1.0	.75	.11	1.0	670	925	–	1:1	–	26.91	29.69
K-7560	N-6560	8000 ct	12.8 ct	3.2	1.0	.75	.11	1.0	765	1.75	.44	25:1	50:1	26.14	26.93
K-7565	N-7565	8000 ct	1000 ct	250	1.0	.75	.11	1.0	695	106	26.5	2.83:1	5.66:1	26.14	26.93
K-7570	N-6570	*8000 ct	1200 ct	–	1.0	.75	.11	1.0	715	153	–	2.58:1	–	26.91	29.69
K-7575	N-6575	*9000 ct	9000 ct	–	1.0	.75	.11	1.0	925	1020	–	1:1	–	26.91	29.69
K-7580	N-6580	10,000 ct	12.8 ct	3.2	1.0	.75	.11	1.0	768	1.6	.4	28:1	56:1	26.14	26.93
K-7585	N-6585	10,000 ct	16 ct	4	1.0	75	.11	1.0	756	1.7	.43	25:1	50:1	26.14	26.93
K-7590	N-6590	10,000 ct	100 ct	25	1.0	.75	.11	1.0	780	10	2.5	10:1	20:1	26.14	26.93
K-7595	N-6595	10,000 ct	200 ct	50	1.0	.75	.11	1.0	780	24	6	7.07:1	14.14:1	26.14	26.93
K-7600	N-6600	10,000 ct	500 ct	125	1.0	.75	.11	1.0	780	60	15	4.47:1	8.94:1	26.14	26.93
K-7605	N-6605	10,000 ct	600 ct	150	1.0	.75	.11	1.0	780	83	21	4.08:1	8.16:1	26.14	26.93
K-7610	N-6610	10,000 ct	1000 ct	250	1.0	.75	.11	1.0	780	106	27	3.16:1	6.32:1	26.14	26.93
K-7615	N-6615	10,000 ct	1200 ct	300	1.0	.75	.11	1.0	780	145	36	2.89:1	5.77:1	26.14	26.93
K-7620	N-6620	10,000 ct	1500 ct	375	1.0	.75	.11	1.0	780	160	40	2.58:1	5.16:1	26.14	26.93
K-7625	N-6625	10,000 ct	2000 ct	500	1.0	.75	.11	1.0	780	300	75	2.24:1	4.47:1	26.14	26.93
K-7630	N-6630	10,000 ct	5000 ct	1250	1.0	.75	.11	1.0	780	610	153	1.41.1	2.83:1	26.14	26.93
K-7635	N-6635	10,000 ct	7500 ct	1875	1.0	.75	.11	1.0	780	932	233	1.16:1	2.31:1	26.14	26.93
K-7640	N-6640	10,000 ct	10,000 ct	2500	1.0	.75	.11	1.0	780	1075	269	1:1	2:1	26.14	26.93
K-7645	N-6645	*10,000 ct	10,000 ct	–	1.0	.75	.11	1.0	715	985	–	1:1	–	26.91	29.69
K-7650	N-6650	15,000 ct	400 ct	100	.66	.66	.11	0.8	1165	52	13	6.12:1	12.25:1	26.14	26.93
K-7652	N-6652	15,000 ct	500 ct	125	.66	.66	.11	0.8	1165	60	15	5.48:1	10.95:1	26.14	26.93
K-7655	N-6655	15,000 ct	600 ct	150	.66	.66	.11	0.8	1165	80	20	5:1	10:1	26.14	26.93
K-7660	N-6660	15,000 ct	10,000 ct	2500	.66	.66	.11	0.8	1165	1050	263	1.22:1	2.45:1	26.14	26.93
K-7665	N-6665	*15,000 ct	15,000 ct	–	.66	.66	.11	0.8	1165	1600	–	1:1	–	26.91	29.69
K-7670	N-6670	15,000 ct	15,000 ct	3750	.66	.66	.11	0.8	1165	1600	400	1:1	2:1	26.14	26.93
K-7675	N-6675	16,000 ct	1000 ct	250	.62	.62	.11	0.8	1560	108	27	4:1	8:1	26.14	26.93
K-7680	N-6680	20,000 ct	500 ct	125	.5	.5	.11	0.7	1750	60	15	6.32:1	12:65:1	26.14	25.93
K-7685	N-6685	20,000 ct	600 ct	150	.5	.5	.11	0.7	1750	82	20.5	5.77.1	11.55:1	26.14	29.69
K-7690	N-6690	20,000 ct	800 ct	200	.5	.5	.11	0.7	1750	98	24.5	5.1	10:1	26.14	29.69
K-7695	N-6695	20,000 ct	1000 ct	250	.5	.5	.11	0.7	1750	135	34	4.47:1	8.94:1	26.14	29.69
K-7700	N-6700	20,000 ct	5000 ct	1250	.5	.5	.11	0.7	1750	610	153	2:1	4:1	26.14	29.69
K-7705	N-6705	20,000 ct	10,000 ct	2500	5	.5	11	0.7	1750	1075	269	1.41:1	2.83:1	26.14	29.69
K-7710	N-6710	*20,000 ct	20,000 ct	–	.5	.5	.11	0.7	1715	2370	–	1:1	–	28.82	29.69
K-7715	N-6715	25,000 ct	500 ct	125	.4	.4	.11	0.6	2470	60	15	7.07:1	14.14:1	26.14	29.98
K-7720	N-6720	25,000 ct	1000 ct	250	.4	4	11	0.6	2470	106	27	5:1	10:1	26.14	29.69
K-7725	N-6725	30,000 ct	50 ct	12.5	.33	.33	.11	0.5	2730	6.2	1.6	24.5:1	49:1	28.82	29.69
K-7730	N-6730	30,000 ct	1200 ct	300	.33	.33	.11	0.5	2815	156	39	5:1	10:1	28.82	29.98
K-7732	N-6732	30,000 ct	500 ct	125	.33	.33	.11	0.5	2730	61	15.3	7.7:1	15.5:1	28.82	29.98
K-7734	N-6734	30,000 ct	200 ct	50	.33	.33	11	0.5	2730	24	6	12.2:1	24.5:1	28.82	29.98
K-7735	N-6735	30,000 ct	5000 ct	1250	.33	.33	.11	0.5	2730	620	155	2.45.1	4.9:1	28.82	29.98
K-7740	N-6740	30,000 ct	10,000 ct	2500	.33	33	11	0.5	2730	1090	272	1.73:1	3.46:1	28.82	29.98
K-7745	N-6745	*30,000 ct	30,000 ct	–	.33	.33	.11	0.5	2730	3740	–	1:1	–	30.27	32.19
K-7750	N-6750	40,000 ct	400 ct	100	25	25	11	0.5	3150	53	13	10:1	20:1	30.27	32.19
K-7755	N-6755	40,000 ct	2000 ct	500	.25	.25	.11	0.5	3150	300	75	4.47.1	8.94.1	30.27	32.19
K-7760	N-6760	40,000 ct	4000 ct	1000	.25	.25	.11	0.5	3150	548	137	3.16:1	6.32:1	30.27	32.19
K-7765	N-6765	40,000 ct	20,000 ct	5000	.25	25	.11	0.5	3150	3075	769	1.41.1	2.83.1	30.27	32.19
K-7770	N-6770	*40,000 ct	40,000 ct	–	.25	25	11	0.5	3940	4350	–	1:1	–	34.33	35.90
K-7775	N-6775	50,000 ct	200 ct	50	.2	.2	.11	0.4	4275	24	6	15.8:1	31.6.1	34.33	35.90
K-7777	N-6777	50,000 ct	500 ct	125	.2	2	.11	0.4	4275	60	15	0:1	20.1	34.33	35.90
K-7778	N-6778	50,000 ct	600 ct	150	.2	.2	.11	0.4	4275	82	21	9.13:1	18.26.1	34.33	35.90
K-7779	N-6779	50,000 ct	50,000 ct	12,500	.2	.2	.11	0.4	4500	6270	1568	1:1	2:1	34.33	35.90
K-7780	N-6780	60,000 ct	15,000 ct	3750	16	.16	.11	0.4	5960	1650	412	2:1	4:1	37.76	38.87
K-7785	N-6785	62,500 ct	50 ct	12.5	16	.16	.11	0.4	5960	6	1.5	35.4:1	70.7.1	37.76	38.87
K-7787	N-6787	80,000 ct	15,000 ct	3750	12	12	11	0.3	7200	1690	423	2.3:1	4.6.1	37.76	38.87
K-7789	N-6789	80,000 ct	80,000 ct	20,000	.12	.12	.11	0.3	7200	9920	2480	1.1	2.1	37.76	38.87
K-7790	N-6790	90,000 ct	10,000 ct	2500	.11	.11	.11	0.3	7500	1350	338	3:1	6:1	42.36	40.64
K-7795	N-6795	95,000 ct	15,000 ct	3750	1	.1	.10	0.3	9550	1635	410	2.5.1	5:1	42.36	40.64
K-7800	N-6800	100,000 ct	60 ct	15	1	1	10	0.3	10,000	8.5	2.2	40.8.1	81.6.1	42.36	40.64
K-7805	N-6805	100,000 ct	100 ct	25	.1	1	.10	0.3	10,000	14	3.5	31.6.1	63.2.1	42.36	40.64
K-7810	N-6810	100,000 ct	500 ct	125	1	.1	.10	0.3	10,000	62	15.5	14.1:1	28.3:1	42.36	40.64
K-7813	N-6813	100,000ct	1000 ct	250	.1	.1	.10	0.3	10,000	140	35	10:1	20:1	42.36	40.64
K-7814	N-6814	100,000 ct	2000 ct	500	.1	1	.10	0.3	10,000	248	62	7.07:1	14.14:1	42.36	40.64
K-7815	N-6815	100,000 ct	10,000 ct	2500	.1	.1	.10	0.3	10,000	1075	270	3.16.1	6.32.1	42.36	40.64
K-7820	N-6820	135,000 ct	82 ct	20.5	.074	.074	.074	0.25	13,700	9.5	2.4	40.6:1	81.2:1	41.26	42.51
K-7823	N-6823	200,000 ct	500 ct	125	.05	05	.05	0.2	17,340	75	19	20.1	40:1	41.26	42.51
K-7825	N-6825	200,000 ct	1000 ct	250	.05	.05	.05	0.2	17,340	133	33	14.1:1	28.3.1	41.26	42.51
K-7830	N-6830	200,000 ct	10,000 ct	2500	.05	05	.05	0.2	17,340	1350	336	4.47:1	8.94.1	41.26	42.51
K-7835	N-6835	200,000 ct	20,000 ct	5000	.05	.05	05	0.2	17,340	3000	750	3.16.1	6.32.1	41.26	43.58
K-7837	N-6837	250,000 ct	200 ct	50	04	.04	04	0.2	17,340	28	7	35.4:1	70.7.1	42.48	43.58
K-7840	N-6840	250,000 ct	1000 ct	250	.04	.04	.04	0.2	17,340	118	30	15.8:1	31.6.1	42.48	19.72
K-SHIELD	MU-METAL SHIELD	.53" d X .56" h (13.46 mm d X 14.22 mm h)												3.50	
N-SHIELD	MU-METAL SHIELD	.53" d X .56" h (13.46 mm d X 14.22 mm h)													3.52

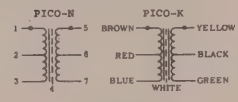
K SERIES Insulated Leads — N SERIES Plug-In



SCHEMATIC FOR TRANSFORMERS WITH SPLIT SECONDARIES



SCHEMATIC FOR TRANSFORMERS WITH ELECTROSTATIC SHIELD



FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- PICO IS APPROVED QPL SOURCE (MIL-T-27)
- MAGNETIC SHIELDS AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED.
- VARIATION OF STANDARD DESIGNS AVAILABLE
- PRIMARY AND SECONDARY WINDINGS CAN BE USED EITHER AS INPUT OR OUTPUT.
- SPECIAL PRODUCTION TECHNIQUES ENSURE UNIFORM SIZE AND LEADS WHICH ARE FREE OF ENCAPSULANT. NO MENISCUS IN LEAD AREA.
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS.

PICO Electronics, Inc.
453 N. MacQuesten Pkwy.
Mt. Vernon, N.Y. 10552

FAX 914-699-5565

For immediate engineering assistance or to place an order—
Call Toll Free 800-228-9747

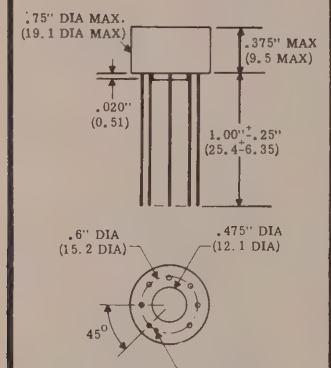
* INCLUDES ELECTROSTATIC SHIELD

*** Discount prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%

Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York

PICO's ultra-miniature transformers

R SERIES Plug-In



All dimensions are in inches, ( ) = MM

SPECIFICATIONS

- **MIL-T-27:** ..... All units manufactured to MIL-T-27, Audio Transformers are Type TF5R21ZZ
- **FREQUENCY RESPONSE:** ..... ±3db, 75 Hz-30 KHz at 1.0 Milliwatt.
- **MAXIMUM DISTORTION:** ..... 5% With Rated Power Level at 1 KHz, 300 kHz and 75 Hz.
- **DIELECTRIC STRENGTH:** ..... All Units Tested at 200 V RMS.
- **INSULATION RESISTANCE:** ... Greater Than 10,000 Megohms at 300 V DC.
- **WEIGHT:** ..... 12 Grams
- **OPERATING TEMPERATURE:** -55°c to +105°c (All Units Can be Supplied to Class S Requirements, +130°c maximum).
- **TERMINALS:** ..... Solid .016 Diameter Conductor. Solderability per MIL-STD-202 Method 208.
- **THERMAL SHOCK:** ..... 25 Cycles, Method 107C, MIL-STD-202D, Test Condition A-1.

THIS PRODUCT IS PATENTED

Delivery— stock to one week

PICO PART NUMBER R-Series Plug-In	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS PAR	POWER WATTS 1KHz and higher	POWER WATTS 300 Hz and higher	POWER WATTS 75 Hz and higher	PRIMARY UNBAL DC CURRENT (ma	PRIMARY DC RESIST OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	SECONDARY DC RESISTANCE OHMS PAR CONN	TURNS RATIO PRIME/SEC SEC SER CONN	TURNS RATIO PRIME/SEC SEC PAR CONN	PICO PRICES 1–9 *** R-Series
R-20003	20 ct	8 ct	2	1.5	.9	.03	22	1.6	.76	.19	1.58:1	3.16:1	32.63
R-20005	20 ct	20 ct	5	1.5	.9	.03	22	1.6	1.9	.48	1:1	2:1	32.63
R-20010	32 ct	32 ct	8	1.5	.9	.03	17.5	2.56	3	.75	1:1	2:1	32.63
R-20015	40 ct	40 ct	10	1.5	.9	.03	16	3.2	3.8	.95	1:1	2:1	32.63
R-20018	48 ct	16 ct	4	1.5	.9	.03	14.5	3.84	1.52	.38	1.73:1	3.46:1	32.63
R-20020	50 ct	50 ct	12.5	1.5	.9	.03	14	4	4.75	1.19	1:1	2:1	32.63
R-20025	80 ct	32 ct	8	1.5	.9	.03	11	6.4	3	.75	1.58:1	3.16:1	32.63
R-20028	100 ct	40 ct	10	1.5	.9	.03	10	8	3.8	.95	1.58:1	3.16:1	32.63
R-20030	100 ct	100 ct	25	1.5	.9	.03	10	8	9.5	2.38	1:1	2:1	32.63
R-20035	120 ct	12.8 ct	3.2	1.5	.9	.03	9	9.6	1.22	.3	3.06:1	6.12:1	32.63
R-20040	120 ct	60 ct	15	1.5	.9	.03	9	9.6	5.7	1.4	1.41:1	2.83:1	32.63
R-20045	120 ct	120 ct	30	1.5	.9	.03	9	9.6	11.4	2.85	1:1	2:1	32.63
R-20050	150 ct	12 ct	3	1.5	.9	.03	8	12	1.14	.29	3.54:1	7.08:1	32.63
R-20055	150 ct	50 ct	12.5	1.5	.9	.03	8	12	4.75	1.19	1.73:1	3.46:1	32.63
R-20060	150 ct	100 ct	25	1.5	.9	.03	8	12	9.5	2.38	1.22:1	2.44:1	32.63
R-20065	150 ct	150 ct	37.5	1.5	.9	.03	8	12	14.3	3.56	1:1	2:1	32.63
R-20070	150 ct	600 ct	150	1.5	.9	.03	8	12	57	14.3	1:2	1:1	32.63
R-20075	200 ct	200 ct	50	1.5	.9	.03	7	16	19	4.75	1:1	2:1	32.63
R-20080	300 ct	12 ct	3	1.5	.9	.03	5.5	24	1.14	.29	5:1	10:1	32.63
R-20085	300 ct	50 ct	12.5	1.5	.9	.03	5.5	24	4.75	1.19	2.45:1	4.9:1	32.63
R-20090	300 ct	150 ct	37.5	1.5	.9	.03	5.5	24	14.25	3.56	1.41:1	2.83:1	32.63
R-20095	300 ct	300 ct	75	1.5	.9	.03	5.5	24	28.5	7.13	1:1	2:1	32.63
R-20100	300 ct	600 ct	150	1.5	.9	.03	5.5	24	57	14.25	1:1.41	1.41:1	32.63
R-20105	320 ct	12.8 ct	3.2	1.5	.9	.03	5.5	25.6	1.22	.3	5:1	10:1	32.63
R-20110	400 ct	40 ct	10	1.5	.9	.03	5	32	3.8	.95	3.16:1	6.32:1	32.63
R-20115	400 ct	120 ct	30	1.5	.9	.03	5	32	11.4	2.85	1.83:1	3.65:1	32.63
R-20120	400 ct	200 ct	50	1.5	.9	.03	5	32	19	4.75	1.41:1	2.83:1	32.63
R-20125	400 ct	400 ct	100	1.5	.9	.03	5	32	38	9.5	1:1	2:1	32.63
R-20130	400 ct	1000 ct	250	1.5	.9	.03	5	32	95	23.8	1:1.58	1.26:1	32.63
R-20135	400 ct	2000 ct	500	1.5	.9	.03	5	32	190	47.5	1:2.24	1:1.12	32.63
R-20140	400 ct	4000 ct	1000	1.5	.9	.03	5	32	380	95	1:3.16	1:1.58	32.63
R-20142	500 ct	12.8 ct	3.2	1.5	.9	.03	4.5	40	1.22	.3	6.25:1	12.5:1	32.63
R-20144	500 ct	16 ct	4	1.5	.9	.03	4.5	40	1.52	.38	5.6:1	11.2:1	32.63
R-20145	500 ct	50 ct	12.5	1.5	.9	.03	4.5	40	4.75	1.19	3.16:1	6.32:1	32.63
R-20147	500 ct	150 ct	37.5	1.5	.9	.03	4.5	40	14.25	3.56	1.83:1	3.65:1	32.63
R-20150	500 ct	500 ct	125	1.5	.9	.03	4.5	40	47.5	11.88	1:1	2:1	32.63
R-20155	*500 ct	500 ct	–	1.5	.9	.03	4.5	40	47.5	–	1:1	–	33.98
R-20160	500 ct	600 ct	150	1.5	.9	.03	4.5	40	57	14.25	1:1.1	1.83:1	32.63
R-20165	600 ct	12.8 ct	3.2	1.5	.9	.03	4	48	1.22	.3	6.85:1	13.7	28.50
R-20167	600 ct	30 ct	7.5	1.5	.9	.03	4	48	2.85	.71	4.47:1	8.94:1	28.50
R-20170	600 ct	48 ct	12	1.5	.9	.03	4	48	4.56	1.14	3.54:1	7.07:1	28.50
R-20175	600 ct	200 ct	50	1.5	.9	.03	4	48	19	4.75	1.73:1	3.46:1	28.50
R-20180**	600 ct	600 ct	150	1.5	.9	.03	4	48	57	14.25	1:1	2:1	32.63
R-20185**	*600 ct	600 ct	–	1.5	.9	.03	4	48	57	–	1:1	–	29.68
R-20186**	*600 ct	900 ct	–	1.5	.9	.03	4	48	85.5	–	1:1.22	–	29.68
R-20187**	600 ct	1200 ct	300	1.5	.9	.03	4	48	114	28.5	1:1.41	1.41:1	28.50
R-20190	640 ct	12.8 ct	3.2	1.5	.9	.03	4	51.2	1.22	.3	7.07:1	14.14:1	28.50
R-20195	700 ct	100 ct	25	1.5	.9	.03	3.5	56	9.5	2.38	2.65:1	5.29:1	28.50
R-20200	800 ct	12.8 ct	3.2	1.5	.9	.03	3.5	64	1.22	.3	7.91:1	15.8:1	28.50
R-20205	800 ct	48 ct	12	1.5	.9	.03	3.5	64	4.56	1.14	4.08:1	8.16:1	28.50
R-20210	800 ct	800 ct	200	1.5	.9	.03	3.5	64	76	19	1:1	2:1	28.50
R-20215	900 ct	600 ct	150	1.5	.9	.03	3	72	57	14.3	1.23:1	2.45:1	28.50
R-20217**	*900 ct	900 ct	–	1.5	.9	.03	3	72	85.5	–	1:1	–	29.68
R-20220	1000 ct	12 ct	3	1.5	.9	.03	3	80	1.14	.29	9.13:1	18.26:1	28.50
R-20225	1000 ct	50 ct	12.5	1.5	.9	.03	3	80	4.75	1.19	4.47:1	8.94:1	28.50
R-20230	1000 ct	1000 ct	250	1.5	.9	.03	3	80	95	23.8	1:1	2:1	28.50
R-20235	1060 ct	12.8 ct	3.2	1.5	.9	.03	3	85	1.22	.3	9.1:1	18.2:1	28.50
R-20240	1200 ct	12.8 ct	3.2	1.5	.9	.03	3	96	1.22	.3	9.68:1	19.4:1	28.50
R-20245	1200 ct	500 ct	125	1.5	.9	.03	3	96	47.5	11.88	1.55:1	3.1:1	28.50
R-20250	1200 ct	1200 ct	300	1.5	.9	.03	3	96	114	28.5	1:1	2:1	28.50
R-20255	*1200 ct	1200 ct	–	1.5	.9	.03	3	96	114	–	1:1	–	29.68
R-20260	1500 ct	12 ct	3	1.5	.9	.03	2.5	120	1.14	.29	11.18:1	22.36:1	28.50
R-20265	1500 ct	500 ct	125	1.5	.9	.03	2.5	120	47.5	11.88	1.73:1	3.46:1	28.50
R-20270	*1500 ct	600 ct	–	1.5	.9	.03	2.5	120	57	–	1.58:1	–	29.68
R-20275	*1500 ct	1500 ct	–	1.5	.9	.03	2.5	120	142	–	1:1	–	29.68
R-20280	1600 ct	12.8 ct	3.2	1.5	.9	.03	2.5	128	1.22	3	11.18:1	22.36:1	28.50
R-20283	2000 ct	8 ct	2	1.5	.9	.03	2.2	160	.76	.19	15.8:1	31.6:1	28.50
R-20285	2000 ct	2000 ct	500	1.5	.9	.03	2.2	160	190	47.5	1:1	2:1	28.50
R-20290	*2000 ct	2000 ct	–	1.5	.9	.03	2.2	160	190	–	1:1	–	29.68
R-20295	2000 ct	8000 ct	2000	1.5	.9	.03	2.2	160	760	190	1:2	1:1	28.50
R-20297	2500 ct	2500 ct	625	1.5	.9	.03	2	200	238	59.5	1:1	2:1	28.50
R-20300	3000 ct	3000 ct	750	1.5	.9	.03	1.8	240	285	71.3	1:1	2:1	28.50
R-20305	*3000 ct	3000 ct	–	1.5	.9	.03	1.8	240	285	–	1:1	–	29.68

*INCLUDES ELECTROSTATIC SHIELD
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PICO PART NUMBER R-Series Plug-In	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS PAR	POWER WATTS 1KHz and higher	POWER WATTS 300 Hz and higher	POWER WATTS 75 Hz and higher	PRIMARY UNBAL DC CURRENT ma	PRIMARY DC RESIST OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	SECONDARY DC RESISTANCE OHMS PAR CONN	TURNS RATIO PRIME/SEC SEC SER CONN	TURNS RATIO PRIME/SEC SEC PAR CONN	PICO PRICES 1–9 *** R-Series
R-20310	3600 ct	3600 ct	900	1.5	.9	.03	1.7	288	342	86	1:1	2:1	32.63
R-20312	4000 ct	16 ct	4	1.5	.9	.03	1.6	320	1.52	.38	15.8:1	31.6:1	32.63
R-20314**	4000 ct	600 ct	150	1.5	.9	.03	1.6	320	57	14.3	2.58:1	5.16:1	32.63
R-20315	4000 ct	1000 ct	250	1.5	.9	.03	1.6	320	95	23.8	2:1	4:1	32.63
R-20320	*4000 ct	8000 ct	–	1.5	.9	.03	1.6	320	760	–	1:1.41	–	33.98
R-20325	5000 ct	500 ct	125	1.5	.9	.03	1.4	400	47.5	11.88	3.16:1	6.32:1	32.63
R-20330	5000 ct	5000 ct	1250	1.5	.9	.03	1.4	400	475	119	1:1	2:1	32.63
R-20335	7500 ct	50 ct	12.5	1.3	.9	.03	1.2	600	4.75	1.19	12.25:1	24.5:1	36.34
R-20340	7500 ct	100 ct	25	1.3	.9	.03	1.2	600	9.5	2.38	8.66:1	17.32:1	36.34
R-20345	7500 ct	600 ct	150	1.3	.9	.03	1.2	600	57	14.3	3.54:1	7.07:1	36.34
R-20350	7500 ct	2500 ct	625	1.3	.9	.03	1.2	600	238	59.5	1.73:1	3.46:1	36.34
R-20355	*7500 ct	7500 ct	–	1.3	.9	.03	1.2	600	713	–	1:1	–	38.75
R-20360	8000 ct	12.8 ct	3.2	1.2	.9	.03	1.1	640	1.22	.3	25:1	50:1	36.34
R-20365	8000 ct	1000 ct	250	1.2	.9	.03	1.1	640	95	23.8	2.83:1	5.66:1	36.34
R-20370	*8000 ct	1200 ct	–	1.2	.9	.03	1.1	640	114	–	2.58:1	–	38.75
R-20375	*9000 ct	9000 ct	–	1.1	.9	.03	1.1	720	855	–	1:1	–	38.75
R-20380	10,000 ct	12.8 ct	3.2	1.0	.9	.03	1	800	1.22	.3	28:1	56:1	36.34
R-20385	10,000 ct	16 ct	4	1.0	.9	.03	1	800	1.52	.38	25:1	50:1	36.34
R-20390	10,000 ct	100 ct	25	1.0	.9	.03	1	800	9.5	2.38	10:1	20:1	36.34
R-20395	10,000 ct	200 ct	50	1.0	.9	.03	1	800	19	4.75	7.07:1	14.14:1	36.34
R-20400	10,000 ct	500 ct	125	1.0	.9	.03	1	800	47.5	11.88	4.47:1	8.94:1	36.34
R-20405	10,000 ct	600 ct	150	1.0	.9	.03	1	800	57	14.25	4.08:1	8.16:1	36.34
R-20410	10,000 ct	1000 ct	250	1.0	.9	.03	1	800	95	23.8	3.16:1	6.32:1	36.34
R-20415	10,000 ct	1200 ct	300	1.0	.9	.03	1	800	114	28.5	2.89:1	5.77:1	36.34
R-20420	10,000 ct	1500 ct	375	1.0	.9	.03	1	800	143	35.8	2.58:1	5.16:1	36.34
R-20425	10,000 ct	2000 ct	500	1.0	.9	.03	1	800	190	47.5	2.24:1	4.47:1	36.34
R-20430	10,000 ct	5000 ct	1250	1.0	.9	.03	1	800	475	119	1.41:1	2.83:1	36.34
R-20435	10,000 ct	7500 ct	1875	1.0	.9	.03	1	800	713	178	1.16:1	2.31:1	36.34
R-20440	10,000 ct	10,000 ct	2500	1.0	.9	.03	1	800	950	238	1:1	2:1	36.34
R-20445	*10,000 ct	10,000 ct	–	1.0	.9	.03	1	800	950	–	1:1	–	38.75
R-20450	15,000 ct	400 ct	100	.66	.66	.03	.8	1200	38	9.5	6.12:1	12.25:1	36.34
R-20452	15,000 ct	500 ct	125	.66	.66	.03	.8	1200	48	12	5.48:1	10.95:1	36.34
R-20455	15,000 ct	600 ct	150	.66	.66	.03	.8	1200	57	14.3	5:1	10:1	36.34
R-20460	15,000 ct	10,000 ct	2500	.66	.66	.03	.8	1200	950	238	1.22:1	2.45:1	36.34
R-20465	*15,000 ct	15,000 ct	–	.66	.66	.03	.8	1200	1430	–	1:1	–	38.75
R-20470	15,000 ct	15,000 ct	3750	.66	.66	.03	.8	1200	1430	357	1:1	2:1	36.34
R-20475	16,000 ct	1000 ct	250	.62	.62	.03	.8	1280	95	23.8	4:1	8:1	36.34
R-20480	20,000 ct	500 ct	125	.5	.5	.03	.7	1600	47.5	11.88	6.32:1	12.65:1	38.75
R-20485	20,000 ct	600 ct	150	.5	.5	.03	.7	1600	57	14.25	5.77:1	11.55:1	38.75
R-20490	20,000 ct	800 ct	200	.5	.5	.03	.7	1600	76	19	5:1	10:1	38.75
R-20495	20,000 ct	1000 ct	250	.5	.5	.03	.7	1600	95	23.8	4.47:1	8.94:1	38.75
R-20500	20,000 ct	5000 ct	1250	.5	.5	.03	.7	1600	475	119	2:1	4:1	38.75
R-20505	20,000 ct	10,000 ct	2500	.5	.5	.03	.7	1600	950	238	1.41:1	2.83:1	38.75
R-20510	*20,000 ct	20,000 ct	–	.5	.5	.03	.7	1600	1900	–	1:1	–	40.29
R-20515	25,000 ct	500 ct	125	.4	.4	.03	.6	2000	47.5	11.88	7.07:1	14.14:1	38.75
R-20520	25,000 ct	1000 ct	250	.4	.4	.03	.6	2000	95	23.8	5:1	10:1	38.75
R-20525	30,000 ct	50 ct	12.5	.33	.33	.03	.6	2400	4.75	1.19	24.5:1	49:1	40.29
R-20530	30,000 ct	1200 ct	300	.33	.33	.03	.6	2400	114	28.5	5:1	10:1	40.28
R-20532	30,000 ct	500 ct	125	.33	.33	.03	.6	2400	47.5	11.88	7.7:1	15.5:1	40.28
R-20534	30,000 ct	200 ct	50	.33	.33	.03	.6	2400	19	4.75	12.2:1	24.5:1	40.28
R-20535	30,000 ct	5000 ct	1250	.33	.33	.03	.6	2400	475	119	2.45:1	4.9:1	40.28
R-20540	30,000 ct	10,000 ct	2500	.33	.33	.03	.6	2400	950	238	1.73:1	3.46:1	40.28
R-20545	*30,000 ct	30,000 ct	–	.33	.33	.03	.6	2400	2850	–	1:1	–	43.40
R-20550	40,000 ct	400 ct	100	.25	.25	.03	.5	3200	38	9.5	10:1	20:1	43.40
R-20555	40,000 ct	2000 ct	500	.25	.25	.03	.5	3200	190	47.5	4.47:1	8.94:1	43.40
R-20560	40,000 ct	4000 ct	1000	.25	.25	.03	.5	3200	380	95	3.16:1	6.32:1	43.40
R-20565	40,000 ct	20,000 ct	5000	.25	.25	.03	.5	3200	1900	475	1.41:1	2.83:1	43.40
R-20570	*40,000 ct	40,000 ct	–	.25	.25	.03	.5	3200	3800	–	1:1	–	48.18
R-20575	50,000 ct	200 ct	50	.2	.2	.03	.4	4000	19	4.75	15.8:1	31.6:1	48.18
R-20577	50,000 ct	500 ct	125	.2	.2	.03	.4	4000	47.5	11.88	10:1	20:1	48.18
R-20578	50,000 ct	600 ct	150	.2	2	.03	.4	4000	57	14.3	9.13:1	18.26:1	48.18
R-20579	50,000 ct	50,000 ct	12,500	.2	.2	.03	.4	4000	4750	1190	1:1	2:1	48.18
R-20580	60,000 ct	15,000 ct	3750	.16	.16	.03	.4	4800	1430	358	2:1	4:1	52.05
R-20585	62,500 ct	50 ct	12.5	.16	.16	.03	.4	5000	4.75	1.19	35.4:1	70.7:1	52.05
R-20587	80,000 ct	15,000 ct	3750	.12	.12	.03	.3	6400	1430	358	2.3:1	4.6:1	52.05
R-20590	90,000 ct	10,000 ct	2500	.11	.11	.03	.3	7200	950	238	3:1	6:1	52.05
R-20595	95,000 ct	15,000 ct	3750	.1	.1	.03	.3	7600	1430	358	2.5:1	5:1	54.63
R-20600	100,000 ct	60 ct	15	.1	.1	.03	.3	8000	5.7	1.43	40.8:1	81.6:1	54.63
R-20605	100,000 ct	100 ct	25	.1	1	.03	.3	8000	9.5	2.38	31 6:1	63.2:1	54.63
R-20610	100,000 ct	500 ct	125	.1	.1	.03	.3	8000	47.5	11.88	14 1:1	28.3:1	54.63
R-20613	100,000 ct	1000 ct	250	.1	.1	.03	.3	8000	95	23.8	10:1	20:1	54 63
R-20614	100,000 ct	2000 ct	500	.1	.1	.03	.3	8000	190	47.5	7.07:1	14.14.1	54.63
R-20615	100,000 ct	10,000 ct	2500	.1	.1	.03	.3	8000	950	238	3.16:1	6.32:1	54.63
R-20620	135,000 ct	82 ct	20.5	.07	.07	.03	.2	10,800	7.8	1.9	40 6:1	81.2 1	57.07

*INCLUDES ELECTROSTATIC SHIELD
**MINIATURIZED TELEPHONE COUPLING APPLICATION
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Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

PICO's ultra-miniature transformers

R SERIES Plug-In

FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- PICO IS APPROVED QPL SOURCE (MIL-T-27)
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- ELECTROSTATIC SHIELDING CAN BE ADDED.
- VARIATION OF STANDARD DESIGNS AVAILABLE
- PRIMARY AND SECONDARY WINDINGS CAN BE USED EITHER AS INPUT OR OUTPUT.
- SPECIAL PRODUCTION TECHNIQUES ENSURE UNIFORM SIZE AND LEADS WHICH ARE FREE OF ENCAPSULANT. NO MENISCUS IN LEAD AREA.
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS.

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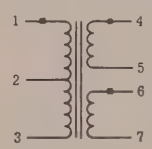
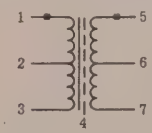


SCHEMATIC FOR TRANSFORMERS WITH ELECTROSTATIC SHIELD



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FAX 914-699-5565

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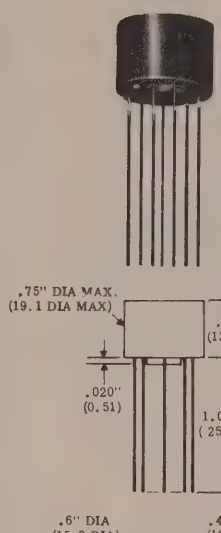
PICO's ultra-miniature transformers

These units can be manufactured and tested to MIL-T-27/359. Contact factory for price and delivery information and appropriate parts numbers (MIL-T-27/359-01 thru MIL-T-27/359-147).

S SERIES Plug-In



Dimensions are in inches (MM)

PICO PART NUMBER S-Series Plug-In	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS PAR	POWER WATTS 1KHz and higher	POWER WATTS 300 Hz and higher	POWER WATTS 50 Hz and higher	PRIMARY UNBAL DC CURRENT ma	PRIMARY DC RESIST OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	SECONDARY DC RESISTANCE OHMS PAR CONN	TURNS RATIO PRIM/SEC SEC SER CONN	TURNS RATIO PRIM/SEC SEC PAR CONN	PICO PRICES 1-9 *** S-Series
S-21003	20 ct	8 ct	2	2.0	1.5	.05	22	1.6	.88	.22	1.58:1	3.16:1	26.62
S-21005	20 ct	20 ct	5	2.0	1.5	.05	22	1.6	2.2	.55	1:1	2:1	26.62
S-21010	32 ct	32 ct	8	2.0	1.5	.05	17.5	2.56	3.52	.88	1:1	2:1	26.62
S-21015	40 ct	40 ct	10	2.0	1.5	.05	16	3.2	4.4	1.1	1:1	2:1	26.62
S-21018	48 ct	16ct	4	2.0	1.5	.05	14.5	3.84	1.76	.44	1.73:1	3.46:1	26.62
S-21020	50 ct	50 ct	12.5	2.0	1.5	.05	14	4	5.5	1.38	1:1	2:1	26.62
S-21025	80 ct	32 ct	8	2.0	1.5	.05	11	6.4	3.52	.88	1.58:1	3.16:1	26.62
S-21028	100 ct	40 ct	10	2.0	1.5	.05	10	8	4.4	1 1	1.58:1	3 16:1	26.62
S-21030	100 ct	100 ct	25	2.0	1.5	.05	10	8	11	2.75	1:1	2:1	26.62
S-21035	120 ct	12.8 ct	3.2	2.0	1.5	.05	9	9.6	1.41	.35	3.06:2	6.12:1	26.62
S-21040	120 ct	60 ct	15	2.0	1.5	.05	9	9.6	6.6	1.65	1.41:1	2.83:1	26.62
S-21045	120 ct	120 ct	30	2.0	1.5	.05	9	9.6	13.2	3.3	1:1	2:1	26.62
S-21050	150 ct	12 ct	3	2.0	1.5	.05	8	12	1.32	.33	3.54:1	7.08:1	26.62
S-21055	150 ct	50 ct	12.5	2.0	1.5	.05	8	12	5.5	1.38	1.73:1	3.46:1	26.62
S-21060	150 ct	100 ct	25	2.0	1.5	.05	8	12	11	2 75	1.22:1	2.44:1	26.62
S-21065	150 ct	150 ct	37.5	2.0	1.5	.05	8	12	16.5	4.13	1:1	2:1	26.62
S-21070	150 ct	600 ct	150	2.0	1.5	.05	8	12	66	16.5	1:2	1:1	26.62
S-21075	200 ct	200 ct	50	2.0	1.5	.05	7	16	22	5.5	1:1	2:1	26.62
S-21080	300 ct	12 ct	3	2.0	1.5	.05	5.5	24	1.32	.33	5:1	10:1	26.62
S-21085	300 ct	50 ct	12.5	2.0	1.5	.05	5.5	24	5.5	1.38	2.45:1	4.9:1	26.62
S-21090	300 ct	150 ct	37.5	2.0	1.5	.05	5.5	24	16.5	4.13	1.41:1	2.83:1	26.62
S-21095	300 ct	300 ct	75	2.0	1.5	.05	5.5	24	33	8.25	1:1	2:1	26.62
S-21100	300 ct	600 ct	150	2.0	1.5	05	5.5	24	66	16.5	1:1.41	1.41:1	26.62
S-21105	320 ct	12.8 ct	3.2	2.0	1.5	.05	5.5	25.6	1.41	.35	5:1	10:1	26.62
S-21110	400 ct	40 ct	10	2.0	1.5	.05	5	32	4.4	1.1	3 16:1	6.32:1	26.62
S-21115	400 ct	120 ct	30	2.0	1.5	.05	5	32	13.2	3.3	1.83:1	3.65:1	26.62
S-21120	400 ct	200 ct	50	2.0	1.5	.05	5	32	22	5.5	1.41:1	2.83:1	26.62
S-21125	400 ct	400 ct	100	2.0	1.5	.05	5	32	44	11	1:1	2:1	26.62
S-21130	400 ct	1000 ct	250	2.0	1.5	.05	5	32	110	27.5	1:1.58	1.26.1	26.62
S-21135	400 ct	2000 ct	500	2.0	1.5	.05	5	32	220	55	1.2.24	1:1.12	26.62
S-21140	400 ct	4000 ct	1000	2.0	1.5	.05	5	32	440	110	1:3.16	1:1.58	26.62
S-21142	500 ct	12.8 ct	3.2	2.0	1.5	.05	4.5	40	1.41	.35	6.25:1	12.5:1	26.62
S-21144	500 ct	16 ct	4	2.0	1.5	.05	4.5	40	1.76	.44	5.6:1	11.2:1	26.62
S-21145	500 ct	50 ct	12.5	2.0	1.5	.05	4.5	40	5.5	1.38	3.16:1	6.32:1	26.62
S-21147	500 ct	150 ct	37.5	2.0	1.5	.05	4.5	40	16.5	4.13	1.83.1	3.65:1	26 62
S-21150	500 ct	500 ct	125	2.0	1.5	.05	4.5	40	55	13.75	1:1	2:1	26.62
S-21155	*500 ct	500 ct	–	2.0	1.5	.05	4.5	40	55	–	1:1	–	27.68
S-21160	500 ct	600 ct	150	2.0	1.5	.05	4.5	40	66	16.5	1:1.1	1.83:1	26.62
S-21165	600 ct	12.8 ct	3.2	2.0	1.5	.05	4	48	1.41	.35	6.85:1	13.7	26.62
S-21167	600 ct	30 ct	7.5	2.0	1.5	.05	4	48	3.3	.83	4.47.1	8.94:1	26.62
S-21170	600 ct	48 ct	12	2.0	1.5	.05	4	48	5.28	1.37	3.54:1	7.07:1	26.62
S-21175	600 ct	200 ct	50	2.0	1.5	.05	4	48	22	5.5	1.73:1	3.46:1	26.62
S-21180**	600 ct	600 ct	150	2.0	1.5	.05	4	48	66	16.5	1:1	2:1	26.62
S-21185**	*600 ct	600 ct	–	2.0	1.5	.05	4	48	66	–	1:1	–	27.68
S-21186**	*600 ct	900 ct	–	2.0	1.5	.05	4	48	99	–	1:1.22	–	27.68
S-21187**	600 ct	1200 ct	300	2.0	1.5	.05	4	48	132	33	1:1.41	1 41:1	26.62
S-21190	640 ct	12.8 ct	3.2	2.0	1.5	.05	4	51	1.41	.35	7.07:1	14.14:1	26.62
S-21195	700 ct	100 ct	25	2.0	1.5	.05	3.5	56	11	2.75	2.65:1	5.29:1	26.62
S-21200	800 ct	12.8 ct	3.2	2.0	1.5	.05	3.5	64	1.41	.35	7.91:1	15.8:1	26.62
S-21205	800 ct	48 ct	12	2.0	1.5	.05	3.5	64	5.28	1.32	4.08:1	8.16:1	26 62
S-21210	800 ct	800 ct	200	2.0	1.5	.05	3.5	64	88	22	1:1	2:1	26.62
S-21215	900 ct	600 ct	150	2.0	1.5	.05	3	72	66	16.5	1.23:1	2.45:1	26.62
S-21217**	*900 ct	900 ct	–	2.0	1.5	.05	3	72	99	–	1:1	–	27.68
S-21220	1000 ct	12 ct	3	2.0	1.5	.05	3	80	1.32	.33	9.13:1	18.26:1	26.62
S-21225	1000 ct	50 ct	12.5	2.0	1.5	.05	3	80	5.5	1.38	4.47:1	8.94:1	26.62
S-21230	1000 ct	1000 ct	250	2.0	1.5	.05	3	80	110	27.5	1:1	2:1	26.62
S-21235	1060 ct	12.8 ct	3.2	2.0	1.5	.05	3	85	1.41	.35	9.1:1	18.2:1	26.62
S-21240	1200 ct	12.8 ct	3.2	2.0	1.5	.05	3	96	1.41	.35	9.68:1	19.4:1	26.62
S-21245	1200 ct	500 ct	125	2.0	1.5	.05	3	96	55	13.75	1.55:1	3.1:1	26.62
S-21250	1200 ct	1200 ct	300	2.0	1.5	.05	3	96	132	33	1:1	2:1	26.62
S-21255	*1200 ct	1200 ct	–	2.0	1.5	.05	3	96	132	–	1:1	–	27.68
S-21260	1500 ct	12 ct	3	2.0	1.5	.05	2.5	120	1.32	.33	11.18:1	22.36:1	26.62
S-21265	1500 ct	500 ct	125	2.0	1.5	.05	2.5	120	55	13.75	1.73:1	3.46:1	26.62
S-21270	*1500 ct	600 ct	–	2.0	1.5	.05	2.5	120	66	–	1.58:1	–	27.68
S-21275	*1500 ct	1500 ct	–	2.0	1.5	.05	2.5	120	165	–	1:1	–	27.68
S-21280	1600 ct	12.8 ct	3.2	2.0	1.5	.05	2.5	128	1.41	.35	11.18:1	22.36:1	26.62
S-21283	2000 ct	8 ct	2	2.0	1.5	.05	2.2	160	.88	.22	15.8:1	31.6:1	26.62
S-21285	2000 ct	2000 ct	500	2.0	1.5	.05	2.2	160	220	55	1:1	2:1	26.62
S-21290	*2000 ct	2000 ct	–	2.0	1.5	.05	2.2	160	220	–	1:1	–	27.68
S-21295	2000 ct	8000 ct	2000	2.0	1.5	.05	2.2	160	880	220	1:2	1:1	27.68
S-21297	2500 ct	2500 ct	625	2.0	1.5	.05	2	200	275	69	1:1	2:1	27.68
S-21300	3000 ct	3000 ct	750	2.0	1.5	.05	1.8	240	330	83	1:1	2:1	27.68
S-21305	*3000 ct	3000 ct	–	2.0	1.5	.05	1.8	240	330	–	1:1	–	27.68

*INCLUDES ELECTROSTATIC SHIELD
**MINIATURIZED TELEPHONE COUPLING APPLICATION
***Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%

Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

SPECIFICATIONS

- **MIL-T-27:** ..... All units manufactured to MIL-T-27, Audio Transformers are Type TF5R21ZZ.
- **FREQUENCY RESPONSE:** ..... ±3db, 50 Hz-30 KHz at 1.0 Milliwatt. (±0.5 db, 300 Hz-5 KHz)
- **MAXIMUM DISTORTION:** ..... 5% With Rated Power Level at 1 KHz, 300 Hz and 50 Hz.
- **DIELECTRIC STRENGTH:** ..... All Units Tested at 200 V RMS.
- **INSULATION RESISTANCE:** ... Greater Than 10,000 Megohms at 300 V DC.
- **WEIGHT:** ..... 17 Grams
- **OPERATING TEMPERATURE:** -55°c to +105°c (All Units Can be Supplied to Class S Requirements, +130°c).
- **TERMINALS:** ..... Solid .020 Diameter Conductor. Solderability per MIL-STD-202 Method 208.
- **THERMAL SHOCK:** ..... 25 Cycles, Method 107C, MIL-STD-202D, Test Condition A-1.

THIS PRODUCT IS PATENTED

PICO Electronics, Inc.

453 N. MacQuesten Pkwy.
Mt. Vernon, N.Y. 10552

FAX 914-699-5565

PICO PART NUMBER S-Series Plug-In	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS PAR	POWER WATTS 1KHz and higher	POWER WATTS 300 Hz and higher	POWER WATTS 50 Hz and higher	PRIMARY UNBAL DC CURRENT ma	PRIMARY DC RESIST OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	SECONDARY DC RESISTANCE OHMS PAR CONN	TURNS RATIO PRIM/SEC SEC SER CONN	TURNS RATIO PRIM/SEC SEC PAR CONN	PICO PRICES 1–9 *** S-Series
S-21310	3600 ct	3600 ct	900	2.0	1.5	.05	1.7	288	396	99	1:1	2:1	27.68
S-21312	4000 ct	16 ct	4	2.0	1.5	.05	1.6	320	1.76	.44	15.8:1	31.6:1	27.68
S-21314**	4000 ct	600 ct	150	2.0	1.5	.05	1.6	320	66	16.5	2.58:1	5.16:1	27.68
S-21315	4000 ct	1000 ct	250	2.0	1.5	.05	1.6	320	110	27.5	2:1	4:1	27.68
S-21320	*4000 ct	8000 ct	–	2.0	1.5	.05	1.6	320	880	–	1:1.41	–	27.68
S-21325	5000 ct	500 ct	125	2.0	1.5	.05	1.4	400	55	13.8	3.16:1	6.32:1	26.62
S-21330	5000 ct	5000 ct	1250	2.0	1.5	.05	1.4	400	550	138	1:1	2:1	26.62
S-21335	7500 ct	50 ct	12.5	1.3	1.3	.05	1.2	600	5.5	1.38	12.25:1	24.5:1	29.48
S-21340	7500 ct	100 ct	25	1.3	1.3	.05	1.2	600	11	2.75	8.66:1	17.32:1	29.48
S-21345	7500 ct	600 ct	150	1.3	1.3	.05	1.2	600	66	16.5	3.54:1	7.07:1	29.48
S-21350	7500 ct	2500 ct	625	1.3	1.3	.05	1.2	600	275	69	1.73:1	3.46:1	29.48
S-21355	*7500 ct	7500 ct	–	1.3	1.3	.05	1.2	600	825	–	1:1	–	31.87
S-21360	8000 ct	12.8 ct	3.2	1.2	1.2	.05	1.1	640	1.4	.35	25:1	50:1	29.48
S-21365	8000 ct	1000 ct	250	1.2	1.2	.05	1.1	640	110	27.5	2.83:1	5.66.1	29.48
S-21370	*8000 ct	1200 ct	–	1.2	1.2	.05	1.1	640	132	–	2.58:1	–	31.87
S-21375	*9000 ct	9000 ct	–	1.1	1.1	.05	1.1	720	990	–	1:1	–	31.87
S-21380	10,000 ct	12.8 ct	3.2	1.0	1.0	.05	1	800	1.4	.35	28:1	56:1	29.48
S-21385	10,000 ct	16 ct	4	1.0	1.0	.05	1	800	1.76	.44	25:1	50:1	29.48
S-21390	10,000 ct	100 ct	25	1.0	1.0	.05	1	800	11	2.75	10:1	20:1	29.48
S-21395	10,000 ct	200 ct	50	1.0	1.0	.05	1	800	22	5.5	7.07:1	14.14:1	29.48
S-21400	10,000 ct	500 ct	125	1.0	1.0	.05	1	800	55	13.75	4.47:1	8.94:1	29.48
S-21405	10,000 ct	600 ct	150	1.0	1.0	.05	1	800	66	16.5	4.08:1	8.16:1	29.48
S-21410	10,000 ct	1000 ct	250	1.0	1.0	.05	1	800	110	27.5	3.16:1	6.32:1	29.48
S-21415	10,000 ct	1200 ct	300	1.0	1.0	.05	1	800	132	33	2.89:1	5.77:1	29.48
S-21420	10,000 ct	1500 ct	375	1.0	1.0	.05	1	800	165	41.3	2.58:1	5.16:1	29.48
S-21425	10,000 ct	2000 ct	500	1.0	1.0	05	1	800	220	55	2.24:1	4.47:1	29.48
S-21430	10,000 ct	5000 ct	1250	1.0	1.0	.05	1	800	550	138	1.41:1	1.83:1	29.48
S-21435	10,000 ct	7500 ct	1875	1.0	1.0	.05	1	800	825	206	1.16:1	2.31:1	29.48
S-21440	10,000 ct	10,000 ct	2500	1.0	1.0	.05	1	800	1100	275	1:1	2:1	29.48
S-21445	*10,000 ct	10,000 ct	–	1.0	1.0	.05	1	800	1100	–	1:1	–	31.87
S-21450	15,000 ct	400 ct	100	.65	.65	.05	.8	1200	44	11	6.12:1	12.25.1	29.48
S-21452	15,000 ct	500 ct	125	.65	.65	.05	.8	1200	55	13.8	5.48:1	10.95:1	29.48
S-21455	15,000 ct	600 ct	150	.65	.65	.05	.8	1200	66	16.5	5:1	10.:1	29.48
S-21460	15,000 ct	10,000 ct	2500	.65	.65	.05	.8	1200	1100	275	1.22:1	2.45:1	29.48
S-21465	*15,000 ct	15,000 ct	–	.65	.65	.05	.8	1200	1650	–	1:1	–	31.87
S-21470	15,000 ct	15,000 ct	3750	.65	.65	.05	.8	1200	1650	413	1:1	2:1	29.48
S-21475	16,000 ct	1000 ct	250	.62	.62	.05	.8	1280	110	27.5	4:1	8:1	29.48
S-21480	20,000 ct	500 ct	125	.5	.5	.05	.7	1600	55	13.8	6.32:1	12.65:1	31.87
S-21485	20,000 ct	600 ct	150	.5	.5	.05	.7	1600	66	16.5	5.77:1	11.55:1	31.87
S-21490	20,000 ct	800 ct	200	.5	.5	.05	.7	1600	88	22	5:1	10:1	31.87
S-21495	20,000 ct	1000 ct	250	.5	.5	.05	.7	1600	110	27.5	4.47:1	8.94:1	31.87
S-21500	20,000 ct	5000 ct	1250	.5	.5	.05	.7	1600	550	138	2:1	4:1	31.87
S-21505	20,000 ct	10,000 ct	2500	.5	.5	.05	.7	1600	1100	275	1:41:1	2.83:1	31.87
S-21510	*20,000 ct	20,000 ct	–	.5	.5	.05	.7	1600	2200	–	1:1	–	32.82
S-21515	25,000 ct	500 ct	125	.4	.4	.05	.6	2000	55	13.8	7.07:1	14.14:1	31.87
S-21520	25,000 ct	1000 ct	250	.4	.4	.05	.6	2000	110	27.5	5:1	10:1	31.87
S-21525	30,000 ct	50 ct	12.5	.33	.33	.05	.6	2400	5.5	1.38	24.5:1	49:1	32.83
S-21530	30,000 ct	1200 ct	300	.33	.33	.05	.6	2400	132	33	5:1	10:1	32.83
S-21532	30,000 ct	500 ct	125	.33	.33	.05	.6	2400	55	13.8	7.7:1	15.5:1	32.83
S-21534	30,000 ct	200 ct	50	.33	.33	.05	.6	2400	22	5.5	12.2.1	24.5:1	32.83
S-21535	30,000 ct	5000 ct	1250	.33	.33	.05	.6	2400	550	137.5	2.45:1	4.9:1	32.83
S-21540	30,000 ct	10,000 ct	2500	.33	.33	.05	.6	2400	1100	275	1.73:1	3.46:1	32.83
S-21545	*30,000 ct	30,000 ct	–	33	.33	.05	.6	2400	3300	–	1:1	–	35.29
S-21550	40,000 ct	400 ct	100	.25	.25	.05	.5	3200	44	11	10:1	20:1	35.29
S-21555	40,000 ct	2000 ct	500	.25	.25	.05	.5	3200	220	55	4 47:1	8.94:1	35.29
S-21560	40,000 ct	4000 ct	1000	.25	.25	.05	.5	3200	440	110	3.16:1	6.32:1	35.29
S-21565	40,000 ct	20,000 ct	5000	.25	.25	.05	.5	3200	2200	550	1.41:1	2.83:1	35.29
S-21570	*40,000 ct	40,000 ct	–	.25	.25	.05	.5	3200	4400	–	1:1	–	39.29
S-21575	50,000 ct	200 ct	50	.2	.2	.05	.4	4000	22	5.5	15.8:1	31.6:1	39.29
S-21577	50,000 ct	500 ct	125	.2	.2	05	.4	4000	55	13.8	10:1	20:1	39.29
S-21578	50,000 ct	600 ct	150	.2	.2	.05	.4	4000	66	16.5	9.13:1	18.26:1	39.29
S-21579	50,000 ct	50,000 ct	12,500	.2	.2	.05	.4	4000	5500	1380	1:1	2:1	39.29
S-21580	60,000 ct	15,000 ct	3750	.16	.16	.05	.4	4800	1650	413	2:1	4:1	39.65
S-21585	62,500 ct	50 ct	12.5	.16	.16	.05	.4	5000	5.5	1.38	35.4:1	70.7:1	39.65
S-21587	80,000 ct	15,000 ct	3750	.12	.12	.05	.3	6400	1650	413	2.3:1	4.6:1	39.65
S-21590	90,000 ct	10,000 ct	2500	.11	.11	.05	.3	7200	1100	275	3:1	6.1	44 54
S-21595	95,000 ct	15,000 ct	3750	.1	.1	.05	.3	7600	1650	413	2.5:1	5:1	44.54
S-21600	100,000 ct	60 ct	15	.1	.1	.05	.3	8000	6.6	1.65	40.8 1	81.6:1	44.54
S-21605	100,000 ct	100 ct	25	.1	.1	.05	.3	8000	11	2.75	31.6.1	63.2:1	44.54
S-21610	100,000 ct	500 ct	125	.1	.1	.05	.3	8000	55	13.8	14.1.1	28.3:1	44.54
S-21613	100,000 ct	1000 ct	250	.1	.1	.05	.3	8000	110	27.5	10:1	20:1	44.54
S-21614	100,000 ct	2000 ct	500	.1	.1.	.05	.3	8000	220	55	7.07:1	14.14.1	44.54
S-21615	100,000 ct	10,000 ct	2500	.1	.1	.05	.3	8000	1100	275	3.16:1	6.32:1	44.54
S-21620	135,000 ct	82 ct	20.5	.07	.07	.05	.2	10,800	9	2.25	40.6:1	81.2:1	46.54

*INCLUDES ELECTROSTATIC SHIELD
**MINIATURIZED TELEPHONE COUPLING APPLICATION

***Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30 %
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York

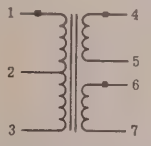
PICO's ultra-miniature transformers

S SERIES
Plug-In

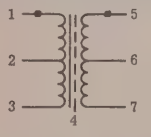
FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- PICO IS APPROVED QPL SOURCE (MIL-T-27)
- MAGNETIC SHIELDS AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED.
- VARIATION OF STANDARD DESIGNS AVAILABLE
- PRIMARY AND SECONDARY WINDINGS CAN BE USED EITHER AS INPUT OR OUTPUT.
- SPECIAL PRODUCTION TECHNIQUES ENSURE UNIFORM SIZE AND LEADS WHICH ARE FREE OF ENCAPSULANT. NO MENISCUS IN LEAD AREA.
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS.

SCHEMATIC FOR TRANSFORMERS WITH SPLIT SECONDARIES



SCHEMATIC FOR TRANSFORMERS WITH ELECTROSTATIC SHIELD



PICO Electronics, Inc.
453 N. MacQuesten Pkwy.
Mt. Vernon, N.Y. 10552

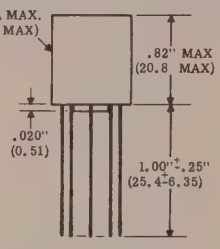
FAX 914-699-5565

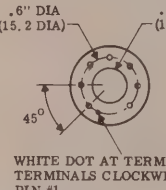
For immediate engineering assistance or to place an order—
Call Toll Free 800-228-9747

Delivery— stock to one week

PICO's ultra-miniature transformers

T SERIES Plug-In





Dimensions are in inches (MM)

SPECIFICATIONS

- **MIL-T-27:** ..... All units manufactured to MIL-T-27, Audio Transformers are Type TF5R21ZZ.
- **FREQUENCY RESPONSE:** ..... ±3db, 20 Hz-25 KHz at 1.0 Milliwatt.
- **MAXIMUM DISTORTION:** ..... 5% With Rated Power Level at 1 KHz and 300 Hz. 10% Distortion at 20 Hz.
- **DIELECTRIC STRENGTH:** ..... All Units Tested at 200 V RMS.
- **INSULATION RESISTANCE:** ... Greater Than 10,000 Megohms at 300 V DC.
- **WEIGHT:** ..... 28 Grams
- **OPERATING TEMPERATURE:** -55°c to +105°c (All Units Can be Supplied to Class S Requirements, +130°c).
- **TERMINALS:** ..... Solid .020 Diameter Conductor. Solderability per MIL-STD-202 Method 208.
- **THERMAL SHOCK:** ..... 25 Cycles, Method 107C, MIL-STD-202D, Test Condition A-1.

THIS PRODUCT IS PATENTED

Delivery— stock to one week

PICO PART NUMBER T-Series Plug-In	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS PAR	POWER WATTS 1KHz and higher	POWER WATTS 300 Hz and higher	POWER WATTS 20 Hz and higher	PRIMARY UNBAL DC CURRENT ma	PRIMARY DC RESIST OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	SECONDARY DC RESISTANCE OHMS PAR CONN	TURNS RATIO PRIME/SEC SEC SER CONN	TURNS RATIO PRIME/SEC SEC PAR CONN	PICO PRICES 1–9 *** T-Series
T-22003	20 ct	8 ct	2	3.0	2.0	.006	22	1.6	.8	.2	1.58:1	3.16:1	29.23
T-22005	20 ct	20 ct	5	3.0	2.0	.006	22	1.6	2	.5	1:1	2:1	29.23
T-22010	32 ct	32 ct	8	3.0	2.0	.006	17 5	2.56	3.2	.8	1:1	2:1	29.23
T-22015	40 ct	40 ct	10	3.0	2.0	.006	16	3.2	4	1	1:1	2:1	29.23
T-22018	48 ct	16 ct	4	3.0	2.0	.006	14.5	3.84	1.6	.4	1.73:1	3.46:1	29.23
T-22020	50 ct	50 ct	12.5	3.0	2.0	.006	14	4	5	1.25	1:1	2:1	29.23
T-22025	80 ct	32 ct	8	3.0	2.0	.006	11	6.4	3.2	.8	1.58:1	3.16:1	29.23
T-22028	100 ct	40 ct	10	3.0	2.0	.006	10	8	4	1	1.58:1	3.16:1	29.23
T-22030	100 ct	100 ct	25	3.0	2.0	.006	10	8	10	2.5	1:1	2:1	29.23
T-22035	120 ct	12.8 ct	3.2	3.0	2.0	.006	9	9.6	1.3	.32	3.06:1	26.12:1	29.23
T-22040	120 ct	60 ct	15	3.0	2.0	.006	9	9.6	6	1.5	1.41:1	2.83:1	29.23
T-22045	120 ct	120 ct	30	3.0	2.0	.006	9	9.6	12	3	1:1	2:1	29.23
T-22050	150 ct	12 ct	3	3.0	2.0	.006	8	12	1.2	.3	3.54:1	7.08:1	29.23
T-22055	150 ct	50 ct	12.5	3.0	2.0	.006	8	12	5	1.25	1.73:1	3.46:1	29.23
T-22060	150 ct	100 ct	25	3.0	2.0	.006	8	12	10	2.5	1.22:1	2.44:1	29.23
T-22065	150 ct	150 ct	37.5	3.0	2.0	.006	8	12	15	3.75	1:1	2:1	29.23
T-22070	150 ct	600 ct	150	3.0	2.0	.006	8	12	60	15	1:2	1:1	29.23
T-22075	200 ct	200 ct	50	3.0	2.0	.006	7	16	20	5	1:1	2:1	29.23
T-22080	300 ct	12 ct	3	3.0	2.0	.006	5.5	24	1.2	.3	5:1	10:1	29.23
T-22085	300 ct	50 ct	12.5	3.0	2.0	.006	5.5	24	5	1.25	2.45:1	4.9:1	29.23
T-22090	300 ct	150 ct	37.5	3.0	2 0	.006	5.5	24	15	3.75	1.41:1	2.83:1	29 23
T-22095	300 ct	300 ct	75	3.0	2.0	.006	5.5	24	30	7.5	1:1	2:1	29.23
T-22100	300 ct	600 ct	150	3.0	2.0	.006	5.5	24	60	15	1:1.41	1.41:1	29.23
T-22105	320 ct	12.8 ct	3.2	3.0	2.0	.006	5.5	25.6	1.3	.32	5:1	10:1	29.23
T-22110	400 ct	40 ct	10	3.0	2.0	006	5	32	4	1	3.16:1	16.32:1	29.23
T-22115	400 ct	120 ct	30	3.0	2.0	.006	5	32	12	3	1.83:1	3.65.1	29.23
T-22120	400 ct	200 ct	50	3.0	2.0	.006	5	32	20	5	1.41:1	2.83:1	29.23
T-22125	400 ct	400 ct	100	3.0	2.0	.006	5	32	40	10	1:1	2:1	29.23
T-22130	400 ct	1000 ct	250	3.0	2.0	.006	5	32	100	25	1:1.58	1.26:1	29.23
T-22135	400 ct	2000 ct	500	3.0	2.0	.006	5	32	200	50	1:2.24	1:1.12	29.23
T22140	400 ct	4000 ct	1000	3.0	2.0	.006	5	32	400	100	1:3.16	1:1.58	29.23
T-22142	500 ct	12.8 ct	3.2	3.0	2.0	.006	4.5	40	1.3	.32	6.25:1	12.5:1	29.23
T-22144	500 ct	16 ct	4	3.0	2.0	.006	4.5	40	1.6	4	5.6:1	11.2:1	29.23
T-22145	500 ct	50 ct	12.5	3.0	2.0	.006	4.5	40	5	1.25	3.16.1	6 32:1	29.23
T-22147	500 ct	150 ct	37.5	3.0	2.0	.006	4.5	40	15	3.75	1.83:1	3.65:1	29.23
T-22150	500 ct	500 ct	125	3.0	2.0	.006	4.5	40	50	12.5	1:1	2:1	29.23
T-22155	*500 ct	500 ct	–	3.0	2.0	.006	4.5	40	50	–	1:1	–	30.46
T-22160	500 ct	600 ct	150	3.0	2.0	.006	4.5	40	60	15	1:1.1	1.83:1	29.23
T-22165	600 ct	12.8 ct	3.2	3.0	2.0	.006	4	48	1.3	.32	6.85:1	13.7:1	29.23
T-22167	600 ct	30 ct	7.5	3.0	2.0	.006	4	48	3	.75	4.47:1	8.94:1	29.23
T-22170	600 ct	48 ct	12	3.0	2.0	.006	4	48	4.8	1.2	3.54:1	7.07:1	29.23
T-22175	600 ct	200 ct	50	3.0	2.0	.006	4	48	20	5	1.73:1	3.46:1	29.23
T-22180**	600 ct	600 ct	150	3.0	2.0	.006	4	48	60	15	1:1	2:1	29.23
T-22185**	*600 ct	600 ct	–	3.0	2.0	.006	4	48	60	–	1:1	–	30.46
T-22186**	*600 ct	900 ct	–	3.0	2.0	.006	4	48	90	–	1:1.22	–	30.46
T-22187**	600 ct	1200 ct	300	3.0	2.0	.006	4	48	120	30	1:1.41	1.41:1	29 23
T-22190	640 ct	12.8 ct	3.2	3.0	2.0	.006	4	51	1.3	.32	7.07:1	14.14:1	29.23
T-22195	700 ct	100 ct	25	3.0	2.0	.006	3.5	56	10	2.5	2.65:1	5.29:1	29.23
T-22200	800 ct	12.8 ct	3.2	3.0	2.0	.006	3.5	64	1.3	.32	7.91:1	15 8:1	29 23
T-22205	800 ct	48 ct	12	3.0	2 0	.006	3.5	64	4.8	1.2	4.08:1	8.16:1	29.23
T-22210	800 ct	800 ct	200	3.0	2.0	.006	3.5	64	80	20	1:1	2:1	29 23
T-22215	900 ct	600 ct	150	3.0	2.0	.006	3	72	60	15	1.22:1	2.45:1	29.23
T-22217**	*900 ct	900 ct	–	3.0	2.0	.006	3	72	90	–	1:1	–	30.46
T-22220	1000 ct	12 ct	3	3.0	2.0	.006	3	80	1.2	.3	9.13:1	18.26:1	29.23
T-22225	1000 ct	50 ct	12.5	3.0	2.0	.006	3	80	5	1.25	4.47:1	8 94:1	29.23
T-22230	1000 ct	1000 ct	250	3.0	2.0	.006	3	80	100	25	1:1	2:1	29.23
T-22235	1060 ct	12.8 ct	3.2	3.0	2.0	.006	3	85	1.3	.32	9.1:1	18.2:1	29.23
T-22240	1200 ct	12.8 ct	3.2	3.0	2.0	.006	3	96	1.3	.32	9.68:1	19.4:1	29.23
T-22245	1200 ct	500 ct	125	3.0	2.0	.006	3	96	50	12.5	1.55:1	3.1:1	29.23
T-22250	1200 ct	1200 ct	300	3.0	2.0	.006	3	96	120	30	1:1	2:1	29.23
T-22255	*1200 ct	1200 ct	–	3.0	2.0	.006	3	96	120	–	1:1	–	30.46
T-22260	1500 ct	12 ct	3	3.0	2.0	.006	2.5	120	1.2	.3	11.18:1	22.36:1	29.23
T-22265	1500 ct	500 ct	125	3.0	2.0	.006	2.5	120	50	12.5	1.73:1	3.46:1	29.23
T-22270	*1500 ct	600 ct	–	3.0	2.0	.006	2.5	120	60	–	1.58:1	–	30.46
T-22275	*1500 ct	1500 ct	–	3.0	2.0	.006	2.5	120	150	–	1:1	–	30.46
T-22280	1600 ct	12.8 ct	3.2	3.0	2.0	.006	2.5	128	1.3	.32	11.18:1	22.36:1	29 23
T-22283	2000 ct	8 ct	2	3.0	2.0	.006	2.2	160	.8	.2	15.8:1	31.6:1	29.23
T-22285	2000 ct	2000 ct	500	3.0	2.0	.006	2.2	160	200	50	1:1	2.1	29.23
T-22290	*2000 ct	2000 ct	–	3.0	2.0	.006	2.2	160	200	–	1:1	–	30.46
T-22295	2000 ct	8000 ct	2000	3.0	2.0	.006	2.2	160	800	200	1:2	1:1	29.23
T-22297	2500 ct	2500 ct	625	3.0	2.0	.006	2	200	250	63	1:1	2:1	29.23
T-22300	3000 ct	3000 ct	750	3.0	2.0	.006	1.8	240	300	75	1:1	2:1	29.23
T-22305	*3000 ct	3000 ct	–	3.0	2.0	.006	1.8	240	300	–	1:1	–	29.23

*INCLUDES ELECTROSTATIC SHIELD
**MINIATURIZED TELEPHONE COUPLING APPLICATION
***Discount Prices: 1–9 Net; 10–24 less 10%; 25–49 less 16%; 50–99 less 23%; 100–499 less 30%
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

For immediate engineering assistance or to place an order— ***Call Toll Free 800-228-9747***

PICO PART NUMBER T-Series Plug-In	PRIMARY IMPEDANCE OHMS	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS SER	SECONDARY IMPEDANCE OHMS SPLIT WINDINGS PAR	POWER WATTS 1KHz and higher	POWER WATTS 300 Hz and higher	POWER WATTS 20 Hz and higher	PRIMARY UNBAL DC CURRENT ma	PRIMARY DC RESIST OHMS	SECONDARY DC RESISTANCE OHMS SER CONN	SECONDARY DC RESISTANCE OHMS PAR CONN	TURNS RATIO PRIM/SEC SEC SER CONN	TURNS RATIO PRIM/SEC SEC PAR CONN	PICO PRICES 1–9 *** T-Series
T-22310	3600 ct	3600 ct	900	2.7	2.0	.006	1.7	288	360	90	1:1	2:1	29.23
T-22312	4000 ct	16 ct	4	2.5	2.0	.006	1.6	320	1.6	.4	15.8:1	31.6:1	29.23
T-22314**	4000 ct	600 ct	150	2.5	2.0	.006	1.6	320	60	15	2.58:1	5.16:1	29.23
T-22315	4000 ct	1000 ct	250	2.5	2.0	.006	1.6	320	100	25	2:1	4:1	29.23
T-22320	*4000 ct	8000 ct	–	2.5	2.0	.006	1.6	320	800	–	1:1.41	–	30.46
T-22325	5000 ct	500 ct	125	2.0	2.0	.006	1.4	400	50	12.5	3.16:1	6.32:1	29.32
T-22330	5000 ct	5000 ct	1250	2.0	2.0	.006	1.4	400	500	125	1:1	2:1	29.32
T-22335	7500 ct	50 ct	12.5	1.3	1.3	.006	1.2	600	5	1.25	12.25:1	24.5:1	32.42
T-22340	7500 ct	100 ct	25	1.3	1.3	.006	1.2	600	10	2.5	8.66:1	17.32:1	32.42
T-22345	7500 ct	600 ct	150	1.3	1.3	.006	1.2	600	60	15	3.54:1	7.07:1	32.42
T-22350	7500 ct	2500 ct	625	1.3	1.3	.006	1.2	600	250	63	1.73:1	3.46:1	32.42
T-22355	*7500 ct	7500 ct	–	1.3	1.3	.006	1.2	600	750	–	1:1	–	34.76
T-22360	8000 ct	12.8 ct	3.2	1.2	1.2	.006	1.1	640	1.3	.32	25:1	50:1	32.42
T-22365	8000 ct	1000 ct	250	1.2	1.2	.006	1.1	640	100	25	2.83:1	5.66:1	32.42
T-22370	*8000 ct	1200 ct	–	1.2	1.2	.006	1.1	640	120	–	2.58:1	–	34.76
T-22375	*9000 ct	9000 ct	–	1.1	1.1	.006	1.1	720	900	–	1:1	–	34.76
T-22380	10,000 ct	12.8 ct	3.2	1.0	1.0	.006	1	800	1.3	.32	28:1	56:1	32.42
T-22385	10,000 ct	16 ct	4	1.0	1.0	.006	1	800	1.6	.4	25:1	50:1	32.42
T-22390	10,000 ct	100 ct	25	1.0	1.0	.006	1	800	10	2.5	10:1	20:1	32.42
T-22395	10,000 ct	200 ct	50	1.0	1.0	.006	1	800	20	5	7.07:1	14.14:1	32.42
T-22400	10,000 ct	500 ct	125	1.0	1.0	.006	1	800	50	12.5	4.47:1	8.94:1	32.42
T-22405	10,000 ct	600 ct	150	1.0	1.0	.006	1	800	60	15	4.08:1	8.16:1	32.42
T-22410	10,000 ct	1000 ct	250	1.0	1.0	.006	1	800	100	25	3.16:1	6.32:1	32.42
T-22415	10,000 ct	1200 ct	300	1.0	1.0	.006	1	800	120	30	2.89:1	5.77:1	32.42
T-22420	10,000 ct	1500 ct	375	1.0	1.0	.006	1	800	150	38	2.58:1	5.16:1	32.42
T-22425	10,000 ct	2000 ct	500	1.0	1.0	.006	1	800	200	50	2.24:1	4.47:1	32.42
T-22430	10,000 ct	5000 ct	1250	1.0	1.0	.006	1	800	500	125	1.41:1	2.83:1	32.42
T-22435	10,000 ct	7500 ct	1875	1.0	1.0	.006	1	800	750	188	1.16:1	2.31:1	32.42
T-22440	10,000 ct	10,000 ct	2500	1.0	1.0	.006	1	800	1000	250	1:1	2:1	32.42
T-22445	*10,000 ct	10,000 ct	–	1.0	1.0	.006	1	800	1000	–	1:1	–	34.76
T-22450	15,000 ct	400 ct	100	.66	.66	.006	.8	1200	40	10	6.12:1	12.25:1	32.42
T-22452	15,000 ct	500 ct	125	.66	.66	.006	.8	1200	50	12.5	5.48:1	10.95:1	32.42
T-22455	15,000 ct	600 ct	150	.66	.66	.006	.8	1200	60	15	5:1	10:1	32.42
T-22460	15,000 ct	10,000 ct	2500	.66	.66	.006	.8	1200	1000	250	1.22:1	2.45:1	32.42
T-22465	*15,000 ct	15,000 ct	–	.66	.66	.006	.8	1200	1500	–	1:1	–	34.76
T-22470	15,000 ct	15,000 ct	3750	.66	.66	.006	.8	1200	1500	375	1:1	2:1	32.42
T-22475	16,000 ct	1000 ct	250	.62	.62	.006	.8	1280	100	25	4:1	8:1	32.42
T-22480	20,000 ct	500 ct	125	.5	.5	.006	.7	1600	50	12.5	6.32:1	12.6:1	34.76
T-22485	20,000 ct	600 ct	150	.5	.5	.006	.7	1600	60	15	5.77:1	11.55:1	34.76
T-22490	20,000 ct	800 ct	200	.5	.5	.006	.7	1600	80	20	5:1	10:1	34.76
T-22495	20,000 ct	1000 ct	250	.5	.5	.006	.7	1600	100	25	4.47:1	8.94:1	34.76
T-22500	20,000 ct	5000 ct	1250	.5	.5	.006	.7	1600	500	125	2:1	4:1	34.76
T-22505	20,000 ct	10,000 ct	2500	.5	.5	.006	.7	1600	1000	250	1.41:1	2.83:1	34.76
T-22510	*20,000 ct	20,000 ct	–	.5	.5	.006	.7	1600	2000	–	1:1	–	36.12
T-22515	25,000 ct	500 ct	125	.4	.4	.006	.6	2000	50	12.5	7.07:1	14.14:1	34.76
T-22520	25,000 ct	1000 ct	250	.4	.4	.006	.6	2000	100	25	5:1	10:1	34.76
T-22525	30,000 ct	50 ct	12.5	.33	.33	.006	.6	2400	5	1.25	24.5:1	49:1	36.12
T-22530	30,000 ct	1200 ct	300	.33	.33	.006	.6	2400	120	30	5:1	10:1	36.12
T-22532	30,000 ct	500 ct	125	.33	.33	.006	.6	2400	50	12.5	7.7:1	15.5:1	36.12
T-22534	30,000 ct	200 ct	50	.33	.33	.006	.6	2400	20	5	12.2:1	24.5:1	36.12
T-22535	30,000 ct	5000 ct	1250	.33	.33	.006	.6	2400	500	125	2.45:1	4.9:1	36.12
T-22540	30,000 ct	10,000 ct	2500	.33	.33	.006	.6	2400	1000	250	1.73:1	3.46:1	36.12
T-22545	*30,000 ct	30,000 ct	–	.33	.33	.006	.6	2400	3000	–	1:1	–	38.73
T-22550	40,000 ct	400 ct	100	.25	.25	.006	.5	3200	40	10	10:1	20:1	38.73
T-22555	40,000 ct	2000 ct	500	.25	.25	.006	.5	3200	200	50	4.47:1	8.94:1	38.73
T-22560	40,000 ct	4000 ct	1000	.25	.25	.006	.5	3200	400	100	3.16:1	6.32:1	38.73
T-22565	40,000 ct	20,000 ct	5000	.25	.25	.006	.5	3200	2000	500	1.41:1	2.83:1	38.73
T-22570	*40,000 ct	40,000 ct	–	.25	.25	.006	.5	3200	4000	–	1:1	–	43.19
T-22575	50,000 ct	200 ct	50	.2	.2	.006	.4	4000	20	5	15.8:1	31.6:1	43.19
T-22577	50,000 ct	500 ct	125	.2	.2	.006	.4	4000	50	12.5	10:1	20:1	43.19
T-22578	50,000 ct	600 ct	150	.2	.2	.006	.4	4000	60	15	9.13:1	18.26:1	43.19
T-22579	50,000 ct	50,000 ct	12,500	.2	.2	.006	.4	4000	5000	1250	1:1	2:1	43.19
T-22580	60,000 ct	15,000 ct	3750	.16	.16	.006	.4	4800	1500	375	2:1	4:1	46.64
T-22585	62,500 ct	50 ct	12.5	.16	.16	.006	.4	5000	5	1.25	35.4:1	70.7:1	46.64
T-22587	80,000 ct	15,000 ct	3750	.12	.12	.006	.3	6400	1500	375	2.3:1	4.6:1	46.64

*INCLUDES ELECTROSTATIC SHIELD
**MINIATURIZED TELEPHONE COUPLING APPLICATION

***Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 Less 23%; 100-499 Less 30%

Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York

PICO's ultra-miniature transformers

T SERIES
Plug-In

FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- PICO IS APPROVED QPL SOURCE (MIL-T-27)
- MAGNETIC SHIELDS AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED.
- VARIATION OF STANDARD DESIGNS AVAILABLE
- PRIMARY AND SECONDARY WINDINGS CAN BE USED EITHER AS INPUT OR OUTPUT.
- SPECIAL PRODUCTION TECHNIQUES ENSURE UNIFORM SIZE AND LEADS WHICH ARE FREE OF ENCAPSULANT. NO MENISCUS IN LEAD AREA.
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS.

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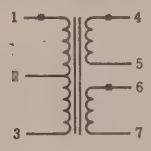

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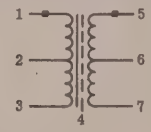

For immediate engineering assistance or to place an order—

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Delivery— stock to one week

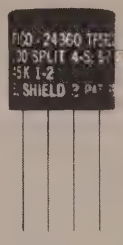
PICO Electronics, Inc.

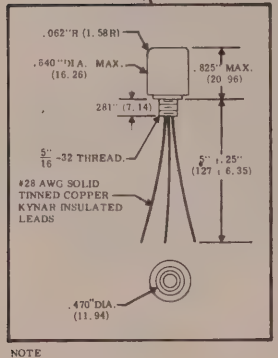
453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552 • • FAX 914-699-5565

PICO Microphone/Transducer Audio Input Transformers

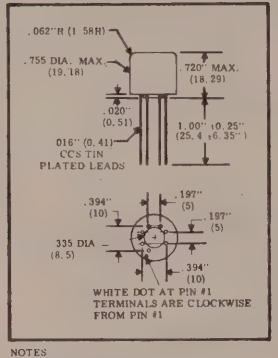
Used for Professional Sound Studios/Broadcast Mixing Consoles/Control and Instrument Amplifiers.

Interchangeable with transformers made by Beyer Dynamic of Germany.





NOTE
ALL DIMENSIONS ARE IN INCHES. ( ) = MM



NOTES
ALL DIMENSIONS ARE IN INCHES. ( ) MM.
CCS-COPPER CLAD STEEL, TINNED 100%.
ELECTROPLATED PER MIL-T-10727A AND ASTM CCS B452.

- *Large step-up ratios with flat frequency response over the entire audio range.*
- *Gapless laminations provide wide bandwidth with extremely low distortion. Use of two magnetic shields made with extra thick mu-metal and gapless core provide negligible hum pick up. All units provided with electrostatic shield.*
- *Your choice of two package styles, stud mounting with flying leads or low profile plug-in. Identical electrical performance regardless of package style.*
- *Frequency response ±1 dB, 30 Hz – 15 kHz.*
- *Low profile plug-in (24000 series) manufactured to MIL-T-27 (TF5R21ZZ).*
- *Because of gapless laminations, unbalanced DC current should be avoided.*
- *Typical distortion of 1% at power level of 0 dBm (1 Milliwatt), 30 Hz – 15 kHz. If the low frequency is raised, the power level for 1% distortion is as follows:*

50 Hz	-	3 Milliwatts (4.7 dBm)
100 Hz	-	10 Milliwatts (10 dBm)
300 Hz	-	150 Milliwatts (21.7 dBm)

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All units have two extra thick mu-metal shields.

Delivery-Stock to 1 week

Modification of standards 9 days!

THIS PRODUCT IS PATENTED

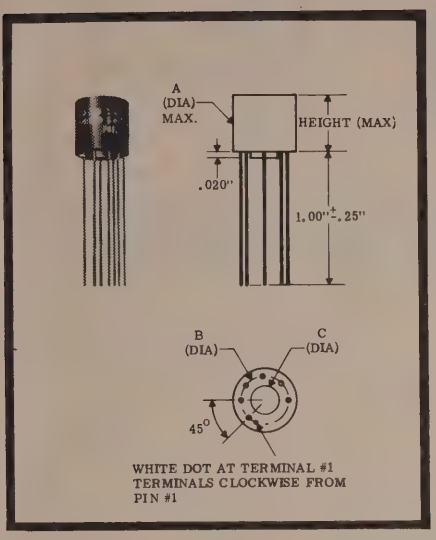
PART NUMBER		IMPEDANCE OHMS		TURNS RATIO PRIM/SEC		D.C. RESISTANCE			TYPICAL PRIM OPEN CIRCUIT IMPEDANCE AT 50 Hz	REPLACES BEYER/GERMANY PART NUMBER		PRICES 1–9***	
COMMERCIAL STUD MOUNTING	MILITARY PLUG-IN	PRIM	SEC	PRIM SERIES CONN	PRIM PAR CONN	PRIM SERIES CONN	PRIM PAR CONN	SEC		STUD MOUNTING (23000 SERIES)	PLUG-IN (24000 SERIES)	COMMERCIAL STUD MOUNTING	MILITARY PLUG-IN
23120	24120	12.5	5K	1:20	–	4.6	–	1K	125	TR-BV35704	STR-BV37704	36.07	43.34
23140	24140	200	200	1:1	–	50	–	75	2K	351 001 001	370 001 001	34.13	39.81
23160	24160	200 ct/50 SPLIT	200	1:1	1:2	50	12.5	75	2K	351 201 001	370 201 001	33.64	40.92
23180	24180	200	2K	1:3.16	–	50	–	580	2K	351 003 002	370 003 002	34.13	39.81
23200	24200	200 ct/50 SPLIT	2K	1:3.16	1:6.33	50	12.5	580	2K	351 203 002	370 203 002	33.64	40.92
23220	24220	200	5K	1:5	–	50	–	1.45K	2K	351 005 003	370 005 003	34.05	39.81
23240	24240	200 ct/50 SPLIT	5K	1:5	1:10	50	12.5	1.45K	2K	351 205 003	370 205 003	34.05	44.65
23260	24260	200	10K	1:7.07	–	50	–	3.45K	2K	351 007 004	370 007 004	33.64	40.92
23280	24280	200 ct/50 SPLIT	10K	1:7.07	1:14.14	50	12.5	3.45K	2K	351 207 004	370 207 004	38.49	45.77
23300	24300	200	20K	1:10	–	85	–	4.75K	2K	351 010 005	370 010 005	35.01	42.24
23320	24320	200 ct/50 SPLIT	20K	1:10	1:20	85	21	4.75K	2K	351 210 005	370 210 005	39.81	47.08
23340	24340	200	45K	1:15	–	85	–	10.4 K	2K	351 015 006	370 015 006	41.65	48.17
23360	24360	200 ct/50 SPLIT	45K	1:15	1:30	85	21	10.4 K	2K	351 215 006	370 215 006	45.77	52.99
23380	24380	200	80K	1:20	–	115	–	13.5 K	2K	351 020 007	370 020 007	43.34	50.57
23400	24400	200 ct/50 SPLIT	80K	1:20	1:40	115	29	13.5 K	2K	351 220 007	370 220 007	48.17	55.40
23420	24420	600 ct	600	1:1	–	140	–	190	6K	TR-145/BV35508 351 101 031	STR-145/BV37508 370 101 031	33.64	40.92
23440	24440	600 ct/150 SPLIT	600	1:1	1:2	140	35	190	6K	351 201 031	370 201 031	41.65	43.34
23460	24460	600 ct/150 SPLIT	2.4K	1:2	1:4	140	35	575	6K	351 202 032	370 202 032	38.49	45.77
23480	24480	600 ct/150 SPLIT	6K	1:3.16	1:6.33	140	35	1.45 K	6K	351 203 033	370 203 033	40.94	46.02
23500	24500	600 ct/150 SPLIT	15K	1:5	1:10	140	35	3.9 K	6K	351 205 034	370 205 034	43.34	50.57
23520	24520	600 ct/150 SPLIT	30K	1:7.07	1:14.14	140	35	7.05 K	6K	351 207 035	370 207 035	45.77	52.99
23540	24540	600 ct/150 SPLIT	60K	1:10	1:20	199	50	11 K	6K	351 210 036	370 210 036	48.17	55.40
23560	24560	1.2K ct/300 SPLIT	1.2K	1:1	1:2	310	78	430	12K	351 201 061	370 201 061	36.07	43.34
23580	24580	1.2K ct/300 SPLIT	5K	1:2.04	1:4.08	310	78	1.4 K	12K	351 202 062	370 202 062	38.49	45.77
23600	24600	1.2K ct/300 SPLIT	12K	1:3.16	1:6.33	310	78	3.75 K	12K	351 203 063	370 203 063	40.94	46.02
23620	24620	1.2K ct/300 SPLIT	30K	1:5	1:10	475	119	8.45 K	12K	351 205 064	370 205 064	43.34	50.57
23640	24640	10K	10K	1:1	–	2.5 K	–	3.1 K	100K	TR-145/BV35590	STR-145/BV37590	34.13	39.81

***Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

PICO Electronics, Inc. 453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552 • • FAX 914-699-5565

PICO's miniature 400 Hz transformers

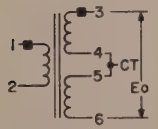
115V/26V Primary Printed Circuit Construction



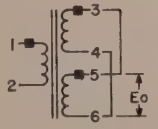
Case Size	Height (Max.)	A (Dia.) Max.	B (Dia.)	C (Dia.)	Terminal Dia.
L	.35	.51	.35	.218	.016 (.41)
N	.5	.51	.35	.218	.016 (.41)
R	.375	.75	.6	.475	.016 (.41)
S	.52	.75	.6	.475	.020 (.51)
T	.82	.75	.6	.475	.020 (.51)

FEATURES
- 400 Hz Aerospace Application
- Smallest Possible Size
- Printed Circuit Plug-In Construction
- Secondary Has Split Winding (Secondary can Be Used at Half Voltage Twice the Current.)

SPECIFICATIONS
- Manufactured to MIL-T-27 (TF5S03ZZ)
- 90°c Ambient
- Input Primary 115v-400 Hz ±20 Hz or 26V-400HZ-±20 Hz (Your Choice-Just Choose The Proper Part No.)
- Regulation is 24% (T Units Have Regulation of 17%)
- Secondary Voltage Adjusted to Nominal Value at Half Load.



SERIES CONNECTED SECONDARY



PARALLEL CONNECTED SECONDARY

This Product is Patented

SEC/ VOLT	SEC/ CURRENT ma	SIZE	MODEL NUMBER 115V PRIMARY	MODEL NUMBER 26V PRIMARY	PICO PRICES 1–9*
5.0 CT	75	L	L-8948	L-8951	32.19
	150	N	N-6948	N-6951	32.19
	204	R	R-20650	R-20815	47.54
	338	S	S-21650	S-21815	42.28
	480	T	T-22650	T-22815	44.09
6.3 CT	59.5	L	L-8947	L-8952	32.19
	119	N	N-6947	N-6952	32.19
	162	R	R-20655	R-20820	47.54
	268	S	S-21655	S-21820	42.28
	381	T	T-22655	T-22820	44.09
8.0 CT	47	L	L-8946	L-8953	32.19
	94	N	N-6946	N-6953	32.19
	128	R	R-20660	R-20825	47.54
	211	S	S-21660	S-21825	42.28
	300	T	T-22660	T-22825	44.09
10 CT	37.5	L	L-8945	L-8954	32.19
	75	N	N-6945	N-6954	32.19
	102	R	R-20665	R-20830	47.54
	169	S	S-21665	S-21830	42.28
	240	T	T-22665	T-22830	44.09
12.8 CT	29	L	L-8940	L-8956	32.19
	58 6	N	N-6940	N 6956	32.19
	79.7	R	R-20670	R-20835	47.54
	132	S	S-21670	S-21835	42.28
	188	T	T-22670	T-22835	44.09
14 CT	26.8	L	L-8937	L-8957	32 19
	53.6	N	N-6937	N-6957	32.19
	72.9	R	R-20675	R-20840	47.54
	121	S	S-21675	S-21840	42.28
	171	T	T-22675	T-22840	44.09
16 CT	23	L	L-8935	L-8958	32.19
	47	N	N-6935	N-6958	32.19
	63.8	R	R-20680	R-20845	47.54
	106	S	S-21680	S-21845	42.28
	150	T	T-22680	T-22845	44.091
18 CT	20.8	L	L-8934	L-8959	32.19
	41.7	N	N-6934	N-6959	32.19
	56.7	R	R-20685	R-20850	47.54
	93.9	S	S-21685	S-21850	42.28
	133	T	T-22685	T-22850	44.09
20 CT	18.8	L	L-8933	L-8961	32.19
	37.5	N	N-6933	N-6961	32.19
	51	R	R-20690	R-20855	47.54
	84.5	S	S-21690	S-21855	42.28
	120	T	T-22690	T-22855	44.09
22 CT	17	L	L-8932	L-8962	32.19
	34	N	N-6932	N-6962	32.19
	46.4	R	R-20695	R-20860	47.54
	76.8	S	S-21695	S-21860	42.28
	109	T	T-22695	T-22860	44.09
24 CT	15.5	L	L-8930	L-8963	32.19
	31	N	N-6930	N-6963	32.19
	42.5	R	R-20700	R-20865	47.54
	70.4	S	S-21700	S-21865	42.28
	100	T	T-22700	T-22865	44.09
28 CT	13.4	L	L-8929	L-8964	32.19
	26.8	N	N-6929	N-6964	32.19
	36.4	R	R-20705	R-20870	47.54
	60.4	S	S-21705	S-21870	42.28
	85.7	T	T-22705	T-22870	44.09
31 CT	12	L	L-8927	L-8966	32.19
	24	N	N-6927	N-6966	32.19
	32.9	R	R-20710	R-20875	47.54
	54.5	S	S-21710	S-21875	42.28
	77.4	T	T-22710	T-2875	44.09
36 CT	10.4	L	L-8925	L-8967	32.19
	20.8	N	N-6925	N-6967	32.19
	28.3	R	R-20715	R-20880	47.54
	46.9	S	S-21715	S-21880	42.28
	66.7	T	T-22715	T-22880	44.09
39 CT	9.6	L	L-8924	L-8968	32.19
	19.2	N	N-6924	N-6968	32.19
	26.2	R	R-20720	R-20885	47.54
	43.3	S	S-21720	S-21885	42.28
	61.5	T	T-22720	T-22885	44.09

SEC/ VOLT	SEC/ CURRENT ma	SIZE	MODEL NUMBER 115V PRIMARY	MODEL NUMBER 26V PRIMARY	PICO PRICES 1–9*
43 CT	8.7	L	L-8923	L-8969	32 19
	17.4	N	N-6923	N-6969	32 19
	23.7	R	R-20725	R-20890	47.54
	39.3	S	S-21725	S-21890	42.28
	55.8	T	T-22725	T-22890	44.09
48 CT	7.8	L	L-8922	L-8971	32.19
	15.6	N	N-6922	N-6971	32.19
	21.1	R	R-20730	R-20895	47.54
	35.2	S	S-21730	S-21895	42 28
	50	T	T-22730	T-22895	44 09
56 CT	6.6	L	L-8920	L-8972	32.19
	13.2	N	N-6920	N-6972	32 19
	18.2	R	R-20735	R-20900	47 54
	30.2	S	S-21735	S-21900	42.28
	42 9	T	T-22735	T-22900	44.09
63 CT	6	L	L-8917	L-8973	32.19
	11.9	N	N-6917	N-6973	32 19
	16.2	R	R-20740	R-20905	47.54
	26.9	S	S-21740	S-21905	42.28
	38.2	T	T-22740	T-22905	44.09
68 CT	5.5	L	L-8915	L-8974	32.19
	11	N	N-6915	N-6974	32.19
	15	R	R-20745	R-20910	47.54
	24.9	S	S-21745	S-21910	42 28
	35 3	T	T-22745	T-22910	44.09
80 CT	4.6	L	L-8910	L-8976	32 19
	9.4	N	N-6910	N-6976	32.19
	12.1	R	R-20750	R-20915	47 54
	21 1	S	S-21750	S-21915	42 28
	30	T	T-22750	T-22915	44 09
88 CT	4.2	L	L-8905	L-8977	32.19
	8.5	N	N-6905	N-6977	32 19
	11.6	R	R-20755	R-20920	47 54
	19.2	S	S-21755	S-21920	42.28
	27.3	T	T-22755	T-22920	44 09
100 CT	3.7	L	L-8902	L-8978	32 19
	8.5	N	N-6902	N-6978	32 19
	10.2	R	R-20760	R-20925	47 54
	16.9	S	S-21760	S-21925	42.28
	24	T	T-22760	T-22925	44 09
115 CT	3.2	L	L-8900	L-8979	32.19
	6.5	N	N-6900	N-6979	32 19
	8.9	R	R-20765	R-20930	47.54
	14.7	S	S-21765	S-21930	42 28
	20.9	T	T-22765	T-22930	44 09
123 CT	8.3	R	R-20770	R-20935	47 54
	13.7	S	S-21770	S-21935	42.28
	19.5	T	T-22770	T-22935	44 09
138 CT	7.4	R	R-20775	R-20940	47 54
	12.2	S	S-21775	S-21940	42 28
	17.4	T	T-22775	T-22940	44 09
157 CT	6.5	R	R-20780	R-20945	47.54
	10 8	S	S-21780	S-21945	42.28
	15 3	T	T-22780	T-22945	44 09
175 CT	5.8	R	R-20785	R-20950	47 54
	9.6	S	S-21785	S-21950	42.28
	13.7	T	T-22785	T-22950	44 09
200 CT	5.1	R	R-20790	R-20955	47 54
	8.4	S	S-21790	S-21955	42 28
	12	T	T-22790	T-22955	44 09
220 CT	7.7	S	S-21795	S-21960	44.43
	10.9	T	T-22795	T-22960	46.32
250 CT	6.8	S	S-21800	S-21965	46.54
	9.6	T	T-22800	T-22965	48.53
275 CT	6.1	S	S-21805	S-21970	48.85
	8.7	T	T-22805	T-22970	52.95
310 CT	5.4	S	S-21810	S-21975	50.79
	7.7	T	T-22810	T-22975	57.00

Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York

*Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%

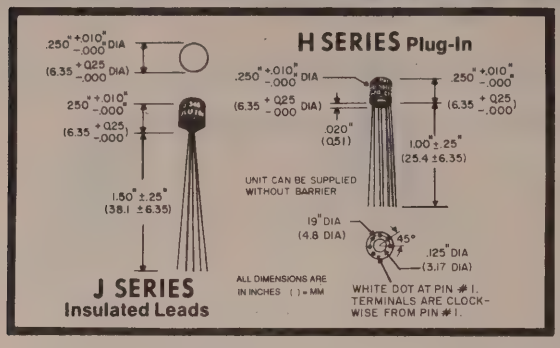
For immediate engineering assistance or to place an order— ***Call Toll Free 800-228-9747***

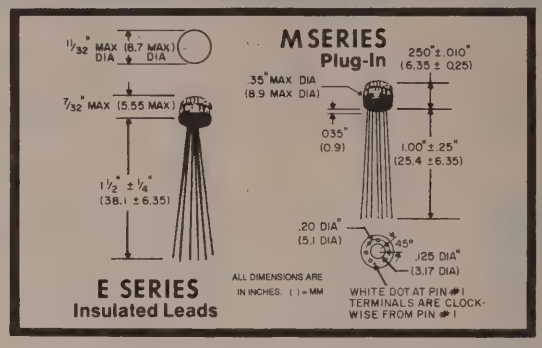
Delivery— stock to one week

PICO Electronics, Inc.

453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552 • • FAX 914-699-5565

PICO's Ultra-Miniature PULSE Transformers


H SERIES Plug-In
.250" +.010" -.000" DIA (6.35 +.025 -.000 DIA)
.250" +.010" -.000" (6.35 +.025 -.000)
1.50" ± .25" (38.1 ± 6.35)
.020" (.051)
1.00" ± .25" (25.4 ± 6.35)
UNIT CAN BE SUPPLIED WITHOUT BARRIER
.19" DIA (4.8 DIA)
45°
.125" DIA (3.17 DIA)
ALL DIMENSIONS ARE IN INCHES ( ) = MM
WHITE DOT AT PIN # 1. TERMINALS ARE CLOCK-WISE FROM PIN # 1.
J SERIES
Insulated Leads


1/32" MAX (6.7 MAX) DIA
7/32" MAX (5.55 MAX)
1 1/2" ± 1/4" (38.1 ± 6.35)
M SERIES
Plug-In
.35" MAX DIA (8.9 MAX DIA)
.250" ± .010" (6.35 ± 0.25)
.035" (0.9)
1.00" ± .25" (25.4 ± 6.35)
.20 DIA" (5.1 DIA)
45°
.125 DIA" (3.17 DIA)
ALL DIMENSIONS ARE IN INCHES. ( ) = MM
WHITE DOT AT PIN # 1 TERMINALS ARE CLOCK-WISE FROM PIN # 1
E SERIES
Insulated Leads

SPECIFICATIONS

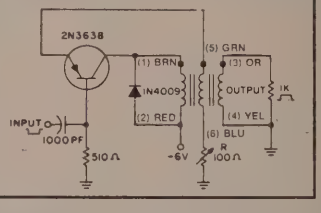
- **MIL-T021038:** ..... All units manufactured to MIL-T-21038
- **DIELECTRIC STRENGTH:** ..... All Units Tested at 200 V RMS.
- **INSULATION RESISTANCE:** ... Greater Than 10,000 Megohms at 300 V DC.
- **WEIGHT:** ..... 1.6 Grams
- **OPERATING TEMPERATURE:** -55°c to +105°c (All Units Can be Supplied to Class S Requirements, +130°c maximum).
- **TERMINALS:** ..... Solid .012 Diameter Conductor. Solderability per MIL-STD-202 Method 208.
- **THERMAL SHOCK:** ..... 25 Cycles, Method 107C, MIL-STD-202D, Test Condition A-1.

THIS PRODUCT IS PATENTED

FEATURES

- EXTREME RESISTANCE TO THERMAL SHOCK
- ULTRA MINIATURE SIZE
- BUILT TO MIL-T-21038
- MAGNETIC SHIELDS AVAILABLE
- ELECTROSTATIC SHIELDING CAN BE ADDED
- VARIATION OF STANDARD DESIGNS AVAILABLE
- SPECIAL PRODUCTION TECHNIQUES ENSURE UNIFORM SIZE AND LEADS WHICH ARE FREE OF ENCAPSULANT. NO MENISCUS IN LEAD AREA.
- EVERY UNIT IN THIS CATALOG CAN BE MADE WITH A 300 THERMAL CYCLE GUARANTEE USING PICO'S SPECIAL SR CONSTRUCTION. CONTACT FACTORY FOR DETAILS.

BLOCKING OSCILLATOR TRANSISTOR TEST CIRCUIT



MILITARY DESIGNATION TP7RX4410CZ TURNS RATIO 4:4:1

PICO PART NUMBER		COUPLING CIRCUIT CHARACTERISTICS							BLOCKING OSCILLATOR CIRCUIT					PICO PRICES 1–9 *	
H-Series Plug-In	J-Series Insulated Leads	P Width µSec	Volt Out	Rise Time	% Over Shoot	Droop %	% Back Swing	Imp* in-out,	P Width µSec	Rise Time	% Over Shoot	Droop %	% Back Swing	H-Series	J-Series
H-5400	J-5600	0 05	0 2	0 01	0	0	20	50	0 05	0 01	0	0	35	22 94	20 44
H-5405	J-5605	0 1	0 5	0 015	0	0	20	50	0 1	0 012	0	0	25	22 94	20 44
H-5410	J-5610	0 2	1 2	0 02	0	0	20	100	0 2	0 02	0	0	15	22 94	20 44
H-5415	J-5615	0 5	1 5	0 023	0	5	25	100	0 5	0 023	0	5	15	22 94	20 44
H-5420	J-5620	1	1 5	0 025	0	20	28	100	1	0 03	0	10	15	22 94	20 44
H-5425	J-5625	2	1 5	0 028	0	15	23	100	2	0 035	0	10	15	22 94	20 44
H-5430	J-5630	3	1 5	0 030	0	15	28	100	3	0 04	0	10	15	22 94	20 44
H-5435	J-5635	5	2	0 035	0	20	20	200	5	0 040	0	15	15	22 94	20 44
H-5440	J-5640	10	2	0 05	0	25	25	200	10	0 060	0	15	10	22 94	20 44
H-5445	J-5645	15	2	0 06	0	25	18	200	15	0 07	0	15	15	22 94	20 44
H-5450	J-5650	25	3	0 1	0	30	30	500	25	0 08	0	15	15	22 94	20 44
H-5455	J-5655	50	3	0 3	0	20	20	500	50	0 2	0	10	5	22 94	20 44
H-5460	J-5660	100	6	0 4	0	15	18	500	100	0 35	0	10	15	22 94	20 44

Coupling circuit measurements made with (1) BRN—(2) RED as input and (3) OR—(4) YEL as output, (5) GRN—(6) BLU winding is open. Input Voltage = 1 V

PICO PART NUMBER		COUPLING CIRCUIT CHARACTERISTICS								BLOCKING OSCILLATOR CIRCUIT					D. C. RESISTANCE			PICO PRICES 1–9 *	
E-Series Insulated Leads	M-Series Plug-In	P. WIDTH µSEC.	VOLT OUT	RISE TIME µSEC.	% OVER SHOOT	DROOP %	% BACK SWING	IMP IN/OUT	FREQ RESP. WITHIN 3 DB	P. WIDTH µSEC.	RISE TIME µSEC.	% OVER SHOOT	DROOP %	% BACK SWING	4 TNS BRN RED	4 TNS OR YEL	1 TURN GRN BLU	E-Series	M-Series
E5020	M5300	0 05	10	0 018	0	0	10	50	150 KHz-30 MHz	0.05	0 02	0	0	35	0 21	0 23	0 13	15 87	17 66
E5040	M5305	0 1	10	0 02	0	0	5	50	100 KHz-17 MHz	0 1	0 025	0	0	25	0 47	0 56	0 17	15 87	17 66
E5060	M5310	0 2	8	0 035	0	0	5	100	16 KHz-10 MHz	0 2	0 030	0	0	15	1 0	1 25	0 37	15 87	17 66
E5080	M5315	0 5	8	0 06	0	0	0	100	7 KHz-3.3 MHz	0 5	0 05	0	0	15	1 5	1 80	0 54	15 87	17 66
E5100	M5320	1	8	0 15	0	0	5	100	7 KHz-2 3 MHz	1	0 08	0	0	15	2 5	3 1	0 9	15 87	17 66
E5120	M5325	2	8	0 17	0	0	10	100	2 2 KHz-1 3 MHz	2	0 10	0	0	15	3 0	3 7	1 1	15 87	17 66
E5140	M5330	3	8	0 20	0	0	10	100	1 7 KHz-1 5 MHz	3	0 20	0	0	15	4 9	6 0	1 8	15 87	17 66
E5160	M5335	5	8	0 20	0	15	25	200	1 8 KHz-1 5 MHz	5	0 30	0	0	3	8 0	9 7	2 9	15 87	17 66
E5180	M5340	10	8	0 4	0	15	20	200	1 5 KHz-1 2 MHz	10	0 35	0	5	10	13 0	15 8	4 7	15 87	17 66

MILITARY DESIGNATION TP7RX5310CZ TURNS RATIO 5:3:1

															5 TURNS	3 TURNS	1 TURN		
E5200	M3545	0 1	8	0 01	0	0	5	140/50	170 KHz-32 MHz	0 1	0 01	0	0	20	0.55	0 40	0 15	15 93	17 66
E5220	M5350	1	8	0 05	0	6	10	280/100	12 5 KHz-3 3MHz	1	0 02	5	5	5	3.0	2 2	0 9	15 93	17 66
E5240	M5355	5	8	0 09	0	12	25	560/200	15 KHz-4 MHz	5	0.05	0	10	10	9 5	7 0	2 6	15 93	17 66

MILITARY DESIGNATION TP7RX4440CZ TURNS RATIO 4:4:4

PICO PART NUMBER		COUPLING CIRCUIT CHARACTERISTICS											PICO PRICES 1–9 *	
E-Series Insulated Leads	M-Series Plug-In	P. WIDTH µSEC.	VOLT OUT	RISE TIME µSEC.	% OVER SHOOT	DROOP %	% BACK SWING	IMP IN/OUT	FREQ RESP. WITHIN 3 DB	4 TNS BRN RED	4 TNS OR YEL	4 TURNS GRN BLU	E-Series	M-Series
E5181	M-5356	0 05	10	0.018	0	0	10	50	150 KHz-30 MHz	0 21	0 23	0 25	17 66	17 66
E5182	M-5357	0.1	10	0.02	0	0	5	50	100 KHz-17 MHz	0 47	0 56	0 67	17 66	17 66
E5183	M-5358	0 2	8	0 035	0	0	5	100	16 KHz-10 MHz	1 0	1 25	1 56	17 66	17 66
E5184	M-5359	0.5	8	0.06	0	0	0	100	7 KHz-3.3 MHz	1 5	1 80	2 2	17 66	17 66
E5185	M-5360	1	8	0.15	0	0	5	100	7 KHz-2.3 MHz	2 5	3 1	3 9	17 66	17 66
E5186	M-5361	2	8	0.17	0	0	10	100	2.2 KHz-1 3 MHz	3 0	3 7	4 6	17 66	17 66
E5187	M-5362	3	8	0 20	0	0	10	100	1.7 KHz-1 5 MHz	4 9	6 0	7 4	17 66	17 66
E5188	M-5363	5	8	0 20	0	15	25	200	1 8 KHz-1 5 MHz	8 0	9 7	11 8	17 66	17 66
E5189	M-5364	10	8	0.4	0	15	20	200	1.5 KHz-1 2 MHz	13.0	15.8	19.2	17 66	17.66

Coupling circuit measurements made with (1) BRN—(2) RED as input and (3) OR—(4) YEL as output, (5) GRN—(6) BLU winding is open: Input Voltage = 1 V

*Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

PICO Electronics, Inc.

453 N. MacQuesten Pkwy.
Mt. Vernon, N.Y. 10552

FAX 914-699-5565

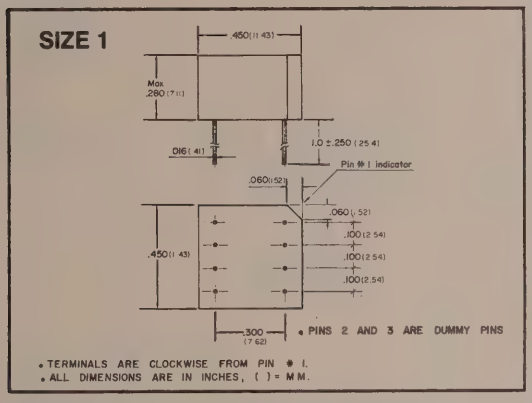
Call Toll Free 800-228-9747

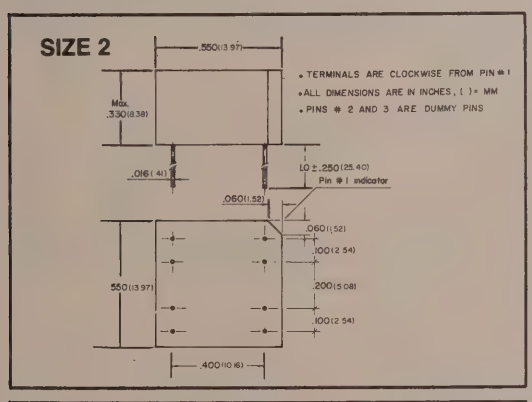
PICO's Pulse Transformers

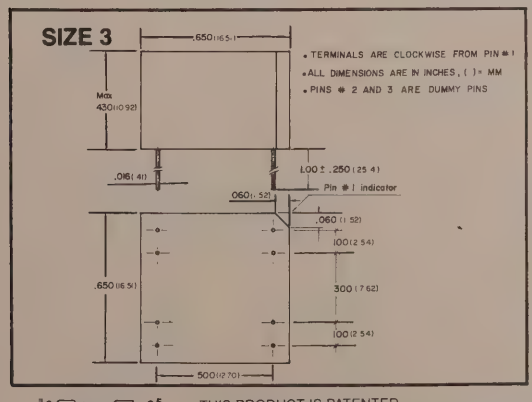
Plug-In

SPECIFICATIONS

- Units manufactured to MIL-T-21038 TP75SXNNNNK2
- **DIELECTRIC STRENGTH:** ..... All Units Tested at 500 V RMS.
- **INSULATION RESISTANCE:** ... Greater Than 10,000 Megohms at 700 V DC.
- **THERMAL SHOCK:** ..... 25 Cycles, Method 107C, MIL-STD-202E, Test Condition A-1.
- **OPERATING TEMPERATURE:** –55°c to +130°c).
- **TERMINALS:** ..... Solid .016 Diameter Conductor. Solderability per MIL-STD-202 Method 208.
- **WEIGHT SIZE:** 1-2.5 Grams 2-4.5 Grams 3-8.0 Grams







SIZE 1

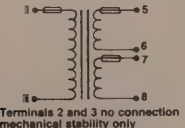
PICO PART # PLUG-IN	TURNS RATIO TOLER. ±5%	Lm TYPICAL µH	LEAKAGE IND. VALUE IN µH TYPICAL LL (N1-N2)	LL (N1-N3)	WINDING RESISTANCE MAX VALUE IN OHMS R(N1)	R(N2)	R(N3)	TYPICAL INTER-WINDING CAP VALUE IN pF C1 (N1-N2)	C2 (N1-N3)	E.T. RATING VOLT-µsec MIN. PRIMARY	PRICE (1-9)
74005	1:1:1	150	.100	.250	.070	.080	.085	25	12	10	14 95
74010	1:1:1	600	400	1.1	15	18	21	25	12	20	14 95
74015	1:1:1	1300	900	2.5	.45	51	.58	25	12	30	14 95
74020	1:1:1	2400	1.6	4.2	1.14	1.27	1.39	25	12	40	14 95
74025	1:1:1	3700	3.0	6.5	2.0	2.3	2.5	25	12	50	14 95
74030	2:1:1	150	250	450	062	.014	014	25	12	10	14 95
74035	2:1:1	600	1.0	1.5	15	074	087	25	12	20	14 95
74040	2:1:1	1300	1.5	3.5	45	10	13	25	12	30	14 95
74045	2:1:1	2400	2.2	6.0	1.14	17	20	25	12	40	14 95
74050	2:1:1	3700	3.4	9.0	2.07	29	32	25	12	50	14 95
74055	3:1:1	200	617	1.0	.081	018	018	25	12	12	14 95
74060	3:1:1	800	1.2	1.5	18	035	040	25	12	24	14 95
74065	3:1:1	1800	2.5	5.0	37	15	16	25	12	36	14 95
74070	3:1:1	3200	4.5	10.0	62	25	.28	25	12	48	14 95
74075	3:1:1	5300	7.0	15.0	1.28	25	28	25	12	60	14 95
74080	3:3:1	200	200	1.0	082	096	025	25	12	12	14 95
74085	3:3:1	800	1.0	1.5	18	22	042	25	12	24	14 95
74090	3:3:1	1800	2.5	5.0	58	73	.28	25	12	36	14 95
74095	3:3:1	3200	4.5	10.0	95	1.18	.55	25	12	48	14 95
74100	3:3:1	5300	7.0	15.0	1.56	1.78	69	25	12	60	14 95
74105	4:2:1	200	.506	2.0	047	-024	019	25	12	12	14 95
74110	4:2:1	800	1.5	3.0	18	.071	041	25	12	24	14 95
74115	4:2:1	1800	3.0	5.5	46	28	16	25	12	36	14 95
74120	4:2:1	3200	5.5	10.0	77	46	25	25	12	48	14 95
74125	4:2:1	5300	8.0	15.0	1.25	72	40	25	12	60	14 95

SIZE 2

PICO PART # PLUG-IN	TURNS RATIO TOLER. ±5%	Lm TYPICAL µH	LEAKAGE IND. VALUE IN µH TYPICAL LL (N1-N2)	LL (N1-N3)	WINDING RESISTANCE MAX VALUE IN OHMS R(N1)	R(N2)	R(N3)	TYPICAL INTER-WINDING CAP VALUE IN pF C1 (N1-N2)	C2 (N1-N3)	E.T. RATING VOLT-µsec MIN. PRIMARY	PRICE (1-9)
74210	1:1:1	250	350	.712	.038	.046	.048	35	18	16	14 95
74215	1:1:1	1000	650	1.2	.12	.15	.17	35	18	32	14 95
74220	1:1:1	2250	1.5	3.0	28	32	37	35	18	48	14 95
74225	1:1:1	4000	2.5	5.0	59	66	74	35	18	65	14 95
74230	1:1:1	6200	4.0	8.0	1.27	1.48	1.56	35	18	80	14 95
74235	2:1:1	250	400	815	038	014	015	35	18	16	14 95
74240	2:1:1	1000	800	1.6	12	044	049	35	18	32	14 95
74245	2:1:1	2250	1.8	3.6	28	11	13	35	18	48	14 95
74250	2:1:1	4000	3.2	6.4	59	17	20	35	18	65	14 95
74255	2:1:1	6200	5.0	10.0	1.26	29	31	35	18	80	14 95
74260	3:1:1	350	400	900	036	017	023	35	18	19	14 95
74265	3:1:1	1400	1.1	2.2	15	035	039	35	18	38	14 95
74270	3:1:1	3000	2.4	5.0	42	062	068	35	18	57	14 95
74275	3:1:1	5500	4.2	8.0	75	23	.24	35	18	76	14 95
74280	3:1:1	9000	6.5	10.0	1.02	39	41	35	18	95	14 95
74285	3:3:1	350	450	1.0	063	068	049	35	18	19	14 95
74290	3:3:1	1400	1.2	2.6	15	17	065	35	18	38	14 95
74295	3:3:1	3000	2.5	5.0	42	48	089	35	18	57	14 95
74300	3:3:1	5500	4.5	9.0	94	1.14	43	35	18	76	14 95
74305	3:3:1	9000	7.0	14.0	1.54	1.74	64	35	18	95	14 95
74310	4:2:1	350	700	1.64	040	023	014	35	18	19	14 95
74315	4:2:1	1400	1.3	2.7	12	067	035	35	18	38	14 95
74320	4:2:1	3000	2.7	5.5	42	12	070	35	18	57	14 95
74325	4:2:1	5500	4.8	9.0	.94	27	15	35	18	76	14 95
74330	4:2:1	9000	7.5	15.0	1.53	35	19	35	18	95	14 95

SIZE 3

PICO PART # PLUG-IN	TURNS RATIO TOLER. +5%	Lm TYPICAL µH	LEAKAGE IND. VALUE IN µH TYPICAL LL (N1-N2)	LL (N1-N3)	WINDING RESISTANCE MAX VALUE IN OHMS R(N1)	R(N2)	R(N3)	TYPICAL INTER-WINDING CAP VALUE IN pF C1 (N1-N2)	C2 (N1-N3)	E.T. RATING VOLT-µsec MIN. PRIMARY	PRICE (1-9)
74515	1:1:1	300	300	400	044	048	054	45	25	25	14 95
74520	1:1:1	1200	1.25	1.9	095	11	13	45	25	50	14 95
74525	1:1:1	2700	1.75	4.2	22	26	29	45	25	75	14 95
74530	1:1:1	4800	3.0	7.3	46	52	59	45	25	100	14 95
74535	1:1:1	7500	4.6	11.4	81	90	99	45	25	125	14 95
74540	2:1:1	300	514	630	044	013	017	45	25	25	14 95
74545	2:1:1	1200	900	1.7	095	043	047	45	25	50	14 95
74550	2:1:1	2700	2.0	3.7	22	10	12	45	25	75	14 95
74555	2:1:1	4800	3.0	6.5	46	17	19	45	25	100	14 95
74560	2:1:1	7500	4.88	10.0	80	28	34	45	25	125	14 95
74565	3:1:1	400	686	800	049	011	011	45	25	30	14 95
74570	3:1:1	1600	1.25	3.0	12	035	038	45	25	60	14 95
74575	3:1:1	3600	2.75	6.5	33	062	068	45	25	90	14 95
74580	3:1:1	6400	4.6	1.20	58	14	15	45	25	120	14 95
74585	3:1:1	10000	7.2	18.0	1.25	13	15	45	25	150	14 95
74590	3:3:1	400	400	1.02	062	072	012	45	25	30	14 95
74595	3:3:1	1600	1.25	1.5	12	14	040	45	25	60	14 95
74600	3:3:1	3600	3.0	2.9	33	38	070	45	25	90	14 95
74605	3:3:1	6400	5.3	5.0	58	73	18	45	25	120	14 95
74610	3:3:1	10000	8.2	7.8	1.35	1.40	20	45	25	150	14 95
74615	4:2:1	400	580	1.12	054	016	009	45	25	30	14 95
74620	4:2:1	1600	1.2	3.0	12	052	028	45	25	60	14 95
74625	4:2:1	3600	2.75	7.0	33	15	084	45	25	90	14 95
74630	4:2:1	6400	4.6	12.0	58	14	080	45	25	120	14 95
74635	4:2:1	10000	7.1	19.6	1.22	27	15	45	25	150	14 95



THIS PRODUCT IS PATENTED

Delivery— stock to one week

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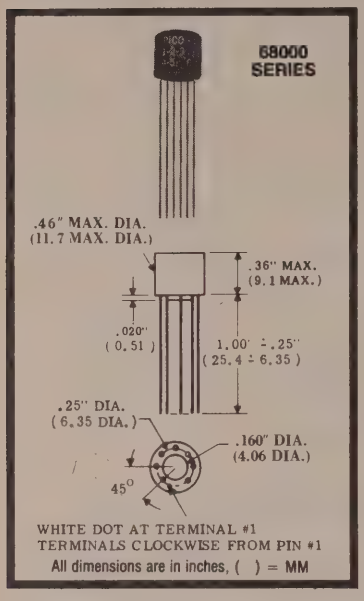
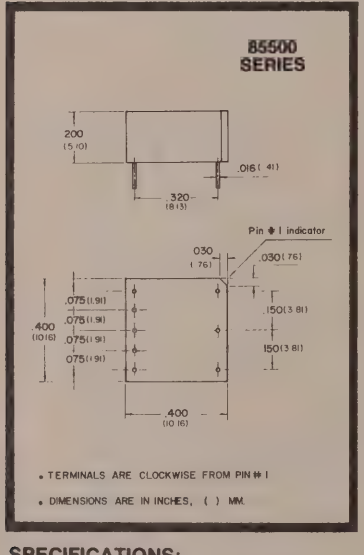
MIL-STD-1553 Interface Transformers Multiplex Data BUS Pulse Transformers





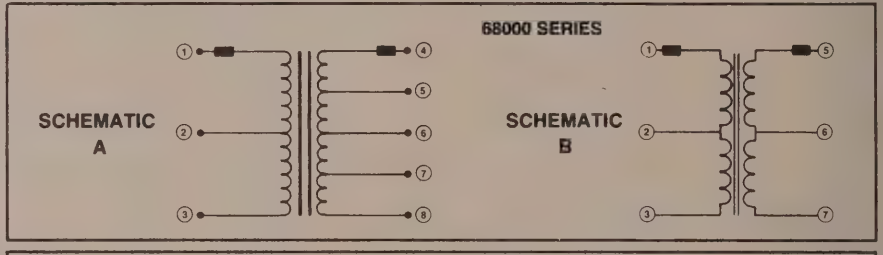
SPECIFICATIONS:

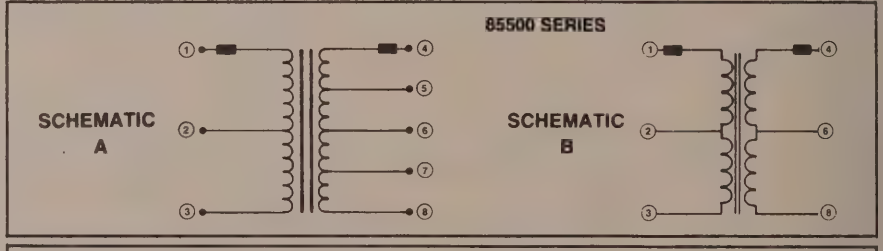
- Units manufactured to MIL-T-21038 and MIL STD 1553
- IMPEDANCE ..... greater than 3KΩ over the band from 75kHz to 1MHz
- DROOP ..... 20% max.
- OVERSHOOT ..... 1V peak
- COMMON MODE REJECTION (CMR) greater than 45dB.
- DIELECTRIC STRENGTH: ..... All Units Tested at 200 V RMS.
- INSULATION RESISTANCE ..... Greater Than 10,000 Megohms at 300 V DC.
- WEIGHT: ... PLUG-IN 4 Grams. SURFACE MOUNT 5 Grams.
- OPERATING TEMPERATURE: ..... −55°c to +130°c).
- TERMINALS: ..... Solid .012 Diameter Conductor. Meet solderability per MIL- STD-202 Method 208

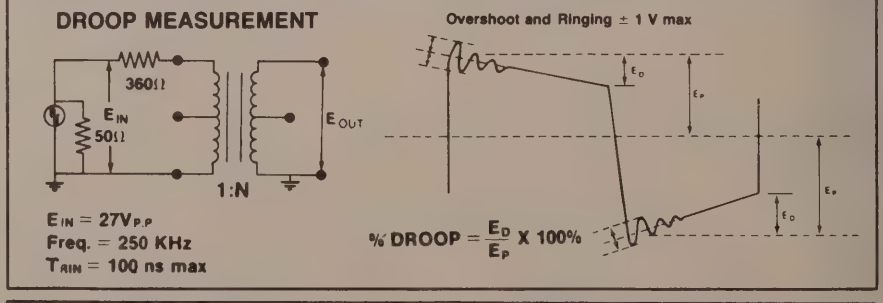
These pulse transformers manufactured to MIL-STD-1553 COMMAND/RESPONSE MULTIPLEX DATA BUS requirements. They also are manufactured to MIL-T-21038 specifications and are designed to meet MAC AIR SPECIFICATIONS A3818, A5690, A5232 and A4905.

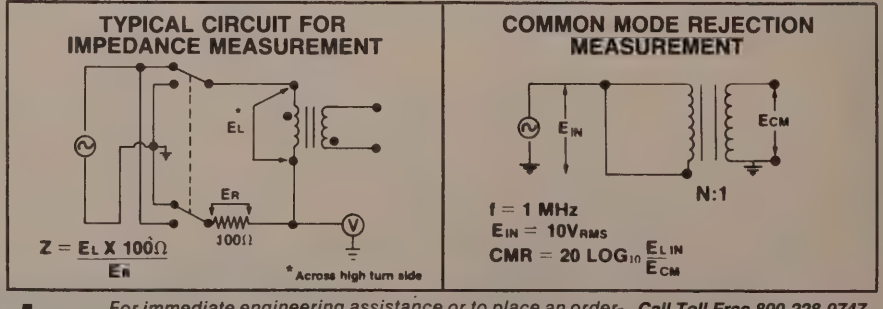
All of these transformers exhibit superior electrical performance. Common mode rejection ratio is greater than 45dB at 1 MHz. Input impedance is greater than 3000 ohms over the band from 75 kHz to 1mHz at 1V rms. This series possesses exceptional waveform integrity: Rise time and fall time is less than 100 nanoseconds. Overshoot and ringing is less than ± 1V peak. Droop is less than 20%.

PICO PART NUMBER 68000 Series	PICO PART NUMBER 85500 Series	TURNS RATIO	PRIMARY	SECONDARY	% DROOP (Typical)	CMR dB (Typical)	SCHEMATIC	PRICE (1–9)
68010	85510	1CT : 1CT 1CT : .707CT	1–3 1–3	4–8 5–7	10	50	A	33.67
68020	85520	1.4CT : 1CT 2CT : 1CT	1–3 1–3	4–8 5–7	10	50	A	33.67
68030	85530	1.25CT : 1CT 1.66CT : 1CT	1–3 1–3	4–8 5–7	10	50	A	33.67
68040	85540	2.3CT : 1CT 3.2CT : 1 CT	1–3 1–3	4–8 5–7	10	50	A	33.67
68050	85550	1CT : 1CT	1–3	5–7	10	50	B	27.76
68060	85560	1CT : 1.41CT	1–3	5–7	10	50	B	27.76
68070	85570	1CT : 1.66CT	1–3	5–7	10	50	B	27.76
68080	85580	1CT : 2CT	1–3	5–7	10	50	B	27.76









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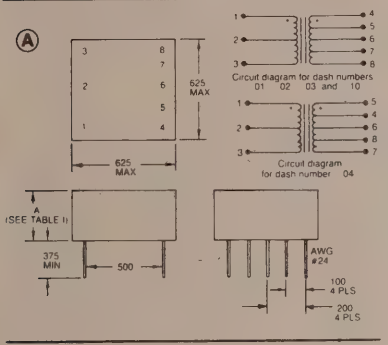
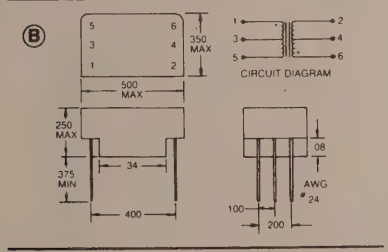
QPL Standards

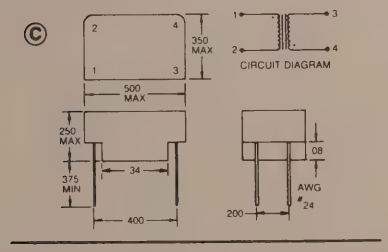
These Units Meet MIL-T-21038/27C, Type TP7SXNNNNKZ

SPECIFICATIONS:

- These units are in strict compliance to MIL-T-21038/27C, type TP7SXNNNNKZ
- IMPEDANCE . . . . . Minimum value shown in table. These values will be met from 75 kHz to 1MHz over temp. range of −55°C to +130°C
- DROOP . . . . . 20% max.
- OVERSHOOT . . . . . 1V peak
- COMMON MODE REJECTION (CMR) 45dB minimum
- DIELECTRIC WITHSTANDING . . . . . 100 VRMS
- INSULATION RESISTANCE . . . . . 1K meghoms min. at 100 VDC
- WEIGHT. . . . . 5 grams max.
- CASE. . . . . epoxy



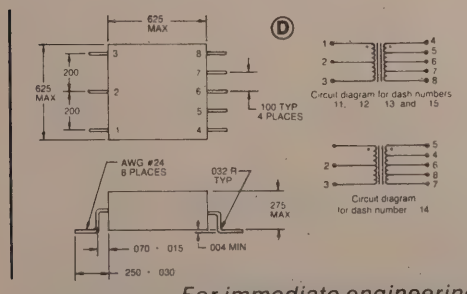


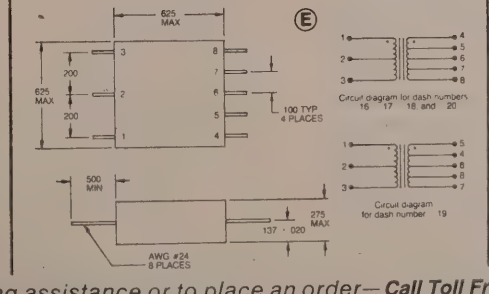


QPL STANDARDS
ELECTRICAL CHARACTERISTICS AND DIMENSIONS

PICO PART NUMBER	MILITARY DESIGNATION MIL-T-21038/27C	TURNS RATIO	PRIMARY	SECONDARY	DC RESISTANCE OHMS (MAX)	IMPEDANCE OHMS (MIN)	CONFIGURATION	"A" MAX	* PICO PRICE 1–4
68201	-01	1:1 ±3% 1:.707 ±3%	1-3 1-3	4-8 5-7	1-3 3.0 4-8 3.0	(1-3) 4,000	A	300	61.53
68206	-02	1.4:1 ±3% 2:1 ±3%	1-3 1-3	4-8 5-7	1-3 3.5 4-8 3.0	(1-3) 7,200	A	250	67.68
68211	-03	1.25:1 ±3% 1.66:1 ±3%	1-3 1-3	4-8 5-7	1-3 3.2 4-8 3.0	(1-3) 4,000	A	250	64.38
68216	-04	2.3:1 ±3% 3.2:1 ±3%	4-8 5-7	1-3 1-3	1-3 1.2 4-8 3.0	(5-7) 3,000	A	300	61.53
68221	-05	1:1.41 ±3%	1-2	3-4	1-2 2.2 3-4 2.7	(3-4) 3,000	C	---	44.93
68226	-06	1.1 ±3%	1-5	2-6	1-5 2.5 2-6 2.8	(1-5) 3,000	B	---	44.93
68231	-07	1:1.41 ±3%	1-5	2-6	1-5 2.2 2-6 2.7	(2-6) 3,000	B	---	44.93
68235	-08	1:1.66 ±3%	1-5	2-6	1-5 1.5 2-6 2.4	(2-6) 3,000	B	---	44.93
68241	-09	1:2 ±3%	1-5	2-6	1-5 1.3 2-6 2.6	(2-6) 3,000	B	---	44.93
68246	-10	2.12:1 ±3% 1.5:1 ±3%	4-8 5-7	1-3 1-3	1-3 1.0 4-8 3.5	(4-8) 4,0000	A	250	61.53
68251	-11	1:1 ±3% 1:.707 ±3%	1-3 1-3	4-8 5-7	1-3 3.0 4-8 3.0	(1-3) 4,000	D	---	61.53
68256	-12	1.4:1 ±3% 2:1 ±3%	1-3 1-3	4-8 5-7	1-3 3.5 4-8 3.0	(1-3) 7,200	D	----	67.68
68261	-13	1.25:1 ±3% 1.66:1 ±3%	1-3 1-3	4-8 5-7	1-3 3.2 4-8 3.0	(1-3) 4,000	D	---	67.68
68266	-14	2.3:1 ±3% 3.2:1 ±3%	4-8 5-7	1-3 1-3	1-3 1.2 4-8 3.0	(5-7) 3,000	D	---	67.68
68271	-15	2.12:1 ±3% 1.5:1 ±3%	4-8 5-7	1-3 1-3	1-3 1.0 4-8 3.5	(4-8) 4,000	D	---	67.68
68276	-16	1:1 ±3% 1:.707 ±3%	1-3 1-3	4-8 5-7	1-3 3.0 4-8 3.0	(1-3) 4,000	E	---	67.68
68281	-17	1.4:1 ±3% 2:1 ±3%	1-3 1-3	4-8 5-7	1-3 3.5 4-8 3.0	(1-3) 7,200	E	---	67.68
68286	-18	1.25:1 ±3% 1.66:1 ±3%	1-3 1-3	4-8 5-7	1-3 3.2 4-8 3.0	(1-3) 4,000	E	---	67.68
68291	-19	2.3:1 ±3% 3.2:1 ±3%	4-8 5-7	1-3 1-3	1-3 1.2 4-8 3.0	(5-7) 3,000	E	---	67.68
68296	-20	2.12:1 ±3% 1.5:1 ±3%	4-8 5-7	1-3 1-3	1-3 1.0 4-8 3.5	(4-8) 4,000	E	----	67.68

*See factory for discount schedule.





Delivery— stock to one week

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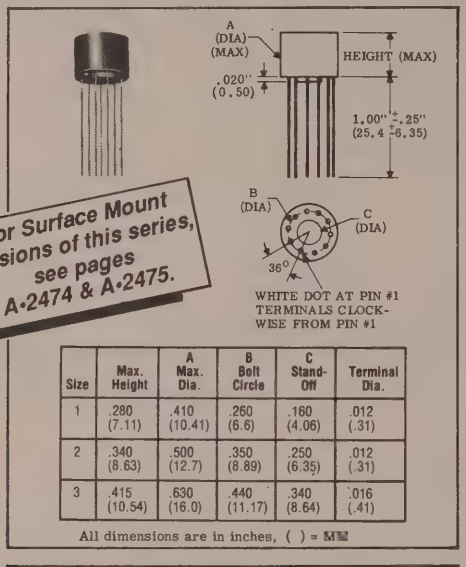
Ultra Miniature DC-DC Converter Transformers

Input Voltages of: 5V, 12V, 24V and 48V

Power Levels up to 40 Watts

All units are magnetically shielded

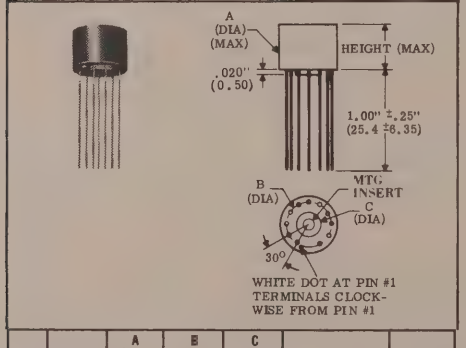
All units can be supplied with higher or lower output voltages. Delivery- stock to one week, special voltages 9 days.



For Surface Mount Versions of this series, see pages A•2474 & A•2475.

Size	Max. Height	A Max. Dia.	B Bolt Circle	C Stand-Off	Terminal Dia.
1	.280 (7.11)	.410 (10.41)	.260 (6.6)	.160 (4.06)	.012 (.31)
2	.340 (8.63)	.500 (12.7)	.350 (8.89)	.250 (6.35)	.012 (.31)
3	.415 (10.54)	.630 (16.0)	.440 (11.17)	.340 (8.64)	.016 (.41)

All dimensions are in inches, ( ) = MM



Size	Max. Height	A Max. Dia.	B Bolt Circle	C Stand-Off	Mtg. Insert	Terminal Dia.
4	.500 (12.7)	.800 (20.32)	.560 (14.22)	.460 (11.68)	—	.016 (.41)
5	.650 (16.51)	.950 (24.13)	.670 (17.0)	.570 (14.48)	6-32 UNC 8 Threads Deep	.020 (.51)
6	.745 (18.92)	1.125 (28.57)	.800 (20.32)	.700 (17.78)	6-32 UNC 8 Threads Deep	.020 (.51)

All dimensions are in inches, ( ) = MM
Note: Sizes 5 and 6 - pins 5, 8 and 9 are omitted

FEATURES

1) Units can be used as self-saturating or for linear switching applications. Operation over ambient temperature range from —55° to +105°c. All units manufactured to the requirements of MIL-T-27 (TF5S40ZZ)
2) All units can be supplied with higher or lower secondary voltages at the same power levels.
3) Secondary can be connected for full-wave bridge or dual bridge.
4) All units are magnetically shielded.

INPUT 5 VOLTS

PART NUMBER	D. C. OUT VOLTS BRIDGE	FULL WAVE	DUAL BRIDGE	MAX. POWER OUT -55°c-+105°c	- 55°c-+70°c	APPROX. SWITCH FREQ. SELF-SATURATED	SQUARE-WAVE DRIVEN**	SIZE	*** PRICE 1-9
31021	10	5	±5	1.5W	3W	15K	30K TO 60K	1	37.77
31041	12	6	±6	1.5W	3W	15K	30K TO 60K	1	37.77
31061	28	14	±14	1.5W	3W	15K	30K TO 60K	1	37.77
31081	48	24	±24	1.5W	3W	20K	40K TO 60K	1	37.77
31101	100	50	±50	1.5W	3W	20K	40K TO 60K	1	37.77
32106	10	5	±5	3W	4.5W	15K	30K TO 60K	2	37.77
32126	12	6	±6	3W	4.5W	15K	30K TO 60K	2	37.77
32146	28	14	±14	3W	4.5W	15K	30K TO 60K	2	37.77
32166	48	24	±24	3W	4.5W	20K	40K TO 60K	2	37.77
32186	100	50	±50	3W	4.5W	20K	40K TO 60K	2	37.77
32189	150	75	±75	3W	–	10K	30K TO 60K	2	43.50
32192	200	100	±100	3W	–	10K	30K TO 60K	2	43.50
32195	300	150	±150	3W	–	10K	30K TO 60K	2	43.50
33104	10	5	±5	5W	7.5W	10K	20K TO 50K	3	37.77
33124	12	6	±6	5W	7.5W	10K	20K TO 50K	3	37.77
33144	28	14	±14	5W	7.5W	10K	20K TO 50K	3	37.77
33164	48	24	±24	5W	7.5W	10K	20K TO 50K	3	37.77
33184	100	50	±50	5W	7.5W	10K	20K TO 50K	3	37.77
33187	150	75	±75	5W	–	10K	30K TO 60K	3	43.50
33190	200	100	±100	5W	–	10K	30K TO 60K	3	43.50
33193	300	150	±150	5W	–	10K	30K TO 60K	3	43.50
34501	10	5	±5	10W	14W	10K	20K TO 40K	4	37.77
34521	28	14	±14	10W	14W	10K	20K TO 40K	4	37.77
34541	40	24	±24	10W	14W	10K	20K TO 40K	4	37.77

** Lower switching frequency may be used at lower output power.

INPUT 12 VOLTS

PART NUMBER	D. C. OUT VOLTS BRIDGE	FULL WAVE	DUAL BRIDGE	MAX. POWER OUT -55°c-+105°c	- 55°c-+70°c	APPROX. SWITCH FREQ. SELF-SATURATED	SQUARE-WAVE DRIVEN**	SIZE	*** PRICE 1-9
31121	12	6	±6	1.5W	3W	15K	30K TO 60K	1	37.77
31141	24	12	±12	1.5W	3W	15K	30K TO 60K	1	37.77
31161	28	14	±14	1.5W	3W	15K	30K TO 60K	1	37.77
31181	48	24	±24	1.5W	3W	20K	40K TO 60K	1	37.77
31201	100	50	±50	1.5W	3W	20K	40K TO 60K	1	37.77
32206	12	6	±6	3W	4.5W	15K	30K TO 60K	2	37.77
32226	24	12	±12	3W	4.5W	15K	30K TO 60K	2	37.77
32246	28	14	±14	3W	4.5W	15K	30K TO 60K	2	37.77
32266	48	24	±24	3W	4.5W	20K	40K TO 60K	2	37.77
32286	100	50	±50	3W	4.5W	20K	40K TO 60K	2	37.77
32289	150	75	±75	3W	–	10K	30K TO 60K	2	43.50
32292	200	100	±100	3W	–	10K	30K TO 60K	2	43.50
32295	300	150	±150	3W	–	10K	30K TO 60K	2	43.50
33204	12	6	±6	5W	7.5W	15K	30K TO 60K	3	37.77
33224	28	14	±14	5W	7.5W	15K	30K TO 60K	3	37.77
33244	48	24	±24	5W	7.5W	20K	40K TO 60K	3	37.77
33264	100	50	±50	5W	7.5W	20K	40K TO 60K	3	37.77
33267	150	75	±75	5W	–	10K	30K TO 60K	3	43.50
33270	200	100	±100	5W	–	10K	30K TO 60K	3	43.50
33273	300	150	±150	5W	–	10K	30K TO 60K	3	43.50
34561	24	12	±12	10W	14W	15K	30K TO 50K	4	37.77
34581	28	14	±14	10W	14W	15K	30K TO 50K	4	37.77
34601	48	24	±24	10W	14W	15K	30K TO 50K	4	37.77
34604	100	50	±50	7.5W	–	10K	30K TO 60K	4	43.50
34607	150	75	±75	7.5W	–	10K	30K TO 60K	4	43.50
34610	200	100	±100	7.5W	–	10K	30K TO 60K	4	43.50
34613	300	150	±150	7.5W	–	10K	30K TO 60K	4	43.50
35110	24	12	±12	17W	25W	–	30K TO 60K	5	54.34
35130	28	14	±14	17W	25W	–	30K TO 60K	5	54.34
35150	48	24	±24	17W	25W	–	30K TO 60K	5	54.34

** Lower switching frequency may be used at lower output power.

***Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York.

For immediate engineering assistance or to place an order– ***Call Toll Free 800-228-9747*** • • FAX 914-699-5565

INPUT 24 VOLTS

PART NUMBER	D. C. OUT VOLTS BRIDGE	FULL WAVE	DUAL BRIDGE	MAX. POWER OUT -55°c-+105°c	- 55°c-+70°c	APPROX. SWITCH FREQ. SELF-SATURATED	SQUARE-WAVE DRIVEN**	SIZE	*** PRICE 1-9
31221	10	5	±5	1.5W	3W	15K	30K TO 60K	1	37.77
31241	28	14	±14	1.5W	3W	15K	30K TO 60K	1	37.77
31261	48	24	±24	1.5W	3W	20K	40K TO 60K	1	37.77
31281	100	50	±50	1.5W	3W	20K	40K TO 60K	1	37.77
32306	10	5	±5	3W	4.5W	15K	30K TO 60K	2	37.77
32326	28	14	±14	3W	4.5W	15K	30K TO 60K	2	37.77
32346	48	24	±24	3W	4.5W	20K	40K TO 60K	2	37.77
32366	100	50	±50	3W	4.5W	20K	40K TO 60K	2	37.77
32369	150	75	±75	3W	–	10K	30K TO 60K	2	43.50
32372	200	100	±100	3W	–	10K	30K TO 60K	2	43.50
32375	300	150	±150	3W	–	10K	30K TO 60K	2	43.50
33284	10	5	±5	5W	7.5W	15K	30K TO 60K	3	37.77
33304	28	14	±14	5W	7.5W	15K	30K TO 60K	3	37.77
33324	48	24	±24	5W	7.5W	20K	40K TO 60K	3	37.77
33344	100	50	±50	5W	7.5W	20K	40K TO 60K	3	37.77
33347	150	75	±75	5W	–	10K	30K TO 60K	3	43.50
33350	200	100	±100	5W	–	10K	30K TO 60K	3	43.50
33353	300	150	±150	5W	–	10K	30K TO 60K	3	43.50
34621	28	14	±14	10W	14W	15K	30K TO 50K	4	37.77
34641	48	24	±24	10W	14W	15K	30K TO 50K	4	37.77
34644	100	50	±50	7.5W	–	10K	30K TO 60K	4	43.50
34647	150	75	±75	7.5W	–	10K	30K TO 60K	4	43.50
34650	200	100	±100	7.5W	–	10K	30K TO 60K	4	43.50
34653	300	150	±150	7.5W	–	10K	30K TO 60K	4	43.50
35170	24	12	±12	17W	25W	–	30K TO 60K	5	54.34
35190	28	14	±14	17W	25W	–	30K TO 60K	5	54.34
35210	48	24	±24	17W	25W	–	30K TO 60K	5	54.34
36710	48	24	±24	25W	40W	–	30K TO 60K	6	65.39
36730	56	28	±28	25W	40W	–	30K TO 60K	6	65.39

** Lower switching frequency may be used at lower output power.

INPUT 48 VOLTS

PART NUMBER	D. C. OUT VOLTS BRIDGE	FULL WAVE	DUAL BRIDGE	MAX. POWER OUT -55°c-+105°c	- 55°c-+70°c	APPROX. SWITCH FREQ. SELF-SATURATED	SQUARE-WAVE DRIVEN**	SIZE	*** PRICE 1-9
31301	24	12	±12	1.5W	3W	15K	30K TO 60K	1	37.77
31321	48	24	±24	1.5W	3W	20K	40K TO 60K	1	37.77
31341	100	50	±50	1.5W	3W	20K	40K TO 60K	1	37.77
31361	150	75	±75	1.5W	3W	20K	40K TO 60K	1	37.77
32386	24	12	±12	3W	4.5W	15K	30K TO 60K	2	37.77
32406	48	24	±24	3W	4.5W	20K	40K TO 60K	2	37.77
32426	100	50	±50	3W	4.5W	20K	40K TO 60K	2	37.77
32446	150	75	±75	3W	4.5W	20K	40K TO 60K	2	37.77
32449	200	100	±100	3W	4.5W	10K	30K TO 60K	2	43.50
32452	300	150	±150	3W	4.5W	10K	30K TO 60K	2	43.50
33364	24	12	±12	5W	7.5W	15K	30K TO 60K	3	37.77
33384	48	24	±24	5W	7.5W	20K	40K TO 60K	3	37.77
33404	100	50	±50	5W	7.5W	20K	40K TO 60K	3	37.77
33424	150	75	±75	5W	7.5W	20K	40K TO 60K	3	37.77
33427	200	100	±100	5W	–	10K	30K TO 60K	3	43.50
33430	300	150	±150	5W	–	10K	30K TO 60K	3	43.50
34661	24	12	±12	10W	14W	15K	30K TO 50K	4	37.77
34681	48	24	±24	10W	14W	15K	30K TO 50K	4	37.77
34701	56	28	±28	10W	14W	15K	30K TO 50K	4	37.77
34704	100	50	±50	7.5W	–	10K	30K TO 60K	4	43.50
34707	150	75	±75	7.5W	–	10K	30K TO 60K	4	43.50
34710	200	100	±100	7.5W	–	10K	30K TO 60K	4	43.50
34713	300	150	±150	7.5W	–	10K	30K TO 60K	4	43.50
35230	24	12	±12	17W	25W	–	30K TO 60K	5	54.34
35250	48	24	±24	17W	25W	–	30K TO 60K	5	54.34
35270	56	28	±28	17W	25W	–	30K TO 60K	5	54.34
36750	48	24	±24	25W	40W	–	30K TO 60K	6	65.39
36770	56	28	±28	25W	40W	–	30K TO 60K	6	65.39
36790	100	50	±50	25W	40W	–	30K TO 60K	6	65.39

** Lower switching frequency may be used at lower output power.

***Discount Prices: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%
Ordering Instructions: No minimum. Net 30 days F.O.B. Mt. Vernon, New York

SCHEMATIC FOR SIZES 1, 2 & 3 USING TRANSFORMERS AS SELF-SATURATING

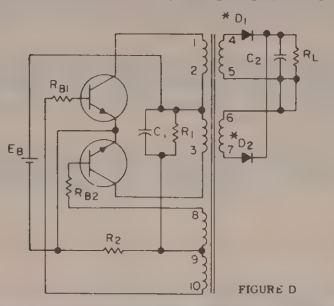


FIGURE D

SCHEMATIC FOR SIZES 1, 2, AND 3 USING TRANSFORMERS AS LINEAR SWITCHING

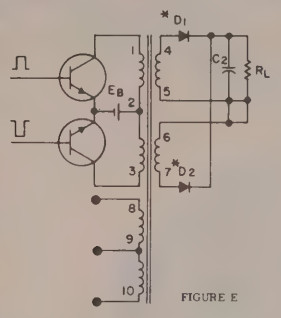


FIGURE E

* D1 AND D2 USE SCHOTTKY OR FAST SWITCHING DIODES

SCHEMATIC FOR SIZE 4 USING TRANSFORMER AS SELF-SATURATING

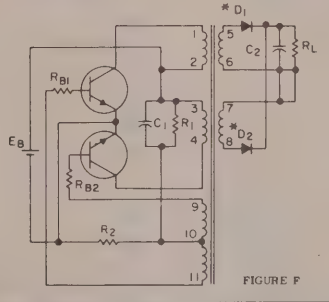


FIGURE F

SCHEMATIC FOR SIZE 4 USING TRANSFORMERS AS LINEAR SWITCHING.

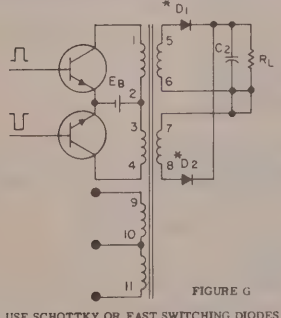


FIGURE G

*D1 & D2 USE SCHOTTKY OR FAST SWITCHING DIODES

SCHEMATIC FOR SIZES 5 & 6 USING TRANSFORMERS AS LINEAR SWITCHING.

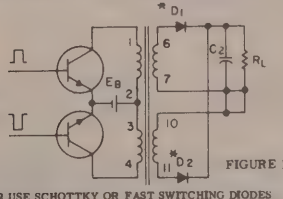


FIGURE H

*D1 & D2 USE SCHOTTKY OR FAST SWITCHING DIODES

PICO Electronics, Inc.
453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552
• FAX 914-699-5565

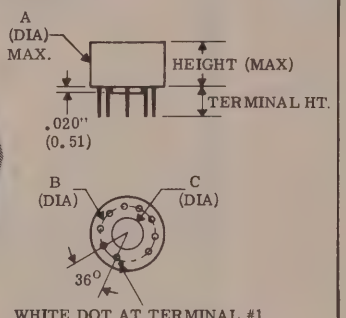
MINIATURIZED SWITCH MODE INVERTER TRANSFORMERS

50KHz-150KHz / 10 Watts-60 Watts

Engineers are increasing the frequency of operation in DC-DC Converters for higher power applications. The availability of power MOSFETS which do not exhibit some of the problems encountered with the bi-polar transistors help to ease the Designer's task. For this reason Pico has developed a series of standard 50KHz to 150KHz transformers for use in push-pull circuits.

For low power applications please consider our self saturating transformers shown on pages 20 and 21 which offer many advantages.

For your custom design applications please contact the Factory.



WHITE DOT AT TERMINAL #1
TERMINALS CLOCKWISE FROM PIN #1

Size	Max. Height	A Max. Dia.	B Bolt Circle	C Stand-Off	Terminal Dia.	Terminal Ht.	Wt. Nominal (Grams)
A	.350 (8.9)	.760 (19.3)	.580 (14.7)	.470 (11.9)	.028 (.71)	.150 (3.8)	8
B	.450 (11.4)	.870 (22.1)	.690 (17.5)	.590 (15.0)	.028 (.71)	.150 (3.8)	14
C	.510 (13.0)	1.110 (28.2)	.915 (23.2)	.750 (19.1)	.035 (.89)	.250 (6.4)	23
D	.650 (16.5)	1.260 (32.0)	1.040 (26.4)	.900 (22.9)	.035 (.89)	.250 (6.4)	37
E	.800 (20.3)	1.510 (38.4)	1.230 (31.2)	1.060 (26.9)	.035 (.89)	.250 (6.4)	54

All dimensions are in inches, ( ) = MM

FEATURES:

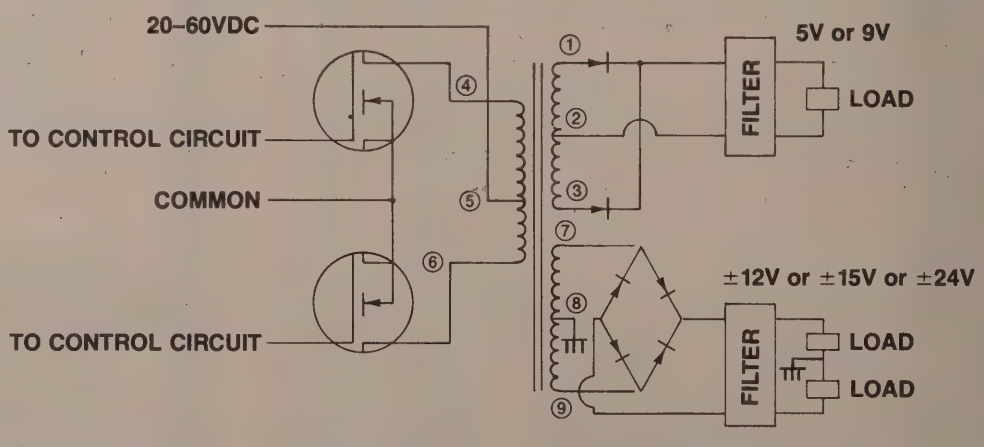
- ***Frequency Range 50KHz–150KHz***
- ***Ultra-Miniature Size***
- ***MIL-T-27***
- ***Can be used for both MOSFET and Bi-Polar drives***
- ***Magnetically Shielded***
- ***LITZ Wire for Maximum Efficiency***
- ***Special units can be supplied with higher or lower secondary voltages, addition of extra windings and taps, smaller size***

SPECIFICATIONS:

- Frequency Range 50KHz–150KHz
- 20 volt input corresponds to 45% duty cycle (i.e. 4.5μsec on time per pulse for 100KHz operation). Units have been designed with an additional 1 volt output to account for losses in switchers, transformer, rectifier and filter.
- MIL-T-27
  All units manufactured to MIL-T-27 and are hermetically sealed in a metal case, Type TF5S03ZZ
- Magnetically Shielded
- Operating Temperature ..... −55°C to +90°C
- Dielectric Strength ..... 500V RMS
- Insulation Resistance ..... Greater than 10,000 Megohms at 500V DC
- Thermal Shock ..... 25 Cycles, Method 107C, MIL-STD-202D. Test Conduction A-1

PUSH PULL CONVERTER

20 Volt input corresponds to 45% duty cycle (i.e. 4.5μsec on time per pulse for 100KHz operation). Units have been designed with an additional 1 Volt output to account for losses in switcher, transformer, rectifier and filter.



*For immediate engineering assistance or to place an order—**Call Toll Free 800-228-9747***

Delivery—stock to one week

PICO Electronics, Inc.

453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552 • • FAX 914-699-5565

POWER = 10 WATTS SIZE 0.76″ DIAM. × 0.35″ HT.

PICO MODEL NUMBER	INPUT VOLTAGE (DC)	SECONDARY OUTPUT #1 (DC)	SECONDARY OUTPUT #2 (DC)	TYPICAL* PRIMARY INDUCTANCE (mH)	TYPICAL** PRIMARY LEAKAGE INDUCTANCE (μH)	SIZE	*** PRICE 1–9
67010	20–60	5	±12	2	3.5	A	37.70
67030	20–60	5	±15	2	3.5	A	37.70
67050	20–60	5	±24	2	3.5	A	37.70
67070	20–60	9	±12	2	3.5	A	37.70
67090	20–60	9	±15	2	3.5	A	37.70
67110	20–60	9	±24	2	3.5	A	37.70

POWER = 20 WATTS SIZE 0.87″ DIAM. × 0.45″ HT.

PICO MODEL NUMBER	INPUT VOLTAGE (DC)	SECONDARY OUTPUT #1 (DC)	SECONDARY OUTPUT #2 (DC)	TYPICAL* PRIMARY INDUCTANCE (mH)	TYPICAL** PRIMARY LEAKAGE INDUCTANCE (μH)	SIZE	*** PRICE 1–9
67130	20–60	5	±12	2.5	4	B	44.35
67150	20–60	5	±15	2.5	4	B	44.35
67170	20–60	5	±24	2.5	4	B	44.35
67190	20–60	9	±12	2.5	4	B	44.35
67210	20–60	9	±15	2.5	4	B	44.35
67230	20–60	9	±24	2.5	4	B	44.35

POWER = 30 WATTS SIZE 1.11″ DIAM. × 0.51″ HT.

PICO MODEL NUMBER	INPUT VOLTAGE (DC)	SECONDARY OUTPUT #1 (DC)	SECONDARY OUTPUT #2 (DC)	TYPICAL* PRIMARY INDUCTANCE (mH)	TYPICAL** PRIMARY LEAKAGE INDUCTANCE (μH)	SIZE	*** PRICE 1–9
67250	20–60	5	±12	1	1	C	52.18
67270	20–60	5	±15	1	1	C	52.18
67290	20–60	5	±24	1	1	C	52.18
67310	20–60	9	±12	1	1	C	52.18
67330	20–60	9	±15	1	1	C	52.18
67350	20–60	9	±24	1	1	C	52.18

POWER = 45 WATTS SIZE 1.26″ DIAM. × 0.65″ HT.

PICO MODEL NUMBER	INPUT VOLTAGE (DC)	SECONDARY OUTPUT #1 (DC)	SECONDARY OUTPUT #2 (DC)	TYPICAL* PRIMARY INDUCTANCE (mH)	TYPICAL** PRIMARY LEAKAGE INDUCTANCE (μH)	SIZE	*** PRICE 1–9
67370	20–60	5	±12	0.7	0.35	D	61.40
67390	20–60	5	±15	0.7	0.35	D	61.40
67410	20–60	5	±24	0.7	0.35	D	61.40
67430	20–60	9	±12	0.7	0.35	D	61.40
67450	20–60	9	±15	0.7	0.35	D	61.40
67470	20–60	9	±24	0.7	0.35	D	61.40

POWER = 60 WATTS SIZE 1.51″ DIAM. × 0.80″ HT.

PICO MODEL NUMBER	INPUT VOLTAGE (DC)	SECONDARY OUTPUT #1 (DC)	SECONDARY OUTPUT #2 (DC)	TYPICAL* PRIMARY INDUCTANCE (mH)	TYPICAL** PRIMARY LEAKAGE INDUCTANCE (μH)	SIZE	*** PRICE 1–9
67490	20–60	5	±12	0.6	0.4	E	72.23
67510	20–60	5	±15	0.6	0.4	E	72.23
67530	20–60	5	±24	0.6	0.4	E	72.23
67550	20–60	9	±12	0.6	0.4	E	72.23
67570	20–60	9	±15	0.6	0.4	E	72.23
67590	20–60	9	±24	0.6	0.4	E	72.23

*MEASURED AT TERMINALS 4-6 WITH 5 VOLTS RMS-100KHz
**MEASURED AT TERMINALS 4-6 WITH 1-3 AND 7-9 SHORTED (0.IV RMS-300 KHz)
***DISCOUNT PRICES: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%

For immediate engineering assistance or to place an order— ***Call Toll Free 800-228-9747***

Delivery— stock to one week

PICO Electronics, Inc.

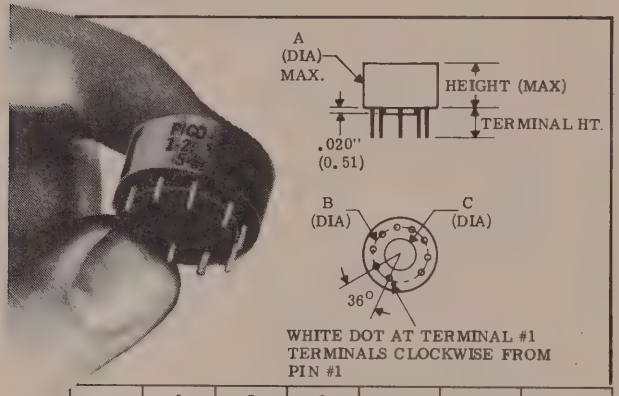
453 N. MacQuesten Pkwy., Mt. Vernon, N.Y. 10552 • • FAX 914-699-5565

MINIATURE FLYBACK CONVERTER TRANSFORMERS

10 Watts - 50 Watts / 50KHz - 100KHz

FEATURES:

- ***Frequency Range 50KHz–100KHz***
- ***Ultra-Miniature Size***
- ***MIL-T-27***
- ***Magnetically Shielded***
- ***Special units can be supplied with higher or lower secondary voltages, addition of extra windings and taps, smaller size***



Size	Max. Height	A Max. Dia.	B Bolt Circle	C Stand-off	Terminal Dia.	Terminal Ht.	Wt. Nominal (Grams)
A	.450 (11.4)	.870 (22.1)	.690 (17.5)	.590 (15.0)	.028 (.71)	.150 (3.8)	14
B	.510 (13.0)	1.110 (28.2)	.915 (23.2)	.750 (19.1)	.035 (.89)	.250 (6.4)	23
C	.650 (16.5)	1.260 (32.0)	1.040 (26.4)	.900 (22.9)	.035 (.89)	.250 (6.4)	37
D	.800 (20.3)	1.510 (38.4)	1.230 (31.2)	1.060 (26.9)	.035 (.89)	.250 (6.4)	54
E	.950 (24.13)	1.750 (44.45)	1.400 (35.56)	1.060 (26.92)	.035 (.89)	.250 (6.4)	80

All dimensions are in inches, ( ) = MM

These Transformers are used in flyback converters where from a wide range of input variation a regulated output is obtained. Circuit simplicity and multiple isolated outputs are some of the advantages of this topology.

All units can be supplied with higher or lower secondary voltages. Additional windings, taps or lower power are also available.

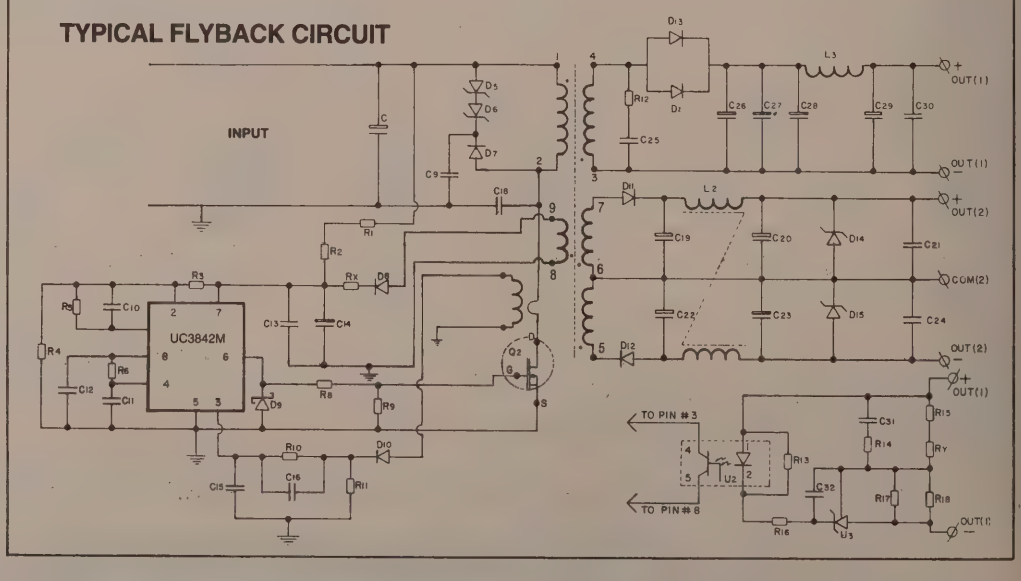
For low power applications please consider our self saturating transformers shown on pages 24 and 25 which offer many advantages.

For your custom design applications please contact the factory.

SPECIFICATIONS:

- Frequency Range 50KHz–100KHz
- MIL-T-27
  All units manufactured to MIL-T-27 and are hermetically sealed in a metal case, Type TF5S03ZZ
- Magnetically Shielded
- Operating Temperature .... −55°C to +130°C
- Ambient Temperature ..... −55°C to +90°C (full power)
- Dielectric Strength ..... 500V RMS
- Insulation Resistance ..... Greater than 10,000 Megohms at 500V DC
- Thermal Shock ..... 25 Cycles, Method 107C, MIL-STD-202D. Test Conduction A-1

TYPICAL FLYBACK CIRCUIT



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Mt. Vernon, N.Y. 10552

FAX 914-699-5565

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POWER = 10 WATTS SIZE .870″ DIAM. × .450″ HT.

PICO MODEL NUMBER	INPUT VOLTAGE (VOLTS)	SECONDARY OUTPUT #1 (VOLTS)	SECONDARY OUTPUT #2 (VOLTS)	TYPICAL* PRIMARY INDUCTANCE (MICROHENRY)	TYPICAL** PRIMARY LEAKAGE INDUCTANCE (NANOHENRY)	SIZE	*** PRICE 1–9
67600	8–24	5	±12	12 5	175	A	37.50
67605	8–24	5	±15	12.5	175	A	37.50
67610	8–24	5	±24	12.5	175	A	37 50
67615	18–36	5	±12	50	700	A	37.50
67620	18–36	5	±15	50	700	A	37.50
67725	18–36	5	±24	50	700	A	37 50
67730	36–72	5	±12	200	2800	A	37 50
67735	36–72	5	±15	200	2800	A	37.50
67740	36–72	5	±24	200	2800	A	37 50

POWER = 20 WATTS SIZE 1.110″ DIAM. × .510″ HT.

67745	8-24	5	±12	6.25	55	B	44.35
67750	8-24	5	± 15	6.25	55	B	44.35
67755	8-24	5	±24	6.25	55	B	44.35
67760	18-36	5	±12	25	215	B	44.35
67765	18-36	5	±15	25	215	B	44.35
67770	18-36	5	±24	25	215	B	44.35
67775	36-72	5	±12	100	860	B	44.35
67780	36-72	5	±15	100	860	B	44.35
67785	36-72	5	±24	100	860	B	44.35

POWER = 30 WATTS SIZE 1.260″ DIAM. × .650″ HT.

67790	8-24	5	±12	3.75	30	C	52.18
67795	8-24	5	±15	3.75	30	C	52 18
67800	8-24	5	±24	3.75	30	C	52 18
67805	18-36	5	±12	15	120	C	52 18
67810	18-36	5	±15	15	120	C	52 18
67815	18-36	5	±24	15	120	C	52.18
67820	36-72	5	±12	60	480	C	52.18
67825	36-72	5	±15	60	480	C	52.18
67830	36-72	5	±24	60	480	C	52.18

POWER = 40 WATTS SIZE 1.510″ DIAM. × .800″ HT.

67835	8-24	5	±12	2.5	20	D	61 40
67840	8-24	5	±15	2 5	20	D	61.40
67845	8-24	5	±24	2.5	20	D	61 40
67850	18-36	5	±12	10	70	D	61.40
67855	18-36	5	±15	10	70	D	61 40
67860	18-36	5	±24	10	70	D	61 40
67865	36-72	5	±12	40	280	D	61 40
67870	36-72	5	±15	40	280	D	61 40
67875	36-72	5	±24	40	280	D	61.40

POWER = 50 WATTS SIZE 1.750″ DIAM. × .950″ HT.

67880	8-24	5	±12	02	15	E	72.23
67885	8-24	5	±15	02	15	E	72 23
67890	8-24	5	±24	02	15	E	72 23
67895	18-36	5	±12	08	60	E	72 23
67900	18-36	5	±15	08	60	E	72.23
67905	18-36	5	±24	08	60	E	72 23
67910	36-72	5	±12	32	240	E	72 23
67915	36-72	5	±15	32	240	E	72 23
67920	36-72	5	±24	32	240	E	72 23

*MEASURED AT TERMINALS 4-6 WITH 5 VOLTS RMS-100KHz
**MEASURED AT TERMINALS 4-6 WITH 1-3 AND 7-9 SHORTED (O.IV RMS-300 KHz)
***DISCOUNT PRICES: 1-9 Net; 10-24 less 10%; 25-49 less 16%; 50-99 less 23%; 100-499 less 30%

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PLITRON
MANUFACTURING INC

TOROIDAL TRANSFORMERS

CUSTOM QUOTES WITHIN HOURS
PROTOTYPES WITHIN DAYS

THE TOROIDAL ADVANTAGE

HIGH ELECTRICAL EFFICIENCY

The continuously wound core of the toroidal transformer has no air gap, resulting in a stacking factor of 95% of its theoretical weight. Since all the windings are symmetrically spread over the entire round gapless core, a higher flux density is possible (toroidal transformers operate at flux densities of 16 to 18 kilogauss, while traditional laminated transformers operate at 12 to14 kilogauss). The magnetic flux is in the same direction as the grain oriented silicon steel core, thus achieving very high electrical efficiencies. Typical efficiency figures for toroidal transformers are 95%. Also, because of low magnetizing current, a toroid requires only 10% of the off load power required by conventional transformers.

SMALL SIZE AND WEIGHT

A product of the high efficiency of toroidal transformers is reduced size and weight. Typically 50% lighter and smaller than conventional laminated transformers. Furthermore, the diameter to height ratio of a toroid can easily be varied (as long as the cross sectional is held constant) to suit the mechanical design - great for low profile equipment.

LOW STRAY MAGNETIC FIELDS

Toroids have no air gaps, and windings are uniformly wound around the core, which results in insignificant amounts of magnetic radiation. This eliminates the need for special shielding and makes toroidal transformers especially suitable for applications in sensitive electronic equipment, such as: low level amplifiers, medical equipment, and CRTs.

REDUCED TRANSFORMER HUM

The absence of an air gap typically provides an 8:1 reduction of induced noise. In addition, the windings enveloping the core effectively reduce magnetostriction — the main source of the familiar 'hum' found in standard vertically laminated transformers.

LOW OPERATING TEMPERATURE

PLITRON toroids have Fe losses measured typically as 1.1 w/Kg. These low losses provide cooler operating temperatures and low magnetizing current.

EASY TO MOUNT

A single center screw quickly and easily mounts a toroidal transformer. Compared to laminated transformer mounting, this cuts down on parts as well as assembly time in your product.

PLITRON PRODUCTS

STANDARD POWER TRANSFORMER LINE

A broad range of high quality, UL and CSA approved, toroidal transformers. Designed for general purpose applications (specifications on facing page).

OEM POWER TRANSFORMER LINE

An economy version of the Standard Line. UL and CSA approved. Single, dual or multi-tapped primaries. 50 to 1500 VA.

ISOLATION TRANSFORMERS

A standard line of transformers to electrically isolate equipment from line. Medical (UL544, IEC601) and Commercial series.

AUDIO OUTPUT TRANSFORMERS

A standard line of output transformers for sound distribution. PLITRON has also developed a wide range of custom audio output transformers, including tube output.

CUSTOM TRANSFORMERS

Computer-aided design solutions for your demanding applications. To 10kVA.

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TOROIDAL TRANSFORMERS

UL Recognized and CSA Approved

STANDARD POWER TRANSFORMER LINE

PLITRON MANUFACTURING INC

DESCRIPTION

The Standard Power Transformer Line of toroids is characterized by its tight regulation, for applications where off load voltages are a concern; and very low temperature rise, which is useful for high ambient operating conditions, or where instantaneous power - in excess of rating- is required.

APPROVALS

All standard line products are UL recognized and CSA approved, and carry the respective labels.
UL file number E110277 for class A insulation systems. CSA file number LR-84566 to C22.2 #66-1982, General Requirements, Canadian Electrical Code, part II; and C22.2 #66-1988, Specialty Transformers Standard.
In addition, 50 Hz transformers are constructed to the commercial requirements of European approval agencies, such as VDE. Primary leadouts are double insulated.

INPUTS

Type A: 117 VAC at 60 Hz.
Type 7: Dual 115 VAC windings, series or parallel connected for 115 or 230 VAC at 50 / 60 Hz.
Type 5: Dual 0-100-120 VAC windings, series or parallel connected for 100, 120, 220 or 240 VAC at 50 / 60 Hz.

INSULATION

Primary to secondary: Polyester tape - class B (130°C), three layers minimum. Meets the test requirement of >2.5 kV for 1 minute, 50 Hz transformers: >4 kV.
Interwinding secondary (where required) and outer insulation: Polyester tape, two layers minimum.

TEMPERATURE RISE

Maximum 40°C. At maximum rated load, continuous.

0 8 A 0 2 6 0 0 0

VA Rating / Regulation

CODE	PWR VA	REG %
99	8	22
00	15	20
01	30	18
02	50	13
03	80	12
04	120	11
05	160	8
06	225	7
07	300	6
08	500	4
09	625	4
10	750	4
11	1000	4
12	1500	4

Input

CODE	APPLICATION DESCRIPTION
A	NORTH AMERICAN 117VAC 60Hz
7	NORTH AMERICAN / EUROPEAN 115/230VAC 50-60Hz
5	GLOBAL (optional*) 100/120/220/240VAC 50-60Hz

Screen Shield

CODE	DESCRIPTION APPLICATION
0	NONE
1	ELECTOSTATIC SCREEN * between primary and secondary
2	MAGNETIC SHIELD * external band
3	BOTH SCREEN & SHIELD *

Output

CODE	VAC RMS SEC1	SEC2	AVAILABILITY
10	6	6	8 VA
11	9	9	
12	12	12	
13	15	15	15 & 30 VA
14	18	18	
15	22	22	
16	25	25	
17	30	30	
18	35	35	
41	31	31	50 to 120VA
19	33	33	
26	40	40	160VA
25	45	45	
33	50	50	225VA
42	55	55	
52	60	60	300VA
28	110	—	
50	117	—	500 to 750 VA
29	220	—	
30	240	—	1000 VA
53	175	175	1500 VA

Output Current Rating RMS

= VA Rating / # of Outputs / Rated VAC

Leads

CODE	DESCRIPTION
0	MAGNET WIRE 200mm, 6mm stripped
1	STRANDED* 350mm, 6mm stripped

Thermal Protection

CODE	DESCRIPTION
0	NONE
1	THERMAL SWITCH*, auto resetting
2	THERMAL FUSE*, one shot

Mounting

CODE	DESCRIPTION
0	Metal disk, 2 Neoprene washers, Bolt, Nut & Flat washer
1	NONE
2	Epoxy Compound Potted and Drilled
3	Vertical Bracket

The part number above, 08A026000, would describe a 500 VA transformer with 117 VAC @ 60 Hz input; 2 x 40 VAC outputs @ 6.25A each; standard mounting hardware; and no options.

OUTPUTS

See output table of part number code.
Dual secondaries are bifilar wound where possible for optimum coupling, and theoretically perfect balancing.

OUTPUT TOLERANCE

Better than 3%, at full load.

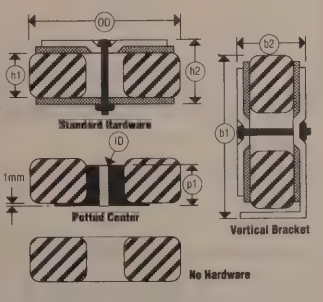
LOAD REGULATION

See VA rating / Regulation chart in figure 3, part number code. Figures given are for 60 Hz operation, for 50 Hz operation figures increase slightly. Consult factory.

MOUNTING

Standard: supplied with 1 steel cup disk, 2 neoprene washers, a bolt, nut and flat washer.

PWR VA	TYP. SIZE (mm) & WEIGHT OD	h1	h2	Kg	OTHER MOUNTING p1	ID	b1	b2
8	55	25	30	0.25	15	5	60	32
15	63	33	37	0 35	23	5	75	39
30	70	33	38	0.45	23	5	75	40
50	80	38	45	0 90	28	5	100	47
80	97	35	39	1 00	25	5	100	42
120	95	43	47	1.20	33	5	100	49
160	110	45	50	1 80	35	5	116	52
225	110	50	55	2 20	40	5	116	57
300	110	57	62	2 60	47	5	116	64
500	135	63	67	4.00	53	6 6	150	69
625	145	78	83	5 00	68	6.6	150	85
750	150	80	85	5 50	70	6 6	150	87
1000	160	80	85	6 30	70	12	170	87
1500	200	75	80	11.70	65	12	210	83



Potted Center: Epoxy compound potted center, drilled. Supplied with base insulating washer.
Vertical Bracket: supplied mounted to a steel bracket with standard hardware.

LEADS

Standard: Magnet wire self leads are PVC sleeved (surface printed UL VW-1, CSA 105°C) .031 wall. Stripped 6mm. Finished length: 200mm.
Optional*: Stranded tinned copper wire (CSA TEW, UL-1015, 105°C). Stripped 6mm. Finished length: 350mm.

THERMAL PROTECTION

Optional*: Normally closed thermal switch in series with primary, auto resetting, *or* a one shot thermal fuse. In series with primary for 60 Hz transformers. Separate lead outs for 50 Hz units, insulated stranded wire (yellow/green). Both open at 120°C core temperature. UL, CSA listed components.

ELECTROSTATIC SCREEN

Optional*: To reduce capacitive coupling, and/or create a physical barrier, between primary and secondary. Copper foil laminated between polyester tape. Wound over primary. Terminated at one end by insulated stranded wire (green / yellow).

MAGNETIC SHIELD

Optional*: To attenuate stray magnetic fields. Multiple layers of grain oriented silicon steel laminated between insulation. Wrapped around circumference of transformer. Increases OD by approx. 1mm.

* OPTIONS

Items marked * (screens, shields, thermal switch, and stranded leads) are subject to a minimum order of 10 units.

MECHANICAL

Typical size and weights listed in the chart left are for 117 VAC 60 Hz transformers. For 50 Hz transformers, size and weight increase slightly.

PART NUMBER CODE

Call PLITRON for assistance in structuring part numbers.

Call for our new, comprehensive, 16 page Toroidal Transformer brochure.

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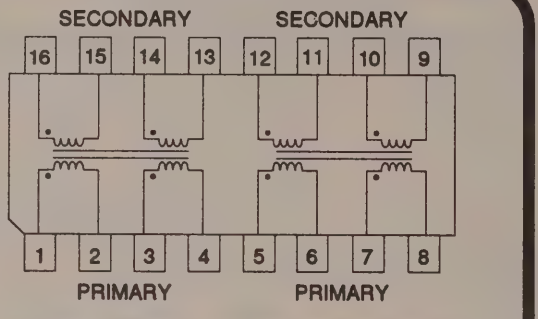
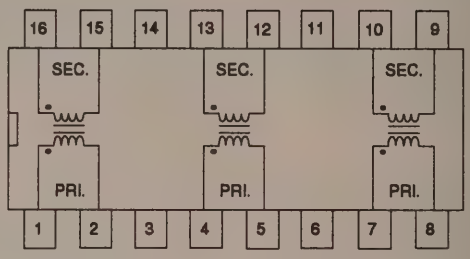
PREMIER MAGNETICS NETWORKING & TRANSFORMER PRODUCTS

Premier Magnetics Incorporated offers a broad line of standard products along with the most responsive engineering services available. Our capabilities range from high volume commercial products to high reliability military devices. Premier Magnetics committment to Quality, Service and Support provides cost effective solutions for the most demanding custom or standard applications. Premier Magnetics maintains a Quality System in compliance with ISO 9002 as well as the requirements of MIL-I-45208A.

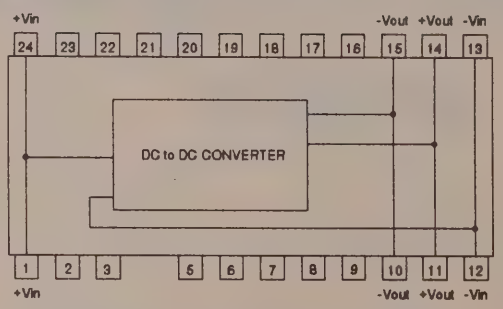
For detailed information on Premier Magnetics Networking Solutions, Transformers, Delay Lines and DC/DC Converters please contact the factory for our full line product catalogs and application manuals.



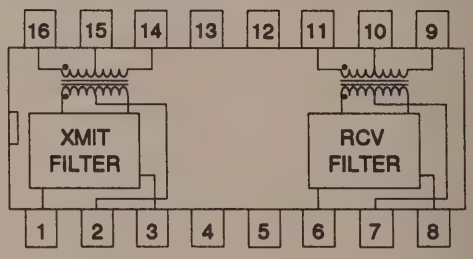
ISDN TRANSFORMERS



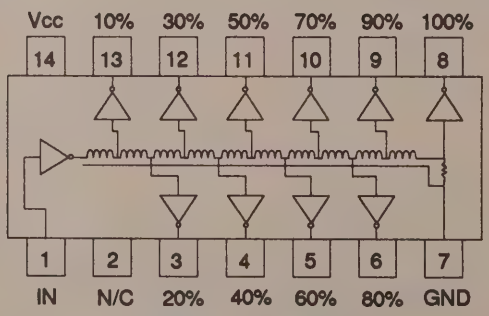
ETHERNET TRANSFORMERS



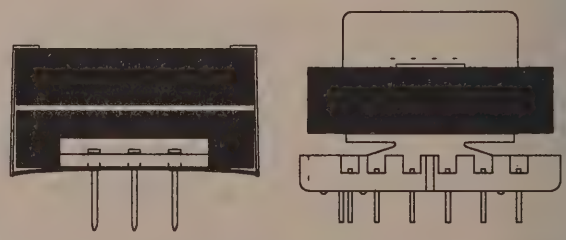
DC/DC CONVERTERS



10 BASE-T FILTERS



DELAY LINES



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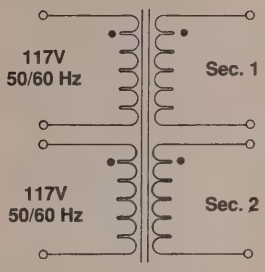
POWERTRONIX

STANDARD TOROIDAL POWER TRANSFORMERS



Power (VA)	Dimensions (OD x H)	Weight (lbs)
18	2.4" x 1.4"	0.7
36	2.8" x 1.6"	1.1
60	3.2" x 1.7"	1.5
100	3.9" x 1.6"	2.6
155	4.4" x 1.6"	3.7
200	4.4" x 1.9"	4.2
325	4.4" x 2.6"	6.2
440	5.3" x 2.3"	7.5
585	5.3" x 2.8"	9.0
690	5.3" x 3.2"	10.3
800	6.3" x 2.5"	11.5
990	6.3" x 2.9"	13.2
1100	6.3" x 3.2"	15.4

DESCRIPTION:

Powertronix Standard Toroidal Power Transformers are designed for step-down voltages or for use in transformer rectifier and filter circuits.

SAFETY APPROVALS:

UL 506 (File # E142730)
CSA 22.2, No. 66 (File # LR 78662)

SPECIFICATIONS:

Primary: 2 x 117 Volt, 50/60 Hz
Secondary: Dual windings, which can be connected in series or parallel
Power: 18 - 1,100 VA
Hi-pot: 4,000 VAC RMS
Mounting: One metal disk and two rubber gaskets included with each transformer.

Part Number AA-	Power (VA)	AC Output Series VCT @ AAC	DC Output with FWBR Series VDC @ ADC	DC Output with FWBR Parallel VDC @ ADC
50018-012	18	12 @ 1.5	13.2 @ 1.0	5.6 @ 2.0
50036-012	36	12 @ 2.9	13.4 @ 1.9	5.7 @ 3.7
50060-012	60	12 @ 5.0	13.6 @ 3.2	5.8 @ 5.9
50018-018	18	18 @ 1.0	21.0 @ 0.6	9.5 @ 1.3
50036-018	36	18 @ 1.9	20.8 @ 1.2	9.4 @ 2.5
50060-018	60	18 @ 3.3	21.4 @ 2.1	9.7 @ 3.9
50100-018	100	18 @ 5.6	21.4 @ 3.2	9.7 @ 6.4
50018-024	18	24 @ 0.8	28.4 @ 0.5	13.2 @ 1.0
50036-024	36	24 @ 1.5	28.6 @ 0.9	13.3 @ 1.9
50060-024	60	24 @ 2.5	29.0 @ 1.6	13.5 @ 3.0
50100-024	100	24 @ 4.2	29.4 @ 2.4	13.7 @ 4.8
50155-024	155	24 @ 6.5	30.0 @ 3.5	14.0 @ 7.0
50200-024	200	24 @ 8.3	29.6 @ 4.5	13.8 @ 9.0
50325-024	325	24@13.5	29.4 @ 7.2	13.6@14.3
50018-030	18	30 @ 0.6	36.0 @ 0.4	17.0 @ 0.8
50036-030	36	30 @ 1.2	36.4 @ 0.7	17.2 @ 1.5
50060-030	60	30 @ 2.0	36.8 @ 1.3	17.4 @ 2.4
50100-030	100	30 @ 3.3	37.4 @ 1.9	17.7 @ 3.8
50155-030	155	30 @ 5.2	37.6 @ 3.3	17.8 @ 6.1
50200-030	200	30 @ 6.7	37.6 @ 3.7	17.8 @ 7.3
50325-030	325	30@10.8	38.2 @ 5.7	18.1@11.4
50018-036	18	36 @ 0.5	43.4 @ 0.3	20.7 @ 0.6
50036-036	36	36 @ 1.0	44.0 @ 0.6	21.0 @ 1.2
50060-036	60	36 @ 1.7	44.6 @ 1.1	21.3 @ 2.0
50100-036	100	36 @ 2.8	45.0 @ 1.7	21.5 @ 3.3
50155-036	155	36 @ 4.3	46.0 @ 2.3	22.0 @ 4.5
50200-036	200	36 @ 5.5	45.8 @ 3.0	21.9 @ 6.0
50325-036	325	36 @ 9.0	46.0 @ 4.6	22.0 @ 9.2
50440-036	440	36@12.2	46.0 @ 6.1	22.0@12.3
50018-044	18	44 @ 0.4	53.4 @ 0.3	25.7 @ 0.5
50036-044	36	44 @ 0.8	54.2 @ 0.5	26.1 @ 1.0
50060-044	60	44 @ 1.4	55.0 @ 0.9	26.5 @ 1.7
50100-044	100	44 @ 2.3	55.2 @ 1.4	26.6 @ 2.7
50155-044	155	44 @ 3.5	56.2 @ 1.9	27.1 @ 3.7
50200-044	200	44 @ 4.5	56.6 @ 2.5	27.3 @ 4.9

Part Number AA-	Power (VA)	AC Output Series VCT @ AAC	DC Output with FWBR Series VDC @ ADC	DC Output with FWBR Parallel VDC @ ADC
50060-048	60	48 @ 1.3	60.2 @ 0.8	29.1 @ 1.5
50100-048	100	48 @ 2.1	60.8 @ 1.2	29.4 @ 2.4
50155-048	155	48 @ 3.2	61.2 @ 1.7	29.6 @ 3.4
50200-048	200	48 @ 4.2	61.4 @ 2.3	29.7 @ 4.6
50325-048	325	48 @ 6.8	62.0 @ 3.6	30.0 @ 7.1
50440-048	440	48 @ 9.2	62.2 @ 4.6	30.1 @ 9.2
50585-048	585	48@12.2	62.6 @ 6.0	30.3@11.8
50690-048	690	48@14.4	63.0 @ 7.0	30.5@14.0
50800-048	800	48@16.7	63.2 @ 7.4	30.6@14.9
50990-048	990	48@20.6	63.2 @ 9.7	30.2@19.5
51100-048	1100	48@22.9	62.4@10.7	30.2@21.5
50100-056	100	56 @ 1.8	71.2 @ 1.1	34.6 @ 2.1
50155-056	155	56 @ 2.8	72.0 @ 1.6	35.0 @ 3.1
50200-056	200	56 @ 3.6	72.4 @ 1.9	35.2 @ 3.8
50100-060	100	60 @ 1.7	76.6 @ 1.0	37.3 @ 1.9
50155-060	155	60 @ 2.6	77.2 @ 1.4	37.6 @ 2.8
50200-060	200	60 @ 3.3	77.2 @ 1.8	37.6 @ 3.5
50325-060	325	60 @ 5.4	78.0 @ 2.9	38.0 @ 5.8
50440-060	440	60 @ 7.3	78.6 @ 3.7	38.3 @ 7.3
50585-060	585	60 @ 9.7	78.6 @ 5.0	38.3 @ 9.8
50690-060	690	60@11.5	79.0 @ 5.5	38.5@11.0
50800-060	800	60@13.3	79.0 @ 6.3	38.5@12.6
50990-060	990	60@16.5	79.0 @ 7.8	38.5@15.5
50690-066	690	66@10.5	87.4 @ 5.1	42.7@10.2
50325-076	325	76 @ 4.3	99.6 @ 2.2	48.8 @ 4.5
50440-076	440	76 @ 5.8	100.0 @ 3.0	49.0 @ 5.8
50585-076	585	76 @ 7.7	100.4 @ 3.8	49.2 @ 7.7
50690-076	690	76 @ 9.1	100.8 @ 4.3	49.4 @ 8.6
50990-076	990	76@13.0	101.4 @ 6.1	49.7@12.1
51100-084	1100	84@13.0	112.2 @ 6.1	55.1@12.1
50990-096	990	96@10.3	128.2 @ 4.8	63.1 @ 9.5

All data are typical values and subject to change without prior notice.

POWERTRONIX *703 Cayman Lane, Foster City, CA 94404*
Tel: (415) 345-6800 Fax: (415) 345-7240

POWERTRONIX

CUSTOM MADE TOROIDAL POWER TRANSFORMERS

DESCRIPTION:

Powertronix Custom made Toroidal Power Transformers are designed and made according to customer specification.

MOUNTING:

- One metal disk and two rubber gaskets
- Center-potted with a thru-hole
- Encapsulate in a round can
- Assembled between two mounting plates

LEAD TERMINATIONS:

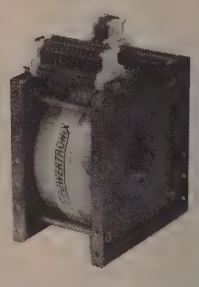
- Solid wires in a sleeving
- Stranded flexible wires
- Leads terminated with AMP, MOLEX, CORCOM or other customer specified terminals

SPECIFICATIONS:

- **Power:** 18 VA – 10,000 VA
- **Frequency:** 47 Hz – 2,000 Hz
- **Primary:** Customer specified
- **Secondary:** Customer specified
- **Efficiency:** 98% – 85%
- **Isolation:** 4,000 VRMS
- **Creepage:** Minimum 8 mm
- **Temperature rise:** Customer specified
- **Voltage tolerance:** Better than 3%

SAFETY APPROVALS:

- UL 506 (File # E 142730)
- UL 544 (File # E 151895)
- CSA 22.2, No. 66 (File # LR 78662)



Power (VA)	No-load loss (W)	Copper loss (W)	Dimensions OD x H (inches)	Weight (lbs)	Dimensions OD x H (inches)	Weight (lbs)	Dimensions L x W (inches)	Weight (lbs)
18	0.3	3.5	2.4" x 1.4"	0.7	2.6" x 1.6"	0.9		
36	0.4	7.0	2.8" x 1.5"	1.1	2.9" x 1.6"	1.2		
60	0.6	11.0	3.2" x 1.7"	1.5	3.4" x 1.7"	1.8		
70	0.7	13.5	3.2" x 1.8"	2.3	3.8" x 1.8"	2.4		
80	0.8	15.5	3.8" x 1.5"	2.6	4.1" x 1.8"	2.7	4.0" x 2.4"	2.7
100	0.8	17.9	3.9" x 1.6"	2.8	4.1" x 1.8"	2.9	4.0" x 2.5"	3.3
125	1.0	20.0	3.9" x 1.8"	2.9	4.1" x 2.0"	3.1	4.0" x 2.7"	3.5
155	1.3	22.5	4.4" x 1.6"	3.7	5.0" x 2.1"	4.1	4.7" x 2.6"	4.1
200	1.6	25.0	4.4" x 1.9"	4.2	5.0" x 2.1"	4.6	4.7" x 2.9"	4.6
250	2.1	25.0	4.4" x 2.4"	5.5	5.0" x 2.6"	5.9	4.7" x 3.4"	5.9
325	2.2	30.0	4.4" x 2.7"	6.2	5.5" x 2.7"	6.6	4.7" x 3.7"	7.2
440	2.7	36.0	5.3" x 2.4"	7.5	5.8" x 3.5"	9.3	5.7" x 3.4"	9.3
585	3.3	39.0	5.3" x 2.8"	9.0	5.8" x 3.5"	9.9	5.7" x 3.8"	10.8
690	4.0	43.0	5.4" x 3.2"	11.0	6.0" x 3.4"	12.4	5.7" x 4.5"	12.8
800	4.4	48.0	6.3" x 2.5"	12.1			6.9" x 3.8"	13.9
990	5.1	53.0	6.4" x 3.0"	13.4			6.9" x 4.3"	15.2
1100	6.1	55.0	6.4" x 3.3"	15.6			6.9" x 4.6"	17.4
1300	6.3	63.0	7.9" x 2.6"	19.4			8.3" x 3.9"	22.0
1600	7.1	65.0	7.9" x 3.0"	23.1			8.3" x 4.3"	26.4
1900	8.2	69.0	7.9" x 3.3"	26.4			8.3" x 4.6"	28.6
2200	9.1	77.0	8.7" x 3.3"	28.6			8.9" x 4.6"	33.0
2500	9.7	82.0	8.7" x 3.5"	33.0			8.9" x 4.8"	37.4
2800	11.0	93.0	9.7" x 3.2"	35.2			9.8" x 4.9"	39.6
3200	13.0	97.0	9.7" x 3.5"	41.8			9.8" x 5.2"	46.2
3700	15.0	102.0	9.7" x 3.9"	46.2			9.8" x 5.6"	52.8
4400	17.0	117.0	10.8" x 3.7"	52.8			11.2" x 5.4"	61.6
5000	20.0	125.0	10.8" x 4.1"	61.6			11.2" x 5.8"	68.2
6300	27.0	140.0	12.4" x 4.7"	74.8			13.8" x 6.4"	81.4
8000	28.0	150.0	13.4" x 4.7"	88.0			13.8" x 6.4"	96.8
10000	30.0	160.0	13.4" x 5.9"	118.8			13.8" x 7.6"	127.6

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POWERTRONIX *703 Cayman Lane, Foster City, CA 94404*
Tel: (415) 345-6800 Fax: (415) 345-7240

POWERTRONIX

TOROIDAL TRANSFORMERS

UL544

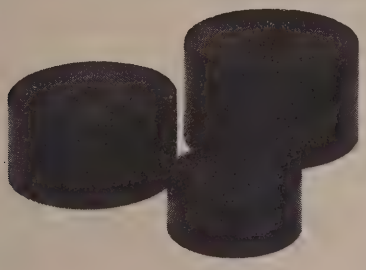
MEDICAL ISOLATION TRANSFORMERS

SPECIFICATIONS:

- **Input:** 2 x (0-100-120) Volt, 50/60 Hz
- **Output:** 2 x 120 Volt
- **Power:** 100 VA – 10,000 VA
- **Isolation:** 4,000 VRMS
- **Leakage current:** < 50 uAmps
- **Overtemperature Protector.**

SAFETY APPROVALS: UL 544 (File # E 151895)
CSA 22.2, No. 66 (File # LR 78662)

SAFETY COMPLIANCE: IEC 601-1, VDE 750, CSA 22.2 No. 601.1



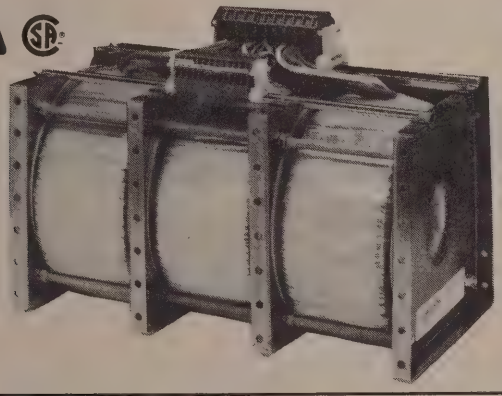
ENCAPSULATED AUDIO POWER TRANSFORMERS

SPECIFICATIONS:

- **Power:** 18 VA – 1,200 VA
- **Size:** Diameter = 2.6" – 7.0"
  Height = 1.6" – 7.0"
- **Input:** Customer specified
- **Output:** Customer specified

FEATURES:

- Ultra Low Noise
- Ultra Low Output Impedance

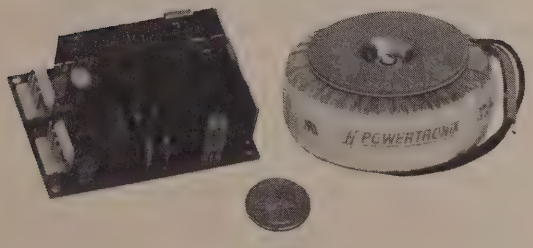


3 PHASE TOROIDAL POWER TRANSFORMERS

SPECIFICATIONS:

- **Power:** 300 VA – 30,000 VA
- **Input:** Customer specified
- **Output:** Customer specified
- **Mounting:** Assembled or separate

SAFETY APPROVALS: UL 506 (File # E 142730)
CSA 22.2, No. 66
(File #LR 78662)



MODULAR AC-DC CONVERTERS

SPECIFICATIONS:

- **Power:** 15 W – 335 W
- **Input:** 2 x 117 Volt, 50/60 Hz
- **Output:** 5 VDC, 12 VDC, 15 VDC, 24 VDC and 28 VDC
- **Current:** 3 ADC, 5 ADC and 12 ADC
- **Size:** 2.3" x 3.3" x 1.5"

FEATURES:

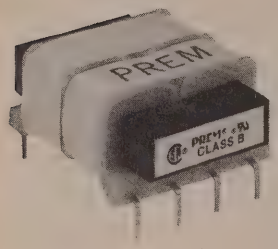
- Short circuit proof
- Current limited
- Low current shut down

Please call us for Full Line Catalogue

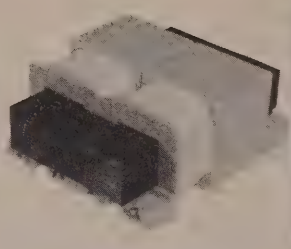
POWERTRONIX *703 Cayman Lane, Foster City, CA 94404*
Tel: (415) 345-6800 Fax: (415) 345-7240

Prem International Series

Low Profile, Interchangeable, VDE-Approved PC Power Transformers



SPW-300



SPW-2300

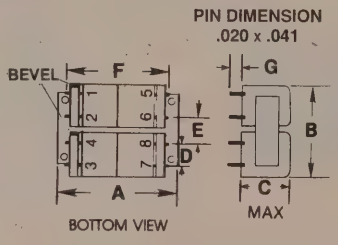
SPW-2300 Series*	—	UL - #1950, #1446, #1585 (Class II & Class III)
	—	VDE - #0805
	—	IEC - #950
SPW-300 Series	—	UL - #506
	—	CSA - 22.2#66-1988 General Purpose

* Approvals Pending

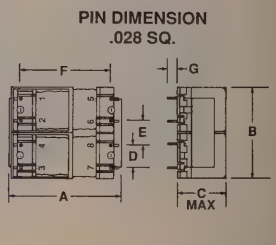
Prem Magnetics, Inc., is proud to announce the introduction of its latest series of Low Profile Printed Circuit Power Transformers. The SPW-2300 Series is rated at 12.0 VA and has outputs ranging from 5.0 VAC to 230 VAC. This series is interchangeable with Prem's SPW-300 (and its competitors') series, having the same pin-out, physical dimensions, and electrical ratings.

Designed for International markets, approvals are pending for IEC 950, VDE 0805, UL 1950 and UL 1585 Class II and III standards.

The SPW-2300 Series transformers, like all Prem products, feature quality construction and design. In addition to shrouded primaries, each transformer has insulating anchor and crossover tapes. Each Prem unit is totally immersed in 100% solids epoxy to withstand aqueous and solvent PC board cleaning systems.



SPW-300



SPW-2300

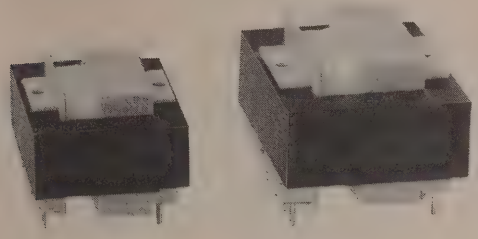
	SPW-300 and SPW-2300
VA	12.0
A	2.500
B	2.000
C	1.065
D	.500
E	.500
F	2.000
G	.200

115/230V DUAL PRIMARIES	SECONDARY	
PART NO.	PARALLEL	SERIES
SPW-300 and SPW-2300	5V @ 2.4A	10V CT @ 1.2A
SPW-301 and SPW-2301	6.3V @ 1.8A	12.6V CT @ 900 mA
SPW-302 and SPW-2302	8V @ 1.4A	16V CT @ 700 mA
SPW-303 and SPW-2303	10V @ 1.2A	20V CT @ 600 mA
SPW-304 and SPW-2304	12V @ 1.0A	24V CT @ 500 mA
SPW-305 and SPW-2305	17V @ 680 mA	34V CT @ 340 mA
SPW-306 and SPW-2306	20V @ 600 mA	40V CT @ 300 mA
SPW-307 and SPW-2307	28V @ 400 mA	56V CT @ 200 mA
SPW-308 and SPW-2308	44V @ 260 mA	88V CT @ 130 mA
SPW-309 and SPW-2309†	60V @ 200 mA	120V CT @ 100 mA
SPW-310 and SPW-2310†	115V @ 100 mA	230V CT @ 50 mA
SPW-311 and SPW-2311	15V @ 800 mA	30V CT @ 400 mA

† Voltage ratings can not be approved under UL 1585

PREM® MAGNETICS, INCORPORATED
3521 N Chapel Hill Road. • McHenry, IL 60050
Tel (815) 385-2700 • FAX: (815) 385-8578

Prem International Series



International Series

(Listed by UL, CSA, IEC and VDE)

UL —#1950, #1446, #1585 Class II, III
VDE —#0805
IEC —#950
CSA —22.2 No. 66-1988 General Purpose

Construction

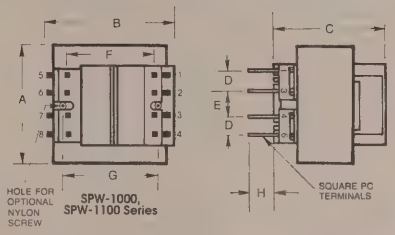
Primary Voltages:
Pins 1-2 3-4
115/230 Volts 50/60 Hz

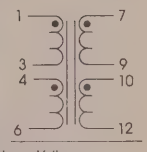
We never compromise on any design feature that might cause you quality problems down the road. This new series of Prem PC power transformers has anchor, insulating and crossover tapes as well as shrouded primaries. Our transformers are not bifilar wound, but have two distinct, separate windings for each primary and each secondary assuring an excellent dielectric HIPOT capability between these dual windings. Prem units are totally immersed in 100% solids epoxy, resulting in capability to withstand aqueous and solvent cleaning systems. All this at a price below our competition means more value for your money!

Testing

All of Prem units are 100% final tested on automated panels for induced voltage (short turns), exciting current, open circuit voltage (turns ratio), polarity (phasing) and dielectric strength. This International Series also undergoes a **4500 VRMS Dielectric Strength (HIPOT).**

	SPW 1000	SPW 1100	SPW 1200	SPW 1300
VA	2.5	5.0	10.0	20.0
A	1.625	1.625	1.875	2.250
B	1.500	1.500	1.562	1.875
C	1.125	1.375	1.375	1.625
D	.200	.200	.200	.400
E	.250	.400	.400	.400
F	1.000	1.000	1.140	1.460
G	1.062	1.062	1.250	1.500
Screw Size	#4	#4	#4	#4
H	.187 min	.187 min	.187 min	.187 min
Pin Size	.025 sq.	.025 sq.	.036 sq.	.036 sq.





Primary Voltages:
Pins 1-3 4-6
115/230 Volts 50/60 Hz

No electro-static shield required

VA	Part No.	Secondary RMS Rating Parallel	Secondary RMS Rating Series
2.5	SPW 1000	5V @ 500 mA	10V CT @ 250 mA
	SPW 1001	6.3V @ 400 mA	12.6V CT @ 200 mA
	SPW 1002	8V @ 300 mA	16V CT @ 150 mA
	SPW 1003	10V @ 240 mA	20V CT @ 120 mA
	SPW 1004	12V @ 200 mA	24V CT @ 100 mA
	SPW 1005	14V @ 180 mA	28V CT @ 90 mA
	SPW 1006	18V @ 140 mA	36V CT @ 70 mA
5.0	SPW 1100	5V @ 1.0A	10V CT @ 500 mA
	SPW 1101	6.3V @ 800 mA	12.6V CT @ 400 mA
	SPW 1102	8V @ 620 mA	16V CT @ 310 mA
	SPW 1103	10V @ 500 mA	20V CT @ 250 mA
	SPW 1104	12V @ 420 mA	24V CT @ 210 mA
	SPW 1105	14V @ 360 mA	28V CT @ 180 mA
	SPW 1106	18V @ 280 mA	36V CT @ 140 mA
10.0	SPW 1200	5V @ 2.0A	10V CT @ 1.0A
	SPW 1201	6.3V @ 1.6A	12.6V CT @ 800 mA
	SPW 1202	8V @ 1.25 A	16V CT @ 620 mA
	SPW 1203	10V @ 1.0A	20V CT @ 500 mA
	SPW 1204	12V @ 840 mA	24V CT @ 420 mA
	SPW 1205	14V @ 720 mA	28V CT @ 360 mA
	SPW 1206	18V @ 560 mA	36V CT @ 280 mA
20.0	SPW 1300	5V @ 4.0A	10V CT @ 2.0A
	SPW 1301	6.3V @ 3.2A	12.6V CT @ 1.6A
	SPW 1302	8V @ 2.5A	16V CT @ 1.25A
	SPW 1303	10V @ 2.0A	20V CT @ 1.0A
	SPW 1304	12V @ 1.66A	24V CT @ 830mA
	SPW 1305	14V @ 1.44A	28V CT @ 720 mA
	SPW 1306	18V @ 1.12A	36V CT @ 560 mA

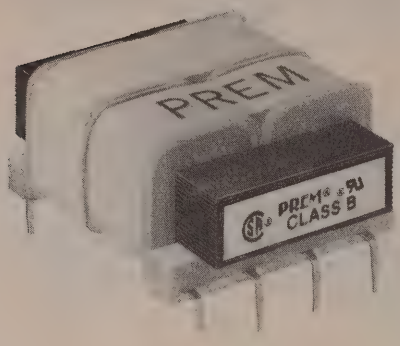
NOTE: Primary and secondary windings are designed to be used as one primary and one secondary winding with either parallel or series connection only.

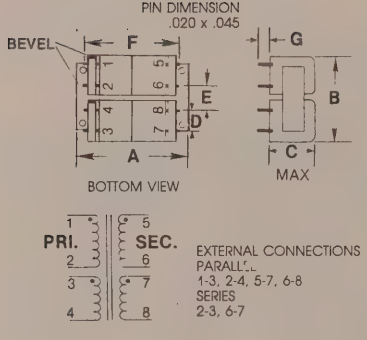
PREM® MAGNETICS, INCORPORATED
3521 N Chapel Hill Road. • McHenry, IL 60050
Tel. (815) 385-2700 • FAX: (815) 385-8578

PC Power Transformers

Recognized Component
Underwriters Labs, Inc.

Certified Component
Canadian Standard Association





- Three flange bobbin design — 1500 VRMS Highpot
- No electro-static shield required

Other primary and secondary voltages may be custom-designed to your specifications. Since 12 terminals are available, tapped primaries or secondaries may also be utilized.

	SPW 050	SPW 100	SPW 150	SPW 300
VA	2.5	6.0	9.0	12.0
A	1.875	1.875	1.875	2.500
B	1.562	1.562	1.562	2.000
C	.660	.850	1.080	1.065
D	.375	.375	.375	.500
E	.375	.375	.375	.500
F	1.600	1.600	1.600	2.000
G	.200	.200	.200	.200

LOW PROFILE POWER TRANSFORMERS

	115/230V DUAL PRIMARIES	SECONDARY	
VA	PART NO.	PARALLEL	SERIES
2.5	SPW-050	5V @ 500 mA	10V CT @ 250 mA
	SPW-051	6.3V @ 400 mA	12.6V CT @ 200 mA
	SPW-052	8V @ 300 mA	16V CT @ 150 mA
	SPW-053	10V @ 250 mA	20V CT @ 125 mA
	SPW-054	12V @ 200 mA	24V CT @ 100 mA
	SPW-055	17V @ 150 mA	34V CT @ 75 mA
	SPW-056	20V @ 120 mA	40V CT @ 60 mA
	SPW-057	28V @ 90 mA	56V CT @ 45 mA
	SPW-058	44V @ 56 mA	88V CT @ 28 mA
	SPW-059	60V @ 40 mA	120V CT @ 20 mA
	SPW-060	115V @ 20 mA	230V CT @ 10 mA
	SPW-061	15V @ 170 mA	30V CT @ 85 mA
6.0	SPW-100	5V @ 1.2A	10V CT @ 600 mA
	SPW-101	6.3V @ 900 mA	12.6V CT @ 450 mA
	SPW-102	8V @ 700 mA	16V CT @ 350 mA
	SPW-103	10V @ 600 mA	20V CT @ 300 mA
	SPW-104	12V @ 500 mA	24V CT @ 250 mA
	SPW-105	17V @ 340 mA	34V CT @ 170 mA
	SPW-106	20V @ 300 mA	40V CT @ 150 mA
	SPW-107	28V @ 200 mA	56V CT @ 100 mA
	SPW-108	44V @ 130 mA	88V CT @ 65 mA
	SPW-109	60V @ 100 mA	120V CT @ 50 mA
	SPW-110	115V @ 50 mA	230V CT @ 25 mA
	SPW-111	15V @ 400 mA	30V CT @ 200 mA
9.0	SPW-150	5V @ 1.80A	10V CT @ 900 mA
	SPW-151	6.3V @ 1.43A	12.6V CT @ 715 mA
	SPW-152	8.0V @ 1.125A	16.0V CT @ 562 mA
	SPW-153	10.0V @ 900 mA	20.0V CT @ 450 mA
	SPW-154	12.0V @ 750 mA	24.0V CT @ 375 mA
	SPW-155	17.0V @ 530 mA	34.0V CT @ 265 mA
	SPW-156	20.0V @ 450 mA	40.0V CT @ 225 mA
	SPW-157	28.0V @ 322 mA	56.0V CT @ 161 mA
	SPW-158	44.0V @ 204 mA	88.0V CT @ 102 mA
	SPW-159	60.0V @ 150 mA	120.0V CT @ 75 mA
	SPW-160	115.0V @ 78 mA	230.0V CT @ 39 mA
	SPW-161	15.0V @ 600 mA	30.0V CT @ 300 mA
12.0	SPW-300	5V @ 2.4A	10V CT @ 1.2A
	SPW-301	6.3V @ 1.8A	12.6V CT @ 900 mA
	SPW-302	8V @ 1.4A	16V CT @ 700 mA
	SPW-303	10V @ 1.2A	20V CT @ 600 mA
	SPW-304	12V @ 1.0A	24V CT @ 500 mA
	SPW-305	17V @ 680 mA	34V CT @ 340 mA
	SPW-306	20V @ 600 mA	40V CT @ 300 mA
	SPW-307	28V @ 400 mA	56V CT @ 200 mA
	SPW-308	44V @ 260 mA	88V CT @ 130 mA
	SPW-309	60V @ 200 mA	120V CT @ 100 mA
	SPW-310	115V @ 100 mA	230V CT @ 50 mA
	SPW-311	15V @ 800 mA	30V CT @ 400 mA

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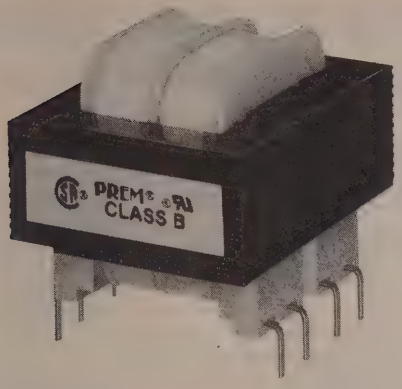
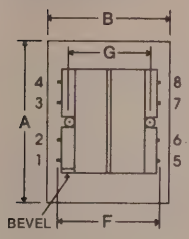
PC Power Transformers

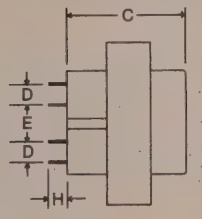
Recognized Component
Underwriters Labs. Inc

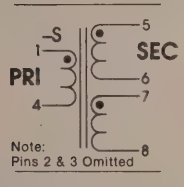
Certified Component
Canadian Standard Association

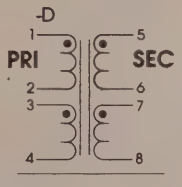


PIN DIMENSION
.020 x .041









- Three flange bobbin design — 2500 VRMS Highpot
- No electro-static shield required

Other primary and secondary voltages may be custom-designed to your specifications.

	SPW 350	SPW 400	SPW 500	SPW 600	SPW 610	SPW 620
VA	1.1	2.4	6.0	12.0	20.0	36.0
A	1.375	1.375	1.625	1.875	2.250	2.625
B	1.125	1.125	1.312	1.562	1.875	2.187
C	.937	1.187	1.290	1.437	1.410	1.562
D	.250	.250	.250	.300	.300	.400
E	.250	.250	.350	.400	.400	.400
F	1.200	1.200	1.270	1.410	1.600	1.850
G	N/A	N/A	1.062	1.250	1.500	NOTE
Screw Size	N/A	N/A	#4	#4	#4	#6
H	.200	.200	.200	.200	.200	.200

VA	PART NO.* SINGLE 115V 6 pin	PART NO.* DUAL 115/230V 8 pin	SECONDARY PARALLEL	SECONDARY SERIES
1.1	SPW-350-S	SPW-350-D	5V @ 220 mA	10V CT @ 110 mA
	SPW-351-S	SPW-351-D	6.3V @ 180 mA	12.6V CT @ 90 mA
	SPW-352-S	SPW-352-D	8V @ 140 mA	16V CT @ 70 mA
	SPW-353-S	SPW-353-D	10V @ 110 mA	20V CT @ 55 mA
	SPW-354-S	SPW-354-D	12V @ 90 mA	24V CT @ 45 mA
	SPW-355-S	SPW-355-D	14V @ 80 mA	28V CT @ 40 mA
	SPW-356-S	SPW-356-D	18V @ 60 mA	36V CT @ 30 mA
	SPW-357-S	SPW-357-D	24V @ 46 mA	48V CT @ 23 mA
	SPW-358-S	SPW-358-D	28V @ 40 mA	56V CT @ 20 mA
	SPW-359-S	SPW-359-D	60V @ 20 mA	120V CT @ 10 mA
2.4	SPW-400-S	SPW-400-D	5V @ 500 mA	10V CT @ 250 mA
	SPW-401-S	SPW-401-D	6.3V @ 400 mA	12.6V CT @ 200 mA
	SPW-402-S	SPW-402-D	8V @ 300 mA	16V CT @ 150 mA
	SPW-403-S	SPW-403-D	10V @ 240 mA	20V CT @ 120 mA
	SPW-404-S	SPW-404-D	12V @ 200 mA	24V CT @ 100 mA
	SPW-405-S	SPW-405-D	14V @ 170 mA	28V CT @ 85 mA
	SPW-406-S	SPW-406-D	18V @ 130 mA	36V CT @ 65 mA
	SPW-407-S	SPW-407-D	24V @ 100 mA	48V CT @ 50 mA
	SPW-408-S	SPW-408-D	28V @ 90 mA	56V CT @ 45 mA
	SPW-409-S	SPW-409-D	60V @ 40 mA	120V CT @ 20 mA
6.0	SPW-500-S	SPW-500-D	5V @ 1.2A	10V CT @ 600 mA
	SPW-501-S	SPW-501-D	6.3V @ 1.0A	12.6V CT @ 500 mA
	SPW-502-S	SPW-502-D	8V @ 800 mA	16V CT @ 400 mA
	SPW-503-S	SPW-503-D	10V @ 600 mA	20V CT @ 300 mA
	SPW-504-S	SPW-504-D	12V @ 500 mA	24V CT @ 250 mA
	SPW-505-S	SPW-505-D	14V @ 400 mA	28V CT @ 200 mA
	SPW-506-S	SPW-506-D	18V @ 340 mA	36V CT @ 170 mA
	SPW-507-S	SPW-507-D	24V @ 250 mA	48V CT @ 125 mA
	SPW-508-S	SPW-508-D	28V @ 220 mA	56V CT @ 110 mA
	SPW-509-S	SPW-509-D	60V @ 100 mA	120V CT @ 50 mA
12.0	SPW-600-S	SPW-600-D	5V @ 2.4A	10V CT @ 1.2A
	SPW-601-S	SPW-601-D	6.3V @ 2.0A	12.6V CT @ 1.0A
	SPW-602-S	SPW-602-D	8V @ 1.6A	16V CT @ 800 mA
	SPW-603-S	SPW-603-D	10V @ 1.2A	20V CT @ 600 mA
	SPW-604-S	SPW-604-D	12V @ 1.0A	24V CT @ 500 mA
	SPW-605-S	SPW-605-D	14V @ 850 mA	28V CT @ 420 mA
	SPW-606-S	SPW-606-D	18V @ 700 mA	36V CT @ 350 mA
	SPW-607-S	SPW-607-D	24V @ 500 mA	48V CT @ 250 mA
	SPW-608-S	SPW-608-D	28V @ 440 mA	56V CT @ 220 mA
	SPW-609-S	SPW-609-D	60V @ 200 mA	120V CT @ 100 mA
20.0	SPW-610-S	SPW-610-D	5V @ 4.0A	10V CT @ 2.0A
	SPW-611-S	SPW-611-D	6.3V @ 3.2A	12.6V CT @ 1.6A
	SPW-612-S	SPW-612-D	8V @ 2.5A	16V CT @ 1.25A
	SPW-613-S	SPW-613-D	10V @ 2.0A	20V CT @ 1.0A
	SPW-614-S	SPW-614-D	12V @ 1.6A	24V CT @ 800 mA
	SPW-615-S	SPW-615-D	14V @ 1.4A	28V CT @ 700 mA
	SPW-616-S	SPW-616-D	18V @ 1.1A	36V CT @ 550 mA
	SPW-617-S	SPW-617-D	24V @ 800 mA	48V CT @ 400 mA
	SPW-618-S	SPW-618-D	28V @ 700 mA	56V CT @ 350 mA
	SPW-619-S	SPW-619-D	60V @ 320 mA	120V CT @ 160 mA
36.0	SPW-620-S	SPW-620-D	5V @ 7.2A	10V CT @ 3.6A
	SPW-621-S	SPW-621-D	6.3V @ 5.7A	12.6V CT @ 2.85A
	SPW-622-S	SPW-622-D	8V @ 4.5A	16V CT @ 2.25A
	SPW-623-S	SPW-623-D	10V @ 3.6A	20V CT @ 1.8A
	SPW-624-S	SPW-624-D	12V @ 3.0A	24V CT @ 1.5A
	SPW-625-S	SPW-625-D	14V @ 2.6A	28V CT @ 1.3A
	SPW-626-S	SPW-626-D	18V @ 2.0A	36V CT @ 1.0A
	SPW-627-S	SPW-627-D	24V @ 1.5A	48V CT @ 750 mA
	SPW-628-S	SPW-628-D	28V @ 1.3A	56V CT @ 650 mA
	SPW-629-S	SPW-629-D	60V @ 600 mA	120V CT @ 300 mA

* **Primary Voltage —S (115V) — D (115/230V)**

Note: 4 corner mounting holes 2.187 x 1.750 centers.

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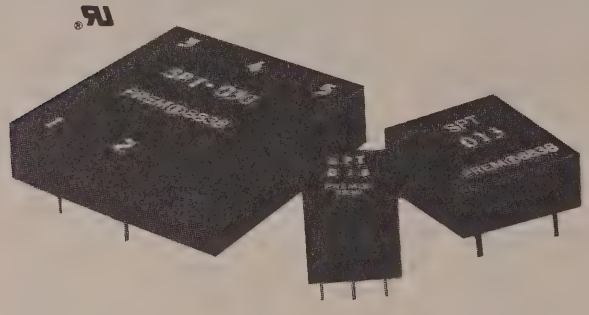
Telephony

Prem's New Line of British Standards Institute (B.S.I) Approved Telephone Interconnect Transformers

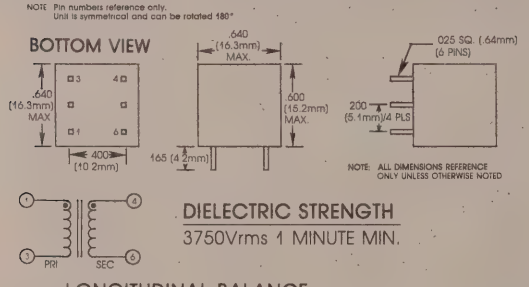


Other manufacturers may offer to ***design for*** B.S.I., but our new series of telephone interconnect transformers is ***already approved by*** the British Standards Institute (B.S.I.).

Designed for voice and data applications in the British market, these transformers also meet Canadian (D.O.C.) and United States (F.C.C.) requirements.

SPT-015

B.S.I. CERTIFICATE NUMBER AVAILABLE UPON REQUEST



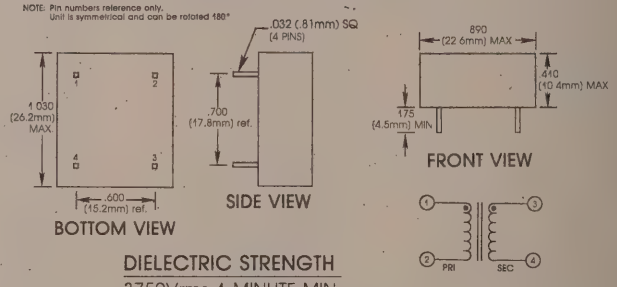
DIELECTRIC STRENGTH
3750Vrms 1 MINUTE MIN.

LONGITUDINAL BALANCE
60dB/MIN. 200-4000Hz PER IEEE STD. 455-1985

TOTAL HARM. DIST. @ 300 Hz .1% TYP.

SPT-013

B.S.I. CERTIFICATE NUMBER AVAILABLE UPON REQUEST

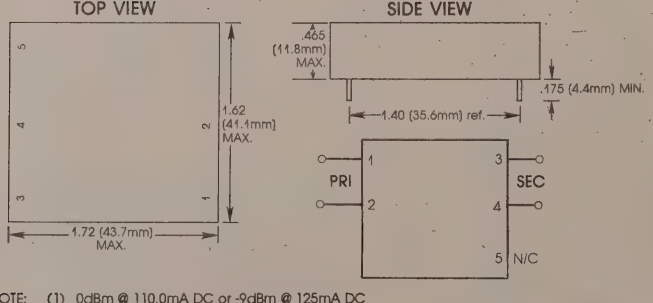


DIELECTRIC STRENGTH
3750Vrms 1 MINUTE MIN.

LONGITUDINAL BALANCE
60dB/MIN. 200-4000Hz PER IEEE STD. 455-1985

TOTAL HARM. DIST. @ 300 Hz .1% TYP.

SPT-030



PC PINS ARE .032" (.8mm) DIA. TINNED PC TERMINALS

DIELECTRIC STRENGTH
3750Vrms 1 MINUTE MIN.

LONGITUDINAL BALANCE
60dB/MIN. 200-4000Hz PER IEEE STD. 455-1985

TOTAL HARM. DIST. @ 300 Hz .1% TYP.

NOTE: (1) 0dBm @ 110.0mA DC or -9dBm @ 125mA DC
(2) DC IMPEDANCE (OFF HOOK)
(3) MINIMUM OF 20mA DC NEEDED FOR OPERATION

SECONDARY LOAD 600Ω W/DC PRI

PART NO.	IMPEDANCE PRI	IMPEDANCE SEC	TURNS RATIO ±2%	MAX DC UNBAL. (mA)	INS. LOSS REF @ 1KHz	RETURN LOSS MIN.	INSULATION RESISTANCE @ 500V DC	RESISTANCE ±10% PRI	RESISTANCE ±10% SEC	FREQUENCY RESPONSE
SPT-013	600	600 nom.	1:1	0	1.2dB	14.0dB @ 200-4000Hz	>100MΩ	58Ω	58Ω	200-4000Hz ± .25dB
SPT-015	600	600	1:1	0	1.3dB	14.0dB @ 200-4000Hz	>100MΩ	70Ω	70Ω	200-4000Hz ± .25dB
SPT-030	600	600	1:1	125mA(1)(3)	1.4dB	14.0dB @ 200-4000Hz	>100MΩ	100<R<300(2)	57Ω	200-4000Hz ± 0.5dB

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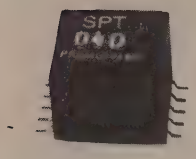
Surface Mount Technology

New Telephone Interconnect Transformers for Surface Mount Technology (SMT) Applications



SPT-040

SPT-042

Both the SPT-040 and the SPT-042 meet United States (FCC) and Canadian (DOC) Standards. In addition, the SPT-040 has received certification to the latest issue of the BSI (British Standards Institution) standard BS 7002 as well as the harmonized pan-European standard EN 60 950. Additionally, the SPT-040 has been certified as meeting the saturation test requirement specified in the BS 6301 (B.S.I.) standard.

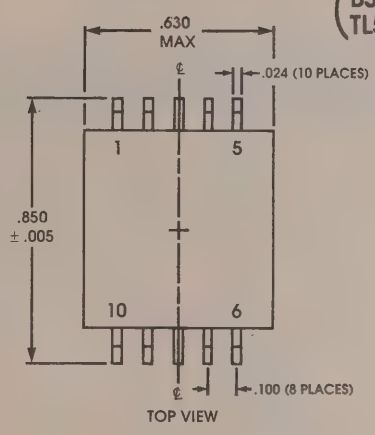
Both have impedance ratios of 600 ohms to 600 ohms and are designed for "dry" (0 DC) circuits. HIPOT rating for the SPT-040 is 3750 VRMS and is 1500 VRMS for the SPT-042. Both units utilize the gull-wing lead style and offer small package dimensions. Both are designed for automated pick and place assembly equipment. Typical weights for the SPT-040 and SPT-042 are 7 and 4 grams respectively.

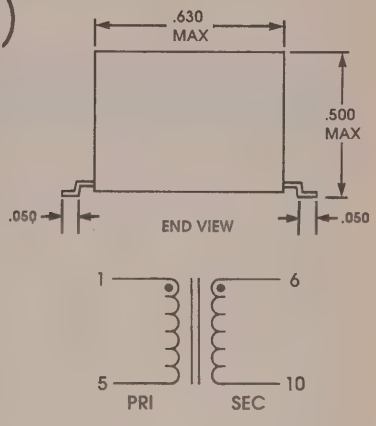
NOTE: These units are symmetrical and can be rotated 180° without changing the pin-out or electrical performance. Terminal numbers are for reference only.

LONGITUDINAL BALANCE

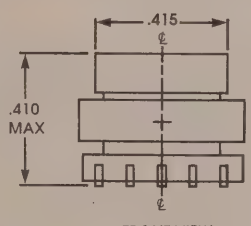
MEETS FCC PART 68.310 (a) REQUIREMENTS, TEST UNIT RL 600Ω

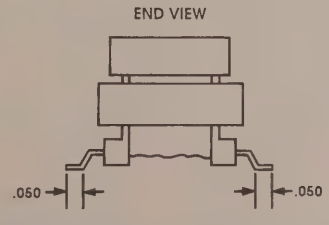
SPT-040 (BSI TL5)

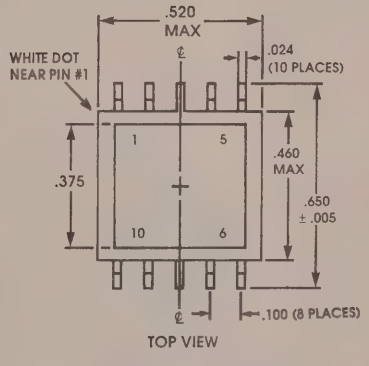


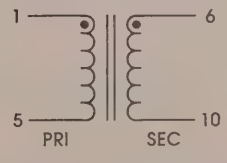


SPT-042









SECONDARY LOAD 600Ω

PART NO.	IMPEDANCE PRI	IMPEDANCE SEC	TURNS RATIO ±2%	MAX DC UNBAL (mA)	INS. LOSS REF @ 1KHz	RETURN LOSS MIN.	HARM DIST. @ 300Hz	RESISTANCE ± 10% PRI	RESISTANCE ± 10% SEC	FREQUENCY RESPONSE
SPT-040	600	600	1:1	0	.8dB	18dB @ 200-4KHz	.2% TYP.	35.6Ω	35.6Ω	200-4KHz ± 0.3dB
SPT-042	600	600	1:1	0	1.2dB	20dB @ 300-3.5KHz	.3% TYP.	56.0Ω	73.0Ω	200-4KHz ± 0.3dB

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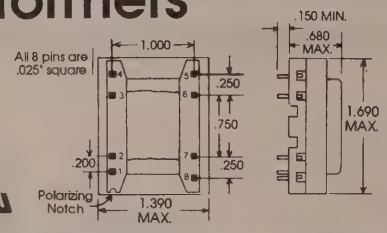
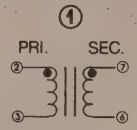
Telephony

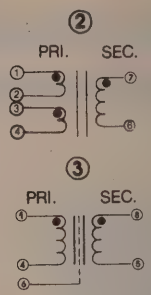
Coupling Transformers

Voice and Data



SCHEMATIC





SECONDARY LOAD 600Ω W/DC PRI

PART NO.	IMPEDANCE PRI	IMPEDANCE SEC	TURNS RATIO ±2%	MAX DC UNBAL.	INS. LOSS REF @ 1KHz	RETURN LOSS MIN. @ 300Hz	HARM. DIST. @ 300Hz	RESISTANCE ±10% PRI	RESISTANCE ±10% SEC	SCH. NO.
SPT-109	600	600	1:1	80mA	1.15dB	11.5dB ①	.1% TYP.	60Ω	72Ω	1
SPT-190	600	600	1:1	80mA	1.20dB	11.0dB	.3% TYP.	60Ω	72Ω	1
SPT-110	600	600	1:1.127	80mA	1.15dB	14.5dB ①	.1% TYP.	67Ω	75.5Ω	2
SPT-191	600	600	1:1.127	80mA	1.30dB	12.5dB	.3% TYP.	67Ω	75.5Ω	2
SPT-111	900	600	1:.8168	80mA	1.55dB	11.0dB ①	.1% TYP.	76Ω	92Ω	1
SPT-192	900	600	1:.8168	80mA	1.60dB	10.5dB	.3% TYP.	76Ω	92Ω	1
SPT-112	900	600	1:.942	80mA	1.20dB	12.5dB ①	.1% TYP.	83Ω	126Ω	2
SPT-193	900	600	1:.942	80mA	1.30dB	11.0dB	.3% TYP.	83Ω	126Ω	2
SPT-127 ②	600	600	1:1	120mA	1.30dB	11.0dB	.1% TYP.	62Ω	100Ω	3

① OTHER OPTIMIZED VALUES OBTAINABLE ② DIELECTRIC STRENGTH 2400VDC (PRI-SEC-CORE)

FREQUENCY RESPONSE
±.5dB (300-3500Hz)

DIELECTRIC STRENGTH
1500 VAC (PRI-SEC-CORE)

LONGITUDINAL BALANCE
MEETS FCC PART 68.310(a) REQUIREMENTS, TEST UNIT RL 600Ω.

Fig. 1

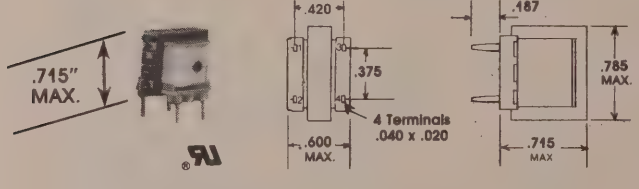


Fig. 3

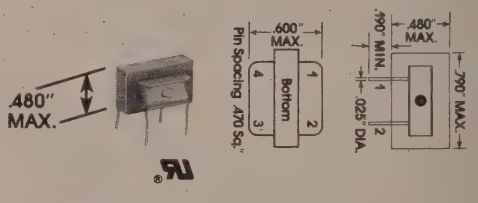


Fig. 2

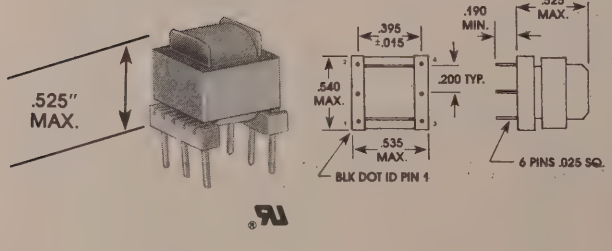
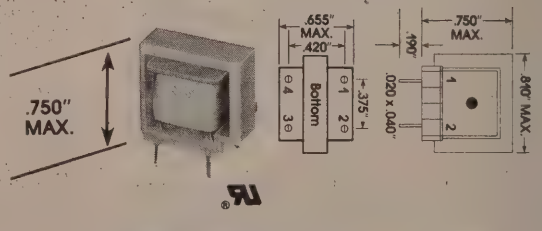
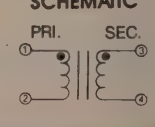


Fig. 4



LONGITUDINAL BALANCE
MEETS FCC PART 68.310(a) REQUIREMENTS, TEST UNIT RL 600Ω.

SCHEMATIC



SECONDARY LOAD 600Ω W/DC PRI

	PART NO.	IMPEDANCE PRI	IMPEDANCE SEC	TURNS RATIO ±2%	MAX DC UNBAL.	INS. LOSS REF @ 1KHz	RETURN LOSS MIN. @ 300Hz	ECHO RETURN LOSS MIN.	HARM. DIST. @ 300Hz	RESISTANCE ±10% PRI	RESISTANCE ±10% SEC	FIG. NO.	FREQUENCY RESPONSE 300-3500Hz	DIELECTRIC STRENGTH PRI-SEC-CORE
	SPT-128	600	600	1:1	0mA	1.00dB	14.5dB	20.5dB	.3% TYP.	35Ω	35Ω	1	±.5dB	1500VAC
†	SPT-2104	600	600	1:1.037	0mA	.90dB	23.0dB	26.0dB	.15% TYP.	36Ω	50Ω	4	±.5dB	1500VAC
	SPT-2105	600	600	1:1	80mA	2.30dB	6.0dB	9.0dB	.15% TYP.	180Ω	75Ω	4	*	1500VAC
†	SPT-1104	600	600	1:1.028	0mA	1.00dB	23.0dB	26.0dB	.5% TYP.	39Ω	50Ω	3	±.5dB	1500VAC
	SPT-2106	600	600	1:1.0523	0mA	1.25dB	21.0dB	25.0dB	.2% TYP.	49Ω	65Ω	2	±.25dB	1500VAC

*FREQUENCY RESPONSE 600-3.5KHz ± 1.0 dB, 300-600Hz ± 3.0 dB † IMPEDENCE MATCHING: ±10% OVER ENTIRE FREQUENCY RANGE

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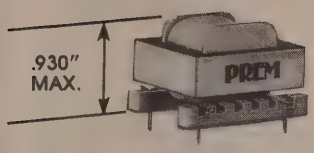


Fig. 1

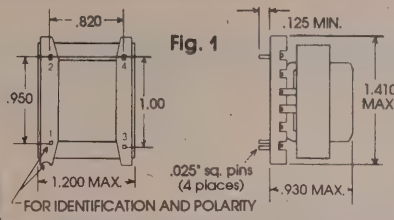
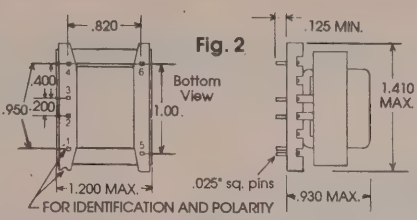


Fig. 2

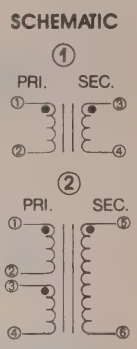


FREQUENCY RESPONSE
±.5dB (300-3500Hz)

DIELECTRIC STRENGTH
1500 VAC (PRI-SEC-CORE)

LONGITUDINAL BALANCE
MEETS FCC PART 68.310(a) REQUIREMENTS, TEST UNIT RL 600Ω.

SCHEMATIC



SECONDARY LOAD 600Ω W/DC PRI

PART NO.	IMPEDANCE PRI	IMPEDANCE SEC	TURNS RATIO ±2%	MAX DC UNBAL.	INS. LOSS REF @ 1KHz	RETURN LOSS MIN. @ 300Hz	HARM. DIST. @ 300Hz	RESISTANCE ±10% PRI	RESISTANCE ±10% SEC	SCH. NO.	FIG. NO.
SPT-116	600	600	1:1	80mA	1.20dB	13.0dB ①	.3% TYP.	66.2Ω	82.2Ω	1	1
SPT-117	600	600	1:1.125	80mA	1.25dB	16.0dB ①	.1% TYP.	76Ω	86Ω	2	2
SPT-118	900	600	1:.8163	80mA	1.50dB	9.5dB ①	.3% TYP.	82.8Ω	85.4Ω	1	1
SPT-119	900	600	1:.946	80mA	1.55dB	12.0dB	.3% TYP.	90Ω	110Ω	2	2
SPT-124	600	600	1:1	80mA	1.20dB	13.0dB ①	.3% TYP.	66Ω	82Ω	2	2

① OTHER OPTIMIZED VALUES OBTAINABLE

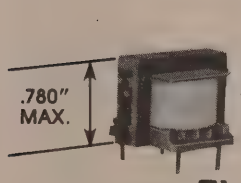
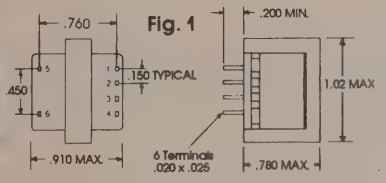


Fig. 1



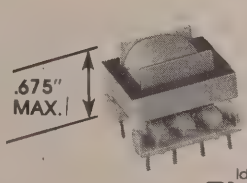
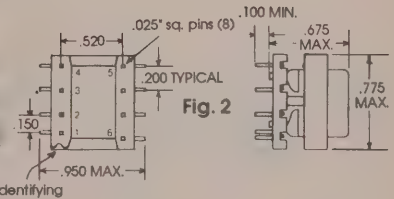


Fig. 2

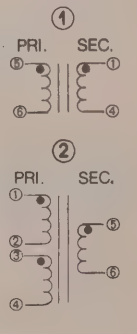


FREQUENCY RESPONSE
(300-3500Hz) ± .5dB
SPT-197 ± .55dB

DIELECTRIC STRENGTH
1500 VAC (PRI-SEC-CORE)

LONGITUDINAL BALANCE
MEETS FCC PART 68.310(a) REQUIREMENTS, TEST UNIT RL 600Ω.

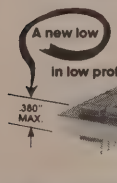
SCHEMATIC



SECONDARY LOAD 600Ω W/DC PRI

PART NO.	IMPEDANCE PRI	IMPEDANCE SEC	TURNS RATIO ±2%	MAX DC UNBAL.	INS. LOSS REF @ 1KHz	RETURN LOSS MIN. @ 300Hz	HARM. DIST. @ 300Hz	RESISTANCE ±10% PRI	RESISTANCE ±10% SEC	SCH. NO.	FIG. NO.
SPT-113	600	600	1:1	50mA	1.25dB	12.5dB ①	.13% TYP.	75Ω	76Ω	2	1
SPT-196	600	600	1:1	50mA	1.30dB	11.0dB	.3% TYP.	75Ω	76Ω	2	1
SPT-115	600	600	1:1	60mA	1.30dB	10.5dB ①	.3% TYP.	63Ω	88Ω	1	1
SPT-131	600	600	1:1	0mA	1.00dB	18.0dB	.15% TYP.	24.5Ω	31Ω	2	2
SPT-197	600	600	1:1	0mA	1.15dB	12.5dB	.3% TYP.	24.5Ω	31Ω	2	2

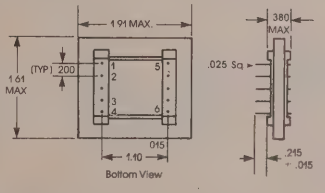
① OTHER OPTIMIZED VALUES OBTAINABLE



The Hugger Concept

This device is easily adaptable to card spacings of 1/2 inch

The Hugger is an extremely low profile package used primarily as a coupling transformer or feed bridge inductor.



FREQUENCY RESPONSE
±.5dB (300-3500Hz)

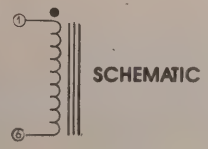
DIELECTRIC STRENGTH
1500 VAC (PRI-SEC-CORE)

LONGITUDINAL BALANCE
MEETS FCC PART 68.310(a) REQUIREMENTS, TEST UNIT RL 600Ω.

FEED-BRIDGE INDUCTOR

SECONDARY LOAD 600Ω W/DC PRI

PART NO.	RESISTANCE ±15%	DIELECTRIC STRENGTH (WINDING-CORE)	INDUCTANCE	
SPT-169	114Ω	1500VAC	@ 0mA DC	.90Hy min.
			80mA DC	.75Hy min.
			120mA DC	.60Hy min.



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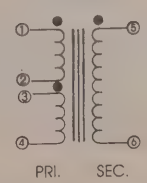

COUPLING TRANSFORMER

PART NO.	IMPEDANCE PRI	IMPEDANCE SEC	TURNS RATIO ±2%	MAX DC UNBAL.	INS. LOSS REF @ 1KHz	RETURN LOSS MIN. @ 300Hz	ECHO RETURN LOSS MIN.	HARM. DIST. @ 300Hz	RESISTANCE ±10% PRI	RESISTANCE ±10% SEC
SPT-172	600	600	1:1	50mA	1.5dB	11.5dB	16.5dB	.1% TYP.	73Ω	103Ω

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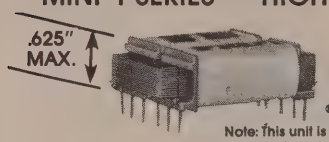
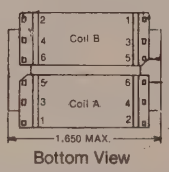
Telephony

Voice/Data Coupling Transformers

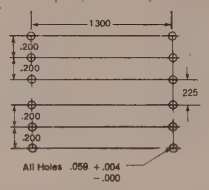
MINI-1 SERIES HIGH CROSSTALK ATTENUATION



Note: This unit is symmetrical and can be rotated 180° without changing the pin-out or electrical performance.



Bottom View

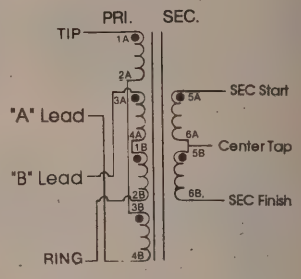


LONGITUDINAL BALANCE
MEETS FCC PART 68.310(a) REQUIREMENTS, TEST UNIT RL 600Ω.

FREQUENCY RESPONSE
±.5dB (300-3500Hz)

DIELECTRIC STRENGTH
1500 VAC (PRI-SEC-CORE)

SCHEMATIC

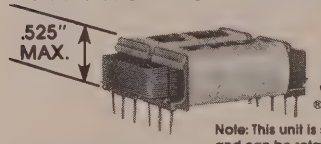


Necessary External Connections:
Short 2A-3B, 4A-1B, 6A-5B

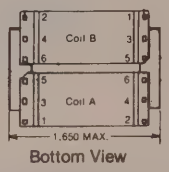
SECONDARY LOAD 600Ω W/DC PRI

PART NO.	IMPEDANCE PRI	IMPEDANCE SEC	TURNS RATIO ±2%	MAX DC UNBAL.	INS. LOSS REF @ 1KHz	RETURN LOSS MIN. @ 300Hz	HARM. DIST. @ 300Hz	RESISTANCE ±10% PRI	RESISTANCE ±10% SEC
SPT-125	600	600	1:1	90mA	1.35dB	13.0dB	.1% TYP.	80Ω	100Ω
SPT-194	600	600	1:1	90mA	1.40dB	12.0dB	.3% TYP.	80Ω	100Ω

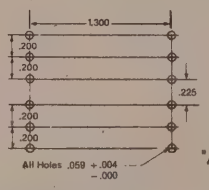
MINI-2 SERIES HIGH CROSSTALK ATTENUATION



Note: This unit is symmetrical and can be rotated 180° without changing the pin-out or electrical performance.



Bottom View

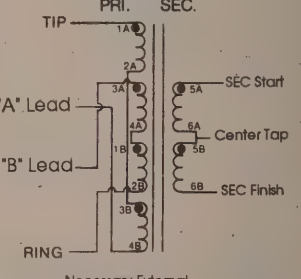


LONGITUDINAL BALANCE
MEETS FCC PART 68.310(a) REQUIREMENTS, TEST UNIT RL 600Ω.

FREQUENCY RESPONSE
±.5dB (300-3500Hz)

DIELECTRIC STRENGTH
1500 VAC (PRI-SEC-CORE)

SCHEMATIC

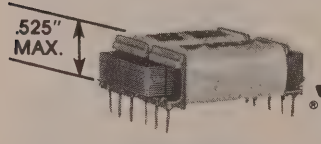


Necessary External Connections:
Short 2A-3B, 4A-1B, 6A-5B

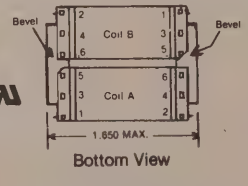
SECONDARY LOAD 600Ω W/DC PRI

PART NO.	IMPEDANCE PRI	IMPEDANCE SEC	TURNS RATIO ±2%	MAX DC UNBAL.	INS. LOSS REF @ 1KHz	RETURN LOSS MIN. @ 300Hz	HARM. DIST. @ 300Hz	RESISTANCE ±10% PRI	RESISTANCE ±10% SEC
SPT-123	600	600	1:1	90mA	1.85dB	12.0dB	.1% TYP.	95Ω	180Ω
SPT-126	600	600	1:1	80mA	2.00dB	11.5dB	.3% TYP.	95Ω	180Ω

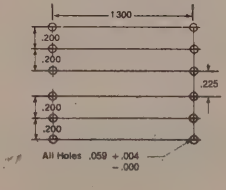
MINI-2 SERIES HIGH CROSSTALK ATTENUATION



Note: This unit is symmetrical and can be rotated 180° without changing the pin-out or electrical performance.



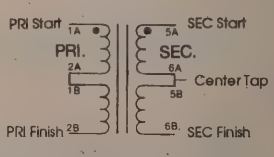
Bottom View



FREQUENCY RESPONSE
±.5dB (300-3500Hz)

DIELECTRIC STRENGTH
1500 VAC (PRI-SEC-CORE)

SCHEMATIC



Necessary External Connections:
Short 2A-1B, 6A-5B

SECONDARY LOAD 600Ω W/DC PRI

PART NO.	IMPEDANCE PRI	IMPEDANCE SEC	TURNS RATIO ±2%	MAX DC UNBAL.	INS. LOSS REF @ 1KHz	RETURN LOSS MIN. @ 300Hz	HARM. DIST. @ 300Hz	RESISTANCE ±10% PRI	RESISTANCE ±10% SEC
SPT-101	600	600	1:1	90mA	1.80dB	11.0dB	.1% TYP.	95Ω	180Ω
SPT-195	600	600	1:1	80mA	2.10dB	11.0dB	.3% TYP.	95Ω	180Ω

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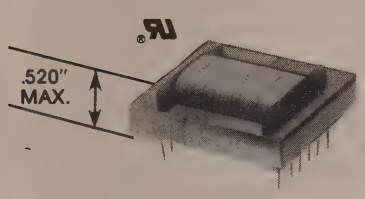
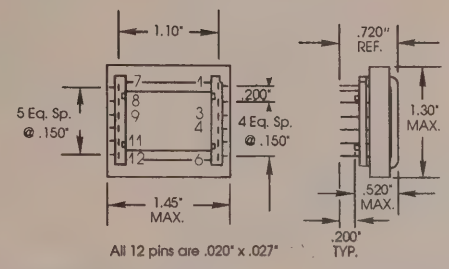
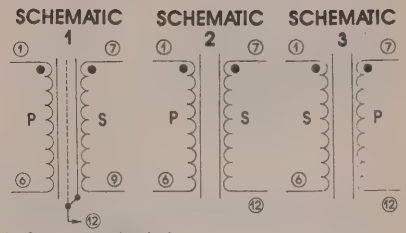
Very Low Profile Coupling Transformers

for British Standard and Domestic Applications operating level -45 to +7dBm





All 12 pins are .020" x .027"



Note: Screen constructed with solid copper foil. Ends overlap > 5mm.

① DIELECTRIC STRENGTH
2200 VDC
(1 MINUTE MIN.)
PRI, CORE, SCREEN-SEC
SEC, CORE, SCREEN-PRI

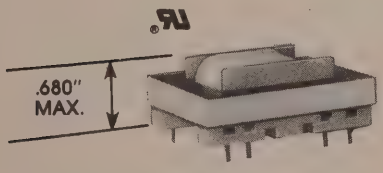
LONGITUDINAL BALANCE
MEETS FCC PART 68.310(a)
REQUIREMENTS, TEST
UNIT RL 600Ω.

INSULATION RESISTANCE
>100MΩ @500 V.D.C.
(BRITISH STANDARD)

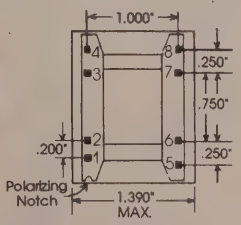
SECONDARY LOAD 600Ω W/DC PRI

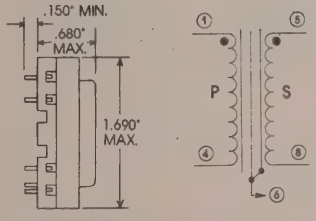
APPLICATION	PART NO.	IMPEDANCE PRI	IMPEDANCE SEC	TURNS RATIO ±2%	MAX DC UNBAL.	INS. LOSS REF @ 1KHz	RETURN LOSS MIN. @ 300Hz	ECHO RETURN LOSS MIN.	HARM. DIST. @ 300Hz	RESISTANCE ±10% PRI	RESISTANCE ±10% SEC	FIG. NO.	FREQUENCY RESPONSE 300-3500Hz	DIELECTRIC STRENGTH PRE-SEC-CORE
BRITISH STANDARD	SPT-186*	600	600	1:1	70mA	1.20dB	10.0dB	16.5dB	.1% TYP.	66Ω	66Ω	1	±.6dB	2200VDC ①
	SPT-1106	600	600	1:1	70mA	1.30dB	8.5dB	15.0dB	.3% TYP.	66Ω	66Ω	1	±1.0dB	2200VDC ①
	SPT-187*	600	600	1:1.08	70mA	1.20dB	11.0dB	19.0dB	.1% TYP.	66Ω	72Ω	1	±.5dB	2200VDC ①
	SPT-1107	600	600	1:1.08	70mA	1.30dB	10.0dB	18.0dB	.3% TYP.	66Ω	72Ω	1	±1.0dB	2200VDC ①
DOMESTIC	SPT-188	600	600	1:1	70mA	1.30dB	12.0dB	16.0dB	.1% TYP.	70Ω	81Ω	2	±.5dB	1500VAC
	SPT-189	600	600	1:1	60mA	2.00dB	12.0dB	16.5dB	.3% TYP.	75Ω	80Ω	3	±.5dB	1500VAC
	SPT-1105	600	600	1:1.045	80mA	1.30dB	9.5dB	17.0dB	.5% TYP.	62.4Ω	60.1Ω	2	±1.0dB	1500VAC

* Prem has supplied SPT-186 and SPT-187 configurations to customers who have BPO approval on their systems; however, usage of SPT-186 and SPT-187 will not guarantee BPO or BSI approval for your specific equipment. SPT-186 and SPT-187 are also applicable for domestic use.



All 8 pins are .025" square





Note: Screen constructed with solid copper foil. Ends overlap > 5mm.

DIELECTRIC STRENGTH
2200 VDC
(1 MINUTE MIN.)
PRI, CORE, SCREEN-SEC
SEC, CORE, SCREEN-PRI

LONGITUDINAL BALANCE
MEETS FCC PART 68.310(a)
REQUIREMENTS, TEST
UNIT RL 600Ω.

INSULATION RESISTANCE
>100MΩ @500 V.D.C.
(BRITISH STANDARD)

SECONDARY LOAD 600Ω W/DC PRI

APPLICATION	PART NO.	IMPEDANCE PRI	IMPEDANCE SEC	TURNS RATIO ±2%	MAX DC UNBAL.	INS. LOSS REF @ 1KHz	RETURN LOSS MIN. @ 300Hz	ECHO RETURN LOSS MIN.	HARM. DIST. @ 300Hz	RESISTANCE ±10% PRI	RESISTANCE ±10% SEC	FREQUENCY RESPONSE 300-3500Hz
BRITISH STANDARD	SPT-184*	600	600	1:1	120mA	1.30dB	10.0dB	15.0dB	.1% TYP.	63.5Ω	99Ω	±.5dB
	SPT-198	600	600	1:1	120mA	1.50dB	9.0dB	12.5dB	.3% TYP.	63.5Ω	99Ω	±1.0dB
	SPT-185*	600	600	1:1.1036	120mA	1.30dB	11.0dB	18.0dB	.1% TYP.	57.5Ω	99Ω	±.5dB
	SPT-199	600	600	1:1.1036	120mA	1.50dB	10.0dB	14.5dB	.3% TYP.	57.5Ω	99Ω	±1.0dB

* Prem has supplied SPT-184 and SPT-185 configurations to customers who have BPO approval on their systems; however, usage of SPT-184 and SPT-185 will not guarantee BPO or BSI approval for your specific equipment. SPT-184 and SPT-185 are also applicable for domestic use.

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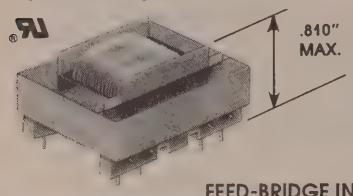
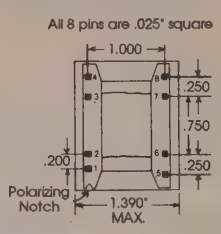
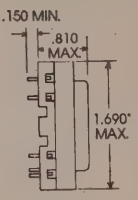
Single Hybrid* Transformers and Feed-Bridge Inductors

*CAN BE CONNECTED AS A DUAL-HYBRID FOR HIGHER PERFORMANCE . . . CONTACT PREM SALES DEPT.

operating level -45 to +7dBm







Frequency Response

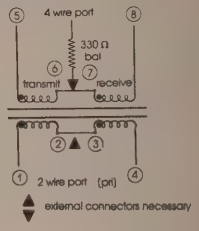
± .5dB (300-3500Hz)

FEED-BRIDGE INDUCTORS

PART NO.	RESISTANCE ±15%	DIELECTRIC STRENGTH (WINDING-CORE)	INDUCTANCE	
SPT-175	95Ω	1500VAC	@ 0 DC 80mA DC 120mA DC	1.7Hy. 1.5Hy. 1.3Hy.

SCHEMATIC

SCHEMATIC

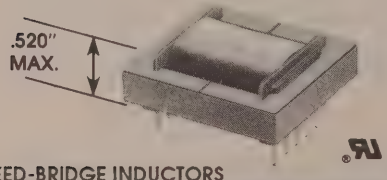


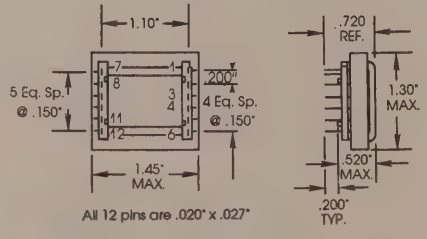
SINGLE-HYBRIDS

PART NO.	IMPEDANCE PRI	IMPEDANCE SEC	PRIMARY RETURN LOSS	LONG BAL.	HYBRID LOSS	TRANS-HYBRID BALANCE	PRIMARY mA DC	TURNS RATIO ±2%	HARM. DIST. @ 300Hz	RESISTANCE ±10% PRI	RESISTANCE ±10% SEC
SPT-176	600	600/600	>11dB-300Hz >22dB*-1KHz	60dB	4.5dB	>15dB-300Hz >31dB**-1KHz	120	1:1.429	.1% TYP.	38.53Ω	63.84Ω
SPT-177	900	600/600	>10dB-300Hz >21dB*-1KHz	60dB	4.5dB	>14dB-300Hz >28dB**-1KHz	120	1:1.158	.1% TYP.	47.55Ω	65.62Ω

DIELECTRIC STRENGTH: 1500 VAC (PRI-SEC-CORE)

** .012μf capacitor across 5-8 for optimum transhybrid balance and primary return loss

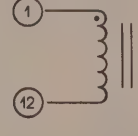




FEED-BRIDGE INDUCTORS

PART NO.	RESISTANCE ±15%	DIELECTRIC STRENGTH (WINDING-CORE)	INDUCTANCE	
SPT-178	88Ω	1500VAC	@ 0 DC 50mA DC 75mA DC 100mA DC	.95Hy. .90Hy. .88Hy. .85Hy.
SPT-179	142Ω	1500VAC	@ 0 DC 50mA DC 90mA DC	1.4Hy. 1.3Hy. 1.2Hy.

SCHEMATIC



Frequency Response

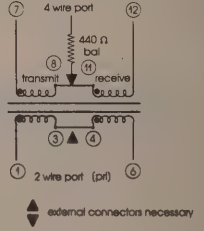
± .5dB (300-3500Hz)

SINGLE-HYBRIDS

PART NO.	IMPEDANCE PRI	IMPEDANCE SEC	PRIMARY RETURN LOSS	LONG BAL.	HYBRID LOSS	TRANS-HYBRID BALANCE	PRIMARY mA DC	TURNS RATIO ±2%	HARM. DIST. @ 300Hz	RESISTANCE ±10% PRI	RESISTANCE ±10% SEC
SPT-180	600	600/600	>20dB-300Hz >25dB-1KHz >28dB-4KHz	60dB	4.5dB	>25dB-300Hz >34dB-1KHz	0	1:1.60	.1% TYP.	74.0Ω	138.0Ω
SPT-181	900	600/600	>20dB-300Hz >25dB-1KHz >28dB-4KHz	60dB	4.5dB	>23dB-300Hz >32dB-1KHz	0	1:1.257	.1% TYP.	120.0Ω	137.0Ω
SPT-182	600	600/600	>14dB-300Hz >23dB-1KHz >28dB-4KHz	60dB	4.5dB	>18dB-300Hz >28dB-1KHz	50	1:1.60	.1% TYP.	74.0Ω	138.0Ω
SPT-183	900	600/600	>12dB-300Hz >20dB-1KHz >26dB-4KHz	58dB	4.5dB	>17dB-300Hz >27dB-1KHz	50	1:1.257	.1% TYP.	120.0Ω	137.0Ω

DIELECTRIC STRENGTH: 1500 VAC (PRI-SEC-CORE)

SCHEMATIC



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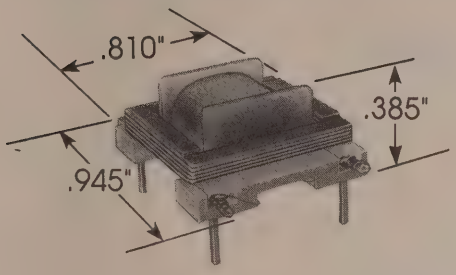
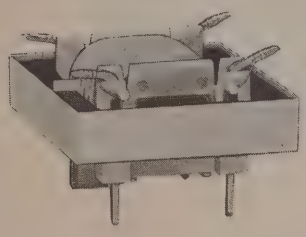
Telephony

New Sub-Miniature Voice/Data Coupling Transformers



SPT-010 thru SPT-012



SPT-020 and SPT-021

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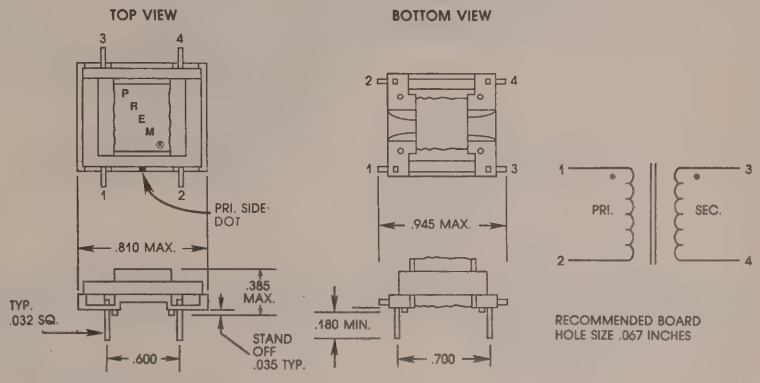


DIELECTRIC STRENGTH

1500 VAC (PRI-SEC-CORE)

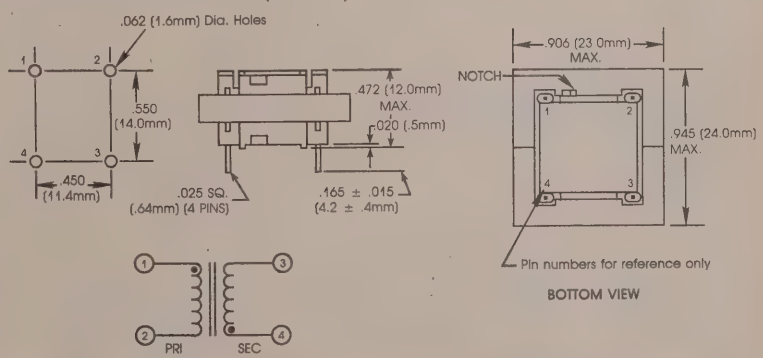
LONGITUDINAL BALANCE

MEETS FCC PART 68.310 (a) REQUIREMENTS, SPT-010 AND SPT-011 TESTED AT 0mA DC WITH SEC LOAD OF 600Ω, SPT-012 TESTED AT 30mA DC WITH SEC LOAD OF 470Ω

These transformers are ideal for applications requiring minimal use of pc board area and very low above-board height. The SPT-010 and SPT-011 are both dry (ODC 600Ω:600Ω) coupling transformers with excellent performance for voice and data applications. The SPT-012 has an impedance ratio of 600Ω:600Ω with a DC current rating of 30mA for data applications. The SPT-020 and SPT-021 are for data applications only. All four parts meet FCC Part 68 dielectric strength and longitudinal balance requirements

SCHEMATIC

Recommended P.C. Pattern (Foil Side)



SECONDARY LOAD ON THE SPT-010 AND SPT-011 600Ω, THE SPT-012, SPT-020 AND SPT-021 470Ω W/DC PRI

PART NO.	IMPEDANCE PRI	IMPEDANCE SEC	TURNS RATIO ±2%	MAX DC UNBAL. (mA)	INS. LOSS REF @ 1KHz	RETURN LOSS MIN.	ECHO RETURN LOSS MIN.	HARM. DIST. @ 300Hz	RESISTANCE ±10% PRI	RESISTANCE ±10% SEC	FREQUENCY RESPONSE
SPT-010	600	600	1:1.0428	0	1.5dB ref.	18.5dB @ 300Hz	23.5dB	.3% TYP.	59.3Ω	74.4Ω	300-3500Hz ± .5dB
SPT-011	600	600	1:1.100	0	1.3dB ref.	25.0dB @ 300Hz	28.0dB	.2% TYP.	62.5Ω	84.5Ω	300-3500Hz ± .25dB
SPT-012	600	600	1:1	30	2.0dB ±.5dB	16.0dB @1800Hz	15.0dB	.1% TYP.**	108.0Ω	131.3Ω	300-600Hz ± 2.0dB 600-3500Hz ± .65dB
SPT-020	600	600	1:1	100	2.5dB max.*	15.0dB @1800Hz	12.0dB	.5% TYP.	108.0Ω	120.0Ω	600-3500Hz ±1.0dB 300-600Hz ± 2.5dB
SPT-021	600	600	1:1	100	2.0dB ±.5dB	16.0dB @1800Hz	13.0dB	.1% TYP.	108.0Ω	120.0Ω	600-3500Hz ± .65dB 300-600Hz ± 2.5dB

*NOTE: Value taken with 600Ω load with 30mA DC on primary **THD measured @1KHz

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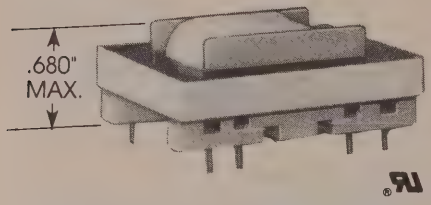
Telephony

Low Profile Coupling Transformers

Telecom Australia Approved • Approval #RA-87/117



Voice and Data Transformers for Telephone Interconnect Systems.

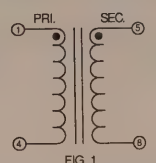
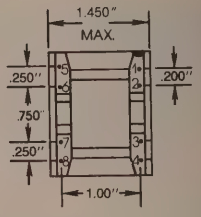


FIG. 1



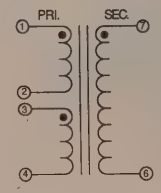
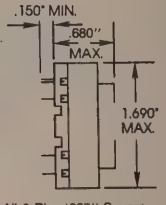


FIG. 2



All 8 Pins .025" Square

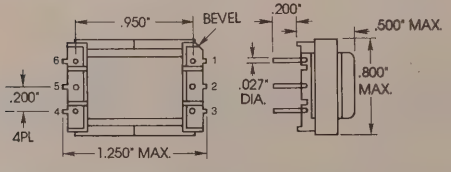
3750 VAC Dielectric for 1 minute
PRI.—SEC. & PRI.—CORE
>100MΩ Insulation Resistance
-45 to +7dBm Operating Level

LONGITUDINAL BALANCE
MEETS FCC PART 68.310 (a) REQUIREMENTS

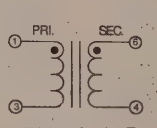
SECONDARY LOAD 600Ω W/DC PRI

PART NO.	IMPEDANCE PRI	IMPEDANCE SEC	TURNS RATIO ±2%	MAX DC UNBAL.	INS. LOSS REF @ 1KHz	RETURN LOSS MIN. @ 300Hz	ECHO RETURN LOSS MIN.	HARM. DIST. @ 300Hz	RESISTANCE ±10% PRI	RESISTANCE ±10% SEC	SCH. NO.	FREQUENCY RESPONSE 300-3500Hz
SPT-1108	600	600	1:1	120mA	1.30dB	10.0dB	14.0dB	.1% TYP.	66Ω	105Ω	1	±.5dB
SPT-1109	600	600	1:1	120mA	1.40dB	9.0dB	12.5dB	.3% TYP.	66Ω	105Ω	1	±1.0dB
SPT-1110	600	600	1:1	80mA	1.20dB	11.0dB	16.0dB	.1% TYP.	67Ω	80Ω	2	±.5dB
SPT-1111	600	600	1:1	80mA	1.30dB	10.0dB	15.0dB	.3% TYP.	67Ω	80Ω	2	±1.0dB
SPT-1112	600	600	1:1	80mA	1.20dB	11.0dB	16.0dB	.1% TYP.	67Ω	80Ω	1	±.5dB
SPT-1113	600	600	1:1	80mA	1.30dB	10.0dB	15.0dB	.3% TYP.	67Ω	80Ω	1	±1.0dB
SPT-1114	600	600	1:1	120mA	1.30dB	10.0dB	14.0dB	.1% TYP.	66Ω	105Ω	2	±.5dB
SPT-1115	600	600	1:1	120mA	1.40dB	9.0dB	12.5dB	.3% TYP.	66Ω	105Ω	2	±1.0dB

Very Low Profile-Condensed Board Space Coupling and Hybrid Transformers



SCHEMATIC



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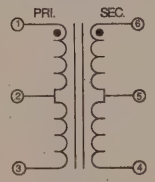

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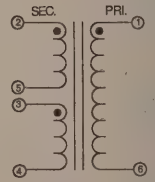

③

FREQUENCY RESPONSE
500-3500Hz ± 1.3dB
300-3500Hz ± 2.5dB
* 500-3500Hz + .3dB
\- .7dB
* 300-3500Hz + .3dB
\- 1.6dB

DIELECTRIC STRENGTH
1500 VAC (PRI-SEC-CORE)

LONGITUDINAL BALANCE
MEETS FCC PART 68.310 (a) REQUIREMENTS

* MEASUREMENTS FOR SPT-2100 HYBRID TRANSFORMER WITH TOTAL SECONDARY LOADED WITH 1200Ω AND RATED DC IN PRIMARY.

SECONDARY LOAD 600Ω W/DC PRI

PART NO.	IMPEDANCE PRI	IMPEDANCE SEC	TURNS RATIO ±2%	MAX DC UNBAL.	INS. LOSS REF @ 1KHz	RETURN LOSS MIN. @ 1.8KHz	HARM. DIST. @ 300Hz	RESISTANCE ±10% PRI	RESISTANCE ±10% SEC	SCH. NO.
SPT-2107	600	600	1:1.04	90mA	1.70dB	14.0dB	.5% TYP.	75Ω	100Ω	1
SPT-2108	600	600	1:1.04	90mA	1.70dB	14.0dB	.5% TYP.	75Ω	100Ω	2
SPT-2109	600	600	1:1.04	90mA	1.70dB	14.0dB	.5% TYP.	75Ω	100Ω	3
SPT-2110	600	600/600	1:1.41	50mA	1.60dB @ 1KHz	14.0dB @ 1KHz	.5% TYP.	75Ω	170Ω	3

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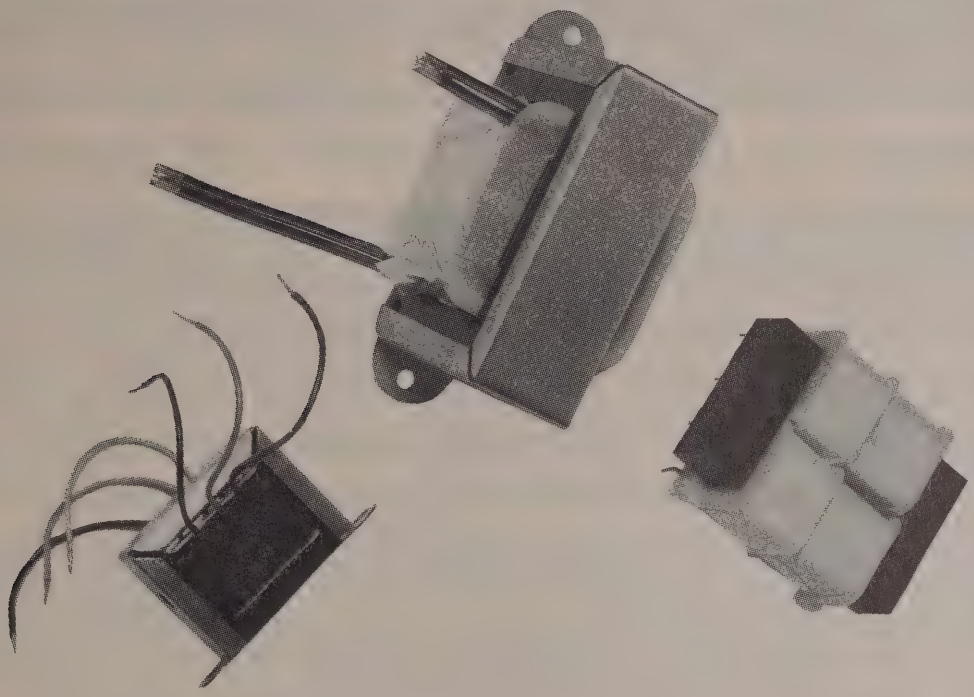
Custom Products



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- Horizontal oscillator and drive transformers
- Toroidal assemblies
- Miniature transformers
- Telephone coupling transformers
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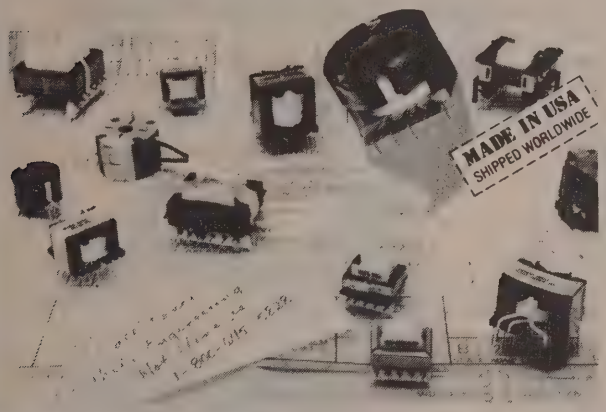

With over three decades of experience, we know how to supply precisely the best custom transformer designs at standard prices. We can supply transformers to meet: UL, CSA, VDE and MIL standards. No matter what your core material or wire size is, you can have a No Charge sample in your hands in a week to 10 days. Our transformers are manufactured with robotic assistance to assure quality and keep cost down. Tell us what you need or are currently making and we'll make it for you, most likely at a lower cost.

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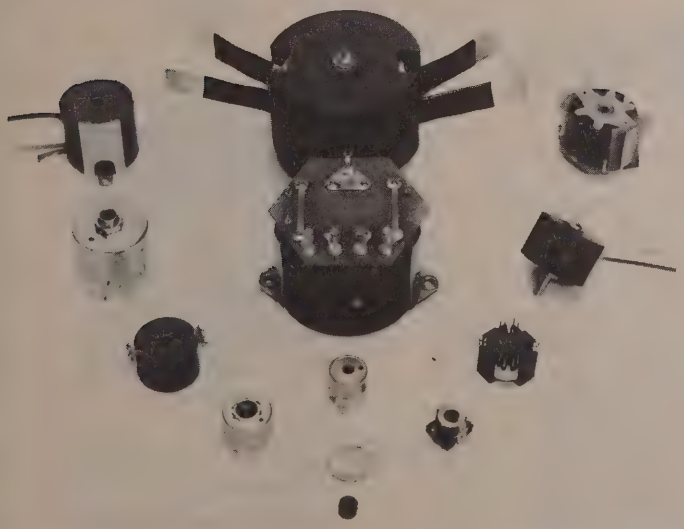
Pot Core Assemblies



Renco has manufactured millions of pot core assemblies since 1955, in the smallest (704 Series), the largest (7042 Series), and every size in between.

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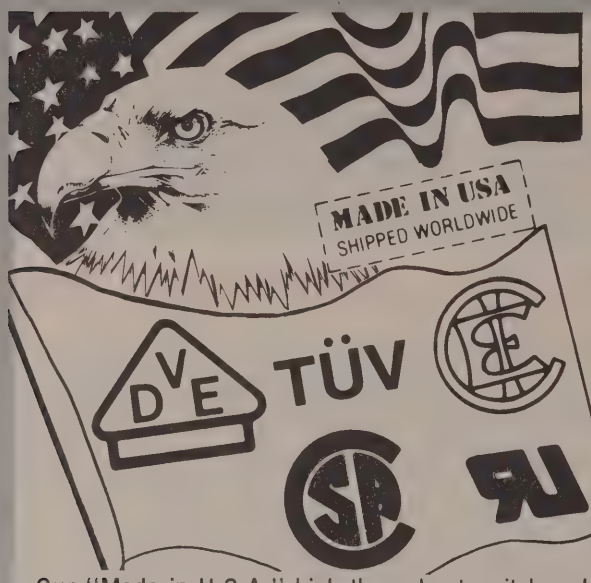

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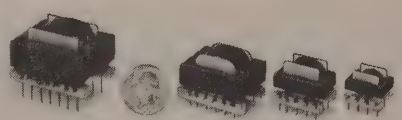
Our large inventory of wire, bobbins and cores assures prompt delivery and off-the-shelf prices.

RL-2600 Series

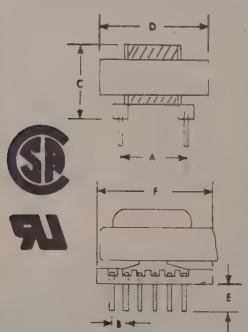
Four Design Packages Available

Custom Power Supply Transformers- Ferrite Core



This series gives switching power supplies the custom-designed transformers they deserve — at standard prices. We have large stocks of research-selected ferrite "E" cores, and glass-filled nylon bobbins, with which we can quickly meet the specification for your power, driver, interstage, and inverter transformers. Prototypes usually shipped within 10 days.

Wound on custom engineered equipment that ensures conformance to requirements.



DIM. (IN)	A	B	C	D	E	F
RL1287-1	0.515	0.200	0.660	0.650	0.175	0.780
RL1287-2	0.630	0.200	0.830	0.770	0.175	1.030
RL1287-3	0.800	0.200	0.915	1.140	0.175	1.375
RL1287-4	1.000	0.200	1.050	1.325	0.375	1.700
RL1287-5	1.100	0.300	1.300	1.700	0.185	1.000
RL1287-6	1.300	0.300	1.500	2.000	0.250	2.300

NUMBER OF TERMINALS — SIZE 0.025 SQ.		
RL1287-1 (#8)	RL1287-2 (#10)	RL1287-3 (#12)
RL1287-4 (1#14)	RL1287-5 (#12)	RL1287-6 (#12)

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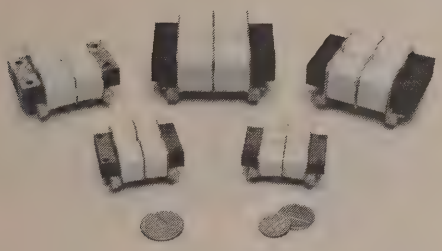
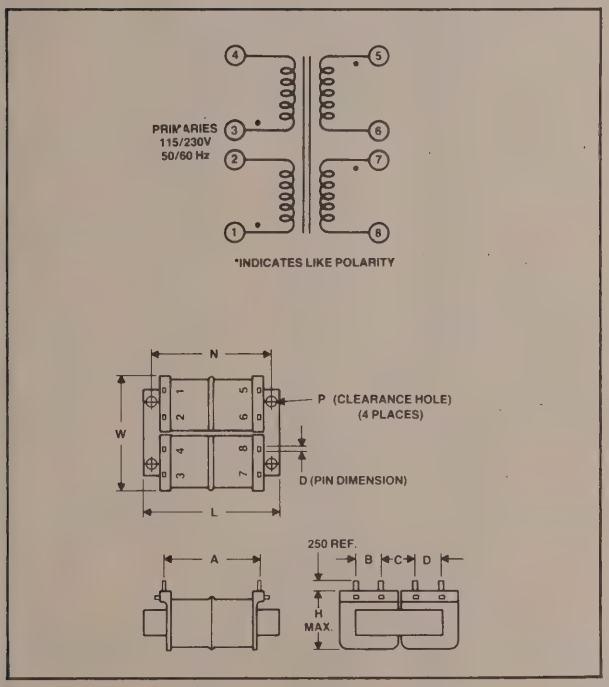


This series of rugged low profile transformers is specifically designed for convenient pc board mounting. The low overall height permits close spacing of adjacent pc boards to obtain maximum system density.

Using nonconcentric side-by-side windings reduces the interwinding capacitance and eliminates the need for electrostatic shielding. Semi-toroidal hum bucking construction results in balanced windings reducing EMI. Dual primary windings permit designs for 115/230VAC, 50/60Hz applications. The two independent secondary windings offer the flexibility of series, parallel or two isolated outputs.

These transformers are HIPOT tested at 1500 Volts RMS and are manufactured to Class B 130°C insulation. All transformers are designed to meet UL and CSA specifications.



Size	A	B	C	L	W
2	1.600	0.375	0.375	1.87	1.56
6	1.600	0.375	0.375	1.87	1.56
12	2.000	0.500	0.500	2.50	2.00
24	1.900	0.600	0.530	2.87	2.25
48	2.180	0.600	0.660	3.12	2.50

Size	H	N	D	P	Oz.
2	0.650	N/A	.041 × .020	N/A	5
6	0.850	N/A	.041 × .020	N/A	7
12	1.065	N/A	.041 × .020	N/A	11
24	1.250	2.41	.041 Sq.	CLEARANCE HOLE FOR #6 SCREW	15
48	1.375	2.62	.041 Sq.	CLEARANCE HOLE FOR #4 SCREW	21

Part No.	Size	SECONDARY* Series	SECONDARY* Parallel
RL-2230-10-50	2	10V C.T. @ 250MA	5V @ 500MA
RL-2230-10-600	6	10V C.T. @ 600MA	5V @ 1.2A
RL-2230-10-1200	12	10V C.T. @ 1200MA	5V @ 2.4A
RL-2230-10-2400	24	10V C.T. @ 2.40A	5V @ 4.80A
RL-2230-10-4800	48	10V C.T. @ 4.80A	5V @ 9.60A
RL-2230-12-200	2	12.6V C.T. @ 200MA	6.3V @ 400MA
RL-2230-12-450	6	12.6V C.T. @ 450MA	6.3V @ 900MA
RL-2230-12-900	12	12.6V C.T. @ 900MA	6.3V @ 1.8A
RL-2230-12-1900	24	12.6V C.T. @ 1.90MA	6.3V @ 2.80A
RL-2230-12-3800	48	12.6V C.T. @ 3.80MA	6.3V @ 7.60A
RL-2230-16-150	2	16V C.T. @ 150MA	8V @ 300MA
RL-2230-16-350	6	16V C.T. @ 350MA	8V @ 700MA
RL-2230-16-700	12	16V C.T. @ 700MA	8V @ 1.4A
RL-2230-16-1500	24	16V C.T. @ 1.50A	8V @ 3.00A
RL-2230-16-3000	48	16V C.T. @ 3.00A	8V @ 6.00A
RL-2230-20-125	2	20V C.T. @ 125MA	10V @ 250MA
RL-2230-20-300	6	20V C.T. @ 300MA	10V @ 600MA
RL-2230-20-600	12	20V C.T. @ 600MA	10V @ 1.2A
RL-2230-20-1200	24	20V C.T. @ 1.20A	10V @ 2.40A
RL-2230-20-2400	48	20V C.T. @ 2.40A	10V @ 4.80A
RL-2230-24-100	2	24V C.T. @ 100MA	12V @ 200MA
RL-2230-24-250	6	24V C.T. @ 250MA	12V @ 500MA
RL-2230-24-500	12	24V C.T. @ 500MA	12V @ 1A
RL-2230-24-1000	24	24V C.T. @ 1.00A	12V @ 2.00A
RL-2230-24-2000	48	24V C.T. @ 2.00A	12V @ 4.00A
RL-2230-30-85	2	30V C.T. @ 85MA	15V @ 170MA
RL-2230-30-200	6	30V C.T. @ 200MA	15V @ 400MA
RL-2230-30-400	12	30V C.T. @ 400MA	15V @ 800MA
RL-2230-30-800	24	30V C.T. @ 800MA	15V @ 1.60A
RL-2230-30-1600	48	30V C.T. @ 1.60A	15V @ 3.20A
RL-2230-34-75	2	34V C.T. @ 75MA	17V @ 150MA
RL-2230-34-170	6	34V C.T. @ 170MA	17V @ 340MA
RL-2230-34-340	12	34V C.T. @ 340MA	17V @ 680MA
RL-2230-34-700	24	34V C.T. @ 700MA	17V @ 1.40A
RL-2230-34-1400	48	34V C.T. @ 1.40A	17V @ 2.80A
RL-2230-40-60	2	40V C.T. @ 60MA	20V @ 120MA
RL-2230-40-150	6	40V C.T. @ 150MA	20V @ 300MA
RL-2230-40-300	12	40V C.T. @ 300MA	20V @ 600MA
RL-2230-40-600	24	40V C.T. @ 600MA	20V @ 1.20A
RL-2230-40-1200	48	40V C.T. @ 1.20A	20V @ 2.40A
RL-2230-56-45	2	56V C.T. @ 45MA	28V @ 90MA
RL-2230-56-100	6	56V C.T. @ 100MA	28V @ 200MA
RL-2230-56-200	12	56V C.T. @ 200MA	28V @ 400MA
RL-2230-56-425	24	56V C.T. @ 425MA	28V @ 850MA
RL-2230-56-850	48	56V C.T. @ 850MA	28V @ 1.70A
RL-2230-88-28	2	88V C.T. @ 28MA	44V @ 56MA
RL-2230-88-65	6	88V C.T. @ 65MA	44V @ 130MA
RL-2230-88-130	12	88V C.T. @ 130MA	44V @ 260MA
RL-2230-120-20	2	120V C.T. @ 20MA	60V @ 40MA
RL-2230-120-50	6	120V C.T. @ 50MA	60V @ 100MA
RL-2230-120-100	12	120V C.T. @ 100MA	60VV @ 200MA
RL-2230-230-10	2	230V C.T. @ 10MA	115V @ 20MA
RL-2230-230-25	6	230V C.T. @ 25MA	115V @ 50MA
RL-2230-230-50	12	230V C.T. @ 50MA	115V @ 100MA

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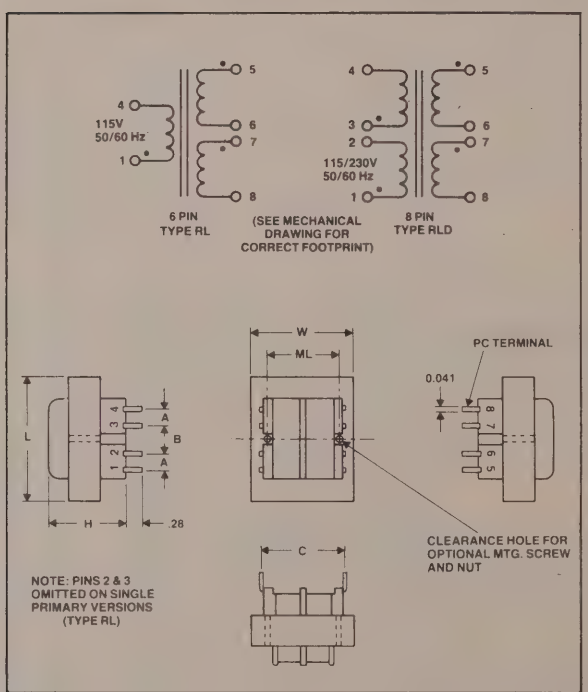
The advanced design and manufacturing techniques of using split bobbins and nonconcentric winding of the primary and secondary results in low interwinding capacitive coupling and eliminates the need for electrostatic shielding. It also avoids crossover of primary and secondary leads.

These transformers can be used in a wide variety of applications since they can be supplied with single 115VAC or dual 115/230VAC primaries for 50/60Hz operation. Their split secondary windings allow them to be hooked-up in series, in parallel or they can be used as independent and isolated outputs.

The RL2240 Series is HIPOT tested at 2500VAC and are manufactured to Class B 130° insulation. All transformers are designed to meet UL and CSA specifications.



PART NUMBER*		SECONDARY RMS RATING	
Single 115V 6 Pin	Dual 115/230V 8 Pin	Series	Parallel
RL-2240-2-10	RLD-2240-2-10	10V C.T. @ 0.11A	5V @ 0.22A
RL-2240-3-10	RLD-2240-3-10	10V C.T. @ 0.25A	5V @ 0.5A
RL-2240-4-10	RLD-2240-4-10	10V-C.T. @ 0.6A	5V @ 1.2A
RL-2240-5-10	RLD-2240-5-10	10V C.T. @ 1.2A	5V @ 2.4A
RL-2240-6-10	RLD-2240-6-10	10V C.T. @ 2A	5V @ 4A
RL-2240-7-10	RLD-2240-7-10	10V C.T. @ 3.6A	5V @ 7.2A
RL-2240-2-12	RLD-2240-2-12	12.6V C.T. @ 0.09A	6.3V @ 0.18A
RL-2240-3-12	RLD-2240-3-12	12.6V C.T. @ 0.2A	6.3V @ 0.4A
RL-2240-4-12	RLD-2240-4-12	12.6V C.T. @ 0.5A	6.3V @ 1.0A
RL-2240-5-12	RLD-2240-5-12	12.6V C.T. @ 1.0A	6.3V @ 2.0
RL-2240-6-12	RLD-2240-6-12	12.6V C.T. @ 1.6A	6.3V @ 3.2A
RL-2240-7-12	RLD-2240-7-12	12.6V C.T. @ 2.85A	6.3V @ 5.71A
RL-2240-2-16	RLD-2240-2-16	16V C.T. @ 0.07A	8V @ 0.14A
RL-2240-3-16	RLD-2240-3-16	16V C.T. @ 0.15A	8V @ 0.3A
RL-2240-4-16	RLD-2240-4-16	16V C.T. @ 0.4A	8V @ 0.8A
RL-2240-5-16	RLD-2240-5-16	16V C.T. @ 0.8A	8V @ 1.6A
RL-2240-6-16	RLD-2240-6-16	16V C.T. @ 1.25A	8V @ 2.5A
RL-2240-7-16	RLD-2240-7-16	16V C.T. @ 2.25A	8V @ 4.5A
RL-2240-2-20	RLD-2240-2-20	20V C.T. @ 0.005A	10V @ 0.11A
RL-2240-3-20	RLD-2240-3-20	20V C.T. @ 0.12A	10V @ 0.24A
RL-2240-4-20	RLD-2240-4-20	20V C.T. @ 0.3A	10V @ 0.6A
RL-2240-5-20	RLD-2240-5-20	20V C.T. @ 0.6A	10V @ 1.2A
RL-2240-6-20	RLD-2240-6-20	20V C.T. @ 1A	10V @ 2A
RL-2240-7-20	RLD-2240-7-20	20V C.T. @ 1.8A	10V @ 3.6A
RL-2240-2-24	RLD-2240-2-24	24V C.T. @ 0.045A	12V @ 0.09A
RL-2240-3-24	RLD-2240-3-24	24V C.T. @ 0.1A	12V @ 0.2A
RL-2240-4-24	RLD-2240-4-24	24V C.T. @ 0.25A	12V @ 0.5A
RL-2240-5-24	RLD-2240-5-24	24V C.T. @ 0.5A	12V @ 1.0A
RL-2240-6-24	RLD-2240-6-24	24V C.T. @ 0.8A	12V @ 1.6A
RL-2240-7-24	RLD-2240-7-24	24V C.T. @ 1.5A	12V @ 3.0A
RL-2240-2-28	RLD-2240-2-28	28V C.T. @ 0.04A	14V @ 0.08A
RL-2240-3-28	RLD-2240-3-28	28V C.T. @ 0.085A	14V @ 0.17A
RL-2240-4-28	RLD-2240-4-28	28V C.T. @ 0.2A	14V @ 0.4A
RL-2240-5-28	RLD-2240-5-28	28V C.T. @ 0.42A	14V @ 0.84A
RL-2240-6-28	RLD-2240-6-28	28V C.T. @ 0.7A	14V @ 1.4A
RL-2240-7-28	RLD-2240-7-28	28V C.T. @ 1.3A	14V @ 2.6A
RL-2240-2-36	RLD-2240-2-36	36V C.T. @ 0.03A	18V @ 0.06A
RL-2240-3-36	RLD-2240-3-36	36V C.T. @ 0.065A	18V @ 0.13A
RL-2240-4-36	RLD-2240-4-36	36V C.T. @ 0.17A	18V @ 0.34A
RL-2240-5-36	RLD-2240-5-36	36V C.T. @ 0.35A	18V @ 0.7A
RL-2240-6-36	RLD-2240-6-36	36V C.T. @ 0.55A	18V @ 1.1A
RL-2240-7-36	RLD-2240-7-36	36V C.T. @ 1A	18V @ 1A
RL-2240-2-48	RLD-2240-2-48	48V C.T. @ 0.023A	24V @ 0.046A
RL-2240-3-48	RLD-2240-3-48	48V C.T. @ 0.05A	24V @ 0.1A
RL-2240-4-48	RLD-2240-4-48	48V C.T. @ 0.125A	24V @ 0.25A
RL-2240-5-48	RLD-2240-5-48	48V C.T. @ 0.25A	24V @ 0.5A
RL-2240-6-48	RLD-2240-6-48	48V C.T. @ 0.4A	24V @ 0.8A
RL-2240-7-48	RLD-2240-7-48	48V C.T. @ 0.75A	24V @ 1.5A
RL-2240-2-56	RLD-2240-2-56	56V C.T. @ 0.02A	28V @ 0.04A
RL-2240-3-56	RLD-2240-3-56	56V C.T. @ 0.045A	28V @ 0.09A
RL-2240-4-56	RLD-2240-4-56	56V C.T. @ 0.11A	28V @ 0.22A
RL-2240-5-56	RLD-2240-5-56	56V C.T. @ 0.22A	28V @ 0.44A
RL-2240-6-56	RLD-2240-6-56	56V C.T. @ 0.35A	28V @ 0.7A
RL-2240-7-56	RLD-2240-7-56	56V C.T. @ 0.65A	28V @ 1.3A
RL-2240-2-120	RLD-2240-2-120	120V C.T. @ 0.01A	60V @ 0.02A
RL-2240-3-120	RLD-2240-3-120	120V C.T. @ 0.02A	60V @ 0.04A
RL-2240-4-120	RLD-2240-4-120	120V C.T. @ 0.05A	60V @ 0.1A
RL-2240-5-120	RLD-2240-5-120	120V C.T. @ 0.1A	60V @ 0.2A
RL-2240-6-120	RLD-2240-6-120	120V C.T. @ 0.16A	60V @ 0.32A
RL-2240-7-120	RLD-2240-7-120	120V C.T. @ 0.3A	60V @ 0.6A

Size	VA	L	W	H	ML
2	1.1	1-3/8	1-1/8	15/16	—
3	2.4	1-3/8	1-1/8	1-3/16	—
4	6.0	1-5/8	1-5/16	1-5/16	1-1/16
5	12.0	1-7/8	1-9/16	1-7/16	1-1/4
6	20.0	2-1/4	1-7/8	1-7/16	1-1/2
7	36.0	2-5/8	2-3/16	1-9/16	†

Size	A	B	C	Optional Mtg. Screw Nut*	Lbs.
2	.250	.250	1.200	None	0.17
3	.250	.250	1.200	None	0.25
4	.250	.350	1.280	4-40 × 1-3/8 Nylon	0.44
5	.300	.400	1.410	4-40 × 1-38 Nylon	0.70
6	.300	.400	1.600	4-40 × 1-3/8 Nylon	0.80
7	.400	.400	1.850	†	1.10

†Size 7 has 4 mounting holes on 2-3/16" × 1-3/4" centers for a #6 screw. Need not be nylon.

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1994 OUR 39th YEAR

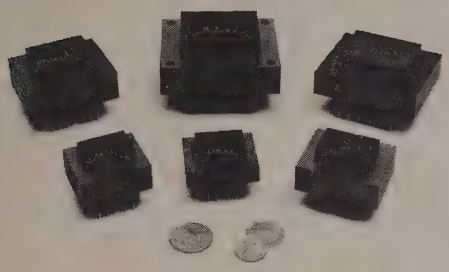
RENCO ELECTRONICS, INC.

Since 1955

"Precisely Your Best Choice"

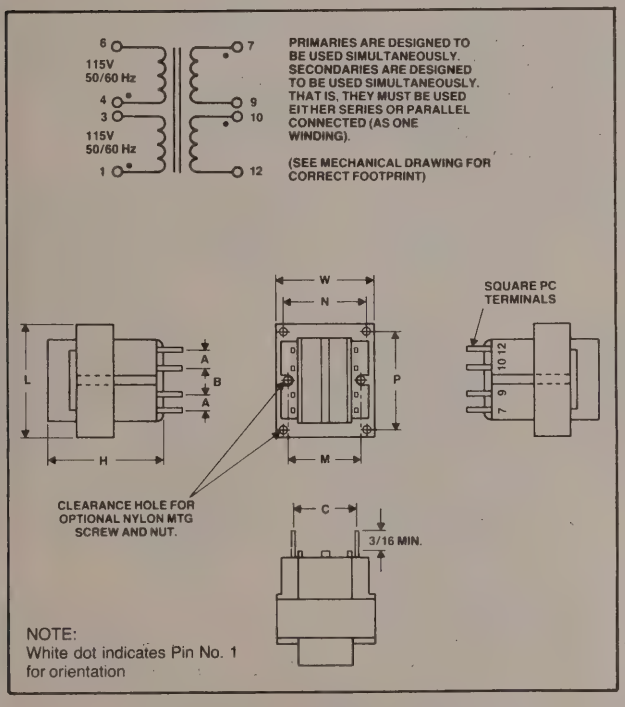
MADE IN USA

We Are A TQM Company



This series of transformers is specifically manufactured to meet or exceed UL, CSA, VDE and IEC specifications. These transformers incorporate advanced dual bobbin nonconcentric design that reduces interwinding capacitance and eliminates the need for electrostatic shielding. Since the windings are balanced no primary circulating currents are present. Use of high temperature, high stability materials results in excellent interwinding insulation and insulation between windings and core.

Slots in the bobbin flanges eliminate lead crossovers and the need for insulating pads resulting in improved lead termination. This series is PC plug-in mount in power ranges from 2.5 to 56 Volt/Amps. The transformers are HIPOT tested at 4000 Volts RMS and are manufactured to Class B 130° insulation.



Part No.	VA (Size)	SECONDARY RMS RATING Series	Parallel
RL-2250-2.5-10	2.5	10V C.T. @ 0.25A	5V @ 0.5A
RL-2250-5.0-10	5.0	10V C.T. @ 0.5A	5V @ 1.0A
RL-2250-10-10	10.0	10V C.T. @ 1.0A	5V @ 2.0A
RL-2250-20-10	20.0	10V C.T. @ 2.0A	5V @ 4.0A
RL-2250-30-10	3.0	10V C.T. @ 3.0A	5V @ 6.0A
RL-2250-56-10	56.0	10V C.T. @ 5.6A	5V @ 11.2A
RL-2250-2.5-12	2.5	12.6V C.T. @ 0.2A	6.3V @ 0.4A
RL-2250-5.0-12	5.0	12.6V C.T. @ 0.4A	6.3V @ 0.8A
RL-2250-10-12	10.0	12.6V C.T. @ 0.8A	6.3V @ 1.6A
RL-2250-20-12	20.0	12.6V C.T. @ 1.6A	6.3V @ 3.2A
RL-2250-30-12	30.0	12.6V C.T. @ 2.4A	6.3V @ 4.8A
RL-2250-56-12	56.0	12.6V C.T. @ 4.4A	6.3V @ 8.8A
RL-2250-2.5-16	2.5	16V C.T. @ 0.15A	8V @ 0.3A
RL-2250-5.0-16	5.0	16V C.T. @ 0.31A	8V @ 0.62A
RL-2250-10-16	10.0	16V C.T. @ 0.62A	8V @ 1.25A
RL-2250-20-16	20.0	16V C.T. @ 1.25A	8V @ 2.5A
RL-2250-30-16	30.0	16V C.T. @ 1.9A	8V @ 3.8A
RL-2250-56-16	56.0	16V C.T. @ 3.5A	8V @ 7.0A
RL-2250-2.5-20	2.5	20V C.T. @ 0.12A	10V @ 0.24A
RL-2250-5.0-20	5.0	20V C.T. @ 0.25A	10V @ 0.5A
RL-2250-10-20	10.0	20V C.T. @ 0.5A	10V @ 1.0A
RL-2250-20-20	20.0	20V C.T. @ 1.0A	10V @ 2.0A
RL-2250-30-20	30.0	20V C.T. @ 1.5A	10V @ 3.0A
RL-2250-56-20	56.0	20V C.T. @ 2.8A	10V @ 5.6A
RL-2250-2.5-24	2.5	24V C.T. @ 0.1A	12V @ 0.2A
RL-2250-5.0-24	5.0	24V C.T. @ 0.21A	12V @ 0.42A
RL-2250-10-24	10.0	24V C.T. @ 0.42	12V @ 0.84A
RL-2250-20-24	20.0	24V C.T. @ 0.83A	12V @ 1.66A
RL-2250-30-24	30.0	24V C.T. @ 1.25A	12V @ 2.50A
RL-2250-56-24	56.0	24V C.T. @ 2.33A	12V @ 4.66A
RL-2250-2.5-28	2.5	28V C.T. @ 0.09A	14V @ 0.18A
RL-2250-5.0-28	5.0	28V C.T. @ 0.18A	14V @ 0.36A
RL-2250-10-28	10.0	28V C.T. @ 0.36A	14V @ 0.72A
RL-2250-20-28	20.0	28V C.T. @ 0.72A	14V @ 1.44A
RL-2250-30-28	30.0	28V C.T. @ 1.06A	14V @ 2.12A
RL-2250-56-28	56.0	28V C.T. @ 2.0A	14V @ 4.0A
RL-2250-2.5-36	2.5	36V C.T. @ 0.07A	18V @ 0.14A
RL-2250-5.0-36	5.0	36V C.T. @ 0.14A	18V @ 0.28A
RL-2250-10-36	10.0	36V C.T. @ 0.28A	18V @ 0.56A
RL-2250-20-36	20.0	36V C.T. @ 0.56A	18V @ 1.12A
RL-2250-30-36	30.0	36V C.T. @ 0.82A	18V @ 1.64A
RL-2250-56-36	56.0	36V C.T. @ 1.56A	18V @ 3.12A

	Dimensions					
VA	L	W	H	A	B	C
2.5	1-5/8	1-5/16	1-1/8	.200	.250	1.000
5.0	1-5/8	1-5/16	1-3/8	.200	.400	1.000
10.0	1-7/8	1-9/16	1-3/8	.200	.400	1.140
20.0	2-1/4	1-7/8	1-5/8	.400	.400	1.450
30.0	2-5/8	2-3/16	1-9/16	.550	.275	1.680
56.0	3	2-1/2	1-13/16	.600	.300	1.900

	Pin	Mtg.			Mtg. Screw		
VA	Dimensions	M	N	P	Size	Quantity	Lbs.
2.5	0.025SQ	1-1/16	—	—	#4	2	0.25
5.0	0.025SQ	1-1/16	—	—	#4	2	0.37
10.0	0.038SQ	1-1/4	—	—	#4	2	0.53
20.0	0.038SQ	1-1/2	—	—	#4	2	0.90
30.0	0.045SQ	—	1-3/4	2-3/16	#6	4	1.15
56.0	0.045SQ	—	2	2-1/2	#6	4	1.70

VDE

SP UL

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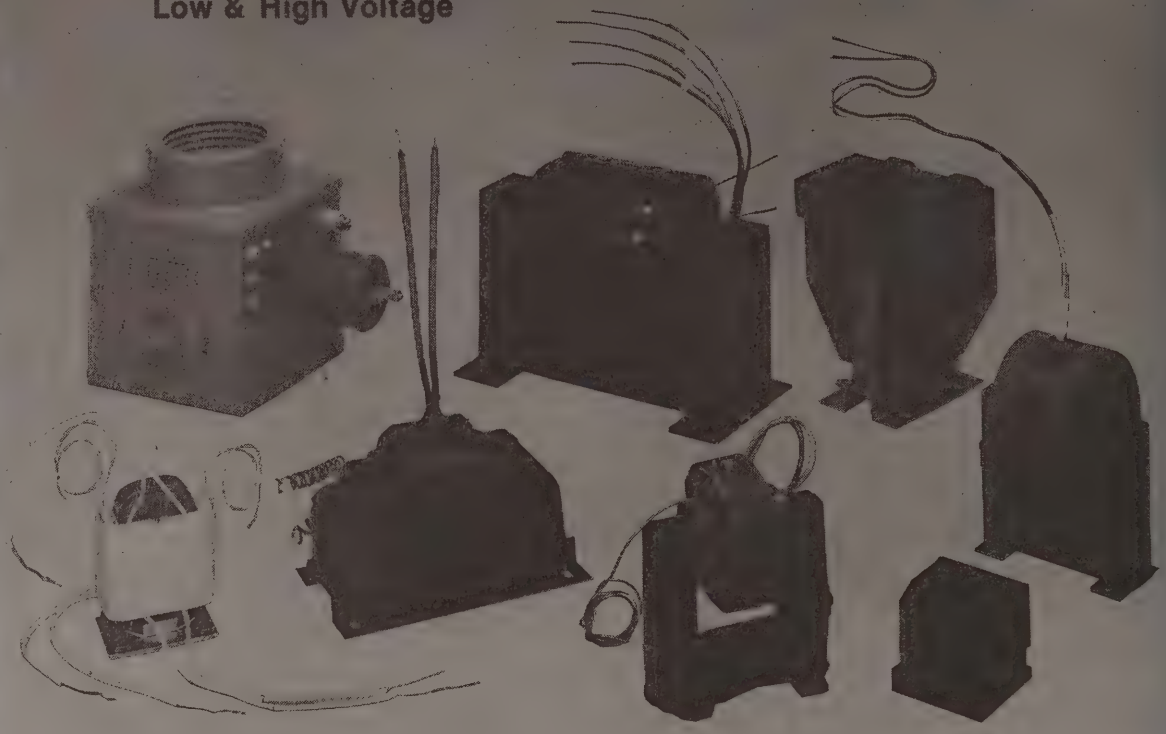
PULSE/POWER MAGNETICS

- **Transformers**
  Medium Voltage High Freq.
  High Voltage High Freq.
  High Voltage Isolation
- **Pulse Transformers**
  Low & High Voltage
- **Filament Transformers**
- **Saturable Reactors**
- **Charging Reactors**
- **Filter Chokes**



FEATURES INCLUDE:

- Epoxy impregnated for up to 30kV dc
- Oil filled hermetically sealed welded constructed to 30 kV and above
- Well suited to applications requiring reliable isolated line voltage at power ratings up to 1kVA
- Electrostatic shield between primary and secondary windings
- Water cooled & oil expansion bellows when required

- Other higher voltage and power units available upon request

RFI Corporation
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Rhombus Industries Inc.

Delay Lines & Pulse Transformers

Pulse Transformers and Magnetics

Since 1970, Rhombus Industries has been supplying quality components for Commercial and Military designs. Our capabilities range from the highest volume generic products to custom communication type transformers. Our factory in Southern California has complete process capabilities to expedite the design cycle and provide timely support in critical situations. Because we provide extensive engineering services and prompt sample turnaround (free of charge), Rhombus has been able to address the most demanding requirements for our wide range of customers. Please call one of our application engineers to discuss the details of your requirement.

Contact the factory, or your local representative or distributor to request detailed literature and samples.

Commercial and Military Magnetics

Pulse Transformers
- General Purpose
- Impedance Matching
- Isolation
- T1/CEPT Telecom.
- SCR Trigger

Inductors
- Low Power
- Toroid
- Current Sense
- Chokes

Audio Transformers

LAN Products
- Ethernet
- StarLan
- Token Ring
- ARCnet

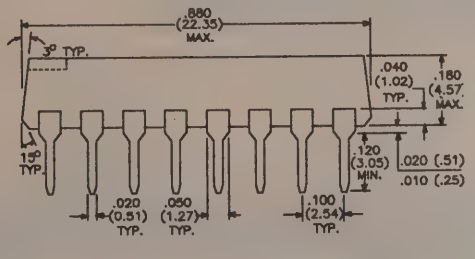
RF Filters
- 10BaseT
- ISDN
- Signal Line

DC / DC Converters
- General Purpose
- LAN Networks

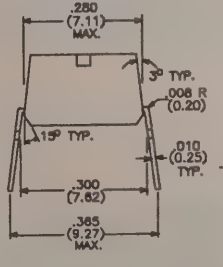
Variety of Configurations - Many Available in Surface Mount Versions

Standard Transfer-molded Packages Physical Dimensions: inches (mm)
Request Catalog for Dual-In-Line Packages for ISDN, T1/CEPT and various LAN transformers

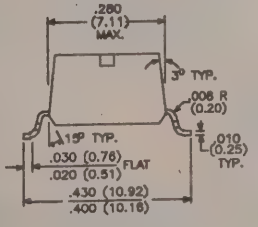
16 Pin DIP
(14 Pin 0.780", 8 Pin 0.500", 6 Pin 0.310")



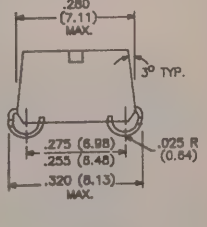
DIP



Gullwing SMD



J-Bend SMD



For Information on Rhombus Industries' Delay Line Products refer to Section 2350

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SHOGYO TRANSFORMERS AND ADAPTERS

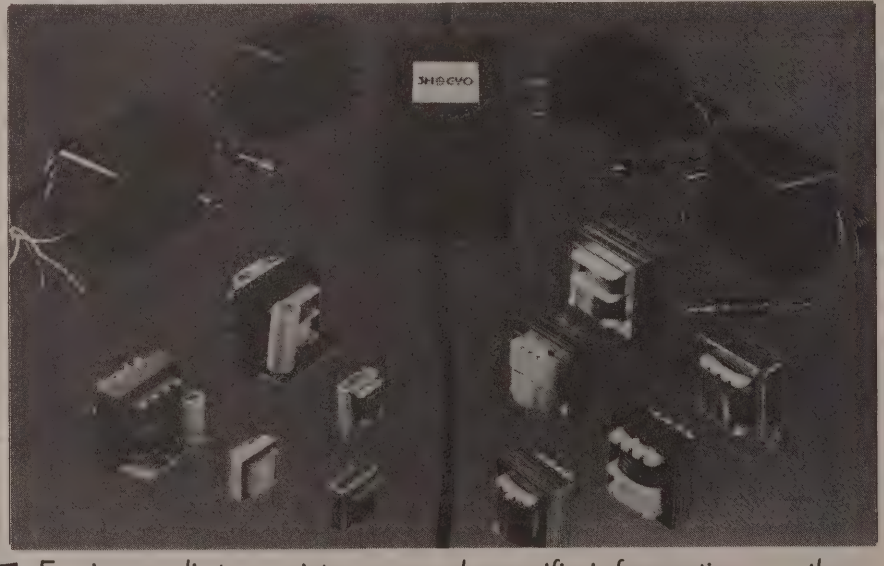
Your design deserves Shogyo quality and reliability.
You deserve...
Shogyo Service...comprehensive, responsive and fast
Shogyo Professionalism...the helpful experience you need
Shogyo Prices...always competitive, usually better
and...
Shogyo Selection...with complete custom design capabilities

Including a diverse offering of UL/CSA approved:

- *Power transformers:*
  standard core sizes from EI-28 to EI-86, Nylon 66, PBT or Phinolic bobbin materials, channel frame or PCB mounting, enclosures with or without endbells, and UL recognized AWM, terminal, or pin connections
- *Double protection power transformers:*
  conform with UL 1411 seven hours construction and abnormal test requirements, 3500V dielectric test voltage
- *Line matching transformers:*
  70.7 and 25 volt, maximum power levels from 2 to 16 watts, standard core sizes from EI-41 to EI-66, and a secondary impedance of 8 ohms
- *Telephone coupling transformers:*
  high quality low insertion loss, core sizes from EI-19 to EI-35, frequency response of 300–3500Hz ± 3dBa, and a secondary impedance of 500, 600, or 900 ohms
- *Lamp ballast transformers:*
  UL 935 listed simple reactance coil type
- *Wall-mount, plug-in adapters:*
  European or American, 120V, 50/60Hz inputs, outputs from 3VDC to 24VDC, 100mA to 1.7Amp, and 0.3 to 14.4 watts

And featuring:

- *PC pin, solder leg mount or lead wire connections*
- *A complete line of mating cords and terminating plug connectors*



For immediate assistance and specific information on the product(s) you require:
Dial 516-466-0911 or FAX 516-466-0922

For complete product listings and specifications, request our free catalog.

SPECIFY SHOGYO ELECTRONIC COMPONENTS AS GOOD AS YOUR DESIGN

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SHOGYO

STACO ENERGY PRODUCTS CO.

FIG. A

FIG. B

FIG. C

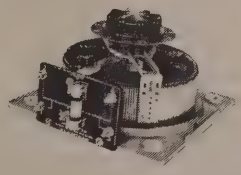

FIG. D

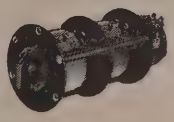

FIG. O

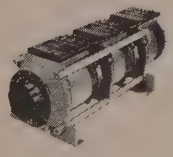

FIG. P

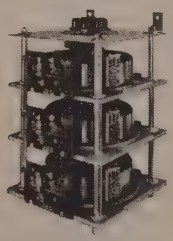

FIG. Q

Staco variable transformers offer versatility and reliability unmatched by solid state voltage controls. Staco contols are used worldwide for industrial and laboratory applications to control voltage, current, power, heat, speed, light and electro-mechanical force. Staco variable transformers provide continuously adjustable output voltage from AC power sources without wave form distortions or SCR generated noise. Outstanding features include gold plated commutators, precise regulation, high efficiency, conservative ratings and rugged construction.

You can select from panel mounted types, cord and plug types, ganged and / or motor driven types, metered types, and fully portable power supplies with or without meters, and ratings from 0.8 amps to 540 amps, 40 volts to 560 volts for single or three phase applications.

Staco has a nationwide network of distributors qualified to offer technical assistance whenever you need it. Additionally, the Staco Engineering Staff is available to help you with special or non-standard applications. Staco's Variable Voltage Controls handbook will be sent to you upon request ...it's loaded with illustrations, engineering data, specifications and ordering information on standard voltage controls.

PANEL OR BENCH MOUNTING MODELS *120 VOLT INPUT SINGLE PHASE*

MFG. TYPE NO.	FIG.	OUTPUT VOLTS	OUTPUT AMPS	KVA	SIZE (INCHES) H x W x D	SH. WT. LBS.
171	A	*0-120/132	1.75	0.23	2 13/16 x 1 7/8	3.0
201	A	*0-120/132	2.0	0.26	2 13/16 x 1 7/8	3.0
221-B	A	*0-120/132	2.5	0.33	2 13/16 x 2 1/8	3.2
291	A	*0-120/132	3.0	0.40	2 13/16 x 2 5/16	3.5
501	B	0-120/140	5.0	0.70	3 3/4 x 3 3/4 x 3 5/16	6.0
1010	B	0-120/140	10.0	1.4	5 5/16 x 5 x 4 3/16	12.0
1010CT	J	0-120/140	10.0	1.4	6 7/8 x 5 x 4 7/16	12.0
SQ1010	B	0-120/140	10.0	1.4	5 7/16 x 4 1/4 x 4 5/32	12.0
1210	B	* *0-120	12.0	1.44	5 5/16 x 5 x 4 3/16	12.0
1210CT	J	* *0-120	12.0	1.44	6 7/8 x 5 x 4 7/16	12.0
SQ1210	B	* *0-120	12.0	1.44	5 7/16 x 4 1/4 x 4 5/32	12.0
1510	C	0-120/140	15.0	2.1	6 1/8 x 6 3/4 x 4 3/4	20.0
1510CT	C	0-120/140	15.0	2.1	8 21/32 x 6 3/16 x 4 1/2	20.0
2510	C	0-120/140	25.0	3.5	8 3/16 x 7 5/8 x 4 1/8	23.0
2510CT	J	0-120/140	25.0	3.5	9 5/8 x 7 5/8 x 4 1/8	26.0
6010	D	0-120/140	60.0	8.4	15 5/8 x 13 7/8 x 5 1/4	67.0
6010C	D	0-120/140	60.0	8.4	15 5/8 x 13 7/8 x 7 1/8	67.0
6010CT	D	0-120/140	60.0	8.4	17 1/16 x 14 x 7 1/8	67.0

PANEL OR BENCH MOUNTING MODELS *240 VOLT INPUT SINGLE PHASE*

MFG. TYPE NO.	FIG.	OUTPUT VOLTS	OUTPUT AMPS	KVA	SIZE (INCHES) H x W x D	SH. WT. LBS.
252	A	0-240/264	0.8	0.21	2 13/16 x 2 7/16	3.5
1020	B	0-240/280	3.5	0.98	5 5/16 x 5 x 4 3/16	12.0
1020CT	J	0-240/280	3.5	0.98	6 7/8 x 5 x 4 7/16	12.0
SQ1020	B	0-240/280	3.5	0.98	5 7/16 x 4 1/4 x 4 5/32	12.0
1220	B	**0-240	5.0	1.2	5 5/16 x 5 x 4 3/16	12.0
1220CT	J	**0-240	5.0	1.2	6 7/8 x 5 x 4 7/16	12.0
SQ1220	B	**0-240	5.0	1.2	5 7/16 x 5 x 4 5/32	12.0
1520	C	0-240/280	9.5	2.66	6 1/8 x 6 3/4 x 4 13/16	20.0
1520CT	J	0-240/280	9.5	2.66	6 3/4 x 9 1/4 x 5	23.0
2520	C	0-240/280	10.0	2.8	8 3/16 x 7 5/8 x 4 1/8	23.0
2520CT	J	0-240/280	10.0	2.8	9 5/8 x 7 5/8 x 4 1/8	26.0
6020	D	0-240/280	35.0	9.8	15 5/8 x 13 7/8 x 5 1/4	63.0
6020C	D	0-240/280	35.0	9.8	15 5/8 x 13 7/8 x 7 1/8	63.0
6020CT	D	0-240/280	35.0	9.8	17 1/16 x 14 x 7 1/8	63.0

THREE PHASE MODELS *240 VOLT OR 480 VOLTS INPUT*

Three phase types are three individual units driven by a common shaft and electricaly connected in three phase wye

MFG. TYPE NO.	FIG.	INPUT VOLTS	INPUT FREQ. HZ	OUTPUT VOLTS	OUTPUT AMPS	KVA	SIZE (INCHES) H x W x D	SH. WT. LBS.
221-B-3	O	240	60	0-240/	2.50	1.00	3 1/4 x 3 1/4 x 8 1/8	9
1010-3	P	240	50/60*	0-240/280	10.0	4.85	6 1/8 x 5 x 14 13/32	36
1510-3	P	240	50/60*	0-240/280	15.0	7.26	7 1/16 x 6 1/8 x 14 9/16	56
2510-3	P	240	50/60*	0-240/280	25.0	12.10	8 3/4 x 7 5/8 x 14 1/8	72
5010-3Y	Q	240	60	0-280/	50.0	24.2	15 5/16 x 13 7/8 x 19 5/8	225
6010-3Y	Q	240	60	0-240/280	60.0	29.1	15 5/16 x 13 7/8 x 19 5/8	242
252-3	O	480	56/60*	0-480/528	0.8	0.73	3 1/4 x 3 1/8 x 8 1/8	9
1020-3	P	480	50/60*	0-480/560	3.5	3.40	6 1/4 x 5 x 14 13/32	36
1520-3	P	480	50/60*	0-480/560	9.5	9.20	7 1/16 x 6 1/4 x 15 11/16	56
2520-3	P	480	56/60*	0-480/560	10.0	9.70	8 3/4 x 7 5/8 x 14 5/8	72
5020-3Y	Q	480	50/60*	0-480/560	28.0	27.2	15 5/16 x 13 7/8 x 19 5/8	225
6020-3Y	Q	480	50/60*	0-480/560	35.0	33.9	15 5/16 x 13 7/8 x 19 5/8	240

CT refers to enclosed coil and terminals *60 HZ Only on Overvoltage Connection
**60 HZ operation only C refers to enclosed coil only

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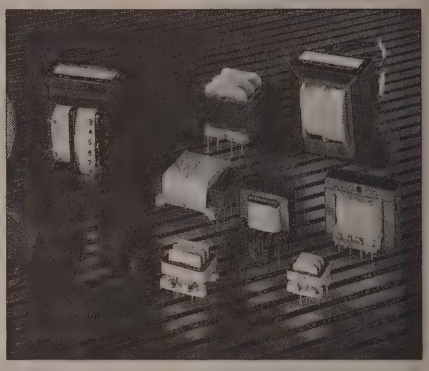
THE SIGNAL WAY OF DOING BUSINESS

Often imitated, but never equaled



The PRONTO PLEDGE 24-Hour Shipping Policy

For over 30 years, Signal has led the magnetic industry. Our innovation, creativity and reliability make Signal one of a kind. We pioneered the industry in the design, manufacture and distribution of transformers and chokes. But we didn't get to be industry leader on our product line alone:

- We sell direct - no intermediary - no additional mark-up
- Largest stocking inventory - over 1,000 different transformers and chokes - in ranges from 1VA to 10 kVA — available **"off the shelf"**
- PRONTO - 24-hour shipments
- Customized J.I.T. programs
- Annual contract program - We'll book your annual requirements, assuring you the most effective volume discounted pricing available
- Safety agency approvals - UL, CSA, VDE, IEC
- Consistent high quality - Our total quality control program utilizes the industry's most modern automated test equipment, to verify that every single unit meets your specifications and our high standards
- Flexibility - Because we use cellular manufacturing dedicated to one project at a time - no one beats our ability to produce high quality product in volume under tight deadlines

Introducing Off-the-Shelf Planar SMPS Magnetics

In keeping with its commitment to leadership in providing tomorrow's magnetics for today's electronic systems, Signal has introduced PLANAR transformers and compatible inductors for switchmode power supplies. Standard versions, available from stock, are designed to plug in to the most frequently used international designs for up to 200 watts of off-line, low voltage SMPS circuits. They are available in one-, two- and three-output configurations with a variety of primary winding complements, to permit easy adjustment to specialized system requirements.

In addition, because of the flexibility of PLANAR construction, it is relatively easy to develop custom variations that accommodate many unique SMPS requirements. Signal's development of PLANAR magnetics could be your opportunity to achieve high power density, high efficiency, and consistent, improved performance at costs in line with your product budget.

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FAX: (516) 239-7208

signal TRANSFORMER

The American Original.™

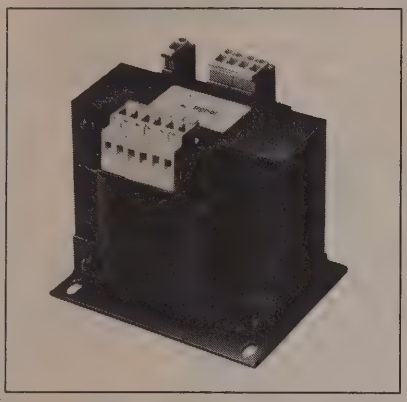
Custom Magnetics are our Specialty

At Signal, your input improves our output, especially when it comes to comments, suggestions and requests concerning your custom prototype or production needs. We are committed to satisfying your custom magnetic requirements. With an engineering staff that possesses over 175 years in magnetic design experience, we offer laminated core, toroid core, ferrite core and pot core type units; as well as EE, EI, and planar type transformers and inductors. You will receive consistently high quality, with very competitive pricing, whether your order is for 1 or 25,000 pieces.

Contents
(See following Pages)

- International Series with Lower Cost & Better Performance
  - MPI International Power
  - More-4-Less® High Power
  - HPI High Power
  - One-4-All® P.C.B. and All-4-One® Chassis Mount
  - International Flathead® Low Profile
  - Triple Output & Regulated Supplies in µp Applications
- P.C. Board Power Transformers
  - SPLIT/TRAN® High Isolation
  - FLATHEAD® Low Profile
  - Miniature Plug-in-Power
- Lightweight/Low-Cost Small Power Transformers
  - 2-4-1 Series
- Transformers for Triple-Output Regulated D.C. Supplies in µp Applications
- Class 2
- Rectifier Power Transformers
- Chokes
  - Filter • Dual
- Step-Down Auto Transformers
- Power Isolation Transformers
- Planar Transformer & matching Inductors

multi-purpose international transformers



FEATURES & BENEFITS

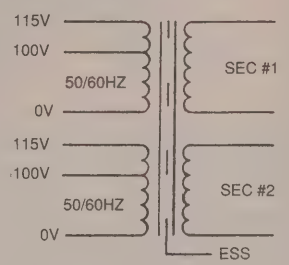
Our new MPI transformers have high performance and international safety characteristics.

Here are some other features that deserve a closer look:

- Higher volumetric efficiency than other 50/60 Hz transformers
- 4000VRMS Hipot
- Regulation – 7.5% or better [dependant on VA rating]
- Low leakage current for medical applications
- 5 mils thick solid copper Faraday shield reduces common mode noise
- Shield terminated to handle high currents
- Incorporate faston/screw type shock proof terminals
- Operate at: 100V, 115V, 200V, 215V, 230V 50/60 Hz
- Pending UL 506, CSA 22.2 # 66 and VDE 0551 (IEC 742) approvals
- Constructed with Class B materials [130°C]

Part No.	SECONDARY Series	SECONDARY Parallel	Part No.	SECONDARY Series	SECONDARY Parallel
MPI-200-10	10Vct @ 20.0A	5V @ 40.0A	MPI-200-28	28Vct @ 7.1A	14V @ 14.2A
MPI-250-10	10Vct @ 25.0A	5V @ 50.0A	MPI-250-28	28Vct @ 8.9A	14V @ 17.9A
MPI-300-10	10Vct @ 30.0A	5V @ 60.0A	MPI-300-28	28Vct @ 10.7A	14V @ 21.4A
MPI-400-10	10Vct @ 40.0A	5V @ 80.0A	MPI-400-28	28Vct @ 14.3A	14V @ 28.6A
MPI-650-10	10Vct @ 65.0A	5V @ 130.0A	MPI-650-28	28Vct @ 23.2A	14V @ 46.4A
MPI-900-10	10Vct @ 90.0A	5V @ 180.0A	MPI-900-28	28Vct @ 32.1A	14V @ 64.2A
MPI-200-12	12Vct @ 16.7A	6V @ 33.3A	MPI-200-36	36Vct @ 5.6A	18V @ 11.2A
MPI-250-12	12Vct @ 20.8A	6V @ 41.7A	MPI-250-36	36Vct @ 6.9A	18V @ 13.8A
MPI-300-12	12Vct @ 25.0A	6V @ 50.0A	MPI-300-36	36Vct @ 8.3A	18V @ 16.7A
MPI-400-12	12Vct @ 33.3A	6V @ 66.6A	MPI-400-36	36Vct @ 11.1A	18V @ 22.2A
MPI-650-12	12Vct @ 54.2A	6V @ 108.4A	MPI-650-36	36Vct @ 18.1A	18V @ 36.2A
MPI-900-12	12Vct @ 75.0A	6V @ 150.0A	MPI-900-36	36Vct @ 25.0A	18V @ 50.0A
MPI-200-16	16Vct @ 12.5A	8V @ 25.0A	MPI-200-40	40Vct @ 5.0A	20V @ 10.0A
MPI-250-16	16Vct @ 15.6A	8V @ 31.2A	MPI-250-40	40Vct @ 6.3A	20V @ 12.6A
MPI-300-16	16Vct @ 18.8A	8V @ 37.6A	MPI-300-40	40Vct @ 7.5A	20V @ 15.0A
MPI-400-16	16Vct @ 25.0A	8V @ 50.0A	MPI-400-40	40Vct @ 10.0A	20V @ 20.0A
MPI-650-16	16Vct @ 40.6A	8V @ 81.2A	MPI-650-40	40Vct @ 16.3A	20V @ 32.6A
MPI-900-16	16Vct @ 56.3A	8V @ 112.5A	MPI-900-40	40Vct @ 22.5A	20V @ 45.0A
MPI-200-20	20Vct @ 10.0A	10V @ 20.0A	MPI-200-48	48Vct @ 4.2A	24V @ 8.3A
MPI-250-20	20Vct @ 12.5A	10V @ 25.0A	MPI-250-48	48Vct @ 5.2A	24V @ 10.4A
MPI-300-20	20Vct @ 15.0A	10V @ 30.0A	MPI-300-48	48Vct @ 6.3A	24V @ 12.6A
MPI-400-20	20Vct @ 20.0A	10V @ 40.0A	MPI-400-48	48Vct @ 8.3A	24V @ 16.7A
MPI-650-20	20Vct @ 32.5A	10V @ 65.0A	MPI-650-48	48Vct @ 13.5A	24V @ 27.1A
MPI-900-20	20Vct @ 45.0A	10V @ 90.0A	MPI-900-48	48Vct @ 18.8A	24V @ 37.5A
MPI-200-24	24Vct @ 8.3A	12V @ 16.7A	MPI-200-230	230Vct @ 0.87A	115V @ 1.7A
MPI-250-24	24Vct @ 10.4A	12V @ 20.8A	MPI-250-230	230Vct @ 1.1A	115V @ 2.2A
MPI-300-24	24Vct @ 12.5A	12V @ 25.0A	MPI-300-230	230Vct @ 1.3A	115V @ 2.6A
MPI-400-24	24Vct @ 16.7A	12V @ 33.3A	MPI-400-230	230Vct @ 1.7A	115V @ 3.4A
MPI-650-24	24Vct @ 27.1A	12V @ 54.2A	MPI-650-230	230Vct @ 2.8A	115V @ 5.6A
MPI-900-24	24Vct @ 37.5A	12V @ 75.0A	MPI-900-230	230Vct @ 3.9A	115V @ 7.8A

SCHEMATIC

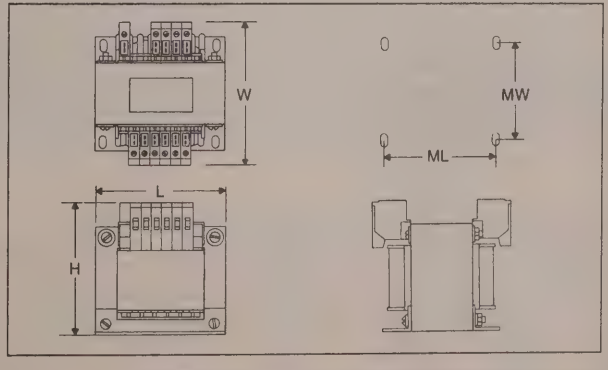


Items shown in shaded area are not normally in stock. They are standard designs generally available in 3-4 weeks.

MECHANICAL DIMENSIONS

Size	L	W	H	ML	MW	WGT
200VA	3.750"	4.203"	3.720"	3.250"	2.800"	6.22 lbs
	95.3mm	106.6mm	94.5mm	82.6mm	71.1mm	2.82 kg
250VA	4.125"	3.898"	4.000"	3.625"	2.601"	6.76 lbs
	104.8mm	99.0mm	101.6mm	92.1mm	66.1mm	3.07 kg
300VA	4.125"	4.223"	4.000"	3.625"	2.915"	7.80 lbs
	104.8mm	107.3mm	101.6mm	92.1mm	74.0mm	3.54 kg
400VA	4.125"	4.805"	4.000"	3.625"	3.505"	9.82 lbs
	104.8mm	122.0mm	101.6mm	92.1mm	89.0mm	4.46kg
650VA	5.250"	4.430"	4.800"	4.500"	3.415"	14.83 lbs
	133.3mm	112.5mm	121.9mm	114.3mm	86.7mm	6.73 kg
900VA	5.250"	5.197"	4.800"	4.500"	4.205"	19.84 lbs
	133.3mm	132.0mm	121.9mm	114.3mm	106.8mm	9.01 kg

MECHANICAL DRAWING



THE PRONTO PLEDGE

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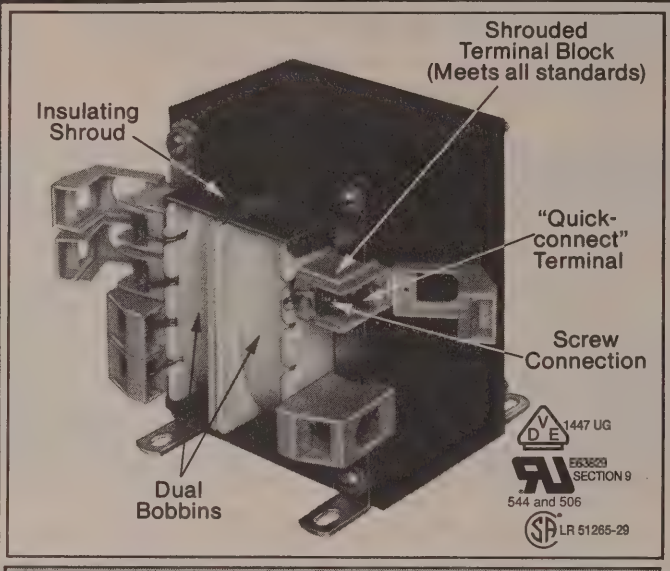
International more-4-less™ high power

GET MUCH MORE PERFORMANCE IN LESS SPACE



Signal's M4L Line is designed with the following "ingredients":

- Grain-Oriented Low Loss, High Saturation Steel
- High Temperature Magnet Wire
- Dual High Temperature Bobbins & Insulating Shroud
- Rugged Dual Terminals (Screw or Quick-Connect) that have international approvals (VDE, IEC, etc.) **AND**
- Superior Electrical & Manufacturing Engineering meeting UL, CSA, VDE, IEC and all international standards.

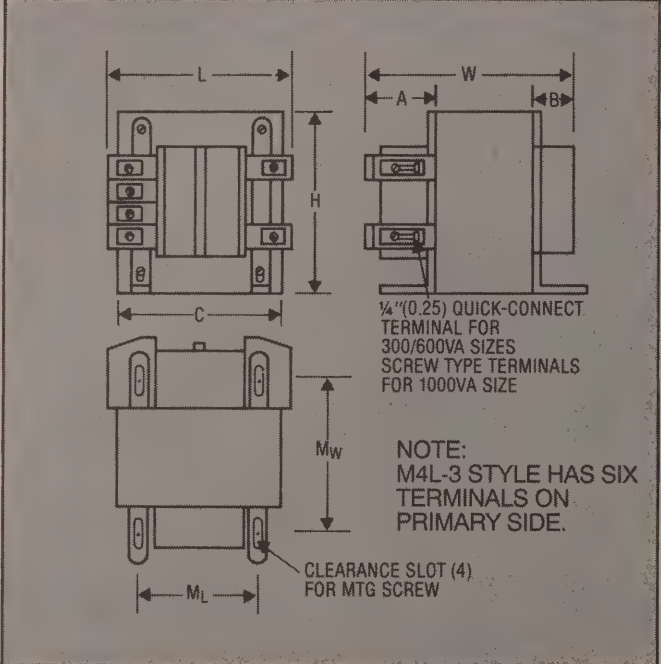
Which accomplish further savings by:

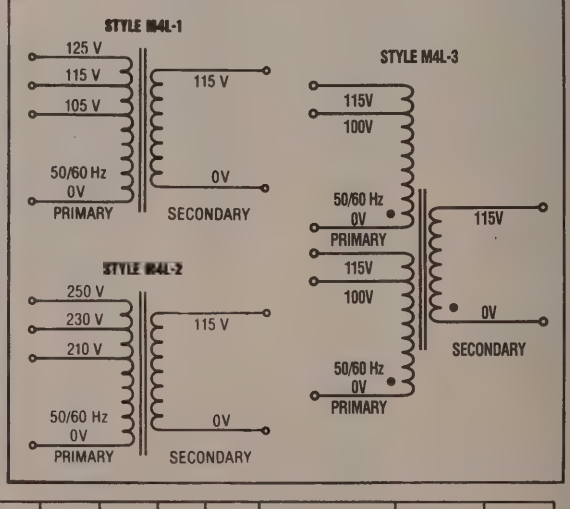
- Reducing the amount of steel and copper required for a given power rating
- Eliminating hand applied tapes, pads or cross-over insulation
- Reducing winding & lead terminating time.

All of which leads to more:

- Efficiency
- Isolation (4000v RMS TEST)
- Safety Standards (meets UL, VDE, CSA, IEC, etc.)

AND Approximately ⅓ less space & weight. Hence, we call it the More-4-Less Series.





Part Number 115V Nominal	Part Number 230V Nominal	Part Number 100-115/200-230V Nominal	VA	Secondary RMS Rating	L	W	H	A	B	C	Mtg. ML	Mtg. MW	Mtg. Screw	Lbs.
M4L-1-3	M4L-2-3	M4L-3-3	300	115V @ 2.6A	3½	3⅞	3¾	1⅛	⅝	3⅛	2½	3⅛	#10	7.0
M4L-1-6	M4L-2-6	M4L-3-6	600	115V @ 5.2A	3⅞	4 15/16	4½	1 3/16	¾	3¾	3	4 1/16	#10	14.3
M4L-1-10	M4L-2-10	M4L-3-10	1000	115V @ 8.7A	5⅜	5⅞	5¼	1½	⅞	4⅜	3½	4 1/16	¼	22.0

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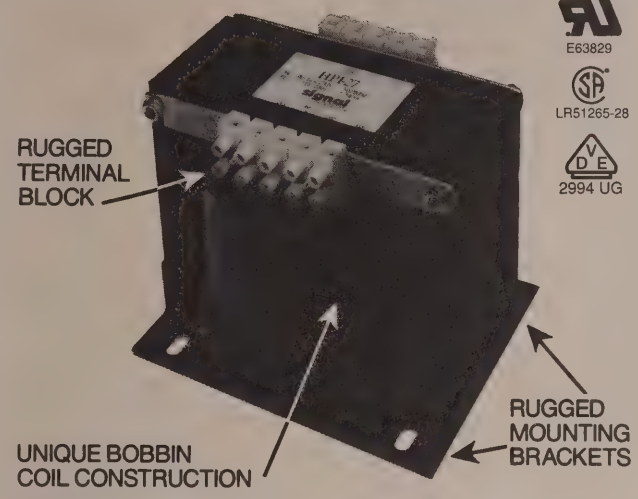
High power international series

GREATER PERFORMANCE IN LESS SPACE AND WEIGHT

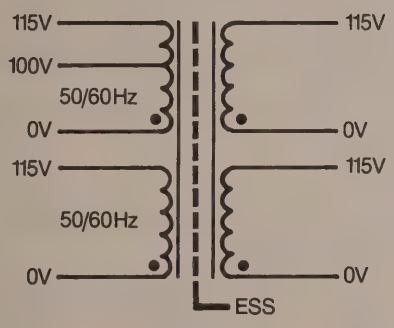


E63829
LR51265-28
2994 UG

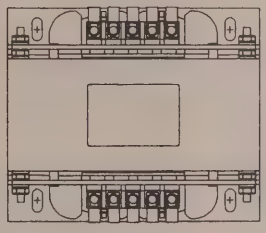
FEATURES & BENEFITS

- 2kVA, 2.75kVA, 3.5kVA
- Featuring "international" dual primaries with taps @ 100V, 115V and 230V, and dual secondary with 115V and 230V tap
- Excellent regulation @ 5-7%
- Isolation (4000V RMS test)
- Rugged barrier strip terminals and brackets designed to be easily accessible for production line mounting with powered wrenches
- Unique coil construction to meet international standards
- VDE Certification: VDE 0550
- CSA Certification: CSA 22.2 #66
- U.L. Recognition: UL 506
- TUV Pending: IEC 950

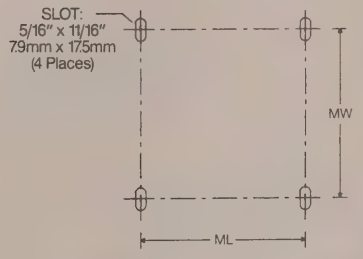
SCHEMATIC



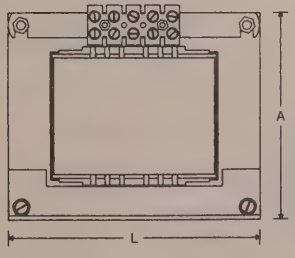
TOP VIEW:



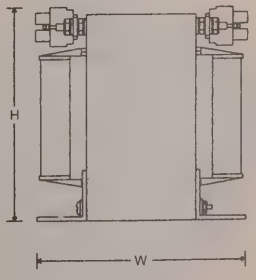
MOUNTING:



FRONT VIEW:



SIDE VIEW:



Part No.	VA	Secondary RMS Rating		Mechanical Dimensions						
		Series	Parallel	L	W	H	A	ML	MW	lbs/kg
HPI-20	2000	230V a 8.7A	115V a 17.4A	7.50" 190.5mm	5.60" 142.2mm	6.56" 166.6mm	6.25" 158.8mm	5.75" 146.1mm	4.35" 110.5mm	41.3 18.71
HPI-27	2750	230V a 12.0A	115V a 24.0A	7.50" 190.5mm	6.23" 158.2mm	6.56" 166.6mm	6.25" 158.8mm	5.75" 146.1mm	4.98" 126.5mm	48.0 21.77
HPI-35	3500	230V a 15.2A	115V a 30.4A	7.50" 190.5mm	7.33" 186.2mm	6.56" 166.6mm	6.25" 158.8mm	5.75" 146.1mm	6.08" 154.4mm	62.4 28.30

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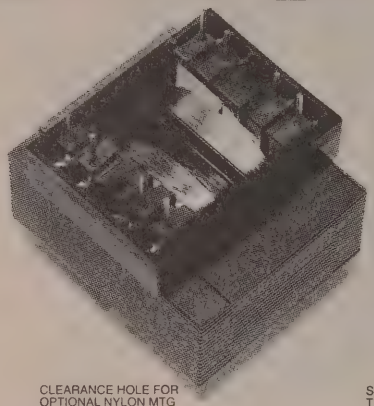
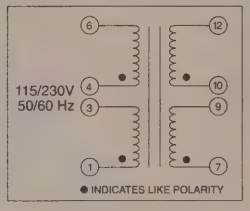
international one-4-all™

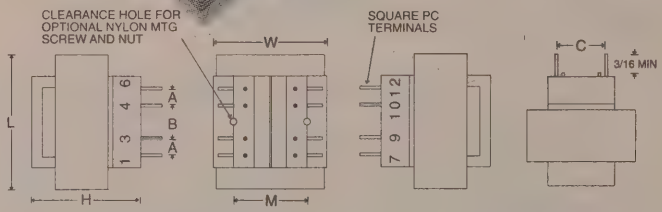
MEETS VDE, CSA, UL, IEC INTERNATIONAL STANDARDS AT LOWER COST & BETTER PERFORMANCE THAN EXISTING SPLIT-BOBBIN TYPES!

2.5, 5.0, 10 VA Sizes Only

E63829 SECTION 10 LR51265 - 29 1446 UG







Dimensions (In inches)							Pin	Mtg.	Mtg. Screw		
VA	L	W	H	A	B	C	Dimensions	M	Size	Qty	Lbs.
2.5	1⅝	1 7/16*	1⅛	0.200	0.250	1.000	0.025SQ	1 1/16	#4	2	0.25
5.0	1⅝	1 7/16*	1⅜	0.200	0.400	1.000	0.025SQ	1 1/16	#4	2	0.37
10.0	1⅞	1 9/16	1⅜	0.200	0.400	1.140	0.038SQ	1¼	#4	2	0.53

*NOTE: Previously this dimension was 1 5/16; now it is 1 7/16.

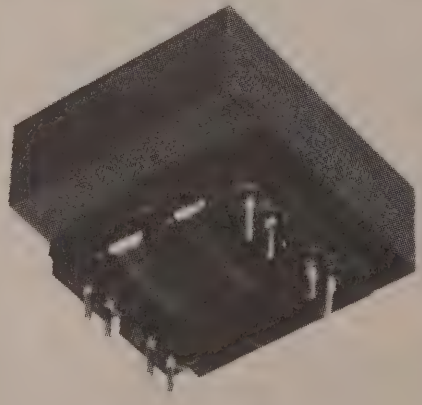
FEATURES & BENEFITS

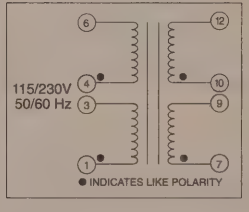
- Concentric primary windings and primary cross-over insulation
- Improved side termination design
- All terminations protected by wrap around shroud
- Precise pin alignment for drop-in applications
- Exact pin for pin replacement with previous 14A units
- Plus, all the advantages provided by the previous 14A Series

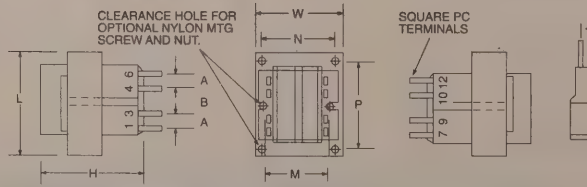
Part No.	VA (Size)	Secondary RMS Rating	
		Series	Parallel
14A-2.5R-10	2.5	10V C.T. @ 0.25A	5V @ 0.50A
14A-5.0R-10	5.0	10V C.T. @ 0.50A	5V @ 1.00A
14A-10R-10	10	10V C.T. @ 1.00A	5V @ 2.00A
14A-2.5R-12	2.5	12.6V C.T. @ 0.20A	6.3V @ 0.40A
14A-5.0R-12	5.0	12.6V C.T. @ 0.40A	6.3V @ 0.80A
14A-10R-12	10	12.6V C.T. @ 0.80A	6.3V @ 1.60A
14A-2.5R-16	2.5	16V C.T. @ 0.15A	8V @ 0.30A
14A-5.0R-16	5.0	16V C.T. @ 0.31A	8V @ 0.62A
14A-10R-16	10	16V C.T. @ 0.62A	8V @ 1.25A
14A-2.5R-20	2.5	20V C.T. @ 0.12A	10V @ 0.24A
14A-5.0R-20	5.0	20V C.T. @ 0.25A	10V @ 0.50A
14A-10R-20	10	20V C.T. @ 0.50A	10V @ 1.00A
14A-2.5R-24	2.5	24V C.T. @ 0.10A	12V @ 0.20A
14A-5.0R-24	5.0	24V C.T. @ 0.21A	12V @ 0.42A
14A-10R-24	10	24V C.T. @ 0.42A	12V @ 0.84A
14A-2.5R-28	2.5	28V C.T. @ 0.09A	14V @ 0.18A
14A-5.0R-28	5.0	28V C.T. @ 0.18A	14V @ 0.36A
14A-10R-28	10	28V C.T. @ 0.36A	14V @ 0.72A
14A-2.5R-36	2.5	36V C.T. @ 0.07A	18V @ 0.14A
14A-5.0R-36	5.0	36V C.T. @ 0.14A	18V @ 0.28A
14A-10R-36	10	36V C.T. @ 0.28A	18V @ 0.56A

20, 30, 56VA Sizes Only

E63829 SECTION 10 LR51265 - 29 1446 UG







FEATURES & BENEFITS

- Dual bobbin construction with insulating shroud using flame retardant material
- Class B (130°C) material
- 4000 VRMS Hipot
- Non-concentric design reduces capacitance and eliminates the need for an electrostatic shield

Part No.	VA (Size)	Secondary RMS Rating	
		Series	Parallel
14A-20-10	20.0	10V C.T. @ 2.0A	5V @ 4.0A
14A-30-10	30.0	10V C.T. @ 3.0A	5V @ 6.0A
14A-56-10	56.0	10V C.T. @ 5.6A	5V @ 11.2A
14A-20-12	20.0	12.6V C.T. @ 1.6A	6.3V @ 3.2A
14A-30-12	30.0	12.6V C.T. @ 2.4A	6.3V @ 4.8A
14A-56-12	56.0	12.6V C.T. @ 4.4A	6.3V @ 8.8A
14A-20-16	20.0	16V C.T. @ 1.25A	8V @ 2.5A
14A-30-16	30.0	16V C.T. @ 1.9A	8V @ 3.8A
14A-56-16	56.0	16V C.T. @ 3.5A	8V @ 7.0A
14A-20-20	20.0	20V C.T. @ 1.0A	10V @ 2.0A
14A-30-20	30.0	20V C.T. @ 1.5A	10V @ 3.0A
14A-56-20	56.0	20V C.T. @ 2.8A	10V @ 5.6A
14A-20-24	20.0	24V C.T. @ 0.83A	12V @ 1.66A
14A-30-24	30.0	24V C.T. @ 1.25A	12V @ 2.50A
14A-56-24	56.0	24V C.T. @ 2.33A	12V @ 4.66A
14A-20-28	20.0	28V C.T. @ 0.72A	14V @ 1.44A
14A-30-28	30.0	28V C.T. @ 1.06A	14V @ 2.12A
14A-56-28	56.0	28V C.T. @ 2.0A	14V @ 4.0A
14A-20-36	20.0	36V C.T. @ 0.56A	18V @ 1.12A
14A-30-36	30.0	36V C.T. @ 0.82A	18V @ 1.64A
14A-56-36	56.0	36V C.T. @ 1.56A	18V @ 3.12A

• Secondaries are designed to be used simultaneously.

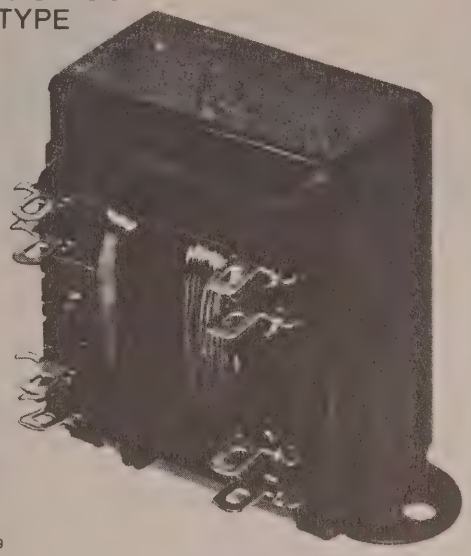
Dimensions (In inches)							Pin	Mtg.			Mtg. Screw		
VA	L	W	H	A	B	C	Dimensions	M	N	P	Size	Quantity	Lbs.
20.0	2¼	1⅞	1⅝	0.400	0.400	1.460	0.038SQ	1½	–	–	#4	2	0.90
30.0	2⅝	2 3/16	1 9/16	0.550	0.275	1.680	0.045SQ	–	1¾	2 3/16	#6	4	1.15
56.0	3	2½	1 13/16	0.600	0.300	1.900	0.045SQ	–	2	2½	#6	4	1.70

...series transformers

FEATURES & BENEFITS

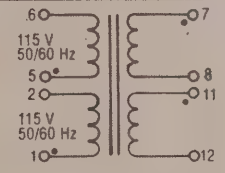
- Low leakage current
- High insulation resistance
- 4000 VRMS Hipot
- Class B (130°C) Material
- Non-concentric design reduces capacitance and eliminates the need for an electrostatic shield
- Dual bobbin construction with insulating shroud using flame retardant material
- Multi-purpose solder lug or quick-connect type terminals

CHASSIS MOUNT TYPE



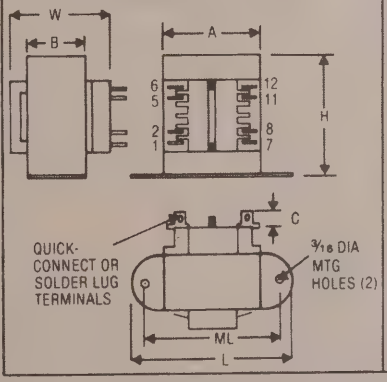
VDE 1448 UG
E83529 SECTION 11
LR 51265-29

Part No.	VA (Size)	Secondary RMS Rating	
		Series	Parallel
A41-25-10	25	10V C.T. @ 2.5A	5V @ 5.0A
A41-43-10	43	10V C.T. @ 4.3A	5V @ 8.6A
A41-80-10	80	10V C.T. @ 8.0A	5V @ 16.0A
A41-130-10	130	10V C.T. @ 13.0A	5V @ 26.0A
A41-175-10	175	10V C.T. @ 17.5A	5V @ 35.0A
A41-25-12	25	12.6V C.T. @ 2.0A	6.3V @ 4.0A
A41-43-12	43	12.6V C.T. @ 3.4A	6.3V @ 6.8A
A41-80-12	80	12.6V C.T. @ 6.3A	6.3V @ 12.6A
A41-130-12	130	12.6V C.T. @ 10.3A	6.3V @ 20.6A
A41-175-12	175	12.6V C.T. @ 14.0A	6.3V @ 28.0A
A41-25-16	25	16V C.T. @ 1.6A	8V @ 3.2A
A41-43-16	43	16V C.T. @ 2.7A	8V @ 5.4A
A41-80-16	80	16V C.T. @ 5.0A	8V @ 10.0A
A41-130-16	130	16V C.T. @ 8.1A	8V @ 16.2A
A41-175-16	175	16V C.T. @ 11.0A	8V @ 22.0A
A41-25-20	25	20V C.T. @ 1.25A	10V @ 2.5A
A41-43-20	43	20V C.T. @ 2.2A	10V @ 4.4A
A41-80-20	80	20V C.T. @ 4.0A	10V @ 8.0A
A41-130-20	130	20V C.T. @ 6.5A	10V @ 13.0A
A41-175-20	175	20V C.T. @ 8.8A	10V @ 17.6A
A41-25-24	25	24V C.T. @ 1A	12V @ 2A
A41-43-24	43	24V C.T. @ 1.8A	12V @ 3.6A
A41-80-24	80	24V C.T. @ 3.3A	12V @ 6.6A
A41-130-24	130	24V C.T. @ 5.4A	12V @ 10.8A
A41-175-24	175	24V C.T. @ 7.3A	12V @ 14.6A
A41-25-28	25	28V C.T. @ 0.9A	14V @ 1.86A
A41-43-28	43	28V C.T. @ 1.5A	14V @ 3.0A
A41-80-28	80	28V C.T. @ 2.8A	14V @ 5.6A
A41-130-28	130	28V C.T. @ 4.6A	14V @ 9.2A
A41-175-28	175	28V C.T. @ 6.25A	14V @ 12.5A
A41-25-36	25	36V C.T. @ 0.7A	18V @ 1.4A
A41-43-36	43	36V C.T. @ 1.2A	18V @ 2.4A
A41-80-36	80	36V C.T. @ 2.2A	18V @ 4.4A
A41-130-36	130	36V C.T. @ 3.6A	18V @ 7.2A
A41-175-36	175	36V C.T. @ 4.8A	18V @ 9.6A
A41-25-230	25	230V C.T. @ 0.11A	115V @ 0.22A
A41-43-230	43	230V C.T. @ 0.19A	115V @ 0.38A
A41-80-230	80	230V C.T. @ 0.35A	115V @ 0.7A
A41-130-230	130	230V C.T. @ 0.57A	115V @ 1.14A
A41-175-230	175	230V C.T. @ 0.76A	115V @ 1.52A

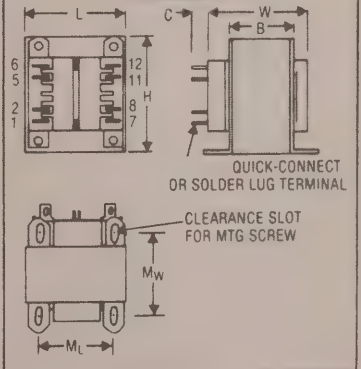


PRIMARIES ARE DESIGNED TO BE USED SIMULTANEOUSLY. SECONDARIES ARE DESIGNED TO BE USED SIMULTANEOUSLY THAT IS, THEY MUST BE USED EITHER SERIES OR PARALLEL CONNECTED (AS ONE WINDING).

MTG STYLE C



MTG STYLE B



Dimensions							Terminals	Mtg. Style	Mtg.		Mtg. Screw	Lbs.
VA	L	W	H	A	B	C			ML	MW		
25	2 13/16	1 7/8	2 5/16	2	1 1/8	5/16	3/16 (.187)	C	2 3/8	–	#6	1.25
43	3 1/8	2 1/16	2 11/16	2 1/4	1 1/8	5/16	3/16 (.187)	C	2 13/16	–	#6	1.6
80	2 1/2	2 3/8	3	–	1 3/8	5/16	3/16 (.187)	B	2	2 3/16	#6	2.8
130	2 13/16	2 7/8	3 3/8	–	1 5/8	3/8	1/4 (0.25)	B	2 1/4	2 1/2	#8	4.1
175	3 1/8	2 7/8	3 3/4	–	1 5/8	3/8	1/4 (0.25)	B	2 1/2	2 1/2	#8	5.5

THE PRONTO PLEDGE

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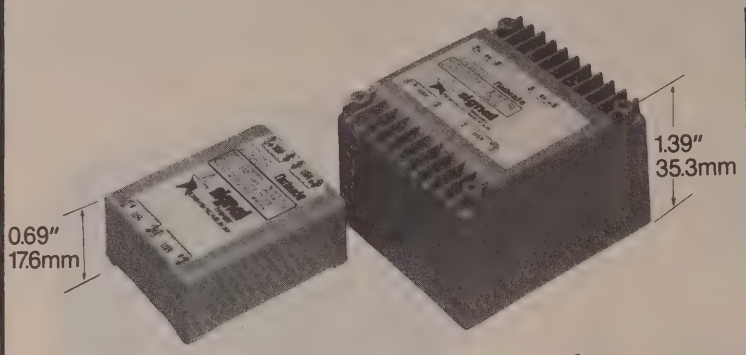
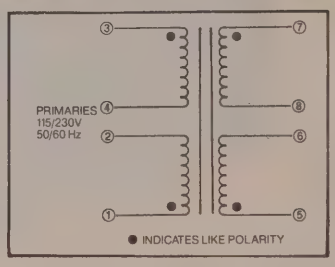
international flathead® series ...





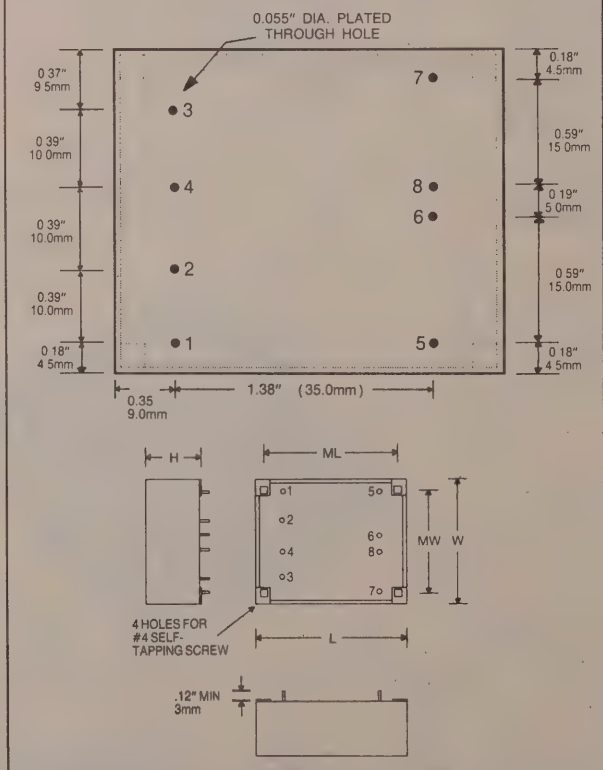
8325
E63829
LR51265

FEATURES & BENEFITS

- VDE Certification: VDE 0805 Part 100 (IEC 950)
- CSA Certification: CSA 22.2 #66
- U.L. Recognition: UL 506
- Low profile (as low as 0.69")
- Full encapsulation
- Rugged pins
- Screw mounting on all units
- Precise pin alignment for drop-in applications
- Class B insulation (130°C)
- Improved lower regulation
- Unique insulating techniques to meet international standards

Part No.	Size	SECONDARY	
		Series	Parallel
IF-2-10	2VA	10Vct @ 200mA	5V @ 400mA
IF-2-12	2VA	12Vct @ 170mA	6V @ 340mA
IF-2-16	2VA	16Vct @ 125mA	8V @ 250mA
IF-2-20	2VA	20Vct @ 100mA	10V @ 200mA
IF-2-24	2VA	24Vct @ 85mA	12V @ 170mA
IF-2-30	2VA	30Vct @ 70mA	15V @ 140mA
IF-2-34	2VA	34Vct @ 60mA	17V @ 120mA
IF-2-40	2VA	40Vct @ 50mA	20V @ 100mA
IF-2-56	2VA	56Vct @ 40mA	28V @ 80mA
IF-2-230	2VA	230Vct @ 9mA	115V @ 18mA
IF-4-10	4VA	10Vct @ 400mA	5V @ 800mA
IF-4-12	4VA	12Vct @ 335mA	6V @ 670mA
IF-4-16	4VA	16Vct @ 250mA	8V @ 500mA
IF-4-20	4VA	20Vct @ 200mA	10V @ 400mA
IF-4-24	4VA	24Vct @ 170mA	12V @ 340mA
IF-4-30	4VA	30Vct @ 135mA	15V @ 270mA
IF-4-34	4VA	34Vct @ 120mA	17V @ 240mA
IF-4-40	4VA	40Vct @ 100mA	20V @ 200mA
IF-4-56	4VA	56Vct @ 70mA	28V @ 140mA
IF-4-230	4VA	230Vct @ 18mA	115V @ 36mA
IF-6-10	6VA	10Vct @ 600mA	5V @ 1.20A
IF-6-12	6VA	12Vct @ 500mA	6V @ 1.00A
IF-6-16	6VA	16Vct @ 375mA	8V @ 750mA
IF-6-20	6VA	20Vct @ 300mA	10V @ 600mA
IF-6-24	6VA	24Vct @ 250mA	12V @ 500mA
IF-6-30	6VA	30Vct @ 200mA	15V @ 400mA
IF-6-34	6VA	34Vct @ 180mA	17V @ 360mA
IF-6-40	6VA	40Vct @ 150mA	20V @ 300mA
IF-6-56	6VA	56Vct @ 110mA	28V @ 220mA
IF-6-230	6VA	230Vct @ 25mA	115V @ 50mA

PRINTED CIRCUIT DRILL PATTERN



Size	L	W	H	ML	MW	WGT
2	2.09" 53.0mm	1.73" 44.0mm	0.69" 17.6mm	1.87" 47.5mm	1.48" 37.5mm	4.6 Oz 0.13 kg
4	2.09" 53.0mm	1.73" 44.0mm	0.77" 19.6mm	1.87" 47.5mm	1.48" 37.5mm	5.4 Oz 0.15 kg
6	2.09" 53.0mm	1.73" 44.0mm	0.89" 22.6mm	1.87" 47.5mm	1.48" 37.5mm	6.9 Oz 0.20 kg

THE PRONTO PLEDGE

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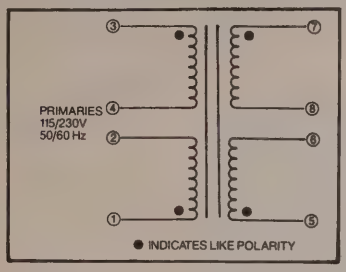

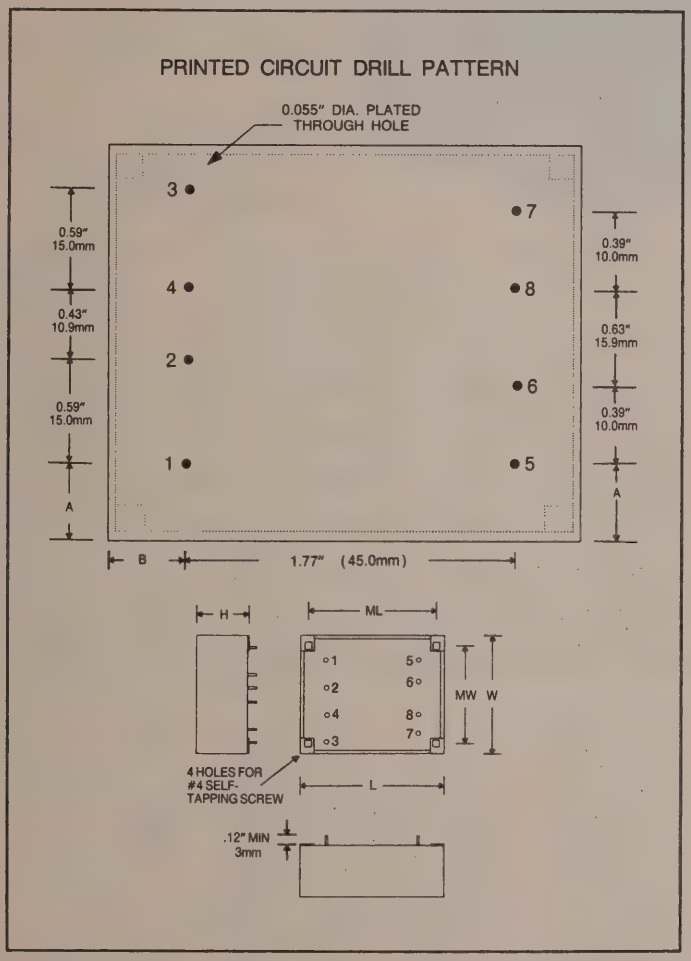

Part No.	Size	SECONDARY	
		Series	Parallel
IF-10-10	10VA	10Vct @ 1.00A	5V @ 2.00A
IF-10-12	10VA	12Vct @ 835mA	6V @ 1.67A
IF-10-16	10VA	16Vct @ 625mA	8V @ 1.25A
IF-10-20	10VA	20Vct @ 500mA	10V @ 1.00A
IF-10-24	10VA	24Vct @ 420mA	12V @ 840mA
IF-10-30	10VA	30Vct @ 335mA	15V @ 670mA
IF-10-34	10VA	34Vct @ 300mA	17V @ 600mA
IF-10-40	10VA	40Vct @ 250mA	20V @ 500mA
IF-10-56	10VA	56Vct @ 180mA	28V @ 360mA
IF-10-230	10VA	230Vct @ 45mA	115V @ 90mA
IF-14-10	14VA	10Vct @ 1.40A	5V @ 2.80A
IF-14-12	14VA	12Vct @ 1.20A	6V @ 2.40A
IF-14-16	14VA	16Vct @ 875mA	8V @ 1.75A
IF-14-20	14VA	20Vct @ 700mA	10V @ 1.40A
IF-14-24	14VA	24Vct @ 600mA	12V @ 1.20A
IF-14-30	14VA	30Vct @ 470mA	15V @ 940mA
IF-14-34	14VA	34Vct @ 415mA	17V @ 830mA
IF-14-40	14VA	40Vct @ 350mA	20V @ 700mA
IF-14-56	14VA	56Vct @ 250mA	28V @ 500mA
IF-14-230	14VA	230Vct @ 60mA	115V @ 120mA
IF-18-10	18VA	10Vct @ 1.80A	5V @ 3.60A
IF-18-12	18VA	12Vct @ 1.50A	6V @ 3.00A
IF-18-16	18VA	16Vct @ 1.15A	8V @ 2.30A
IF-18-20	18VA	20Vct @ 900mA	10V @ 1.80A
IF-18-24	18VA	24Vct @ 750mA	12V @ 1.50A
IF-18-30	18VA	30Vct @ 600mA	15V @ 1.20A
IF-18-34	18VA	34Vct @ 530mA	17V @ 1.06A
IF-18-40	18VA	40Vct @ 450mA	20V @ 900mA
IF-18-56	18VA	56Vct @ 320mA	28V @ 640mA
IF-18-230	18VA	230Vct @ 80mA	115V @ 160mA
IF-24-10	24VA	10Vct @ 2.40A	5V @ 4.80A
IF-24-12	24VA	12Vct @ 2.00A	6V @ 4.00A
IF-24-16	24VA	16Vct @ 1.50A	8V @ 3.00A
IF-24-20	24VA	20Vct @ 1.20A	10V @ 2.40A
IF-24-24	24VA	24Vct @ 1.00A	12V @ 2.00A
IF-24-30	24VA	30Vct @ 800mA	15V @ 1.60A
IF-24-34	24VA	34Vct @ 700mA	17V @ 1.40A
IF-24-40	24VA	40Vct @ 600mA	20V @ 1.20A
IF-24-56	24VA	56Vct @ 430mA	28V @ 860mA
IF-24-230	24VA	230Vct @ 105mA	115V @ 210mA
IF-30-10	30VA	10Vct @ 3.00A	5V @ 6.00A
IF-30-12	30VA	12Vct @ 2.50A	6V @ 5.00A
IF-30-16	30VA	16Vct @ 1.90A	8V @ 3.80A
IF-30-20	30VA	20Vct @ 1.50A	10V @ 3.00A
IF-30-24	30VA	24Vct @ 1.25A	12V @ 2.50A
IF-30-30	30VA	30Vct @ 1.00A	15V @ 2.00A
IF-30-34	30VA	34Vct @ 900mA	17V @ 1.80A
IF-30-40	30VA	40Vct @ 750mA	20V @ 1.50A
IF-30-56	30VA	56Vct @ 550mA	28V @ 1.10A
IF-30-230	30VA	230Vct @ 130mA	115V @ 260mA

Size	L	W	H	ML	MW	A	B	WGT
10	2.66" 67.6mm	2.24" 57.0mm	0.89" 22.6mm	2.46" 62.5mm	1.97" 50.0mm	0.42" 10.6mm	0.45" 11.3mm	10.3 Oz 0.29 kg
14	2.66" 67.6mm	2.24" 57.0mm	0.96" 24.3mm	2.46" 62.5mm	1.97" 50.0mm	0.42" 10.6mm	0.45" 11.3mm	11.9 Oz 0.34 kg
18	2.66" 67.6mm	2.24" 57.0mm	1.09" 27.6mm	2.46" 62.5mm	1.97" 50.0mm	0.42" 10.6mm	0.45" 11.3mm	14.1 Oz 0.40 kg
24	2.68" 68.0mm	2.26" 57.5mm	1.23" 31.3mm	2.46" 62.5mm	1.97" 50.0mm	0.43" 10.9mm	0.46" 11.5mm	16.5 Oz 0.47 kg
30	2.68" 68.0mm	2.26" 57.5mm	1.39" 35.3mm	2.46" 62.5mm	1.97" 50.0mm	0.43" 10.9mm	0.46" 11.5mm	19.7 Oz 0.58 kg

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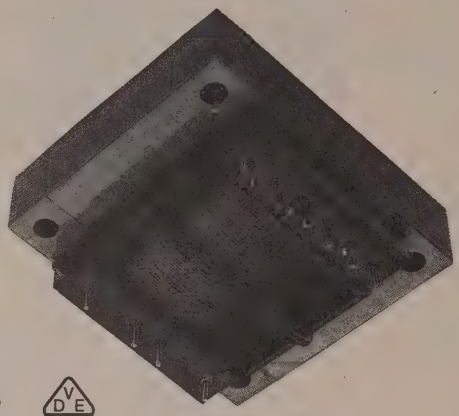
one-4-all transformers... p.c. board for triple-output regulated supplies in (μp) applications

PC BOARD TYPE

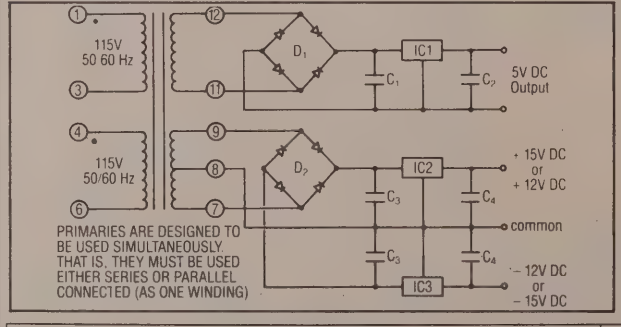


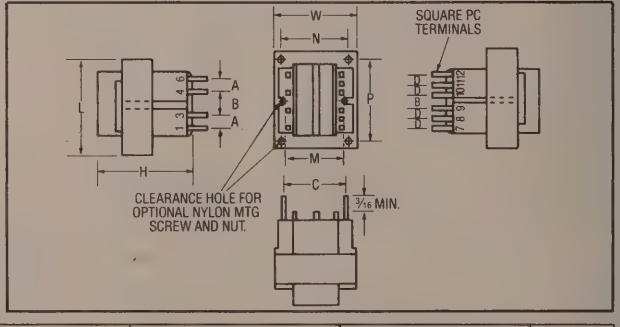
LR 51265-35 E63829 SECTION 10 4361 UG

- Dual complementary outputs–with your regulators, ±12VDC and ±15 VDC.
- Additional isolated single output gives you 5VDC after regulation.
- Low noise alternative to multi-output switchers.
- PC board mount has the advantages of Signals one-4-all International Series–isolation and dual bobbin construction.
- UL recognized UL506
- VDE Certification: VDE 0805 Part 100 (IEC 950)
- CSA Certification: CSA 22.2 #66

PART NUMBER PRIMARY 50/60 Hz	DC OUTPUT		VA	SUGGESTED COMPONENTS					C_2 C_4 See Note ①	
115/230V	Regulator 1	Regulator 2		C_1	C_3	IC1③	IC2③	IC3③	D1④	D2④
14A-20-512	5V @ 750MA	±12V @ 200MA	20	2.3 KMFD @ 50 VDC	600 MFD @ 50 VDC	LM-323K-5	LM-340K-12	LM-320K-12	PE20	PF20
14A-20-515	5V @ 750MA	±15V @ 175MA	20			LM-323K-5	LM-340K-15	LM-320K-15	PE20	PF20
14A-30-512	5V @ 1.25A	±12V @ 250MA	30	4.1 KMFD @ 15 VDC	1.1 KMFD @ 50 VDC	LM-323K-5	LM-340K-12	LM-320K-12	PE20	PF20
14A-30-515	5V @ 1.25A	±15V @ 200MA	30		600 MFD @ 50 VDC	LM-323K-5	LM-340K-15	LM-320K-15	PE20	PF20
14A-56-512	5V @ 3A	±12V @ 300MA	56	10.0 KMFD @ 15 VDC	1.1 KMFD @ 50 VDC	LM-338②	LM-340K-12	LM-320K-12	PP20	PF20
14A-56-515	5V @ 3A	±15V @ 250MA	56			LM-338②	LM-340K-15	LM-320K-15	PP20	PF20

Note ①: Output capacitors C_2 and C_4 are required to stabilize regulators. Values can be 1 MFD min. tantalum or 10 MFD min. electrolytic. 20V min.
Note ②: LM-338 is an adjustable regulator and MFR's specifications (National Semiconductor) should be consulted for values of external components.
Note ③: All IC's are National Semiconductor types.
Note ④: All bridges are EDI types.





Dimensions								Pin	Mtg.			Mtg. Screw		
VA	L	W	H	A	B	C	D	Dimensions	M	N	P	Size	Quantity	Lbs.
20.0	2¼	1⅞	1⅝	.400	.400	1.460	.200	0.038SQ	1½	–	–	#4	2	0.90
30.0	2⅝	2³⁄₁₆	1⁹⁄₁₆	.550	.275	1.680	.275	0.045SQ	–	1¾	2³⁄₁₆	#6	4	1.15
56.0	3	2½	1¹³⁄₁₆	.600	.300	1.900	.300	0.045SQ	–	2	2½	#6	4	1.70

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all-4-one™ transformers... chassis mount for triple-output regulated supplies in (μp) applications

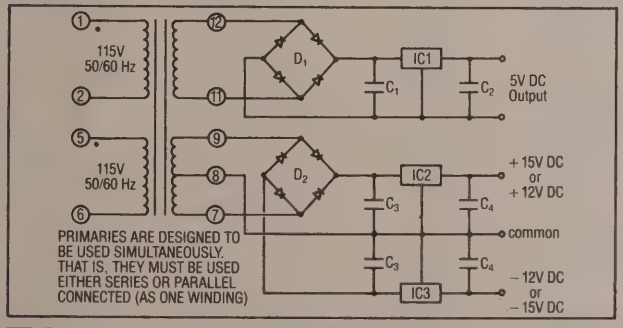
CHASSIS MOUNT TYPE

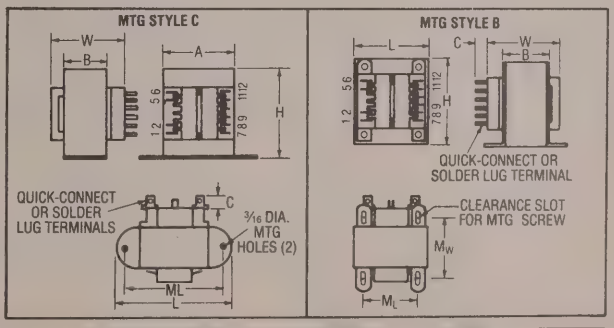
- Dual complementary outputs–with your regulators, ±12VDC and ±15VDC.
- Additional isolated single output gives you 5VDC after regulation.
- Low noise alternative to multi-output switchers.
- Chassis mount has the advantages of Signals all-4-one International Series – isolation and dual bobbin construction.
- UL recognized UL506
- VDE Certification: VDE 0805 Part 100 (IEC 950)
- CSA Certification: CSA 22.2 #66

LR 51265-35 E63829 SECTION 11 4362 UG

PART NUMBER PRIMARY 50/60 Hz	DC OUTPUT		VA	SUGGESTED COMPONENTS					C_2 C_4 See Note ①	
115/230V	Regulator 1	Regulator 2		C_1	C_3	IC1③	IC2③	IC3③	D1④	D2④
A41-25-512	5V @ 1.25A	±12V @ 150MA	25	4.1 KMFD @ 15 VDC	600 MFD @ 50 VDC	LM-323K-5	LM-340K-12	LM-320K-12	PE20	PF20
A41-25-515	5V @ 1.25A	±15V @ 130MA	25			LM-323K-5	LM-340K-15	LM-320K-15	PE20	PF20
A41-43-512	5V @ 2A	±12V @ 300MA	43	8 KMFD @ 15 VDC	1.1 KMFD @ 50 VDC	LM-323K-5	LM-340K-12	LM-320K-12	PE20	PF20
A41-43-515	5V @ 2A	±15V @ 250MA	43			LM-323K-5	LM-340K-15	LM-320K-15	PE20	PF20
A41-80-512	5V @ 3.5A	±12V @ 600MA	80	10 KMFD @ 15 VDC	2.1 KMFD @ 50 VDC	LM-338②	LM-340K-12	LM-320K-12	PP20	PF20
A41-80-515	5V @ 3.5A	±15V @ 500MA	80			LM-338②	LM-340K-15	LM-320K-15	PP20	PF20

Note ①: Output capacitors C_2 and C_4 are required to stabilize regulators. Values can be 1 MFD min. tantalum or 10 MFD min. electrolytic. 20V min.
Note ②: LM-338 is an adjustable regulator and MFR's specifications (National Semiconductor) should be consulted for values of external components.
Note ③: All IC's are National Semiconductor types.
Note ④: All bridges are EDI types.




MTG STYLE C
MTG STYLE B
QUICK-CONNECT OR SOLDER LUG TERMINALS
3/16 DIA. MTG HOLES (2)
QUICK-CONNECT OR SOLDER LUG TERMINAL
CLEARANCE SLOT FOR MTG SCREW

Dimensions							Terminals	Mtg. Style	Mtg.		Mtg. Screw	Lbs.
VA	L	W	H	A	B	C			ML	MW		
25	2 13/16	1 7/8	2 5/16	2	1 1/8	5/16	3/16 (.187)	C	2 3/8	–	#6	1.25
43	3 1/8	2 1/16	2 11/16	2 1/4	1 1/8	5/16	3/16 (.187)	C	2 13/16	–	#6	1.6
80	2 1/2	2 3/8	3	–	1 3/8	5/16	3/16 (.187)	B	2	2 3/16	#6	2.8

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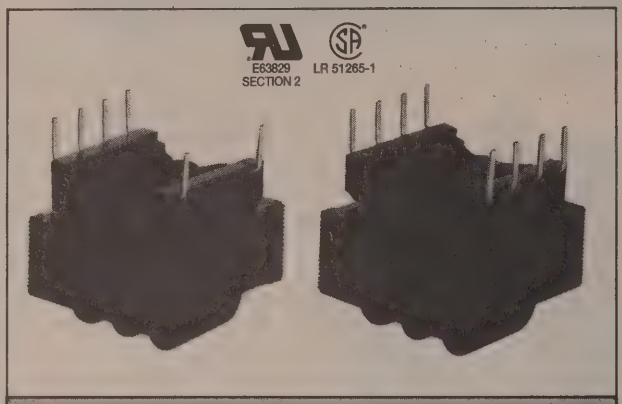
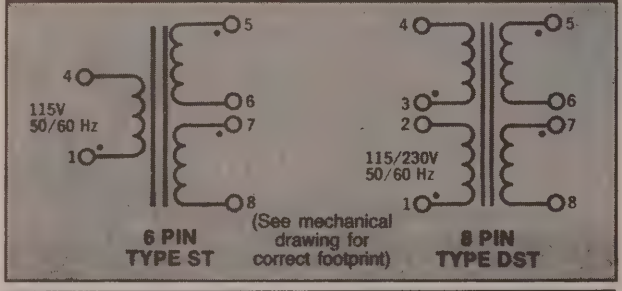
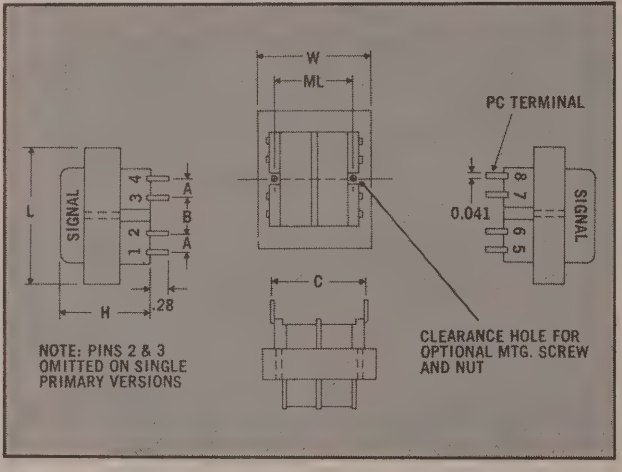
split/tran® p.c. board transformers

SPLIT BOBBIN—HIGHLY ISOLATED







Size	VA	L	W	H	ML	A	B	C	Optional Mtg. Screw & Nut*	Lbs.
2	1.1	1 3/8	1 1/8	15/16	—	.250	.250	1.200	None	0.17
3	2.4	1 3/8	1 1/8	1 3/16	—	.250	.250	1.200	None	0.25
4	6	1 5/8	1 5/16	1 5/16	1 1/16	.250	.350	1.280	4-40 x 1 3/8 Nylon	0.44
5	12	1 7/8	1 9/16	1 7/16	1 1/4	.300	.400	1.410	4-40 x 1 3/8 Nylon	0.70
6	20	2 1/4	1 7/8	1 7/16	1 1/2	.300	.400	1.600	4-40 x 1 3/8 Nylon	0.80
7	36	2 5/8	2 3/16	1 9/16	†	.400	.400	1.850	†	1.1

* Available from Signal: Part No. ST-MS (Screw) & Part No. ST-MN (Nut).
† Size 7 has 4 mtg. holes on 2 3/16 x 1 3/4 centers for a #6 screw. Need not be nylon.

"Split-Tran" transformers combine the best features of our "2-4-1" Series and Signal's pioneering line of pc board miniature transformers.

The use of a "split bobbin" allows the primaries and secondaries to be wound non-concentrically, i.e., side by side rather than one over the other. This results in cost savings and superior performance, namely:

- High isolation — **2500V** hipot is standard.
- Low capacitive coupling — no electro-static shield necessary.
- Less manufacturing time — no cross-overs of primary and secondary leads.
- PC pins — allow direct insertion in PC boards.
- Class S insulation — 130°C.

Each transformer is available with single 115V or dual 115/230V primaries. In addition, secondaries are split so that they can be series or parallel connected.

Special variations will be quoted and shipped promptly.

PART NUMBER*		SECONDARY RMS RATING	
Single 115V 6 Pin	Dual 115/230V 8 Pin	Series	Parallel
ST 2-10	DST 2-10	10V C.T. @ 0.11A	5V @ 0.22A
ST 3-10	DST 3-10	10V C.T. @ 0.25A	5V @ 0.5A
ST 4-10	DST 4-10	10V C.T. @ 0.6A	5V @ 1.2A
ST 5-10	DST 5-10	10V C.T. @ 1.2A	5V @ 2.4A
ST 6-10	DST 6-10	10V C.T. @ 2A	5V @ 4A
ST 7-10	DST 7-10	10V C.T. @ 3.6A	5V @ 7.2A
ST 2-12	DST 2-12	12.6V C.T. @ 0.09A	6.3V @ 0.18A
ST 3-12	DST 3-12	12.6V C.T. @ 0.2A	6.3V @ 0.4A
ST 4-12	DST 4-12	12.6V C.T. @ 0.5A	6.3V @ 1.0A
ST 5-12	DST 5-12	12.6V C.T. @ 1.0A	6.3V @ 2.0A
ST 6-12	DST 6-12	12.6V C.T. @ 1.6A	6.3V @ 3.2A
ST 7-12	DST 7-12	12.6V C.T. @ 2.85A	6.3V @ 5.7A
ST 2-16	DST 2-16	16V C.T. @ 0.07A	8V @ 0.14A
ST 3-16	DST 3-16	16V C.T. @ 0.15A	8V @ 0.3A
ST 4-16	DST 4-16	16V C.T. @ 0.4A	8V @ 0.8A
ST 5-16	DST 5-16	16V C.T. @ 0.8A	8V @ 1.6A
ST 6-16	DST 6-16	16V C.T. @ 1.25A	8V @ 2.5A
ST 7-16	DST 7-16	16V C.T. @ 2.25A	8V @ 4.5A
ST 2-20	DST 2-20	20V C.T. @ 0.055A	10V @ 0.11A
ST 3-20	DST 3-20	20V C.T. @ 0.12A	10V @ 0.24A
ST 4-20	DST 4-20	20V C.T. @ 0.3A	10V @ 0.6A
ST 5-20	DST 5-20	20V C.T. @ 0.6A	10V @ 1.2A
ST 6-20	DST 6-20	20V C.T. @ 1A	10V @ 2A
ST 7-20	DST 7-20	20V C.T. @ 1.8A	10V @ 3.6A
ST 2-24	DST 2-24	24V C.T. @ 0.045A	12V @ 0.09A
ST 3-24	DST 3-24	24V C.T. @ 0.1A	12V @ 0.2A
ST 4-24	DST 4-24	24V C.T. @ 0.25A	12V @ 0.5A
ST 5-24	DST 5-24	24V C.T. @ 0.5A	12V @ 1.0A
ST 6-24	DST 6-24	24V C.T. @ 0.8A	12V @ 1.6A
ST 7-24	DST 7-24	24V C.T. @ 1.5A	12V @ 3.0A
ST 2-28	DST 2-28	28V C.T. @ 0.04A	14V @ 0.08A
ST 3-28	DST 3-28	28V C.T. @ 0.085A	14V @ 0.17A
ST 4-28	DST 4-28	28V C.T. @ 0.2A	14V @ 0.4A
ST 5 28	DST 5-28	28V C.T. @ 0.42A	14V @ 0.84A
ST 6-28	DST 6-28	28V C.T. @ 0.7A	14V @ 1.4A
ST 7-28	DST 7-28	28V C.T. @ 1.3A	14V @ 2.6A
ST 2-36	DST 2-36	36V C.T. @ 0.03A	18V @ 0.06A
ST 3-36	DST 3-36	36V C.T. @ 0.065A	18V @ 0.13A
ST 4-36	DST 4-36	36V C.T. @ 0.17A	18V @ 0.34A
ST 5-36	DST 5-36	36V C.T. @ 0.35A	18V @ 0.7A
ST 6-36	DST 6-36	36V C.T. @ 0.55A	18V @ 1.1A
ST 7-36	DST 7-36	36V C.T. @ 1A	18V @ 2A
ST 2-48	DST 2-48	48V C.T. @ 0.023A	24V @ 0.046A
ST 3-48	DST 3-48	48V C.T. @ 0.05A	24V @ 0.1A
ST 4-48	DST 4-48	48V C.T. @ 0.125A	24V @ 0.25A
ST 5-48	DST 5-48	48V C.T. @ 0.25A	24V @ 0.5A
ST 6-48	DST 6-48	48V C.T. @ 0.4A	24V @ 0.8A
ST 7-48	DST 7-48	48V C.T. @ 0.75A	24V @ 1.5A
ST 2-56	DST 2-56	56V C.T. @ 0.02A	28V @ 0.04A
ST 3-56	DST 3-56	56V C.T. @ 0.045A	28V @ 0.09A
ST 4-56	DST 4-56	56V C.T. @ 0.11A	28V @ 0.22A
ST 5-56	DST 5-56	56V C.T. @ 0.22A	28V @ 0.44A
ST 6-56	DST 6-56	56V C.T. @ 0.35A	28V @ 0.7A
ST 7-56	DST 7-56	56V C.T. @ 0.65A	28V @ 1.3A
ST 2-120	DST 2-120	120V C.T. @ 0.01A	60V @ 0.02A
ST 3-120	DST 3-120	120V C.T. @ 0.02A	60V @ 0.04A
ST 4-120	DST 4-120	120V C.T. @ 0.05A	60V @ 0.1A
ST 5-120	DST 5-120	120V C.T. @ 0.1A	60V @ 0.2A
ST 6-120	DST 6-120	120V C.T. @ 0.16A	60V @ 0.32A
ST 7-120	DST 7-120	120V C.T. @ 0.3A	60V @ 0.6A

* Explanation of Part Number: Series - ST; Size 4; Series Secondary Volts - 36

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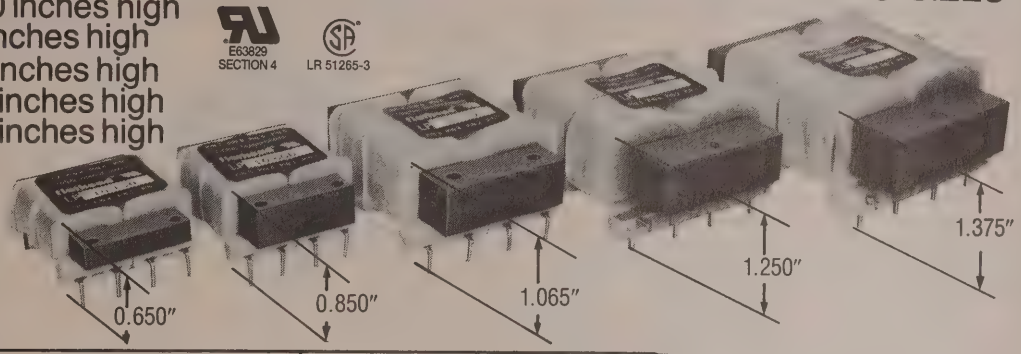
flathead® plug in power transformers ...in 2 new larger sizes

FOR PRINTED CIRCUIT APPLICATIONS

2.5VA – 0.650 inches high
6VA – 0.850 inches high
12VA – 1.065 inches high
24 VA – 1.250 inches high
48 VA – 1.375 inches high

E63829 SECTION 4 LR 51265-3

5 SIZES

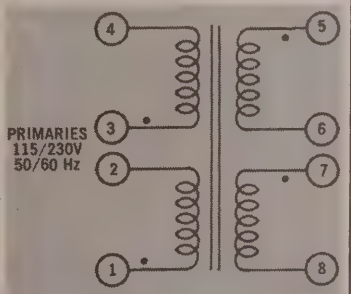


Part No.	Size	SECONDARY* Series	Parallel
LP 10-250	2	10V C.T. @ 250MA	5V @ 500MA
LP 10-600	6	10V C.T. @ 600MA	5V @ 1.2A
LP 10-1200	12	10V C.T. @ 1200MA	5V @ 2.4A
LP 10-2400	24	10V C.T. @ 2.40A	5V @ 4.80A
LP 10-4800	48	10V C.T. @ 4.80A	5V @ 9.60A
LP 12-200	2	12.6V C.T. @ 200MA	6.3V @ 400MA
LP 12-450	6	12.6V C.T. @ 450MA	6.3V @ 900MA
LP 12-900	12	12.6V C.T. @ 900MA	6.3V @ 1.8A
LP 12-1900	24	12.6V C.T. @ 1.90A	6.3V @ 3.80A
LP 12-3800	48	12.6V C.T. @ 3.80A	6.3V @ 7.60A
LP 16-150	2	16V C.T. @ 150MA	8V @ 300MA
LP 16-350	6	16V C.T. @ 350MA	8V @ 700MA
LP 16-700	12	16V C.T. @ 700MA	8V @ 1.4A
LP 16-1500	24	16V C.T. @ 1.50A	8V @ 3.00A
LP 16-3000	48	16V C.T. @ 3.00A	8V @ 6.00A
LP 20-125	2	20V C.T. @ 125MA	10V @ 250MA
LP 20-300	6	20V C.T. @ 300MA	10V @ 600MA
LP 20-600	12	20V C.T. @ 600MA	10V @ 1.2A
LP 20-1200	24	20V C.T. @ 1.20A	10V @ 2.40A
LP 20-2400	48	20V C.T. @ 2.40A	10V @ 4.80A
LP 24-100	2	24V C.T. @ 100MA	12V @ 200MA
LP 24-250	6	24V C.T. @ 250MA	12V @ 500MA
LP 24-500	12	24V C.T. @ 500MA	12V @ 1A
LP 24-1000	24	24V C.T. @ 1.00A	12V @ 2.00A
LP 24-2000	48	24V C.T. @ 2.00A	12V @ 4.00A
LP 30-85	2	30V C.T. @ 85MA	15V @ 170MA
LP 30-200	6	30V C.T. @ 200MA	15V @ 400MA
LP 30-400	12	30V C.T. @ 400MA	15V @ 800MA
LP 30-800	24	30V C.T. @ 800MA	15V @ 1.60A
LP 30-1600	48	30V C.T. @ 1.60A	15V @ 3.20A
LP 34-75	2	34V C.T. @ 75MA	17V @ 150MA
LP 34-170	6	34V C.T. @ 170MA	17V @ 340MA
LP 34-340	12	34V C.T. @ 340MA	17V @ 680MA
LP 34-700	24	34V C.T. @ 700MA	17V @ 1.40A
LP 34-1400	48	34V C.T. @ 1.40A	17V @ 2.80A
LP 40-60	2	40V C.T. @ 60MA	20V @ 120MA
LP 40-150	6	40V C.T. @ 150MA	20V @ 300MA
LP 40-300	12	40V C.T. @ 300MA	20V @ 600MA
LP 40-600	24	40V C.T. @ 600MA	20V @ 1.20A
LP 40-1200	48	40V C.T. @ 1.20A	20V @ 2.40A
LP 56-45	2	56V C.T. @ 45MA	28V @ 90MA
LP 56-100	6	56V C.T. @ 100MA	28V @ 200MA
LP 56-200	12	56V C.T. @ 200MA	28V @ 400MA
LP 56-425	24	56V C.T. @ 425MA	28V @ 850MA
LP 56-850	48	56V C.T. @ 850MA	28V @ 1.70A
LP 88-28	2	88V C.T. @ 28MA	44V @ 56MA
LP 88-65	6	88V C.T. @ 65MA	44V @ 130MA
LP 88-130	12	88V C.T. @ 130MA	44V @ 260MA
LP 120-20	2	120V C.T. @ 20MA	60V @ 40MA
LP 120-50	6	120V C.T. @ 50MA	60V @ 100MA
LP 120-100	12	120V C.T. @ 100MA	60V @ 200MA
LP 230-10	2	230V C.T. @ 10MA	115V @ 20MA
LP 230-25	6	230V C.T. @ 25MA	115V @ 50MA
LP 230-50	12	230V C.T. @ 50MA	115V @ 100MA

Signal expanded its Flathead® Series because of the trend toward higher power usage on PC boards. Two larger sizes (24 and 48 VA) are now available.

Basic design, layout and construction specifications have not changed. The only exception is that more rugged plug-in pins, using square wire, have been incorporated in order to properly handle the weights and currents required.

(See mechanical drawing for correct footprint)



Regulation of size 2 and 6 units is 30%; size 12 units is 20%; size 24 and 48 units is 15%; i.e., no load-secondary voltage is 15% higher than full load.

LOW PROFILE: Allows ¾″ card spacing for 2.5va units, 1 inch card spacing for 6va units, or 1¼″ inch card spacing for 12va units, 1½″ inch card spacing for 24va and 1⅝″ inch card spacing for 48va.

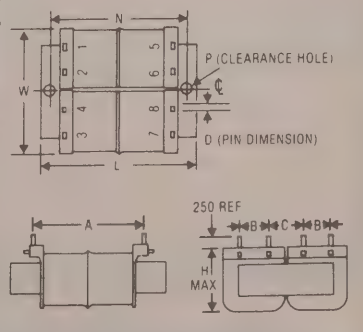
DUAL PRIMARIES: 115/230v, 50/60 Hz.

NON-CONCENTRIC WINDING: Where secondary is wound alongside primary rather than directly over it. This added isolation reduces inter-winding capacitance and **eliminates the need for an electro-static shield.**

1500V. RMS HIPOT: Is standard because of the advantage of non-concentric windings.

HUM-BUCKING CONSTRUCTION: (Semi-toroidal) results in reduced radiated magnetic field and balanced windings.

The LP line of transformers is ideal for low height, critical pc board power applications in semi-conductor control and instrumentation. They are used extensively in single or dual output dc supplies and isolated control circuit and reference supplies.



Size	A	B	C	L	W	H	N	D	P	Oz.
2	1.600	0.375	0.375	1.87	1.56	0.650	——	.041 x .020	——	5
6	1.600	0.375	0.375	1.87	1.56	0.850	——	.041 x .020	——	7
12	2.000	0.500	0.500	2.50	2.00	1.065	——	.041 x .020	——	11
24	1.900	0.600	0.530	2.87	2.25	1.250	2.41	.041 Sq.	CLEARANCE HOLE FOR # 4 SCREW	15
48	2.180	0.600	0.660	3.12	2.50	1.375	2.62	.041 Sq.	CLEARANCE HOLE FOR # 6 SCREW	21

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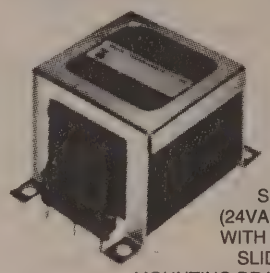
miniature plug in power transformers for printed circuits applications

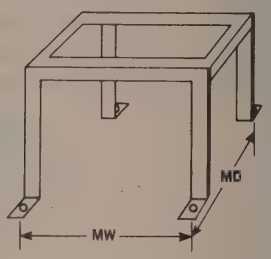
PRIMARY 50/500 Hz		SECONDARY RMS RATING*		
Single 115V (6 Pin)	Dual 115/230V (8 Pin)	Series	Parallel	(VA)
PC 10-90	DPC 10-90	10V C.T.@ 90MA	5V@ 180MA	1.0
PC 10-120	DPC 10-120	10V C.T.@ 120MA	5V@ 240MA	1.2
PC 10-440	DPC 10-440	10V C.T.@ 440MA	5V@ 880MA	4.4
PC 10-1000	DPC 10-1000	10V C.T.@ 1.0A	5V@ 2.0A	10.0
PC 10-2400	DPC 10-2400	10V C.T.@ 2.4A	5V@ 4.8A	24.0
PC 12-70	DPC 12-70	12.6V C.T.@ 70MA	6.3V@ 140MA	1.0
PC 12-100	DPC 12-100	12.6V C.T.@ 100MA	6.3V@ 200MA	1.2
PC 12-350	DPC 12-350	12.6V C.T.@ 350MA	6.3V@ 700MA	4.4
PC 12-800	DPC 12-800	12.6V C.T.@ 800MA	6.3V@ 1.6A	10.0
PC 12-2000	DPC 12-2000	12.6V C.T.@ 2.0A	6.3V@ 4.0A	24.0
PC 16-55	DPC 16-55	16V C.T.@ 55MA	8V@ 110MA	1.0
PC 16-75	DPC 16-75	16V C.T.@ 75MA	8V@ 150MA	1.2
PC 16-260	DPC 16-260	16V C.T.@ 260MA	8V@ 520MA	4.4
PC 16-640	DPC 16-640	16V C.T.@ 640MA	8V@ 1.28A	10.0
PC 16-1500	DPC 16-1500	16V C.T.@ 1.50A	8V@ 3.0A	24.0
PC 20-45	DPC 20-45	20V C.T.@ 45MA	10V@ 90MA	1.0
PC 20-60	DPC 20-60	20V C.T.@ 60MA	10V@ 120MA	1.2
PC 20-220	DPC 20-220	20V C.T.@ 220MA	10V@ 440MA	4.4
PC 20-500	DPC 20-500	20V C.T.@ 500MA	10V@ 1.0A	10.0
PC 20-1200	DPC 20-1200	20V C.T.@ 1.20A	10V@ 2.40A	24.0
PC 24-35	DPC 24-35	24V C.T.@ 35MA	12V@ 70MA	1.0
PC 24-50	DPC 24-50	24V C.T.@ 50MA	12V@ 100MA	1.2
PC 24-180	DPC 24-180	24V C.T.@ 180MA	12V@ 360MA	4.4
PC 24-450	DPC 24-450	24V C.T.@ 450MA	12V@ 900MA	10.0
PC 24-1000	DPC 24-1000	24V C.T.@ 1.0A	12V@ 2.0A	24.0
PC 28-30	DPC 28-30	28V C.T.@ 30MA	14V@ 60MA	1.0
PC 28-40	DPC 28-40	28V C.T.@ 40MA	14V@ 80MA	1.2
PC 28-160	DPC 28-160	28V C.T.@ 160MA	14V@ 320MA	4.4
PC 28-360	DPC 28-360	28V C.T.@ 360MA	14V@ 720MA	10.0
PC 28-800	DPC 28-800	28V C.T.@ 800MA	14V@ 1.60A	24.0
PC 34-25	DPC 34-25	34V C.T.@ 25MA	17V@ 50MA	1.0
PC 34-35	DPC 34-35	34V C.T.@ 35MA	17V@ 70MA	1.2
PC 34-125	DPC 34-125	34V C.T.@ 125MA	17V@ 250MA	4.4
PC 34-300	DPC 34-300	34V C.T.@ 300MA	17V@ 600MA	10.0
PC 34-700	DPC 34-700	34V C.T.@ 700MA	17V@ 1.40A	24.0
PC 40-20	DPC 40-20	40V C.T.@ 20MA	20V@ 40MA	1.0
PC 40-30	DPC 40-30	40V C.T.@ 30MA	20V@ 60MA	1.2
PC 40-110	DPC 40-110	40V C.T.@ 110MA	20V@ 220MA	4.4
PC 40-250	DPC 40-250	40V C.T.@ 250MA	20V@ 500MA	10.0
PC 40-600	DPC 40-600	40V C.T.@ 600MA	20V@ 1.20A	24.0
PC 56-15	DPC 56-15	56V C.T.@ 15MA	28V@ 30MA	1.0
PC 56-20	DPC 56-20	56V C.T.@ 20MA	28V@ 40MA	1.2
PC 56-80	DPC 56-80	56V C.T.@ 80MA	28V@ 160MA	4.4
PC 56-180	DPC 56-180	56V C.T.@ 180MA	28V@ 360MA	10.0
PC 56-420	DPC 56-420	56V C.T.@ 420MA	28V@ 840MA	24.0
PC 120-8	DPC 120-8	120V C.T.@ 8MA	60V@ 16MA	1.0
PC 120-10	DPC 120-10	120V C.T.@ 10MA	60V@ 20MA	1.2
PC 120-35	DPC 120-35	120V C.T.@ 35MA	60V@ 70MA	4.4
PC 120-85	DPC 120-85	120V C.T.@ 85MA	60V@ 170MA	10.0
PC 120-200	DPC 120-200	120V C.T.@ 200MA	60V@ 400MA	24.0

*See Table on opposite page for method of determining RMS Secondary Current.

BLACK DOT ON LABEL INDICATES POSITION OF TERMINAL #1

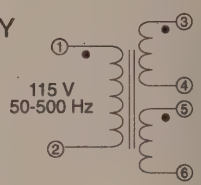
E63829 SECTION 6 LR51265 -3

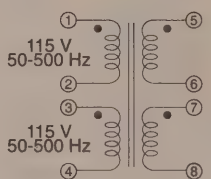




SIZE 24 (24VA) UNIT WITH 24-BR SLIDE-ON MOUNTING BRACKET

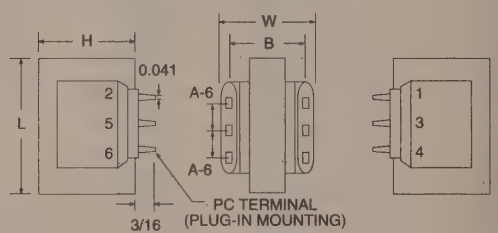
SINGLE 115V PRIMARY TYPE PC 6 PINS



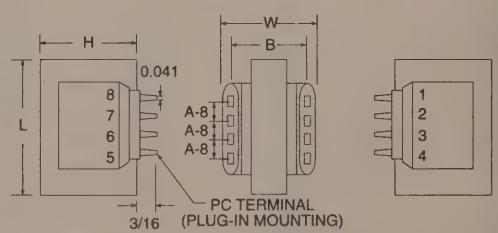


DUAL 115/230V PRIMARIES TYPE DPC 8 PINS

See mechanical drawing for correct footprint.



TYPE PC 6 PINS



TYPE DPC 8 PINS

DIMENSIONS (in inches)

Size (VA)	L	W	H	A-6 (6 Pin)	A-8 (8 Pin)	B	WT. (OZ.)	OPTIONAL BRACKET* No.	MW	MD
1.0	1	1 3/8	0.83	0.250	0.200	1.200	2.5	—	—	—
1.2	1 3/8	1 1/8	1 3/16	0.312	0.200	1.000	3	—	—	—
4.4	1 5/8	1 1/4	1 3/8	0.400	0.250	1.100	5	—	—	—
10.0	1 7/8	1 7/16	1 5/8	0.400	0.250	1.300	9	10-BR	1 41/64	1 1/8
24.0	1 5/8	2 1/4	1 3/8	0.400	0.250	2.100	12	24-BR	1 3/8	2

* An optional "Slide On" Mounting Bracket is available for sizes 10 & 24. The brackets do not use up any extra "Floor Space" but add 1/32" to the height of the transformer.

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cut size and weight with "2-4-1" series of small power transformers

AVAILABLE WITH SINGLE (115V) OR DUAL (115/230V) PRIMARIES

E63829 SECTION 1 LR51265 -3

Part Number		Secondary RMS Rating	Part Number		Secondary RMS Rating
Single 115V	Dual 115/230V		Single 115V	Dual 115/230V	
241-3-10	Not Available	10V C.T. @ 0.25A	241-3-28	Not Available	28V C.T. @ 0.085A
241-4-10	DP 241-4-10	10V C.T. @ 0.60A	241-4-28	DP 241-4-28	28V C.T. @ 0.20A
241-5-10	DP 241-5-10	10V C.T. @ 1.2A	241-5-28	DP 241-5-28	28V C.T. @ 0.42A
241-6-10	DP 241-6-10	10V C.T. @ 3.0A	241-6-28	DP 241-6-28	28V C.T. @ 1.1A
241-7-10	DP 241-7-10	10V C.T. @ 5.0A	241-7-28	DP 241-7-28	28V C.T. @ 2.0A
241-8-10	DP 241-8-10	10V C.T. @ 10A	241-8-28	DP 241-8-28	28V C.T. @ 3.6A
241-3-12	Not Available	12.6V C.T. @ 0.20A	241-3-36	Not Available	36V C.T. @ 0.065A
241-4-12	DP 241-4-12	12.6V C.T. @ 0.50A	241-4-36	DP 241-4-36	36V C.T. @ 0.17A
241-5-12	DP 241-5-12	12.6V C.T. @ 1.0A	241-5-36	DP 241-5-36	36V C.T. @ 0.35A
241-6-12	DP 241-6-12	12.6V C.T. @ 2.5A	241-6-36	DP 241-6-36	36V C.T. @ 0.85A
241-7-12	DP 241-7-12	12.6V C.T. @ 4.0A	241-7-36	DP 241-7-36	36V C.T. @ 1.5A
241-8-12	DP 241-8-12	12.6V C.T. @ 8.0A	241-8-36	DP 241-8-36	36V C.T. @ 2.8A
241-3-16	Not Available	16V C.T. @ 0.15A	241-3-48	Not Available	48V C.T. @ 0.05A
241-4-16	DP 241-4-16	16V C.T. @ 0.40A	241-4-48	DP 241-4-48	48V C.T. @ 0.125A
241-5-16	DP 241-5-16	16V C.T. @ 0.80A	241-5-48	DP 241-5-48	48V C.T. @ 0.25A
241-6-16	DP 241-6-16	16V C.T. @ 2.0A	241-6-48	DP 241-6-48	48V C.T. @ 0.63A
241-7-16	DP 241-7-16	16V C.T. @ 3.5A	241-7-48	DP 241-7-48	48V C.T. @ 1.2A
241-8-16	DP 241-8-16	16V C.T. @ 6.25A	241-8-48	DP 241-8-48	48V C.T. @ 2.0A
241-3-20	Not Available	20V C.T. @ 0.12A	241-3-56	Not Available	56V C.T. @ 0.045A
241-4-20	DP 241-4-20	20V C.T. @ 0.30A	241-4-56	DP 241-4-56	56V C.T. @ 0.11A
241-5-20	DP 241-5-20	20V C.T. @ 0.60A	241-5-56	DP 241-5-56	56V C.T. @ 0.22A
241-6-20	DP 241-6-20	20V C.T. @ 1.5A	241-6-56	DP 241-6-56	56V C.T. @ 0.54A
241-7-20	DP 241-7-20	20V C.T. @ 2.8A	241-7-56	DP 241-7-56	56V C.T. @ 1.00A
241-8-20	DP 241-8-20	20V C.T. @ 5.0A	241-8-56	DP 241-8-56	56V C.T. @ 1.8A
241-3-24	Not Available	24V C.T. @ 0.10A	241-3-120	Not Available	120V C.T. @ 0.02A
241-4-24	DP 241-4-24	24V C.T. @ 0.25A	241-4-120	DP 241-4-120	120V C.T. @ 0.05A
241-5-24	DP 241-5-24	24V C.T. @ 0.50A	241-5-120	DP 241-5-120	120V C.T. @ 0.10A
241-6-24	DP 241-6-24	24V C.T. @ 1.25A	241-6-120	DP 241-6-120	120V C.T. @ 0.25A
241-7-24	DP 241-7-24	24V C.T. @ 2.4A	241-7-120	DP 241-7-120	120V C.T. @ 0.50A
241-8-24	DP 241-8-24	24V C.T. @ 4.0A	241-8-120	DP 241-8-120	120V C.T. @ 0.85A

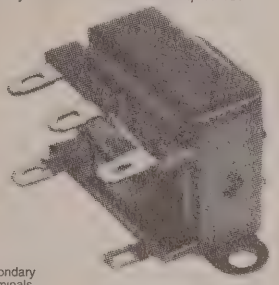
Explanation of part number series 241 Size-4 Sec. Volts - 36 Prefix "DP" used for dual primary versions

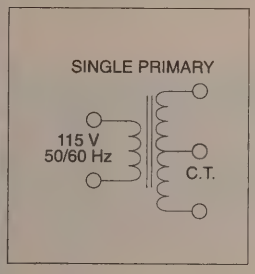
METHOD OF DETERMINING SECONDARY CURRENT RATINGS

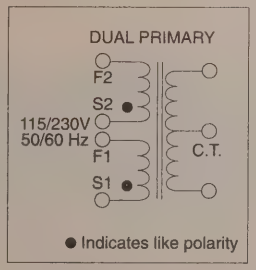
The secondary currents shown in the tables are RMS ratings. Depending upon rectifier circuit configurations, the RMS secondary current is different than the DC output current. This is indicated in the chart below:

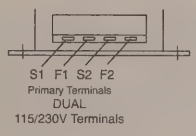
Rectifier Type	Filter Type	RMS Secondary Current Is
Full Wave Center-Tap	Choke Input	= 0.7 x DC Amps
Full Wave Center-Tap	Capacitor Input	= 1 to 1.2 x DC Amps
Full Wave Bridge	Choke Input	= DC Amps
Full Wave Bridge	Capacitor Input	= 1.6 to 1.8 x DC Amps

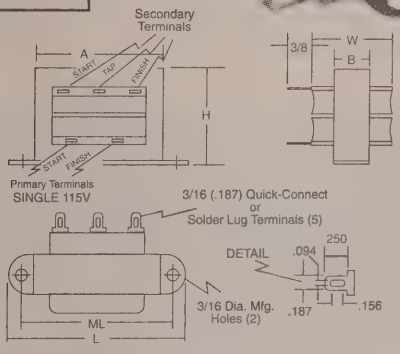
For example, in a F.W. Bridge circuit with a capacitive filter, if the load is 1 Amp DC, the RMS Secondary current is 1.6 to 1.8 Amp RMS.











DIMENSIONS (in inches)

Size	VA	L	W	H	A	B	ML	Lbs.
3	2.4	2 1/16	1 1/16	1 3/16	1 5/8	9/16	1 3/4	0.25
4	6	2 3/8	1 1/4	1 3/8	1 11/16	11/16	2	0.44
5	12	2 13/16	1 3/8	1 5/8	1 15/16	13/16	2 3/8	0.7
6	30	3 1/4	1 11/16	1 15/16	2 5/16	1 1/16	2 13/16	1.1
7	56	3 11/16	1 13/16	2 1/4	2 11/16	1 1/16	3 1/8	1.7
8	100	4 1/32	2 1/4	2 9/16	3 1/16	1 5/16	3 9/16	2.75

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p.c. board transformers for triple-output regulated supplies

IDEAL FOR MICROPROCESSOR APPLICATIONS

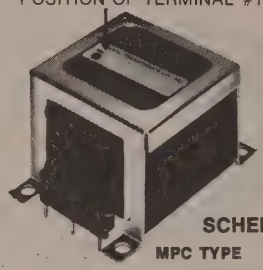
"MP" types have been developed specifically for use in triple-output regulated DC supplies that are commonly used in **Microprocessor Circuits** and other logic, op-amp combinations. Two output combinations have been provided, namely 5V and ±12V, and 5V and ±15V.

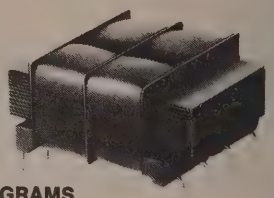
All "MP" units are rated in terms of the final **DC** output after a standard three terminal IC regulator. They are designed to provide these outputs with AC line inputs of 100 to 130V 50/60 Hz (or 200 to 260V for nominal 230V lines).

Two basic mechanical configurations are available. Standard PC types (MPC or DMPC) are tested to pass 1500V RMS hipot. Optional mounting brackets are available. MPL types are based on Signal's "flat-head" style and feature low profile, 115/230V primaries, hum-bucking construction, 1500V RMS hipot and the advantages of non-concentric winding (low inter-winding capacitance, high isolation, and no need for an electro-static shield).

All MP's are stocked in depth for immediate delivery. In addition, special variations can be supplied with reasonable delivery times.

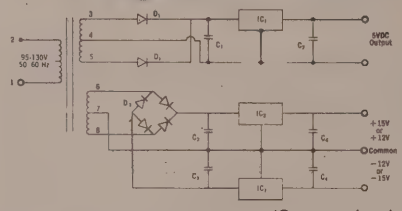
BLACK DOT ON LABEL INDICATES POSITION OF TERMINAL #1.



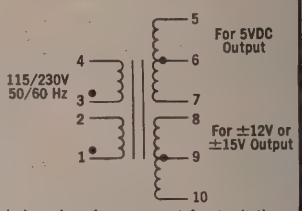


SCHEMATIC DIAGRAMS

MPC TYPE



DMPC & MPL TYPES



(See mechanical drawing for correct footprint)

MPC & DMPC TYPES

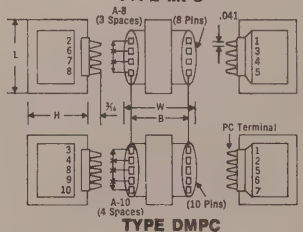
PART NUMBER PRIMARY 50/60 Hz 115V (8 Pin)	PART NUMBER PRIMARY 50/60 Hz 115/230V (10 Pin)	DC OUTPUT Regulator I	DC OUTPUT Regulator II	Size	SUGGESTED COMPONENTS C_1	C_2	C_3	C_4	D_1(2)	D_2(4)	IC_1*	IC_2*
MPC-X-12	DMPC-X-12	5VDC 360ma	±12VDC 60ma	X	2100MFD 30V	2.7MFD 20V	250MFD 50V	10MFD 20V	1N4001	1N4002	LM341P-5.0	LM326N
MPC-X-15	DMPC-X-15	5VDC 360ma	±15VDC 50ma	X	2100MFD 30V	2.7MFD 20V	250MFD 50V	10MFD 20V	1N4001	1N4002	LM341P-5.0	LM325N
MPC-Y-12	DMPC-Y-12	5VDC 835ma	±12VDC 150ma	Y	4000MFD 20V	2.7MFD 20V	1000MFD 50V	2.7MFD 20V	1N4001	1N4002	LM340K-5.0	LM326N
MPC-Y-15	DMPC-Y-15	5VDC 835ma	±15VDC 130ma	Y	4000MFD 20V	2.7MFD 20V	1000MFD 50V	2.7MFD 20V	1N4001	1N4002	LM340K-5.0	LM325N

MPL TYPES (Dual 115/230V Primary is Standard)

MPL- 6-12	5VDC 135ma	±12VDC 40ma	6	1000MFD 20V	2.7MFD 20V	150MFD 50V	10MFD 20V	1N4001	1N4002	LM342P-5.0	LM326N
MPL- 6-15	5VDC 135ma	±15VDC 35ma	6	1000MFD 20V	2.7MFD 20V	150MFD 50V	10MFD 20V	1N4001	1N4002	LM342P-5.0	LM325N
MPL-12-12	5VDC 270ma	±12VDC 85ma	12	2100MFD 30V	2.7MFD 20V	250MFD 50V	10MFD 20V	1N4001	1N4002	LM341P-5.0	LM326N
MPL-12-15	5VDC 270ma	±15VDC 70ma	12	2100MFD 30V	2.7MFD 20V	250MFD 50V	10MFD 20V	1N4001	1N4002	LM341P-5.0	LM325N

*National Semiconductor

TYPE MPC

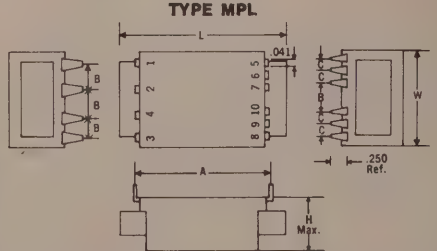


TYPE DMPC

E63829 SECTION 6
LR 51265-30

Size	L	W	H	A-8 (8 Pin)	A-10 (10 Pin)	B	Lbs.	Optional Bracket No.	MW	MD
X	1⅞	1⅛	1⅝	.250	.200	1.300	.56	10-BR	1¹¹⁄₆₄	1⅛
Y	1⅝	2¼	1⅜	.250	.200	2.100	.75	24-BR	1⅜	2

TYPE MPL



E63829 SECTION 8
LR 51265-30

Size	L	W	H	A	B	C	Lbs.
6	1⅞	1⅛	0.850	1.600	0.375	0.187	.43
12	2½	2	1.065	2.000	0.500	0.250	.68

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"2-4-1"™ style split-bobbin transformers for triple-output (µp) applications (type MT)

Signal has extended its line of triple-output transformers for microprocessor applications with three new sizes rated to 100VA (35 watts DC regulated). Similar to the split-bobbin design used in Signal's "2-4-1" series, the chassis-mounted style allows for these new higher power applications.

Two output combinations are provided: 5V and ±12V; and 5V and ±15V. Designated "MT" (single primary) and "DMT" (dual primary), these transformers are rated in terms of the final DC output after a 3-terminal IC regulator. They are designed to provide these outputs with AC line inputs of 100-130V, 50/60 Hz (or 200-260V for nominal 230V lines). All auxiliary components required to complete the DC supply are tabulated.

All MT types are stocked in depth for immediate delivery. In addition, custom variations can be supplied with minimal turnaround time.

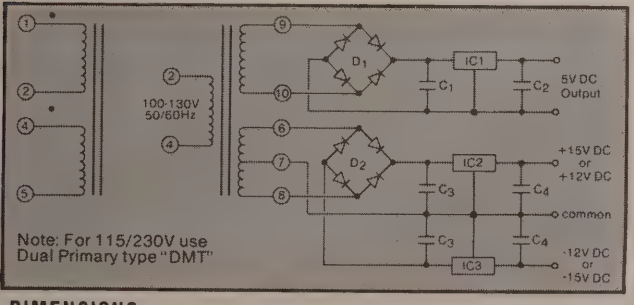
Specifications

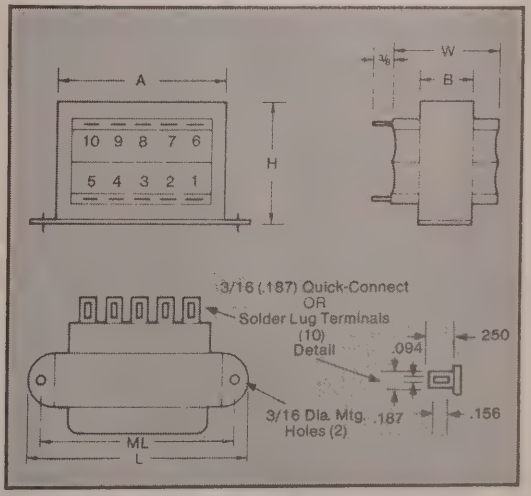
E63829 SECTION 7 LR 51265-30

PART NUMBER PRIMARY 50/60Hz		DC OUTPUT		SIZE	SUGGESTED COMPONENTS C_2 C_4 See Note ①						
115V	115/230V	Regulator 1	Regulator 2		C_1	C_3	IC1③	IC2③	IC3③	D1④	D2④
MT-6-12	DMT-6-12	5V @ 1.75A	±12V @ 210MA	6	10 KMFD @ 20V DC	1.5 KMFD @ 50V DC	LM-323K-5	LM-340K-12	LM-320K-12	3N253	3N247
MT-6-15	DMT-6-15	5V @ 1.75A	±15V @ 175MA	6			LM-323K-5	LM-340K-15	LM-320K-15	3N253	3N247
MT-7-12	DMT-7-12	5V @ 2.8A	±12V @ 350MA	7	15 KMFD @ 20V DC	2 KMFD @ 50V DC	LM-323K-5	LM-340K-12	LM-320K-12	MDA-400	3N247
MT-7-15	DMT-7-15	5V @ 2.8A	±15V @ 280MA	7			LM-323K-5	LM-340K-15	LM-320K-15	MDA-400	3N247
MT-8-12	DMT-8-12	5V @ 4A	±12V @ 600MA	8	26 KMFD @ 20V DC	3.1 KMFD @ 50V DC	LM-338②	LM-340K-12	LM-320K-12	MDA-800	3N247
MT-8-15	DMT-8-15	5V @ 4A	±15V @ 500MA	8			LM-338②	LM-340K-15	LM-320K-15	MDA-800	3N247

Note ① : Output capacitors C_2 and C_4 are required to stabilize regulators. Values can be 1 MFD min. tantalum or 10 MFD min. electrolytic, 20V min.
Note ② : LM-338 is an adjustable regulator and MFR's specifications (National Semiconductor) should be consulted for values of external components.
Note ③ : All IC's are National Semiconductor types.
Note ④ : All diodes are Motorola types.

SCHEMATIC





DIMENSIONS

Size	L	W	H	A	B	ML	Lbs.
6	3 1/4	1 3/4	1 15/16	2 5/16	1 1/16	2 13/16	1.1
7	3 11/16	1 13/16	2 1/4	2 11/16	1 1/16	3 1/8	1.7
8	4 1/32	2 1/4	2 9/16	3 1/16	1 5/16	3 9/16	2.75

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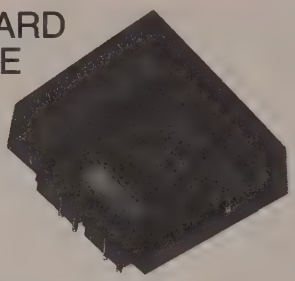
class 2 transformers

- Available in ratings of 2.5 through 80VA
- Choose between inherently limited and non-inherently limited.
- Designed with the same dual bobbin construction as our International Series.
- 4000 VRMS Primary and Secondary isolation.

PC BOARD TYPE

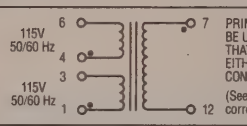


E11658 (M)

Specifications

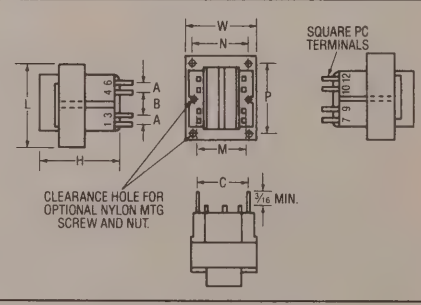
PART NO.	SECONDARY RMS RATING	SECONDARY FUSE REQD.
CL2-2.5-12	12V @ .20A	N/A*
CL2-2.5-24	24V @ .10A	N/A*
CL2-5.0-12	12V @ .42A	N/A*
CL2-5.0-24	24V @ .20A	N/A*
CL2-10-12	12V @ .83A	N/A*
CL2-10-24	24V @ .42A	N/A*
CL2-20-12	12V @ 1.66A	N/A*
CL2-20-24	24V @ .833A	N/A*
CL2-30-12	12V @ 2.50A	3.0A**
CL2-30-24	24V @ 1.25A	N/A*
CL2-50-12	12V @ 4.20A	5.0A**
CL2-50-24	24V @ 2.10A	2.5A**

SCHEMATIC



PRIMARIES ARE DESIGNED TO BE USED SIMULTANEOUSLY. THAT IS, THEY MUST BE USED EITHER SERIES OR PARALLEL CONNECTED (AS ONE WINDING).

(See mechanical drawing for correct footprint)



DIMENSIONS

Dimensions							Pin	Mtg.			Mtg. Screw		
VA	L	W	H	A	B	C	Dimensions	M	N	P	Size	Quantity	Lbs.
2.5	1⅝	1⁵⁄₁₆	1⅛	.200	.250	1.000	0.025SQ	1¹⁄₁₆	–	–	#4	2	0.25
5.0	1⅝	1⁵⁄₁₆	1⅜	.200	.400	1.000	0.025SQ	1¹⁄₁₆	–	–	#4	2	0.37
10.0	1⅞	1⁹⁄₁₆	1⅜	.200	.400	1.140	0.038SQ	1¼	–	–	#4	2	0.53
20.0	2¼	1⅞	1⅝	.400	.400	1.460	0.038SQ	1½	–	–	#4	2	0.90
30.0	2⅝	2³⁄₁₆	1⁹⁄₁₆	.550	.275	1.680	0.045SQ	–	1¾	2³⁄₁₆	#6	4	1.15
50.0	3	2½	1¹³⁄₁₆	.600	.300	1.900	0.045SQ	–	2	2½	#6	4	1.70

CHASSIS MOUNT TYPE

E11658 (M)

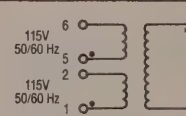
Specifications

*INHERENTLY LIMITED
**NON-INHERENTLY LIMITED
MAXIMUM SECONDARY FUSE VALUE SPECIFIED

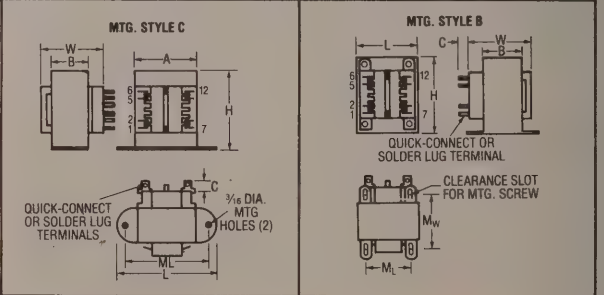
ALL PRIMARIES ARE 115/230 VOLT 50/60 HZ

PART NO.	SECONDARY RMS RATING	SECONDARY FUSE REQD.
CL2-25-12	12V @ 2.10A	2.5A**
CL2-25-24	24V @ 1.05A	N/A*
CL2-40-12	12V @ 3.33A	4.0A**
CL2-40-24	24V @ 1.66A	2.0A**
CL2-80-24	24V @ 3.33A	4.0**

SCHEMATIC



PRIMARIES ARE DESIGNED TO BE USED SIMULTANEOUSLY. THAT IS, THEY MUST BE USED EITHER SERIES OR PARALLEL CONNECTED (AS ONE WINDING).



DIMENSIONS

Dimensions								Mtg.	Mtg.		Mtg.	
VA	L	W	H	A	B	C	Terminals	Style	ML	MW	Screw	Lbs.
25	2¹³⁄₁₆	1⅞	2⁵⁄₁₆	2	1⅛	⅝	³⁄₁₆ (.187)	C	2⅜	–	#6	1.25
40	3⅛	2¹⁄₁₆	2¹¹⁄₁₆	2¼	1⅛	⅝	³⁄₁₆ (.187)	C	2¹³⁄₁₆	–	#6	1.6
80	2½	2⅜	3	–	1⅜	⅝	³⁄₁₆ (.187)	B	2	2³⁄₁₆	#6	2.8

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Inwood, NY 11696
Fax: (516) 239-7208

rectifier power transformers

CHOICE OF SINGLE 115V OR DUAL 115/230V PRIMARIES

Primary 50/60 Hz		Secondary RMS Rating*									
Single 115V.	Dual* 115/230V.	Series	Parallel	Mtg. Style	L	W	H	ML	MW	Mtg. Screw	Approx. Lbs.
10-1	DL 10-1	10V C.T. @ 1A	5V C.T. @ 2A	C	2⅞	1¾	2⅝	2⅜	—	#8	1.0
10-2	DL 10-2	10V C.T. @ 2A	5V C.T. @ 4A	C	3⅛	2⅛	2¾	2 13/16	—	#8	1.5
10-4	DL 10-4	10V C.T. @ 4A	5V C.T. @ 8A	C	3⅜	2⅜	3 1/16	3⅛	—	#8	2.3
10-6	DL 10-6	10V C.T. @ 6A	5V C.T. @ 12A	B	3⅜	2¾	2 13/16	2 13/16	2⅛	#8	3.3
10-8	DL 10-8	10V C.T. @ 8A	5V C.T. @ 16A	B	3⅜	3⅛	2 13/16	2 13/16	2½	#8	4.0
10-12	DL 10-12	10V C.T. @ 12A	5V C.T. @ 24A	B	3¾	3¼	3⅛	3⅛	2½	#8	5.0
10-25	DL 10-25	10V C.T. @ 25A	5V C.T. @ 50A	B	4½	3¾	3¾	3¾	2¾	#10	8.7
10-50‡	DL 10-50	10V C.T. @ 50A	5V C.T. @ 100A	B	5¼	5½	4⅜	4⅜	3⅝	¼	17.0
10-100‡	DL 10-100	10V C.T. @ 100A	5V C.T. @ 200A	B	6⅜	7¼	5 5/16	5 5/16	4⅜	¼	34.5
12.8-1	DL 12.8-1	12.8V C.T. @ 1A	6.4V C.T. @ 2A	C	2⅞	2	2 5/16	2⅜	—	#8	1.2
12.8-2	DL 12.8-2	12.8V C.T. @ 2A	6.4V C.T. @ 4A	B	3	2½	2½	2½	2	#8	2.3
12.8-4	DL 12.8-4	12.8V C.T. @ 4A	6.4V C.T. @ 8A	B	3	2⅞	2½	2½	2⅜	#8	2.8
12.8-6	DL 12.8-6	12.8V C.T. @ 6A	6.4V C.T. @ 12A	B	3⅜	3 1/16	2 13/16	2 13/16	2½	#8	4.0
12.8-8	DL 12.8-8	12.8V C.T. @ 8A	6.4V C.T. @ 16A	B	3¾	3⅛	3⅛	3⅛	2¼	#8	4.5
12.8-12	DL 12.8-12	12.8V C.T. @ 12A	6.4V C.T. @ 24A	B	4⅛	3¼	3 1/16	3 1/16	2⅜	#10	6.0
12.8-25	DL 12.8-25	12.8V C.T. @ 25A	6.4V C.T. @ 50A	B	5¼	4¼	4⅜	4⅜	2⅞	#10	12.5
12.8-50‡	DL 12.8-50	12.8V C.T. @ 50A	6.4V C.T. @ 100A	B	5¼	6	4⅜	4⅜	4⅛	¼	20.7
12.8-100‡	DL 12.8-100	12.8V C.T. @ 100A	6.4V C.T. @ 200A	B	6⅜	7¼	5 5/16	5 5/16	4⅜	¼	34.5
16-1	DL 16-1	16V C.T. @ 1A	8V C.T. @ 2A	C	2⅞	2	2 5/16	2⅜	—	#8	1.2
16-2	DL 16-2	16V C.T. @ 2A	8V C.T. @ 4A	C	3⅛	2¼	2¾	2 13/16	—	#8	1.7
16-4	DL 16-4	16V C.T. @ 4A	8V C.T. @ 8A	B	3⅜	2¾	2 13/16	2 13/16	2⅛	#8	3.3
16-6	DL 16-6	16V C.T. @ 6A	8V C.T. @ 12A	B	3¾	3⅛	3⅛	3⅛	2¼	#10	4.5
16-8	DL 16-8	16V C.T. @ 8A	8V C.T. @ 16A	B	3¾	3½	3⅛	3⅛	2⅝	#10	5.4
16-12	DL 16-12	16V C.T. @ 12A	8V C.T. @ 24A	B	4⅛	3⅞	3 7/16	3 7/16	3	#10	7.9
16-25	DL 16-25	16V C.T. @ 25A	8V C.T. @ 50A	B	4½	5⅜	3¾	3¾	4	#10	14.5
16-50‡	DL 16-50	16V C.T. @ 50A	8V C.T. @ 100A	B	6⅜	5¾	5 5/16	5 5/16	3¾	¼	26.5
16-100‡	DL 16-100	16V C.T. @ 100A	8V C.T. @ 200A	B	7½	7½	6⅝	6¾	4⅝	¼	50.0
24-1	DL 24-1	24V C.T. @ 1A	12V C.T. @ 2A	B	3	2½	2½	2½	2	#8	2.3
24-2	DL 24-2	24V C.T. @ 2A	12V C.T. @ 4A	B	3	2⅞	2½	2½	2⅜	#8	2.9
24-4	DL 24-4	24V C.T. @ 4A	12V C.T. @ 8A	B	3¾	3⅛	3⅛	3⅛	2¼	#8	4.5
24-6	DL 24-6	24V C.T. @ 6A	12V C.T. @ 12A	B	4⅛	3¼	3 7/16	3 7/16	2⅜	#10	5.8
24-8	DL 24-8	24V C.T. @ 8A	12V C.T. @ 16A	B	4⅛	3⅞	3 7/16	3 7/16	3	#10	7.9
24-12‡	DL 24-12	24V C.T. @ 12A	12V C.T. @ 24A	B	4½	4½	3¾	3¾	3⅜	#10	11.0
24-20‡	DL 24-20	24V C.T. @ 20A	12V C.T. @ 40A	B	5¼	4¾	4⅜	4⅜	3⅜	¼	15.3
24-25‡	DL 24-25	24V C.T. @ 25A	12V C.T. @ 50A	B	5¼	5⅝	4⅜	4⅜	4⅛	¼	19.5
24-50‡	DL 24-50	24V C.T. @ 50A	12V C.T. @ 100A	B	6⅜	6¼	5 5/16	5 5/16	4⅜	¼	31.3
——	24-100 △	24V C.T. @ 100A	12V C.T. @ 200A	B	7½	7	6⅜	6⅜	4⅛	¼	43.0
36-1	DL 36-1	36V C.T. @ 1A	18V C.T. @ 2A	B	3	2¾	2½	2½	2¼	#8	2.6
36-2	DL 36-2	36V C.T. @ 2A	18V C.T. @ 4A	B	3⅜	2 15/16	2 13/16	2 13/16	2⅜	#8	3.8
36-4	DL 36-4	36V C.T. @ 4A	18V C.T. @ 8A	B	4⅛	3⅜	3 7/16	3 7/16	2⅝	#10	6.8
36-6	DL 36-6	36V C.T. @ 6A	18V C.T. @ 12A	B	4½	3¾	3¾	3¾	2¾	#10	8.7
36-8‡	DL 36-8	36V C.T. @ 8A	18V C.T. @ 16A	B	4½	4½	3¾	3¾	3⅜	#10	11.0
36-12‡	DL 36-12	36V C.T. @ 12A	18V C.T. @ 24A	B	5¼	5	4⅜	4⅜	3⅜	¼	15.0
36-20‡	DL 36-20	36V C.T. @ 20A	18V C.T. @ 40A	B	6⅜	5⅜	5 5/16	5 5/16	3⅜	¼	22.8
36-25‡	DL 36-25	36V C.T. @ 25A	18V C.T. @ 50A	B	6⅜	5¾	5 5/16	5 5/16	3¾	¼	26.5
36-30‡	DL 36-30	36V C.T. @ 30A	18V C.T. @ 60A	B	6⅜	6	5 5/16	5 5/16	4⅜	¼	31.5
——	36-50△	36V C.T. @ 50A	18V C.T. @ 100A	B	6⅜	7¼	5 5/16	5 5/16	5⅛	¼	40.0
56-1	DL 56-1	56V C.T. @ 1A	28V C.T. @ 2A	B	3⅜	2⅞	2 13/16	2 13/16	2¼	#8	3.5
56-2	DL 56-2	56V C.T. @ 2A	28V C.T. @ 4A	B	3¾	3¼	3⅛	3⅛	2½	#8	5.0
56-4	DL 56-4	56V C.T. @ 4A	28V C.T. @ 8A	B	4⅛	3¾	3 7/16	3 7/16	3	#10	7.7
56-6	DL 56-6	56V C.T. @ 6A	28V C.T. @ 12A	B	5¼	4¼	4⅜	4⅜	2⅞	#10	12.0
56-8‡	DL 56-8	56V C.T. @ 8A	28V C.T. @ 16A	B	5¼	5	4⅜	4⅜	3⅝	¼	17.0
56-12‡	DL 56-12	56V C.T. @ 12A	28V C.T. @ 24A	B	6⅜	5¼	5 1/16	5 5/16	3⅜	¼	22.0
56-25‡	DL 56-25	56V C.T. @ 25A	28V C.T. @ 50A	B	6⅜	7⅛	5 5/16	5 5/16	5⅛	¼	38.0
——	56-50△	56V C.T. @ 50A	28V C.T. @ 100A	B	7½	7½	6¼	6¾	4⅞	¼	56.3
68-1	DL 68-1	68V C.T. @ 1A	34V C.T. @ 2A	B	3⅜	2 15/16	2 13/16	2 13/16	2⅜	#8	3.8
68-2	DL 68-2	68V C.T. @ 2A	34V C.T. @ 4A	B	4⅛	3⅜	3 7/16	3 7/16	2⅝	#10	6.8
68-4	DL 68-4	68V C.T. @ 4A	34V C.T. @ 8A	B	4½	4½	3¾	3¾	3⅜	#10	11.5
68-6‡	DL 68-6	68V C.T. @ 6A	34V C.T. @ 12A	B	5¼	5	4⅜	4⅜	3⅜	¼	15.0
68-8‡	DL 68-8	68V C.T. @ 8A	34V C.T. @ 16A	B	5¼	5½	4⅜	4⅜	3⅞	¼	19.0
68-12‡	DL 68-12	68V C.T. @ 12A	34V C.T. @ 24A	B	6⅜	5¾	5 5/16	5 5/16	3¾	¼	26.5
——	68-25△	68V C.T. @ 25A	34V C.T. @ 50A	B	6⅜	7¼	5 5/16	5 5/16	5⅛	¼	39.7
80-1	DL 80-1	80V C.T. @ 1A	40V C.T. @ 2A	B	3⅜	3 1/16	2 13/16	2 13/16	2½	#8	4.0
80-2	DL 80-2	80V C.T. @ 2A	40V C.T. @ 4A	B	4⅛	3⅜	3 7/16	3 7/16	2⅝	#10	6.8
80-4	DL 80-4	80V C.T. @ 4A	40V C.T. @ 8A	B	5¼	4¼	4⅜	4⅜	2⅞	¼	12.3
80-6‡	DL 80-6	80V C.T. @ 6A	40V C.T. @ 12A	B	5¼	5½	4⅜	4⅜	3⅞	¼	19.0
80-8‡	DL 80-8	80V C.T. @ 8A	40V C.T. @ 16A	B	6⅜	5¼	5 5/16	5 5/16	3¼	¼	20.5
80-12‡	DL 80-12	80V C.T. @ 12A	40V C.T. @ 24A	B	6⅜	6	5 5/16	5 5/16	4⅛	¼	29.0
——	80-25△	80V C.T. @ 25A	40V C.T. @ 50A	B	7½	6½	6¼	6¾	3⅞	¼	40.3

△Available with dual primary only. Therefore, prefix "DL" is not required.
‡ Nominal 115V primary has added taps, I.E., 105/115/125V, Dual (DL) version is 115/230V only.

Items shown in shaded area are not normally in stock. They are standard designs generally available in 3-4 weeks.

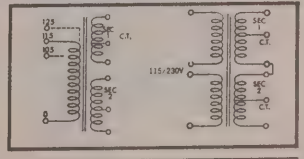
All transformers are designed conservatively and are rated for 50/60 Hz. Only prime raw materials are used. Units are thoroughly impregnated and baked with Signal's own high gloss varnish. The transformers and chokes are rugged in construction, well insulated, and have a consistently uniform appearance. All ratings are at full load current continuous operation. Hipot rating of 1500V RMS is standard.

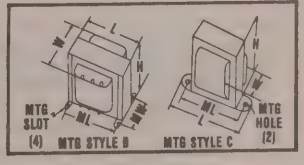
Electrical ratings have been chosen to cover a wide range of applications. All transformers have two center-tapped secondary windings, which may be series or parallel connected as indicated in rating chart.

*The secondary currents shown in the tables are RMS ratings. Depending upon rectifier circuit configurations, the RMS secondary current is different than the DC output current. This is indicated in the chart below:

Rectifier Type	Filter Type	RMS Secondary Current Is
Full Wave Center-Tap	Choke Input	= 0.7 x DC Amps
Full Wave Center-Tap	Capacitor Input	= 1 to 1.2 x DC Amps
Full Wave Bridge	Choke Input	= DC Amps
Full Wave Bridge	Capacitor Input	= 1.6 to 1.8 x DC Amps

For example, in a F.W. Bridge circuit with a capacitive filter, if the load is 1 Amp DC, the RMS Secondary current is 1.6 to 1.8 Amp RMS.





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filter chokes

1.0 TO 200 AMPS

Signal's line of filter chokes is the most extensive available. It is designed to complement the selection of Rectifier Power Transformers so that a set may be specified for power supplies using inductive filters.

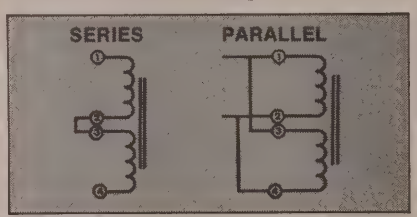
The inductance ratings given are minimum values guaranteed at full DC current. All resistance ratings are maximum values. Special variations or intermediate values of inductance, current, or resistance can be supplied promptly and accurately.

FOR MECHANICAL DIMENSIONS REFER TO TRANSFORMER OUTLINES ON PREVIOUS PAGE

Part No.	Inductance (MHY)	Current (Amps)	Resistance (Ohms)	Mtg. Style	L	W	H	ML	MW	Mtg. Screw	Approx. Lbs.
CH-1	100	1	1.5	B	3	2½	2½	2½	2	#8	2.3
CH-2	70	2	0.9	B	3⅜	2¾	2⅞	2 13/16	2⅛	#8	3.2
CH-4	70	4	0.6	B	3¾	3⅛	3¼	3⅛	2½	#8	5.3
CH-6	40	6	0.4	B	3¾	3⅝	3¼	3⅛	3	#8	6.5
CH-8	30	8	0.3	B	4⅛	3⅝	3½	3 7/16	3	#10	8
CH-12	15	12	0.1	B	5¼	4	4 7/16	4⅜	3⅛	#10	13.7
CH-16	15	16	0.08	B	5¼	4⅝	4 7/16	4⅜	3⅝	#10	17.5
CH-20	7	20	0.05	B	5¼	4	4 7/16	4⅜	3⅛	#10	13.3
CH-25	5	25	0.025	B	5¼	4¾	4 7/16	4⅜	3⅞	#10	17.8
CH-30	4	30	0.01	B	6⅜	5	5⅜	5 5/16	3⅜	¼	24.4
CH-50	1.4	50	0.01	B	6⅜	5¼	5⅜	5 5/16	3¾	¼	26.7
CH-100	0.5	100	0.005	B	6⅜	6¼	5⅜	5 5/16	4⅛	¼	31.4
CH-200	0.3	200	0.001	B	7½	7½	6¼	6¾	4⅛	¼	48.0

dual chokes

FOR LOWER INDUCTANCE APPLICATIONS



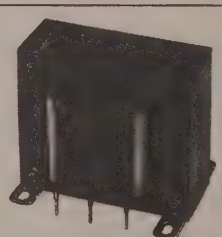
Part No.	Series Connected Ind. (MHY)	Series Connected Curr. (Amps)	Series Connected Res. Ω	Parallel Connected Ind. (MHY)	Parallel Connected Curr. (Amps)	Parallel Connected Res. Ω	Mtg. Style	Dimensions L	W	H	ML	MW	Mtg. Screw	Appr. Lbs.
CL-1-2	72	1	1.4	18	2	0.35	C	2⅞	1¾	2 5/16	2⅜	—	#8	0.9
CL-2-4	40	2	0.7	10	4	0.18	C	3⅛	2⅛	2¾	2 13/16	—	#8	1.5
CL-4-8	20	4	0.3	5	8	0.075	B	3	2⅞	2½	2½	2½	#8	3.0
CL-6-12	12	6	0.15	3	12	0.038	B	3⅜	3 1/16	2 13/16	2 13/16	2½	#8	4.0
CL-12-24	4.8	12	0.052	1.2	24	0.013	B	3⅜	3 1/16	2 13/16	2 13/16	3	#8	5.3
CL-25-50	1.2	25	0.012	0.3	50	0.003	B	3¾	3⅜	3⅜	3⅛	2¾	#8	6.0
CL-50-100	0.5	50	0.0043	0.12	100	0.0011	B	4½	3¾	3¾	3¾	2½	#8	8.0

Signal's Dual Chokes are supplied with 2 windings which may be series or parallel connected with rating shown on chart. This line is basically designed for application requiring lower inductance value at high currents, such as low voltage, DC supplies or SCR filters.

step down auto transformers

50/60 Hz 100-2000 VA — 230/115V

ENCLOSED STYLE "EB"



OPEN FRAME STYLE "OF"

(May be used step-up or step-down)

UL APPROVED 2 PRONG LINE CORD RECEPTACLE — LOW REGULATION
BLACK ENAMEL FINISH

VA	Cat. No.	Width	Depth	Height	Mtg. Centers	Lbs.
100	110	1⅞	2⅜	2½	1½ x 1 11/16	1.5
120	112	2⅞	2⅛	3½	2¼ x 1¾	3.0
150	115	2⅞	3⅜	3½	2¼ x 2	3.5
200	120	2⅞	3½	3½	2¼ x 2⅛	4.0
250	125	2⅞	3⅞	3½	2¼ x 2½	4.8
300	130	3¼	3⅞	3⅞	2½ x 2 7/16	5.5
500	150	3¼	4⅞	3⅞	2½ x 3 7/16	8
750	175	3¼	5⅞	3⅞	2½ x 4 7/16	11
1000	1100	4½	5⅛	5½	3½ x 3½	14
1500	1150	4½	6⅛	5½	3½ x 4½	20
2000	1200	4½	7⅛	5½	3½ x 5½	26

BLACK ENAMEL FINISH. 8" LEADS
INEXPENSIVE VERSION FOR USE IN EQUIPMENT

VA	Cat. No.	Width	Depth	Height	Mtg. Centers	Lbs.
100	110-OF	2¼	2	1 13/16	2 13/16*	1.3
120	112-OF	3⅜	2½	2⅞	2 13/16 x 1⅞	2.5
150	115-OF	3⅜	2¾	2⅞	2 13/16 x 2⅛	3.0
200	120-OF	3⅜	2⅞	2⅞	2 13/16 x 2¼	3.5
250	125-OF	3⅜	3¼	2⅞	2 13/16 x 2⅝	4.2
300	130-OF	3¾	3¼	3⅛	3⅛ x 2½	5.0
500	150-OF	3¾	4¼	3⅛	3⅛ x 3½	8.0
750	175-OF	3¾	5¼	3⅛	3⅛ x 4½	11
1000	1100-OF	5¼	4½	4⅜	4⅜ x 3⅛	14
1500	1150-OF	5¼	5½	4⅜	4⅜ x 4⅛	19
2000	1200-OF	5¼	6½	4⅜	4⅜ x 5⅛	25

* Part 110-OF is mounted by means of a channel with 2 mtg. tabs.

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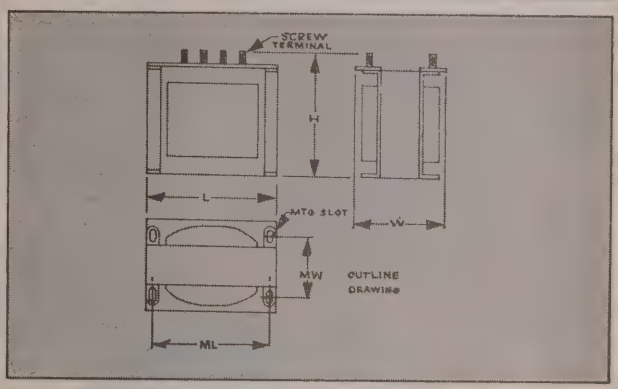
power isolation transformers

INDUSTRIAL GRADE/STEP-UP OR STEP-DOWN. MANY POSSIBLE VOLTAGE RATINGS.

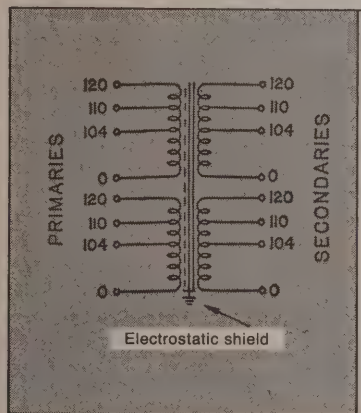
AVAILABLE FROM STOCK FOR IMMEDIATE SHIPMENT

The "DU" and "SU" lines are designed for a maximum of 55°C rise above ambient for use on standard power lines from 50 to 500 Cps. Only prime raw materials are used. Units are thoroughly impregnated and baked with Signal's own high gloss black baking varnish. The transformers are rugged in construction, well-insulated and have a consistently uniform appearance. All ratings are at full load current, continuous operation. 2500V. RMS Hipot is standard.

Heavy ¼ inch phenolic terminal boards are provided with plated brass screws and flat washers (10-32 on ¼ and ½ KVA, ¼-20 on larger sizes). Connections can be easily made with a nut driver. It is also simple to alter the interconnections to change transformer ratings. **Electrostatic shields are provided grounded to the core.** The connection is made with a lug to ground and may be opened if an ungrounded shield is desired.



DU SERIES 110/220 Dual Primary to 110/220V. Dual Sec. (Primary & Secondary may be reversed)

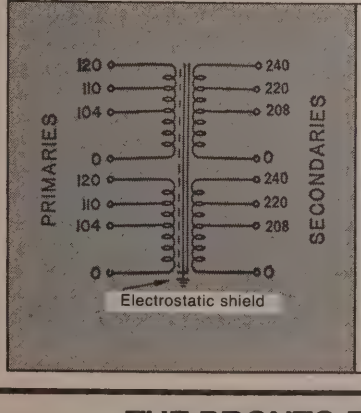


As shown on the schematic diagram the "DU" line is designed with dual primaries and secondaries. All four windings are identically rated at 0/104/110/120 volts. This permits series or parallel connections on either primary or secondary. Therefore, a nominal 110 to 110 volt, 220 to 220 volt, 110 to 220 volt, or 220 to 110 volt transformer can be set up. The winding taps permit intermediate series ratings such as 208, 214, or 230 volts. It is also possible to make auto-transformer connections by connecting a primary group in series with a secondary group. Such nominal ratings as 440 to 220 volts or 220 to 440 volts can be set-up, in addition to the standard ratings described above. A further advantage to auto-transformer connection is the fact that the KVA rating of a particular type is doubled.

Part No.	KVA	Series Secondaries Volts	Series Secondaries Max. Amps	Parallel Secondaries Volts	Parallel Secondaries Max. Amps	Mechanical Dimensions L *	W *	H *	ML †	MW ‡	Mtg. & Term. Screw	Appr. Lbs.
DU-¼	¼	0/208/220/240	1.1	0/104/110/120	2.2	5 5/16	4¼	5¼	4⅜	2½	#10	12
DU-½	½	0/208/220/240	2.3	0/104/110/120	4.6	5 5/16	5 5/16	5¼	4⅜	3⅝	#10	18
DU-1	1	0/208/220/240	4.5	0/104/110/120	9	7 5/16	6¼	7⅜	6¾	4⅛	¼	33
DU-2	2	0/208/220/240	9	0/104/110/120	18	7 5/16	8¼	7⅜	6¾	6	¼	56
DU-3	3	0/208/220/240	14	0/104/110/120	28	7 5/16	9¼	7⅜	6¾	7	¼	70
DU-5	5	0/208/220/240	23	0/104/110/120	46	7 5/16	10¾	7⅜	6¾	8½	¼	89
DU-7.5	7.5	0/208/220/240	31	0/104/110/120	62	9	10¾	8	7½	6½	¼	105
DU-10	10	0/208/220/240	41	0/104/110/120	82	9	13	8	7½	9	¼	150

* Maximum. † ±1/16 ‡ ±⅛

SU SERIES 110/220 Dual Primary to 220/440V. Dual Sec. (Primary & Secondary may be reversed)



"SU" transformers are similar to "DU" types except that a 220/240V secondary is provided.

Part No.	KVA	Series Secondaries Volts	Series Secondaries Max. Amps	Parallel Secondaries Volts	Parallel Secondaries Max. Amps	Mechanical Dimensions L *	W *	H *	ML †	MW ‡	Mtg. & Term. Screw	Appr. Lbs.
SU-¼	¼	0/416/440/480	0.55	0/208/220/240	1.1	5 5/16	4¼	5¼	4⅜	2½	#10	12
SU-½	½	0/416/440/480	1.15	0/208/220/240	2.3	5 5/16	5 5/16	5¼	4⅜	3⅝	#10	18
SU-1	1	0/416/440/480	2.25	0/208/220/240	4.5	7 5/16	6¼	7⅜	6¾	4⅛	¼	33
SU-2	2	0/416/440/480	4.5	0/208/220/240	9	7 5/16	8¼	7⅜	6¾	6	¼	56
SU-3	3	0/416/440/480	7	0/208/220/240	14	7 5/16	9¼	7⅜	6¾	7	¼	70
SU-5	5	0/416/440/480	11.5	0/208/220/240	23	7 5/16	10¾	7⅜	6¾	8½	¼	89
SU-7.5	7.5	0/416/440/480	15.5	0/208/220/240	31	9	10¾	8	7½	6½	¼	105
SU-10	10	0/416/440/480	20.5	0/208/220/240	41	9	13	8	7½	9	¼	150

* Maximum. † ±1/16 ‡ ±⅛

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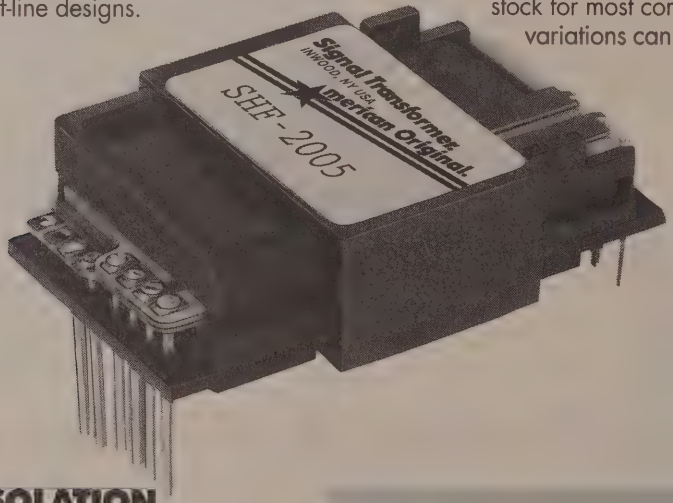
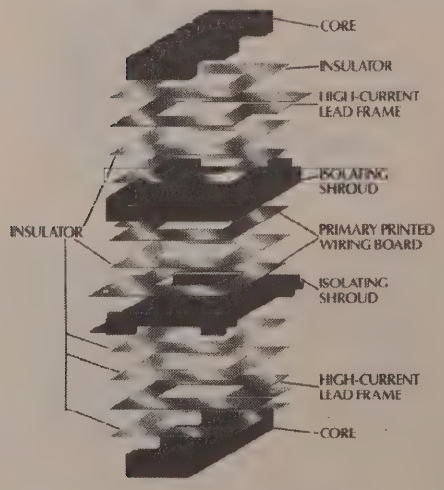
OFF-THE-SHELF SIGNAL PLANAR MAGNETICS FOR HIGH EFFICIENCY, HIGH FREQUENCY SWITCH MODE POWER SUPPLIES

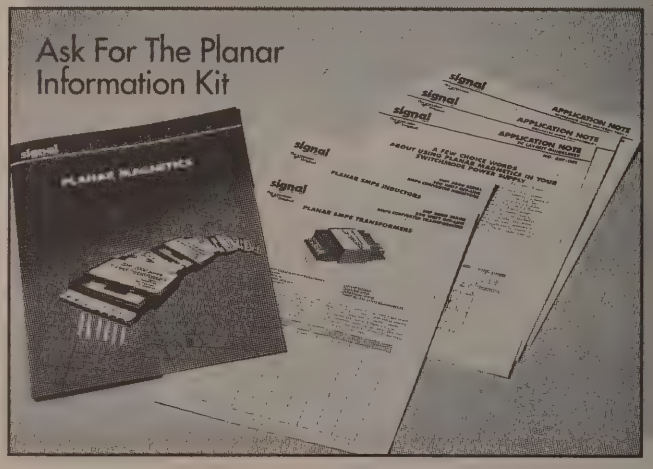
Signal's SHF PLANAR magnetic components take much of the pain and guesswork out of SMPS design. They upgrade performance, reduce package size, improve reliability, minimize design time, satisfy safety requirements and are available from stock. They provide the following advantages.

- LOW CONSISTENT PARASITIC REACTANCES... minimal leakage inductance and parasitic capacitances assure high frequency performance and high power supply reliability. Mechanical structure assures consistent, repeatable values.
- HIGH POWER DENSITY...ultra low profile configuration no longer demands excess height...compatible with 13 watt/in^3 or greater off-line designs.
- HIGH EFFICIENCY AT HIGH OPERATING FREQUENCY... 97% in the 250 to 500 kHz range...usable up to 1MHz.
- DESIGNED TO MEET INTERNATIONAL SAFETY AGENCY REQUIREMENTS... using 130°C rated insulation materials.
- LIGHTWEIGHT...PCB mountable
- OFF-THE-SHELF...standard designs are available from stock for most common applications. Many variations can be provided with minimal delay.



HIGH ISOLATION PLANAR ANATOMY





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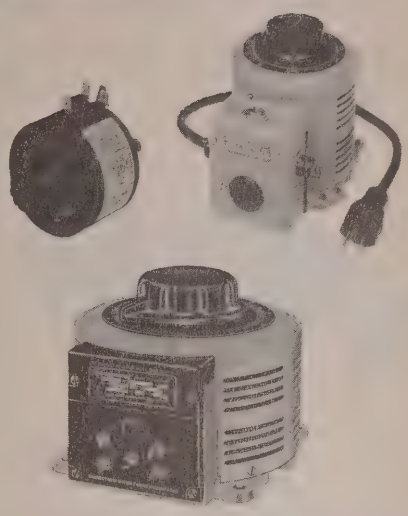
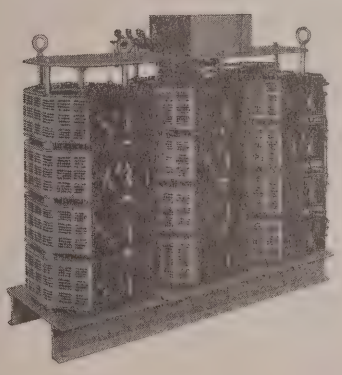
POWERSTAT® Variable Transformers with POWERKOTE® Coils

Epoxy-coated POWERKOTE Coils make the POWERSTAT line the most outstanding value in variable transformers today. *Without increase in price, size or weight,* only POWERSTAT Variable Transformers give an average of 20% higher current ratings, 10:1 greater overload capability, longer life, greater resistance to fungus, salt spray and other contaminating atmospheres. POWERKOTE Coil commutator bars are embedded in place preventing steady-state operating temperature and severe overloads from distorting the commutator.

POWERSTAT Variable Transformers deliver continuously adjustable voltage from AC power lines. They introduce no waveform distortion and feature rugged construction, precious metal plated commutators, excellent regulation, high efficiency and conservative ratings. All manually operated types except the 10C-12 Series are available with motor drives if desired. Motor driven speeds are 5, 15, 30 or 60 seconds for full range travel on all except types 4-gang and over which do not offer the 5-second speed. Single types in the 116C-216C, 117C-217C, 126-226, and 136B-236B Series are also offered with 3-wire cord plug sets. 1156D-1256D Series types are available in ratings to 244 kVA and 1296D Series types to 313 kVA.



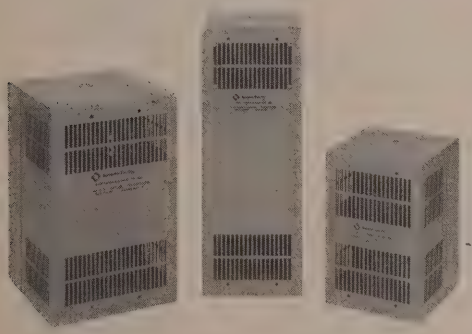


Enclosed Types

Meet OSHA requirements. Portable 120 V, single phase units have grounded NEMA cord-plugs, on-off switches, grounded output receptacles, pilot lights and fuses. Panel controls are recessed for protection from accidental bumping. Rear slots for hanger brackets. Type L10C rated 0-132 V, 2 A; type L21C rated 0-140 V, 4.5 A; type L116C rated 0-140 V, 10 A.

Heavy Duty 1296D Series

Single and 3-phase, manual and motor-driven types in the 1296D series boost ratings in the line to 313 kVA. They operate from 240 VAC, 50/60 Hz lines with rated output 35 A for constant current and 39 A for constant impedance loads. Common utilization voltages 240 to 575 VAC. Request special 1296D Series bulletin for complete data.



Variable Transformer Enclosures

New PBA Series Enclosures are specifically designed to house manually operated and motor-driven, open construction (suffix U) POWERSTAT Variable Transformers. Most are offered as independent assemblies suitable for new or retrofit applications. Constructed of heavy gauge sheet metal, these enclosures are classified NEMA Type 1 as defined in NEMA Standard ICS 1-110.

Three of the four series offered house small to medium frame size variable transformers having power ratings between 0.5 kVA, single phase and 15 kVA, 3 phase. The PBA50 series units are for use with larger assemblies having ratings between 6kVA, single phase and 60 kVA, three phase and can be fitted with optional caster kits.

Call 1-800-446-6161 today for instant attention.

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383 Middle Street
Bristol, Connecticut 06010 USA

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STANCOR

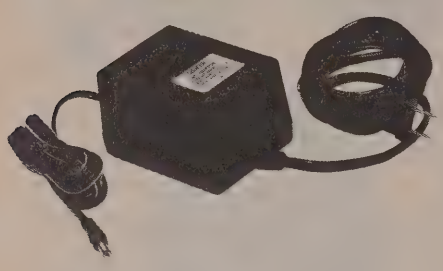
Wall Plug-In Power Sources

WALL PLUG-IN POWER SOURCES—EUROPEAN AND DOMESTIC

DOMESTIC MODELS

Listed UL

Certified CSA



AC-AC MODELS INPUT 120V, 60 Hz.

STANCOR Part Number	Rated Output Volts	Rated Output MA	Size
STA-3545B	4.5 AC	300	1
STA-4190B	9.0 AC	300	2
STA-4190D	9.0 AC	500	2
STA-4110	10.0 AC	700	2
STA-3512E •	12.0 AC	100	1
STA-3512F •	12.0 AC	200	1
STA-4112A	12.0 AC	500	2
STA-4812B •	12.0 AC	850	3
STA-4116	16.0 AC	250	2
STA-4118 •	18.0 AC	300	2
STA-4820 •	20.0 AC	700	3
STA-4124	24.0 AC	300	2

AC-DC UNREGULATED MODELS 120V, 60 Hz.

STANCOR Part Number	Rated Output Volts	Rated Output MA	Size
STA-3530A	3.0 DC	400	1
STA-3530	3.0 DC	500	1
STA-3540	4.4 DC	400	1
STA-3560B	6.0 DC	100	1
STA-3560	6.0 DC	200	1
STA-3560A	6.0 DC	300	1
STA-4160	6.0 DC	600	2
STA-4160A	6.0 DC	800	2
STA-4860	6.0 DC	1000	3
STA-4860A	6.0 DC	1200	3
STA-5760	6.0 DC	2000	4
STA-3575	7.5 DC	100	1
STA-3575A	7.5 DC	300	1
STA-4875	7.5 DC	1000	3
STA-5775	7.5 DC	1500	4
STA-3590B	9.0 DC	100	1
STA-3590	9.0 DC	200	1
STA-3590A	9.0 DC	300	1
STA-4190A	9.0 DC	500	2
STA-4190F	9.0 DC	700	2
STA-4890	9.0 DC	1000	3
STA-4890A	9.0 DC	1200	3
STA-3512	12.0 DC	50	1
STA-3512C	12.0 DC	100	1
STA-3512B	12.0 DC	200	1
STA-4112B	12.0 DC	300	2
STA-4112	12.0 DC	400	2
STA-4112C	12.0 DC	500	2
STA-4812D	12.0 DC	600	3
STA-4812A	12.0 DC	1000	3
STA-5712	12.0 DC	1200	4
STA-4812	12.5 DC	800	3
STA-5713	13.5 DC	1300	4
STA-5713A	13.5 DC	1700	4
STA-4814	14.5 DC	800	3
STA-4815	15.0 DC	600	3
STA-5715	15.0 DC	1000	4
STA-3518	18.5 DC	80	1

AC-DC REGULATED MODELS INPUT 120V, 60 Hz.

STANCOR Part Number	Rated Output Volts	Rated Output MA	Size
STA-4130 •	3.0 DC	350	2
STA-4850	5.0 DC	600	9
STA-4190C •	9.0 DC	200	2
STA-4890B	9.0 DC	400	9
STA-4110A	10.0 DC	300	2
STA-300R	12.0 DC	200	2

• UL listed only/not CSA certified.
•• No agency approvals.
See next page for Model Sizes and Output Terminations.

DESK TOP MODELS

AC-DC UNREGULATED DESK TOP MODELS INPUT 120V, 60 Hz.

STANCOR Part Number	Rated Output Volts	Rated Output MA	Size
STA-6690	9.0 DC	3000	7
STA-6612	12.0 DC	2000	7
STA-6612A	12.0 DC	2500	7
STA-6612B	12.0 DC	3000	7
STA-5713AC	13.5 DC	1700	4
STA-6013A	13.5 DC	2100	5
STA-6613	13.5 DC	2400	7
STA-6615	15.0 DC	2000	7
STA-6618	18.0 DC	2000	7
STA-6624	24.0 DC	1500	7

AC-AC DESK TOP MODELS INPUT 120V, 60 Hz.

STANCOR Part Number	Rated Output Volts	Rated Output MA	Size
STA-5760A •	6.0 AC	3300	4
STA-5790	9.0 AC	3400	4

EUROPEAN MODELS

Certified VDE GS

AC-DC UNREGULATED MODELS INPUT 220V, 50 Hz.

STANCOR Part Number	Rated Output Volts	Rated Output MA	Size
STAF-3924F	4.5 DC	350	6
STAF-1847F	4.8 DC	500	2
STAF-1848F	5.2 DC	1000	3
STAF-0381F	6.0 DC	500	2
STAF-0797F	6.0 DC	1000	3
STAF-2100F	6.2 DC	300	6
STAF-0834F	6.2 DC	350	2
STAF-2243F	7.5 DC	300	2
STAF-2223F	9.0 DC	200	6
STAF-3309F	9.0 DC	300	2
STAF-1058F	9.0 DC	500	2
STAF-0329F	9.0 DC	1000	3
STAF-3382F	12.0 DC	300	2
STAF-2343F	12.0 DC	500	3
STAF-1454F	12.0 DC	1000	4
STAF-1948F	12.0 DC	1200	4
STAF-0460F	12.6 DC	800	3
STAF-1059F	13.5 DC	1300	4
STAF-0354F	14.5 DC	800	3

AC-AC MODELS INPUT 220V, 50 Hz.

STANCOR Part Number	Rated Output Volts	Rated Output MA	Size
STAF-1433F	2.9 AC	320	6
STAF-2099F	3.0 AC	120	6
STAF-0418F	4.5 AC	120	6
STAF-0437F	9.0 AC	130	6
STAF-2098F	24.0 AC	400	3

DESK TOP MODELS

AC-DC UNREGULATED DESKTOP MODELS INPUT 220V, 50 Hz.

STANCOR Part Number	Rated Output Volts	Rated Output MA	Size
STAF-2134F	13.5 DC	1700	5
STAF-3775F	13.5 DC	2100	8
STAF-3777F	13.5 DC	2400	8
STAF-3613F	14.0 DC	1400	5
STAF-1972F	15.0 DC	1000	4

DOMESTIC AND EUROPEAN DIMENSIONS AND SPECIFICATIONS

MODEL SIZE CHART

	L		W		H	
	mm	inches	mm	inches	mm	inches
1	55.0	2.2	42.8	1.7	37.2	1.5
2	63.0	2.5	51.0	2.0	41.0	1.6
3	70.5	2.8	56.0	2.2	47.0	1.9
4	84.5	3.3	64.5	2.5	55.0	2.2
5	95.2	3.7	72.0	2.8	57.0	2.2
6	55.0	2.2	42.8	1.7	35.6	1.4
7	120.0	4.7	80.0	3.1	66.5	2.6
8	120.0	4.7	82.0	3.2	66.5	2.6
9	89.0	3.5	61.0	2.4	48.0	1.9

OUTPUT TERMINATIONS

Stancor wall plug-in power sources have output termination compatible with Switchcraft PC-722A or 722A with 6 ft. output cord. Secondary plug size 2.1 x 5.5 mm. Wired Outside-Positive; Inside-Negative for AC-DC models.

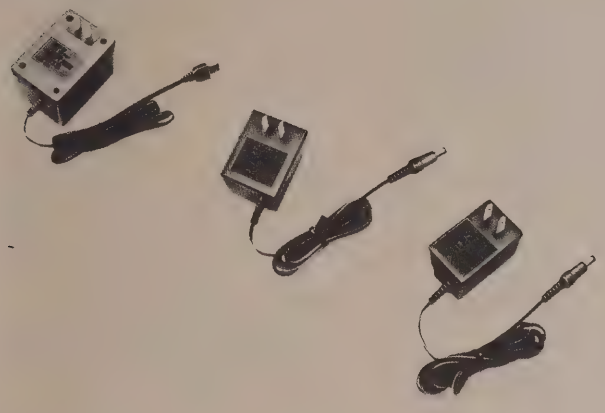
STANCOR PRODUCTS • 131 Godfrey St. • Logansport, IN 46947 • Phone 219-722-2244 • FAX: 219-722-5189

STANCOR

Wall Plug-In Power Sources

WALL PLUG-IN POWER SOURCES—EUROPEAN AND DOMESTIC

UL-CSA SERIES



Reliable power sources for modems, data communication terminals, security systems, LED displays, power tools, home or personal computers, microprocessors, telecommunications products, battery power systems, medical products and test equipment. Choice of AC-DC regulated or unregulated models or AC-AC models. Wall plug-in power sources are the perfect solution for:

- Gaining agency approval: UL, CSA, VDE
- Reducing size and weight of product; allows low-profile design
- Removing heat from sensitive circuitry
- Eliminating need for cooling devices
- Reducing design time for product
- Providing a secure, tamperproof power source
- Providing safer, low power to any application

Stancor Wall Plug-In Power Sources have output termination compatible with Switchcraft® PC-722A or 722A with 6-ft. output cord. Other terminations available on special order.

AC-DC MODELS—UL/CSA UNREGULATED SERIES 120 VAC INPUT (ALL MODELS)

Stancor No.	Rated Output (DC) V	mA	CSA
W60DUH40-1	6.0	400	Listed
W75DUJ50-1	7.5	500	Listed
W140DUJ35-1	14.0	350	Listed
W200DUJ28-1	20.0	280	Listed
W240DUH05-1	24.0	50	Listed

N/A = Not Available

AC-DC MODELS—UL/CSA REGULATED SERIES 120 VAC INPUT (ALL MODELS)

Stancor No.	Rated Output (DC) V	Reg.	mA	CSA
W60DRJ40-1	6.0	0.5	400	Comply

AC-AC MODELS—UL/CSA CLASS II TRANSFORMERS 120 VAC, 60 Hz INPUT (ALL MODELS)

Stancor No.	Rated Output VAC	mA RMS	CSA
W170AUK50-2*	17.0#	500	Listed
W180AUM88-1	18.0	880	N/A
W240AUJ45-1	24.0	450	Comply
W240AUM66-1	24.0	660	N/A

***Termination:** 6-ft. cord with AMP connector: mates with AMP 3-102202-4 or 3-102203-4. #Center tapped. N/A = Not Available.

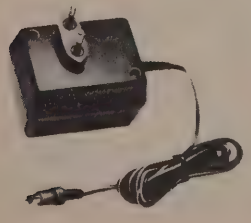
EUROPEAN MODELS 220 VAC, 50 Hz INPUT (ALL MODELS)

Stancor No.	Rated Output (DC) V	mA	VDE
REGULATED SERIES			
W60DRK40-X1	6.0	400	Comply
W90DRK30-X1	9.0	300	Comply
W120DRK25-X1	12.0	250	Comply
AC-AC MODELS			
W95AUG15-X1	9.5	150	Comply
W120AUG10-X1	12.0	100	Comply

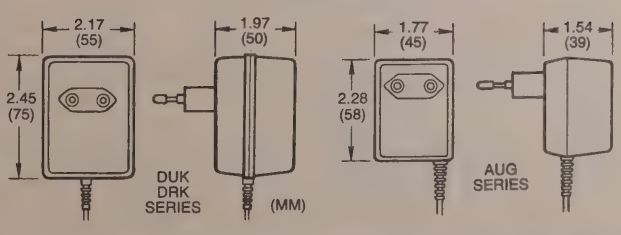
UL—CSA SERIES DIMENSIONS INCHES (MM)

Model Series	L	W	H
DUF	2.09 (53)	1.42 (36)	1.50 (38)
DUH, AUH	2.36 (60)	1.77 (45)	1.65 (42)
DUJ, DRJ, AUJ	2.40 (61)	2.17 (55)	1.61 (41)
DRL, AUK	3.19 (81)	2.32 (59)	2.05 (52)
DUM, AUM	3.23 (82)	2.36 (60)	1.89 (48)

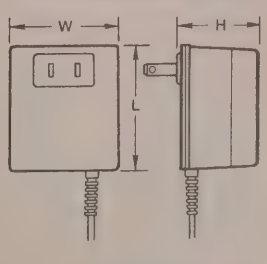
EUROPEAN VDE SERIES



EUROPEAN SERIES DIMENSIONS INCHES (MM)



UL—CSA SERIES SEE DIMENSIONS TABLE



STANCOR®

Transformers

RECTIFIER, CONTROL AND FILAMENT TRANSFORMERS WITH SINGLE SECONDARY

All primaries 50-60 Hz. May be operated from a 400 Hz source with no change in output rating.
All secondary voltages ±3%. Insulation test voltage is twice allowable rms working voltage plus 1000 volts.

Stancor Number	Secondary V	Secondary A	Insul. Test V_{rms}	Pri. Volts	Termination Pri.	Termination Sec.	Mtg.	Size Inches H. × W. × D.	MW MW × MD
P-8385	6.3 CT	0.3	1500	117	Leads	Leads	A	1 1/4 × 2 1/8 × 1 3/8	1 3/4
P-6465	6.3 CT	0.6	1500	117	Leads	Leads	A	1 3/8 × 2 3/8 × 1 1/2	2
P-8705	6.3 CT	0.6	1500	230	Leads	Leads	A	1 3/8 × 2 3/8 × 1 1/2	2
P-8389	6.3	1.0	1500	117	Leads	Leads	A	1 5/8 × 2 7/8 × 1 5/8	2 3/8
P-6134	6.3 CT	1.2	5000	117	Leads	Leads	A	1 5/8 × 2 7/8 × 1 7/8	2 3/8
P-8190	6.3	1.2	3000	117	Leads	Leads	A	2 × 3 1/4 × 1 7/8	2 13/16
P-6466	6.3 CT	3.0	2500	117	Leads	Leads	A	2 × 3 1/4 × 2 1/8	2 13/16
P-8648	6.3 CT	4.0	1500	117	Leads	Leads	A	2 3/8 × 3 3/4 × 2 1/8	3 1/8
P-8651	6.3 CT	8.0	1500	117	Leads	Leads	A	2 5/8 × 4 × 2 1/4	3 9/16
P-6464	6.3 CT	10.0	2000	117	Leads	Leads	C	3 1/2 × 2 13/16 × 3 1/4	2 1/4 × 2
P-6309	6.3 CT	20.0	2500	117/107	Leads	Leads	NV	4 9/16 × 3 3/4 × 3 3/5	3 × 2 3/8
P-5015*	7.5 CT	4.0	2500	117	Lugs	Lugs	NV	3 1/8 × 2 1/2 × 2 1/4	2 × 2 1/8
P-8652	10.0 CT	1.0	1500	117	Leads	Leads	A	2 × 3 1/4 × 1 5/8	2 13/16
P-8653	10.0 CT	2.0	1500	117	Leads	Leads	A	2 × 3 1/4 × 2	2 13/16
P-8380	10.0 CT	3.0	1500	117	Leads	Leads	A	2 3/8 × 3 3/4 × 2 1/4	3 1/8
P-8654	10.0 CT	4.0	1500	117	Leads	Leads	A	2 5/8 × 4 × 2 1/8	3 9/16
P-8655	10.0 CT	6.0	1500	117	Leads	Leads	NV	3 1/8 × 2 1/2 × 2 3/4	2 × 2 5/16
P-8656	10.0 CT	8.0	1500	117	Leads	Leads	NV	3 7/16 × 2 13/16 × 3	2 1/4 × 2 1/2
P-6461	10.0 CT	10.0	2000	117	Leads	Leads	C	3 7/8 × 3 1/4 × 3 9/16	2 1/2 × 2 11/16
P-8390	12.0	0.15	1500	117	Leads	Leads	A	1 1/4 × 2 1/8 × 1 1/4	1 3/4
P-8391	12.0	0.35	1500	117	Leads	Leads	A	1 3/8 × 2 3/8 × 1 3/8	2
P-8392	12.0	0.70	1500	117	Leads	Leads	A	1 5/8 × 2 7/8 × 1 5/8	2 3/8
P-8393	12.0	1.2	1500	117	Leads	Leads	A	2 × 3 1/4 × 1 5/8	2 13/16
P-8657	12.0	2.0	1500	117	Leads	Leads	A	2 × 3 1/4 × 2 1/8	2 13/16
P-8658	12.0	4.0	1500	117	Leads	Leads	A	2 5/8 × 4 × 2 1/4	3 9/16
P-8659	12.0	6.0	1500	117	Leads	Leads	NV	3 7/16 × 2 13/16 × 2 5/8	2 1/4 × 2 1/8
P-8660	12.0	8.0	1500	117	Leads	Leads	NV	3 13/16 × 3 1/8 × 2 3/4	2 1/2 × 2 1/8
P-8384	12.6 CT	1.0	1500	117	Leads	Leads	A	2 × 3 1/4 × 1 3/4	2 13/16
P-8550	12.6 CT	1.5	1500	115	Leads	Leads	A	1 15/16 × 3 5/16 × 2	2 13/16
P-8130	12.6 CT	2.0	1500	117	Leads	Leads	A	2 × 3 1/4 × 2 1/8	2 13/16
P-8358	12.6 CT	3.0	1500	117	Leads	Leads	A	2 3/8 × 3 3/4 × 2 1/4	3 1/8
P-8641	12.6 CT	4.0	1500	117	Leads	Leads	A	2 5/8 × 4 × 2 3/8	3 9/16
P-8716	12.6 CT	4.0	2500	230	Leads	Leads	A	2 5/8 × 4 × 2 3/8	3 9/16
P-8642	12.6 CT	6.0	1500	117	Leads	Leads	C	3 1/2 × 2 13/16 × 3 3/8	2 1/4 × 2 3/16
P-8643	12.6 CT	8.0	1500	117	Leads	Leads	C	3 7/8 × 3 1/8 × 3 5/8	2 1/2 × 2 3/8
P-8644	12.6 CT	10.0	1500	117	Leads	Leads	C	4 1/4 × 3 7/16 × 3 7/8	2 3/4 × 2 3/4
P-8577	14.0 CT	0.25	1500	115/230	Leads	Leads	A	1 3/8 × 2 3/8 × 1 1/2	2
P-8553	14.0 CT	0.25	1500	115	Leads	Leads	A	1 3/8 × 2 3/8 × 1 3/8	2
P-8555	14.0 CT	1.0	1500	115	Leads	Leads	A	1 15/16 × 3 1/4 × 1 3/4	2 13/16
P-8556	14.0 CT	2.0	1500	115	Leads	Leads	A	2 1/4 × 3 11/16 × 1 15/16	3 1/8
P-8557	14.0 CT	4.0	1500	115	Leads	Leads	NV	3 × 2 1/2 × 2 7/16	2 × 2 1/4
P-8558	14.0 CT	6.0	1500	115	Leads	Leads	NV	3 3/8 × 2 13/16 × 2 7/8	2 1/4 × 2 3/8
P-8690	18.0 CT	0.75	1500	115	Leads	Leads	A	1 15/16 × 3 5/16 × 2	2 13/16
P-8691	18.0 CT	1.0	1500	115	Leads	Leads	A	1 15/16 × 3 5/16 × 2 1/8	2 13/16
P-8692	18.0 CT	1.5	1500	115	Leads	Leads	A	2 9/32 × 3 3/4 × 2 1/8	3 1/8
P-8693	18.0 CT	2.0	1500	115	Leads	Leads	A	2 9/32 × 3 3/4 × 2 1/4	3 1/8
P-8500	20.0 CT	0.05	2500	115/230	Leads	Leads	A	1 1/4 × 2 1/8 × 1 1/4	1 3/4
P-8504	20.0 CT	0.25	2500	115/230	Leads	Leads	A	1 3/8 × 2 3/8 × 1 3/8	2
P-8505	20.0 CT	0.3	2500	115/230	Leads	Leads	A	1 3/8 × 2 3/8 × 1 3/8	2
P-8507	20.0 CT	0.5	2500	115/230	Leads	Leads	A	1 5/8 × 2 7/8 × 1 1/2	2 3/8
P-8508	20.0 CT	1.0	2500	115/230	Leads	Leads	A	2 × 3 1/4 × 2 1/4	2 13/16
P-8604	20.0 CT	1.0	1500	117	Leads	Leads	A	2 × 3 1/4 × 2 1/8	2 13/16
P-8559	20.0 CT	2.0	1500	115	Leads	Leads	NV	2 9/16 × 4 × 2 1/4	3 9/16
P-8560	20.0 CT	4.0	1500	115	Leads	Leads	NV	3 3/8 × 2 13/16 × 2 7/8	2 1/4 × 2 3/8
P-8551#	24.0	1.0	1500	115	Leads	Leads	A	1 15/16 × 3 1/4 × 2 1/8	2 13/16
P-8694#	24.0	2.0	1500	115	Leads	Leads	A	2 9/16 × 4 × 2	3 9/16
P-8394	24.0 CT	0.09	1500	117	Leads	Leads	A	1 1/4 × 2 1/8 × 1 1/4	1 3/4
P-8720	24.0 CT	0.09	1500	230	Leads	Leads	A	1 1/4 × 2 1/8 × 1 1/4	1 3/4
P-8395	24.0 CT	0.2	1500	117	Leads	Leads	A	1 3/8 × 2 3/8 × 1 3/8	2
P-8578	24.0 CT	0.2	1500	115/230	Leads	Leads	A	1 3/8 × 2 3/8 × 1 1/2	2
P-8396	24.0 CT	0.4	1500	117	Leads	Leads	A	1 5/8 × 2 7/8 × 1 5/8	2 3/8
P-8397	24.0 CT	0.7	1500	117	Leads	Leads	A	2 × 3 1/4 × 1 3/4	2 13/16
P-8661	24.0 CT	1.0	1500	117	Leads	Leads	A	2 × 3 1/4 × 2 1/16	2 13/16
P-8575	24.0 CT	1.0	1500	115/230	Leads	Leads	A	1 15/16 × 3 5/16 × 2	2 13/16
P-8662	24.0 CT	2.0	1500	117	Leads	Leads	A	2 5/8 × 4 × 2 3/8	3 9/16
P-8863	24.0 CT	4.0	1500	117	Leads	Leads	NV	3 13/16 × 3 1/8 × 2 13/16	2 3/4 × 2 1/8
P-8664	24.0 CT	6.0	1500	117	Leads	Leads	NV	4 3/16 × 3 7/16 × 2 13/16	2 3/4 × 2 1/4
P-8665	24.0 CT	8.0	1500	117	Leads	Leads	NV	4 3/16 × 3 7/16 × 3 3/8	2 3/4 × 2 3/4
P-8695	24.0 CT	10.0	1500	115	Leads	Leads	NV	4 1/8 × 3 7/16 × 3 3/4	2 3/4 × 3
P-8666	24.0 CT	12.0	1500	117	Leads	Leads	NV	4 9/16 × 3 3/4 × 4 5/8	3 × 3 1/4
P-6469	25.2	1.0	1500	117	Leads	Leads	A	2 × 3 1/4 × 2 1/8	2 13/16
P-8707	25.2	1.0	1500	230	Leads	Leads	A	2 × 3 1/4 × 2 1/8	2 13/16
P-8180	25.2 CT	1.0	1500	117	Leads	Leads	A	2 × 3 1/4 × 2 1/4	2 13/16
P-8357	25.2 CT	2.0	1500	117	Leads	Leads	A	2 5/8 × 4 × 2 1/4	3 9/16
P-8574	25.2 CT	2.0	1500	115/230	Leads	Leads	A	2 19/32 × 4 × 2 1/4	3 9/16
P-8388	25.2 CT	2.8	1500	117	Leads	Leads	A	2 5/8 × 4 × 2 1/4	3 9/16
P-8645	25.2 CT	5.0	1500	117	Leads	Leads	C	4 1/4 × 3 7/16 × 3 7/8	2 3/4 × 2 11/16
P-8646	25.2 CT	7.5	1500	117	Leads	Leads	C	4 1/4 × 3 1/2 × 4 1/4	2 3/4 × 3 1/8
P-8609	26.8 CT	1.0	1500	117	Leads	Leads	A	2 × 3 1/4 × 2 1/8	2 13/16
P-8600	28.0 CT	0.09	1500	117	Leads	Leads	A	1 1/4 × 2 1/8 × 1 1/4	1 3/4
P-8601	28.0 CT	0.18	1500	117	Leads	Leads	A	1 3/8 × 2 3/8 × 1 3/8	2
P-8602	28.0 CT	0.3	1500	117	Leads	Leads	A	1 5/8 × 2 7/8 × 1 5/8	2 3/8
P-8603	28.0 CT	0.8	1500	117	Leads	Leads	A	2 × 3 1/4 × 2 1/8	2 13/16
P-8667	28.0 CT	1.0	1500	117	Leads	Leads	A	2 × 3 1/4 × 2 1/8	2 13/16
P-8668	28.0 CT	2.0	1500	117	Leads	Leads	NV	3 1/8 × 2 1/2 × 2 1/2	2 × 2 3/16

*Has electrostatic shield. #60 Hz only.

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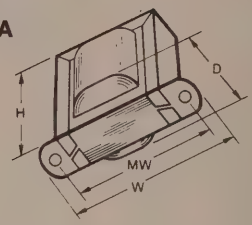

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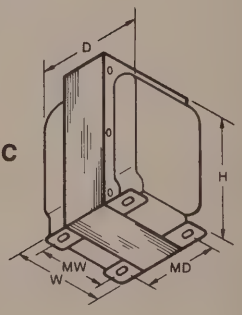
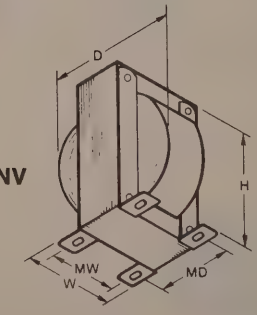


NV

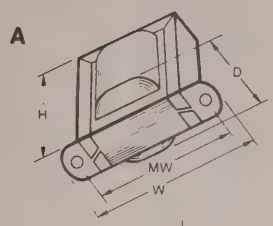


STANCOR®

Transformers

RECTIFIER, CONTROL, AND FILAMENT TRANSFORMERS (CONT'D)
WITH SINGLE SECONDARY

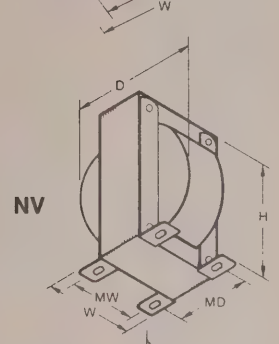
Stancor Number	Secondary V	Secondary A	Insul. Test V_{rms}	Prf. Volts	Termination Pri.	Termination Sec.	Mtg.	Size, Inches H. × W. × D.	MW MW × MD
P-8669	28.0 CT	4.0	1500	117	Leads	Leads	NV	3 13/16 × 3 1/8 × 3 1/4	2 1/2 × 2 1/2
P-8670	28.0 CT	6.0	1500	117	Leads	Leads	NV	4 3/16 × 3 7/16 × 3 1/2	2 3/4 × 2 5/8
P-8610	36.0 CT	0.07	1500	117	Leads	Leads	A	1 1/4 × 2 1/8 × 2 1/4	1 3/4
P-8611	36.0 CT	0.14	1500	117	Leads	Leads	A	1 3/8 × 2 3/8 × 1 3/8	2
P-8612	36.0 CT	0.3	1500	117	Leads	Leads	A	1 5/8 × 2 7/8 × 1 5/8	2 3/8
P-8613	36.0 CT	0.55	1500	117	Leads	Leads	A	2 × 3 1/4 × 1 7/8	2 13/16
P-8671	36.0 CT	1.0	1500	117	Leads	Leads	A	2 3/8 × 3 3/4 × 2 1/4	3 1/8
P-8672	36.0 CT	2.0	1500	117	Leads	Leads	NV	3 7/16 × 2 13/16 × 2 3/4	2 1/4 × 2 1/8
P-8673	36.0 CT	4.0	1500	117	Leads	Leads	NV	4 3/16 × 3 1/16 × 2 7/8	2 3/4 × 2 3/8
P-8674	36.0 CT	6.0	1500	117	Leads	Leads	NV	4 9/16 × 3 3/4 × 3 1/2	3 × 2 5/8
P-8542	40.0 CT	0.25	2500	115/230	Leads	Leads	A	1 5/8 × 2 7/8 × 1 1/2	2 3/8
P-8564	40.0 CT	1.0	1500	115	Leads	Leads	A	2 9/16 × 4 × 2 1/4	3 9/16
P-8566	40.0 CT	4.0	1500	115	Leads	Leads	NV	3 3/4 × 3 1/8 × 3 1/2	2 1/2 × 2 7/8
P-8605	48.0 CT	1.0	2500	117+	Leads	Leads	A	2 5/8 × 4 × 2 3/8	3 9/16

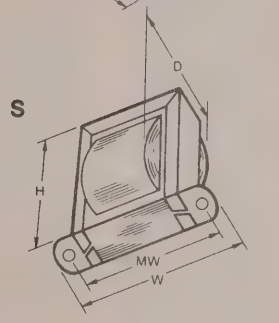


UNIVERSAL CONTROL/RECTIFIER TRANSFORMERS

For 50/60 Hz. but may be operated from a 400 Hz source with no change in output ratings. By connecting primaries in series (for 230 volts) but using only 115 V input, a series of half-voltage output raings becomes available at full rated current from each secondary. Solder lug termination.

Stancor Number	Mtg. Style	Secondary Parallel	Secondary Series	VA	MW MW × MD
P-6375	S	6.0 V at 2.0 A	12.0 VCT at 1.0 A	12	2 3/8
P-6376	S	6.0 V at 4.0 A	12.0 VCT at 2.0 A	24	2 13/16
P-6377	S	12.0 V at 4.0 A	24.0 VCT at 2.0 A	48	3 1/8
P-6378	NV	12.0 V at 8.0 A	24.0 VCT at 4.0 A	96	2 1/4 × 2 1/4
P-6379	NV	12.0 V at 16.0 A	24.0 VCT at 8.0 A	192	2 3/4 × 3
P-8615	S	24.0 V at 0.5 A	48.0 VCT at 0.25 A	12	2 3/8
P-8616	S	24.0 V at 1.0 A	48.0 VCT at 0.5 A	24	2 13/16
P-8617	S	24.0 V at 2.0 A	48.0 VCT at 1.0 A	48	3 1/8
P-8618	NV	24.0 V at 4.0 A	48.0 VCT at 2.0 A	96	2 1/4 × 2 1/4
P-8619	NV	24.0 V at 8.0 A	48.0 VCT at 4.0 A	192	2 3/4 × 3

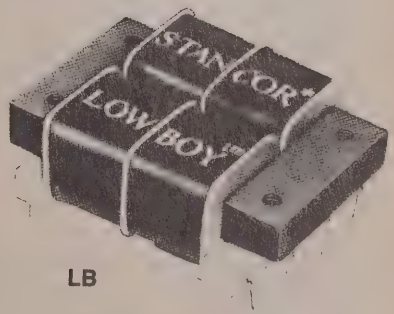




LOW BOY™ LOW-PROFILE POWER TRANSFORMERS

Case style. LB. Primaries are dual 115/230 volts. 50/60 Hz.

Stancor Number	Secondary Series	Secondary Parallel	VA	Size, Inches H. × W. × D.
LB210	10.0 VCT @ 0.2 A	5.0 V @ 0.4 A	2	0.625 × 1.562 × 1.875
LB310	10.0 VCT @ 0.3 A	5.0 V @ 0.6 A	3	0.625 × 1.562 × 1.875
LB215	15.0 VCT @ 0.15 A	7.5 V @ 0.3 A	2	0.625 × 1.562 × 1.875
LB240	40.0 VCT @ 0.06 A	20.0 V @ 0.12 A	2	0.625 × 1.562 × 1.875
LB256	56.0 VCT @ 0.045 A	28.0 V @ 0.09 A	2	0.625 × 1.562 × 1.875
LB288	88.0 VCT @ 0.028 A	44.0 V @ 0.056 A	2	0.625 × 1.562 × 1.875
LB2120	120.0 VCT @ 0.02 A	60.0 V @ 0.04 A	2	0.625 × 1.562 × 1.875
LB2230	230 VCT @ 0.01 A	115 V @ 0.02 A	2	0.625 × 1.562 × 1.875
LB315	15.0 VCT @ .225 A	7.5 V @ 0.45 A	3	0.625 × 1.562 × 1.875
LB410	10.0 VCT @ 0.4 A	5.0 V @ 0.8 A	4	0.875 × 1.562 × 1.875
LB510	10.0 VCT @ 0.5 A	5.0 V @ 1.0 A	5	0.875 × 1.562 × 1.875
LB412	12.0 VCT @ 0.333 A	6.0 V @ 0.667 A	4	0.875 × 1.562 × 1.875
LB512	12.0 VCT @ 0.417 A	6.0 V @ .0833 A	5	0.875 × 1.562 × 1.875
LB420	20.0 VCT @ 0.2 A	10.0 V @ 0.4 A	4	0.875 × 1.562 × 1.875
LB520	20.0 VCT @ 0.25 A	10.0 V @ 0.5 A	5	0.875 × 1.562 × 1.875
LB424	24.0 VCT @ 0.167 A	12.0 V @ 0.333 A	4	0.875 × 1.562 × 1.875
LB524	24.0 VCT @ 0.208 A	12.0 V @ 0.417 A	5	0.875 × 1.562 × 1.875
LB4120	120.0 VCT @ 0.033 A	60.0 V @ 0.066 A	4	0.875 × 1.562 × 1.875
LB5120	120.0 VCT @ 0.042 A	60.0 V AK 0.084 A	5	0.875 × 1.562 × 1.875
LB610	10.0 VCT @ 0.6 A	5.0 V @ 1.2 A	6	0.875 × 1.562 × 1.875
LB1210	10.0 VCT @ 1.2 A	5.0 V @ 2.4 A	12	1.062 × 2.000 × 2.500
LB612	12.6 VCT @ 0.45 A	6.3 V @ 0.9 A	6	0.875 × 1.562 × 1.875
LB1212	12.6 VCT @ 0.9 A	6.3 V @ 1.8 A	12	1.062 × 2.000 × 2.500
LB616	16.0 VCT @ 0.35 A	8.0 V @ 0.7 A	6	0.875 × 1.562 × 1.875
LB1216	16.0 VCT @ 0.7 A	8.0 V @ 1.4 A	12	1.062 × 2.000 × 2.500
LB620	20.0 VCT @ 0.3 A	10.0 V @ 0.6 A	6	0.875 × 1.562 × 1.875
LB1220	20.0 VCT @ 0.6 A	10.0 V @ 1.2 A	12	1.062 × 2.000 × 2.500
LB624	24.0 VCT @ 0.25 A	12.0 V @ 0.5 A	6	0.875 × 1.562 × 1.875
LB1224	24.0 VCT @ 0.5 A	12.0 V @ 1.0 A	12	1.062 × 2.000 × 2.500
LB634	34.0 VCT @ 0.17 A	17.0 V @ 0.34 A	6	0.875 × 1.562 × 1.875
LB1234	34.0 VCT @ 0.34 A	17.0 V @ 0.68 A	12	1.062 × 2.000 × 2.500
LB640	40.0 VCT @ 0.15 A	20.0 V @ 0.3 A	6	0.875 × 1.562 × 1.875
LB1240	40.0 VCT @ 0.3 A	20.0 V @ 0.6 A	12	1.062 × 2.000 × 2.500
LB656	56.0 VCT @ 0.1 A	28.0 V @ 0.2 A	6	0.875 × 1.562 × 1.875
LB1256	56.0 VCT @ 0.2 A	28.0 V @ 0.4 A	12	1.062 × 2.000 × 2.500
LB688	88.0 VCT @ 0.065 A	44.0 V @ 0.13 A	6	0.875 × 1.562 × 1.875
LB1288	88.0 VCT @ 0.13 A	44.0 V @ 0.26 A	12	1.062 × 2.000 × 2.500
LB6120	120.0 VCT @ 0.05 A	60.0 V @ 0.1 A	6	0.875 × 1.562 × 1.875
LB12120	120.0 VCT @ 0.1 A	60.0 V @ 0.2 A	12	1.062 × 2.000 × 2.500
LB6230	230.0 VCT @ 0.025 A	115 V @ 0.05 A	6	0.875 × 1.562 × 1.875
LB12230	230.0 VCT @ 0.05 A	115 V @ 0.1 A	12	1.062 × 2.000 × 2.500



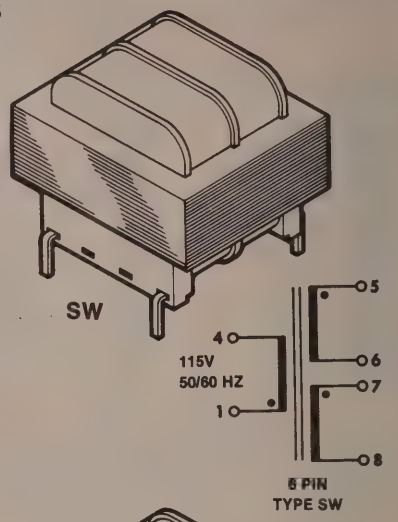
LB

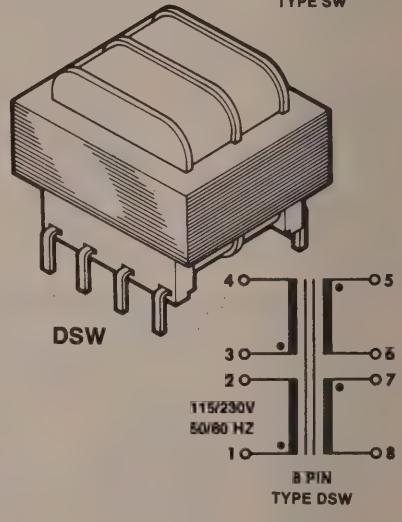
STANCOR Transformers

"SIDE WINDER" SPLIT BOBBIN PC MOUNT POWER TRANSFORMERS
PRIMARY 115V 50/60Hz OR 115/230V 50/60Hz

Case style SW or DSW

Secondary Ratings		Size Inches H. x W. x D.	115 V Primary	115/230 V Primary
Series	Parallel		Stancor No.	Stancor No.
10.0 VCT at 0.11 A	5.0 V at 0.22 A	15/16 x 1 1/8 x 1 3/8	SW-210	DSW-210
10.0 VCT at 0.25 A	5.0 V at 0.5 A	13/16 x 1 1/8 x 1 3/8	SW-310	DSW-310
10.0 VCT at 0.6 A	5.0 V at 1.2 A	15/16 x 15/16 x 1 5/8	SW-410	DSW-410
10.0 VCT at 1.2 A	5.0 V at 2.4 A	17/16 x 1 9/16 x 1 7/8	SW-510	DSW-510
10.0 VCT at 2.0 A	5.0 V at 4.0 A	17/16 x 1 7/8 x 2 1/4	SW-610	DSW-610
12.6 VCT at 0.09 A	6.3 V at 0.18 A	15/16 x 1 1/8 x 1 3/8	SW-212	DSW-212
12.6 VCT at 0.2 A	6.3 V at 0.4 A	13/16 x 1 1/8 x 1 3/8	SW-312	DSW-312
12.6 VCT at 0.5 A	6.3 V at 1.0 A	15/16 x 15/16 x 1 5/8	SW-412	DSW-412
12.6 VCT at 1.0 A	6.3 V at 2.0 A	17/16 x 1 9/16 x 1 7/8	SW-512	DSW-512
12.6 VCT at 1.6 A	6.3 V at 3.2 A	17/16 x 1 7/8 x 2 1/4	SW-612	DSW-612
16.0 VCT at 0.07 A	8.0 V at 0.14 A	15/16 x 1 1/8 x 1 3/8	SW-216	DSW-216
16.0 VCT at 0.15 A	8.0 V at 0.3 A	13/16 x 1 1/8 x 1 3/8	SW-316	DSW-316
16.0 VCT at 0.4 A	8.0 V at 0.8 A	15/16 x 15/16 x 1 5/8	SW-416	DSW-416
16.0 VCT at 0.8 A	8.0 V at 1.6 A	17/16 x 1 9/16 x 1 7/8	SW-516	DSW-516
16.0 VCT at 1.25 A	8.0 V at 2.5 A	17/16 x 1 7/8 x 2 1/4	SW-616	DSW-616
20.0 VCT at 0.055 A	10.0 V at 0.11 A	15/16 x 1 1/8 x 1 3/8	SW-220	DSW-220
20.0 VCT at 0.12 A	10.0 V at 0.24 A	13/16 x 1 1/8 x 1 3/8	SW-320	DSW-320
20.0 VCT at 0.3 A	10.0 V at 0.6 A	15/16 x 15/16 x 1 5/8	SW-420	DSW-420
20.0 VCT at 0.6 A	10.0 V at 1.2 A	17/16 x 1 9/16 x 1 7/8	SW-520	DSW-520
20.0 VCT at 1.0 A	10.0 V at 2.0 A	17/16 x 1 7/8 x 2 1/4	SW-620	DSW-620
24.0 VCT at 0.045 A	12.0 V at 0.09 A	15/16 x 1 1/8 x 1 3/8	SW-224	DSW-224
24.0 VCT at 0.1 A	12.0 V at 0.2 A	13/16 x 1 1/8 x 1 3/8	SW-324	DSW-324
24.0 VCT at 0.25 A	12.0 V at 0.5 A	15/16 x 15/16 x 1 5/8	SW-424	DSW-424
24.0 VCT at 0.5 A	12.0 V at 1.0 A	17/16 x 1 9/16 x 1 7/8	SW-524	DSW-524
24.0 VCT at 0.8 A	12.0 V at 1.6 A	17/16 x 1 7/8 x 2 1/4	SW-624	DSW-624
28.0 VCT at 0.04 A	14.0 V at 0.08 A	15/16 x 1 1/8 x 1 3/8	SW-228	DSW-228
28.0 VCT at 0.085 A	14.0 V at 0.17 A	13/16 x 1 1/8 x 1 3/8	SW-328	DSW-328
28.0 VCT at 0.2 A	14.0 V at 0.4 A	15/16 x 15/16 x 1 5/8	SW-428	DSW-428
28.0 VCT at 0.42 A	14.0 V at 0.84 A	17/16 x 1 9/16 x 1 7/8	SW-528	DSW-528
28.0 VCT at 0.7 A	14.0 V at 1.4 A	17/16 x 1 7/8 x 2 1/4	SW-628	DSW-628
32.0 VCT at 0.035 A	16.0 V at 0.07 A	15/16 x 1 1/8 x 1 3/8	SW-232	DSW-232
32.0 VCT at 0.075 A	16.0 V at 0.15 A	13/16 x 1 1/8 x 1 3/8	SW-332	DSW-232
32.0 VCT at 0.188 A	16.0 V at 0.376 A	15/16 x 15/16 x 1 5/8	SW-432	DSW-432
32.0 VCT at 0.375 A	16.0 V at 0.750 A	17/16 x 1 9/16 x 1 7/8	SW-532	DSW-532
32.0 VCT at 0.625 A	16.0 V at 1.25 A	17/16 x 1 7/8 x 2 1/4	SW-632	DSW-632
36.0 VCT at 0.03 A	18.0 V at 0.06 A	15/16 x 1 1/8 x 1 3/8	SW-236	DSW-236
36.0 VCT at 0.065 A	18.0 V at 0.13 A	13/16 x 1 1/8 x 1 3/8	SW-336	DSW-336
36.0 VCT at 0.17 A	18.0 V at 0.34 A	15/16 x 15/16 x 1 5/8	SW-436	DSW-436
36.0 VCT at 0.35 A	18.0 at 0.7 A	17/16 x 1 9/16 x 1 7/8	SW-536	DSW-536
36.0 VCT at 0.55 A	18.0 V at 1.1 A	17/16 x 1 7/8 x 2 1/4	SW-636	DSW-636
48.0 VCT at 0.023 A	24.0 V at 0.046 A	15/16 x 1 1/8 x 1 3/8	SW-248	DSW-248
48.0 VCT at 0.05 A	24.0 V at 0.1 A	13/16 x 1 1/8 x 1 3/8	SW-348	DSW-348
48.0 VCT at 0.125 A	24.0 V at 0.25 A	15/16 x 15/16 x 1 5/8	SW-448	DSW-448
48.0 VCT at 0.25 A	24.0 V at 0.5 A	17/16 x 1 9/16 x 1 7/8	SW-548	DSW-548
48.0 VCT at 0.4 A	24.0 V at 0.8 A	17/16 x 1 7/8 x 2 1/4	SW-648	DSW-648
56.0 VCT at 0.02 A	28.0 V at 0.04 A	15/16 x 1 1/8 x 1 3/8	SW-256	DSW-256
56.0 VCT at 0.045 A	28.0 V at 0.09 A	13/16 x 1 1/8 x 1 3/8	SW-358	DSW-356
56.0 VCT at 0.11 A	28.0 V at 0.22 A	15/16 x 15/16 x 1 5/8	SW-456	DSW-456
56.0 VCT at 0.22 A	28.0 V at 0.44 A	17/16 x 1 9/16 x 1 7/8	SW-556	DSW-556
56.0 VCT at 0.35A	28.0 V at 0.7 A	17/16 x 1 7/8 x 2 1/4	SW-656	DSW-656
120 VCT at 0.01 A	60.0 V at 0.02 A	15/16 x 1 1/8 x 1 3/8	SW-2120	DSW-2120
120 VCT at 0.02 A	60.0 V at 0.04 A	13/16 x 1 1/8 x 1 3/8	SW-3120	DSW-3120
120 VCT at 0.05 A	60.0 V at 0.1 A	15/16 x 15/16 x 1 5/8	SW-4120	DSW-4120
120 VCT at 0.1 A	60.0 V at 0.2 A	17/16 x 1 9/16 x 1 7/8	SW-5120	DSW-5120
120 VCT at 0.16 A	60.0 V at 0.32 A	17/16 x 1 7/8 x 2 1/4	SW-6120	DSW-6120





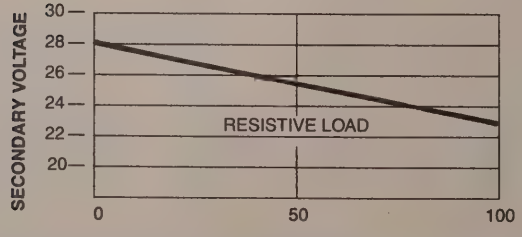
TYPE P-591 ENERGY-LIMITING TRANSFORMER

U.L. RECOGNIZED (File E-52313)

CSA CERTIFIED (LR 68068)

GENERAL DATA

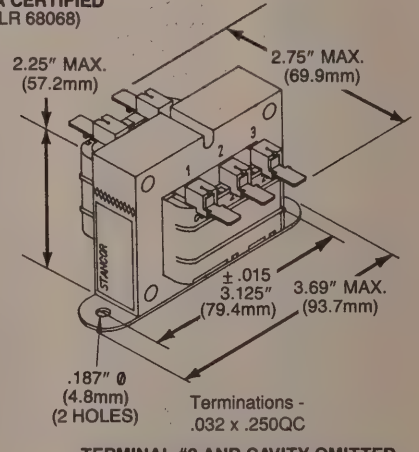
STANCOR Part No.	Volt-Amperes (VA)	Frequency (Hertz)	Primary Input (Volts)	Wt. Lbs.
P-591-900 P-591-901 P-591-902	30	50/60	120 240 208/240	1.20 .54Kg
P-591-910 P-591-911 P-591-912	40	50/60	120 240 208/240	1.30 .59Kg



% RATED SECONDARY CURRENT

Composite of 30 and 40 VA Regulation Curves.

Notes: Inductive loads produce slighly different voltages. Above curves subject to 2% manufacturing tolerance.



TERMINAL #2 AND CAVITY OMITTED ON 120 AND 240V TRANSFORMERS

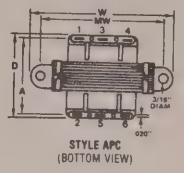
STANCOR PRODUCTS • 131 Godfrey St. • Logansport, IN 46947 • Phone 219-722-2244 • FAX: 219-722-5189

STANCOR

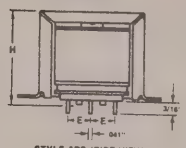
Transformers

MINIATURE, PLUG-IN PC POWER TRANSFORMERS

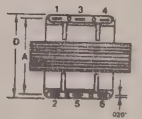
Stancor No.	Case Style	Secondary: Parallel	Secondary: Series	Size, Inches H. × W. × D.	Mounting: MW	Mounting: A	Mounting: E
WITH 115 VOLT PRIMARY AND EQUAL SECONDARIES							
PPC-1	PC	4.0 V at 0.376 A	8.0 VCT at 0.188 A	1 1/8 × 1 13/32 × 1 5/32	—	1	.31
PPC-2	PC	7.5 V at 0.2 A	15.0 VCT at 0.1 A	1 1/8 × 1 13/32 × 1 5/32	—	1	.31
PPC-3	PC	15.0 V at 0.1 A	30.0 VCT at 0.05 A	1 1/8 × 1 13/32 × 1 5/32	—	1	.31
PPC-4	PC	27.0 V at 0.056 A	54.0 VCT at 0.028 A	1 1/8 × 1 13/32 × 1 5/32	—	1	.31
PPC-7	PC	20.0 V at 0.076 A	40.0 VCT at 0.038 A	1 1/8 × 1 13/32 × 1 5/32	—	1	.31
PPC-11	APC	4.0 V at 1.13 A	8.0 VCT at 1.562 A	1 13/32 × 2 3/8 × 1 1/4	2	1.1	.4
PPC-12	APC	7.5 V at 0.6 A	15.0 VCT at 0.3 A	1 13/32 × 2 3/8 × 1 1/4	2	1.1	.4
PPC-13	APC	15.0 V at 0.3 A	30.0 VCT at 0.15 A	1 13/32 × 2 3/8 × 1 1/4	2	1.1	.4
PPC-14	APC	27.0 V at 0.168 A	54.0 VCT at 0.084 A	1 13/32 × 2 3/8 × 1 1/4	2	1.1	.4
PPC-17	APC	20.0 V at 0.224 A	40.0 VCT at 0.112 A	1 13/32 × 2 3/8 × 1 1/4	2	1.1	.4
PPC-22	APC	7.5 V at 1.0 A	15.0 VCT at 1.05 A	1 5/8 × 2 13/16 × 1 15/32	2 3/8	1.3	.4
PPC-23	APC	15.0 V at 0.5 A	30.0 VCT at 0.25 A	1 5/8 × 2 13/16 × 1 15/32	2 3/8	1.3	.4
PPC-27	APC	20.0 V at 0.376 A	40.0 VCT at 0.188 A	1 5/8 × 2 13/16 × 1 15/32	2 3/8	1.3	.4
WITH 115/230 VOLT DUAL PRIMARIES AND EQUAL SECONDARIES							
PPC-8	PC	15.0 V at 0.1 A	30.0 VAC at 0.05 A	1 3/16 × 1 3/8 × 1 1/8	—	1.0	.20
PPC-46	PC	7.5 V at 0.2 A	15.0 VCT at 0.1 A	1 1/56 × 1 3/8 × 1 1/8	—	1.0	.20
PPC-51	PC	115 V at 0.026 A	230 VCT at 0.013 A	1 1/56 × 1 3/8 × 1 1/8	—	1.0	.20
PPC-18	APC	6.3 V at 0.7 A	12.6 VCT at 0.35 A	1 7/16 × 2 3/8 × 1 1/4	2	1.1	.25
PPC-47	APC	7.5 V at 0.6 A	15.0 VCT at 0.3 A	1 3/8 × 2 3/8 × 1 1/4	2	1.1	.25
PPC-19	APC	8.0 V at 0.56 A	16.0 VCT at 0.28 A	1 7/16 × 2 3/8 × 1 1/4	2	1.1	.25
PPC-28	APC	10.0 V at 0.45 A	20.0 VCT at 0.225 A	1 7/16 × 2 3/8 × 1 1/4	2	1.1	.25
PPC-20	APC	12.0 V at 0.36 A	24.0 VCT at 0.18 A	1 7/16 × 2 3/8 × 1 1/4	2	1.1	.25
PPC-48	APC	15.0 V at 0.3 A	30.0 VCT at 0.15 A	1 3/8 × 2 3/8 × 1 1/4	2	1.1	.25
WITH 115/230 VOLT DUAL PRIMARIES AND UNEQUAL SECONDARIES							
DPC-X-12	PC	10.0 VCT at 0.39 A	20.0 VCT at 0.107 A	1 5/8 × 1 7/8 × 1 7/16	—	1.3	.25
DPC-Y-12	PC	10.0 VCT at 0.9 A	20.0 VCT at 0.27 A	1 3/8 × 1 5/8 × 2 1/4	—	2.1	.20
DPC-Y-15	PC	10.0 VCT at 0.9 A	24.0 VCT at 0.24 A	1 3/8 × 1 5/8 × 2 1/4	—	2.1	.20



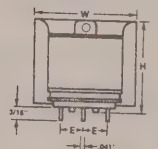
STYLE APC (BOTTOM VIEW)



STYLE APC (SIDE VIEW)



STYLE PC (BOTTOM VIEW)



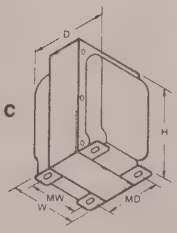
STYLE PC (SIDE VIEW)

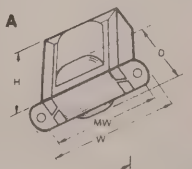
UNIVERSAL RECTIFIER TRANSFORMERS

Each transformer has the winding arrangement shown. The 117 VAC primary is connected to terminals 1, 2, 3, and 4. The separate winding 5, 6, and 7 may be used in series with the primary to raise or lower the secondary voltage output. Transformers are designed for 50-60 Hz operations, but may also be operated at 400 Hz. Case style is NV with solder lug terminations.

Stancor Number	Approx. Applies VAC Under Load	Max. DC Output: Resistive or Induct load: Volts	Max. DC Output: Resistive or Induct load: Amps	Max. DC Output: Capacitive Load: Volts	Max. DC Output: Capacitive Load: Amps	Filter Capacitor µF	Dimensions: H	Dimensions: W	Dimensions: D	Dimensions: MW	Dimensions: MD
RT-201	11.7-29.4*	11.2	2.0	13.8	2.0	1000	3 1/8	2 1/2	2 3/8	2	2 1/8
RT-202	11.1-28.5†	23.0	1.25	30.0	1.25	500					
	12.0-29.8*	11.1	4.0	14.7	4.0	2000	3 7/16	2 13/16	2 3/4	2 1/4	2 3/8
RT-204	12.0-29.8†	24.3	2.0	33.0	2.0	1000					
	11.7-29.2*	12.0	8.0	14.5	8.0	4000	3 13/16	3 1/8	3 7/8	2 1/2	2 7/8
RT-206	11.6-29.2†	24.0	4.0	32.4	4.0	2000					
	12.0-29.7*	11.5	12.0	14.4	12.0	6000	4 5/16	3 7/16	4 1/4	2 3/4	3 1/4
RT-208	12.0-29.7†	24.0	6.0	32.0	6.0	3000					
	12.1-29.2*	11.4	15.0	14.8	15.0	7500	4 9/16	3 3/4	5	2 15/16	3 3/4
RT-2012	12.1-29.2†	23.7	8.0	32.5	8.0	4000					
	12.2-29.0*	11.4	22.5	14.3	22.5	11250	5 5/16	4 3/8	5 7/8	3 1/2	4 1/4
RT-401	12.2-29.0†	23.5	12.0	33.0	12.0	6000					
	24.0-59.0*	25.0	2.0	34.0	2.0	2500	3 7/16	2 13/16	3 11/16	2 1/4	2 1/2
RT-402	24.0-59.0†	52.5	1.0	73.5	1.0	1500					
	23.0-58.0*	25.0	4.0	33.5	4.0	3000	3 13/16	3 1/8	4 1/2	2 1/2	3 1/16
RT-408	23.0-58.0†	51.5	2.0	72.5	2.0	1500					
	25.0-54.1*	23.4	12.0	32.0	12.0	4000	5 5/16	4 3/8	6 3/4	3 1/2	5 1/4
	25.0-54.1†	46.3	8.0	66.8	8.0	4000					

*CT rectifier circuit. †Bridge rectifier circuit.





AUTOTRANSFORMERS

STEP-DOWN RATIO

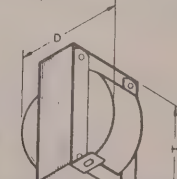
Grounded safety type with case and core connected to third conductor of NEMA standard cord and receptacle. Primaries 230 VAC, secondaries 115 VAC. 50/60 Hz. May be operated from a 400 Hz source with no change in output ratings.

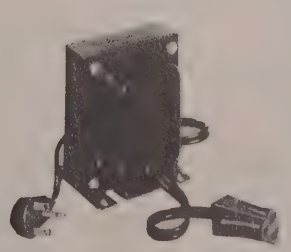
Stancor Number	Mtg. Style	VA	Size, Inches W. × D. × H.	Wt. Lbs.	MW MW × MD
GSD-75	C	75	3 3/16 × 2 3/4 × 3 7/8	3.0	2 1/2 × 1 1/2
GSD-100	C	100	3 3/16 × 3 × 3 7/8	3.7	2 1/2 × 1 3/4
GSD-150	C	150	3 3/16 × 3 1/4 × 3 7/8	4.4	2 1/2 × 2
GSD-250	C	250	3 3/16 × 3 5/8 × 3 7/8	5.8	2 1/2 × 2 3/8
GSD-350	C	350	3 13/16 × 4 5/16 × 3 7/8	7.3	2 1/2 × 3
GSD-500	C	500	3 13/16 × 4 7/16 × 4 5/8	10.6	3 × 3 1/4
GSD-750	C	750	3 13/16 × 5 3/16 × 4 5/8	14.4	3 × 4 1/8
GSD-1000	C	1000	3 13/16 × 6 × 4 5/8	17.0	3 × 5
GSD-1500	C	1500	4 5/8 × 6 × 5 1/2	20.0	3 1/2 × 4 1/4

Primaries 230 VAC, secondaries 115 VAC. 50/60 Hz. May be operated from a 400 Hz source with no change in output ratings. NEMA standard line cord and female receptacle.

P-8620*	A	50	3 11/16 × 1 7/8 × 2 5/16	1.5	3 1/8
P-8630	C	85	2 5/8 × 2 3/4 × 3 1/2	2.5	2 × 1 3/4
P-8631	C	125	2 5/8 × 3 × 3 1/2	3.0	2 × 2
P-8632	C	200	3 1/8 × 3 3/4 × 3 7/8	4.2	2 1/2 × 2
P-8634	C	400	3 1/8 × 4 3/4 × 3 7/8	7.0	2 1/2 × 3

*Has lead wires instead of cord and receptacle.





STEP-UP RATIO

Primaries 115 VAC, secondaries 230 VAC. 50/60 Hz. May be operated from a 400 Hz source with no change in output ratings. NEMA standard line cord and female receptacle.

P-8637	C	85	2 5/8 × 2 3/4 × 3 1/2	2.5	2 × 1 3/4
P-8638	C	125	2 5/8 × 3 × 3 1/2	3.0	2 × 2
P-8639	C	300	3 1/8 × 3 7/8 × 3 7/8	5.2	2 1/2 × 2 3/8
P-8640	C	500	3 3/4 × 4 3/4 × 4 9/16	10.3	3 × 3 5/16
P-8689	C	1000	4 1/2 × 5 1/2 × 5 3/8	17.4	3 × 4 15/16

STANCOR

Transformers

ISOLATION TRANSFORMERS

Transformers have NEMA standard line cord for primary and female receptacle for secondary, except where noted.

Stancor Number	Input Volts	Output Volts	Mtg. Style	VA	Size. Inches W. x D. x H.	MW MW x MD
STRAIGHT ISOLATION						
Case, core, and electrostatic shield connected to third conductor of line cord for safety.						
GIS-100	115	115	C	100	$2^{13}/_{16}$ x $3^{9}/_{16}$ x $3^{1}/_{2}$	$2^{1}/_{4}$ x $2^{7}/_{16}$
GIS-150	115	115	C	150	$3^{3}/_{16}$ x $4^{3}/_{16}$ x $3^{7}/_{8}$	$2^{1}/_{2}$ x $2^{15}/_{16}$
GIS-250	115	115	C	250	$3^{1}/_{4}$ x $4^{3}/_{8}$ x $4^{11}/_{16}$	3 x $3^{3}/_{16}$
GIS-500	115	115	C	500	$3^{3}/_{4}$ x 6 x $4^{11}/_{16}$	3 x $4^{13}/_{16}$
GIS-1000	115	115	C	1000	$4^{9}/_{16}$ x $8^{1}/_{8}$ x $5^{1}/_{2}$	$3^{1}/_{2}$ x $6^{1}/_{2}$
STEP-DOWN ISOLATION						
Case, core, and electrostatic shield connected to third conductor of line cord for safety.						
GISD-100	230	115	C	100	$2^{13}/_{16}$ x $3^{9}/_{16}$ x $3^{1}/_{2}$	$2^{1}/_{4}$ x $2^{7}/_{16}$
GISD-150	230	115	C	150	$3^{3}/_{16}$ x $4^{3}/_{16}$ x $3^{7}/_{8}$	$2^{1}/_{2}$ x $2^{15}/_{16}$
GISD-250	230	115	C	250	$3^{1}/_{4}$ x $4^{1}/_{4}$ x $4^{11}/_{16}$	3 x $3^{3}/_{16}$
GISD-500	230	115	C	500	$3^{3}/_{4}$ x 6 x $4^{11}/_{16}$	3 x $4^{13}/_{16}$
GISD-1000	230	115	C	1000	$4^{9}/_{16}$ x $8^{1}/_{8}$ x $5^{1}/_{2}$	$3^{1}/_{2}$ x $6^{1}/_{2}$
STRAIGHT ISOLATION						
Electrostatic shield grounded to core.						
P-6413*	115	115	A	0.6	$2^{1}/_{8}$ x $1^{1}/_{4}$ x $1^{1}/_{4}$	$1^{3}/_{4}$
P-6411*	115	115	A	15	$3^{1}/_{4}$ x $1^{7}/_{8}$ x 2	$2^{13}/_{16}$
P-6412*	115	115	A	35	$3^{3}/_{4}$ x 2 x $2^{3}/_{8}$	$3^{1}/_{8}$
P-6410	115	115	C	50	$2^{13}/_{16}$ x $3^{1}/_{8}$ x $3^{1}/_{2}$	$2^{1}/_{4}$ x $1^{7}/_{8}$
P-6160	105/115/125*	115	C	100	$3^{3}/_{4}$ x $3^{3}/_{4}$ x $4^{11}/_{16}$	3 x $2^{9}/_{16}$
P-6161	105/115/125*	115	C	250	$3^{3}/_{4}$ x $5^{1}/_{2}$ x $4^{11}/_{16}$	3 x $4^{5}/_{16}$

*Has lead wires. # Has selector Switch.

HIGH-CURRENT FILTER CHOKES

Inductance measured at 1 volt. 60 Hz. Insulation test voltage is twice allowable rms working voltage plus 1000 volts. Lead wire termination.

Stancor Number	Induc-tance mH	DC Amps	DC Resis. Ohms	Insul. Test V_{rms}	Mtg. Style	Size. Inches W. x D. x H.	MW MW x MD
TC-1	3.0	1.0	0.25	1000	A2	$1^{1}/_{2}$ x $1^{1}/_{8}$ x $1^{3}/_{16}$	$1^{1}/_{8}$ x $^{7}/_{16}$
TC-2	11.0	1.0	0.75	1000	A2	$1^{1}/_{2}$ x $1^{1}/_{8}$ x $1^{3}/_{16}$	$1^{1}/_{8}$ x $^{7}/_{16}$
C-2685	35.0	2.0	0.75	1500	NH	$2^{5}/_{8}$ x $2^{1}/_{8}$ x $2^{5}/_{16}$	$2^{3}/_{16}$ x 2
C-2686	25.0	4.0	0.43	1500	NH	$3^{3}/_{8}$ x $2^{5}/_{8}$ x $2^{7}/_{8}$	$2^{13}/_{16}$ x $2^{1}/_{8}$
C-2687	10.0	8.0	0.15	1500	NH	$3^{3}/_{4}$ x 3 x $3^{3}/_{16}$	$3^{1}/_{8}$ x $2^{1}/_{2}$
C-2688	10.0	12.5	0.11	1500	NH	$4^{1}/_{8}$ x $3^{1}/_{8}$ x $3^{1}/_{2}$	$3^{7}/_{16}$ x $2^{3}/_{8}$

CONTROL TRANSFORMERS

Designed for microprocessor power and logic circuits.

Stancor Number	Secondary V	Secondary A	Insul. Test V_{rms}	Prf. Volts	Termination Pri.	Termination Sec.	Mtg.	Size. Inches H. x W. x D.	MW MW x MD
P-8696	32.0 CT 15.0 CT	0.25 0.75	1500	230	Leads	Leads	A	$2^{1}/_{4}$ x $3^{3}/_{4}$ x $1^{7}/_{8}$	$3^{1}/_{8}$
P-8750	32.0 CT 15.5 CT	0.25 0.75	1500	115	Leads	Leads	A	$2^{1}/_{4}$ x $3^{3}/_{4}$ x $1^{7}/_{8}$	$3^{1}/_{8}$
P-8754	32.0 CT 15.0 CT	1.0 10.0	1500	115	Leads	Leads	NV	$4^{1}/_{8}$ x $3^{7}/_{16}$ x $3^{1}/_{2}$	$2^{3}/_{4}$ x $2^{3}/_{4}$

LINE TO VOICE COIL TRANSFORMERS

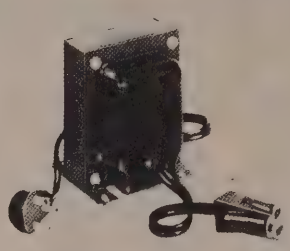
Transformers with 70-7 V constant voltage output. Lug terminations except 8084, leads. Test Volts, 1000.

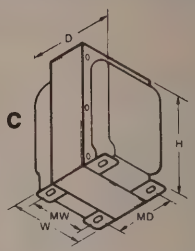
Stancor Number	Mtg. Style	Impedance Ohms Primary	Impedance Ohms Secondary	Audio Watts	MW MW x MD
A-8102	S	625//1250/2500/5000/10000	4/8/16	8/4/2 1/0.5	2
A-8103	S	312/625/1250/2500/5000/10000	4/8/16	16/8/4/2 1/0.5	$2^{13}/_{16}$
A-8105	A	1000/2000/4000/8000/16000	4/8	5/2.5 1.25/0.62/.31	2
A-8109	A	2500/5000/10000	4/8	2/1/0.5	$1^{3}/_{4}$
A-8084	A	1250/2500/5000/10000/20000/40000	8	4/2/1/0.5 0.25/0.12	$2^{3}/_{8}$
A-8078	S	167/250/500/1000	4/8/16	30/12/10/5	$2^{3}/_{8}$

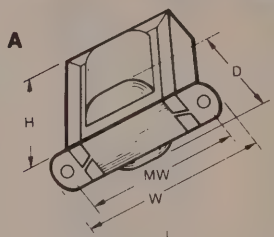
TELEPHONE COUPLING TRANSFORMERS

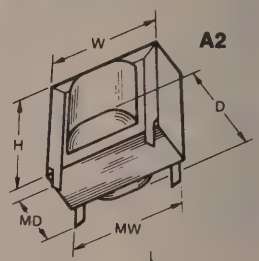
Case style.

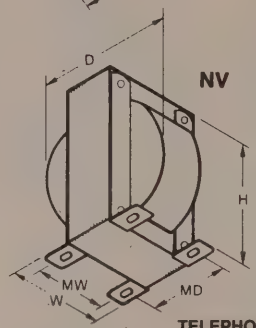
Stancor Number	Mtg.	Impedance Ohms Primary	Impedance Ohms Secondary	mA DC	Inser. ition Loss dB
TTPC-1	A	600 CT	600 CT	O	1.4
TTPC-2	B	600	600	O	1.2
TTPC-5	B	4000	600	O	1.5
TTPC-6	E	600	600 CT	90	1.8
TTPC-7	A	600	600	O	1.2
TTPC-8	A	600 CT	600 CT	O	1.2
TTPC-13	G	600	600 CT Split	90	1.8
PCT-24	K	900 CT	600	3	2.0
PCT-27	K	600	600 CT 150 Split	3	2.0
PCT-77	K	600 CT	600 CT	3	2.0
PCT-78	K	600 CT	600	3	2.0

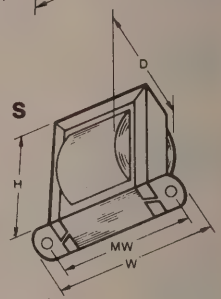




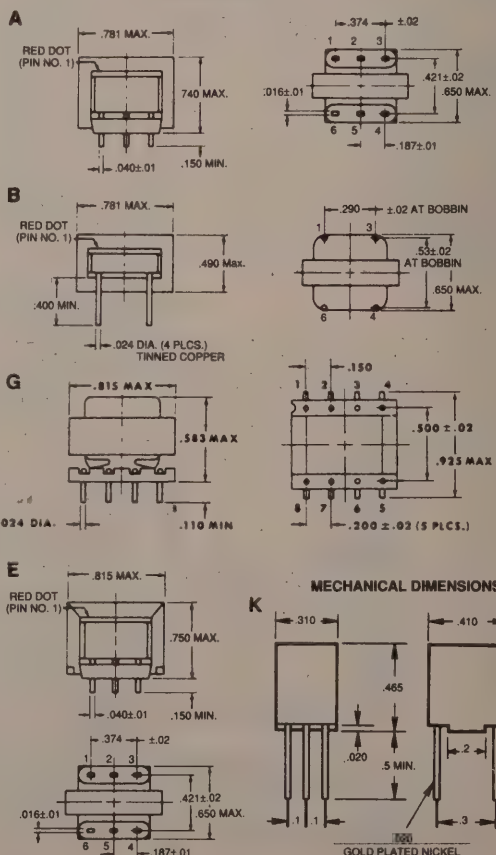




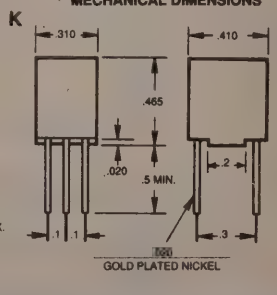




TELEPHONE COUPLING



MECHANICAL DIMENSIONS



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VARIAC® AUTOTRANSFORMERS & REGULATORS

Purchase a variable autotransformer from Technipower and you'll get an original Variac.

U2

W50H

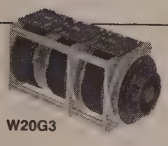
W5

W-Type Single Phase Panel Mount Autotransformers

The following units are single phase 120 and 240 volts AC with 0-117% linear output voltage. The 240 volts (H) models can achieve 0-233% with 120 volt input with appropriate derating. Many units are UL & CSA approved.

Variac Part Number	Output Voltage	Output Amps		Max. kVA	Size Inches			Shipping Weight (Lbs.)
		Rated	Maximum		W	H	D	
U2	0-140	2.0	3.0	0.28	3 1/4	3 11/16	2 15/16	3
W2	0-140	2.4	3.1	0.34	3 1/4	3 11/16	3 15/16	4
W5	0-140	6.0	7.0	0.84	4 1/2	4 15/16	3 15/16	8
W5H	0-280	2.0	2.6	0.56	4 1/2	4 15/16	3 15/16	8
W5L	0-120	8.5	11.0	1.32	4 1/2	4 15/16	4 11/16	8
W8	0-140	8.5	11.0	1.19	4 1/2	4 15/16	4 7/16	9
W8L	0-120	10.0	13.0	1.56	4 1/2	4 15/16	4 7/16	12
W10	0-140	10.0	13.0	1.40	5 3/4	6 5/16	3 15/16	13
W10H	0-280	4.0	5.2	1.12	5 3/4	6 5/16	4 11/16	12
W20	0-140	20.0	26.0	2.80	7 1/2	8 1/16	4 5/8	24
W20H	0-280	8.0	10.4	2.24	7 1/2	8 1/16	4 5/8	23
W30	0-140	30.0	36.0	4.2	10	11 13/16	4 1/8	38
W30H	0-280	12.0	15.6	3.36	10	11 13/16	4 1/8	36
W50	0-140	50.0	50.0	7.0	12 1/2	13 3/4	6 1/4	57
W50H	0-280	25.0	32.5	7.0	12 1/2	13 3/4	6 1/4	60

Manual Three Phase Ganged Variable Autotransformers


W20G3

208-240 Volt Input, 50-60 Hz

W2G3	0-240	2.4	3.1	0.99	3 1/4	3 11/16	12	13
W5G3	0-240	6.0	7.8	2.49	4 1/2	4 15/16	12 1/8	22
W8G3	0-240	8.5	11.0	3.53	4 1/2	4 15/16	13 15/16	27
W10G3	0-240	10.0	13.0	4.16	5 3/4	6 5/16	14	40
W20G3	0-240	20.0	26.0	8.31	7 1/2	8 1/16	13 3/4	71
W30G3	0-240	30.0	36.0	12.47	12 1/2	13 3/4	20 7/8	113
W50G3	0-240	50.0	50.0	20.78	12 1/2	13 3/4	20 7/8	206

480 Volt Input, 50-60 Hz

W5HG3	0-480	2.0	2.6	1.66	4 1/2	4 15/16	12 1/8	22
W10HG3	0-480	4.0	5.2	3.33	5 3/4	6 5/16	14	39
W20HG3	0-480	8.0	10.4	6.65	7 1/2	8 1/16	13 3/4	[illegible]
W30HG3	0-480	12.0	15.6	9.96	12 1/2	13 3/4	20 7/8	107
W50HG3	0-480	25.0	32.5	20.78	13 13/16	17 1/16	2 11/16	230

W8MT3VM

W8MT3

Single-Phase Portable Variable Autotransformers

Portable cased variable autotransformers with three-wire cord and receptacle and convenient carrying handle. A double-pole on-off switch disconnects both sides of the line. The output circuit is protected by either a thermal overload breaker, resettable from the panel or by easily accessible and replaceable fuses. Voltmeter, ammeter, and/or wattmeter models are also available.

W5MT3	0-140	5.0	—	0.70	4 7/8	6 9/16	4 3/8	15
W10MT3	0-140	10.0	—	1.40	6 3/4	9 1/2	5 1/4	24
W20MT3	0-140	18.0	—	2.52	8 5/8	11 15/16	5 3/8	28
W5HMT3	0-280	2.0	—	0.56	4 7/8	6 9/16	4 3/8	15
W10HMT3	0-280	4.0	—	1.12	6 3/4	9 1/2	5 1/4	24
W20HMT3	0-280	8.0	—	2.24	8 5/8	11 15/16	5 3/8	35

1581-1582 Series Automatic Voltage Regulators

Types 1581 And 1582 Automatic Voltage Regulators

These regulators combine high accuracy with large capacity for laboratory & industrial applications including computers, measurement systems, transmitter supplies and critical industrial processes. Other types of units are available in rack or bench cabinet & wall cabinet. The units listed are single phase regulators, but they can be used to regulate three phase lines by combining two units for open-delta or three units for wye or closed delta applications.

Sizes (W x H x D): Type 1581, 19 x 7 x 10.5 in; Type 1582, 19 x 7 x 14.25 in.

Power Factor: 0 to 1, leading or lagging. Response rms, no distortion. Controls are front panel screwdriver adjustment.

Variac Part Number	Input			Output				Shipping Weight (Lbs.)
	Voltage	Variation	Hz	Adjustable Voltage	Current Rating	kVA	Regulation	
1581-9631	115	±10%	57-63	103 to 127	50A	5.8	±0.25%	92
1581-9898	115	+24 to -18%	57-63	103 to 127	40A	2.9	±0.25%	92
1581-9516	230	±5%	57-63	206 to 254	40A	9.2	±0.25%	92
1581-9817	230	±10%	57-63	206 to 254	20A	4.6	±0.25%	92
1581-9770	230	+24 to -18%	57-63	206 to 254	10A	2.3	±0.5%	92
1582-9831	115	±10%	57-63	103 to 127	85A	9.8	±0.25%	110
1582-9898	115	+24 to -18%	57-63	103 to 127	42.5A	4.9	±0.25%	110
1582-9516	230	±5%	57-63	206 to 254	85A	19.7	±0.25%	110
1582-9817	230	±10%	57-63	206 to 254	42.5A	9.8	±0.25%	110
1582-9770	230	+24 to -18%	57-63	206 to 254	21.3A	4.9	±0.5%	110

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TOROIDAL COMPONENTS TECHNICAL INFORMATION

THE COMPANY

TALEMA ELECTRONIC, INC. began operations in mid-1983. As a member of the TALEMA INTERNATIONAL GROUP OF COMPANIES, the significant growth of the U.S. operation was made possible by sharing design and manufacturing technologies with its German and Irish affiliates.

The factory is located in central Missouri, an area which typically has lower labor rates than coastal areas and offers the advantage of being the geographic center of the continental United States, thereby cutting shipping expenses.

ADVANTAGES OF TOROIDS

LOW WEIGHT
Save as much as 50% over traditional frame style transformers.

SMALL SIZE
To assist in the design of low profile, slim-line equipment.

EASE OF MOUNTING
One bolt through the center is all that's needed.

LOW MAGNETIC STRAYFIELD EMISSIONS
Excellent choice to reduce screen distortion in CRT's and high resolution monitors without costly shielding or reduce audible "hum" in high-end audio equipment.

IMPROVED EFFICIENCY
Reduces power consumption.

TALEMA PRODUCTS

UL RECOGNIZED STANDARD TRANSFORMERS with both single and dual secondary windings are available in power ranges from 15VA to 1000VA at a variety of output voltages. (See page A•2569)

CUSTOM DESIGNED TRANSFORMERS are available in sizes from 0.5VA to 8KVA for applications where standard transformers do not optimize electrical or mechanical performance. In-house manufacturing of silicon steel tapewound cores allows our engineers to economically vary core height and diameter to meet virtually any application.

SOPHISTICATED COMPUTER DESIGN software enables our engineers to quickly and accurately design custom transformers for rectified loads, eliminating approximations and producing prototypes that work the first time.

COMPLIANCE TO SAFETY STANDARDS is an advantage TALEMA offers equipment engineers. Our facility is certified to manufacture RECOGNIZED transformers, typically allowing even custom transformers to bear the UR symbol of recognition without expensive, time consuming applications.

UL RECOGNIZED INSULATION MATERIALS insure these standards are met. The insulation system of our standard line is rated for Class A, 105°C. For higher temperature applications, a **UL RECOGNIZED CLASS B**, 130 C insulation system is available.

OTHER PRODUCTS
3-PHASE TRANSFORMERS
AUTO TRANSFORMERS
CURRENT TRANSFORMERS
INDUCTORS & CHOKES
AUDIO TRANSFORMERS

SPECIAL OPTIONS
STATIC COPPER SHIELDING
MAGNETIC SHIELDING
POTTING IN SPECIAL HOUSINGS

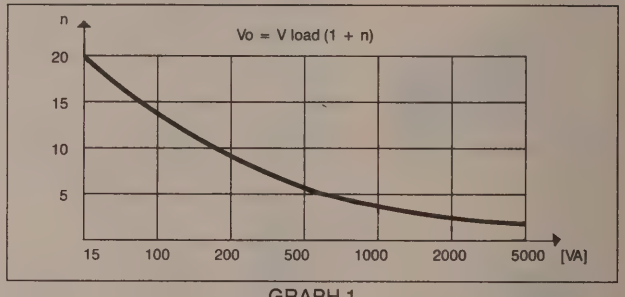
QUALITY

Other companies make grand claims such as "highest quality available", or they tout the "superiority" of their product. TALEMA doesn't have to—the fact that we maintain a ship-to-stock vendor rating with over 200 national and multinational companies is, to us, the best testimonial of our commitment to quality.

APPLICATION NOTES

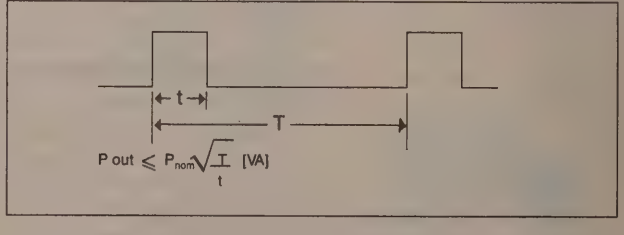
TEMPERATURE RISE
TALEMA transformers are ordinarily designed for a temperature rise of 55°C to 65°C at full load. Ventilation, mounting configuration, and load duty cycle are important considerations.

VOLTAGE DROP
Graph 1 shows the percentage of voltage drop for standard cores at 50/60 Hz. (Voltage drop is slightly higher in transformers designed for 60 Hz only operation.)

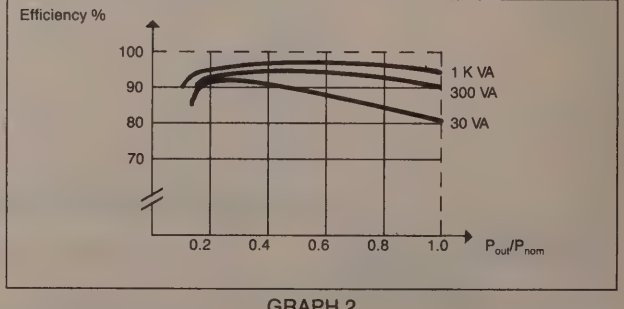


GRAPH 1

DUTY CYCLE
A smaller transformer can be used if the load is intermittent. Because the output power in this case significantly exceeds the nominal power, the secondary full-load voltage (using standard line as an example) drops below the voltages shown on the next page. The full-load voltage drop increases proportionately with the current being drawn.



EFFICIENCY
Graph 2 shows typical efficiency which can be expected as a function of the power relationship P_{out} / P_{nom} and transformer size.



GRAPH 2

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TOROIDAL COMPONENTS TECHNICAL INFORMATION

CUSTOM DESIGNED TOROIDAL TRANSFORMERS

Working in close partnership with equipment designers, TALEMA uses its technological expertise to create transformers which are as much a part of original equipment design as any other element of the final product. By operating in this way, TALEMA provides the optimum response to highly specific requirements across a wide application profile including professional audio equipment, specialty lighting, computers, video monitors, compact power supplies, and medical equipment.

We begin the design process by working closely with the equipment designer to create the transformer specifications. Often, our engineering staff will evaluate other key components of newly designed equipment to accurately specify power requirements, size, noise, and strayfield levels in order to provide the highest level of performance within a specific cost per unit framework. Then, by utilizing sophisticated design software, our engineers can quickly and accurately design the optimum toroidal transformer for your application.

There are some key properties of toroidal technology which are critical to success in sensitive applications. TALEMA boasts unequalled experience in the control of these areas.

THE CORE AND NOISE.

The quality of the toroidal core is a vital consideration for sensitive applications. TALEMA has invested heavily to provide extensive core manufacturing, annealing, and testing facilities. Using high grade grain oriented silicon steel, with typical losses of 0.70 watts/lb at 1.7 Tesla, the core is manufactured in-house under close supervision of Quality Control in order to maintain the performance characteristics of the high grade steel.

Because TALEMA cores are manufactured from a continuous strip of high grade steel with both ends welded, there are no loose sheets or laminations to vibrate—minimizing the possibility of mechanical hum.

SIZE CONSTRAINTS

TALEMA engineers are able to utilize a wide range of diameter to height ratios, giving the equipment designer the opportunity to achieve the ultimate level of electrical performance within a specific size.

PERIMETER SHIELD

RADIATED MAGNETIC STRAYFIELD

Achieving low levels of stray field radiation is an important consideration for the equipment designer, as this phenomenon can create unwanted noise through interference with sensitive electronics.

A toroidal transformer generally offers a reduction of 8:1 in magnetic interference levels compared with traditional frame style laminate types. The engineer still has to be aware of the need to locate the transformer away from the sensitive parts of a circuit. Sometimes the only solution is to separate the device entirely by mounting in a remote enclosure, but this can be costly and undesirable.

TALEMA's engineering staff has vast experience in solving this type of problem, and has developed a range of successful techniques over several years. These include:

- Using a combination of lower flux density and special winding techniques to provide further field reduction.
- Grouping of leads to minimize openings in the windings while maintaining safe isolation.
- Applying a low cost silicon steel perimeter shield which is built into the transformer to further reduce stray field by an order of eight to ten times.

MEDICAL APPLICATIONS

TALEMA has vast experience designing toroidal transformers to meet the requirements of UL 544 and IEC 601. The most important aspects of designing a transformer of UL 544 requirements are construction, leakage current, and abnormal operation as defined in UL 544 sections 19, 27, and 41, respectively.

Unless the customer dictates otherwise, we use construction called out in paragraphs 19.4 C or E. These are for patient-care equipment.

Paragraph C is satisfied by using a grounded copper shield between primaries and secondaries in combination with a thermal protection device. Often, our customers prefer this type of construction because the copper shield is considered a fail-safe protection against electrical shock. However, this approach adds cost and may be unnecessary.

COPPER SHIELD

A more economical approach is construction per paragraph E, which is satisfied by using a thermal protection device in combination with "three layers of insulating material", of which any combination of two layers are capable of withstanding a 3500 volt 60 Hz dielectric withstand test potential for 1 minute.

LEAKAGE CURRENT

Leakage current is that current which can be conducted through the patient's body if the protective ground to the wall power cord is broken. Toroidal transformers can contribute leakage current through two paths: from primary to secondary, and from primary to mounting surface. Drawing on years of experience, our engineers can design toroidal transformers and mounting techniques that will minimize the transformers contribution to system leakage. However, the equipment designer must also account for other components within the system that will contribute leakage current such as power cords, switches, line filters, and fuse holders.

TALEMA can measure leakage current with a tester constructed to the circuit in UL 544 figure 27.1 and section 27.5, at the customer's request.

ABNORMAL OPERATION

Section 34 of UL 544 describes tests which the transformer will be subjected to in order to confirm that abnormal operation (which the system may encounter in actual service) will not present a shock or fire hazard to the patient or operator. Equipment designers should investigate the possible abnormal tests UL may perform on their particular system, then contact TALEMA engineers for assistance in creating the transformer specifications. Working together with our engineers as a team, designers can be assured of accurate, functional transformers without multiple iterations thereby cutting development costs.

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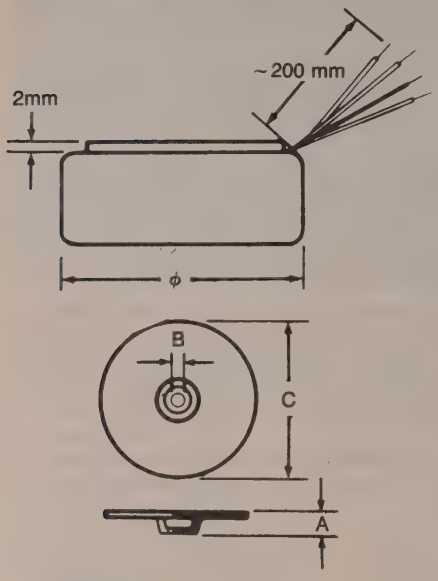
TOROIDAL COMPONENTS TECHNICAL INFORMATION



UL RECOGNIZED 117 VOLT, 60Hz STANDARDS

Part Number	SECONDARY DATA Full Load Voltage	No Load Voltage	Current	Dimensions and weight with Centering Washers ϕ mm	Height/mm	Weight/kg
15 VA UR0015-1-010	10	11.9	1.50	60	31	0.3
UR0015-1-015	15	17.8	1.00			
UR0015-1-030	30	35.7	0.50			
UR0015-2-006	2x6	2x7.2	1.25			
UR0015-2-010	2x10	2x11.9	0.75			
UR0015-2-012	2x12	2x14.3	0.62			
UR0015-2-015	2x15	2x17.8	0.50			
UR0015-2-018	2x18	2x21.4	0.41			
30 VA UR0030-1-010	10	11.9	3.00	72	32	0.48
UR0030-1-024	24	28.6	1.25			
UR0030-1-030	30	35.7	1.00			
UR0030-2-006	2x6	2x7.2	2.50			
UR0030-2-010	2x10	2x11.9	1.50			
UR0030-2-012	2x12	2x14.7	1.25			
UR0030-2-015	2x15	2x17.8	1.00			
UR0030-2-018	2x18	2x21.4	0.83			
50 VA UR0050-1-024	24	27.8	2.10	82	35	0.67
UR0050-1-035	35	40.6	1.40			
UR0050-1-117	117	135.8	0.43			
UR0050-2-006	2x6	2x6.9	4.10			
UR0050-2-010	2x10	2x11.6	2.50			
UR0050-2-012A	2x12	2x14.4	2.08			
UR0050-2-015	2x15	2x17.4	1.60			
UR0050-2-020	2x20	2x23.2	1.25			
80 VA UR0080-1-015	15	17.4	5.30	95	36	0.92
UR0080-1-024	24	27.8	3.30			
UR0080-1-035	35	40.6	2.30			
UR0080-1-042	42	48.7	1.90			
UR0080-1-117	117	135.8	0.68			
UR0080-2-006	2x6	2x6.9	6.60			
UR0080-2-012	2x12	2x14.4	3.33			
UR0080-2-018	2x18	2x20.9	2.20			
UR0080-2-022	2x22	2x25.5	1.80			
UR0080-2-030	2x30	2x34.8	1.30			
120 VA UR0120-1-024	25	27.2	5.00	95	45	1.2
UR0120-1-042	42	47.5	2.80			
UR0120-1-117	117	132.3	1.00			
UR0120-2-012	2x12	2x13.9	5.00			
UR0120-2-018	2x18	2x20.4	3.30			
UR0120-2-022	2x22	2x24.9	2.70			
UR0120-2-030	2x30	2x34.5	2.00			
160 VA UR0160-1-024	24	27.3	6.70	115	40	1.5
UR0160-1-042	42	47.8	3.80			
UR0160-1-054	54	61.6	2.90			
UR0160-1-117	117	133.3	1.37			
UR0160-2-012	2x12	2x14.1	6.67			
UR0160-2-018	2x18	2x20.5	4.40			
UR0160-2-022	2x22	2x25.1	3.60			
UR0160-2-030	2x30	2x34.2	2.60			
225 VA UR0225-1-024	24	27.0	9.40	115	48	1.9
UR0225-1-060	60	67.2	3.70			
UR0225-1-117	117	131.0	1.90			
UR0225-2-012	2x12	2x13.8	9.38			
UR0225-2-030	2x30	2x33.7	3.70			
300 VA UR0300-1-024	24	26.2	12.50	115	58	2.5
UR0300-1-060	60	65.8	5.00			
UR0300-1-117	117	128.0	2.60			
UR0300-2-012	2x12	2x13.4	12.50			
UR0300-2-030	2x30	2x32.9	5.00			
500 VA UR0500-1-117	117	126.5	4.30	140	60	3.6
UR0500-2-024	2x24	2x25.9	10.40			
UR0500-2-030	2x30	2x32.4	8.30			
UR0500-2-060	2x60	2x65.2	4.20			
625 VA UR0625-1-117	117	127.0	5.30	160	48	4.4
UR0625-2-024	2x24	2x26.0	13.00			
UR0625-2-030	2x30	2x32.7	10.40			
UR0625-2-060	2x60	2x65.0	5.20			
800 VA UR0800-1-117	117	125.2	6.80	160	60	5.6
UR0800-2-024	2x24	2x25.5	16.70			
UR0800-2-028	2x28	2x29.4	14.29			
UR0800-2-030	2x30	2x32.2	13.30			
UR0800-2-060	2x60	2x64.0	6.70			
1000 VA UR1000-1-117	117	123.4	8.50	160	72	6.7
UR1000-2-024	2x24	2x25.6	20.80			
UR1000-2-030	2x30	2x31.4	16.70			
UR1000-2-060	2x60	2x63.4	8.30			

CENTERING WASHER mm

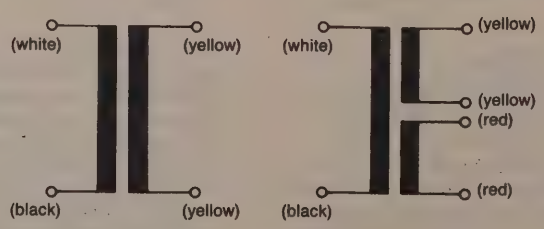
Power	A	B	C	Mtg. Torque IN-LB
15	4	5	50	3.5
30-50	4	6.7	60	7
80-120	6	6.7	70	10
160-300	6	6.7	90	15
500-625	6	6.7	112	15
500-1000	10	13	145	18

PRIMARY DATA

Secondary Power	Primary Current with Load	Primary No Load Current	Primary Resistance T = 20° C	No Load Core Loss
VA	A	mA	Ohm	W
15	0.15	1.8	43	0.21
30	0.31	2.3	23	0.27
50	0.49	3.8	11	0.44
80	0.79	4.4	7.4	0.52
120	1.2	6.6	4.5	0.78
160	1.6	7.2	3.1	0.85
225	2.1	10.9	1.9	1.3
300	2.8	14.4	1.4	1.7
500	4.6	21.5	0.5	2.5
625	5.8	24.8	0.4	2.9
800	7.3	33.3	0.3	3.9
1000	9.0	41.3	0.2	4.8

CONNECTION WIRES

Standard length: 200 mm
(secondaries can be connected in series or parallel).



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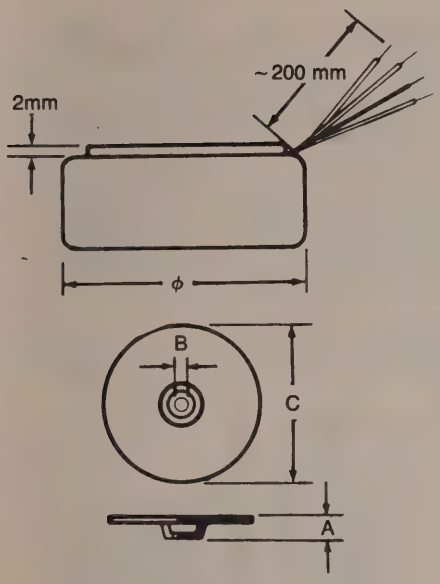
TOROIDAL COMPONENTS TECHNICAL INFORMATION

UL RECOGNIZED 117/234 VOLT, 50/60 Hz STANDARDS



PART NUMBER	SECONDARY DATA			Dimensions and weight with Centering Washers		
	FULL LOAD VOLTAGE	NO LOAD VOLTAGE	CURRENT EACH SEC	Ømm	HTmm	WTkg
30 VA						
UR2030-2-015	2×15	2×18.6	1.00	72	32	0.48
UR2030-2-018	2×18	2×21.6	0.84			
UR2030-2-117	2×117	2×145.6	0.13			
50VA						
UR2050-2-015	2×15	2×17.5	1.70	82	35	0.67
UR2050-2-018	2×18	2×20.6	1.40			
UR2050-2-117	2×117	2×133.8	0.21			
80VA						
UR2080-2-015	2×15	2×17.3	2.70	95	36	0.92
UR2080-2-018	2×18	2×20.9	2.30			
UR2080-2-117	2×117	2×134.8	0.34			
120VA						
UR2120-2-012	2×12	2×13.5	5.00	95	45	1.20
UR2120-2-015	2×15	2×16.9	4.00			
UR2120-2-018	2×18	2×20.3	3.30			
UR2120-2-117	2×117	2×132.1	0.51			
160VA						
UR2160-2-012	2×12	2×13.6	6.70	115	40	1.50
UR2160-2-015	2×15	2×17.0	5.40			
UR2160-2-018	2×18	2×20.1	4.50			
UR2160-2-117	2×117	2×131.5	0.70			
225VA						
UR2225-2-012	2×12	2×13.1	9.40	115	48	1.90
UR2225-2-015	2×15	2×16.8	7.50			
UR2225-2-018	2×18	2×20.0	6.30			
UR2225-2-117	2×117	2×127.7	1.00			
300VA						
UR2300-2-012	2×12	2×13.2	12.50	115	58	2.50
UR2300-2-015	2×15	2×16.4	10.00			
UR2300-2-018	2×18	2×19.5	8.30			
UR2300-2-117	2×117	2×127.5	1.30			

CENTERING WASHER mm

Power	A	B	C	Mtg. Torque IN-LB
15	4	5	50	3.5
30-50	4	6.7	60	7
80-120	6	6.7	70	10
160-300	6	6.7	90	15
500-625	6	6.7	112	15
500-1000	10	13	145	18

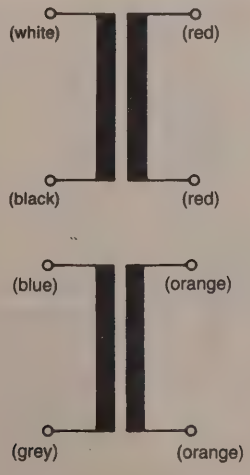
ORDERING INFORMATION

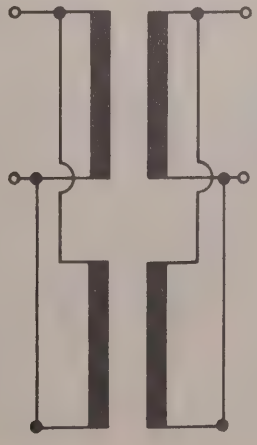
Orders for standard transformers must include the following information:

1. Transformer part number
2. Quantity per item
3. Delivery address
4. Billing address (if different from above)
5. Date of delivery
6. Method of shipment

CONNECTION WIRES

Standard length: 200 mm (primaries or secondaries can be connected in series or parallel).





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STANDARD TOROIDAL TRANSFORMER, PC MOUNT, LOW PROFILE, PRIMARY 2×110V or 220V 50/60 Hz

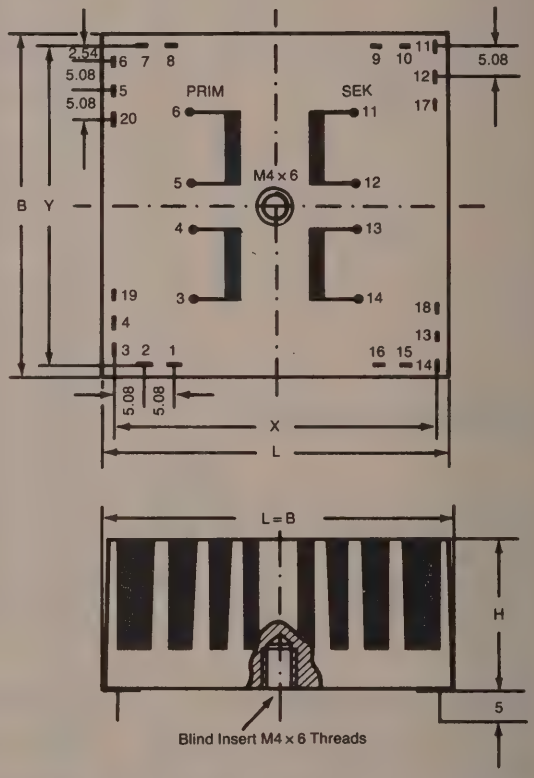
ADVANTAGES: Lower strayfield, higher efficiency, reduced "standby" current, reduced weight.

Standard Outputs

Power VA	Dimensions L×D×H mm	Pin Pattern XY mm	Pin Pattern mm	Weight Total gr	Weight Cu gr	Reg. ΔV/Sec %	Δt °C	Eff. %	No. Load IOtyp mA	220V Fuse mA	Max. Secondary Range VA	Max. Secondary Range ΔV/Sec %	Max. Secondary Range Δt °C	Max. Secondary Range Eff. %	Max. Secondary Range Rec. fuse mA
1.6	39.6×39.6×18.5	35.58	1.0×0.5	82	20	33	13	73	1.0	32	2.0	60	30	60	32
3.2	44.7×44.7×19.5	40.64	1.0×0.5	110	26	44	24	69	1.5	32	3.7	80	40	50	50
5.0	49.7×49.7×19.5	45.72	1.0×0.5	144	33	47	29	67	2.0	50	5.5	80	40	50	63
7.0	49.7×49.7×23.1	45.72	1.0×0.5	174	36	35	29	72	3.0	63	7.5	70	40	60	80
10.0	55.0×55.0×26.0	50.80	1.0×0.5	252	45	22	27	79	3.0	80	12.0	60	45	60	100
15.0	60.0×60.0×26.3	55.88	1.0×0.5	304	57	24	30	77	4.0	100	16.0	60	40	65	125
25.0	60.0×60.0×37.0	55.88	1.0×0.5	430	85	19	28	82	5.0	160	—	—	—	—	—

Order Number	Talema P/N	Sec-Full Load V	Current mA	Open Circuit V	Regulation %	Efficiency %
	1.6 VA					
70000	1.6-2-007	2× 7	114	2× 9.3	33	73
70001	1.6-2-009	2× 9	89	2×12.0	33	73
70002	1.6-2-012	2×12	67	2×16.0	33	73
70003	1.6-2-015	2×15	53	2×20.0	33	73
70004	1.6-2-018	2×18	44	2×23.9	33	73
70005	1.6-2-022	2×22	36	2×29.3	33	73
	3.2 VA					
70010	3.2-2-007	2× 7	229	2×10.1	44	69
70011	3.2-2-009	2× 9	178	2×13.0	44	69
70012	3.2-2-012	2×12	133	2×17.3	44	69
70013	3.2-2-015	2×15	107	2×21.6	44	69
70014	3.2-2-018	2×18	89	2×25.9	44	69
70015	3.2-2-022	2×22	73	2×31.7	44	69
	5 VA					
70020	005-2-007	2× 7	357	2×10.3	47	67
70021	005-2-009	2× 9	278	2×13.2	47	67
70022	005-2-012	2×12	208	2×17.6	47	67
70023	005-2-015	2×15	167	2×22.1	47	67
70024	005-2-018	2×18	139	2×26.5	47	67
70025	005-2-022	2×22	114	2×32.3	47	67
	7 VA					
70030	007-2-007	2× 7	500	2× 9.5	35	72
70031	007-2-009	2× 9	389	2×12.5	35	72
70032	007-2-012	2×12	292	2×16.2	35	72
70033	007-2-015	2×15	233	2×20.3	35	72
70034	007-2-018	2×18	194	2×24.3	35	72
70035	007-2-022	2×22	159	2×29.7	35	72
	10 VA					
70040	010-2-007	2× 7	714	2× 8.5	22	79
70041	010-2-009	2× 9	556	2×11.0	22	79
70042	010-2-012	2×12	417	2×14.6	22	79
70043	010-2-015	2×15	333	2×18.3	22	79
70044	010-2-018	2×18	278	2×22.0	22	79
70045	010-2-022	2×22	227	2×26.8	22	79
	15 VA					
70050	015-2-007	2× 7	1071	2× 8.7	24	77
70051	015-2-009	2× 9	833	2×11.2	24	77
70052	015-2-012	2×12	625	2×14.9	24	77
70053	015-2-015	2×15	500	2×18.6	24	77
70054	015-2-018	2×18	417	2×22.3	24	77
70055	015-2-022	2×22	341	2×27.3	24	77
	25 VA					
70060	025-2-007	2× 7	1785	2× 8.3	19	82
70061	025-2-009	2× 9	1377	2×10.7	19	82
70062	025-2-012	2×12	1041	2×14.3	19	82
70063	025-2-015	2×15	832	2×17.8	19	82
70064	025-2-018	2×18	694	2×21.4	19	82
70065	025-2-022	2×22	568	2×26.2	19	82

Primary-secondary test voltage 4.0 KV (VDE 0550).
Primaries and secondaries for parallel or series hookup.
Ambient operating temperature +60°C maximum.
Insulation Class A (105°C)



Pin No. 19 and 20 only in Version 15 and 25VA
Pin No. 17 and 18 only in Version 3, 2 thru 25VA

Schematic for alternate types per customer specifications

Special Voltages 1.6 VA thru 25 VA

Primary	Pin #	Secondary	Pin #
1. 100-120V	3-4	1. 7-120V	14-13
2. 100-120V	5-6	2. 7-120V	12-11
3. 5- 30V	7-2	3. 7- 42V	10-15
4. 5- 30V	8-1	4. 7- 42V	9-15
5. 220V	3-6		
and other special voltages			

Specifications subject to change.

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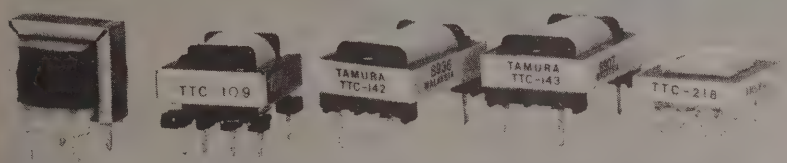
DELIVERS AC PRODUCTS FROM STOCK

See Page A•2574
A•2575



TELECOMMUNICATIONS TRANSFORMERS MEET FCC PART 68

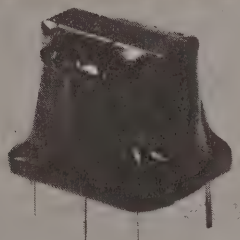
See Page A•2572

MINIATURE AUDIO & FCC PART 68 COUPLING

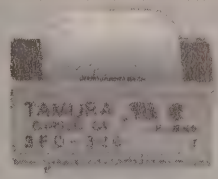
A•1299
A•1610

COMMON MODE COILS

See Page A•2578



SCR/TRIAC TRIGGER TRANSFORMERS

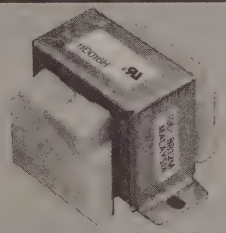


See Page A•2576

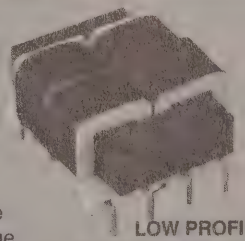
OEM PC BOARD POWER TRANSFORMERS

See Page A•1297

NOISE, COMMON MODE & POWER COILS

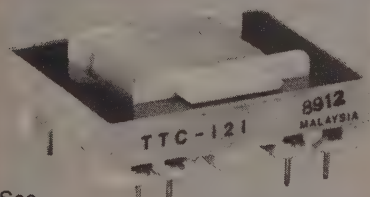


INTERNATIONAL PCB POWER
UL 1411, IEC, VDE & CSA
Contact Tamura



See Page A•2577

LOW PROFILE PCB POWER TRANSFORMERS



See Page A•2574

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See Page A•2573

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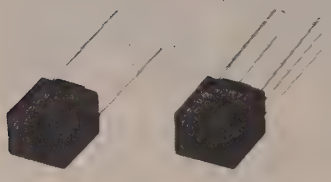
TAMURA MINIATURE ENCAPSULATED TRANSFORMERS AND INDUCTORS

Input, Interface, Isolation & Output Impedance Matching Circuits



FEATURES

- FCC Part 68 (hi-pot 1.5kV or 1kV).
- Miniature: 0.31"x0.41"x0.465".
- Tested to MIL-T-27 Specifications.
- Dielectric Strength: 1kVrms.
- Insulation Resistance: 10kMΩ.
- Oper. Temp: ≤105˚C.
- Thermal Shock: 5 cyc, -55≈105˚C.
- Freq. Response: ±2dB, .3≈100kHz.
- Max. Distort: 10-25% @ rated pwr.
- Impedance: 3.2 to 200kΩ.
- Solder/Gold Plated Nickel Leads.
- Molded Case Constr/Base Mtg Pad.

MINIATURE ENCAPSULATED TRANSFORMERS:

MODEL No.	MATCHING Z PRI:SEC [4]	PRI [2] maDC	DCR (Ω) PRI	DCR (Ω) SEC	PWR [3] (mW)	TURN RATIO PRI	TURN RATIO SEC	FIG No.	PRICE (qty) 1-9	10-24	25-99	100up
MET-01	200kCT:1000CT	0.00	5300	120	10	14.10	1	1	$15.40	$13.90	$12.30	$10.80
MET-02	100kCT:1000CT	0.00	4300	120	10	10.00	1	1	15.40	13.90	12.30	10.80
MET-03	50kCT: 1000CT	0.00	3800	90	25	7.07	1	1	15.40	13.90	12.30	10.80
MET-04	50k:1kCT*	0.00	3800	90	25	14.10	1/1	2	15.40	13.90	12.30	10.80
MET-05	25kCT:1000CT	0.50	1600	95	30	5.00	1	1	15.10	13.60	12.10	10.60
MET-06	25K:1kCT*	0.25	1600	95	30	10.00	1/1	2	15.10	13.60	12.10	10.60
MET-07	25kCT:600CT	0.50	1600	95	30	6.45	1	1	15.10	13.60	12.10	10.60
MET-09	10kCT:10kCT	1.00	1000	1300	40	1.00	1	1	15.10	13.60	12.10	10.60
MET-10	10kCT:4000CT	1.00	1000	500	40	1.58	1	1	15.10	13.60	12.10	10.60
MET-11	10kCT:2000CT	1.00	1000	300	40	2.23	1	1	15.10	13.60	12.10	10.60
MET-12	10K:2kCT*	0.50	1000	300	40	4.47	1/1	2	15.10	13.60	12.10	10.60
MET-13	10kCT:1500CT	1.00	1000	260	40	2.58	1	1	15.10	13.60	12.10	10.60
MET-15	10k:1.2kCT*	0.50	1000	220	40	5.77	1/1	2	15.10	13.60	12.10	10.60
MET-17	10kCT:500CT	1.00	1000	80	40	4.47	1	1	15.10	13.60	12.10	10.60
MET-18	10kCT:4.0	1.00	1200	1	40	50.00	1	3	12.30	11.10	9.80	8.60
MET-19	10k:3.2	0.50	1200	0.8	40	55.90	1	4	12.30	11.10	9.80	8.60
MET-20	8000CT:3.2	1.00	1000	0.8	40	50.00	1	3	12.30	11.10	9.80	8.60
MET-21	5000CT:2000CT	1.00	490	300	40	1.58	1	1	14.30	12.90	11.40	10.00
MET-22	2500CT:2500CT	1.00	280	350	40	1.00	1	1	14.30	12.90	11.40	10.00
MET-23	1600CT:3.2	2.50	186	0.8	50	22.30	1	3	12.30	11.10	9.80	8.60
MET-24	1500CT:600	3.00	160	95	50	1.58	1	3	12.30	11.10	9.80	8.60
MET-25	1200CT:3.2	3.00	125	0.7	50	19.40	1	3	12.30	11.10	9.80	8.60
MET-26	1000CT:1000CT	3.00	80	100	50	1.00	1	1	13.40	12.10	10.70	9.40
MET-27	1000CT:600CT	3.00	85	95	50	1.29	1	1	13.40	12.10	10.70	9.40
MET-28	1000:50	3.00	110	8	50	4.47	1	4	12.30	11.10	9.80	8.60
MET-29 [1]	900CT:600	3.00	80	95	50	1.22	1	3	13.40	12.10	10.70	9.40
MET-31 [1]	600CT:600CT	3.00	70	95	50	1.00	1	1	13.00	11.70	10.40	9.10
MET-32 [1]	600:600CT*	3.00	70	95	50	2.00	1/1	2	13.00	11.70	10.40	9.10
MET-33	600CT:250CT	3.00	70	35	50	1.55	1	1	13.00	11.70	10.40	9.10
MET-35	600CT:8	4.50	60	1.5	50	8.66	1	3	11.90	10.70	9.50	8.30
MET-36	600CT:3.2	4.50	60	0.7	50	13.70	1	3	11.90	10.70	9.50	8.30
MET-37	500CT:600	3.00	65	95	50	0.91	1	3	11.90	10.70	9.50	8.30
MET-39	500:50	3.00	55	8	50	3.16	1	4	11.90	10.70	9.50	8.30
MET-40	320CT:3.2	6.00	35	0.7	50	10.00	1	3	11.90	10.70	9.50	8.30
MET-41	300CT:600	7.00	41	98	50	0.71	1	3	11.90	10.70	9.50	8.30
MET-42	150:12	10.00	20	2.5	50	3.54	1	4	11.90	10.70	9.50	8.30
MET-43	120CT:3.2	10.00	13	0.7	50	6.12	1	3	11.90	10.70	9.50	8.30
MET-44	300CT:12	7.00	42	3.4	50	5.00	1	3	11.90	10.70	9.50	8.30
MET-45	10k:10kCT*	1.00	1100	1300	50	2.00	1/1	2	15.10	13.60	12.10	10.60
MET-46 [1]	600:600	3.00	72	93	50	1.00	1	4	12.30	11.10	9.80	8.60
MET-49 [1]	600:600/600	3.00	72	210	50	1.41	1/1	2	13.00	11.70	10.40	9.10
MET-50	10k:125	0.00	1100	28	10	8.62	1	4	22.30	20.10	17.80	15.60
MET-59 [1]	600:600CT*	3.00	70	95	50	2.00	1/1	2A	13.00	11.70	10.40	9.10
MET60	135:135CT	10.00	10	10	50	1.00	1	1	12.30	11.10	9.80	8.60
METC-99	MU METAL SHIELD	-	-	-	-	-	-	1	2.30	2.10	1.80	1.60

Note 1: Meets FCC part 68 (Hi-pot 1.5kV or 1.0kV).
Note 2: PRI maDC - Primary maximum rated unbalanced current in milli-amps, DC.
Note 3: PWR (mW) - Maximum power level in milli-watts @ 300Hz.
Note 4: CT* - Winding can be connected as a centertapped winding or as two isolated windings.

MET & MEI SCHEMATIC & CONNECTION DIAGRAMS

FIG. 1

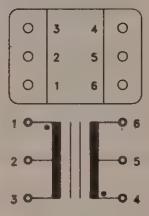


FIG. 2

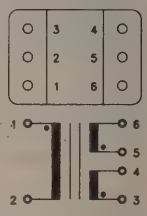


FIG. 2A

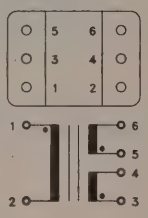


FIG. 3

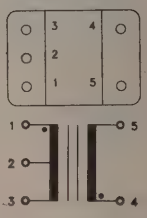


FIG. 4

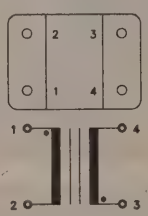
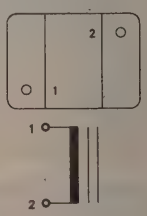


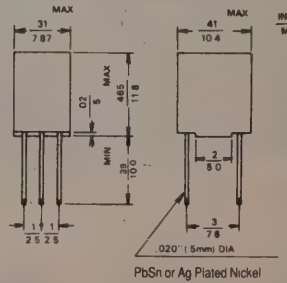
FIG. 5



MINIATURE ENCAPSULATED INDUCTORS:

MODEL No.	INDUCTANCE H (min) @ 300Hz	Q (min) @ 1V 1kHz	DCR (Ω)	DC (ma)	FIG No.	PRICE (qty) 1-9	10-24	25-99	100up
MEI-01	6 @ 15V	5.0	1800	2.0	5	$12.30	$11.10	$9.80	$8.60
MEI-02	3.5 @ 15V	4.0	1200	2.0	5	11.90	10.70	9.50	8.30
MEI-03	1.25 @ 3V	3.5	180	2.0	5	11.40	10.30	9.10	8.00
MEI-04	0.3 @ 3V	3.0	40	4.0	5	11.30	10.20	9.00	7.90
MEI-05	0.1 @ 3V	2.0	15	5.0	5	11.30	10.20	9.00	7.90

MECHANICAL DIMENSIONS



PbSn or Ag Plated Nickel

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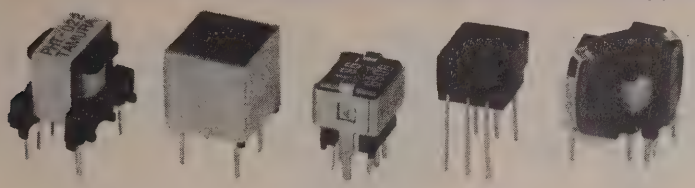
TAMURA WIDE BAND and PULSE TRANSFORMERS

For Isolation, Data Interface and ISDN Applications



ENCAPSULATED PULSE TRANSFORMERS FOR ISOLATION & DATA INTERFACE

MODEL No.	FIG No.	PRIM [1] OCL mH	TURNS RATIO	PRI [2] C pF	SEC [3] L µH	DCR (Ω)	CKT DIA	FEATURES (CROSS REF)	PRICE (qty) 1-9	10-24	25-99	100up
PHT-029	3	1.70mH	1:0.83	87	3.9	0.27:0.12	A	-	$4.30	$3.90	$3.70	$3.00
PHT-023	RM5	2.40mH	1:0.65	25	2.0	0.45:0.13	C	(AIE 315-0719)	8.60	7.70	7.30	6.00
G511 [4]	G5	2.00mH	1:1	25	8.0	1:1	A	2kV rms hipot for LAN	6.00	5.40	5.10	4.20
PHT-022	2F	0.50mH	1:1	26	1.7	1.3:1.4	A	Low cost	4.50	4.10	3.80	3.10
G516	G5	0.50mH	1:1:3	32	0.7	1.35:1.35	A	-	3.70	3.30	3.10	2.60
PHT-031	EP10	10.00mH	1:4	15	350.0	7.3:24	A	2.5kV rms hipot	7.80	7.00	6.60	5.50
G510	G5	0.05mH	1CT:1CT	18	0.5	1.3:1.3	D	(Valor TT1500)	3.70	3.30	3.10	2.60
G509	G5	0.50mH	1CT:1CT	32	0.4	1.3:1.3	D	-	3.80	3.40	3.20	2.70
G508	G5	2.00mH	1CT:1CT	37	0.8	2.5:2.5	D	(Pulse PE-8270)	4.30	3.90	3.70	3.00
PHT-032	2F	7.00mH	1CT:1CT	30	19.0	2.4:2.8	D	(AIE 315-0729)	4.80	4.30	4.10	3.40
G517	G5	1.00mH	1CT:1.41CT	32	1.5	1.5:1.5	D	(Technitrol T1553-20)	3.80	3.40	3.20	2.70
PHT-030	EP7	9.00mH	1CT:2	12	15.0	1.6:3.8	C	-	10.80	9.70	9.20	7.60
G515	G5	0.20mH	2CT:1CT	8	0.8	0.9:0.5	D	-	3.70	3.30	3.10	2.60
G512	G5	2.00mH	2CT:1	19	1.8	2.5:1.4	C	(Pulse PE-8276)	4.30	3.90	3.70	3.00
G504	G5	0.05mH	1:1:1	18	0.5	1.3:1.3:1.3	E	(Valor CT1500)	3.70	3.30	3.10	2.60
G503	G5	0.20mH	1:1:1	18	0.3	0.9:0.9:0.9	E	-	3.70	3.30	3.10	2.60
G52E111 [5]	G5	0.25mH	1:1:1	16	0.5	1.1:1.1:1.1	E	(Datatronic 4258-0004)	4.50	4.10	3.80	3.10
G502	G5	0.50mH	1:1:1	32	0.4	1.3:1.3:1.3	E	(Pulse PE-5762)	3.80	3.40	3.20	2.70
PHT-029-3	3	1.00mH	1:1:1	130	1.0	0.75:0.75:0.75	E	-	4.50	4.10	3.80	3.10
G513	G5	1.20mH	1:1:1	25	0.5	0.7:0.7:0.7	E	-	4.30	3.90	3.70	3.00
G514	G5	1.20mH	1:1:1	30	0.7	0.7:0.7:0.7	E	-	3.80	3.40	3.20	2.70
G501	G5	2.00mH	1:1:1	37	0.8	2.5:2.5:2.5	E	-	4.30	3.90	3.70	3.00
G53E111P [5]	G5	2.50mH	1:1:1	35	0.8	2.4:2.4:2.4	E	(Datatronic 4258-0007)	5.10	4.60	4.30	3.60
PHT-034	2F	2.50mH	1:1:1	30	5.0	2:2:2	E	(Pulse PE-2229X)	4.90	4.40	4.20	3.40
G500	G5	5.00mH	1:1:1	60	1.3	3.9:3.9:3.9	E	0.25" ht.	4.70	4.20	4.00	3.30
G52J111P [5]	G5	0.80mH	1:1:1	20	0.4	1.4:1.4:1.4	E	-	4.60	4.10	3.90	3.20
G74B111 [5]	G7	12.50mH	1:1:1	127	3.0	8.9:8.9:8.9	E	(Datatronic 4259-0004)	7.80	7.00	6.60	5.50
PHT-068	EP13	35.00mH	1CT:1CT:1CT	20	50.0	3.5:6:5.5	T	-	6.60	5.90	5.60	4.60
G52E211 [5]	G5	0.25mH	2:1:1	10	2.5	1.0:0.7:0.7	E	(Technitrol 21HHA)	4.50	4.10	3.80	3.10
G507	G5	0.50mh	2:1:1	11	1.1	1.3:0.7:0.7	E	-	4.10	3.70	3.50	2.90
G506	G5	2.00mH	2:1:1	19	1.8	2.5:1.4:1.4	E	-	4.80	4.30	4.10	3.40
G505	G5	5.00mH	2:1:1	33	3.6	3.9:2:2	E	-	5.40	4.90	4.60	3.80
PHT-015	2F	0.60mH	4:1:4	12	19.0	0.6:0.2:0.6	F	1.2kV rms hipot	4.60	4.10	3.90	3.20

DATA BUS INTERFACE TRANSFORMERS: FOR MIL-STD-1553 APPLICATIONS

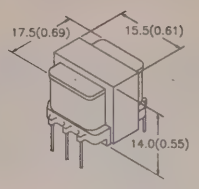
PHT-027 [5]	G5	2.90mH	1CT:1CT	50	2.3	1.25:1.25	D	(Technitrol T1553-21)	17.00	15.30	14.50	11.90
PHT-028 [5]	G5	2.90mH	1CT:1CT	25	2.3	1.25:1.25	D	(Technitrol 12UHD)	23.80	21.40	20.20	16.70
PHT-036 [5]	G5	4.00mH	1CT:1.41CT	24	0.9	1:1.4	D	(Technitrol T1553-22)	6.70	6.00	5.70	4.70

ISDN DATA TRANSFORMERS: MEET CCITT I-430

SEP-1	EP13	30.0mH	1CT:2CT	50	13.0	1.1:2.6	D	AMD 79030A	13.90	12.50	11.80	9.70
SEP-2	EP13	30.0mH	1CT:1CT	50	15.0	1.1:1.3	D	Motorola MC145474	13.90	12.50	11.80	9.70
SEP-3	EP13	30.0mH	1CT:2.5CT	50	13.0	1.1:4.2	D	Intel 29C53 Transmit	13.90	12.50	11.80	9.70
SEP-4	EP13	30.0mH	1CT:1.8CT	50	13.0	1.2:2.6	D	Intel 29C53 Receive	13.90	12.50	11.80	9.70
SEP-5	EP13	30.0mH	1CT:2CT	50	10.0	10:20	D	NEC µPD98201 Receive	14.70	13.20	12.50	10.30
SEP-6	EP13	30.0mH	1CT:1CT	50	10.0	2.2:2.2	D	NEC µPD98201 Transmit	14.70	13.20	12.50	10.30
SRM-1	RM5	30.0mH	1CT:2CT	50	15.0	2.2:4.8	D	Mitel MT8930	10.20	9.20	8.70	7.10
SRM-2	RM5	30.0mH	1CT:1CT	50	22.0	2.2:1.5	D	Motorola MC145474	10.20	9.20	8.70	7.10
SRM-3	RM5	30.0mH	1CT:2.5CT	50	15.0	2.2:8.2	D	Intel 29C53 Transmit	10.20	9.20	8.70	7.10
SRM-4	RM5	30.0mH	1CT:1.8CT	50	15.0	2.2:4.2	D	Intel 29C53 Receive	10.20	9.20	8.70	7.10

Note 1: "OCL" is typical primary open circuit inductance (L), in milli-Henry (except PHT-023), as read on an LC meter.
Note 2: "C pF" is primary to secondary interwinding capacitance (C) in pico-Farad.
Note 3: "L µH" is primary winding leakage inductance (L), in micro-Henry, with the secondary(s) shorted.
Note 4: Designed for IEEE-802.3 LAN applications.
Note 5: Designed and tested to MIL-T-27 specifications.

FIGS 3



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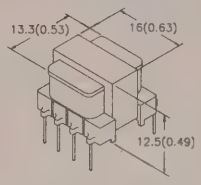
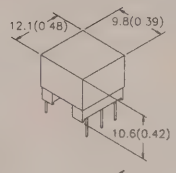


EP7



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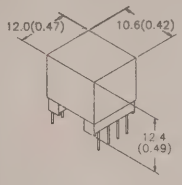

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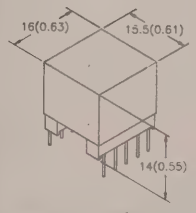
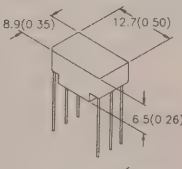


G5



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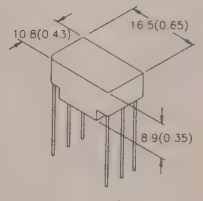

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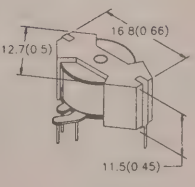
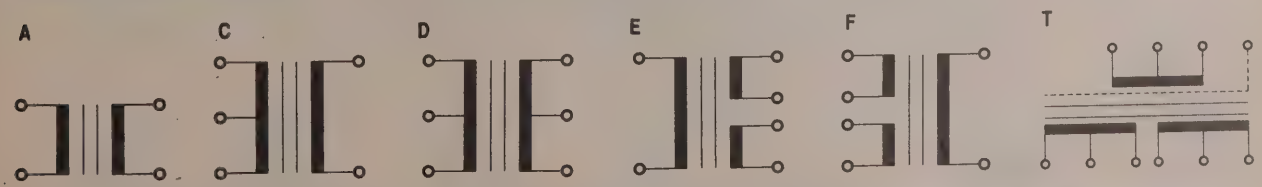


SCHEMATIC CIRCUIT DIAGRAMS



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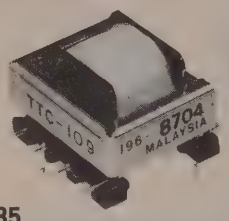
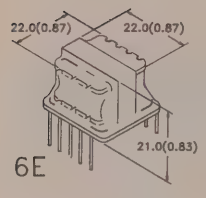
TAMURA TELECOMMUNICATIONS TRANSFORMERS - MEET FCC PART 68

Holding Coils, Miniature Encapsulated and "DRY" (no DC bias) Coupling Transformers

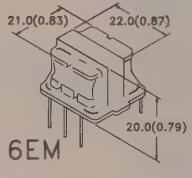


UL FILE# E142035

CSA CERT.# LR81383



6E



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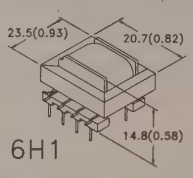
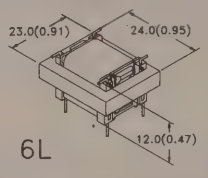


6H1



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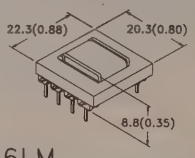

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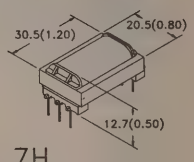
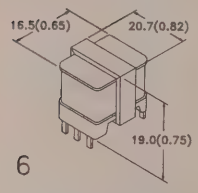


7H



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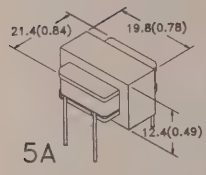
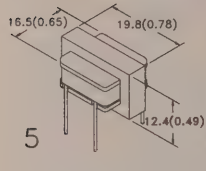


5A



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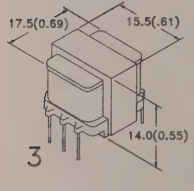

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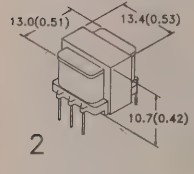

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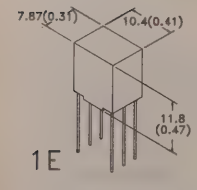

1E

NOW UL RECOGNIZED AND CSA CERTIFIED

"DRY" TELCOM COUPLING TRANSFORMERS (no DC bias) - FCC PART 68

MODEL No.	FIG No.	IMPEDANCE (Ω) PRI : SEC [1]	maDC UNBAL	IL [2] dB	FR [3] ± dB	CKT DIA	FEATURES (CROSS REF)	PRICE (qty) 1-9	10-24	25-99	100up
TTC-170	2	600:600	0	1.7	0.7	A	0.385" typ. ht.	$6.90	$6.20	$5.50	$4.80
TTC-170-2	2	600:600CT*	0	1.7	0.7	E	Small size	7.30	6.60	5.80	5.10
TTC-135	3	600:S:600	0	1.3	0.3	J	With static shield	7.60	6.80	6.10	5.30
TTC-171-2	3	600:600CT*	0	2.0	1.0	E	0.49" typ. ht.	6.70	6.00	5.40	4.70
TTC-167	3	10k:10k	0	1.4	0.7	A	Bridging transformer	7.60	6.80	6.10	5.30
TTC-02	5	600:600	0	1.2	0.4	A	Low cost	7.30	6.60	5.80	5.10
TTC-118	5	600:600	0	0.8	0.3	A	(Microtran T-1104)	7.40	6.70	5.90	5.20
TTC-03	5	600CT:600CT	0	0.8	0.3	D	(Stancor TTPC-03)	7.80	7.00	6.20	5.50
TTC-04	5	600:900	0	1.0	0.3	A	-	7.30	6.60	5.80	5.10
TTC-05	5	4k:600	0	1.0	0.3	A	Bridging transformer	7.80	7.00	6.20	5.50
TTC-108-1	6	600:600	0	1.2	0.3	A	-	6.00	5.40	4.80	4.20
TTC-110	6	600:600	0	0.8	0.3	A	(Stancor TTPC-07)	8.00	7.20	6.40	5.60
TTC-112	6	600:900	0	0.9	0.2	A	(James 13648)	8.10	7.30	6.50	5.70
TTC-108	6	600CT:600CT	0	1.2	0.3	D	Low cost	6.20	5.60	5.00	4.30
TTC-09	6	600CT:600CT	0	0.8	0.3	D	(Dale TA10-04)	8.30	7.50	6.60	5.80
TTC-13	6	4k:600	0	0.9	0.3	A	(Stancor TTPC-11)	8.10	7.30	6.50	5.70
TTC-263	6L	600:600	0	0.8	0.3	A	(Midcom 671-8000)	5.00	4.50	4.00	3.50
TTC-266	6LM	600:600	0	1.2	0.5	A	.375" typ. ht.	11.50	10.40	9.20	8.00
TTC-266-2	6LM	600:600CT*	0	1.2	0.5	E	-	11.80	10.60	9.40	8.30
TTC-101	8	600:1200CT*	0	0.8*	0.3	E	(Stancor TTPC-09)	12.60	11.30	10.10	8.80
TTC-168	8	600:600/600	0	0.6*	0.1	E	(Midcom 671-0256)	16.50	14.90	13.20	11.50

ENCAPSULATED TELCOM COUPLING TRANSFORMERS FOR MINATURE CIRCUITS & SEVERE ENVIRONMENTS [4]

MET-31	1E	600CT:600CT	3	1.5	1.0	D	(Triad SP-67)	13.00	11.70	10.40	9.10
MET-32	1E	600:600CT*	3	1.5	1.2	E	Tested to MIL-T-27	13.00	11.70	10.40	9.10
MET-46	1E	600:600	3	1.5	1.0	A	1500V rms hipot	12.30	11.10	9.80	8.60
MET-49	1E	600:600/600	3	1.6	1.1	E	Single hybrid	13.00	11.70	10.40	9.10
MET-29	1E	900CT:600	3	1.5	1.0	C	-	13.40	12.10	10.70	9.40
METC-99	1E	MU METAL SHIELD	-	-	-	-	EMI slip-on can	2.30	2.10	1.80	1.60
DP-108	6E	600:600CT	5	0.9	0.6	D	-	9.40	8.50	8.00	7.50
DP-101	6E	600CT:600CT	5	0.9	0.5	D	Tested to MIL-T-27	9.40	8.50	8.00	7.50
DP-105	6E	4kCT:600CT	1	1.1	0.6	B	Bridging transformer	9.40	9.40	8.50	7.50
DP-128	6EM	600:S:600CTx2	0	0.8	0.7	M	Electro - static shield	14.40	13.00	12.20	11.50
DP-129	6EM	600CT:S:600CT	0	0.9	0.1	N	Hi-performance	18.90	17.00	16.10	15.10
DP-204	28E	600:600CT	10	0.9	0.5	B	-	12.80	11.50	10.90	10.20
DP-222	28E	600CT*:600CT*	10	0.9	0.5	I	-	14.80	13.30	12.60	11.80
DP-226	28E	600:600CTx2	0	0.9	0.7	I	Single hybrid	15.50	14.00	13.20	12.40
DP-225	28E	4kCT*:S:600CT*	3	0.9	0.6	M	Bridging transformer	14.80	13.30	12.60	11.80

HOLDING COILS FOR TELCOM CIRCUITS

TTC-212	8M	HLDG: 0.275Hy	80	-	-	G	-	9.00	8.10	7.20	6.30
TTC-119 or	9	HLDG: 2.0Hy	60	-	-	H	(Triad TY350P)	11.50	10.40	9.20	8.00
TTC-119	9	HLDG: 1.3Hy	100	-	-	H	(Dale TA12-01)	11.50	10.40	9.20	8.00
TTC-120	11H1	HLDG: 1.4Hy	120	-	-	G	(Midcom 671-4031)	16.40	14.80	13.10	11.50

Note 1: CT* indicates winding can be connected as a centertapped winding or as two isolated windings.
Note 2: Typical insertion loss (IL) in dB @ rated unbalanced maDC, 0dBm & 1kHz. (*) add 3dB to IL for single hybrid use with balancing netwrok on 2-wire side.
Note 3: Typical frequency response (FR) from 0.3 to 3.5kHz, relative to 1kHz at rated maDC & 0dBm.
Note 4: Designed and tested to MIL-T-27 specifications.

A B C D E G

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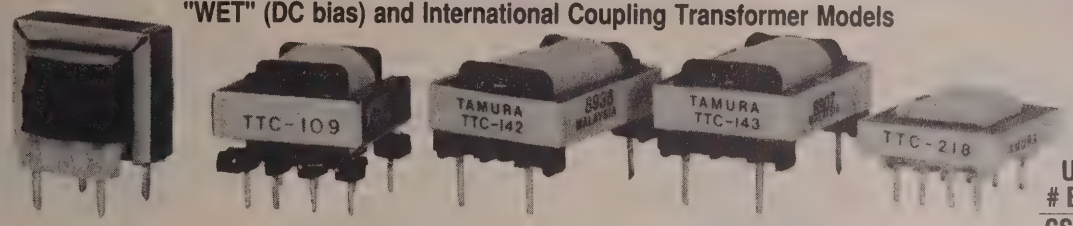
TAMURA TELECOMMUNICATIONS TRANSFORMERS - MEET FCC PART 68

"WET" (DC bias) and International Coupling Transformer Models

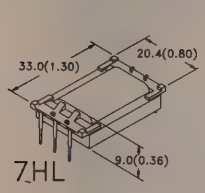


Original "Wet" Telcom

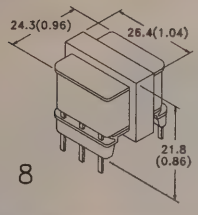
UL FILE # E142035

CSA CERT. # LR81383

Height Above PC Board	18.3mm	16.0mm	12.7mm	12.7mm	8.9mm



7HL



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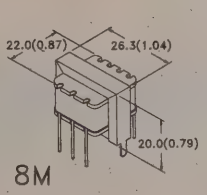
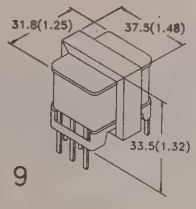


8M



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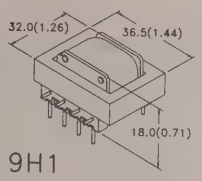
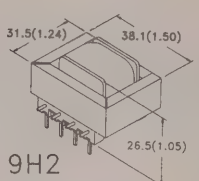


9H1



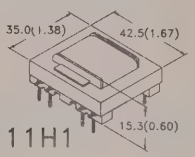
9H2

"WET" TELCOM COUPLING TRANSFORMERS (DC bias) - FCC PART 68

MODEL No.	FIG No.	IMPEDANCE (Ω) PRI : SEC [1]	maDC UNBAL	IL [2] dB	FR [3] ± dB	CKT DIA	FEATURES (CROSS REF)	PRICE (qty) 1-9	10-24	25-99	100up
TTC-258	5A	600:600	80	1.7	2.1	A	490" max. ht.	$10.90	$9.80	$8.70	$7.60
TTC-258-2	5A	600:600CT*	80	1.7	2.1	E	-	11.40	10.30	9.10	8.00
TTC-105	6	600:600	90	2.0	3.0	A	Low cost	6.10	5.50	4.90	4.30
TTC-105-1	6	600:600CT	90	2.0	3.0	B	(Stancor TTPC-06)	6.20	5.60	5.00	4.30
TTC-109	6H1	600:600	90	2.0	3.0	A	-	6.70	6.00	5.40	4.70
TTC-204	6H1	600:600	100	2.5	0.7	A	(Midcom 671-1046)	6.70	6.00	5.40	4.70
TTC-109-1	6H1	600:600CT	90	2.0	3.0	C	-	6.70	6.00	5.40	4.70
TTC-109-2	6H1	600:600CT*	90	2.0	3.0	E	(Stancor TTPC-13)	6.80	6.10	5.40	4.80
TTC-264	6L	600:600	100	2.3	2.1	A	(Midcom 671-8001)	5.00	4.50	4.00	3.50
TTC-265	6L	600:600	100	1.9	1.9	A	(Midcom 671-8005)	5.90	5.30	4.70	4.10
TTC-218	6LM	600:600	50	1.5	1.3	A	0.35" max. ht.	11.50	10.40	9.20	8.00
TTC-218-2	6LM	600:600CT*	50	1.5	1.3	E	-	11.80	10.60	9.40	8.30
TTC-142	7H	600:600	90	1.8	2.0	A	0.500" max. ht.	8.30	7.50	6.60	5.80
TTC-143	7H	600:600	90	1.6	1.8	A	For hi-speed modem	10.60	9.50	8.50	7.40
TTC-215	7H	600:600	90	1.6	1.8	A	Low cross talk	17.80	16.00	14.20	12.50
TTC-176-2	7H	600:600CT*	50	1.0	1.4	E	-	11.20	10.10	9.00	7.80
TTC-142-2	7H	600:600CT*	90	1.8	2.0	E	-	9.00	8.10	7.20	6.30
TTC-174	7H	600:600/600	50	1.0*	1.4	E	Single hybrid.	11.20	10.10	9.00	7.80
TTC-231	7H	600:1200CT	90	1.5	1.7	B	(Midcom 671-1489)	11.20	10.10	9.00	7.80
TTCC-7H	7H	MU METAL SHIELD	-	-	-	-	EMI slip-on can	5.20	4.70	4.20	3.60
TTC-142-LB	7HL	600:600	90	1.8	2.4	A	.36" max. ht.	8.70	7.80	7.00	6.10
TTC-143-LB	7HL	600:600	90	1.6	2.2	A	For hi-speed modem	10.90	9.80	8.70	7.60
TTC-142-2LB	7HL	600:600CT*	90	1.8	2.4	E	-	9.40	8.50	7.50	6.60
TTC-211	8M	600:600	90	1.2	1.5	A	Low cost	9.00	8.10	7.20	6.30
TTC-211-2	8M	600:600CT*	90	1.2	1.5	E	-	9.80	8.80	7.80	6.90
TTC-130	9H1	600:600	90	1.8	0.3	A	For hi-speed modem	12.00	10.80	9.60	8.40
TTC-130-2	9H1	600CT*600CT*	90	1.8	0.3	E	-	12.30	11.10	9.80	8.60
TTC-126-2	9H2	600:600	90	0.8	0.6	A	-	14.00	12.60	11.20	9.80
TTC-126	9H2	600CT*:600CT*	90	0.8*	0.6	I	-	14.10	12.70	11.30	9.90
TTC-126-3	9H2	600:600/600	50	0.8	0.3	E	Hi-perform hybrid	14.10	12.70	11.30	9.90
TTC-122	11H1	600:600	80	0.9	0.5	A	(Stancor TTPC-15)	16.80	15.10	13.40	11.80
TTC-121	11H1	600:600CT*	80	0.9	0.5	E	(Stancor TTPC-14)	17.20	15.50	13.80	12.00
TTC-123	11H1	900:600	80	0.9	0.6	A	(Prem SPT-111)	16.90	15.20	13.50	11.80
TTC-125	25H2	600CT*:600CT*	80	1.8	0.3	I	(Stancor TTPC-19)	21.90	19.70	17.50	15.30
TTC-124	25H2	600CT*:600CT	80	1.3	0.4	K	(Stancor TTPC-18)	22.40	20.20	17.90	15.70
TTC-129	25H2	600CT*:600/600	90	1.5*	0.4	L	-	22.50	20.30	18.00	15.70

INTERNATIONAL TELCOM COUPLING TRANSFORMERS - (EUROPE, UK, AUSTRALIA)

TTC-158	7H	600:600	0	1.1	0.3	A	BSI telcom	17.80	16.00	14.20	12.50
TTC-243	7H	600:S:600	0	1.5	0.5	J	3750VAC hi-pot	20.50	18.50	16.40	14.30
TTC-238	7H	600:600	0	1.4	0.4	A	BABT telcom	18.80	16.90	15.00	13.20
TTC-238-1	7H	600CT:600CT	0	1.4	0.8	D	-	19.80	17.80	15.80	13.90
TTC-158-1	7H	600CT:600CT	0	1.1	0.3	D	3750VAC hi-pot	18.50	16.70	14.80	12.90
TTC-198	8M	600:600CT	0	1.2	0.3	B	Australia telcom	12.30	11.10	9.80	8.60
TTC-164	9H1	600:S:600	0	0.9	0.2	J	Europe bi-directional	14.90	13.40	11.90	10.40
TTC-221	7H	600:600	80	1.3	1.9	A	3750VAC hi-pot	18.50	16.70	14.80	12.90
TTC-131	9H1	600:S:600	90	1.8	0.3	J	BSI telcom	14.90	13.40	11.90	10.40
TTC-160	11H3	600:S:600	120	1.3	0.5	A	(PREM SPT-185)	24.20	21.80	19.40	16.90
TTC-199	11H4	600:600	70	1.2	0.5	A	(PREM SPT-186)	21.50	19.40	17.20	15.00



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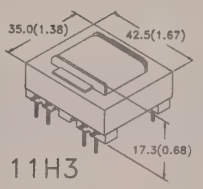

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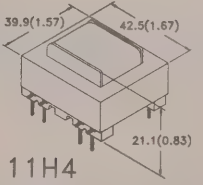

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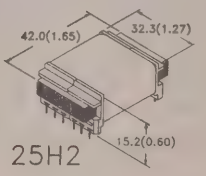
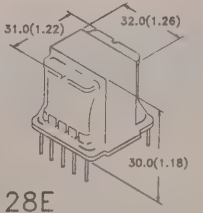
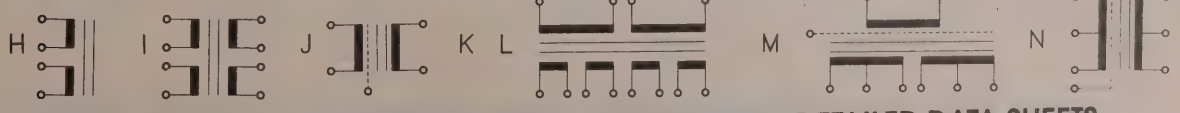


25H2



28E

NOW UL RECOGNIZED AND CSA CERTIFIED



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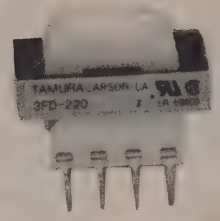
TAMURA OEM PC BOARD POWER TRANSFORMERS

3F Series - 3 Flange Bobbin



FEATURES

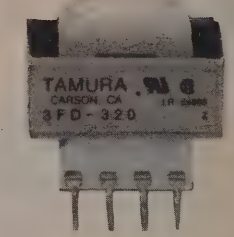
- UL 1585 Class II & III Xfmrs File No. E95844.
- UL Gnl Purpose Xfmrs File No. E91239.
- UL Class B Insulation Sys.
- CSA Cert: CSA 22.2 Nos. 0, 66 File No. LR 69808.
- 2500VAC Hipot, Pri to Sec.
- 115V or 115/230V Primary.
- Bobbin Molded Term. Nos.
- 1.1, 2.4, 6 & 12VA.
- Tube Packaged.
- 80 Models Stocked.
- Competitive Prices.
- Drop-in Compatibility.
- DC Power Supply Models.
- 120 Million Xfrms Shipped/Year.

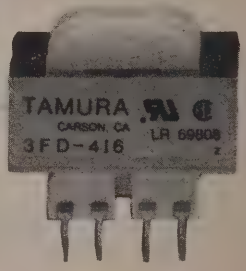
3F SERIES MODELS AND RATINGS

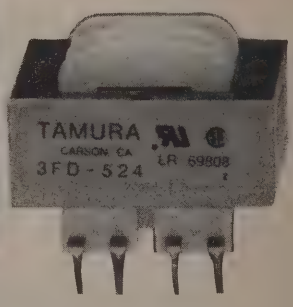
UL 130B - FILE NO. E92957

115V, 50/60 Hz. PRIMARY					115/230V, 50/60 Hz. PRIMARY					SECONDARY RATINGS rms		
MODEL No.	PRICE (qty)				MODEL No.	PRICE (qty)				SERIES CONNECTION	PARALLEL CONNECTION	VA
	1-9	10-24	25-99	100up		1-9	10-24	25-99	100up			
3FS-210	$4.90	$4.40	$4.20	$3.70	3FD-210	$5.70	$5.10	$4.80	$4.30	10.0V CT, 0.110A	5.0V, 0.220A	1.1
3FS-310	4.90	4.40	4.20	3.70	3FD-310	5.70	5.10	4.80	4.30	10.0V CT, 0.250A	5.0V, 0.500A	2.4
3FS-410	5.40	4.90	4.60	4.10	3FD-410	6.30	5.70	5.40	4.70	10.0V CT, 0.600A	5.0V, 1.200A	6.0
3FS-510	6.30	5.70	5.40	4.70	3FD-510	7.10	6.40	6.00	5.30	10.0V CT, 1.200A	5.0V, 2.400A	12.0
3FS-212	4.90	4.40	4.20	3.70	3FD-212	5.70	5.10	4.80	4.30	12.6V CT, 0.090A	6.3V, 0.180A	1.1
3FS-312	4.90	4.40	4.20	3.70	3FD-312	5.70	5.10	4.80	4.30	12.6V CT, 0.200A	6.3V, 0.400A	2.4
3FS-412	5.40	4.90	4.60	4.10	3FD-412	6.30	5.70	5.40	4.70	12.6V CT, 0.500A	6.3V, 1.000A	6.0
3FS-512	6.30	5.70	5.40	4.70	3FD-512	7.10	6.40	6.00	5.30	12.6V CT, 1.000A	6.3V, 2.000A	12.0
3FS-216	4.90	4.40	4.20	3.70	3FD-216	5.70	5.10	4.80	4.30	16.0V CT, 0.070A	8.0V, 0.140A	1.1
3FS-316	4.90	4.40	4.20	3.70	3FD-316	5.70	5.10	4.80	4.30	16.0V CT, 0.150A	8.0V, 0.300A	2.4
3FS-416	5.40	4.90	4.60	4.10	3FD-416	6.30	5.70	5.40	4.70	16.0V CT, 0.400A	8.0V, 0.800A	6.0
3FS-516	6.30	5.70	5.40	4.70	3FD-516	7.10	6.40	6.00	5.30	16.0V CT, 0.800A	8.0V, 1.600A	12.0
3FS-220	4.90	4.40	4.20	3.70	3FD-220	5.70	5.10	4.80	4.30	20.0V CT, 0.055A	10.0V, 0.110A	1.1
3FS-320	4.90	4.40	4.20	3.70	3FD-320	5.70	5.10	4.80	4.30	20.0V CT, 0.120A	10.0V, 0.240A	2.4
3FS-420	5.40	4.90	4.60	4.10	3FD-420	6.30	5.70	5.40	4.70	20.0V CT, 0.300A	10.0V, 0.600A	6.0
3FS-520	6.30	5.70	5.40	4.70	3FD-520	7.10	6.40	6.00	5.30	20.0V CT, 0.600A	10.0V, 1.200A	12.0
3FS-224	4.90	4.40	4.20	3.70	3FD-224	5.70	5.10	4.80	4.30	24.0V CT, 0.045A	12.0V, 0.090A	1.1
3FS-324	4.90	4.40	4.20	3.70	3FD-324	5.70	5.10	4.80	4.30	24.0V CT, 0.100A	12.0V, 0.200A	2.4
3FS-424	5.40	4.90	4.60	4.10	3FD-424	6.30	5.70	5.40	4.70	24.0V CT, 0.250A	12.0V, 0.500A	6.0
3FS-524	6.30	5.70	5.40	4.70	3FD-524	7.10	6.40	6.00	5.30	24.0V CT, 0.500A	12.0V, 1.000A	12.0
3FS-228	4.90	4.40	4.20	3.70	3FD-228	5.70	5.10	4.80	4.30	28.0V CT, 0.040A	14.0V, 0.080A	1.1
3FS-328	4.90	4.40	4.20	3.70	3FD-328	5.70	5.10	4.80	4.30	28.0V CT, 0.085A	14.0V, 0.170A	2.4
3FS-428	5.40	4.90	4.60	4.10	3FD-428	6.30	5.70	5.40	4.70	28.0V CT, 0.200A	14.0V, 0.400A	6.0
3FS-528	6.30	5.70	5.40	4.70	3FD-528	7.10	6.40	6.00	5.30	28.0V CT, 0.420A	14.0V, 0.840A	12.0
3FS-236	4.90	4.40	4.20	3.70	3FD-236	5.70	5.10	4.80	4.30	36.0V CT, 0.030A	18.0V, 0.060A	1.1
3FS-336	4.90	4.40	4.20	3.70	3FD-336	5.70	5.10	4.80	4.30	36.0V CT, 0.065A	18.0V, 0.130A	2.4
3FS-436	5.40	4.90	4.60	4.10	3FD-436	6.30	5.70	5.40	4.70	36.0V CT, 0.170A	18.0V, 0.340A	6.0
3FS-536	6.30	5.70	5.40	4.70	3FD-536	7.10	6.40	6.00	5.30	36.0V CT, 0.350A	18.0V, 0.700A	12.0
3FS-248	4.90	4.40	4.20	3.70	3FD-248	5.70	5.10	4.80	4.30	48.0V CT, 0.023A	24.0V, 0.046A	1.1
3FS-348	4.90	4.40	4.20	3.70	3FD-348	5.70	5.10	4.80	4.30	48.0V CT, 0.050A	24.0V, 0.100A	2.4
3FS-448	5.40	4.90	4.60	4.10	3FD-448	6.30	5.70	5.40	4.70	48.0V CT, 0.125A	24.0V, 0.250A	6.0
3FS-548	6.30	5.70	5.40	4.70	3FD-548	7.10	6.40	6.00	5.30	48.0V CT, 0.250A	24.0V, 0.500A	12.0
3FS-256	4.90	4.40	4.20	3.70	3FD-256	5.70	5.10	4.80	4.30	56.0V CT, 0.020A	28.0V, 0.040A	1.1
3FS-356	4.90	4.40	4.20	3.70	3FD-356	5.70	5.10	4.80	4.30	56.0V CT, 0.045A	28.0V, 0.090A	2.4
3FS-456	5.40	4.90	4.60	4.10	3FD-456	6.30	5.70	5.40	4.70	56.0V CT, 0.110A	28.0V, 0.220A	6.0
3FS-556	6.30	5.70	5.40	4.70	3FD-556	7.10	6.40	6.00	5.30	56.0V CT, 0.220A	28.0V, 0.440A	12.0
3FS-2120	4.90	4.40	4.20	3.70	3FD-2120	5.70	5.10	4.80	4.30	120.0V CT, 0.010A	60.0V, 0.020A	1.1
3FS-3120	4.90	4.40	4.20	3.70	3FD-3120	5.70	5.10	4.80	4.30	120.0V CT, 0.020A	60.0V, 0.040A	2.4
3FS-4120	5.40	4.90	4.60	4.10	3FD-4120	6.30	5.70	5.40	4.70	120.0V CT, 0.050A	60.0V, 0.100A	6.0
3FS-5120	6.30	5.70	5.40	4.70	3FD-5120	7.10	6.40	6.00	5.30	120.0V CT, 0.100A	60.0V, 0.200A	12.0

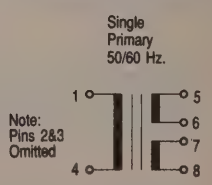
Note 1: Individual transformer coil rating is parallel connection voltage & series connection current.

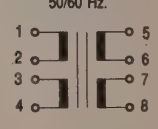






3F SERIES SCHEMATICS



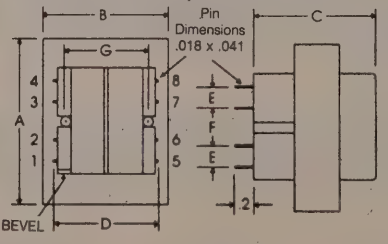


3F SERIES DIMENSIONS AND WEIGHTS[2]

SERIES PREFIX	A	B	C	D	E	F	G	WT
3FS, D-2	1.38 (35.1)	1.16 (29.5)	0.94 (23.9)	1.200 (30.5)	0.250 (6.4)	0.250 (6.4)	N/A	2.7 (77.1)
3FS, D-3	1.38 (35.1)	1.16 (29.5)	1.18 (30.0)	1.200 (30.5)	0.250 (6.4)	0.250 (6.4)	N/A	4.0 (113.4)
3FS, D-4	1.62 (41.2)	1.31 (33.3)	1.31 (33.3)	1.28 (32.5)	0.250 (6.4)	0.350 (8.9)	1.062 (27.0)	7.02 (199.6)
3FS, D-5	1.89 (48.0)	1.58 (40.1)	1.44 (36.6)	1.41 (35.8)	0.300 (7.6)	0.400 (10.2)	1.25 (31.8)	11.2 (317.5)

Note 2: Dimensions in inches (mm). Weight in ounces (gm).

3F SERIES MECHANICAL SPECIFICATIONS



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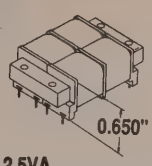
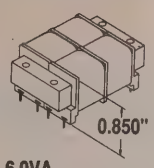
TAMURA LOW PROFILE, PLUG-IN, POWER TRANSFORMERS

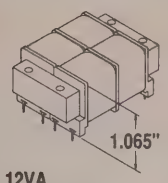
UL RECOG.
FILE NO. E145619



2.5VA



6.0VA



12VA

CSA CERT.
FILE NO. LR81383-7

FEATURES

- Three Flange Bobbin.
- 1500V RMS Hipot.
- 115/230VAC, 50/60Hz., Dual Primary.
- Low Profile: 0.65", 0.85", 1.065" Heights.
- 3 Sizes: 2.5, 6.0 and 12VA Ratings.
- NL-FL Regulation: 30%; 12VA, 20%.
- Tube Packaged.
- 80 Models Stocked.
- Competitive Prices.
- Drop-in compatibility.
- DC Power Supply Models.
- 120M Xfmrs Shipped/Year.

UL 130B - FILE NO. E92957

LOW PROFILE SERIES MODELS and RATINGS

MODEL No.	SECONDARY RATINGS		VA	PRICE (qty)			
	SERIES	PARALLEL		1-9	10-24	25-99	100up
3FL-10-250	10 VCT @ 0.250A	5V @ 0.500A	2.5	$7.25	$6.55	$6.15	$5.45
3FL-10-600	10 VCT @ 0.600A	5V @ 1.200A	6.0	8.00	7.20	6.80	6.00
3FL-10-1200	10 VCT @ 1.200A	5V @ 2.400A	12.0	10.00	9.00	8.50	7.50
3FL-12-200	12.6 VCT @ 0.200A	6.3V @ 0.400A	2.5	7.25	6.55	6.15	5.45
3FL-12-475	12.6 VCT @ 0.475A	6.3V @ 0.950A	6.0	8.00	7.20	6.80	6.00
3FL-12-950	12.6 VCT @ 0.950A	6.3V @ 1.900A	12.0	10.00	9.00	8.50	7.50
3FL-16-150	16 VCT @ 0.150A	8V @ 0.300A	2.5	7.25	6.55	6.15	5.45
3FL-16-350	16 VCT @ 0.350A	8V @ 0.700A	6.0	8.00	7.20	6.80	6.00
3FL-16-700	16 VCT @ 0.700A	8V @ 1.400A	12.0	10.00	9.00	8.50	7.50
3FL-20-125	20 VCT @ 0.125A	10V @ 0.250A	2.5	7.25	6.55	6.15	5.45
3FL-20-300	20 VCT @ 0.300A	10V @ 0.600A	6.0	8.00	7.20	6.80	6.00
3FL-20-600	20 VCT @ 0.600A	10V @ 1.200A	12.0	10.00	9.00	8.50	7.50
3FL-24-100	24 VCT @ 0.100A	12V @ 0.200A	2.5	7.25	6.55	6.15	5.45
3FL-24-250	24 VCT @ 0.250A	12V @ 0.500A	6.0	8.00	7.20	6.80	6.00
3FL-24-500	24 VCT @ 0.500A	12V @ 1.000A	12.0	10.00	9.00	8.50	7.50
3FL-30-85	30 VCT @ 0.085A	15V @ 0.170A	2.5	7.25	6.55	6.15	5.45
3FL-30-200	30 VCT @ 0.200A	15V @ 0.400A	6.0	8.00	7.20	6.80	6.00
3FL-30-400	30 VCT @ 0.400A	15V @ 0.800A	12.0	10.00	9.00	8.50	7.50
3FL-34-75	34 VCT @ 0.075A	17V @ 0.150A	2.5	7.25	6.55	6.15	5.45
3FL-34-170	34 VCT @ 0.170A	17V @ 0.340A	6.0	8.00	7.20	6.80	6.00
3FL-34-340	34 VCT @ 0.340A	17V @ 0.680A	12.0	10.00	9.00	8.50	7.50
3FL-40-60	40 VCT @ 0.060A	20V @ 0.120A	2.5	7.25	6.55	6.15	5.45
3FL-40-150	40 VCT @ 0.150A	20V @ 0.300A	6.0	8.00	7.20	6.80	6.00
3FL-40-300	40 VCT @ 0.300A	20V @ 0.600A	12.0	10.00	9.00	8.50	7.50
3FL-56-45	56 VCT @ 0.045A	28V @ 0.090A	2.5	7.25	6.55	6.15	5.45
3FL-56-100	56 VCT @ 0.100A	28V @ 0.200A	6.0	8.00	7.20	6.80	6.00
3FL-56-200	56 VCT @ 0.200A	28V @ 0.400A	12.0	10.00	9.00	8.50	7.50
3FL-88-28	88 VCT @ 0.028A	44V @ 0.056A	2.5	7.25	6.55	6.15	5.45
3FL-88-65	88 VCT @ 0.065A	44V @ 0.130A	6.0	8.00	7.20	6.80	6.00
3FL-88-130	88 VCT @ 0.130A	44V @ 0.260A	12.0	10.00	9.00	8.50	7.50
3FL-120-20	120 VCT @ 0.020A	60V @ 0.040A	2.5	7.25	6.55	6.15	5.45
3FL-120-50	120 VCT @ 0.050A	60V @ 0.100A	6.0	8.00	7.20	6.80	6.00
3FL-120-100	120 VCT @ 0.100A	60V @ 0.200A	12.0	10.00	9.00	8.50	7.50
3FL-230-10	230 VCT @ 0.010A	115V @ 0.020A	2.5	7.25	6.55	6.15	5.45
3FL-230-25	230 VCT @ 0.025A	115V @ 0.050A	6.0	8.00	7.20	6.80	6.00
3FL-230-50	230 VCT @ 0.050A	115V @ 0.100A	12.0	10.00	9.00	8.50	7.50

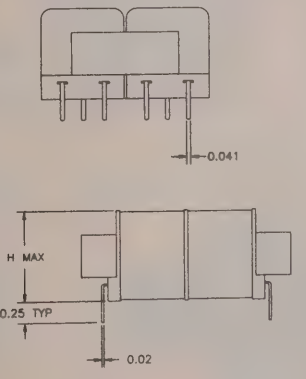
Note 1: Individual Xfmr coil rating is parallel connection voltage & series connection current.

3FL SERIES DIMENSIONS and WEIGHTS [2]

VA	A	B	C [3]	L	W	H	WT
2.5	1.60 (40.6)	0.375 (9.5)	0.187 (4.8)	1.87 (47.5)	1.56 (39.6)	0.650 (16.5)	5 (142)
6.0	1.60 (40.6)	0.375 (9.5)	0.187 (4.8)	1.87 (47.5)	1.56 (39.6)	0.850 (21.6)	7 (198)
12.0	2.00 (50.8)	0.500 (12.7)	0.250 (6.4)	2.50 (63.5)	2.00 (50.8)	1.065 (27.1)	11 (312)

Note 2: Dimensions in inches (mm). Weight in oz. (gm).
Note 3: 3 output config. has 10 pins, all others 8 pins (omit pin 6 & 9).

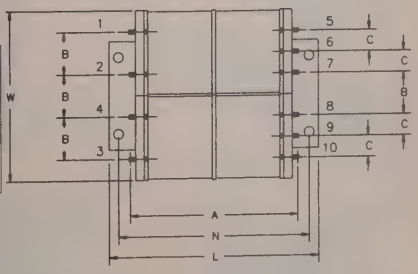
3FL SERIES MECHANICAL SPECIFICATIONS



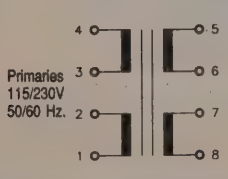
THREE (3) OUTPUT TRANSFORMER MODELS & RATINGS

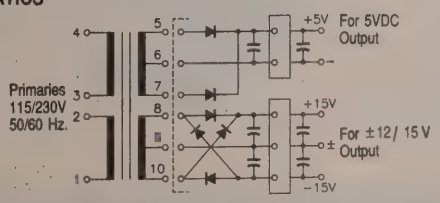
Regulated Power Supplies for Microprocessors

MODEL No.	SECONDARY 1 AC - rms	SECONDARY 2 AC - rms	DC OUTPUT 1 C.T.F.W.	DC OUTPUT 2 C.T.F.W.	VA	PRICE (qty)			
						1-9	10-24	25-99	100up
3FL-612	17.5V, 155ma	31.5V, 65ma	+5V, 135ma	± 12V, 40ma	6	$9.75	$8.80	$8.30	$7.30
3FL-615	17.5V, 155ma	37.5V, 60ma	+5V, 135ma	± 15V, 35ma	6	9.75	8.80	8.30	7.30
3FL-1212	17.0V, 340ma	29.0V, 140ma	+5V, 270ma	± 12V, 85ma	12	11.25	10.15	9.55	8.45
3FL-1215	17.0V, 340ma	36.0V, 115ma	+5V, 270ma	± 15V, 70ma	12	11.25	10.15	9.55	8.45



3FL SERIES SCHEMATICS





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TAMURA ENCAPSULATED SCR and TRIAC TRIGGER TRANSFORMERS

Tamura's STT series transformers are designed for low cost source isolation in half and full wave SCR or TRIAC control citcuits. The STT trigger transformers are encapsulated for environmental protection and pass 2600V rms dielectric breakdown testing.

MODEL No.	TURNS RATIO	PRIM L mH(≥)	LEAK L uH(≤)	WDG C pF	E.T. (≥) V-µsec	DCR ohms (max)	DIA No.	PRICE (qty) 1-9	10-24	25-99	100up
STT-101	1:1	1.0	15	80	90	2.5/2.5	1	$12.40	$11.20	$10.50	$9.90
STT-102	1:1	5.0	50	80	200	5.0/5.0	1	12.40	11.20	10.50	9.90
STT-103	1:1	10.0	100	80	280	7.0/7.0	1	12.40	11.20	10.50	9.90
STT-104	1:1:1	1.0	25	80	90	2.5/2.5/2.5	2	13.80	12.40	11.70	11.00
STT-105	1:1:1	5.0	100	80	200	5.0/5.0/5.0	2	13.80	12.40	11.70	11.00
STT-106	1:1:1	10.0	200	80	280	7.0/7.0/7.0	2	13.80	12.40	11.70	11.00
STT-107	2:1	1.0	20	80	90	2.5/1.5	1	12.40	11.20	10.50	9.90
STT-108	2:1	5.0	60	80	200	5.0/2.5	1	12.40	11.20	10.50	9.90
STT-109	2:1	10.0	130	80	280	7.0/3.5	1	12.40	11.20	10.50	9.90
STT-110	2:1:1	1.0	30	80	90	2.5/1.5/1.5	2	13.80	12.40	11.70	11.00
STT-111	2:1:1	5.0	130	80	200	5.0/2.5/2.5	2	13.80	12.40	11.70	11.00
STT-112	2:1:1	10.0	200	80	280	7.0/3.5/3.5	2	13.80	12.40.	11.70	11.00

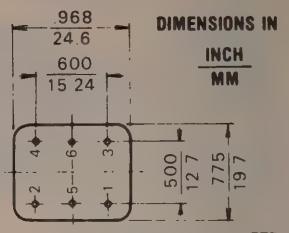
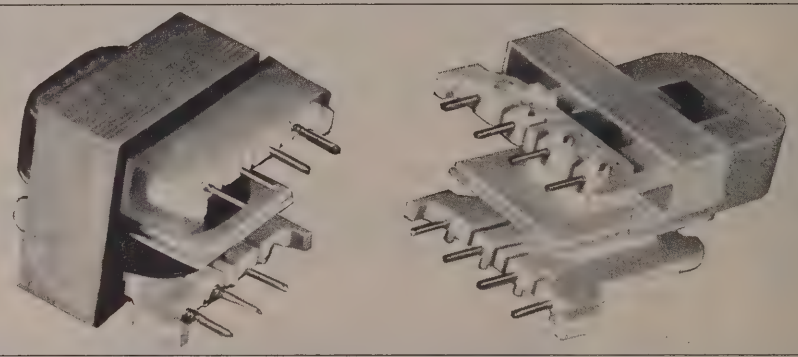


DIAGRAM 1

DIAGRAM 2

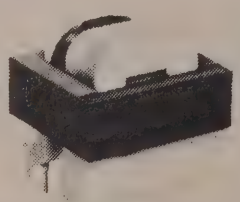
Tamura Designs Custom Power and Audio Transformers

FILE NO.
TAMRADIO
E59673

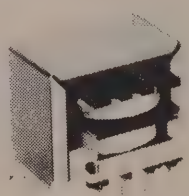


INTERNATIONAL POWER TRANSFORMERS – UL, CSA, IEC, MITI

PEPF Series
- Ratings–0.7 to 6VA
- Physical Barrier Between Primary, Secondary & Core

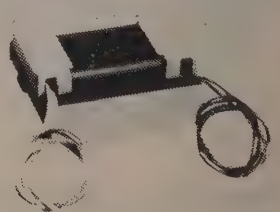


PEPY Series
- Ratins–4 to 20VA
- Physical Barrier Between Primary, Secondary & Core

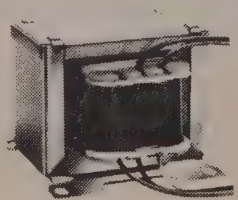


PEE Series
- Ratings–0.7 to 40VA
- 8mm Creepage
- 4000VAC HiPot

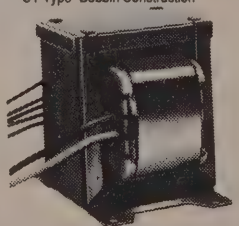
PMZF Series
- 10 to 80VA
- Minimum Flux Field for CRT Applications
- Low Profile



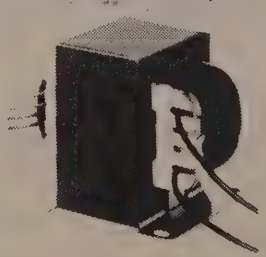
PEB Series
- Ratings–70 to 300VA
- Horizontal Mounting
- CU Flux Shorting Band
- Concentric Wound Coils
- "CY Type" Bobbin Construction



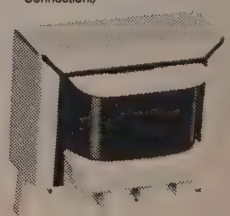
PEBT Series
- Ratings–70 to 300VA
- Vertical Mounting
- CU Flux Shorting Band
- Concentric Wound Coils
- "CY Type" Bobbin Construction



PEKT Series
- Ratings–70 to 200VA
- Welded Stack
- Shielded Core to Reduce Stray Field



EPH Series AUDIO TRANSFORMERS
- Double Protection System
- 3500VAC HiPot
- Isolation for TV Audio and Video External Connections



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TAMURA WALL PLUG-IN and SCREW TERMINAL AC-AC TRANSFORMERS

120VAC, 60Hz. and 220VAC, 50Hz.

UL file nos. E82180 CSA file nos. LR38236 VDE file nos.7969-3330 7969-3331

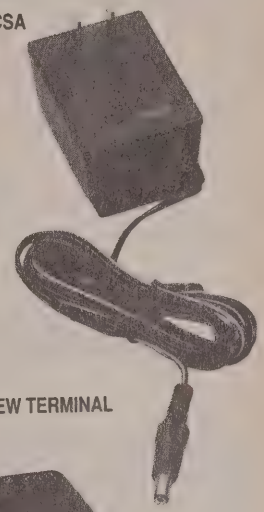
FEATURES

- UL Class II Xfmrs - UL 1310.
- UL 544 Medical Capability.
- Thermal Overload Protection.
- 100% Testing.
- Transformer: 3 flange bobbin.
- US 3-Blade Ground Plug Available.
- Temp Range: 0 to +40˚C.
- Case Temp Rise: ≤35˚C.
- Oper Humidity: 10-90% RH.
- Material: Black ABS resin/UL 94-V0.
- No Audible Noise.
- Mounting Tab Available.

AC-AC CLASS 2 TRANSFORMERS - 120VAC, 60 Hz

UL/CSA MODEL No.	RATED OUTPUT VOLTS AC	RATED OUTPUT ma AC	OUTPUT VAC 100% FL 108VAC	OUTPUT VAC 100% FL 132VAC	OUTPUT VAC 10% FL 132VAC	UL[2]	CSA[3]	PLUG[4]	PRICE (qty) 1-9	10-24	25-99	100up
310A0001	2.5	500	2.15	2.70	3.20	UL*	L	P	$6.40	$5.40	$5.10	$4.50
420A0003	9.0	800	7.75	9.20	10.90	UL*	L	M	8.90	7.60	7.10	6.20
825A0007G	9.0	1500	7.85	10.00	11.25	UL	L	I	16.60	14.10	13.30	11.60
420A0001	11.0	600	9.85	12.35	13.65	UL*	L	I	8.90	7.60	7.10	6.20
310A0002	12.0	110	11.00	13.70	15.30	UL*	C	I	6.70	5.70	5.40	4.70
825A0001	12.0	1300	10.50	13.50	15.90	UL	C	I	16.30	13.90	13.00	11.40
816A0001	14.0	500	12.60	15.85	17.75	UL	L	I	15.00	12.70	12.00	10.50
420A0002	14.0	770	12.25	15.50	18.30	UL*	L	I	8.90	7.60	7.10	6.20
420A0008	16.5	600	14.10	18.25	19.90	UL	C	I	8.90	7.60	7.10	6.20
818A0001	17CT	500	16.00	20.10	23.40	UL	L	V	11.90	10.10	9.50	8.30
825A0002	18.0	880	15.95	21.50	22.90	UL	C	I	16.30	13.90	13.00	11.40
420A0005	24.0	450	20.60	26.50	30.50	UL*	L	I	8.90	7.60	7.10	6.20
825A0003	24.0	660	21.00	26.60	30.25	UL	C	I	16.30	13.90	13.00	11.40

FIG. 1 UL/CSA



SCREW TERMINAL TYPE - 120VAC, 60Hz.

820A0060-03	10.0	1200	8.60	11.40	12.75	UL	L	SCRW	13.90	11.80	11.10	10.40
825A0050-03	10CT	1600	8.70	11.30	12.65	UL	L	SCRW	16.20	13.80	13.00	12.10
830A0060-03	10.0	2000	8.60	11.20	12.55	UL	L	SCRW	16.10	13.70	12.90	12.10
820A0061-03	12.0	1000	10.25	13.75	15.40	UL	L	SCRW	13.90	11.80	11.10	10.40
825A0051-03	12CT	1330	10.40	13.60	15.25	UL	L	SCRW	16.20	13.80	13.00	12.10
830A0061-03	12.0	1600	10.55	13.75	15.30	UL	L	SCRW	16.10	13.70	12.90	12.10
820A0062-03	14.0	850	12.05	15.70	17.55	UL	L	SCRW	13.90	11.80	11.10	10.40
825A0052-03	14CT	1140	12.00	15.60	17.45	UL	L	SCRW	15.40	13.10	12.30	11.60
830A0062-03	14.0	1430	11.90	15.50	17.35	UL	L	SCRW	16.10	13.70	12.90	12.10
820A0063-03	16.0	750	13.50	17.70	20.10	UL	L	SCRW	13.90	11.80	11.10	10.40
825A0053-03	16CT	1000	13.80	18.05	20.05	UL	L	SCRW	15.40	13.10	12.30	11.60
830A0063-03	16.0	1250	13.65	17.90	19.90	UL	L	SCRW	15.30	13.00	12.20	11.50
820A0064-03	18.0	650	15.45	20.30	22.65	UL	L	SCRW	13.90	11.80	11.10	10.40
825A0054-03	18CT	880	15.45	20.30	22.70	UL	L	SCRW	14.50	12.30	11.60	10.90
830A0064-03	18.0	1110	15.35	20.25	22.60	UL	L	SCRW	15.30	13.00	12.20	11.50
820A0065-03	20.0	600	17.00	22.35	25.10	UL	L	SCRW	13.90	11.80	11.10	10.40
825A0055-03	20CT	800	17.10	22.40	25.10	UL	L	SCRW	14.50	12.30	11.60	10.90
830A0065-03	20.0	1000	16.95	22.30	25.05	UL	L	SCRW	15.30	13.00	12.20	11.50
820A0066-03	22.0	550	18.85	24.85	27.80	UL	L	SCRW	13.90	11.80	11.10	10.40
825A0056-03	22CT	720	18.75	24.75	27.65	UL	L	SCRW	14.50	12.30	11.60	10.90
830A0066-03	22.0	900	18.70	24.70	27.60	UL	L	SCRW	15.30	13.00	12.20	11.50
820A0067-03	24.0	500	20.70	26.95	30.10	UL	L	SCRW	13.90	11.80	11.10	10.40
825A0057-03	24CT	660	20.60	26.85	29.95	UL	L	SCRW	14.50	12.30	11.60	10.90
830A0067-03	24.0	830	20.60	26.85	30.00	UL	L	SCRW	15.30	13.00	12.20	11.50

FIG. 2 SCREW TERMINAL

Note 1: Typ. output VAC for load & line shown.

Note 2: UL Notes: UL, UL1310 listed; UL*, UL 1310 & UL1411 Xfmr.

Note 3: Complies (C) or listed (L) to CSA 22.2, No. 223/66.

Note 4: Screw term: 4ea #6-32; input gnd & output screw term gnd.

AC-AC TRANSFORMER - 220VAC, 50Hz. - VDE APPROVED

VDE MODEL NO.	RATED OUTPUT VOLTS AC	RATED OUTPUT ma AC	OUTPUT VAC[5] 100% FL 198VAC	OUTPUT VAC[5] 100% FL 242VAC	OUTPUT VAC[5] 10% FL 242VAC	PLUG TYPE	PRICE (qty) 1-9	10-24	25-99	100up
310F0006	9.5	150	9.40	11.80	18.50	I	$9.70	$8.20	$7.80	$6.80
310F0007	12.0	100	10.00	14.00	18.70	I	9.70	8.20	7.80	6.80

FIG. 3 VDE

Note 5: Typical output voltage for % load (FL) and line (VAC) as indicated.

MECHANICAL DIMENSION TABLE

SERIES PREFIX	LENGTH (L) mm (inch)	WIDTH (W) mm (inch)	HEIGHT (H) mm (inch)	WEIGHT gm (oz)	FIG No.
310A	60 (2.36)	45 (1.77)	35 (1.38)	150 (5.29)	1
310F	58 (2.28)	45 (1.77)	39 (1.54)	190 (6.70)	3
420A	61 (2.40)	55 (2.17)	41 (1.62)	270 (9.52)	1
816A	81 (3.19)	59 (2.32)	52 (2.05)	297 (10.49)	1
818A	51 (2.01)	60 (2.36)	50 (1.97)	330 (11.64)	1
820A-03	75 (2.95)	63 (2.48)	50 (1.97)	400 (14.13)	2
825A	82 (3.23)	60 (2.36)	55 (2.17)	490 (17.28)	1
825A-03	75 (2.95)	63 (2.48)	50 (1.97)	470 (16.58)	2
830A-03	75 (2.95)	63 (2.48)	50 (1.97)	530 (18.73)	2

OUTPUT PLUG DIMENSIONS

PLUG TYPE	D1 (mm)	D2 (mm)	L (mm)	MALE/ FEMALE	FIG No.
I	5.5	2.10	9.5	FEMALE	4
M	5.5	2.55	9.5	FEMALE	4
O	5.5	2.55	12.4	FEMALE	4
P	2.5	2.30	11.0	MALE	5
V	3 POS. AMP 102241-1 MOLDED				N/A

FIG. 4 FEMALE

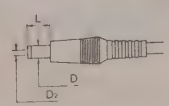
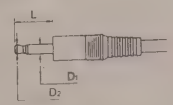


FIG. 5 MALE



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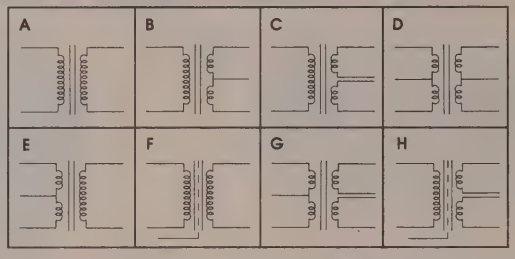
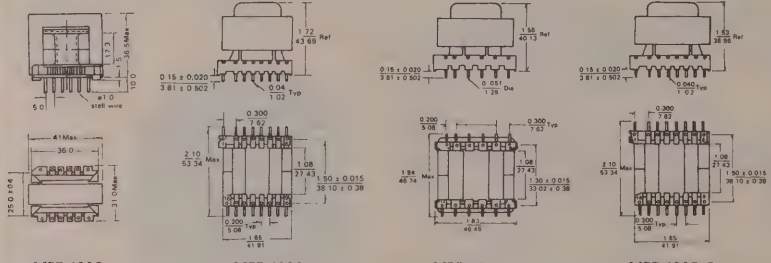


Impedance		Schematic
Primary	Secondary	
600	600	A, F
600	600CT	B, H
600	600/600	C
600CT	600CT	D, G
900/600	600	E
4000	600	A

Frequency Response	300-4,000Hz ±0.2dB~ ±1.0dB	**Resistance**	± 15%
Longitudinal Balance	Per FCC 68.310	**Insertion Loss**	0.3dB ~1.0dB
Return Loss	20dB Min.	**Insulation Resistance**	> 100Meg Ohms @ 500VDC
Impedance	± 10% (at 1kHz)		

SWITCHING POWER TRANSFORMER

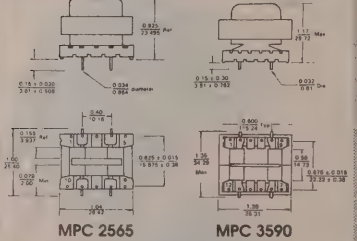


MPT 4012 MPT 4220 MPT 4215-1 MPT 4215-2

	MPT 4012	MPT 4215	MPT 4220
Power Capacity		235W	300W
Ae cm^2	1.48	1.82	2.30
Le cm	7.7	9.70	9.70
Aw cm	1.60	2.87	2.87

For use only in equipment where the acceptability of the combination is determined by Underwriters Laboratories Inc. — Underwriters Laboratories Inc. ®

COMMON MODE CHOKE



MPC 2565 MPC 3590

- Standard E core package.
- Cost effective design.
- Designs meeting UL, CSA, VDE & IEC Requirements.
- 3750V RMS dielectric strength.
- Toroidal constructions also available on request.

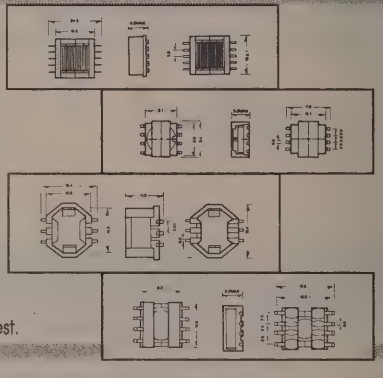
MPC 2565	
Current Rating *	1.0 AMP
Inductance/Section	4.5 mh MIN
D.C.R.	.2 Ω MAX
Leakage Inductance	75 µh MAX
MPC 3590	
Current Rating *	3.0 AMP
Inductance/Section	5 mh MIN
D.C.R.	.1 Ω MAX
Leakage Inductance	90 µh MAX

* Based on 400 circular MILS/AMP

SURFACE MOUNT TRANSFORMERS INDUCTORS

FEATURES:

- Compact for HIGH DENSITY surface mounting.
- Low profile, designed for optimum weight/volume and performance ratio.
- Suitable for surface mounting to withstand reflow process requirements.
- High voltage output(up to 1000 VRMS) provided by multi-sectional bobbin designed for secondary winding.
- High "Q", High "SRF", made by Ferrite material for CHIP inductor.
- Bulk packing or Tape & Reel available per your request.

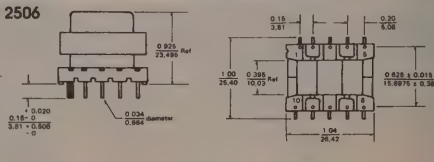


DRIVER TRANSFORMER

FEATURES:

- Small Ferrite core package.
- Designed for 15V or 30V DC input, 20 KHZ or higher operating frequency.
- Designed for UL, CSA, VDE & IEC requirements, electric strength is 3750 V RMS between primary and secondary.
- Provides max inductance, low leakage and interwinding capacitance.

MPD 2506



TYPICAL CHARACTERISTICS

MPD 2506	
Initial Permeability	2000
Ae cm^2	.40
le cm	4.87

For use only in equipment where the acceptability of the combination is determined by Underwriters Laboratories Inc. — Underwriters Laboratories Inc. ®

SEE OUR COILS, CHOKES IN VOLUME A PAGE 1300; AND LIGHTING BALLASTS IN VOLUME B PAGE 1199.

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For over 30 years, the industry has known Torelco as a partner that supplies toroids of superior quality, shipped to you with flawless adhesion to delivery schedules. Coils from .093 inside diameter, to over 10 inches outside diameter can be wound using wire sizes from 8 AWG through 46 AWG, in open or cased styles, varnish or epoxy encapsulated.

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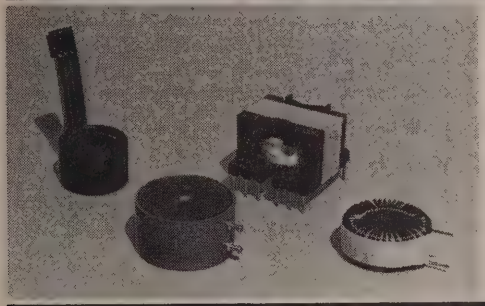

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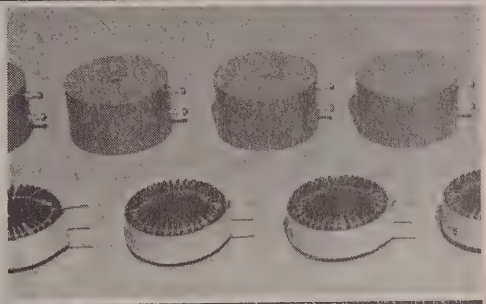

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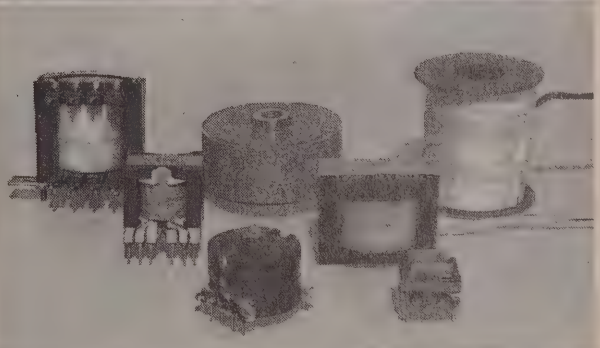

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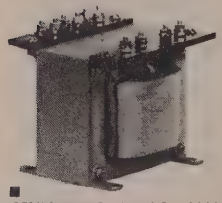
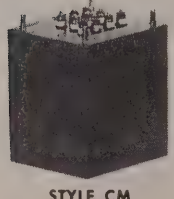
STYLE B



STYLE B (OVER 700 VA)

STYLE BE

STYLE V



STYLE CM

SECONDARY VOLTS TAP VOLTS	PART NO.	RATING VA	PRIMARY VOLTS 50-500 Hz.	OPTIONAL SECONDARY HOOKUP SERIES VOLTS	SERIES AMPS (RMS)	PARALLEL VOLTS	PARALLEL AMPS (RMS)
10 VOLTS Parallel: 2.5, 5V Series: 7.5, 10V	10 02	20	115	10V CT OR 7.5V	2 5 10 20	5V CT OR 2.5V	4 10 20 40
	10 05	50	115				
	10 10	100	115				
	10 20	200	115				
12.6 VOLTS Parallel: 3.1, 6.3V Series: 9.4, 12.6V	12 02	24	115	12.6V CT OR 9.4V	2 5 10 20	6.3V CT OR 3.1V	4 10 20 40
	12 05	60	115				
	12 10	120	115				
	12 20	240	115				
16 VOLTS Parallel: 4, 8V Series: 12, 16V	16 01	16	115	16V CT OR 12V	1 2 5 10 20	8V CT OR 4V	2 4 10 20 40
	16 02	32	115				
	16 05	80	115				
	16 10	160	115				
	16 20	320	115				
24 VOLTS Parallel: 6, 12V Series: 18, 24V INTERMEDIATE RATINGS AVAILABLE	24 01	24	115	24V CT OR 18V	1 2 4 6 8 12 20 25 50 100	12V CT OR 6V	2 4 8 12 16 24 40 50 100 200
	24 02	48	115				
	24 04	96	115				
	24 08	144	115				
	24 08	192	115				
	24 12	288	105, 115, 125				
	24 20	480	105, 115, 125				
	24 25	600	105, 115, 125				
	24 50	1200	105, 115, 125				
	24 100	2400	115, 230				
36 VOLTS Parallel: 9, 18V Series: 27, 36V	36 00	18	115	36V CT OR 27V	0.5 1 2 4 6 8 12 20 30 50 100	18V CT OR 9V	1 2 4 8 12 16 24 40 60 100 200
	36 01	36	115				
	36 02	72	115				
	36 04	144	115				
	36 06	216	115				
	36 08	288	115				
	36 12	432	105, 115, 125				
	36 20	720	105, 115, 125				
	36 30	1080	105, 115, 125				
	36 50	1800	115, 230				
	36 100	3600	115, 230				
56 VOLTS Parallel: 14, 28V Series: 42, 56V	56 01	56	115	56V CT OR 42V	1 2 5 8 12 25 50 100	28V CT OR 14V	2 4 10 16 24 50 100 200
	56 02	112	115				
	56 05	280	115				
	56 08	448	105, 115, 125				
	56 12	672	105, 115, 125				
	56 25	1400	105, 115, 125				
	56 50	2800	115, 230				
	56 100	5600	115, 230				
64 VOLTS Parallel: 16, 32V Series: 48, 64V	64 00	32	115	64V CT OR 48V	0.5 1 2 4 8 12 25 50	32V CT OR 16V	1 2 4 8 16 24 50 100
	64 01	64	115				
	64 02	128	115				
	64 04	256	115				
	64 08	512	105, 115, 125				
	64 12	780	105, 115, 125				
	64 25	1600	105, 115, 125				
	64 50	3200	115, 230				
68 VOLTS Parallel: 17, 34V Series: 51, 68V	68 01	68	115	68V CT OR 51V	1 2 4 8 12	34V CT OR 17V	2 4 8 16 24
	68 02	136	115				
	68 04	272	115				
	68 08	544	105, 115, 125				
	68 12	816	105, 115, 125				
80 VOLTS Parallel: 20, 40V Series: 60, 80V	80 01	80	115	80V CT OR 60V	1 2 5 10 25 50	40V CT OR 20V	2 4 10 20 50 100
	80 02	160	115				
	80 05	400	115				
	80 10	800	105, 115, 125				
	80 25	2000	115, 230				
	80 50	4000	115, 230				
120 VOLTS Parallel: 30, 60V Series: 90, 120V	120 01	120	115	120V CT OR 90V	1 2 4 8 12	60V CT OR 30V	2 4 8 16 24
	120 02	240	115				
	120 04	480	115				
	120 08	960	105, 115, 125				
	120 12	1440	105, 115, 125				
180 VOLTS Parallel: 45, 90V Series: 135, 180V	180 00	90	115	180V CT OR 135V	0.5 1 4 8	90V CT OR 45V	1 2 8 16
	180 01	180	115				
	180 04	720	105, 115, 125				
	180 08	1440	105, 115, 125				
230 VOLTS Parallel: 57.5, 115V Series: 172.5, 230V	230 00	115	115	230V CT OR 172.5V	0.5 1 2 5 8	115V CT OR 57.5V	1 2 4 10 16
	230 01	230	115				
	230 02	460	115				
	230 05	1150	105, 115, 125				
	230 08	1840	115, 230				
300 VOLTS Parallel: 75, 150V Series: 225, 300V	300 00	150	115	300V CT OR 225V	0.5 1 2 5	150V CT OR 75V	1 2 4 10
	300 01	300	115				
	300 02	600	115				
	300 05	1500	105, 115, 125				

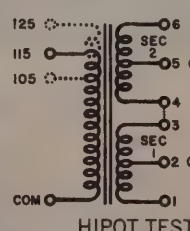
FOUR STYLES STOCKED IN DEPTH

DC TO RMS CONVERSION CHART

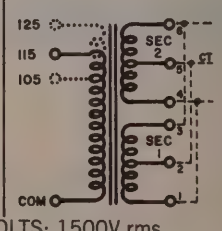
SECONDARY RMS CURRENT = DC CURRENT × FACTOR BELOW	Choke Input Filter or Inductive Load	Resistive Load	Capacitor Input Filter or Capacitive Load
FULL WAVE BRIDGE	1.0	1.0	1.8
FULL WAVE C.T.	.7	1.0	1.15

CUSTOM VARIATIONS QUOTED PROMPTLY

SERIES HOOKUP



PARALLEL HOOKUP



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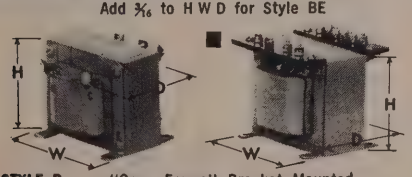
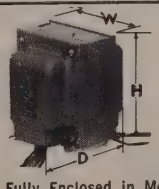
PART NO.	• BRACKET MTD. (STYLE B) • ENCAPSULATED (STYLE BE) H	W	D	MW	MD	WGT.	• FULLY MTD. SHELLS (STYLE V) H	W	D	MW	MD	WGT.	• HERMETIC SEALED MIL-T (STYLE CM) H	W	D	MW	MD	WGT.	PART NO.
10 02	2¼	2⅝	2⅛	2⅜	1 11/16	1¼	2⅝	2⅜	2	1¾	1¼	1¼	3⅛	3	2⅜	2 25/32	1 27/32	2	10 02
10 05	2½	3	2⅝	2½	2⅛	2⅜	3⅛	2½	2¾	2	1 13/16	2½	3 13/16	3½	3	2⅝	2⅛	4	10 05
10 10	3⅛	3¾	3	3⅛	2⅛	4⅜	3⅞	3¼	3⅝	2½	2⅜	5	4¼	3⅞	3⅝	3	2 7/16	7¾	10 10
10 20	3¾	4½	3⅝	3¾	2⅜	7½	4⅝	3⅞	3⅞	3	2 13/16	8	5 1/16	5	4¼	4 1/16	3⅝	12½	10 20
12 02	2½	3	2⅛	2½	1⅝	1½	3 1/16	2½	2¼	2	1 5/16	1⅝	3 13/16	3½	3	2⅝	2⅛	2½	12 02
12 05	2½	3	2⅞	2½	2⅜	2¾	3 1/16	2½	3	2	2 1/16	2⅞	3 13/16	3½	3	2⅝	2⅛	4	12 05
12 10	3⅛	3¾	3 11/16	3⅛	2½	5¼	3⅞	3¼	3¾	2½	2½	5½	4 1/16	4¼	3⅝	3⅝	2 1/16	8	12 10
12 20	3¾	4½	4	3¾	2¾	9	4⅝	3⅞	4⅝	3	3⅛	9¼	5 1/16	5	4¼	4 1/16	3⅝	13	12 20
16 01	2¼	2⅝	2	2⅜	1⅝	1¼	2⅝	2⅜	1 15/16	1¾	1⅜	1⅜	3⅛	3	2⅜	2 25/32	1 27/32	2⅛	16 01
16 02	2½	3	2	2½	1¾	1⅞	3 1/16	2½	2½	2	1⅝	1⅞	3 13/16	3½	3	2⅝	2⅛	3⅛	16 02
16 05	2 13/16	3⅜	2¾	2 13/16	2¼	3½	3⅜	2 13/16	3 1/16	2¼	2⅜	3¾	4¼	3⅞	3 15/16	3	2⅞	5¼	16 05
16 10	3⅞	4⅛	3¾	3⅞	2⅝	7	4⅛	3 1/16	4	2¾	3	7⅛	4⅞	4⅝	3 15/16	3 11/16	3	11	16 10
16 20	3¾	4½	5	3¾	3¾	12¾	4⅝	3⅞	5⅜	3	3¼	13	5 1/16	5	4¼	4 1/16	3⅝	16¼	16 20
24 01	2½	3	2⅛	2½	1¾	1¾	3 1/16	2½	2½	2	1 1/16	1¾	3 13/16	3½	3	2⅝	2⅛	3¼	24 01
24 02	2½	3	2½	2½	2	2¼	3 1/16	2½	2⅝	2	1¾	2¼	3 13/16	3½	3	2⅝	2⅛	4¼	24 02
24 04	3⅛	3¾	3⅛	3⅛	2⅛	4¼	3⅞	3¼	3¼	2½	2 1/16	4⅜	4 1/16	4¼	3⅝	3⅝	2 1/16	7½	24 04
24 06	3 1/16	4⅛	3½	3 1/16	2⅜	6	4⅛	3 1/16	3¾	2¾	2 1/16	6¼	4⅞	4⅝	3 15/16	3 11/16	3	10	24 06
24 08	3 1/16	4⅛	4	3 1/16	2⅞	7½	4⅛	3 1/16	4¼	2¾	3⅛	7¾	4⅞	4⅝	3 15/16	3 11/16	3	13	24 08
24 12	3¾	4½	4⅝	3¾	3⅜	11	4⅝	3⅞	4⅞	3	3¾	11⅜	5 1/16	5	4¼	4 1/16	3⅝	15	24 12
24 20	4⅜	5¼	5¼	4⅜	3 1/16	16¼	5⅜	4½	5⅜	3½	3⅞	16⅞	6¼	5¾	4⅞	4⅜	3½	23	24 20
24 25	4⅜	5¼	5¼	4⅜	3⅞	18½	5⅜	4½	5¾	3½	4¼	19½	6¼	5¾	4⅞	4⅜	3½	26	24 25
24 50	■5½	6⅜	7⅛	5 5/16	5¼	42	6⅜	5 5/16	7¼	4¼	5½	43	7½	6⅞	5 13/16	5 5/16	4¼	53	24 50
24 100	■6 1/32	7⅛	7⅜	5 13/16	5¼	51							8¼	7⅛	6 17/32	5 13/16	4 25/32	65	24 100
36 00	2¼	2⅝	1⅞	2⅜	1⅝	1¼	2⅝	2⅜	2⅛	1¾	1⅜	1½	3 13/16	3½	3	2⅝	2⅛	3⅜	36 00
36 01	2½	3	2⅛	2½	1⅞	2	3¼	2½	2⅝	2	1 11/16	2	3 13/16	3½	3	2⅝	2⅛	3¼	36 01
36 02	2 13/16	3⅜	2¾	2 13/16	2¼	3½	3⅜	2 13/16	3 5/16	2¼	2⅛	3½	4¼	3⅞	3 5/16	3	2 7/16	5¼	36 02
36 04	3 1/16	4⅛	3⅝	3 1/16	2½	6¼	4⅛	3 1/16	4	2¾	2⅞	6½	4⅞	4⅝	3 15/16	3 11/16	3	10	36 04
36 06	3¾	4½	3¾	3¾	2⅝	8¼	4⅝	3⅞	4 1/16	3	2⅞	8½	5 1/16	5	4¼	4 1/16	3⅝	11	36 06
36 08	3¾	4½	4¾	3¾	3½	11¾	4⅝	3⅞	5 1/16	3	3⅞	12½	5 1/16	5	4¼	4 1/16	3⅝	15½	36 08
36 12	4⅜	5¼	5⅜	4⅜	3¾	17½	5⅜	4½	5¾	3½	4⅛	17⅞	6¼	5¾	4⅞	4⅜	3½	22½	36 12
36 20	4⅜	5¼	6⅜	4⅜	4⅞	23¾	5⅜	4½	6¾	3½	5¼	25	7⅜	6¾	5 13/16	5 5/16	4¼	29	36 20
36 30	■5½	6⅜	6¾	5 5/16	4⅞	34½	6⅜	5 5/16	6¾	4¼	4 1/16	36	7½	6⅞	5 13/16	5 5/16	4¼	42	36 30
36 50	■6 1/32	7⅛	6¾	5 13/16	5¼	48							8¼	7⅛	6 17/32	5 13/16	4 25/32	55	36 50
36 100	■7½	9	9¼	7⅝	7⅛	85													36 100
56 01	2½	3	2¾	2½	2¼	2½	3 1/16	2½	3	2	2	2¾	3 13/16	3½	3	2⅝	2⅛	4	56 01
56 02	3⅛	3¾	3¾	3⅛	2⅜	4½	3⅞	3¼	3¾	2½	2⅜	4¾	4⅞	4¼	3⅝	3⅝	2 1/16	6¾	56 02
56 05	3¾	4½	4¾	3¾	3½	11½	4⅝	3⅞	5⅛	3	4	12	5 1/16	5	4¼	4 1/16	3⅝	18	56 05
56 08	4⅜	5¼	5	4⅜	3 1/16	16¾	5⅜	4½	5⅝	3½	4	17	6¼	5¾	4⅞	4⅜	3½	24	56 08
56 12	■5½	6⅜	5½	5⅝	3⅞	24	6⅜	5⅝	5½	4¼	3½	25	7½	6⅞	5 13/16	5⅝	4¼	30	56 12
56 25	■5½	6⅜	7	5⅝	5⅛	33	6⅜	5 5/16	7	4¼	5 1/16	34½	7½	6⅞	5 13/16	5⅝	4¼	45	56 25
56 50	■6 1/32	7⅛	8	5 13/16	6	60							8¼	7 15/16	6 17/32	5 13/16	4 25/32	68	56 50
56 100	■7⅝	9	11½	7⅝	9⅝	146													56 100
64 00	2¼	2⅝	2 5/16	2⅜	2	1¾	2⅝	2⅜	2⅜	1¾	1½	1¾	3⅛	3	2⅜	2⅜	1 27/32	2½	64 00
64 01	2½	3	2 13/16	2½	2⅜	3	3 1/16	2½	3	2	2⅛	2¾	3 13/16	3½	3	2⅝	2⅛	4½	64 01
64 02	3⅛	3¾	3 1/16	3⅛	2⅜	4¾	3⅞	3¼	3⅛	2½	2	4⅛	4⅞	4¼	3⅝	3⅝	2 1/16	8	64 02
64 04	3¾	4½	4¼	3¾	3 1/16	10	4⅝	3⅞	4⅝	3	3½	10½	5 1/16	5	4¼	4 1/16	3⅝	14½	64 04
64 08	4⅜	5¼	5⅝	4⅜	3 15/16	18¾	5⅜	4½	6	3½	4⅜	18½	6¼	5¾	4⅞	4⅜	3½	24	64 08
64 12	■5½	6⅜	5¾	5⅝	3⅞	26	6⅜	5 5/16	5⅞	4¼	3⅞	28	7½	6⅞	5 13/16	5⅝	4¼	34	64 12
64 25	■6½	7⅛	7½	5 13/16	5⅞	52							8¼	7⅛	6 17/32	5 13/16	4 25/32	66	64 25
64 50	■7⅝	9	7⅝	7⅝	5¾	75							10 3/8	8	6¾	6¾	5½	105	64 50
68 01	2½	3	2 13/16	2½	2⅜	3¼	3 1/16	2½	3	2	2 1/16	2⅞	3 13/16	3½	3	2⅝	2⅛	4½	68 01
68 02	3⅛	3¾	3⅛	3⅛	2½	5	3⅞	3¼	3¾	2½	2½	5½	4 1/16	4¼	3⅝	3⅝	2 1/16	8	68 02
68 04	3¾	4½	4⅜	3¾	3⅛	10½	4⅝	3⅞	5⅛	3	3⅞	12½	5 1/16	5	4¼	4 1/16	3⅝	15	68 04
68 08	4⅜	5¼	5¾	4⅜	4	19½	5⅜	4½	6	3½	4⅜	19	6¼	5¾	4⅞	4⅜	3½	23	68 08
68 12	■5½	6⅜	5⅞	5⅝	4	26	6⅜	5 5/16	6	4¼	4	30	7½	6⅞	5 13/16	5⅝	4¼	35	68 12
80 01	2 13/16	3⅜	2¾	2 13/16	2¼	3½	3⅜	2 13/16	3 5/16	2¼	2 3/16	3¾	4¼	3⅞	3⅝	3	2 7/16	5½	80 01
80 02	3 1/16	4⅛	3⅝	3 1/16	2½	6½	4⅛	3 1/16	4 5/16	2¾	2⅝	7	4⅞	4⅝	3 15/16	3 11/16	3	11	80 02
80 05	4⅜	5¼	5⅛	4⅜	3½	15¼	5⅜	4½	5½	3½	3⅞	16½	6¼	5¾	4⅞	4⅜	3½	27	80 05
80 10	■5½	6⅜	5½	5⅝	4	28	6⅜	5 5/16	5¾	4¼	4	29	7½	6⅞	5 13/16	5⅝	4¼	35	80 10
80 25	■6½	7⅛	6⅜	5 13/16	4¼	39							8¼	7⅛	6 17/32	5 13/16	4 25/32	53	80 25
80 50	■7⅝	9	8½	7⅝	6⅝	89													80 50
120 01	3⅛	3¾	3⅜	3⅛	2½	5⅜	3⅞	3¼	3¾	2½	2½	5½	4⅞	4¼	3⅝	3⅝	2 1/16	8	120 01
120 02	3¾	4½	4	3¾	3⅛	9¾	4⅝	3⅞	4⅜	3	3⅛	9	5 1/16	5	4¼	4 1/16	3⅝	12	120 02
120 04	4⅜	5¼	4⅞	4⅜	3⅝	16⅜	5⅜	4½	5½	3½	3⅞	15	6¼	5¾	4⅞	4⅜	3½	25	120 04
120 08	■5½	6⅜	5¾	5⅝	4⅝	33	6⅜	5 5/16	6	4¼	4¼	34	7½	6⅞	5 13/16	5⅝	4¼	34	120 08
120 12	■5½	6⅜	7½	5⅝	5¾	43	6⅜	5 5/16	7¾	4¼	6	44	7½	6⅞	5 13/16	5⅝	4¼	47	120 12
180 00	3⅛	3¾	3	3⅛	2⅛	4¼	3⅞	3¼	3⅛	2½	2	4¼	4⅞	4¼	3⅝	3⅝	2 1/16	7⅛	180 00
180 01	3⅞	4⅛	3⅞	3⅞	2⅝	7	4⅛	3 1/16	4⅛	2¾	3	7¼	4⅞	4⅝	3 15/16	3 11/16	3	12	180 01
180 04	4⅜	5¼	6⅜	4⅜	4⅞	24	5⅜	4½	6¾	3½	5¼	25	7⅜	6¾	5 13/16	5⅝	4¼	29	180 04
180 08	■5½	6⅜	7½	5⅝	5¾	43	6⅜	5 5/16	7¾	4¼	6	44	7½	6⅞	5 13/16	5⅝	4¼	47	180 08
230 00	3⅛	3¾	3¼	3⅛	2⅜	5	3⅞	3¼	3⅜	2½	2⅜	5⅛	4⅞	4¼	3⅝	3⅝	2 1/16	7¾	230 00
230 01	3 1/16	4⅛	4⅜	3 1/16	3⅛	8¼	4⅛	3 1/16	4⅝	2¾	3½	8¾	4⅞	4⅝	3 15/16	3 11/16	3	12¾	230 01
230 02	4⅜	5¼	5½	4⅜	3¾	17	5⅜	4½	5 11/16	3½	4	17	6¼	5¾	4⅞	4⅜	3½	27	230 02
230 05	■5½	6⅜	5⅞	5⅝	4	29	6⅜	5 5/16	6⅛	4¼	4⅜	30	7½	6⅞	5 13/16	5⅝	4¼	35	230 05
230 08	■6½	7⅛	7⅝	5 13/16	5½	50							8¼	7⅜	6 17/32	5 13/16	4 25/32	68	230 08
300 00	3 1/16	4⅛	3⅜	3 1/16	2⅝	6	4⅛	3 1/16	3⅞	2¾	2¾	6¼	4⅞	4⅝	3 15/16	3 11/16	3	10½	300 00
300 01	3¾	4½	4⅝	3¾	3 1/16	11¼	4⅝	3⅞	4 13/16	3	3¾	11¼	5⅞	5	4¼	4 1/16	3⅝	14½	300 01
300 02	4⅜	5¼	6	4⅜	4⅝	20	5⅜	4½	6½	3½	5	21	7⅜	6⅞	5 13/16	5⅝	4¼	28	300 02
300 05	■5½	6⅜	6⅝	5 5/16	5	38	6⅜	5 5/16	6 7/8	4¼	5⅛	40	8¾	6⅞	5 13/16	5⅝	4¼	53	300 05

Add 3/16 to H W D for Style BE



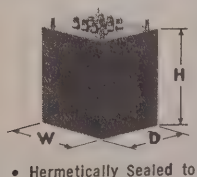
STYLE B:
- "Open Frame" Bracket Mounted
- Double Vacuum Varnish Impregnated

STYLE BE:
- Conforms to MIL-T-27B
- Epoxy Encapsulation added to Style B



OUTLINE DRAWINGS AVAILABLE

STYLE V:
- Fully Enclosed in Metal Shells
- Ease of "Wiring with Leads"
- Attractive Appearance
- Dbl Vacuum Varnish Impregnated



STYLE CM:
- Hermetically Sealed to MIL-T-27B
- Environment Proof
- Attractive Gray Finish
- Permanent Name Plate

CONTACT FACTORY FOR PRICES

QUALITY ENGINEERED
TODD SYSTEMS INC.
PRECISION BUILT
FAX: (914) 963-3506
50 ASH STREET, YONKERS, NY, U.S.A. 10701
(914) 963-3400

TODD ENGINEERED

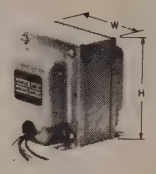
LINE ISOLATION . . . . . HIGH CURRENT CHOKES

LINE ISOLATION — OUTPUT 115 VOLTS — 50/60 HERTZ UL COMPONENTS

STRAIGHT ISOLATION — ELECTROSTATIC SHIELD CONNECTED TO CORE — TWO STYLES

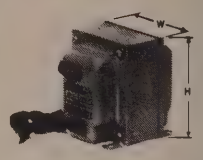
CATALOG NUMBER	WATTS (VA)	INPUT VOLTS	HIPOT TEST VOLTS	DIMENSIONS H	W	D	MW	MD	WGT.
LI-25	25	115	1500	3 1/8	2 5/8	2 1/2	2	1 1/2	1 5/8
LI-50	50	115	1500	3 1/2	2 7/8	3	2 1/4	1 7/8	3
LI-100	100	115	1500	3 1/2	2 7/8	4 1/2	2 1/4	3 1/2	5
LI-175	175	115	1500	4 5/8	3 7/8	3 7/8	3	2 3/4	7
LI-250	250	115	1500	4 5/8	3 7/8	4 3/8	3	3 1/4	10
LI-350	350	115	1500	4 5/8	3 7/8	5 1/4	3	4 1/8	14
LI-500	500	115	1500	6	4 3/8	5 1/8	3 7/16	3 3/8	17 1/2
LI-750	750	115	1500	6	4 3/8	6 3/8	3 7/16	4 1/2	24
LI-1000	1000	115	1500	6	4 3/8	7 1/4	3 7/16	5 1/2	30
LI-1500	1500	115	1500	6 1/2	5 1/2	7 1/2	4 1/4	5 3/8	39
LI-2000	2000	115	1500	6 1/2	5 1/2	9	4 1/4	6 7/8	48
LI-100-1	100	230	2000	3 1/2	2 7/8	3 1/2	2 1/4	2 1/4	4
LI-250-1	250	230	2000	4 5/8	3 7/8	4 3/8	3	3 1/4	10
LI-350-1	350	230	2000	4 5/8	3 7/8	5	3	4	12
LI-500-1	500	230	2000	6	4 3/8	5 1/8	3 7/16	3 3/8	17 1/2
LI-1000-1	1000	230	2000	6	4 3/8	7 1/4	3 7/16	5 1/2	30
LI-1500-1	1500	230	2000	6 1/2	5 1/2	7 1/2	4 1/4	5 3/8	42
LI-2000-1	2000	230	2000	6 1/2	5 1/2	9	4 1/4	6 7/8	58

STYLE L



LEAD WIRE TERMINALS

STYLE G



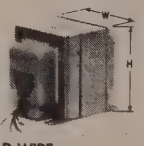
LINE CORD RECEPTACLE (W/GROUND)

ADJUSTABLE ISOLATION — ELECTROSTATIC SHIELD CONNECTED TO CORE

- PRIMARY TAPPED
- TWO STYLES

CATALOG NUMBER	WATTS (VA)	INPUT VOLTS	HIPOT TEST VOLTS	DIMENSIONS H	W	D	MW	MD	WGT.
LI-50-2	50	105/115/125	1500	3 1/2	2 7/8	3 7/8	2 1/4	2 1/2	3
LI-100-2	100	105/115/125	1500	3 1/2	2 7/8	4 3/8	2 1/4	3	4 1/2
LI-250-2	250	105/115/125	1500	4 5/8	3 7/8	5 1/8	3	4	11 1/2
LI-500-2	500	105/115/125	1500	6	4 3/8	5 7/8	3 7/16	4 1/8	19
LI-1000-2	1000	105/115/125	1500	6	4 3/8	8 1/8	3 7/16	6 3/8	34
LI-50-3	50	210/230/250	2000	3 1/2	2 7/8	3 7/8	2 1/4	2 1/2	3
LI-100-3	100	210/230/250	2000	3 1/2	2 7/8	4 3/8	2 1/4	3	4 1/2
LI-250-3	250	210/230/250	2000	4 5/8	3 7/8	5 1/8	3	4	11 1/2
LI-350-3	350	210/230/250	2000	4 5/8	3 7/8	5 3/4	3	4 3/4	13
LI-500-3	500	210/230/250	2000	6	4 3/8	5 7/8	3 7/16	4 1/8	19
LI-1000-3	1000	210/230/250	2000	6	4 3/8	8 1/8	3 7/16	6 3/8	34

STYLE L



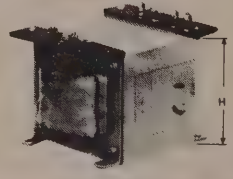
LEAD WIRE TERMINALS

STYLE G

LINE CORD RECEPTACLE (W/GROUND)

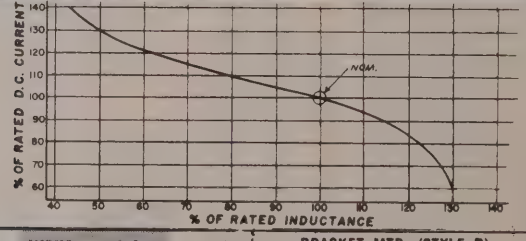
HIGH POWER ISOLATION — ELECTROSTATIC SHIELD CONNECTED TO CORE — BRACKET MOUNTED

CATALOG NUMBER	WATTS (VA)	INPUT VOLTS	HIPOT TEST VOLTS	DIMENSIONS H	W	D	MW	MD	WGT.
LI-2500-4	2500	115/230	2000	6 1/8	7 1/8	8 3/4	5 7/8	7	60
LI-3000-4	3000	115/230	2000	7 1/2	9	7 7/8	7 1/2	6 1/2	95
LI-4000-4	4000	115/230	2000	7 1/2	9	9	7 1/2	7 5/8	113
LI-5000-4	5000	115/230	2000	7 1/2	9	10 1/4	7 1/2	8 7/8	135
LI-6000-4	6000	115/230	2000	7 1/2	9	11 3/4	7 1/2	10 1/4	168
LI-2500-5	2500	230/460	2500	6 1/8	7 1/8	8 3/4	5 7/8	7	60
LI-3000-5	3000	230/460	2500	7 1/2	9	7 7/8	7 1/2	6 1/2	95
LI-4000-5	4000	230/460	2500	7 1/2	9	9	7 1/2	7 5/8	113
LI-5000-5	5000	230/460	2500	7 1/2	9	10 1/4	7 1/2	8 7/8	135
LI-6000-5	6000	230/460	2500	7 1/2	9	11 3/4	7 1/2	10 1/4	168



SCREW TERMINALS

HIGH CURRENT CHOKES — 50/500 HERTZ — DIMENSIONS REFER TO HIGH CURRENT XFMR SKETCHES



- **Matching styles complement high current transformers**
- **Wide variety of compatible current ratings**

INDUCTANCE VARIATION

Graph indicates typical variation of inductance (%) when used at D.C. currents (%) other than the rated values.

Chokes operated at D. C. currents higher than rated value must be run on an intermittent basis to avoid overheating.

CATALOG NUMBER	INDUCTANCE (mh)	D.C. CURRENT (AMPS)	RESISTANCE (OHMS)	• BRACKET MTD. (STYLE B) • ENCAPSULATED (STYLE BE) H	W	D	MW	MD	WGT.	• FULLY MTD. SHELLS (STYLE V) H	W	D	MW	MD	WGT.	• HERMETICALLY SEALED MIL-T (STYLE CM) H	W	D	MW	MD	WGT.
CH-00	200	.5	3.00	2 1/4	2 5/8	2	2	1 3/4	1 1/2	2 5/8	2 1/4	2 1/4	1 3/4	1 5/8	1 3/4	3 1/8	3	2 3/16	2 5/16	1 7/8	2 1/8
CH-01	100	1	1.50	2 1/2	2	2 1/8	2 1/2	2	2 1/4	3 1/8	2 1/2	2 5/8	2	1 3/4	2 1/4	3 13/16	3 1/2	3	2 5/8	2 1/8	3 1/4
CH-02	80	2	1.30	2 1/2	3	2 1/2	2 1/2	2	2 1/2	3 1/8	2 1/2	2 1/2	2	1 3/4	2 1/2	3 13/16	3 1/2	3	2 5/8	2 1/8	3 1/2
CH-04	60	4	.60	3 1/8	3 3/4	3 1/4	3 1/8	2 1/2	5 1/4	3 7/8	3 5/16	3 3/4	2 1/2	2 1/4	6	4 5/16	4 1/4	3 5/8	3 5/16	2 11/16	7 1/4
CH-05	50	5	.50	3 1/8	3 3/4	3 3/8	3 1/8	2 3/4	5 3/4	3 7/8	3 5/16	4	2 1/2	3	6 1/2	4 7/16	4 1/4	3 5/8	3 5/16	2 11/16	8
CH-06	40	6	.35	3 1/8	3 3/4	3 3/8	3 1/8	2 3/4	6	3 7/8	3 5/16	4	2 1/2	3	6 1/2	4 7/16	4 1/4	3 5/8	3 5/16	2 11/16	8 5/8
CH-08	30	8	.25	3 1/2	4 1/8	3 7/8	3 3/8	3	8	4 1/8	3 1/2	4 3/8	2 3/4	3 3/8	8 1/2	4 7/8	4 5/8	4	3 11/16	3	11 1/8
CH-12	20	12	.12	3 3/4	4 1/2	4 7/8	3 3/8	3 1/2	15 1/2	4 5/8	3 7/8	4 7/8	3	3 3/4	14	5 7/16	5	4 1/4	4 1/16	3 5/16	20
CH-16	15	16	.08	4 7/16	5 1/4	4 5/8	4 3/8	3 3/8	14 1/4	5 7/16	4 1/2	5 1/4	3 1/2	3 3/4	15	6 1/4	5 3/4	4 7/8	4 3/8	3 1/2	22 1/2
CH-20	10	20	.05	4 7/16	5 1/4	4 1/2	4 3/8	3 1/2	15 1/2	5 7/16	4 1/2	5 3/8	3 1/2	3 7/8	16	6 1/4	5 3/4	4 7/8	4 3/8	3 1/2	24
CH-25	6.5	25	.028	4 7/16	5 1/4	5	4 3/8	4	18 1/2	5 7/16	4 1/2	5 7/8	3 1/2	4 3/8	19 1/2	6 1/4	5 3/4	4 7/8	4 3/8	3 1/2	26 1/2
CH-30	5.5	30	.022	5 3/8	6 3/8	4 1/2	5 1/4	3 1/4	21	6 1/2	5 7/16	5 1/2	4 1/4	3 1/4	24	7 1/2	6 7/8	5 13/16	5 5/16	4 1/4	29 1/2
CH-40	4.0	40	.014	5 3/8	6 3/8	4 5/8	5 1/4	3 1/2	23	6 1/2	5 7/16	5 3/4	4 1/4	3 1/2	25	7 1/2	6 7/8	5 13/16	5 5/16	4 1/4	32 1/2
CH-50	3.0	50	.010	5 3/8	6 3/8	5 1/2	5 1/4	4 1/8	29	6 1/2	5 7/16	6 3/8	4 1/2	4 1/8	30	7 1/2	6 7/8	5 13/16	5 5/16	4 1/4	37
CH-100	.8	100	.003	5 3/8	6 3/8	5 3/4	5 1/4	4 5/8	35	6 1/2	5 7/16	6 7/8	4 1/4	4 5/8	36	7 1/2	6 7/8	5 13/16	5 5/16	4 1/4	45
CH-200	.35	200	.001	6 1/8	7 1/8	6 3/4	5 7/8	5 1/2	43												

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TODD ENGINEERED

STEPDOWN AUTOTRANSFORMERS

CONVERT DOMESTIC APPLIANCES FOR USE ON FOREIGN VOLTAGES

50/60 HERTZ—*UL* COMPONENTS

PORTABLE MODEL — 220/240 INPUT 110/120 OUTPUT

CATALOG NUMBER	WATTS (VA)	WEIGHT LBS.	DIMENSIONS H	W	D
SD-35	20	.7	1 1/2	1 3/4	2 3/4
SD-36	40	1.3	1 5/8	2	3 3/4
SD-37	60	1.4	1 5/8	2	3 3/4
SD-41	80	1.5	1 5/8	2	3 3/4

LINE CORD • RECEPTACLE

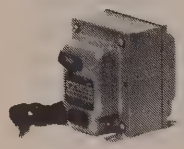
CHANNEL MOUNTED MODEL — 220/240 INPUT 110/120 OUTPUT

CATALOG NUMBER	WATTS (VA)	WEIGHT LBS.	DIMENSIONS H	W	D
SD-24	50	1.6	2 1/4	2 3/4	2 1/4
SD-21	65	1.6	2 1/4	2 3/4	2 1/4
SD-25	80	1.9	2 1/4	2 3/4	2 3/8
SD-23	100	1.9	2 1/4	2 3/4	2 3/8
SD-26	125	2.4	2 5/8	3 1/16	2 1/2
SD-27	150	2.4	2 5/8	3 1/16	2 1/2

LINE CORD • PIGTAIL

HEAVY DUTY MODEL — 220/240 INPUT 110/120 OUTPUT

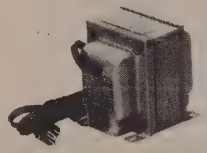
CATALOG NUMBER	WATTS (VA)	WEIGHT LBS.	DIMENSIONS H	W	D
SD-16	100	2.5	3 1/8	2 5/8	3 1/4
SD-17	150	3.3	3 1/8	2 5/8	3 5/8
SD-38	200	4	3 1/8	2 5/8	4
SD-12	250	4.5	3 1/8	2 5/8	4 3/8
SD-43	300	4.6	3 1/8	2 5/8	4 1/2
SD-18	350	6.5	4 5/8	3 7/8	3 5/8
SD-11	500	9.7	4 5/8	3 7/8	4 1/4
SD-19	750	12	4 5/8	3 7/8	5
SD-13	1000	13.8	4 5/8	3 7/8	5 1/4
SD-14	1500	19	4 5/8	3 7/8	6 5/8



TWO PRONG LINE CORD/RECEPTACLE

HEAVY DUTY GROUNDED MODEL — 220/240 INPUT 110/120 OUTPUT

CATALOG NUMBER	WATTS (VA)	WEIGHT LBS.	DIMENSIONS H	W	D
SD-16G	100	2.5	3 1/8	2 5/8	3 3/8
SD-17G	150	3.3	3 1/8	2 5/8	3 3/4
SD-38G	200	3.8	3 1/8	2 5/8	4 3/16
SD-12G	250	4.5	3 1/8	2 5/8	4 9/16
SD-43G	300	4.5	3 1/8	2 5/8	4 5/8
SD-18G	350	6.7	4 5/8	3 7/8	4 1/8
SD-11G	500	8.7	4 5/8	3 7/8	4 3/4
SD-19G	750	12.4	4 5/8	3 7/8	5 5/8
SD-13G	1000	13.7	4 5/8	3 7/8	6
SD-14G	1500	18.2	4 5/8	3 7/8	7 1/16
SD-20G	2000	24.2	5 15/16	4 3/8	6 7/16
SD-39G	2500	36	6 3/8	5 5/16	7 5/8



3 WIRE (GROUNDING) LINE CORD/RECEPTACLE

INDUSTRIAL MODEL — 220/240 INPUT 110/120 OUTPUT

CATALOG NUMBER	WATTS (VA)	WEIGHT LBS.	DIMENSIONS H	W	D
SD-11JB	500	9.0	4	4 1/2	5 7/8
SD-19JB	750	12.8	4	4 1/2	6 3/4
SD-13JB	1000	14.3	4	4 1/2	7 3/4
SD-14JB	1500	18.5	4	4 1/2	9
SD-20JB	2000	25.	4 9/16	5 3/4	8 5/8
SD-39JB	2500	36.5	5 5/8	6 3/8	9 1/2
SD-28JB	3000	44.5	6 1/4	7	10
SD-29JB	4000	61.	6 1/4	7	12
SD-22JB	5000	54.	6 1/4	7	11
SD-30JB	6000	66.	6 1/4	7	12 1/4

JUNCTION BOX LEAD TERMINALS

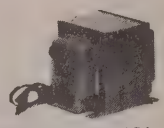
3 TAP REFRIGERATION — 188/210 210/234 234/258 → 105V-50Hz (115V - 60Hz. INPUT V. +10%)

CATALOG NUMBER	WATTS (VA)	WEIGHT LBS.	DIMENSIONS H	W	D
SD-31G	350	7.7	4 5/8	3 7/8	4 7/8
SD-32G	550	10.5	4 5/8	3 7/8	5 3/8
SD-33G	750	12.7	4 5/8	3 7/8	6
SD-42G	850	14.7	4 5/8	3 7/8	6 3/8
SD-34G	1000	17	4 5/8	3 7/8	7
SD-40G	1500	24.5	5 1/2	4 1/2	7 7/8
SD-44G	2000	24.7	5 1/2	4 1/2	7 7/8

CATALOG NUMBER	WATTS (VA)	WEIGHT LBS.	DIMENSIONS H	W	D
SD-31L	350	7.5	4 5/8	3 7/8	3 7/8
SD-32L	550	9.9	4 5/8	3 7/8	4 3/8
SD-33L	750	12.2	4 5/8	3 7/8	5
SD-42L	850	14	4 5/8	3 7/8	5 1/2
SD-34L	1000	16.2	4 5/8	3 7/8	6
SD-40L	1500	24	5 1/2	4 1/2	6 7/8
SD-44L	2000	24	5 1/2	4 1/2	6 7/8

STYLE G

TAP SWITCH



3 WIRE (GROUNDING) LINE CORD/RECEPTACLE

STYLE L

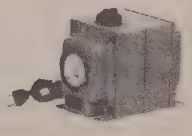
JUNCTION BOX

LEAD WIRE TERMINALS

MULTI-TAPPED VOLTAGE REGULATOR — METER • SWITCH

TYPE	PRIMARY VOLTS (SELECTOR SWITCH TAPS)								OUTPUT VOLTS
11	84	92	100	108	115	122	130	138	110/120
12	84	92	100	108	115	122	130	138	220/240
21	170	185	200	215	230	245	260	275	110/120
22	170	185	200	215	230	245	260	275	220/240

CATALOG NUMBER	TYPE	WATTS (VA)	WGT. LBS.	DIMENSIONS H	W	D
MVR-17	11 or 22	150	4.7	4 5/8	3 7/8	4 7/8
MVR-18	11 or 22	350	6.5	4 5/8	3 7/8	5 1/4
MVR-11	11 or 22	500	8.2	4 5/8	3 7/8	5 7/8
MVR-19	11 or 22	750	10	4 5/8	3 7/8	6 3/8
MVR-13	11 or 22	1000	13.7	4 5/8	3 7/8	7
MVR-14	11 or 22	1500	15.5	6	4 3/8	6 3/4
MVR-20	11 or 22	2000	20.5	6	4 3/8	7 3/8
MVR-17	12 or 21	150	5.9	4 5/8	3 7/8	5 1/2
MVR-18	12 or 21	350	7.9	4 5/8	3 7/8	5 3/4
MVR-11	12 or 21	500	11.2	4 5/8	3 7/8	6 5/8
MVR-19	12 or 21	750	15.5	4 5/8	3 7/8	7 1/4
MVR-13	12 or 21	1000	19	6	4 3/8	7 1/4
MVR-14	12 or 21	1500	25	6	4 3/8	8 3/8
MVR-20	12 or 21	2000	33.5	6	4 3/8	9 3/4



3 WIRE (GROUNDING) LINE CORD/RECEPTACLE

PANEL MOUNTED VOLTAGE REGULATOR — METER • SWITCH JUNCTION BOX

TYPE	PRIMARY VOLTS (SELECTOR SWITCH TAPS)								OUTPUT VOLTS
11	84	92	100	108	115	122	130	138	110/120
12	84	92	100	108	115	122	130	138	220/240
21	170	185	200	215	230	245	260	275	110/120
22	170	185	200	215	230	245	260	275	220/240

CATALOG NUMBER	TYPE	WATTS (VA)	WGT. LBS.	DIMENSIONS H	W	D
PVR-20	11 or 22	2000	27.	5 3/4	6 3/8	10 5/8
PVR-28	11 or 22	3000	34.5	5 3/4	6 3/8	11 1/2
PVR-29	11 or 22	4000	42.5	5 3/4	6 3/8	12 1/4
PVR-22	11 or 22	5000	48.5	5 3/4	6 3/8	13
PVR-30	11 or 22	6000	50.5	5 3/4	6 3/8	13 3/4
PVR-20	12 or 21	2000	57.5	6 1/2	7	13
PVR-28	12 or 21	3000	63	6 1/2	7	14 1/8
PVR-29	12 or 21	4000	67.5	6 1/2	7	14 1/2
PVR-22	12 or 21	5000	74.5	6 1/2	7	15
PVR-30	12 or 21	6000	78.5	6 1/2	7	15 1/2

- JUNCTION BOX
- LEAD TERMINALS

CONTACT FACTORY FOR PRICES

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Toroid®
SUPERIOR TRANSFORMERS

TOROIDAL POWER TRANSFORMERS
GENERAL INFORMATION

FEATURES OF TOROIDAL DESIGN

Compared to the conventional E/I laminated transformer, our toroidal transformers offer you many important advantages.

- Very low magnetic strayfield emission levels
- Quiet operation -- very low hum
- Half the size and weight
- High efficiency
- Easy assembly

For detailed information on the superior performance capabilities of our toroidals, please call or FAX the factory.

COMPANY FACTS

Our company is dedicated to the design and production of high performance toroidal power transformers and chokes. Engineers in a broad range of industries have discovered the performance advantages of our toroidals. Our transformers are used in medical electronics, test and measurement systems, industrial controls, data communications, motor controls, light fixtures, audio systems as well as in many other areas.

Since our company was founded in Maryland in late 1982, we have built a solid reputation on superior quality in design and workmanship. We have maintained our position as industry leader as a result of our continuous effort to provide total customer support from design to delivery.

This brochure contains information about our products, design capabilities and the technical support you can expect from us. Application Notes, Transformer Design Guide, and Product Datasheets are available upon request. If you would like to receive these product publications or have any questions, please use our toll-free number (800) 274-5793 or FAX number (410) 860-0302.

PRODUCT PROGRAM

CUSTOM DESIGN

Custom made transformers are designed from 20VA to 12,000VA with UL and CSA safety standard certifications, or in compliance with international safety standards for industrial or medical applications. A separate chart on these pages lists typical dimensions of various power ratings using our standard core sizes. Other core sizes, either taller and narrower or flatter and wider are available.

STANDARD OFF-THE-SHELF

Standard design rectifier transformers UL and CSA recognized are available for both 117V/60Hz and 115/230V, 50-60Hz operation from 20VA to 1,000VA. See separate page for available power ratings and voltages. A line of multi-voltage rectifier transformers for 5V and +/- 15V regulated DC is also available from stock, as shown elsewhere in these pages.

Low Profile PC Mount Transformers

Our new Mini-Blue Series of UL recognized standard transformers for PC Mount is listed on the last page.

Medical Isolation Transformers

A new line of standard isolation transformers for commercial and medical electronics applications are also listed on a separate page.

OTHER PRODUCTS

- 400 HZ TRANSFORMERS
- 3-PHASE TRANSFORMERS
- AUTO TRANSFORMERS
- INVERTER TRANSFORMERS FOR 50 OR 60HZ
- CURRENT TRANSFORMERS FOR CONTROL APPLICATIONS
- FILTER CHOKES OF TOROIDAL DESIGN FOR 50/60HZ

QUALITY

Our Quality System has been established to comply with requirements of MIL-1-45208A and ISO 9000 Quality Standards. We have a UL family recognition to UL1411 (industrial) and UL544 (medical) for both class A (105C) and class B (130) insulation systems.

Final inspection is performed on 100% of all specified electrical and mechanical data. Our standard electrical tests include *no-load currents* and *no-load voltages* and 4000V Hi-pot test between primary and secondaries. Winding resistances are verified on every production lot. Visual inspection includes physical dimensions and appearances. Other tests as specified by customer are optional, e.g., level of magnetic strayfields, mechanical hum, leakage current, leakage capacitance, etc.

FOREIGN SAFETY STANDARDS

In addition to offering UL recognized transformers, we also have a CSA family recognition to CSA C22.2 No. 66.1988. When required we will construct our transformers to comply with other foreign safety standards, such as EN 60742, IEC 742, VDE 0550, etc.

MEDICAL SAFETY STANDARDS

Our UL family recognition for custom designed transformers also includes UL544 safety standard for medical equipment. For equipment exported to Canadian and the overseas markets, our transformers can be built to meet their equivalent standards (CSA C22.2 No. 125, VDE 0551, IEC 601.1, etc.).

INSULATION SYSTEMS

To meet the stringent safety requirements for transformers, we use only UL recognized material. Toroid transformers are constructed with reinforced insulation, which allows the transformer to be used without grounding. All our transformers are 100% hi-pot tested at 4000V rms for 2 seconds and have a minimum creep distance of 8 mm.

36 MONTH PRODUCT WARRANTY

TOROID CORPORATION OF MARYLAND
SUPERIOR TRANSFORMERS — SUPERIOR SUPPORT FROM DESIGN TO DELIVERY
ENGINEERING HOT LINE NUMBER: 800-274-5793
2020 NORTHWOOD DR., SALISBURY, MD 21801-9627
(410) 860-0300 • FAX (410) 860-0302

The Industry Leader in Power Toroids

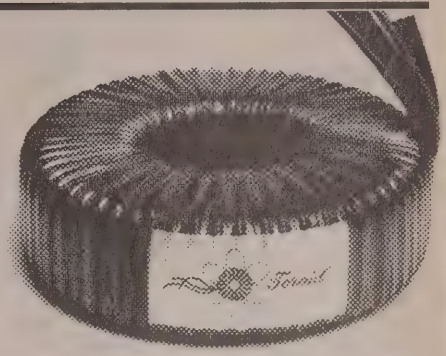
TOROIDAL POWER TRANSFORMERS

DESIGN GUIDE AND APPLICATION NOTES

Toroid®
SUPERIOR TRANSFORMERS

OUR CUSTOM DESIGN CAPABILITIES

Our experienced design group uses sophisticated software programs to calculate the optimal solution of your transformer or choke requirements. Our programs also allow for highly accurate calculations based on your DC data after rectification. Therefore, our prototypes will meet your specifications the first time around. No time is wasted on trial and error. With over 20 years in the toroidal power business, we are the experts. And you can trust us with your most complex transformer designs, up to 10,000VA.

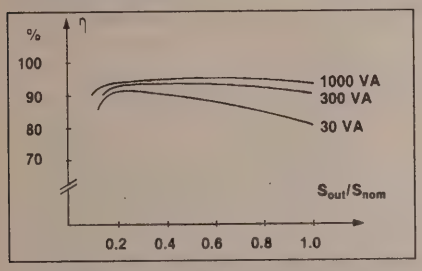


DESIGN DATA AND APPLICATION NOTES

A custom designed transformer is usually based on a standard core with appropriate power rating. Data for our standard cores are shown on the following page. Special cores can be manufactured to meet specific requirements, e.g. extremely low profile designs.

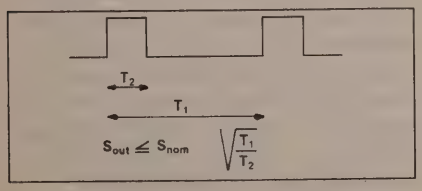
EFFICIENCY

The figure shows typical curves for efficiency as a function of output power in relation to nominal output power for different core sizes.



DUTY CYCLE

A smaller transformer can be designed if the load is not constant and the duty cycle is much shorter than the transformer's thermal time constant (which has a magnitude of hours). Note that the voltage drop increases linearly with the instantaneous current.

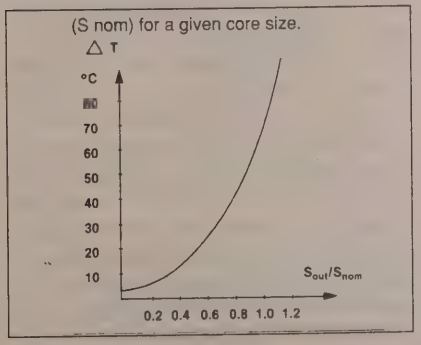


TEMPERATURE CONSIDERATIONS

Operating temperature is an important safety factor. Our transformers, built for Class A (105°C) operation, are normally calculated for a temperature rise of 60°-65°C. Actual increase will depend on how and where the transformer is mounted and how well it is cooled. When higher temperature ratings are needed, we offer UL recognized (UL1411 and UL544) transformers to class B (130°C). Transformers rated for class H (180°C) are also available.

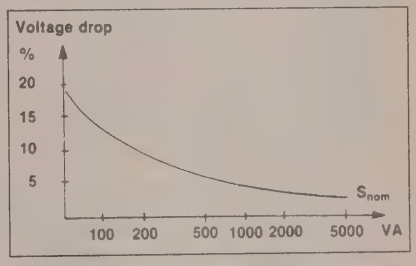
Using a larger core size will reduce the temperature rise due to the small core losses (in comparison with a laminated E/I core). The temperature rise will drop drastically when the output power is reduced. At half the load the temperature rise will only be about 25% of the rise at full load.

The figure shows how temperature rise varies with the actual output power (S out) in relation to nominal power (S nom) for a given core size.



VOLTAGE DROP

This chart shows voltage drop at full load for standard cores at 50/60Hz. The voltage drop is slightly higher for a 60Hz transformer. A design with an oversized core will reduce voltage drop and temperature rise.



ULTRA-LOW MAGNETIC STRAYFIELD EMISSION DESIGN

Our standard design considerably reduces the strayfields in comparison with a laminated transformer. For sensitive applications, our optional Ultra-low Strayfield Design, achieved through a special process, further reduces the emission. In applications such as high resolution CRT displays, a magnetic shield around the circumference of the transformer can be added to achieve even lower strayfield levels.

36 MONTH PRODUCT WARRANTY

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TOROIDAL POWER TRANSFORMERS

DESIGN GUIDE AND APPLICATION NOTES

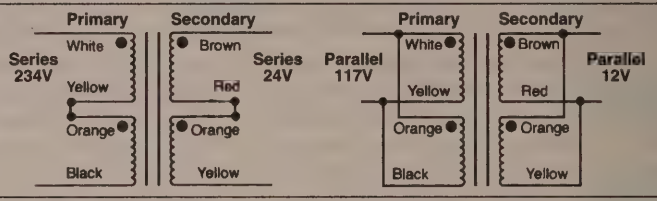
A GUIDE

This chart shows size, weight, no-load losses of our custom made transformers from 20VA-10,000VA using our standard core sizes. Other configurations available to meet your needs.

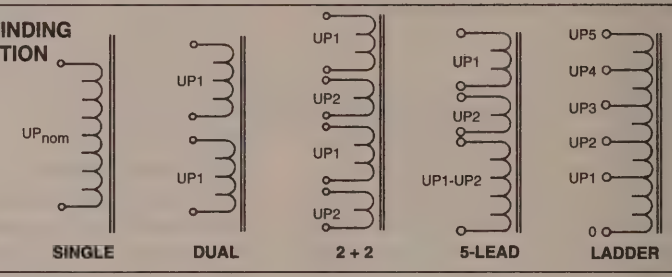
60 Hz operation		50/60 Hz operation		Approx Size & Weight of finished transformer	
Max rated power (VA)	No-load loss (W)	Max rated power (VA)	No-load loss (W)	OD × H (inches)	Weight (lbs)
26	.26	20	.20	2.4 × 1.2	.7
45	.32	35	.24	2.8 × 1.3	1.1
65	.48	50	.36	2.9 × 1.8	1.4
70	.54	57	.40	3.2 × 1.4	1.5
100	.79	85	.59	3.3 × 1.9	2.0
105	.63	87	.47	3.7 × 1.4	2.2
120	.77	100	.57	3.9 × 1.5	2.2
150	.94	120	.70	3.7 × 1.8	2.9
180	1.14	150	.85	3.9 × 1.9	3.0
185	1.21	150	.90	4.5 × 1.6	3.3
200	1.26	165	.94	3.8 × 2.3	3.3
240	1.52	190	1.13	3.9 × 2.3	3.8
265	1.81	225	1.35	4.5 × 1.9	4.4
360	2.41	300	1.80	4.5 × 2.3	5.3
440	2.60	360	1.94	5.5 × 2.0	5.7
600	3.06	500	2.28	5.5 × 2.4	8.2
720	3.82	600	2.85	5.5 × 2.8	9.7
1,000	4.70	800	3.51	6.3 × 2.4	12.1
1,200	5.90	1,000	4.40	6.3 × 2.9	15.0
1,450	7.10	1,200	5.30	6.3 × 3.3	17.4
1,700	7.20	1,400	5.40	7.9 × 2.6	20.0
2,000	9.00	1,700	6.70	7.9 × 3.0	24.0
2,400	10.80	2,000	8.10	7.9 × 3.3	27.8
2,750	10.30	2,300	7.70	8.7 × 3.2	29.7
3,250	12.40	2,700	9.30	8.7 × 3.5	35.2
3,500	10.8	3,000	10.8	9.2 × 4.7	41.2
4,100	14.3	3,600	14.3	10.3 × 4.7	44.6
5,000	15.4	4,500	15.4	11.6 × 4.7	52.3
6,200	18.0	5,400	18.0	11.6 × 5.0	65.5
7,000	21.2	6,000	21.2	13.0 × 4.8	72.0
7,800	24.7	6,600	24.7	13.2 × 5.1	79.5
8,500	22.0	7,600	22.0	13.9 × 5.0	82.0
10,000	25.7	8,500	25.7	14 × 5.5	95.5

Power rating (VA) is determined by secondary RMS data. Physical size may vary from above data depending on number of primary and secondary windings.

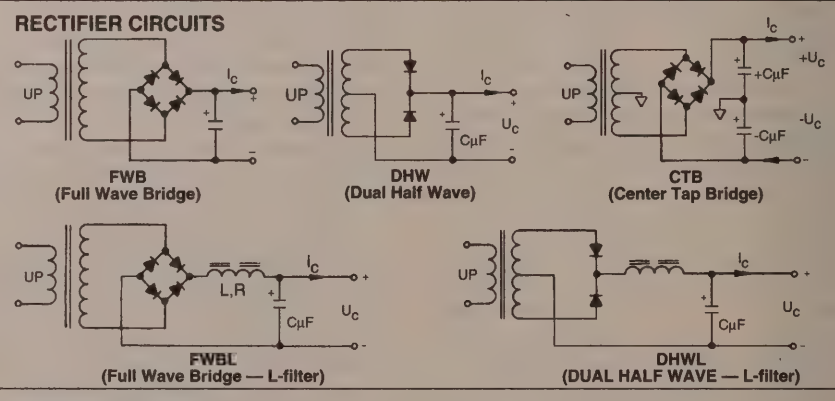
TERMINATION OF DUAL PRIMARIES AND SECONDARIES IN SERIES AND PARALLEL



PRIMARY WINDING CONFIGURATION



RECTIFIER CIRCUITS



STATIC SHIELDING

Static shielding may be required to minimize capacitive coupling between primary and secondary winding when the transformer is used in an extremely noisy environment. Since the shield adds layers, a larger core size may be necessary to provide adequate inside diameter for the shuttle of the winding machine.

IN-RUSH CURRENTS

A consequence of the superior magnetic properties of a toroidal transformer is that the transformer "remembers" what polarity the primary voltage had immediately before the power was last shut off. Whenever the voltage has the same polarity when the transformer next is turned on, the core will saturate for part of a half-cycle, and a high in-rush current will flow in the primary of the transformer. This in-rush current is larger than the in-rush current in a conventional transformer, but it is of very short duration, so it will not affect slow-blow fuses or magnetic overload protectors with thermal delay characteristic. (Some delayed magnetic overload protectors act instantly if the current exceeds a certain value. These cannot be used with large toroidal transformers unless a current limiting resistor is used as described below.)

For very large transformers (1,500VA and up), it is common to use a small current-limiting primary resistor to reduce the magnitude of the in-rush current, and a delayed by-pass relay to short out the resistor after 30-200 milliseconds. This method eliminates external voltage dips caused by the in-rush current, but slow-blow fuses or delayed magnetic overload protectors must still be used, as is the case for all types of transformers.

36 MONTH PRODUCT WARRANTY

TOROID CORPORATION OF MARYLAND

SUPERIOR TRANSFORMERS — SUPERIOR SUPPORT FROM DESIGN TO DELIVERY

ENGINEERING HOT LINE NUMBER: 800-274-5793
2020 NORTHWOOD DR., SALISBURY, MD 21801-7805
(410) 860-0300 • FAX (410) 860-0302

The Industry Leader in Power Toroids

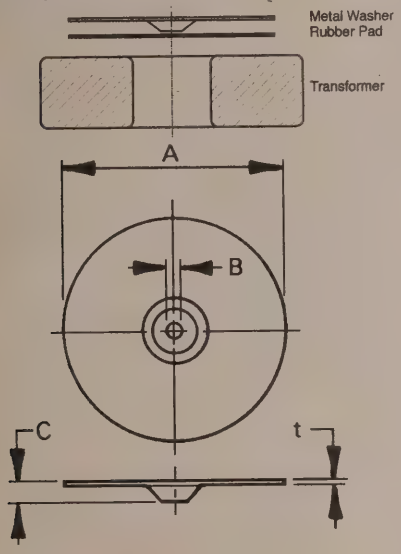
TOROIDAL POWER TRANSFORMERS

MOUNTING METHODS AND HARDWARE

Toroid®
SUPERIOR TRANSFORMERS

MOUNTING WASHER AND RUBBER PADS

The most economical way of mounting the transformer horizontally is using a metal washer and rubber pads. This mounting method is quite adequate for transformers up to 15 lbs (7 kg), provided the transformer is not installed in a product subject to rough handling.



P/N	A	B	C	t
W050	2.0	0.17	0.18	0.04
W060	2.4	0.20	0.22	0.05
W070	2.8	0.24	0.26	0.05
W090	3.5	0.25	0.28	0.06
W110	4.4	0.32	0.33	0.08
W145	5.7	0.32	0.37	0.08

APPLICATION NOTES

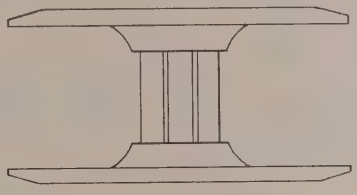
Our engineering staff has written three application notes:

- **Bulletin #1** -- Form Factor and Size of Rectifier Transformers
- **Bulletin #2** -- International Supply Voltages and Primary Windings for Power Transformers
- **How to Specify Transformers** -- A design guide for using toroidal transformers.

We will be glad to send you any of these bulletins free of charge.

POLY-MOUNT

Our Poly-Mount is an option to the standard metal washer and rubber pads for transformers with power ratings up to 600VA. The Poly-Mount is shipped as an integral part of the transformer and will reduce the mounting time of the transformer. The Poly-Mount consists of two parts made of UL recognized Polyamide with high temperature ratings. A screw through the center hole holds the assembly to the chassis. The Poly-Mount adds slightly to the total height of the transformer.

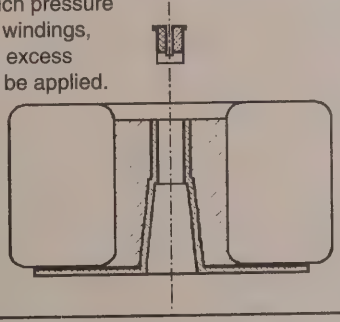


THE EURO-MOUNT

The Euro-Mount is a UL listed plastic insert with a tapered hollow stem in the center. A threaded insert is located at the top of the stem. The cavity surrounding the stem inside the transformer is filled with epoxy. Up to 300 VA the Euro-Mount comes with a single insert. For larger sizes two stems each with an insert are used.

The Euro-Mount is an extremely secure mounting method and guarantees a totally flat bottom of the transformer.

The Euro-Mount eliminates the risk of too much pressure on the windings, should excess torque be applied.



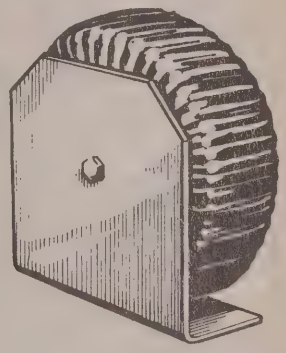
***CAUTION** — It is important that our transformer is mounted in such a way that the mounting screw and the metal chassis will not form a closed loop and thereby a shorted turn on the transformer.*

POTTED CENTER

For large size transformers, 15 lbs or more, or when the washer may cause height problems, we recommend Epoxy potting with a center hole. The top of the potting will be recessed to accommodate the screw head. A flat bottom of the potting is available upon request.

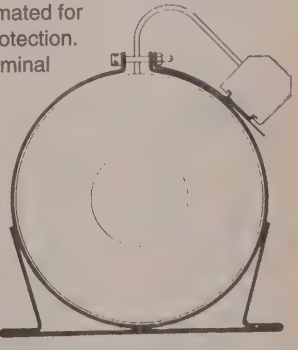
THE L-BRACKET

This L-shaped steel bracket is an economical solution for vertical mounting. A metal washer and two rubber pads are furnished with each L-Bracket. The L-Bracket is available for transformers up to 700VA. Larger sizes are custom designed.



THE OMEGA BRACKET

The Omega bracket is highly recommended when a rugged installation is required — or for large size transformers. The Omega bracket is available for transformers up to 4500VA. Like the L-Mount, the Omega is made of heavy gauge steel, yellow-chromated for corrosion protection. UL listed terminal blocks are optional.



LEADS AND CONNECTORS

Eight-inch flying self-leads are standard. Other lead lengths, multi-stranded leads, or connectors are available options.

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SUPERIOR TRANSFORMERS — SUPERIOR SUPPORT FROM DESIGN TO DELIVERY

The Industry Leader in Power Toroids

TOROIDAL POWER TRANSFORMERS

STANDARD DESIGNS

Toroid®
SUPERIOR TRANSFORMERS

RECTIFIER TRANSFORMERS FOR 117V/60Hz, UL/CSA RECOGNIZED

TCM Part No.	Power (VA)	Secondary Data Volts (V)	Amps (A)	No-load Voltage (V)	Typical DC Data when transformer supplies bridge rectifier with large filter capacitor: Secondaries in Series DC Volt (V)	DC Current (A)	Secondaries in Parallel DC Volt (V)	DC Current (A)	Dimensions (Inches) OD x H	Weight (Lbs.)	TCM Part No.	Prices FOB Factory Salisbury, MD 1-4 Pcs.	5-24 Pcs.
602.152	26	2 x 15	.87	2 x 18.6	36.0 or 2 x 18.0	.55	17.0	1.20	2.4 x 1.2	0.7	602.152	$32.60	$30.00
602.182		2 x 18	.71	2 x 22.5	44.0 or 2 x 22.0	.45	21.0	.90	2.4 x 1.2	0.7	602.182	32.60	30.00
604.122	45	2 x 12	1.77	2 x 14.5	29.0 or 2 x 14.5	1.08	13.5	2.16	2.8 x 1.3	1.1	604.122	34.50	31.70
604.152		2 x 15	1.40	2 x 18.1	36.6 or 2 x 18.3	.86	17.3	1.72	2.8 x 1.3	1.1	604.152	34.50	31.70
604.182		2 x 18	1.24	2 x 21.6	44.0 or 2 x 22.0	.76	21.0	1.52	2.8 x 1 3	1.1	604.182	34.50	31.70
607.152	70	2 x 15	2.30	2 x 17.3	37.0 or 2 x 18.5	1.34	17.8	2.68	3.2 x 1.4	1.5	607.152	36.20	33.30
607.182		2 x 18	1.90	2 x 20.8	44.8 or 2 x 22.4	1.10	21.4	2.20	3.2 x 1.4	1.5	607.182	36.20	33.30
607.242		2 x 24	1.44	2 x 27.6	60.0 or 2 x 30.0	.84	29.0	1.68	3.2 x 1.4	1.5	607.122	36.20	33.30
612.082	120	2 x 8.5	7.06	2 x 9.5	20.0 or 2 x 10.0	3.90	9.0	7.80	3.9 x 1.5	2.2	612.082	41.40	38.10
612.122		2 x 12	5.00	2 x 13.3	29.4 or 2 x 14.7	2.70	13.7	5.40	3.9 x 1.5	2.2	612.122	41.40	38.10
612.152		2 x 15	4.00	2 x 16.6	37.6 or 2 x 18.8	2.20	17.8	4.40	3.9 x 1.5	2.2	612.152	41.40	38.10
617.152	180	2 x 15	5.90	2 x 16.4	38.0 or 2 x 19.0	3.10	18.0	6.20	3.9 x 1.9	3.0	617.152	48.30	44.40
617.182		2 x 18	5.00	2 x 19.5	45.8 or 2 x 27.9	2.60	21.9	5.20	3.9 x 1.9	3.0	617.182	48.30	44.40
617.242		2 x 24	3.58	2 x 26.3	61.8 or 2 x 30.9	1.90	29.9	3.80	3.9 x 1.9	3.0	617.182	48.30	44.40
636.382	360	2 x 38	4.74	2 x 40.3	100.0 or 2 x 50.0	2.30	49.0	4.60	4.5 x 2.3	5.3	636.382	63.80	58.70

ISOLATION TRANSFORMERS WITHOUT ENCLOSURE

Commercial and Medical Equipment for US/Canada and International Markets

FOR COMMERCIAL APPLICATIONS

Standard Isolation Transformers UL recognized to UL1411. Comply with CSA/TUV/IEC 742, 4000V hi-pot tested, 8 mm creep distance. Supplied with metal washer and rubber pads.*

DUAL PRIMARIES (2 x 117V), 50-60Hz operation.

TCM Part No.	Power (VA)	Secondary Rating (RMS) In Series (Center Tap) AC Volt (V)	AC Amps (A)	In Parallel AC Volt (V)	AC Amps (A)	No-load Voltage (V)	Dimensions (Inches) OD x H	Weight (Lbs.)	Prices FOB Factory Salisbury, MD 1-4 Pcs.
713.1202	150		0.64		1.28	2 x 130.1	3.9 x 1.9	3.0	$ 53.10
718.1202	190		0.81		1.62	2 x 129.5	4.5 x 1.8	3.8	60.25
732.1202	320		1.37		2.74	2 x 126.3	4.9 x 2.2	5.9	64.90
738.1202	385	234	1.65	117	3.30	2 x 125.3	4.9 x 2.4	6.7	69.40
749.1202	470		2.01		4.02	2 x 123.8	5.3 x 2.4	8.1	78.30
767.1202	670		2.86		5.72	2 x 122.7	6.3 x 2.3	10.9	89.45
782.1202	820		3.50		7.00	2 x 122.6	6.3 x 2.7	13.1	99.35
798.1202	1000		4.27		8.54	2 x 121.9	6.4 x 3.3	17.0	129.50

FOR MEDICAL AND COMMERCIAL APPLICATIONS

Standard Isolation Transformers UL recognized to UL544. Comply with CSA/TUV/IEC 601.1, with 50 µA leakage current, 4000V hi-pot tested, 8 mm creep distance, auto resettable fuse. Supplied with epoxy potted center with hole for mounting bolt.*

QUAD PRIMARIES (100V, 120V, 220V, 240V), 50-60Hz operation

TCM Part No.	Power (VA)	Secondary Rating (RMS) In Series (Center Tap) AC Volt (V)	AC Amps (A)	In Parallel AC Volt (V)	AC Amps (A)	No-load Voltage (V)	Dimensions (Inches) OD x H	Weight (Lbs.)	Prices: FOB Factory Salisbury, MD 1-4 Pcs.
910.1202	1000		4.17		8.34	2 x 124.7	7.0 x 3.7	17.5	$149.60
915.1202	1500		6.25		12.50	2 x 124.5	9.0 x 3.7	24.2	168.40
920.1202	2000		8.33		16.66	2 x 124.0	10.0 x 4.0	32.5	255.40
925.1202	2500	240	10.42	120	20.84	2 x 123.3	11.0 x 4.0	38.5	282.60
930.1202	3000		12.50		25.00	2 x 122.2	11.0 x 4.5	47.0	336.60
940.1202	4000		16.67		33.34	2 x 122.2	12.0 x 4.5	59.0	354.80
950.1202	5000		20.83		41.66	2 x 122.1	12.5 x 4.8	72.5	482.25

Supplied at no extra cost. See page A•2589 for available mounting hardware options.

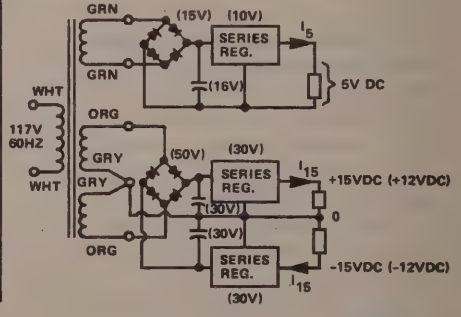
MULTIVOLTAGE RECTIFIER TRANSFORMERS

For 5V and ±15V (or ±12V) Regulated DC at 108V-130V Line, 60Hz (available from stock)

Maximum DC Current I_5	I_{15}	OD x H (Inches) Weight	TCM Part No.	Prices FOB Factory Salisbury, MD 1-4 Pcs.	5-24 Pcs.
1.0A	.25A	2.4 x 1.2 .7 lbs	102.515	$41.00	$37.70
2.0A	.30A	2.8 x 1.3 1.1 lbs	104.515	44.10	40.60
3.0A	.50A	3.2 x 1.4 1.5 lbs	107.515	47.30	43.50
5.0A	.90A	3.9 x 1.5	112.515	53.60	49.30

These transformers are designed to work with user-provided components per schematic shown. Note that the rated operating voltage for each component must be larger than the voltage shown in the diagram, and diodes and regulators must be rated to handle the DC current actually used. Capacitor sizes should be at least 7,000 µF per ampere DC used.

Supplied with metal washer and rubber pads at no extra charge. See separate page for available mounting hardware options.



36 MONTH PRODUCT WARRANTY

TOROID CORPORATION OF MARYLAND

SUPERIOR TRANSFORMERS — SUPERIOR SUPPORT FROM DESIGN TO DELIVERY

ENGINEERING HOT LINE NUMBER: 800-274-5793

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The Industry Leader in Power Toroids

Toroid®
SUPERIOR TRANSFORMERS

TOROIDAL RECTIFIER TRANSFORMERS

RECOGNIZED TO UL 1411 — CSA CERTIFIED

WITH DUAL PRIMARIES (117/234V, 50-60HZ) AND WITH DUAL SECONDARIES

TCM Part No.	Power (VA)	Secondary Rating (RMS) In Series (Center Tap) AC Volt (V)	In Series (Center Tap) AC Amps (A)	In Parallel AC Volt (V)	In Parallel AC Amps (A)	No-load Voltage (V)	Typical DC Data when transformer supplies bridge rectifier with large filter capacitor: Secondaries in Series DC Volt (V)	Secondaries in Series DC Current (A)	Secondaries in Parallel DC Volt (V)	Secondaries in Parallel DC Current (A)	Dimensions (Inches) OD x H	Weight (Lbs.)	TCM Part No.	Prices FOB Factory Salisbury, MD 1-4 Pcs.
701.062	20	12	1.67	6	3.34	2 x 7.7	13.2	1.10	5.6	2.20	2.4 x 1.2	0.7	701.062	$ 33.60
704.062	35		2.92		5.84	2 x 7.5	13.4	1.85	5.7	3.70	2.8 x 1.3	1.1	704.062	38.00
707.062	57		4.75		9.50	2 x 7.1	13.6	2.85	5.8	5.70	3.2 x 1.4	1.5	707.062	39.80
704.082	35	17	2.10	8.5	4.20	2 x 10.3	19.2	1.40	8.6	2.80	2.8 x 1.3	1.1	704.082	38.00
707.082	57		3.30		6.60	2 x 10.1	20.0	2.00	9.0	4.00	3.2 x 1.4	1.5	707.082	39.80
711.082	100		5.90		11.80	2 x 9.6	20.2	3.50	9.1	7.00	3.9 x 1.5	2.2	711.082	45.60
701.092	20	18	1.11	9	2.22	2 x 11.8	21.0	0.73	9.5	1.46	2.4 x 1.2	0.7	701.092	33.80
704.092	35		1.94		3.88	2 x 11.3	20.8	1.24	9.4	2.48	2.8 x 1.3	1.1	704.092	38.00
707.092	57		3.17		6.34	2 x 10.6	21.4	1.90	9.7	3.80	3.2 x 1.4	1.5	707.092	39.80
711.092	100		5.56		11.12	2 x 10.3	21.4	3.20	9.7	6.40	3.9 x 1.5	2.2	711.092	45.60
701.122	20	24	0.83	12	1.66	2 x 15.4	28.4	0.55	13.2	1.10	2.4 x 1.2	0.7	701.122	33.60
704.122	35		1.46		2.92	2 x 15.0	28.6	0.93	13.3	1.86	2.8 x 1.3	1.1	704.122	38.00
707.122	57		2.38		4.76	2 x 14.4	29.0	1.40	13.5	2.80	3.2 x 1.4	1.5	707.122	39.80
711.122	100		4.17		8.34	2 x 13.7	29.4	2.40	13.7	4.80	3.9 x 1.5	2.2	711.122	45.60
713.122	150		6.25		12.50	2 x 13.2	30.0	3.40	14.0	6.80	3.9 x 1.9	3.0	713.122	53.10
718.122	190		7.94		15.84	2 x 13.2	29.6	4.30	13.8	8.60	4.5 x 1.8	3.8	718.122	60.25
701.152	20	30	0.67	15	1.34	2 x 19.3	36.0	0.44	17.0	0.88	2.4 x 1.2	0.7	701.152	33.60
704.152	35		1.20		2.40	2 x 18.8	36.4	0.74	17.2	1.48	2.8 x 1.3	1.1	704.152	38.00
707.152	57		1.90		3.80	2 x 18.2	36.8	1.10	17.4	2.20	3.2 x 1.4	1.5	707.152	39.80
711.152	100		3.33		6.66	2 x 17.3	37.4	1.90	17.7	3.80	3.9 x 1.5	2.2	711.152	45.60
713.152	150		5.00		10.00	2 x 16.6	37.6	2.75	17.8	5.50	3.9 x 1.9	3.0	713.152	53.10
718.152	190		6.33		12.66	2 x 16.4	37.6	3.50	17.8	7.00	4.5 x 1.8	3.8	718.152	60.25
732.152	320		10.67		21.34	2 x 16.2	38.2	5.70	18.1	11.40	4.5 x 2.2	5.9	732.152	64.90
701.182	20	36	0.56	18	1.12	2 x 23.4	43.4	0.37	20.7	0.74	2.4 x 1.2	0.7	701.182	33.60
704.182	35		1.00		2.00	2 x 22.7	44.0	0.62	21.0	1.22	2.8 x 1.3	1.1	704.182	38.00
707.182	57		1.60		3.20	2 x 21.2	44.6	0.95	21.3	1.90	3.2 x 1.4	1.5	707.182	39.80
711.182	100		2.78		5.56	2 x 20.4	45.0	1.65	21.5	3.30	3.9 x 1.5	2.2	711.182	45.60
713.182	150		4.17		8.34	2 x 20.0	46.0	2.20	22.0	4.40	3.9 x 1.9	3.0	713.182	53.10
718.182	190		5.28		10.56	2 x 19.8	45.8	2.90	21.9	5.80	4.5 x 1.8	3.8	718.182	60.25
732.182	320		8.89		17.78	2 x 19.4	46.0	4.60	22.0	9.20	4.9 x 2.2	5.9	732.182	64.90
738.182	385		10.69		21.38	2 x 19.2	46.0	5.40	22.0	10.80	4.9 x 2.4	6.7	738.182	69.40
701.222	20	44	0.45	22	0.90	2 x 28.8	53.4	0.30	25.7	0.60	2.4 x 1.2	0.7	701.222	33.60
704.222	35		0.80		1.60	2 x 27.8	54.2	0.50	26.1	1.00	2.8 x 1.3	1.1	704.222	38.00
707.222	57		1.30		2.60	2 x 26.1	55.0	0.78	26.5	1.56	3.2 x 1.4	1.5	707.222	39.80
711.222	100		2.27		4.54	2 x 25.0	55.2	1.35	26.6	2.70	3.9 x 1.5	2.2	711.222	45.60
713.222	150		3.41		6.82	2 x 24.6	56.2	1.80	27.1	3.60	3.9 x 1.9	3.0	713.222	53.10
718.222	190		4.32		8.64	2 x 24.3	56.6	2.34	27.3	4.68	4.5 x 1.8	3.8	718.222	60.25
707.242	57	48	1.19	24	2.38	2 x 28.2	60.2	0.72	29.1	1.44	3.2 x 1.4	1.5	707.242	39.80
711.242	100		2.08		4.16	2 x 27.6	60.8	1.19	29.4	2.38	3.9 x 1.5	2.2	711.242	45.60
713.242	150		3.13		6.26	2 x 26.7	61.2	1.70	29.6	3.40	3.9 x 1.9	3.0	713.242	53.10
718.242	190		3.96		7.92	2 x 26.3	61.4	2.20	29.7	4.40	4.5 x 1.8	3.8	718.242	60.25
732.242	320		6.67		13.34	2 x 25.8	62.0	3.50	30.0	7.00	4.9 x 2.2	5.9	732.242	64.90
738.242	385		8.02		16.04	2 x 25.7	62.2	4.05	30.1	8.10	4.9 x 2.4	6.7	738.242	69.40
749.242	470		9.79		19.58	2 x 25.6	62.6	4.75	30.3	9.50	5.3 x 2.4	8.1	749.242	78.30
767.242	670		13.96		27.92	2 x 25.3	63.0	6.80	30.5	13.60	6.3 x 2.3	10.9	767.242	89.45
782.242	820		17.08		34.16	2 x 25.1	63.2	8.10	30.6	16.20	6.3 x 2.7	13.1	782.242	99.35
798.242	1000		20.83		41.66	2 x 25.0	62.4	9.80	30.2	19.60	6.4 x 3.3	17.0	798.242	129.50
711.282	100	56	1.79	28	3.58	2 x 31.7	71.2	1.05	34.6	2.10	3.9 x 1.5	2.2	711.282	45.60
713.282	150		2.68		5.36	2 x 30.8	72.0	1.48	35.0	2.96	3.9 x 1.9	3.0	713.282	53.10
718.282	190		3.39		6.78	2 x 31.1	72.4	1.82	35.2	3.64	4.5 x 1.8	3.8	718.282	60.25
711.302	100	60	1.67	30	3.34	2 x 34.5	76.6	0.95	37.3	1.90	3.9 x 1.5	2.2	711.302	45.60
713.302	150		2.50		5.00	2 x 33.3	77.2	1.35	37.6	2.70	3.9 x 1.9	3.0	713.302	53.10
718.302	190		3.17		6.34	2 x 33.2	77.2	1.72	37.6	3.44	4.5 x 1.8	3.8	718.302	60.25
732.302	320		5.33		10.66	2 x 32.2	78.0	2.80	38.0	5.60	4.9 x 2.2	5.9	732.302	64.90
738.302	385		6.42		12.84	2 x 32.1	78.6	3.20	38.3	6.40	4.9 x 2.4	6.7	738.302	69.40
749.302	470		7.83		15.66	2 x 31.7	78.6	3.95	38.3	7.90	5.3 x 2.4	8.1	749.302	78.30
767.302	670		11.17		22.34	2 x 31.7	79.0	5.40	38.5	10.80	6.3 x 2.3	10.9	767.302	89.45
782.302	820		13.67		27.34	2 x 31.4	79.0	6.50	38.5	13.00	6.3 x 2.7	13.1	782.302	99.35
767.332	670	66	10.15	33	20.30	2 x 34.7	87.4	5.00	42.7	10.00	6.3 x 2.3	10.9	767.332	89.45
732.382	320	76	4.21	38	8.42	2 x 40.8	99.6	2.20	48.8	4.40	4.9 x 2.2	5.9	732.382	64.90
738.382	385		5.02		10.14	2 x 40.5	100.0	2.60	49.0	5.20	4.9 x 2.4	6.7	738.382	69.40
749.382	470		6.18		12.36	2 x 40.2	100.4	3.10	49.2	6.20	5.3 x 2.4	8.1	749.382	78.30
767.382	670		8.82		17.64	2 x 40.2	100.8	4.20	49.4	8.40	6.3 x 2.3	10.9	767.382	89.45
782.382	820		10.79		21.58	2 x 39.8	101.4	5.10	49.7	10.20	6.3 x 2.7	13.1	782.382	99.35
798.422	1000	84	11.90	42	23.80	2 x 43.6	112.2	5.60	55.1	11.20	6.4 x 3.3	17.0	798.422	129.50
782.482	820	96	8.54	48	17.14	2 x 50.4	128.2	4.00	63.1	8.00	6.3 x 2.7	13.1	782.482	99.35
798.552	1000	110	9.09	55	18.18	2 x 57.0	148.0	4.35	73.0	8.70	6.4 x 3.3	17.0	798.552	129.50

The above transformers are supplied with metal washers and rubber pads at no extra cost. See page A•2589 for available mounting hardware options.

36 MONTH PRODUCT WARRANTY

TOROID CORPORATION OF MARYLAND

SUPERIOR TRANSFORMERS — SUPERIOR SUPPORT FROM DESIGN TO DELIVERY

ENGINEERING HOT LINE NUMBER: ***800-274-5793***

2020 NORTHWOOD DR., SALISBURY, MD 21801-7805
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Toroid®
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PC MOUNT TOROIDAL POWER TRANSFORMERS
DATA AND PRICE SHEET

PC MOUNT SERIES TOROIDAL POWER TRANSFORMERS

Primaries: 2 x 115V/50-60Hz. **Secondaries:** Dual as listed below.
Primaries and secondaries for parallel or series connection.
Class A (105C) Insulation class. 60C max. ambient operating temperature.
4000V Hi-pot test. Complies with VDE 0550. UL recognized to UL1411.
Transformer potted inside glass-filled Nylon encapsulation with blind insert (M4x6).

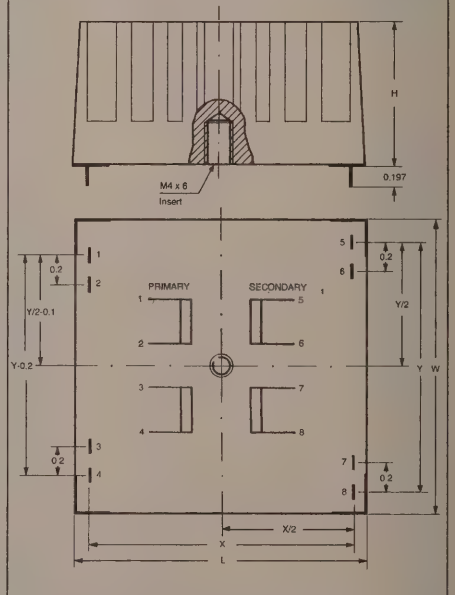
TCM Part No.	Rated Power	Secondary Data Volt	mA	No-load Voltage (V)	% Regulation	Size L x W x H Weight	Prices FOB Factory Salisbury, MD 1-4 Pcs.	5-24 Pcs.
801.072		2 x 7	114	2 x 9.3				
801.092		2 x 9	89	2 x 12.0		1.56" x 1.56"		
801.122	1.6	2 x 12	67	2 x 16.0	33	H = .73"	$17.40	$15.20
801.152		2 x 15	53	2 x 20.0		3 oz.		
801.182		2 x 18	44	2 x 23.9				
801.222		2 x 22	36	2 x 29.3				
803.072		2 x 7	229	2 x 10.1				
803.092		2 x 9	178	2 x 13.0		1.76" x 1.76"		
803.122	3.2	2 x 12	133	2 x 17.3	44	H = .77"	$19.20	$16.75
803.152		2 x 15	107	2 x 21.6		4 oz.		
803.182		2 x 18	89	2 x 25.9				
803.222		2 x 22	73	2 x 31.7				
805.072		2 x 7	357	2 x 10.3				
805.092		2 x 9	278	2 x 13.2		1.96" x 1.96"		
805.122	5.0	2 x 12	208	2 x 17.6	47	H = .77"	$20.70	$18.05
805.152		2 x 15	167	2 x 22.1		5 oz.		
805.182		2 x 18	139	2 x 26.5				
805.222		2 x 22	114	2 x 32.3				
807.072		2 x 7	500	2 x 9.5				
807.092		2 x 9	389	2 x 12.2		1.96" x 1.96"		
807.122	7.0	2 x 12	292	2 x 16.2	22	H = .91"	$20.80	$18.10
807.152		2 x 15	233	2 x 20.3		6 oz.		
807.182		2 x 18	194	2 x 24.3				
807.222		2 x 22	159	2 x 29.7				
810.072		2 x 7	714	2 x 8.5				
810.092		2 x 9	556	2 x 11.0		2.17" x 2.17"		
810.122	10.0	2 x 12	417	2 x 14.6	22	H = 1.02"	$25.55	$22.25
810.152		2 x 15	333	2 x 18.3		9 oz.		
810.182		2 x 18	278	2 x 22.0				
810.222		2 x 22	227	2 x 26.8				
815.072		2 x 7	1071	2 x 8.7				
815.092		2 x 9	833	2 x 11.2		2.36" x 2.36"		
815.122	15.0	2 x 12	625	2 x 14.9	24	H = 1.04"	$29.40	$25.55
815.152		2 x 15	500	2 x 18.6		11 oz.		
815.182		2 x 18	417	2 x 22.3				
815.222		2 x 22	341	2 x 27.3				
825.072		2 x 7	1785	2 x 8.3				
825.092		2 x 9	1377	2 x 10.7		2.36" x 2.36"		
825.122	25.0	2 x 12	1041	2 x 14.3	19	H = 1.38"	$37.95	$34.49
825.152		2 x 15	832	2 x 17.8		15 oz.		
825.182		2 x 18	694	2 x 21.4				
825.222		2 x 22	568	2 x 26.2				

AC voltages are nominal. Tolerance for standard transformers ±3%.
Prices apply to total order quantity. Mixing and scheduled shipments over maximum 12 months allowed.
Please call factory for larger volume prices. Prices and data are subject to change without prior notice.

Part numbers in bold are available from stock.

The Mini-Blue Series

SPACING AND PIN CONFIGURATION
Pin Dimensions: .039" x .020"



36 MONTH PRODUCT WARRANTY

TOROID CORPORATION OF MARYLAND
SUPERIOR TRANSFORMERS — SUPERIOR SUPPORT FROM DESIGN TO DELIVERY
ENGINEERING HOT LINE NUMBER: 800-274-5793
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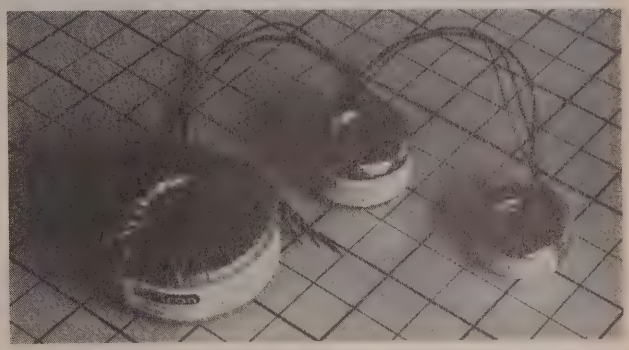


STANDARD PROGRAM, TOROIDAL POWER TRANSFORMERS

In order to meet the day-to-day demand for prototypes and short production runs, we carry a stock of semi-fabricated transformers. These consist of cores with the primary winding and insulation already in place. In most cases the core with a 117V 60Hz primary represents the generic part of a transformer, whereas the secondary often requires special voltages, centertaps or multi-voltages at different current ratings.

By means of our semi-fabricated stock, in the majority of cases we can tailor make your secondaries with windings as required and color coded leads, and ship product out within a few days from the receipt of your order.

The stock program provides us with added flexibility, but in no way limits our capability of providing you with totally tailored transformers, meeting demands for odd dimensions, multiple primaries, or off-standard operating frequencies.

NEW LINE POWER TOROIDS
RATINGS 1,000 TO 10,000 VA

OFF-THE-SHELF SERIES "S" PRIMARY WOUND TRANSFORMERS

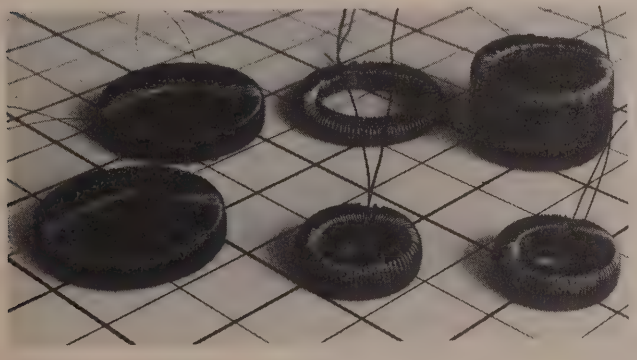
VA RATING FULL LOAD	REGULATION % VOLTAGE	MOUNTING DETAILS	FINISHED O.D x HT.	FIN. WEIGHT APP. LBS.
15	15	A	2.2" x 1.1"	.4
26	14	A	2.3" x 1.3"	.6
42	13	A	2.6" x 1.6"	.9
65	12	B	3.0" x 1.6"	1.3
100	10	B	3.4" x 1.8"	1.7
135	9	B	3.8" x 1.8"	2.6
180	8	B	4.1" x 1.9"	3.1
240	7	C	4.2" x 2.0"	3.9
320	6	C	4.5" x 2.1"	4.8
450	6	C	4.9" x 2.4"	5.8
600	5	C	5.2" x 2.8"	7.7

MOUNTING DETAILS

Zinc plated, circular steel washer +2 neoprene washers.
Mounting by means of one central screw.

SIZE 1	2" DIA.	.19 HOLE
SIZE 2	2.38" DIA.	.19 HOLE
SIZE 3	2.75" DIA.	.25 HOLE
SIZE 4	3.50" DIA.	.25 HOLE
SIZE 5	4.38" DIA.	.31 HOLE

CURRENT TRANSFORMERS, CHOKES, BALLASTS AND FILTERS



The toroidal design is utilized in instrument transformers to measure high currents in power cables and busbars. Instrument transformers can be taped, resin dipped or potted.

Toroids are also used to regulate current in AC systems for electronic and lighting applications and to filter out transients in sensitive electronic equipment. For these applications cores are often provided with a closely controlled air gap which is cut into the core before the wire is put into place. Core size, Gap width, Number of turns and Wire gauge are infinitely variable design parameters.

TORTRAN Inc. 915 PEMBROKE STREET, BRIDGEPORT, CT 06608
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THE MOST RESPECTED NAME IN MAGNETIC COMPONENTS

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Litz Wire Wound
Swinging
Toroidal

COILS
Audio Frequency
Bobbin Wound
Custom Designed
Encapsulated
Foil Wound
High Current
High Frequency
High "Q"
High Temperature
Layer Wound
Litz Wire Wound
Mil. Spec.
Miniature
Molded
Multiple Wound
Saturable Reactor
Solenoid
Strip Wound
Switching, Power
Toroidal

INDUCTORS
Air Core
Audio Frequency
Bobbin Wound
Common Mode
Current Sense
Custom Designed
Filter
Foil Wound
High Current
High Frequency
High "Q"
Layer Wound

INDUCTORS (CONT.)
Litz Wire Wound
Mil. Spec.
Miniature
Multiple Wound
Open Coil
Planar
Series Regulator
Strip Wound
Surface Mount
Switching, Power
Toroidal

REACTORS
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Audio Frequency
Bobbin Wound
Custom Designed
Filter
Foil Wound
High Current
High Frequency
High "Q"
Layer Wound
Litz Wire Wound
Multiple Wound
Saturable
Strip Wound
Switching, Power
Toroidal

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Mil. Spec.
Oil Well
Open Construction
Planar
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Printed Circuit
Pulse
Rectifier
Reference
Signal
Saturable
Split Bobbin
Strip Wound
Subminiature
Surface Mount
Switching, Power
Three Phase
Toroidal
Vacuum Impregnated

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TOROTEL PRODUCTS INCORPORATED 13402 SOUTH 71 HIGHWAY GRANDVIEW, MO 64030 (816) 761-6314 FAX (816) 763-2278

400 Hz MINIATURE POWER TRANSFORMERS

Reference for all Industrial and Military Standard 400 Hz Miniature Power Transformers

These 400 Hz Miniature Power Transformers are selected for use in all Military and Industrial applications requiring high performance in the smallest possible package size. They conform to all of the requirements of MIL-T-27, Class S (-55°C to +130°C). The minimum continuous operating life expectancy is 10,000 hours. This series is available having power ratings of 0.5 VA through 25 VA. The primaries are 115 Vrms with secondary voltages ranging from 5 Vrms through 300 Vrms. It is recommended that these transformers be specified for all applications where space, weight, and cost effectiveness are prime considerations.

PART NUMBER EXAMPLE

0.5 S T 26

- 0.5 — V.A. Rating (See Table I)
- S — Package Style
- T — Schematic (See Table I)
- 26 — Secondary Voltage (See Table II)

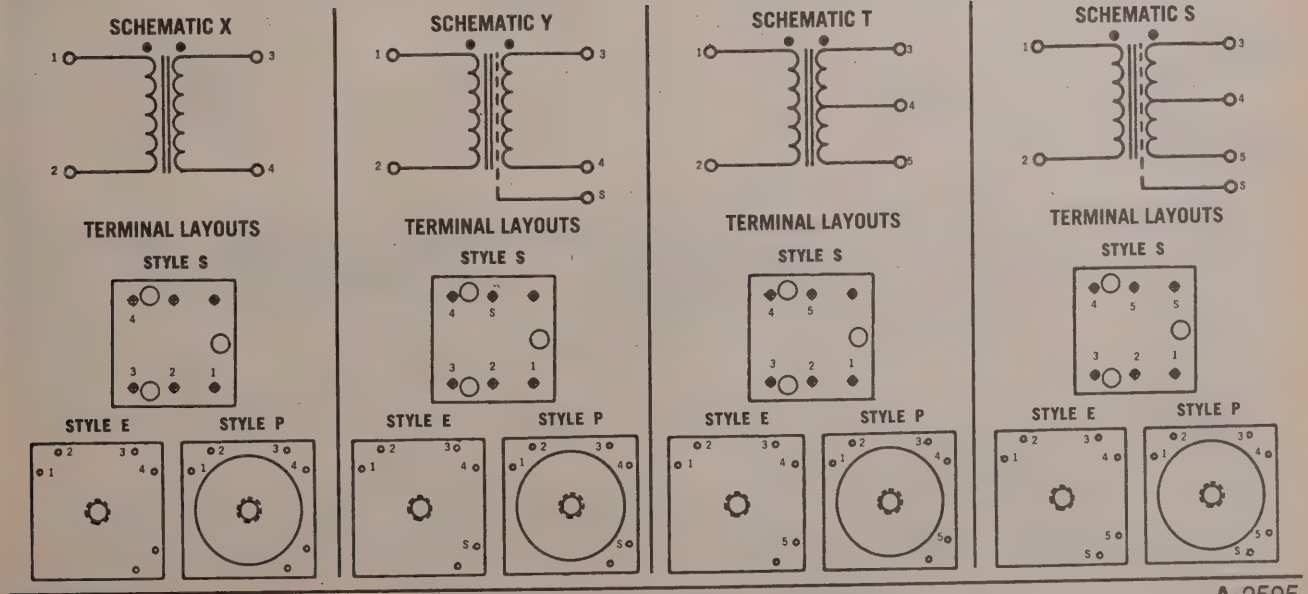
TABLE I

VA Rating	Package Style	Schematic	Size	Max. Height (Inches)	Regulation (%)		Available Secondary Voltages (VRMS)		Exciting Current (ma)	Efficiency (%)		Temperature Rise (°C) — MIL-T-27 No Heat Sink		Weight (Oz.)	
					Nom.	Max.	Min.	Max.	Max.	Min.	Nom.	Nom.	Max.	Nom.	Max.
0.5	S	T, X	—	—	15	18	5	300	1	65	70	10	15	0.38	0.4
0.5	S	S, Y	—	—	17	21	5	300	1	65	70	12	17	0.38	0.4
1.5	E, P	T, X	A	0.47	20	23	5	300	1.5	70	76	13	17	0.76	0.85
1.5	E, P	S, Y	A	0.59	15	18	5	300	3	70	76	13	17	0.97	1.1
2	E, P	T, X	A	0.78	3	3.7	5	300	6	72	87	10	15	1.5	1.65
2.4	E, P	S, Y	A	1.03	3	3.8	5	300	9	73	88	11	16	1.9	2.2
3	E, P	T, X	A	0.59	15	18	5	300	3	75	84	15	20	0.97	1.1
3	E, P	S, Y	A	0.78	10	12	5	300	6	75	84	15	20	1.5	1.65
3.6	E, P	T, X	A	1.03	3	3.8	5	300	9	76	87	10	15	1.9	2.2
6	E, P	T, X	A	0.78	10	12	5	300	6	81	88	18	25	1.5	1.65
6	E, P	S, Y	A	1.03	8	10	5	300	9	80	88	18	25	1.9	2.2
7.3	E, P	S, T, X, Y	B	0.97	3	3.5	5	300	16	84	92	15	23	3.2	3.4
9	E, P	T, X	A	1.03	8	10	5	300	9	83	89	23	30	1.9	2.2
13	E, P	S, T, X, Y	B	1.20	3	3.6	5	300	25	87	93	21	28	4.2	4.4
16	E, P	S, T, X, Y	B	0.97	7	8	5	300	16	87	92	25	32	3.2	3.4
25	E, P	S, T, X, Y	B	1.20	6	7	5	300	25	88	93	36	45	4.2	4.4

TABLE II INDUSTRY STANDARD SECONDARY VOLTAGES

Secondary Voltage	5	5.5	6	6.3	7	7.5	8	9	10	11	12	12.6	13	15	16	18	20	22	24	26	28	30	33
Maximum Working Voltage	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325
Secondary Voltage	36	39	43	47	51	56	62	68	75	82	91	100	110	115	120	130	150	180	200	220	240	270	300
Maximum Working Voltage	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	325	440	440	440	580	580

SCHEMATIC AND TERMINAL CONFIGURATIONS



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400 Hz MINIATURE POWER TRANSFORMERS

Reference for all Industrial and Military Standard 400 Hz Miniature Power Transformers

PHYSICAL SPECIFICATIONS

Size: Sizes for Standard VA Types are given in Table I, and Outline Drawings.

Construction: MIL-T-27, Grade 5; Black Epoxy Encapsulated.

Terminals: Printed circuit pins — tinned brass.

Terminal Strength (Method 211 of MIL-STD-202, Test Condition A): 2.0 pounds.

Marking: Includes MIL-T-27 Type Designation, winding ratings, maximum working voltage, schematic, Torotel name, and part number.

ENVIRONMENTAL SPECIFICATIONS

Operating Temperature Range: -55°C to +130°C (ambient plus temperature rise).

Altitude: 70,000 feet, maximum.

Vibration: MIL-STD-202, Method 204, Test Condition D.

Life Expectancy: 10,000 hours minimum.

Other Environmental Specifications: In accordance with MIL-T-27, Grade 5, Class S, Family 03.

ELECTRICAL SPECIFICATIONS

Primary Voltage: 115 volts rms ±10%

Frequency: 400 Hz ±5%.

Secondary Voltage: See Table II.

Secondary Voltage Tolerance: ±3% at full load and 115 volts, 400 Hz applied to primary.

Electrostatic Shielding (Schematics S and Y): 5 to 1 minimum voltage ratio at 20 KHz.

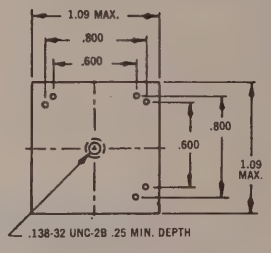
Phase Shift: 1.0 electrical degree between primary and secondary voltage at rated load, maximum.

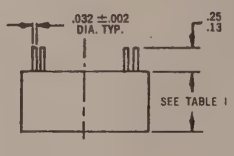
Insulation Resistance: 10,000 megohms minimum at 500 VDC.

Dielectric Strength: At sea level—2.8 times the maximum working voltage. At reduced barometric pressure—1.25 times the maximum working voltage.

Mech. Tol. = ±.005 unless indicated.

PACKAGE STYLE E





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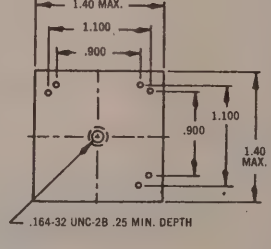

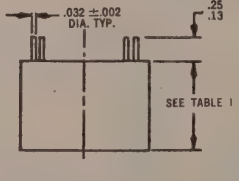

PACKAGE STYLE P

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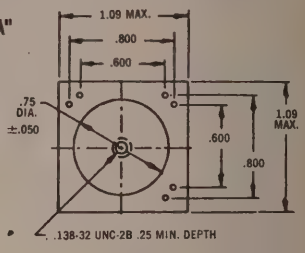

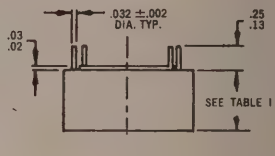

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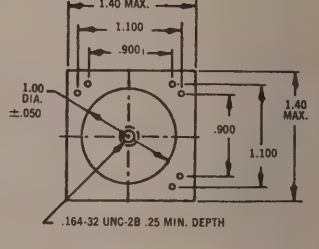
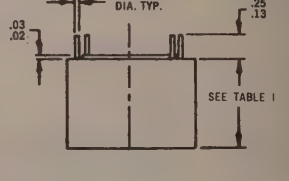
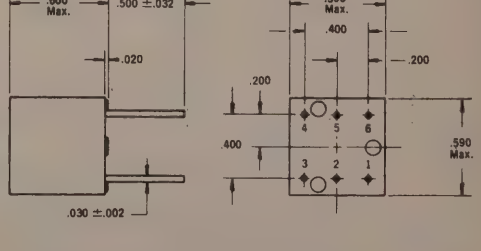




PACKAGE STYLE S



MECH. TOL. FOR STYLE "S" = ±.010 UNLESS INDICATED

Military-Aerospace

MIL-T-27 / QPL APPROVED / MIL-STD-2000 / MIL-STD-981

PULSE: RF/Pulse; Hc-Tran; Gen. App.;

DESIGNED TO MEET MIL-T-21038 / 2,4,6,8,9,11,17,18,25,-27* OR CUSTOMIZE YOUR OLD DESIGN TO MEET CURRENT NEED.

SURFACE MOUNT: Convert Old Design Into Surface Mount

MINATURE 400 HZ POWER TRANSFORMERS: QPL APPROVED MIL-T-27 / 37- / 47* 308 Standard Designs

400 HZ 3Ø POWER TRANSFORMERS: Designed To Meet MIL-T -27 / 344 THRU / 349*

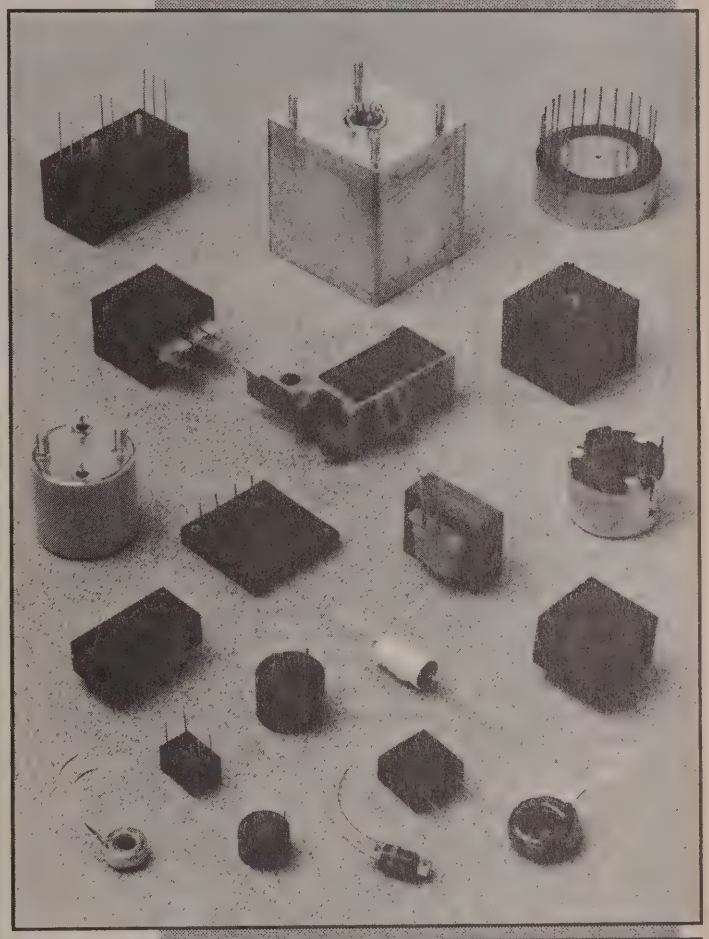
SWITCHING REGULATOR INDUCTORS: Designed To Meet MIL-T-27 / 287 / 288 / 289*

SCOTT "T" TRANSFORMERS: Precision Toroidal; Syncro-Resolver / Resolver-Synchro

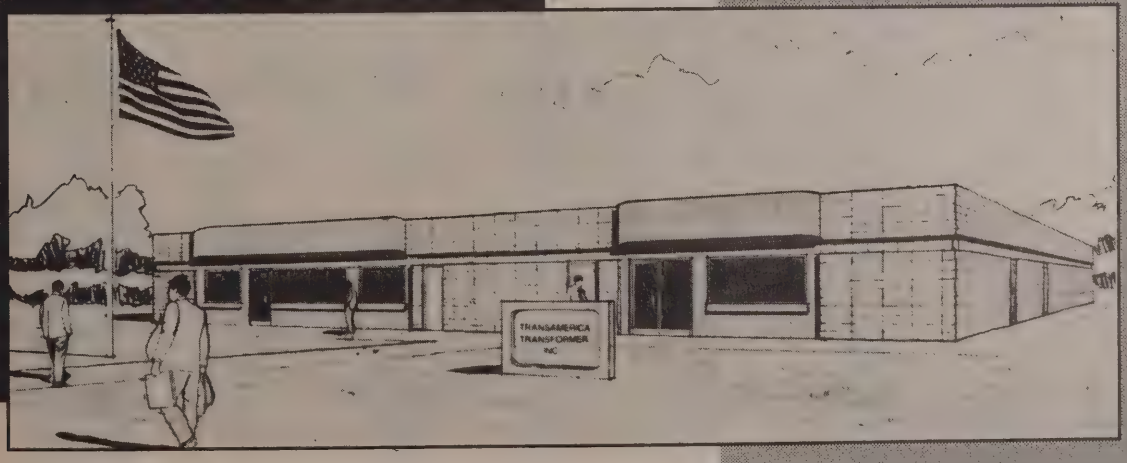
ALL YOUR CUSTOM NEEDS: PROTO-TYPE SERVICE - ONE WEEK DELIVERY

*NOT ALL PARTS ARE ON QPL CHECK WITH FACTORY FOR CURRENT STATUS

CALL FOR STANDARD LINE CATALOGUE OR CUSTOM DESIGN ASSISTANCE



THE SOURCE FOR MILITARY MAGNETICS



TRANS AMERICAN TRANSFORMER INC.

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TRANSFORMER TECHNOLOGIES INC.

Standard and Custom Toroidal Power Transformers up to 3000VA.

Also Conventional EI. and Ferrite Custom Designed to your Specifications.

Complete DC Toroidal Power Supply Packages

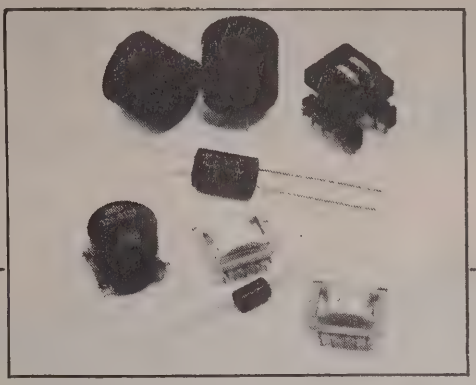
UL Recognized

The transformers listed below are supplied with a dimpled mounting washer and two rubber insulators.
Inputs based on 120V 60Hz
115/230V 50Hz also available.

NOMINAL POWER VA	SECONDARY OUTPUT VOLTS AC.			SECONDARY CURRENT AMPS AC		SIZE OD x H WEIGHT	PART NUMBER
	OUTPUT	PARALLEL	SERIES	PARALLEL	SERIES		
20	2 x 9	9V	18V	2.22	1.11	2.4 x 1.3 .7 LBS	SPT-20-9
	2 x 12	12V	24V	1.67	.835		SPT-20-12
	2 x 15	15V	30V	1.33	.666		SPT-20-15
	2 x 18	18V	36V	1.12	.560		SPT-20-18
	2 x 24	24V	48V	.83	.417		SPT-20-24
40	2 x 9	9V	18V	4.44	2.22	2.8 x 1.3 1.2 LBS	SPT-40-9
	2 x 12	12V	24V	3.34	1.67		SPT-40-12
	2 x 15	15V	30V	2.66	1.33		SPT-40-15
	2 x 18	18V	36V	2.24	1.12		SPT-40-18
	2 x 24	24V	48V	1.66	.83		SPT-40-24
60	2 x 9	9V	18V	6.66	3.33	3.2 x 1.5 1.5 LBS	SPT-60-9
	2 x 12	12V	24V	5.00	2.50		SPT-60-12
	2 x 15	15V	30V	4.00	2.00		SPT-60-15
	2 x 18	18V	36V	3.34	1.67		SPT-60-18
	2 x 24	24V	48V	2.50	1.25		SPT-60-24
80	2 x 9	9V	18V	8.88	4.44	3.6 x 1.5 1.8 LBS	SPT-80-9
	2 x 12	12V	24V	6.66	3.33		SPT-80-12
	2 x 15	15V	30V	5.33	2.66		SPT-80-15
	2 x 18	18V	36V	4.44	2.22		SPT-80-18
	2 x 24	24V	48V	3.33	1.66		SPT-80-24
100	2 x 9	9V	18V	11.11	5.55	3.9 x 1.5 2.2 LBS	SPT-100-9
	2 x 12	12V	24V	8.33	4.17		SPT-100-12
	2 x 15	15V	30V	6.67	3.33		SPT-100-15
	2 x 18	18V	36V	5.56	2.78		SPT-100-18
	2 x 24	24V	48V	4.17	2.08		SPT-100-24
120	2 x 12	12V	24V	10.00	5.00	3.9 x 1.7 2.7 LBS	SPT-120-12
	2 x 15	15V	30V	8.00	4.00		SPT-120-15
	2 x 18	18V	36V	6.67	3.33		SPT-120-18
	2 x 24	24V	48V	5.00	2.50		SPT-120-24
150	2 x 12	12V	24V	12.50	6.25	3.9 x 1.9 3.2 LBS	SPT-150-12
	2 x 15	15V	30V	10.00	5.00		SPT-150-15
	2 x 18	18V	36V	8.33	4.17		SPT-150-18
	2 x 24	24V	48V	6.25	3.12		SPT-150-24
180	2 x 12	12V	24V	15.00	7.50	4.5 x 1.5 3.6 LBS	SPT-180-12
	2 x 15	15V	30V	12.00	6.00		SPT-180-15
	2 x 18	18V	36V	10.00	5.00		SPT-180-18
	2 x 24	24V	48V	7.50	3.75		SPT-180-24
200	2 x 15	15V	30V	13.33	6.66	4.5 x 1.7 4.0 LBS	SPT-200-15
	2 x 18	18V	36V	11.11	5.55		SPT-200-18
	2 x 22	22V	44V	9.09	4.54		SPT-200-22
	2 x 24	24V	48V	8.33	4.16		SPT-200-24
	220V	—	—	.90	—		SPT-200-220
250	2 x 18	18V	36V	13.89	6.95	4.5 x 1.9 4.6 LBS	SPT-250-18
	2 x 22	22V	44V	11.36	5.68		SPT-250-22
	2 x 24	24V	48V	10.42	5.21		SPT-250-24
	2 x 30	30V	60V	8.33	4.17		SPT-250-30
	220V	—	—	1.14	—		SPT-250-220
300	2 x 18	18V	36V	16.67	8.33	4.5 x 2.2 5.2 LBS	SPT-300-18
	2 x 22	22V	44V	13.64	6.82		SPT-300-22
	2 x 24	24V	48V	12.50	6.25		SPT-300-24
	2 x 30	30V	60V	10.00	5.00		SPT-300-30
	220V	—	—	1.36	—		SPT-300-220
350	2 x 24	24V	48V	14.58	7.29	4.5 x 2.4 5.8 LBS —	SPT-350-24
	2 x 30	30V	60V	11.66	5.38		SPT-350-30
	2 x 33	33V	66V	10.60	5.30		SPT-350-33
	2 x 38	38V	76V	9.21	4.60		SPT-350-38
	220V	—	—	1.59	—		SPT-350-220
400	2 x 30	30V	60V	13.33	6.66	5.2 x 2.1 6.1 LBS —	SPT-400-30
	2 x 33	33V	66V	12.12	6.06		SPT-400-33
	2 x 38	38V	76V	10.52	5.26		SPT-400-38
	220V	—	—	1.81	—		SPT-400-220
550	2 x 30	30V	60V	18.33	9.16	5.5 x 2.4 8.5 LBS —	SPT-550-30
	2 x 33	33V	66V	16.66	8.33		SPT-550-33
	2 x 38	38V	76V	14.47	7.23		SPT-550-38
	220V	—	—	2.50	—		SPT-550-220

Transformer Technologies Inc. 402 Locust Street, Mt. Vernon, N.Y. 10552 • 914-668-1600 • FAX 914-668-4794

VERNITRON
CORPORATION
AIE MAGNETICS DIVISION
2800 Anvil St. N. • St. Petersburg, FL 33710
(813) 347-2181 • FAX: (813) 347-3881



TRANSFORMERS

Switcher Transformers
AIE Magnetics manufactures custom ferrite E core, Pot core, PQ, EP, ETD, and Toroid transformers operating from 20 KHz to 500 KHz. Bobbin construction is utilized which can conform to the requirements of all safety agencies such as UL, VDE, CSA, CENELEC or IEC.

TYPICAL APPLICATIONS
• FLYBACK • BOOST CONTROLS
• HALF BRIDGE • FORWARD CONVERTER

FEATURES
• BOBBIN CONSTRUCTION
• COST EFFECTIVE CUSTOM DESIGNS

Wide Band Transformers
AIE Magnetics offers thousands of existing designs of impedance matching wide band transformers. These miniature transformers are ideal for coupling and impedance matching over a frequency range from audio to several megahertz. The units feature printed circuit and axial lead designs.

TYPICAL APPLICATIONS
• LOW POWER CIRCUITS • COMMUNICATIONS EQUIPMENT • INDUSTRIAL CONTROLS • ANALOG MONITORING EQUIPMENT • TEST EQUIPMENT • IF • RF

FEATURES
• MINIATURE SIZE • WIDE FREQUENCY RESPONSE
• LOW DISTORTION • LOW PHASE SHIFT • UP TO 1 WATT RATING

Pulse Transformers
AIE Magnetics has developed pulse transformers, for transfer of maximum pulse power with volt-microsecond products ≥10, excellent pulse reproduction, lowest leakage inductances and high inductance values, our unique bobbin and sleeve constructions are used. Our toroidal construction is limited to low volt-microsecond products ≤ 10, very low DC bias current; and less than 50% duty cycles. This type of transformer is widely used in digital equipment for isolation and voltage transformation.

TYPICAL APPLICATIONS
• MULTIVIBRATORS • ONE-SHOT OSCILLATORS
• BLOCKING OSCILLATORS • VOLTAGE TRANSFORMATION • ISOLATION

FEATURES
• MAXIMUM PULSE POWER • HIGH INDUCTANCES
• LOW LEAKAGE INDUCTANCES • SMALL PACKAGE SIZE

Modem Transformers
AIE Magnetics offers an extensive line of modem transformers including units for private line transmission at 56,000 bits per second.

TYPICAL APPLICATIONS
• DATA COMMUNICATIONS
• TELECOMMUNICATIONS

FEATURES
• LARGE SELECTION
• COST-EFFECTIVE DESIGN
• LOW DISTORTION

Low Profile Modem Transformers
AIE Magnetics has designed and developed a line of very low profile transformers for voice or data communication for use on voice grade telephone lines. They have a maximum height of .400" and occupy only 1.0 square inch of circuit board space. Two types of units were designed; one to carry 5 mA dc unbalance current, the other Ø mA dc. Longitudinal balance is better than 60 dB over the operating frequency range of 300 Hz to 3500 Hz.

TYPICAL APPLICATIONS
• DATA COMMUNICATIONS
• TELECOMMUNICATIONS

FEATURES
• MINIATURE SIZE
• COST-EFFECTIVE DESIGN
• LEVEL: –15 dBm to +7 dBm
• VOLTAGE BREAKDOWN: 1500 VAC MIN.
• LONGITUDINAL BALANCE: 60 dB MIN. (MEASURED ON A WILCOM T-207 TEST SET)
• DISTORTION: 0.5% max.

Ulveco

Toroidal Power Transformers

Low Weight
Typically 50% lighter than traditional stacked lamination transformers.

Small Size
Low height profile allows slim, compact design of electronic equipment.

Flexible Dimensions
The Ulveco Toroidal Power Transformer can be "modeled" to fit very limited spaces and still conform to your electrical requirements.

Easy To Mount
Just one center screw easily and quickly mounts the Ulveco Toroidal Power Transformer to the chassis.

Low Magnetic Strayfield
No air gap and with primary and secondary windings evenly spread around the core, resulting in a very low radiated magnetic field.

Low Mechanical Hum
A single continuous strip of steel tightly wound into a roll results in a very solid and stable unit. No loose parts to buzz.

Small No Load Losses
Ulveco Toroidal Power Transformers can reduce open circuit power by 90% compared to traditional stacked lamination transformers.

- **UL/CSA certified—custom made toroidal transformers**
- **Quick response to design inquiries**
- **Computer aided programs provide quick solutions**
- **Rapid delivery of low cost prototype samples**
- **Wide choice of mounting arrangements**
- **20 VA to 10,000 VA**

Over 90% of our output is for custom designs. Because they require no elaborate production tools and are individually wound, **toroidal transformers are particularly suited to custom designs.**

Take advantage of our **custom design service at no obligation.** Our experts can become part of your power supply design group. We'll show you how you can optimize your product's appearance and performance without increasing cost.

Our interactive computer aided design facilities enable us to optimize designs for either AC or DC loads.

Other Products:

- 3-Phase Transformers, to 30 KVA
- 400 Hz Transformers
- Auto Transformers
- Filter Chokes for 50/60 Hz
- Inverter Transformers for 50/60 Hz

For additional Product and Design Data and Application Notes, please call for our informative 16 page brochure.

Ulveco *Is* Dedicated To Product Quality & Customer Service.

Experience
With over twenty-five years of dedication to product excellence and quality, Ulveco enjoys the position of U.S. leader in the design and manufacture of toroidal power transformers and inductors. We know Ulveco has been successful because of two key company philosophies:

— A strong belief that our quality standards will drive us to success

— A commitment to unequaled customer service.

Quality—UL & CSA Recognized—ISO 9001 Certified
ULVECO is certified as a manufacturer of "Recognized" transformers for various configurations from class A (105°C) to class H (180°C). Every single transformer that we make is tested before delivery.

Customer Service
ULVECO's engineering and sales office, located at the manufacturing facility in Houston, Texas, is staffed with experienced transformer designers using proprietary software programs for optimal designs.

In addition to our custom designed toroids, we carrry an extensive inventory of

OFF-THE-SHELF TRANSFORMERS

for 117V/60 Hz, or 2 x 117V/50 - 60 Hz, in power ratings of 15 VA to 1000 VA, UL, CSA, recognized. Please call 1-800-972-8213 for price and data sheets.

QUALITY IS AN ULVECO TRADITION - NOW ALSO ISO 9001 CERTIFIED

Ulveco Inc. • 10401 Westoffice Drive, Houston, TX 77042 • Tel: 1-800-972-8213 • FAX (713) 977-5031

Ulveco

Custom Designed Toroidals

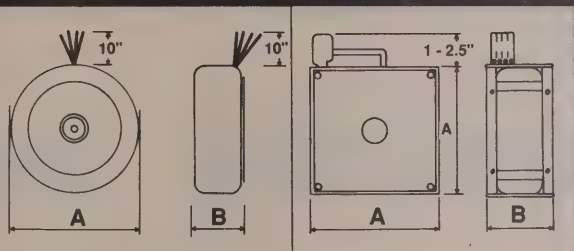
The Design Process
Our Computer Aided Design System, based upon years of experience, processes customer furnished data and presents our designers with several alternative solutions for electrical and mechanical dimensions, and a specification is assembled. In some cases the specification is forwarded to the customer for review, in others, prototype design is begun immediately.

Prototype Design
Initial prototypes are designed according to our general procedure based upon UL 1411, 506 and 544, as applicable, as well as CSA 22.2, No. 66. Every effort is made to fit the prototype design into our standard manufacturing process, but, when necessary, engineering and manufacturing cooperate to find new ways to solve customer's problems.

Prototypes
Prototypes are built and extensively tested, usually within a few days, by our regular production and inspection departments. After additional engineering tests for conformity to design specifications and safety agency requirements, the prototypes are shipped with their individual test reports. Our customers are encouraged both to bench test the transformers and to test them in the end equipment. We discuss and process modifications and, when necessary, furnish new prototypes. In most cases, the design is covered by our existing safety agency recognition/certification. In the few instances not covered, we will work closely with the agencies involved until the toroids are accepted.

Questions? Call 1-800-972-8213

General Data Custom Designed Toroidals



Disk Mounting | Flange Mounting

Nominal Power (VA)	Copper Losses[2] (W)	Core Losses (w)	Disk Mounting Dimensions A inch	B inch	Weight lb	Flange Mounting Dimensions A inch	B inch	Weight lb
15 (18)[1]	3.0	0.20	2.5	1.3	0.7			
30 (36)	5.8	0.25	3.0	1.5	1.1			
50 (60)	8.6	0.45	3.2	1.4	1.6			
80 (95)	12.0	0.60	3.9	1.5	2.2			
120 (145)	16.0	0.90	3.9	1.9	3.0	3.9	2.8	3.6
160 (190)	19.0	1.20	4.5	1.7	3.8	4.7	2.7	5.1
225 (270)	20.0	1.40	4.5	2.0	4.9	4.7	3.1	6.0
300 (360)	22.0	1.70	4.6	2.6	5.7	4.7	3.5	6.9
400 (480)	27.0	2.00	5.4	2.0	6.5	5.7	3.3	8.7
500 (600)	31.0	2.40	5.4	2.4	8.0	5.7	3.7	10.0
625 (750)	36.0	3.10	5.5	3.2	9.5	5.7	4.2	12.0
800 (960)	45.0	3.80	6.4	2.7	12.3	6.9	3.9	14.0
990 (1200)	45.0	4.70	6.4	3.0	16.0	6.9	4.3	17.0
1100 (1320)	45.0	6.50	6.4	3.3	17.0	6.9	4.6	19.0
1300 (1560)	60.0	5.70	8.0	2.6	20.0	8.3	3.9	22.0
1600 (1920)	62.0	7.10	8.0	3.0	23.0	8.3	4.3	24.0
1900 (2280)	65.0	8.50	8.0	3.4	26.0	8.3	4.7	29.0
2200 (2640)	73.0	8.10	8.9	3.3	29.0	9.3	5.1	33.0
2500 (3000)	79.0	9.70	8.9	3.5	33.0	9.3	5.3	37.0
2800 (3360)	89.0	11.00	9.8	3.1	35.0	10.2	4.9	40.0
3200 (3840)	91.0	11.00	9.8	3.5	42.0	10.2	5.3	46.0
3700 (4440)	93.0	15.00	9.8	3.9	46.0	10.2	5.7	51.0
4400 (5280)	112.0	17.00	11.2	4.3	53.0	11.6	6.1	59.0
5000 (6000)	112.0	20.00	11.2	4.7	62.0	11.6	6.5	68.0
6300 (7560)	130.0	27.00	12.4	4.7	76.0	13.8	6.5	82.0
8000 (9600)	140.0	28.00	13.4	4.7	88.0	13.8	6.5	97.0
10000 (12000)	140.0	39.00	13.4	5.9	120.0	13.8	7.7	130.0

The values given are typical values.
[1] Values within parenthesis are for 60Hz operation only.
[2] Copper losses at 25°C ambient temperature and full load.

ISO 9001 Registered

LISTED BABT PRODUCTION FACILITY

UL 544
UL 1950
UL 1411
UL 506
UL 1446

LIFETIME WARRANTY

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Transformers and Chokes

Pulse Transformers and Common Mode Chokes for data communications and telecommunications applications.

Ethernet LAN Coupling Transformers

Series/Part Number	Package	OCL min (µH)	Turns Ratio	DWV min (V rms)	Comments
LT6000 thru LT6005	16–pin DIP	35 to 250	1:1	500	3 coils
LT6030 thru LT6035	16–pin DIP			2000	
ST6030 thru ST6035	16–pin SMD				
ST7030 thru ST7035	16–pin SOIC				
PT3836	6–pin DIP	200	1CT:1CT	2000	1 coil
PT3785	16–pin DIP				2 coils
ST7001	16–pin SOIC				
PT4069	16–pin DIP	200	1CT:1CT/1CT:1.4CT	2000	2 coils
ST7011	16–pin SOIC				
PT4068	16–pin DIP	200	1CT:1CT/1CT:1.4CT	2000	2 coils plus common-mode choke
ST7010	16–pin SOIC				

Token Ring 4/16 Mbps Transformers

Series/Part Number	Package	OCL min (µH)	Turns Ratio	DWV min (V rms)	Comments
LT6014	8–pin DIL	1000	1:1:2:2	500	4Mbps/1 coil
LT6015	16–pin DIL				2 coils
LT6023	8–pin DIL	250	1:1:2:2	500	16 Mbps/1 coil
ST7023	8–pin SOIC				
LT6024	16–pin DIL				2 coils
ST7024	16–pin SOIC				
LT6029	8–pin DIL	750	1:1:1:1	500	16 Mbps/1 coil
LT6046	16–pin DIL				2 coils
ST6046	16–pin SMD				
LT6047	20–pin DIL	400	2:9:22	500	16 Mbps/2 coils 100 and 150 ohm
ST7047	20–pin SOIC				
PT4072	16–pin DIL	80	1:1:2:2	500	16 Mbps/2 coils
PT4083	8–pin DIL	200	1:1:1.25:1.25	500	16 Mbps/1 coil
ST7059	16–pin SOIC	400	1:1:1:1	750	16 Mbps/2 coils
LT6059	8–pin DIL	400	1:1:.817:.817	750	16 Mbps/1 coil
LT6057	16–pin DIL				16 Mbps/2 coils
ST7057	16–pin SOIC				

Applications

- Signal isolation, impedance matching, signal conditioning, EMI filtering and noise suppression in:
  - — Local Area Networks
    - Ethernet, 10BASE-T, Token Ring
  - — ISDN/Telecommunications
    - TI interface
    - S interface
    - U interface
  - — Data coupling

Features

- 200 V rms to 2000 V rms isolation models
- Through-hole and surface-mount packages
- Tape and reel packaging
- Low cost
- Custom designs available

Common Mode Chokes

Part Number Through Hole	Part Number Surface Mount	OCL min (µH)	No. of Signal Lines	DWV min (V rms)	Comments
PT4104		7.5	3	200	6–pin DIL
PT4105		7.5	5	200	10–pin DIL
PT4106	ST7062	7.5	10	200	20–pin DIL/SOIC
PT3868		18	4	500	8–pin DIL
PT3983	ST3983	18	4	500	8–pin DIL/SMD
PT3934	ST3934	25	4	500	8–pin DIP/SMD
PT4085		36	2 X 2	500	8–pin DIL Dual
PT3710		40	4	2000	8–pin DIL
PT4059	ST7078	68	4	500	8–pin DIP/SOIC
PT4014	ST7004	68	3 X 2	500	14–pin DIP/SOIC Dual
PT5039	ST5039	3.6	4	500	8–pin DIL/SMD

For information on other Valor products, see Section 4025 - Converters, Section 2750 - Filters

For additional information on these products, please call your local Valor representative or distributor as listed in the front of this volume.

VALOR

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Transformers and Chokes

Pulse Transformers for data communications & telecommunications applications.

T1/CEPT Interface Transformers

Single Coil, 6-pin STEP Package

Part Number	OCL (mH)	Turns Ratio	Part Number	OCL (mH)	Turns Ratio
PT5002	1.5	1:1:1	PT5008	1.5	1:.5:.5
PT5003	1.5	1:1.36	PT5009	1.5	1:.63:.63
PT5004	1.5	1:2CT	PT5019	1.5	1:1.266 (tap at 1 and 1.15)
PT5005	1.5	1:.575:.575	PT5022	.06	1:1.266CT
PT5006	1.5	1:1.15CT	PT5023	2.0	2.53CT:1
PT5007	1.5	1:1:1.266	PT5029	0.8	1:1:2.62

Dual Coil, 14-pin DIL Package

Part Number	COIL #1		COIL #2	
	OCL (mH)	Turns Ratio	OCL (mH)	Turns Ratio
PT5010	1.5	1:2CT	1.5	1:1.15CT
PT5011	1.5	1:2CT	1.5	1:1.266 (tap at 1)
PT5020	1.5	1:2CT	1.5	1:1.266 (tap at 1 and 1.15)
PT5028	1.5	1:2CT	1.5	1:2CT

DWV is 1500 V rms.

S Interface Transformers

Single Coil, 6-pin DIL Package

Part Number	OCL (mH)	Turns Ratio
PT5000	30	1CT:2CT
PT5001	22	1CT:2CT
PT5014	22	1CT:1.8CT
PT5016	22	1CT:2.5CT
PT5017	22	1CT:1CT

Dual Coil, 16-pin DIL Package

Part Number	Each Coil	
	OCL (mH)	Turns Ratio
PT5024	22	1:1:2.5:2.5
PT5036	22	1:1:1:1

DWV is 2000 V rms.

Data Coupling Transformers

6-pin Package			OCL (mH)	Turns Ratio
STEP	DIP	SMD		
TT1502			5000	1CT:1CT
TT1202			2000	1CT:1CT
TT1102			1000	1CT:1CT
TT2501			500	2CT:1CT
TT1501	TC1501	CS1501	500	1CT:1CT
TT2201			200	2CT:1CT
TT1201	PT3836	CS1201	200	1CT:1CT
CT1502			5000	1:1:1
CT1202			2000	1:1:1
CT1102			1000	1:1:1
CT1501	TH1501	ST1501	500	1:1:1
CT1201	TH1201	ST1201	200	1:1:1
CT1101	TH1101	ST1101	100	1:1:1

U Interface Transformers

Part Number	OCL (mH)	Turns Ratio	Package
PT4084	50	1:1:1.5	8–pin RM Core
PT5031	13	1:1:1.25	8–pin RM Core
PT5046	6.45	1:1:1.52	8–pin RM Core
PT5027	1.7	1:1:2.5	6–pin DIL

For information on other Valor products, see Section 4025 - Converters, Section 2750 - Filters

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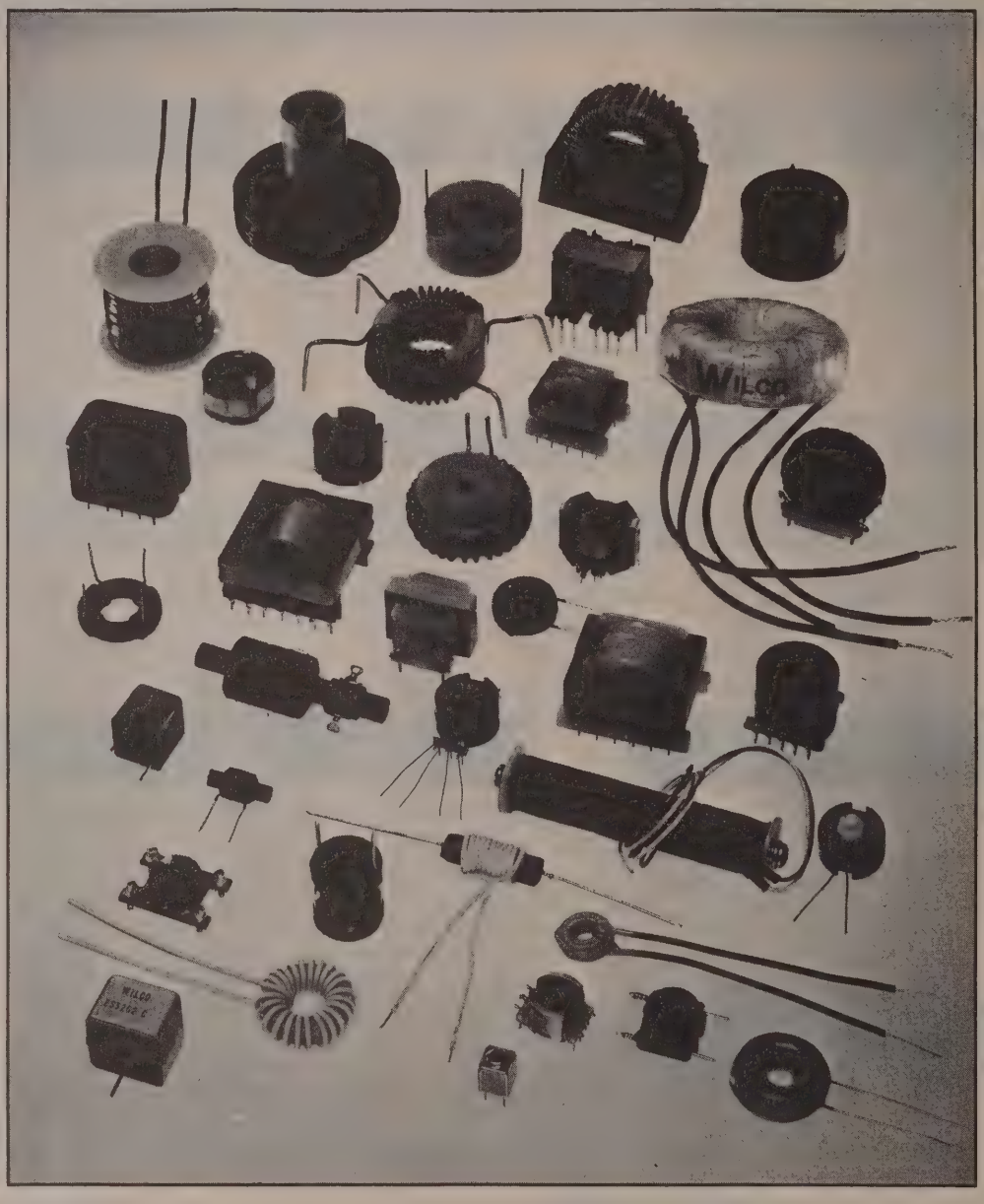

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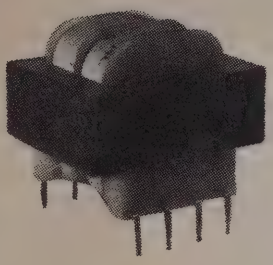

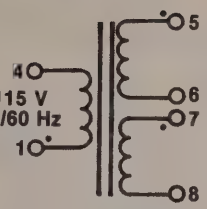

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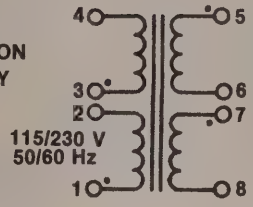
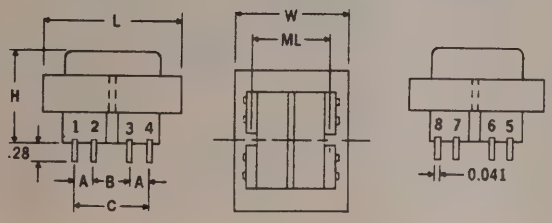


8 PIN - DPC



Size	VA	L	W	H	ML	A	B	C	Lbs.
1	1.1	1 3/8	1 1/8	15/16	—	.250	.250	1.200	0.17
2	2.4	1 3/8	1 1/8	1 3/16	—	.250	.250	1.200	0.25
3	6	1 5/8	1 5/16	1 5/16	1 1/16	.250	.350	1.280	0.44
4	12	1 7/8	1 9/16	1 7/16	1 1/4	.300	.400	1.410	0.70
5	20	2 1/4	1 7/8	1 7/16	1 1/2	.300	.400	1.600	0.80
6	36	2 5/8	2 3/16	1 9/16	NA	.400	.400	1.850	1.1

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PART NUMBER		SECONDARY RMS RATING	
SINGLE 115V 6 PIN	DUAL 115/230V 8 PIN	SERIES	PARALLEL
SPC-1-10	DPC-1-10	10V C.T. @ 0.11A	5V @ 0.22A
SPC-2-10	DPC-2-10	10V C.T. @ 0.25A	5V @ 0.5A
SPC-3-10	DPC-3-10	10V C.T. @ 0.6A	5V @ 1.2A
SPC-4-10	DPC-4-10	10V C.T. @ 1.2A	5V @ 2.4A
SPC-5-10	DPC-5-10	10V C.T. @ 2A	5V @ 4A
SPC-6-10	DPC-6-10	10V C.T. @ 3.6A	5V @ 7.2A
SPC-1-12	DPC-1-12	12.6V C.T. @ 0.09A	6.3V @ 0.18A
SPC-2-12	DPC-2-12	12.6V C.T. @ 0.2A	6.3V @ 0.4A
SPC-3-12	DPC-3-12	12.6V C.T. @ 0.5A	6.3V @ 1.0A
SPC-4-12	DPC-4-12	12.6V C.T. @ 1.0A	6.3V @ 2.0A
SPC-5-12	DPC-5-12	12.6V C.T. @ 1.6A	6.3V @ 3.2A
SPC-6-12	DPC-6-12	12.6V C.T. @ 2.85A	6.3V @ 5.7A
SPC-1-16	DPC-1-16	16V C.T. @ 0.07A	8V @ 0.14A
SPC-2-16	DPC-2-16	16V C.T. @ 0.15A	8V @ 0.3A
SPC-3-16	DPC-3-16	16V C.T. @ 0.4A	8V @ 0.8A
SPC-4-16	DPC-4-16	16V C.T. @ 0.8A	8V @ 1.6A
SPC-5-16	DPC-5-16	16V C.T. @ 1.25A	8V @ 2.5A
SPC-6-16	DPC-6-16	16V C.T. @ 2.25A	8V @ 4.5A
SPC-1-20	DPC-1-20	20V C.T. @ 0.055A	10V @ 0.11A
SPC-2-20	DPC-2-20	20V C.T. @ 0.12A	10V @ 0.24A
SPC-3-20	DPC-3-20	20V C.T. @ 0.3A	10V @ 0.6A
SPC-4-20	DPC-4-20	20V C.T. @ 0.6A	10V @ 1.2A
SPC-5-20	DPC-5-20	20V C.T. @ 1A	10V @ 2A
SPC-6-20	DPC-6-20	20V C.T. @ 1.8A	10V @ 3.6A
SPC-1-24	DPC-1-24	24V C.T. @ 0.045A	12V @ 0.09A
SPC-2-24	DPC-2-24	24V C.T. @ 0.1A	12V @ 0.2A
SPC-3-24	DPC-3-24	24V C.T. @ 0.25A	12V @ 0.5A
SPC-4-24	DPC-4-24	24V C.T. @ 0.5A	12V @ 1.0A
SPC-5-24	DPC-5-24	24V C.T. @ 0.8A	12V @ 1.6A
SPC-6-24	DPC-6-24	24V C.T. @ 1.5A	12V @ 3.0A
SPC-1-28	DPC-1-28	28V C.T. @ 0.04A	14V @ 0.08A
SPC-2-28	DPC-2-28	28V C.T. @ 0.085A	14V @ 0.17A
SPC-3-28	DPC-3-28	28V C.T. @ 0.2A	14V @ 0.4A
SPC-4-28	DPC-4-28	28V C.T. @ 0.42A	14V @ 0.84A
SPC-5-28	DPC-5-28	28V C.T. @ 0.7A	14V @ 1.4A
SPC-6-28	DPC-6-28	28V C.T. @ 1.3A	14V @ 2.6A
SPC-1-36	DPC-1-36	36V C.T. @ 0.03A	18V @ 0.06A
SPC-2-36	DPC-2-36	36V C.T. @ 0.065A	18V @ 0.13A
SPC-3-36	DPC-3-36	36V C.T. @ 0.17A	18V @ 0.34A
SPC-4-36	DPC-4-36	36V C.T. @ 0.35A	18V @ 0.7A
SPC-5-36	DPC-5-36	36V C.T. @ 0.55A	18V @ 1.1A
SPC-6-36	DPC-6-36	36V C.T. @ 1A	18V @ 2A
SPC-1-48	DPC-1-48	48V C.T. @ 0.023A	24V @ 0.046A
SPC-2-48	DPC-2-48	48V C.T. @ 0.05A	24V @ 0.1A
SPC-3-48	DPC-3-48	48V C.T. @ 0.125A	24V @ 0.25A
SPC-4-48	DPC-4-48	48V C.T. @ 0.25A	24V @ 0.5A
SPC-5-48	DPC-5-48	48V C.T. @ 0.4A	24V @ 0.8A
SPC-6-48	DPC-6-48	48V C.T. @ 0.75A	24V @ 1.5A
SPC-1-56	DPC-1-56	56V C.T. @ 0.02A	28V @ 0.04A
SPC-2-56	DPC-2-56	56V C.T. @ 0.045A	28V @ 0.09A
SPC-3-56	DPC-3-56	56V C.T. @ 0.11A	28V @ 0.22A
SPC-4-56	DPC-4-56	56V C.T. @ 0.22A	28V @ 0.44A
SPC-5-56	DPC-5-56	56V C.T. @ 0.35A	28V @ 0.7A
SPC-6-56	DPC-6-56	56V C.T. @ 0.65A	28V @ 1.3A
SPC-1-120	DPC-1-120	120V C.T. @ 0.01A	60V @ 0.02A
SPC-2-120	DPC-2-120	120V C.T. @ 0.02A	60V @ 0.04A
SPC-3-120	DPC-3-120	120V C.T. @ 0.05A	60V @ 0.1A
SPC-4-120	DPC-4-120	120V C.T. @ 0.1A	60V @ 0.2A
SPC-5-120	DPC-5-120	120V C.T. @ 0.16A	60V @ 0.32A
SPC-6-120	DPC-6-120	120V C.T. @ 0.3A	60V @ 0.6A

SPC OR DPC =SERIES 1-6 =SIZE 10-120 =VOLTS/SECONDARY

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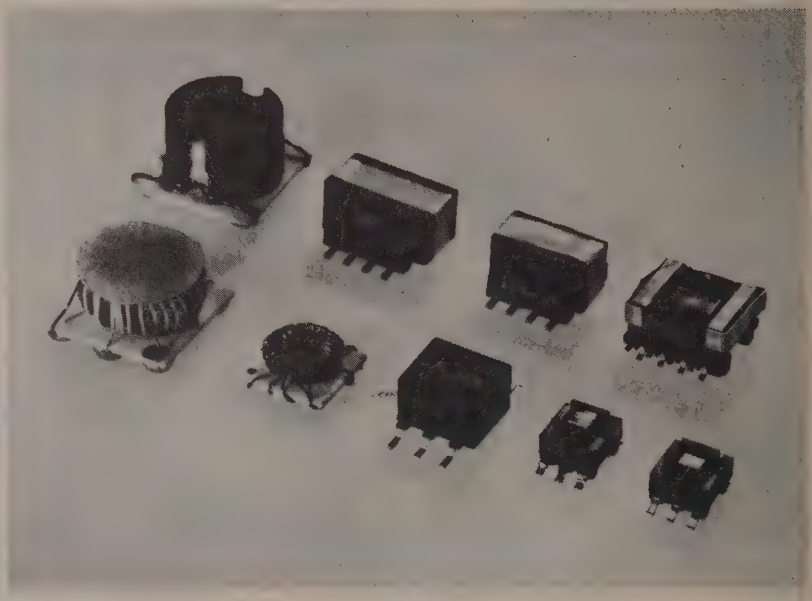

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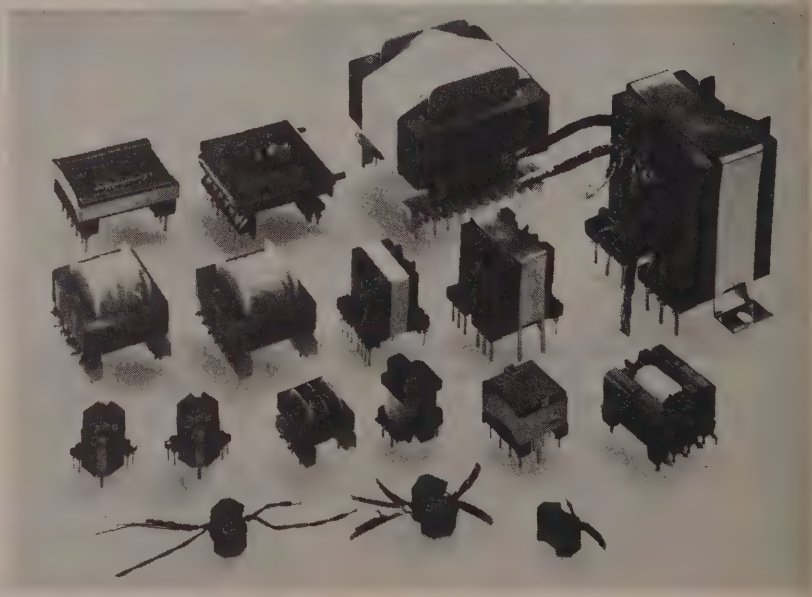

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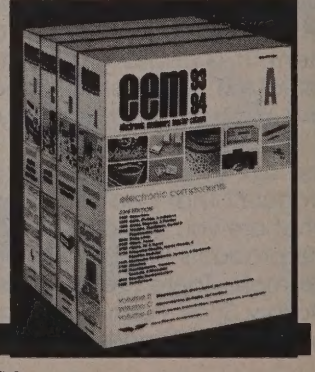

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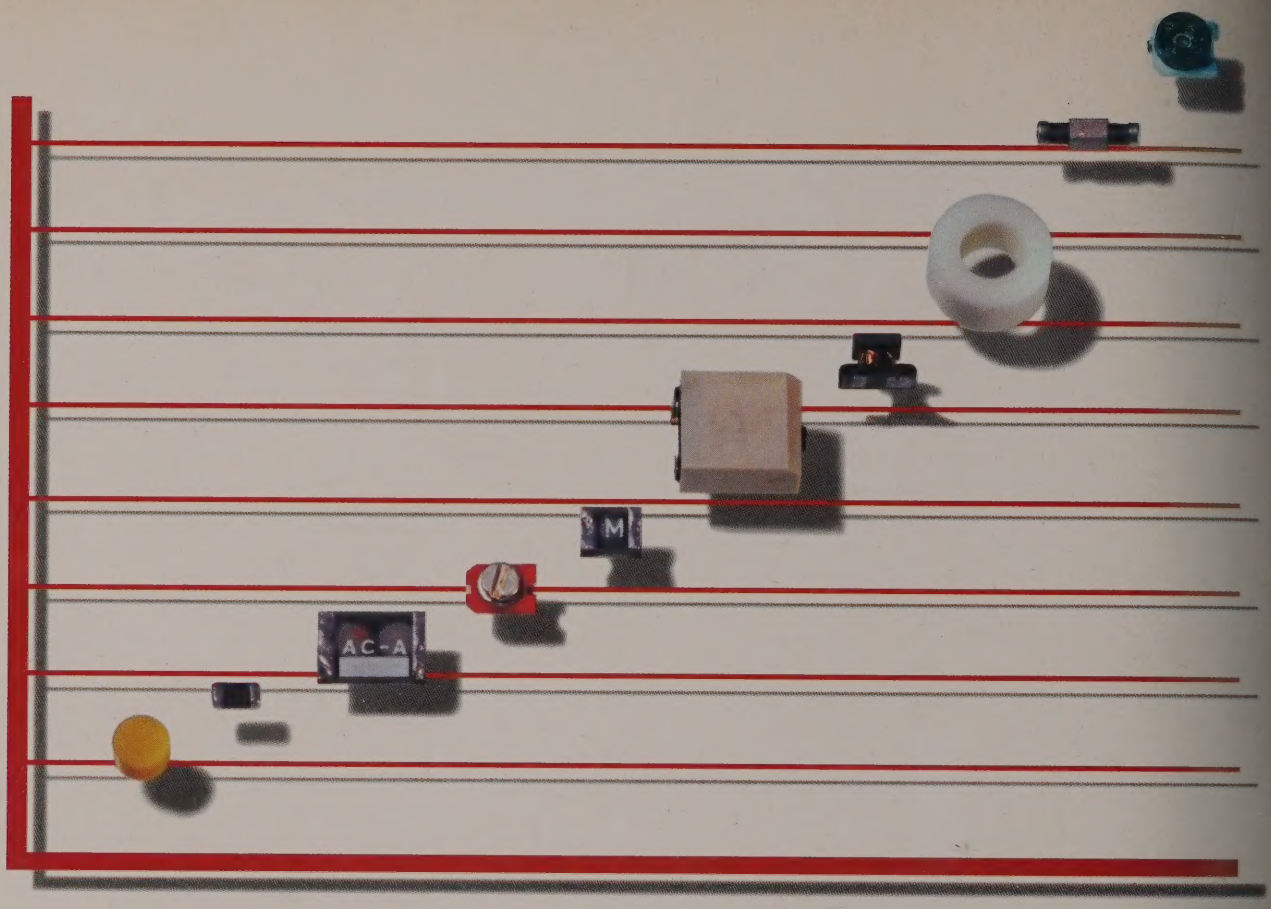

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